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National Uranium Resource Evaluation

URANIUM POTENTIAL IN PRECAMBRIAN CONGLOMERATES OF THE CENTRAL ARIZONA ARCH

FINAL REPORT

By: Phillip Anderson
Karl R. Wirth

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Tucson, Arizona 85703

January 1981

PREPARED FOR THE U.S. DEPARTMENT OF ENERGY
Grand Junction Office, Colorado

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August 1980

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ABSTRACT

The Precambrian quartz-pebble conglomerates in a 9,500 km^2 area of central Arizona between the Mazatzal and Sierra Ancha Mountains were investigated for the presence of significant uranium concentrations or environments favorable for uranium concentration. Abundant conglomerates are found in either the 1740 to 1720 m.y.-old Alder Group, the 1700 m.y.-old Mazatzal Group, or the 1300 to 1250 m.y.-old Apache Group.

Alder Group conglomerates are sheared, argillaceous, relatively poor in quartz pebbles, and show stratigraphic evolution from deep-water marine volcanic conglomerates to shallow-water marine and fluvial conglomerates. Mazatzal Group conglomerates are folded, locally sheared, distinctively siliceous, relatively rich in quartz pebbles, and were deposited under fluvial to shallow-water marine transgressive conditions. Apache Group conglomerates are undeformed, feldspathic, rich in sedimentary fragments, and laid down as a transgressive strand-line sequence. Heavy mineral accumulations are rich in specular hematite and most strongly concentrated at the base of the Mazatzal Group, principally in Deadman conglomerates.

Supplementing detailed geologic study of the conglomerates is a systematic analysis of major-element, trace-element, and uranium-geochemical data for over 300 rock samples. This analysis provides a relationship between scintillometer data and uranium content for different rock types and gives correlation coefficients between uranium and related metals in the heavy-mineral assemblage.

A radiometric variance plot of averages for the various conglomerate types shows that Apache Group conglomerates are Th-rich and too evolved, marine Mazatzal and Alder conglomerates are U-poor, whereas only high-energy fluvial environments in basal Deadman and Mazatzal conglomerates strongly concentrated uranium values. Thus the Mazatzal Group displays the unique association of uranium concentration with specular hematite, as well as marked areal variability in the trace element content of the heavy mineral concentrate depending on source area and position in the fluvial paleochannel network.

Reevaluation of accepted criteria for uranium concentration in Precambrian quartz-pebble conglomerates in light of new data on uranium-mineral stability under nonreducing conditions and new observations on major world deposits leads to the conclusion that the presence of a U-rich source terrain is singularly the most important factor in finding a conglomeratic uranium deposit.

Most Precambrian conglomerates of the world contain depositional environments and heavy mineral concentrates conducive to uranium concentration, but insufficient uranium is present in the source. The reason pyritic, carbonaceous siltstones in the Apache Group of central Arizona contain stratabound uranium deposits is that a nearby U-rich source of high K_2O rhyolitic volcanism was available during deposition of the siltstones.

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1.0 INTRODUCTION

During May and June 1979, Bendix Field Engineering Corporation, on behalf of the U.S. Department of Energy, offered for bids a subcontract to investigate the Precambrian conglomerates of the Central Arizona Arch for their uranium potential. On August 1, 1979, the subcontract was awarded to Wallaby Enterprises of Tucson, Arizona.

Wallaby Enterprises requested assistance from Phillip Anderson in the direction of the project because his extensive work on the Precambrian geology of Arizona for a Ph.D. dissertation at the University of Arizona had already prepared much of the necessary geologic groundwork, and inclusion of his data was deemed essential to the successful completion of the study.

1.1 Purpose

In response to a Congressional directive, the Department of Energy set out to evaluate uranium reserves within the United States, including known deposits and potential reserves in new deposits. In light of the fact that most of the world's uranium reserves lie only in certain geologic environments, it was logical to seek out these same environments in the United States and evaluate them first. One of these environments is the Precambrian quartz-pebble conglomerate setting, and its importance lies in the fact that two of the world's largest uranium deposits -- Witwatersrand, South Africa, and Blind River-Elliot Lake, Ontario, Canada -- formed in this setting. The environment is restricted in time mostly to the Early Proterozoic period in Earth's history between 2.5 and 2.0 b.y. ago.

Precambrian rock sequences of similar Proterozoic, but somewhat younger, ages are known in central Arizona to contain uranium deposits. These and older sequences also contain a great abundance and diversity of Precambrian conglomerates, most of which had not been studied in any great detail. This raised the possibility that a uranium-rich geologic environment similar to the ones in South Africa and Canada might be found in central Arizona, so the area was a natural target for detailed investigation.

The purpose of this study was to examine the Precambrian conglomerates of central Arizona in sufficient depth to determine whether they contain any obvious uranium concentrations and whether their geologic environment of deposition was permissive or prohibitive of conditions favoring uranium concentration. The former goal was accomplished by a systematic geologic study of the conglomerates in the field. The latter goal was attained by detailed analysis of geochemical results from the Precambrian conglomerates in central Arizona and by comparing their depositional environment with those of uranium-bearing Precambrian quartz-pebble conglomerates elsewhere in the world.

1.2 Scope

This project studied the geology and uranium potential of conglomerates found in three major, unconformity-bounded, Precambrian stratigraphic rock groups called the Alder Group, the Mazatzal Group, and the Apache Group. The Central Arizona Arch was a unique area in which to study all three stratigraphic assemblages, since 90 percent of Mazatzal Group, about 80 percent of important conglomerates in the Alder Group, and the thickest and most uranium-rich section of the Apache Group in the state all occurred in this one area. Because the only remaining exposure of Mazatzal Group in the state outside of the Central Arizona Arch area is near Chino Valley, just north of Prescott, we decided to briefly sample it also and include it as a comparative study area.

The region containing all important outcrops of Precambrian quartz-pebble conglomerates in central Arizona defines the Central Arizona Arch study area. This region involves mostly Gila County and small parts of Yavapai and Maricopa Counties north of Globe, south of Pine, east of the Verde River and west of Canyon Creek (fig. 1). The study area lies between lat. 38°28' and 34°28' N. and between long. 110°38' and 111°40' W. (Townships 2 to 11 north, Ranges 7 to 16 east) and involves a 95- by 100-km area (3,900 square miles).

For descriptive convenience the study area is subdivided into 10 subareas, as in figure 1. The southern Mazatzal Mountains and East Verde River areas contain mostly Alder Group rocks; the Mazatzal Wilderness and Pine Creek areas contain mostly Mazatzal Group rocks; the Christopher Mountain and Diamond Butte areas contain all three stratigraphic groups; the Sierra Ancha Mountains and Roosevelt Lake area contain Apache Group strata; and the Four Peaks-Hess Canyon areas contain quartzites of debatable origin. Elevations of the study areas range from 1,900 feet at Roosevelt Dam (Sonoran desert cactus) to 7,900 feet on Mazatzal Peak (Lodgepole-Ponderosa forest), with the majority of the areas studied at about 5,000 feet (Juniper woodland to desert shrubland).

The Central Arizona Arch Project commenced on August 3, 1979, and involved about four months each of field work and analytical-compilation work. Field time in mapping and sampling totaled 160 man days, but without helicopter assistance in sampling the Mazatzal Wilderness this time would have been doubled.

In excess of 450 samples were collected; of these, 300 rock samples and 33 water samples were analyzed for uranium and trace elements. The percentage of conglomerate varies greatly from one stratigraphic group to another and from one area to another because of exposure, so these variations controlled sample density. In the Mazatzal Wilderness and Pine Mountain areas, sample density was 6 per mi^2 (2.6 per km^2); in the Diamond Butte, Christopher Mountain, and southern Mazatzal Mountain areas, the density was 1.5 per mi^2 (0.6 per km^2), whereas in the Sierra Ancha Mountain and East Verde River areas, sample density was 0.5 per mi^2 (0.2 per km^2).

Road access to the Sierra Ancha Mountains, southern Mazatzal Mountains, and Roosevelt Lake area is relatively good, whereas to the Diamond Butte,

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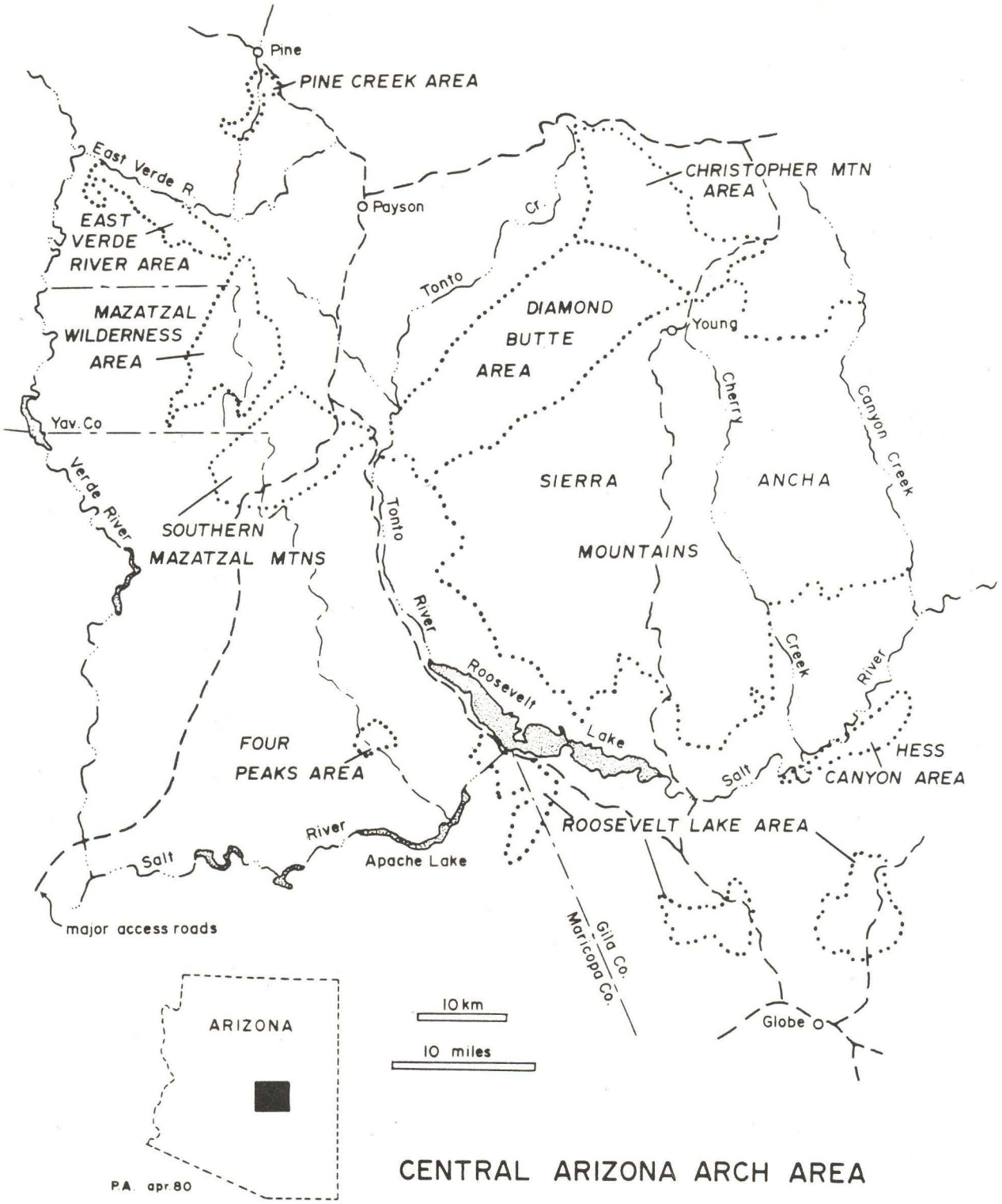
Figure 1: LOCATION MAP OF CENTRAL ARIZONA ARCH AREA



CENTRAL ARIZONA ARCH AREA

FIGURE 1

Christopher Mountain, Pine Creek, and Hess Canyon areas it is relatively poor. There is no vehicular access to the Mazatzal Wilderness, East Verde River, and Four Peaks areas, so all samples from these areas were collected on foot or with helicopter assistance.

The geologic scope of this study was influenced by Phillip Anderson's previous mapping of Mazatzal and Alder Groups throughout the Central Arizona Arch study area for a Ph.D. dissertation. From his work, a complete set of quadrangle maps showing two of the three stratigraphic groups of interest were available at the beginning of the project. Thus it was possible for us to undertake a much more intensive study just of the geologic, depositional-environment, and geochemical details of discrete conglomerate horizons than would be possible for us if the preliminary map data had had to be collected first. This report is a complete presentation of the geologic, geochemical, and environmental findings of the Central Arizona Arch study, specifically as they relate to the potential for uranium concentrations in Precambrian conglomerates. During the course of this study we also generated data concerning the genesis of known uranium deposits in the Sierra Ancha mountains, and our findings are presented in this report.

1.3 Methods

The Central Arizona Arch study progressed systematically from (1) an initial assembly of all previous information on the area to (2) the collection of geologic, scintillometer, spectrometer, and sample data from the field, (3) analysis of this new data, and (4) application of the results to expand upon previous geologic understanding of the region and to answer the geologic and economic questions posed by the investigation. Primary sources of new information were geologic field studies and analytical results of rock samples. The field studies involved three separate but concurrent tasks: (1) geologic mapping and rock sampling of conglomerates throughout the study area; (2) examination of representative uranium occurrences in the Sierra Ancha Mountains concurrent with sampling conglomerates in the Apache Group; and (3) water sampling of selected drainages.

Analytical results of rock samples included macroscopic and microscopic descriptions as well as geochemical analyses. Previous experience in the desert environment indicated that neither local soil nor stream-sediment samples would prove to be accurate uranium tracers. Details of the geologic and geochemical methods employed in this study are as follows.

1.3.1 Geologic

All Precambrian rock sequences known or likely to contain conglomerates were transferred from the 7.5 minute quadrangle maps of Phillip Anderson's previous work onto a new set of 7.5 minute quadrangles for field use. This data encompassed all major outcrops of Alder and Mazatzal Group rocks; the general distribution of Apache Group strata was transferred from existing state, county, and other maps.

Each major exposure was then investigated in the field for the presence of any conglomerate outcrops. If present, the conglomerates were mapped, described, and sampled. Geologic data gained from the major exposures included:

1. a description of the stratigraphic section, thickness measurements, and the distribution of conglomerate beds within the strata;

2. structure, including bedding attitudes, foliation, and folds;

3. character samples of the rocks typically found in the section, collected for later detailed analysis;

4. a record of sedimentary structures in the sequence pertinent to understanding its depositional environment.

Once a conglomerate unit most appropriate to the quartz-pebble conglomerate type had been found, it was:

1. described in detail noting thickness, continuity, or lensoidal character and typical sedimentary structures;

2. examined and measured for fragment types, sizes, and variations, relative proportions of fragments, fragment-to-matrix ratios, and a field estimate of the heavy-metal content;

3. sampled by collecting representative 1- to 3-pound-size rocks for character and thin section, and representative material for the geochemical-analysis sample;

4. photographed for important textures and sedimentary structures.

After character and thin-section samples were collected from the field, the character samples were described in detail by eye and with the aid of a hand lens. This information was combined with the field data for each sample site and recorded on a Site and Sample Description Form. At least one such form for each of the 300 sample sites can be found in appendix E.

A geologic unit code was devised so that at a glance it would provide rapid recognition of the sample's stratigraphic group, fragment size, finer material, and oxidation state of iron in its matrix. Explanation of this geologic code is found in appendix A.

Samples were sent to Western Petrographic, Tucson, Arizona, for preparation, usually into large 2" x 3" thin sections. The large size was necessary for any realistic representation of matrix and fragments in the coarse conglomerates. However, because of expensive cutting costs and relatively slow turnaround, not all samples were thin sectioned. A total of 137 rocks were selected for thin sections and analyzed as being representative of conglomerates in the study area. Analysis under the petrographic microscope involved detailed descriptions of matrix, fragments, heavy minerals, textures, and structures, as well as inferences about source terrains.

Binocular microscopic examination assisted in the identification of fragments not intersected in the thin section. The data for each thin section are recorded in a Thin Section Description Form which follows each respective Site and Sample Description Form in appendix E.

1.3.2 Geochemical

The first stage in investigating the uranium geochemistry of the Central Arizona Arch area was the compilation of all known uranium occurrences, because this essentially provides a geochemical map of known anomalous uranium concentrations. The next step was the use of a gross gamma-count scintillometer as an indirect tool to prospect for uranium concentrations. Either a Geometrics GR101A or a Mount Sopris SC 132 portable gamma-ray scintillometer was carried at all times by the field crews except for rare occasions when three people were separately working the same area and only two scintillometers were available. Some test readings of Apache Group conglomerates were taken with a Geometrics GR310 Spectrometer because high Th values were suspected in these rocks.

Continuous scintillometer profiles were made throughout the conglomerate-bearing stratigraphy whether or not conglomerates were present at all localities. Stable scintillometer readings were taken at least twice at every sample site and averaged. Every major Precambrian rock unit in the study region, whether siltstone, conglomerate, diabase, granite, rhyolite, or volcanic agglomerate, was repeatedly measured for scintillometer response so that an accurate radiometric characterization of every rock unit would be available for comparison to the analytical results.

In addition to the geologic information collected at each sample site: (a) a scintillometer reading was obtained and recorded, and (b) a sample was taken for geochemical analysis of a variety of rock chips, both matrix and fragments, representative of the conglomerate unit as a whole. Typically these samples comprised 10 to 20 fresh rock chips, the aggregate ranging from 5 to 15 pounds, but averaging about 7 to 8 pounds for all samples. This sampling of collective rock chips was done only to the extent that the chips which constituted a single sample were either:

(a) representative of the one conglomerate unit or single depositional environment;

(b) collectively representative of a series of conglomerate units of similar scintillometer values or similar depositional conditions; or

(c) an aggregate representation of a stratigraphic section in which there was no drastic variation in scintillometer response or depositional environment.

If there was a significant difference in scintillometer response between nearby conglomerate layers -- usually a 30 to 150 percent difference -- the radiometrically hotter of the two was invariably sampled. In areas where

(a) a drastic difference in scintillometer response (2 to 10 X) was noted between lithologically similar conglomerates, or (b) a distinct facies change in the depositional environment of the conglomerate (such as hematitic oxidized matrix to reduced sulfide-bearing matrix) was observed, invariably two separate samples were taken for geochemical analysis. In many places, such variations in the depositional environment were sought out along strike. These criteria are not applicable where epigenetic features such as later faults and sulfide-bearing veinlets cut the conglomerates.

Rigid adherence to these sampling rules was deemed necessary in order to be able to make detailed comparisons, in our final analysis, between the scintillometer values, the uranium geochemical results, and the depositional environment of the conglomerates. Such an analysis is certainly one of the major goals of our study.

1.4 Previous Work

Although this part of central Arizona was initially explored and opened up by pioneering gold miners who found Precambrian lode-gold near Payson in the late 1800s and early 1900s, geologic investigation of the Central Arizona Arch area was not forthcoming before the pioneering studies of E. D. Wilson (1922) and A. A. Stoyanow (1936). Geologic studies of the Precambrian rocks progressed little following these works, even after World War II, when uranium deposits in the Sierra Anchas were explored. The early 1970s saw several detailed geologic studies of small parts of the Central Arizona Arch region, but only in the last five years has there been any comprehensive study of the Precambrian geology of the whole region.

1.4.1 Geologic

The first two geologic studies directly pertinent to the Central Arizona Arch were those of Eldred D. Wilson (1922, 1939) and A. A. Stoyanow (1936, 1942). Stoyanow (1936) noticed a topographic high of nondeposition during the Paleozoic which must have existed from Precambrian time. This he called "Mazatzal Land" from Wilson's (1922) earlier study of Mazatzal quartzite (Stoyanow, 1942). This is the work from which the concept of a Central Arizona "Arch," or positive area, originated. The results of our study clearly confirm the presence of a long-lived positive area in Central Arizona.

Wilson (1939) was the first to map and try to piece together older Precambrian stratigraphy of Arizona, and his original studies still remain the most accurate statement about the Mazatzal Group until publication of P. Anderson's detailed geologic mapping of Precambrian rocks in Central Arizona. Wilson (1939) defined the Alder Group as those volcanic and sedimentary rocks lying stratigraphically under Red Rock rhyolite and also under the major unconformity at the base of the Mazatzal-Deadman quartzites. He subdivided Mazatzal-type quartzites into three distinct sequences: (1) basal Deadman quartzite and conglomerate; (2) intervening Maverick Shale; and (3) upper Mazatzal quartzite. Anderson (in prep.) has redefined this

whole sequence as the Mazatzal Group, consisting of Deadman Formation, Maverick Formation, and Mazatzal Peak Formation, while essentially retaining all of Wilson's original divisions.

Gastil (1954, 1958) attempted to revise Wilson's work so as to generate a unified stratigraphic subdivision scheme for the entire Precambrian of Arizona. His mapping of the Diamond Butte area provided detailed stratigraphy in the Alder Group, but his overall goal was not attained because of incorrect correlations and too small a study area.

In 1959, Wilson's mapping was adapted into the Gila county geologic map (Wilson, Moore and Pierce, 1959). Later, Shride (1967) mapped the Apache Group in the Sierra Ancha Mountains and produced the first major work on the younger Precambrian stratigraphy in the Central Arizona Arch area. Livingston studied the Hess Canyon area in order to resolve age relationships among the older Precambrian rocks south of Roosevelt Lake (Livingston, 1969; Livingston and Damon, 1968). Finally, Wilson's work was once again revised and incorporated into the state geologic map of Arizona (Wilson, Moore and Cooper, 1969).

Two more recent geologic and geochronologic studies of small parts of the Central Arizona Arch area are by Ludwig (1974), who remapped the Slate Creek Divide area of the southern Mazatzal Mountains that Wilson (1939) had previously studied, and Conway (1976), who mapped the internal structure of the Tonto River felsic-volcanic complex, overlapping with Gastil's (1958) area and work. Lee Silver provided geologic control on the age of the "Mazatzal Revolution" (Silver, 1964), on the Sierra Ancha diabase (Smith and Silver, 1975), and on the felsic volcanics lying between the Alder and Mazatzal groups (Ludwig and Silver, 1973; Conway, 1976).

P. Anderson extensively mapped all the older Precambrian rocks throughout the Central Arizona Arch area between 1975 and 1979 and indicated the stratigraphic, chemical, and tectonic characteristics of their Precambrian "island arc" setting (Anderson, 1976, 1977, 1978; Anderson and Guilbert, 1979). His comprehensive geologic mapping, geochemistry, and regional synthesis is currently in preparation. Other studies indirectly related to the Precambrian geology of the Central Arizona Arch area are by Titley (1962), Martinsen (1975), and Mayer (1979). Wilson (1939) and Krieger (1965) studied the Mazatzal exposures in Chino Valley north of Prescott, also mentioned here.

Concurrent with our Central Arizona Arch uranium study, the U.S. Geological Survey was undertaking reconnaissance (1:48,000) geologic mapping of Apache Group rocks in the central and Southern Sierra Ancha Mountains. Their map was only available to us at the end of our sampling program, but because it is of greater detail than our reconnaissance study of Apache Group in the Sierra Anchas, we have deferred to their mapping in this area. Thus, the geologic data for the central and southern Sierra Anchas shown on the 1:125,000 scale maps (figs. 2 and 3) is adapted from the preliminary maps of Bergquist, Shride, and Wrucke (in prep.).

1.4.2 Economic

Uranium deposits were discovered between 1950 and 1954 in the Dripping Spring siltstone of the Apache Group throughout the Sierra Ancha Mountains. The U.S. Atomic Energy Commission and the U.S. Geological Survey investigated the region and produced a series of "PRRs" -- preliminary reconnaissance reports -- on radioactive prospects (Schwartz, 1957; Williams, 1957; U.S. Atomic Energy Commission, 1970). Since the U.S. Geological Survey's detailed investigation into the genesis of the uranium mineralization (Granger and Raup, 1962, 1969; Neuerburg and Granger, 1960), there has been no major study of the source and origin of the uranium mineralization. Wyoming Mineral Corporation is the exploration company that has been most actively evaluating the uranium potential of the region in recent years.

Granger and Raup (1962, 1969) concluded that the uranium mineralization was introduced by the diabase bodies that intruded the Apache Group and was localized in the favorable reducing Dripping Spring-siltstone host by reactions at diabase contacts. They indicated that this was their working genetic model from the beginning and that they set up elaborate geochemical tests to prove that the diabase was the uranium source:

> The geological characteristics of the diabase intrusives, their wall rocks and the associated uranium deposits led to an hypothetical petrologic model of the physical and chemical events beginning with magma and ending in ore deposits; this model guided sampling, and interpretation of the geochemical data (Neuerburg and Granger, 1960, p. 760).

Although they repeatedly observed the very tight stratigraphic confinement of the uranium mineralization to a single, unusually K-rich horizon in the Dripping Spring siltstone, Granger and Raup (1969) still maintained that the diabase was the uranium source because the richest vein mineralization always occurred at or near diabase contacts. Apparently these workers were not aware that the K-rich unit in the Dripping Spring siltstone is anomalously rich in uranium throughout the central Sierra Ancha Mountains, regardless of the presence or absence of diabase.

In this report we provide geologic and geochemical data to shed new light on the origin of the uranium mineralization in the Dripping Spring siltstone, and our conclusions differ substantially from those of Granger and Raup. Although the genesis of uranium in the siltstones is not directly pertinent to evaluation of quartz-pebble conglomerates in the Central Arizona Arch area, the depositional environment it represents, and the probable source of the uranium in this environment, is of paramount importance in understanding environmental controls on uranium fixation.

A complete and thorough compilation of all available data on mineral commodities and mining or prospect localities for all mining districts in the Central Arizona Arch study area was undertaken as an initial phase of our investigation. Principal sources of mineral deposit data were:

1. the Arizona Department of Mineral Resources, Phoenix office files of Gila, Maricopa, and Yavapai counties for the localities of base and precious metal, plus non-metallics;

2. Preliminary Reconnaissance Reports of the U.S. Atomic Energy Commission and U.S. Geological Survey (1970) for the uranium mines and prospects.

In addition many unpublished reports, notes on mineral commodities in various publications, and the records of several journals and newspapers were amalgamated to make the "Mining-District Data-Base Files" of Wallaby Enterprises. The essence of this information is shown as mineral occurrences in figure 2.

The absence of mineral commodities next to any mine indicated on the map means in most cases that there was no written record of the mine's production. The mineral commodities, listed as elements for convenience, are shown in decreasing order of economic importance of the metals at the time of mining. Without discussing the details of non-uranium metal deposits in the Central Arizona Arch area, the geochemical distribution of metals can clearly be seen from this map. In addition to PRR files, Granger and Raup (1969) served as a guide to the distribution of uranium prospects in the Sierra Ancha Mountains.

2.0 GEOLOGIC FRAMEWORK OF CONGLOMERATES

All Precambrian conglomerates in the Central Arizona Arch area were deposited in two relatively brief geologic intervals from 1750 to 1700 m.y. ago and from 1350 to 1250 m.y. ago.* A major event of plutonism, orogeny, uplift, and erosion separates the two time periods. This event has been referred to as the Mazatzal orogeny (Wilson, 1939), the exact timing of which has been debated (Silver, 1964; Livingston and Damon, 1968), but which in Wilson's original definition is really a multiplicity of events (Anderson, in prep.). Conglomerate-bearing sequences that predate the Mazatzal orogeny are therefore gently to severely deformed, whereas those that postdate it are essentially flat-lying and undeformed. The time plane separating the two tectonic assemblages is the "Great Unconformity" of continental proportions (Anderson, 1976).

2.1 General Setting

Conglomerates in the Central Arizona Arch are contained within one of three broad stratigraphic groups. The oldest is the Alder Group, originally termed Alder Series by Wilson (1939) for exposures in the Southern Mazatzal Mountains near Slate Creek divide. It is now known to be 1720 m.y. old or possibly older (Ludwig, 1974), and some parts of it in the Tonto Creek-Diamond Butte area may well be 1730 to 1740 m.y. old (Anderson, in prep.). The tectonic setting of the early parts of the Alder Group was a deep-water submarine volcanic chain or island arc of basaltic-andesite composition (Anderson, 1977), but later in its history it evolved into a shallower water island arc of dominantly dacitic to rhyolitic composition, whence it progressed to a subaerial condition.

The Mazatzal Group was deposited in a similar setting about 1700 m.y. ago when the Alder-Group volcanic chain was shallowly submerged once again. The specific depositional environment of Mazatzal Group conglomerates and quartzites was not well known before the Central Arizona Arch study, and we consider our new understanding of this environment one of the most significant outcomes of this study. The Mazatzal Group is post-tectonic to the extent that a significant amount of deformation in the Alder Group predated its deposition, syntectonic to the extent that the Mazatzal Group was derived directly from uplift and erosion of the underlying volcanic and sedimentary material, such as is typically found in a cannibalistic successor-basin assemblage, but distinctly pre-orogenic to the extent that the two main folding events of the "Mazatzal Orogeny" have affected it (Anderson, in prep.)

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* All such dates in this report are referenced to Uranium-Lead dating of zircons using decay constants used at the time of publication (1964-1976). Newly accepted constants (post-1978) would revise these numbers to ages younger by about three to four percent (e.g., 1720 m.y. is revised to 1670 m.y.).

The pre- to syn-orogenic tectonic settings of the Alder and Mazatzal Groups contrast markedly to that of the Apache Group, which was entirely post-orogenic. All the major Precambrian deformation, plutonism, orogeny, uplift, and erosion resulted in stabilization and peneplanation of the earlier terrains such that the Apache Group was deposited in an intracratonic setting on stable Precambrian continental crust (Anderson, 1976). As with the Mazatzal Group, a generally shallow-water condition prevailed throughout its deposition. Age of the Apache Group is bracketed as younger than the 1400 m.y.-old plutons intruding Precambrian crust before uplift and erosion, and older than 1250 m.y.-old diabase that cut Apache strata (Smith and Silver, 1975; Livingston and Damon, 1968; Shride, 1967); thus it is estimated at between 1300 and 1250 m.y. old (Anderson, in prep.).

For the purposes of this report, the geology of the Central Arizona Arch area is best described in two ways: first, from a broad perspective of where favorable conglomerate units lie within each stratigraphic group; and second, from a closer geologic view of each subarea within the Central Arizona Arch, noting how conglomerate horizons relate in detail to their surrounding stratigraphy in each subarea. This geologic discussion of the Central Arizona Arch region is totally slanted toward the conglomerate occurrences to the exclusion, or at best brief mention, of other geologic features in the area which are not directly pertinent to the Precambrian pebble-conglomerate problem. P. Anderson's dissertation (in prep.) thoroughly treats all these other geologic aspects of the region, so this discussion is complementary to that work in the sense of being oriented towards conglomerates.

2.2 Alder Group

The earliest rocks in the Central Arizona Arch area are mafic to intermediate volcanic and pyroclastic rocks formed 1740 m.y. ago in an island arc setting. Neither was there Archean basement present south of the edge of the Wyoming craton in northern Colorado and Utah, nor was there an earlier Proterozoic granitoid basement to these volcanic island arcs (Anderson, 1976, 1978; Anderson and Guilbert, 1979). Clastic sediments shed off the edge of the Wyoming Archean craton are abundant in the Grand Canyon area, which is also without early granitoid basement, but these sediments did not reach as far south as central Arizona. Thus all early clastic rocks in the Central Arizona Arch area are of direct volcanic derivation (Anderson, 1978).

Conglomerates are found principally on the flanks of volcanic centers as thick volcaniclastic wedges, and in distal basins interlayered with finer grained tuffaceous sediments. As the volcanic centers evolved from basaltic andesite through dacite to rhyolite, so the volcaniclastic deposits progressively increased in abundance, diversity, and maturity. Thus most of the early conglomerates were made up entirely of dacitic to andesitic volcanic fragments in a crystal or lithic-crystal tuff matrix of intermediate composition. Rhyolitic compositions richer in quartz dominated the later volcanic conglomerates.

After the climax of dacitic-rhyolitic volcanism, but <u>before</u> the major culmination of subaerial rhyolitic ignimbrite activity in the Central Arizona Arch, shallow sedimentary basins fed from highlands by fluvial

conglomerate channels were developed throughout the region of Alder Group's deposition. Purple shale, siltstone, felsic tuffs, and quartz wackes were deposited in these intermediate- to shallow-water basins, whereas quartz-rich sandstones and conglomerates were deposited in the fluvial channels. The quartz-jasper-volcanic rock fragment conglomerates found in this part of the Alder Group are distinctly younger than the volcanic conglomerates described earlier, and contain a much greater abundance of clastic detrital material. They are therefore distinguished from the volcanic conglomerates in the Alder Group by their more clastic "sedimentary" appearance. The relative stratigraphic positions of the two conglomerate types are diagrammatically shown in figure 7.

Both types of conglomerates were sampled in this study. Obviously the quartz-jasper-volcanic rock fragment conglomerates (or Alder "sedimentary" conglomerates) much more closely approach the quartz-pebble conglomerate lithotype, but it was considered important that some volcanic conglomerates be sampled to determine whether the early volcanic environment was comparatively rich or poor in uranium. The volcanic conglomerates sampled vary from feldspar-rich dacitic agglomerates and conglomerates to rhyolitic breccias and conglomerates. An important variant, particularly in the Hess Canyon and East Verde River areas, is a finer grained angular conglomerate of diverse dacite, chert, tuff, chalcedony, and jasper fragments in a poorly sorted lithic-crystal dacite-tuff matrix. As these deposits lay distant from the main volcanic centers, they were probably deeper water volcanic mud flows.

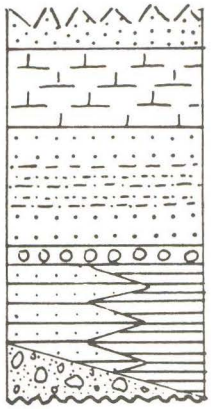
Although a wide variety of lithologically diverse "sedimentary" conglomerates were sampled from the Alder Group, nearly all are characterized by the presence of quartz and jasper pebbles. These Alder conglomerates typically have an impure, sandy-brown to dirty (quartz-wacke as opposed to quartz-arenite) matrix. These features, together with the ever-present moderate to strong foliation throughout the matrix, sheared appearance, and fragment elongation, distinguish these Alder conglomerates from any in the Mazatzal and Apache Groups. Quartzites and grit in the Alder Group are wackes rich in volcanic fragments and are thus distinctive lithologically from purer quartz-rich grits of the Mazatzal Group.

Alder conglomerates generally have undergone at least one strong deformational event, which affected them less than adjacent incompetent strata but served to draw their outcrops into long northeast-trending folds, shear their matrices, and flatten their fragments. Metamorphic grade is generally low enough that volatile elements (K, U) have not been significantly remobilized.

2.3 Mazatzal Group

Overlying the Alder Group, in sequence, is a thick but laterally variable assemblage of rhyolitic ignimbrites, a regional angular unconformity, and then the Mazatzal Group (fig. 7). One of the most important features of the Mazatzal Group is its non-volcanic depositional setting. That is, there was no contemporaneous volcanism contributing volcanic fragments directly into the depositional site, and all of the rhyolitic fragments at the base of

Figure 7: SIMPLIFIED STRATIGRAPHIC COLUMNS OF CONGLOMERATE-BEARING PRECAMBRIAN ROCK GROUPS IN THE CENTRAL ARIZONA ARCH



Troy quartzite

Mescal limestone (30-70m)

Dripping Spring Formation (30-200m)

Barnes conglomerate (0-20m)

Pioneer Formation (0-80m)

Scanlan conglomerate (10-100m)

APACHE GROUP
(1350-1250 m.y.)
T = 1 km or less

MAZATZAL GROUP
(1710-1650 m.y.)
T = 1 km or more

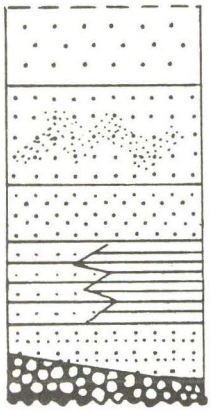
white Mazatzal quartzite (30-200m)

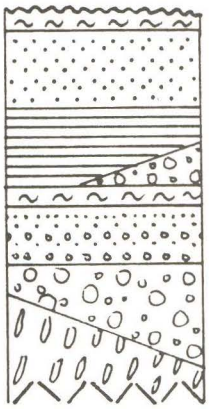
maroon Mazatzal quartzite (100-250m)

red Mazatzal quartzite (20-80m)

Maverick shale-siltstone (0-100m)

Deadman quartzite and conglomerate (0-250m)





Red Rock rhyolite

Reef Ridge quartzites and conglomerate

purple slates

rhyolitic conglomerate

rhyolitic tuff

quartzite & conglomerate

rhyolitic conglomerate

dacitic agglomerate

ALDER GROUP
(1740-1720 m.y.)
T = highly variable

unconformity section broken ---- top not seen

the Mazatzal Group were derived by erosion of the subjacent felsic volcanic terrain. The great volume of conglomerate in the Mazatzal Group is in accord with sedimentary structures indicating that shallow-water marine or fluvial conditions persisted throughout most of its deposition.

Conglomerates in the Mazatzal Group are characteristically stained brick red to deep maroon to reddish black from their ever-present hematite, specularite, or both.* Mazatzal conglomerates usually contain abundant white quartz pebbles, chert, bright red jasper, blackish banded-iron-formation pebbles, and red rhyolite pebbles, but the proportions vary from unit to unit. The matrix is usually quartz rich and grains are interlocking, giving a hard, indurated character to the rock. The matrix consists typically of sand- to grit-sized, well-sorted quartz, chert, and jasper as well as other grains found as fragments, and is relatively pure and clean, with little or no interstitial clay. Instead, interstitial hematite is always present, often along with accessory detrital specularite, zircon, and leucoxene.

The diagnostic red to maroon to black color, the hard siliceous character, and the relatively clean, well-sorted, quartz-rich nature of a Mazatzal conglomerate at once distinguish it from Alder and Apache Group conglomerates. Similarly, the abundant quartz-jasper fragments, hematitic stain, and siliceous, well-indurated nature of Mazatzal conglomerates at once distinguish them from Apache Group conglomerates. In fact, Mazatzal conglomerates are so markedly different from those in the Alder and Apache Groups that is is difficult to see how earlier workers (e.g., Gastil, 1954, 1958; Conway, 1976) could have confused them had they studied the Mazatzal Group. In fact, Mazatzal conglomerates are so distinctive that no other conglomerates in the Precambrian of Arizona resemble them (Anderson, in prep.).

Because the lithology of Mazatzal Group rocks is so uniform, it is not always easy to differentiate between different parts of the Group; often one needs a knowledge of stratigraphic position via marker units. In the Mazatzal Wilderness, the distinctive Maverick shale separates basal Deadman conglomerates and quartzites from overlying Mazatzal Peak quartzites and conglomerates. In northern areas where the Maverick or its equivalent is absent and a basal conglomerate is immediately overlain by Mazatzal quartzite, it is not always clear whether the basal conglomerate is a true Deadman correlative or was developed in post-Maverick time.

Except for these northern areas, Deadman conglomerates are almost always distinguishable by their dark reddish brown or black color, which is caused by abundant specularite or hematite. Typically the conglomerates are packed with large elongate red rhyolite and hematitic-claystone fragments which are of volcanic and intra-formational derivations. In places these fragments are flattened and elongated by the deformation that has more noticeably affected Deadman than Mazatzal Peak conglomerates. Detrital specularite is a ubiquitous component of Deadman rocks, with some units containing up to

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* "Specularite" in this report refers to crystalline (as opposed to earthy) hematite or "specular" hematite. It can be either blue-grey metallic or black in color and can occur with or without the red powdery hematite.

50 percent well-bedded detrital specularite. Proportions of conglomerate and quartzite are highly variable in the Deadman, from places of only dark reddish-brown and black fine-grained quartzite to places of only boulder and cobble conglomerate; if both are present, the conglomerate is the older and usually the more hematitic because specularite is most strongly concentrated at the base of the sequence.

A great variety of Deadman conglomerates were sampled, ranging from the very coarse basal conglomerates packed with red rhyolite boulders through hematitic rhyolite-quartz granule conglomerates, to grit and quartzite laden with heavy-mineral concentrations. The purpose of the sampling was to see what type of geochemical or microscopic geologic signature might correlate to the anomalously high radioactivity of the Deadman units.

Maverick shale is present only in the Mazatzal Wilderness area, where it was first described and named by Wilson (1922, 1939). Unknown to Wilson was a major repetition of the Mazatzal Group in the Sheep Basin Mountain area (southern Diamond Butte area of fig. 1) due east of the Mazatzal Mountains. P. Anderson recognized the threefold division of the Mazatzal Group in this area in 1975, but noted that a coarser grained, more oxidized hematitic facies of the Maverick was found here. Red argillaceous siltstones and quartzites lie in the same stratigraphic position as the Maverick shale and are thus a different facies of the Maverick unit, but the lithologic contrast between Maverick and these quartzites is so great that they were first called Coffeepot quartzites by P. Anderson during his 1977 mapping (P. Anderson, in prep.).

The normal lithology of the Maverick shale in the Mazatzal Wilderness area is a sickly greenish yellow (poupon yellow), thinly laminated, very thinly bedded shale with local siltstone and quartzite. The greenish yellow color is due to montmorillonitic or chloritic material plus pyrite throughout the matrix. Though the shale facies are pyritic throughout, the coarser grained quartzites and conglomerates almost never are, so a pyritic conglomerate was not found in this formation. The conglomerates that occur in the Maverick are usually thin (less than 1 m) and fine-grained, but are always distinctive in their green matrix coloration despite the abundance of red jasper, quartz, and chert fragments. Because of the general lack of conglomerates in the Maverick, it was only incidentally sampled for geochemical comparison to the other conglomerate types.

Following Wilson's (1939) original usage, the term "Mazatzal quartzites and conglomerates" is used to describe all upper stratigraphic units within the Mazatzal Group that are not recognizably either of Deadman or Maverick affinity. The type area for these rocks is Mazatzal Peak in the Mazatzal Wilderness area, hence the strict stratigraphic assignment of these rocks to the Mazatzal Peak Formation has been suggested (Anderson, in prep.). Mazatzal quartzites and conglomerates are generally interlayered with one another in cyclically repetitive units in an overall upward fining stratigraphic sequence.

They are characterized and distinguished from all other conglomerates in the Central Arizona Arch area by:

1. a pervasive brick red to maroon hematite stain throughout the matrix;

2. a fragment assemblage, almost exclusively, of bright red jasper, white quartz, and red to pink chert;

3. a completely seriate grain size population, abundant cross bedding, and specularite concentrations on cross beds; and

4. a very clean, well-sorted, hard, indurated siliceous matrix with little argillaceous material.

Large fractured milky quartz pebbles and large jasper fragments are also diagnostic of Mazatzal conglomerates. Their siliceous nature and other criteria permit Mazatzal conglomerates to be recognized at high metamorphic grades even though the red color disappears when hematite is converted to specularite.

Mazatzal conglomerates vary significantly in grain size, abundance of heavy minerals, and in the diversity of some fragment types, but the main characteristics remained uniform in nearly all samples. Significant variants were found (a) as coarse rhyolite-boulder conglomerates in the Pine Creek area which may be Deadman correlatives and (b) in the white grit and granule conglomerate layers in the uppermost strata of the Mazatzal Wilderness. The relative purity and whiteness (lack of hematite) of these uppermost strata define an important variant of the Mazatzal quartzites and conglomerates useful in understanding regional facies changes of the unit and in dealing with problematic quartzite sequences further south. Such sequences are found in the Hess Canyon and Four Peaks areas, where pure white quartzites are correlated with the Mazatzal by Livingston (1969), Livingston and Damon (1968), and Wilson, Moore and Cooper (1969), yet bear no resemblance to the Mazatzal quartzites in any of the essential features, except that both are quartzites. This problem is addressed in this report and in more detail by Anderson (in prep.).

Strata of the Mazatzal Group vary from intensely to very weakly deformed, even though the sequence is regionally cross-folded by two phases of folding (Anderson, in prep.). Deadman quartzites and conglomerates are the most strongly folded and tectonically disrupted. Where Maverick shale is present it has pervasively crenulated like an accordion to take up strain so that the overlying, more competent Mazatzal quartzite did not have to fold tightly in most places. Instead, the Mazatzal broke up into a series of reversely faulted slices and thrust plates to accommodate the general crustal shortening during deformation. In the Precambrian of Arizona, the rule is that strain is highly variable and heterogeneously distributed through all volcanic belts (Anderson, 1977; Anderson and Guilbert, 1979), so in areas of high strain (e.g., Gun Creek) even the Mazatzal conglomerates are highly flattened and elongate.

2.4 Apache Group

Compared to the Mazatzal and Alder Groups, the Apache Group has been relatively well studied because its strata are essentially flat lying, undeformed and more straightforward than the older Precambrian rocks in central Arizona. A reasonably thorough treatment of Apache Group stratigraphy is available (Shride, 1967), so the units are noted only briefly here as they pertain to conglomerates in the section. Because relatively thorough mapping of the Apache Group in the Sierra Ancha Mountains has been undertaken by Bergquist, Shride, and Wrucke (in prep.), we attempted no major mapping revisions of the Group in this study. During our work, however, we made some very interesting discoveries which are directly pertinent to facies changes within the Apache Group, as well as to the source and localization of uranium mineralization in the Dripping Spring Formation. These findings are discussed in the latter parts of this report.

Tectonically, the Apache Group is a shallow-water, clastic-carbonate assemblage deposited in a stable cratonic setting (Anderson, 1976). The lower part is almost entirely impure, poorly sorted conglomerate, sandstone, siltstone, and shale, whereas the upper part is dominantly limestones and pure, mature sandstones and quartzites. Consistent with other typically stable cratonic settings throughout the world, the Group contains swarms of diabase dikes and sills.

After regional peneplanation of the older Precambrian rocks in Arizona, the first unit of the Apache Group to be deposited was the Scanlan conglomerate. This is a basal conglomerate of locally derived, resistant rocks such as the Mazatzal quartzites, but in some places the matrix also contains significant amounts of feldspathic detritus derived from the Young granite and Ruin porphyritic quartz monzonite, where the Scanlan locally rests upon the granites.

Overlying the Scanlan conglomerates is a purple to red hematitic fine-grained unit, the Pioneer shale, and then a distinctive round-pebble, sandy-matrix conglomerate called the Barnes (fig. 7). Shride (1967) recognized that all of these units are not found very far north of the Young area, but he was uncertain whether this was a primary lap out of strata akin to Stoyanow's (1942) lap out of the Paleozoics on an ancestral "Mazatzal Land" high, or was due to latest Precambrian erosion.

The next higher unit is the Dripping Spring Formation, which consists of a lower sandstone and conglomerate, and an upper siltstone member in which the Sierra Ancha uranium deposits are found. Conglomerates in the lower strata are distinctive in their sandy brown quartz and orange to pink feldspathic matrix and their diverse fragment assemblage. An important suite of orange, felsic volcanic fragments occurs within the Dripping Spring conglomerates at some localities. The significance of these fragments as well as the pink tuffaceous laminations found throughout the uranium-bearing siltstones of the upper Dripping Spring are discussed later.

The upper Apache Group strata consist of the Mescal limestone and the overlying Troy sandstone and quartzite. The Mescal unit is of some interest to this study because chert and limestone breccias and conglomerates within it have high radiometric values and were sampled to determine the cause. The Troy quartzite is of little interest because of its high stratigraphic position and paucity of conglomerate.

In southern Arizona, it is customary to include Barnes conglomerate in the Dripping Spring Formation (Stanley B. Keith, pers. commun.). In the Sierra Ancha area of central Arizona, this is neither warranted nor desirable. The lithologic and depositional-environment characteristics of the many conglomerates in the Dripping Spring unit of central Arizona are all very similar but are in marked contrast to those of the Barnes conglomerate. From our conglomerate-oriented viewpoint the Barnes is therefore treated separately from Dripping Spring conglomerates even though a grouping of the two may be preferable elsewhere for stratigraphic reasons.

3.0 GEOLOGY OF THE CENTRAL ARIZONA ARCH

In this section, the detailed geologic setting of the conglomerates sampled in this study will be described. The conglomerates were taken from Alder, Mazatzal, and Apache Group rocks exposed in ten subareas within the main Central Arizona Arch study area and from one place, Chino Valley, outside the main study area. Characteristics of the individual conglomerate units, their abundance and position in the stratigraphic section, their correlations, ages, and depositional settings are all considered here.

For ease of sample identification by area, each site number includes a prefix identifying the subarea where it was taken. "P" was used for the Pine Creek area, "C" for the Christopher Mountain area, "D" for the Diamond Butte area, "M" for the southern Mazatzal Mountains, Mazatzal Wilderness, and East Verde River areas, "S" for the Sierra Ancha Mountain and Roosevelt Lake areas, "H" for Hess Canyon, "F" for Four Peaks, and "B" for Chino Valley. Numbers after the prefixes were assigned by the order in which the samples were taken, with an "A" or "B" suffix indicating different samples from the same site.

Because of the multiplicity of different rock types in most subareas, a geologic unit code was devised so that the map reader can see at a glance exactly what type of conglomerate was taken at each sample site and to which stratigraphic group it belongs. The letter prefix of the four-symbol code denotes the particular conglomerate in each group that was sampled, the first digit indicates the oxidation state of the conglomerate (e.g., whether hematitic or pyritic), the second digit signifies whether any material finer than conglomerate was included in the sample, and the final digit shows the grain size of the conglomerate, with increasing numbers indicating increasing size of fragments. Thus, on the geochemical sample maps (figs. 4 and 6), instant visual correlation is provided between any or all of the following: (a) sample location, (b) stratigraphic type of conglomerate, (c) radiometric value, (d) uranium geochemical value, (3) oxidation state, and (f) fragment size.

Our size classification of fragments is an adaptation of the phi-scale or Wentworth scheme (e.g., Folk, 1968). Because fine-pebble conglomerates and very coarse-grained quartzites are abundant in the area, a more detailed classification of conglomerates in this size range was warranted. In our scheme, the broad "pebble" size range is broken down into "pebble" and "granule," whereas the English term "grit" has been used to describe rocks just coarser grained than quartzites, because of their abundance in the Central Arizona area. Thus our pebble and granule conglomerates would all be called pebble conglomerates by the Wentworth scheme, and our grit would be called granule conglomerate. A full explanation of the geologic unit code system and the size classifications used in this study can be found in appendices A and B.

The subareas which follow are discussed in a generally north to south sequence. This is approximately the order in which the areas were sampled, for logistical reasons, and coincides with a general north-to-south fining of many of the conglomerate units. Mazatzal Group is found dominantly in the north of the Central Arizona Arch area, so it is treated first. Alder Group is found mainly in the central regions and Apache Group in the southern areas, so these units are considered later. All following geologic descriptions of each subarea are brief and in summary form for the purpose of describing broad correlations and regional trends in the rock sequences. This is deliberately done in order to complement the detailed site-by-site rock descriptions on the Site and Sample Description and Thin Section Description Forms in appendix E, wherein a large part of the geological information in this report lies. Sample numbers (e.g., P 12) are inserted at various places in the text to allow the reader to correlate the overview in the text with the detailed geology of each particular sample site.

We have prepared geologic maps of the Central Arizona Arch area at 1:125,000 (fig. 3) and of the Mazatzal Wilderness area at 1:24,000 (fig. 5) to accompany the geologic discussion in the text. The map data is derived mostly from earlier mapping by P. Anderson, some from our mapping during this study, and some for part of the Apache Group from previous and U.S. Geological Survey mapping. At these map scales the individual conglomerate units that we sampled are too small to be shown separately. Even the Scanlan, Barnes, and Dripping Spring conglomerates are too thin to be shown separately on figure 3. The units shown on these maps, therefore, are those known to contain conglomerates, not just the conglomerates themselves. Other Precambrian units not known to contain conglomerates have been omitted from the maps.

3.1 Pine Creek Area

On the Buckhead Mesa quadrangle south of the town of Pine, there are large exposures of the Mazatzal Group found in the drainages of Pine Creek. This area has been studied in detail by Wilson (1939), Anderson (in prep.), and the present study, briefly by Mayer (1979), and it is mentioned by Conway (1976). Mazatzal quartzites and conglomerates are exposed here principally in two areas:

1. a southern area extending from Natural Bridge south down Pine Creek into its western tributaries;

2. a northern area extending from near Highway 87 west through the narrows of Pine Creek to just south of Pine.

At the southeastern edge of both areas, the Mazatzal rests unconformably on a red quartz-feldspar porphyritic rhyolite body that is a continuation of the eastern part of the Verde Batholith (Anderson, in prep.).

Wilson (1939) measured a stratigraphic section in the southern part of the southern exposure and arrived at a stratigraphic thickness of about 1,200 m. In this area, we obtained the same thickness by measuring the outcrop width and multiplying by the cosine of the average dip (50°W). Similar calculations on the northern exposure, which appears to be much thicker than the southern one, indicate an apparent stratigraphic thickness of 3,000 m. Clearly, these figures are a gross overestimation of the true thickness of Mazatzal rocks in the Pine Creek area, Wilson's appearing more reasonable only because he measured a less complete section. As is evident from the descriptions of Mazatzal quartzite in the Mazatzal Wilderness, shallowly dipping reverse and thrust faults ubiquitously repeat stratigraphy, and similar but less obvious faults are found in the Pine Creek section. All published stratigraphic thickness of the Mazatzal Group must therefore be viewed skeptically. This is especially true where the Deadman unit is tectonically thinned, Maverick thickened by accordion folding, and Mazatzal thickened by repeated thrusting, as is the case in the Wilderness.

At the base of the Mazatzal sequence in Pine Creek, resting directly on red rhyolite, is a huge coarse-boulder conglomerate of felsic volcanic and plutonic rock fragments in a hematitic matrix (P 9). This characteristic red boulder conglomerate is 15 to 20 m thick just above Natural Bridge in Pine Creek, but southward it thickens significantly to over 100 m at the southern end of outcrop in Pine Creek (P 7, P 8). Typically, the coarse-fragment conglomerate contains rounded, spherical, 30 to 50 cm boulders of aphanitic red and purple rhyolite, andesite tuff and distinctive boulders of coarse-grained Payson granite. No boulders of the immediately underlying spherulitic rhyolites, or of Verde Batholith-type red rhyolite were found. The conglomerate matrix is hematitic grit- and granule-size material similar to the fragments.

Overlying the basal boulder conglomerate is 50 to 100 m of pebble conglomerate, granule conglomerate, and grit in an upward-fining sequence. Many of these conglomerates are poorly sorted and contain little or no red jasper

(P 5, P 6), but better cementing, more jasper, and matrix quartz are noted up section (P 1). The thickness of these upper pebble conglomerate to grit units appears also to be greater in the southern part of the exposure.

A spherulitic red rhyolite sill, almost identical in character to the rhyolites underlying the Mazatzal at site P 9, intrudes the Mazatzal quartzites and conglomerates about 100 m up section. This one sill is continuous throughout the Pine Creek section from north to south (P 3, P 1, P 5, P 7). It intrudes at a stratigraphic level that conveniently separates lower brick red conglomerate-bearing strata from upper, pale maroon, evenly bedded, medium-grained quartzites containing little or no conglomerate. This fortuitous position at a stratigraphic hiatus in the Mazatzal sequence suggests that the sill could possibly be a flow, but present evidence favors a sill (Anderson, in prep.).

In the northern exposures of Mazatzal quartzite just south of Pine there is no conglomeratic material coarser than fine pebbles. At the base of the section, on rhyolite, is 10 m of granule and pebble conglomerate underneath the rhyolite sill (P 3). Overlying this sill and to the west are thinly bedded and planar cross-bedded quartzites containing local grit and granule conglomerate layers interbedded with periodic shale rip-up layers (P 4, P 10). This is overlain by orange-colored quartzites and siltstones with a very low iron content, though not low enough for the quartzites to be white, as in the Mazatzal Wilderness. In the narrows of Pine Creek, further west, are a series of soft-sediment slump structures in well-bedded, specularite-rich maroon quartzite that gives higher scintillometer response (P 12). This occurrence of maroon quartzites above the orange ones, the presence of tectonic breccia zones in the quartzites near P 11, numerous fault zones in the creek near P 12, and a strong change in the bedding directions from P 11 to P 12 sites indicate that much of the tectonic stacking of the Mazatzal Group in the Pine section occurs in and west of Pine Creek.

From the above data it is apparent that a source terrain including Payson granite and red rhyolites similar to those near Tonto Creek was exposed to the east, and this material was being shed westward onto rhyolites that are part of the Verde Batholith. Initial deposits were very coarse and poorly sorted, but these rapidly fined and increased in maturity upward such that, above the first 100 m or more of section, mature, well-bedded maroon quartzites dominated the rest of the section for probably more than 500 m. Above this, a slight decrease in hematite content of the sediments resulted in paler, pink to orange quartzites that are now abundant in the northern exposures of Pine Creek. Subsequent reverse faulting or thrusting has resulted in an apparent two-times thickening of the Mazatzal sequence. There is as yet no conclusive evidence to decide whether the basal boulder conglomerates at Pine are time-correlative to either Deadman or Mazatzal strata in the Wilderness.

3.2 Mazatzal Mountains

Exposures of the Mazatzal Group in the Mazatzal Mountains are essentially restricted to the east-central part of the Wilderness area. Alder Group rocks are exposed both north and south of this, along the East Verde river to the north, and in the Slate Creek Divide area of the southern Mazatzal Mountains to the south (figs. 1, 2, 3). Wilson (1939) provided excellent reconnaissance mapping of the Mazatzal Mountains before there was good topographic coverage, concentrating specifically on the Mazatzal Group. More recently the Alder Group has been reported on by Ludwig (1974) and briefly by Martinsen (1975) in the south and north areas respectively. From 1975 to 1979, P. Anderson (in prep.) remapped all exposures of the Alder and Mazatzal Groups in the Mazatzal Mountains at a scale of 1:24,000. It is this detailed mapping which guided sampling for the present study.

The largest and most spectacular exposures as well as the most complete section of Mazatzal Group occurs in the Mazatzal Wilderness area. This section contains abundant quartz-pebble conglomerate, pyritic facies were noted in some rock types, and the basal Deadman unit was known from P. Anderson's work to be both rich in conglomerate and high in heavy-mineral concentrates. Since all of the most favorable criteria were present in the Mazatzal Wilderness area, and our initial scintillometer reconnaissance uncovered high radiometric response from the Deadman unit, we decided to make this the area of detailed investigation and highest sample density for the Central Arizona Arch project. Thus the geologic and geochemical results for this part of the Mazatzal Wilderness area have been presented at 1:24,000 scale (figs. 5 and 6). Helicopter assistance was necessary to provide access for field crews and to lift samples within the time limitations of the study, and was approved by the U.S. Forest Service under special permit.

The stratigraphic sequence, as noted previously, consists of a relatively thin basal Deadman unit of conglomerate and quartzite, an overlying thicker unit of Maverick shale and siltstone, and an uppermost and thickest unit of Mazatzal quartzite with minor conglomerate. Strictly the top unit is Mazatzal Peak quartzite, although the informal designation is used throughout this report. Abundant pebble conglomerate was known at the base of the Deadman unit and in lower portions of the Mazatzal quartzite unit, but in the course of this study additional conglomerates were found at many stratigraphic positions in all three units. Conglomerates were sampled at all stratigraphic positions because of the need to gain a complete understanding of the depositional environment, to test uranium and scintillometer values for their correlations with other features such as heavy-mineral concentrations, and to compare the geochemical characteristics of conglomerates at various stratigraphic levels. However, sampling and study were concentrated on the basal portions or those areas likely to yield the most interesting results. To follow is a discussion of these conglomerates in the Mazatzal Group from the bottom up.

3.2.1 Deadman Unit

The Deadman unit is a remarkable, perhaps unique, rock sequence in its intense concentrations of specular hematite at or near its basal unconformity.

For the most part, Deadman rests unconformably on brick red, hematitic rhyolites related to Wilson's (1939) Red Rock rhyolite (post-Alder Series). These rhyolites are described at sites M 59, M 60, M 73, M 93, and M 98. Above the unconformity, Deadman strata usually consist of two parts: (1) a basal boulder to pebble conglomerate made up mainly of the rhyolite clasts; and (2) an upper sequence of well-stratified quartzites with lesser conglomerates in which rhyolite is still the dominant fragment type. The lower conglomerate varies anywhere from 0 to 80 m thick depending on location in the Wilderness. Similarly, thickness of the upper quartzite unit varies with location from an impressive 250 m on Cactus Ridge along the front of the Mazatzal Mountains to about 10 to 30 m in the upper reaches of Maverick Basin.

Some of this thinning is tectonically imposed, as in the sinuous outcrops of Deadman along the front of the Mazatzal Mountains (M 21 south to M 17), and in the Maverick basin area (M 67 to M 74), but most is not. Most thickness changes in Deadman directly reflect primary depositional trends of paleochannels, onlaps onto topographic highs, and lateral thinning at the margins of the unit. An example of this onlap, possibly onto a topographic high of rhyolite in the Cypress Butte quadrangle, is near site M 71 in upper Deadman Creek, where both Maverick shale and Deadman quartzites are anomalously thin (20 to 40 m) regardless of superimposed deformation.

The overall thinning near the basin edges is noticed most at the northern and southern outcrop limits of Deadman in the Wilderness. North of North Peak, Deadman progressively decreases in amount of conglomerate, scintillometer counts, interbeds of purple shale, and specularite content, as well as in thickness, to the west until, at site M 27, no material coarser than grit is present in a 60 m-thick Deadman unit that is white at its top. Similar thinning is observed far to the south in the drainages of Davenport Wash, but here total thickness of the Deadman unit is controlled by local conglomerate channels.

The thickest exposures of Deadman quartzite and conglomerate occur in the central part of Mazatzal Group exposures from Barnhardt Canyon and Cactus Ridge west to the junctions of North and South Fork with the main Deadman Creek drainage (figs. 5 and 6). Here the conglomerates are thickest and contain the greatest heavy mineral concentrations. One of the most remarkable features of the Deadman unit lies in this strong concentration of heavy minerals at its base, in some places amounting to 90 percent of the rock. This is a phenomenon partly independent of conglomerate concentrations: where conglomerate occurs at the base of the unit, specularite will usually be concentrated there as well; but where there are no basal conglomerates, basal quartzites are still usually rich in specularite. In a few places, strong concentrations of heavy minerals are found higher in the Deadman quartzite section (e.g., M 65, M 66, M 61, M 16). At localities lacking in conglomerate, the most usual condition is for the lower Deadman quartzites to contain a 1 to 10 m-thick zone immediately above the basal unconformity of intensely black-colored rock in which heavy mineral content ranges from 10 to 95 percent (M 25, M 77, M 80, M 83, M 84, M 139). Frequently associated with these specularite concentrations are thin (1-2 m) layers of rip-up conglomerates where hematite-rich (50-70 percent) muds have been broken up and incorporated into immediately overlying or adjacent strata.

3.2.1.1 Heavy Mineral Assemblage. Components of the heavy-mineral concentrate in Deadman rocks are quite distinctive of this particular Precambrian geologic environment. They are also typical of virtually all heavy-mineral concentrates in other Older Precambrian conglomeratic strata throughout the Central Arizona Arch area, except that they are best developed and in the greatest concentrations at the base of the Deadman unit. These concentrates consist dominantly to almost exclusively of detrital specularite. In thin and polished section, as well as on cut and broken faces of hand specimens, the well-rounded, highly spherical morphology of the black specularite grains with their abundant evidence of peripheral abrasion clearly indicates their detrital origin.

What the original mineral phase of the nearly equant grains was is difficult to prove, but one fact is certain: when the grains were weathered out of their source rocks and transported to their depositional site in the conglomerates or quartzites, they were already specularite grains. Neither detrital magnetite nor pyrite has ever been noted in any of the samples or outcrops of black, iron-rich conglomerates or quartzites despite extensive tests for both minerals. In thin and polished section there is no evidence to suggest the presence of a more reduced iron phase during deposition, subsequent diagenetic changes, metamorphism, weathering, or surface oxidation, a phase which could have been later converted to specularite.

On the contrary, the evidence indicates that the only crystalline iron phase to be eroded, abraded, and deposited in the conglomerates and quartzites was specularite (or crystalline hematite). In many rocks, earthy (non-crystalline) hematite was also present as a detrital, powdery phase, presumably the result of much finer grinding of detrital specularite. However, some earthy hematite could have precipitated out of solution. In either case this powdery hematite now occupies cementing positions between matrix grains and stains the rocks some shade of red even when only about 0.1 percent is present.

Proof that specularite was the detrital phase in the conglomerates and quartzites lies in the fact that one can observe all the ensuing conversions that have affected the specularite after its deposition. The main diagenetic change, evident only in thin section because of its small scale, is the formation of specularite overgrowths: in specularite-rich rocks, or in small patches or layers where specularite is locally concentrated, one observes microcrystalline overgrowths or regrowths of tiny acicular specularite crystals around the edges of larger detrital specularite grains and within interstitial red cement (see Thin Section Description Forms in appendix E). These crystals probably grew in response to local pressure solution of the specularite grains during compaction. They obviously grew after deposition, because such delicate crystals could not have survived abrasion. This growth must have occurred before metamorphism because metamorphic recrystallization is superimposed upon it. It is not a low-grade metamorphic phenomenon because it occurs in totally unmetamorphosed rocks, so it is presumed to be diagenetic.

Metamorphic effects involve progressive change of all the hematite phases in the rock, starting with the most reactive powdery hematite phases, but eventually affecting detrital specularite grains before middle amphibolite

facies and conversion of them into well-recrystallized metallic blue-gray specularite. It is this type of crystalline hematite that is most usually referred to as specularite, but we see no need to reserve the term for crystalline hematite with an external metallic luster. The detrital specularite probably appeared this way before it was abraded, as many of the detrital grains show the metallic luster on cleavage surfaces. Worn edges of the detrital specularite now give the mineral its black cast.

Post-metamorphic alteration and surface weathering of the specularite are seen in many places to involve a conversion of crystalline specularite to a very deep red (almost opaque in thin section) amorphous hematite that gives the rocks a very dark stain. Thus, the descriptions of many Deadman conglomerate samples as "black to dark reddish-brown stained" is reference to this phenomenon of specularite weathering to the dark red hematite phase.

Other hydraulically heavy mineral phases are present along with the detrital specularite concentrations. The most obvious in thin section is zircon, usually in concentrations less than 1 percent but locally up to as much as 10 percent. The zircons are nearly always surficially abraded to varying degrees, and locally show overgrowths or metamict texture. In a few rocks, euhedral zircons of probable felsic volcanic origin are noted. Detrital apatite is present in some rocks as dirty, well-abraded, almost opaque grains.

Leucoxene is sometimes abundant as a powdery white opaque mineral in beds of heavy minerals, but the detrital phase from which it is derived is not known with certainty. Although small rutile needles are occasionally found in thin section, these could be of diagenetic origin similar to the specularite needles, and the primary Ti-phase could be either ilmenite or rutile. The lack of magnetism of the heavy mineral concentrates, hence no magnetite or ilmeno-magnetite, along with the fact that a discrete metallic Ti-phase has not been found in thin section, suggests that Ti might be in solid solution with hematite as hemo-ilmenite. If leucoxene is a faithful indicator of Ti in the heavy mineral concentrate, then not all hematite is Ti-bearing. Abraded sphene and possible anatase are rarely present in some rocks. Tourmaline is unrecorded.

This assemblage of heavy minerals is not at all consistent with derivation from a typical plutonic and metamorphic source terrain, where one would expect to find magnetite, tourmaline, and detrital micas in abundance. Instead the specularite indicates that the source rocks were well oxidized to a hematitic state, and the zircon-sphene-leucoxene assemblage is most consistent with a felsic rhyolite-granite source. When one examines the underlying rhyolitic terrain this is precisely what one finds -- well-oxidized, hematitic, and specularitic rhyolites (Anderson, in prep.).

3.2.1.2 Conglomerate Paleochannels. As the Site and Sample Description Forms in appendix E indicate, the thick conglomerate deposits at the base of the Deadman unit are individually very complex because of the great diversity in fragment types and sizes, sorting, rounding, proportion of heavy minerals, color, stain, and degree of deformation; in addition, the conglomerate

deposits are highly variable in thickness and are not present everywhere. However, singling out the main characteristics of each conglomerate above these detailed complexities produces the rather remarkable result that there are only four distinctly different types of basal Deadman conglomerate in the Mazatzal Wilderness. These are:

1. angular, hematitic claystone-rhyolite cobble conglomerate;

2. red rhyolite boulder conglomerate;

3. specularite-rich quartzite-rhyolite conglomerate;

4. specularite-fragment (intra-formational) conglomerate.

The first could be called the Barnhardt Canyon conglomerate type, after the place where P. Anderson first discovered it in 1975 and originated the concept of finding uranium concentrations in the heavy mineral concentrates in these rocks. This conglomerate is a spectacular aggregate of multi-colored angular rhyolitic and hematite-rich cobbles packed into a reddish black specularitic matrix (M 16, M 19). This specific lithotype is so unmistakably diagnostic that, after first noting its restriction just to the Barnhardt Canyon area, we were later surprised to find an identical duplicate of it in the upper drainages of Deadman Creek near North Fork (M 73, M 74, M 75). This exact lithotype occurs only in these two specific areas on either side of the Mazatzal Wilderness exposures (figs. 5 and 6).

The main types of fragments in these type 1 conglomerates are (a) dark purple aphanitic to quartz-phenocrystic rhyolite, (b) specularite-banded iron formation, (c) banded dark jasper, and (d) hematite claystone made up of about 30 percent hematite and 70 percent clay. These hematitic claystone fragments are highly unusual in that their edges terminate in long wispy tails. This feature indicates that they were soft when deposited in the conglomerate, so it is unlikely that they were derived from the pre-Mazatzal terrain.

The hematitic claystone fragments were most probably derived from the break up of previously deposited Deadman strata. This breaking away of clay banks and reincorporation of claystone fragments into a cobble conglomerate is a common occurrence on the edges of a downcutting river channel, and is suggestive of a fluvial origin for the Deadman conglomerates. Similar processes occur in tidal-flat environments but the rest of the cobbles -- hard rhyolite, jasper, and banded iron formation -- could not be accounted for in a marine setting. Also consistent with a river-channel origin is the restricted spatial distribution of unique conglomerate types. Thus, the Barnhardt Canyon-type conglomerate forms a narrow channel-shaped deposit extending, presumably continuously, from Barnhardt Canyon almost due west (N.85°W.) to Maverick Spring in Deadman Creek. The coarse conglomeratic material in this channel originally was no more than 200 to 300 m wide, and occurs nowhere to the north or south of this zone. This structure is referred to as the "main Deadman paleochannel."

The second conglomerate type is referred to as the Cactus Ridge type, for the place where it most prominently crops out. This unit comprises the thickest (up to 80 m) basal conglomerate in the Deadman and, except where

faulted, occurs continuously along Cactus Ridge and in the outcrops west of Y-Bar basin from Bear Spring around into the upper South Fork of Deadman Creek (figs. 5 and 6). A conglomerate similar but not identical to this is found in the western part of the range (type 3). The main characteristic of the Cactus Ridge-type conglomerate is the preponderance of different rhyolite fragments -- some aphanitic, some feldspar and/or quartz phenocrystic, some flow-banded, ignimbritic, granophyric, cherty, and of varying sizes from pebble to large boulders -- but all are well rounded and to some degree hematitic, usually red to pink but occasionally yellow or white. The fragments and the matrix are usually rhyolitic feldspathic and argillaceous detritus; both jasper and nonvolcanic quartz are either noticeably absent throughout the conglomerate or in low abundance at the margins of the conglomerate lens.

The provenance of this conglomerate is clearly the main mass of Red Rock rhyolite that lies immediately to the south and southeast, because every rhyolite boulder can be matched exactly with a lithology in the rhyolite mass (Anderson, in prep.). In some areas the connection between underlying rhyolite and Deadman boulder conglomerate is so close that the basal conglomerate appears to be an in situ regolith of rhyolite boulders (M 95, M 99, M 102, M 103). Indeed, in many places it is practically impossible to distinguish rhyolite cobble conglomerates at the base of the Deadman from rhyolitic (i.e., volcaniclastic) conglomerates and agglomerates in the Red Rock unit directly below, because both contain rhyolitic fragments in a rhyolitic matrix (e.g., M 57, M 63, M 93, M 95, M 96, M 98, M 99).

Elsewhere the conglomerates show clear signs of water working: they are crudely stratified, but not bedded in detail, and are generally poorly sorted (e.g., M 53, M 54). At site M 54, 15 m of coarse Deadman boulder conglomerate rests on rhyolitic conglomerate of the Red Rock unit. This is overlain by 5 m of pebble conglomerate, grit, and quartzite, another 12 m of boulder conglomerate, the section is broken by a spherulitic red rhyolite sill as in the Pine Creek section and then overlain by 5 m more of pebble conglomerate and quartzite. Such crude stratification of coarse material in generally upward-fining but repetitive cycles where poor sorting is the rule is typical of a fluvial depositional environment. The lens-shaped geometry of the deposit with lateral thinning in cross section together with its longitudinal extent in a northwest direction is also indicative of a fluvial type of deposit.

The deposit could in part be an alluvial debris fan shed off a local rhyolite high, but most of the material is crudely stratified and appears water worked. This paleochannel did not extend north to Barnhardt Canyon or west of M 102 site, and in fact it most likely did not reach M 103 site. The basal conglomerate between M 102 and M 103 is apparently a separate channel deposit of rhyolitic debris formed in a local recessive valley between two resistant ridges of yellow rhyolite on the east (M 102) and cherty rhyolite on the west (M 100); this channel laps out in both of these directions and therefore probably paralleled the Cactus Ridge paleochannel.

The third conglomerate type occurs only in southern Deadman exposures in the drainages of Davenport and Mazatzal washes and on the ridge between Davenport Wash and Deadman Creek (figs. 5 and 6). Some parts of the

conglomerate are rich in specularite fragments, and others are rich in rhyolitic fragments that are characterized by their large glassy quartz phenocrysts (M 131). The most distinctive feature of this conglomerate type is the presence of granular, highly specularitic (30%) quartzite fragments. These could be from the underlying source terrain or intraformationally derived from Deadman strata (M 131, M 132, M 133). An interesting feature of this basal Deadman conglomerate is that it thickens from almost 0 in Mazatzal Wash to 12 m where specularite-rich (M 131), to 30 m where rich in rhyolite fragments (west of M 132). It is probably thickest in Davenport Wash and tapers laterally again to the northwest where it is only 1 to 5 m thick (near M 126). Thus it delimits (approximately, as outcrops permit) a north-south-trending paleochannel wherein dominantly rhyolitic and specularitic quartzite detritus was deposited.

The fourth conglomerate type is the thinnest and the blackest of the conglomerates. It is rich in specularite and commonly contains elongate to flat, presumably intra-formational, chips of hematitic claystone, specularitic mud or specularite-hematite-rich shale. In some places, this conglomerate type occurs nowhere near one of the main paleochannels (e.g., M 25, M 39), but frequently it is found flanking the paleochannel edges (M 73, M 77, M 83, M 86, M 102). The significance of this association is treated in the interpretive part of this report.

This discussion of the Deadman unit has focused on basal conglomerates because of their importance in understanding the depositional environment of the Deadman. Many finer grained conglomerates exist as thinner layers in the upper Deadman quartzite strata that make up by far the bulk of the Deadman unit. The characteristics of these conglomerates are discussed further by way of comparisons and contrasts with similar units in the Mazatzal quartzite strata much higher in the section.

3.2.2 Maverick Unit

The usual habit of the Maverick is a dark-green to greenish-yellow shale which has either visible specks of pyrite or a matrix reduced to the point that no oxide phases of iron (magnetite, hematite) are present. Along the Barnhardt Canyon trail, where the Maverick is best exposed, there are abundant white quartzite interbeds within highly contorted Maverick shales and siltstones. Some quartzites are hematite-stained from oxidation of pyrite in the adjacent shales. The typical Maverick lithology of well-laminated, pyritic, greenish-yellow, reduced shale is restricted to the Mazatzal Wilderness area, and more oxidized facies exist elsewhere.

Even within the Wilderness area there are significant departures from this usual lithology. At several places in the section we sampled grit and granule conglomerate layers in the upper Maverick unit which are highly distinctive because of their greenish matrix and well-sorted assemblage of quartz, jasper, and chert fragments. These conglomerate layers occur principally in the north and west of the range from North Peak around to the South Fork of Deadman Creek (M 24, M 82, M 78). They are continuous over the paleohigh near M 71 where Maverick thins drastically, and are less

abundant in the southern outcrop areas (M 121, M 64). The granule conglomerate and grit layers are usually 0.1 to 1 m thick and comprise rather angular fragments of bright red jasper, dark red chert, and white quartz in striking contrast to their dark green, clay-rich matrix.

At one place (M 78) the presence of such conglomerates in the section is coincident with a locally strong specularite concentration near the top of the Maverick unit. This indicates, as does the hematitic nature of these conglomerates, that hematitic and specularitic detritus were still present in the source areas during Maverick deposition, but higher energy conditions were needed to bring the oxidized material in and preserve it in a normally reducing environment. Under the lower energy, reducing conditions, and slower sediment influx characteristic of the rest of the Maverick unit, there would have been sufficient time to convert iron oxide material from the source terrain into pyrite.

3.2.3 Mazatzal Unit

The best exposures of the Mazatzal quartzites and conglomerates in the upper Mazatzal Group (i.e., "Mazatzal Peak Formation") are encountered in an ascent of the west ridge of Mazatzal Peak (M 45 to beyond M 51). Here is exhibited the full array of color changes in the quartzites as governed by small amounts of matrix hematite, all of the major conglomerate units and the features which distinguish them, and even some of the thrust faults that typically break up the quartzites. The stratigraphic variations are as follows.

The basal one-third of Mazatzal quartzites and conglomerates is brick red, similar to the color of hematite powder. The middle one-third varies from dark or deep maroon and purple upwards to pale maroon and finally to lavender and pink. The upper one-third, which is not exposed in many other places or has been eroded away, is white to very pale pink. These changes are correlated with a linear decrease in the amount of disseminated, interstitial, powdery hematite from about 5 percent in brick red rocks to about 1 percent in pale maroon rocks, to 0 percent in white rocks. The transition from brick red to maroon strata is represented by M 42 to M 44 on Mazatzal Peak, M 109 to M 113 near South Fork, and M 24 to M 38 on North Peak. The maroon to pink to white transition and its associated conglomerates are treated in the northern and middle parts of the Central Mazatzal Peaks (M 29, M 30, M 35 to M 37) as well as on Mazatzal Peak (M 44 to M 51) and North Peak (M 38 and M 39).

Conglomerates in the basal brick-red strata are typified by 6 to 30 mm granule- to medium pebble-size fragments, and rarely by larger 30 to 60 mm pebble- to cobble-size fragments. The pebble population is characterized by the abundance of red jasper and red aphanitic rhyolite fragments, as well as ever-present quartz. The matrix of these basal brick-red conglomerates contains specularite which usually represents an iron enrichment 3 to 10 times greater than the enclosing quartzites (e.g., M 18, M 31, M 34, M 42, M 43, M 48, M 70, M 91, M 101, M 111, M 118). Conglomerate units within the upper quartzites of the Deadman unit look like these basal Mazatzal ones, but

the Deadman conglomerates are invariably distinguished by their higher specularite contents, more abundant rhyolite over jasper and quartz fragments, and their characteristic red-brown to brownish-black, very thinly bedded to laminated enclosing quartzites (e.g., M 17, M 21, M 38, M 52, M 60, M 62, M 103, M 119).

Starting from the lowermost conglomerates in the Mazatzal unit, several features are apparent:

1. the percentage of rhyolite fragments decreases quickly up section;

2. the percentage of jasper decreases slowly up section;

3. the percentage of pink chert increases steadily up section;

4. specular hematite content decreases quickly up section, except for an unusual concentration of specularite at the base of the upper white quartzites;

5. earthy hematite in the matrix decreases up section;

6. the degree of sorting and rounding increases up section; and

7. both size of conglomerate fragments and thickness of conglomerate beds decrease up section along with a tendency for the pebbles to be sparser up section.

All of these variations point to increasing sediment maturity up section in the Mazatzal unit.

Thus a conglomerate at a midpoint in the maroon quartzite section would typically be a granule to fine-pebble conglomerate of quartz, lesser chert, jasper, and few rhyolite fragments in a partly specularitic, coarse-grained quartzite matrix. Examples near this stratigraphic position are M 9, M 15, M 33, M 35, M 38, M 45, M 49, M 105, M 109, M 133, and M 120. The end product in this trend of increasing maturity is a very well-rounded and sorted, ultraclean, mature white quartzite to grit, the coarser fraction of which is solely perfectly rounded grit and granules of quartz and chert. Examples near this uppermost conglomerate-bearing level are M 11, M 22, M 29, M 32, M 37, M 39, M 46, M 51, and M 107.

One of the main distinctive features of a rock in the Mazatzal quartzite unit is its good sorting and clean matrix of only quartz and hematite, with usually no clay. The matrix of a conglomerate in the upper Deadman strata is significantly cleaner and more mature than that of one in the lower units, but generally neither is as clean or mature as a typical Mazatzal conglomerate matrix. Also there is a notable lack of jasper in the Deadman as compared to Mazatzal rocks.

Considering their wide lateral extent, Mazatzal conglomerates at a particular stratigraphic level are surprisingly uniform in character, fragment size, composition, and content of matrix or interstitial heavy minerals.

Thus, given a suite of conglomerate occurrences in, for example, the lower brick-red unit from various places in the Mazatzal range, there are no lithologic criteria to decide whether they all represent the same or different stratigraphic horizons. This very feature is the main contrast between Mazatzal and Deadman conglomerates: the Deadman ones are very provincial, as would be expected in a fluvial setting where different source terrains are eroding into specific channelways; in contrast, the uniformity of Mazatzal conglomerates is suggestive of a shallow water marine setting where wave action works to mix hydraulically different particles from a variety of source terrains, both reworked grains and new material, into a uniform conglomerate type. Although depositional environment is considered at length later, it is mentioned here for comparison to the environment of Mazatzal rocks in adjacent areas.

3.2.4 Structure

The structure of the Mazatzal Group in the Wilderness could in itself be the subject of a separate report, but the main deformational styles are briefly mentioned here. Although Deadman quartzite is relatively competent, it is thin, and because it lies at the base of the Group, it has been most strongly deformed in a manner similar to the underlying volcanosedimentary strata. The bulk of the Alder Group is relatively incompetent and has been pervasively cut by strong, vertically disposed foliation which is often confused with bedding. On the east and west sides of the Mazatzal range, Deadman is drawn into disharmonic, long-isoclinal to open-concentric folds. The basal conglomerates of the Deadman are susceptible, especially in zones of high strain, to extreme flattening (up to 10 to 1) and lineation (up to 5 to 1 ratio) by closely spaced shear planes. In these areas, stratigraphic and textural features are locally obliterated and the unit is tectonically thinned.

Maverick shale is usually compressed into accordion-style chevron folds and therefore often apparently thickened, but this depends on whether foliation parallels or is perpendicular to stratigraphy. In the west and southwest part of the range where foliation parallels stratigraphy, the Maverick unit is tectonically thinned to one-third of its original thickness and is also stratigraphically thinner. Maverick thus forms a structurally incompetent zone capped by a décollement surface above which the massive, more competent Mazatzal quartzites deformed in an independent fashion.

Occasionally deformation in Mazatzal quartzites takes the form of upright folds, warps, overturned folds, or vertically plunging broad arches (e.g., South Fork, M 100 to M 118), but deformation usually caused failure along low-angle reverse fault planes, resulting in imbricate stacking of thrust slices. This accounts for the many occurrences of lower red-unit conglomerates on the high peaks (e.g., Central Mazatzal Peaks) and in complex zones (South Fork to Chilson Camp). Even the Mazatzal Peak section contains a series of reverse faults of small displacement. Only in the precipitous cliffs lining the east side of Deadman Creek is the Mazatzal Group relatively undisturbed tectonically and fully displaying all of its 2,200 feet (700 m) of stratigraphic grandeur.

3.2.5 Alder Group

Volcanic and nonvolcanic conglomerates in the Alder Group were sampled from two areas: the East Verde River area lies to the north, and the Slate Creek Divide area lies to the south of Mazatzal Group exposures in the Mazatzal Wilderness (figs. 1, 3, 4, 5, 6). In the East Verde River area there are two types of conglomerates. One is a volcanic conglomerate of gray volcanic siltstone and tuff fragments in a volcanic siltstone matrix (M 142) which is perfectly preserved from any effects of shearing. This conglomerate is part of a thick volcaniclastic sequence in the East Verde River area that predates Payson diorite and is therefore a distal facies of the main volcanic center in the Diamond Butte-Mount Ord area. This specific rock type is almost a duplicate of volcanic conglomerates in the Hess Canyon area (H 1 and H 2). The other conglomerate type in the East Verde River area is a strongly hematitic, oxidized, cobble to boulder conglomerate deposited either in a shallow-water fluvial or subaerial environment on a basement of Payson diorite.

Rocks exposed throughout the southern Mazatzal Mountains in the Slate Creek Divide area are typical of "volcanic" and "sedimentary" conglomerates found in the Alder Group. Slate Creek cuts through various purple slates, siltstones, and wackes which are a westerly projection of rocks in the Diamond Butte area. Contained within this sequence are gray to sandy brown quartzite beds that are typical of the quartzites containing sedimentary-rock-fragment conglomerates in the Alder Group (M 1, M 2, M 5, M 6). To the south one finds volcanic wackes and a thick andesitic volcanic pile, whereas to the north abundant felsic volcaniclastic rocks occur near Pine Mountain. Fragmental rhyolites and rhyolitic conglomerates in contact with purple slates near Pine Mountain were sampled (M 4). A jasper-iron formation "sedimentary"-type conglomerate which marks the time horizon between this rhyolitic volcanism and deposition of purple slates was also sampled (M 3). The detailed geology of such units as these is treated in the discussion of the Diamond Butte area, because in this area a much more complete stratigraphic section is found.

3.3 Christopher Mountain Area

In the northeasternmost part of the Central Arizona Arch area only Mazatzal quartzite and Apache Group are exposed (figs. 1 and 3). Neither a basal Deadman-like quartzite nor Maverick-like shaley rocks are found among Mazatzal strata, but the base of the Mazatzal quartzite is seen to rest in sharp depositional contact on rhyolite at the west end of Christopher Mountain (Anderson, in prep.). In turn, the Apache strata lie unconformably across both folded Mazatzal quartzite and the underlying rhyolite-granite terrain. Apache Group at its northern extremity consists of Scanlan conglomerate and a possible coarse-grained facies of Pioneer shale, as well as Dripping Spring and higher units; the Barnes and Pioneer shale are absent.

Unlike the Pine area, Mazatzal quartzite in the Christopher Mountain area contains no coarse conglomerate; the coarsest rocks are pebble to granule conglomerates, and over 95 percent of the section is made up of quartzite and grit. Specularite is generally ubiquitous throughout the quartzites and conglomerates, and in many places there are abundant concentrations of detrital specularite on bedding and cross bedding planes (C 1, C 4, C 5, C 6, C 7). The thick sequence of clean, quartz-rich, pale- to dark-maroon Mazatzal quartzites exposed in the Christopher Mountain area was presumably deposited under marine conditions where wave or bottom-current action was able to provide the good sorting and winnowing of heavy minerals throughout the section. Shallow-water features such as ripple marks are found only locally (C 8). Stratigraphic homogeneity is the rule, and one sees no evidence of either basal conglomerates or coarse channel deposits to suggest the presence of an emergent terrain in this vicinity during deposition of the Mazatzal quartzite.

Mazatzal exposures define a series of northeast-plunging synforms whose outcrops terminate to the southwest (e.g., C 6). As these exposures are traced to the southeast, metamorphic grade progressively increases, indicating the proximity of a granitic batholith. North of Young we discovered roof pendants of Mazatzal quartzite within the Young granite which had been metamorphosed to amphibolite grade. This relationship restricts the age of the Mazatzal Group to older than the 1650 m.y.-old Young granite (Anderson, in prep.). In these roof pendants the Mazatzal quartzite is white because the small amount of dispersed hematite which is usually in the matrix to give it a maroon cast, at amphibolite grade has been converted to sparse, tiny grains of black specularite. Jasper fragments in sparse granule to pebble conglomerates within these pendants are also black from the same type of hematite conversion (C 9).

Scanlan conglomerate undergoes tremendous primary changes in thickness and character at the base of the Apache Group in the Christopher Mountain area. On the Chamberlain Trail above Haigler Creek we observed, over less than 1 km, rapid thinning and fining of the Scanlan boulder conglomerate from a thickness of 100 m in the creek to 20 m at the sample site (C 4, C 10) to less than 1 m a little further north (C 3; fig. 3). North of this on Christopher Mountain, Scanlan is absent, evidently because of non-deposition.

One of the most interesting Scanlan localities is on the southwest side of Christopher Mountain where an anomalously thick channel deposit of coarse boulder Scanlan conglomerate is found (C 2). The east edge of the channel is in north-south-trending contact with a vertical to slightly overhanging wall of Mazatzal quartzite, and unconformably overlying both Mazatzal and Scanlan uphill are nearly flat-lying east-west-trending Dripping Spring sandstones. Contact of the three units forms a T-junction which cannot be explained without Scanlan being a vertical-walled channel deposit. Within the conglomerate are huge, moderately well-rounded 1 to 2 m boulders of Mazatzal quartzite in an oxidized goethitic to hematitic muddy matrix (C 2). Cross-bedded lenses of poorly sorted sand and gravel in the boulder conglomerate indicate fluvial rather than mud-flow origin for the deposit.

The Scanlan boulder conglomerate channel filling appears to have been deposited on about a 25° paleoslope of Mazatzal quartzite and has between 180 and 250 m of vertical relief. It is overlain laterally and at the top by horizontally bedded, hematitic sandstones and siltstones. These overlying rocks probably belong to the Dripping Spring Formation, but uncertainty results because the Pioneer Formation undergoes a distinct facies change from purple, hematitic shales in the southern Sierra Anchas northward into hematitic siltstones and sandstones, so the rocks could be a coarse-grained facies of Pioneer. Scanlan undergoes a parallel facies change from the north where it consists of oxidized, hematitic channel-type deposits of coarse boulder conglomerate, southward into blanket-shaped deposits of better sorted cobble conglomerate with a darker, more reduced matrix.

3.4 Diamond Butte Area

The geology of the Diamond Butte area is dominated by the largest and most complete exposures of Alder Group in the Central Arizona Arch: both the older volcanic conglomerates and the younger sedimentary-fragment conglomerates are present in great diversity. The geologic map (fig. 3) shows both volcanic and sedimentary terrains in one pattern where they are complexly intermixed in the central Diamond Butte area. Southern exposures near Sheep Basin Mountain contain a deformed but complete Mazatzal Group section which differs significantly from the type section in the Mazatzal Wilderness area. Barnes conglomerate is absent from the Apache Group here, and Scanlan conglomerate, possibly Pioneer siltstone, parts of the Dripping Spring unit, and locally Mescal limestone make up flat mesas capping the older Precambrian units.

3.4.1 Alder Group

Some of the oldest volcanic conglomerates in the Alder Group are exposed in the Spring and Rock Creek drainages between Buzzard Roost and Mailbox Mesas. Many are dark gray to brownish black volcanic conglomerates made up of aphanitic dacite fragments in a dark dacitic lithic-crystal tuff matrix (D 7). Others are more rhyolitic and lie at higher stratigraphic positions between the dacitic rocks and overlying quartzites. These felsic units include coarse rhyolitic boulder conglomerates south of Winter Camp and rhyolitic lithic-crystal tuffs partly interbedded with the quartzites near Flying W Ranch (Gastil, 1958). In places these felsic volcanic conglomerates lie below the sedimentary-fragment conglomerates (D 53) and in other places above (D 13). The volcanic conglomerates generally vary from completely undeformed (D 7) to strongly sheared and flattened (D 56). Locally they contain interbedded sedimentary fragments such as siltstones (D 39).

Where conglomerates of mainly volcanic fragments and volcanic matrix are interbedded with quartzites and conglomerates of mainly sedimentary-rock fragments, it becomes difficult to distinguish the two types. One such area is in Gastil's (1954) "Flying W Formation" (D 5 and D 6), but we used the presence of abundant jasper with quartz and chert fragments to distinguish the "sedimentary" conglomerates. Transitional rocks of mixed volcanic and sedimentary fragments (D 5, D 16) are less abundant than conglomerates of either strictly volcanogenic material or dominantly nonvolcanic material. Such transitional units typically delimit the end of volcanism and the beginning of clastic sedimentation (e.g., D 16) or else represent intermittent influxes of volcanic detritus into a nonvolcanic depositional setting (D 5).

The sedimentary-fragment conglomerates occur stratigraphically higher in the Alder Group, either unconformably on earlier volcanic rocks or at the top of conglomerate sequences of upwardly increasing maturity (e.g., D 52 to D 2 to D 54). Elsewhere they are found strictly within thick Alder quartzite units such as Gastil's (1954) "Houden Formation." These gray to sandy brown, impure quartzites and quartz wackes, as mentioned earlier, are distinctive of sedimentary rocks in the Alder Group and are in no way similar to Mazatzal Group rocks even though Gastil (1958) erroneously made such a

correlation. This type of gray to brown, impure, argillaceous quartzite is termed the Reef Ridge type here for the locality north of Sheep Basin Mountain where they are best exposed. All of Gastil's quartzites are correlatives of the Reef Ridge quartzite unit.

Within the impure quartzites are many different conglomerate horizons, all of which are characterized by the presence of bright red jasper, red chert, white quartz and occasional red rhyolite fragments. In nearly all cases the fragments are smaller than a 30 mm medium-pebble size and are usually sheared and flattened by deformation. The matrix is typically an impure quartz wacke of seriate grain sizes and is almost invariably sheared and foliated such that clays have been recrystallized to sericite, and the rock attains a lumpy semischist appearance. The finer grain-size conglomerates to quartz wackes are represented by D 3, D 12, D 15, D 18, D 19, and D 20, whereas the coarser, pebble conglomerates are represented by D 2, D 14, D 17, D 23, and D 54. Strongly sheared conglomerates are D 55 and D 57, whereas some of the most spectacular, unsheared jasper-pebble conglomerates are D 21, D 22, and D 23 on Houden Mountain.

Although not obvious, detrital specularite is present in about half of the Alder "sedimentary" conglomerates. It is particularly apparent in the associated gray argillaceous quartzites where it invariably emphasizes bedding and cross-bedding planes (D 8, D 15), indicating that both specularite and jasper were present at an early stage in the evolution of the Alder Group, most probably just at the termination of the main volcanic events. Banded-iron-formation time horizons such as that represented by D 16 probably signify the oldest hematite concentrated by sedimentary processes in this region, and much of the specularitic and jaspery material in the younger rocks originated by erosion of either these layers or recycled material from these layers. The immense volumes of rhyolite extruded after deposition of the Reef Ridge quartzites and before deposition of the Mazatzal Group, however, contributed most of the specularite to the base of the Deadman quartzite. This gradation from Reef Ridge-type quartzites and conglomerates into rhyolitic crystal tuffs and ignimbrites is represented by D 13 and D 39.

In the lower Alder stratigraphy where volcanic conglomerates dominate, features indicative of current action are absent. Nearly all of these volcanic deposits are poorly bedded, suggesting rapid accumulation without reworking in a deep marine environment. Both bedding and cross bedding are better developed in the lower sedimentary-fragment conglomerates but are not dominant until the stratigraphic level of Reef Ridge quartzites is attained. At this level ripple marks and other marine features are quite uncommon, many of the quartzite and conglomerate units themselves appear lensoidal and not laterally extensive, and the conglomeratic material typically occurs as large cross-bedded lenses 50 to 500 m wide in the midst of quartzite strata. This is especially true on Houden Mountain, where two separate quartzite units appear to have formed discrete channels which coalesce southwestward toward Reef Ridge (fig. 3). This geometry and internal structure suggest that some of the Reef Ridge quartzite units represent fluvial channels rather than marine deposits.

3.4.2 Mazatzal Group

The Diamond Butte area contains several important exposures of Mazatzal Group involving rocks of great lithologic diversity. In the area northeast of Young are a series of metamorphosed white Mazatzal quartzite roof pendants which are a southward continuation of exposures in the Christopher Mountain area (D 28, D 29). Between Young and Mailbox Mesa a larger outcrop of Mazatzal quartzite and conglomerate is intruded by the west margin of the Young granite; here one sees best the progressive metamorphic conversion of red jasper in sparse-pebble conglomerates into black specularitic fragments in highly recrystallized white quartzites (D 4). Southwest of this, near Buzzard Roost Mesa, Rock Creek exposes Mazatzal quartzite with abundant cross-bedded grit layers (D 9). Here Mazatzal rocks occur both in unconformable relation upon Alder volcanic strata and as thin fault slices intermixed with the Alder Group.

Much further north, on McDonald Mountain, one finds the doubly plunging, canoe-shaped, synformal keels that are most characteristic of Mazatzal Group structure. At the north end of the McDonald Mountain exposure there is an abundance of discontinuous, cross-bedded conglomerate lenses typical of the type and scale of cross beds present throughout much of the Mazatzal Group. Here we undertook measurements of the section and cross beds specifically to determine the scale of the conglomerate lenses. The base of the Mazatzal unit is a fractured and deformed pink to white quartzite which rests unconformably on dark purple to maroon fragmental rhyolite. A relatively thin unit of poorly bedded and cross-bedded, dark brick red to maroon siltstone separates the basal quartzites from the overlying thicker (100 m) unit of dark to pale maroon quartzite, grit, and granule to small-pebble conglomerate. This maroon quartzite unit is well cross bedded and is most typical of Mazatzal outcrops in the region. However, within it, an individual stratification unit 10 to 40 cm thick containing foreset beds cannot be followed for more than 10 m along strike. Individual grit or granule layers, whether foreset or at the base of a cross-bedded unit, can rarely be followed for more than 3 or 4 m. In contrast, megascopically different-colored major stratification units (such as the maroon or overlying red unit) can be followed for 1 km or so.

Conglomerate and grit lenses in the maroon unit (D 10) contrast markedly to the next major overlying brick red unit, which consists of much more thinly cross-bedded (1-2 m) and bedded (4-5 cm) quartzite with almost no coarse-sand or grit-sized grains (D 11). Although these two units -- maroon coarse-grained quartzite and conglomerate, and red finer grained quartzite -- are of comparable continuity and thickness (100 m versus 70 m), they appear to represent significantly different depositional environments. As in the Mazatzal Wilderness area, the maroon Mazatzal quartzites show all the features indicative of a shallow marine environment, whereas the uppermost finer grained quartzite appears to have been a more poorly lithified beach-dune deposit or wind-blown sand.

The central part of McDonald Mountain is the core of a major synclinal keel where upper units of the Mazatzal quartzite are found (D 22, D 31), but at the southern extremity of the synform the lower Mazatzal quartzite strata

are once again exposed close to the rhyolite contact (D 24, D 26). Quartzites in a tributary of Soldier Camp Creek are well cross-bedded and contain 20 cm-wide layers of jasper-rhyolite-chert granule conglomerate which give higher scintillometer responses (140 to 200 cps) than adjacent quartzites (80 cps). As one progresses to the very basal part of the Mazatzal stratigraphy, background scintillometer response progressively increases to 200 cps, at which point a thin, 30 cm-wide bed of 80 to 100 percent detrital specularite providing 400 to 450 cps is encountered (D 25). The lower half of this bed contains interlaminated specularite and dark maroon quartzite, whereas the upper half is massive specularite and other heavy minerals. This represents one of the most highly radioactive beds found in the Mazatzal quartzite. Slickensided fault surfaces of sheared quartz and hematite slightly higher in the section give 650 to 700 cps scintillometer response. Apparently the shearing process has redistributed radioactivity and specularite from their site originally syngenetic to quartzites by recrystallization and concentration on the fault surfaces. Radioactive components are therefore either moved together with or in specular hematite.

Mazatzal Group rocks exposed in the southern part of the Diamond Butte area near Sheep Basin Mountain are very different from Mazatzal rocks in the northern areas. Instead of just Mazatzal quartzite resting on the underlying terrain, both Deadman and Maverick-equivalent units are found below the Mazatzal of Sheep Basin Mountain. Deadman is thick, quartzitic at its top, conglomeratic at its base in the north-central part of the exposure, and impressively rich in specularite. The stratigraphic equivalent of the Maverick shale in this area is a sequence, 400 m thick or more, of well-bedded, poorly cross-bedded brick red to reddish brown to black siltstones and fine-grained quartzites (D 42). This Maverick-equivalent Coffeepot quartzite unit contains only oxidized phases of iron -- specularite and hematite -- and those in abundance. Reduced facies rocks such as green or yellow pyritic shale are found nowhere in this area, so Coffeepot quartzite and siltstones represent a coarser grained oxide facies of the Maverick shale.

Although the basal pebble to cobble conglomerate of the Deadman is highly deformed on the north end of Sheep Basin Mountain, many fragments from the underlying Alder volcano-sedimentary terrain such as Reef Ridge-type quartzite, jasper, rhyolite, dacite, siltstone, and quartz wacke can be identified (D 32). South along strike the Deadman unit becomes progressively more specularitic at its base, and conglomerates are richer in hematitic rhyolite and specularite. Densely packed specularitic rhyolite- and quartzite-pebble to cobble conglomerates in a specularite-rich volcanic wacke matrix at site D 33 are overlain by abundantly and complexly trough cross-bedded dark reddish-brown to black Deadman quartzites. To the south the basal specularitic conglomerate thins and becomes sparser with only dark purple, vesicular rhyolite as fragments in a specularite-rich, cross-bedded quartzite matrix (D 34). At site D 35, fragment size is markedly diminished, but specularite content of the basal conglomerate is still high, providing some significantly high radioactive anomalies (D 35a).

Thus conglomerate beds and lenses occur right at the base of the Deadman unit over a 3 to 4 km-wide zone; further south at site D 40 there is almost no coarse conglomerate, but detrital specularite content is still high at a

distance of over 6 km from the main conglomerate zone. If the Deadman unit is followed through a tight fold another 5 km back to the east, there is still intense concentration of detrital specularite right at the basal unconformity (D 41). It must be concluded, therefore, that detrital specularite is concentrated over virtually the entire length of the basal Deadman unconformity in the Sheep Basin Mountain area, whereas conglomerate units are concentrated in zones or channels, mostly in the northern 3 km of exposure.

Equally important to an understanding of the depositional environment of Mazatzal Group here is the fact that conglomerates in upper Mazatzal quartzite units of Sheep Basin Mountain contain much larger fragments than those in the Mazatzal Wilderness area. Whether sampled north (D 38) or south (D 36) of Sheep Basin Mountain, the conglomerates contain 20 to 80 mm sparse white quartz, red jasper and chert pebbles and cobbles either dispersed throughout cross-bedded maroon quartzites or concentrated on cross-bed sets. The Mazatzal quartzites of Sheep Basin Mountain display magnificently large trough cross-bed sets, some of which extend laterally for 40 m. Some stratification units are crudely graded whereas others are reverse graded. Characteristically the conglomerates contain 5 to 35 percent sparse pebbles spread in lenses throughout a coarse-grained quartzite matrix. This type of deposit is typical of a high-energy fluvial system: the matrix is clean, the pebbles are coarse, but the sorting is poor because the fluvial sediment has been rapidly dumped as migrating bars of poorly sorted sand and gravel.

Local radiometric highs are found in some parts of these conglomerates (e.g., D 38a). Poor outcrop in this area does not permit an evaluation of whether the radioactivity is related to stratigraphy or to later faulting and introduction of pyritic material.

In conclusion, Mazatzal Group in the Sheep Basin Mountain area, taken as a whole, is a coarser grained facies deposited under higher energy conditions than stratigraphically equivalent rocks in the Mazatzal Wilderness area. As in the Wilderness, both Deadman and Maverick-equivalent units lap out to the north in such a way that further north in the Diamond Butte area only finer grained, lower energy-environment Mazatzal quartzites are deposited directly on the underlying rhyolite terrain. Broad paleochannels and their borders can also be delimited in the Deadman here, as in the Wilderness.

3.4.3 Apache Group

In the Diamond Butte area the Apache Group is extensively intruded by diabase between the Scanlan and Dripping Spring Formations (Gastil, 1958), but where there is no diabase one sees that most of the strata normally present between these two units are missing. Barnes conglomerate is absent here because it laps out further south in the Sierra Ancha Mountains; so might Pioneer shale, except that the presence of red-shale rip-up conglomerates in Dripping Spring units suggests the possibility of intraformational erosion of Pioneer in this northern area.

Scanlan conglomerate at the basal unconformity west of Young records the erosion of a complex underlying Precambrian source terrain. Alder volcanic and sedimentary rocks, red rhyolite, granophyre, Mazatzal quartzite, diorite,

vein quartz, chert, and jasper are all found as cobbles in a matrix of pink quartzofeldspathic material derived from the Young granite (D 1). However, this is exactly what one might expect to find in the Scanlan, because all these rock types constitute the underlying source terrain in the Diamond Butte area. In essence, therefore, Scanlan conglomerate throughout this area represents the sum total of all the constituents in the underlying terrain; the relative proportions and size of fragments depend on the relative hardness of each specific source rock and its proximity to the depositional site. Thus, only where Young granite is nearby is the Scanlan matrix rich in quartz and feldspar from the granite; likewise the matrix and fragments are specularite-rich only where rhyolite or Mazatzal Group source rocks are nearby.

An important feature of Scanlan is the systematic variability in the oxidation state of the matrix depending on thickness and geographic location of the unit. In the Christopher Mountain area where Scanlan forms thick channel-shaped deposits, its matrix is most oxidized and consists of an orange, muddy limonitic to goethitic material. Throughout the central Diamond Butte area where Scanlan forms relatively thin (15 to 30 m) blanket-shaped deposits, its matrix is specularitic to hematitic or feldspathic, but neither surface-oxidized nor reduced. A resistant ridge of Deadman quartzite extending from Del Shay Basin easterly into Gun Creek (D 35, D 40, D 41) formed a paleohigh and disrupted the continuity of Apache Group sedimentation, because immediately south of this ridge Scanlan thickens dramatically to over 75 m. The Scanlan matrix in this area appears reduced (e.g., S 6) by the presence of carbonaceous material, although some of the dark gray to black color could be from detrital specularite locally derived by erosion of the Deadman ridge (S 16). These variations indicate an increasing water depth during Scanlan deposition from north to south, a trend also probably applicable to the whole of the Apache Group (Shride, 1967).

Thus north of the Deadman paleo-ridge Scanlan is overlain by a thin, red, hematitic silty to shaley unit which could be either a different facies of Pioneer Shale or the basal part of Dripping Spring Formation. In some places such as Rock Creek, basement topography was locally undulating because this recessive shaley material is thicker in some of the deeper pockets (D 45, D 48, D 49). Most conglomerate layers in the Dripping Spring are intraformational or from break up of this softer material, and rarely are there exotic clasts. South of the Deadman paleoridge, Apache Group is made up of a thicker, more complete rock section in the Sierra Ancha Mountains.

3.5 Sierra Ancha Mountains

Precambrian geology of the Sierra Ancha Mountains consists entirely of the Apache Group (studied by Shride, 1967, and more recently mapped by Bergquist, Shride, and Wrucke, in prep.) and underlying granitic rocks of the Ruin Batholith or Young granite (Anderson, in prep.). No older layered sedimentary rocks are exposed, but younger Precambrian layered diabase sills and dikes are abundant in the Apache Group and have been the subject of considerable interest (Shride, 1967; Smith, 1969, 1970; Smith and Silver, 1975; Livingston and Damon, 1968; Granger and Raup, 1962, 1969; Neuerburg and Granger, 1960).

Conglomerates dominate the Scanlan and Barnes units and occur as secondary components of the Dripping Spring and Troy units, which are stratigraphically higher (fig. 7). Most conglomerates are polymictic, but many are dominated by quartz and quartzite fragments. Boulder and cobble conglomerates tend to be more abundant in the lower strata, whereas pebble to granule conglomerates are typical of the upper units. Approximately equal numbers of samples from Scanlan, Barnes, and Dripping Spring conglomerates were taken, with fewer samples from radioactive Mescal limestone breccia and only one sample from Troy conglomerate.

Without a knowledge of stratigraphic position in the Apache Group it is often difficult to distinguish some Scanlan conglomerates from Dripping Spring conglomerate and even difficult, in places, to differentiate Barnes conglomerate. All have similar characteristics of a brownish, locally maroon, hematite-stained feldspathic matrix with well-rounded pebbles of Mazatzal quartzite and other older Precambrian rocks. This similarity hindered geologic mapping and sampling of the Sierra Ancha Mountains early on in the program, until we discovered some mutually exclusive criteria in the Roosevelt Lake area which made it possible to distinguish between the conglomerates without knowing their stratigraphic position.

Scanlan conglomerate typically consists of well-rounded boulders of Mazatzal quartzite and minor chert in a dirty, usually more hematitic, quartzofeldspathic matrix. It contains characteristic orange to pink K-feldspar from the Young granite in the north and often contains altered, milky perthitic feldspar from the Ruin Batholith further south. It never contains orange aphanitic rhyolite fragments. It is the most indurated of the three conglomerates, so the fragments and matrix grains will often break.

In contrast, the Barnes conglomerate is least indurated, so the extremely well-rounded, characteristic ellipsoidal to cigar-shaped white quartz, quartzite, and chert pebbles always fall away from the matrix. The grain size population of Barnes is diagnostically bimodal with a very pure white quartz-grain matrix. Scanlan conglomerate is usually coarser grained and much more poorly sorted than Barnes conglomerate, which is always very well sorted.

In contrast, the fragments in Dripping Spring conglomerates are lithologically quite diverse. In addition to abundant Mazatzal quartzite, there are commonly chert, jasper, and volcanic rock fragments as well as a great variety of shaley to silty fragments ripped up from underlying Apache strata. Most diagnostic is the matrix, where, in addition to pink feldspars from the

Young granite, there are bright orange aphanitic rhyolite fragments not present in any other conglomerate older than the Dripping Spring conglomerates. Not only do these orange rhyolite fragments serve to mark this conglomerate, but their stratigraphic position near uranium-bearing strata is important. Conglomerates in the Dripping Spring tend to be relatively poorly sorted with fragments that can vary from very angular to moderately well rounded, and they contain a seriate grain-size population in which matrix and fragment sizes merge.

Scanlan undergoes no major variations in lithology throughout the Sierra Ancha Mountains except near the Deadman ridge to the north where it is anomalously thick and full of locally derived friable rock types (S 16). Further south on the west and south sides of the Sierra Ancha range the matrix of Scanlan is rich in quartz and feldspar detritus from the immediately underlying Ruin porphyritic quartz monzonite (S 33, S 56). Elsewhere there are minor variations in grain size, character, thickness, and sorting due to locally undulating basement topography or variable source material (S 4, S 6, S 13, S 16, S 18, S 19, S 38, S 51). Generally, Scanlan forms a uniform blanket conglomerate deposit of coarse pebbles, cobbles, and boulders at the basal unconformity and, as discussed later, such a deposit is difficult to explain with conventional fluvial or marine depositional-environment models.

The usual red hematitic shale that makes up the overlying Pioneer Formation undergoes a systematic facies change from the southeastern Sierra Ancha Mountains where it is red shale (e.g., S 33 to S 34) through progressively coarsening grain size to the northwest where it is red siltstone and sandstone. The coarser grain size is apparent on the flanks of Armer Mountain, where a hematitic purplish red siltstone to sandstone directly overlies Scanlan. Here Scanlan conglomerate shows coarse trough cross-bedding, poor sorting and strata lensing from 1 to 10 m thick -- all signs of it being a fluvial channel deposit. The Pioneer-equivalent contains pink K-feldspars of probable Young granite origin, and overlying Barnes conglomerate also contains pink K-feldspars of definite Young granite origin. A southerly transport direction of detrital material from the north is therefore indicated.

Because of the northerly source, a northerly or northwesterly coarsening and thickening of the Pioneer up to the Young granite would be expected. This is indeed the case, and in fact the thickest and coarsest grained section of Pioneer occurs in Salome Canyon between S 51 and S 52, where 50 m or more of red sandstone is exposed. North of here, the Pioneer is virtually absent or represented only by a thin layer of red siltstone 10 to 30 cm thick. This break in Pioneer thickness does not correspond to the Deadman ridge affecting Scanlan further north, but as near as we can determine from poor basement exposures in the Sierra Ancha Mountains, it corresponds very closely if not exactly with the contact between the Young granite and Ruin quartz monzonite batholiths. Quartz monzonite of the Ruin Batholith is much more susceptible to surface decomposition and is eroded to a lower elevation than the Young granite. Deep weathering of the quartz monzonite under the Apache Group (up to 100 m below S 56) indicates that a similar topographic variance existed during deposition of the Apache Group. Thus the coarsest and thickest Pioneer section filled the low-lying area over the recessive Ruin quartz

monzonite. Sediment was derived by erosion of Young granite in the north, and the Pioneer evidently lapped out against the erosional scarp of Young granite at the Ruin Batholith contact.

Difficulty with the depositional environment of the blanket Scanlan deposit is superseded only by problems in finding a modern analogue for deposition of the Barnes conglomerate. Barnes always occurs as a thin blanket deposit 5 to 20 m thick, and is the only conglomerate in the Central Arizona Arch area that is aptly described as supermature. The lithologic uniformity of its bimodal population of large, well-rounded ellipsoidal to cigar-shaped pebbles in a very mature, clean matrix of well-rounded sand to grit-size grains is astounding. Only the most resistant materials -- quartzite, vein quartz, chert, and sometimes jasper -- make up the fragments. The larger pebbles obviously acted as rollers in the beach or stream environment. However, a normal fluvial origin for the Barnes is difficult to uphold because of the absence of essential features such as stratigraphic lenses and channeling, large-scale trough cross-bedding, grading, and poor sorting in any part of the Barnes conglomerate.

The northernmost exposures of Barnes conglomerate that we were able to find and sample were in Blevens Canyon just north of Greenback Peak, where the unit appears to be only 1 to 2 m thick (S 14, S 15). Barnes is absent from the Juniper Mountain section further north, so if these outcrops are close to the most northerly extent of Barnes, its lap out corresponds essentially to the same batholith-contact line affecting the Pioneer.

In this same Blevens Canyon area there is a broad zone of chert breccias in the Mescal limestone unit which are not laterally extensive, as far as we could determine. These breccias could signify either (a) founder breccias, (b) a breccia facies within a reef deposit, (c) collapse breccias along a topographic break in the basement surface, or (d) a tectonic breccia zone, but the last is least likely. Regardless of the origin, the chert breccias are commonly limonite stained and cellular, probably from weathering of included pyrite, and are radioactive (200 to 450 cps). The only rock stratigraphically higher than the Mescal that was sampled is fine pebble to granule conglomerate in the Troy quartzite (S 20). Lithologically, Troy quartzite is much like the poorly cemented, white granule conglomerates high in the Mazatzal Group in the Wilderness area, except the Troy matrix is full of rhyolitic and feldspathic material probably derived from the underlying Dripping Spring unit.

As near as can be determined from existing exposures, the same break affecting the Pioneer also demarcates a major change in the lithology of the Dripping Spring Formation. North and northwest of this line quartzites dominate the Dripping Spring unit, and the few conglomerates present are of intraformational derivation. However, south of the break conglomerates are thicker, more abundant, more polymictic, and contain abundant pink matrix K-feldspars, most probably from the Young granite. Young-granite K-feldspars are also present in some conglomerates further north (e.g., S 2, S 3, S 5, S 7), so these distinctions are part of a general trend rather than a sharp break in Dripping Spring sedimentation. Alternatively, the paleo-break in slope where the various units lap out to the north could be transgressive northward with time.

One certain feature of Dripping Spring conglomerate is that the fragments of distinctive orange aphanitic rhyolite are only found in conglomerates south of the topographic break in the basement. We found small dikes of the orange rhyolite cutting lower Apache strata further north in the Diamond Butte area, but never flows or fragments of such rhyolite in the conglomerates of this northern area. Dripping Spring conglomerates throughout the central and southern Sierra Ancha Mountains and southward on into the Roosevelt Lake area contain these orange aphanitic rhyolite fragments in abundance. At one sample site, S 50, there are orange feldspathic "quartzites" of high radiometric response which could be tuffaceous and more directly related to the rhyolitic volcanism. This site is an isolated knob, so its relative stratigraphic position is not known, but lithologically identical orange tuff layers are found in the radioactive part of the Dripping Spring strata at other localities.

Gastil (1954a) reported K-feldspar-rich beds of rhyolitic tuff in the underlying Pioneer shale and suggested that much of what has been called shale throughout the Sierra Ancha Mountains could really be rhyolitic tuff. The rhyolite fragments in Dripping Spring conglomerates could have been derived by erosion of rhyolitic tuff layers in the underlying Pioneer, but the angularity of the fragments suggests little if any water working. The uniform aphanitic matrix and the presence of small K-feldspar microcrysts in the orange rhyolite fragments suggest that unweathered volcanic flow material was most probably contributed directly to the Dripping Spring conglomerates. Thus volcanism producing the rhyolitic fragments would have been contemporaneous with deposition of the Dripping Spring units, as Gastil (1954a) also suggested for the Pioneer. If so, the high radioactivity of the orange aphanitic rhyolite (e.g., dikes exceed 600 cps) is of significance in considering the origin of uranium deposits in the Dripping Spring Formation.

3.5.1 Uranium Deposits

Though the Apache Group has undergone no Precambrian deformation, it has been substantially metamorphosed where diabase bodies have intruded. For example, Mescal limestone, where impure, is metamorphosed to a magnetite-rich skarn, and where pure, to chrysotile-asbestos rock. Also, there is a very definite correlation in that nearly all the small uranium mines and prospects in the middle-member siltstone of the Dripping Spring Formation that were studied by Granger and Raup (1969) occur at or near diabase contacts. Thus the diabase is responsible for producing most of the high-grade metallic and nonmetallic mineral deposits of the Sierra Ancha Mountains, and from this point of view it is understandable that the diabase might at first be thought to be responsible for introducing the uranium into the Dripping Spring siltstone (Schwartz, 1957; Neuerburg and Granger, 1960).

However, this interpretation is in conflict with every other piece of evidence pertaining to the distribution of radioactivity in the rocks. In our traverses through the Sierra Ancha Mountains we meticulously recorded many scintillometer profiles through diabase bodies, both near the uranium deposits and distant from them. In all cases, scintillometer response within the diabase bodies was abysmally low at 5 to 25 cps, in some places seeming

to be even less than cosmic-background values. Diabase, in fact, gives a negative scintillometer response relative to all other rock types in the region, regardless of type or age. Even in the general vicinity of uranium deposits we found the diabase to be anomalously low in radioactivity (30 to 50 cps). Only right at the diabase contact with radioactive Dripping Spring siltstone is there a significant increase in the scintillometer response, up to 200 to 300 cps, but even here the contrast between radioactively enriched diabase and highly radioactive siltstones is usually more than one order of magnitude (e.g., 255 cps in diabase versus 3,500 cps in siltstones, Workman Creek deposit).

Under these conditions, the suggestion that diabase could be so altruistic as to give up all of its uranium to adjacent country rock and leave itself depleted relative to other rocks is pure fantasy. We carefully reviewed all of the geochemical arguments advanced by Neuerburg and Granger (1960) and Granger and Raup (1962, 1969) and found no evidence presented for outward migration of uranium-bearing solutions from the diabase that could not alternatively be interpreted as inward migration of the uranium-bearing solutions from metamorphosed siltstones. As quoted previously in this report, a preconceived model of a diabase source for uranium "...guided sampling and interpretation of the geochemical data."

A more regional perspective on the uranium deposits in the Dripping Spring would have provided these workers with two valuable pieces of information:

1. diabase is everywhere low in background radioactivity and geochemically low in uranium except where it is in contact with carbonaceous, pyritic siltstones of the Dripping Spring Formation; and

2. the black, carbonaceous Dripping Spring siltstones and shales are anomalously high in background radioactivity wherever they are found in the central and southern Sierra Ancha Mountains, regardless of the presence or absence of diabase.

We found that the higher scintillometer response of the siltstones was so systematic that one could almost map stratigraphy by it. The maximum readings on the scintillometer (over about 2,000 cps) in the siltstones do, however, correlate to the proximity of a diabase contact, indicating that the intrusion of, and heat or fluids from, the diabase has served to enrich uranium in the Dripping Spring siltstones at the diabase contact (cf. Williams, 1957).

Diabase is not known to have substantially recrystallized, hydrothermally affected, or caused any of the Scanlan, Barnes, or Dripping Spring conglomerates to be enriched in uranium or other metals. Rather than just static thermal metamorphism, hydrothermal exchange with chemically reactive rocks seems to have caused the widest "contact aureoles," because Mescal limestone and carbonaceous pyrite shales are the only rocks substantially affected by diabase.

Three samples of radioactive Dripping Spring siltstone were taken to see what uranium values correlated to scintillometer readings in the range of 1,000 to 9,000 cps (S 35, S 37, S 55). Sample S 55 was taken from the Red Bluff uranium mine dumps where we investigated the characteristics of the fresh siltstones in detail. Three features were most notable:

1. the clastic silty to clayey component of the siltstones and shales seemed to be everywhere rich in carbonaceous material (sub-graphite);

2. strata-bound syngenetic pyrite is consistently present in small amounts (1 to 5 percent) and is either dispersed throughout particular layers in the siltstones or is concentrated as thin laminae on shaley partings between siltstone layers;

3. black, carbonaceous beds are repetitiously interlayered with pink to orange, non-carbonaceous, siliceous rhyolitic tuff layers.

In some places at site S 55, one sees thinly and delicately laminated pink to white rhyolitic tuff with bedding planes contorted by soft-sediment deformation. Elsewhere the pink to orange rhyolite tuff participates in thin graded-bedding cycles with carbonaceous siltstones and shales. All cycles start with the coarser feldspathic tuff material and end with the finest, carbonaceous and pyritic, clay material.

The siltstone samples, and thus the rhyolitic tuff layers within them, are unusually high in potassium (see Williams, 1957, and following section). Most of the pink to orange material is therefore some variety of K-feldspar. A highly unusual depositional environment would be required if this feldspar-rich material were to be eroded from a source terrain and transported into a shale-rich basin as the only coarse detritus without quartz or other detrital grains; there would be no explanation for the fine-scale, compositionally exclusive interlamination that is observed, and presumably all of the rock would be black if it consisted only of clastic detritus. Rather, the features we observed indicate clearly the simultaneous deposition of two somewhat independent components:

1. terrigenous silt and shale material deposited in a reducing environment as carbonaceous, pyritic shale and siltstone; and

2. K-feldspar-rich rhyolitic tuff material contributed directly to the reducing basin from contemporaneous effusive rhyolitic volcanism.

In many of the uranium deposits where unaltered, fresh rock can be found, one also finds these tuffaceous layers and therefore the evidence for rhyolitic volcanism contemporaneous with deposition of Dripping Spring siltstones and carbonaceous shales. In fact there is enough evidence that a rhyolitic component probably should be considered the normal condition of the radioactive middle member of the Dripping Spring Formation, not the exception. Interestingly, the middle-member black siltstone and shale is restricted to the central and southern Sierra Ancha Mountains, more or less to the same vicinity as the Pioneer shale and its thicker siltstone facies. Thus the

Dripping Spring black siltstone could be controlled by the same topographic boundary that restricted the Pioneer to a basin bounded on the north by the Young granite. The distribution of uranium deposits (fig. 2) might indicate this to be true, but we have not undertaken a detailed study of all siltstone-related deposits as this was not the main purpose of our study. Some radioactive anomalies do lie in Dripping Spring quartzites to the north (S 7), and these rocks could be coarser-grained facies of the shales and siltstones in the reducing basin to the south.

3.6 Other Areas

From the main region of Precambrian conglomerates in the Central Arizona Arch, Apache Group extends across Salt River into the Roosevelt Lake area and more easterly into the Globe area, whence it extends patchily throughout southeastern Arizona (Shride, 1967). Mazatzal Group or rocks suggested to be correlative to it are found principally at three other localities: Four Peaks, Hess Canyon, and Chino Valley, near Prescott. Conglomeratic Alder Group rocks are also found in the Hess Canyon area, and although more such rocks extend westerly into the Cave Creek area (west of fig. 1), these were not sampled in this study.

3.6.1 Roosevelt Lake

Apache Group outside of the main Sierra Ancha Mountains is found as folded and tilted or faulted strata extending from Roosevelt Lake easterly around to Chrome Butte (northeast of Globe in figs. 1, 2, and 3), all of which areas were sampled briefly.

Just down from Roosevelt Lake Dam the basal Apache unconformity is well exposed in an east-tilted Apache Group section. Here Scanlan boulder conglomerate rests on a granitic to granodioritic gneiss slightly older than the Young granite. The Scanlan is very poorly sorted with abundant granitic detritus in the matrix and large boulders of Mazatzal quartzite typically constituting the fragments (S 42). Further south the matrix contains specularite (S 44). The criteria that were listed earlier as distinctive of Scanlan as opposed to Barnes or Dripping Spring conglomerates are very apparent in the Roosevelt Lake area. Feldspars from the Young granite are not abundant, and orange aphanitic rhyolite fragments are absent.

Dripping Spring conglomerates are found in the lower sandstone member near Roosevelt Dam (S 41), south of Roosevelt (S 43), on the highway to Globe (S 45), and near Chrome Butte (S 47, S 48). The conglomerates are typically finer grained and better sorted than Scanlan, although more poorly rounded. Both pink feldspars and abundant orange to pink aphanitic rhyolite fragments diagnostic of the higher stratigraphic position in the Apache Group are found in the Dripping Spring conglomerates. The only conglomerate type found in the Dripping Spring further north was an intraformational one (S 57). Unlike the Dripping Spring or Scanlan conglomerates, Barnes in the Roosevelt Lake area is white, non-hematitic and typical of the character found throughout much of southeast Arizona (S 49). For the purposes of geochemical comparisons to Apache Group rocks outside of the Central Arizona Arch area, one sample of Dripping Spring conglomerate (S 54) was taken near a uranium prospect in the Pinal Mountains (south of figs. 1, 2, and 3).

3.6.2 Hess Canyon

An interlayered sequence of white quartzite, red siltstone, and hematitic shale occurs south of Salt River in the Hess Canyon area (figs. 2, 3). It was studied in detail by Livingston (1969), who correlated these rocks

with the Mazatzal Group. This correlation is difficult to make on a lithologic basis because there are no rocks resembling either the Deadman or Maverick units, and the quartzites do not lithologically resemble the main mass of Mazatzal quartzite, grit, and conglomerate anywhere else in the central Arizona area. However, the correlation is tenable on the basis of stratigraphic position as both quartzites overlie rhyolitic ignimbrites and predate the main Precambrian deformation (Anderson, in prep.).

The relatively thin (200 m or less) Hess Canyon quartzite sequence consists of white to pink to pale maroon, generally non-hematitic quartzites, pale red siltstones, and darker muddy red strata interlayered on a scale of tens of meters. Concentrations of detrital specularite are virtually absent even at the base of the quartzite sequence, and all hematite is dispersed as powdery material strictly in the finest grained rocks. The main white quartzites are so pure and massive that their dominant structure is perlitic cracks.

Not only do the quartzites tend to be fine-grained, but the section is essentially devoid of any coarse detritus including grit or conglomerate. The only conglomerates we found in Hess Canyon were intraformational ones of softer shaley and silty material broken up at the top of a softer unit and incorporated into the base of a quartzite unit. These rocks were mixed with chip samples from the adjacent quartzites for a general geochemical representation of the Hess Canyon quartzite section (H 3, H 4). There are abundant dark-spotted quartzites which superficially appear to be sparse conglomerates, but this is a weathering phenomenon.

The most prominent sedimentary structure is current or oscillation ripple marks, which are especially abundant in the siltstone units. Mud cracks are present in the hematitic shales, and tiny scour channels are present at contacts between quartzite and siltstone, whereas planar cross-bedding or miniature trough cross-bedding in the absence of large-scale trough cross-bedding characterizes the quartzites. These features require that the depositional environment be a shallow-water marine, intertidal, or littoral setting. The absence of coarse material in the sediments and the lack of heavy mineral concentrates suggest that this shallow-water setting was distant from any major source terrain such as was present further north during deposition of the Mazatzal Group.

Stratigraphically below the rhyolitic ignimbrites under the Hess Canyon quartzites is a series of volcaniclastic rocks ranging from dacitic lithic-crystal tuffs and rhyolitic agglomerates to volcanic siltstones. Although the details (P. Anderson, in prep.) are not essential to this report, these rocks were sampled (H 1 and H 2) because they are representative of volcanic conglomerates in the Alder Group, and their lithologic characteristics and distal volcanic setting are closely similar to volcanic conglomerates in the East Verde River area; geochemical comparisons were therefore warranted.

3.6.3 Four Peaks

As in Hess Canyon, folded white quartzites that make up Four Peaks south of the Mazatzal Mountains (fig. 3) have been correlated with the Mazatzal

Group (Wilson, 1939; Wilson, Moore, and Cooper, 1968). Their lithology and setting are significantly different from either Mazatzal Group further north or Hess Canyon quartzites to the east. White quartzites occupy a tight syncline which makes up Four Peaks and rest unconformably on pelitic sediments that are quite highly metamorphosed by the adjacent 1400 m.y.-old Four Peaks batholith (Anderson, in prep.).

Everywhere but in the lowest 50 m, the Four Peaks quartzites are uniformly pure white, fine grained, massive to somewhat structureless, but locally moderately well bedded and cross bedded, and contain minor grit but no conglomerate for a thickness of more than 400 m. A traverse up First Peak in no way resembles any part of the distinctive Mazatzal strata in the Mazatzal Wilderness except for the uppermost white quartzite unit that caps the highest peaks (e.g., North Peak).

However, a traverse around to Fourth Peak cuts through the basal 50 m of section, and it is here that one sees numerous attributes of the Four Peaks quartzites which indicate that they are probably correlative with, but a different facies of, the Mazatzal Group. On the south side of Fourth Peak the quartzites are somewhat hematitic at the base, black quartzite with detrital specularite is present, minor grit and granule conglomerate is infrequently found in cross-bedded lenses, and sparse, granule- to pebble-size black specularitic fragments are found in some quartzite layers. Pale maroon to pale purple quartzites in the lower 35 m of section are locally specularite bedded, cross bedded, contain thin specularite-concentrate layers, and in general contain from 0.5 to 3 percent total hematite.

These features, present where sample F 1 was taken, definitely support the correlation that the Four Peaks quartzites are a facies of the Mazatzal Group deposited under different conditions in the south. Current ripple marks, miniature trough cross beds, and planar cross beds in the absence of coarse material and large-scale cross bedding suggest a quieter marine, possibly deeper water, environment for the Four Peaks quartzites, away from strong wave action where the sediments infrequently experienced bottom current activity. The setting of Four Peaks as a deeper water offshore facies of the Mazatzal Group is therefore quite likely, but certainly not yet proven.

3.6.4 Chino Valley

In marked contrast to Four Peaks and Hess Canyon, the exposures of folded conglomeratic quartzites in Granite Creek near Chino Valley, north of Prescott, are instantly recognizable as part of the Mazatzal Group even though the exposures lie 125 km northwest of the Mazatzal Mountains. The quartzites are well bedded and trough cross bedded and contain ever-present concentrations of detrital specularite. The section is generally maroon to brick red quartz-jasper-chert quartzite and grit, but coarse quartz-jasper-pebble conglomerate is very abundant and in places makes up 50 percent of the section.

In particular there are two thick conglomerate units containing spectacular pebbles and cobbles of large white quartz and red jasper. These rounded fragments are set in a black to white to red, poorly sorted matrix of conglomerate and quartzite that is very rich in detrital specularite. Both the upper (B 138) and the lower (B 140) conglomerates were sampled strictly for the purposes of comparing geochemical and scintillometer profiles of Mazatzal rocks here with those in the Central Arizona Arch area.

The area was first studied by Wilson (1939) and Kreiger (1965), but the detailed geology and depositional environment of the Mazatzal rocks here are being restudied by K. R. Wirth (in prep.). In essence, the very coarse and poorly sorted nature of the specularitic conglomerates and quartzites of the Chino Valley section, with cobbles, pebbles, and granules abundantly to sparsely spread on large trough cross-bed sets throughout hundreds of meters of stratigraphy, indicates that this area was the site of a long-lived fluvial system during deposition of the Mazatzal Group (K. Wirth, in prep.). The uppermost red to maroon, finer grained planar cross-bedded quartzites might be the only rocks in the 1,500 m section deposited in a marine setting. Detailed compositional differences between the quartzites and conglomerate pebbles in the Chino Valley area versus those in the Mazatzal Wilderness area can be accounted for by an understanding of the differences between the complex source terrains in each region (P. Anderson, in prep.).

4.0 GEOCHEMICAL RESULTS

Out of about 450 rock units that were sampled during the course of this study, nearly 300 were pertinent either to the quartz-pebble conglomerate lithotype or were required for geochemical comparisons to other rock units and were sent to Oak Ridge Gaseous Diffusion Plant in Tennessee for geochemical analyses. In addition, 30 water samples representing small drainage basins removed from contaminated areas were also submitted for analysis.

Acid soluble or readily extractable uranium was determined by fluorometric analysis (UF1) and reported in parts per million (ppm) for rock or parts per billion (ppb) for water samples. Rock samples were also analyzed for their total uranium content by delayed neutron activation (U-NT) and these results reported in ppm. All of the samples were analyzed for six major elements and 22 trace elements: the major-element values for Al, Ca, Fe, K, Mg, and Na were reported in percentages; trace-element values for Ag, B, Ba, Be, Ce, Co, Cr, Cu, Li, Mn, Mo, Nb, Ni, P, Sc, Sr, Th, Ti, V, Y, Zn, and Zr were reported in ppm. These results can be found in the computer print-out reproduced in appendix D, with detection limits for the trace elements indicated by the minimum value quoted for each element. UF1 and U-NT detection limits are quoted as 0.25 and 0.20 ppm (or 0.20 ppb UF1 for water samples) respectively. All such major and trace element analyses were done by the argon-plasma emission spectroscopy method.

In addition, we requested that 32 pebble conglomerates be analyzed for Au and five rocks be analyzed for their free carbon content. Gold was analyzed by delayed neutron activation and the detection limit quoted as 0.2 ppm. Free carbon was analyzed by the LECO method of ignition with a 10 ppm detection limit.

4.1 Sample Distribution

In our sampling program we attempted to distribute the number of samples evenly in proportion to the distribution of conglomerate throughout the Central Arizona Arch area. The Sample Summary Tables (appendix C) are our main tabulation of all samples analyzed in this study. The sample numbers are indexed by area and are keyed to stratigraphic group, conglomerate type, radiometric, uranium-geochemical, and location information in these tables. Average radiometric results are also presented in table 1.

From the Sample Summary Tables and table 1 it can be seen that: (a) 35 conglomerates were sampled from volcanic and sedimentary units in the Alder group; (b) 68 Deadman, 6 Maverick, and 104 Mazatzal samples, to make a total of 178, were taken from the Mazatzal Group; and (c) 25 Scanlan, 16 Barnes, 25 Dripping Spring, 8 Mescal, and 1 Troy, to make a total of 75 samples, were taken from the Apache Group. This sample distribution is in proportion to the outcrop area of each rock unit and the amount of conglomerate each unit contains, with two exceptions: (a) proportionately less

Table 1: AVERAGE RADIOMETRIC RESULTS

Rock Type	Area	No. Samples	Scintillometer (cps) Avg.	High	Low	U-NT Geochemistry (ppm) Avg.	High	Low
Alder volcanic (V)	all	12	157	240	85	3.08	4.7	1.8
Alder sed. (A)	all	23	110	270	55	1.76	4.4	0.7
Deadman (D)	Mazatzal (m)	63	131	300	47	4.50	19.0	0.6
"	Sheep Basin (sb)	7	161	235	122	9.45	33.0	4.8
Maverick (K)	Mazatzal (m)	6	85	100	66	1.30	1.8	1.0
"	Sheep Basin (sb)	0	125	--	--	--	--	--
Mazatzal (M)	Mazatzal (m)	63	73	140	55	1.39	5.0	0.5
"	Pine (p)	12	115	228	55	2.82	7.7	1.0
"	Christopher (cm)	9	81	111	65	2.03	5.7	0.7
"	Diamond Butte (db)	11	120	452	63	4.18	32.0	0.9
"	Sheep Basin (sb)	4	93	142	57	5.23	11.3	2.0
"	Chino Valley (cv)	2	82	--	--	1.95	--	--
"	Hess Canyon (hc)	2	100	--	--	1.40	--	--
"	Four Peaks	1	--	--	--	1.10	--	--
Scanlan (S)	North (n)	13	170	345	88	2.30	3.3	1.3
"	South (s)	12	134	200	100	2.45	3.4	1.3
Barnes (B)	all	16	114	175	50	1.60	4.9	0.8
Dripping Spring	North (n)	3	187	250	150	2.73	3.9	1.8
" (DS)	South (s)	18	150	285	85	1.71	3.3	0.3
"	Siltstone	3	3267	8000	800	303.70	462.8	101.9
Mescal (L)	all	8	200	450	90	1.79	4.1	0.8
Rhyolite and Granite (R&Gr)	all	7	189	250	140	3.35	7.8	0.8
Diabase	all	0	25	15	50	--	--	--
Average			151.5			5.84		
Average without Siltstone			119.5			2.77		

NOTE: Letters in brackets following each rock type and area are used to identify the points plotted in figure 9.

Alder volcanic conglomerate was sampled because of dissimilarity to quartz pebble conglomerate; and (b) proportionately more Deadman samples were taken because of their higher radiometric response. In addition, we took seven samples of rhyolites and granites in order to see if they could have been high-U sourceterrains for some of the conglomerates.

4.2 Surface Radiometrics

During geologic mapping and surface sampling, scintillometer profiles of all rock units in the Central Arizona Arch area were obtained. We used two total-gamma counting portable scintillometers, a Mount Sopris SC-132 and a Geometrics GR101A. At some sites in the Sierra Ancha Mountains differential spectrometer readings from a Geometrics GR310 portable gamma-ray spectrometer were taken for comparison to Mount Sopris scintillometer readings. For consistency, all scintillometer values in the text and appendices have been normalized to the counts-per-second (cps) readings of the Mount Sopris scintillometer via the correlation chart of figure 8. The correlation is not linear because each scintillometer behaves differentially to the other depending on whether their maximum-response curve is keyed to low or high radiometric readings. Most correlations were made in the range of less than 200 cps.

In all cases the differential spectrometer readings from the Geometrics GR310 were very poor approximations of the analytical values of U, Th and K in the rocks. Spectrometer values were consistently 2 to 4 times too high for U, 2 times too low to 10 times too high for Th, and 2 to 12 times too low for K values. This as well as the unpredictability of whether the reading is too high or low in any sample makes the spectrometer readings more misleading than useful. There is good correlation between total spectrometer counts and total scintillometer counts.

Table 1 shows that there is relatively good correlation between scintillometer values and U-NT values if each rock type is considered separately. This is because there is a separate correlation coefficient between U-NT values and scintillometer reading for each rock type, but when all different rock types are grouped there is much poorer aggregate correlation (fig. 16).

Figure 9 is a plot of the data in table 1 and shows well the rock type dependence of scintillometer versus uranium-value correlation. This radiometric variance graph is particularly interesting in that it provides information about both the depositional environments of the rock units and their state of evolution or maturity. The highest energy conglomerates occur on the right side and the lowest energy conglomerates occur on the left; the most primitive U-rich geologic units are along lines with the lowest slopes whereas the most mature or evolved Th- (or K-) rich rocks have the steeper slopes. We will return to discussion of figure 9 in the interpretive part of this report.

During the course of field work several features were observed to correlate well with variation in scintillometer readings:

FIGURE 8

Scintillometer Correlation Chart

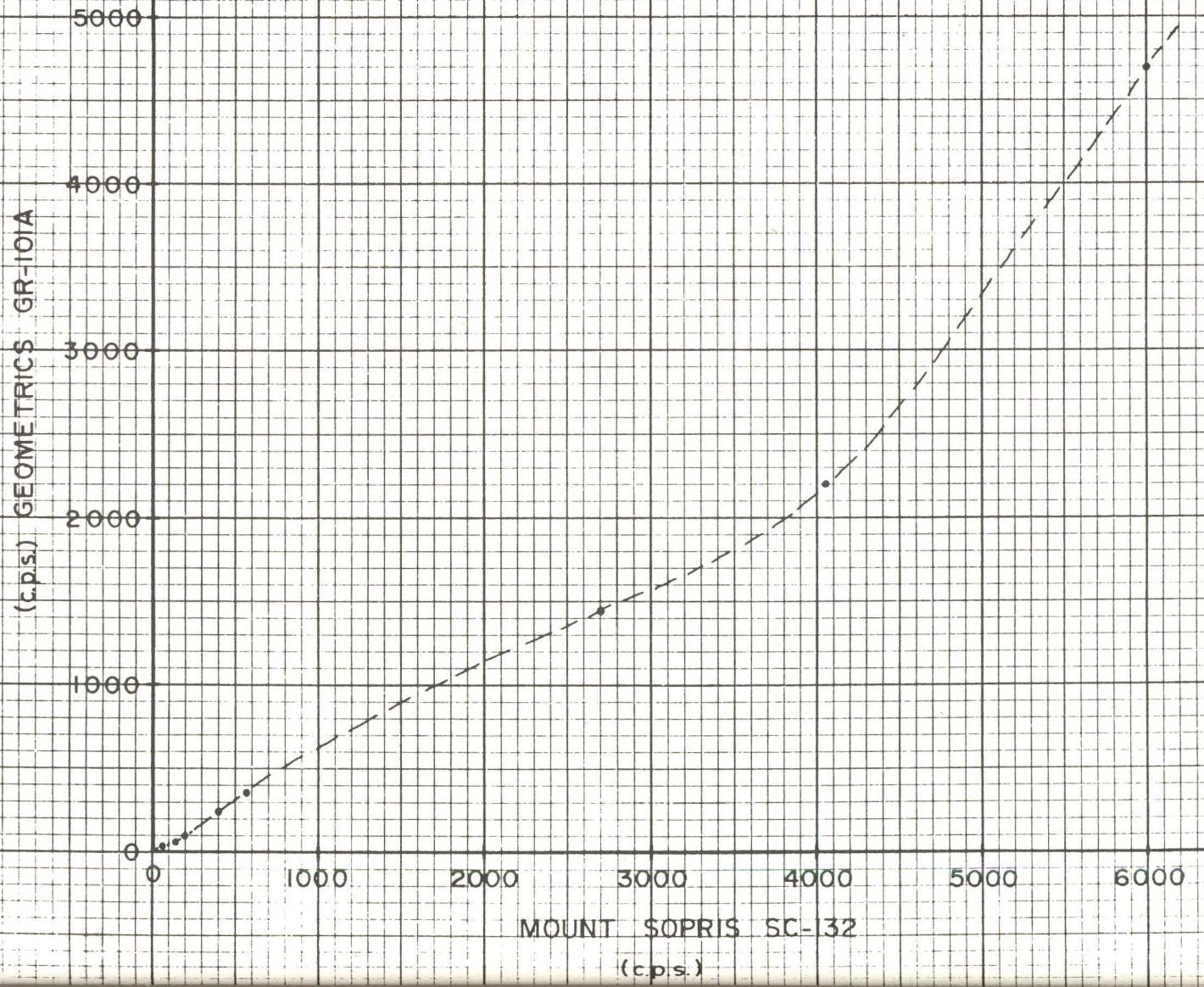
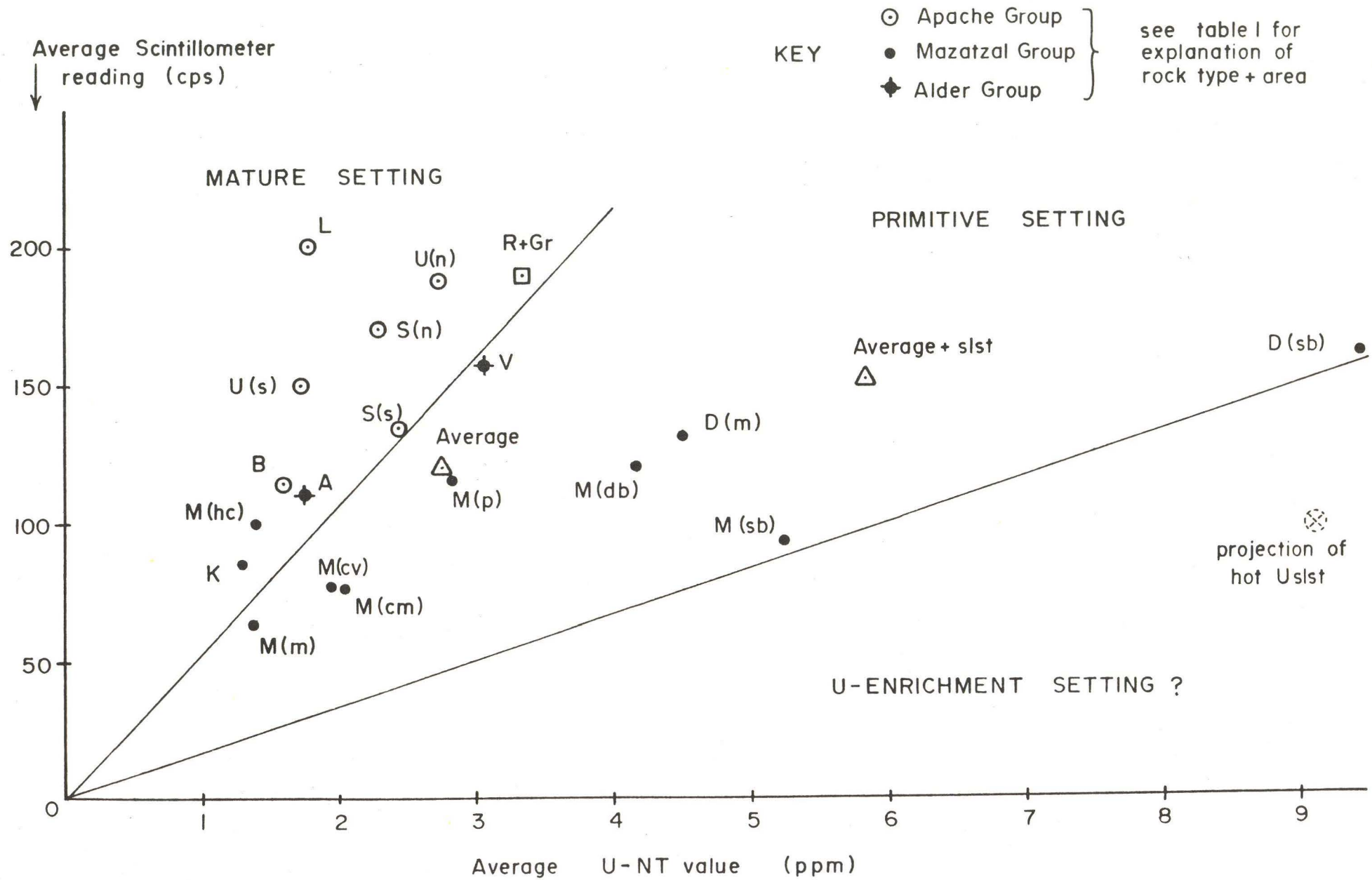


FIGURE 9 : RADIOMETRIC VARIANCE FOR AVERAGE CONGLOMERATE VALUES



1. traverses across stratigraphy, most notably in the Mazatzal and Alder Groups, showed that the coarser grained conglomerates or grits in most cases give higher scintillometer readings than quartzites;

2. in these same sections higher scintillometer readings correlate with concentrations of heavy metals;

3. the bases of many units in the Mazatzal Group have higher scintillometer responses than upper parts of the section;

4. in basal Deadman conglomerate units where rhyolitic boulders from the adjacent rhyolite terrain are cycled into the conglomerates, the rhyolite bodies themselves always give higher scintillometer response than the rhyolitic conglomerate unless heavy-mineral concentrates are present;

5. analogous to 4. is the correlation that volcanic conglomerates in the Alder Group give higher scintillometer readings than nonvolcanic conglomerates;

6. in many parts of the Apache Group, the coarsest grained sedimentary rocks give the lowest scintillometer response.

Scintillometer values between 160 and 200 cps are typical for the earliest dacitic to rhyolitic volcanic units in the Alder Group, whereas the volcanic conglomerates derived by erosion of these rocks usually give 130 to 180 cps readings. An analogous situation exists with the Red Rock rhyolites and ignimbrites between the Alder and Mazatzal Groups: the rhyolites rarely are less than 200 cps, whereas the rhyolite-boulder conglomerates derived from them in paleochannels at the base of the Deadman give 140 to 190 cps readings. Similarly, the boulder conglomerate at the base of the Mazatzal at Pine gives 165 cps, whereas the Payson granite from which most of the material is derived yields readings up to 200 cps. The Young granite is somewhat radiometrically hotter, up to 320 cps, but the basal Scanlan conglomerate of largely granite detritus resting on it west of Young provides only a 160 cps response. The Ruin porphyritic quartz monzonite is one of the most radiometrically responsive (up to 280 cps) but basal Scanlan containing mostly residual granitoid grus from the Ruin rocks in the southern Sierra Ancha Mountains gives a 200 cps response.

This systematic realtion of a basal conglomerate being 20 to 40 percent less radioactive than the material it is derived from is of fundamental importance in determining whether or not the basal-conglomerate environment in central Arizona Precambrian conglomerates concentrated uranium values in excess of those in the source rocks. In fact, it suggests that in the absence of some other concentrating factor they did not, because the normal residual conglomerate is slightly depleted in radioactive components relative to its source rock, simply from the addition of other sedimentary detritus. Discovering this relationship caused us to search for other concentrating factors during the sampling program.

From this search emerged a consistent and unfailing relationship in the Central Arizona Arch area: wherever one finds a concentration of specularite or heavy metals there is a significantly higher scintillometer response. This condition is not surprising in itself, but we found it to be true even in places where the concentration was only powdery hematite in clayey or slatey rocks. An excellent example of this is an anomalously high reading of 345 cps in red hematitic shales at the base of the Scanlan conglomerate in the Diamond Butte area (D 50) in a place where no highly radioactive source rocks are apparent. This means that not only is the higher radioactivity intrinsic to detrital heavy minerals such as zircon, sphene, apatite, leucoxene, and rutile, but radioactivity must also be fixed by the high hematitic concentrations in places where there are none of these detrital minerals.

Thus, heavy-mineral or hematitic concentrations typically cause scintillometer anomalies in the range of 200 to 250 cps, usually 2 to 3 times background. These heavy mineral concentrations correlate to substantially higher U-NT values in the Mazatzal Group rocks than in Apache Group rocks having the same range of scintillometer values, as figure 9 shows. The only rocks in the Central Arizona Arch which have highly anomalous scintillometer readings in excess of 300 cps are not conglomerates, but are the Mescal chert breccia and Dripping Spring siltstone.

A general conclusion from the surface radiometric (scintillometer) data is that if used carefully with respect to different rock types, it provides extremely accurate field information on where uranium concentrations occur within specific rock units, as well as providing a surprisingly precise measure of the uranium concentrations in some rock sequences. The scintillometer can be a superb tool for discriminating or mapping different rock types if used wisely.

4.3 Uranium Geochemistry

The fluorometric method of uranium analysis detects uranium in compounds soluble in nitric or hydrofluoric acid, whereas delayed neutron activation presumably detects all uranium in a sample, regardless of how it is bound. The UF1 to U-NT ratio should therefore be a good measure of the readily extractable uranium in the rock, and ideally should never be greater than 1. Allowing for a 10 percent analytical precision, 15 percent of the UF1/U-NT ratios exceeded 1.1, with the highest ratio being 4.2 (see Sample Summary Tables, appendix C).

There is a tendency for the finer grained rocks rich in clay or highly altered rocks to exceed 1, suggesting that uranium in these cases might have been mobilized into loosely bound lattice sites. Even more samples (20%) had unusually low UF1/U-NT ratios less than 0.5, and we noticed a tendency for these results to correlate to rocks high in heavy mineral concentrations, thus suggesting that uranium may be bound in insoluble Fe or Ti compounds which were not broken down in acid. However, both of these relations are by no means consistent and apply only to some samples. This, plus the fact that 30 percent of the UF1/U-NT ratios fall outside the 0.7 to 1.2 range, suggests that there may be analytical problems with several samples either in

UF1 or U-NT values. In this geochemical discussion, all results are taken at face value, but we rely more heavily on the U-NT values than on the UF1 values; at a point where uranium extraction from rocks is considered, UF1 values may attain greater importance.

A series of frequency histograms of U-NT values for different rock types in different areas has been prepared from the U-NT geochemical data (figs. 10 to 15). Each sample plotted on these histograms can be identified individually in the Sample Summary Tables by comparing its area, code, and U-NT value. Figure 10 shows the total U-NT profile for all samples of conglomerates in the Central Arizona Arch area. Three highly radioactive Dripping Spring siltstones, S 55, S 37, and S 35, were sampled from uranium prospects in the Southern Sierra Ancha Mountains for comparative purposes. These radioactive samples contain between 110 and 460 ppm uranium and are excluded from all of the histograms.

The two conglomerates with highest U values are a 32 ppm Mazatzal sample and a 33 ppm Deadman sample, both of which are rich in specularite concentrations. The seven samples between 10 and 20 ppm are all specularitic Deadman samples except for a pyritic Mazatzal sample, D 38A, on Sheep Basin Mountain. From the U-NT distribution in Figure 10, any U values above 6.5 ppm are statistically anomalous; the modal value is from 1 to 1.5 ppm and the median occurs between 2.5 and 3 ppm. Whereas this data is interesting, it says nothing about how uranium is distributed in the different rock units or in different areas.

From figures 11 and 12, the distribution of U-NT values for conglomerates in the Mazatzal unit indicates a pronounced tendency toward higher values in the Diamond Butte, Christopher Mountain, and Pine areas than in the Mazatzal Wilderness area. This is especially apparent if one compares the modal or background shift. For geologic reasons it is important to distinguish between Mazatzal samples in the Sheep Basin Mountain area and those further north in the Diamond Butte area. When this is done (fig. 9, table 1), it is clear that both the average U-NT, background U-NT, and maximum U-NT values are all highest in the Sheep Basin and Diamond Butte areas, and higher in the Pine, Christopher Mountain, and Chino Valley areas than in the Mazatzal Wilderness and Hess Canyon. This difference uniquely corresponds to higher energy depositional environments in the areas with higher U-NT values versus lower energy depositional environments in the areas with lower U-NT values.

An analogous contrast between Deadman conglomerates in the Mazatzal Wilderness area versus the Sheep Basin Mountain area (grouped as Diamond Butte area on figure 13) is even more striking. Both the most anomalous and the average U-NT values of Deadman conglomerates from the Sheep Basin Mountain area are much higher than those of Deadman conglomerates in the Wilderness area. Once again, this relationship correlates with an overall higher energy fluvial environment of deposition in the Sheep Basin Mountain area (fig. 9, table 1). We did not attempt to take a statistically impressive number of samples from the Sheep Basin Mountain area because those chosen were representative of the typically higher background and anomalous values of the area.

FIGURE 10:

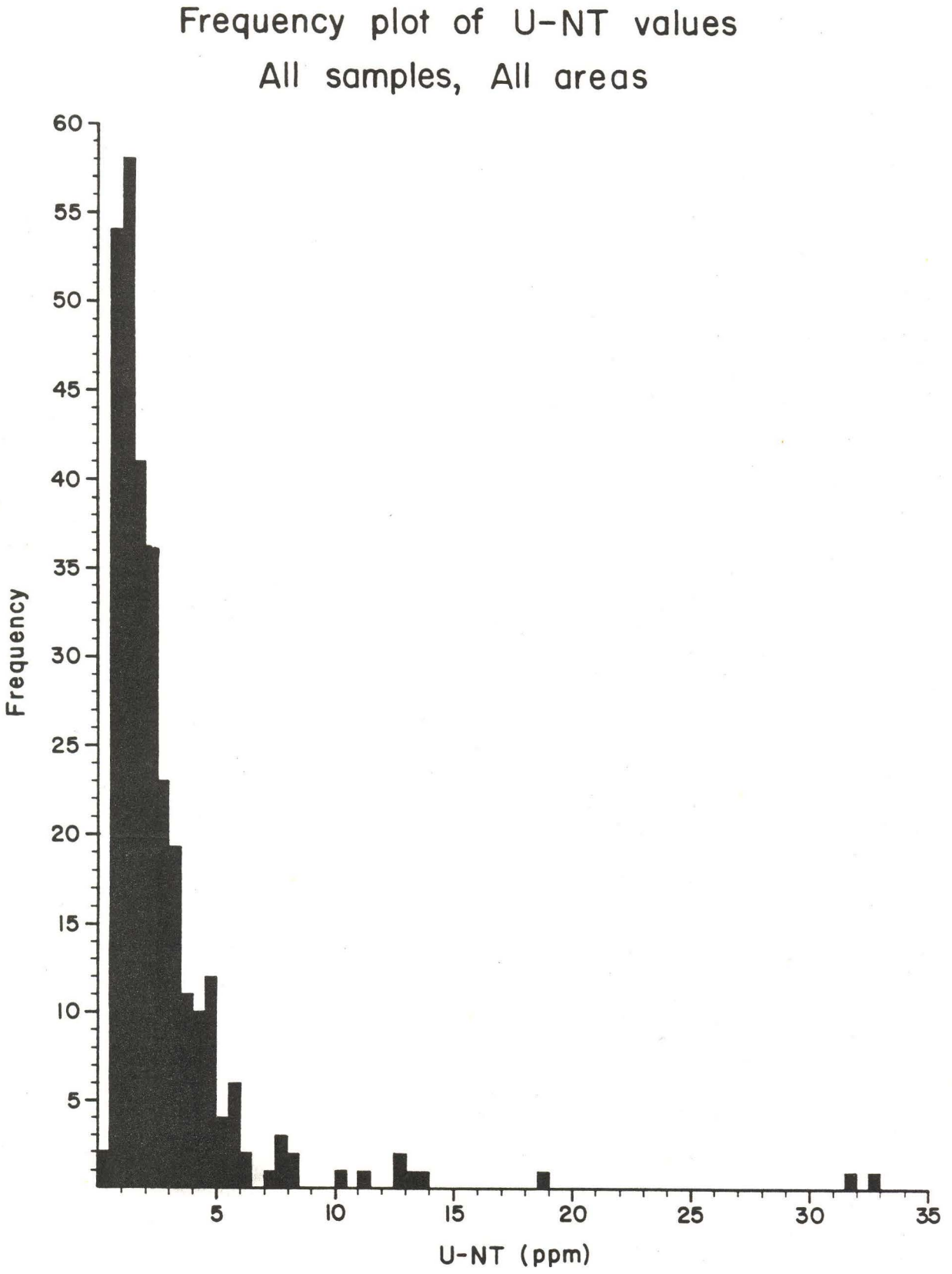
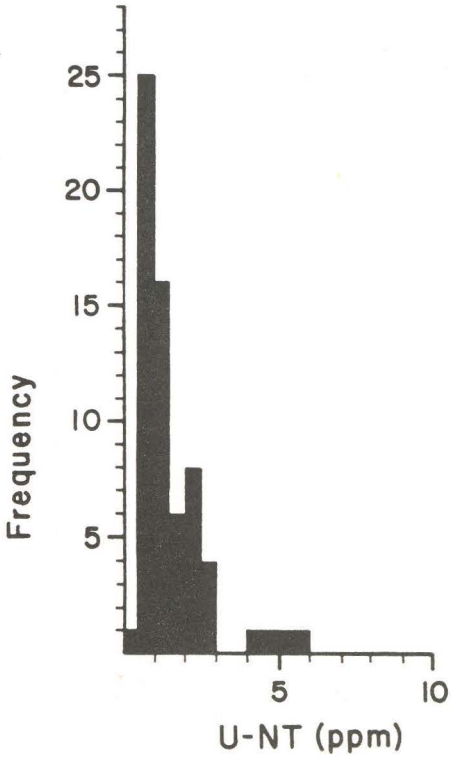

Frequency plot of U-NT values
All samples, All areas
Frequency
60
55
50
45
40
35
30
25
20
15
10
5
5
10
15
20
25
30
35
U-NT (ppm)

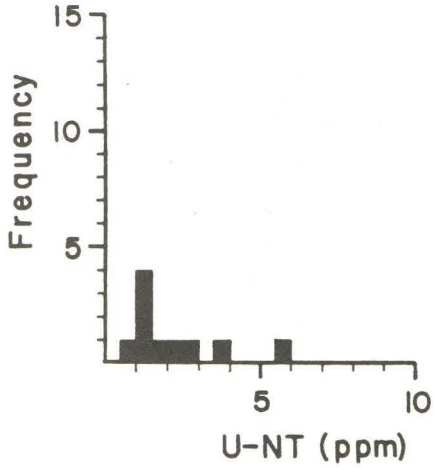
FIGURE 11:

Frequency plot of U-NT values

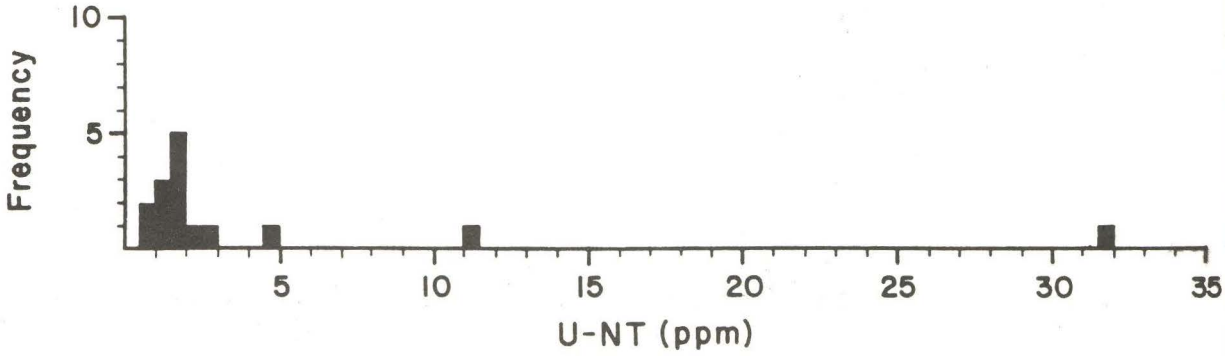
Mazatzal conglomerate samples



Mazatzal Wilderness Area



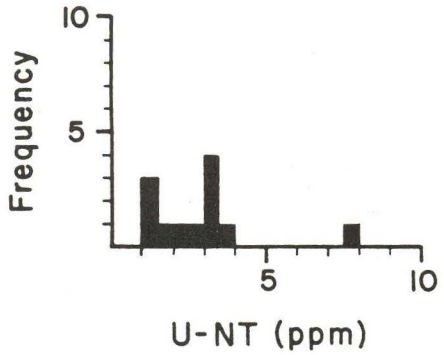
Christopher Mountain Area



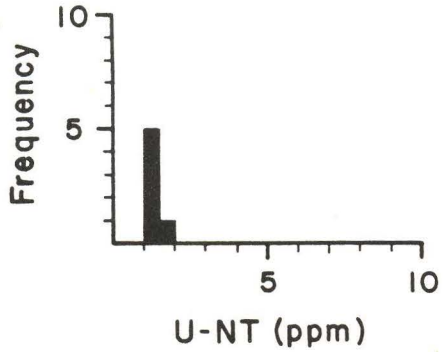
Diamond Butte Area

FIGURE 12:

Frequency plot of U-NT values
Mazatzal and Maverick conglomerate samples



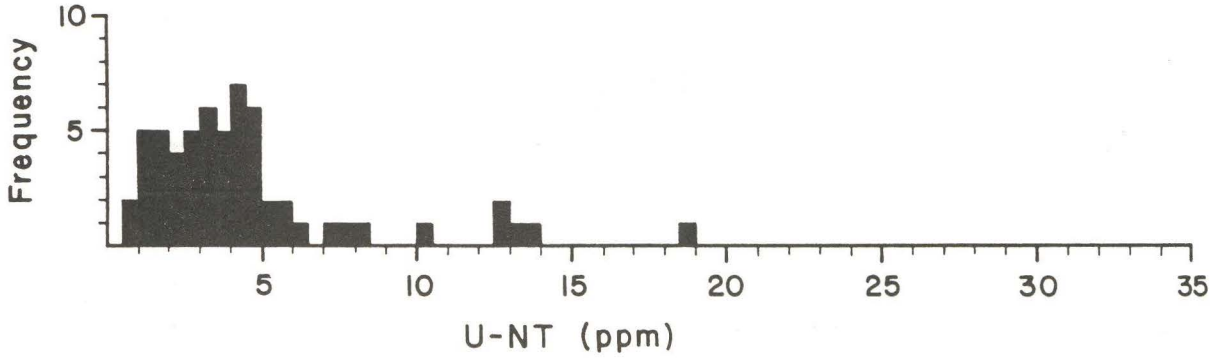
Mazatzal conglomerate,
Pine Area



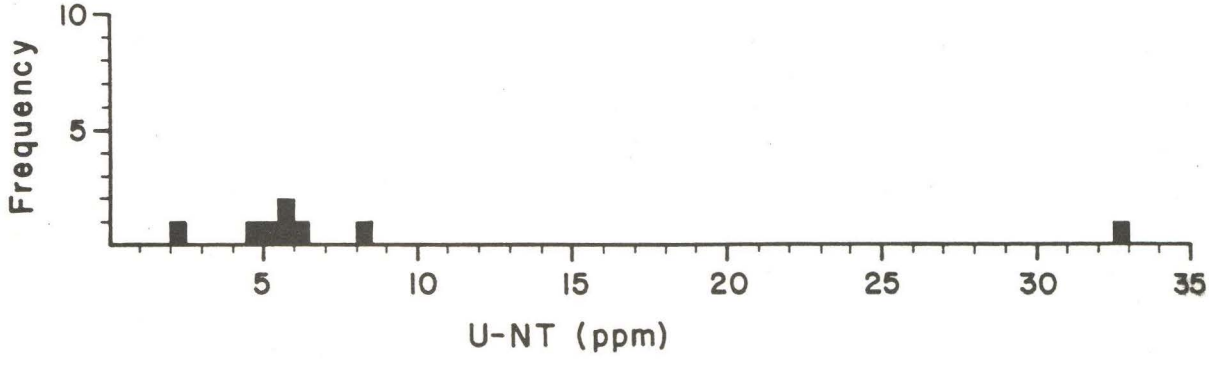
Maverick conglomerate,
Mazatzal Wilderness Area

FIGURE 13:

Frequency plot of U-NT values
Deadman conglomerate samples



Mazatzal Wilderness Area



Diamond Butte Area

Had there been conglomerate units to sample in the coarser grained red siltstone and quartzite facies of the Maverick unit in the Sheep Basin Mountain area, the generally higher scintillometer values (Table 1) suggest that U-NT values would be significantly higher than those of Maverick in the Mazatzal Wilderness (fig. 12). This would make a unified increase in U-NT values for all Mazatzal rocks toward higher energy environments.

In contrast to Mazatzal Group rocks, the different conglomerate units in the Apache Group show no significant variations in average, modal, or background U-NT values from one area to the next (figs. 14, 15), although there are significant variations in scintillometer response (fig. 9, table 1). This conclusion is quite important because both Scanlan and Dripping Spring conglomerate units undergo lateral facies changes from higher to lower energy environments similar to those in the Mazatzal and Deadman conglomerates, but in the Apache conglomerates there is not a comparable variation in U-NT values. A possible reason for this is mentioned later in our interpretation of the Apache Group's depositional environment.

As might be expected from the greater rhyolitic component of the volcanic conglomerates, there is a significant difference in average scintillometer values and average U-NT values between volcanic and "sedimentary" conglomerates in the Alder Group (table 1, fig. 9). However, there is no detectable systematic variation of U-NT values by area for either of these rock units. The Mazatzal Group conglomerates are therefore unique in their areal variation of uranium values.

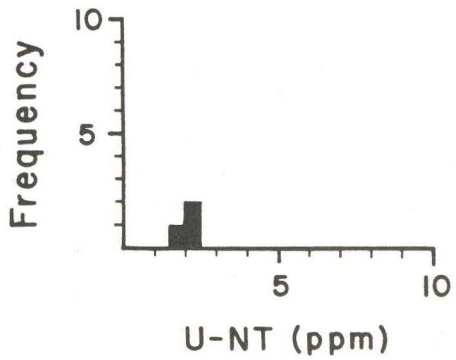
4.4 Trace Element Geochemistry

All rock samples were analyzed for 22 trace elements, reported in ppm, as well as for 6 major elements, reported in percentage; this data is reproduced in appendix D. All of these analyses were performed by argon-plasma emission spectroscopy, which is a relatively inexpensive and rapid method quite effective for many trace elements, especially the heavy elements. However, the method is known to be inaccurate for elements which are in unusually high concentrations even though analytical precision and reproducibility may be good.

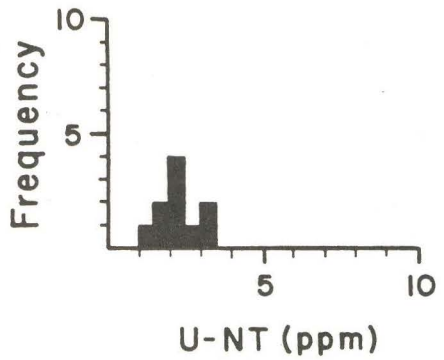
Short of performing check analyses of these results, one element we were able to monitor reasonably well was iron, because from thin section, hand specimen, and specific gravity it is possible to make a reasonably accurate estimate (±10%) of the iron content of rocks that are dominantly specularite. In many of the samples where all iron was contained in 60 to 75 percent detrital specularite and hematite stain was not a problem, we knew these rocks had to contain about 30 to 40 percent iron, or 25 percent at an absolute minimum, but results came back in the range of 8 to 15 percent iron (D 25, D 35, D 41, M 78a, M 97, etc.). Thus many of the high trace element and major element values are probably underestimations of the real values, but if the analyses are used in a comparative sense, little problem is encountered.

FIGURE 14:

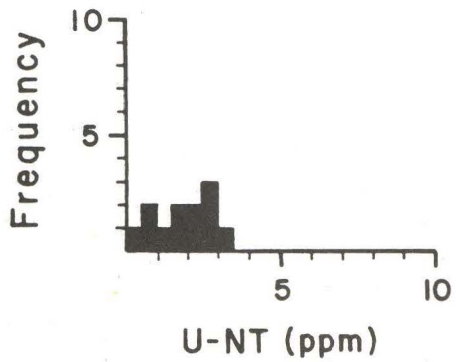
Frequency plot of U-NT values
Lower Apache Group samples



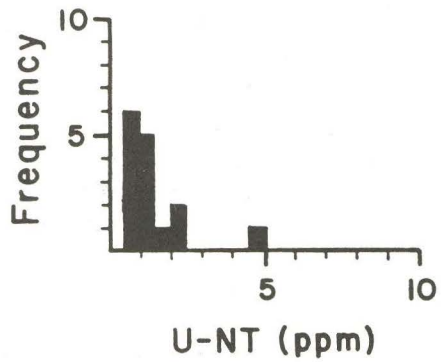
Scanlan conglomerate,
Christopher Mountain Area



Scanlan conglomerate,
Diamond Butte Area



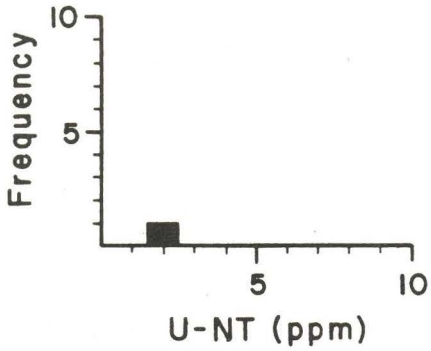
Scanlan conglomerate,
Sierra Ancha Mountains



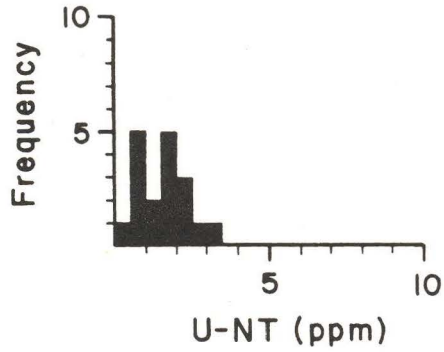
Barnes conglomerate,
Sierra Ancha Mountains

FIGURE 15:

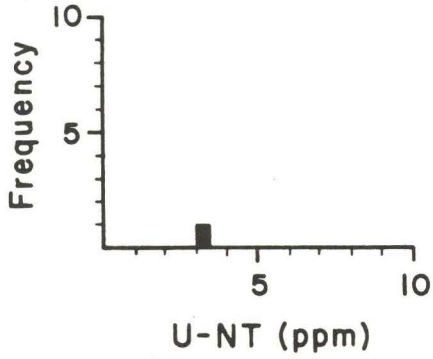
Frequency plot of U-NT values
Upper Apache Group samples



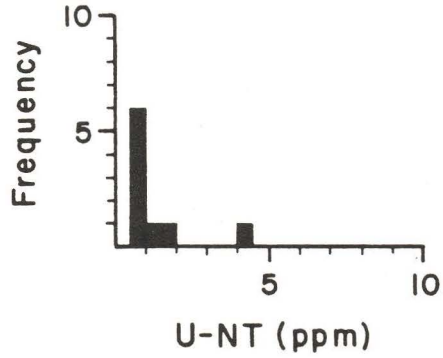
Dripping Spring conglomerate,
Diamond Butte Area



Dripping Spring conglomerate,
Sierra Ancha Mountains



Troy quartzite,
Sierra Ancha Mountains



Mescal limestone,
Sierra Ancha Mountains

In lieu of undertaking a lengthy statistical treatment of all the trace and major element results in light of their questionable accuracy, the data was scanned simply for anomalous values of each trace or major element. Both the statistical population of element values itself and the type of values expected in sedimentary rocks from Turekian and Wedepohl (1961) were used as a guide to establish an "anomalous" threshold for each element. These values, for each element, are: 7 ppm UF1 or U-NT, 2 ppm Ag, 5% Al, 40 ppm B, 700 ppm Ba, 3 ppm Be, 4% Ca, 150 ppm Ce, 20 ppm Co, 55 ppm Cr, 50 ppm Cu, 6% Fe, 4% K, 70 ppm Li, 0.6% Mg, 700 ppm Mn, 4 ppm Mo, 1% Na, 10 ppm Nb, 20 ppm Ni, 1,000 ppm P, 19 ppm Sc, 150 ppm Sr, 30 ppm Th, 2,500 ppm Ti, 100 ppm V, 50 ppm Y, 100 ppm Zn, and 250 ppm Zr. Values above these thresholds were identified and marked as anomalous.

From the resulting array of anomalous values diversified among many samples, the following rock samples were singled out:

1. those with more than six anomalous elements;

2. all of the samples with anomalous U-NT values;

3. at least one anomalous sample representative of each major conglomerate type.

The data for these selected samples are compiled in table 2, which is a table designed purely for the purposes of visual correlation between different elements in the "most anomalous" rocks from the Central Arizona Arch. In this table a + sign indicates that the element is anomalous, an * indicates a very high or the most anomalous value for that element, and a - sign, just in the iron and uranium columns, indicates that the value is high but not quite above the "anomalous" threshold. At the bottom of each column is the percentage of the total anomalous values for that element in this table.

From table 2, which contains almost two-thirds of all geochemically anomalous results from the Central Arizona Arch conglomerates, some very elucidating comparisons are apparent. First and most obvious is the strong correlation between Fe and U content of nearly all Mazatzal and Deadman samples, a correlation which overshadows all others in the table. High U values in the Mazatzal Group therefore closely correlate to specularite-rich rocks. The lack of a Fe-U correlation in both Alder and Apache Group rocks is in striking contrast. High vanadium values correlate most strongly to high Fe, less so to high U and P, and geologically correlate to Deadman conglomerates and high specularite concentrations.

High Ba, B, and Al correlate to conglomerates rich in rhyolitic volcanic material, whereas high Al, Mg, and Mn correlate also to Alder and Apache Group rocks rich in argillaceous material. Only the earliest Alder volcanic conglomerates or Payson granite are high in Na, whereas the K-rich rhyolitic volcanism that contributed to Dripping Spring radioactive siltstones causes these samples to be K-rich. Since the table is dominantly a list of conglomerates with anomalous U values, those elements with low percentages correlate antithetically to high U. These elements include B, Li, Ni, Nb, and P, many of which are light elements, as might be expected, but somewhat unexpectedly there is almost an antithetic correlation between U and Th.

TABLE 2

GEOCHEMICAL CORRELATION SUMMARY OF ANOMALOUS CENTRAL ARIZONA ARCH ROCKS

Sample	Code	AG	AL	B	BA	BE	CA	CE	CO	CR	CU	FE	K	LI	MG	MN	MO	NA	NB	NI	P	SC	SR	TH	TI	U	V	Y	ZN	ZR	
D7	V004		+	+	+	+			+			+		+	+			+			+	+	+		+	-	+		+		Alder Volcanics
D56	V003		+		+	+										+		+	+												
M142	V003		+		+					+					+	+		+		+			+		+	-					
H2	V002		+		+					+					+			+		+			+		+						
D33	D103		+		+					+						*						+			+		+				Deadman Unit
D34	D103		+						+	+		+								+		+			+		+		+		
D35	D202		+							+		+										+			+						
D35A	D203						+					+								+	*	+	+		+	+	+	+	+		
D40	D203		+						+	+		+								+		+			+		+		+		
D41	D211								+	+		+								*		+			*	+	+				
M25	D201											+		+										*							
M65	D203											+									+					+					
M66	D203											+											+			+	+				
M73	D202					+			+			+					+				+					+	+				
M75	D203	+				+			+			+					+		+		+					+					
M77	D203					+		+				+		+												+	+				
M86	D202								+		+	+				+				+	+	+					+				
M97	D203											+		+		+	+									+					
M100	D212											+														+	+				
M102	D203											+									+	+				+					
M115	D102		+					+				-							+				+					+		+	Maverick
M139	D203									+		*								+	+					+	+				
M78A	K210					+			+			+		+			+									-					
D25	M210	+						+		+		+											+	*		+	+			*	Mazatzal
D38A	M102																								+	+				+	
M88	M102								+		+	+								+					+	-	+				
P12	M110					+				+							+		+				+	+		+				+	
M63	R004		+		+			+											+											+	Rhyolite and Granite
G2	Pays-G		+		+													+								-			+		
G4	Ruin-G		+			+												+	+					+		+					
D50	S102		+		+								+																	+	Apache Group
S3	U103						*								+	+							+			-					
S21	L003						+				+				+	+					+			+					+		
S20	T103		+										+		+				+		+				+					+	
S35	U420		+								+		+				*			+						*		+			Radioactive Siltstones
S37	U420		+		+						+		+		+										+	*			*		
S55	U420		+										+				+								+	*					
Percent All Anomalies		100	49	6.7	41	73	60	67	90	67	50	67	50	42	70	87	60	55	27	63	40	82	69	45	70	100	70	75	80	50	62.2 Avg.

Most of the heavy metals -- Ca, Co, Cr, Fe, Sc, Ti, U, V, and Zr -- tend to have sympathetic correlation to one another although there are interesting variations. Both Cr and Zr are high in conglomerates with anomalous UFl/U-NT ratios suggesting that UFl acid dissolution did not fully liberate radioactive elements from zircons. High Zr values do not correlate as well with high U rocks as they do with particular host rocks such as Mazatzal conglomerates or rhyolitic rocks. Both Ce and Zr anomalies correspond to high Fe rocks and some Deadman units as well. Co, Cr, Ni, Sc, Ti, and V anomalies are all most abundant in Deadman rocks and collectively correlate to Fe. All these elements compose the heavy-metal assemblage concentrated with detrital specularite even though discrete minerals for these elements have not been found. It is most probable that Ce substitutes for Zr or is otherwise contained in zircon, whereas the metallic elements Co, Ni, Cr, Sc, and V are bound within the titaniferous hematite compounds.

High concentrations of P can clearly be singled out as detrital apatite: one Deadman sample, D 35a, a Scanlan sample, D 44, and a Barnes sample, S 39, had the highest P values at 21,500, 22,000, and 8,000 ppm respectively. The highest Ti and Ni values (11,700 ppm and 72 ppm) occurred in a Deadman sample, D 41, which is well bedded, nearly pure specularite. Deadman samples also contained the highest Fe, Mn, and Th values.

In contrast to this, the uranium mineralization in the Dripping Spring siltstones is of a very different geochemical character. It is dominantly a high Cu-Zn-Mo plus U, typical base-metal mineral assemblage. This metal assemblage is neither in character with a diabase source nor could it be adequately accounted for by erosion and recycling of material from a terrain (i.e., earlier Apache, Mazatzal, or Alder strata or earlier granitic rocks) that was not at all enriched in these metals (table 2). The Cu-Zn-Mo-U assemblage is perfectly in accord, though, with a K-rich rhyolitic source of volcanism that was contemporaneous with deposition of the tuffaceous radioactive siltstones.

In the 32 quartz-jasper pebble conglomerates in the Alder, Mazatzal, and Apache Groups that we requested be analyzed for gold, all Au values were reported to be below the detection limit of 0.2 ppm. Three samples were measurable in their carbon values: M 64 is 200 ppm C, confirming the suspicion that Maverick conglomerate has been blackened by carbon alteration; S 6, Scanlan near the Deadman paleoridge in Del Shay basin, contains 132 ppm C, confirming that a local reducing environment exists here in the Scanlan conglomerate; and S 14, Barnes sample, contains 183 ppm C, suggesting also a possible local reducing environment in the Barnes.

4.5 Uranium Correlations

As field work repeatedly confirmed the correlation that concentrations of specularite and other heavy minerals consistently gave higher scintillometer response, it was apparent that all the possibilities had to be checked to find out exactly why this was so. Scintillometer response can be caused by any combination of radioactive potassium, thorium, and uranium; we knew iron and zirconium were concentrated in the specularite-rich material and

presumed that titanium was also. In order to test these seven parameters against uranium content we requested a series of scatter plots of the geochemical data from Oak Ridge Laboratories, some of which are reproduced as figures 16 to 30.

Unfortunately, parts of the data could not be retrieved separately, so Alder, Mazatzal, and Apache Group conglomerates appear together in the scatter plots. In order to display most of the low-value data it was necessary to delete the three highly radioactive siltstones from all plots and the two U-rich, anomalous samples, D 25 and D 35a, from some of the plots. The outcomes of the scatter plots are discussed in the following paragraphs.

Figure 16 displays a very good correlation between UF1 and U-NT values which is largely a measure more of analytical precision than of geologic reality, so a close correlation is to be expected. The correlation coefficient for this graph is 1.14, equivalent to an average UF1/U-NT value of 0.875. Figure 17 is similar to the earlier figure 9 of average values of U-NT against scintillometer readings, except that figure 17 presents all sample data, not just averages. This plot contains three distinct trends of data: one of strong uranium enrichment corresponding to Deadman and Mazatzal samples in high-energy environments east of the Mazatzal Wilderness; another of moderate uranium enrichment comprising the bulk of Alder and lower-energy environment Mazatzal rocks; and a third trend of increasing scintillometer values somewhat independent of uranium values that correspond principally to Apache Group conglomerates. On figure 17, the three trends can be resolved only in the region of high-value data points, whereas in figure 9 the same three trends are much more evident. The same types of trends are present on figure 18 but are less clearly shown.

A plot of UF1/U-NT ratio, ideally a constant, against scintillometer counts (fig. 19) shows that the values which depart significantly from the 0.875 ratio are presumably not correlated to other radioactive sources such as potassium or thorium. There is a somewhat poorly defined positive correlation between potassium and scintillometer counts (fig. 20), indicating the presence of a consistent background radiation from radioactive potassium. The highest K values shown in figure 20 belong to either Apache Group conglomerates, rhyolitic conglomerates, or rhyolites and granites.

If thorium content contributed systematically to scintillometer counts, a positive correlation on figure 21 would be expected. Instead, most samples have Th contents of less than 15 ppm independent of their scintillometer response, and this value provides a baseline upon which to add the counts produced by U and K contents. Most rocks in the Central Arizona Arch have Th/U ratios of less than 2, which is about the average value for granitic rocks in the region (fig. 22). Mescal chert breccias are the only rocks consistently high in thorium, although some specularitic Mazatzal and Deadman conglomerates, rhyolitic conglomerates, an Alder "sedimentary" conglomerate, and a granite are Th rich and occur in the high-Th field of figures 21 and 22. The lack of both a positive correlation on figure 22 and a negative correlation on figure 23 can be interpreted to suggest that Th enrichment was not produced by the in situ decay of uranium. Th is probably not bound in insoluble iron compounds or zircons such as uranium appears to be, but rather the processes of U-enrichment and Th-enrichment appear to have been largely independent.

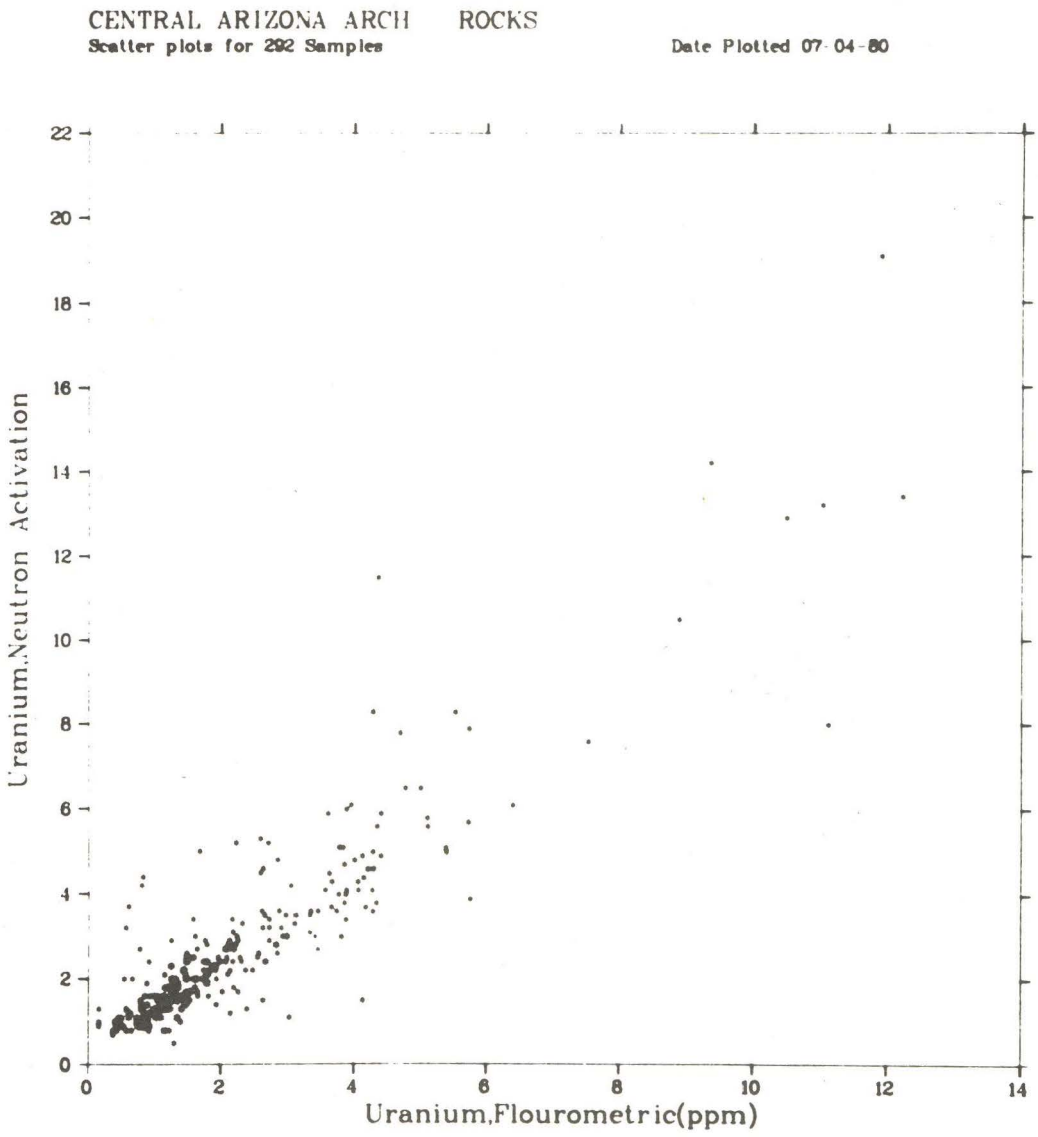


Figure 16. Scatter plot of U-NT versus UF1 for all Central Arizona Arch conglomerates.

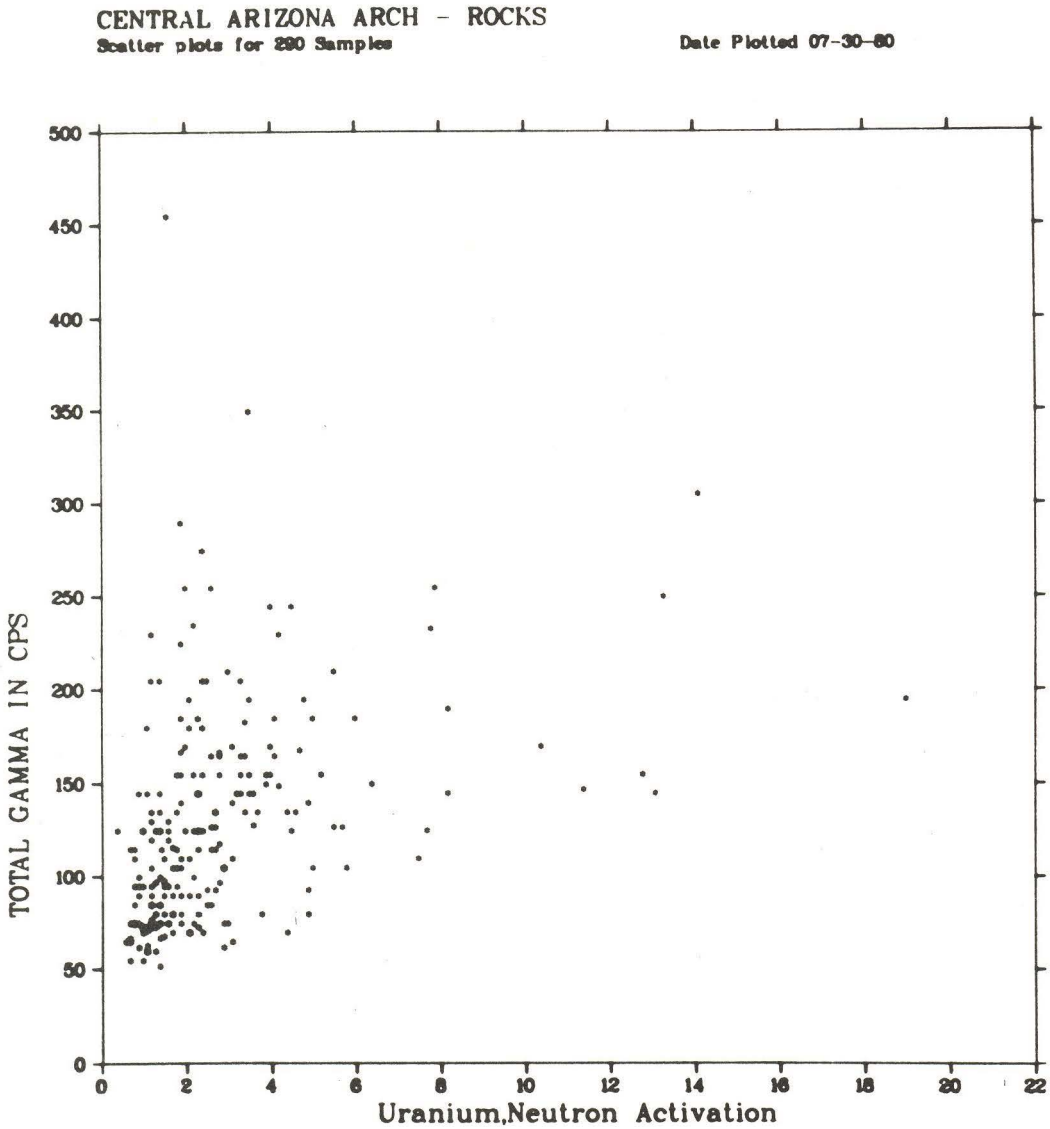


Figure 17. Scatter plot of U-NT versus scintillometer values for all but two anomalous conglomerate samples in the Central Arizona Arch. This graph presents all sample data whereas figure 9 shows only average values for each rock type.

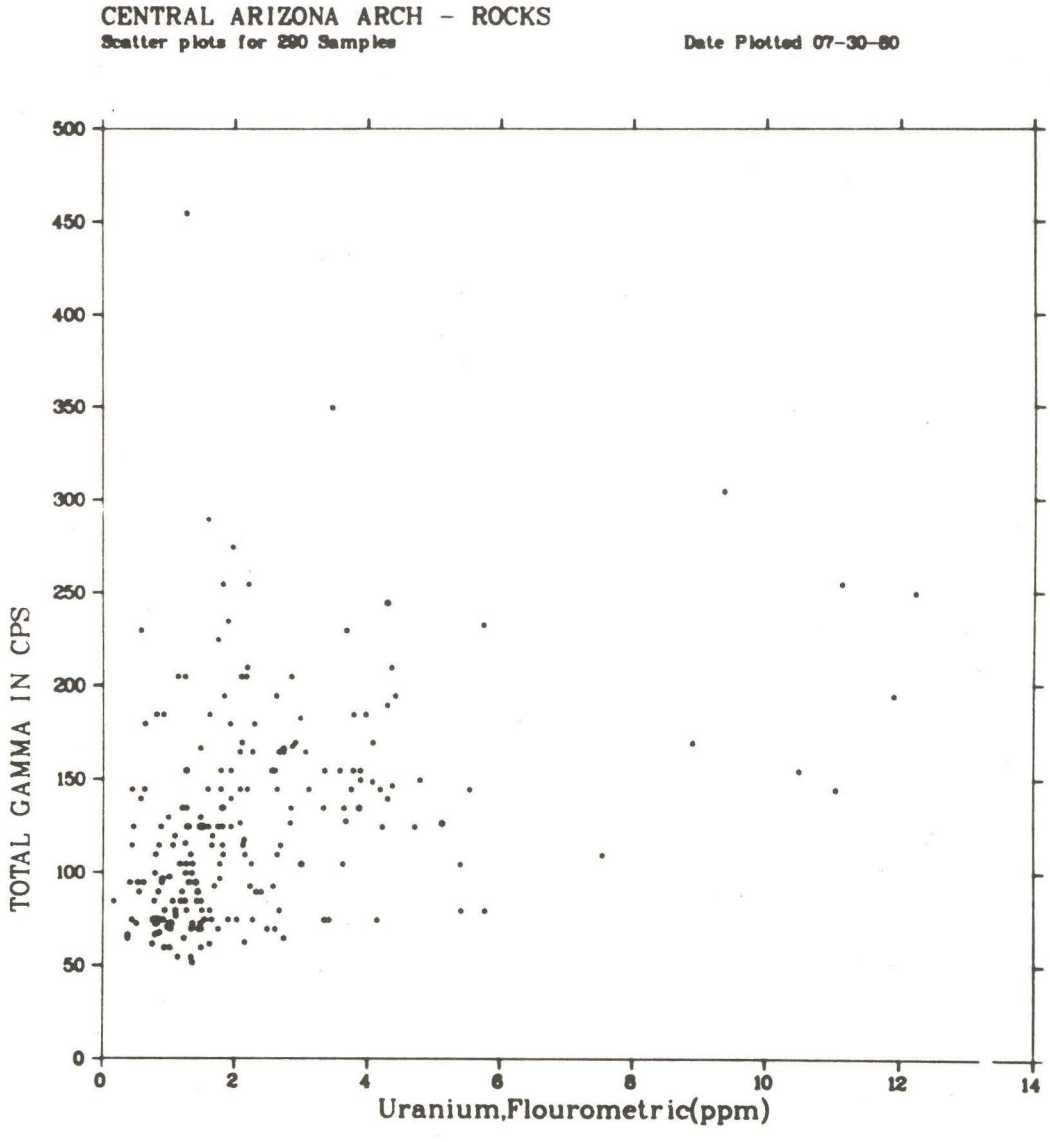


Figure 18. Scatter plot of UF1 versus scintillometer values in all but two anomalous conglomerates of the Central Arizona Arch.

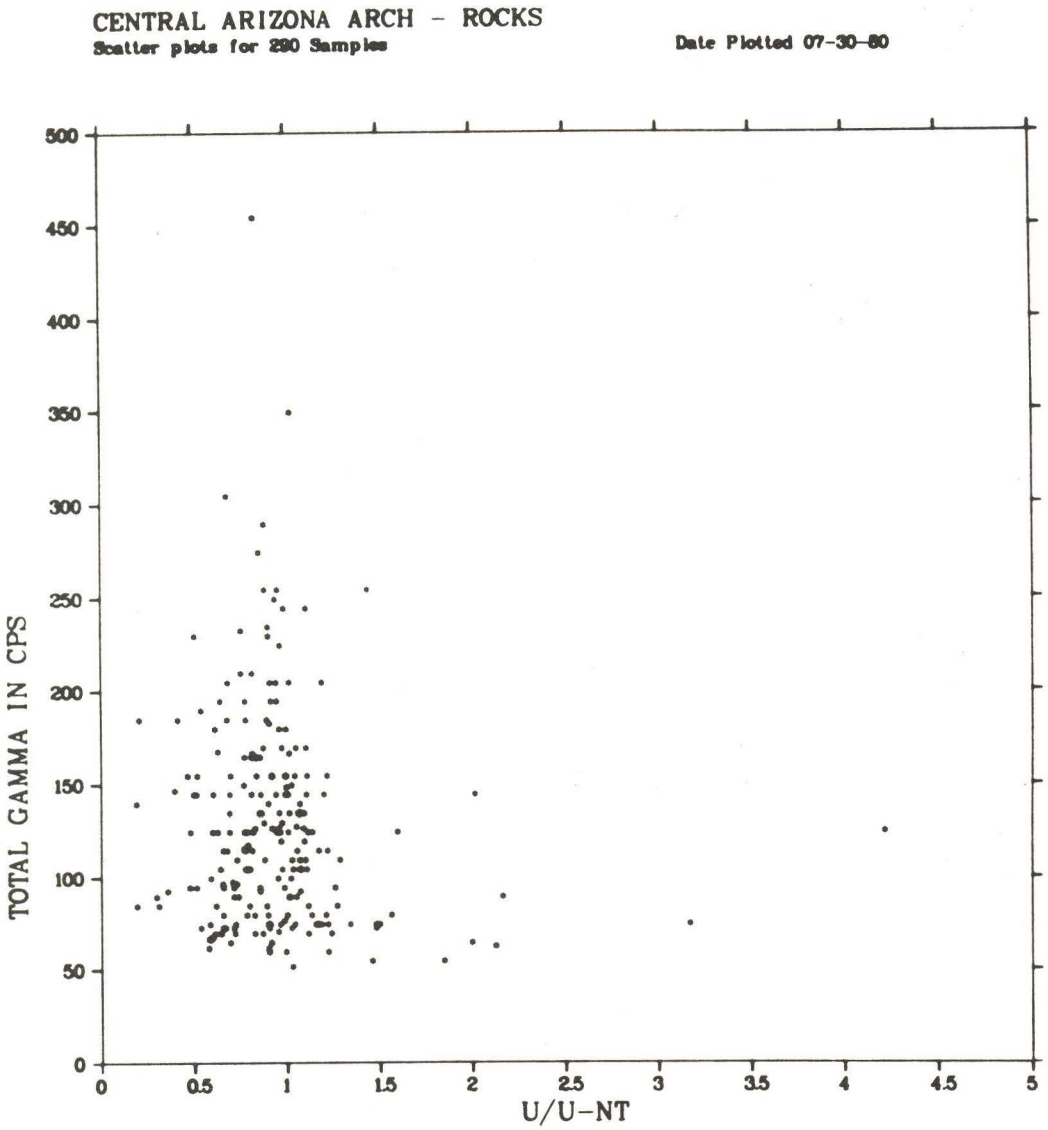


Figure 19. Scatter plot of UF1/U-NT ratio versus scintillometer values in all but two anomalous samples of Central Arizona Arch conglomerates.

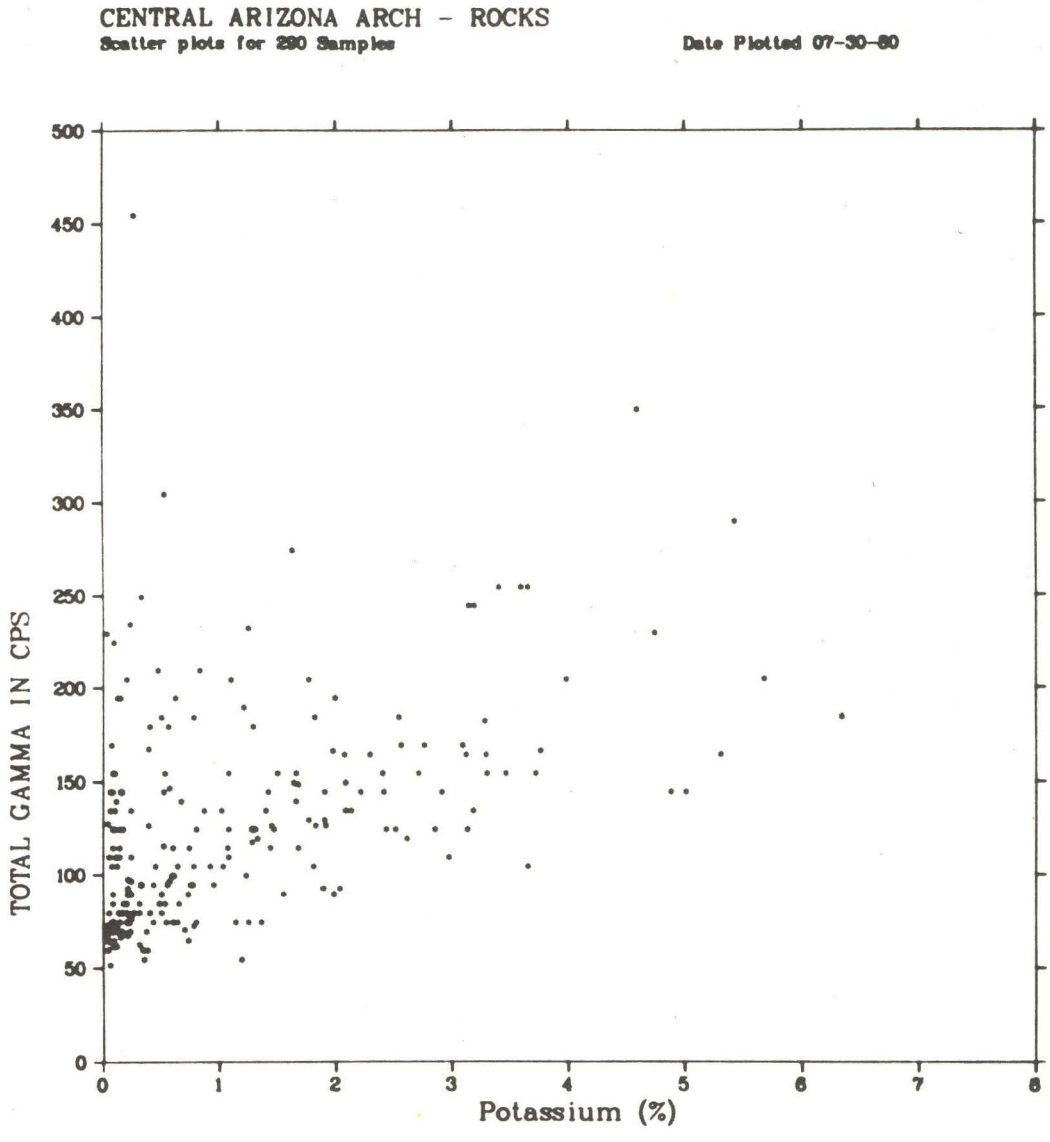


Figure 20. Scatter plot of potassium versus scintillometer values for all but two anomalous conglomerates in the Central Arizona Arch.

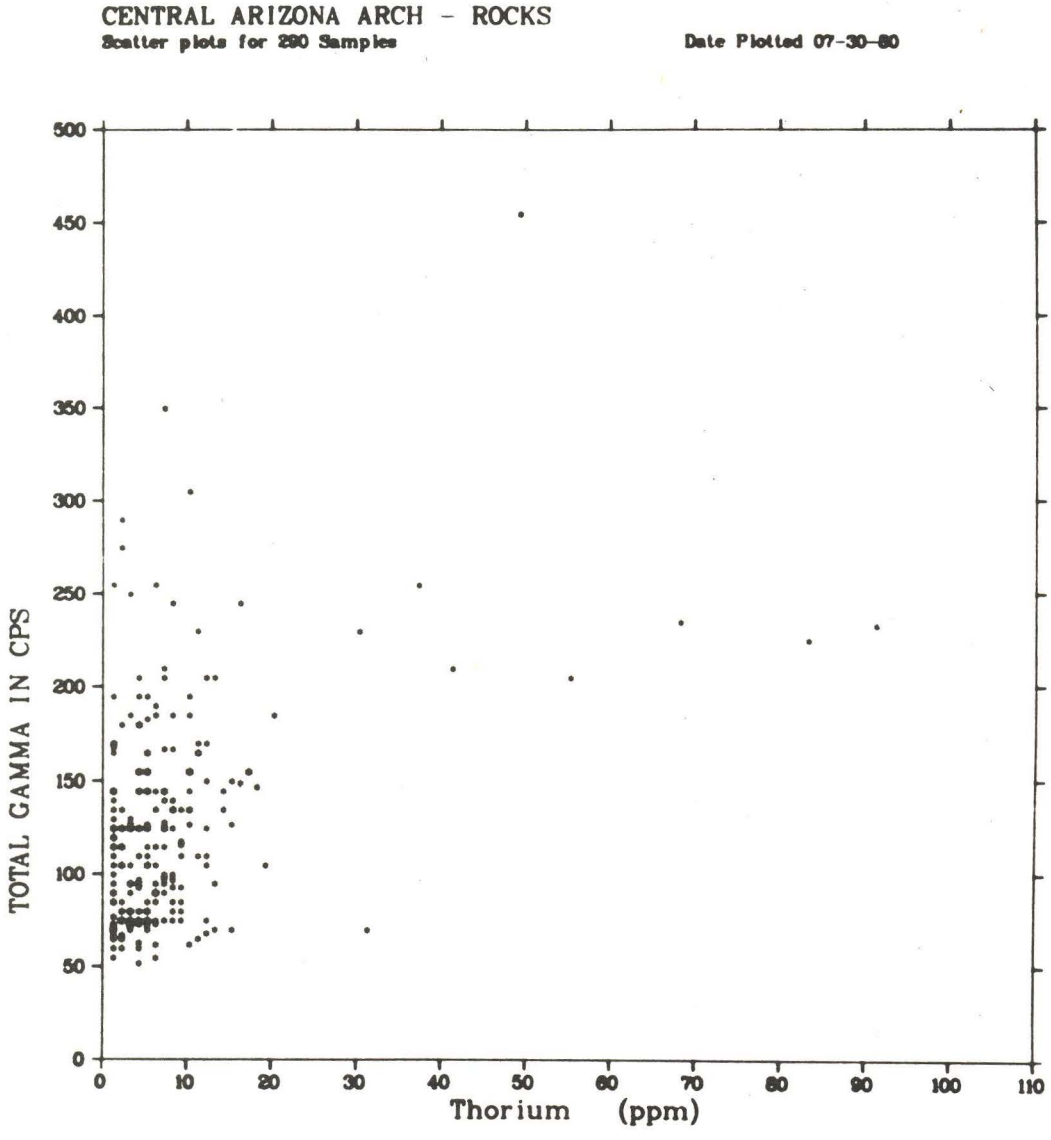


Figure 21. Scatter plot of thorium versus scintillometer values for all but two anomalous conglomerates in the Central Arizona Arch.

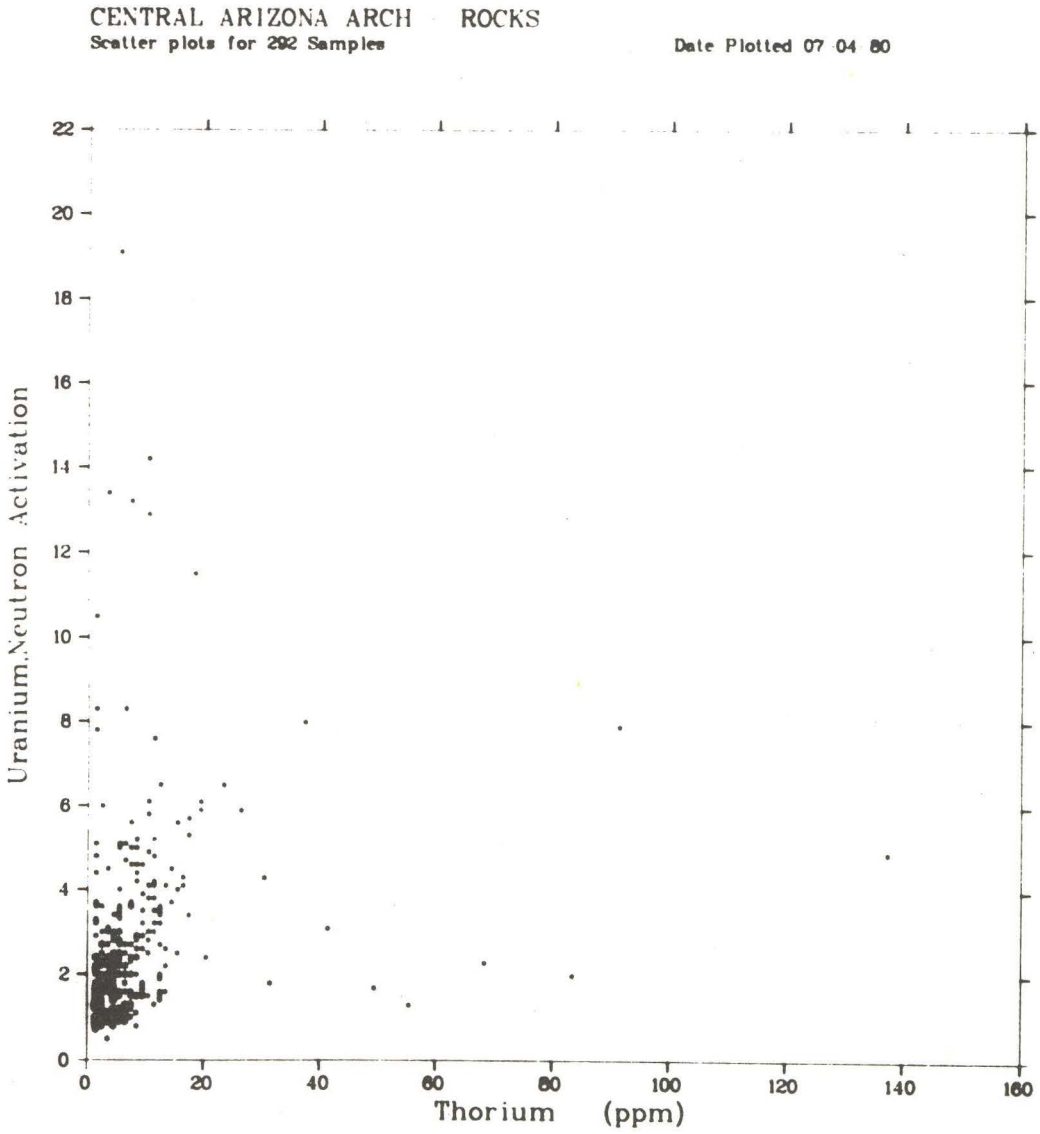


Figure 22. Scatter plot of thorium versus U-NT values for all conglomerates in the Central Arizona Arch except two anomalously radioactive samples.

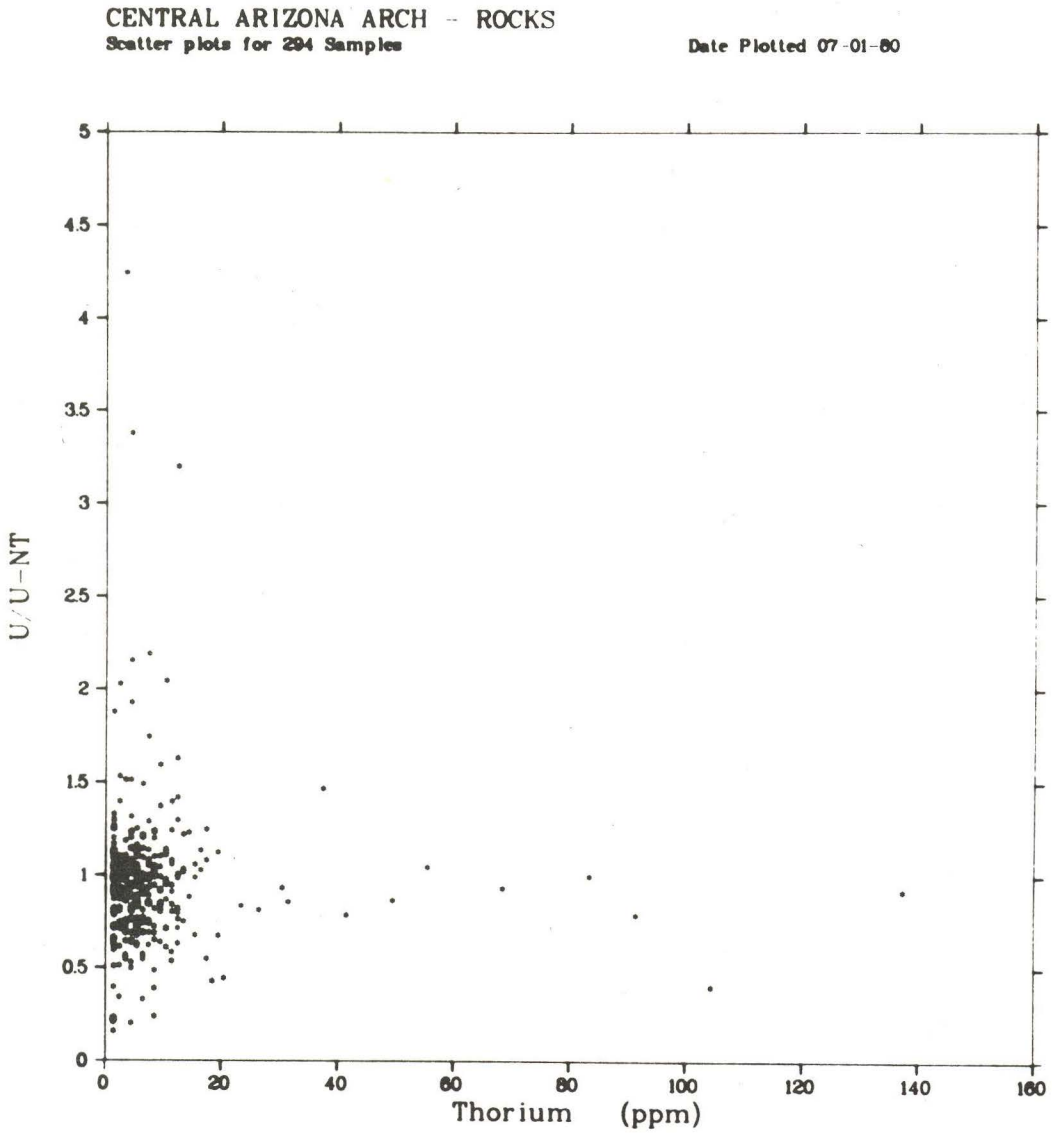


Figure 23. Scatter plot of thorium versus U/U-NT ratio for all conglomerate samples in the Central Arizona Arch.

A general conclusion from figures 17 to 23 is therefore that scintillometer values over and above certain background levels of radiation from thorium and radiogenic potassium are a direct product of uranium concentrations in the rocks. Because high scintillometer response is a direct measure of increased uranium content and our field observations demonstrated that high scintillometer response also correlates to increased heavy-metal content, we must conclude that some component of the heavy-metal concentrations causes the fixation of uranium. The scatter plots to follow pertain to the identification of this component.

Conglomerates in both the Alder Group and the Apache Group have no tendency towards iron enrichment and consequently plot as a vertical column of points on the left side of figure 24 at less than 4% Fe. If one excludes this column from figure 24, a positive correlation between scintillometer values and iron content is apparent, in accord with field observations. However, since the scintillometer values are mainly the result of U content, an even stronger correlation between Fe and U values should be expected. This is exactly what one sees on figures 25 and 26, where correlation coefficients of 0.66 and 0.43 ppm U per 1% Fe, respectively, can be determined. These average values quoted for each diagram may be made up of two separate parallel trends, the strongest iron-enrichment trend at lower U values belonging to Deadman and the other belonging to Mazatzal conglomerates, although there are barely enough data points to differentiate the two trends.

Initially, because we observed abundant detrital zircons in many layers of detrital specularite, we suspected that both zirconium and titanium would be most strongly concentrated with heavy-mineral concentrations and iron-rich conglomerates at the base of the Mazatzal Group. However, figure 27 reveals a much more complex pattern among rocks of the Mazatzal Group of at least two if not three different enrichment trends with no simple positive correlation between increasing Zr + Ti and Fe. Conglomerates of the Apache and Alder Groups plot in the cluster near the origin because they are not enriched in either component. From table 2 and the original analytical data it can be seen that both Mazatzal and Deadman conglomerates in the Sheep Basin Mountain area are strongly enriched in titanium, but those in the Mazatzal Wilderness area are not. Thus Ti-rich rocks are confined to either a specific source region or a higher energy fluvial depositional environment.

Eleven out of the 14 samples anomalously high in zirconium were taken from the base of the Mazatzal Group. Of these, one is from the Pine Creek area, one is from Sheep Basin Mountain, and the rest are from the coarse rhyolite-boulder conglomerates at the base of the Deadman unit of Cactus Ridge and Davenport Wash in the Mazatzal Wilderness. All of these Zr-rich samples are unified by their abundance of Red Rock-type rhyolitic fragments, so it is logical to conclude that the zircons came from the rhyolite. The only basal Mazatzal sample which does not conform to this correlation is D 25, the specularite bed at the base of McDonald Mountain Mazatzal quartzite; at 1,400 ppm Zr, it is the highest zirconium sample. All except two of the samples are not unusually rich in iron and do not form part of the shallow-sloping iron-enrichment trend of figure 27.

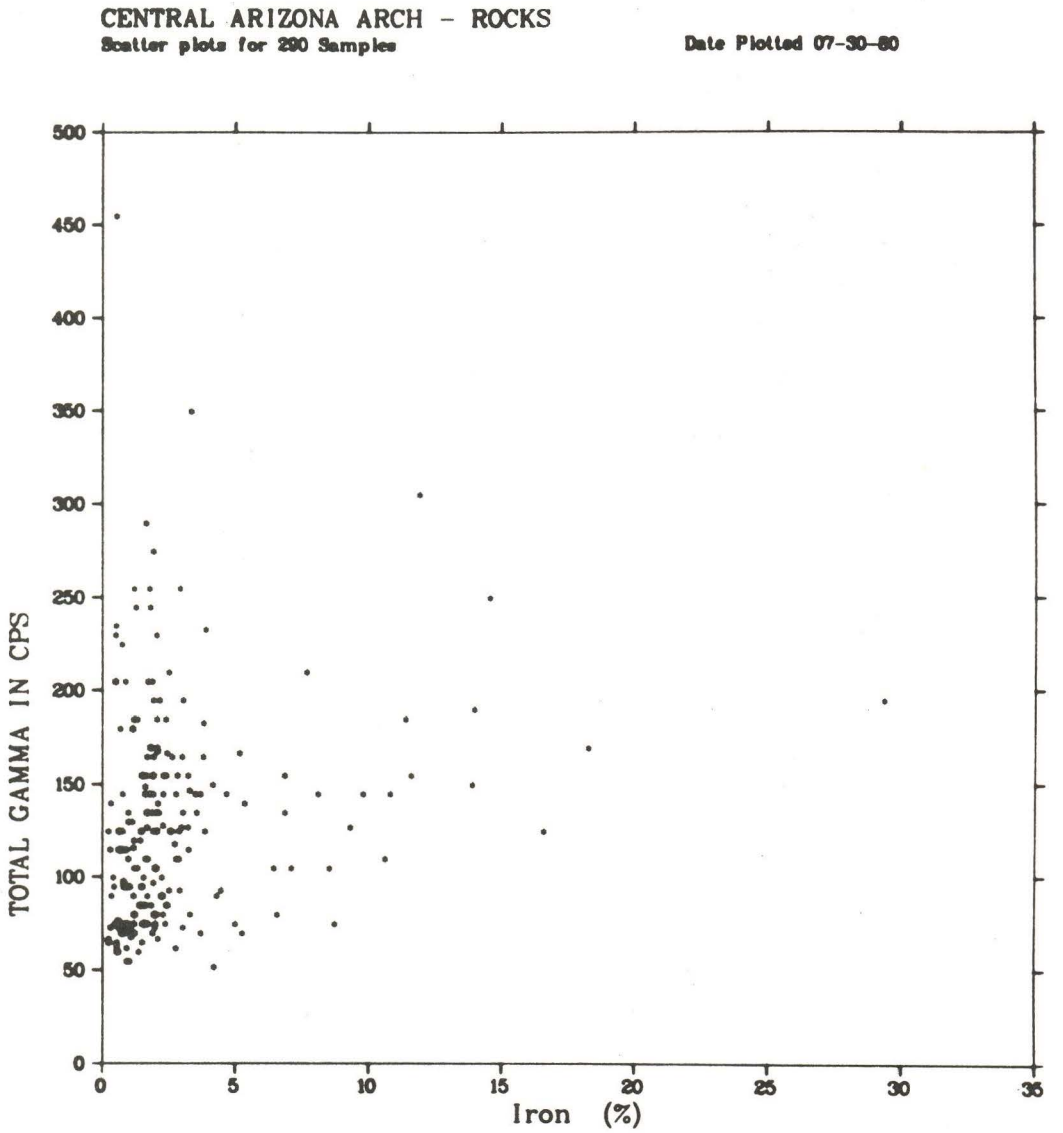


Figure 24. Scatter plot of iron versus scintillometer values for all but two anomalous conglomerates in the Central Arizona Arch.

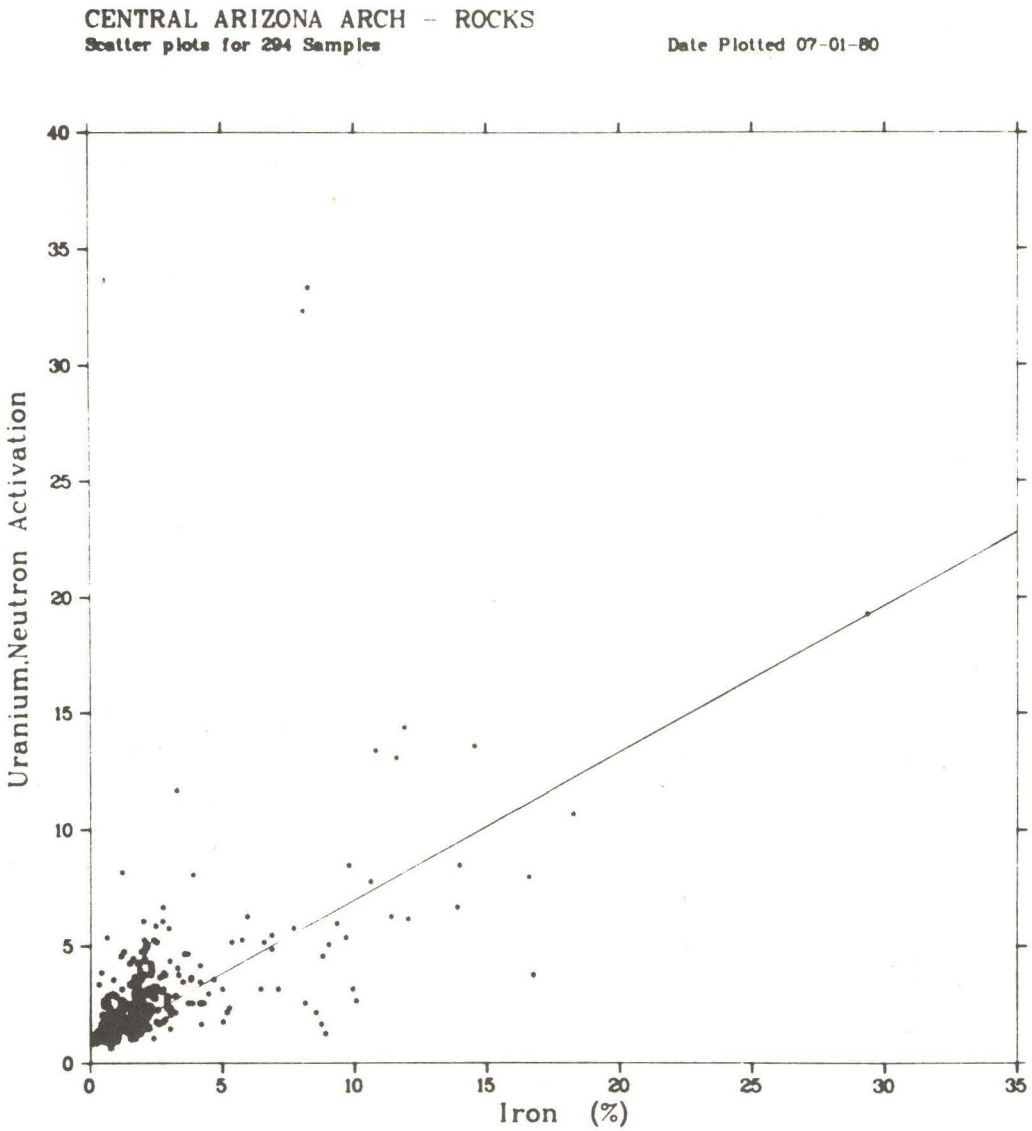


Figure 25. Scatter plot of U-NT values versus iron content of all conglomerates in the Central Arizona Arch. The line of approximate best fit has a correlation coefficient of 0.657 ppm U per 1% Fe.

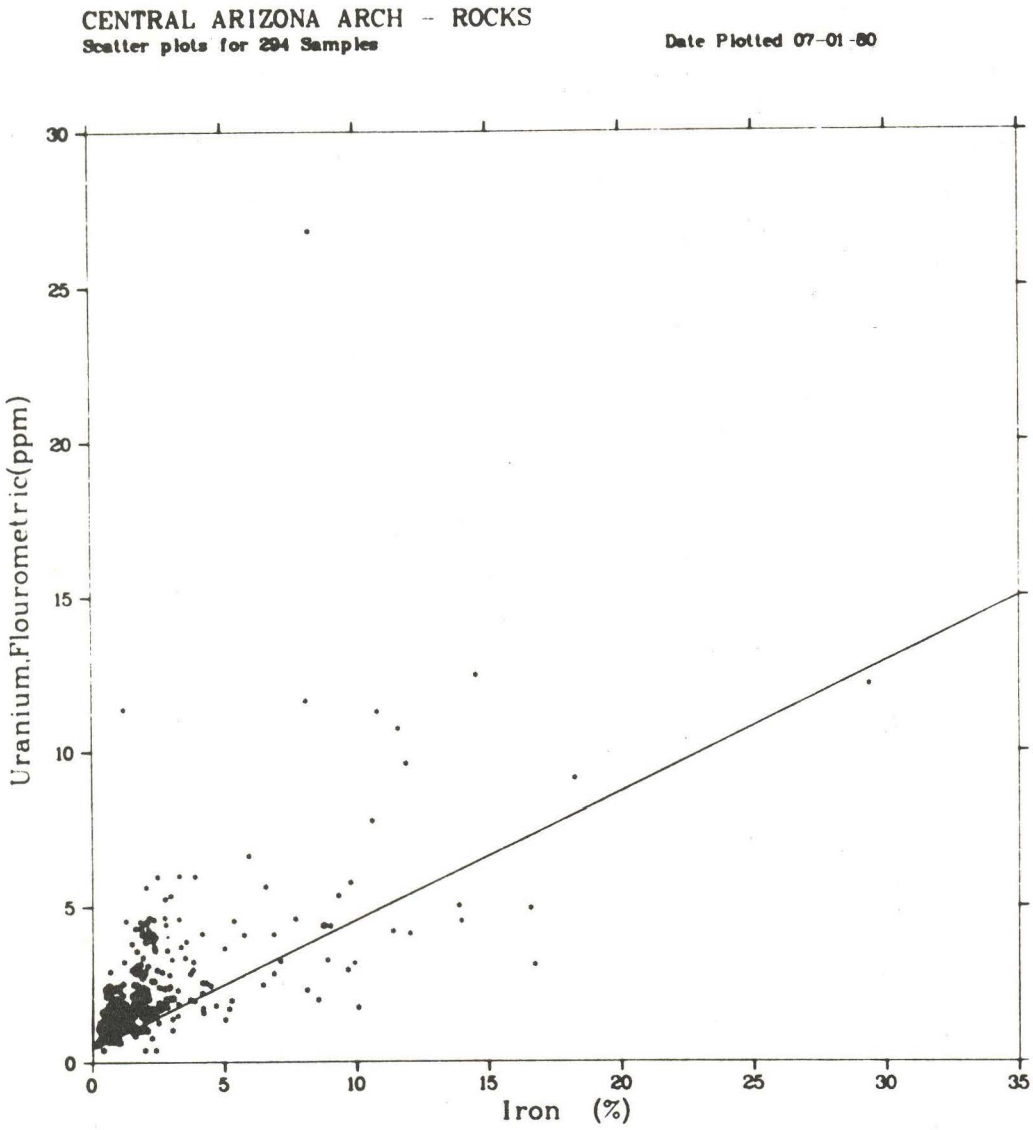


Figure 26. Scatter plot of UFl values versus iron content of all conglomerates from the Central Arizona Arch. The line of approximate best fit has a correlation coefficient of 0.428 ppm U(Fl) per 1% Fe.

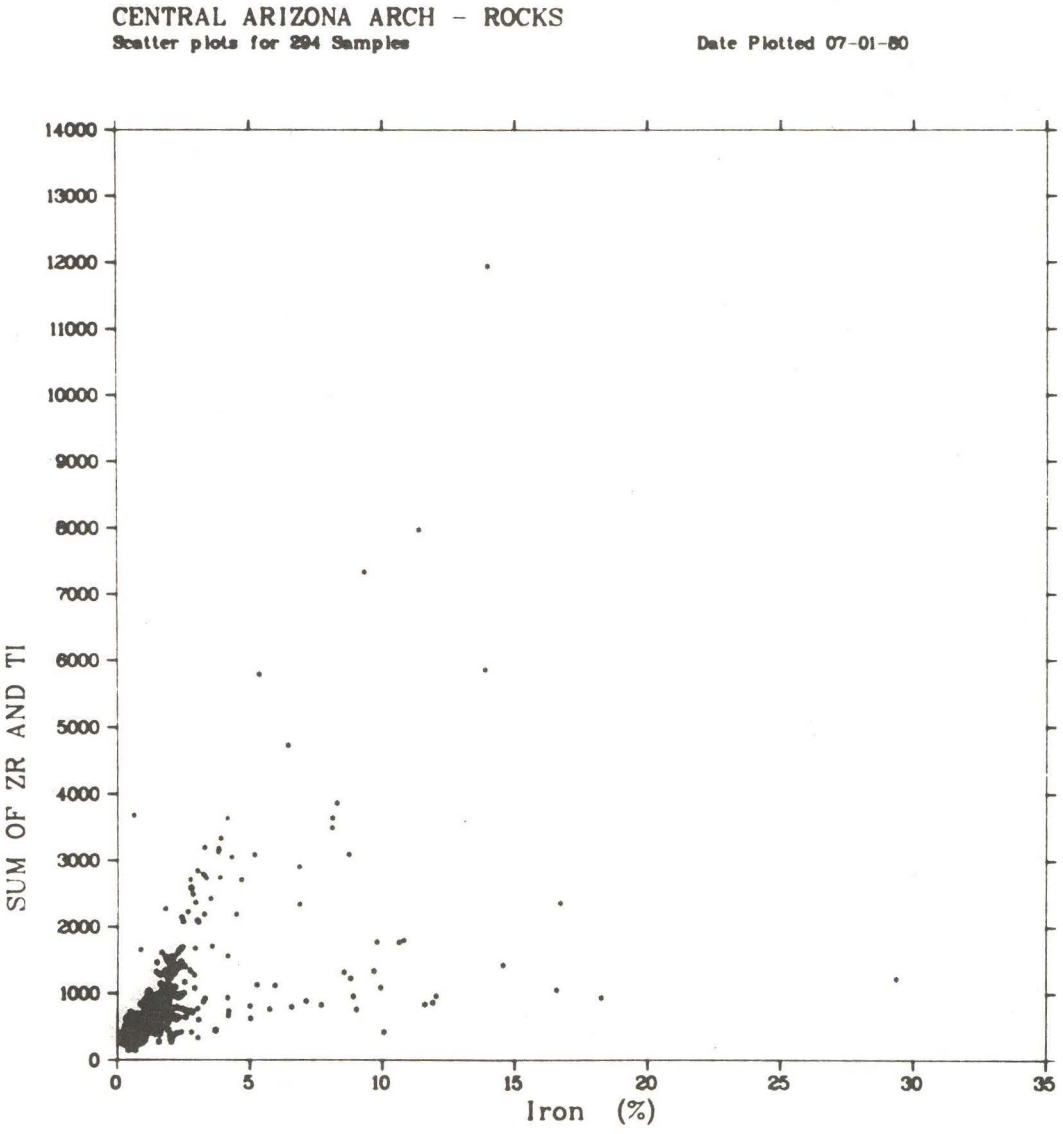


Figure 27. Scatter plot of iron versus zirconium + titanium for all conglomerates in the Central Arizona Arch.

Figure 28 shows that there is a weak correlation between U-NT and Ti values in Mazatzal Group rocks, but this trend is probably a consequence of the close relation between titanium and iron in these samples (fig. 27). Examination of figure 29 certainly seems to indicate a positive correlation of uranium with zirconium especially if the D 25 sample, which plots at a 40° angle off the top right corner of the diagram, is included. However, in both figures 28 and 29, high Ti and Zr values generally correlate to samples with less than 8 ppm U, so the higher U-NT values on these diagrams are not Apache or Alder rocks, but a whole suite of iron-rich Deadman samples in the Mazatzal Wilderness area that are rich in neither Zr nor Ti.

The trend of strongest iron enrichment therefore relates to basal Deadman rocks in the Mazatzal Wilderness where neither Ti nor Zr is concentrated in abundance. These are the samples which show a strong correlation with no other element but iron, as comparison of figures 29 and 30 demonstrates. The main purpose of undertaking this analysis was to find out whether detrital zircons in the heavy mineral concentrates are responsible for the increased scintillometer and uranium values or whether the uranium is bound mainly in some other way. Our analysis shows that the high U-NT values do not correspond to high values in any other parameter in the scatter plots but Fe, and table 2 indicates that we have not overlooked any other likely correlations. Because of the exclusive correlation between high Fe and high U-NT values, we are led to the conclusion that uranium is bound with either specularite or hematite in these iron-rich rocks, and therefore that high concentrations of hematite can effectively fix uranium.

4.6 Hydrogeochemical and Aerial Radiometric Results

The southern half of the Central Arizona Arch area lies on the northern part of the Mesa 2° AMS sheet, and the remainder is on the Holbrook 2° sheet. Concurrently with our program, a Hydrogeochemical and Stream Sediment Reconnaissance (HSSR) of the Mesa 2° sheet was underway. Our experience concurred with some previous Bendix HSSR studies indicating that stream sediments in the desert environment are not particularly good uranium tracers because of the sediment's infrequent contact with water. However, HSSR water sampling has worked particularly well in northwestern Arizona to detect a variety of uranium anomalies.

We therefore decided to limit our stream sampling to waters and concentrate on the northern half of our study area, that is, on the Holbrook quad, because this would not be duplicated by the HSSR results of the Mesa quad. We purposely tried not to sample any drainages which could have picked up uranium from the radioactive Dripping Spring siltstone in the central and southern Sierra Ancha Mountains since the anomalies from this would certainly mask anything else. Thus our sampling was concentrated mainly on small-area drainages in the Pine, Christopher Mountain, Diamond Butte, and Mazatzal Mountain areas. We took 33 samples of spring water, well water, or slow-flowing to almost-standing but not stagnant stream water. Precautions to avoid contamination were followed meticulously.

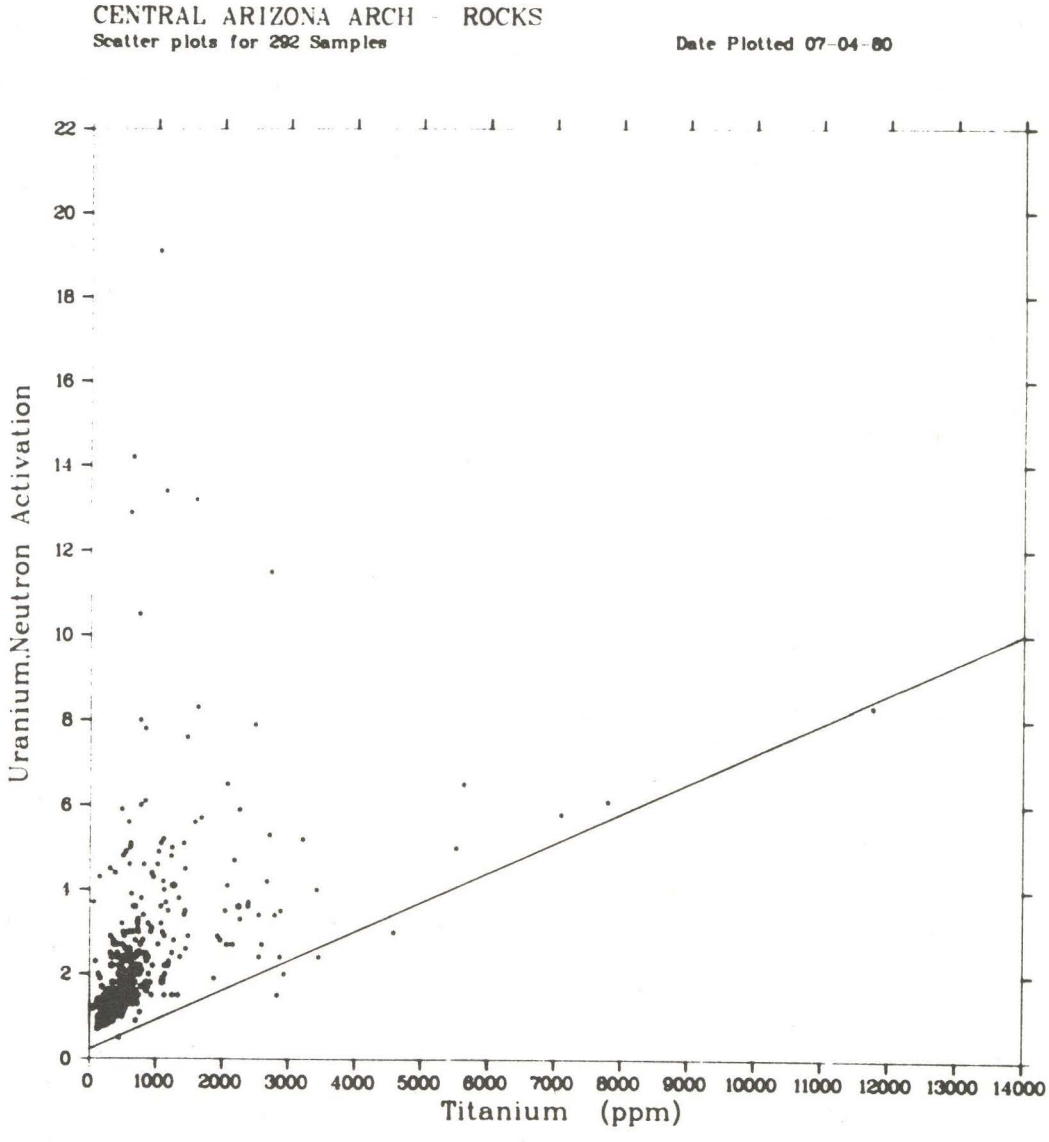


Figure 28. Scatter plot of titanium versus U-NT values for all but two anomalous conglomerates in the Central Arizona Arch. The line of strongest Ti enrichment has a correlation coefficient of 7.142 ppm U per 1% Ti.

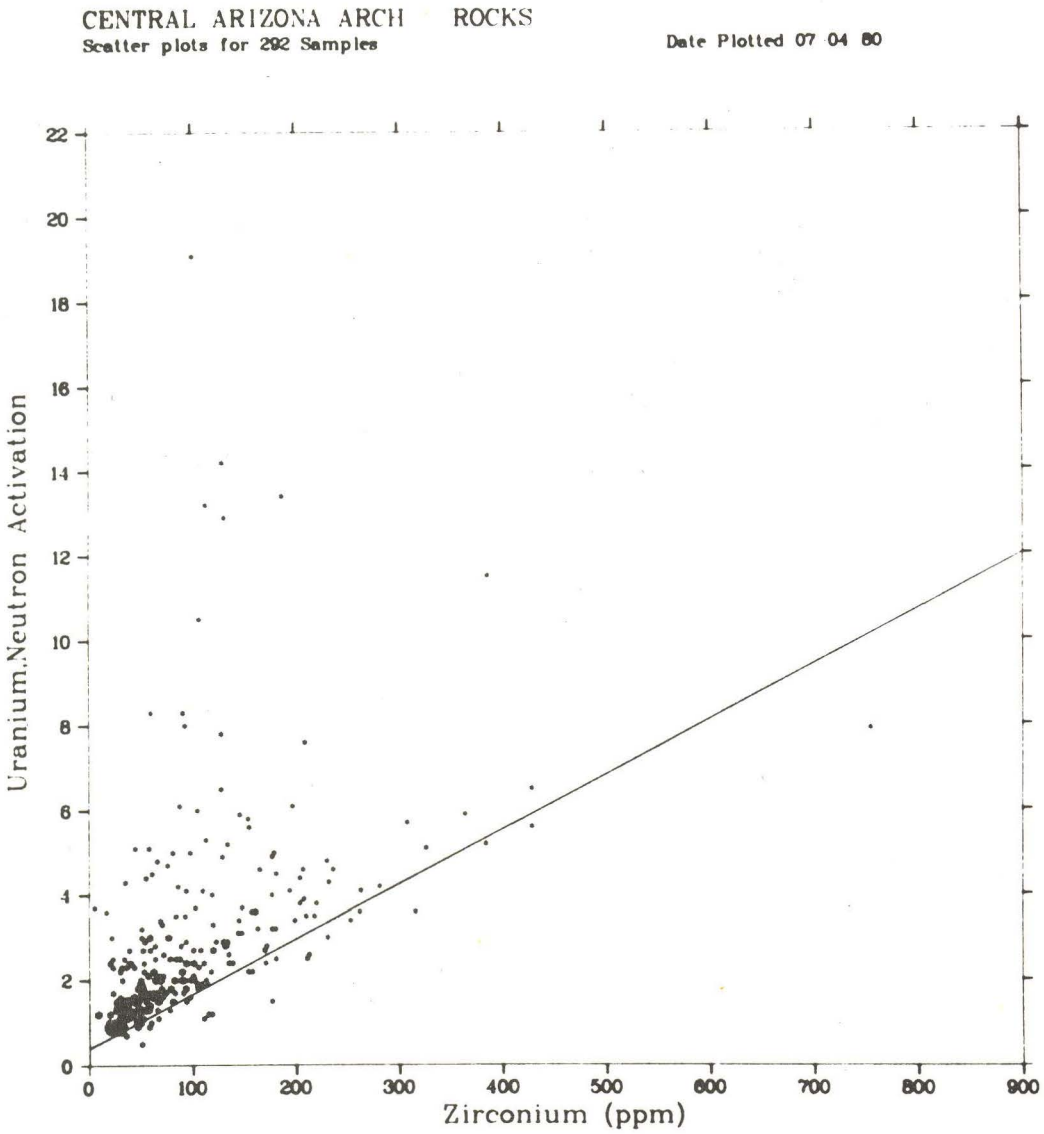


Figure 29. Scatter plot of zirconium versus U-NT values for all but two anomalous conglomerates in the Central Arizona Arch. The line of strongest Zr enrichment has a correlation coefficient of 133.33 ppm per 1% Zr.

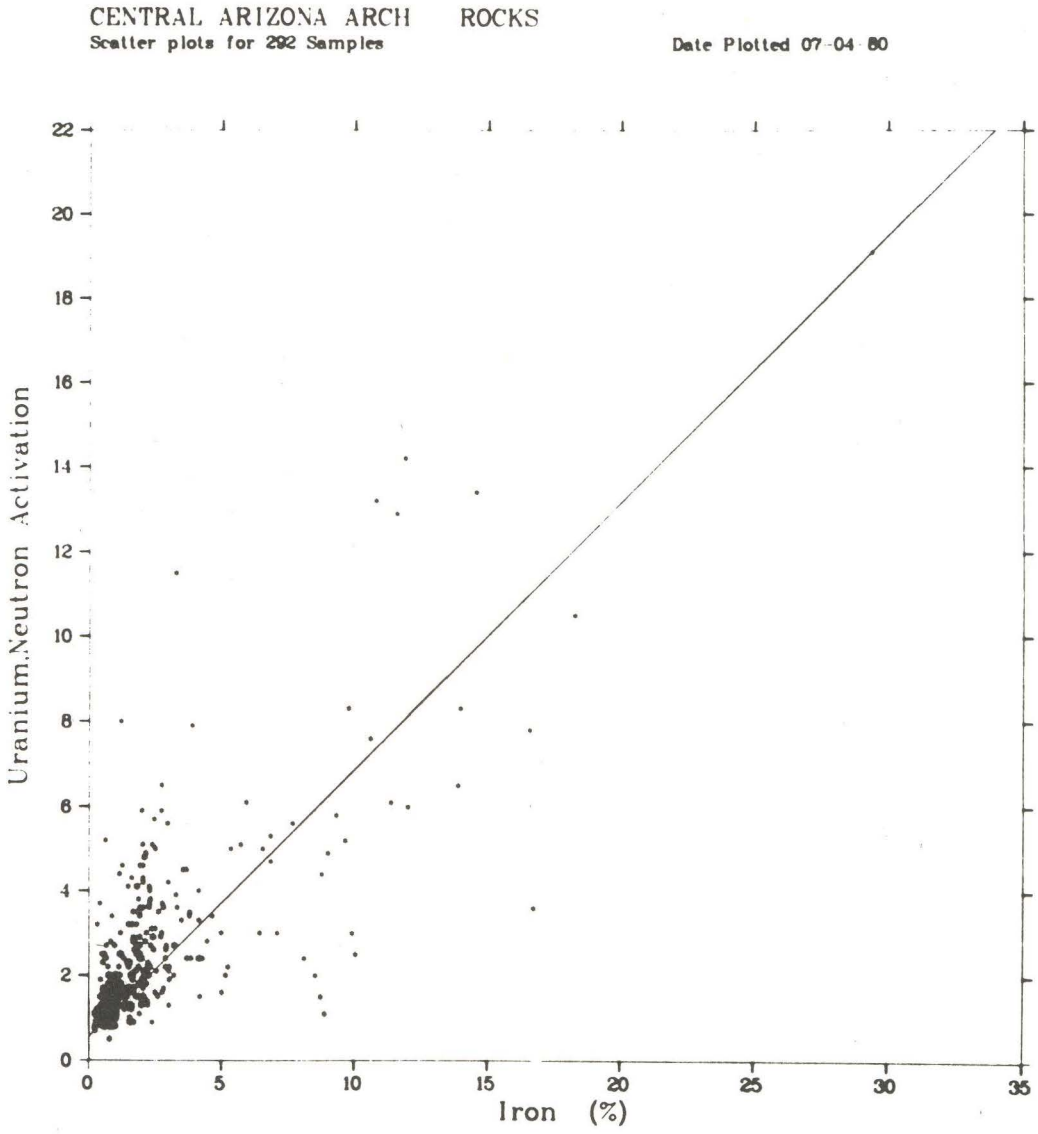


Figure 30. Scatter plot of iron versus U-NT values for all but two anomalous conglomerates in the Central Arizona Arch. (This is an enlargement of the lower portion of figure 25.) The line of approximate best fit has a correlation coefficient of 0.657 ppm U per 1% Fe.

Our purpose was mainly to test whether any radioactive conglomerates found in the study were also detected by ground water flowing over or through these zones; thus it was critical not to have contamination from radioactive siltstones. Uranium values were determined by UF1 method and quoted in ppb. The results appear on the computer print-out in appendix D and are listed in the Sample Summary Tables (appendix C). The data are plotted on figures 4 and 6 with rock sample data. We found no essential systematic differences between the values in well, spring, or stream water, except that barely moving surface water close to a spring seemed to be optimal for sampling and results.

There is a somewhat negative correlation of UF1 values with elevation in that many drainages sampled at lower elevation were of higher background than other samples. This correlates to a high Ca value in the water and suggests that these lower drainages encountered caliche-rich Tertiary gravels, Tertiary volcanics, or young sediments. Tertiary lake beds and some gravels in Arizona are well known to be U-rich, and the higher values in W 10 are attributed to this. Higher values in W 4, W 8, W 29, W 23, and W 33 are all possibly related to Tertiary volcanic rocks at higher elevations or Mazatzal Group rocks, although the first three could also be from the Red Rock rhyolite outcrops in the Slate Creek Divide area.

We are almost certain that two major anomalies, W 14 and W 18, have detected local radiometric hot areas in the Apache Group. W 18 could correlate to radioactive Dripping Spring sandstones found in the cliffs near S 6, above Del Shay Basin, which probably are a coarser grained northerly facies of the radioactive Dripping Spring siltstones. W 14 anomaly is most likely derived from the U-rich hematite concentrations at the base of the Scanlan on the mesa above Winter Camp (D 50). The only value that almost certainly relates to a Mazatzal Group rock is W 17, down from the radioactive Mazatzal specularite concentration, D 25. In the Mazatzal Wilderness area, W 33, W 23, and W 10 anomalies could be produced by Mazatzal or Deadman conglomerates, but this is less likely than derivation from the nearby Tertiary volcanics and gravels.

The largest anomaly, W 31, of 39.29 ppb U in water, occurred in the least likely place: on a tributary of South Fork in the Mazatzal Wilderness area above all basal Deadman specularite concentrations. Conceivably a lower unit of Mazatzal conglomerates could be thrust up to produce this anomaly, but the U values in the rock samples are scarcely sufficient to produce this high a value. Either there is a buried radioactive zone in the Mazatzal unit which we did not detect here, or else the anomaly results from the cap of Tertiary volcanic rocks lying between Mazatzal Peak and Chilson Camp (fig. 6); this anomaly is not yet satisfactorily accounted for unless it relates to the Tertiary rocks.

In conclusion, three of the 33 water samples produced sufficiently anomalous readings of 10 to 20 times background to be interesting. Two are accounted for by known local radioactive anomalies in the Apache Group, and one in the Wilderness seemingly cannot be accounted for by Precambrian conglomerates or quartzites. HSSR reconnaissance is therefore quite useful if the geologic controls are known well enough in the sampled area to determine whether anomalies relate to rocks other than the ones of interest.

At the time of writing of this report the HSSR results from the Mesa 2° sheet program were not available in map form. A supplement to the main report (Koller, 1980) lists no uranium values for water samples, so we are presently unable to make comparisons. Ideally, the HSSR study should detect a major uranium geochemical anomaly in all tributaries draining out of the central and southern Sierra Ancha Mountains which will overshadow all other results on the sheet. These apparently less significant anomalies could in fact be quite important if one is seeking specific geologic environments of uranium concentration, as has been the purpose of this study. Indeed, later comparisons of the HSSR data with our results must be made with great care because of the abundance throughout the area of Tertiary volcanics, gravels, and lake beds, as well as the Dripping Spring siltstone, all of which are more radioactive than Precambrian pebble conglomerates.

The type of radiometric anomaly to be expected over the Sierra Ancha Mountains is well illustrated by the airborne radiometric results obtained over the Mesa AMS 2° sheet in a previous Bendix study. To facilitate comparison of our new geologic and geochemical information and HSSR results to the airborne radiometrics, the entire radiometric map is reproduced here as figure 31 at 1:250,000 scale, even though only the northern third of the map is pertinent to our study. Apart from the large airborne radiometric anomaly over the Sierra Ancha Mountains, obviously caused by exposed radioactive Dripping Spring siltstones, there are a number of smaller anomalies in other areas of interest to this study whose origins are not so obvious.

The anomalies near the Hess Canyon quartzites, Four Peaks quartzites and southern Mazatzal Mountain or Slate Creek Divide areas are unexplained unless they relate to Red Rock-type rhyolites that are present under the quartzites in all these areas. Several rather major anomalies occur on the west side of Tonto Creek from Theodore Roosevelt Lake up to the north boundary of the quadrangle. There are no conglomerates or Apache Group in this area, and the granites in outcrop to the west are radiometrically low, so these anomalies apparently correlate to the Tertiary gravels and lake beds in the basin. The major anomalies in the Roosevelt Lake area, as in the Sierra Ancha Mountains, correlate to outcrops of the Apache Group, probably Dripping Spring siltstone.

5.0 INTERPRETATIONS

With all of the foregoing data, a continuous uranium-geochemical profile throughout the time-space evolution of the Precambrian crust in the Central Arizona Arch has been developed. We have treated all the igneous rocks briefly and have considered all the sedimentary and volcanic rocks from the detailed perspective of their conglomerate units. This body of data itself speaks quite definitively about the source materials for the Precambrian conglomerates, their depositional settings, the causes of uranium concentrations within them, and the maximum limits to these concentrations. Also, our recent data on uranium occurrences in Dripping Spring siltstones points away from earlier interpretations to a new, much more logical source for this uranium concentration.

5.1 Source Areas

This far south of the Wyoming Archean craton there was no Archean material available for inclusion into volcanic or sedimentary deposits of the Central Arizona Arch. The earliest conglomerates in the Alder Group were volcanic and derived from dacitic to rhyolitic material of generally 2 to 4 ppm U content extruded by submarine volcanic eruptions. Siliceous, cherty, jaspery, and banded-iron-formation exhalations of 1.0 to 2.5 ppm U contents capped many of these volcanic units and were available for later erosion into younger, generally nonvolcanic conglomerate settings. The lower U values of these younger Alder "sedimentary" conglomerates are consequently due to the preponderance of U-poor source material and sedimentary reworking.

A period of felsic rhyolitic volcanism and subaerial ignimbrite activity of higher 4.5 to 5.5 ppm U content followed deposition of the Alder Group but preceded Mazatzal Group deposition. These rhyolites were intrinsically iron-rich, and all of their iron was converted to earthy or specular hematite in the extrusive oxidizing environment. Remnants of this uppermost Fe-rich rhyolitic material, containing up to 10-15 percent Fe_2O_3, still exist in Tonto Basin. Whereas the previous Alder volcanism provided much of the jasper and quartz material to the sedimentary environment, these younger Red Rock-type rhyolites contributed most of the specularite and other heavy minerals to form detrital heavy-mineral concentrates at the base of the Mazatzal Group. Because the Red Rock-type rhyolites were both iron-rich and relatively U-rich compared to most other Precambrian rock units in central Arizona, the Mazatzal Group generally, but especially in the concentrates of heavy minerals at its base, displays the unique association of uranium enrichment with hematite concentration. This association produced the highest U values in Precambrian conglomerates of the Central Arizona Arch.

The detrital heavy mineral concentrates play an important role in identifying geochemically different source terrains that may have grossly similar lithology. For example, the source Red Rock rhyolites in the Mazatzal Wilderness area are zircon-rich compared to rhyolites east of Sheep

Basin Mountain which are much richer in titanium. Similar variability between the Ti-rich concentrates in eastern areas compared to just Fe-rich (i.e., Ti- and Zr-poor) concentrates in the western part of the Deadman fluvial system most probably correlate to fluvial environments of higher and lower energy respectively.

Broadly coeval with the extrusive U-rich rhyolites were a series of red granites of somewhat lower, 1 to 4 ppm, uranium content, including the Verde and Payson red granite batholiths. Border rhyolitic phases of these batholiths are no richer in U than the core phases, so many of the granites and rhyolites available for erosion at the time were not as U-rich as Red Rock-type rhyolites.

Between Mazatzal and Apache Group deposition two granite batholiths intruded and were available as source material for the Apache Group in addition to all the earlier plutonic, volcanic, and sedimentary terrains. One of these batholiths, the Young Granite, was relatively uranium poor, with 1 to 1.5 ppm U, whereas the other, the Ruin Batholith, was relatively U-rich, with 2.5 to 8 ppm U. However, the easily eroded Ruin quartz monzonite was recessive and mainly covered by, rather than a source for, Apache Group sediments, so it contributed little detritus to any conglomerate units in the Sierra Ancha Mountains except the basal Scanlan conglomerate.

One of the more satisfying aspects of the conglomerate study is this very point: by examining the complete section, all the fragments in the conglomerates are accounted for by the source rocks potentially available within the same region. There are no especially exotic fragments, and no open-ended speculations as to postulated but unseen source terrains. The conglomerates are a direct product of their immediately adjacent environments.

5.2 Depositional Environments

The earliest Alder or pre-Alder rocks formed in a deep-water intra-oceanic setting with an Archean land mass possibly lying far to the northwest (Anderson, in prep.), but the depositional setting rapidly progressed to shallower water conditions as the deep basins between volcanic islands were filled with detritus. At the end of Alder Group deposition, regressive marine and local fluvial conditions provided a setting appropriate for large volumes of rhyolite to be extruded subaerially. As this material was eroded back to sea level, the resulting fluvial, then shallow-water marine, sedimentary sequences constituted the Mazatzal Group. After an intervening break of 300 m.y. without depositional record, Apache Group was deposited, once again under fluvial and transgressive shallow-water marine conditions.

5.2.1 Alder Group

Most conglomerates in the Alder Group were deposited in a basin between two major volcanic centers that once occupied the southern Slate Creek Divide area near Mount Ord and the northeastern Diamond Butte area near Young. The earliest volcanic conglomerates deposited in this basin accumulated in a

relatively deep-water marine setting well below the level of current action, but progressive infilling of the basin in time gave rise to progressively shallower marine conditions. A much deeper water setting existed laterally on the flanks of the main volcanic chain: turbidity currents and density flows of material from foundering slope sediments produced the coarsely graded, poorly sorted volcaniclastic deposits typically found peripheral to the main volcanic centers in the East Verde River and Hess Canyon areas (Anderson, 1978, in prep.).

In the shallower intervolcanic basins, the earliest dacitic conglomerates are poorly sorted, very poorly bedded, and show no evidence of current action; the younger volcanic conglomerates are generally better sorted and bedded, but still show no current features. Not until the upper cycle of "sedimentary" conglomerates -- where reworking and higher energy conditions gave rise to increasingly greater proportions of sedimentary material -- is there definite evidence of shallower water conditions and current action. The lower conglomerates of this upper cycle, even though abundant in quartz and jasper pebbles, are characterized by a dirty brown argillaceous matrix. Typically these conglomerates are moderately sorted and bedded and contain thin graded-bedding units; but they contain no ripple marks or cross beds, which would mark the beginning of shallow-water conditions and frequent current action.

The uppermost clean quartzites and conglomerates in the Alder Group, termed Reef Ridge quartzites in this report or Houden quartzites by Gastil, were deposited under very shallow water conditions. No mud cracks were found in immediately subjacent purple shales to suggest fluvial or intertidal conditions, but the character of the quartzite-conglomerate deposits themselves does suggest fluvial and shallow marine conditions. Houden quartzites near Diamond Butte, as well as further east near Young, seem to define discrete channels in which there are large, cross-bedded layers and bars of coarse quartz-jasper pebble conglomerate. These channels coalesce southwestward into a single thick unit of quartzite on Reef Ridge, whence quartzites without coarse conglomeratic features extend all the way west into the Slate Creek Divide area.

We interpret this variability to mean that the uppermost Alder quartzite and conglomerates composed a network of fluvial channels which carried coarser material off a highland in the northeast and fed finer detritus into a shallow-water marine setting to the southwest. The heavy minerals are concentrated most abundantly in the fluvial and beach zones, and little coarse or heavy material was carried out into the marine setting.

Thus the conglomerates in the Alder Group record the progressive infilling of an intervolcanic basin, maturing of sediments, and shallowing water conditions with time. The final result was a shallow-water marine to fluvial setting which controlled the subaqueous to subaerial variability of the immediately ensuing rhyolitic eruptions.

5.2.2 Mazatzal Group

At individual sample sites in the Mazatzal Group there are frequently insufficient criteria to distinguish shallow-water marine from fluvial conditions, and for this reason all possibilities were objectively listed in site and sample descriptions of the rock units; the multiple alternatives are especially apparent in some Deadman and Mazatzal conglomerates. However, from an overall perspective it is clear that the earliest record of Mazatzal Group sedimentation started out in a fluvial setting. Basal Mazatzal conglomerates in the Pine area and Deadman conglomerates in the Sheep Basin Mountain and Mazatzal Wilderness areas show distinct paleochannels which appear to converge from all directions onto the central Mazatzal Wilderness exposures.

The inferred geography of these paleochannels is shown on figure 32 (in pocket). The base of the Pine Creek exposures contains Payson granite regolith reworked into a coarse fluvial deposit which thickens to the south, presumably where it laps off the granite high. In the absence of current structures and in working with a small area of exposure, we presume the transport direction was to the south, although it could have been partly to the west.

The geography of paleochannels of Deadman conglomerates to the south and of Mazatzal Wilderness exposures is relatively well defined (fig. 32). Here a major high of rhyolite existed to the south near Pine Mountain, probably one of the main accumulations of Red Rock rhyolite. In some places the basal conglomerates exposed along Cactus Ridge are simply in situ regoliths of rhyolite boulders preserved on hill slopes. Elsewhere most of the rhyolite-boulder material was washed into one of several main fluvial channels. The larger ones coalesced from the southern source terrain into a major channel of the poorly stratified fluvial conglomerates now exposed on Cactus Ridge. A distributary channel of specularite-rich Deadman conglomerate deposited over a valley filled by rhyolite boulders is exposed where the Deadman unit now crosses South Fork (fig. 32).

In contrast to this locally hill slope-dominated, rhyolite-boulder fluvial system in the Wilderness, the Deadman conglomerates of the Sheep Basin Mountain area represent a broad network of fluvial channels in which much detrital specularite was concentrated from an eastern rhyolitic terrain. In outcrops of hematitic rhyolitic volcanics to the east, one finds abundant vesicles filled with specularite (D 33), and it is this already-rounded specularite which is an ideal source for the rounded detrital specularite found in the Mazatzal Group. Maximum, average, and minimum uranium values of Deadman conglomerates in this higher energy fluvial environment to the east are all higher than the values further west. Part of the reason for this is almost certainly that the rhyolite source terrain here was more specularite-rich and therefore originally richer in uranium.

It is highly likely, but not known for certain because of the break in outcrops, that the Sheep Basin Mountain paleochannel network extended westerly and continued directly into the main central Deadman paleochannel which extends from Barnhardt Canyon west to Maverick Spring. Although wide

and well-defined, this main Deadman paleochannel was of distinctly lower energy than those to the east or south: much of the detrital specularite is very fine grained and intermixed with finely ground, reddish brown hematite; fragments are smaller and softer, and many of them are soft hematitic mudstone or banded specularitic sediments. Almost certainly these angular, soft hematitic fragments were broken off the banks of the channel and were incorporated further downstream with the main bedload of cobbles and pebbles.

In fact, most of the intraformational specularite-rich fragments at the base of the Deadman occur along the edges of the main channel just in this western area. If we picture a 200 to 300 m-wide river channel filled with rhyolite cobbles in the center and banked by raised levees on either side, we have a perfect model for the main Deadman paleochannel. Because the eroding detritus was very hematitic, the muds and silts deposited on the flood plain when the levees were breached during storm washes would have been rich in fine powdery hematite and specularite. During the next storm wash when the levees were breached again, these hematitic muds would be ripped up from the flood plain near the levees and some would be reincorporated back into the central channel as it migrated laterally. This describes exactly the main Deadman paleochannel geometry, with specularite-rich mud rip-ups proximal to the channel and thin specularite- and hematite-layered quartzites, siltstones, and shales distal from the channel.

Whether this main paleochannel was once joined by the Pine Creek and Cactus Ridge paleochannels and originally continued to the west of Deadman Creek is unknown. It could have turned south to form the north-south trending paleochannel of the Davenport-Mazatzal Wash area. One interesting piece of geochemical information bears on this problem. Deadman conglomerates exposed in the western Wilderness were found to be anomalously rich in molybdenum; no other conglomerates in our study region -- not even Deadman conglomerates in other areas -- contain anomalous Mo values. From Wallaby Enterprises' previous Mazatzal Wilderness evaluation it was known that the Verde Batholith immediately to the west on Cyrpess Butte and Table Mountain quadrangles is one of the only Precambrian batholiths in the region containing molybdenum prospects. This implies that part of the Verde Batholith was exposed and contributing material to the Deadman at this point. Either this material could have been fed in from the Davenport Wash paleochannel in the south, or the main paleochannel of Deadman could have encountered a scarp of granite here and turned south to fill the Davenport Wash paleochannel. As present we prefer the latter interpretation because it explains an unusual mixture of rhyolite and specularite clasts in the paleochannel further to the south (fig. 32).

For this network of Deadman fluvial channels to be overlain by upper Mazatzal strata of obvious marine character, a transgressive marine condition is required where the land was either subsiding or being eroded rapidly back to sea level. It is possible for the quartzitic Deadman strata which overlie the basal conglomerates to have been part of a well-developed fluvial system, but it is somewhat unlikely because of the well-laminated, poorly cross-bedded, well-sorted, and more mature nature of the blanket quartzite deposits. More logically, the upper Deadman quartzites represent an estuarine or drowned river-valley setting in a coastal environment which is transitional from

strictly fluvial to strictly marine conditions. The characteristic drowned-coastal features of laminated hematitic muds in the quiet estuaries and well-sorted sands where there are periodic currents nearer the open ocean adequately account for the upper Deadman quartzitic strata, their variability, and their restriction just to the Wilderness area. Occurrences of herringbone ripple marks in the upper Deadman quartzites at North Fork (M 77) and abundant oscillation ripple marks further north (M 26) are exactly the types of current structures one would expect in such an environment. The change from fluvial to marine corresponds to a distinct change in the character of sediments from strictly local, poorly sorted conglomerates rich in unstable rhyolitic material to more widespread, better sorted and well-washed quartzites and granule conglomerates rich in detrital quartz and jasper.

Continued drowning of the fluvial coastal topography produced a quiet-water, back-bay environment where pyritic Maverick shales were deposited in a restricted setting just in the Mazatzal Wilderness area. In all surrounding areas, hematitic sediments continued to be deposited in higher energy environments, so the pyritic character of Maverick shales results simply from the local reducing conditions typically found in back-bay environments. The grit layers sampled in the Maverick shale almost certainly represent storm washes of coarse material into the bay, and whenever the coarse detritus was brought in, so too was the hematite.

Apparently estuarine and back-bay environments never existed in Mazatzal Group rocks further north or south of the Wilderness area. The Sheep Basin Mountain area remained a high energy fluvial site into the upper Mazatzal quartzite units, whereas in the Pine area basal fluvial conglomerates were directly overlain by cross-bedded, well-sorted marine quartzites. The back-bay environment of the Maverick shale gave way upwards to a higher energy marine environment as marine conditions transgressed over nearly all of the Central Arizona Arch.

At this point, the scale of sedimentation became huge, and Mazatzal-age strata were deposited over a large part of Arizona. The variations in Mazatzal-age rocks from Hess Canyon to Four Peaks to the southern Mazatzal Wilderness area are consistent with progressively northward-shallowing water conditions. In upper Mazatzal strata of the Wilderness area we detected a parallel change from higher energy grit- and conglomerate-bearing strata north of South Fork to sublittoral nonconglomeratic quartzites south of South Fork which once lay further offshore. However, this change transgresses up section to the north, confirming the general northward marine transgression (fig. 32).

The key distinctive features of the Mazatzal quartzite unit are cleaner sediments and much better sorting. Also distinctive are the abundant but small-scale trough to planar cross beds, oscillation and current ripple marks, and cross-bed-bound grit lenses. All of these features are characteristic of a near-shore marine environment in the shallow neritic to littoral zones. The tendency for all conglomerate layers to invariably attain a uniform quartz-chert-jasper pebble assemblage bespeaks continuously thorough mixing of various sediment types by ceaseless wave action. The grit, granule, and fine pebble conglomerate lenses, typically interbedded with well-sorted clean coarse-grained quartzites, are also characteristic of a littoral or beach environment.

In other places, conditions were not the same. Mazatzal rocks in the Chino Valley area near Prescott are dominated by poorly sorted, large trough cross-bedded conglomerates and quartzites typical of fluvial environments, and this area represents the site of a long-lived fluvial system probably coeval with all of the Mazatzal Group further east. Similar poorly sorted, sparsely conglomeratic quartzites in the Sheep Basin Mountain area with huge trough cross-bedded specularite layers also indicate that Mazatzal units here were most likely fluvial at the base, even though probably marine higher up section.

The depositional environment of the upper white Mazatzal quartzite unit in the Wilderness appears to have been quite different: the grits and quartzites are very mature, contain only exceptionally well-rounded quartz and chert, and grain faces are highly abraded. In addition, some process has acted to remove from these clean quartz sands whatever dispersed hematitic or specularitic material they might have contained, and concentrate this as a specularite- and hematite-rich zone at the base of the white unit. We suggest that these rocks have been rendered this way by wind action, and that the upper white quartzites probably represent either subaerial beach dunes or wind-blown sands. The wind action has evidently reworked what might earlier have been a shallow marine or littoral sand to remove the dispersed heavy minerals and concentrate them at the base of the wind-blown unit.

It is possible that in nearly all places in the Central Arizona Arch where Mazatzal quartzites are exposed the uppermost quartzite could have been reworked by wind action. Units of very mature, well-rounded quartzite and grit that are compatible with a wind-blown origin are found at the top of the Mazatzal quartzite section near Pine, on McDonald Mountain, on Sheep Basin Mountain, and possibly at Four Peaks, in addition to the Mazatzal Wilderness area. This aeolian setting could be significant because it is the last depositional environment recorded in the Mazatzal Group. There are no strata known or remaining in the Mazatzal Group that are younger than the white quartzites; presumably they were either blown away or never deposited.

5.2.3 Apache Group

Many characteristics of the depositional setting of Apache Group conglomerates have already been discussed, so a summary of the main features is given here. The basal Scanlan boulder conglomerate was deposited as a subaerial network of fluvial channels where it lapped onto the source area of Mazatzal quartzite in the north. Steep river canyons here were filled with poorly sorted and stratified boulder conglomerate of Mazatzal rocks in an oxidized goethitic matrix, and the thin conglomerates that flanked these canyons were essentially hill-slope regoliths of angular Mazatzal quartzite fragments.

Scanlan sediments spread out laterally to form a broad blanket deposit further to the south which progressively changes facies southward into more reduced conditions, but nowhere sufficiently reduced to be pyritic. We know of no modern analogue to account for a thin blanket of boulder conglomerate spread over a wide area except for a residual basal conglomerate which would

be formed when shallow marine conditions transgress over an old erosion surface. This model is appropriate for Scanlan because it rests right on the erosion surface, but it cannot account for equally coarse conglomerates in the Dripping Spring and Barnes units higher in the section. These conglomerates are sufficiently coarse to be fluvial deposits, but they do not show the features of broad meandering river systems. Their blanket geometry and supermaturity, especially the Barnes, are incompatible with a fluvial origin, and are more suggestive of a high-energy beach setting. However, in a marine setting it is difficult to deposit a layer of supermature cobble conglomerate amidst abundant hematitic shales. In short, no conventional or fixist viewpoint of sedimentary environments can explain the formation of conglomerates in the Apache Group.

The only satisfactory explanation, which may seem the most radical one, is to make all of the Apache Group a sequential array of time-transgressive strand-line related lithotypes. In this model, the Scanlan would be the residual paleo-erosion surface deposit, which is clearly fluvial in its upper northern reaches. The Pioneer -- variously shale to siltstone depending on proximity of source material -- would be the back-beach lagoonal to estuarine intertidal zone. This would be fronted by Barnes conglomerate which is best explained as a high-energy beach-gravel deposit. The Dripping Spring unit -- variously sandstone, siltstone, shale and conglomerate -- would represent the shallow-water littoral and neritic sandy deposits immediately offshore from the beach. These could readily change laterally into siltstones and shales in restricted places.

Mescal, including the chert breccias, could readily represent a fore-reef and back-reef facies pair further offshore, which would have aided the local restricted-basin conditions in parts of the Dripping Spring unit. Algal mats and reef structures are well displayed in the Mescal exposure near Roosevelt dam. The Troy quartzite would then be the well-sorted and worked sands found offshore in the open ocean. In this case, all of these lithologic units would have to be time-transgressive units which, in the Central Arizona Arch area, would have constituted a "wave" of deposits moving northward as marine conditions transgressed over the entire area in late Precambrian time.

5.3 Causes of Uranium Concentrations

In the Alder Group we discovered no significant uranium concentrations, and because the volcanic and sedimentary material available for incorporation into the conglomerates was limited to rocks geochemically low in uranium, we would not expect to find any significant uranium anomalies. The relatively deep-water marine environment is unfavorable for concentrating uranium, the volcanic source material was not sufficiently evolved to be U-rich, and even the shallow-water marine to fluvial conglomerates high in the Alder Group had insufficient recycled material of appreciable uranium content to concentrate anomalous radioactivity. Thus no syngenetic uranium concentrations other than what would be expected from the geochemistry of the source material are likely to be found.

The Radiometric Variance Graph, figure 9, shows what range of geochemical values might be expected in each type of setting. A primitive setting can be defined as those conglomerates which were the first to cycle material from the underlying source terrain, unless the source terrain itself was a composite of highly evolved rocks. Primitive settings are found in island arc assemblages, or at stratigraphically low levels in the tectonic history of a region. In contrast, a mature setting for conglomerates can be defined as either where most of the source material has been reworked many times before incorporation into its final host or else where the source terrain itself is highly evolved. Examples of a mature setting are in areas of evolved-arc or continental crust, or at stratigraphically high levels in the sedimentary record of a tectonically active region.

Thus it is apparent from figure 9 that Alder volcanic conglomerates (V) lie in a primitive setting, whereas the "sedimentary" conglomerates (A) are more mature through recycling of earlier detritus. Also apparent from figure 9 is that the trend of Alder Group rocks is not conducive to strong uranium enrichment. The general trend of Apache Group conglomerates is even less conducive to uranium enrichment, in contrast to Mazatzal Group rocks which, of all the conglomerates, have a trend most conducive to uranium enrichment.

Several fundamentally important features are concealed within the apparent simplicity of figure 9. The uranium content of the coarse detritus is a major factor controlling the amount of uranium in each conglomerate type and therefore the slope of the line defined by each stratigraphic group. A high-energy depositional environment, such as a fluvial one, is the main factor causing relative uranium enrichment, and thus governing the placement of a conglomerate to the right of figure 9 along a line of lower slope. This is evident both from the high energy fluvial environments of Deadman and Mazatzal conglomerates in the Sheep Basin Mountain area and from Barnes and Scanlan conglomerates in the Apache Group. The processes of thorium and potassium enrichment work towards increase of gross-gamma scintillometer counts at any given U value, thus governing the placement of conglomerate points to the top left of figure 9, along the lines of steepest slopes. The significance of the Radiometric Variance Graph is that the location of each conglomerate point, and the combination of the three controlling factors implied by this location, are perfectly in accord with what we inferred from the field data.

We did find significant uranium concentrations in Mazatzal Group conglomerates, and one reason for our detailed analysis of them was to determine whether it is possible for these geochemically anomalous concentrations to make an economically interesting concentration somewhere. New felsic volcanic material added to the crust was responsible for introducing geochemically higher amounts of uranium into the surface system, but sedimentary hydraulic processes were responsible for concentrating uranium in conglomerates and quartzites. The critical link is that the uranium in the rhyolites was bound up in heavy minerals such as hematite, zircon and other more complex metallic phases, and therefore sedimentary processes were able to concentrate this uranium. Thus wherever a specific U-rich source rock was eroding and a depositional environment was available to concentrate heavy minerals in abundance, we found a uranium geochemical anomaly.

In addition to uranium bound in zircon, sphene, apatite and other possible phases such as rutile, cerite, and monazite, much uranium was bound in hematite either simply in specularite or complexed with Ti phases such as ilmenite, hemoilmenite, and leucoxene. The geochemical values obtained for our most specularite-rich rocks of 32 and 33 ppm U are probably a realistic measure of the total uranium content of a nearly pure specularite-plus-zircon concentrate. The correlation coefficients of 7.142 ppm U per 1% Ti, 133.33 ppm U per 1% Zr, and 0.657 ppm U per 1% Fe on figures 28, 29, and 30 represent the maximum values to which uranium can be concentrated by Ti, Zr, and Fe concentrations in Central Arizona Arch conglomerates. From these values, a theoretically pure zircon concentrate could contain 8,666 ppm U, a pure ilmenite concentrate could contain 357 ppm U, and a pure specular hematite concentrate could contain 46 ppm U at a maximum. It is doubtful that such maximal values and pure mineral concentrates would exist in a natural environment, and if so, the linear correlation evident at low values might not hold for high concentrations of the elements. A realistic maximum for a concentrate of mainly hematite with lesser Ti and Zr would therefore be about 70 to 100 ppm U, and this is not enough to be of major economic interest.

The geochemically strongest uranium concentrations out of all conglomerates in the Central Arizona Arch area were in basal Deadman conglomerates near Sheep Basin Mountain. The high uranium content of these rocks correlates not to zircon but to high concentrations of specularite and Ti values up to almost 1.2 percent. From the paleogeography of Deadman fluvial channels (fig. 32) we concluded that the Deadman conglomerates of the Sheep Basin Mountain area were deposited under some of the highest energy fluvial conditions, were close to an eastern rhyolite source terrain, and this terrain was possibly the richest in specularite of all the rhyolite sources for which there is an erosional record. In such an environment, high concentrations of detrital specularite and either rutile, ilmenite, or hemoilmenite would be expected.

Following the geochemistry of the conglomerates downstream into the main Deadman paleochannel, one sees both U and Ti values decrease markedly, while Fe values persist. Evidently most of the U-rich and Ti-rich heavy minerals were hydraulically the heaviest and were deposited in the upper reaches of the fluvial channel, whereas the hydraulically lighter heavy minerals were carried down into the Mazatzal Wilderness area. The fact that one observes a U correlation with only Fe and no other element in the lower reaches of the channel network in the Wilderness indicates that uranium was contained within specularite grains carried this far down from their source. In conclusion, the process of uranium concentration with detrital heavy minerals in Precambrian quartz pebble conglomerates was without a doubt operative in the Mazatzal Group, but the uranium-specularite association observed is not in accord with the Precambrian quartz-pebble conglomerate model.

Figure 9 shows that both Deadman and Mazatzal conglomerates in the Sheep Basin Mountain area are the most strongly U-enriched of all Central Arizona Arch conglomerates. This is because both conglomerates represent high-energy fluvial systems close to a relatively U-rich source area, the Deadman conglomerates being more U-rich only by virtue of their greater heavy-metal content.

Except for one U-rich heavy-mineral concentrate which has displaced, on figure 9, the average value for Mazatzal conglomerates in the Diamond Butte area, all Mazatzal conglomerates in the Pine, Christopher Mountain, Diamond Butte, and Mazatzal Wilderness areas cluster in the region of neither U enrichment nor U depletion. We ascribe this to the marine depositional environment and its tendency to homogenize rather than concentrate. Presumably fluvial Mazatzal conglomerates from Chino Valley plot in this same area because only U-poor source rocks were available in the Prescott region and even these were far from the depositional site. It is appropriate that Mazatzal rocks from Hess Canyon plot in the mature setting, as they represent the lowest energy environment farthest from a source region of any areas of Mazatzal Group rocks. Indeed, as figure 9 confirms, the low-energy environment of Maverick conglomerates is geologically quite comparable to that of the Hess Canyon area.

No significant uranium concentrations were found in conglomerates of the Apache Group. Apparently this is because no U-rich source material was available for erosion during deposition of the Apache Group that had not already been worked and concentrated during a previous event. The Ruin Batholith could have provided a relatively U-rich source, but little of it was available for erosion at the time of Apache Group deposition. Local uranium anomalies found in the Scanlan conglomerate at the base of the Apache Group relate either to residual granitoid material from the Ruin Batholith or to local hematite concentrations. One such hematite concentration near Diamond Butte contains anomalous radioactivity, and no cause other than the powdery hematite itself can be found for uranium fixation.

Neither Barnes nor Dripping Spring conglomerates have any tendency to concentrate uranium, and the reason for this is apparent from figure 9. All Apache Group conglomerates lie along a trend of low U-enrichment but relatively high scintillometer counts, meaning that principally thorium and radioactive potassium contribute to the scintillometer response of these rocks. The upward maturing of the Apache Group can well be seen from this diagram as successively younger units lie along lines of successively steeper slopes, ending with the most Th-rich unit of all, the Mescal chert breccias. Subtracting a background value for radioactive potassium, one can see that only Apache Group rocks have Th/U ratios significantly greater than the granitic rocks in the same region, and this is viewed as a criterion unfavorable for U concentration (Roscoe, 1969).

Chert breccias in the Mescal unit are indeed radioactive, but most of this radioactivity is due to thorium enrichment. A collapse origin for these breccias has been suggested in the Site Description Forms (appendix E), but a reef origin is equally plausible. In either case, some epigenetic process is required whereby thorium can be introduced into the breccias at any point during or after brecciation. The most likely cause is groundwater flow through the open breccia network, a process which altered the chert and introduced pyrite mineralization as well as giving rise to Th-enrichment.

The reason for the Th-rich groundwater flow is more problematic. However, the radioactive zone does spatially correspond very well to the major basement break or contact between batholiths that influenced Apache Group

sedimentation all the way from Scanlan up to the Mescal unit. This fundamental basement feature could have localized fumarolic activity related to Dripping Spring volcanism. The subsequent interaction of a U-rich juvenile fluid with groundwater would then give rise to a Th-enriched groundwater in the near-surface environment.

5.3.1 Sierra Ancha Deposits

Evidence has been presented to show that: (a) uranium mineralization in the Dripping Spring Formation of the Apache Group is syngenetically tied to a carbonaceous, pyritic siltstone; (b) this uranium could not have come from intrusive diabase although the diabase has certainly remobilized it; (c) the Cu-Zn-Mo base-metal association of the uranium mineralization, as well as the lack of a U-rich exposed source terrain at this time, is inconsistent with derivation of uranium from the preexisting Precambrian terrain; (d) there are tuffaceous layers interbedded with most of the siltstone unit and therefore abundant evidence for high-K_2O rhyolitic volcanism contemporaneous with uranium deposition; and (e) clasts of this rhyolitic material are found only throughout the upper Dripping Spring unit and ensuing conglomerates.

We suggest that all the evidence points clearly to the potassic, rhyolitic, tuffaceous volcanism as the obvious and logical source for the uranium. High-K_2O rhyolitic volcanism is a common occurrence in relatively stable cratonic areas such as central Arizona was during deposition of the Apache Group. Most if not all of the Dripping Spring volcanism was effusive to the extent that mostly fine-grained tuffaceous material was expelled from vents or centers into a shallow marine setting; some larger fragments were contributed directly to conglomerates. Because essentially all of the rhyolitic material was dispersed into the sedimentary environment, the only remaining evidence of the volcanism is either as fine particles or K_2O anomalies in tuffs, as fragments in conglomerates, or rarely as one of the feeder dikes. Williams (1957) and Schwartz (1957) report K_2O values from 10 to 12 percent as quite usual for the siltstones, but such high values in carbonaceous siltstones require a major contribution from potassic, if not ultra-potassic, rhyolitic volcanism.

The reducing conditions in Dripping Spring siltstones, including both pyrite and carbonaceous material, were essential for fixation of the uranium in the siltstone. If Gastil is correct, the volcanism started during deposition of the Pioneer Formation, but the stagnant environment appropriate for U-fixation was not available until the marine transgression proceeded far enough north for relatively quiet-water restricted-basin conditions to be attained in the Sierra Ancha Mountains. Uranium in solution, upon encountering lower oxygen fugacity, Eh and pH conditions, was precipitated as an organically bound complex with carbon, and this is the same form in which much of the uranium is found today.

Scaling down by a fixed ratio the U-NT and scintillometer values for U-rich Dripping Spring siltstones so that the average value can be plotted on figure 9, it is apparent that the siltstones plot in a field of very strong uranium enrichment exceeding the fields of all of the Central Arizona Arch

conglomerates. It is quite possible that the conglomerates themselves would have to plot in this same field before they were of economic interest. However, for conglomerates to plot in this field, a combination of a U-rich source area, a very high energy depositional environment, and a primitive geologic setting are required, and figure 9 shows that these conditions were not attained in any Central Arizona Arch conglomerates.

By proposing a high-K_2O rhyolitic source and syngenetic mode of deposition for uranium in the Dripping Spring siltstone, we do not wish to slight the economic importance of the diabase. Although the uranium concentrations syngenetic in siltstone reach 300 ppm, in all likelihood the thermal remobilizing effects of the diabase are required in order to convert this dispersed carbon-bound uranium mineralization into a mineable uranium deposit rich in uraninite.

5.4 Constraints on the Quartz-Pebble Conglomerate Model

The literature on the world's major uranium deposits in conglomerates was reviewed by Houston and others (1980) to establish a model that could guide the many Precambrian quartz-pebble conglomerate investigations throughout the United States. In large part, the model is based on two of the world's largest and richest uranium deposits at Blind River, Ontario, Canada, and Witwatersrand gold fields, South Africa. Unfortunately, there are many important features of ore deposits which cannot be gleaned from the literature but which are obvious from an on-site field examination. Such is the case with the Sierra Madre Wyoming uranium occurrences, the Blind River deposit, and the Witwatersrand deposits, so in our report we wish to point out major contrasts that the senior author has seen in his field visits to these three deposits.

Quartz-pebble conglomerates containing detrital uraninite from Blind River and the Witwatersrand bear great lithologic resemblance to one another both in macroscopic physical appearance and in their detailed depositional characteristics of bedding, cross bedding, and heavy-mineral concentrations. However, the overall geologic and depositional settings of the two deposit types are quite different. The Blind River deposits, like the Wyoming uranium occurrences, are true paleo-erosion surfaces where the resistant quartz pebbles and heavy minerals which accumulated on the erosion surface were the first material to be deposited during a marine transgression. Highly radioactive granites occur in the nearby region and are the obvious source for the uranium. The uranium values, especially at Blind River, are contained strictly within oligomictic quartz-pebble conglomerates.

In marked contrast, pebble conglomerates of the Witwatersrand gold fields of South Africa constitute thick alluvial fan deposits which are productive for gold and uranium only in areas of marine regression (D. A. Pretorius, pers. commun., 1980). The productive conglomerates are narrow sinuous fluvial paleochannels which occur high in the stratigraphic section, nowhere near the basal unconformity. These braided channels contain the highest gold values up the paleoslope towards the feeder canyons, whereas the highest uranium values occur further down the paleoslope of the alluvial fan because the detrital uraninite was hydraulically lighter than gold. There

are no highly radioactive source granites in the immediate vicinity, and general uplift of the source region accompanied progradation of the fan out into the yoked basin. Most surprising of all is the fact that the majority of productive horizons are polymictic and contain pebbles of quartz, chert, quartzite, rhyolite, granite, and possibly jasper. Sedimentologic experts in South Africa, Dr. W. E. L. Minter and M. A. S. Thomas, confirmed to the senior author that uranium is not restricted to the oligomictic conglomerates (also recorded in Western Holdings Limited, 1980 bore-hole drilling logs).

The Wyoming uranium occurrences in the Sierra Madre Mountains contrast with the Blind River deposits principally in age. The low-grade metamorphosed quartzose sedimentary sequences that contain the uranium-bearing conglomerates in Wyoming are, from the senior author's familiarity with the Precambrian of the western United States, definitely not part of the Proterozoic tectonic assemblage that lies a little to the south in Colorado. The basal conglomerates are almost certainly late Archean, predate 2.4 b.y.-old earliest Proterozoic granites, and are unrelated to the Proterozoic tectonic evolution of the western U.S. This means that the granitic source for the uraninite must be the 3.0 b.y.-old deformed Archean granites that occur in southern Wyoming.

In light of these facts contrasting the Wyoming, Canadian, and South African detrital concentrations of uranium, we view several aspects of the Precambrian quartz-pebble conglomerate model proposed by Mathews and others (1979) and Houston and others (1980) as being much more important than others.

1. The restriction to oligomictic quartz-pebble conglomerates is not valid, although this specific lithotype may be important for paleo-erosion surface deposits.

2. Although high-energy fluvial conditions definitely seem to be a requirement for uranium concentration, only some types of deposits are restricted to the bases of fluvial sequences; certainly the world's largest deposits, Witwatersrand, are not.

3. A blanket age restriction to the Early Proterozoic is not as important as the environmental factors required for uranium concentration in pebble conglomerates. These factors might have existed only during a particular segment of Earth's history, or they may well have existed at different times in different places; for example, the right conditions were attained earlier in Wyoming than they were in eastern Canada.

4. A reducing environment is not the only condition under which detrital uraninite can survive or uranium be precipitated from solution and fixed in a solid phase; however, reducing conditions may be required for an economic deposit.

5. Standing out above all other features is the nature of the source terrain; this is what we consider to be singularly the most important factor in the location of a uranium concentration in pebble conglomerates.

A common assumption is that a reducing environment is essential for the fixation of uranium and its precipitation out of solution. It is evident from Eh-pH diagrams of uranium mineral stabilities (e.g., Langmuir, 1978) that neutral to low Eh conditions are required for uraninite stability, but when these are compared with the Eh-pH stabilities of various iron phases (e.g., Krauskopf, 1967), it is clear that uraninite and hematite are both stable in the region of neutral Eh and pH conditions, and that this stability field could be enlarged by changing the activities of the various components. Simpson and Bowles (1977) cite the present-day occurrence of detrital uraninite in the Indus river as evidence that uraninite can exist in an oxidizing environment. Thus they argue successfully that reducing atmospheric conditions during the Precambrian are neither an essential nor desirable postulate of the Precambrian quartz-pebble conglomerate model.

A much more accurate statement is, therefore, that uraninite, or uranium minerals generally, are stable under neutral to reducing to slightly oxidizing conditions, and can coexist with either pyrite, siderite, or hematite. An example of the uraninite-hematite coexistence is in the newly discovered Roxby Downs uranium deposit in South Australia, where uraninite and brannerite occur in highly hematitic and pyritic shales and possibly in conglomerates. When the tonnage of this deposit is finally assessed, it could be one of the world's largest uranium deposits in sedimentary rocks.

Thus although pyrite is not essential for uranium fixation, its presence may favor stability of detrital uraninite and promote high or economic uranium concentrations. Because of the absence of pyrite in Central Arizona Arch conglomerates, we were unable to generate Fe-U correlation coefficients for iron in the pyrite phase, but it should be interesting to see if such coefficients would greatly exceed our values for hematite. Also, if free carbon or organic matter is not a requirement for uranium enrichment, it certainly aids precipitation of uranium from solution. This empirical observation is true of many deposits, not just the conglomerates, and there is no age restriction on where one might find a pyritic, carbonaceous reducing environment; the 1.2 b.y.-old Sierra Ancha uranium deposits occur in just such an environment.

The age requirement is usually considered critical to finding reducing conditions within a subaerial fluvial system. It is a common assumption that the Early Precambrian atmosphere must have been oxygen deficient for pyrite and uraninite to be preserved in a fluvial system exposed partly to the atmosphere. The corollary assumption is that during most of the Proterozoic, since about 2.2 b.y. ago, the atmosphere was too oxidizing to preserve these minerals in a fluvial setting.

The senior author views this surmise with some skepticism at present. In 3.3 b.y.-old cross-bedded Archean quartzites in a perfect state of preservation within the Barberton volcanic belt of South Africa near Swaziland, M. J. Viljoen pointed out to the senior author detrital specularite concentrations on cross beds which looked exactly like those in the Mazatzal Group. If the atmosphere was so reducing at that early 3.3 b.y.-old point in time, detrital specularite could not exist, yet it does. Indeed, if Simpson and

Bowles' (1977) arguments are correct, and Eh-pH stability diagrams do seem to support their conclusion, reducing conditions are not required for uraninite stability.

Nevertheless, singularly the most important criterion for uranium-bearing Precambrian quartz-pebble conglomerates, we believe, is the composition of the source terrain. If uranium is to be concentrated hydraulically in a fluvial system, it must be present in the source region, and if detrital uraninite is to be concentrated, then the source terrain must contain uraninite. This simple conclusion is far more fundamental than it might at first appear. All the right conditions can exist for detrital concentrations of uranium, but if the source rocks are not highly anomalous in uranium, an economic concentration cannot be made.

For example, is it more valid to view the sedimentary uranium concentrations in the Sierra Madre range of Wyoming as a fortuitous consequence of the right depositional environment of the conglomerates, or do they exist because the source Archean granites are highly enriched in uranium? We made a random stop in the Baggott Rocks granite near highway 230 south of Saratoga, Wyoming, where we obtained readings of 700 to 900 cps on our Mount Sopris scintillometer. These values are five to seven times those of any source granites in the Central Arizona Arch area. If a granite is anomalously rich in uranium to begin with, then its late-stage quartz veins will almost certainly contain uraninite, and it is just these two components which are required to make the uraninite-bearing quartz-pebble conglomerate. Is it the depositional environment that is the controlling factor in this case, or is it the source rocks? Are the Wyoming conglomerates uranium-bearing because they are older than 2.2 b.y., or is it because they are adjacent to highly radioactive source granites?

From another viewpoint, it could be said that if the conditions are not favorable in a fluvial conglomerate for the concentration of uranium, it will be concentrated in some other type of environment, such as are the Sierra Ancha deposits of central Arizona. However, if an anomalous amount of uranium is not available, it cannot be concentrated anywhere. There are vastly more Precambrian quartz-pebble conglomerates throughout Late Archean and Early Proterozoic stratified sequences of the world which are barren of uranium than there are those which are productive, and the reason for this is not that depositional conditions are generally unfavorable, but that highly radioactive source rocks are generally lacking in most places.

We believe this to be true of the Central Arizona Arch area; favorable depositional environments existed, but the source rocks were not rich in uranium. All of the iron phases in the source rhyolites were oxidized to specularite and hematite, probably during extrusion but certainly before erosion of the rhyolites. Because of the profusion of hematite in the source terrain, there were no reduced-iron minerals available for erosion, so reduced pyritic conditions are not found in the Precambrain quartz-pebble conglomerates of the Central Arizona Arch. Are we to conclude therefore that the oxidized hematitic condition of the conglomerates precluded concentration of uranium? Certainly not, because our geochemical data show that it is the specularite and hematite which have concentrated most of the uranium available in the fluvial system.

The problem seems to be in a lack of uranium at the source. If the hematitic source rocks were enriched in uranium, this U-enrichment would have been carried by the specularite into the detrital heavy mineral concentrates; these concentrates would have then contained several hundred ppm uranium, and the area would have been more interesting economically. But the anomalous U-values are not present in the source rocks, so it is not possible for the detrital concentrates to be U-rich, even though the detrital heavy-mineral concentrating process operated superbly well at the base of the Deadman unit. In fact, concentrations of up to 33 ppm uranium are more than one might have expected out of source rocks averaging four to five ppm uranium.

If pyritic, reduced-facies rocks really do contain the ultimate answer to whether uranium concentration is a problem of depositional environment or source rocks, then it is instructive to compare different reduced-facies rocks within the Central Arizona Arch area. The Maverick unit of the Mazatzal Group is a pyritic, somewhat carbonaceous, reduced siltstone, just as the Dripping Spring unit of the Apache Group also contains pyritic, carbonaceous, reduced siltstones. Both units formed in identical depositional environments, but the Maverick unit is completely devoid of uranium concentrations whereas the Dripping Spring unit contains very highly anomalous uranium concentrations. The difference is clearly not in the depositional environment but in the source: the Maverick had no U-rich source, whereas the Dripping Spring unit had a highly radioactive rhyolitic tuff as a source.

Although no U-geochemical data is available on just the tuffs themselves, some of our sample material was more than 40 percent tuff, so it is likely that the rhyolitic tuff alone contained in excess of 15 percent K_2O and 50 ppm uranium before inclusion into the depositional setting. It is these kinds of highly radioactive source rocks that are required before uranium can be concentrated in highly anomalous amounts in a sedimentary environment. In fact, source rocks even richer in uranium than these may be needed to make an economic uranium deposit. The depositional environment, the mode of uranium concentration, the oxidation state of the atmosphere, the age of the concentration, and whether or not the uranium is of detrital sedimentary or volcanic origin may all be factors which are inconsequential compared to the requirement of a U-rich source rock in close proximity to the depositional site.

6.0 CONCLUSIONS

In the Central Arizona Arch area, Precambrian quartz-pebble and other conglomerates occur in either the Alder Group, the Mazatzal Group, or the Apache Group. Those in the Alder Group formed in an intervolcanic setting variously under deep-water marine to fluvial conditions but are completely devoid of uranium concentrations because the early volcanic rocks which were the source for the conglomerates are not at all U-rich. Had Alder or earlier conglomerates been deposited much closer to an Archean shield where radioactive granites were eroding, there would have been potential in these conglomerates for uranium concentrations.

An important episode of felsic igneous activity intervened before deposition of the Mazatzal Group; the extrusive, rhyolitic ignimbrite phases were strongly hematitic, rich in specularite and relatively enriched in uranium, whereas the intrusive granophyric and granitic phases were relatively poor in uranium, but none of the igneous products could be described as anomalously rich in uranium. The ensuing array of Deadman conglomerates in fluvial channels at the base of the Mazatzal Group were thereby able to make geochemically somewhat higher uranium concentrations of up to 33 ppm U, or seven to eight times source-rock values, but no uranium concentrations of major economic interest.

The abundant heavy-mineral concentrates at the base of the Mazatzal Group are proof that the fluvial conglomerate environment was working to concentrate detrital heavy minerals, indeed somewhat more effectively than expected when 80 percent heavy-mineral concentrates are found. Because uranium was either bound with specularite or fixed by powdery hematite, there is a strong Fe-U correlation in Mazatzal Group rocks which is absent in the Alder Group and Apache Group. Titanium, probably as ilmenohematite, is concentrated in the highest energy part of the Deadman fluvial system, zirconium is restricted to zircon-rich rhyolite source areas, but U values persist in specularite concentrates downstream in the main channels. However, because available source rocks were not anomalously rich in uranium, fluvial processes in the Mazatzal Group were not able to make economically important uranium concentrations.

Similarly, no U-rich source material of any sizeable volume was available to Apache Group conglomerates, so they, like Alder conglomerates, also contain no significant uranium concentrations even though appropriate fluvial environments were present. In contrast to earlier, more primitive conglomerate settings, the Th/U ratios of Apache Group rocks significantly exceed values of the source granites, and therefore the Apache Group setting is probably too evolved to contain uranium concentrations in quartz-pebble conglomerates.

A comparison between the U-poor conglomerates in the Apache Group and Dripping Spring siltstones which contain economically important uranium concentrations indicates what features are lacking in conglomerates. The pyritic, carbonaceous siltstones contain strata-bound uranium values and a

distinctive Cu-Zn-Mo-U metal assemblage which are both inconsistent with a diabase source for the uranium. These features, the high K_2O content of the siltstones, and the abundance of rhyolitic tuff interbedded with carbonaceous siltstones point to K_2O-rich rhyolitic volcanism as the source for the uranium. First the U-rich source rock is necessary to provide the uranium, and secondarily the favorable environment, such as a reducing environment, is needed to fix the uranium in a solid phase, and both requirements were lacking in the conglomerates.

A major conclusion of this study is that Precambrian conglomerates of the Central Arizona Arch comprise a great variety of rock types that are aggregates of their surrounding source rocks; their compositions are predictable from a knowledge of their source material, as are the occurrences and variations in the composition of heavy metal concentrates. Both the conglomerates themselves and their heavy metal concentrations contain just the amount of uranium that would be expected from the geochemical characteristics of their source terrains.

The final conclusion of this study is therefore that uranium concentrations of economic interest were not found in the Precambrian conglomerates of central Arizona because there was insufficient uranium in the source terrains to concentrate by sedimentary processes. The right time for sedimentary uranium concentration in conglomerates comes only once in the tectonic evolution of a part of the Precambrian crust, and it comes to different parts of the crust at different times. If the right radioactive source rocks are not available for erosion at that time, then no amount of reducing conditions or favorable depositional environments can make a uranium deposit.

If a source rock rich in uranium is available at the time, then and only then do the favorable depositional environments and reducing conditions become the critical determining factors. Another important factor is the close spatial connection between the uranium source and the favorable depositional environment, because uranium is relatively easily dispersed. If a conglomerate setting was not conducive to uranium concentration but a favorable site such as a reducing shale basin existed within the same crustal segment, presumably the uranium could be concentrated there instead of in the conglomerates.

The clustering of most of the world's largest quartz-pebble-conglomerate uranium deposits to Late Archean-Early Proterozoic time is an observed fact which has classically been interpreted as a transient condition when an oxygen-deficient atmosphere was able to preserve detrital uraninite. Recent observations of detrital uraninite in modern fluvial systems, and the theoretical stability of uraninite under typical fluvial conditions of neutral to oxidizing Eh and near-neutral pH sheds doubt on this interpretation. Instead, these deposits may record a time in Earth's history when highly radioactive granitic or rhyolitic source rocks were especially abundant, and if so, search for uranium concentrations in Precambrian quartz-pebble conglomerates warrants reconsideration from the viewpoint of a source-rock concept.

7.0 RECOMMENDATIONS

One purpose of undertaking a detailed and objective evaluation of the Precambrian conglomerates in central Arizona was to save the expense of further investigation of these rocks if it was not warranted. Whereas we cannot claim to have tested every Precambrian conglomerate or all exposures in the region, we tested all of the major horizons that were either previously known or found during the study. We believe that enough have been tested to see clearly the type of results emerging from them.

From the results of this study, there appear to be no sedimentary uranium concentrations in Precambrian conglomerates of the Central Arizona Arch. We therefore recommend that the DOE-Bendix undertake no further work on them at this time. Reserves for uranium concentrations in the conglomerates of over 33 ppm U cannot be calculated because no results higher than this were obtained.

There may be significant uranium reserves in the Dripping Spring siltstones of the central and southern Sierra Ancha Mountains, but this study made no detailed assessment of reserves in non-conglomeratic environments. It is likely that the siltstones need to have been metamorphosed before mineable grades can be found, and consequently such metamorphic deposits will be of much lower tonnage than the primary disseminated uranium mineralization.

Concerning future search for uranium concentrated in the quartz-pebble conglomerate environment, we have two major recommendations. It would be logical and most cost effective to first sample and evaluate the source terrains such as granites in a given region before the conglomerates are investigated in detail and at greater expense. If no geochemically U-rich or anomalous source rocks are present in the region, and covered bodies have not been overlooked, we believe that no economically interesting uranium concentrations will be found there. From a knowledge of the uranium contents of source rocks in a given region, our study shows how it is possible to predict that the uranium content of the conglomerate derived from this source will be less than the source rock itself by a fixed ratio. The uranium content of heavy metal concentrations derived from this source can also be estimated by determining the mineralogy of the concentrates and the correlation coefficients of uranium with its carrier metal. In other words, a major part of evaluating the economic potential of a region can be done relatively quickly and inexpensively in the source area, before one ventures into the details of the sedimentary sequences.

Second, we found that the two most useful tools for analyzing the depositional environment of Precambrian quartz-pebble conglomerates in the Central Arizona Arch were a scintillometer and a total uranium (U-NT) geochemical analysis. Aside from all other geologic and geochemical data, a simple plot of the two parameters, average scintillometer counts and average U-NT values, was able to separate out high-energy fluvial environments

favorable for uranium concentration, from all other types of environments. If this method works as well in other places as it did in the Central Arizona Arch area, it could be an exceptionally powerful method of exploring for uranium concentrations in Precambrian quartz pebble conglomerates.

8.0 ACKNOWLEDGEMENTS

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APPENDIX A

Explanation of Geologic Unit Codes and Site Numbers

APPENDIX A

Explanation of Geologic Unit Codes

Letter Prefix

Apache Group	Mazatzal Group	Alder Group
T = Troy	M = Mazatzal	A = Sedimentary Alder
L = Mescal	K = Maverick	V = Volcanic Alder
U = Dripping Spring	D = Deadman	
B = Barnes		
S = Scanlan		

First Digit

Indicates oxidation state

0 = white (non hematitic or no hematite stain)
1 = hematitic red
2 = specularite (dark to black from specular hematite)
3 = magnetite-bearing
4 = pyritic

Second Digit

Indicates finer material included in sample

0 = no finer grained rocks included
1 = quartzite
2 = siltstone
3 = shale

Third Digit

Fragment size of dominant fragments in sample

0 = no conglomerate in sample
1 = grit size conglomerate
2 = granule conglomerate
3 = pebble conglomerate
4 = cobble conglomerate
5 = boulder conglomerate

APPENDIX B

Grain Size Classification Chart Used in This Report

APPENDIX B

Explanation of Grain-Fragment Size Classification

Size Range	Fragment	Rock Name
>200 mm	boulder	boulder conglomerate
200 - 60 mm	cobble	cobble conglomerate
60 - 20 mm	pebble	pebble conglomerate
20 - 6 mm	granule	granule conglomerate
6 - 2 mm	grit	grit or grit conglomerate
2 - 0.2 mm	sand	sandstone
0.2 - 0.006 mm	silt	siltstone
<0.006 mm	clay	shale

Explanation of Site Numbers

B = Chino Valley area
C = Christopher Mountain area
D = Diamond Butte area
F = Four Peaks area
H = Hess Canyon area
M = Mazatzal Mountain, Mazatzal Wilderness, and East Verde River areas
P = Pine Creek area
S = Sierra Ancha Mountains and Roosevelt Lake areas
W = Water sample designation

APPENDIX C

Sample Summary Tables Arranged by Subareas

(NOTE: If there is any discrepancy between coordinates listed here and map location of a sample, the map location is to be taken as the correct one.)

CENTRAL ARIZONA ARCH PROJECT - PINE, CHRISTOPHER MOUNTAIN, HESS CANYON, FOUR PEAKS, CHINO VALLEY AREAS, AND GRANITE SAMPLES

Site No.	Sample No.	Code	Counts	U-FL	U-NT	U/TU	Location	Quad	Lat.	Long.	Who	When	T.S.
P1	154014	M102	60	2.7	3.0	.90	Natural Bridge	Buckhead Mesa	34°19'18"	111°27'28"	P	S 18	x
P2	154061	M102	122	2.8	2.6	1.08	Lower Narrows	"	34°21'00"	111°25'45"	K	O 15	x
P3	154062	M111	68	.98	1.10	.89	"	"	34°21'00"	111°25'50"	K	O 15	x
P4	154063	M112	55	.98	1.00	.98	"	"	34°21'00"	111°26'25"	K	O 15	x
P5	154152	M103	--	3.1	3.3	.94	S. of Natural Bridge	"	34°18'54"	111°28'02"	J	N 15	x
P6	154153	M101	--	1.23	1.8	.68	"	"	34°18'56"	111°28'03"	J	N 15	x
P7	154154	M103	105	2.6	3.0	.87	"	"	34°18'32"	111°28'23"	K	N 15	
P8	154155	M104	165	4.04	3.9	1.04	"	"	34°18'31"	111°28'20"	K	N 15	
P9	154156	M104	165	2.88	3.0	.96	N. of Natural Bridge	"	34°19'25"	111°27'17"	K	N 15	x
P10	154157	M102	--	1.12	1.4	.80	Halfway to Narrows	"	34°20'07"	111°27'02"	K	N 15	x
P11	154238	M101	65	1.41	2.0	.70	Narrows-Pine	"	34°21'25"	111°27'32"	K	D 03	
P12	154239	M110	228	5.71	7.7	.74	"	"	34°21'08"	111°27'13"	K	D 03	x
C1	154015	M102	65	1.45	2.3	.63	Christopher Cr. Camp	Promontory Butte	34°18'20"	111°02'40"	P	S 20	x
C2	154017	S105	100	1.22	1.6	.76	Christopher Mtn. Rd.	"	34°12'08"	111°02'28"	P	S 20	x
C3	154018	S102	120	1.77	2.20	.80	Chamberlain Trail	Young	34°14'36"	110°57'29"	P	S 20	x
C4	154021	M211	111	1.21	1.60	.76	"	"	34°14'20"	110°57'38"	K	S 21	x
C5	154027	M201	100	3.58	5.70	.63	Ellinwood Ranch	Diamond Butte	34°12'28"	111°02'38"	P	S 21	x
C6	159024	M201	92	1.73	2.70	.64	Lost Camp Canyon	"	34°11'30"	111°02'20"	P	S 22	x
C7	154025	M101	92	.86	1.20	.72	Horse Mtn	"	34°14'57"	111°01'50"	K	S 22	x
C8	154026	M201	93	.97	1.40	.69	"	"	34°13'31"	111°01'43"	K	S 22	x
C9	154046	M212	90	.49	.70	.70	Young-Heber Rd	Young	34°09'30"	111°53'10"	P	O 02	x
C10	154111	S204	--	1.95	2.2	.89	Chamberlain Train	"	34°14'20"	111°57'34"	K	O 31	
C11	154149	M102	--	1.23	1.3	.95	Bear Flat	Promontory Butte	34°16'33"	111°02'28"	P	N 15	
C12	154150	U105	150	3.54	3.9	.91	Crouch Mesa	Young	34°09'35"	110°53'49"	J	N 16	x
C13	154151	M101	90	1.36	1.4	.97	Chamberlain Trail	"	34°14'18"	110°57'42"	K	N 16	x
H1	154339	V003	240	4.25	3.90	1.09	Salt River-Hess Cyn	Haystack Butte	33°42'45"	110°43'01"	P	M 05	
H2	154340	V002	160	3.03	4.00	.76	"	"	33°42'47"	110°43'01"	P	M 05	
H3	154341	M120	120	1.23	2.10	.59	Hess Canyon	"	33°42'22"	110°42'08"	P	M 05	
H4	154342	M110	80	<.25	.80	.18	"	"	33°42'27"	110°43'52"	P	M 05	
F1	154343	M010	--	<.25	1.10	.11	South Peak	Four Peaks	33°40'14"	111°19'55"	P	M 06	
B138	154345	M203	85	1.40	1.40	1.0	Granite Creek	Chino Valley N.	34°74'26"	112°22'40"	P	M 02	
B140	154347	M203	80	.74	2.50	.30	"	"	34°48'50"	112°19'00"	P	M 02	
G1	154029	G	225	.54	1.10	.49	E. of Granite Tank	Young	34°06'54"	110°59'53"	P	S 22	x
G2	154351	G	150	1.22	2.70	.45	W. of Star Valley	Payson North	34°15'08"	111°16'19"	P	F 28	
G3	154352	R	140	.40	.80	.50	Haigler Creek	Young	34°12'30"	110°58'13"	P	[illegible] 28	
G4	154353	G	250	11.09	7.80	1.42	Armer Mtn	Armer Mtn	33°47'50"	111°10'22"	P	F 29	
G5	154354	G	180	.88	2.20	.40	Salome Creek	"	33°46'19"	111°07'06"	P	F 29	X

CENTRAL ARIZONA ARCH PROJECT - DIAMOND BUTTE AREA

Site No.	Sample No.	Code	Counts	U-FL	U-NT	U/TU	Location	Quad	Lat.	Long.	Who	When	T.S.
D1	154027	S103	160	2.04	2.50	.82	E. of Granite Tank	Young	34°06'54"	110°59'55"	P	S 22	x
D2	154028	A102	105	.76	.70	1.09	Thurlo Wildlife Tank	Diamond Butte	34°07'37"	111°01'15"	P	S 22	x
D3	154047	A102	113	2.1	2.70	.78	Mailbox Mesa	Buzzard Roost	34°05'13"	111°02'47"	K	O 02	x
D4	154048	M202	100	1.32	1.70	.78	Little Walnut Canyon	"	34°05'08"	111°02'07"	K	O 03	x
D5	154049	A202	88	2.19	2.60	.84	NE Flying W Ranch	"	34°07'18"	111°04'50"	K	O 03	x
D6	154050	A202	70	1.86	2.10	.89	"	"	34°07'27"	111°04'50"	K	O 03	x
D7	154051	V004	140	2.04	2.20	.93	"	"	34°06'53"	111°05'37"	P	O 03	x
D8	154052	A011	90	1.26	1.50	.84	"	"	34°07'15"	111°06'00"	P	O 03	x
D9	154053	M201	75	1.58	1.60	.99	N of Rose Tungsten Mine	"	34°03'08"	111°09'15"	K	O 04	x
D10	154054	M111	70	1.5	1.30	1.15	NE McDonald Mtn	McDonald Mtn	34°10'38"	111°08'12"	P	O 05	x
D11	154055	M111	105	1.29	1.80	.72	"	"	34°10'35"	111°08'28"	K	O 05	x
D12	154056	A011	70	1.61	1.80	.89	Lower Coffeepot Trail	Gisela	34°08'05"	111°15'25"	K	O 10	x
D13	154064	A102	240	4.27	4.40	.97	SW Reef Ridge	Sheep Basin Mtn	34°03'37"	111°13'47"	K	O 11	x
D14	154065	A202	75	1.06	1.20	.88	Middle Reef Ridge	"	34°03'37"	111°12'57"	K	O 11	x
D15	154066	A211	70	1.99	1.50	1.33	"	"	34°04'23"	111°12'45"	K	O 11	
D16	154067	V102	150	3.32	3.40	.98	Fred Pranty Cabin	"	34°04'00"	111°10'12"	P	O 17	x
D17	154068	A103	95	.75	.80	.94	"	"	34°04'45"	111°29'35"	P	O 17	x
D18	154069	A011	270	1.93	2.30	.84	NE Reef Ridge	"	34°05'03"	111°12'13"	K	O 17	x
D19	154070	A202	80	1.45	2.40	.60	S of Soldier Camp Mtn	"	34°05'37"	111°10'30"	K	O 17	x
D20	154071	A101	55	1.45	1.20	1.21	Houden Mtn	"	34°07'00"	111°09'03"	P	O 17	x
D21	154072	A212	70	.78	1.10	.71	"	"	34°06'37"	111°09'00"	K	O 17	x
D22	154073	A213	70	.72	.70	1.03	"	"	34°06'36"	111°08'37"	K	O 17	x
D23	154074	A202	85	.51	1.80	.28	"	"	34°06'36"	111°08'37"	P	O 18	x
D24	154075	M103	63	.82	1.40	.59	SW McDonald Mtn	Sheep Basin	34°07'23"	111°12'11"	P	O 18	x
D25	154076	M210	452	11.36	32.00	.35	"	McDonald Mtn	34°07'35"	111°11'33"	P	O 18	x
D26	154077	M110	85	1.16	1.60	.73	"	Sheep Basin	34°07'25"	111°11'37"	P	O 18	x
D27	154028	M101	65	1.30	1.60	.81	Middle McDonald Mtn	McDonald Mtn	34°09'10"	111°09'40"	K	O 18	x
D28	154079	M212	--	.70	.90	.78	N Crouch Mesa	Young	34°08'50"	110°53'40"	K	O 19	x
D29	154080	M212	68	.77	1.20	.64	NE of Young	"	34°07'49"	110°53'45"	K	O 19	x
D30	154081	S114	150	2.52	2.30	1.10	S Houden Mtn	Sheep Basin	34°05'10"	111°07'50"	K	O 19	x
D31	154082	M101	--	1.07	.90	1.19	SW McDonald Mtn	McDonald Mtn	34°08'27"	111°10'40"	K	O 20	
D32	154083	D104	122	2.04	2.50	.82	NE Sheep Basin Mtn	Sheep Basin	34°03'03"	111°11'45"	P	O 23	x
D33	154084	D103	135	4.26	4.80	.89	NE of Coffeepot Cabin	"	34°02'43"	111°10'25"	P	O 23	x
D34	154085	D103	180	3.93	5.90	.67	SW of Coffeepot Cabin	"	34°02'00"	111°10'45"	P	O 23	x
D35	154086	D202	145	4.75	6.30	.75	S of Sheep Basin Peak	"	34°00'53"	111°12'03"	K	O 24	x
D35A	154087	D203	235	26.55	33.00	.80	"	"	34°00'53"	111°12'03"	K	O 24	x
D36	154088	M103	85	1.40	2.00	.70	"	"	34°01'40"	111°12'40"	P	O 23	x
D37	154089	M103	57	1.58	2.80	.56	NE Sheep Basin Mtn	Sheep Basin Mtn	34°02'40"	111°11'53"	K	O 23	x
D38	154091	M202	88	1.65	4.80	.34	"	"	34°02'03"	111°11'53"	K	O 23	x
D38A	154092	M102	142	4.33	11.30	.38	"	"	34°02'03"	111°11'53"	K	O 23	x
D39	154093	V003	145	3.85	3.80	1.01	NW of Del Shay Cabin	Picture Mtn	33°59'47"	111°12'30"	P	O 24	x
D40	154094	D203	122	5.08	5.60	.91	"	Sheep Basin Mtn	34°00'30"	111°13'55"	K	O 24	x
D41	154095	D211	185	8.26	8.10	.53	Sorrel Horse Canyon	"	34°00'42"	111°09'40"	P	O 25	x
D42	154096	D202	150	2.57	5.10	.50	Skunk Tank Mtn	"	34°01'03"	111°09'20"	K	O 35	x
D43	154100	S203	250	1.78	1.9	.94	Breadpan Canyon	Buzzard Roost	34°05'20"	111°06'43"	K	N 01	
D44	154101	S203	130	3.30	3.3	1.00	Walnut Canyon	"	34°05'12"	111°03'03"	K	N 01	
D45	154102	S204	88	2.54	2.4	1.06	S of Spring Creek Mine	"	34°04'22"	111°04'35"	K	N 01	
D46	154103	S103	162	2.70	2.7	1.0	Potato Butte	"	34°05'12"	111°00'15"	K	N 01	
D47	154104	S205	200	1.21	1.3	.93	N of Spring Creek Ranch	"	34°02'10"	111°02'30"	K	N 02	
D48	154105	U103	250	2.17	2.5	.87	W of Rose Tungsten Mine	"	34°01'55"	111°04'37"	K	N 02	
D49	154106	U204	162	1.44	1.8	.80	Rose Tungsten Mine Rd	"	34°02'10"	111°04'18"	K	N 02	
D50	154107	S102	345	3.43	3.4	1.01	SE of Winter Camp	Diamond Butte	34°08'[illegible]	111°04'23"	K	N 03	x
D51	154108	S203	200	2.82	2.4	1.17	Marsh Creek Ranch Rd	"	34°09'03"	111°01'41"	K	N 03	
D52	154109	S104	130	1.78	1.7	1.05	E of Granite Tank	"	34°07'46"	111°00'17"	K	N 03	
D53	154110	V203	178	2.95	3.3	.89	NE of Granite Tank	"	34°07'46"	111°00'17"	K	N 03	
D54	154158	A203	90	.58	.90	.64	N of Granite Tank	"	34°08'07"	111°00'32"	K	N 16	x
D55	154240	A202	205	2.15	2.90	.74	NE of Del Shay Ranch	Kayler Butte	33°57'43"	111°16'15"	K	D 05	
D56	154241	V003	140	4.15	3.50	1.19	"	"	33°58'03"	111°16'17"	K	D 05	
D57	154242	A003	105	2.11	2.00	1.05	"	"	33°58'08"	111°16'30"	K	D 05	x

CENTRAL ARIZONA ARCH PROJECT - MAZATZAL MOUNTAINS AREA

Site No.	Sample No.	Code	Counts	U-FL	U-NT	U/TU	Location	Quad	Lat.	Long.	Who	When	T.S.
M1	154030	A110	90	.37	.80	.46	Lower Slate Creek	Kayler Butte	33°57'50"	111°22'50"	P	S 25	x
M2	154031	A103	140	1.75	2.20	.80	"	"	33°57'40"	111°22'55"	K	S 25	x
M3	154034	A103	120	1.44	1.90	.76	S. of Pine Butte	Reno Pass	33°58'56"	111°26'15"	P	S 25	x
M4	154035	V004	190	1.80	2.00	.90	Pine Mountain Road	"	33°57'46"	111°27'06"	P	S 25	x
M5	154040	A110	140	.59	1.00	.59	W. of Ord Mine	"	33°57'25"	111°24'02"	K	S 25	
M6	154041	V203	190	1.80	2.00	.90	"	"	33°57'25"	111°24'02"	K	S 25	x
M7	154115	M101	65	.99	.90	1.12	Malpais Spring	Mazatzal Peak	34°04'53"	111°29'05"	K	N 06	x
M8	154116	M102	68	1.32	.90	1.47	S. Bear Spring	"	34°04'07"	111°28'44"	K	N 06	
M9	154117	M101	80	1.38	1.10	1.25	Divide Trail	"	34°04'15"	111°28'28"	J	N 06	x
M10	154118	M101	60	1.19	.60	1.98	N. Chilson Camp	"	34°05'24"	111°29'33"	K	N 07	
M11	154119	M001	110	.81	.70	1.16	Upper North Fork	"	34°05'57"	111°29'37"	K	N 07	x
M12	154120	M110	72	1.07	1.10	.97	"	"	34°06'01"	111°29'46"	K	N 07	x
M13	154121	M101	--	.54	.60	.90	"	"	34°06'00"	111°29'33"	J	N 07	x
M14	154122	M101	70	.40	.70	.57	W. of Chilson Camp	"	34°04'57"	111°29'47"	K	N 08	
M15	154123	M102	80	1.21	1.10	1.10	Above & S. of Barnhardt	"	34°05'30"	111°27'07"	J	N 08	
M16	154125	D103	130	3.83	4.50	.85	Barnhardt Canyon	"	34°05'37"	111°26'48"	P	N 09	
M17	154126	D201	47	1.32	1.30	1.02	"	"	34°05'48"	111°26'53"	P	N 09	
M18	154128	M101	80	1.14	1.30	.88	Cliffs above Barn. C.	"	34°05'55"	111°27'09"	P	N 09	
M19	154129	D203	100	2.21	2.80	.79	"	"	34°05'47"	111°26'36"	P	N 09	x
M20	154159	M101	--	.85	.90	.94	Near "The Park"	North Peak	34°09'17"	111°29'25"	J	N 13	x
M21	154160	D102	--	2.29	3.10	.74	E. of North Peak	"	34°09'45"	111°28'01"	K	N 13	x
M22	154261	M001	--	.86	.90	.96	Upper North Fork	Table Mountain	34°06'05"	111°30'09"	P	D 12	
M23	154161	M101	75	1.23	1.60	.77	NE Cliff of N. Peak	North Peak	34°09'22"	111°28'21"	K	N 13	
M24	154162	K002	--	1.01	1.40	.72	"	"	34°09'27"	111°28'24"	K	N 13	x
M25	154163	D201	140	4.10	4.70	.87	North Peak Trail	"	34°10'12"	111°28'08"	J	N 13	x
M26	154164	D112	75	.90	1.40	.64	Peak N. of Mineral Cr.	"	34°04'32"	111°29'02"	P	N 13	x
M27	154165	M111	65	2.45	2.00	1.22	"	"	34°09'58"	111°28'52"	P	N 13	x
M28	154166	D211	65	2.57	4.30	.60	"	"	34°10'25"	111°28'35"	P	N 13	x
M29	154167	M001	--	.81	1.00	.81	Main Peaks Ridge	Mazatzal Peak	34°07'05"	111°28'18"	P	N 17	
M30	154168	M111	--	2.07	2.50	.83	"	"	34°07'23"	111°28'22"	P	N 17	x
M31	154169	M102	--	2.34	2.00	1.17	"	"	34°06'44"	111°28'15"	P	N 17	x
M32	154170	M001	68	.77	1.10	.70	"	"	34°05'57"	111°27'16"	K	N 17	x
M33	154171	M002	62	.34	.60	.57	"	"	34°06'22"	111°27'43"	K	N 17	
M34	154172	M102	68	1.44	2.20	.65	"	"	34°06'37"	111°28'10"	K	N 17	x
M35	154173	M101	--	.90	.70	1.29	Ridge S. of N. Peak	North Peak	34°08'14"	111°28'23"	P	N 18	x
M36	154174	M001	-	.81	.70	1.16	"	"	34°08'18"	111°28'50"	P	N 18	
M37	154175	M002	--	<.25	.80	.16	"	"	34°08'22"	111°28'43"	P	N 18	x
M38	154176	M101	68	.47	.90	.52	Ridge N. of N. Peak	"	34°09'15"	111°28'28"	K	N 18	
M39	154177	M002	68	1.01	1.00	1.01	North Peak	"	34°09'07"	111°28'34"	K	N 18	
M40	154178	M101	--	2.20	5.00	.44	Ridge S. of N. Peak	"	34°07'36"	111°28'48"	J	N 18	
M41	154179	M101	--	.70	.76	.92	"	"	34°07'41"	111°28'27"	J	N 18	x
M42	154180	M102	--	1.12	1.60	.70	Suicide Ridge	Mazatzal Peak	34°04'12"	111°28'08"	P	N 19	x
M43	154182	M103	--	1.42	2.00	.71	"	"	34°04'10"	111°28'06"	P	N 19	x
M44	154183	M101	--	.79	4.20	.19	"	"	34°04'09"	111°27'57"	P	N 19	x
M45	154184	M102	--	1.33	1.60	.83	"	"	34°04'08"	111°27'48"	P	N 19	x
M46	154185	M001	60	.34	.50	.68	"	"	34°09'28"	111°27'08"	K	N 19	x
M47	154186	M202	65	1.71	2.00	.85	"	"	34°04'17"	111°26'20"	K	N 19	
M48	154187	M202	--	1.51	1.50	1.01	"	"	34°04'13"	111°26'18"	K	N 19	x
M49	154188	M101	--	.87	.80	1.09	"	"	34°05'11"	111°26'10"	J	N 19	
M50	154189	M001	--	1.36	.80	1.70	"	"	34°04'39"	111°26'39"	J	N 19	x
M51	154190	M001	--	2.15	2.50	.86	"	"	34°03'59"	111°27'38"	P	N 19	
M52	154191	D102	--	1.71	1.80	.95	S. Cactus Ridge	"	34°01'46"	111°28'23"	P	N 20	x
M53	154192	D203	--	4.31	3.60	1.20	"	"	34°01'46"	111°28'15"	P	N 20	x

Site No.	Sample No.	Code	Counts	U-FL	U-NT	U/TU	Location	Quad	Lat.	Long.	Who	When	T.S.
M54	154193	D103	--	3.86	3.90	.99	S. Cactus Ridge	Mazatzal Peak	34°01'43"	111°28'12"	P	N 20	x
M55	154194	D103	--	6.37	5.90	1.08	"	"	34°02'43"	111°27'10"	K	N 20	x
M56	154195	D102	--	3.43	2.50	1.37	"	"	34°02'43"	111°27'10"	K	N 20	x
M57	154196	D203	--	3.78	2.80	1.35	"	"	34°02'41"	111°27'07"	K	N 20	x
M58	154197	D103	150	3.85	3.20	1.20	"	"	34°02'01"	111°27'41"	J	N 20	x
M59	154198	D102	75	5.73	3.70	1.55	"	"	34°02'01"	111°27'41"	J	N 20	x
M60	154199	D103	75	2.63	2.20	1.20	"	"	34°02'11"	111°27'49"	J	N 20	x
M61	154200	D203	--	2.90	2.80	1.04	"	"	34°02'10"	111°27'50"	P	N 20	x
M62	154201	D202	--	1.43	1.20	1.19	"	"	34°02'45"	111°28'02"	P	N 20	x
M63	154202	R004	--	4.26	3.40	1.25	"	"	34°02'41"	111°27'04"	K	N 20	x
M64	154203	K012	66	.94	1.00	.94	Saddle N of Cactus Ridge	"	34°05'26"	111°26'57"	K	N 21	x
M65	154204	D203	245	12.19	13.20	.92	N. Cactus Ridge	"	34°03'23"	111°26'57"	P	N 21	x
M66	154205	D203	120	4.67	7.60	.61	"	"	34°03'26"	111°26'42"	P	N 21	x
M67	154209	D101	70	.88	.60	1.47	S. of "The Park"	North Peak	34°08'23"	111°29'57"	K	N 27	
M68	154210	M102	70	.82	.70	1.17	"	"	34°08'11"	111°24'35"	K	N 27	
M69	154211	M101	--	1.13	.60	1.88	Maverick Basin	Table Mountain	34°07'28"	111°20'18"	J	N 27	
M70	154212	M202	80	1.02	1.30	.78	W. of Chilson Camp	"	34°04'40"	111°30'05"	P	N 27	
M71	154213	D201	105	1.78	1.40	1.27	Maverick Basin	Cypress Butte	34°07'53"	111°30'18"	P	N 29	
M72	154214	M101	70	2.23	1.50	1.49	Deadman Creek	Table Mountain	34°07'28"	111°30'21"	P	N 29	
M73	154215	D202	150	10.46	12.70	.82	"	"	34°07'06"	111°30'55"	P	N 29	x
M74	154216	D204	205	4.32	5.40	.80	"	"	34°06'50"	111°31'04"	P	N 30	
M75	154217	D203	300	9.33	14.00	.67	"	"	34°06'47"	111°31'03"	P	N 30	x
M76	154218	M202	70	3.38	2.80	1.21	"	"	34°06'34"	111°30'57"	P	N 30	
M77	154219	D203	165	8.86	10.30	.86	N. Fork Deadman Cr.	Table Mountain	34°06'16"	111°31'00"	P	N 30	x
M78	154220	K001	85	2.36	1.10	2.15	S. Fork Deadman Cr.	"	34°05'10"	111°31'55"	P	D 01	
M78A	154245	K210	100	1.73	1.30	.96	"	"	34°05'10"	111°31'55"	P	D 01	
M79	154221	M102	140	2.60	1.30	2.00	"	"	34°05'06"	111°35'54"	P	D 01	
M80	154222	D211	100	2.97	2.80	1.06	"	"	34°05'16"	111°32'61"	P	D 01	
M81	154223	M202	70	3.31	2.90	1.14	"	"	34°05'42"	111°31'19"	K	D 01	
M82	154224	K001	90	1.37	1.10	1.25	"	"	34°05'49"	111°31'24"	K	D 01	
M83	154225	D202	120	1.46	1.30	1.12	"	"	34°05'50"	111°31'35"	K	D 01	
M84	154226	D113	--	1.30	1.40	.93	"	"	34°04'20"	111°25'40"	J	D 03	
M85	154227	D101	58	2.11	1.00	2.11	Eisenhower Spring	Mazatzal Peak	34°06'18"	111°25'55"	K	D 04	
M86	154228	D202	--	2.85	3.40	.84	"	"	34°06'07"	111°26'04"	K	D 04	
M87	154229	D203	163	2.83	4.60	.62	"	"	34°05'55"	111°26'10"	K	D 04	
M88	154230	M102	70	4.10	1.30	3.15	Barnhardt Canyon	"	34°05'45"	111°26'02"	K	D 04	
M89	154231	D103	130	3.60	4.30	.84	NE Cactus Ridge	"	34°04'12"	111°25'50"	K	D 06	
M90	145232	D203	110	1.77	1.70	1.04	"	"	34°04'10"	111°25'50"	K	D 06	x
M91	154233	D204	75	5.37	4.80	1.12	"	"	34°04'10"	111°25'50"	K	D 06	x
M92	154234	D203	123	3.63	3.50	1.04	"	"	34°04'10"	111°25'48"	K	D 06	
M93	154236	D202	150	3.74	3.80	.98	"	"	34°04'10"	111°25'44"	K	D 06	x
M94	154237	M202	--	1.50	1.50	1.00	"	"	34°04'30"	111°25'58"	K	D 06	x
M95	154262	D203	130	3.83	3.60	1.06	W. of Mazatzal Peak	"	34°03'10"	111°28'30"	K	D 10	
M96	154263	D203	120	4.18	4.40	.95	"	"	34°03'17"	111°28'35"	K	D 10	
M97	154264	D203	105	7.50	7.40	1.01	"	"	34°03'20"	111°28'30"	K	D 10	
M98	154265	R102	--	5.70	5.50	1.04	"	"	34°04'20"	111°28'33"	K	D 10	
M99	154266	D102	144	4.03	4.10	.98	"	"	34°03'25"	111°28'33"	K	D 10	
M100	154267	D212	140	11.00	13.00	.85	U.S. Fork Deadman Cr.	Table Mountain	34°03'09"	111°30'28"	P	D 10	
M101	154268	M102	100	1.12	1.10	1.02	"	"	34°03'12"	111°30'32"	P	D 10	
M102	154269	D203	140	5.50	8.10	.68	"	"	34°03'16"	111°30'10"	P	D 10	
M103	154270	D202	135	1.90	1.80	1.06	"	Mazatzal Peak	34°03'20"	111°29'50"	P	D 10	
M104	154271	M101	--	.50	.70	.71	W. of Malpais Spring	"	34°04'45"	111°29'37"	J	D 10	
M105	154222	M101	--	.95	1.0	.95	Brody Seep	"	34°04'28"	111°29'32"	J	D 10	
M106	154273	M001	--	.84	.80	1.05	"	"	34°04'21"	111°29'30"	J	D 10	

CAAP
MAZATZAL MOUNTAINS AREA
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Site No.	Sample No.	Code	Counts	U-FL	U-NT	U/TU	Location	Quad	Lat.	Long.	Who	When	T.S.
M107	154274	M101	--	.44	.80	.55	Brody Seep	Mazatzal Peak	34°04'15"	111°29'27"	J	D 10	
M108	154275	M111	--	.62	.60	1.03	U.S. Fork Deadman Cr.	Table Mountain	34°04'06"	111°30'16"	P	D 11	
M109	154276	M201	--	1.48	2.30	.64	"	Mazatzal Peak	34°04'45"	111°29'56"	P	D 11	
M110	154277	M201	--	1.10	1.40	.79	"	"	34°03'40"	111°29'45"	P	D 11	
M111	154278	M202	--	1.55	2.30	.67	"	"	34°03'48"	111°28'30"	P	D 11	
M112	154279	M101	55	.89	1.00	.89	S. of Brody Seep	"	34°04'02"	111°29'00"	J	D 11	
M113	154280	M101	57	.71	.80	.89	"	"	34°04'07"	111°29'00"	J	D 11	
M114	154281	M101	62	.75	1.30	.58	W. of Brody Seep	Mazatzal Peak	34°04'02"	111°24'47"	J	D 11	
M115	154282	D102	--	4.98	6.30	.79	W. of Mazatzal Peak	"	34°03'35"	111°28'53"	K	D 11	
M116	154284	D102	--	3.98	4.60	.87	"	"	34°03'37"	111°28'53"	K	D 11	x
M117	154285	D103	--	4.38	5.70	.77	"	"	34°03'30"	111°28'40"	K	D 11	
M118	154286	M202	--	3.86	5.80	.67	E. of Club Ranch	Table Mountain	34°02'37"	111°31'02"	P	D 13	
M119	154287	D201	--	.57	3.50	.16	"	"	34°02'27"	111°31'02"	P	D 13	
M120	154288	M101	--	3.00	.90	3.33	"	"	34°02'03"	111°32'21"	P	D 13	
M121	154289	K001	--	1.62	1.40	1.16	NE of Club Ranch	"	34°03'22"	111°32'10"	J	D 13	
M122	154290	M101	--	.77	.80	.96	"	"	34°03'19"	111°32'10"	J	D 13	
M123	154291	M101	--	.83	.70	1.19	"	"	34°05'00"	111°32'04"	J	D 13	
M124	154292	M001	--	.77	.70	1.10	"	"	34°02'30"	111°32'10"	J	D 13	
M125	154293	D102	122	5.09	5.40	.94	NW of Club Ranch	"	34°03'42"	111°33'22"	K	D 13	
M126	154294	D103	180	3.75	4.90	.77	"	"	34°03'37"	111°33'34"	K	D 13	
M127	154295	D102	180	.77	4.00	.19	"	"	34°03'31"	111°33'34"	K	D 13	
M128	154296	D103	110	2.08	2.60	.80	"	"	34°03'57"	111°33'02"	K	D 13	
M129	154297	D103	--	.63	1.80	.35	Bear Creek	"	34°01'45"	111°33'10"	J	D 14	
M130	154298	D103	--	2.60	4.40	.59	"	"	34°01'47"	111°33'27"	J	D 14	
M131	154299	D204	--	4.12	4.20	.98	Davenport Wash	"	34°02'38"	111°33'03"	P	D 14	
M132	154300	D202	150	1.90	2.10	.90	Mazatzal Wash	"	34°02'12"	111°33'23"	K	D 14	
M133	154301	D203	190	2.59	3.40	.76	"	"	34°02'10"	111°33'23"	K	D 14	
M134	154307	D202	--	3.81	4.90	.78	Front Deadman (N)	Mazatzal Peak	34°06'41"	111°26'32"	K	D 16	
M135	154308	D201	--	1.47	2.20	.67	"	"	34°06'57"	111°26'32"	K	D 16	
M136	154309	D202	--	2.69	5.00	.54	"	"	34°06'55"	111°26'50"	K	D 16	
M137	154310	D202	--	1.12	1.90	.59	"	"	34°07'00"	111°27'23"	K	D 16	
M138	154311	D102	75	1.46	1.80	.81	"	North Peak	34°08'12"	111°28'07"	P	D 16	
M139	154312	D203	190	11.87	18.90	.63	"	"	34°08'03"	111°27'28"	P	D 16	
M140	154313	V003	120	1.70	2.20	.77	East Verde River	Wet Bottom Mesa	34°14'43"	111°39'30"	P	D 18	x
M141	154314	V103	150	1.23	1.80	.68	"	Cane Springs	34°15'32"	111°36'40"	P	D 18	x
M142	154315	V003	85	2.28	2.20	1.04	"	Cypress Butte	34°14'21"	111°34'30"	P	D 18	x

CENTRAL ARIZONA ARCH PROJECT - SIERRA ANCHA AREA

Site No.	Sample No.	Code	Counts	U-FL	U-NT	U/TU	Location	Quad	Lat.	Long.	Who	When	T.S.
S1	154112	L403	120	1.90	1.20	1.58	Pine Mountain	McFadden Peak	33°56'64"	110°58'22"	L	N 01	
S2	154113	U102	150	1.75	1.70	1.03	Bryant Canyon	Young	34°01'40"	110°59'00"	L	N 03	x
S3	154114	U102	120	1.26	.30	4.20	Squaw Mesa	"	34°01'40"	110°57'50"	L	N 03	
S4	154134	S103	140	3.08	3.10	.99	Juniper Mountain	Picture Mountain	33°55'47"	111°12'39"	L	N 10	
S5	154135	U113	160	2.63	3.30	.80	"	"	33°55'46"	111°12'35"	L	N 10	
S6	154136	S203	130	1.76	2.60	.68	New Juniper Spring	"	33°55'08"	111°12'05"	L	N 10	x
S7	154137	U213	130	1.16	1.10	1.05	Del Shay	"	34°00'12"	111°12'00"	L	N 11	x
S8	154138	L103	70	.76	.80	1.95	N Bear Head Mountain	Copper Mountain	33°56'33"	111°07'17"	L	N 12	
S9	154140	L003	230	1.86	2.10	.89	NE Bear Head Mountain	"	33°56'54"	111°06'20"	L	N 12	
S10	154141	L103	450	1.23	1.50	.82	"	"	33°56'57"	111°06'12"	L	N 12	
S11	154142	L104	200	1.10	1.10	1.00	"	"	33°56'08"	111°06'13"	L	N 12	
S12	154143	L003	220	1.71	1.80	.95	Pine Mountain	McFadden Peak	33°57'12"	110°59'02"	L	N 13	
S13	154144	S103	130	1.23	1.30	.95	Walnut Creek	Picture Mountain	33°53'46"	111°11'20"	L	N 14	
S14	154145	B103	125	1.44	1.50	.96	Duport Canyon	Copper Mountain	33°53'25"	111°03'54"	L	N 17	
S15	154146	B103	115	1.05	1.10	.95	Cataract Canyon	"	33°55'15"	111°05'07"	L	N 17	x
S15B	154246	B103	115	1.62	1.50	1.08	"	"	33°55'20"	111°02'50"	L	N 17	
S16	154147	S103	140	1.55	3.20	.48	West Skunk Tank Mtn.	Sheep Basin Mtn.	34°00'35"	111°12'35"	L	N 20	
S17	154148	U102	175	.60	1.00	.60	"	"	34°00'34"	111°12'31"	L	N 20	
S18	154247	S004	120	1.43	1.30	1.10	Juniper Canyon	Picture Mountain	33°53'31"	111°11'06"	L	N 21	
S19	154248	S003	110	1.61	2.50	.64	Walnut Creek	"	33°53'21"	111°11'14"	L	N 21	
S20	154249	T103	160	2.70	3.20	.84	Board Tree Saddle	McFadden Peak	33°58'17"	111°56'45"	L	N 29	
S21	154250	L003	225	3.64	4.10	.89	"	"	33°57'46"	110°56'34"	L	N 29	
S22	151251	U403	110	2.65	2.20	1.20	Cherry Creek	"	33°55'20"	110°54'24"	L	N 29	x
S23	154252	B003	90	--	--	--	"	"	33°53'13"	110°54'10"	L	N 29	
S24	154253	B103	175	2.26	2.30	.98	"	"	33°52'13"	110°54'16"	L	D 06	
S25	154254	L002	90	.85	1.70	.50	"	"	33°53'11"	110°53'49"	L	D 06	
S26	154255	U102	180	1.58	1.80	.88	"	"	33°52'28"	110°53'49"	L	D 06	x
S27	154256	B103	120	1.49	1.50	.99	"	"	33°50'39"	110°52'34"	L	D 06	x
S28	154257	B003	175	1.89	2.00	.94	"	"	33°49'24"	110°51'40"	L	D 07	
S29	154258	B103	110	1.02	1.34	.76	"	"	33°50'05"	110°52'16"	L	D 07	
S30	154259	B103	120	.84	.90	.93	Oak Creek	"	33°57'18"	110°48'17"	L	D 07	
S31	154260	B103	140	2.15	2.20	.98	"	"	33°51'28"	110°48'17"	L	D 07	
S32	154330	B003	50	1.10	.60	1.83	Coon Creek Butte	"	33°45'39"	110°54'59"	W	D 13	
S33	154331	S103	200	2.06	2.30	.90	SE of Coon Creek	Rockinstraw Mtn.	33°43'35"	110°50'35"	W	D 13	
S34	154332	B103	125	.95	1.10	.86	"	"	33°44'18"	110°50'52"	W	D 13	
S35	154333	U420	800	470.80	462.80	1.02	Bull Canyon	McFadden Peak	33°45'21"	110°51'35"	W	D 13	
S36	154354	B003	50	1.30	.90	1.44	Rose Creek	"	33°48'45"	110°54'13"	W	D 14	
S37	154335	U420	1000	112.00	109.90	1.02	Workman Creek	"	33°50'49"	110°58'23"	W	D 14	
S38	154336	S103	100	2.96	2.80	1.06	Cherry Creek	"	33°47'40"	110°50'44"	W	D 15	
S39	154337	B103	100	5.36	4.90	1.09	"	"	33°47'46"	110°51'02"	W	D 15	
S40	154338	U003	--	2.16	1.60	1.35	"	"	33°47'35"	110°50'30"	W	D 15	
S41	154316	U003	165	2.07	1.90	1.09	Below Roosevelt Dam	Theodore Roosevelt	33°40'07"	111°09'57"	K	F 07	
S42	154317	S004	140	3.71	3.40	1.09	"	"	33°39'47"	111°10'10"	K	F 07	
S43	154318	U203	160	2.23	2.70	.83	S. of Roosevelt	"	33°29'10"	111°07'48"	K	F 08	
S44	154319	S004	130	2.81	2.60	1.08	"	"	33°39'28"	111°08'42"	K	F 08	
S45	154320	U203	95	1.21	2.10	.58	Hicks Wash, Salt R. Mtn	Rockinstraw Mtn.	33°31'02"	110°52'28"	K	F 08	
S46	154321	B003	120	.42	.90	.47	"	"	33°31'00"	110°53'22"	K	F 08	
S47	154322	U002	120	1.56	2.30	.68	Chrome Butte	Chrome Butte	33°30'50"	110°48'18"	K	F 10	
S48	154323	U003	85	.80	.80	1.00	"	"	33°30'45"	110°43'18"	K	F 10	
S49	154324	B003	95	1.31	1.30	1.01	"	"	33°30'20"	110°43'27"	K	F 10	
S50	154325	U110	285	1.56	1.80	.87	Cactus 1&2 Prospects	Windy Hill	33°42'58"	111°04'05"	K	F 12	
S51	154326	S203	--	1.17	1.30	.90	Dutchwoman Butte	Armer Mountain	33°46'18"	111°06'33"	K	F 12	
S52	154327	U203	--	1.17	1.10	1.08	"	"	33°45'17"	111°06'15"	K	F 12	
S53	154328	U203	--	1.31	1.30	1.01	Salome Mountain	Greenback Creek	33°46'44"	111°07'54"	K	F 12	
S54	154329	U203	710	.90	.60	.67	Final Pass	Final Peak	33°32'51"	110°47'39"	K	F 10	
S55	154348	U420	8000	367.00	338.4	1.08	Red Bluff Mine Dumps	Rockinstraw Mtn.	33°44'58"	110°56'21"	F	[illegible] 28	
S56	154349	S003	135	.53	3.00	.18	Armer Mountain	Armer Mountain	33°47'26"	111°01'44"	K	F 29	
S57	154350	U103	200	2.14	3.20	.47	Theodore Roosevelt	Theodore Roosevelt	33°44'37"	111°10'55"	K	M 04	

CENTRAL ARIZONA ARCH PROJECT - WATER SAMPLES

Site No.	Sample No.	Inferred Producing Horizon	Sample Type	U-FL (Uppb)	Location	Quad	Lat.	Long.	Who	When	Contamination
W1	154013	M	Stream	.57	Pine Cr.-Nat. Bridge	Buckhead Mesa	34°19'27"	111°27'17"	P	S 18	Sewerage/Pine
W2	154019	AS	Stream	1.33	Granite Tank	Diamond Butte	34°07'34"	111°00'30"	P	S 22	Diabase
W3	154020	MS	Spring	.59	Bear Spring	Young	34°14'42"	110°58'50"	K	S 22	None
W4	154042	YM	Well	3.05	Gold Creek Well	Gisela	34°00'05"	111°21'27"	K	S 24	Metal pipes
W5	154043	AVRM	Stream	.77	Gun Creek	Kayler Butte	33°58'40"	111°17'30"	K	S 24	None
W6	154032	A	Spring	.83	Slate Creek	"	33°57'40"	111°25'55"	K	S 25	None
W7	154033	VA	Spring	.59	Pine Mountain Mine	Reno Pass	33°58'55"	111°26'47"	K	S 25	Mercury
W8	154036	ARM	Stream	4.47	Sycamore Creek	"	33°58'06"	111°27'09"	P	S 27	Mines
W9	154037	AM	Spring	.36	Jones Canyon	Gisela	34°02'45"	111°15'45"	K	S 27	Cows
W10	154038	ARM	Well	2.56	Clover Well	Mazatzal Peak	34°04'49"	111°22'56"	K	S 27	Metal pipe
W11	154038	ARM	Spring	.22	Garden Spring	"	34°05'33"	111°26'04"	K	S 27	None
W12	154044	AM	Stream	.92	Mt. Ord	Reno Pass	33°57'17"	111°24'02"	K	S 27	Mine
W13	154045	VM	Stream	.83	W. of City Creek	North Peak	34°12'47"	111°29'41"	P	S 29	Cows
W14	154057	AV	Spring	15.44	Jones Spring	Diamond Butte	34°07'48"	111°05'14"	K	O 03	None
W15	154058	GSB	Spring	.29	Spring Creek Spring	Buzzard Roost	34°01'14"	111°22'30"	P	O 04	None
W16	154059	A	Stream	2.51	Fred Pranty Cabin	Sheep Basin Mtn.	34°04'36"	111°09'48"	P	O 17	None
W17	154060	MR	Stream	1.79	S. of Pocket Spring	McDonald Mountain	34°04'37"	111°12'03"	P	O 18	None
W18	154097	UBS	Spring	12.61	Del Shay	Picture Mountain	33°59'32"	111°12'15"	P	O 24	None
W19	154098	BS	Spring	.98	Skunk Tank Mountain	Sheep Basin Mtn.	34°01'03"	111°09'20"	K	O 25	Dripping Spring
W20	154099	M	Stream	.28	N. Sheep Basin Mtn.	Sheep Basin Mtn.	34°02'44"	111°13'40"	K	O 25	None
W21	154130	M	Spring	<.20	Casterser Seep	Mazatzal Peak	34°05'27"	111°27'57"	K	N 06	None
W22	154131	M	Spring	.95	Malpais Spring	"	34°04'49"	111°29'07"	K	N 06	None
W23	154132	M	Spring	3.10	Brody Seep	"	34°04'31"	111°29'08"	J	N 06	None
W24	154133	M	Spring	.50	Chilson Spring	"	34°05'08"	111°29'25"	J	N 08	Metal tank
W25	154206	RKMD	Stream	1.52	Mineral Spring Creek	North Peak	34°10'35"	111°28'05"	K	N 13	None
W26	154207	MD	Stream	.27	Cactus Ridge Stream	Mazatzal Peak	34°02'55"	111°26'57"	K	N 20	None
W27	154243	RD	Spring	1.28	Eisenhower Spring	"	34°06'13"	111°25'40"	K	D 04	None
W28	154244	RD	Stream	.47	N.E. Cactus Ridge	"	34°07'10"	111°25'52"	K	D 06	None
W29	154302	R	Stream	1.93	Above Sunflower Mine	Reno Pass	33°57'35"	111°29'22"	K	D 09	Arsenic
W30	154303	D	Spring	.39	W. Deadman Fold	Mazatzal Peak	34°03'25"	111°28'33"	K	D 10	None
W31	154304	M	Stream	39.29	Below Malpais Spring	"	34°04'23"	111°29'50"	P	D 11	None
W32	154305	M	Stream	<.20	Upper Mazatzal Wash	Table Mountain	34°02'24"	111°31'07"	P	D 13	None
W33	154306	M	Stream	2.02	Upper Davenport Wash	"	34°03'07"	111°32'02"	J	D 13	None

TABLE 2

GEOCHEMICAL CORRELATION SUMMARY OF ANOMALOUS CENTRAL ARIZONA ARCH ROCKS

Sample	Code	AG	AL	B	BA	BE	CA	CE	CO	CR	CU	FE	K	LI	MG	MN	MO	NA	NB	NI	P	SC	SR	TH	TI	U	V	Y	ZN	ZR	
D7	V004		+	+	+	+			+			+		+	+			+			+	+	+		+	-	+		+		Alder Volcanics
D56	V003		+		+	+										+		+	+												
M142	V003		+		+					+					+	+		+		+			+		+	-					
H2	V002		+		+					+					+			+		+			+		+						
D33	D103		+		+					+						*						+			+		+				Deadman Unit
D34	D103		+						+	+		+								+		+			+		+		+		
D35	D202		+							+		+										+			+						
D35A	D203						+					+								+	*	+	+		+	+	+	+	+		
D40	D203		+						+	+		+								+		+			+		+		+		
D41	D211								+	+		+								*		+			*	+	+				
M25	D201											+		+										*							
M65	D203											+									+					+					
M66	D203											+											+			+	+				
M73	D202					+			+			+					+				+					+	+				
M75	D203	+				+			+			+					+		+		+					+					
M77	D203					+		+				+		+													+				
M86	D202								+		+	+				+				+	+	+					+				
M97	D203											+		+		+	+									+					
M100	D212											+														+	+				
M102	D203											+									+	+				+					
M115	D102		+					+				-							+				+					+		+	Maverick Mazatzal and Granite
M139	D203									+		*								+	+					+	+				
M78A	K210					+			+			+		+			+									-					
D25	M210	+						+		+		+											+	*		+	+			*	
D38A	M102																								+	+				+	
M88	M102								+		+	+								+					+	-	+				
P12	M110					+				+							+		+				+	+		+				+	
M63	R004		+		+			+											+											+	
G2	Pays-G		+		+													+								-			+		
G4	Ruin-G		+			+												+	+					+		+					
D50	S102		+		+								+																	+	Apache Group
S3	U103						*								+	+							+			-					
S21	L003						+				+				+	+					+			+					+		
S20	T103		+										+		+				+		+				+					+	
S35	U420		+								+		+				*			+						*		+			Radioactive Siltstones
S37	U420		+		+						+		+		+										+	*			*		
S55	U420		+										+				+								+	*					
Percent All Anomalies		100	49	6.7	41	73	60	67	90	67	50	67	50	42	70	87	60	55	27	63	40	82	69	45	70	100	70	75	80	50	

APPENDIX D

Computer Print-Out of Sample Results from
Oak Ridge Gaseous Diffusion Plant, Tennessee

(NOTE: If there is any discrepancy between coordinates listed here and map location of a sample, the map location is to be taken as the correct one.)

OR SAMPLE NUMBER	D. O. E. SAMPLE NUMBER ST LAT	LONG	L TY REP	SITE	S-GC	U-FL (PPM)	U-NT (PPM)	TOT (CPS)	U/TU	AG (PPM)	AL (%)	B (PPM)	BA (PPM)	BE (PPM)
154014	40-34.322	-111.458	-3-92-A	P001	M102	2.73	3.00	60	0.90	<2	3.74	14	119	1
154015	40-34.306	-111.044	-3-92-A	C001	M102	1.45	2.30	65	0.63	<2	1.21	<10	43	1
154017	40-34.286	-111.041	-3-92-A	C002	S105	1.22	1.60	100	0.76	<2	4.27	<10	316	1
154018	40-34.243	-110.958	-3-92-A	C003	S102	1.77	2.20	120	0.80	<2	1.59	20	99	2
154021	40-34.239	-110.959	-3-92-A	C004	M211	1.21	1.60	111	0.76	<2	1.15	<10	103	1
154022	40-34.208	-111.044	-3-92-A	C005	M201	3.58	5.70	130	0.63	<2	0.49	<10	81	<1
154024	40-34.192	-111.106	-3-92-A	C006	M201	1.73	2.70	92	0.64	<2	0.90	<10	74	<1
154025	40-34.249	-111.021	-3-92-A	C007	M101	0.86	1.20	92	0.72	<2	1.11	<10	139	1
154026	40-34.225	-111.029	-3-92-A	C008	M201	0.97	1.40	93	0.69	<2	0.79	12	75	<1
154027	40-34.116	-110.999	-3-92-A	D001	S103	2.04	2.50	160	0.82	<2	2.65	<10	434	1
154028	40-34.127	-111.021	-3-92-	D002	A102	0.75	0.70	105	1.09	<2	3.34	<10	331	1
154029	40-34.116	-110.995	-3-92-A	G001	G100	0.54	1.10	225	0.49	<2	6.18	15	876	2
154030	40-33.964	-111.381	-3-92-A	M001	A110	0.37	0.80	90	0.46	<2	1.49	10	180	<1
154031	40-33.961	-111.382	-3-92-A	M002	A103	1.75	2.20	140	0.80	<2	0.94	<10	62	<1
154034	40-33.982	-111.438	-3-92-A	M003	A103	1.44	1.90	120	0.76	<2	4.10	27	665	1
154035	40-33.963	-111.452	-3-92-A	M004	V004	4.38	4.70	190	0.93	<2	7.26	57	556	2
154040	40-33.957	-111.401	-3-92-A	M005	A110	0.59	1.00	140	0.59	<2	0.62	<10	67	<1
154041	40-33.957	-111.401	-3-92-A	M006	V002	1.80	2.00	190	0.90	<2	2.50	42	227	1
154046	40-34.158	-110.886	-3-92-A	C009	M212	0.49	0.70	90	0.70	<2	0.75	<10	133	<1
154047	40-34.087	-111.046	-3-92-A	D003	A102	2.10	2.70	113	0.78	<2	3.03	20	390	1
154048	40-34.086	-111.035	-3-92-A	D004	M202	1.32	1.70	100	0.78	<2	2.50	<10	218	1
154049	40-34.122	-111.081	-3-92-A	D005	A202	2.19	2.60	88	0.84	<2	4.28	20	506	4
154050	40-34.124	-111.081	-3-92-A	D006	A002	1.86	2.10	70	0.89	<2	1.26	26	120	4
154051	40-34.115	-111.094	-92-A	D007	V004	2.04	2.20	140	0.93	<2	6.91	55	884	4
154052	40-34.121	-111.100	-92-A	D008	A011	1.25	1.50	90	0.84	<2	2.53	12	222	2
154053	40-34.052	-111.071	-3-92-A	D009	M201	1.58	1.60	75	0.99	<2	1.01	15	315	<1
154054	40-34.177	-111.137	-3-92-A	D010	M111	1.50	1.30	70	1.15	<2	0.75	10	21	<1
154055	40-34.176	-111.139	-3-92-A	D011	M111	1.29	1.80	105	0.72	<2	0.35	<10	21	<1
154056	40-34.051	-111.257	-3-92-A	D012	A011	1.61	1.80	70	0.89	<2	3.18	16	438	1
154061	40-34.350	-111.429	-3-92-A	P002	M102	2.80	2.60	122	1.08	<2	4.47	46	466	2
154062	40-34.350	-111.431	-3-92-A	P003	M111	0.98	1.10	68	0.89	<2	0.69	<10	21	<1
154063	40-34.350	-111.440	-3-92-A	P004	M112	0.98	1.00	55	0.98	<2	0.64	<10	16	<1
154064	40-34.060	-111.230	-3-92-A	D013	A102	4.27	4.40	240	0.97	<2	5.24	<10	718	2
154065	40-34.060	-111.216	-3-92-A	D014	A202	1.05	1.20	75	0.88	<2	1.35	<10	196	<1
154066	40-34.073	-111.212	-3-92-A	D015	A211	1.99	1.50	70	1.33	<2	3.43	13	530	1
154067	40-34.067	-111.170	-3-92-A	D016	V102	3.32	3.40	150	0.98	<2	4.11	10	419	3
154068	40-34.079	-111.160	-3-92-A	D017	A103	0.75	0.80	95	0.94	<2	1.58	<10	187	<1
154069	40-34.084	-111.204	-3-92-A	D018	A011	1.93	2.30	270	0.84	<2	3.60	35	560	2
154070	40-34.094	-111.175	-3-92-A	D019	A202	1.45	2.40	80	0.60	<2	1.43	<10	308	1
154071	40-34.117	-111.151	-3-92-A	D020	A101	1.45	1.20	55	1.21	<2	0.68	<10	104	<1
154072	40-34.110	-111.150	-3-92-A	D021	A212	0.73	1.10	70	0.71	<2	1.79	<10	189	1
154073	40-34.110	-111.144	-3-92-A	D022	A213	0.72	0.70	70	1.03	<2	1.25	<10	150	<1
154074	40-34.110	-111.144	-3-92-A	D023	A202	0.51	1.80	85	0.28	<2	1.78	12	217	1
154075	40-34.123	-111.202	-3-92-A	D024	M103	0.82	1.40	63	0.59	<2	0.60	<10	26	<1
154076	40-34.126	-111.192	-3-92-A	D025	M210	11.36	32.00	452	0.35	6	0.55	<10	108	3
154077	40-34.124	-111.194	-3-92-A	D026	M110	1.16	1.60	85	0.73	<2	1.33	<10	43	1
154078	40-34.153	-111.161	-3-92-A	D027	M101	1.30	1.60	65	0.81	<2	0.63	<10	63	1
154079	40-34.157	-110.887	-3-92-A	D028	M212	0.70	0.90		0.78	<2	0.59	<10	143	<1
154080	40-34.130	-111.896	-3-92-A	D029	M212	0.77	1.20	68	0.64	<2	1.39	<10	238	<1
154081	40-34.086	-111.121	-3-92-A	D030	S114	2.52	2.30	150	1.10	<2	3.69	21	456	1
154082	40-34.141	-111.178	-3-92-A	D031	M101	1.07	0.90		1.19	<2	0.70	<10	20	<1
154083	40-34.051	-111.193	-3-92-A	D032	C104	2.04	2.50	122	0.82	<2	4.22	19	496	1
154084	40-34.045	-111.174	-3-92-A	D033	C103	4.26	4.30	135	0.89	<2	6.36	12	1040	2
154085	40-34.033	-111.179	-3-92-A	D034	C103	3.93	5.90	180	0.67	<2	5.22	10	611	2
154086	40-34.015	-111.201	-3-92-A	D035	C202	4.75	6.30	145	0.75	<2	5.09	10	421	1

OR SAMPLE NUMBER	CA (%)	CO (PPM)	CR (PPM)	CU (PPM)	FE (%)	LI (PPM)	MG (%)	MN (PPM)	MO (PPM)	NA (%)	NB (PPM)	NI (PPM)	P (PPM)	SC (PPM)	TH (PPM)
154014	<0.05	<4	5	10	1.39	19	<0.05	139	<4	<0.05	8	3	102	3	11
154015	<0.05	<4	14	3	1.12	8	<0.05	19	<4	<0.05	<4	2	156	1	15
154017	<0.05	<4	14	<2	1.90	4	0.13	37	<4	<0.05	<4	5	181	4	<2
154018	0.13	<4	36	3	2.80	19	0.42	28	<4	<0.05	<4	7	489	3	7
154021	<0.05	<4	16	<2	1.08	4	0.09	14	<4	<0.05	<4	3	33	1	9
154022	<0.05	<4	33	2	1.91	11	<0.05	23	<4	<0.05	<4	5	142	1	19
154024	<0.05	<4	30	3	1.83	53	<0.05	16	<4	<0.05	<4	5	96	1	8
154025	<0.05	<4	12	2	0.72	6	0.08	29	<4	<0.05	<4	2	31	1	4
154026	<0.05	<4	13	2	0.70	10	<0.05	17	<4	<0.05	<4	2	119	1	7
154027	0.14	<4	22	4	1.84	7	0.14	36	<4	0.07	<4	6	551	2	5
154028	0.10	<4	17	<2	1.62	5	0.15	25	<4	0.05	<4	4	411	5	<2
154029	<0.05	<4	3	<2	0.41	3	0.14	17	<4	0.20	<4	2	155	3	11
154030	<0.05	<4	18	8	0.95	4	<0.05	61	<4	<0.05	<4	7	127	2	<2
154031	1.80	6	26	58	3.60	21	0.07	269	<4	0.06	<4	26	211	5	5
154034	0.07	7	33	55	2.46	10	0.13	448	<4	0.20	<4	12	271	5	4
154035	<0.05	<4	6	5	2.06	4	0.09	445	<4	1.72	7	4	96	4	10
154040	<0.05	<4	20	8	1.52	20	<0.05	40	<4	<0.05	<4	4	117	1	<2
154041	<0.05	8	29	44	2.95	39	<0.05	562	<4	0.09	<4	18	198	4	4
154046	<0.05	<4	10	3	0.71	2	<0.05	52	<4	<0.05	<4	4	61	1	3
154047	0.06	<4	60	3	2.63	9	0.28	65	<4	0.06	<4	13	218	6	9
154048	<0.05	<4	15	3	1.92	4	0.07	40	<4	<0.05	<4	4	79	5	12
154049	0.08	4	74	3	4.37	28	0.28	86	<4	0.41	<4	17	381	6	4
154050	0.20	<4	18	3	1.43	10	0.12	70	<4	<0.05	<4	5	844	2	2
154051	0.86	21	28	24	8.02	201	0.64	574	<4	1.53	<4	19	1759	19	<2
154052	0.12	<4	19	8	1.42	51	0.18	60	<4	0.39	<4	6	179	3	4
154053	<0.05	<4	17	2	1.12	3	<0.05	10	<4	<0.05	<4	<2	74	1	3
154054	<0.05	<4	25	4	1.09	4	<0.05	15	<4	<0.05	<4	3	65	1	8
154055	<0.05	<4	15	5	0.88	2	<0.05	34	<4	<0.05	<4	4	90	1	12
154056	<0.05	<4	9	4	1.51	3	0.11	14	<4	0.18	<4	5	188	3	4
154061	0.06	4	5	13	1.59	7	0.17	374	<4	0.05	11	4	85	4	5
154062	<0.05	<4	4	4	0.69	4	<0.05	43	<4	<0.05	<4	2	62	<1	<2
154063	<0.05	<4	2	3	0.45	3	<0.05	24	<4	<0.05	<4	2	43	1	2
154064	<0.05	<4	<1	2	1.17	12	0.15	24	<4	1.09	14	2	44	1	8
154065	<0.05	4	18	7	1.92	6	0.05	177	<4	0.05	<4	15	199	2	2
154066	<0.05	<4	13	7	1.60	5	0.09	18	<4	0.12	<4	6	102	3	9
154067	<0.05	5	22	10	2.73	4	0.15	182	<4	0.08	10	10	207	7	5
154068	0.07	<4	16	9	1.46	8	<0.05	73	<4	0.14	<4	5	304	2	<2
154069	0.07	<4	16	8	1.83	3	0.14	42	<4	0.06	<4	7	264	4	2
154070	<0.05	<4	51	14	2.36	1	<0.05	50	<4	0.05	<4	12	131	3	8
154071	<0.05	<4	7	2	0.50	1	<0.05	32	<4	<0.05	<4	2	20	1	<2
154072	<0.05	4	41	5	1.89	1	0.06	34	<4	<0.05	<4	16	66	3	7
154073	<0.05	<4	24	3	1.46	2	0.05	16	<4	<0.05	<4	5	76	2	3
154074	<0.05	<4	36	4	2.15	3	0.07	24	<4	<0.05	<4	9	97	3	6
154075	<0.05	<4	10	3	0.98	3	<0.05	20	<4	<0.05	<4	<2	103	1	12
154076	<0.05	4	151	7	8.01	5	<0.05	59	<4	<0.05	<4	13	525	15	104
154077	<0.05	<4	11	3	1.08	6	<0.05	22	<4	<0.05	<4	3	102	2	6
154078	<0.05	<4	11	5	0.64	5	<0.05	28	<4	<0.05	<4	2	137	1	31
154079	<0.05	<4	7	4	0.67	3	<0.05	54	<4	<0.05	<4	4	36	1	2
154080	<0.05	<4	16	2	0.94	2	<0.05	49	<4	0.06	<4	4	106	2	4
154081	0.05	<4	9	4	1.81	6	0.10	89	<4	<0.05	8	3	226	2	10
154082	<0.05	<4	5	3	0.55	2	<0.05	<1	<4	<0.05	<4	2	49	1	8
154083	0.09	6	18	5	3.13	10	0.07	447	<4	0.08	6	12	654	9	3
154084	0.16	13	59	8	5.26	31	0.25	2999	<4	0.39	<4	18	838	19	7
154085	0.13	28	109	3	11.29	18	0.19	425	<4	0.08	<4	48	627	23	10
154086	<0.05	5	84	6	13.79	4	0.06	28	<4	0.08	<4	20	556	47	12

CENTRAL ARIZONA ARCH - ROCKS

OR SAMPLE NUMBER	TI (PPM)	V (PPM)	Y (PPM)	ZN (PPM)	ZR (PPM)	K (%)	SR (PPM)	CE (PPM)
154014	684	15	35	44	160	0.71	37	75
154015	710	8	8	7	75	0.10	123	34
154017	1053	19	10	8	67	3.63	28	26
154018	815	35	8	12	136	1.06	7	41
154021	311	15	5	8	49	0.50	14	31
154022	445	29	10	6	143	0.10	84	52
154024	278	51	6	9	51	0.22	41	35
154025	404	10	7	15	56	0.55	8	35
154026	252	5	4	4	40	0.19	136	29
154027	995	36	16	22	98	2.27	17	48
154028	656	23	7	9	44	2.95	13	34
154029	202	8	5	6	44	4.72	33	68
154030	162	24	2	11	16	0.53	50	18
154031	301	38	4	27	17	0.14	52	12
154034	459	68	7	31	54	1.45	73	50
154035	1003	11	17	69	174	1.97	37	127
154040	250	25	2	13	17	0.13	64	19
154041	419	46	8	45	59	0.60	66	29
154046	289	12	2	7	18	0.30	11	21
154047	1090	103	19	17	127	1.26	43	84
154048	1063	39	13	16	102	1.01	21	47
154049	1935	77	27	21	128	1.87	23	67
154050	473	28	8	7	33	0.58	10	18
154051	3421	127	22	115	91	1.40	173	67
154052	743	37	8	24	49	0.93	29	34
154053	428	22	6	5	44	0.29	20	14
154054	262	20	5	4	35	0.19	28	33
154055	439	10	6	4	79	0.03	50	43
154056	481	28	11	20	67	1.12	18	51
154061	769	15	25	105	130	1.81	50	83
154062	139	3	3	5	23	0.03	39	20
154063	140	3	4	5	40	0.02	27	17
154064	562	<2	32	57	204	3.17	19	85
154065	158	34	5	18	31	0.38	22	20
154066	557	33	8	19	67	1.34	26	32
154067	2204	34	37	45	158	1.64	24	99
154068	284	25	5	10	28	0.57	26	10
154069	690	39	12	34	85	1.61	13	56
154070	571	40	6	9	69	0.51	21	41
154071	184	13	4	9	33	0.32	3	13
154072	615	25	6	11	46	0.78	7	31
154073	311	23	5	7	31	0.52	7	<10
154074	457	35	7	10	47	0.71	10	26
154075	357	14	5	7	51	0.19	31	21
154076	1954	183	41	22	1412	0.07	359	239
154077	640	9	5	4	76	0.22	55	39
154078	453	6	5	4	76	0.02	82	42
154079	281	13	3	8	30	0.24	5	10
154080	657	22	3	7	30	0.76	13	42
154081	1204	22	33	15	178	3.28	9	40
154082	258	4	3	4	44	0.03	39	30
154083	2559	60	17	50	105	1.43	62	54
154084	5487	127	32	98	176	1.64	103	63
154085	7758	296	23	201	85	1.80	36	48
154086	5601	434	24	76	125	1.62	34	25

OR SAMPLE NUMBER	D. O. E. SAMPLE NUMBER ST LAT	LONG	L TY REP	SITE	S-GC	U-FL (PPM)	U-NT (PPM)	TOT (CPS)	U/TU	AG (PPM)	AL (%)	B (PPM)	BA (PPM)	BE (PPM)
154087	40-34.015	-111.201	-3-92-A	D35A	C203	26.55	33.00	235	0.80	<2	4.25	<10	459	2
154088	40-34.028	-111.211	-3-92-A	D036	M103	1.40	2.00	85	0.70	<2	0.64	<10	69	<1
154089	40-34.044	-111.198	-3-92-A	D037	M103	1.58	2.80	57	0.56	<2	0.37	<10	63	<1
154091	40-34.034	-111.198	-3-92-A	D038	M202	1.65	4.80	88	0.34	<2	0.60	<10	70	<1
154092	40-34.034	-111.198	-3-92-A	D38A	M102	4.33	11.30	142	0.38	<2	1.61	28	216	1
154093	40-33.996	-111.208	-3-92-A	D039	V003	3.65	3.80	145	1.01	<2	5.54	12	939	2
154094	40-34.008	-112.218	-3-92-A	D040	D203	5.08	5.60	122	0.91	<2	5.52	12	492	2
154095	40-34.012	-111.161	-3-92-A	D041	D211	4.26	4.10	185	0.53	<2	3.43	<10	312	1
154096	40-34.017	-111.156	-3-92-A	D042	D202	2.57	5.10	159	0.50	<2	3.67	21	703	1
154100	40-34.089	-111.112	-3-92-A	D043	S203	1.78	1.90	250	0.94	<2	3.77	13	416	1
154101	40-34.087	-111.051	-3-92-A	D044	S203	3.30	3.30	130	1.00	<2	3.03	12	401	1
154102	40-34.073	-111.076	-3-92-A	D045	S204	2.54	2.40	88	1.06	<2	3.26	32	250	1
154103	40-34.087	-111.004	-3-92-A	D046	S102	2.70	2.70	162	1.00	<2	2.77	11	230	1
154104	40-34.036	-111.042	-3-92-A	D047	S205	1.21	1.30	200	0.93	<2	5.10	10	881	1
154105	40-34.032	-111.077	-3-92-A	D048	U103	2.17	2.50	250	0.87	<2	5.88	52	442	3
154106	40-34.036	-111.072	-3-92-A	D049	U204	1.44	1.80	162	0.80	<2	3.97	<10	383	1
154107	40-34.142	-111.073	-3-92-A	D050	S102	3.43	3.40	345	1.01	<2	6.74	18	1430	2
154108	40-34.151	-111.028	-3-92-A	D051	S203	2.82	2.40	200	1.17	<2	5.68	<10	845	1
154109	40-34.129	-111.005	-3-92-A	D052	S104	1.78	1.70	130	1.05	<2	4.22	<10	637	1
154110	40-34.129	-111.005	-3-92-A	D053	V203	2.95	3.30	178	0.89	<2	7.78	17	1164	2
154111	40-34.239	-110.959	-3-92-A	C010	S204	1.95	2.20		0.89	<2	2.13	<10	146	2
154112	40-33.945	-110.973	-3-92-A	S001	L403	1.90	1.20	120	1.58	<2	0.33	<10	75	1
154113	40-34.061	-110.983	-3-92-A	S002	U102	1.75	1.70	150	1.03	<2	3.86	<10	552	1
154114	40-34.028	-110.964	-3-92-A	S003	U103	1.26	0.30	120	4.20	<2	1.16	<10	85	<1
154115	40-34.081	-111.485	-3-92-A	M007	M101	0.99	0.90	65	1.10	<2	0.49	<10	44	<1
154116	40-34.069	-111.480	-3-92-R	M008	M102	1.32	0.90	68	1.47	<2	0.75	14	44	<1
154117	40-34.071	-111.475	-3-92-A	M009	M101	1.38	1.10	80	1.25	<2	1.49	11	154	<1
154118	40-34.093	-111.492	-3-92-A	M010	M101	1.19	0.60	60	1.98	<2	0.53	<10	28	<1
154119	40-34.095	-111.494	-3-92-A	M011	M001	0.81	0.70	110	1.16	<2	0.58	21	26	<1
154120	40-34.100	-111.496	-3-92-A	M012	M101	1.07	1.10	72	0.97	<2	2.08	15	52	<1
154121	40-34.100	-111.492	-3-92-A	M013	M101	0.54	0.60		0.90	<2	0.29	<10	37	<1
154122	40-34.082	-111.496	-3-92-A	M014	M101	0.40	0.70	70	0.57	<2	0.51	<10	44	<1
154123	40-34.091	-111.452	-3-92-A	M015	M102	1.21	1.10	80	1.10	<2	0.88	<10	51	<1
154125	40-34.094	-111.447	-3-92-A	M016	D103	3.83	4.50	130	0.85	<2	2.50	<10	38	1
154126	40-34.097	-111.448	-3-92-A	M017	D201	1.32	1.30	47	1.02	<2	1.00	<10	29	<1
154128	40-34.099	-111.452	-3-92-A	M018	M101	1.14	1.30	80	0.88	<2	1.45	<10	139	1
154129	40-34.096	-111.443	-3-92-A	M019	D203	2.21	2.80	100	0.79	<2	5.29	<10	80	2
154134	40-33.930	-111.211	-3-92-A	S004	S103	3.08	3.10	140	0.99	<2	3.80	44	368	1
154135	40-33.929	-111.211	-3-92-A	S005	U113	2.63	3.30	160	0.80	<2	4.60	32	533	1
154136	40-33.919	-111.201	-3-92-A	S006	S202	1.76	2.60	130	0.68	2	2.37	29	237	1
154137	40-34.003	-111.200	-3-92-A	S007	U213	1.16	1.10	130	1.05	<2	0.95	<10	89	<1
154138	40-33.942	-111.121	-3-92-A	S008	L103	0.76	0.80	70	0.95	<2	0.32	<10	33	<1
154140	40-33.948	-111.106	-3-92-A	S009	L003	1.86	2.10	230	0.89	<2	0.42	14	85	1
154141	40-33.949	-111.103	-3-92-A	S010	L102	1.23	1.50	450	0.82	<2	0.35	25	90	1
154142	40-33.936	-111.104	-3-92-A	S011	L104	1.10	1.13	200	1.00	<2	0.37	23	52	<1
154143	40-33.953	-110.984	-3-92-A	S012	L003	1.71	1.80	220	0.95	<2	0.48	10	56	1
154144	40-33.896	-111.189	-3-92-A	S013	S103	1.23	1.30	130	0.95	<2	1.97	23	262	1
154145	40-33.890	-111.065	-3-92-A	S014	B104	1.44	1.50	125	0.96	<2	1.65	14	212	<1
154146	40-33.921	-111.052	-3-92-A	S015	B103	1.05	1.10	115	0.95	<2	2.01	<10	205	<1
154147	40-34.010	-111.210	-3-92-A	S016	S103	1.55	3.20	140	0.48	<2	3.62	18	340	1
154148	40-34.009	-111.209	-3-92-A	S017	U102	0.60	1.00	175	0.60	<2	0.66	<10	62	<1
154149	40-34.276	-111.058	-3-92-A	C011	M102	1.23	1.30		0.95	<2	0.54	<10	37	<1
154150	40-34.160	-110.897	-3-92-A	C012	V105	3.54	3.90	150	0.91	<2	3.88	25	903	2
154151	40-34.238	-110.962	-3-92-A	C013	M101	1.36	1.40	90	0.97	<2	0.85	27	47	1
154152	40-34.315	-111.467	-3-92-A	M005	M103	3.10	3.30		0.94	<2	6.59	42	536	2

OR SAMPLE NUMBER	CA (%)	CO (PPM)	CR (PPM)	CU (PPM)	FE (%)	LI (PPM)	MG (%)	MN (PPM)	MO (PPM)	NA (%)	NB (PPM)	NI (PPM)	P (PPM)	SC (PPM)	TH (PPM)
154087	4.85	16	48	20	8.19	7	0.08	590	<4	0.07	<4	29	21509	30	9
154088	<0.05	4	12	4	2.14	13	<0.05	79	<4	<0.05	<4	6	91	2	6
154089	0.07	<4	14	2	2.66	7	<0.05	86	<4	<0.05	<4	5	393	2	10
154091	<0.05	<4	24	2	2.42	2	<0.05	34	<4	<0.05	<4	6	38	2	8
154092	<0.05	<4	45	3	3.18	5	0.08	37	<4	<0.05	<4	6	141	4	18
154093	0.34	6	29	6	4.06	13	0.28	384	<4	1.13	5	14	523	14	15
154094	0.11	20	71	14	9.23	6	0.16	232	<4	0.12	<4	32	480	19	10
154095	0.20	38	168	5	13.88	8	0.23	604	<4	0.05	<4	72	873	33	6
154096	0.09	9	65	5	6.76	3	0.11	209	<4	<0.05	<4	27	314	23	17
154100	0.33	<4	10	4	1.68	10	0.10	269	<4	<0.05	<4	5	255	3	<2
154101	4.95	<4	31	3	1.58	12	0.18	73	<4	<0.05	5	4	22039	5	9
154102	<0.05	<4	16	3	2.81	9	0.16	266	<4	<0.05	4	5	330	3	9
154103	<0.05	<4	22	5	2.34	4	0.18	37	<4	<0.05	<4	6	138	3	8
154104	0.22	<4	28	2	1.79	19	0.93	159	<4	0.08	<4	14	670	4	7
154105	0.20	7	39	5	2.83	113	0.39	155	<4	0.05	<4	22	805	8	6
154106	0.35	<4	66	5	5.07	59	0.05	285	<4	<0.05	<4	11	1356	5	7
154107	0.27	6	13	4	3.24	30	0.55	230	<4	0.48	8	10	495	8	7
154108	<0.05	<4	10	6	1.62	9	<0.05	58	<4	0.07	5	7	224	2	13
154109	0.18	<4	26	3	2.94	12	0.32	100	<4	0.23	<4	9	715	7	2
154110	0.31	6	20	<2	3.72	20	0.74	160	<4	1.19	7	19	915	11	5
154111	0.20	<4	31	4	4.05	76	<0.05	65	4	<0.05	<4	8	880	3	<2
154112	0.19	<4	11	31	0.57	9	0.06	108	<4	<0.05	<4	6	747	2	12
154113	0.51	<4	9	<2	1.56	18	0.12	64	<4	0.05	<4	3	1653	2	4
154114	12.94	4	10	5	0.68	8	3.88	1167	<4	<0.05	6	5	76	5	3
154115	<0.05	<4	10	13	0.72	4	0.06	46	<4	<0.05	<4	<2	114	<1	5
154116	<0.05	<4	14	2	0.53	4	0.17	28	<4	<0.05	<4	4	120	1	3
154117	<0.05	<4	19	6	1.54	3	0.07	57	<4	0.05	<4	3	71	2	<2
154118	<0.05	<4	6	7	0.45	12	0.22	24	<4	<0.05	<4	3	15	1	2
154119	<0.05	<4	9	5	0.20	3	0.12	13	<4	<0.05	<4	5	37	1	6
154120	0.05	9	9	11	0.50	21	0.47	36	<4	<0.05	<4	10	55	2	<2
154121	<0.05	<4	8	3	0.54	5	0.12	28	<4	<0.05	<4	2	88	1	8
154122	0.07	<4	10	3	0.86	2	0.07	25	<4	<0.05	<4	2	143	<1	5
154123	<0.05	<4	20	8	1.45	8	0.05	50	<4	<0.05	<4	8	83	2	6
154125	0.36	7	23	28	6.77	36	<0.05	70	<4	<0.05	<4	15	1695	13	6
154126	<0.05	<4	10	10	4.10	46	<0.05	25	<4	<0.05	<4	4	59	2	4
154128	<0.05	<4	21	9	1.32	5	0.15	61	<4	<0.05	<4	5	70	2	9
154129	0.20	6	23	22	6.35	12	<0.05	113	<4	<0.05	<4	10	1084	21	5
154134	0.20	<4	35	3	3.40	12	0.29	41	<4	0.06	<4	24	972	8	5
154135	0.07	<4	26	<2	2.54	10	0.28	66	<4	0.09	<4	8	338	7	11
154136	0.06	<4	27	10	2.04	8	0.17	60	<4	0.05	<4	8	243	5	8
154137	0.17	<4	9	5	0.88	3	0.12	50	<4	<0.05	<4	4	706	1	<2
154138	0.07	<4	5	8	0.38	12	0.24	12	<4	<0.05	<4	6	81	1	2
154140	1.75	<4	7	60	0.43	5	0.11	93	<4	<0.05	<4	5	7876	2	58
154141	1.05	<4	9	9	0.44	5	0.26	201	<4	<0.05	<4	4	2562	2	49
154142	<0.05	<4	6	17	0.41	3	<0.05	26	<4	<0.05	<4	4	124	2	55
154143	0.17	6	5	87	0.65	6	<0.05	31	<4	<0.05	<4	5	756	4	83
154144	<0.05	<4	22	2	1.93	23	0.14	50	<4	<0.05	<4	6	230	3	8
154145	0.05	<4	10	3	0.88	5	0.07	30	<4	<0.05	<4	5	272	1	3
154146	0.06	<4	9	5	1.34	5	0.09	31	<4	<0.05	<4	3	200	1	<2
154147	0.12	6	43	3	4.57	8	0.26	195	<4	<0.05	<4	19	577	14	4
154148	0.30	7	3	4	0.58	4	0.22	240	<4	<0.05	<4	12	1268	3	4
154149	<0.05	<4	16	3	1.12	3	<0.05	28	<4	<0.05	<4	5	34	1	9
154150	0.48	<4	17	7	1.39	7	0.23	63	<4	0.08	5	5	2162	7	10
154151	<0.05	<4	17	2	1.37	7	0.05	28	<4	0.06	<4	2	29	1	13
154152	<0.05	<4	7	11	1.81	5	0.10	322	<4	<0.05	13	4	95	4	12

OR SAMPLE NUMBER	TI (PPM)	V (PPM)	Y (PPM)	ZN (PPM)	ZR (PPM)	K (%)	SR (PPM)	CE (PPM)
154087	3638	164	86	129	101	1.49	244	42
154088	615	21	5	8	50	0.19	61	28
154089	557	23	6	8	48	0.07	95	22
154091	1203	40	7	9	78	0.19	13	26
154092	2686	52	28	14	383	0.55	48	82
154093	3389	59	47	58	116	2.06	48	84
154094	7058	229	32	142	151	1.89	36	36
154095	11725	359	25	89	88	1.19	20	30
154096	2670	131	18	48	110	1.48	28	44
154100	744	23	23	21	98	3.63	10	35
154101	1402	39	43	10	81	2.11	51	56
154102	1414	38	22	29	132	2.01	12	17
154103	1448	40	17	15	120	1.95	8	55
154104	1087	39	10	27	63	3.96	59	35
154105	2121	44	24	19	117	3.57	35	37
154106	2895	56	15	19	65	3.74	50	35
154107	2351	49	33	50	259	4.57	45	86
154108	504	13	31	10	210	5.66	20	34
154109	1838	67	24	13	106	3.16	48	93
154110	2843	64	31	35	215	3.26	112	58
154111	1325	35	14	17	108	2.01	19	36
154112	93	15	6	5	24	0.15	18	<10
154113	564	23	19	8	111	3.70	26	30
154114	404	13	21	10	48	1.26	439	17
154115	175	3	2	8	28	0.06	18	16
154116	291	6	4	8	48	0.08	14	19
154117	480	26	9	12	55	0.63	18	10
154118	120	3	2	13	28	0.02	4	10
154119	171	4	2	5	29	0.12	11	21
154120	446	11	3	48	52	0.22	20	20
154121	143	5	2	9	25	0.04	7	18
154122	138	4	2	7	20	0.20	10	14
154123	494	14	6	10	48	0.18	38	27
154125	2143	90	20	36	73	0.04	32	33
154126	568	34	3	7	46	0.04	14	21
154128	698	18	10	9	91	0.46	22	31
154129	4548	128	21	21	56	0.05	46	43
154134	2229	58	15	17	68	2.39	26	34
154135	2008	56	17	15	90	3.27	26	55
154136	1228	39	9	7	61	1.38	23	30
154137	334	16	8	5	29	0.85	9	54
154138	221	7	3	10	29	0.06	5	<10
154140	55	9	31	3	20	0.21	35	22
154141	148	15	19	3	20	0.25	17	<10
154142	86	17	5	4	33	0.18	5	<10
154143	97	22	18	7	29	0.07	14	16
154144	1205	35	7	11	30	1.00	21	40
154145	462	17	13	6	59	1.75	7	24
154146	308	15	7	10	53	2.59	7	14
154147	2517	89	17	27	66	1.88	13	56
154148	18	9	11	6	6	0.38	7	187
154149	603	15	5	7	65	0.08	27	24
154150	1248	26	17	11	91	2.38	33	55
154151	427	15	5	6	63	0.31	22	17
154152	1145	13	44	73	207	2.53	57	78

OF SAMPLE NUMBER	D. O. E. SAMPLE NUMBER ST LAT	LONG	L TY REP	SITE	S-GC	U-FL (PPM)	U-NT (PPM)	TOT (CPS)	U/TU	AG (PPM)	AL (%)	B (PPM)	BA (PPM)	BE (PPM)
154153	40-34.316	-111.467	-3-92-A	P006	M101	1.23	1.80		0.68	<2	0.95	<10	28	<1
154154	40-34.309	-111.473	-3-92-A	P007	M103	2.60	3.00	105	0.87	<2	2.50	<10	38	1
154155	40-34.309	-111.472	-3-92-A	P008	M104	4.04	3.90	165	1.04	<2	6.11	34	499	2
154156	40-34.324	-111.455	-3-92-A	P009	M104	2.88	3.00	165	0.96	<2	6.05	42	654	2
154157	40-34.335	-111.451	-3-92-A	P010	M102	1.12	1.40		0.80	<2	0.94	<10	30	<1
154158	40-34.135	-111.009	-3-92-A	D054	A203	0.58	0.90	90	0.64	<2	1.34	<10	138	1
154159	40-34.155	-111.490	-3-92-A	M020	M101	0.85	0.90		0.94	<2	0.77	53	76	<1
154160	40-34.162	-111.467	-3-92-A	M021	D103	2.29	3.10		0.74	<2	0.68	10	21	<1
154161	40-34.156	-111.472	-3-92-A	M023	M101	1.23	1.60	75	0.77	<2	1.76	10	56	1
154162	40-34.155	-111.473	-3-92-A	M024	K002	1.01	1.40		0.72	<2	2.48	<10	179	1
154163	40-34.171	-111.469	-3-92-A	M025	D201	4.10	4.70		0.87	<2	2.09	15	138	2
154164	40-34.076	-111.484	-3-92-A	M026	D112	0.90	1.40	75	0.64	<2	1.20	10	63	1
154165	40-34.166	-111.481	-3-92-A	M027	M111	2.45	2.00	65	1.22	<2	0.83	12	50	<1
154166	40-34.174	-111.476	-3-92-A	M028	C211	2.57	4.30	65	0.60	<2	0.57	<10	52	<1
154167	40-34.118	-111.472	-3-92-A	M029	M001	0.81	1.00		0.81	<2	0.94	<10	24	<1
154168	40-34.123	-111.473	-3-92-A	M030	M111	2.07	2.50		0.83	<2	0.63	<10	20	<1
154169	40-34.112	-111.471	-3-92-A	M031	M102	2.34	2.00		1.17	<2	1.19	<10	72	1
154170	40-34.099	-111.454	-3-92-A	M032	M001	0.77	1.10	68	0.70	<2	1.19	<10	44	<1
154171	40-34.106	-111.462	-3-92-A	M033	M002	0.34	0.60	62	0.57	<2	0.47	12	43	<1
154172	40-34.110	-111.469	-3-92-A	M034	M102	1.44	2.20	68	0.65	<2	0.88	<10	37	<1
154173	40-34.137	-111.473	-3-92-A	M035	M101	0.90	0.70		1.29	<2	0.75	<10	23	<1
154174	40-34.138	-111.475	-3-92-A	M036	M001	0.81	0.70		1.16	<2	1.04	13	31	<1
154175	40-34.139	-111.479	-3-92-A	M037	M002	<0.25	0.80		0.16	<2	1.00	<10	23	<1
154176	40-34.154	-111.474	-3-92-A	M038	M101	0.47	0.90	63	0.52	<2	0.66	<10	49	<1
154177	40-34.152	-111.476	-3-92-A	M039	M002	1.01	1.00	68	1.01	2	0.44	<10	29	<1
154178	40-34.127	-111.480	-3-92-A	M040	M101	2.20	5.00		0.44	2	1.27	<10	33	<1
154179	40-34.128	-111.474	-3-92-A	M041	M101	0.70	0.76		0.92	<2	0.57	<10	27	<1
154180	40-34.070	-111.469	-3-92-A	M042	M102	1.12	1.60		0.70	<2	1.25	<10	72	1
154182	40-34.069	-111.468	-3-92-A	M043	M103	1.42	2.00		0.71	<2	0.62	<10	50	<1
154183	40-34.069	-111.466	-3-92-A	M044	M101	0.79	4.20		0.19	<2	1.50	<10	84	<1
154184	40-34.069	-111.463	-3-92-A	M045	M102	1.33	1.60		0.83	<2	0.75	<10	54	<1
154185	40-34.074	-111.452	-3-92-A	M046	M001	0.34	0.50	60	0.68	<2	0.86	<10	42	<1
154186	40-34.071	-111.439	-3-92-A	M047	M202	1.71	2.00	65	0.85	<2	2.20	<10	120	1
154187	40-34.070	-111.438	-3-92-A	M048	M202	1.51	1.50		1.01	<2	1.18	<10	82	<1
154188	40-34.086	-111.436	-3-92-A	M049	M101	0.87	0.80		1.09	<2	0.77	19	36	<1
154189	40-34.077	-111.444	-3-92-A	M050	M001	1.36	0.80		1.70	<2	0.78	<10	21	<1
154190	40-34.066	-111.461	-3-92-A	M051	M001	2.15	2.50		0.86	<2	1.88	87	709	1
154191	40-34.029	-111.473	-3-92-A	M052	D102	1.71	1.80		0.95	<2	0.75	<10	48	<1
154192	40-34.029	-111.471	-3-92-A	M053	D203	4.31	3.60		1.20	<2	3.21	<10	92	1
154193	40-34.029	-111.470	-3-92-A	M054	D103	3.86	3.90		0.99	<2	2.65	<10	142	1
154194	40-34.045	-111.453	-3-92-A	M055	D103	6.37	5.90		1.08	<2	3.05	<10	116	1
154195	40-34.044	-111.451	-3-92-A	M056	D102	3.43	2.50		1.37	<2	1.65	16	34	<1
154196	40-34.044	-111.451	-3-92-A	M057	D203	3.78	2.80		1.35	<2	3.43	<10	76	1
154197	40-34.034	-111.461	-3-92-A	M058	D103	3.85	3.20	150	1.20	<2	3.40	25	193	1
154198	40-34.034	-111.461	-3-92-A	M059	D102	5.73	3.70	75	1.55	<2	2.41	12	247	2
154199	40-34.036	-111.464	-3-92-A	M060	D103	2.63	2.20	75	1.20	<2	2.19	13	40	<1
154200	40-34.036	-111.464	-3-92-A	M061	D203	2.90	2.80		1.04	<2	1.73	<10	61	1
154201	40-34.046	-111.467	-3-92-A	M062	D202	1.43	1.20		1.19	<2	0.57	<10	31	<1
154202	40-34.044	-111.449	-3-92-A	M063	F004	4.26	3.40		1.25	2	6.62	30	1291	3
154203	40-34.057	-111.449	-3-92-A	M064	K012	0.94	1.00	66	0.94	<2	1.85	<10	190	1
154204	40-34.056	-111.447	-3-92-A	M065	D203	12.19	13.20	245	0.92	<2	2.38	12	134	2
154205	40-34.057	-111.445	-3-92-A	M066	D203	4.67	7.60	120	0.61	<2	1.90	<10	135	2
154209	40-34.140	-111.499	-3-92-A	M067	D101	0.68	0.60	70	1.47	<2	0.59	<10	22	1
154210	40-34.136	-111.493	-3-92-A	M068	M102	0.82	0.70	70	1.17	<2	0.78	<10	24	1
154211	40-34.124	-111.505	-3-92-A	M069	M101	1.13	0.60		1.88	<2	0.38	<10	16	1

OR SAMPLE NUMBER	CA (%)	CO (PPM)	CR (PPM)	CU (PPM)	FE (%)	LI (PPM)	MG (%)	MN (PPM)	MO (PPM)	NA (%)	NB (PPM)	NI (PPM)	P (PPM)	SC (PPM)	TH (PPM)
154153	<0.05	<4	11	6	0.96	5	<0.05	95	<4	<0.05	<4	2	86	1	3
154154	<0.05	<4	4	9	1.53	35	<0.05	86	<4	<0.05	6	8	90	3	9
154155	<0.05	<4	4	7	1.74	6	0.09	278	<4	<0.05	15	3	97	4	11
154156	0.05	<4	7	10	1.71	6	0.11	485	<4	<0.05	14	3	121	4	12
154157	<0.05	<4	7	4	0.70	5	<0.05	23	<4	<0.05	<4	2	52	2	9
154158	<0.05	<4	13	4	0.86	5	0.06	21	<4	<0.05	<4	5	63	3	6
154159	<0.05	<4	8	5	0.95	6	<0.05	31	<4	<0.05	<4	3	84	1	3
154160	<0.05	<4	15	<2	4.06	113	<0.05	93	<4	<0.05	<4	3	34	2	<2
154161	<0.05	12	27	10	1.84	64	0.48	60	<4	<0.05	<4	21	65	4	4
154162	<0.05	27	17	22	2.40	23	0.52	150	<4	0.20	<4	14	82	4	5
154163	0.11	10	14	11	8.92	220	0.05	522	<4	<0.05	<4	12	551	4	137
154164	<0.05	<4	10	7	1.10	48	<0.05	30	<4	<0.05	<4	5	68	2	3
154165	<0.05	<4	19	5	1.79	11	0.10	54	<4	<0.05	<4	5	257	2	<2
154166	<0.05	<4	11	2	3.60	7	<0.05	79	<4	<0.05	<4	6	198	2	3
154167	<0.05	<4	7	3	0.34	7	0.38	25	<4	<0.05	<4	4	75	<1	7
154168	<0.05	<4	15	3	0.88	3	0.11	16	<4	<0.05	<4	4	109	<1	2
154169	<0.05	4	44	4	2.23	9	0.20	50	<4	<0.05	<4	11	108	3	6
154170	<0.05	<4	10	<2	2.93	7	0.38	25	<4	<0.05	<4	10	87	1	6
154171	<0.05	<4	7	3	0.14	3	0.14	18	<4	<0.05	<4	3	35	<1	2
154172	<0.05	5	35	9	1.88	8	0.27	48	<4	<0.05	<4	9	81	2	3
154173	<0.05	<4	9	2	1.48	5	0.27	22	<4	<0.05	<4	6	174	<1	<2
154174	<0.05	<4	8	6	0.33	7	0.40	23	<4	<0.05	<4	6	40	<1	4
154175	<0.05	<4	10	10	0.32	6	0.40	32	<4	<0.05	<4	8	63	<1	4
154176	<0.05	<4	12	3	0.83	5	0.14	21	<4	<0.05	<4	8	51	<1	3
154177	<0.05	<4	11	6	0.21	6	0.13	16	<4	<0.05	<4	5	54	1	5
154178	<0.05	7	17	12	0.53	16	0.28	27	<4	<0.05	4	13	59	2	8
154179	<0.05	<4	10	2	0.82	3	0.13	13	<4	<0.05	<4	4	95	<1	5
154180	<0.05	<4	33	9	2.09	8	0.06	68	<4	<0.05	<4	10	141	3	2
154182	0.11	<4	41	3	1.41	6	<0.05	38	<4	<0.05	<4	4	517	2	3
154183	<0.05	<4	10	8	1.06	3	0.06	69	<4	<0.05	<4	5	50	1	<2
154184	<0.05	<4	23	5	1.81	5	<0.05	55	<4	<0.05	<4	11	83	2	3
154185	<0.05	<4	5	3	0.14	5	0.26	13	<4	<0.05	<4	3	42	<1	<2
154186	0.06	<4	25	8	5.16	13	<0.05	222	<4	<0.05	<4	7	246	5	<2
154187	<0.05	<4	33	8	2.73	10	<0.05	138	<4	<0.05	<4	4	130	2	<2
154188	0.06	<4	7	4	0.48	3	0.22	18	<4	<0.05	<4	3	246	<1	5
154189	<0.05	<4	6	5	0.29	9	0.06	62	<4	<0.05	<4	4	70	<1	7
154190	0.18	<4	8	19	0.56	9	0.13	25	<4	<0.05	<4	5	809	1	2
154191	<0.05	<4	11	12	1.51	12	<0.05	108	<4	<0.05	<4	5	109	2	7
154192	<0.05	<4	10	5	2.23	26	<0.05	114	<4	<0.05	10	5	231	4	11
154193	<0.05	<4	14	14	2.19	16	<0.05	128	<4	<0.05	11	10	156	3	13
154194	<0.05	5	60	<2	5.84	30	0.06	111	<4	<0.05	4	9	244	5	19
154195	<0.05	<4	16	3	2.25	11	<0.05	47	<4	<0.05	<4	5	117	2	12
154196	<0.05	<4	17	12	2.08	67	<0.05	104	<4	<0.05	10	7	209	5	11
154197	<0.05	<4	46	6	1.83	9	<0.05	53	<4	<0.05	<4	5	185	5	17
154198	<0.05	6	15	19	3.20	15	<0.05	183	<4	<0.05	5	8	220	4	9
154199	<0.05	<4	14	3	1.89	14	<0.05	54	<4	<0.05	4	4	119	3	8
154200	<0.05	5	34	<2	9.83	23	<0.05	351	<4	<0.05	<4	4	110	4	4
154201	<0.05	<4	18	8	2.12	7	<0.05	71	<4	<0.05	<4	5	42	1	4
154202	<0.05	<4	6	5	1.96	5	0.12	413	<4	0.05	17	4	98	5	12
154203	<0.05	4	17	7	0.87	6	0.20	241	<4	<0.05	<4	7	89	2	<2
154204	0.56	10	42	3	14.46	21	<0.05	573	<4	<0.05	<4	9	2709	12	3
154205	<0.05	10	38	2	16.48	26	<0.05	261	<4	<0.05	<4	8	290	3	<2
154209	<0.05	<4	8	4	0.79	11	<0.05	9	<4	<0.05	<4	4	49	<1	4
154210	<0.05	4	9	4	0.68	8	0.27	19	<4	<0.05	<4	6	59	1	6
154211	<0.05	<4	13	3	0.68	6	<0.05	13	<4	<0.05	<4	2	34	<1	4

OR SAMPLE NUMBER	TI (PPM)	V (PPM)	Y (PPM)	ZN (PPM)	ZR (PPM)	K (%)	SR (PPM)	CE (PPM)
154153	719	6	7	6	61	<0.02	102	35
154154	843	12	29	21	174	0.09	36	66
154155	1221	12	41	66	191	3.07	24	88
154156	1038	11	38	69	178	2.54	32	99
154157	317	11	9	8	63	0.06	38	30
154158	468	20	7	4	46	0.75	9	22
154159	366	12	5	7	64	0.31	28	18
154160	691	14	6	10	117	0.10	18	20
154161	1061	16	15	23	102	0.18	33	38
154162	817	23	11	39	61	0.43	13	40
154163	505	30	18	30	126	0.62	45	39
154164	583	11	5	12	55	0.24	24	28
154165	672	21	9	15	86	0.21	26	23
154166	268	26	6	11	58	0.14	9	15
154167	363	4	5	12	112	<0.02	16	30
154168	325	5	9	10	167	0.06	33	15
154169	1145	29	14	19	151	0.21	55	37
154170	174	14	3	15	35	0.09	22	15
154171	115	3	2	12	24	<0.02	8	13
154172	655	18	10	19	168	0.04	47	30
154173	120	4	2	15	27	<0.02	13	<10
154174	120	4	3	15	55	0.02	11	17
154175	215	4	3	18	47	0.02	11	21
154176	223	4	3	10	46	0.06	19	14
154177	261	5	6	9	116	<0.02	20	30
154178	3174	21	16	49	381	0.09	19	28
154179	107	5	2	8	26	0.05	24	21
154180	879	20	10	10	91	0.31	47	35
154182	721	13	10	7	115	0.16	45	28
154183	348	10	7	11	52	0.36	20	21
154184	807	16	10	9	90	0.15	33	24
154185	83	<2	2	6	33	0.07	19	14
154186	915	51	10	15	88	0.35	36	27
154187	516	17	9	10	71	0.19	34	26
154188	109	4	2	12	23	0.11	9	16
154189	447	3	3	11	57	0.02	4	18
154190	373	12	10	6	49	1.59	24	11
154191	408	7	13	7	80	0.05	81	52
154192	1309	18	28	18	217	0.08	177	89
154193	1217	19	46	67	260	0.36	68	134
154194	797	52	26	14	194	0.36	197	75
154195	728	16	13	8	117	0.02	81	47
154196	1059	12	43	16	228	0.15	134	116
154197	773	17	23	18	196	1.06	217	131
154198	594	29	34	35	205	0.48	115	108
154199	848	20	15	8	122	0.14	77	56
154200	835	29	11	20	73	0.09	86	43
154201	242	14	3	11	28	0.05	12	21
154202	1034	6	44	79	313	2.50	20	163
154203	489	8	2	12	6	0.68	18	36
154204	1199	56	32	30	184	0.31	88	96
154205	797	110	13	32	125	0.06	154	79
154209	120	2	1	3	20	0.20	13	<10
154210	167	3	1	12	15	0.06	13	24
154211	105	4	2	3	24	0.12	13	14

OF SAMPLE NUMBER	D. O. E. SAMPLE NUMBER ST LAT	LONG	L TY REP	SITE	S-CC	U-FL (PPM)	U-NT (PPM)	TUT (CPS)	U/TU	AG (PPM)	AL (%)	B (PPM)	BA (PPM)	BE (PPM)
154212	40-34.077	-111.501	-3-92-A	M070	M202	1.02	1.30	80	0.78	<2	0.56	<10	21	1
154213	40-34.131	-111.505	-3-92-A	M071	D201	1.78	1.40	105	1.27	<2	0.48	<10	29	1
154214	40-34.124	-111.506	-3-92-A	M072	M101	2.23	1.50	70	1.49	<2	0.76	<10	35	1
154215	40-34.118	-111.515	-3-92-A	M073	D202	10.46	12.70	150	0.82	2	1.50	<10	110	5
154216	40-34.114	-111.518	-3-92-A	M074	D204	4.32	5.40	205	0.80	<2	2.72	<10	181	3
154217	40-34.113	-111.517	-3-92-A	M075	D203	5.33	14.00	300	0.67	3	2.04	<10	186	7
154218	40-34.109	-111.516	-3-92-A	M076	M202	3.38	2.80	70	1.21	<2	1.76	13	94	1
154219	40-34.104	-111.517	-3-92-A	M077	D203	8.86	10.30	165	0.86	<2	3.59	28	99	4
154220	40-34.086	-111.532	-3-92-A	M078	K001	2.36	1.10	85	2.15	<2	1.46	17	158	1
154221	40-34.085	-111.532	-3-92-A	M079	M102	2.60	1.30	140	2.00	<2	1.77	20	78	1
154222	40-34.088	-111.534	-3-92-A	M080	D211	2.97	2.80	100	1.06	2	3.12	16	230	5
154223	40-34.095	-111.522	-3-92-A	M081	M202	3.31	2.90	70	1.14	<2	3.38	19	321	2
154224	40-34.097	-111.523	-3-92-A	M082	K001	1.37	1.10	90	1.25	<2	1.87	<10	198	1
154225	40-34.097	-111.526	-3-92-A	M083	D202	1.46	1.30	120	1.12	<2	0.91	16	62	<1
154226	40-34.072	-111.544	-3-92-A	M084	D113	1.30	1.40		0.93	<2	0.63	<10	45	<1
154227	40-34.105	-111.428	-3-92-	M085	D101	2.11	1.00	58	2.11	<2	0.81	16	62	<1
154228	40-34.102	-111.434	-3-92-A	M086	D202	2.85	3.40		0.84	<2	3.63	<10	107	3
154229	40-34.102	-111.436	-3-92-A	M087	D203	2.83	4.60	163	0.62	<2	1.02	<10	62	<1
154230	40-34.056	-111.434	-3-92-A	M088	M102	4.10	1.30	70	3.15	<2	3.99	<10	144	1
154231	40-34.119	-111.428	-3-92-A	M089	D103	3.60	4.30	130	0.84	<2	1.96	<10	68	3
154232	40-34.119	-111.427	-3-92-A	M090	D203	1.77	1.70	110	1.04	<2	0.49	<10	26	1
154233	40-34.119	-111.427	-3-92-A	M091	D204	5.37	4.80	75	1.12	<2	0.76	<10	77	1
154234	40-34.119	-111.426	-3-92-A	M092	D203	3.63	3.50	123	1.04	<2	1.71	<10	36	2
154236	40-34.119	-111.426	-3-92-A	M093	D202	3.74	3.80	150	0.98	<2	1.55	<10	67	3
154237	40-34.075	-111.433	-3-92-	M094	M202	1.50	1.50		1.00	<2	1.08	<10	44	2
154238	40-34.357	-111.459	-3-92-A	P011	M101	1.41	2.00	65	0.70	<2	0.57	<10	28	1
154239	40-34.352	-111.454	-3-92-A	P012	M110	5.71	7.70	228	0.74	2	2.38	<10	305	7
154240	40-33.962	-111.271	-3-92-A	D055	A202	2.15	2.90	205	0.74	2	1.36	<10	259	2
154241	40-33.967	-111.271	-3-92-	D056	V003	4.15	3.50	140	1.19	<2	5.42	12	883	8
154242	40-33.969	-111.275	-3-92-A	D057	A003	2.11	2.00	105	1.05	2	2.38	<10	401	3
154245	40-******	-*******	-3-92-A	M78A	K210	1.73	1.80	100	0.96	<2	3.27	<10	124	4
154246	40-******	-*******	-3-92-A	S158	B103	1.62	1.50	115	1.08	<2	1.53	13	203	1
154247	40-******	-*******	-3-92-A	S018	S004	1.43	1.30	120	1.10	<2	1.42	<10	456	<1
154248	40-******	-*******	-3-92-A	S019	S003	1.61	2.50	110	0.64	<2	2.51	18	474	1
154249	40-******	-*******	-3-92-A	S020	T103	2.70	3.20	160	0.84	<2	5.89	<10	561	2
154250	40-******	-*******	-3-92-A	S021	L003	3.64	4.10	225	0.89	<2	0.20	18	78	<1
154251	40-******	-*******	-3-92-A	S022	U403	2.65	2.20	110	1.20	<2	1.91	89	726	1
154252	40-******	-*******	-3-92-A	S023	E003			90						
154253	40-******	-*******	-3-92-A	S024	B103	2.26	2.30	175	0.98	<2	1.49	12	199	1
154254	40-******	-*******	-3-92-A	S025	L002	0.85	1.70	90	0.50	<2	0.56	<10	57	<1
154255	40-******	-*******	-3-92-A	S026	U102	1.58	1.80	180	0.88	<2	2.38	<10	335	<1
154256	40-******	-*******	-3-92-A	S027	B103	1.49	1.50	120	0.99	<2	2.32	<10	314	<1
154257	40-******	-*******	-3-92-A	S028	B003	1.69	2.00	175	0.94	<2	0.71	12	53	<1
154258	40-******	-*******	-3-92-A	S029	E103	1.02	1.34	110	0.76	<2	0.81	<10	109	<1
154259	40-******	-*******	-3-92-A	S030	E103	0.84	0.90	120	0.93	<2	2.72	<10	324	<1
154260	40-******	-*******	-3-92-A	S031	B103	2.15	2.20	140	0.98	<2	3.30	<10	402	<1
154261	40-37.101	-111.502	-3-92-A	M022	M001	0.86	0.90		0.96	<2	0.40	<10	29	<1
154262	40-34.053	-111.475	-3-92-A	M095	D203	3.83	3.60	130	1.06	<2	3.87	<10	97	1
154263	40-34.055	-111.476	-3-92-A	M096	D203	4.18	4.40	120	0.95	<2	3.98	<10	120	1
154264	40-34.056	-111.476	-3-92-A	M097	D203	7.50	7.40	105	1.01	<2	3.50	<10	138	1
154265	40-34.056	-111.476	-3-92-A	M098	B102	5.70	5.50		1.04	2	3.76	<10	145	1
154266	40-34.057	-111.476	-3-92-A	M099	D102	4.03	4.10	144	0.98	<2	6.30	20	253	2
154267	40-34.052	-111.508	-3-92-A	M100	D212	11.00	13.00	140	0.85	<2	2.88	<10	47	1
154268	40-34.053	-111.509	-3-92-A	M101	M102	1.12	1.10	100	1.02	<2	1.52	14	125	<1
154269	40-34.054	-111.503	-3-92-A	M102	D203	5.50	8.10	140	0.68	<2	3.22	<10	30	1

OR SAMPLE NUMBER	CA (%)	CO (PPM)	CR (PPM)	CU (PPM)	FE (%)	LI (PPM)	MG (%)	MN (PPM)	MO (PPM)	NA (%)	NB (PPM)	NI (PPM)	P (PPM)	SC (PPM)	TH (PPM)
154212	<0.05	6	13	21	1.32	3	0.1[illegible]	31	<4	<0.05	<4	5	84	1	5
154213	<0.05	6	11	5	2.68	2	<0.05	29	<4	<0.05	<4	3	65	1	4
154214	<0.05	6	11	4	1.46	8	0.19	48	<4	<0.05	<4	7	89	2	2
154215	0.45	28	32	11	11.50	46	0.05	150	6	<0.05	8	11	2045	9	10
154216	<0.05	16	13	11	7.59	42	<0.05	58	5	<0.05	12	3	301	5	7
154217	0.31	27	18	13	11.80	59	<0.05	97	10	<0.05	11	8	1702	6	10
154218	0.07	5	26	6	4.90	16	0.16	88	<4	<0.05	<4	15	291	3	5
154219	<0.05	14	54	14	18.17	156	0.18	188	<4	<0.05	<4	18	330	10	<2
154220	<0.05	7	26	39	2.13	7	0.12	53	<4	<0.05	<4	6	104	2	7
154221	<0.05	<4	19	8	1.68	5	0.10	39	<4	<0.05	<4	10	65	3	10
154222	0.22	5	19	21	7.0[illegible]	214	0.09	656	<4	<0.05	<4	11	1303	6	3
154223	0.05	<4	17	8	2.27	107	0.05	51	<4	0.06	<4	8	217	5	3
154224	<0.05	5	15	22	0.77	8	0.16	68	<4	<0.05	4	6	68	2	7
154225	0.05	<4	25	4	2.51	7	0.25	85	<4	<0.05	<4	10	94	2	<2
154226	<0.05	<4	11	7	0.46	9	0.08	23	<4	<0.05	<4	3	102	<1	6
154227	0.06	<4	12	11	0.44	2	<0.05	32	<4	<0.05	<4	3	258	1	4
154228	0.51	46	20	105	16.63	26	0.09	1428	<4	0.11	<4	21	1941	26	2
154229	<0.05	<4	22	6	2.00	3	<0.05	17	<4	<0.05	<4	4	48	1	<2
154230	0.14	25	42	75	8.64	33	0.09	354	<4	0.07	<4	22	711	17	12
154231	<0.05	11	42	12	3.45	23	0.09	119	<4	<0.05	10	8	176	7	14
154232	<0.05	<4	17	5	0.82	7	<0.05	22	<4	<0.05	<4	4	45	1	2
154233	<0.05	15	30	5	6.47	22	<0.05	106	<4	<0.05	8	5	204	6	5
154234	<0.05	5	15	6	2.19	14	<0.05	27	4	<0.05	8	2	130	4	7
154236	<0.05	5	14	9	2.21	16	<0.05	48	<4	<0.05	8	4	207	4	5
154237	<0.05	5	20	5	1.96	11	<0.05	110	<4	<0.05	<4	6	126	3	4
154238	<0.05	<4	10	4	0.63	4	<0.05	24	<4	<0.05	<4	2	80	1	13
154239	<0.05	11	60	13	3.80	3	0.10	175	9	<0.05	13	9	304	5	91
154240	0.08	7	32	5	2.42	6	0.05	84	<4	0.10	<4	4	382	4	41
154241	0.26	11	23	21	2.68	8	0.34	815	<4	1.23	11	10	548	13	14
154242	0.74	14	32	22	2.79	8	0.19	660	<4	0.08	<4	21	1281	8	5
154245	<0.05	26	29	29	8.44	86	0.29	117	5	<0.05	8	7	186	6	6
154246	0.06	<4	11	6	1.09	8	0.08	43	<4	<0.05	<4	7	259	2	<2
154247	0.09	4	19	4	1.95	22	0.13	78	<4	0.12	<4	5	282	2	4
154248	0.11	<4	31	<2	3.15	28	0.26	120	<4	0.14	<4	8	661	4	7
154249	0.27	12	8	3	3.70	11	0.68	105	<4	0.08	15	14	1201	7	5
154250	7.05	17	4	158	1.95	21	4.62	1016	<4	0.07	<4	12	1352	2	30
154251	0.18	<4	8	20	0.57	10	0.13	25	<4	<0.05	<4	4	813	1	<2
154252															
154253	0.06	<4	11	6	1.07	7	0.08	91	<4	<0.05	<4	5	248	2	4
154254	<0.05	<4	10	18	0.35	8	0.20	24	<4	<0.05	<4	6	65	2	3
154255	0.06	<4	11	6	1.09	4	0.05	30	<4	<0.05	<4	6	264	2	3
154256	<0.05	<4	7	4	1.38	53	<0.05	27	<4	<0.05	<4	7	95	1	3
154257	<0.05	<4	9	16	1.04	8	0.15	35	<4	<0.05	<4	5	136	2	2
154258	<0.05	<4	7	2	0.63	9	0.08	23	<4	<0.05	<4	<2	116	1	2
154259	0.08	<4	9	4	1.82	4	<0.05	27	<4	0.05	<4	3	312	1	2
154260	0.24	<4	8	6	1.82	5	0.13	64	<4	0.05	<4	5	1175	2	4
154261	<0.05	<4	7	3	0.17	4	0.22	55	<4	<0.05	<4	2	45	<1	5
154262	<0.05	<4	6	5	1.78	64	<0.05	167	<4	<0.05	12	2	190	2	10
154263	<0.05	5	4	7	1.95	127	<0.05	333	<4	0.08	17	7	202	2	7
154264	<0.05	7	18	2	10.52	75	<0.05	1037	4	<0.05	7	6	253	3	11
154265	<0.05	8	11	7	2.37	40	<0.05	170	<4	0.05	15	10	254	4	17
154266	<0.05	<4	7	5	1.52	3	0.11	77	<4	0.08	17	7	61	2	16
154267	<0.05	<4	16	<2	10.71	12	<0.05	84	<4	<0.05	<4	3	230	13	7
154268	<0.05	<4	13	10	1.24	7	0.12	50	<4	0.07	<4	4	86	2	2
154269	0.28	<4	37	<2	9.69	14	<0.05	84	<4	<0.05	<4	5	1345	21	<2

OR SAMPLE NUMBER	TI (PPM)	V (PPM)	Y (PPM)	ZN (PPM)	ZR (PPM)	K (%)	SR (PPM)	CE (PPM)
154212	231	4	2	14	40	0.06	22	15
154213	243	20	6	3	47	0.22	27	17
154214	572	8	8	9	88	0.12	33	20
154215	578	150	37	23	128	0.51	36	33
154216	551	16	20	14	152	0.81	61	45
154217	608	26	35	25	126	0.51	121	98
154218	609	38	11	19	75	0.41	48	32
154219	705	101	16	381	104	0.05	82	243
154220	437	16	8	15	46	0.48	12	23
154221	896	14	8	11	79	0.50	28	45
154222	703	56	20	162	56	0.43	149	29
154223	692	17	15	50	145	1.23	29	52
154224	477	13	8	10	47	0.73	9	42
154225	570	14	6	16	43	0.12	29	14
154226	310	4	4	20	68	0.12	20	24
154227	289	16	4	19	28	0.29	7	12
154228	2217	196	22	68	14	0.16	34	<10
154229	469	14	8	6	63	0.37	15	15
154230	2792	143	17	68	174	0.62	36	42
154231	1402	29	13	17	178	0.22	63	81
154232	482	9	3	5	46	0.06	20	12
154233	576	110	11	4	95	0.03	23	12
154234	1115	23	22	11	145	0.02	46	64
154236	1089	21	24	15	174	0.06	58	56
154237	824	18	10	7	80	0.21	79	28
154238	288	8	9	2	155	<0.02	71	25
154239	2456	57	29	14	752	1.23	245	82
154240	902	45	13	4	141	0.45	66	30
154241	2360	53	34	76	100	2.19	67	90
154242	1089	50	14	40	60	1.06	47	35
154245	1101	44	8	6	89	0.62	17	<10
154246	829	22	11	45	62	1.31	74	22
154247	1295	38	7	8	23	1.29	23	12
154248	2027	62	11	16	36	1.42	22	32
154249	2755	52	43	11	250	5.29	16	134
154250	110	22	25	374	32	<0.02	126	<10
154251	381	12	10	6	50	1.66	24	<10
154252								
154253	813	21	11	44	61	1.27	72	22
154254	123	51	4	85	48	0.41	4	<10
154255	850	25	12	14	61	2.52	59	26
154256	576	17	10	9	55	2.41	10	16
154257	307	14	7	18	27	0.54	6	33
154258	522	12	5	4	34	0.58	6	17
154259	384	21	6	6	49	3.11	13	40
154260	605	30	20	15	58	4.86	21	57
154261	195	3	2	14	28	<0.02	5	21
154262	740	6	33	25	201	0.08	99	101
154263	986	6	38	34	233	0.08	92	139
154264	1430	24	35	44	206	0.12	100	136
154265	1644	14	35	40	305	0.23	90	135
154266	924	8	49	77	229	1.66	9	91
154267	1559	208	11	16	110	0.06	65	55
154268	685	14	10	12	75	0.76	14	33
154269	1586	91	16	19	57	0.04	17	<10

OR SAMPLE NUMBER	D. O. F. SAMPLE NUMBER ST LAT	LONG	L TY REP	SITE	S-CC	U-FL (PPM)	U-NT (PPM)	TOT (CPS)	U/TU	AG (PPM)	AL (%)	B (PPM)	BA (PPM)	BE (PPM)
154270	40-34.056	-111.497	-3-92-A	M103	D202	1.90	1.80	135	1.06	<2	1.22	<10	59	1
154271	40-34.079	-111.494	-3-92-A	M104	M101	0.50	0.70		0.71	<2	0.49	13	27	<1
154272	40-34.074	-111.226	-3-92-A	M105	M101	0.95	1.00		0.95	2	0.65	<10	22	<1
154273	40-34.072	-111.492	-3-92-A	M106	M001	0.84	0.80		1.05	<2	0.70	<10	63	<1
154274	40-34.071	-111.491	-3-92-A	M107	M101	0.44	0.80		0.55	<2	0.49	<10	19	<1
154275	40-34.068	-111.504	-3-92-A	M108	M111	0.62	0.60		1.03	<2	0.46	<10	24	<1
154276	40-34.063	-111.499	-3-92-A	M109	M201	1.48	2.30		0.64	<2	0.85	<10	53	1
154277	40-34.061	-111.496	-3-92-A	M110	M201	1.10	1.40		0.79	<2	0.71	<10	39	<1
154278	40-34.063	-111.492	-3-92-A	M111	M202	1.55	2.30		0.67	<2	0.68	<10	36	<1
154279	40-34.067	-111.483	-3-92-A	M112	M101	0.89	1.00	55	0.89	<2	0.65	<10	43	<1
154280	40-34.069	-111.483	-3-92-A	M113	M101	0.71	0.80	57	0.89	<2	0.34	15	24	<1
154281	40-34.067	-111.496	-3-92-A	M114	M101	0.75	1.30	62	0.58	<2	0.64	<10	38	<1
154282	40-34.058	-111.476	-3-92-A	M115	C102	4.98	6.30		0.79	<2	6.49	<10	234	2
154284	40-34.060	-111.481	-3-92-A	M116	D102	3.98	4.60		0.87	<2	3.67	<10	173	1
154285	40-34.058	-111.478	-3-92-A	M117	D103	4.38	5.70		0.77	<2	4.11	<10	142	1
154286	40-34.044	-111.517	-3-92-A	M118	M202	3.86	5.80		0.67	<2	0.71	<10	38	<1
154287	40-34.041	-111.517	-3-92-A	M119	C201	0.57	3.50		0.16	<2	<0.05	<10	2	<1
154288	40-34.034	-111.535	-3-92-A	M120	M101	3.00	0.90		3.33	<2	1.24	54	88	1
154289	40-34.056	-111.536	-3-92-A	M121	K001	1.62	1.40		1.16	<2	2.47	13	281	1
154290	40-34.055	-111.536	-3-92-A	M122	M101	0.77	0.80		0.96	<2	0.23	<10	14	<1
154291	40-34.050	-111.534	-3-92-A	M123	M101	0.83	0.70		1.19	<2	0.50	<10	16	<1
154292	40-34.042	-111.536	-3-92-A	M124	M001	0.77	0.70		1.10	<2	0.79	<10	72	<1
154293	40-34.064	-111.554	-3-92-A	M125	C102	5.09	5.40	122	0.94	2	2.71	<10	136	2
154294	40-34.063	-111.559	-3-92-A	M126	C103	3.75	4.90	180	0.77	<2	4.43	<10	90	1
154295	40-34.062	-111.559	-3-92-A	M127	C102	0.77	4.00	180	0.19	2	3.64	12	116	1
154296	40-34.071	-111.551	-3-92-A	M128	C103	2.08	2.60	110	0.80	<2	3.25	14	181	1
154297	40-34.029	-111.553	-3-92-A	M129	C103	0.63	1.80		0.35	<2	1.04	<10	59	<1
154298	40-34.030	-111.557	-3-92-A	M130	C103	2.61	4.40		0.59	<2	3.16	<10	88	1
154299	40-34.044	-111.551	-3-92-A	M131	D204	4.12	4.20		0.98	<2	4.06	<10	223	1
154300	40-34.037	-111.555	-3-92-A	M132	D202	1.90	2.10	150	0.90	<2	1.64	<10	100	1
154301	40-34.036	-111.555	-3-92-A	M133	D203	2.59	3.40	190	0.76	<2	3.25	<10	78	1
154307	40-34.108	-111.442	-3-92-A	M134	M202	3.81	4.90		0.78	<2	0.73	<10	111	<1
154308	40-34.116	-111.442	-3-92-A	M135	D201	1.47	2.20		0.67	<2	0.61	<10	54	<1
154309	40-34.115	-111.447	-3-92-A	M136	D202	2.69	5.00		0.54	<2	1.25	12	80	1
154310	40-34.117	-111.456	-3-92-A	M137	D202	1.12	1.90		0.59	<2	1.83	<10	65	<1
154311	40-34.137	-111.469	-3-92-A	M138	C102	1.46	1.80	75	0.81	<2	0.63	<10	44	<1
154312	40-34.134	-111.466	-3-92-A	M139	D203	11.87	18.90	190	0.63	<2	1.51	<10	79	2
154313	40-34.245	-111.658	-3-92-A	M140	V003	1.70	2.20	120	0.77	<2	6.73	57	968	1
154314	40-34.259	-111.611	-3-92-A	M141	V103	1.23	1.30	150	0.68	<2	6.70	49	1087	2
154315	40-34.239	-111.575	-3-92-A	M142	V003	2.28	2.20	85	1.04	<2	7.66	30	1237	1
154316	40-33.669	-111.166	-3-92-A	S041	U003	2.07	1.90	165	1.09	<2	2.25	19	235	<1
154317	40-33.663	-111.169	-3-92-A	S042	S004	3.71	3.40	140	1.09	<2	4.93	66	588	1
154318	40-33.653	-111.130	-3-92-A	S043	U203	2.23	2.70	160	0.83	<2	2.44	<10	196	<1
154319	40-33.658	-111.145	-3-92-A	S044	S004	2.81	2.60	130	1.08	<2	2.87	34	528	1
154320	40-33.517	-110.874	-3-92-A	S045	U203	1.21	2.10	95	0.58	<2	0.79	14	99	<1
154321	40-33.517	-110.889	-3-92-A	S046	B003	0.42	0.90	120	0.47	<2	0.91	<10	143	<1
154322	40-33.514	-110.722	-3-92-A	S047	U002	1.56	2.30	120	0.68	<2	3.05	15	450	1
154323	40-33.512	-110.720	-3-92-A	S048	U003	0.80	0.80	85	1.00	<2	1.30	<10	239	<1
154324	40-33.506	-110.724	-3-92-A	S049	B003	1.31	1.30	95	1.01	<2	1.53	12	136	1
154325	40-33.716	-111.068	-3-92-A	S050	U110	1.56	1.80	285	0.87	<2	5.48	<10	913	1
154326	40-33.772	-111.109	-3-92-A	S051	S203	1.17	1.30		0.90	<2	1.98	14	142	<1
154327	40-33.771	-111.104	-3-92-A	S052	U203	1.17	1.10		1.06	<2	2.27	<10	246	<1
154328	40-33.780	-111.132	-3-92-A	S053	U203	1.31	1.30		1.01	<2	3.21	26	511	1
154329	40-33.547	-110.794	-3-92-A	S054	U203	0.40	0.60	110	0.67	<2	1.09	32	165	<1
154330	40-33.761	-110.916	-3-92-A	S032	B003	1.10	0.60	50	1.83	<2	0.76	<10	32	<1

OR SAMPLE NUMBER	CA (%)	CO (PPM)	CR (PPM)	CU (PPM)	FE (%)	LI (PPM)	MG (%)	MN (PPM)	MO (PPM)	NA (%)	NB (PPM)	NI (PPM)	P (PPM)	SC (PPM)	TH (PPM)
154270	<0.05	<4	10	6	2.00	19	<0.05	34	<4	<0.05	<4	2	146	2	8
154271	<0.05	<4	8	2	0.62	2	<0.05	25	<4	<0.05	<4	3	34	<1	4
154272	<0.05	<4	11	7	0.95	2	0.10	19	<4	<0.05	<4	7	48	1	5
154273	<0.05	<4	7	6	0.32	8	0.24	48	<4	<0.05	<4	3	36	1	6
154274	<0.05	<4	13	6	0.87	1	<0.05	25	<4	<0.05	<4	4	51	<1	<2
154275	<0.05	<4	12	9	0.81	2	<0.05	86	<4	<0.05	<4	7	58	<1	<2
154276	<0.05	4	12	<2	9.96	3	<0.05	27	<4	<0.05	<4	3	167	1	6
154277	<0.05	5	29	6	4.92	8	0.17	124	<4	<0.05	<4	10	46	1	4
154278	<0.05	4	26	7	1.71	5	0.18	63	<4	<0.05	<4	10	164	1	5
154279	<0.05	<4	15	6	1.26	2	<0.05	29	<4	<0.05	<4	6	53	1	4
154280	<0.05	<4	17	10	0.82	3	<0.05	26	<4	<0.05	<4	5	50	1	6
154281	<0.05	<4	7	3	1.99	4	0.08	19	<4	<0.05	<4	4	51	<1	<2
154282	<0.05	6	11	6	2.65	33	0.09	167	<4	<0.05	24	8	435	8	23
154284	<0.05	7	12	8	2.02	26	<0.05	108	<4	<0.05	11	10	321	5	11
154285	<0.05	6	15	6	2.64	27	0.08	266	<4	<0.05	11	7	285	6	26
154286	<0.05	<4	45	<2	11.93	5	0.15	58	<4	<0.05	<4	7	15	3	2
154287	<0.05	<4	<1	<2	0.32	1	<0.05	<4	<4	<0.05	<4	<2	5	<1	<2
154288	<0.05	<4	49	7	8.80	8	0.13	73	<4	<0.05	<4	6	138	2	4
154289	<0.05	7	12	13	0.78	7	0.13	112	<4	0.05	<4	4	107	3	<2
154290	<0.05	<4	9	3	0.58	2	<0.05	20	<4	<0.05	<4	3	54	<1	4
154291	<0.05	4	12	3	0.45	4	0.17	16	<4	<0.05	<4	6	87	<1	4
154292	<0.05	<4	5	5	0.22	7	0.18	18	<4	<0.05	<4	7	45	<1	4
154293	<0.05	<4	11	15	2.88	63	<0.05	131	<4	<0.05	5	4	246	5	15
154294	<0.05	<4	8	6	2.30	61	<0.05	103	<4	<0.05	10	5	141	5	6
154295	<0.05	<4	10	8	1.96	23	<0.05	86	<4	<0.05	6	3	164	6	8
154296	<0.05	<4	6	25	0.74	56	<0.05	26	<4	0.05	<4	5	172	3	5
154297	<0.05	<4	8	7	0.68	61	<0.05	19	<4	<0.05	<4	2	99	2	<2
154298	<0.05	<4	9	5	1.83	33	<0.05	22	<4	<0.05	4	3	138	4	9
154299	<0.05	6	15	4	8.69	47	<0.05	730	<4	<0.05	<4	4	234	6	8
154300	<0.05	<4	12	7	1.44	81	<0.05	109	<4	<0.05	<4	4	165	3	4
154301	<0.05	<4	6	9	1.83	83	<0.05	68	<4	<0.05	5	5	124	5	<2
154307	0.76	<4	18	2	5.64	4	<0.05	86	<4	<0.05	<4	7	3781	2	<2
154308	0.14	<4	31	5	4.08	4	0.05	36	<4	<0.05	<4	8	666	1	5
154309	<0.05	5	41	<2	9.57	5	0.05	47	<4	<0.05	<4	7	114	4	11
154310	<0.05	<4	15	4	2.92	18	<0.05	52	<4	<0.05	<4	4	183	3	4
154311	<0.05	4	18	4	2.19	27	0.05	45	<4	<0.05	<4	6	51	2	5
154312	0.75	14	114	<2	29.28	13	<0.05	658	<4	<0.05	<4	22	3588	11	5
154313	0.21	8	22	15	3.76	15	0.46	448	<4	0.61	<4	17	687	8	8
154314	0.13	9	11	6	3.13	40	0.24	246	<4	0.23	9	25	205	4	5
154315	1.65	14	59	30	4.20	63	1.44	1224	<4	2.32	<4	29	731	11	3
154316	0.05	<4	17	4	1.97	4	<0.05	24	<4	<0.05	<4	4	267	2	<2
154317	0.05	<4	8	6	2.20	8	0.15	122	<4	0.05	5	7	61	3	7
154318	0.39	5	11	5	1.59	7	<0.05	60	<4	<0.05	<4	6	1915	2	<2
154319	<0.05	<4	17	7	1.60	11	0.12	134	<4	0.06	<4	3	205	2	10
154320	0.07	<4	20	3	2.14	4	<0.05	23	<4	<0.05	<4	4	343	1	7
154321	0.08	<4	7	10	0.14	5	<0.05	12	<4	<0.05		2	353	1	2
154322	0.06	6	10	10	0.51	4	<0.05	267	<4	<0.05		5	613	1	5
154323	<0.05	<4	7	7	0.25	3	<0.05	24	<4	<0.05	<4	3	117	1	<2
154324	<0.05	<4	10	7	0.32	7	0.05	23	<4	<0.05	<4	4	88	1	8
154325	0.12	7	13	72	1.55	10	0.24	127	4	0.12	<4	18	344	4	2
154326	0.05	<4	10	4	0.91	9	0.09	18	<4	<0.05	<4	3	311	2	5
154327	0.10	4	6	8	0.69	3	<0.05	126	<4	<0.05	<4	4	818	1	<2
154328	0.09	<4	9	3	0.99	17	0.09	21	<4	0.07	<4	4	428	1	4
154329	0.07	<4	8	4	0.51	3	<0.05	23	<4	<0.05	<4	3	323	1	<2
154330	<0.05	<4	6	3	0.93	8	0.05	24	<4	<0.05	<4	5	73	<1	<2

OR SAMPLE NUMBER	TI (PPM)	V (PPM)	Y (PPM)	ZN (PPM)	ZR (PPM)	K (%)	SR (PPM)	CE (PPM)
154270	416	7	10	10	110	0.09	39	89
154271	167	2	1	4	21	0.02	16	17
154272	217	4	2	6	39	<0.02	13	26
154273	338	4	3	14	45	0.24	4	22
154274	158	<2	2	4	24	0.04	16	<10
154275	132	5	1	5	19	<0.02	10	19
154276	273	43	2	13	20	0.20	25	24
154277	458	18	4	17	41	0.08	22	20
154278	729	9	8	16	208	0.07	22	21
154279	413	10	5	6	41	0.36	23	23
154280	282	6	4	4	43	0.10	12	16
154281	192	7	2	9	31	0.13	18	11
154282	2037	12	50	44	425	0.10	204	343
154284	1193	11	31	27	227	0.34	151	140
154285	2223	16	34	45	361	0.12	145	187
154286	729	112	9	18	102	0.08	13	11
154287	21	<2	<1	2	3	0.11	1	<10
154288	721	53	8	16	108	0.33	31	33
154289	657	19	11	14	58	0.87	20	36
154290	187	2	3	3	44	<0.02	9	14
154291	183	3	2	9	25	0.03	33	18
154292	264	2	2	6	28	0.06	12	11
154293	1550	14	28	22	425	0.37	82	130
154294	1035	10	53	23	323	0.48	13	126
154295	1075	11	30	19	278	0.76	43	118
154296	323	4	20	13	169	0.72	36	44
154297	458	3	10	6	87	0.11	28	47
154298	780	9	22	11	162	0.35	39	63
154299	898	16	24	32	201	0.50	54	87
154300	571	9	10	11	103	0.08	52	69
154301	620	8	18	15	158	0.13	34	40
154307	582	48	17	16	55	0.15	24	<10
154308	502	37	5	13	36	0.17	9	23
154309	1077	207	7	19	131	0.38	48	73
154310	576	17	11	9	69	0.07	53	67
154311	436	20	5	14	87	0.11	24	31
154312	1002	186	23	58	98	0.10	52	49
154313	2518	99	13	48	99	2.49	60	31
154314	650	53	13	89	95	2.69	66	15
154315	2834	93	13	94	91	1.96	397	51
154316	453	21	11	8	65	2.74	18	51
154317	660	22	26	55	154	2.89	15	30
154318	486	26	15	13	91	3.10	5	49
154319	653	17	9	19	86	2.06	49	53
154320	819	36	5	7	28	0.59	6	18
154321	265	10	4	10	27	0.78	8	<10
154322	384	13	16	58	81	2.83	25	50
154323	149	7	3	43	21	1.53	5	16
154324	352	11	6	74	31	1.21	5	10
154325	629	20	10	51	99	5.41	74	47
154326	492	14	6	4	52	1.45	6	15
154327	184	6	10	7	63	2.88	13	61
154328	451	8	9	8	77	2.86	24	26
154329	189	9	4	10	16	1.05	12	<10
154330	225	12	2	5	28	0.33	8	17

OR SAMPLE NUMBER	D. G. E. SAMPLE NUMBER ST LAT	LONG	L TY REP	SITE	S-GC	U-FL (PPM)	U-NT (PPM)	TOT (CPS)	U/TU	AG (PPM)	AL (%)	B (PPM)	BA (PPM)	BE (PPM)
154331	40-33.726	-110.844	-3-92-A	S033	S103	2.06	2.30	200	0.90	<2	2.65	14	417	1
154332	40-33.738	-110.848	-3-92-A	S034	B103	0.95	1.10	125	0.86	<2	1.68	15	320	1
154333	40-33.756	-110.860	-3-92-A	S035	U420	470.80	462.80	800	1.02	2	6.99	11	572	1
154334	40-33.813	-110.987	-3-92-A	S036	B003	1.30	0.90	50	1.44	<2	1.01	<10	59	<1
154335	40-33.847	-110.973	-3-92-A	S037	U420	112.00	109.90	1000	1.02	<2	6.87	<10	871	1
154336	40-33.794	-110.846	-3-92-A	S038	S103	2.96	2.80	100	1.06	<2	1.03	11	179	<1
154337	40-33.796	-110.851	-3-92-A	S039	E103	5.36	4.90	100	1.09	<2	1.91	<10	298	1
154338	40-33.793	-110.842	-3-92-A	S040	U003	2.16	1.60		1.35	<2	2.98	<10	493	<1
154339	40-33.712	-110.717	-3-92-A	H001	V003	4.25	3.90	240	1.09	<2	8.00	19	1226	2
154340	40-33.713	-110.717	-3-92-A	H002	V002	3.03	4.00	160	0.76	<2	7.95	<10	752	2
154341	40-33.706	-110.702	-3-92-A	H003	M120	1.23	2.10	120	0.59	<2	2.60	16	264	1
154342	40-33.707	-110.731	-3-92-A	H004	M110	<0.25	0.70	80	0.18	<2	0.95	<10	93	<1
154343	40-33.671	-111.332	-3-92-A	F001	M010	<0.25	1.10		0.11	<2	1.13	15	73	<1
154345	40-34.791	-112.378	-3-92-A	B138	M203	1.40	1.40	85	1.00	<2	0.62	<10	24	<1
154347	40-34.814	-112.317	-3-92-A	B140	M203	0.74	2.50	80	0.30	<2	1.16	<10	67	<1
154348	40-33.749	-111.940	-3-92-A	S055	U420	367.00	338.40	8000	1.08	<2	7.97	<10	520	1
154349	40-33.791	-111.021	-3-92-A	S056	S003	0.53	3.00	135	0.18	<2	0.82	<10	98	<1
154350	40-33.694	-111.182	-3-92-A	S057	U103	2.14	3.20	200	0.67	2	4.24	44	55	1
154351	40-34.252	-111.272	-3-92-A	G002	G	1.22	2.70	150	0.45	<2	6.44	<10	757	1
154352	40-34.208	-110.570	-3-92-A	G003	R	0.40	0.80	140	0.50	<2	5.22	25	344	2
154353	40-33.797	-111.023	-3-92-A	G004	G	11.09	7.80	250	1.42	<2	6.25	<10	508	4
154354	40-33.772	-111.118	-3-92-A	G005	G	0.88	2.20	180	0.40	<2	6.48	11	739	2

DR SAMPLE NUMBER	CA (%)	CO (PPM)	CR (PPM)	CU (PPM)	FE (%)	LI (PPM)	MG (%)	MN (PPM)	MO (PPM)	NA (%)	NB (PPM)	NI (PPM)	P (PPM)	SC (PPM)	TH (PPM)
154331	0.07	<4	15	4	0.40	18	0.12	86	<4	0.44	<4	4	263	2	4
154332	0.05	<4	7	40	1.04	8	0.11	34	<4	<0.05	<4	4	154	1	<2
154333	<0.05	6	23	67	2.88	9	0.07	41	102	0.07	4	21	468	11	14
154334	0.05	<4	10	4	0.81	4	0.08	64	<4	<0.05	<4	3	181	1	6
154335	1.80	11	37	140	1.18	8	0.80	225	<4	0.13	6	11	329	7	<2
154336	<0.05	<4	11	5	1.10	9	<0.05	233	<4	<0.05	<4	6	176	1	2
154337	1.67	<4	31	2	1.54	18	0.31	394	<4	<0.05	<4	7	8806	2	5
154338	11.70	<4	8	4	0.90	9	0.09	196	<4	0.05	5	3	521	2	2
154339	0.35	<4	16	15	1.71	48	0.46	342	<4	1.96	10	9	399	6	16
154340	1.77	13	100	11	2.91	53	1.50	505	<4	1.78	7	50	492	12	11
154341	<0.05	<4	21	6	1.37	24	0.14	65	<4	<0.05	<4	10	110	4	5
154342	<0.05	7	10	11	2.30	22	0.18	530	<4	<0.05	<4	9	79	2	<2
154343	<0.05	<4	7	2	1.89	2	0.05	16	<4	<0.05	<4	5	27	1	<2
154345	<0.05	<4	12	4	1.60	3	<0.05	62	<4	<0.05	<4	4	104	1	<2
154347	0.08	<4	15	9	1.75	4	<0.05	51	<4	<0.05	<4	7	90	2	2
154348	<0.05	<4	51	45	1.87	6	<0.05	6	49	0.05	4	11	294	12	6
154349	<0.05	<4	10	4	0.23	5	0.05	20	<4	<0.05	<4	3	109	1	<2
154350	0.06	<4	13	16	0.78	30	0.08	14	<4	<0.05	4	5	228	4	12
154351	0.93	<4	5	7	2.31	18	0.28	412	<4	2.60	9	4	263	3	4
154352	<0.05	<4	3	5	0.67	14	0.29	49	<4	0.11	15	4	51	1	6
154353	0.45	<4	4	6	1.11	27	0.38	297	<4	2.38	15	2	209	3	37
154354	0.11	<4	3	2	1.23	10	0.26	52	<4	0.21	<4	4	485	3	20

OR SAMPLE NUMBER	TI (PPM)	V (PPM)	Y (PPM)	ZN (PPM)	ZR (PPM)	K (%)	SR (PPM)	CE (PPM)
154331	566	15	9	9	31	1.75	25	52
154332	540	14	5	7	34	1.88	17	14
154333	2191	48	71	10	201	6.53	59	63
154334	229	7	4	11	35	1.17	5	14
154335	6307	52	37	534	178	6.79	16	39
154336	470	16	5	8	19	0.90	9	16
154337	1383	43	29	12	42	1.79	17	34
154338	529	17	16	16	48	3.09	25	<10
154339	2038	30	22	44	107	3.12	155	80
154340	2636	76	26	58	83	2.05	256	71
154341	1157	25	5	26	41	1.27	13	30
154342	277	19	3	45	15	0.15	6	24
154343	219	15	3	10	36	0.58	6	14
154345	347	16	3	6	27	0.06	35	24
154347	459	17	7	13	56	0.29	62	21
154348	5551	61	22	27	182	8.20	30	44
154349	450	6	6	9	48	0.65	5	14
154350	1387	32	24	11	142	1.08	113	60
154351	1893	16	41	118	131	3.44	81	103
154352	349	11	6	15	29	4.99	54	36
154353	720	9	31	42	90	3.38	74	113
154354	471	16	11	7	38	6.32	52	62

ELEMENT	NO. SAMPLES ANALYZED MEASURABLE VALUES	BELOW DETECTION LIMIT	DETECTION LIMIT	MINIMUM VALUE	MAXIMUM VALUE	MEAN	MEDIAN	MODE	STANDARD DEVIATION	COEFFICIENT OF VARIATION	LN TRANSFORMATION MEAN	LN TRANSFORMATION S. D.	ROBUST MEAN	ROBUST S. D.
U	270	3	<0.25	<0.25	367.00	3.73	1.62	0.88	22.327	5.983	0.59	0.80	0.54	0.73
U-NT	177			0.30	33.00	3.04	2.00	1.23	4.055	1.333	0.75	0.76	0.71	0.75
U/TU	177			0.16	4.20	0.94	0.89	0.88	0.460	0.488	-0.15	0.41	-0.14	0.35
AG	7	126	<2	<2	6	2	<2	<2	1.5	0.6	0.91	0.42		
AL	133			0.33	7.78	2.50	1.93	0.60	1.804	0.722	0.62	0.81	0.63	0.77
B	53	80	<10	<10	57	20	<10	<10	11.8	0.6	2.87	0.48		
BA	133			16	1430	260	143	69	282.4	1.1	5.00	1.12	5.00	1.17
BE	100	33	<1	<1	8	1	<1	<1	1.4	0.8	0.42	0.56		
CA	51	82	<0.05	<0.05	12.94	0.68	<0.05	<0.05	1.994	2.935	-1.57	1.21		
CO	56	77	<4	<4	46	10	<4	<4	9.2	0.9	2.11	0.67		
CR	132	1	<1	<1	168	26	18	10	24.2	0.9	2.98	0.74	2.96	0.78
CU	125	8	<2	<2	105	10	5	3	14.3	1.4	1.86	0.86	1.69	1.08
FE	133			0.41	18.17	3.36	2.03	1.86	3.631	1.081	0.79	0.89	0.77	0.95
LI	133			1	214	19	8	3	32.7	1.7	2.26	1.10	2.22	1.14
MG	77	56	<0.05	<0.05	3.88	0.22	0.06	<0.05	0.450	2.013	-1.95	0.77		
MN	133			9	2999	172	62	22	329.3	1.9	4.36	1.18	4.32	1.15
MO	7	126	<4	<4	10	6	<4	<4	2.4	0.4	1.75	0.37		
NA	44	89	<0.05	<0.05	1.72	0.31	<0.05	<0.05	0.458	1.463	-1.93	1.14		
NB	31	102	<4	<4	17	8	<4	<4	3.2	0.4	2.07	0.38		
NI	131	2	<2	<2	72	8	6	5	9.0	1.0	1.88	0.74	1.83	0.76
P	133			8	22039	678	180	103	2658.5	3.9	5.32	1.24	5.27	1.18
SC	129	4	<1	<1	47	5	3	<1	7.1	1.3	1.23	0.93	1.13	1.16
TH	117	16	<2	<2	104	9	6	<2	12.9	1.4	1.93	0.71	1.78	0.72
TI	133			93	11725	1191	672	266	1568.0	1.3	6.61	0.93	6.58	0.96
V	132	1	<2	<2	434	46	24	23	64.2	1.4	3.30	1.01	3.27	1.13
Y	133			1	86	15	11	8	13.2	0.8	2.38	0.92	2.40	0.91
ZN	133			2	381	28	14	9	44.9	1.6	2.78	1.00	2.75	1.08
ZR	133			6	1412	109	78	47	143.2	1.3	4.34	0.81	4.34	0.77
K	132	1	<0.02	<0.02	5.66	1.00	0.51	0.04	1.172	1.171	-0.81	1.45	-0.80	1.55
SR	133			3	439	54	35	19	64.0	1.2	3.56	0.93	3.55	0.95
CE	128	5	<10	<10	243	48	35	35	38.2	0.8	3.65	0.66	3.59	0.74
TGAM	161			375	*****	*****	*****	19135	*******	1.0	11.36	2.18	11.45	1.87

CENTRAL ARIZONA ARCH GROUNDWATER

OR SAMPLE NUMBER	D. O. E. SAMPLE NUMBER ST	LAT	LONG	L	TY	REP	SITE	S-GC	U (PPB)	AG (PPB)	AL (PPB)	B (PPB)	BA (PPB)	BE (PPB)	CA (PPM)	CO (PPB)	CR (PPB)
154013	40	-34.324	-111.455	-3-		-A	W001	000M	0.57	<2	<10	4	15	<1	24.3	<2	<4
154019	40	-34.126	-111.008	-3-		-A	W002	AMS	1.33	<2	<10	27	16	<1	53.2	<2	<4
154020	40	-34.245	-110.981	-3-	01	-A	W003	MS	0.59	<2	15	4	32	<1	10.4	<2	<4
154032	40	-33.961	-111.382	-3-	01	-A	W006	A103	0.83	<2	<10	51	162	<1	65.4	<2	<4
154033	40	-33.951	-111.445	-3-	01	-A	W007	UA	0.59	<2	<10	15	<2	<1	91.1	2	<4
154036	40	-33.968	-111.452	-3-		-A	W008	ARM	4.47	2	<10	42	83	<1	86.3	3	4
154037	40	-34.046	-111.262	-3-	01	-A	W009	AM	0.36	<2	<10	42	178	1	55.9	<2	<4
154038	40	-34.080	-111.382	-3-	03	-A	W010	MAXR	2.56	<2	<10	35	206	<1	19.9	<2	<4
154039	40	-34.092	-111.434	-3-	01	-A	W011	RMA	0.22	<2	22	6	3	<1	6.4	<2	<4
154042	40	-34.001	-111.357	-3-	03	-A	W004	UM	3.05	<2	<10	17	4	<1	79.2	<2	<4
154043	40	-33.978	-111.292	-3-		-A	W005	AVRM	0.77	<2	<10	64	66	<1	31.9	<2	<4
154044	40	-33.955	-111.401	-3-		-A	W012	AM	0.92	<2	<10	21	50	<1	63.1	<2	<4
154045	40	-34.213	-111.495	-3-		-A	W013	VM	0.83	3	<10	38	44	<1	65.5	<2	5
154057	40	-34.130	-111.087	-3-		-A	W014	AV	15.49	<2	<10	26	39	<1	53.0	4	<4
154058	40	-34.029	-111.042	-3-		-A	W015	GSB	0.29	<2	<10	20	94	<1	46.8	<2	<4
154059	40	-34.077	-111.163	-3-		-A	W016	A	2.51	<2	<10	36	78	<1	47.8	2	<4
154060	40	-34.127	-111.201	-3-		-A	W017	MR	1.79	7	<10	27	45	<1	23.3	3	<4
154097	40	-33.992	-111.204	-3-		-A	W018	YBS	12.61	<2	<10	22	133	<1	42.7	<2	<4
154098	40	-34.017	-111.156	-3-		-A	W019	DBS	0.98	2	24	23	59	<1	9.1	<2	<4
154099	40	-34.047	-111.228	-3-		-A	W020	M	0.28	<2	<10	27	48	<1	52.7	2	<4
154130	40	-34.091	-111.466	-3-	01	-A	W021	M	<0.20	<2	<10	9	40	<1	14.3	<2	<4
154131	40	-34.080	-111.485	-3-		-A	W022	M	0.95	<2	<10	37	75	<1	33.8	<2	<4
154132	40	-34.075	-111.486	-3-	01	-A	W023	M	3.10	<2	<10	13	26	<1	59.5	<2	<4
154133	40	-34.086	-111.490	-3-	01	-A	W024	M	0.50	<2	12	10	25	<1	7.4	3	<4
154206	40	-37.176	-111.385	-3-		-A	W025	RKMD	1.52	4	<10	12	149	<1	42.8	<2	<4
154207	40	-34.049	-111.447	-3-		-A	W026	MD	0.27	8	<10	15	53	<1	19.2	<2	<4
154243	40	-34.104	-111.428	-3-	01	-A	W027	VD	1.28	2	<10	23	20	<1	84.2	2	<4
154244	40	-34.069	-111.426	-3-	01	-A	W028	RD	0.47	10	<10	15	27	<1	9.8	<2	<4
154302	40	-33.960	-111.489	-3-		-A	W029	R	1.93	10	<10	17	20	<1	62.3	<2	<4
154303	40	-34.057	-111.476	-3-	01	-A	W030	D	0.39	23	20	8	14	<1	6.3	<2	<4
154304	40	-34.073	-111.497	-3-		-A	W031	M	39.29	10	<10	9	87	<1	66.3	6	<4
154305	40	-34.040	-111.519	-3-		-A	W032	M	<0.20	12	<10	11	32	<1	13.7	<2	<4
154306	40	-34.052	-111.534	-3-		-A	W033	M	2.02	19	10	13	14	<1	10.6	<2	<4

CENTRAL ARIZONA ARCH GROUNDWATER

OR SAMPLE NUMBER	CU (PPB)	FE (PPB)	K (PPM)	LI (PPB)	MG (PPM)	MN (PPB)	MO (PPB)	NA (PPM)	NI (PPB)	P (PPB)	SC (PPB)	SI (PPM)	SR (PPB)	TI (PPB)	V (PPB)
154013	<2	27	1.3	<2	8.2	<2	<4	2.9	<4	<40	<1	<0.1	77	<2	<4
154019	<2	25	0.9	2	44.3	<2	<4	22.4	<4	60	<1	13.5	244	<2	<4
154020	5	25	1.4	2	3.5	3	<4	3.5	7	<40	<1	6.1	53	<2	<4
154032	<2	<10	3.4	29	34.2	<2	9	22.0	<4	<40	<1	9.2	620	<2	<4
154033	<2	<10	0.8	25	24.3	<2	9	16.7	5	<40	<1	9.3	282	<2	<4
154036	<2	10	1.6	16	32.1	<2	<4	22.8	<4	<40	<1	9.2	493	<2	<4
154037	<2	<10	1.6	33	28.8	<2	<4	39.6	4	<40	<1	17.1	315	<2	<4
154038	<2	<10	5.4	50	15.7	<2	<4	51.5	<4	<40	<1	11.7	801	<2	4
154039	<2	33	0.5	<2	2.2	<2	<4	3.1	<4	<40	<1	4.9	31	<2	<4
154042	<2	<10	3.1	109	22.8	2	5	15.6	4	<40	<1	23.0	1127	<2	5
154043	<2	<10	2.9	11	21.0	<2	<4	43.2	<4	<40	<1	7.1	273	<2	<4
154044	<2	<10	0.5	7	26.0	<2	11	28.9	<4	<40	<1	10.5	516	<2	4
154045	<2	<10	0.4	4	35.9	<2	7	20.4	7	<40	<1	9.1	232	<2	<4
154057	<2	<10	1.1	16	18.9	<2	<4	13.0	7	<40	<1	9.4	221	<2	<4
154058	<2	<10	1.5	5	22.1	<2	<4	5.7	<4	<40	<1	9.1	133	<2	<4
154059	<2	<10	0.5	7	38.7	<2	8	23.5	<4	<40	<1	12.6	353	<2	<4
154060	3	<10	5.4	4	9.1	<2	<4	11.0	<4	<40	<1	0.7	159	<2	<4
154097	<2	<10	1.6	4	24.1	<2	5	7.8	<4	<40	<1	14.8	164	<2	<4
154098	7	<10	3.6	<2	3.1	<2	<4	2.5	<4	140	<1	5.0	55	<2	4
154099	<2	<10	0.9	5	34.3	<2	<4	20.7	<4	<40	<1	9.8	303	<2	<4
154130	<2	<10	2.1	3	6.2	<2	<4	5.9	5	137	<1	12.6	118	<2	<4
154131	4	32	4.4	9	18.9	7	15	4.9	27	497	<1	11.3	227	<2	8
154132	<2	<10	1.2	6	29.9	<2	<4	10.9	<4	223	<1	20.4	516	<2	4
154133	<2	27	1.2	<2	2.4	<2	7	3.0	16	54	<1	5.7	70	<2	<4
154206	<2	<10	0.8	12	15.9	<2	17	17.7	4	<40	<1	11.7	147	<2	<4
154207	<2	14	1.2	4	4.8	<2	<4	6.5	4	<40	<1	9.6	83	<2	<4
154243	<2	<10	<0.1	2	26.5	<2	16	13.3	<4	<40	<1	6.0	255	<2	6
154244	<2	12	0.7	4	2.7	<2	9	3.5	<4	77	<1	6.4	51	<2	<4
154302	<2	<10	0.4	6	46.3	<2	<4	21.3	<4	<40	<1	6.7	340	<2	<4
154303	4	25	2.6	<2	1.7	<2	<4	5.0	4	<40	<1	6.1	34	<2	<4
154304	2	<10	3.4	4	34.9	<2	14	18.6	<4	<40	<1	5.0	639	<2	<4
154305	<2	16	1.6	3	4.4	2	7	7.0	4	<40	<1	12.9	70	<2	<4
154306	<2	31	0.7	7	5.0	<2	<4	5.7	<4	118	<1	10.5	64	<2	<4

OR SAMPLE NUMBER	Y (PPB)	ZN (PPB)	ZR (PPB)
154013	<1	<4	<2
154019	<1	<4	<2
154020	<1	32	<2
154032	<1	7	<2
154033	<1	28	<2
154036	1	8	3
154037	<1	13	<2
154038	<1	11	<2
154039	<1	<4	<2
154042	<1	137	<2
154043	<1	<4	<2
154044	<1	<4	<2
154045	1	10	5
154057	1	<4	<2
154058	<1	4	<2
154059	<1	9	2
154060	1	6	3
154097	<1	12	<2
154098	1	<4	5
154099	<1	9	<2
154130	<1	7	<2
154131	1	16	<2
154132	<1	<4	<2
154133	1	34	<2
154206	<1	8	<2
154207	<1	10	<2
154243	<1	32	<2
154244	<1	12	10
154302	<1	42	2
154303	1	19	5
154304	<1	51	<2
154305	<1	17	2
154306	<1	12	<2

CENTRAL ARIZONA ARCH GROUNDWATER 04-05-80

ELEMENT	NO. SAMPLES ANALYZED MEASURABLE VALUES	BELOW DETECTION LIMIT	DETECTION LIMIT	MINIMUM VALUE	MAXIMUM VALUE	MEAN	MEDIAN	MODE	STANDARD DEVIATION	COEFFICIENT OF VARIATION	LN TRANSFORMATION MEAN	S. D.	ROBUST MEAN	S. D.
U	37	2	<0.20	<0.20	367.00	13.05	0.83	0.38	60.215	4.615	0.33	1.53	-0.11	1.65
		2	<0.25											
AG	11	15	<2	<2	23	9	<2	<2	6.8	0.7	1.95	0.85		
AL	5	21	<10	<10	22	15	<10	<10	5.1	0.3	2.72	0.33		
B	26			4	64	21	15	14	15.8	0.7	2.81	0.75	2.81	0.84
BA	25	1	<2	<2	206	57	32	26	57.1	1.0	3.58	1.07	3.51	1.46
BE	1	25	<1	<1	1	1	<1	<1	0.0	0.0	0.0	0.0		
CA	26			6.3	91.1	41.6	33.8	67.1	28.65	0.69	3.40	0.90	3.42	0.94
CD	5	21	<2	<2	6	3	<2	<2	1.6	0.5	1.08	0.45		
CR	2	24	<4	<4	5	4	<4	<4	0.7	0.2	1.50	0.16		
CU	4	22	<2	<2	5	3	<2	<2	1.3	0.3	1.27	0.40		
FE	12	14	<10	<10	33	23	<10	<10	8.0	0.3	3.07	0.41		
K	25	1	<0.1	<0.1	5.4	1.8	1.2	1.6	1.33	0.76	0.30	0.75	0.25	0.88
LI	22	4	<2	<2	109	15	4	<2	24.2	1.5	2.08	1.11	1.65	1.49
MG	26			1.7	46.3	19.2	18.9	4.2	14.10	0.74	2.53	1.07	2.56	1.07
MN	4	22	<2	<2	7	3	<2	<2	2.4	0.7	1.11	0.59		
MO	12	14	<4	<4	17	10	<4	<4	4.0	0.4	2.28	0.39		
NA	26			2.9	51.5	16.0	13.3	3.5	13.24	0.83	2.42	0.90	2.41	0.98
NI	12	14	<4	<4	27	7	<4	<4	7.0	0.9	1.79	0.63		
P	7	19	<40	<40	497	167	<40	<40	156.2	0.9	4.83	0.77		
SC	0	26	<1	<1	<1		<1	<1						
SI	25	1	<0.1	<0.1	23.0	10.3	9.2	9.3	4.54	0.44	2.25	0.41	2.21	0.50
SR	26			31	1127	295	232	65	274.3	0.9	5.23	1.03	5.23	1.07
TI	0	26	<2	<2	<2		<2	<2						
V	6	20	<4	<4	8	5	<4	<4	1.6	0.3	1.61	0.28		
Y	5	21	<1	<1	1	1	<1	<1	0.0	0.0	0.0	0.0		
ZN	20	6	<4	<4	137	25	11	<4	29.2	1.2	2.88	0.78	2.46	1.04
ZR	6	20	<2	<2	10	4	<2	<2	3.0	0.7	1.33	0.63		

APPENDIX E

Site and Sample Description Forms

Thin Section Description Forms

This appendix contains much of the detailed geologic information in this report. The information gathered in the field at each sample site makes up the first part of the Site and Sample Description Forms; the second part is a description of the character samples collected from each site. Between one-third and one-quarter of the samples were thin sectioned. A Thin Section Description Form for each selected sample follows its respective Site and Sample Description Form.

The forms are arranged by subareas in generally a north to south trend, and in order of increasing numbers. The order of subareas is:

P = Pine Creek area
C = Christopher Mountain area
D = Diamond Butte area
M = Mazatzal Mountain area
H = Hess Canyon area
F = Four Peaks area
B = Chino Valley area
S = Sierra Ancha area
G = Granite and rhyolite samples

SITE AND SAMPLE DESCRIPTION

Site Number: P 1 **Sample Number:** 154014 **Code:** M 102

Location: Natural Bridge **Scintillometer Counts:** 60 cps

Quadrangle: Buckhead Mesa **U Value (U/NT) ppm:** 3.0

Sec., Twp, Ra.: S5, 11N, 9E **Coordinates:** 34°19'18", 111°27'28"

Geologic Unit: Pebble conglomerate near base of Mazatzal quartzite

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Above Natural Bridge 250m of Mazatzal quartzite and conglomerate are exposed, consisting of 120m of maroon quartzite split by a 30m rhyolite sill, underlain by 80m of conglomerate and grit which is underlain by 50m of quartzite and grit with no base exposed at this point. Upper maroon quartzites are quartz rich with some jasper and quartz grit fragments, whereas conglomerates above and below the rhyolite sill are dominated by jasper and chert fragments with quartz and rhyolite less abundant.

Variability: Quartz, jasper, rhyolite and chert fragments range from 5 x 10mm to 30 x 20cm and are commonly 5 x 10cm. A general fining of grain sizes upwards is seen with an absence of conglomerate or grit above the rhyolite sill. A distinct color change from brick red in the grits and conglomerates to maroon in the upper quartzites also occurs here.

Sedimentary Structures: Sequence is well bedded with large (1m) trough cross bedding; graded bedding and poorly developed laminar bedding are found in the coarser conglomeratic units; planar cross bedding and good laminar bedding typify grits and quartzites.

Depositional Environment: Moderate to high energy stream to alluvial fan or flood plain conditions are indicated for the lower parts of the section, with lower energy fluvial or beach environment for the upper parts.

SAMPLE DESCRIPTION : Rock contains 10 to 30mm fragments of brick red jasper, pale pink chert and smaller (5-10mm) fragments of chert, rhyolite, quartz and chalcedony in a grit-size matrix of hematite-stained, grit-size quartz, chert and other rock chips. Bedding is poorly developed and quartz fragments are in low abundance compared to other Mazatzal conglomerates from other areas. Other samples in the section have more rhyolite and quartz pebbles. Sample is strongly stained with earthy hematite but specularite is absent. Large fragments are supported by well-packed matrix of grit. Scintillometer counts are highest in the coarsest grained conglomerates of this section.

Sampler: P. Anderson **Date:** Sept. 18, 1979

THIN SECTION DESCRIPTION

Site Number: P 1 **Sample Number:** 154014 **Code:** M 102

Percent Fragments: 50% **Percent Matrix:** 40%

Percent Heavies & Mafics: 10% **Stain:** earthy red-hematite

Rock Type: Mazatzal conglomerate **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
red rhyolite	45%	23-2mm	Sub-rounded	1:2.5
red jasper	25%	12-2mm	Sub-angular	1:3
orange chert	22%	8-2mm	Sub-rounded	1:1.5
clear quartz	8%	2.5-2mm	Rounded	1:1

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	75%	2-.02mm	mostly unstrained volcanic crystals
chert	3%	2-.04mm	sub-rounded
red jasper	4%	2-.08mm	sub-angular to sub-rounded
specularite	1%	.14-.06mm	sub-rounded detrital grains
specularite	2%	.19-.04mm	recrystallized
hematite	3%	massive stain	interstitial stain with sericite & specularite
quartzite	2%	1.0-.4mm	rounded
rhyolite	1%	1.2-.8mm	sub-angular to sub-rounded
zircon	< 1%	.09-.06mm	sub-rounded detrital
sericite	9%	.17-.005mm	platy crystals and felted masses

Cement: earthy hematite, recrystallized quartz, carbonate (?)

Interstitials: sericite, recrystallized specularite, carbonate

Textures and recrystallization: Rock completely unstrained and undeformed; most clay in matrix is recrystallized to sericite; quartz in matrix shows broken embayed volcanic crystals; matrix of rhyolite fragments completely recrystallized

Structures: bedding and cross-bedding is defined by specularite concentrations and by subparallel alignment of elongate fragments

Comments on Genesis: Both the fresh volcanic quartz crystals in the matrix and abundance of rhyolite fragments and cherty rhyolite indicate that the conglomerate was derived almost entirely by erosion of a hematitic rhyolite terrain.

Rock Name: rhyolite-chert fragment conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: P 2 **Sample Number:** 154061 **Code:** M 102

Location: Lower Narrows **Scintillometer Counts:** 122 cps

Quadrangle: Buckhead Mesa **U Value (U by NT) ppm :** 2.6

Sec., Twp, Ra.: S27, 12N, 9E **Coordinates:** 34°21'00"; 111°25'45"

Geologic Unit: granule conglomerate near the base of Mazatzal quartzite

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : East of the Narrows of Pine Creek 175m of Mazatzal quartzite and conglomerate are exposed below the rhyolite sill. P2 is a representative sample of the granule conglomerate layer 3m thick at the base of the section. Above this, there is an upward fining of fragment size in the conglomerate horizon, giving a total of 2m of grit. The remainder of the section below the rhyolite sill is composed of medium-grained, purplish red cross-bedded quartzite.

Variability: Rhyolite, chert and jasper fragments range from 5 x 3mm to 30 x 27mm and are commonly 15 x 12mm. Fragment and matrix-grain sizes fine upward toward the rhyolite sill. Color of the conglomerate horizon ranges from a dirty pink to red and becomes earthy hematite-red to maroon in the quartzite layers.

Sedimentary Structures: Conglomerate horizons show no well-defined bedding structures or preferred-fragment orientation. Grit higher in the sequence shows subparallel fragment orientation and graded bedding. The upper quartzite are dominated by planar cross beds averaging 7-15cm in thickness.

Depositional Environment: A moderate-to high-energy environment, possibly an alluvial fan or river channel is indicated for the conglomerate horizon. Finer grain size and good bedding structures indicate lower energy conditions for upper units.

SAMPLE DESCRIPTION : The fragment-to-matrix ratio is 1:1. The matrix is composed of poorly sorted pink to yellow-green chert, red to dark purple, massive jasper, pink to purple rhyolite, clear quartz (volcanic?) and clay (altered feldspars?). The matrix supports 5 to 10mm fragments of mostly pink to light purple quartz-phenocrystic rhyolite, lesser dark red to purple, massive jasper and pink to pale yellow chert. All fragments are sub-angular in character and commonly have axial ratios of 1:2. Specularite and hematite stain are absent in the sample, but appear in grit above the granule conglomerate horizon. Scintillometer counts are highest in the coarsest conglomerates.

Sampler: K. Wirth **Date:** Oct. 15, 1979

THIN SECTION DESCRIPTION

Site Number: P 2 **Sample Number:** 154061 **Code:** M 102

Percent Fragments: 63% **Percent Matrix:** 33%

Percent Heavies & Mafics: 4% **Stain:** hematite

Rock Type: Mazatzal Conglomerate **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
rhyolite	100%	25-2.0 mm	sub-rounded	1:2

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
rhyolite	36%	2.0 - .26 mm	sub-rounded
quartz	28%	1.0 - .02 mm	broken, embayed volcanic crystals
specularite	1%	.2 - .08 mm	rounded (detrital?)
hematite	5%	powdery	fine interstitial grains and stain
clay	30%	.004 mm	recrystallized masses

Cement: mostly recrystallized sericite and minor hematite

Interstitials: sericite, hematite

Textures and recrystallization: Delicate flow banding and euhedral quartz phenocrysts perfectly preserved in rhyolite fragments; no intergrain suturing or recrystallization; most matrix and altered fragments are still clay-altered (to incipient sericite).

Structures:
Some flow-banded, flat fragments roughly parallel bedding but no bedding obvious in thin section

Comments on Genesis: Rock is wholly a volcanic conglomerate. Both matrix and fragments are derived from quartz-phenocrystic, hematitic-red rhyolite, and were deposited in a channel environment of high energy but poor sorting of matrix from fragments, but good fragment sizing.

Rock Name: red monomictic, hematitic-rhyolite pebble conglomerate

THIN SECTION DESCRIPTION

Site Number: P 2a **Sample Number:** **Code:** M 101

Percent Fragments: 45% **Percent Matrix:** 51%

Percent Heavies & Mafics: 4% **Stain:** hematite

Rock Type: Mazatzal grit **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
rhyolite	95%	10 - 2.0 mm	sub-angular	1:2
quartz	3%	2.3 - 2.0 mm	sub-angular	1:1.5
chert	2%	2.5 - 1.0 mm	sub-angular	1:2.5

(two types of rhyolite: quartz-rich cherty type; sericite-rich type with sparse quartz phenocrysts)

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
rhyolite	35%	2.0 - .5 mm	sub-angular
quartz	26%	2.0 - .02 mm	broken, embayed volcanic phenocrysts
specularite	1%	.6 - .16 mm	rounded detrital
specularite	1%	powdery	recrystallized with hematite
hematite	4%	powdery	fine interstial grains and masses, stain
sericite	33%	.01 mm	recrystallized interstitial masses

Cement: mostly recrystallized sericite and red earthy hematite

Interstitials: sericite, hematite, recrystallized specularite

Textures and recrystallization: matrix and fragment-alteration clay recrystallized to fine grained sericite; primary angularity preserved without recrystallization, suturing or polygonization

Structures: pronounced primary fragment elongation may define bedding

Comments on Genesis: Dominant rhyolite, with minor chert-volcanic quartz terrain is indicated for source, with abundant hematite in depositional environment also derived from rhyolite terrain.

Rock Name: red, hematitic rhyolite-fragment granule conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: P 3 **Sample Number:** 154062 **Code:** M 111

Location: Lower Narrows **Scintillometer Counts:** 68 cps

Quadrangle: Buckhead Mesa **U Value (U/NT) ppm:** 1.10

Sec., Twp, Ra.: S28, 12N, 9E **Coordinates:** 34°21'00"; 111°25'50"

Geologic Unit: Grit conglomerate in the middle of the Mazatzal

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : P 3 is a representative sample of the section stratigraphically above site P 2 and west of the 20m rhyolite sill. Above the rhyolite 20m of medium-purple to red quartzite with 7 to 20cm cross beds is exposed. Cross beds thin to an average of 2-6cm thickness in the upper 40m. Local beds vary in color from yellow to light purple. Throughout the section are local 1 to 5cm-thick lenses of grit to coarse-sand size quartz, rhyolite and jasper. With upward fining, rhyolite fragments tend to diminish and be absent at the top of the section. Several 2 to 4cm beds of dark red shale occur in the middle of the section.

Variability: Fragment size varies from 1 to 8mm and commonly averages 2 to 4mm. The proportion of quartz to jasper is constant throughout the sampled horizon. Grit layers are lensoid and fine laterally and up section. Scintillometer counts show little variation throughout the section.

Sedimentary Structures: Planar cross bed sets, 2 to 20cm thick, and occasional trough cross beds are well-defined throughout the section.

Depositional Environment: Low energy environment as indicated by the well-sorted character and small size of the fragments and occasional shaley layers. Possibly a low energy near-shore environment.

SAMPLE DESCRIPTION : The sample was taken from a series of thinly, cross bedded lenses near the top of the section. The fragment to matrix ratio is 2:1. The matrix is composed of mostly quartz, minor jasper and rare limonitic clots. The nearly spherical fragments range from 1 to 8mm and average 2-6mm in size. Jasper is slightly more angular than the rounded quartz. Hematite stain gives the sample a maroon color and specularite is found on some bedding planes.

Sampler: K. Wirth **Date:** Oct. 15, 1979

SITE AND SAMPLE DESCRIPTION

Site Number: P 4 **Sample Number:** 154063 **Code:** M 112

Location: Lower Narrows **Scintillometer Counts:** 55 cps

Quadrangle: Buckhead Mesa **U Value (U/NT) ppm:** 1.00

Sec., Twp, Ra.: S28, 12N, 9E **Coordinates:** 34°21'00", 111°26'25"

Geologic Unit: granule conglomerate near the middle of Mazatzal quartzite

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : P 4 is a representative sample taken from a 400m thick section of medium-grained maroon quartzite immediately up section from site P 3. The lower part of the section is composed of a well-sorted, thinly-bedded and cross-bedded quartzite ranging in color from maroon to dark red. Occasional shaley and shale rip-up layers occur throughout. The middle part of the section has a similar quartzite matrix and also contains a sparse granule conglomerate of jasper and shale. The upper part of the section contains shaley layers and light purple to maroon quartzite with white oxidation spots. Scintillometer counts are similar throughout the section.

Variability: Fragment size varies from 3 to 18mm but averages 6 to 15mm. Most conglomerate layers are sparse though some layers of denser, small-fragment conglomerate do occur.

Sedimentary Structures: Most of the section is planar cross-bedded in 5-12cm sets, and ranging as thick as 20mm.

Depositional Environment: A fairly consistently low energy environment subjected to short periods of higher energy and indicated by the sparse granules and shale rip-up layers. Possibly a moderately near-shore marine or tidal flat environment.

SAMPLE DESCRIPTION : Grit to granule (3-18mm) size fragments of jasper occur in a light purple to maroon, hematite-stained matrix. The fragments consist mostly of massive black specularitic chert, lesser red jasper and minor shale, and occupy 15% of the rock. Minor specularite occurs in the more dense conglomerate layers.

Sampler: K. Wirth **Date:** Oct. 15, 1979

THIN SECTION DESCRIPTION

Site Number: P4 Sample Number: 154063 Code: M 112

Percent Fragments: 20% Percent Matrix: 78%

Percent Heavies & Mafics: 2% Stain: hematite

Rock Type: Mazatzal Conglomerate Stratigraphic Group: Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	14%	2.9 - 2.0 mm	sub-rounded	1:1.5
chert	30%	4.0 - 2.0 mm	sub-rounded	1:1.5
jasper	37%	4.5 - 2.0 mm	sub-angular	1:1.5
rhyolite	19%	4.8 - 2.0 mm	sub-rounded	1:1.5

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	86%	2.0 - .02 mm	sub-rounded recrystallized grains
chert	2%	2.0 - .17 mm	sub-rounded
jasper	2%	2.0 - .23 mm	sub-rounded
specularite	1%	.12 - .03 mm	rounded detrital grains
hematite	1%	.004 mm	fine interstitial grains
sericite	7%	.03 mm	recrystallized plates and masses
zircon	< 1%	.15 - .03 mm	rounded detrital grains
leucoxene	2%		white powdery alteration spots

Cement: recrystallized quartz and sericite; minor hematite

Interstitials: recrystallized quartz and sericite, hematite

Textures and recrystallization: rock texture is a tightly interlocked mosaic of quartz grains with polyhedral, sutured, interpenetrating grain boundaries; some quartz undulose; clays recrystallized to sericite-hematite clots; jasper, chert and rhyolite fragments poorly recrystallized

Structures:
bedding planes are defined by higher densities of fragments in some layers.

Comments on Genesis: Very mature quartz-rich source terrain with some chert, volcanic and jasper material; depositional environment possibly beach with abundant winnowing action.

Rock Name: Sparse chert-jasper grit to pink quartzite

SITE AND SAMPLE DESCRIPTION

Site Number: P 5 **Sample Number:** 154152 **Code:** M 103

Location: S of Natural Bridge **Scintillometer Counts:** ND

Quadrangle: Buckhead Mesa **U Value (U/NT) ppm:** 3.3

Sec., Twp, Ra.: S7, 11N, 9E **Coordinates:** 34°18'54", 111°28'02"

Geologic Unit: granule to cobble conglomerates near the base of the Mazatzal quartzite

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : About 150m of hematitic granule to cobble Mazatzal conglomerate outcrops south of Natural Bridge and west of Pine Creek. It lies at nearly the same stratigraphic horizon as site P1 and P2. The base of the section is poorly lithified and sorted. Quartzite and rhyolite dominate as fragment types and are supported by a medium to coarse-grained quartz-and rhyolite-grus matrix. Up section, fragment size decreases and jasper and hematite proportions increase. Conglomerates just below the rhyolite sill near the top of the section, show much better lithification.

Variability: Fragments range from 2 to 200mm in length and average 15 to 150mm. Sorting is generally poor except for a single 15cm wide quartzite bed. Conglomerates become more hematitic and jasper-rich and show a general fining up-section.

Sedimentary Structures: The base of the section is devoid of good bedding or other sedimentary structures. Bedding becomes better defined up section.

Depositional Environment: A high energy river channel type environment as indicated by the lack of well-defined bedding, poor sorting and the large fragment size.

SAMPLE DESCRIPTION : P 5 is a representative sample of the pebble conglomerate which outcrops near the middle of the described section. The conglomerate is composed mostly of light-red quartz-phenocrystic rhyolite, lesser dark aphanitic rhyolite and minor quartzite. Fragments are angular to sub-rounded and average 8 to 45mm in length. They are supported by a medium to coarse quartz-(volcanic?) and rhyolite-grus matrix (possibly of the same origin as the rhyolite fragments). The fragment to matrix ratio is 1:1. Detrital specular hematite is absent, but red hematite stain is present throughout the section.

Sampler: J. Trembly **Date:** Nov. 15, 1979

THIN SECTION DESCRIPTION

Site Number: P 5 Sample Number: 154152 Code: M 103

Percent Fragments: 58% Percent Matrix: 35%

Percent Heavies & Mafics: 7% Stain: hematite

Rock Type: Mazatzal Conglomerate Stratigraphic Group: Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
red rhyolite	100%	35 - 3.0 mm	rounded	1:2

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	34%	1.8 - .04 mm	clear volcanic crystals
jasper	2%	1.0 - .4 mm	sub-angular banded
chert	1%	.9 - .4 mm	sub-rounded
rhyolite	29%	3.0 - .32 mm	strongly hematitic
specularite	1%	.4 - .18 mm	rounded grains, (detrital?)
specularite	4%	cryptocrystalline	recrystallized with hematite
hematite	4%	powdery	fine interstitial grains and stain
sericite	25%	<.01 mm	recrystallized plates and masses

Cement: Mostly recrystallized sericite; also minor hematite and recrystallized specularite

Interstitials: recrystallized sericite and specularite, hematite

Textures and recrystallization: recrystallization within fragments is along fracture lines; little or no recrystallization of matrix, except undulose extinction in quartz and sericite in matrix.

Structures: Good flow banding in rhyolite fragments; no bedding in matrix, but incipient foliation developing in mica alignment and hematite concentration

Comments on Genesis: Both fragments and matrix are of the same felsic, hematitic, rhyolitic volcanic origin; hence a nearby rhyolite source terrain

Rock Name: red aphanitic rhyolite - fragment pebble conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: P 6 Sample Number: 154153 Code: M 101

Location: S of Natural Bridge Scintillometer Counts: ND

Quadrangle: Buckhead Mesa U Value (U/NT) ppm: 1.8

Sec., Twp, Ra.: S7, 11N, 9E Coordinates: 34°18'56", 111°28'03"

Geologic Unit: grit conglomerate near the middle of the Mazatzal quartzite

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : P 6 is a representative sample of the grit conglomerate which outcrops in a 17m section of Mazatzal quartzite above the rhyolite sill. The quartzite is mostly light purple to maroon in color and medium to coarse grained. Occasional 20-50cm cross-bedded maroon shale layers and 5 to 10cm thick lenses of grit are interbedded. Darker layers tend to be finer-grained.

Variability:

Sedimentary Structures: Planar cross bedding throughout the section.

Depositional Environment: Low to medium energy environment as indicated by the moderately-sorted matrix with small fragments. Quartzite and shale layers indicate periods of lower energy. Possibly a [illegible] r-shore environment.

SAMPLE DESCRIPTION : Light purple to maroon grit. Fragments sub-rounded to rounded, average 1 to 6mm in length. The fragments are mostly of quartz, with lesser jasper and minor light red to dark rhyolite. The fragment to matrix ratio is 1:4. Specularite is absent. Bedding and cross bedding structures are poorly defined.

Sampler: J. Trembly Date: Nov. 15, 1979

THIN SECTION DESCRIPTION

Site Number: P6 **Sample Number:** 154153 **Code:** M 101

Percent Fragments: 15% **Percent Matrix:** 81%

Percent Heavies & Mafics: 4% **Stain:** hematite

Rock Type: Mazatzal Quartzite **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	100%	3.0 - 2.0	sub-rounded	1:1.5

fragments gradational to matrix sizes

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	78%	2.0	rounded, polygonized, partly recrystallized
jasper	2%	1.6 - .31 mm	sub-rounded, banded
chert	5%	1.3 - .28 mm	sub-rounded, recrystallized
specularite	<1%	.2 - .09 mm	rounded, detrital
specularite	<1%	powdery	recrystallized, interstitial masses
hematite	4%	powdery	fine interstitial grains and stain
sericite	10%	<.04 mm	recrystallized circular masses
rhyolite	1%	1.3 - .7 mm	sub-angular
zircon	<1%	.14 mm	subhedral

Cement: mostly recrystallized sericite; also minor recrystallized quartz, specularite, and hematite

Interstitials: sericite, recrystallized quartz and specularite, hematite

Textures and recrystallization: most quartz is recrystallized, unstrained with polygonal 120° boundaries, argillaceous and hematitic material interstitial, except for circular aggregates of sericite which are overgrown on all grains.

Structures: fragment sizes, densities and coarse matrix-material variations may define bedding

Comments on Genesis: Relatively pure, mature sediment,well sorted, from predominately quartz-rich source terrain

Rock Name: pale pink hematitic, quartz-rich grit

SITE AND SAMPLE DESCRIPTION

Site Number: P 7 **Sample Number:** 154154 **Code:** M 103

Location: S of Natural Bridge **Scintillometer Counts:** 105 cps

Quadrangle: Buckhead Mesa **U Value (U by NT) ppm :** 3.0

Sec., Twp, Ra.: S7, 11N, 9E **Coordinates:** 34° 18' 32"; 111° 28' 23"

Geologic Unit: pebble conglomerate near the middle of Mazatzal quartzite

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Approximately 50 meters of conglomerate is exposed in the section below the rhyolite sill, similar to that of sites P1, P2 and P5. Quartzite immediately below the rhyolite is red to maroon in color and contains occasional small fragments of rhyolite, minor quartz and rare jasper. Bedding is moderately defined and detrital heavies are absent. Down section this rock grades into a much denser pebble to cobble conglomerate containing mostly rhyolite, rare quartzite and trace jasper. Specularite is present in moderate amounts in the matrix. Bedding is poorly-defined to absent. Site P7 is located near the base of the conglomerate section.

Variability: Down section, there is a general increase in matrix sizes, fragment sizes, fragment and heavy mineral percentages, and a decrease in sorting. Scintillometer counts vary from 70cps at the top to 105cps near the base of the section.

Sedimentary Structures: Bedding is poorly defined to absent at the base of the section. Bedding in the upper horizons is defined by conglomerate layers and planar cross-bed sets of 5 to 20cm thickness.

Depositional Environment: Possibly a river channel to near-shore marine environment transitional between higher-energy conglomerates below and lower-energy quartzites above. A decrease in energy conditions is indicated by an increase in sorting up section and by a decrease in fragment size and percentage.

SAMPLE DESCRIPTION :

Granule-to cobble-size fragments averaging 8 to 61mm in length, occur in a maroon matrix in a fragment to matrix ratio of 1:1. The matrix is composed of poorly sorted, medium-sand to fine-grit grains of mostly rhyolite, minor clear volcanic quartz, specularite and interstitial clays. Fragments are mostly rhyolite, either pink quartz-feldspar phenocrystic, dark-banded or light aphanitic; others include quartzite, jasper and chert. Most fragments, sub-angular to sub-rounded, have an axial ratio of 1:2, and the elongate ones show sub parallel alignment.

Sampler: K. Wirth **Date:** Nov. 15, 1979

SITE AND SAMPLE DESCRIPTION

Site Number: P 8 **Sample Number:** 154155 **Code:** M 104

Location: S of Natural Bridge **Scintillometer Counts:** 165 cps

Quadrangle: Buckhead Mesa **U Value (U/NT) ppm:** 3.9

Sec., Twp, Ra.: S7, 11N, 9E **Coordinates:** 34°18'31", 111°28'28"

Geologic Unit: cobble to boulder conglomerate near base of the Mazatzal quartzite

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Site P8 extends from the base of the Mazatzal quartzite to the base of the described section of Site P7, a total of 150m. Conglomerate is present throughout the section with little variation. Fragments of cobble to boulder size (60 to 300mm in length) lie in a matrix of poorly-sorted granules to coarse sands. Lithification is very poor at the base of the section, but increases up section with an increase in sorting and matrix percent. Fragment size decreases up section. Bedding is very poorly defined to absent.

Variability: Color at the base of the section is earthy brown and becomes maroon to red near the top. Rhyolite fragments dominate throughout the section. Jasper and quartzite appear near the top. Scintillometer counts range from 105cps at the top to 165 near the base of the section.

Sedimentary Structures: There is a poor alignment of more elongate fragments.

Depositional Environment: Very high energy environment as indicated by large fragments, poor sorting, and lack of bedding planes. Possibly a river channel.

SAMPLE DESCRIPTION : Pebble- to cobble-sized fragments support a matrix in a ratio of 3:1. The matrix is poorly sorted, containing grains of coarse sand- to granule-size and is composed of mostly lightish red rhyolite and minor clear quartz (volcanic?). The fragments, angular to sub-rounded, average 35 to 90mm in length. Axial ratios range from 1:1 to 1:4. Fragments are of mostly rhyolite, either quartz-feldspar phenocrystic (red), light banded or dark aphanitic. Detrital heavies are not present in obvious proportions.

Sampler: K. Wirth **Date:** Nov. 15, 1979

SITE AND SAMPLE DESCRIPTION

Site Number: P 9 **Sample Number:** 154156 **Code:** M 104

Location: N of Natural Bridge **Scintillometer Counts:** 165 cps

Quadrangle: Buckhead Mesa **U Value (U by NT) ppm :** 3.00

Sec., Twp, Ra.: S5, 11N, 9E **Coordinates:** 34° 19' 25"; 111° 27' 17"

Geologic Unit: cobble and boulder conglomerate at base of Mazatzal quartzite

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : This section lies immediately below that of Site P1 and stratigraphically level with P5 and P8. A total of 20m of cobble to boulder conglomerate is exposed in Pine Creek, north of Natural Bridge. Fragments are mostly of rhyolite, either light red and phenocrystic or dark and aphanitic to spherulitic. Lithification is poor in the fragment-supported matrix. The matrix is composed of sand to grit-sized sub-angular fragments, consisting of mostly rhyolite gruss, minor quartzite and clear volcanic quartz, rare jasper and hematite stain. The base of the section rests on rhyolite.

Variability: There is a general increase in sorting and lithification, and a decrease in fragment size and percentage toward the top of the section. Quartz and jasper also become more important components toward the top of the section. Fragment size also decreases laterally to the north.

Sedimentary Structures: The section contains no well-defined sedimentary structures.

Depositional Environment: A very high energy and immature sedimentary environment is indicated by the large fragment size, poor sorting and lack of bedding structures.

SAMPLE DESCRIPTION : Conglomerate contains 55% sub-angular to sub-rounded fragments, averaging 16 to 45mm in length, which are mostly rhyolite (quartz-and feldspar-phenocrystic to aphanitic and spherulitic), minor quartzite and rare chert. The matrix is poorly sorted and consists of mostly rhyolite gruss, minor quartize, chert, clear volcanic quartz and rare jasper. Some hematite stain is present and detrital specularite is absent.

Sampler: K. Wirth **Date:** Nove. 15, 1979

THIN SECTION DESCRIPTION

Site Number: P 9 **Sample Number:** 154156 **Code:** M 104

Percent Fragments: 62% **Percent Matrix:** 34%

Percent Heavies & Mafics: 4% **Stain:** hematite

Rock Type: Mazatzal conglomerate **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : **(percentages are based on 100% fragments)**

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
rhyolite	92%	23 - 2.0 mm	sub-angular	1:2
quartz	5%	3.0 - 2.0 mm	sub-angular	1:1.5
chert	3%	3.0 - 2.0 mm	angular	1:1.5

MATRIX & HEAVIES : **(percentages are based on 100% matrix & heavies)**

Type & color	Percentage	Size range	Description
rhyolite	21%	2.0 - .4 mm	altered and hematitic
quartz	37%	2.0 - .02 mm	broken euhedral, embayed volcanic crystals
specularite	1%	.21 - .1 mm	rounded detrital to subhedral
specularite	3%	powdery	recrystallized with hematite
hematite	4%	powdery	fine interstitial grains and stain
sericite	34%	<.005	foliate shred-like masses

Cement: mostly recrystallized sericite; also minor hematite and recrystallized specularite

Interstitials: sericite, hematite, recrystallized specularite

Textures and recrystallization: Aphanitic volcanic fragments are recrystallized (devitrified) but rock is not recrystallized by strain enough to affect volcanic quartz crystals. Interstitial clay recrystallized to foliate shred-like sericite masses.

Structures: No bedding planes or fragment alignments are seen

Comments on Genesis: Poorly sorted, friable rhyolitic volcanic material indicates a source close to depositional site, without long transport or shallow-water reworking conditions.

Rock Name:
red rhyolite-fragment conglomerate.

SITE AND SAMPLE DESCRIPTION

Site Number: P 10 **Sample Number:** 154157 **Code:** M 102

Location: N. of Natural Bridge **Scintillometer Counts:** ND

Quadrangle: Buckhead Mesa **U Value (U/NT) ppm:** 1.4

Sec., Twp, Ra.: S32, 12N, 9E **Coordinates:** 34°20'07", 111°27'02"

Geologic Unit: granule conglomerate near middle of the Mazatzal quartzite

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY: Approximately 20m of light orange to maroon, well sorted, fine to medium-grained quartzite is exposed, of which 17m consist of nearly pure quartzite. The rest consists of sparse jasper, rhyolite, chert, quartz and shale (?) fragments, sub-rounded in character. Minor specularite is also present.

Variability: Little or no variation throughout the section.

Sedimentary Structures: Planar cross beds of 5-15cm thickness throughout. Large undulations are present on some bedding planes with wave length of 70-120cm and amplitudes of 3-7cm. Possibly mega-ripples?

Depositional Environment: Very low energy, as indicated by the nearly pure quartzite with interruptions of higher energy, as indicated by sparse granule fragments. Definite current activity is indicated by ripple marks. Possibly a near-shore, but moderate depth, environment.

SAMPLE DESCRIPTION :

Fragments (15%) sub-rounded to angular, are supported by a matrix (85%) of light orange to maroon, fine to medium grained quartzite. Fragments, averaging 3 to 12mm, consist mostly of jasper, some rhyolite, minor chert and rare quartz. Some very elongate flattened fragments may be shale rip-ups.

Sampler: K. Wirth **Date:** Nov. 15, 1979

THIN SECTION DESCRIPTION

Site Number: P 10 **Sample Number:** 154157 **Code:** M 102

Percent Fragments: 18% **Percent Matrix:** 79%

Percent Heavies & Mafics: 3% **Stain:** hematitic, pale red

Rock Type: Mazatzal quartzite **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
jasper	35%	3 - 2.0 mm	sub-rounded	1:2
chert	18%	3 - 2.0 mm	sub-rounded	1:2
rhyolite	47%	6.5 - 2.0 mm	sub-angular	1:2
quartz	<1%	3.2 mm	rounded	1:1.5

Rhyolite fragments are hematitic and aphanitic

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	78%	1.8 - .02 mm	sub-rounded, polygonized grains
jasper	4%	2.0 - .21 mm	sub-angular
chert	3%	2.0 - .17 mm	sub-rounded
rhyolite	2%	2.0 - .4 mm	sub-rounded
specularite	1%	.3 - .01 mm	rounded detrital grains
specularite	2%	powdery	recrystallized with hematite
hematite	3%	<.008 mm	interstitial grains and stain
limonite	1%	powdery	with some sericite masses
sericite	6%	<.04 mm	recrystallized plates and masses

Cement: recrystallized sericite, quartz, specularite, and hematite

Interstitials: sericite, recrystallized quartz and specularite, hematite, limonite

Textures and recrystallization: most quartz grains are internally polygonized, are undulose, and have partially sutured grain boundaries; recrystallized sericite and hematite are interstitial to interlocking quartz-grain mosaic; chert and jasper are not appreciably recrystallized.

Structures:

Sericite trains parallel shearing, probably not bedding, which is not seen in thin section

Comments on Genesis:

Moderately well-sorted but not mature sediment implies a relatively higher energy reworking environment with a volcanic and sedimentary source area nearby

Rock Name:

hematitic chert-quartz-jasper grit

SITE AND SAMPLE DESCRIPTION

Site Number: P 11 **Sample Number:** 154238 **Code:** M 101

Location: Narrows - Pine **Scintillometer Counts:** 65 cps

Quadrangle: Buckhead Mesa **U Value (U/NT) ppm:** 2.00

Sec., Twp, Ra.: S29, 12N, 9E **Coordinates:** 34°21'25";111°27'32"

Geologic Unit: quartz-rich grit

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : The quartzite is a fairly consistent light to medium maroon color. Grains are fine to medium sand-sized and well sorted. Cross-bed sets average 4 to 12cm in thickness and sometimes contain 1 to 4cm thick lenses of quartz, minor rhyolite and jasper grit.

Variability:

Sedimentary Structures: Planar cross-beds of 4-12cm thickness. Also, some thin fine-grained layers with ripple marks.

Depositional Environment: Low energy mature-sediment type environment. Short interruptions of higher energy as evidenced by grit layers.

SAMPLE DESCRIPTION : Rounded fragments of grit occur in an equal amount of light maroon, fine- to medium-grained quartzite matrix. Fragments, 1 to 5mm in length, consist of mainly quartz, minor jasper, rhyolite and rare chert.

Sampler: K. Wirth **Date:** Dec. 3, 1979

SITE AND SAMPLE DESCRIPTION

Site Number: P 12 **Sample Number:** 154239 **Code:** M 110

Location: Narrows - Pine **Scintillometer Counts:** 228 cps

Quadrangle: Buckhead Mesa **U Value (U/NT) ppm:** 7.70

Sec., Twp, Ra.: S29, 12N, 9E **Coordinates:** 34°21'08"; 111°27'13"

Geologic Unit: fine-grained quartzite

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Hematitic maroon, very fine-grained quartzite layers of 15 to 45cm thickness are interbedded with much thicker beds of medium-grained earthy-red quartzite. Finer layers have heavy concentrations of specularite on planar cross beds. Conglomerate fragments are absent in this section.

Variability: Scintillometer counts range from 60cps in the medium-grained quartzites, to 150 and 228cps in the different fine-grained layers.

Sedimentary Structures: Planar cross-bedding is present throughout the section in thin 2-7cm sets.

Depositional Environment: Very low energy, quiet environment, as indicated by the fine-grained, well sorted quartzites. Possibly an off-shore marine environment.

SAMPLE DESCRIPTION :A Hematitic maroon layer 33cm thick, is composed of well-sorted, very fine to fine-grained quartzite. No fragments are present. On 2-7cm thick cross-bedding planes are concentrated 3mm layers of dense black specularite. Small mica plates are visible on bedding surfaces.

Sampler: K. Wirth **Date:** Dec. 3, 1979

THIN SECTION DESCRIPTION

Site Number: P 12 Sample Number: 154239 Code: M 110

Percent Fragments: 0% Percent Matrix: 81%

Percent Heavies & Mafics: 19% Stain: hematite

Rock Type: Mazatzal quartzite Stratigraphic Group: Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios

No fragments present

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
Quartz	61%	.36 - .03mm	subangular, partly sutured
Chert	3%	.2 - .13mm	sub-rounded
Specularite	11%	.2 - .95mm	rounded detrital grains
Specularite	6%	powdery	recrystallized with hematite
Hematite	5%	powdery	fine interstitial grains and stain
Leucoxene	1%	powdery	alteration clots
Zircon	2%	.21 - .04mm	rounded grains
Sericite-clays	11%	<.04mm	masses interstitial to quartz grains

Cement: recrystallized quartz, sericite, specularite, and hematite

Interstitials: recrystallized quartz, sericite, specularite, and hematite

Textures and recrystallization: quartz grains undulose, partly sutured and composite; sericite-hematite forms a matrix interstitial to the quartz and preserves the primary angularity of the quartz grain boundaries.

Structures: Detrital specularite, zircon and leucoxene are strongly concentrated into 1.5 to 0.7 mm thick layers, which define bedding or cross-bedding planes, and together they make up to 85% of these layers.

Comments on Genesis: An argillaceous quartz sand with narrow bands of heavy-mineral concentrates implies thorough reworking and sorting of a specularite-rich source terrain.

Rock Name: Specularite-bedded and cross-bedded, red quartzite.

SITE AND SAMPLE DESCRIPTION

Site Number: C 1 **Sample Number:** 154015 **Code:** M 102

Location: Christopher Creek Camp **Scintillometer Counts:** 65 cps

Quadrangle: Promontory Butte **U Value (U/NT) ppm:** 2.3

Sec., Twp, Ra.: S25, 11N, 12E **Coordinates:** 34°18'20", 111°02'40"

Geologic Unit: Quartz - jasper pebble conglomerate in Mazatzal quartzite

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY: Sample was collected over 200 stratigraphic feet of Mazatzal quartzite section where thin (20cm) pebble-to granule-conglomerate layers containing quartz, jasper, chert, lesser rhyolite, slaty and dark (volcanic?) fragments with specularite concentrations occur in the finer grained Mazatzal quartzite to grit. Most of the quartzite is medium to coarse grained pale to dark maroon from specularite and hematite stain, grains coarser than 2mm are generally quartz with minor jasper. Some quartz could be of volcanic origin.

Variability: Shaly beds giving 160-180 cps are interbedded with quartzite giving 40-50 cps. More conglomeratic layers are quite variable in occurrence and thickness but are enriched (70-90cps) over the quartzites in radioactive counts. Abundance and size of cross beds vary proportionately with the frequency of conglomerate layers.

Sedimentary Structures: Quartzite, grit and conglomerate are well bedded and trough cross bedded. Cross beds are about 15 cm thick, criss-crossing and randomly oriented. Specularite is concentrated at base of stratification and cross bedded units, but cross bedding is not everywhere present.

Depositional Environment:

Systematically and frequently fluctuating energy conditions in either a coarse (near-shore) beach deposit or braided-river system with alluvial fans and or flood plains.

SAMPLE DESCRIPTION : Sample material varies from granule (5-15mm) to pebble (25-30mm) conglomerate which in finer grained types are 1/3 milky quartz, 1/3 dark brick red jasper and 1/3 bright red jasper and chert fragments. Coarser grained conglomerates are 1/4 milky white quartz pebbles, 1/4 bright red jasper, 1/4 dark red jasper and chert, and 1/4 black specularite-rich banded iron formation or jasper. Fragments are angular (chert) to well rounded (quartz). Matrix is bimodal with larger (3mm) grit size quartz grains and finer, strongly hematitic sandy and silty material. Rarer, well rounded fragments consist of well-recrystallized quartzite, some leucoxene (?)-bearing banded iron formation, zoned quartz-jasper, and chalcedonic chert. Fragment-to-matrix ratio varies from 1:1 to 1:2 with finer grained conglomerates, so all are matrix supported conglomerates.

Sampler: P. Anderson **Date:** Sept. 20, 1979

THIN SECTION DESCRIPTION

Site Number: C 1 Sample Number: 154015 Code: M 102

Percent Fragments: 65% Percent Matrix: 29%

Percent Heavies & Mafics: 6% Stain: strong brick red hematite stain

Rock Type: Mazatzal Conglomerate Stratigraphic Group: Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
Quartz	62%	8 - 3mm	Sub-rounded	1:2
Red Jasper	15%	10 - 2.5mm	Sub angular	1:2 (contains 10-50% hematite)
Rhyolite	2%	5 - 2mm	Rounded	1:1
Chert	5%	6.5 - 1.5mm	Sub-rounded	1:2.5
Sericitic	4%	3 - 2mm	Angular	1:4
Quartzite	12%	8 - 4mm	Rounded	1:1 foliated

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
Quartz	55%	3 - .05mm	Recrystallized and shredded
Sericite	25%	.07 - .02mm	Interstitial and grain-aggregates up to 0.6 mm
Specularite	1%	0.3 - .09mm	Detrital grains gone to hematite
Specularite	4%	.2 - .07mm	Acicular and platy crystals, regrowths
Zircon	1%	0.6 - .07mm	Subhedral with overgrowths
Chert	4%	1.5 - 0.1mm	Sub-rounded
Hematite	10%	1 - 0.05mm	Alteration of specularite and color stain

Cement: earthy hematite and recrystallized quartz

Interstitials: Sericite plates and clumps, recrystallized specularite, massive earthy hematite and some clay

Textures and recrystallization: Quartzite fragments are foliated to strongly recrystallized; other grains partly sutured and interlocking; foliated sericite rims larger grains; about 20% of grains and matrix recrystallized.

Structures: bedding structures are not obvious, fragments show no preferred orientations; heavies are not concentrated, but show equal distribution.

Comments on Genesis: Two different types of quartzite fragments (foliate and recrystallized) are in source terrain with high-hematite jasper or banded iron formation. Some clear unstrained quartz is of volcanic origin. Rock not metamorphosed enough to lose brick red color.

Rock Name: Hematitic quartz - jasper - quartzite granule conglomerate

THIN SECTION DESCRIPTION

Site Number: C 1 Sample Number: 154015 Code: M 102

Percent Fragments: 65% Percent Matrix: 29%

Percent Heavies & Mafics: 6% Stain: strong brick red hematite stain

Rock Type: Mazatzal Conglomerate Stratigraphic Group: Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
Quartz	62%	8 - 3mm	Sub-rounded	1:2
Red Jasper	15%	10 - 2.5mm	Sub angular	1:2 (contains 10-50% hematite)
Rhyolite	2%	5 - 2mm	Rounded	1:1
Chert	5%	6.5 - 1.5mm	Sub-rounded	1:2.5
Sericitic	4%	3 - 2mm	Angular	1:4
Quartzite	12%	8 - 4mm	Rounded	1:1 foliated

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
Quartz	55%	3 - .05mm	Recrystallized and shredded
Sericite	25%	.07 - .02mm	Interstitial and grain-aggregates up to 0.6 mm
Specularite	1%	0.3 - .09mm	Detrital grains gone to hematite
Specularite	4%	.2 - .07mm	Acicular and platy crystals, regrowths
Zircon	1%	0.6 - .07mm	Subhedral with overgrowths
Chert	4%	1.5 - 0.1mm	Sub-rounded
Hematite	10%	1 - 0.05mm	Alteration of specularite and color stain

Cement: earthy hematite and recrystallized quartz

Interstitials: Sericite plates and clumps, recrystallized specularite, massive earthy hematite and some clay

Textures and recrystallization: Quartzite fragments are foliated to strongly recrystallized; other grains partly sutured and interlocking; foliated sericite rims larger grains; about 20% of grains and matrix recrystallized.

Structures: bedding structures are not obvious, fragments show no preferred orientations; heavies are not concentrated, but show equal distribution.

Comments on Genesis: Two different types of quartzite fragments (foliate and recrystallized) are in source terrain with high-hematite jasper or banded iron formation. Some clear unstrained quartz is of volcanic origin. Rock not metamorphosed enough to lose brick red color.

Rock Name: Hematitic quartz - jasper - quartzite granule conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: C 2 **Sample Number:** 154017 **Code:** S 105

Location: Christopher Mtn. Fire Rd. **Scintillometer Counts:** 100

Quadrangle: Promontory Butte **U Value (U/NT) ppm:** 1.6

Coordinates: 34°17'08", 111°02'28"

Sec., Twp, Ra.: S1, 10N, 12E

Geologic Unit: Scanlan boulder conglomerate

Stratigraphic Group: Apache Group

SITE GEOLOGY : Scanlan boulder conglomerate occurs as an anomalously thick channel deposit cut into a paleobedrock of Mazatzal quartzite. It is overlain by flat-lying sandstone of upper units in the Apache Group (Dripping Spring?). The conglomerate apparently is a slope (river chasm?) deposit with about 800 vertical feet outcrop. It is composed of mostly boulders of Mazatzal quartzite in an oxidized, limonitic, muddy matrix of poorly sorted sand, silt clay and gravel. The boulder conglomerate may have been deposited on a steep paleoslope, but by fluvial processes because of the well-rounded boulders.

Variability: Boulder size varies from 3.5m down to a common size of 1m for large boulders. The most abundant size boulder is 30-50cm and includes Mazatzal quartzite, re aphanitic rhyolite and purple rhyolite types. The conglomerate fines laterally (to west) and down slope (up section). Some sandy layers are interbedded with the boulder conglomerate.

Sedimentary Structures: Bedding is crudely defined by alignment of the larger boulders or by sandy lenses but in most places is vanishingly poor to absent. No cross bedding is evident.

Depositional Environment: A steep (up to 30°) river chasm or stream channel (subject to storm washes) originating near a paleohigh of Mazatzal quartzite. Oxidizing fluvial conditions here compared to reducing submarine conditions further south.

SAMPLE DESCRIPTION : Pebble to cobble size (20-70mm) fragments of Mazatzal quartzite, rounded to subangular, lie in a finer grained matrix of sand, silt and clay size material supporting smaller granule size fragments of altered quartzite, rhyolite, jasper, shale and altered volcanic (?) rock. Mazatzal quartzite fragments are dark maroon and well bedded. The conglomerate matrix is a dirty reddish-brown, limonitic, poorly-sorted sandy mud which contains spherical patches of whitish clay not stained by geothite or limonite.

Sampler: P. Anderson **Date:** Sept. 20, 1979

THIN SECTION DESCRIPTION

Site Number: C 2 **Sample Number:** 154017 **Code:** S 105

Percent Fragments: 90% **Percent Matrix:** 10%

Percent Heavies & Mafics: 1% **Stain:** Orange hematite stain

Rock Type: Scanlan Conglomerate **Stratigraphic Group:** Apache Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
Quartzite	95%	68 - 4mm	Rounded	1:2.5 Mazatzal
Jasper	5%	7.5 - 2mm	Sub-rounded	1:3

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
Feldspar (?)	20%	0.4 - 0.05mm	Interlocking (adularia?) crystals composing rims of spheres
Sericite	20%	0.05 - 0.01mm	In cores of spheres
Clays	20%	Less than .01mm	In matrix and rims of spheres
Hematite (goethite)	20%	powder	Concentrated in matrix, none in spheres
Carbonate	10%	0.01mm	In cavities between grains
Quartz	10%	1.0 - 0.1mm	Angular broken grains

Cement: Hematite and carbonate

Interstitials: Clay and hematite (geothite)

Textures and recrystallization: Large Mazatzal fragments are hematite-and clay-altered at rims by oxidation, matrix is angular, poorly sorted and composed largely of uncrystallized clay material

Structures: Concretionary (?) spheres of feldspar (adularia?) sericite and clay have formed in matrix between fragments. Conglomerate is fragment supported.

Comments on Genesis:
Derived directly by erosion of Mazatzal Group source material, deposited in loosely consolidated matrix.

Rock Name: Scanlan boulder conglomerate of Mazatzal quartzite fragments in hematitic muddy matrix.

SITE AND SAMPLE DESCRIPTION

Site Number: C 3 **Sample Number:** 154018 **Code:** S 102

Location: Chamberlin Trail **Scintillometer Counts:** 120 cps

Quadrangle: Young **U Value (U/NT) ppm:** 2.2

Sec., Twp, Ra.: S6, 10N, 14E **Coordinates:** 34°14'36", 110°57'29"

Geologic Unit: basal Scanlan conglomerate

Stratigraphic Group: Apache Group

SITE GEOLOGY : Scanlan sits uncomformably on Mazatzal quartzite here and is composed of very angular pink, red and white, well-bedded Mazatzal quartzite fragments from 5 to 30 cm long in a blackish (probably carbon-bearing) muddy to sandy matrix. This is overlain by sandy brown sandstones, probably Dripping Springs Fm. To south are striking white to pink, highly angular Mazatzal quartzite cobbles in a dark hematitic matrix, and further south near C4 is coarse boulder conglomerate up to 85m thick of Mazatzal quartzite boulders in a goethitic matrix.

Variability: Scanlan is less than 1m thick at sampling point and variable radioactivity from 80 to 160 cps. To south this thickens to 10-15m with dark hematitic matrix then further south to coarse boulder conglomerate with counts from 120 to 170 cps.

Sedimentary Structures: Very little good bedding is observed, some cross bedding seen in sandy to gritty layers and outlined by hematite concentrations. Poor sorting, stratification or imbrication in the fragment-supported conglomerate.

Depositional Environment: This sample is very close to the northern lap out of Scanlan against Christopher Mountain, so a rapid southward thickening of stream talus, a debris slope, or a shore edge is represented. Most likely is braided stream channels because of the variable lateral thickness of the conglomerates.

SAMPLE DESCRIPTION :

Fragments of white to pinkish Mazatzal quartzite 40 to 30mm, and more commonly 20 to 10mm, lie in a dark greenish gray to yellowish-brown limonite-stained matrix. Fragments are subrounded to angular, but the smaller quartz grains are rounded. Most fragments are elongate parallel to bedding and define the bedding. Matrix material includes grit-size quartz grains, sand and silt but abundant yellowish brown clay. Hematitic quartzite, red jasper and sericitic quartzite are other less common varities of fragments.

Sampler: P. Anderson **Date:** Sept. 20, 1979

THIN SECTION DESCRIPTION

Site Number: C 3 **Sample Number:** 154018 **Code:** S 102

Percent Fragments: 75% **Percent Matrix:** 25%

Percent Heavies & Mafics: 20% **Stain:** some red hematite stain

Rock Type: Scanlan Conglomerate **Stratigraphic Group:** Apache Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
Quartzite	60%	30 - 3mm	Sub-rounded	1:1.5 Mazatzal
Quartz	25%	3 - 1mm	Rounded	1:1 Some volcanic
Hematite-sericite	10%	8 - 4mm	Sub-angular	1:2.5 Scanlan matrix (?)
Chert	5%	3 - 1mm	Sub-rounded	1:2.5

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
Quartz	3%	0.2 - .02mm	Angular broken grains
Clay	0%	.01mm	Brown-stained matrix mass
Specularite	10%	.18 - .02mm	Angular ghost grains
Hematite	15%	.02mm	Breakdown of specularite
Sericite	3%	0.3 - .02mm	Overgrowths, some interstitial
Feldspar	2%	.0.2mm	Angular broken grains
Zircon	1%	.01mm	Rounded detrital grains
Carbonate	1%	2mm	Long interstial patches

Cement: Carbonate, earthy hematite

Interstitials: Patchy and earthy hematite, clays

Textures and recrystallization: Large quartzite fragments are strongly recrystallized but Scanlan matrix material is completely unrecrystallized. Angular matrix quartz, hematite and feldspar in a matrix of brown clay are interstitial to touching fragments.

Structures: No bedding or cross bedding apparent. Hematite & sericite & clay fragments are either altered hematitic rhyolite or a redeposited piece of Scanlan matrix.

Comments on Genesis: Essentially all large fragments are clearly of Mazatzal-quartzite origin, recrystallized and deformed before Scanlan deposition. Poor sorting and angularity of matrix implies rapid deposition in oxidizing conditions.

Rock Name: Fragment-supported Scanlan conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: C 4 **Sample Number:** 154021 **Code:** M 211

Location: Chamberlin Trail **Scintillometer Counts:** 110 cps

Quadrangle: Young **U Value (U/NT) ppm:** 1.6

Sec., Twp, Ra.: S6, 10N, 14E **Coordinates:** 34°14'20", 110°57'34"

Geologic Unit: Mazatzal quartzite and grit

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : South of C 3 the Mazatzal underlying Scanlan consists of grit layers interbedded with coarse-to medium-grained cross-bedded quartzite. Specularite and other heavies are concentrated commonly along foreset beds but also in discreet laminations. This area was sampled principally to see what types of heavy metals are concentrated in these beds. Scintillometer response is uniformly 105-110 cps, without any special highs.
Grit to granule conglomerate layers are up to 50 cm wide but commonly 10-20 cm wide and constitute about 30% of the section.

Variability: Good foreset beds with specularite are developed in sandy layers which are interspersed by quartz-jasper grit or quartz-granule conglomerate.

Sedimentary Structures: The foreset beds are most commonly planar truncated; these planar cross bed sets are very abundant without trough cross beds, and current azimuths are variable.

Depositional Environment: Cross beds suggest a beach environment where washing and recutting increased sorting and winnowed heavies to concentrate them as foreset beds.

SAMPLE DESCRIPTION : Mazatzal grit here is pale brick red to pale maroon, quartz-rich and shows thin (1-2mm) specularite-rich laminations over a 5cm-amplitude cross-bed set. Adjacent matrix is sand-rich with white material (clay?) cementing the sand grains. Fragments (5-10mm long) are mostly (80%) well-rounded, milky, composite quartz grains, lesser jasper (10%) and chert (10%). Longer fragments are generally parallel to bedding, but specularite is seen only on cross-bed sets.

Sampler: P. Anderson **Date:** Sept. 21, 1979

THIN SECTION DESCRIPTION

Site Number: C 4 **Sample Number:** 154021 **Code:** M 211

Percent Fragments: 37% **Percent Matrix:** 55%

Percent Heavies & Mafics: 8% **Stain:** maroon hematitic stain

Rock Type: Mazatzal Conglomerate **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
Milky quartz	50%	10 - 2mm	Rounded	1:1.5
Glassy quartz	20%	3 - 1mm	Rounded	1:1 volcanic origin?
Quartzite	19%	14 - 3.5mm	Sub-rounded	1:2.5 hematite stained
Jasper	7%	2.5 - 1mm	Sub-rounded	1:1.5
Chert	4%	2.5 - 1mm	Sub-angular	1:2

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
Quartz	43%	1 - .01mm	Recrystallized, polygonized & shredded
Specularite	21%	0.7 - .16mm	Sub-rounded, detrital grains
Specularite	3%	.02 - .01mm	Acicular & platy crystals, regrowths
Hematite	5%	.007mm	Breakdown of specularite and in matrix
Sericite	1%	0.2 - 0.6mm	Interstitial to and foliated around grains and in clumps
Clay	21%	.01mm	Recrystallized
Zircon	1%	0.4 - .01mm	Partly altered
Jasper & Chert	5%	1 - 0.5	Rounded detrital grains

Cement: earthy-red hematite and quartz regrowths

Interstitials: Hematite, leucoxene (?), clay

Textures and recrystallization: Many quartz grains are interlocking and sutured especially in the matrix, quartz shows undulose extinction, is recrystallized and some grains are polygonized; rock texture is about 25%. recrystallized

Structures: Well-bedded; specularite is concentrated on bedding and cross-bedding planes; most fragments are concentrated in a 35mm wide bed.
Clay material rims the edges of larger fragments.

Comments on Genesis: Large, highly strained quartzite grains suggest proximal metamorphic source with detrital specularite and zircon. Clear glassy quartz grains are probably of volcanic origin but conglomerate too mature and well sorted to contain volcanic rock fragments.

Rock Name: Maroon hematitic and specularitic quartz-quartzite granule conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: C 5 **Sample Number:** 154022 **Code:** M 201

Location: Ellinwood Ranch **Scintillometer Counts:** 100cps

Quadrangle: Diamond Butte **U Value (U/NT) ppm:** 5.7

Sec., Twp, Ra.: S17, 10N, 13E **Coordinates:** 34°12'28", 111°02'38"

Geologic Unit: Mazatzal grit to conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Between Ellinwood Ranch and Haigler Creek, Mazatzal quartzite is more deformed and metamorphosed than in other parts of the Christopher Mountain region. Much red hematite is recrystallized to specularite and original detrital specularite is concentrated as dark bands 1mm to 40cm wide, as bedding planes, or as foreset-bed sets. Pebble conglomerate to grit layers range from 5cm to 30cm wide in a predominantly quartzitic rock. Conglomerate interbeds consist mainly of grit to granule size and are 70% white quartz fragments, 10% jasper fragments, 10% chert and quartzite, and 10% red-altered rhyolite fragments.

Variability: Main difference between here and site C 4 is the higher grade of metamorphism and deformation here. Specularite content of matrix varies from 20 to 40% down to 2%. Over 15 grit horizons comprise sample, but all uniform scintillometer response of 90 to 100cps.

Sedimentary Structures: Cross bedding with well-developed heavy minerals (mainly specularite) on foreset beds; lensoidal grit and granule conglomerate layers, but some are continuous for up to 100m.

Depositional Environment:
Analogous if not identical to C 4 (beach). Possibly alluvial fan because of lensoidal grit and granule conglomerate layers.

SAMPLE DESCRIPTION :
Quartz-jasper grit to pebbly conglomerate is about 70% fragments consisting of 2/3 white quartz and 1/3 red jasper, pale pink chert, and pink-altered microphenocrystic rhyolite. The matrix is dominantly quartz and fine-grained sericite. Specularite is not abundant (5-10% of matrix). A sutured, interpenetrating fabric is evident along with slight flattening of fragments and tectonic elongation. Rock is a recrystallized, relatively hard, dark maroon grit to granule clonglomerate.

Sampler: P. Anderson **Date:** Sept. 21, 1979

THIN SECTION DESCRIPTION

Site Number: C 5 **Sample Number:** 154022 **Code:** M 201

Percent Fragments: 35% ? **Percent Matrix:** 60%

Percent Heavies & Mafics: 5% **Stain:** pale maroon hematitic stain

Rock Type: Mazatzal Conglomerate **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
Quartz	75%	6 - 1mm	rounded	1:2
Chert	6%	4 - 1mm	rounded	1:4
Jasper	8%	4 - 1mm	sub-rounded	1:3
Rhyolite	6%	5 - 2mm	sub-rounded	1:2
Quartzite	5%	4 - 1mm	sub-rounded	1:2

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
Quartz	47%	0.8 - 0.1mm	Strained in matrix
Sericite	35%	0.2 - 0.02mm	Recrystallized from clay matrix
Specularite	10%	0.3 - 0.08mm	Mainly detrital, some interstitial patches
Jasper	3%	0.5 - 0.2mm	
Chert	4%	0.5 - 0.2mm	
Zircon	1%	0.15mm	altered but unzoned

Cement: Recrystallized, earthy hematite gone to specularite

Interstitials: Recrystallized quartz, sericite, specularite, minor earthy hematite

Textures and recrystallization: Most quartz fragments undulose and polygonized; matrix quartz and sericite recrystallized; quartz in quartzite fragments strongly foliated and shredded; sericite foliated around quartz fragments; sutured grain boundaries abundant.

Structures: bedding planes defined by abundant matrix sericite in some zones, abundant detrital specularite, zircon and fine-grained quartz in other zones. Matrix quartz and fragments partly aligned but not well bedded.

Comments on Genesis: Moderate-energy deposition but no indication of paleo-environment. Quartzite from the Alder group was present in source area, but non-volcanic quartz was the main source material.

Rock Name: Moderately recrystallized quartz-rich grit with chert, jasper, rhyolite and quartzite fragments.

SITE AND SAMPLE DESCRIPTION

Site Number: C 6 **Sample Number:** 154024 **Code:** M 201

Location: Lost Camp Canyon **Scintillometer Counts:** 92 cps

Quadrangle: Diamond Butte **U Value (U/NT) ppm:** 2.7

Sec., Twp, Ra.: S32, 11N, 13E **Coordinates:** 34°11'30", 111°04'20"

Geologic Unit: quartz-rich Mazatzal grit

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : This sample is representative of the southern fold-core extension of Mazatzal quartzite of C5 extending south across Haigler Creek. Quartzite uncomformably overlies rhyolite on both sides, is sheared at its contact and much of the outcrop is oxidized (altered). Most of the quartzite section is pale maroon, abundantl cross-bedded with some foreset specularite concentrations and it contains quart-rich grit layers from 5 to 15cm wide. Coarse grained fragments are absent. Where sheared the grit appears as a pale maroon sericitic schist with lumps of sheared quartz, chert, jasper and quartzite grains flattened parallel to foliation (axes 1:5:7).

Variability: Little radioactive (90cps) or grain-size variability at this site but uniformity of sand to grit size grains and lack of coarser fragments is in marked contrast to outcrops further north.

Sedimentary Structures: Abundant but small-scale planar cross beds, gritty layers and heavy mineral concentrations less frequent than further north.

Depositional Environment: All features indicate lower energy or more uniform energy conditions here than further north, suggesting deeper water, offshore conditions of submarine environment (below wave action). Also possibly alluvial-fan conditions but less likely.

SAMPLE DESCRIPTION :

Grit contains mostly quartz (50%), chert (25%), quartzite (10%), jasper (10%), and chalcedony (5%) fragments of uniform 4 x 2mm size, elongated (partly sutured and recrystallized) in an oxidized, hematitic, dark-red matrix of finer sand, silt and hematite. Fragments are 60 to 70% of rock, with some layers fragment-supported, others matrix-supported. Fragments and matrix quartz are well rounded but generally not high sphericity. Fragment elongation could be depositional preferred orientation or tectonic, as weathering rims do not permit an estimation of grain suturing.

Sampler: P. Anderson **Date:** Sept. 22, 1979

THIN SECTION DESCRIPTION

Site Number: C6 **Sample Number:** 154024 **Code:** M201

Percent Fragments: 53% **Percent Matrix:** 44%

Percent Heavies & Mafics: 3% **Stain:** dark maroon hematite stain

Rock Type: Mazatzal Conglomerate **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios	
Clear quartz	35%	4.5 - 2.0mm	Rounded	1:1.5	incl. muscovite
White quartz	25%	5.7 - 3.0mm	Sub-rounded	1:2	
Chert	16%	6.5 - 2.3mm	Sub-rounded	1:2	some metachert
Jasper	10%	4.7 - 2.0mm	Sub-rounded	1:2	
Quartzite	12%	5.5 - 2.0mm	Rounded	1:2	
Sericitic	2%	4.0 - 2.0mm	Sub-rounded	1:2	rhyolite

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
Quartz	60%	1.0 - 0.1mm	angular
Chert	8%	2.0 - 0.5mm	smaller subangular equivalent of fragments
Jasper	5%	1.0 - 0.5mm	poorly formed angular grains
Hematite	19%	powder	red earthy matrix cement
Clays	5%	.01mm	absent in some layers
Sericite	2%	0.4 - 0.1mm	overgrowths in & on edges of quartz fragments
Zircon	1%	0.2 - 0.04mm	euhedral in quartz grains

Cement: mainly earthy hematite

Interstitials: clay & hematite

Textures and recrystallization: Significant number of quartz grains (clear and white) are aligned and strained, quartzite grains are strongly shredded and foliated, chert and jasper are polygonally recrystallized; matrix is unrecrystallized and shows interstitial texture

Structures: Clays present in some bedding units, absent in others, fragments show preferred orientation from either deposition or strain; no specularite concentrations; bedding is defined by fragment distribution,not by heavies or grain-size differences.

Comments on Genesis: Several types of quartzites, recrystallized chert, jasper, muscovite-bearing quartz and strained-quartz fragments in source terrain suggesting complex metasedimentary source area; rock is low enough grade to preserve earthy hematite.

Rock Name: Hematitic red quartz-quartzite-chert granule conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: C 7 Sample Number: 154025 Code: M 101

Location: Horse Mtn. Scintillometer Counts: 92 cps

Quadrangle: Diamond Butte U Value (U/NT) ppm: 1.20

Sec., Twp, Ra.: S32, 11N, 13E Coordinates: 34°14'57", 111°01'50"

Geologic Unit: quartz - jasper grit conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : The Mazatzal quartzite on the south side of Horse Mountain is mostly maroon in color and composed of well-sorted medium sand-sized grains. The quartzite has a sheared appearance and some veins of remobilized quartz are present. Nearly horizontally-lying Scanlan conglomerate rests on vertically-dipping Mazatzal.

Variability: Quartzite varies from maroon well-sorted quartzite to gritty quartzite. Grit layers are lensoid and show well-defined cross-bedding with specularite concentrated on bedding planes. Grits vary in size from 1 to 8mm, but average 3-5mm in length. Compositions of the grit varies from nearly all quartz to mostly quartz, minor jasper and rare rhyolite.

Sedimentary Structures:
Planar cross bedding, emphasized by specularite concentrated on bedding planes.

Depositional Environment: Uniform energy conditions, depositing medium-grained moderately sorted quartzites, pervade throughout the section. Brief periods of higher energy are indicated by grit layers. Possibly a near-shore marine environment.

SAMPLE DESCRIPTION : Maroon, medium to coarse-grained quartzite, containing 2 to 6mm-long sub-rounded, fragments, of mostly quartz, minor jasper and rare rhyolite. The fragment to matrix ratio is 1:3. Specularite and leucoxene (?) are concentrated on cross-bedding planes, which occur in 2-7cm sets. Recrystallization of the quartzite is evident in the sutured character of the matrix. Some veins of remobilized white quartz are present.

Sampler: K. Wirth Date: Sept. 22, 1979

THIN SECTION DESCRIPTION

Site Number: C 7 Sample Number: 154025 Code: M 101

Percent Fragments: 62% Percent Matrix: 30%

Percent Heavies & Mafics: 2% Stain: maroon hematite stain

Rock Type: Mazatzal Conglomerate Stratigraphic Group: Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
White quartz	65%	5.5 - 1.5mm	Rounded	1:1.5
Jasper	9%	2.5 - 1.5mm	Sub-rounded	1:2
Chert	7%	1.0mm	Sub-rounded	1:2
Quartzite	16%	4.5 - 1.5mm	Rounded	1:2
Rhyolite (?)	3%	3.0 - 1.5mm	Rounded	1:1 sericitic

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
Quartz	60%	1.5 - 0.2mm	Subrounded discreet grains
Clay	15%	.01mm	Interstitial brown material
Specularite	12%	0.17 - 0.18mm	Subrounded detrital grains
Hematite	5%	powder	Alteration of Specularite and disseminated
Rhyolite (?)	3%	0.8 - 0.4mm	Hematite-sericite-quartz fragments
Chert	2%	1.0 - 0.5mm	Smaller subangular fragments
Zircon	1%	0.18 - 0.10mm	altered, some metamict
Leucoxene	2%	0.15mm	concentrated in specularite bed

Cement: Some fine grained silica in veinlets and between grains, hematite

Interstitials: Clay & hematite & sericite

Textures and recrystallization: Quartzite and quartz fragments are recrystallized and polygonized but grain - grain - matrix relations show no recrystallization. Fragments contacting but no suturing, minor contact-point strain; black rim to most fragments; specularite partly broken down to hematite.

Structures:
Good bedding-cross bedding sets in one area emphasized by specularite, leucoxene and fine grained quartz; fragment concentrations, clay matrix and elongate fragments define bedding elsewhere

Comments on Genesis: Mainly strained to foliated quartz and metasedimentary rocks in source terrain but conglomerate is barely deformed and recrystallized. Low strain and little recrystallization of original oxidized-hematite condition.

Rock Name: Well-bedded, cross-bedded, hematitic-specularitic quartz-quartzite grit.

SITE AND SAMPLE DESCRIPTION

Site Number: C 8 Sample Number: 154026 Code: M 201

Location: Horse Mtn. Scintillometer Counts: 93 cps

Quadrangle: Diamond Butte U Value (U/NT) ppm: 1.40

Sec., Twp, Ra.: S9, 10N, 13E Coordinates: 34°13'31", 111°01'43"

Geologic Unit: quartz - jasper - rhyolite grit

Stratigraphic Group: Mazatzal quartzite

SITE GEOLOGY : Vertically-dipping maroon quartzite rests unconformably on earthy hematite-red rhyolite. The quartzite is for the most part pure except for occasional thin layers of grit or dark maroon shale. Grit layers are dominated by white quartz grains of 1 to 5mm size. Minor jasper and rhyolite and rare shale rip-up fragments are also present in grit layers. Detrital specularite is present on some foreset and planar cross-bed set bedding planes.

Variability: The quartzites vary from dark maroon to pale orange in color. Grains are mostly medium sand-sized and sub-rounded. Occasional coarser grit layers and finer shale layers are interbedded, but do not make up more than 10% of the total outcrop.

Sedimentary Structures: Planar cross-beds of 7-20cm thickness are common throughout; mudcracks with thick red hematite are present in more shaley layers.

Depositional Environment: Uniform conditions, depositing medium-grained quartzite, pervaded throughout much of the history of the section. Short periods of higher and lower energy and emergence are indicated by grit and shale layers with mudcracks. Foreshore to backshore environment.

SAMPLE DESCRIPTION : Maroon quartzite with matrix-supported fragments occur in a rock with 85% matrix. The matrix is medium grained and moderately well-sorted within local layers. Quartz and jasper are the main grain-types in the matrix. Sub-angular to sub-rounded fragments of mainly quartz, minor jasper, rhyolite and apparent rare shale chips average 1 to 5mm in length. Some recrystallization is evidenced in the sutured grain boundaries and veins of remobilized quartz. Some detrital specularite is present on bedding planes.

Sampler: K. Wirth Date: Sept. 22, 1979

THIN SECTION DESCRIPTION

Site Number: C 8 **Sample Number:** 154026 **Code:** M 201

Percent Fragments: 30% **Percent Matrix:** 67%

Percent Heavies & Mafics: 3% **Stain:** pink hematitic stain

Rock Type: Mazatzal conglomerate **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
white quartz	84%	7.5 - 1.5mm	sub-rounded	1:2
jasper	4%	3.0 - 1.5mm	sub-angular	1:2
rhyolite	2%	4.7 - 1.5mm	sub angular	1:2
chert	3%	2.8 - 1.5mm	sub-rounded	1:1.5
sericite	2%	2.0 - 1.5mm	sub-angular	1:2.5
quartzite	5%	2.0 - 1.5mm	sub-angular	1:1.5

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	55%	1.5 - 0.1mm	mainly recrystallized
sericite	27%	0.08 - 0.02mm	well recrystallized felted mats
chert	7%	1.5 - 0.5mm	recrystallized
jasper	5%	1.0 - 0.2mm	up to 70% specularite
specularite	5%	0.3 - 0.05mm	highly spherical, detrital grains
hematite	2%	0.01mm	local alteration of sericite
zircon	1%	0.08mm	well crystalline

Cement: minor earthy hematite, recrystallized quartz

Interstitials: sericite, (clay?), hematite, recrystallized quartz

Textures and recrystallization: most matrix quartz and fragment quartz (& chert) are significantly recrystallized; sericite mats are completely recrystallized from clay ; grains sutured and interlocking; heavies interstitial; quartzite grains strongly foliate.

Structures:

Planar cross bedding structures are defined by concentrations of specularite and hematite in bedding planes. A 12mm-thick bed of coarse fragments defines bedding direction in an otherwise equigranular-textured rock.

Comments on Genesis:

Rock derived from erosion of a mature quartz-rich terrain with minor volcanic, metamorphic and jasper-chert rock types as well. Significant post-depositional metamorphism is shown. Heavy fraction is detrital specularite mainly. Depositional environment is well washed and sorted.

Rock Name:

recrystallized quartz-rich, quartzite-chert grit

SITE AND SAMPLE DESCRIPTION

Site Number: C 9 **Sample Number:** 154046 **Code:** M 212

Location: Young - Heber Rd. **Scintillometer Counts:** 90 cps

Quadrangle: Young **U Value (U/NT) ppm:** 0.70

Sec., Twp, Ra.: S2, 9N, 14E **Coordinates:** 34°09'30"

Geologic Unit: Metamorphosed Mazatzal quartzite to sparse conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Outcrops on the highway north of Young lie 100 to 200m from the contact of the Young granite. This pink granite has intruded and metamorphosed Mazatzal quartzite to sufficiently high grade to destroy the hematitic appearance. The quartzite is white throughout but contains black fragments and black lines marking bedding and cross-bedding planes. Except for the sparse black fragments in some layers, the quartzite is devoid of obvious grit or conglomerate. However, metamorphism has most probably polygonized most of the quartz grains that were originally as large as the jasper grains.

Variability: Most of the section is medium to coarse-grained quartzite with some rare grit layers but no obvious conglomerate layers. Much of the conglomerate appearance could have been destroyed by metamorphism.

Sedimentary Structures: Relict planar cross-bedding is abundant in the quartzite.

Depositional Environment: In the absence of contradictory evidence, most probably equivalent to C 4.

SAMPLE DESCRIPTION : The white quartzite consists of an interlocking mosaic of highly recrystallized quartz grains with finely disseminated muscovite (1%) and 5 to 15% dark gray to black patches that in some places show sharp fragment boundaries and elsewhere diffuse grain-boundaries. In the core of several rounded black fragments are relict spots (1-3mm) of dark red hematitic jasper indicating that the black fragments were jasper in which hematite is now metamorphosed to black specularite. Fragments range from 15 to 5mm so quartzite appears to be a metamorphosed sparse-jasper fragment conglomerate. Except for distinct specularite concentrations on bedding laminations and cross-beds, few other sedimentary features remain.

Sampler: P. Anderson **Date:** Oct. 2, 1979

THIN SECTION DESCRIPTION

Site Number: C 9 **Sample Number:** 154046 **Code:** M 212

Percent Fragments: 10% **Percent Matrix:** 85%

Percent Heavies & Mafics: 5% **Stain:** black to none

Rock Type: Mazatzal quartzite **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	100%	5 - 2mm	very angular	1:2
jasper	-		not seen in this section	
specularite	-		not seen in this section	

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	79%	2 - 0.4mm	recrystallized, shredded, polygonized
muscovite	10%	0.8 - .02mm	recrystallized platy grains
specularite	7%	1 - .04mm	recrystallized
specularite	2%	.5 - .04mm	subhedral detrital
hematite	1%	massive	massive patches with muscovite
biotite	< 1%	.17 - .08mm	with muscovite
zircon	1%	.16 - .04mm	rounded detrital
chlorite	< 1%	.85mm	small recrystallized plates

Cement: recrystallized quartz

Interstitials: muscovite, biotite, chlorite and recrystallized quartz

Textures and recrystallization: quartz grains moderately sutured, strained, recrystallized, some shredding, foliation and subparallel alignment; muscovite, specularite and interstitial quartz are all well-recrystallized; rock generally an interlocking mosaic of grains.

Structures:
specularite concentrations clearly define 1- to 3mm-wide bedding and cross-bedding laminations

Comments on Genesis: Very well-sorted, very mature quartz-specularite sand suggests quartz-rich source terrain and thorough winnowing and washing of quartz-specularite sand such as in a beach environment.

Rock Name: specularite cross-bedded quartzite

SITE AND SAMPLE DESCRIPTION

Site Number: C 10 **Sample Number:** 154111 **Code:** S 204

Location: Chamberlain Trail **Scintillometer Counts:** ND

Quadrangle: Young **U Value (U by NT) ppm :** 2.20

Sec., Twp, Ra.: S6, 10N, 14E **Coordinates:** 34° 14' 20", 110° 57' 34"

Geologic Unit: Scanlan conglomerate

Stratigraphic Group: Apache Group

SITE GEOLOGY : A 5-8 meter thick Scanlan unit consists of fine-grained grey-black to brown specularite sandstone and quartzite. Interbedded are 40cm-thick conglomerate layers with angular pebble to cobble-size fragments of Mazatzal quartzite. Sample is close to C4 and C13.

GR 310 spectrometer readings: Total counts 40.08cps; K=3.59cps; Th=1.24cps; U=1.56cps. Equivalents = 1.85% K, 11.9 ppm Th and 8.74 ppm U.

Variability: The Scanlan conglomerate shows a reduction in fragment size and density near the top of the unit. It grades upwards into shales which contain ripple marks and mud cracks. The conglomerate layers themselves show little internal compositional or size variation.

Sedimentary Structures: Mazatzal quartzite fragments in the conglomerate show no preferred orientation, so bedding structures are undefined. Ripple marks and mud cracks appear in the shales immediately above the Scanlan conglomerate.

Depositional Environment: A river channel type of environment is indicated by the lack of well defined bedding planes, angularity of the fragments and by the poorly sorted character of the conglomerate. Trend towards lower energy deposition with time is indicated by the fining-upwards sequence.

SAMPLE DESCRIPTION :

Rectangular and angular fragments 18 to 70mm long are supported in a fine-grained quartzite matrix in a ratio of 1:1. The matrix is well sorted and composed of well rounded quartz grains. The black color of the matrix may be due to very fine specularite or some carbonaceous material. Fragments are mostly white to purple Mazatzal quartzite. Minor amounts of pale green chert and sub-rounded white quartz are also present. Fragments show no preferred orientation or imbrication.

Sampler: K. Wirth & J. D. Loghry **Date:** Oct. 31, 1979

SITE AND SAMPLE DESCRIPTION

Site Number: C 11 **Sample Number:** 154149 **Code:** M 102

Location: Bear Flat **Scintillometer Counts:** ND

Quadrangle: Promontory Butte **U Value (U/NT) ppm:** 1.3

Sec., Twp, Ra.: S2, 11N, 12E **Coordinates:** 34°16'33", 111°03'28"

Geologic Unit: hematitic grit in Mazatzal quartzite

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Mazatzal quartzite sits uncomformably on granite and is uncomformably overlain by Scanlan conglomerate on the west end of Christopher Mountain. Here it is a dark maroon, well-bedded and thinly-bedded but not abundantly cross-bedded quartzite containing in places quartz - jasper granule conglomerate layers. Most of the quartzite is a medium- to fine-grained, pervasively hematite-stained quartzite with layering defined by subtle changes in grain size and specularite content. Detrital specularite is concentrated as 1mm-thick laminae on bedding and cross-bedding planes.

Variability: Mazatzal quartzite here shows little variability from medium-grained quartzite with only 5% of the section containing grit or conglomerate. Most variability is where local pyritic and limonite-stained zones cut the stratigraphy.

Sedimentary Structures: Cross bedding common but not ubiquitous, always planar.

Depositional Environment: Uniform energy, submarine conditions below intertidal zone with periodic but infrequent higher-energy sediment influx.

SAMPLE DESCRIPTION : Grit sample is quartz-fragment rich (90%) with minor hematitic quartzite, chert and rare jasper (10%) with fragment-to-matrix ratio 3:1. A pale orangy pink color is present throughout the matrix from disseminated hematite (less than 1%). Few fragments are dark from sericite or specularite concentrations. Thin layers (1-2mm) of detrital specularite concentrations define bedding planes and foresets of cross-bed sets. Specularite is mostly confined to these zones and not spread throughout the matrix. Both fragments and matrix appear to be significantly recrystallized.

Sampler: P. Anderson **Date:** Nov. 15, 1979

SITE AND SAMPLE DESCRIPTION

Site Number: C 12 **Sample Number:** 154150 **Code:** U 105

Location: Crouch Mesa **Scintillometer Counts:** 150 cps

Quadrangle: Young **U Value (U/ NT) ppm:** 3.9

Sec., Twp, Ra.: S35, 10N, 14E **Coordinates:** 34°09'35"; 110°53'49"

Geologic Unit: Dripping Spring conglomerate

Stratigraphic Group: Apache Group

SITE GEOLOGY : A conglomerate unit of 1 to 3 meter thickness is underlain by approximately 6 meters of yellow medium-to coarse-grained quartzite. The lower-quartzite unit is in contact with the Young Granite. The conglomerate is Scanlan-like in appearance, but by definition can not be the basal Scanlan conglomerate due to the presence of the 6 meters of underlying quartzite.

Variability: Scintillometer counts are constant throughout the quartzite, averaging 80-120 cps. The conglomerate layer is slightly higher in scintillometer counts, averaging 120-150 cps. The conglomerate layer also appears to be lensoidal with a total length of 60-100 meters.

Sedimentary Structures: More elongate fragments show imbrication, possibly defining a general north-to-south current direction.

Depositional Environment: Fluvial channel deposit as indicated by poor sorting, fragment angularity and size, and lensoidal shape of conglomerate unit.

SAMPLE DESCRIPTION : This sample is nearly idential to the conglomerate layer sampled at Site C11. The matrix is composed of a brown to maroon silt to fine sand. It supports sub-angular 8-80mm-long fragments in a ratio of 3:2. Fragments are composed mostly of recrystallized Mazatzal quartzite (Site C9 type). Mazatzal quartzite fragments are rectangular in shape and contain moderate amounts of specularite. Some rounded fragments of yellow to pink granite (Young Granite?) and pink feldspars are also present. Pink rhyolite (?) and white vein-quartz, sub-rounded to rounded and elongate in character, are also present in minor amounts.

Sampler: K. Wirth & J. Trembly **Date:** November 16, 1979

THIN SECTION DESCRIPTION

Site Number: C 12 **Sample Number:** 154150 **Code:** U 105

Percent Fragments: 78% **Percent Matrix:** 13%

Percent Heavies & Mafics: 9% **Stain:** hematite

Rock Type: Dripping Spring Congl. **Stratigraphic Group:** Apache Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartzite	93%	42 - 2.5 mm	sub-rounded	1:2
rhyolite	7%	7 mm	sub-angular	1:1.5

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartzite	6%	2.5 - .4 mm	sub-rounded
quartz	40%	1.3 - .03 mm	sub-angular to sub-rounded
muscovite	12%	.8 - .09 mm	angular detrital fragments
sericite	4%	<.01 mm	recrystallized masses
specularite	5%	.3 - .08 mm	rounded, broken detrital grains
hematite	33%	powdery	fine interstitial grains and masses

Cement: mostly hematite and minor recrystallized sericite

Interstitials: sericite, hematite

Textures and recrystallization: most sericite recrystallized from clay. Matrix is framework supported, with angular quartz grains touching. No recrystallization of matrix; quartzite fragments sutured and foliated

Structures: fragments too coarse for bedding to be seen

Comments on Genesis: Fragments are derived from a source terrain of Mazatzal quartzite, hematitic rhyolite and altered Alder volcanics. Detrital specularite in matrix is consonant with same Mazatzal source.

Rock Name: Hematitic quartzite-pebble conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: C 13 **Sample Number:** 154151 **Code:** M 101

Location: Chamberlain Trail **Scintillometer Counts:** 90 cps

Quadrangle: Young **U Value (U by NT) ppm :** 1.4

Sec., Twp, Ra.: S1, 10N, 13E **Coordinates:** 34°14'18"; 110°57'42"

Geologic Unit: Mazatazl grit

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Mazatzal quartzite is light pink to light purple and medium-to coarse-grained with some grit. This site lies below the section described in sites C4 and C10.

Variability: The concentrations of heavies and the density of conglomerate fragments are highly variable throughout the section.

Sedimentary Structures: Planar crossbeds and conglomerate lenses

Depositional Environment: Stable, moderate energy conditions for quartzite and grit; suggests a shallow water, near-shore marine or fluvial environment

SAMPLE DESCRIPTION : The sample is a light purple to maroon, medium-grained quartzite containing 2-6cm layers of grit-to granule-size fragments in a matrix to-fragment ratio of 3:1. Fragments are sub-angular to sub-rounded, average 4-8mm in length, and consist mostly of quartz, minor jasper, chert and rare shale or siltstone. Elongate fragments are aligned parallel to bedding and cross-bedding planes, both of which are emphasized by specularite concentrations.

Sampler: K. Wirth **Date:** Nov. 16, 1979

THIN SECTION DESCRIPTION

Site Number: C 13 **Sample Number:** 154151 **Code:** M 101

Percent Fragments: 63% **Percent Matrix:** 32%

Percent Heavies & Mafics: 5% **Stain:** hematite

Rock Type: Mazatzal quartzite **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	60%	7.0 - 2.0 mm	sub-rounded	1:1.5
jasper	10%	4.3 - 1.0 mm	sub-angular	1:2
chert	8%	4.5 - 2.0 mm	sub-rounded	1:2
quartzite	4%	4.8 - .20 mm	sub-rounded	1:2
rhyolite	18%	9 - 2.0 mm	sub-angular	1:2

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	80%	2.0 - .02 mm	rounded and recrystallized
jasper	3%	2.0 - .21 mm	sub-rounded
chert	4%	2.0 - .17 mm	sub-rounded
rhyolite	2%	2.0 - .32 mm	sub-rounded
specularite	4%	.4 - .03 mm	rounded detrital grains
specularite	1%	<.08 mm	recrystallized plates with hematite and sericite
hematite	2%	powdery	interstitial grains and stain
leucoxene	<1%	powdery	alteration
sericite	4%	<.09 mm	recrystallized plates and masses
zircon	<1%	.4 - 19 mm	rounded detrital

Cement:

Recrystallized quartz, sericite and specularite; also hematite

Interstitials:

recrystallized quartz, sericite and specularite, hematite, leucoxene

Textures and recrystallization:

Most quartz grains show moderate undulose extinction and grain boundary suturing; some quartz grains are composite or polygonized; recrystallized quartz, sericite and specularite interfinger in the intersticies; interlocking & suturing abundant but sericite matrix remains interstitial

Structures:

cross-bedding planes are clearly defined by specularite and hematite concentrations. Some larger flat rhyolite granules parallel bedding.

Comments on Genesis: Resistant terrain of vein quartz, jasper and minor rhyolite with abundant specularite is required in the source area. Well bedded and cross bedded suggests fluvial environment, moderate energy with good granule sorting but leaving clay matrix

Rock Name: quartz-jasper-rhyolite-chert granule conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: D 1 Sample Number: 154027 Code: S 103

Location: E of Granite Tank Scintillometer Counts: 160 cps

Quadrangle: Young U Value (U by NT) ppm : 2.50

Sec., Twp, Ra.: S22, 9N, 13E Coordinates: 34° 06' 59"; 110° 59' 55"

Geologic Unit: Polymictic conglomerate of Scanlan

Stratigraphic Group: Apache Group

SITE GEOLOGY :
Scanlan conglomerate rests unconformably on Young granite just west of Young. It is a pebble conglomerate of mainly pink to red Mazatzal quartzite and conglomerate cobbles, fine grained white quartzite, brick red rhyolite, red jasper, vein and white quartz pebbles, with some mafic volcanic and dioritic pebbles as well. Unconformity is very sharp and bedding well defined at 020/40° NW.

Variability:
Counts are uniformly 140 to 160 cps, with little variation in the conglomerate except for a fining of fragment sizes upwards.

Sedimentary Structures:
Scanlan is well bedded, graded bedded, in some places cross bedded, and generally fining upwards.

Depositional Environment:
Fragment diversity suggests a complex Alder volcanic, Alder sedimentary, red rhyolite to granite and Mazatzal source terrain eroding into a fluvial channel, outwash plain or prograding beach gravel to form a blanket deposit.

SAMPLE DESCRIPTION :
Fragments of Mazatzal quartzite, white quartzite, bedded quartzite, and vein quartz tend to be the largest sizes (4-6cm), with most other fragments smaller than this. Rhyolite, quartzite and jasper fragments tend to be rounder than white and vein quartz pebbles. Conglomerate is matrix supported in a matrix of coarse (grit to sand) grained quartz-feldspar sand, pink broken feldspars, red-brown rhyolite chips and biotite or specularite in a pale brick red hematitic groundmass. Only white quartz and yellow quartzite pebbles do not have the red cast that is pervasive throughout the rest of the rock.

Sampler: P. Anderson **Date:** Sept. 22, 1980

THIN SECTION DESCRIPTION

Site Number: D 1 Sample Number: 154027 Code: S 103

Percent Fragments: 70% Percent Matrix: 23%

Percent Heavies & Mafics: 7% Stain: none

Rock Type: Scanlan Conglomerate Stratigraphic Group: Apache Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
chert	44%	45 - 2mm	sub-rounded	1:5 - 1:2
purple quartzite	26%	23mm	rounded	1:3
red rhyolite	17%	12 - 2mm	rounded	1:2
red jasper	6%	6 - 2mm	rounded	1:2
feldspar	4%	3 - 2mm	euhedral crystal	1:3
white quartz	3%	6 - 2mm	sub-rounded	1:2

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	62%	2 - .04mm	rounded
chert	13%	2 - .28mm	sub-rounded to rounded
red jasper	5%	2 - .4mm	sub-rounded
specularite	5%	.4 - .07mm	sub-rounded, detrital grains
specularite	3%	.7 - .05mm	recrystallized plates, masses, overgrowths
hematite	1%	massive	interstitial stain with specularite,sericite
feldspar	5%	1 - 0.5mm	altered orange feldspars
biotite	1%	.3 - .05mm	masses and radiating plates with specularite
zircon	1%	.2 - .04mm	sub-rounded, elongate, detrital grains
clays(?)	3%	---	finely crystalline interstitial masses

Cement: recrystallized quartz, earthy hematite, clays

Interstitials: clays, earthy hematite, biotite, recrystallized specularite, shredded and recrystallized quartz.

Textures and recrystallization: quartz grains show undulose extinction; shredded and recrystallized quartz in the matrix; subhedral overgrowths on feldspars and larger quartz, quartzite and chert grains; recrystallized biotite plates and specularite near detrital specularite.

Structures:

Bedding structures are not visible at a small scale in this coarse grained sample. Detrital specularite shows good bedding interstitial to larger fragments

Comments on Genesis: Some characteristic orange-colored feldspars come from the Young granite but most fragments are of Mazatzal quartzite and Alder cherts deposited in a poorly-sorted, fluvial or submarine basal-conglomerate environment

Rock Name: quartzite-chert pebble conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: D 2 **Sample Number:** 154028 **Code:** A 102

Location: Thurlo Wildlife Tank **Scintillometer Counts:** 105 cps

Quadrangle: Diamond Butte **U Value (U by NT) ppm :** .70

Sec., Twp, Ra.: S16, 9N, 13E **Coordinates:** 34° 07' 37"; 111° 01' 15"

Geologic Unit: jasper - chert pebble conglomerate

Stratigraphic Group: Alder Group

SITE GEOLOGY :
On road to Thurlo Wildlife Tank is a typical Alder-type "sedimentary" pebble to granule conglomerate. Characteristically, fragments are elongated parallel to prominent foliation of the matrix, and recrystallized mica trains (from clay-rich matrix) give the rock a semi-schist appearance. Fragments are typically gray to pink chert, red jasper, white quartz, sericitic, schistose, pinkish rhyolite, dark red rhyolite, green andesite or diorite, and flattened or schistose mafic tuff. Some parts of the conglomerate are not unlike Scanlan or Mazatzal in appearance, except for prominent foliation.

Variability:
Counts are uniformly 100 to 110 cps with little variability. Except for variable sizes and types of fragments from place to place, and variations in foliation intensity, the conglomerate appears very uniform.

Sedimentary Structures:
Structures indicating shallow water or wave action are notably absent. Some graded bedding and bedding planes are apparent.

Depositional Environment:
Relatively deep water sub-littoral conditions where sedimentary and volcanic material was depositing at a uniform rate.

SAMPLE DESCRIPTION :

The Alder "sedimentary" conglomerate is characterized by a sandy brown, quartz-rich, partly feldspathic matrix of seriate grain sizes from sand-to grit-size quartz, to silt and clay material (now recrystallized micas and siliceous intergrowths). Large (10-20mm) banded red jasper, recrystallized quartz and quartzite (?) retain their oval shapes, whereas fine grained gray chert, red rhyolite and silty fragments are reoriented elongate to foliation. Matrix shows a prominent mica and recrystallized quartz foliation. Rare specularite-banded rhyolite and jasper fragments are present.

Sampler: P. Anderson **Date:** Sept. 22, 1979

THIN SECTION DESCRIPTION

Site Number: D 2 **Sample Number:** 154028 **Code:** A 102

Percent Fragments: 5% **Percent Matrix:** 93%

Percent Heavies & Mafics: 2% **Stain:** Maroon hematite stain

Rock Type: boulder conglomerate **Stratigraphic Group:** Alder Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
white quartz	43%	8 -2mm	sub-rounded	1:2
red jasper	34%	7.5 - 2mm	sub-angular	1:2.5
chert	23%	3.7 - 2mm	sub-angular	1:2

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
clear quartz	65%	2 - .04mm	sub-rounded to angular
jasper	7%	2 - .08mm	sub-rounded to angular
chert	5%	2 - .09mm	sub-angular to rounded
quartzite	5%	2 - 1mm	strongly recrystallized, rounded
specularite	3%	.2 - .05mm	rounded, detrital grains
specularite	2%	.17 - .03mm	recrystallized plates, masses, overgrowths
hematite	5%	powdery	interstitial stain and with specularite
clay	8%	--	finely crystalline interstitial masses
sericite	< 1%	.08 - .01	foliated masses in matrix

Cement: clays, hematite, recrystallized quartz

Interstitials: clays, recrystallized specularite; hematite; recrystallized and shredded quartz

Textures and recrystallization: Foliated masses of sericite-hematite-altered feldspar -clay define main rock foliation, interstitial to which are angular, less recrystallized quartz and altered rock fragments. Much of primary material, including quartz is recrystallized by deformation

Structures:

Color changes and grain size changes define bedding.

Subparallel alignment to fragments, heavy minerals and foliated micaceous masses are bedding features transposed by foliation.

Comments on Genesis:

Rock was originally an impure, poorly sorted, dirty-matrix lithic wacke or volcanic sandstone of rapidly-recycled detritus from a volcanic source area. Indicates deeper water conditions where washing and cleaning action was absent.

Rock Name: foliated quartz-jasper-altered volcanic-rock-fragment granule conglomerate

THIN SECTION DESCRIPTION

Site Number: D 3 **Sample Number:** 154047 **Code:** A 102

Percent Fragments: 35% **Percent Matrix:** 58%

Percent Heavies & Mafics: 7% **Stain:** Maroon hematite stain

Rock Type: granule conglomerate **Stratigraphic Group:** Alder Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
white quartz	25%	8 - 2mm	sub-rounded	1:1.5
red rhyolite	17%	9 - 2mm	sub-rounded	1:2
jasper	20%	7 - 2mm	sub-angular	1:2
chert	25%	8 - 2mm	sub-rounded	1:3
clear quartz	3%	2.5 - 2mm	rounded	1:15
volcanic rock fragments	10%	4 - 2mm	sub-angular	1:3

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
clear quartz	60%	2 - .08mm	sub-rounded, polygonized, strained
quartzite	5%	2 - 0.3mm	foliated interlocking and shredded
jasper	4%	2 - .07	sub-angular to sub-rounded
chert	4%	2 - .08	sub-rounded
specularite	8%	0.6 - .18mm	rounded detrital grains
specularite	1%	0.3 - .05mm	recrystallized plates and masses
hematite	1%	powdery	interstitial stain and masses
sericite	5%	.05 - .02mm	recrystallizing from clay & feldspar
clay	12%	.01 - .005mm	interstitial matrix to all grains
leucoxene, zircon	<1%	powdery	mixed in with specularite

Cement: hematite, clays, leucoxene, recrystallized specularite and quartz

Interstitials: Clays and sericite, recrystallized shredded quartz, specularite, hematite, leucoxene

Textures and recrystallization: quartz grains are polygonized, strained and undulos but are supported in a clay-sericite matrix and not sutured. Sericite-clay matrix foliated and recrystallized from elongate volcanic fragments.

Structures: Foliation dominant over, and oblique to bedding, but bedding defined by specularite concentrations, fragment concentrations and grain size variations

Comments on Genesis: Like D2, a dirty volcanic sandstone, poorly sorted and relatively immature, derived by erosion of rhyolite-jasper-volcanic rock fragment - volcanic quartz terrain, dominantly rhyolitic. Relatively low energy depositional environment

Rock Name: foliated, impure, rhyolite-quartz-jasper granule conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: D4 Sample Number: 154048 Code: M202

Location: Upper Little Walnut Canyon
Quadrangle: Buzzard Roost Mesa

Scintillometer Counts: 100 cps
U Value (U by NT) ppm : 1.7

Sec., Twp, Ra.: S32, 9N, 13E

Coordinates: 34° 05' 08" N, 111° 02' 07" W

Geologic Unit: Mazatzal Conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Nearly 100 meters of interbedded quartzite and conglomerate are exposed at this site resting unconformably on Alder rocks. Conglomerate fragments vary in size form grit to small cobble and are commonly well-sorted within local layers which average 1-3 meters in thickness. Matrix grains are commonly medium to coarse-sand sized. At the top of the Mazatzal quartzite approximately 1 meter of Scanlan conglomerate is exposed.

Variability: Conglomerate layers vary in fragment size, density, thickness and composition.

Sedimentary Structures: Trough cross-beds of 40-90 cm thickness are present throughout the section.

Depositional Environment: Interbedded quartzites and conglomerates appear to indicate frequent changes in energy conditions. Possibly a fluvial or near-shore marine, shallow-water environment.

SAMPLE DESCRIPTION : A grey coarse-grained matrix supports sub-rounded granules and pebbles in a ratio of 3:1. Medium to coarse-sand size matrix grains show some recrystallization and are composed of mostly quartz, minor rhyolite and jasper. Interstitial spaces contain recrystallized specularite. Fragments are sub-angular to sub-rounded and average 3-25 mm in length. Quartz and black quartz-phenocrystic rhyolite are the most common fragment types. Lesser amounts of sheared yellow rhyolite, dark maroon rhyolite and jasper are also present.

Sampler: K. Wirth

Date: October 3, 1979

THIN SECTION DESCRIPTION

Site Number: D 4 **Sample Number:** 154048 **Code:** M 202

Percent Fragments: 60% **Percent Matrix:** 38%

Percent Heavies & Mafics: 2% **Stain:** local earthy hematite

Rock Type: Mazatzal conglomerate **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
white quartz	22%	9 - 2.5mm	rounded	1:1.5
jasper	17%	10 - 2.5mm	sub-rounded	1:2
chert	13%	12 - 2.5mm	sub-rounded	1:3
quartzite	15%	15 - 2.0mm	rounded	1:3
rhyolite	21%	2.0mm	sub-rounded	1:2
rock fragments	12%	5 mm	sub-rounded	1:1.5

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	43%	2.5 - .02mm	rounded detrital, shredded and recrystalliz
chert	29%	2.5 - .2mm	sub-rounded
jasper	20%	2.5 - .08	sub-rounded
specularite	1%	0.2. - .09	rounded, detrital grains
specularite	2%	.09 - .01	recrystallized plates, masses
hematite	3%	powdery	recrystallized interstitials and stain
rhyolite	5%	2.0 - .2mm	sub-rounded grains
sericite	4%	.09 - .01mm	recrystallized plates and masses
clay	3%	---	finely crystalline interstitial

Cement: Clay, sericite, recrystallized quartz and specularite hematite stain

Interstitials: shredded and recrystallized quartz, clay, sericite, hematite stain

Textures and recrystallization: Some polygonization, strain and suturing of quartz but nearly all primary conglomerate texture preserved. Matrix clay is recrystallized to interstitial sericite clots, fine grained silica recrystallized to anhedral interlocking quartz

Structures:
Bedding structures not obvious, but fragments show subparallel orientation of long axes and heavy minerals lie locally in bedding concentrations.

Comments on Genesis: Mazatzal conglomerate here is a mixture of virtually all the different rock types found in the underlying Alder volcanic and sedimentary terrains, including impure, sericitic volcanic sandstone or wacke, flow-banded and quartz-phenocrystic rhyolite, chert, jasper and vein quartz.

Rock Name: quartz-jasper-chert-quartzite-rhyolite-rock fragment conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: D5 Sample Number: 154049 Code: A202

Location: NE of Flying W. Ranch Scintillometer Counts: 88 cps

Quadrangle: Buzzard Roost Mesa U Value (U by NT) ppm : 2.6

Sec., Twp, Ra.: S13, 9N, 12E Coordinates: 34° 07' 18" N, 111° 04' 50" W

Geologic Unit: Alder granule conglomerate

Stratigraphic Group: Alder Group

SITE GEOLOGY : This sample is down section from site D6. Exposure is poor and the details of the section are not known. Generally it lies stratigraphically above Gastil's Houden or Flying W units.

Variability:

Sedimentary Structures: Poorly-defined cross-beds of 30-70 cm thickness are present, but not common. Some contain minor concentrations of specularite on their bedding planes.

Depositional Environment: Relatively quiet energy conditions with brief periods of higher energy depositing grit and granule fragments, moderate water depths.

SAMPLE DESCRIPTION : A dark grey, foliated, sericite-rich, medium sand-size matrix supports sub-angular granules in a ration of 4:3. The matrix has a well defined foliation. Recrystallized sericite supports fine to medium sand-size grains of volcanic quartz and minor volcanic rock fragments. Conglomerate fragments are sub-angular to sub-rounded and average 3-27 mm in length. They are composed of mostly grey, maroon, green and yellow volcanic rock fragments, probably rhyolitic in composition. While quartz, jasper , chert and maroon shale fragments are present in minor amounts, quartz being the most common and shale the least common minor-fragment types.

Sampler: K. Wirth Date: October 3, 1979

THIN SECTION DESCRIPTION

Site Number: D 5 **Sample Number:** 154049 **Code:** A 202

Percent Fragments: 65% **Percent Matrix:** 33%

Percent Heavies & Mafics: 2% **Stain:** earthy hematite

Rock Type: granule conglomerate **Stratigraphic Group:** Alder Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
chert	19%	3 - 3.0mm	sub-rounded	1:2
jasper	12%	7 - 2.0mm	sub-angular	1:3
quartz	4%	3.2 - 2.0mm	rounded	1:1.5
volcanic rock fragments	65%	8 - 2.0mm	sub-rounded	1:3

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	44%	2 - .005mm	mostly rounded clear volcanic quartz
chert	4%	2 - .04mm	show banding
jasper	3%	2 - .05mm	show specularite banding
feldspars	4%	1.3 - .2mm	perthite, microcline and plagioclase
volcanic rock fragments	25%	2.0 - .09mm	felsic phenocrystic volcanic rocks
clay	8%	---	finely crystalline interstitial masses
sericite	1%	.04 - .005	recrystallized plates
specularite	6%	2 - .02mm	rounded detrital; minor recrystallized
leucoxene (?)	2%	2 - .04mm	rounded grains; white in reflected light
hematite	3%	powdery	interstitial stain

Cement: Mostly hematite, clays and quartz

Interstitials: Shredded, recrystallized quartz, clays, chert, hematite

Textures and recrystallization: Most of rhyolitic volcanic fragments contain recrystallized sericite; recrystallization not major except with matrix quartz, sericite and hematite; fragments matrix-supported

Structures: Elongation of fragments accomplished by slip lines through the rock of recrystallized quartz and sericite (resembles veining) but produces fragment reorientation and matrix foliation

Comments on Genesis: Detrital rock produced entirely by the erosion of volcanic ter rich in flow-banded, quartz-phenocrystic rhyolite, volcanic feldspars and quartz, chert, jasper, and highly altered sericitic volcanic rock fragments

Rock Name: Foliated, impure, volcanic-rock-fragment granule conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: D6 **Sample Number:** 154050 **Code:** A202

Location: NE of Flying W Ranch **Scintillometer Counts:** 70 cps

Quadrangle: Buzzard Roost Mesa **U Value (U by NT) ppm :** 2.1

Sec., Twp, Ra.: S6, 9N, 12E **Coordinates:** 34° 07' 27"N, 111° 04' 50"W

Geologic Unit: Alder granule conglomerate

Stratigraphic Group: Alder Group

SITE GEOLOGY : This sample site lies up section from the sampled site D5, and lies between Gastil's flying W formation and dacitic volcanic agglomerates in the creek south of Winter Camp.

Variability:

Sedimentary Structures: Cross-bedding structures are not defined. Conglomerate fragments occur in 16-60 cm-thick lenses.

Depositional Environment: Relatively stable energy conditions with brief periods of higher energy conditions depositing grit and granule fragments, moderate to shallow water depths.

SAMPLE DESCRIPTION : A light green to grey impure, sand-size matrix supports sub-rounded granules and grit of mostly quartz in a ratio of 2:1. The coarse sand-size matrix is mostly quartz with minor jasper and chert. Interstitial spaces contain minor specularite, hematite and dominantly sericitic greenish micas. Sub-rounded fragments average 3-8 mm in length and are also mostly quartz, minor green chert and jasper. Traces of red rhyolite and dark green mafic fragments are also present.

Sampler: K. Wirth **Date:** October 3, 1979

THIN SECTION DESCRIPTION

Site Number: D 6 **Sample Number:** 154050 **Code:** A 202

Percent Fragments: 57% **Percent Matrix:** 40%

Percent Heavies & Mafics: 3% **Stain:** traces of hematite

Rock Type: granule conglomerate **Stratigraphic Group:** Alder Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
white quartz	90%	14 - 2mm	rounded	1:1.5
banded jasper	5%	3mm - 2mm	sub-rounded	1:1
chert	5%	2.8 - 2.0mm	sub-rounded	1:1

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	52%	2 - .01mm	mostly recrystallized interlocking mosaic
specularite	5%	.09 - .02 mm	rounded, detrital grains
specularite	4%	.08 - .01mm	recrystallized plates and masses
jasper	10%	2 - .4mm	sub-rounded
chert	15%	2 - .08mm	sub-rounded
leucoxene	2%	.09 - .01mm	fine-grained masses
hematite	2%	powdery	recrystallized masses and stain
sericite	5%	.08 - .005	recrystallized plates
clay	3%	---	fine interstitial
zircon	2%	.09 - .01mm	detrital grains with other heavies

Cement: recrystallized quartz and specularite, clays, sericite minor hematite

Interstitials: Shredded and recrystallized quartz, clays, sericite, minor hematite leucoxene.

Textures and recrystallization: quartz grains strongly undulose, interpenetrating and sutured, polygonized, some show strain twinning and foliation; matrix clay recrystallized to sericite, matrix quartz recrystallized to foliate interlocking mosaic. Conglomerate is fragment-supported, matrix interstitial, about 35% recrystallized

Structures: Matrix or fragments are not obviously bedded, but interstitial, mafic, heavy minerals show local bedding concentrations.

Comments on Genesis: White quartz and jasper are dominant suggesting a purer source terrain or higher energy depositional environment. Abundant interstitial clay is indicative of Alder deposition as opposed to Mazatzal quartzites and conglomerates.

Rock Name: recrystallized, fragment-supported, quartz-jasper conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: D 7 **Sample Number:** 154051 **Code:** V 004

Location: N of Flying W Ranch **Scintillometer Counts:** 140 cps

Quadrangle: Buzzard Roost Mesa **U Value (U by NT) ppm :** 2.20

Sec., Twp, Ra.: S23, 9N, 12E **Coordinates:** 34° 06' 53"; 111° 05' 37"

Geologic Unit: rhyolitic conglomerate and jasper-pebble conglomerate

Stratigraphic Group: Alder Group

SITE GEOLOGY :
In Spring Creek north of Flying W Ranch is a sequence of Alder volcanic and sedimentary conglomerates immediately underlying Gastil's "Houden" quartzite. These vary from highly hematitic, red jasper - volcanic rock fragment pebble conglomerates to coarse cobble conglomerates packed with large, rounded, gray-green to black aphanitic to phenocrystic rhyolite and dacite fragments. These rocks are interbedded with graded-bedded siltstones and shales, cross bedded sandstones, grits and a great diversity of graded, poorly sorted conglomerates, in terms of the protoliths.

Variability·
Volcanic sediments are interbedded with non-volcanic sediments throughout the section with scintillometer counts varying from 80 to 200 cps.

Sedimentary Structures:
Mostly graded bedding, some lode and cut casts and rhythmic interbedding are present without any shallow water sedimentary structures.

Depositional Environment:
Deep water, probably marine conditions into which alternating amounts of coarser volcanic and finer terrigenous detritus were being deposited.

SAMPLE DESCRIPTION :
Sample A is a hematitic jasper-red rhyolite - chert - sericitic rhyolite granule to pebble conglomerate in which all fragments are flattened to about 1:4 elongation. Matrix is of black specularite, quartzose, sand-size grains with significant micaceous interstitial material.

Sample B is a striking conglomerate of greenish gray, well-rounded but significantly flattened, rhyolitic to dacitic volcanic fragments set in a blackish matrix of highly flattened and elongated sand-to grit-size chips of the same volcanic material, feldspar crystals and broken volcanic shards in a groundmass of altered volcanic glass.

Sampler: P. Anderson **Date:** Oct. 3, 1979

THIN SECTION DESCRIPTION

Site Number: D 7 **Sample Number:** 154051 **Code:** V 004

Percent Fragments: 88% **Percent Matrix:** 10%

Percent Heavies & Mafics: 2% **Stain:** hematite stain

Rock Type: Volcanic conglomerate **Stratigraphic Group:** Alder Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
dacitic volcanics	96%	50 - 5 mm	rounded	1:2.5
rhyolitic volcanics	4%	12 - 4 mm	rounded	1:1.5

chlorite, quartz and specularite form amygdule fillings in dacitic fragments
quartz, sericite and specularite form amygdule fillings in rhyolitic fragments

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
volcanic rock fragments	27%	2 - 1 mm	altered, locally relict feldspar laths
quartz	19%	0.6 - 0.01 mm	angular broken grains
altered feldspar	8%	1.5 - 0.1 mm	carlsbad twinned albite, orthoclase
sericite	13%	1.5 - 0.05 mm	matrix material with hematite
jasper	10%	2 - 0.5 mm	banded to massive specularite
specularite	15%	1 - 0.1 mm	rounded detrital grains, patches
hematite	3%	powdery	pervasive stain throughout sericite
clay	5%	--	gradational down in size from sericite

Cement: hematite, clay, sericite, possibly calcite

Interstitials: sericite, quartz, clay, altered feldspar; chlorite in vugs.

Textures and recrystallization: Primary feldspar microlaths in dacitic volcanic fragments preserved although now albite in a sericite, quartz, hematite, clay matrix; no deformation at all, little recrystallization except matrix silica and sericite

Structures: Rock is supported by generally elongate, large volcanic rock fragments in contact. Matrix is entirely interstitial to this and primarily volcanic material; bedding not seen on thin-section scale.

Comments on Genesis: This is a typical volcanic conglomerate in the Alder Group where the matrix is the same composition as the dacitic volcanic fragments. A distinct late-volcanic concentration of specular hematite is seen both in the matrix and the intervolcanic vugs.

Rock Name: Dacitic volcanic conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: D 8 **Sample Number:** 154052 **Code:** A 011

Location: NW of Flying W Ranch **Scintillometer Counts:** 90 cps

Quadrangle: Buzzard Roost Mesa **U Value (U by NT) ppm :** 1.50

Sec., Twp, Ra.: S14, 9N, 12E **Coordinates:** 34° 07' 15"; 111° 06' 00"

Geologic Unit: brown cross-bedded Houden quartzite

Stratigraphic Group: Alder Group

SITE GEOLOGY :

Quartzites of the Houden unit here contain no conglomerate, are slightly impure, fine- to medium-grained, gray to dark gray, very well-bedded and trough cross-bedded, sandy quartzites. Their sandy brown appearance (from argillaceous matrix material) distinguishes them from all quartzites in the Mazatzal Group. Rocks are impure or argillaceous quartzites rather than quartz wackes.

Variability:

Coarsest grained material is coarse sand, and shales or siltstones are essentially absent.

Sedimentary Structures:

Very well defined bedding and trough cross bedding with specularite concentrations on cross beds.

Depositional Environment:

Probably reasonably shallow water marine with current action but no strong wave action (cleaning or planar cross bedding).

SAMPLE DESCRIPTION :

Sample is a sandy brown, where weathered, to grayish brown, where fresh, fine grained argillaceous quartzite with prominent specularite concentrations defining bedding and cross bedding planes.

Sampler: P. Anderson **Date:** Oct. 3, 1979

THIN SECTION DESCRIPTION

Site Number: D 8 **Sample Number:** 154052 **Code:** A 011

Percent Fragments: 0% **Percent Matrix:** 93%

Percent Heavies & Mafics: 7% **Stain:** None

Rock Type: quartzite **Stratigraphic Group:** Alder Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios

fragments in hand specimen are just coarser grained quartz than in thin section

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	71%	1 - 0.1 mm	subangular to sub-rounded, strained
jasper	2%	0.2 mm	sub-angular
specularite	4%	0.3 - 0.1 mm	rounded detrital
specularite	1%	0.01 mm	recrystallized
sericite	17%	0.05 - 0.01 mm	recrystallized plates and masses
chert	4%	0.3 - 0.1 mm	sub-angular to sub-rounded
blue mineral	1%	.03 - .01 mm	metamorphic growth
zircon	<1%	.005 mm	rounded detrital
feldspar	<1%	.02 mm	plagioclase

Cement: recrystallized quartz, clays

Interstitials: sericite, recrystallized quartz, specularite

Textures and recrystallization: quartz grains strained and undulose, but little recrystallization or deformation of primary rock texture is seen. Some chert, matrix quartz and all matrix clay is recrystallized; matrix now mostly foliated sericite

Structures: Cross bedding is well defined by specularite and zircon concentrations (detrital and recrystallized specularite). Bedding too subtle to be seen in thin section.

Comments on Genesis: The matrix-supported nature of angular quartz grains in an argillaceous (sericitic), somewhat foliated matrix in this impure quartzite is absolutely typical of Alder sediments - still a volcanic source terrain here but a cleaner, higher energy, shallower water depositional setting

Rock Name: specularite cross-bedded impure quartzite

SITE AND SAMPLE DESCRIPTION

Site Number: D 9 **Sample Number:** 154053 **Code:** M 201

Location: N. of Rose Tungsten Mine **Scintillometer Counts:** 75 cps

Quadrangle: Buzzard Roost Mesa **U Value (U by NT) ppm :** 1.60

Sec., Twp, Ra.: S12, 8N, 12E **Coordinates:** 34° 03' 08"; 111° 04' 15"

Geologic Unit: quartz-jasper granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY :
Mazatzal quartzite in Rock Creek Canyon lies unconformably on rhyolitic conglomerates and quartzites of the Alder Group. Mazatzal here is homoclinally dipping at 025/56° NW and looks to be overlain by Alder volcanics, but the upper contact is a fault. Mazatzal rocks here are thickly bedded (0.3 to 0.7m), poorly to moderately-well cross bedded and are the typical deep pale maroon color.

Variability:
Sequence contains in places grit and granule layers 7-14cm thick which were collectively taken for the sample.

Sedimentary Structures:
Some cross bedding and good bedding apparent.

Depositional Environment:
Relatively shallow water, high energy environment (braided stream or beach) to provide a clean well sorted quartzite or conglomerate.

SAMPLE DESCRIPTION :
Conglomerate is a framework supported aggregate of recrystallized, partly interlocking white quartz granules (85%), rounded red hematitic to dark specularitic jasper granules, gray chert and black specularite grains (15%) in a matrix of recrystallized, interlocking quartz grains. Matrix tends to break around pebbles rather than through them.

Sampler: P. Anderson **Date:** Oct. 4, 1979

THIN SECTION DESCRIPTION

Site Number: D 9 **Sample Number:** 154053 **Code:** M 201

Percent Fragments: 15% **Percent Matrix:** 80%

Percent Heavies & Mafics: 5% **Stain:** pale red hematitic

Rock Type: Mazatzal Conglomerate **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	90%	4.5 - 2 mm	rounded	1:1.5
jasper	5%	3.5 - 2 mm	sub-rounded	1:3
chert	3%	4.5 - 2 mm	sub rounded	1:2
quartzite	2%	3 - 2 mm	sub-rounded	1:1.5

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	79%	2 - .02 mm	sub-rounded detrital, shredded, recrystallized
jasper	1%	2 - .4 mm	sub-angular
chert	1%	2 - .09 mm	sub-angular to sub-rounded
specularite	5%	.2 - .03	rounded detrital
specularite	1%	.1 - .02	recrystallized
hematite	2%	powdery	stain
leucoxene	1%	.14 - powder	detrital grains and alteration
sericite	10%	.01 - .005	foliate, crystalline, interstitial
zircon	<1%	.9 - .04	rounded detrital

Cement: recrystallized quartz, sericite, hematite

Interstitials: sericite, recrystallized quartz, hematite and recrystallized specularite, leucoxene

Textures and recrystallization: quartz is undulose, strain twinned, polygonized, interpenetrating and sutured, quartz commonly recrystallized on edges of grains or in strain shadows between grains; interstitial matrix material recrystallized to sericite, quartz and hematite

Structures:
bedding structures not obvious in thin section but quartz fragments are flattened and elongate packed parallel to slip lines and foliation planes of higher sericite concentrations

Comments on Genesis: Matrix is somewhat impure for a typical Mazatzal conglomerate but distinctive stain, a mature source terrain of quartz, jasper, chert and quartzite, and the moderate to high energy environment producing a mature specularite conglomerate are typical

Rock Name: quartz-jasper granule conglomerate, slightly deformed

SITE AND SAMPLE DESCRIPTION

Site Number: D 10 **Sample Number:** 154054 **Code:** M 111

Location: NE McDonald Mtn. **Scintillometer Counts:** 70 cps

Quadrangle: McDonald Mtn. **U Value (U by NT) ppm :** 1.30

Sec., Twp, Ra.: S21, 10N, 12E **Coordinates:** 34° 10' 38"; 111° 08' 12"

Geologic Unit: hematitic quartz grit

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY :
At base of Mazatzal Group on McDonald Mountain is a deep pale maroon, well bedded quartzite unit that contains thin 10-40cm grit interbeds. The interbeds comprise the D 10 sample. This changes upwards into a brick red, much more thinly cross bedded quartzite unit that makes up the bulk of McDonald Mountain.

Variability:
Sequence highly variable in grain size and color, but grit or conglomerate only is present at base of sequence.

Sedimentary Structures:
Abundant discontinuous, large-scale trough cross bedding, prominent bedding, occasional graded bedding and ripple marks.

Depositional Environment:
Braided stream channel or beach environment as major troughs are truncated and discontinuous. High energy, good sorting.

SAMPLE DESCRIPTION :
Well-bedded maroon quartzite contains a 5cm interbed of framework-supported quartz grit. This grit consists of white, well rounded quartz grains 2 to 4cm long tightly packed enough to exclude much finer matrix sand or silt (5 to 10% at most).

Grit layers in upper brick red units are thinner than this (2-3cm) and grain size is smaller.

Sampler: P. Anderson **Date:** Oct. 5, 1979

THIN SECTION DESCRIPTION

Site Number: D 10 **Sample Number:** 154054 **Code:** M 111

Percent Fragments: 25% **Percent Matrix:** 71%

Percent Heavies & Mafics: 4% **Stain:** dark maroon

Rock Type: Mazatzal conglomerate **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	84%	7.5 - 2 mm	sub-rounded	1:1.5
jasper	10%	7.5 - 2 mm	sub-angular	1:3
chert	3%	2.5 - 2 mm	sub-rounded	1:2
quartzite	3%	2 mm	sub-rounded	1:2

flakes of muscovite occur in the cores of some quartz fragments

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	78%	2 - .02 mm	partly recrystallized
jasper	2%	2 - .8 mm	dispersed hematite
chert	3%	2 - .78 mm	partly recrystallized
specularite	5%	.09 - .03 mm	detrital grains
specularite	1%	.04 - .02 mm	recrystallized
hematite	7%	powdery	stain to matrix and interstitials
clays - sericite	4%	.01 - .005 mm	finely crystalline interstitial grains

Cement: sericite, hematite, recrystallized quartz

Interstitials: shredded and recrystallized quartz, recrystallized specularite, hematite, sericite and clays

Textures and recrystallization: quartz grains frayed, recrystallized and sutured at margins, internally strained, polygonized and foliated, interlocking, sutured; matrix quartz, sericite and hematite recrystallized to an anhedral mosaic

Structures: bedding planes are defined by differing fragment densities, graded bedding and specularite concentrations on some bedding planes

Comments on Genesis: A mature source terrain of quartz, jasper, chert and quartzite in a well-sorted, clean depositional environment.

Rock Name: quartz-jasper granule conglomerate, slightly deformed and recrystallized

SITE AND SAMPLE DESCRIPTION

Site Number: D11 **Sample Number:** 154055 **Code:** M111

Location: NE McDonald Mtn Scintillometer Counts: 105 cps

Quadrangle: McDonald Mtn. U Value (U by NT) ppm : 1.8

Sec., Twp, Ra.: S29, 9N, 12E Coordinates: 34° 10' 35"N, 111° 08' 20"W

Geologic Unit: Upper Mazatzal quartzite and grit

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : The sample was taken along the top of an exposed ridge of Mazatzal quartzite where it is folded into a syncline. Quartzites near the core are fairly homogeneous in appearance. Some quartz veins and slickensides are present.

Variability: Color varies from deep red-maroon to light tan, yellow and white. Detrital heavies are concentrated on some bedding planes and are absent on others.

Sedimentary Structures: Planar cross-bed sets average 6-12 cm in thickness.

Depositional Environment: A relatively shallow-water marine environment, possibly a beach sand, but also could be a low-energy fluvial system.

SAMPLE DESCRIPTION : A fine -grained, dark red to maroon matrix supports lenses of coarse sand and grit in a 3:2 ratio. Fine-sand size matrix grains are mostly quartz and trace jasper and have thick interstitial fillings of earthy red hematite. Hematite, and possibly some specularite, are concentrated in 2-5 mm thick layers. Coarse-sand and grit-size fragments are composed of mostly quartz and trace jasper. Coarse layers are lensoidal in shape and truncate previously deposited layers.

Sampler: K. Wirth Date: October 5, 1979

THIN SECTION DESCRIPTION

Site Number: D 11 **Sample Number:** 154055 **Code:** M111

Percent Fragments: 45% **Percent Matrix:** 47%

Percent Heavies & Mafics: 8% **Stain:** none

Rock Type: Mazatzal conglomerate **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	69%	7 - 2 mm	sub-rounded	1:1.5
jasper	9%	6 - 2 mm	sub-angular	1:3
chert	12%	4 - 2 mm	sub-rounded	1:2
quartzite	7%	6 - 2 mm	sub-rounded	1:1.5
rhyolite	3%	3 - 2 mm	sub-rounded	1:2

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	80%	2 - .02 mm	shredded and recrystallized
jasper	4%	2 - .2 mm	sub-angular
chert	5%	2 - .2 mm	recrystallized
quartzite	2%	2 - .7 mm	strained and recrystallized
specularite	<1%	.09 - .04 mm	rounded detrital
specularite	1%	.06 - .01 mm	recrystallized with hematite
hematite	1%	powdery	interstitial stain
clay	2%	.01 - .005 mm	recrystallized interstitial masses
sericite-muscovite	6%	.04 - .01 mm	recrystallized plates around grains

Cement: recrystallized quartz, sericite, clay, and specularite

Interstitials: recrystallized and shredded quartz, sericite, muscovite, specularite and minor hematite

Textures and recrystallization:

quartz grains are internally polygonized and sutured, externally sutured and shredded, matrix quartz is recrystallized to a shredded network, chert, rhyolite and sericite are strongly recrystallized; the rock texture is half metamorphic.

Structures:

bedding planes are defined by parallel alignment of elongate fragments, by differences in fragment densities of different layers and by primary specularite concentrations

Comments on Genesis:

Higher energy environment produces a well sorted, relatively clean sediment from a complex hematitic quartz-chert-jasper-rhyolite source terrain.

Rock Name: Recrystallized, specularitic quartz-rich grit.

SITE AND SAMPLE DESCRIPTION

Site Number: D12 **Sample Number:** 154056 **Code:** A011

Location: Lower Coffeepot Trail **Scintillometer Counts:** 70 cps

Quadrangle: Gisela U Value (U by NT) ppm : 1.80

Sec., Twp, Ra.: S8, 8N, 11E Coordinates: 34^{0} 03' 05"N, 111^{0} 15' 25"W

Geologic Unit: Quartzites of Reef Ridge

Stratigraphic Group: Alder Group

SITE GEOLOGY : Quartzites in the Alder Group at this site are commonly grayish (to light purple) in color and appear cleaner than most other Alder conglomerates. They are sericitic, sheared and dissected by numerous quartz veins. Grit or granule layers are sparse and most quartzite is moderately well sorted. The rock type is quite different than either Mazatzal quartzite or more argillaceous types of Alder lower in the stratigraphy.

Variability: Some interbedded layers of silt and shale are present.

Sedimentary Structures: No longer visible due to deformation.

Depositional Environment: Relatively shallow-water conditions, uniform energy submarine, transitional from deeper-water shales below to shallow-water and subaerial rhyolites above.

SAMPLE DESCRIPTION : A grey, fine-grained matrix of mostly quartz, sericite and lesser amounts of pink rhyolite and other dark volcanic rock fragments, supports sub-angular grit in a ratio of 3:1. Fragments are mostly quartz, white sericite, pink rhyolite and lesser dark volcanic rock fragments. The rock has an overall sheared, gray sericite appearance.

Sampler: K. Wirth **Date:** October 10, 1979

THIN SECTION DESCRIPTION

Site Number: D 12 **Sample Number:** 154056 **Code:** A 011

Percent Fragments: 76% **Percent Matrix:** 23%

Percent Heavies & Mafics: 1% **Stain:** minor limonite

Rock Type: feldspathic quartzite **Stratigraphic Group:** Alder Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	73%	2.8 - .2 mm	sub-angular	1:2
chert	27%	3.2 - .2 mm	sub-angular	1:3

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	43%	.2 - .02 mm	strained and recrystallized
sericite - muscovite	50%	<.04 mm	recrystallized foliated mats
feldspar	4%	.7 mm	perthitic, orange-stained
specularite	1%	.23 - .1 mm	rounded detrital
limonite	2%	powdery	fine interstitials and stain
specularite	1%	powdery	recrystallized masses

Cement: mostly recrystallized sericite and silica

Interstitials: sericite, limonite, recrystallized specularite

Textures and recrystallization: most primary mineral grains are broken, strained, recrystallized or shredded; fine grained sericite forms an interstitial network to quartz grains; some fragments recrystallized to felted sericite mats

Structures: Crude foliation penetrates through mineral grains by breakage and elongation,not boudinage or twinning, sericite defines good foliation

Comments on Genesis: Matrix material was originally very impure and argillaceous to provide a high sericite content; source rocks were volcanic, principally rhyolitic, for quartz and feldspar, and also sedimentary for chert.

Rock Name: recrystallized, feldspathic quartzite to wacke

SITE AND SAMPLE DESCRIPTION

Site Number: D13 **Sample Number:** 154064 **Code:** V102

Location: SW Reef Ridge **Scintillometer Counts:** 240 cps

Quadrangle: Sheep Basin Mtn **U Value (U by NT) ppm :** 4.4

Sec., Twp, Ra.: S4, 8N, 11E **Coordinates:** 34° 03' 37"N, 111° 13' 47" W

Geologic Unit: Volcanic Conglomerate

Stratigraphic Group: Alder Group

SITE GEOLOGY : Sheared volcanic-rock-fragment conglomerate is in contact with pink to orange quartz-phenocrystic rhyolite, which also has been deformed. The lower part of the conglomerate unit is in contact with easily-eroded purple slates and phyllites.

Variability: Little variability as the section is mostly gray quartzites with conglomerate being the variant.

Sedimentary Structures: None are visible due to deformation.

Depositional Environment: Shallow-water marine, as in D12.

SAMPLE DESCRIPTION : A fine-grained grey to maroon foliated matrix of mostly fine-grained volcanic quartz phenocrysts and altered pink volcanic material, supports green and pink sericite fragments in a ratio of 5:1. Fragments average 5-35 mm in length and are composed of pink and green sericite-rich, quartz-phenocrystic rhyolite fragments. Fragments are flattened to discoidal in shape with axial ratios of 1:6:7. Both fragments and matrix show the effects of shearing.

Sampler: K. Wirth **Date:** October 11, 1979

THIN SECTION DESCRIPTION

Site Number: D 13 **Sample Number:** 154064 **Code:** A 102

Percent Fragments: 33% **Percent Matrix:** 65%

Percent Heavies & Mafics: 2% **Stain:** hematite

Rock Type: rhyolite tuff **Stratigraphic Group:** Alder Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
rhyolite	62%	12.8 - .4 mm	sub-angular	1:3
quartz	31%	1.3 - .2 mm	sub-angular	1:1.5
feldspar	7%	.7 - .3 mm	sub-angular	1:1.5

quartz phenocrysts in rhyolite fragments show rectangular volcanic-type outlines with numerous embayments

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	87%	.09 mm	recrystallized masses, broken volcanic crystals
sericite	9%	.005 mm	foliated whispy mats, patchy networks
leucoxene	<1%	.02 - .01 mm	altered detrital grains
hematite	4%	powdery	interstitial grains and stain

Cement: recrystallized quartz, sericite, and minor hematite

Interstitials: sericite, cryptocrystalline silica, hematite

Textures and recrystallization: Rock shows a classic lithic-crystal tuff texture with quartz and K-feldspar phenocrystic, sericitic, shard-shaped rhyolite tuff fragments in a crystalline matrix of silica, sericite and broken volcanic phenocrysts.

Structures: Foliation is developed parallel to primary rock weakness, which was the original tuffaceous layering.

Comments on Genesis: Rhyolitic tuff is a primary volcaniclastic deposit in a subaqueous environment with no sedimentary reworking

Rock Name: foliate, pink-fragment, hematitic rhyolitic tuff.

SITE AND SAMPLE DESCRIPTION

Site Number: D14 Sample Number: 154065 Code: A202

Location: Middle Reef Ridge Scintillometer Counts: 75 cps

Quadrangle: Sheep Basin Mtn U Value (U by NT) ppm : 1.2

Sec., Twp. Rg.: S3, 8N, 11E Coordinates: 34° 03' 37"N, 111° 12' 57"W

Geologic Unit: Quartz-granule conglomerate

Stratigraphic Group: Alder Group

SITE GEOLOGY : The conglomerate described here is in contact with the very resistant grey and white quartzites that form the main part of Reef Ridge. These quartzites are generally devoid of conglomerate fragments and finer interstitial micas, and are uniform-gray, well-bedded, somewhat cross-bedded, massive and siliceous in outcrop.

Variability: Interbedded with conglomerate layers are 20cm thick non-conglomeratic muddy quartzite layers, which show cross-bedding.

Sedimentary Structures: Cross-bedding with heavy mineral concentrations on bedding planes is common.

Depositional Environment: Shallow water, possibly near-shore marine but also could have been below wave action because of the lack of gravel. Might have been a fluvial system, but this is much less likely.

SAMPLE DESCRIPTION : A yellow-stained, grey matrix of medium-to-fine-grained quartz containing interstitial sericite supports elongate granule-size fragments in a ratio of 3:2. Quartz granules to pebbles average 8-20mm in length and are ellipsoidal in shape. White quartz fragments are accompanied by lesser amounts of jasper, purple slate, dark rhyolite and minor chert.

Sampler: K. Wirth Date: October 11, 1979

THIN SECTION DESCRIPTION

Site Number: D 14 **Sample Number:** 154065 **Code:** A 202

Percent Fragments: 83% **Percent Matrix:** 12%

Percent Heavies & Mafics: 6% **Stain:** black, specularitic

Rock Type: sheared conglomerate **Stratigraphic Group:** Alder Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Gra'n length variation	Roundness	Axial ratios
rhyolite	31%	15-2.0mm	sub-angular	1:2
quartz	7%	7-2.0mm	sub-rounded	1:1.5
jasper	17%	21-2.0mm	sub-angular	1:2
chert	45%	18-2.0mm	sub-rounded	1:2

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
rhyolite	8%	2.0-1.2mm	foliated sericitic mats
quartz	52%	2.0-.02mm	interlocking, recrystallized, strained
jasper	4%	2.0-.8mm	recrystallized specularite
chert	9%	2.0-.3mm	recrystallized
sericite	21%	< .01mm	recrystallized plates and masses
specularite	4%	.3-.1mm	rounded, detrital (?)
specularite	1%	powdery	recrystallized with hematite
hematite	1%	powdery	interstitial grains and stain

Cement: recrystallized quartz and sericite; minor recrystallized specularite and hematite

Interstitials: sericite, quartz, recrystallized quartz and specularite.

Textures and recrystallization: Most matrix quartz recrystallized, interlocking and strained; interstitial sericite and silica recrystallized to a shredded network; quartz, chert and rhyolite fragments recrystallized or polygonized

Structures: Some primary bedding orientation defined by felted mats of sericite (altered rhyolitic fragments); foliation is most prominent.

Comments on Genesis: Mixed rhyolitic volcanic to granophyric, and resistant sedimentary source terrain eroded to form originally an impure conglomerate with a wacke matrix.

Rock Name: foliated and recrystallized chert-rhyolite-quartz-jasper conglomerate.

SITE AND SAMPLE DESCRIPTION

Site Number: D15 Sample Number: 154066 Code: A211

Location: Middle Reef Ridge Scintillometer Counts: 70

Quadrangle: Sheep Basin Mtn U Value (U by NT) ppm : 1.5

Sec., Twp, Ra.: S3, 8N, 11E Coordinates: 34° 04' 23"N, 111° 12' 45" W

Geologic Unit: Rhyolite-fragment quartz wacke

Stratigraphic Group: Alder Group

SITE GEOLOGY : One side of the unit described here in contact with a sheared, fine-grained, volcanic-rock-fragment conglomerate with a sericitic matrix. The other side of the sampled unit is in contact with a fine-grained matrix-supported conglomerate. Fragments are sheared, sericitic and vary in color from white to pink to green. Minor amounts of quartz and chert are also present as fragments.

Variability: The quartz matrix content is highly variable and appears to have no direct relationship to fragment content.

Sedimentary Structures: Some more quartz-rich layers are thinly bedded and cross-bedded in 6-30 mm-thick layers.

Depositional Environment:

SAMPLE DESCRIPTION : The sample is made up of fine-grained quartz, with recrystallized quartz and sericite as interstitials. Bedding directions are defined by thin, 1 mm- thick concentrations of specularite on cross-bedding planes which appear to be lengthened by shearing. Supported by the matrix, and comprising 12% of the rock, are several 2-12 mm long sericite-rich volcanic fragments (probably rhyolitic in composition). These are discoidal and have axial ratios of 1:7:7. Overall, the sample has an impure light brown color, and pitted appearance.

Sampler: K. Wirth Date: October 11, 1979

SITE AND SAMPLE DESCRIPTION

Site Number: D 16 **Sample Number:** 154067 **Code:** V 102

Location: Fred Pranty Cabin **Scintillometer Counts:** 150 cps

Quadrangle: Sheep Basin Mtn. **U Value (U by NT) ppm :** 3.40

Sec., Twp, Ra.: S6, 8N, 12E **Coordinates:** 34° 04' 00"; 111° 10' 12"

Geologic Unit: jasper-quartz granule conglomerate

Stratigraphic Group: Alder Group

SITE GEOLOGY :
The jasper-quartz granule conglomerate is a relatively thin unit lying stratigraphically above a large dacitic mass, and below the main thickness of purple slates and sediments in the Diamond Butte area: it therefore represents the transition from volcanic to sedimentary sequences in the Alder Group. Conglomerate bed contains mainly granule size jasper and quartz pebbles with flattened, pebble-size rhyolite fragments in a hematitic quartz wacke matrix.

Variability:
Conglomerate is intersheared with purple quartzite, siltstone, slate and tuff here so primary variations are difficult to discern.

Sedimentary Structures:
Masked by strong shearing.

Depositional Environment:
Relatively deep, quiet water, probably marine, definitely intravolcanic - a hiatus or time break at the end of volcanism, the unit essentially is a facies equivalent of a banded iron formation.

SAMPLE DESCRIPTION :
In a darkish purple quartz-rich sand-to grit-size matrix, there are 12-8mm size bright red jasper fragments, vein quartz pebbles up to 25mm, flattened sericitic rhyolite fragments, and abundant, platy, thin, dark purple volcanic fragments, now appearing like purple slate or phyllite. In some places there are small 1-3mm fragments of nearly pure specularite. The rock is most impressive in its hematite content, which is at least 10% by volume.

Sampler: P. Anderson **Date:** Oct. 17, 1979

THIN SECTION DESCRIPTION

Site Number: D 16 **Sample Number:** 154067 **Code:** V 102

Percent Fragments: 28% **Percent Matrix:** 67%

Percent Heavies & Mafics: 5% **Stain:** purple hematite

Rock Type: Volcanic wacke **Stratigraphic Group:** Alder Group

FRAGMENTS : **(percentages are based on 100% fragments)**

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
rhyolite	56%	14-1.0mm	sub-angular	1:3
chert	11%	4-1.0mm	sub-rounded	1:2
jasper	18%	7-1.0mm	sub-angular	1:2
quartz	15%	2.8-1.0mm	sub-angular	1:1.5

MATRIX & HEAVIES : **(percentages are based on 100% matrix & heavies)**

Type & color	Percentage	Size range	Description
quartz	25%	1.0-.01mm	clear, broken volcanic grains
chert	10%	1.0-.2mm	sub-rounded, hematitic
rhyolite	15%	1.0-.31mm	mostly altered to sericite
sericite	33%	< .01mm	recrystallized, foliated networks
specularite	3%	.6-.1mm	rounded,detrital
specularite	8%	powdery	bedded masses altering to hematite
hematite	4%	powdery	alteration from specularite
limonite	1%	powdery	alteration from hematite
leucoxene	<1%	.3-.1mm	detrital grains with white reflection
jasper	1%	1.0-.4mm	sub-angular

Cement: Recrystallized quartz and sericite, hematite, limonite and recrystallized specularite.

Interstitials:

Recrystallized quartz, sericite, specularite, hematite and limonite

Textures and recrystallization:

Primary volcaniclastic texture of clear volcanic quartz and rhyolitic shards in a recrystallized sericitic matrix remains through moderate to weak recrystallization of matrix and some fragments

Structures:

Primary foliate texture of the volcaniclastic sediment is preserved; foliation and elongation of grains is parallel to bedding.

Comments on Genesis:

Rock is both a polymict volcanic tuff and a rhyolitic volcanic wacke. Origin from dominantly felsic volcaniclastic activity with other sedimentary material incorporated in submarine depositional setting.

Rock Name:

Recrystallized, sericitic, rhyolitic (to dacitic?) volcanic wacke.

SITE AND SAMPLE DESCRIPTION

Site Number: D 17 **Sample Number:** 154068 **Code:** A 103

Location: Fred Pranty Cabin **Scintillometer Counts:** 95 cps

Quadrangle: Sheep Basin Mtn. **U Value (U by NT) ppm :** 0.80

Sec., Twp, Ra.: S31, 12E, 9N **Coordinates:** 34° 04' 45"; 111° 09' 35"

Geologic Unit: jasper-chert-rhyolite pebble conglomerate

Stratigraphic Group: Alder Group

SITE GEOLOGY :
Immediately below a quartzite near Fred Pranty Cabin is a series of 0.4 to 3m thick conglomerate beds in quartz wacke, volcanic sandstone and grit. Sequence is a poorly sorted alternating succession of fine to coarse, partly volcanic clastics, now sheared and slightly metamorphosed. Sample material varies from quartzite-jasper-chert granule conglomerate up to sericitic chip-chert-jasper-vein quartz pebble conglomerate (2-4cm-size fragments).

Variability:
Numerous variations in grain size, with jasper and white vein quartz forming the larger fragments, chert and quartzite the smaller, with the sericitic fragments (sheared rhyolite) being the flattest.

Sedimentary Structures:
Absence of shallow water features such as good cleaning, bedding and cross bedding. Some poorly developed size-sorting is apparent.

Depositional Environment:
Depositional environment is one of rapid dumping of volcanic and sedimentary detritus in a submarine deeper water environment, possibly outwash fans, with no beach reworking.

SAMPLE DESCRIPTION :
The rock is somewhat sheared and foliated, with a pale pink to gray matrix of quartz plus sericite (quartz wacke) and small chert fragments. Large red jasper pebbles up to 4cm in size, clear to pink chert pebbles up to 3cm in size, and some vein quartz pebbles are somewhat flattened and elongated in the semi-schist matrix. Gray to orange to pink concentrations of sericite apparently in the matrix, on close inspection, define the outlines of highly flattened sericitic rhyolite fragments, now largely sheared out along foliation planes.

Sampler: P. Anderson **Date:** Oct. 17, 1979

THIN SECTION DESCRIPTION

Site Number: D17 **Sample Number:** 154068 **Code:** A103

Percent Fragments: 41% **Percent Matrix:** 58%

Percent Heavies & Mafics: 1% **Stain:** pale maroon hematite

Rock Type: pebble conglomerate **Stratigraphic Group:** Alder Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
jasper	73%	25-2 mm	subangular	1:2
chert	9%	5-2 mm	subrounded	1:2
rhyolite	18%	25-2 mm	angular	1:10

(rhyolite is granophyric, sericitic and non-phenocrystic)

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	78%	1.8-.01 mm	large subangular grains, shredded matrix
jasper	2%	2.0-.33 mm	subangular, banded
chert	1%	2.0-.12 mm	subrounded, recrystallized
rhyolite	3%	2.0-.4 mm	angular, sheared, largely altered to sericite
sericite	10%	<.03 mm	recrystallized plates and masses
specularite	2%	.21-.09 mm	rounded detrital
hematite	2%	powdery	fine, interstitial grains and stain
limonite	2%	powdery	rectangular pseudomorphs after pyrite?

Cement: Recrystallized and shredded quartz, sericite, hematite

Interstitials: Recrystallized quartz and sericite, hematite, specularite, limonite.

Textures and recrystallization: Matrix texture is dominated by strongly recrystallized larger quartz grains lying in a matrix of finely shredded and recrystallized aligned sericite and quartz; fragments are extensively recrystallized; specularite is altered to hematite.

Structures: Tectonic fabric to matrix is anastomosing around larger fragments; bedding features are destroyed by deformation.

Comments on Genesis: Dominantly of rhyolitic and cherty origin with abundant specularitic jasper in source terrain; rock fabric is extensively recrystallized; matrix 80% recrystallized; fragments about 40% recrystallized.

Rock Name: sheared and foliated jasper-rhyolite pebble conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: D18 Sample Number: 154069 Code: A011

Location: NE Reef Ridge Scintillometer Counts: 270 cps

Quadrangle: Sheep Basin Mtn U Value (U by NT) ppm : 2.3

Sec., Twp, Ra.: S34, 9N, 11E Coordinates: 34° 05' 03"N, 111° 12' 13"W

Geologic Unit: Alder conglomerate

Stratigraphic Group: Alder Group

SITE GEOLOGY : This sample site is located about 10 m south of the rhyolite described at site D13. Quartzites surrounding the sampled horizon are generally fine-grained and conglomerate fragments are absent. Some 20-100 cm-thick beds of muddy quartzite and micaceous slate are interbedded with the quartzites.

Variability: Conglomerate layers are highly variable and range from (1) tan to grey, coarse-grained quartz containing fragments of mostly quartz, some jasper, rhyolite and volcanic rock fragment grit, to (2) dark grey quartz wackes containing sheared volcanic rock fragments and quartz grit.

Sedimentary Structures: Bedding thickness varies from 2-6 cm in fine-grained layers to 30-60 cm coarse-grained layers. Cross-bedding is not well defined.

Depositional Environment: Shallow water marine as in D12.

SAMPLE DESCRIPTION : The rock is a gray to tan quartzite of medium to coarse-grained, interlocking quartz, minor jasper, pink and red volcanic fragments and chert. Interstitials are sericite, specularite and chlorite. Thin 5-10 mm beds of grit are interbedded with 1-2 cm-thick beds of quartzite, both of which are made up of similar quartz-rich material. Most fragments are elongate, 2-8 mm long, and sub-angular to sub-rounded.

Sampler: K. Wirth Date: October 17, 1979

THIN SECTION DESCRIPTION

Site Number: D18 **Sample Number:** 154069 **Code:** A011

Percent Fragments: 38% **Percent Matrix:** 60%

Percent Heavies & Mafics: 2% **Stain:** brownish gray

Rock Type: Alder grit **Stratigraphic Group:** Alder Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	40%	3.0-1.3 mm	subangular	1:1.5
jasper	21%	3.2-1.3 mm	angular	1:2
rhyolite	32%	5.0-1.3 mm	angular	1:5
chert	7%	4.0-1.3 mm	subangular	1:2

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	33%	1.3-.02 mm	subrounded and recrystallized
chert	4%	1.3-0.3 mm	subrounded
rhyolite	32%	1.3-.5 mm	subangular, sheared and altered to sericite
specularite	<1%	.2-.11 mm	rounded
specularite	1%	powdery	recrystallized with hematite
hematite	<1%	powdery	interstitial grains and stain
limonite	2%	powdery	interstitial grains and stain
sericite	26%	<.03 mm	recrystallized plates and masses
chlorite	2%	<.13 mm	recrystallized plates with rhyolite

Cement: Mostly recrystallized sericite and quartz; also specularite, hematite and limonite.
Interstitials: Recrystallized sericite, quartz, specularite, chlorite, limonite and hematite.
Textures and recrystallization: Dominated by clear angular quartz grains locally sutured and polygonized, in a matrix of highly sericitic material which is extensively recrystallized; primary grain shapes are usually preserved.

Structures: Elongation of long fragments such as rhyolite might define bedding but overall fabric of matrix is one of tectonic foliation by deformation and recrystallization.

Comments on Genesis: Derived from a quartz-rich source terrain, probably volcanic because of the abundant argillaceous and rhyolitic components, and specularitic nature of jasper. Substantially deformed and metamorphosed.

Rock Name: highly sericitic quartzose grit

SITE AND SAMPLE DESCRIPTION

Site Number: D19 Sample Number: 154070 Code: A202

Location: S of Soldier Camp Mtn Scintillometer Counts: 80cps

Quadrangle: Sheep Basin Mtn U Value (U by NT) ppm : 2.40

Sec., Twp, Ra.: S25, 9N, 11E Coordinates: 34° 05' 37"N, 111° 10' 30"W

Geologic Unit: Quartz-rhyolite-jasper conglomerate

Stratigraphic Group: Alder Group

SITE GEOLOGY : The rocks exposed at this site are highly varible in composition but can be divided into two main types. One type is a gray quartzite containing minor amounts of quartz, jasper and rhyolite grit in some cross-beds. The other type is a dark gray, sercitic quartzite to quartz-granule conglomerate, as described below. Both units are interbedded and vary in thickness.

Variability: Scintillometer counts range from 75-96 cps across the section. Quartz-rich and better-sorted layers tend to have lower scintillometer values than those layers with fragments.

Sedimentary Structures: Planar and trough cross-beds average 12-30cm thick in coarser grained layers, and 3-10 cm in finer grained layers.

Depositional Environment: Shallow-water marine environment, possibly nearer shore or just shollower water than the previous samples because of more frequent conglomerate interbeds.

SAMPLE DESCRIPTION : A yellow-stained, dark grey sericitic and foliated matrix of fine-grained quartz supports granules of quartz, sheared volcanics and jasper. Fine sand-size grains of volcanic and reworked quartz make up most of the matrix. Interstitial spaces contain specularite and recrystallized sericite. Fragments are sub-rounded to sub-angular and average 3-30 mm in lenth. Quartz and sericite-rich sheared volcanic fragments are the main fragment types. Also present are lesser amounts of dark red rhyolite, jasper and grey chert.

Sampler: K. Wirth Date: October 17, 1979

THIN SECTION DESCRIPTION

Site Number: D19 **Sample Number:** 154070 **Code:** A202

Percent Fragments: 57% **Percent Matrix:** 39%

Percent Heavies & Mafics: 4% **Stain:** dark maroon to lavender

Rock Type: pebble conglomerate **Stratigraphic Group:** Alder Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
jasper	21%	12.0-2.0 mm	subangular	1:2
quartz	29%	14.0-2.0 mm	subrounded	1:1.5
rhyolite	50%	14.0-2.0 mm	subangular	1:4

(rhyolite is sericitic and aphanitic; partly recrystallized; one is feldspar phenocrystic)

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	50%	2.0-.04 mm	subrounded, recrystallized
jasper	7%	2.0-.3 mm	subangular, specularitic
rhyolite	11%	2.0-.4 mm	subangular, mostly altered to sericite
specularite	1%	.2-.08 mm	rounded detrital
specularite	2%	powdery	recrystallized with hematite
hematite	2%	powdery	interstitial grains and stain
limonite	2%	powdery	coatings along foliation planes
sericite	23%	<.04 mm	recrystallized matrix material
chlorite	2%	.57-.02 mm	recrystallized plates with rhyolite
zircon	<1%	.09-.03 mm	rounded

Cement: Mostly recrystallized sericite and quartz, minor hematite and specularite.

Interstitials: Hematite, linomite and recrystallized sericite, quartz and specularite.

Textures and recrystallization: Coarser grained matrix quartz forms an oriented mosaic parallel to elongate fragments and lies in a finer grained matrix of strongly recrystallized and foliated sericite and silica. Matrix and fragments are about 40% recrystallized.

Structures: Beds of differing matrix grain sizes define 1 to 2 cm wide beds, in large part sheared by strong recrystallization accompanying deformation.

Comments on Genesis: A source terrain including feldspar-phenocrystic volcanics, chert and jasper is required, which is consistent with the composition of the earlier parts of the Alder Group; strongly deformed.

Rock Name: foliated, sheared quartz-jasper-rhyolite pebble conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: D 20 **Sample Number:** 154071 **Code:** A 101

Location: Houden Mtn. **Scintillometer Counts:** 55 cps

Quadrangle: Sheep Basin Mtn. **U Value (U by NT) ppm :** 1.20

Sec., Twp, Ra.: S17, 9N, 12E **Coordinates:** 34° 07' 00"; 111° 09' 03"

Geologic Unit: quartz-jasper granule conglomerate in Houden quartzite

Stratigraphic Group: Alder Group

SITE GEOLOGY :
On Houden Mountain near Sand tank, the westermost of two major quartzite units contains a pale orange to pink, quartz-rich grit and sparse granule conglomerate of very sparse, bright red jasper and more frequent quartz granules, which was sampled. Another lower gray quartzite unit contains very rare layers of jasper-chert-volcanic rock (or slate) fragment grit, which was not sampled.

Variability:
Fragment size and abundance are highly variable, with jasper confined to some layers, volcanic rock (or slate) chip fragments confined to other layers, and quartz fragments in most layers.

Sedimentary Structures:
Poorly defined bedding, essentially no cross bedding noted.

Depositional Environment:
Although relatively pure quartzite, environment is still inferred to be deeper water or low energy fluvial because of lack of good sizing, sorting, and abundant current structures.

SAMPLE DESCRIPTION :
Samples vary from pale pink to pale maroon and are grits of whitish quartz grains with completely seriate grain sizes from 8 down to 2mm, and all finer sizes in the matrix. In this occur sparse (1-5%) bright to pale red jasper fragments, some very sparse red fragments of unknown (probably rhyolite) origin and rare pink chert. A comparative sample from the lower unit contains only flat slate (or vrf) chips in a quartz grit to sand-size matrix.

Sampler: P. Anderson **Date:** Oct. 17, 1979

THIN SECTION DESCRIPTION

Site Number: D20 Sample Number: 154071 Code: A101

Percent Fragments: 17% Percent Matrix: 88%

Percent Heavies & Mafics: 5% Stain: hematitic

Rock Type: Houden conglomerate Stratigraphic Group: Alder Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
specularitic chert	42%	15-2 mm	subangular	1:2
quartz	36%	3.4-2.0 mm	sub-rounded	1:1.5
rhyolite	22%	6.4-2.0 mm	subangular	1:3

(rhyolite is sericitic and aphanitic; chert is partly jaspery)

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	69%	2.0-.03 mm	subrounded, fine quartz recrystallized
chert	16%	2.0-.2 mm	subrounded
rhyolite	7%	2.0-.4 mm	subangular, highly sericitic
specularite	2%	powdery	recrystallized with hematite
leucoxene	1%	.25-.1 mm	alteration on rounded grains
hematite	2%	powdery	fine interstitial grains, masses and stain
sericite-clay	3%	<.01 mm	recrystallized plates and masses

Cement: Mostly recrystallized quartz and sericite, minor hematite.

Interstitials: Recrystallized quartz sericite and specularite, hematite.

Textures and recrystallization: Quartzite matrix consists of closely packed, sutured and strained quartz (local deformation lamellae) with relatively little interstitial fine-grained sericitic material; roundness and sphericity are relatively high for an Alder conglomerate, and there is good sorting with each grain type.

Structures: Some quartz is aligned but not dominantly recrystallized; bedding is not defined in thin section and foliation is only incipiently developed.

Comments on Genesis: A well-sorted, clean, relatively mature sediment for the Alder Group dominantly sedimentary-volcanic source with only the most resistant grains present in this conglomerate.

Rock Name: specularitic-chert sparse-granule conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: D21 Sample Number: 154072 Code: A212

Location: Houden Mtn Scintillometer Counts: 70 cps

Quadrangle: Sheep Basin Mtn U Value (U by NT) ppm : 1.1

Sec., Twp, Ra.: S20, 9N, 12E Coordinates: 34° 06' 37"N, 111° 09' 00"W

Geologic Unit: Granule conglomerate in Houden quartzite.

Stratigraphic Group: Alder Group

SITE GEOLOGY : The quartzite ridges on Houden Mountain are composed of mostly fine to medium-grained grey-green quartzite. They vary from well-sorted sparse to fragment-packed conglomerates. Matrix-supported conglomerates commonly contain granule to pebble-size fragments of quartz, jasper, chert and volcanic fragments in a quartz-rich matrix. Fragment-supported conglomerates contain a higher percentage of fine interstitials in the matrix which now appear as foliated sericite and quartz.

Variability: The amount of interstitial mica and clay in the matrix is highly variable throughout the section. Dense conglomerate layers are restricted to the area exposed in the antiform of the Houden Mountain fold.

Sedimentary Structures: Except for occasional conglomerate fragments, the quartzite is massive in appearance.

Depositional Environment: Fluvial or near-shore marine, most likely marine as surrounding volcaniclastic deposits show evidence of sub-marine deposition.

SAMPLE DESCRIPTION : A grey, fine-grained quartzite matrix, with minor interstitial sericite, supports sub-rounded granules of quartz, jasper and volcanic fragments. Fine matrix quartz grains have minor sericite and possibly same specularite in their intersticies. Fragments are sub-rounded and average 5-23 mm long, but are sometimes as long as 35mm. White quartz, jasper, grey chert, black and dark-red aphanitic rhyolite as well as sheared light-colored sericitic rhyolite fragmets occur in varying amounts throughout the section. Sheared volcanic fragment are discoidal, with axial ratios of 1:6:7 , and others are more elongate or ellipsoidal, with axial ratios of 1:1:3.

Sampler: K. Wirth Date: October 17, 1979

THIN SECTION DESCRIPTION

Site Number: D21 **Sample Number:** 154072 **Code:** A212

Percent Fragments: 43% **Percent Matrix:** 55%

Percent Heavies & Mafics: 2% **Stain:** pale lavender hematite

Rock Type: Houden conglomerate **Stratigraphic Group:** Alder Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	26%	9-2.0 mm	rounded	1:1.5
jasper	30%	7.8-2.0 mm	subrounded	1:2
rhyolite	35%	23-2.0 mm	subrounded	1:3
chert	9%	4-2.0 mm	subrounded	1:2

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	38%	2.0-.02 mm	subrounded and recrystallized
jasper	11%	2.0-.4 mm	subrounded
chert	5%	2.0-.4 mm	subrounded
rhyolite	21%	2.0-.5 mm	subrounded, altered to sericite
specularite	1%	.2-.09 mm	rounded
specularite	<1%	powdery	recrystallized with hematite
hematite	2%	powdery	interstitial grains and stain
limonite	1%	powdery	interstitial grains and stain
sericite	21%	<.04 mm	recrystallized plates and masses

Cement: Mostly recrystallized sericite; minor recrystallized quartz, specularite and hematite.

Interstitials: Sericite, recrystallized quartz and specularite, hematite, limonite.

Textures and recrystallization: Larger matrix grains are relatively well packed, angular and somewhat recrystallized, strained quartz supported by an interstitial matrix of sericitic material (recrystallized clay); grains and fragments are oriented, partly sutured, but not interlocking.

Structures: Elongate fragments show subparallel orientation, but this may be a deformational alignment rather than a primary structure.

Comments on Genesis: Dominantly sedimentary with lesser sericitic volcanic material in the source; deposited in a relatively high energy environment; sediment maturity higher than average for Alder Group; foliation intensity is prominent and typical of Alder rocks.

Rock Name: foliated, quartz-jasper-volcanic rock fragment granule conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: D22 Sample Number: 154073 Code: A213

Location: Houden Mountain Scintillometer Counts: 70 cps

Quadrangle: Sheep Basin Mountain U Value (U by N.) ppm : 0.70

Sec., Twp, Ra.: S20, 9N, 12E Coordinates: 34° 06' 36"N, 111° 08' 38"W

Geologic Unit: Sparse-pebble conglomerate in Houden quartzite.

Stratigraphic Group: Alder Group

SITE GEOLOGY : Same as Site D21.

Variability: Fragment density varies from sparse to extremely low.

Sedimentary Structures: Well, but thickly bedded.

Depositional Environment: Fluvial or near-shore marine as in D21.

SAMPLE DESCRIPTION : This sample is similar in appearance and composition to sample D21 except that fragments are much more sparse in this sample. Fragment length is commonly pebble size as opposed to granule size in sample site D21.

Sampler: K. Wirth Date: October 17, 1979

THIN SECTION DESCRIPTION

Site Number: D22 **Sample Number:** 154073 **Code:** A213

Percent Fragments: 37% **Percent Matrix:** 62%

Percent Heavies & Mafics: 1% **Stain:** none

Rock Type: Houden conglomerate **Stratigraphic Group:** Alder Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	75%	23-20.0 mm	rounded	1:1.5
chert	14%	10.0-9.0 mm	rounded	1:2
jasper	11%	14 mm	subrounded	1:2

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	77%	1.1-.02 mm	rounded, fine quartz is recrystallized
chert	2%	.6-.4 mm	rounded
jasper	3%	.7-.3 mm	subrounded
sericite	18%	<.03 mm	recrystallized plates and masses
specularite	<1%	.2-.09 mm	rounded detrital
hematite	<1%	powdery	interstitial grains

Cement: Mostly recrystallized sericite, also minor recrystallized quartz.

Interstitials: Recrystallized sericite and quartz, hematite.

Textures and recrystallization: Vein quartz fragments are strongly recrystallized, chert is not. Matrix quartz comprises a partly recrystallized, sutured, poorly aligned mosiac supported in places by finer grained recrystallized sericite and quartz.

Structures: Quartz grains show optical orientation and about 40% recrystallization even though no macroscopic foliation is evident in the rock, and bedding is not apparent.

Comments on Genesis: Well-sorted, mature sediment in the Alder Group containing better worked, more resistant rock types even though the same mixed volcanic and sedimentary source material was available.

Rock Name: quartz-chert-jasper pebble conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: D 23 **Sample Number:** 154074 **Code:** A 202

Location: Houden Mtn. **Scintillometer Counts:** 85 cps

Quadrangle: Sheep Basin Mtn. **U Value (U by NT) ppm :** 1.80

Sec., Twp, Ra.: S20, 9N, 12E **Coordinates:** 34° 06' 36"; 111° 08' 37"

Geologic Unit: quartz-jasper pebble conglomerate, Houden Formation

Stratigraphic Group: Alder Group

SITE GEOLOGY :
The easternmost of the two quartzites on Houden Mountain contains abundant quartz-jasper pebble conglomerate at its base. Some beds of the conglomerate are clearly matrix-supported, sparse quartz-pebble conglomerate, whereas other layers are packed with a variety of quartz, jasper, chert, slate, and dark volcanic-rock fragments, some of which are in contact but generally are still supported in a quartz wacke matrix.

Variability:
The size, sorting, and to some extent the type of pebble in the conglomerate are all stratigraphically controlled.

Sedimentary Structures:
Relatively well bedded, some cross bedding seen, but graded bedding in terms of sizing and sorting is seen.

Depositional Environment:
Shallower water, higher energy, possibly fluvial, braided channel conditions.

SAMPLE DESCRIPTION :
The rock is a fragment-packed conglomerate (50% fragments) of relatively angular white, pink and red-spotted chert, bright and dark red jasper, white vein quartz in about equal proportions, with lesser dark green and red volcanic rock fragments. All are about 7-20mm in size and relatively equant. The quartz wacke matrix is an aggregate of sand-size quartz, sericitic or argillaceous material and red to gray specularite and hematite. The conglomerate is striking in its appearance because of the abundant red jasper pebbles.

Sampler: P. Anderson **Date:** Oct. 18, 1979

THIN SECTION DESCRIPTION

Site Number: D23 **Sample Number:** 154074 **Code:** A202

Percent Fragments: 73% **Percent Matrix:** 20%

Percent Heavies & Mafics: 7% **Stain:** none

Rock Type: Houden conglomerate **Stratigraphic Group:** Alder Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	33%	12.5-2.0 mm	rounded	1:1.5
jasper	33%	13.8-2.0 mm	subrounded	1:1.5
chert	11%	7.0-2.0 mm	rounded	1:1.5
rhyolite	23%	8.0-2.0 mm	subrounded	1:1.5

(jasper fragments are well banded, locally containing angular chert chips)

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	48%	2.0-.02 mm	subangular and recrystallized
jasper	6%	2.0-.4 mm	subangular
chert	4%	2.0-.3 mm	subrounded
rhyolite	3%	2.0-.5 mm	subrounded, mostly altered to sericite
specularite	8%	.3-.08 mm	rounded detrital and clusters
specularite	3%	powdery	recrystallized with hematite
hematite	2%	powdery	interstitial grains
sericite	26%	<.04 mm	recrystallized plates and masses in matrix

Cement: Mostly recrystallized sericite; also minor recrystallized quartz, specularite and hematite.

Interstitials: Recrystallized sericite, quartz, specularite, and hematite.

Textures and recrystallization: Abundant matrix sericite (and clay) preserves primary detrital shape of specularite and quartz; fragments are closely packed, partly sutured, but neither matrix grains nor fragments are significantly recrystallized; grain sizes are completely seriate.

Structures: Bedding is not apparent in thin section but mainly relates to differing concentrations of fragments. Some fragments are slightly reoriented to form an incipient foliation.

Comments on Genesis: The source of this conglomerate was rich in jasper, specularite, chert and quartz, and depositional conditions might have been fluvial to account for the large fragment sizes with poor sorting and seriate grain sizes.

Rock Name: specularitic, jasper-quartz granule conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: D 24 **Sample Number:** 154075 **Code:** M 103

Location: SW McDonald Mtn. **Scintillometer Counts:** 63 cps

Quadrangle: Sheep Basin Mtn. **U Value (U by NT) ppm :** 1.40

Sec., Twp, Ra.: S15, 9N, 11E **Coordinates:** 34° 07' 23"' 111° 12' 11"

Geologic Unit: quartz pebble conglomerate in Mazatzal quartzite

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY :
Near the base of the Mazatzal quartzite, a zone of abundant conglomerate float close to outcrop was sampled as it is typical of the clean, well sorted pebble conglomerates in the Mazatzal. The purpose was to see whether typical Mazatzal-like conglomerates were high in U or Au valuesat an early stage in the sampling program.

Variability:
Variation from red hematite to partly black, specularitic hematite in some jasper fragments suggests upper greenschist or higher metamorphic grades.

Sedimentary Structures:
Specularite concentrations are on cross beds and base of foresets.

Depositional Environment:
Though not directly in place, a higher energy fluvial environment or possibly beach gravel is suggested for this rock.

SAMPLE DESCRIPTION :
The sample is a pale pink (sparsely hematitic matrix) conglomerate with an almost pure quartz matrix (except for disseminated specularite) suspending mostly quartz pebbles from 25 to 5mm long, sparse jasper pebbles up to 25mm long and abundant smaller (12-2mm) fragments of pure specularite or specularitic quartzite. Specularite is concentrated on bedding and cross bedding planes, and some pink chert fragments are also present.

Sampler: P. Anderson **Date:** Oct. 18, 1979

THIN SECTION DESCRIPTION

Site Number: D24a **Sample Number:** 154075 **Code:** M110

Percent Fragments: 0% **Percent Matrix:** 94%

Percent Heavies & Mafics: 6% **Stain:** pale maroon

Rock Type: Mazatzal quartzite **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	77%	1.4-.02 mm	rounded to subrounded, sutured
jasper	2%	1.0-.4 mm	subrounded
chert	1%	.9-.33 mm	subrounded
sericite	13%	<.03 mm	recrystallized plates and masses
specularite	2%	.2-.05 mm	rounded detrital
specularite	2%	powdery	recrystallized with hematite
hematite	3%	powdery	massive interstitial filling and grains
zircon	<1%	.04-.02 mm	rounded

Cement: Mostly recrystallized sericite except in layers where hematite is cement.

Interstitials: Recrystallized sericite, specularite, hematite.

Textures and recrystallization: Primary rounded character of quartz grains preserved where abundant sericite makes up the matrix, or more angular character of quartz preserved in layers where the matrix is specularite and hematite. Elsewhere quartz is interpenetrating, recrystallized and sutured.

Structures: Bedding planes are defined by alignment of zones of abundant sericite and hematite concentrations.

Comments on Genesis: Matrix is relatively impure for a Mazatzal quartzite, but quartz-rich nature of coarser material and specularite concentrations are definitive.

Rock Name: Impure specularite-cross-bedded quartzite

SITE AND SAMPLE DESCRIPTION

Site Number: D 25 **Sample Number:** 154076 **Code:** M 210

Location: SW McDonald Mtn. **Scintillometer Counts:** 452 cps

Quadrangle: McDonald Mtn. **U Value (U by NT) ppm :** 32.00

Sec., Twp, Ra.: S14, 9N, 11E **Coordinates:** 34° 07' 35"; 111° 11' 35"

Geologic Unit: massive and banded specularite bed in Mazatzal quartzite

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY :
In creek at the south end of McDonald Mountain near the base of the Mazatzal quartzite is a 25cm thick bed of massive to thinly laminated specularite (50 to 100%) in the quartzite. This gives a radiometric anomaly from 120 to 450 cps or about 4 x background. Under the specularite bed is dark maroon quartzite giving 130 cps and above are several small, dark red hematitic clay beds giving up to 200 cps. Sheared, slickensided hematitic fault surfaces in the creek near here give 650 to 700 cps.

Variability:
The specularite bed is well laminated at its base and interbedded with quartz grains for 11cm but grades upward into fine grained massive specularite over 14cm. Both top and bottom of the bed are knife sharp.

Sedimentary Structures:
Specularite grains are too small to observe detrital texture in hand specimen, but the well bedded nature of the specularite clearly indicates a primary syngenetic origin.

Depositional Environment:
In a fluvial, river channel type deposit, this specularite bed is a heavy mineral concentrate akin to specularite concentrations on the base of cross beds, but on a much larger scale.

SAMPLE DESCRIPTION :

The bedded specularite sample is a well layered, black and dark maroon laminated iron-rich quartzite with layers of specularite 0.5 to 10mm thick, generally 2-3mm thick, alternating with layers of quartz grains 1 to 3mm thick. The quartz layers have a minor (10-20%) yellow-white argillaceous component.

The massive specularite sample consists of sparkly metallic silver-red gray, fine grained specularite, interspersed with perhaps 10 to 15% small quartz grains. Internally, it shows no good bedding structures.

Sampler: P. Anderson **Date:** Oct. 18, 1979

THIN SECTION DESCRIPTION

Site Number: D25 **Sample Number:** 154076 **Code:** M210

Percent Fragments: 0% **Percent Matrix:** 8%

Percent Heavies & Mafics: 92% **Stain:** black

Rock Type: Mazatzal quartzite **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	1%	.15-.03 mm	subrounded to angular
zircon	6%	.18-.03 mm	rounded
rutile-ilmenite	4%	.18-.03 mm	rounded
sericite	3%	<.03 mm	recrystallized masses in interstitial spaces
specularite	80%	<.18 mm	rounded
specularite	1%	powdery	recrystallized between detrital specularite grains
hematite	<1%	powdery	interstitial grains
leucoxene	5%	powdery	opaque white interstitial masses

Cement: Specularite and sericite.

Interstitials: Specularite, sericite and hematite.

Textures and recrystallization: Quartz and sericite form angular interstitial filling of cavities between opaque specularite grains. Specularite generally is recrystallized and an interlocking mosaic as overgrowth on primary detrital grains.

Structures: Thin bedding laminations 0.5 to 1.0 mm thick defined by concentrations of heavies next to concentrations of quartz and sericite.

Comments on Genesis: Heavy mineral concentrate rich in specularite, zircon and a titanium mineral phase at base of Mazatzal quartzite unit.

Rock Name: bedded specularite-rich heavy-mineral concentrate

THIN SECTION DESCRIPTION

Site Number: D25a **Sample Number:** '54076 **Code:** M210

Percent Fragments: 0% **Percent Matrix:** 45%

Percent Heavies & Mafics: 55% **Stain:** brownish red, in layers

Rock Type: Mazatzal quartzite **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	28%	.21-.02 mm	subrounded to subangular
sericite	12%	<.03 mm	recrystallized plates and masses
chert	<1%	.17 mm	subrounded
zircon	3%	.17-.04 mm	rounded
rutile	5%	.19-.11 mm	rounded, sometimes with leucoxene alteration
specularite	27%	.2-.04 mm	rounded
specularite	3%	powdery	recrystallized with hematite and specularite
hematite	20%	powdery	interstitial grains and stain
leucoxene	2%	powdery	opaque white masses

Cement: Specularite-rich layers--mostly recrystallized specularite and minor sericite and hematite; quartz-rich layers--mostly sericite and hematite.
Interstitials: Recrystallized specularite and sericite, hematite.

Textures and recrystallization: Matrix hematite in heavy-mineral layers preserves primary shape of detrital specularite; matrix sericite in quartz-rich layers preserves primary detrital character of quartz grains.

Structures: Bedding is well and regularly defined by 0.5 to 3 mm thick layers alternating from heavy mineral-rich layers to quartz-sericite-rich layers.

Comments on Genesis: Lying immediately above the previous thin section, this thin section represents the upper part of the heavy-mineral bed where quartz is more abundant and specularite is less abundant.

Rock Name: Well-bedded specularite-quartz heavy-mineral concentrate

SITE AND SAMPLE DESCRIPTION

Site Number: D 26 Sample Number: 154077 Code: M 110

Location: SW McDonald Mtn. Scintillometer Counts: 85 cps

Quadrangle: Sheep Basin Mtn. U Value (U by NT) ppm : 1.60

Sec., Twp, Ra.: S14, 9N, 11E Coordinates: 34° 07' 25"; 111° 11' 37"

Geologic Unit: specularite cross-bedded quartzites

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY :

On hill above D 25, a composite sample of all different types of quartzites, grit and sparse granule conglomerate was taken as representative of 200 stratigraphic meters of the lower maroon quartzites that make up the base of the Mazatzal quartzite in the McDonald Mountain section. The rocks vary from dark maroon hematitic quartzite as in creek, to thinly bedded and cross bedded white quartzite, to red to brick-red hematitic quartzite and grit.

Variability:

Principal variation between quartzites of the McDonald Mountain section is in the proportions of hematite. Grain size is relatively constant and small.

Sedimentary Structures:

Abundant trough cross beds, some planar cross beds, ripple marks, channel and scour marks.

Depositional Environment:

Shallow water, braided river system or near shore beach type environment with strong current action but mature, well sorted fine grained (possibly reworked?) source quartz.

SAMPLE DESCRIPTION :

Sample chosen is typical of the dark maroon quartzites, and consists of 3 to 5cm bedding units, scoured at base by overlying bed, within which are small trough cross-bedded laminae of hematite-rich layers 1mm wide and quartz rich layers 3mm wide. There is pronounced concentration of hematite on cross-bed sets and at the base of a cross-bedded sequence (base of scoured bedding surface). The quartzite is medium grained and partly recrystallized.

Sampler: P. Anderson Date: Oct. 18, 1979

SITE AND SAMPLE DESCRIPTION

Site Number: D27 Sample Number: 154078 Code: M101

Location: Middle McDonald Mountain Scintillometer Counts: 65 cps

Quadrangle: McDonald Mountain U Value (U by NT) ppm : 1.6

Sec., Twp. Ra.: S6, 9N, 12E Coordinates: 34° 09' 10"N, 111° 09' 40"W

Geologic Unit: Mazatzal grit conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : The quartzites on McDonald Mountain are mostly fine to medium-grained and dark red, maroon, and purple in color. Bedding and cross-bedding planes are defined by concentrations of heavy minerals and average 5-8 cm in thickness. Some layers contain thin lenses of grit or very sparse and angular shale chips.

Variability: The section shows very little variation in color, texture or structure.

Sedimentary Structures: 5-8 cm thick cross-beds.

Depositional Environment: An environment with constant minor fluctuations in energy conditions as in a near-shore marine environment with constant, gentle wave action.

SAMPLE DESCRIPTION : A fine-to medium-grained dark purple to red, moderately sorted matrix of mostly quartz and hematite supports 25-30% grit fragments. White quartz grit averages 2-4 mm in length and makes up most of the fragment fraction. Minor amounts of red jasper and occasional shale or siltstone grit fragments are present.

Sampler: K. Wirth Date: October 18, 1979

THIN SECTION DESCRIPTION

Site Number: D27 **Sample Number:** 154075 **Code:** M101

Percent Fragments: 31% **Percent Matrix:** 67%

Percent Heavies & Mafics: 2% **Stain:** pale earthy red hematite

Rock Type: Mazatzal grit **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	95%	3.3-.7 mm	subrounded	1:1.5
jasper	5%	1.8-.7 mm	subangular	1:2

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	58%	.7-.02 mm	subrounded, polygonized, sutured
jasper	3%	.7-.3 mm	subangular
muscovite	1%	.2-.08 mm	detrital plates
sericite	33%	<.04 mm	recrystallized plates and masses
specularite	1%	.2-.08 mm	rounded
hematite	3%	powdery	interstitial grains and stain
chert	1%	0.4 mm	recrystallized

Cement: Recrystallized sericite and minor hematite.

Interstitials: Sericite, hematite.

Textures and recrystallization: Quartz is strongly polygonized, sutured, broken into patchwork mosaics, and intershredded at edges with recrystallized sericite even though sericite content is high.

Structures: Bedding poorly defined by layers of differing grain size.

Comments on Genesis: Probably an originally specularitic argillaceous quartzite and grit, strong deformation has extensively recrystallized the rock, deformed the original quartz-grain textures and converted specularite to hematite.

Rock Name: recrystallized quartz-rich grit

SITE AND SAMPLE DESCRIPTION

Site Number: D28 Sample Number: 154079 Code: M212

Location: N End of Crouch Mesa Scintillometer Counts: ND

Quadrangle: Young U Value (U by NT) ppm : 0.90

Sec., Twp, Ra.: S2, 9N, 14E Coordinates: 34° 08' 50"N, 110° 53' 40"W

Geologic Unit: Metamorphosed Mazatzal conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Here the contact of Young granite intruding Mazatzal quartzite (mismapped as Houden by Gastil) is very well exposed and proof that Mazatzal quartzite predates 1650 m.y. The quartzite and conglomerate in the Mazatzal exposure is sufficiently metamorphosed to convert all the red hematite stain of the matrix into fine-grained disseminated black specularite, thus changing the color of the rock from red to metallic-specularitic gray to white.

Variability: Here we observed best, and photographed, the remarkable metamorphic conversion of large, bright red jasper pebbles into blackish gray specularitic fragments, a change that takes place from the margin of the pebble inwards, leaving relict red jasper spots within the pebbles core. Closer to the contact, these spots diminish until they are all gone.
Sedimentary Structures: Good bedding and specularitic cross-bedding were observed through the metamorphism.

Depositional Environment: Shallow water , probably near-shore marine as for most coarse-fragment Mazatzal; possiby fluvial.

SAMPLE DESCRIPTION : Three samples collected at different distances from the granite contact illustrate the lithologic conversion by metamorphism as follows. The first contains jasper fragments in a recrystallized, coarse-grained quartz matrix; the small jaspers are specularitic, whereas the larger fragments are only converted to specularite on the rim-- the core remains dark red jasper. The next sample shows recrystallized specularite interstitial in a finer grained quartz matrix and contains quartz pebbles (now completely recrystallized) and jasper pebbles, the hematite in which is almost totally converted to specularite except for small red spots in the cores of the largest grains. The third sample is a thoroughly recrystallized quartzite in which all the sparse fragments are white (meta-quartz) or black (meta-jasper), and the matrix specularite, in areas of previously cross-bedded hematite, is well recrystallized and remobilized into fracture veinlets.

Sampler: P. Anderson and K. Wirth Date: October 19, 1979

THIN SECTION DESCRIPTION

Site Number: D28 **Sample Number:** 154079 **Code:** M212

Percent Fragments: 0% **Percent Matrix:** 98%

Percent Heavies & Mafics: 2% **Stain:** none

Rock Type: Mazatzal quartzite **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	95%	3.2-.04 mm	recrystallized, sutured, composite
muscovite	3%	.5-.03 mm	recrystallized
specularite	1%	.2-.01 mm	rounded detrital and subhedral recrystallized
hematite	1%	powdery	interstitial grains

Cement: Mostly sutured quartz, minor recrystallized muscovite.

Interstitials: Hematite and muscovite.

Textures and recrystallization: Texture is a thoroughly recrystallized mosaic of large, interlocking and somewhat polygonized quartz grains with most fine-grained matrix material recrystallized by metamorphism.

Structures: None apparent in thin section.

Comments on Genesis: Thorough recrystallization by thermal metamorphism has converted the rock to a completely metamorphic quartzite. None of the jasper fragments were intersected in thin section.

Rock Name: Metamorphically recrystallized quartzite.

SITE AND SAMPLE DESCRIPTION

Site Number: D29 Sample Number: 154080 Code: M212

Location: NE of Young Scintillometer Counts: 68 cps

Quadrangle: Young U Value (U by NT) ppm : 1.2

Sec., Twp, Ra.: S10, 9N, 14E Coordinates: 34° 07' 49"N, 110° 53' 45"W

Geologic Unit: Metamorphosed Mazatzal granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Close to, and similar to C9, where roof pendants of recrystallized Mazatzal quartzite and conglomerate lie in Young granite.

Variability: Color varies from white to gray and light green. Many layers are sericitic and some contain secondary hematite.

Sedimentary Structures: Cross beds average 5-25 cm in thickness.

Depositional Environment: Near-shore marine or fluvial, similar to C9 or D28.

SAMPLE DESCRIPTION : A grayish, recrystallized, specularite-bearing quartzite contains a pebble of recrystallized quartz. Around the pebble, the quartz and specularite are recrystallized but not strongly foliated (strain shadow) whereas in layers away from the pebble, the rock has a strongly foliated texture. A cut face reveals that, internally, the quartzite is studded with about 5% pale green sericite.

Sampler: K. Wirth Date: October 19, 1979

THIN SECTION DESCRIPTION

Site Number: D29 **Sample Number:** 154080 **Code:** M211

Percent Fragments: 5% **Percent Matrix:** 90%

Percent Heavies & Mafics: 5% **Stain:** traces of hematite

Rock Type: Mazatzal quartzite **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	100%	4.5-1.3 mm	subrounded	1:2

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	84%	1.3-.04 mm	recrystallized, sutured, composite
sericite	8%	<.04 mm	partially recrystallized to muscovite
specularite	4%	.7-.02 mm	partially recrystallized; subhedral
muscovite	4%	.7-.1 mm	recrystallized from sericite
zircon	<1%	.3-.08 mm	rounded

Cement: Recrystallized quartz, shredded quartz and sericite.

Interstitials: Sericite.

Textures and recrystallization: Coarser grained layers consist of well-recrystallized muscovite and large composite quartz grains whereas finer grained layers are an intersheared mosaic of shredded sericite and elongate foliated quartz grains.

Structures: Bedding planes are defined by alternating coarser and finer grained layers which were originally grit and quartzite, and by linear concentrations of recrystallized specularite.

Comments on Genesis: Although probably as recrystallized as D28, deformation accompanied recrystallization of this quartzite such that the finer grained layers are strongly foliated.

Rock Name: foliated, recrystallized, specularite-bedded quartzite

SITE AND SAMPLE DESCRIPTION

Site Number: D30 Sample Number: 154081 Code: 5114

Location: S. end of Houden Mtn. Scintillometer Counts: 150 cps

Quadrangle: Sheep Basin Mtn. U Value (U by NT) ppm : 2.3

Sec., Twp, Ra.: S28, 9N, 12E Coordinates: 34° 05' 10" N, 111° 07' 50" W

Geologic Unit: Scanlan cobble conglomerate

Stratigraphic Group: Apache Group

SITE GEOLOGY : Approximately 10 meters of Scanlan conglomerate outcrops here. The section is composed of 1-3 meter-thick beds of conglomerate. All have nearly the same composition and character, except for variations in fragment size.

Variability: Fragment size is consistent within any one given layer, but highly variable between layers and across the section.

Sedimentary Structures: Crude and large-scale bedding; no cross-bedding noted.

Depositional Environment: Fluvial, coarse river-channel deposit, as indicated by poor sorting, large matrix and fragment grain sizes, and immaturity.

SAMPLE DESCRIPTION : Rounded pebbles and cobbles of quartzite (Mazatzal and others) rhyolite, sericitic volcanic fragments and jasper support a fine-sand to grit-size matrix of similar composition in a ratio of 3:2. Hematite, sericite and clay interstitials give the rock an earthy brown color and easily-weathered character.

Sampler: K. Wirth Date: Oct. 19, 1979

SITE AND SAMPLE DESCRIPTION

Site Number: D31 **Sample Number:** 154082 **Code:** M101

Location: SW McDonald Mtn. **Scintillometer Counts:** 80 cps

Quadrangle: McDonald Mtn. **U Value (U by NT) ppm :** 0.90

Sec., Twp, Ra.: S12, 9N, 11E **Coordinates:** 34° 08' 27" N, 111° 10' 40" W

Geologic Unit: Mazatzal grit conglomerate

Stratigraphic Group: Mazatzal group

SITE GEOLOGY : Most of McDonald Mountain consists of red and maroon well sorted, fine and medium-grained quartzite. Interbedded with these are thin layers of angular shale fragments or quartz grit.

Variability: In general, the section shows very little variation except for thin layers of coarse material.

Sedimentary Structures: Planar and trough cross-beds average 7-15 cm in thickness

Depositional Environment: Near-shore marine as indicated by the maturity of sediments and consistent energy conditions.

SAMPLE DESCRIPTION : A pale maroon to red-colored grit contains medium to coarse-grained, partially recrystalized quartz, in an interstitial hematitic quartz ground mass. This matrix supports about 20% coarser-grained (up to 6mm) grit-size quartz, jasper and chert, but these are not particularily distinctive from the matrix material because the rock's grain sizes are completely seriate, and recrystallizatio has caused most grains to be interlocking.

Sampler: K. Wirth **Date:** Oct. 20, 1979

SITE AND SAMPLE DESCRIPTION

Site Number: D 32 **Sample Number:** 154083 **Code:** D 104

Location: NE Sheep Basin Mtn. **Scintillometer Counts:** 122 cps

Quadrangle: Sheep Basin Mtn. **U Value (U by NT) ppm :** 2.50

Sec., Twp, Ra.: S11, 8N, 11E **Coordinates:** 34° 03' 03"; 111° 11' 45"

Geologic Unit: deformed, polymictic Deadman conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY :
On the north end of Sheep Basin Mountain, Deadman conglomerate is drawn into a tightly attenuated fold limb and the conglomerate in outcrop is strongly flattened. It contains large boulders and cobbles of Reef Ridge-type sandy brown quartzites and siltstones, white quartzite, sericitic rhyolite, and less abundant jasper and chert in a semi-schistose quartz wacke matrix. The conglomerate also contains cobbles of volcanic-rock-fragment conglomerate whose provenance is from the north.

Variability:
Size of fragment depends on rock type, but is typically around 5 to 6cm (large cobble), but sizes are seriate down to the grit to sand size matrix material. Lower in iron than adjacent Deadman outcrops.

Sedimentary Structures:
Most obliterated by strong flattening without significant metamorphism.

Depositional Environment:
Fluvial; river channel deposit, more specifically on the north side of the major east-west Deadman conglomerate paleochannel.

SAMPLE DESCRIPTION :
Sample is a conglomerate of large flattened siltstone and argillaceous to silty sandstone (11-4cm), white quartzite (2-4cm), red jasper (1-3cm), hematitic rhyolite (1-5cm) and other diverse cobbles to pebbles in a matrix of finer grained chert, hematitic slate, sericitic and hematitic rhyolite, quartz jasper and siltstone granules, together with sand-to grit-size quartz, clays, sericite, hematite and altered volcanic detritus. The rock is strongly foliated, moderately lineated and pale purple to maroon in color.

Sampler: P. Anderson **Date:** Oct. 23, 1979

THIN SECTION DESCRIPTION

Site Number: D32 Sample Number: 154083 Code: D104

Percent Fragments: 27% Percent Matrix: 68%

Percent Heavies & Mafics: 5% Stain: brownish

Rock Type: Deadman conglomerate Stratigraphic Group: Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
sericitic quartzite	38%	20-2 mm	subrounded	1:2
chert	10%	10-2 mm	subangular	1:3
jasper	12%	12-2 mm	subangular	1:2
sericitic rhyolite	31%	18-2 mm	angular	1:6
quartz	9%	3-2 mm	rounded	1:1.5

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	32%	2-.02 mm	unstrained, broken volcanic grains
jasper	3%	2-.06 mm	subangular to subrounded
chert	5%	2-.04 mm	subangular to subrounded
specularite	5%	.4-.02 mm	rounded detrital
specularite	4%	.2-.01 mm	recrystallized
hematite	2%	powdery	stain
leucoxene	2%	powdery	alteration clots
limonite	1%	powdery	stain
sericite	18%	.09-.005 mm	recrystallized foliated masses
clay	28%	--	finely foliated mats

Cement: Recrystallized quartz, sericite, hematite, specularite.

Interstitials: Recrystallized quartz, specularite, clay, sericite, hematite, limonite, leuxocene.

Textures and recrystallization: Highly euhedral, unstrained, clear volcanic quartz crystals have been broken and drawn into augen shapes by matrix foliation; large fragments and quartz grains lie unstrained in a highly schistose, foliated matrix of clay, sericite and hematite.

Structures: Bedding is defined by the highly foliated schistose character of the matrix and by fragment elongation, both of which are primary features later emphasized by deformation and flattening.

Comments on Genesis: Most of the matrix sericitic and clayey material, the clear matrix quartz grains and about 1/3 of the fragments are of rhyolitic volcanic origin; the remainder of fragments are exotic sedimentary ones from the Alder Group.

Rock Name: foliate sericitic quartzite-jasper-rhyolite conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: D 33 Sample Number: 154084 Code: D 103

Location: NE of Coffeepot Cabin Scintillometer Counts: 135 cps

Quadrangle: Sheep Basin Mtn. U Value (U by NT) ppm : 4.80

Sec., Twp, Ra.: S7, 8N, 12E Coordinates: 34° 02' 43"; 111° 10' 25"

Geologic Unit: hematitic Deadman conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY :

Northeast of Coffee trail, moderately dipping, folded Deadman conglomerate forms a sinuous ridge. On the northwest end of the ridge the conglomerate is very hematite (specularite)-rich, especially the fragments, and is interbedded with dark, finer grained, cross-bedded quartzites, impure volcanic-rock-fragment quartzites and quartz wackes. The quartzites and conglomerates, both matrix and fragments, are made up almost entirely of volcanic material, rhyolitic to dacitic in composition.

Variability:

Although fragment size and hematite content are variable, almost all of the Deadman here is a very dark reddish brown to black.

Sedimentary Structures:

Quartzite beds between conglomerate layers are well and complexly trough-cross bedded.

Depositional Environment:

Shallow water, river channel environment with source material very close to preserve volcanic rock fragments and finer altered volcanic detritus.

SAMPLE DESCRIPTION :

The conglomerate sample consists of dark reddish brown to black, highly hematitic volcanic rock fragments in a lighter brown and yellow-spotted matrix. Some rhyolite to dacite fragments are quartz and K-feldspar phenocrystic, most are finely vesicular, a few are cherty, and in many the vesicles are filled by specularite. The matrix is composed almost solely of volcanic material—broken felds clay, cherty vesicle-like material, altered volcanic detritus—such that the rock might almost be called a volcaniclastic, if it were not for the cross bedding and other sedimentary structures.

Sampler: P. Anderson Date: Oct. 23, 1979

THIN SECTION DESCRIPTION

Site Number: D33 Sample Number: 154084 Code: D103

Percent Fragments: 80% Percent Matrix: 6%

Percent Heavies & Mafics: 14% Stain: black specularitic

Rock Type: Deadman conglomerate Stratigraphic Group: Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
rhyolite	95%	50-2 mm	subangular	1:2
jasper	5%	7-2 mm	subrounded	1:2

(rhyolite fragments are black, rich in specularite which fills vesicles and replaces phenocrysts, contain quartz phenocrysts, leucoxene spots, and are similar in composition to the matrix).

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
specularite	34%	.5-.02 mm	rounded detrital; filled vesicles, replaced
specularite	6%	.04-.01 mm	recrystallized networks
hematite	9%	earthy	stain near specularite
leucoxene	5%	.4-.07 mm	alteration patches in specularite
quartz	28%	.8-.02 mm	broken volcanic phenocrysts
zircon	<1%	.25-.08 mm	rounded detrital
sericite	2%	.4-.05 mm	recrystallized from clay
clay	12%	--	unrecrystallized alteration of matrix
limonite	4%	stain	around specularite

Cement: Recrystallized specularite, quartz, hematite and clay.

Interstitials: Specularite; quartz, clay, leucoxene, hematite, limonite.

Textures and recrystallization: Rhyolite fragments are clay rich and little recrystallized with phenocrysts of quartz and specularite; matrix is rich in specularite and hematite with cavity fillings between these grains.

Structures: Bedding wraps around one large fragment.

Comments on Genesis: This high iron (specularite) and titanium (leucoxene) conglomerate is derived solely from a highly specularitic, quartz-phenocrystic rhyolite terrain in which all the mafic minerals had been converted to specular hematite; heavies are enriched in matrix.

Rock Name: Highly specularitic black rhyolite conglomerate.

SITE AND SAMPLE DESCRIPTION

Site Number: D 34 **Sample Number:** 154085 **Code:** D 103

Location: SW of Coffee Pot Cabin **Scintillometer Counts:** 180 cps

Quadrangle: Sheep Basin Mtn. **U Value (U by NT) ppm :** 5.90

Sec., Twp, Ra.: S13, 8N, 11E **Coordinates:** 34° 02' 00"; 111° 10' 45"

Geologic Unit: Deadman conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY :
In center of folded Deadman outcrop east of D 33 a composite sample of coarser grained material from the Deadman was collected over 200m. Compared to D 34, the Deadman is leaner with conglomerate here and conglomerates are not so tightly packed with fragments; neither the matrix nor fragments are as hematitic. Occasionally pink quartzite and chert fragments are found.

Variability:
As conglomerate decreases in amount, the proportion of jet black cross-bedded quartzite increases in abundance over the previous sample site. The same leaning and fining tendency seen laterally, occurs up section in the Deadman.

Sedimentary Structures:
Cross bedding, graded bedding, lodes, scour channels and a general fining-upwards sequence are seen.

Depositional Environment:
As well as a proximal volcanic source terrain, a shallow water, fluvial (or possibly submarine) channel deposit is suggested, which gives way in time to lower energy conditions.

SAMPLE DESCRIPTION :
The sample is a conglomerate with a strong color and textural contrast between the dark purple to maroon, soft sericitic hematitic or clayey rhyolitic volcanic fragments 15 to 40mm in size, set in a pale brownish, gritty matrix of less-hematitic quartz wacke material (quartz, clays, silty volcanic detritus, now mostly quartz and sericite). Infrequent green volcanic fragments are seen. Rhyolitic volcanic fragments here are characterized by a unique texture of oval-shaped, pale yellowish siliceous spots, which are filled vesicles in the volcanics.

Sampler: P. Anderson **Date:** Oct. 23, 1979

THIN SECTION DESCRIPTION

Site Number: D34 **Sample Number:** 154085 **Code:** D103

Percent Fragments: 42% **Percent Matrix:** 56%

Percent Heavies & Mafics: 12% **Stain:** dark reddish brown

Rock Type: Deadman conglomerate **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
rhyolite	80%	22-2 mm	subrounded	1:2
jasper	13%	4-2 mm	subangular	1:2 & 1:5
chert	7%	5.5-2 mm	subrounded	1:1

(rhyolite fragments vary from highly sericitic (80%) to quartz phenocrystic to specularite phenocrystic and frequently are vesicular)

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	33%	2-.02 mm	broken clear volcanic phenocrysts
chert	5%	2-.07 mm	subrounded detrital
specularite	21%	.8-.02 mm	euhedral crystals and rounded detrital
specularite	4%	.5-.01 mm	recrystallized plates often rimming quartz
leucoxene	4%	.4-.1 mm	alteration clots with specularite
hematite	2%	powdery	stain
limonite	1%	powdery	stain
sericite	25%	.04-.01 mm	fleted matrix mats
clay	5%	--	partly recrystallized to matrix sericite
zircon	<1%	.05-.02 mm	rounded detrital

Cement: Sericite, hematite, specularite, quartz.

Interstitials: Recrystallized quartz, specularite, sericite, hematite, limonite, clay, leucoxene.

Textures and recrystallization: Specularite and quartz are both euhedral and of volcanic-phenocryst origin; primary grain shapes are well preserved in a matrix of abundant, somewhat recrystallized and foliated sericite and clay. Matrix is similar to the rhyolite fragments except it is richer in specularite.

Structures: General elongation of rhyolite fragments define bedding and also foliation.

Comments on Genesis: From leucoxene content, specularite must be high in titanium. This, plus the euhedral nature of many specularite grains, both as detrital grains in matrix and as phenocrysts in volcanic fragments, suggests that Ti-rich specularite existed as primary phenocrysts in the source rhyolites.

Rock Name: specularite-quartz phenocrystic rhyolite-fragment conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: D35 **Sample Number:** 154086 **Code:** D202

Location: S. of Sheep Basin Peak **Scintillometer Counts:** 145 cps

Quadrangle: Sheep Basin Mtn. **U Value (U by NT) ppm :** 6.3

Sec., Twp, Ra.: S23, 8N, 11E **Coordinates:** 34° 00' 53" N, 111° 12' 03" W

Geologic Unit: Deadman granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Deadman quartzite and conglomerate here is a southerly continuation of the Deadman ridge sampled from D32 to D34. The southward-fining tendancy continues until, at this site, there are no fragments coarser than 1-2 cm-long flat, schistose plates. The outcrop is high in specularite content, and a dark metallic-blue to brownish-black in color.

Variability: Scintillometer response is quite variable across the outcrop; most areas are between 100 and 170 cps but radiometrically hotter zone up to 250 cps were found, and sampled as a separate sample (D35A).

Sedimentary Structures: Poor outcrop and strong foliation obscure bedding; rock relatively poorly sorted and immature.

Depositional Environment: Either the edge of a fluvial channel deposit or the base of a transgressive marine sequence at the edge of a channel.

SAMPLE DESCRIPTION : A dark bluish to gray to black quartz, sericite and specularite-rich matrix contains flattened, sericitic, schistose light green, dark gray and black fragments of volcanic and slaty material. Fragments occupy about 25% of the rock and vary from 8-23 mm in length, with a few as long as 30-40 mm. The dominant feature of the rock is the blackish cast from abundant (20-30%) specularite.

Sampler: K. Wirth & P. Anderson **Date:** Oct. 24, 1979

THIN SECTION DESCRIPTION

Site Number: D35 **Sample Number:** 154086 **Code:** D202

Percent Fragments: 25% **Percent Matrix:** 45%

Percent Heavies & Mafics: 30% **Stain:** black-reddish brown specularite

Rock Type: Deadman conglomerate **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
rhyolite	100%	16-12 mm	subangular	1:2

(dark reddish brown rhyolite fragments are highly sericitic with abundant specularite phenocrysts, sericitized phenocrysts or vesicles, and lesser quartz phenocrysts)

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	40%	1.3-.02 mm	angular, broken volcanic phenocrysts
rhyolite	4%	1.6-.07 mm	subangular
jasper	2%	2-.8 mm	subangular
specularite	28%	.7-.1 mm	rounded detrital
specularite	4%	.4-.02 mm	recrystallized with detrital specularite
sericite	13%	.2-.005 mm	recrystallized plates and masses
hematite	5%	powdery	stain
leucoxene	2%	.45-.17 mm	alteration clots
zircon	<1%	.04 mm	rounded detrital
limonite	2%	powdery	stain

Cement: Recrystallized specularite and quartz, sericite, hematite.

Interstitials: Recrystallized specularite and quartz, sericite, hematite, leucoxene.

Textures and recrystallization: Specularite varies from euhedral crystals in fragments to rounded embayed vesicle fillings with sericite, to subrounded detrital grains; angular quartz crystals are clearly of volcanic origin; matrix texture is dominated by masses of sericite and recrystallized specularite stained by hematite and limonite.

Structures: Sericite foliation and fragment elongation may be either bedding, foliation, or both.

Comments on Genesis: In this conglomerate is evidence for both rounded specularite (as vesicle fillings) and euhedral specularite (phenocrysts or pseudophenocrysts) in the sericitic rhyolites as the source for detrital specularite in the Deadman unit. The conglomerate is nearly all derived from the rhyolites.

Rock Name: highly specularitic and sericitic rhyolite-fragment conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: D 35A Sample Number: 154087 Code: D 203

Location: S. of Sheep Basin Mtn. Peak Scintillometer Counts: 245 cps

Quadrangle: Sheep Basin Mtn. U Value (U by NT) ppm : 33.0

Sec., Twp, Ra.: S23, 8N, 11E Coordinates: 34°00'53"; 111°12'03"

Geologic Unit: Deadman pebble conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Site geology is the same as for D 35, but this sample was taken because it gave a much higher scintillometer response. It lies stratigraphically below D 35 and may represent the most basal material of the Deadman conglomerate here.

Variability: Scintillometer readings variable over short distances (3-5m).

Sedimentary Structures: Not seen because of poor outcrop.

Depositional Environment: Same as D 35.

SAMPLE DESCRIPTION : The matrix of this sample is similar to that of the sample taken at site D 35, except that it contains a much higher specularite content. Fragments here are less sheared, and of pebble size, more rounded, and consist totally of red to pink aphanitic rhyolite. Much of the specularite of the matrix has been weathered out (originally 30-40%), leaving a cellular appearance on the surface of the rock.

Sampler: K. Wirth Date: 24 October 1979

THIN SECTION DESCRIPTION

Site Number: D35a **Sample Number:** 154087 **Code:** D203

Percent Fragments: 28% **Percent Matrix:** 40%

Percent Heavies & Mafics: 32% **Stain:** black to dark red-brown

Rock Type: Deadman conglomerate **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
rhyolite	100%	3.6-2 mm	subangular	1:3

(rhyolite is aphanitic, flow banded and hematite-stained)

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
specularite	43%	.6-.01 mm	detrital and recrystallized, locally massive
hematite	5%	powdery	stain in less specularitic layers
limonite	4%	powdery	stain in specularite-rich layers
altered feldspar	11%	2-.03 mm	subangular, sericitized
quartz	17%	2-.02 mm	subrounded, detrital, recrystallized (minor)
sericite	10%	.2-.01 mm	recrystallized plates and masses
clay	6%	--	finely crystalline interstitials
zircon	1%	.2-.035 mm	rounded detrital
leucoxene	3%	.5-.03 mm	alteration clots with specularite

Cement: Recrystallized specularite, sericite, quartz, hematite, limonite.

Interstitials: Recrystallized specularite, sericite, clay, hematite, limonite, quartz, feldspar.

Textures and recrystallization: Clear, angular quartz grains are of volcanic origin; rock texture mostly unrecrystallized except for foliated sericite trains along slip lines, now limonite stained; specularite is recrystallized and forms overgrowths between detrital grains; zircons are euhedral, volcanic.

Structures: Bedding may be defined by a layer of rhyolite fragments which is discordant to the sericitic foliation planes and slip lines.

Comments on Genesis: Rock derived totally from specularite-rich, sericitic rhyolites. Conglomerate is high in iron and presumably titanium from the presence of leucoxene, but high scintillometer response may relate to either high Fe + Ti content or cause of abundant iron staining.

Rock Name: highly specularitic, sericitic rhyolite-fragment conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: D 36 **Sample Number:** 154088 **Code:** M 103

Location: S. of Sheep Basin Mtn. **Scintillometer Counts:** 85 cps

Quadrangle: Sheep Basin Mtn. **U Value (U by NT) ppm :** 2.00

Sec., Twp, Ra.: S22, 8N, 11E **Coordinates:** 34° 01' 40"; 111° 12' 40"

Geologic Unit: Mazatzal quartz pebble conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY :
On the east side of Sheep Basin Mountain is an excellent exposure of quartz-pebble conglomerates in the Mazatzal quartzite sequence 70 to 100 meters above its base. The basal units are magnificently cross-bedded maroon quartzites with abundant specularite concentrations. In this are pebble conglomerate beds 0.5 to 12m thick which vary from very sparse to packed with quartz and jasper pebbles. Sample taken over 100 meter vertical section.

Variability:
Cross beds in the quartzite vary from 1 to 30m long; conglomerate layers are often on the cross-bed sets and quartz : jasper ratio varies with the cross-bed set.

Sedimentary Structures:
Huge trough cross beds are the dominant structure.

Depositional Environment:
Probably a broad braided river channel network of fluctuating energy conditions and good sorting power.

SAMPLE DESCRIPTION :
Milky vein quartz pebbles 12 to 25mm in diameter, of high sphericity and roundness, with lesser, more elipsoidal pink quartzite, chert and red jasper pebbles 5 to 15mm long are set in a matrix of quartz sand, grit and specularite grains. The specularite has been concentrated around the edges of the quartz pebbles in cavities between them and adjacent grains where a hydraulic trap for heavy particles is typically found. Conglomerate is 60% fragments, is framework-supported, and the matrix is about 20 to 30% specularite.

Sampler: P. Anderson **Date:** Oct. 23, 1979

THIN SECTION DESCRIPTION

Site Number: D36 **Sample Number:** 154088 **Code:** M103

Percent Fragments: 40% **Percent Matrix:** 52%

Percent Heavies & Mafics: 8% **Stain:** blackish-red specularite

Rock Type: Mazatzal conglomerate **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	50%	22-2 mm	rounded	1:1.5-1:2
chert	15%	8.5-2 mm	subrounded	1:1
jasper	35%	9-2 mm	subangular	1:1.5

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	64%	2.0-.02 mm	rounded detrital, sutured; recrystallized
chert	6%	2.0-.6 mm	subrounded, partly recrystallized
jasper	4%	2.0-.7 mm	subangular, bedded
specularite	15%	.7-.01 mm	rounded detrital
specularite	3%	.8-.01 mm	recrystallized with detrital specularite
hematite	2%	powdery	red stain under reflected light
limonite	<1%	powdery	yellow-brown stain
leucoxene	<1%	powdery	opaque; white in reflected light
zircon	<1%	.2-.005	rounded detrital
(blue-green mineral)	<1%	.4-.2 mm	possibly chlorite
sericite	6%	.05-.001 mm	interstitial foliated masses

Cement: Recrystallized quartz, sericite, hematite and specularite.

Interstitials: Recrystallized quartz, sericite, specularite, hematite, limonite, leucoxene.

Textures and recrystallization: Quartz grains show undulose extinction, partial suturing on some grain boundaries and minor overgrowths into the matrix; recrystallized specularite forms overgrowth on detrital specularite; matrix sericite locally preserves primary quartz shapes.

Structures: Bedding structures are defined by concentrations of detrital specularite and by differing fragment densities in various layers between the larger fragments.

Comments on Genesis: Although the matrix is significantly recrystallized, most textures and mineralogy of a typical specularitic Mazatzal conglomerate are seen in this rock. Source terrain included vein quartz and specularite, bedded jasper and chert.

Rock Name: Specularitic quartz-jasper-chert pebble conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: D 37 Sample Number: 154089 Code: M 103

Location: NE Sheep Basin Mtn. Scintillometer Counts: 57 cps

Quadrangle: Sheep Basin Mtn. U Value (U by NT) ppm : 2.8

Sec., Twp, Ra.: S11, 8N, 11E Coordinates: 34°02'40"; 111°11'53"

Geologic Unit: Mazatzal pebble conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Pale maroon to purple, medium-grained quartzites, minor grit and quartz-pebble conglomerate make up the Mazatzal on Sheep Basin mountain. The coarser layers are deposited in graded and cyclically repetitive stratification units 2-70cm thick. The outcrops are about 1/3 of the way up the Mazatzal section of Sheep Basin Mountain, and stratigraphically may be close to D 36.

Variability: Conglomerates in the lower part of the section have pebble-size fragments as an average, but this decreases up section to an average fragment size of grit.

Sedimentary Structures: Minor concentrations of specularite on bedding and cross-bedding planes in the quartzites define 5-25cm thick bedding sets.

Depositional Environment: Either a near-shore marine, beach deposit or fluvial, braided river network feeding in coarser detritus in cyclical higher energy periods.

SAMPLE DESCRIPTION : A pale maroon to purple medium-grained, rounded quartz-rich matrix contains an equal proportion of rounded pebbles. The fragments consist of quartz (80%), pink and dark rhyolite (13%) and jasper (7%). Minor detrital specularite is also present in the matrix.

Sampler: K. Wirth Date: 23 October 1979

THIN SECTION DESCRIPTION

Site Number: D37 **Sample Number:** 154089 **Code:** M103

Percent Fragments: 55% **Percent Matrix:** 35%

Percent Heavies & Mafics: 10% **Stain:** blackish red specularite

Rock Type: Mazatzal conglomerate **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	50%	25-2 mm	rounded	1:1.5
jasper	43%	26-2 mm	subrounded	1:2
chert	7%	8-2 mm	subrounded	1:2

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	59%	2-.02 mm	rounded detrital, sutured, recrystallized
chert	6%	2-.09 mm	subrounded, partly recrystallized
jasper	6%	2-.8 mm	subrounded to rounded
specularite	12%	.8-.02 mm	rounded detrital
specularite	1%	.7-.01 mm	recrystallized with detrital specularite
hematite	3%	powdery	stain around specularite
sericite	12%	.15-.005 mm	recrystallized interstitial radial crystals
zircon	1%	.2-.03 mm	rounded detrital
leucoxene	<1%	powdery	alteration powder
(green-blue mineral)	<1%	.7 mm	possibly chlorite

Cement: Recrystallized quartz, specularite, sericite, minor hematite and leucoxene.

Interstitials: Recrystallized quartz, specularite, hematite, sericite, and leucoxene.

Textures and recrystallization: Rounded detrital texture of specularite is very well preserved; larger quartz fragments are sutured, internally polygonized and strained; matrix is interlocking recrystallized sericite and quartz with some rounded detrital quartz grains preserved.

Structures: Possibly defined by crude elongation of larger fragments.

Comments on Genesis: Mazatzal conglomerate derived from terrain rich in jasper, chert, vein quartz and specularite with relatively high specularite content; moderately recrystallized by deformation.

Rock Name: specularitic quartz-jasper-chert pebble conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: D 38 Sample Number: 154091 Code: M 202

Location: NE Sheep Basin Mtn. Scintillometer Counts: 88 cps

Quadrangle: Sheep Basin Mtn. U Value (U by NT) ppm : 4.8

Sec., Twp, Ra.: S14, 8N, 11E Coordinates: 34°02'03"; 111°11'53"

Geologic Unit: Mazatzal quartz-jasper granule conglomerate

Stratigraphic Group: Mazatzal group

SITE GEOLOGY : Above Coffeepot trail about 2/3 of the way up the Sheep Basin Mountain Mazatzal section is a thick sequence of quartz-jasper granule conglomerates over 50m thick. These vary from very sparse to moderately dense granules and pebbles in a maroon quartzite matrix. Stratigraphically this sample is higher than D 36 or D 37.

Variability: Some conglomerate layers contain only quartz granules, while others contain quartz, rhyolite, and jasper.

Sedimentary Structures: Good bedding, cross bedding, possibly graded bedding.

Depositional Environment: Fluvial as indicated by the poorly sorted and conglomeratic character of the sediments, but a shallow-water marine or beach setting is possible.

SAMPLE DESCRIPTION : Fine- to medium-grained maroon and purple quartzites support granules and small pebbles in a ratio of 3:2. The matrix consists of rounded quartz and minor amounts of detrital specularite. Fragments are rounded and are mainly white quartz (75%), rhyolite (23%), and jasper (2%), although other parts of the section are richer in jasper.

Sampler: K. Wirth Date: 23 October 1979

THIN SECTION DESCRIPTION

Site Number: D38 Sample Number: 154091 Code: M202

Percent Fragments: 50% Percent Matrix: 30%

Percent Heavies & Mafics: 20% Stain: black specularitic

Rock Type: Mazatzal conglomerate Stratigraphic Group: Mazatzal group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	77%	28-2 mm	rounded	1:1.5
jasper	20%	11-2 mm	subrounded	1:2
chert	3%	4-2 mm	subrounded	1:2

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	40%	2-.02 mm	rounded detrital, strained, recrystallized
chert	9%	2-.9 mm	subrounded
jasper	2%	2-1.3 mm	subrounded
specularite	30%	.63-.08 mm	rounded detrital
specularite	1%	.2-.02 mm	recrystallized with detrital specularite
hematite	1%	powdery	stain
limonite	2%	powdery	stain
zircon	2%	.4-.07 mm	rounded detrital
sericite	12%	.17-.005 mm	recrystallized interstitial masses
clay	1%	--	finely crystalline interstitial masses

Cement: Recrystallized sericite, specularite and quartz.

Interstitials: Recrystallized quartz, sericite, specularite; clay, hematite, limonite.

Textures and recrystallization: Abundant detrital specularite shows perfectly detrital texture; large vein quartz pebble shows dramatic deformation lamellae; most matrix quartz is sutured except where sericite is interstitial.

Structures: General elongation of ellipsoidal pebbles crudely defines bedding.

Comments on Genesis: Rounded detrital specularite is very abundant in this section indicating proximity to a specularite source; abundance of vein quartz also, may indicate that source is specularite-quartz veins.

Rock Name: highly specularitic quartz-pebble conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: D 38A Sample Number: 154092 Code: M 102

Location: NE Sheep Basin Mtn. Scintillometer Counts: 142 cps

Quadrangle: Sheep Basin Mtn. U Value (U by NT) ppm : 11.3

Sec., Twp, Ra.: S14, 8N, 11E Coordinates: 34°02'03"; 111°11'53"

Geologic Unit: Mazatzal granule conglomerate

Stratigraphic Group: Mazatzal group

SITE GEOLOGY : Close to D38 site, higher scintillometer readings were encountered, so a separate sample was taken. The abundant yellow limonite stain on the conglomerate suggests the presence of pyrite, either as a part of the conglomerate, or introduced later along fractures. Abundant shearing and fracturing of the conglomerate was noted in this area to be more than usual.

Variability: The presence of pyrite may or may not be related to higher scintillometer readings.

Sedimentary Structures: Same as site D 38.

Depositional Environment: Presumably the same as D 38.

SAMPLE DESCRIPTION : This sample is essentially the same as D 38 except for slightly smaller quartz granules and the yellow limonitic stain. It could represent a pyritic facies of the Mazatzal, but that is unlikely because only a small area (50m wide) is yellow stained and the surrounding rock is the usual hematitic oxide-facies Mazatzal quartzite and conglomerate.

Sampler: K. Wirth and P. Anderson Date: 23 October 1979

THIN SECTION DESCRIPTION

Site Number: D38a **Sample Number:** 154092 **Code:** M102

Percent Fragments: 55% **Percent Matrix:** 25%

Percent Heavies & Mafics: 20% **Stain:** specularite and limonite

Rock Type: Mazatzal conglomerate **Stratigraphic Group:** Mazatzal Quartzite

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	38%	21-2 mm	rounded	1:1.5
quartzite	55%	14-2 mm	subrounded	1:1
chert	4%	4-2 mm	subangular	1:2
jasper	3%	4-2 mm	subangular	1:2

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	61%	2-.005 mm	rounded detrital, sutured, recrystallized
quartzite	1%	2-.7 mm	subrounded
chert	5%	2-.2 mm	subrounded
jasper	2%	2-.5 mm	subangular
specularite	15%	.4-.02 mm	rounded detrital
specularite	1%	.2-.005 mm	recrystallized with detrital specularite
hematite	1%	powdery	interstitial masses; stain
goethite	1%	.09-powder	fibers in concentric bands; stain
zircon	<1%	.9-.01 mm	rounded detrital
sericite	10%	.09-.005 mm	recrystallized plates around grains
clay	3%	powdery	finely crystalline interstitial masses

Cement: Recrystallized quartz, specularite, hematite, goethite.

Interstitials: Recrystallized quartz, sericite, clay, hematite, specularite, goethite.

Textures and recrystallization: Larger quartz pebbles show strain twinning, deformation lamellae and foliation bands; matrix quartz and specularite show primary detrital shapes in an interstitial mass of sericite, clay and recrystallized quartz.

Structures: Bedding structures are poorly defined in thin section, possibly by the crude alignment of quartz pebbles.

Comments on Genesis: There is no cause apparent in thin section for the higher radioactive response of this conglomerate compared to D38, except for the presence of limonite.

Rock Name: specularitic quartz-pebble conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: D 39 **Sample Number:** 154093 **Code:** V 003

Location: NW of Del Shay Cabin **Scintillometer Counts:** 145 cps

Quadrangle: Picture Mtn. **U Value (U by NT) ppm :** 3.80

Sec., Twp, Ra.: S35, 8N, 11E **Coordinates:** 33° 59' 47"; 111° 12' 30"

Geologic Unit: lineated volcanic conglomerate

Stratigraphic Group: Alder Group

SITE GEOLOGY :

In Del Shay basin, a typical rhyolitic volcanic conglomerate of the Alder Group is in contact with a pink-orange rhyolite to the east (Young-granite related) and white rhyolitic crystal tuffs to the west. The polymictic conglomerate is interbedded with the lithic-crystal tuffs, but distinguished from them by the presence of gray siltstone and mudstone chips. The matrix and fragments are both dominantly of felsic volcanic material.

Variability:

Polymict fragments disappear to the west, into the main mass of volcaniclastics, indicating this represents a sedimentary interlude in the volcaniclastic deposition.

Sedimentary Structures:

Obscured by foliation and lineation.

Depositional Environment:

Probably deep water marine and intervolcanic.

SAMPLE DESCRIPTION :

A pinkish to brownish yellow gritty matrix of clear volcanic quartz grains, sheared pink K-feldspar grains, volcanic shards, small volcanic rock fragments and other detritus support a variety of gray slate, siltstone, mudstone fragments 15 to 25mm long, as well as abundant pink and gray sericitic rhyolitic chips 5 to 15 mm long. Dominant feature of the rock is the pronounced vertical lineation and flattened lineated fragments on the foliation planes.

Sampler: P. Anderson **Date:** Oct. 24, 1979

THIN SECTION DESCRIPTION

Site Number: D39 **Sample Number:** 154093 **Code.** /003

Percent Fragments: 23% **Percent Matrix:** 73%

Percent Heavies & Mafics: 4% **Stain:** tan to flesh brown

Rock Type: volcanic conglomerate **Stratigraphic Group:** Alder Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
sericitic rhyolite	73%	7.5-2.0 mm	subrounded	1:2
cherty rhyolite	27%	4.0-2.0 mm	subrounded	1:2

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	23%	1.4-.2 mm	clear, embayed broken volcanic crystals
sericite	52%	.17-.005 mm	foliated felted mats
cherty rhyolite	6%	2-.8 mm	subrounded
jaspery rhyolite	5%	2-.9 mm	subrounded
specularite	8%	.5-.1 mm	euhedral and embayed, broken crystals
hematite	<1%	powdery	stain
chlorite	3%	.2-.04 mm	interstitial clusters
altered feldspars	2%	1-0.5 mm	mainly sericitized
specularite	1%	.3-.005 mm	recrystallized material

Cement: Sericite, minor hematite and quartz .

Interstitials: Specularite, sericite, chlorite, hematite, some limonite.

Textures and recrystallization: Most rhyolitic fragments are elongate and shard-shaped; quartz crystals are clearly broken volcanic crystals which are virtually unsheared and undeformed; specularite and feldspar also appear to be broken volcanic crystals.

Structures: Rock structure is dominated by a foliated mass of sericite and elongate sericitic fragments whose origin is depositional during tuff formation; fabric is not tectonic as none of the rock components are substantially recrystallized.

Comments on Genesis: This conglomerate is remarkable in that it is essentially a lithic-crystal tuff with volcanic quartz as the crystals and sericitic rhyolite as the lithic fragments, yet it contains euhedral, partly broken crystals of specularite, implying that volcanism contributed specularite directly to the depositional environment.

Rock Name: specularite-quartz-rhyolite lithic-crystal tuff.

THIN SECTION DESCRIPTION

Site Number: D39 **Sample Number:** 154093 **Code.** /003

Percent Fragments: 23% **Percent Matrix:** 73%

Percent Heavies & Mafics: 4% **Stain:** tan to flesh brown

Rock Type: volcanic conglomerate **Stratigraphic Group:** Alder Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
sericitic rhyolite	73%	7.5-2.0 mm	subrounded	1:2
cherty rhyolite	27%	4.0-2.0 mm	subrounded	1:2

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	23%	1.4-.2 mm	clear, embayed broken volcanic crystals
sericite	52%	.17-.005 mm	foliated felted mats
cherty rhyolite	6%	2-.8 mm	subrounded
jaspery rhyolite	5%	2-.9 mm	subrounded
specularite	8%	.5-.1 mm	euhedral and embayed, broken crystals
hematite	<1%	powdery	stain
chlorite	3%	.2-.04 mm	interstitial clusters
altered feldspars	2%	1-0.5 mm	mainly sericitized
specularite	1%	.3-.005 mm	recrystallized material

Cement: Sericite, minor hematite and quartz .

Interstitials: Specularite, sericite, chlorite, hematite, some limonite.

Textures and recrystallization: Most rhyolitic fragments are elongate and shard-shaped; quartz crystals are clearly broken volcanic crystals which are virtually unsheared and undeformed; specularite and feldspar also appear to be broken volcanic crystals.

Structures: Rock structure is dominated by a foliated mass of sericite and elongate sericitic fragments whose origin is depositional during tuff formation; fabric is not tectonic as none of the rock components are substantially recrystallized.

Comments on Genesis: This conglomerate is remarkable in that it is essentially a lithic-crystal tuff with volcanic quartz as the crystals and sericitic rhyolite as the lithic fragments, yet it contains euhedral, partly broken crystals of specularite, implying that volcanism contributed specularite directly to the depositional environment.

Rock Name: specularite-quartz-rhyolite lithic-crystal tuff.

SITE AND SAMPLE DESCRIPTION

Site Number: D 40 Sample Number: 154094 Code: D 203

Location: Del Shay Basin Scintillometer Counts: 122 cps

Quadrangle: Sheep Basin Mtn. U Value (U by NT) ppm : 5.6

Sec., Twp, Ra.: S28, 8N, 11E Coordinates: 34°00'30"; 111°13'05"

Geologic Unit: specularitic Deadman quartz-pebble conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : The southernmost extremity of the Deadman unit where it projects into Del Shay Basin is black with abundant specularite and is about 40m thick. The lower 25 meters consist of easily weathered conglomerates as described below. These are overlain by more resistant ridge-forming dark gray to black, medium-grained quartzites.

Variability:

Sedimentary Structures: The deformed conglomerates and very thickly bedded quartzites show no obvious sedimentary structures.

Depositional Environment: A fluvial environment or base of a transgressive marine sequence is suggested by the poor sorting and immaturity.

SAMPLE DESCRIPTION : A dark stained sericite-rich, medium-grained matrix of quartzite supports pebbles of quartzite in a ratio of 2:1. The fragments are well-rounded and commonly have axial ratios of 2:3:10. Their elongate shape may be due to deformation. Large fragments are often found weathered free of the matrix.

Sampler: K. Wirth Date: 24 October 1979

THIN SECTION DESCRIPTION

Site Number: D40 **Sample Number:** 154094 **Code:** D203

Percent Fragments: 60% **Percent Matrix:** 30%

Percent Heavies & Mafics: 10% **Stain:** dark brownish red

Rock Type: Deadman conglomerate **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
rhyolite	100%	37-5.0 mm	subangular	1:2

(rhyolite is all highly specularitic and varies from quartz-rich where embayed quartz is the main phenocryst, to sericite-rich where specularite and sericite replace phenocrysts with originally trapezoidal outlines)

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	28%	2.0-0.1 mm	clear, large, embayed broken phenocrysts
specularite	23%	1.5-0.2 mm	rounded detrital
specularite	12%	powdery	masses between detrital grains
hematite	15%	powdery	red stain with recrystallized specularite
sericite	16%	.17-.005 mm	recrystallized patches, vug fillings
leucoxene	4%	powdery	alteration patches in specularite-hematite
rutile-ilmenite	1%	.5-.04 mm	dark brown altered crystals
zircon	1%	.06-.04 mm	rounded detrital

Cement: Hematite, recrystallized specularite, sericite.

Interstitials: Quartz, sericite, specularite, hematite, leucoxene.

Textures and recrystallization: Matrix contains rectangular, embayed quartz phenocrysts identical to those in rhyolite fragments; matrix sericite is equivalent to clots in rhyolite fragments; black hematite and recrystallized specularite form massive fillings between detrital specularite grains in the matrix to make it more Fe-rich than fragments.

Structures: A general elongation of material in matrix parallels fragment elongation and presumably defines bedding.

Comments on Genesis: Conglomerate is a direct degradation product of highly hematitic and specularitic rhyolites in a nearby source terrain. Black appearance of rock is due to abundance of black specularite and hematite in the rock.

Rock Name: highly hematitic and specularitic rhyolite-fragment conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: D 41 **Sample Number:** 154095 **Code:** D 211

Location: Sorrel Horse Canyon **Scintillometer Counts:** 185 cps

Quadrangle: Sheep Basin Mtn. **U Value (U by NT) ppm :** 8.10

Sec., Twp, Ra.: S29, 8N, 12E **Coordinates:** 34° 00' 42"; 111° 09' 40"

Geologic Unit: specularite layers in Deadman quartzite

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY :
In Sorrel Horse Canyon massive specularite beds are found within the basal parts of the Deadman unit. The one sampled is close to or right at the basal uncomformity with underlying volcanics. The specularite shows clear evidence of being a detrital heavy mineral concentrated at the base of a depositional sequence. Massive specularite rock is graded by size of particles, is both well-bedded and well cross-bedded.

Variability:
Upwards the specularite beds quickly give way to flattened slate-chip conglomerates, some quartz wackes and quartz-rich grits before normal cross-bedded quartzite is encountered.

Sedimentary Structures:
Graded bedding, cross bedding and prominent bedding planes are evident in the specularite-rich rock.

Depositional Environment:
Basal heavy mineral concentrate at the bottom of a river channel or transgressive marine (beach) deposit.

SAMPLE DESCRIPTION :
Metallic gray to black, massive, rounded detrital specularite grains with variable (0 to 15%) siliceous material compose a well-bedded and cross-bedded, medium-grained sedimentary rock. Some specularite is recrystallized, like matrix quartz is in a quartzite, but the detrital character of the specularite, and inter-granular character of specularite and quartz in the foreset beds are well preserved. The rock is completely black.

Sampler: P. Anderson **Date:** Oct. 25, 1979

THIN SECTION DESCRIPTION

Site Number: D41 **Sample Number:** 154095 **Code:** D211

Percent Fragments: 5% **Percent Matrix:** 40%

Percent Heavies & Mafics: 55% **Stain:** black specularite

Rock Type: Deadman quartzite **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
black specularite	100%	16 mm by 4 mm	angular	1:4

(fragments consist of 90% black specularite, 5% sericite, 2% brown-red rutile (or hematite) and 3% quartz)

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
specularite	42%	1.0-0.1 mm	rounded detrital cores joined by recrystallized specularite, inseparable in thin section
hematite	12%	powdery	stain
rutile-ilmenite	2%	0.3-0.07 mm	brown altered crystals with hematite
leucoxene	2%	.4-.1 mm	alteration clots
quartz	10%	.6-.04 mm	broken rectangular volcanic phenocrysts
quartz	17%	.04-.005	recrystallized cherty matrix material
zircon	1%	.4-.04 mm	rounded detrital
sericite	12%	.17-.005 mm	recrystallized plates and masses
chert	2%	.7-.02 mm	subrounded

Cement: Mostly recrystallized specularite, some quartz, sericite, hematite, limonite.
Interstitials: Recrystallized specularite, quartz, sericite, hematite, limonite.

Textures and recrystallization: Specularite texture is dominated by massive overgrowths on detrital cores, quartz is either as broken volcanic phenocrysts or cherty matrix fillings; sericite forms elongate interstitial texture to specularite.
Structures: Bedding is well defined by specularite-rich layers 1 to 4 mm thick interspersed by silicate layers, but these layers and specularite fragments are elongated at a 55° oblique angle to bedding by superimposed shear foliation.
Comments on Genesis: Rock is a well-bedded heavy mineral concentrate of mainly Ti-bearing specularite, with an obvious volcanic source for the silicate phases of the rock, if not all of it.

Rock Name: specularite-bedded quartzite; heavy mineral concentrate

THIN SECTION DESCRIPTION

Site Number: D41a **Sample Number:** -- **Code:**--

Percent Fragments: 0% **Percent Matrix:** 95%

Percent Heavies & Mafics: 5% **Stain:** red-brown to gray

Rock Type: Coffeepot quartzites **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	18%	1.1-.2 mm	rounded rectangular volcanic phenocrysts
quartz	45%	.23-.02 mm	recrystallized cherty matrix quartz
specularite	8%	.5-.1 mm	rounded detrital
specularite	3%	.3-.01 mm	recrystallized with detrital specularite
sericite	17%	.2-.005 mm	foliated matrix masses
chert	3%	2.7-.4 mm	subrounded
hematite	3%	powdery	stain
limonite	2%	powdery	stain
leucoxene	1%	powdery	alteration clots

Cement: Recrystallized quartz, sericite, recrystallized specularite, hematite and limonite.
Interstitials: Sericite, recrystallized quartz, recrystallized specularite, hematite, limonite.
Textures and recrystallization: Larger quartz grains and sericite masses are augen shaped with strongly foliated matrix sericite and quartz lying interstitial to larger silicate and specularite grains; recrystallized sericite in strain shadows and grain-boundary planes.
Structures: Strong foliation and tectonic elongation of all rock components dominates over any primary structures.

Comments on Genesis: Quartz wacke is largely derived by degradation of volcanic material such as rhyolites below Deadman unit in this area. Essential difference between this rock and underlying Deadman is only in its lower specularite content.

Rock Name: specularite-quartz wacke

SITE AND SAMPLE DESCRIPTION

Site Number: D 42 Sample Number: 154096 Code: D 202

Location: Skunk Tank Mtn. Scintillometer Counts: 150 cps

Quadrangle: Sheep Basin Mtn. U Value (U by NT) ppm : 5.1

Sec., Twp, Ra.: S20, 8N, 12E Coordinates: 34°01'03"

Geologic Unit: Deadman granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : The NE extent of Deadman rocks in upper Gun Creek consists of a basal portion containing conglomerates with volcanic fragments and a wacke matrix as described below. Upwards these grade into cleaner quartzites with sparse conglomeratic and interbedded hematitic layers. Above this is a series of quartz wackes, semi-schists sericitic quartzites and quartzites, the upper portions of which may grade into the Coffeepot quartzites. The sample involves several hundred meters of section.

Variability: Fragment size and density increase down section.

Sedimentary Structures: Mostly obscured by deformation.

Depositional Environment: Possibly a fluvial environment but a shallow-water marine setting is also possible.

SAMPLE DESCRIPTION : A dark matrix of very sericitic quartz-wacke material supports fragments in a ratio of 2:1. The fragments are composed of mostly pink, green, and silvery, platey, sericitic volcanic rock fragments averaging 6-50mm in length. Minor amounts of discoidal quartzite fragments are also present. These average 5-90mm in length. Rare grit-size jasper is also present. Foliaition and a sericitic sheen on foliation planes is the most prominent feature of the rock.

Sampler: K. Wirth Date: 25 October 1979

THIN SECTION DESCRIPTION

Site Number: D42 **Sample Number:** 154096 **Code:** D202

Percent Fragments: 27% **Percent Matrix:** 66%

Percent Heavies & Mafics: 7% **Stain:** grayish to purple hematite

Rock Type: Deadman conglomerate **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
rhyolite	47%	12-2 mm	subangular	1:3
chert	20%	10-2 mm	subangular	1:3
quartz-wacke	30%	16-2 mm	subrounded	1:2
quartz	3%	2 mm	angular	1:1

(rhyolite fragments are aphanitic and sericitic; quartz wacke fragment is similar to matrix of conglomerate, but with more volcanic quartz crystals and specularite)

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	11%	2-.2 mm	broken angular volcanic crystals
quartz	35%	.14-.04 mm	recrystallized matrix quartz
chert	6%	2-.4 mm	subrounded
jasper	4%	2-.6 mm	subangular
quartzite	1%	1.3 mm	subrounded
sericite	13%	.01-.005 mm	recrystallized plates and felted masses
clay	15%	--	interstitials and cloudy masses
zircon	<1%	.06-.04 mm	rounded detrital
specularite	3%	.7-.01 mm	recrystallized with detrital specularite
hematite	1%	powdery	stain
leucoxene	1%	.5-.1 mm	alteration clots associated with ilmenite (?)

Cement: Sericite and clay, recrystallized quartz and specularite, hematite.

Interstitials: Clay, sericite, hematite, recrystallized quartz and specularite.

Textures and recrystallization: Large embayed volcanic quartz crystals are evident; most specularite is detrital; most sericite and clay forms either a felted matrix mass or occurs with fine-grained quartz in fragments as recrystallization of glassy material.

Structures: Strong foliation of matrix with elongation of larger fragments is apparently tectonic.

Comments on Genesis: Some fragments are intraformationally derived from lower, more specularite- and quartz-phenocryst-rich layers; remainder of fragments and matrix are degradation products of specularitic aphanitic rhyolite.

Rock Name: clay-rich, rhyolitic conglomeratic wacke

SITE AND SAMPLE DESCRIPTION

Site Number: D 43 Sample Number: 154100 Code: S 203

Location: Breadpan Canyon Scintillometer Counts: 250 cps

Quadrangle: Buzzard Roost Mesa U Value (U by NT) ppm : 1.9

Sec., Twp, Ra.: S27, 9N, 13E Coordinates: 34°05'20"; 111°06'43"

Geologic Unit: Scanlan pebble conglomerate

Stratigraphic Group: Apache Group

SITE GEOLOGY : Geology is similar to sample D 30 except the sample is taken from further southeast along strike of the Apache Group. Site geology is as in D 30. A smaller fragment size is found in this sample, and the rock contains somewhat higher concentrations of detrital specularite.

Variability: Same as D 30.

Sedimentary Structures: Same as D 30.

Depositional Environment: Same as D 30.

SAMPLE DESCRIPTION : Same as D 30.

Sampler: K. Wirth Date: 1 November 1979

SITE AND SAMPLE DESCRIPTION

Site Number: D 44 Sample Number: 154101 Code: S 203

Location: Walnut Canyon Scintillometer Counts: 130 cps

Quadrangle: Buzzard Roost Mesa U Value (U by NT) ppm : 3.3

Sec., Twp, Ra.: S31, 9N, 13E Coordinates: 34°05'12"; 111°03'03"

Geologic Unit: Scanlan pebble conglomerate

Stratigraphic Group: Apache Group

SITE GEOLOGY : At this site only 10-35cm of horizontally bedded Scanlan conglomerate is exposed above the vertically dipping Alder Group. Above the Scanlan conglomerate lie several meters of fine-grained siltstones to quartzite of probable coarse-grained Pioneer or Dripping Spring affinity.

Variability: Scintillometer counts range from 75 cps in the Alder Group to 130 cps in the Scanlan conglomerate and 185 cps in the overlying quartzites.

Sedimentary Structures: None except bedding observed.

Depositional Environment: Possibly a fluvial environment or part of a transgressive marine sequence.

SAMPLE DESCRIPTION : A brick-orange to earthy-red colored matrix supports angular pebbles in a ratio of 2:1. The matrix is composed of fine-grained quartz with hematite cement. Fragments are mostly grey Alder-Group quartzites, are sub-angular to angular and average 6-20mm in length. Rare amounts of 10mm-long slate and schistose fragments are also present.

Sampler: K. Wirth Date: 1 November 1979

SITE AND SAMPLE DESCRIPTION

Site Number: D 45 Sample Number: 154102 Code: S 204

Location: Spring Creek Mine Scintillometer Counts: 88 cps

Quadrangle: Buzzard Roost Mesa U Value (U by NT) ppm : 2.4

Sec., Twp, Ra.: S36, 9N, 12E Coordinates: 34°04'22"; 111°04'35"

Geologic Unit: Scanlan cobble conglomerate

Stratigraphic Group: Apache Group

SITE GEOLOGY : Same as D 43 except that here the Scanlan conglomerate has a thickness of approximately 30 meters.

Variability:

Sedimentary Structures: Bedding is crudely defined by the sub-parallel orientation of elongate fragments.

Depositional Environment: Fluvial as indicated by the large size of fragments and the relative immaturity of the sediments.

SAMPLE DESCRIPTION : Rounded pebbles, cobbles and boulders support an earthy red, coarse-grained matrix in a ratio of 3:1. The matrix consists of quartz, quartzite and rhyolite fragments and is poorly cemented by hematite. Fragments average 6-20 cm in length and are well-rounded. Mazatzal quartzite cobbles make up most (75%) of the fragment fraction. Lesser amounts of Alder quartzite (12%), rhyolite (10%) and sheared volcanics (2%) are also present.

Sampler: K. Wirth Date: 1 November 1979

SITE AND SAMPLE DESCRIPTION

Site Number: D 46 Sample Number: 154103 Code: S 103

Location: Potato Butte Scintillometer Counts: 162 cps

Quadrangle: Buzzard Roost Mesa U Value (U by NT) ppm : 2.7

Sec., Twp, Ra.: S34, 9N, 13E Coordinates: 34°05'12"; 111°00'15"

Geologic Unit: Scanlan cobble conglomerate

Stratigraphic Group: Apache Group

SITE GEOLOGY : Scanlan conglomerate lies unconformably and horizontally on an irregular erosion surface in the Young granite. The basal 1m of Scanlan consists entirely of disaggregated granite and quartzo-feldspathic grus interstitial to granite fragments, hence the exact contact is difficult to pinpoint.

Variability: Scintillometer counts range from 250 cps in the granite to 162 cps in the Scanlan conglomerate at the contact to 104 cps in the upper portions of the conglomerate.

Sedimentary Structures: Massive, structureless conglomerate of large boulders in a feldspathic matrix.

Depositional Environment: Fluvial as indicated by large size and poor sorting in the sediments.

SAMPLE DESCRIPTION : This sample has nearly the same character as samples from sites D 45 and D 43. The major difference is that this sample has a fine-grained white (yellow-stained on weathered surfaces) matrix. Also, the amount of Alder quartzite and rhyolite fragments is greater at the expense of Mazatzal quartzite fragments. A small fragment of granite was also found in the conglomerate at this site.

Sampler: K. Wirth Date: 1 November 1979

SITE AND SAMPLE DESCRIPTION

Site Number: D 47 Sample Number: 154104 Code: S 205

Location: Spring Creek Ranch Scintillometer Counts: 200 cps

Quadrangle: Buzzard Roost U Value (U by NT) ppm : 1.3

Sec., Twp, Ra.: S16, 8N, 13E Coordinates: 34°02'10"; 111°02'30"

Geologic Unit: Scanlan boulder conglomerate

Stratigraphic Group: Apache Group

SITE GEOLOGY : Approximately 5 meters of Scanlan conglomerate are exposed here. The conglomerate is consistent in its character throughout the section (see sample description). Above it lie over 20 meters of fine-grained and thinly bedded siltstones and quartzites.

Variability: Scintillometer counts range from 200 cps in the Scanlan conglomerate to 290 cps in the overlying siltstones and quartzites.

Sedimentary Structures: None observed in the conglomerates. Concretions and soft-sediment deformation structures occur in the siltstones.

Depositional Environment: Fluvial environment of deposition is preferred because of the large size and poorly sorted character of the sediments.

SAMPLE DESCRIPTION : An earthy maroon matrix of fine-grained quartz sand supports large cobbles and boulders of quartzite in a ratio of 5:4. The fragments are blocky and sub-angular in character. Most exceed 30cm in length, with some as long as 70cm, and others as short as 15cm. Grey quartzites (Reef Ridge-Alder?) are the most common fragment type. Minor amounts of chlorite-altered diorite are also present. Both fragment types are also found as grit and granules.

Sampler: Karl Wirth Date: 2 November 1979

SITE AND SAMPLE DESCRIPTION

Site Number: D 48 Sample Number: 154105 Code: U 103

Location: Rose Tungsten Mine Scintillometer Counts: 250 cps

Quadrangle: Buzzard Roost Mesa U Value (U by NT) ppm : 2.5

Sec., Twp, Ra.: S13, 8N, 12 E Coordinates: 34°01'55", 111°08'37"

Geologic Unit: Dripping Spring pebble conglomerate

Stratigraphic Group: Apache Group

SITE GEOLOGY : Dripping Spring formation is found in a tributary of Rock Creek, southwest of the Rose Tungsten mine. The section is poorly exposed, but conglomerate occurs in 10-50cm thick beds. The main cliff-forming Dripping Spring quartzite lies immediately above the conglomerate.

Variability: Pebble conglomerate is a coarser grained variant of the usual impure arkosic quartzite of the Dripping Spring.

Sedimentary Structures: Mudcracks and ripple marks occur in the shales above and below the conglomerates.

Depositional Environment: Fluvial or near-shore marine environment of deposition.

SAMPLE DESCRIPTION : Grey quartzite (Alder?), dark rhyolite, sericitic and sheared volcanics, chert and quartz are supported by a shaley, earthy-red matrix in a ratio of 2:1. The fragments are sub-angular to angular and average 20-60mm in length. Total thickness of the conglomerate unit sampled was 50cm.

Sampler: K. Wirth Date: 2 November 1979

SITE AND SAMPLE DESCRIPTION

Site Number: D 49 **Sample Number:** 154106 **Code:** U 204

Location: Rose Tungsten Mine Rd. **Scintillometer Counts:** 162 cps

Quadrangle: Buzzard Roost Mesa **U Value (U by NT) ppm :** 1.8

Sec., Twp, Ra.: S13, 8N, 13E **Coordinates:** 34°02'10"; 111°04'18"

Geologic Unit: Dripping Spring cobble conglomerate

Stratigraphic Group: Apache Group

SITE GEOLOGY : About 40m below outcrops of Mescal limestone, cobble conglomerate occurs in the Dripping Spring formation above the main cliff-forming quartzite units.

Variability: Fragment size and type vary considerably from bed to bed.

Sedimentary Structures: None except bedding noted.

Depositional Environment: Fluvial or near-shore marine, in either case, a high energy environment.

SAMPLE DESCRIPTION : This sample is similar to the one described at site D 48 except that here the matrix is brick orange to yellow, white quartz fragments are more common, and the fragment size is generally larger. Abundant brownish limonite in the matrix indicates that either hematite or pyrite has weathered out. The matrix is very clay-rich and altered.

Sampler: K. Wirth **Date:** 2 November 1979

SITE AND SAMPLE DESCRIPTION

Site Number: D 50 Sample Number: 154107 Code: S 103

Location: SE of Winter Camp Scintillometer Counts: 345 cps

Quadrangle: Diamond Butte U Value (U by NT) ppm : 3.4

Sec., Twp, Ra.: S12, 9N, 12E Coordinates: 34°08'33"; 111°04'23"

Geologic Unit: Scanlan pebble conglomerate

Stratigraphic Group: Apache Group

SITE GEOLOGY : Approximately 10 meters of basal Scanlan conglomerate are exposed here. Most of the section is composed of cobble to boulder conglomerate with pebble-size fragments filling the interstices. This is one of the radiometrically hottest Scanlan samples in the Diamond Butte area.

Variability: The Scanlan (or basal Apache erosion surface) represents a local radiometric anomaly where readings climb from 100-120 cps in the underlying Alder to almost 400 at the unconformity and rapidly drop back to 150-200 in the upper part of the Scanlan.

Sedimentary Structures: Earthy hematite (15-30%) is concentrated at the unconformity.

Depositional Environment: Fluvial environment of deposition as indicated by poor sorting and large fragment sizes.

SAMPLE DESCRIPTION : A poorly cemented medium-grained and earthy red matrix lies interstitial to 65% rounded pebbles, cobbles, and boulders of mostly dark red rhyolite, lesser diabasic material (10%), gray quartzite (15%), and sheared volcanics (1%). The matrix is composed of mostly feldspathic material with interstitial sericite and hematite. Fragments are subangular and average 6-35mm in length. Much of the red matrix is derived from the red rhyolites in the immediate vicinity of Mailbox Mesa.

Sampler: K. Wirth Date: 3 November 1979

THIN SECTION DESCRIPTION

Site Number: D50 **Sample Number:** 154107 **Code:** S102

Percent Fragments: 59% **Percent Matrix:** 37%

Percent Heavies & Mafics: 4% **Stain:** earthy red hematite

Rock Type: Scanlan conglomerate **Stratigraphic Group:** Apache Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
rhyolite	98%	26-2.0 mm	subangular	1:2.5
quartz	2%	2.3-2.0 mm	subrounded	1:1.5

(rhyolite fragments vary from aphanitic, sericitic and granophyric to quartz phenocrystic with rare pseudomorphs, now hematite, which might have originally been hornblende before resorption)

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	35%	2.0-.03 mm	subangular, some rectangular volcanic
rhyolite	24%	2.0-.3 mm	subangular
sericite	8%	<.03 mm	recrystallized plates and masses
specularite	5%	.5-.04 mm	rounded
hematite	11%	powdery	matrix fillings and pervasive stain
clay	15%	--	cloudy matrix masses stained by hematite
limonite	2%	--	stain with hematite

Cement: Hematite, limonite, sericite, recrystallized quartz.

Interstitials: Clay, sericite, hematite, quartz.

Textures and recrystallization: Primary angular quartz fragments and sericitic clay-quartz rhyolite fragments preserved in completely unrecrystallized clay-hematite-sericite-cryptocrystalline silica matrix.

Structures: Parallel alignment of elongate tabular fragments suggest bedding.

Comments on Genesis: Derived mainly from erosion of rhyolitic volcanic material, deposited in basically an oxidizing environment as even specularite is altered mainly to earthy hematite.

Rock Name: red hematitic rhyolite-fragment conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: D 51 Sample Number: 154108 Code: S 203

Location: Marsh Creek Ranch Rd. Scintillometer Counts: 200 cps

Quadrangle: Diamond Butte U Value (U by NT) ppm : 2.4

Sec., Twp, Ra.: S4, 9N, 13E Coordinates: 34°04'03"; 111°01'41"

Geologic Unit: Scanlan pebble conglomerate

Stratigraphic Group: Apache Group

SITE GEOLOGY : Poor outcrop in low-lying terrain, with knobs of Scanlan projecting above what is probably a flat-lying erosion surface on diabase.

Variability: Fragment size variable from one hill to the other, possibly bedding controlled.

Sedimentary Structures: Crude orientation of some pebbles might define bedding.

Depositional Environment: Residual basal deposit developed from detritus remaining on an erosion surface, concentrated in either a fluvial or shallow-water, transgressing marine sequence.

SAMPLE DESCRIPTION : Large 2-5cm, highly angluar pebbles of dark and light red, quartz- and feldspar-phenocrystic rhyolite and darker shaley, schistose or volcanic fragments lie in a pink to brownish orange, somewhat vuggy matrix of coarse-grained feldspathic clayey and rhyolitic volcanic detritus. Both fragments and matrix are identical to underlying rhyolitic material on the road to Flying W Ranch exposed near Mailbox Mesa, and were possibly derived from it. Clots of orange goethitic material represent hematite or pyrite weathered out of the rock.

Sampler: K. Wirth Date: 3 November 1979

SITE AND SAMPLE DESCRIPTION

Site Number: D 52 Sample Number: 154109 Code: S 104

Location: E of Granite Tank Scintillometer Counts: 130 cps

Quadrangle: Diamond Butte U Value (U by NT) ppm : 1.7

Sec., Twp, Ra.: S15, 9N, 13E Coordinates: 34°07'46"; 111°00'17"

Geologic Unit: Scanlan cobble conglomerate

Stratigraphic Group: Apache Group

SITE GEOLOGY : Scanlan here rests unconformably on Alder Group conglomerates sampled D 54, but is downfaulted and lies topographically lower than them east of Granite Tank. The base of the Scanlan here is in contact with diabase and its thickness in unknown because it outcrops as small knobs on the flat plain of diabase.

Variability: Conglomerates contain sandstone interbeds in places.

Sedimentary Structures: Bedding poorly defined.

Depositional Environment: Most probably fluvial environment as the matrix preserves primary limonitic oxidation.

SAMPLE DESCRIPTION : The rock is very similar to sample D 51 with 2-10mm size cobbles of Mazatzal white quartzite and red rhyolite as the dominant fragments with less abundant gray quartzite and sheared volcanic fragments. The framework-supported, angular-fragment conglomerate contains an interstitial pink to yellowish-brown limonitic matrix studded with large glassy quartz crystals probably from the Young granite, abundant feldspathic detritus from either the rhyolites or Young granite, and a yellowish-brown to pink cast from the weathered feldspars.

Sampler: K. Wirth Date: 3 November 1979

SITE AND SAMPLE DESCRIPTION

Site Number: D 53 Sample Number: 154110 Code: U 203

Location: NE of Granite Tank Scintillometer Counts: 178

Quadrangle: Diamond Butte U Value (U by NT) ppm : 3.3

Sec., Twp, Ra.: S10, 9N, 13E Coordinates: 34°07'46"; 111°00'17"

Geologic Unit: Alder volcanic-rock fragment conglomerate

Stratigraphic Group: Alder Group

SITE GEOLOGY : Here the contact between volcanic conglomerates and overlying sedimentary conglomerates in the Alder Group is very well defined and runs along the base of the cliffs leading up to 5995 hill north of Granite Tank. D 53 is a sample of the dominantly volcanic-fragment conglomerate containing large purple to brownish black volcanic fragments of diverse types but all of Alder Group relation.

Variability: Some layers appear to be composed of andesitic flow material, or could be andesitic dikes.

Sedimentary Structures: Graded bedding, cyclically repetitive, upward-fining sequences.

Depositional Environment: Deep water intravolcanic deposition, possibly turbidity flows off the flank of a volcano.

SAMPLE DESCRIPTION : Of two representative rocks, one is a coarse pebble to cobble conglomerate of tabular, matrix-supported volcanic rock fragments varying in composition from black and white-spotted andesitic tuff (?) to slaty andesitic tuff (?) to purple, feldspar-bearinn dacite or rhyolite, to whitish feldspathic rhyolite fragments of compositions similar to the matrix. The other rock shows sequences of dacitic crystal tuff material (rock fragments, mainly feldspar crystals, minor quartz crystals) in 5cm-thick repetitive graded beds of upward-fining dacitic tuff grading into a gray to black aphanitic mud or ash at the top.

Sampler: K. Wirth and P. Anderson Date: 3 March 1979

SITE AND SAMPLE DESCRIPTION

Site Number: D 54 Sample Number: 154158 Code: A 203

Location: N of Granite Tank Scintillometer Counts: 90 cps

Quadrangle: Diamond Butte U Value (U by NT) ppm : 0.90

Sec., Twp, Ra.: S10 9N, 13E Coordinates: 34°08'07"; 111°00'32"

Geologic Unit: Alder pebble conglomerate

Stratigraphic Group: Alder Group

SITE GEOLOGY : The exposures of Alder "sedimentary" conglomerate lie on 5995 hill top, immediately above sample D 53 and along strike from outcrops previously sampled as D 2. Some of the Alder conglomerate here superficially resembles Mazatzal except for its dirtier matrix and great diversity of fragment types.

Variability: Conglomerates are interbedded with more pure and better sorted quartzite layers.

Sedimentary Structures: Some cross bedding, but mainly bedding apparent.

Depositional Environment: Shallower water and higher energy environment than D 53; a significant change suggesting the possibility of an unconformity and time break between the two samples.

SAMPLE DESCRIPTION : The rock has a dirty, light-brown and medium-grained matrix of well-recrystallized quartz, feldspar, specularite, and fine-grained chert, rhyolite and specularite-rich fragments. This has interstitial fillings of sericite and detrital specularite. Fragments averaged 5-30mm and consist mainly of rounded vein quartz, red, gray, and black chert, dark aphanitic rhyolite, jasper and other slatey gray, possibly volcanic fragments. The conglomerate varies from framework to matrix supported as the pebbles decrease in abundance from 60 to 40 % and in size from 8 to 3cm.

Sampler: K. Wirth and P. Anderson Date: 16 November 1979

THIN SECTION DESCRIPTION

Site Number: D54 **Sample Number:** 154158 **Code:** A203

Percent Fragments: 73% **Percent Matrix:** 20%

Percent Heavies & Mafics: 7% **Stain:** dark maroon hematitic

Rock Type: pebble conglomerate **Stratigraphic Group:** Alder Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	40%	40-2.0 mm	subrounded	1:3 and 1:1.5
chert	35%	27.5-2.0 mm	subrounded	1:2
jasper	15%	13-2.0 mm	subangular	1:2
rhyolite	10%	9.6-2.0	subrounded	1:2

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	77%	2.0-.02 mm	subrounded, sutured, composite
chert	8%	2.0-.22 mm	subrounded, banded hematitic
jasper	3%	2.0-.33 mm	subangular
specularite	8%	.42-.02 mm	rounded detrital
specularite	1%	powdery	recrystallized with detrital specularite
sericite	2%	<.01 mm	recrystallized plates and masses
zircon	<1%	.28-.09 mm	rounded
rhyolite	1%	2.0-.3 mm	mostly recrystallized to sericite

Cement: Recrystallized sericite and specularite; sutured quartz.

Interstitials: Sericite, specularite, sutured quartz.

Textures and recrystallization: Large vein quartz strongly deformed and recrystallized but chert is unaffected; matrix quartz grains preserve primary detrital shapes in a finer grained quartz-sericite matrix; specularite is rounded, detrital and interstitial.

Structures: Fragments show crude subparallel alignment which is probably primary.

Comments on Genesis: Source rich in specularite, chert and vein quartz, thus a dominantly sedimentary with minor volcanic source terrain; vein quartz appears to have been deformed before inclusion into conglomerate.

Rock Name: specularitic quartz-chert-jasper pebble conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: D 55 **Sample Number:** 154240 **Code:** A 202

Location: NE of Del Shay Ranch **Scintillometer Counts:** 205 cps

Quadrangle: Kayler Butte **U Value (U by NT) ppm :** 2.9

Sec., Twp, Ra.: S6, 7N, 11E **Coordinates:** 33°57'43"; 111°16'15"

Geologic Unit: Alder granule conglomerate

Stratigraphic Group: Alder group

SITE GEOLOGY : This section is composed of approximately 230 meters of Alder quartzite of which only about 30 meters contain conglomerate layers. These are located about mid-section and form a resistant ridge.

Variability: Fragment: matrix ratios vary from 1:2 to 1:4.

Sedimentary Structures: Cross-bedding sets average 15-30cm in thickness while conglomerate layers are commonly 20-40cm thick.

Depositional Environment: A fluvial or near-shore marine environment of deposition.

SAMPLE DESCRIPTION : This sample consists of a partly sericitic, grey, medium-grained quartz-specularite-rich matrix that supports sub-angular and sub-rounded fragments in a ratio of 3:1. Fragments average 6-20mm, are elongate or platy in character, and are composed of white quartz (35%), rhyolite (20%), jasper (15%), sheared dark volcanics (15%) and red to gray chert (5%).

Sampler: K. Wirth **Date:** 5 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: D 56 Sample Number: 154241 Code: V 003

Location: NE of Del Shay Ranch Scintillometer Counts: 140 cps

Quadrangle: Kayler Butte U Value (U by NT) ppm : 3.5

Sec., Twp, Ra.: S6, 7N, 11E Coordinates: 33°58'03"; 111°16'17"

Geologic Unit: sheared slate-fragment quartz wacke

Stratigraphic Group: Alder Group

SITE GEOLOGY : Samples D 56 and D 57 are representative of the conglomerates occupying the ridges south of Del Shay basin. D 56 is typical of many Alder "sedimentary" conglomerates when highly sheared: fragments are flattened into elongate, linear plates and the matrix attains a lumpy appearance from the sericitic interstitial material sheared around 1-2mm matrix quartz grains.

Variability: Quite considerable in terms of conglomerate abundance, grain size, fragment percentage and degree of shearing across the section.

Sedimentary Structures: Most obscured by deformation.

Depositional Environment: Presumably shallow water marine similar to other Alder settings.

SAMPLE DESCRIPTION : The rock is a strongly foliated semi-schist consisting of a gritty lumpy matrix of elongate quartz grains and sheared gray to pale brown sericite containing a diversity of elongate, flat platy fragments ranging in length from 5 to 45mm. Most fragments are of pink to orange, sheared rhyolitic material whereas some are dark greenish gray to gray-black sheared volcanic or slate fragments. Some moderately well-crystallized sericite gives the rock a faint sheen, but much less so than a phyllite.

Sampler: K. Wirth and P. Anderson Date: 5 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: D 57 Sample Number: 154242 Code: A 003

Location: NE of Del Shay Ranch Scintillometer Counts: 105 cps

Quadrangle: Kayler Butte U Value (U by NT) ppm : 2.0

Sec., Twp, Ra.: S6, 7N, 11E Coordinates: 33°58'08"; 111°16'30"

Geologic Unit: sheared jasper-slate-fragment conglomerate

Stratigraphic Group: Alder Group

SITE GEOLOGY : A little west of site D 56 is more massive, coarser-fragment conglomerate and more resistant quartzite, but still generally the same part of the Alder Group. Strong shearing has imparted a darker green cast to the matrix than would be expected from the high quartz content.

Variability: Less volcanic material and better sorted, cleaner sedimentary material in present here.

Sedimentary Structures: Most if not all observed by shearing.

Depositional Environment: Presumably marine and relatively shallow water compared to volcanic conglomerates.

SAMPLE DESCRIPTION : The rock comprises pink to red to white elongate siliceous fragments intersheared with a dark greenish, sericite-quartz matrix. Most of the fragments are of vein quartz, now sheared to 1 x 5 x 7cm in dimensions as an average although some similarly sheared red jasper gray chert, red rhyolite, brown quartzite and purple slate fragments are present. Some dark volcanic fragments may be present but are difficult to distinguish from the pale to dark green, sericite-rich quartz matrix.

Sampler: K. Wirth and P. Anderson Date: 5 December 1979

THIN SECTION DESCRIPTION

Site Number: D57 **Sample Number:** 154242 **Code:** A003

Percent Fragments: 88% **Percent Matrix:** 10%

Percent Heavies & Mafics: 2% **Stain:** pink to maroon hematitic

Rock Type: rhyolitic conglomerate **Stratigraphic Group:** Alder Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
chert	42%	28-3.3 mm	subrounded	1:3
jasper	9%	7.0-2.0 mm	subangular	1:3
quartz	10%	8-2.0 mm	subrounded	1:5
rhyolite	39%	15-2.0 mm	subangular	1:4

(chert contains weathered pyrite cubes; rhyolite is foliated and sericitic)

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	15%	2.0-.02 mm	clear embayed volcanic crystals, now polygonized
chert	<1%	1.6 mm	subrounded
rhyolite	37%	2.0-.3 mm	strongly sericitic and foliated
sericite	45%	<.02 mm	recrystallized plates and masses
specularite	1%	.2-.09 mm	detrital; sheared; partially recrystallized
specularite	2%	powdery	recrystallized
chlorite	<1%	<.02 mm	recrystallized plates

Cement: Recrystallized sericite, quartz and specularite.

Interstitials: Sericite, chlorite, quartz, specularite.

Textures and recrystallization: Matrix is a mass of foliated sericite and lesser cryptocrystalline silica foliated around augen-shaped quartz crystals and larger fragments whose shapes have been significantly affected by shearing.

Structures: Foliation is strongly superimposed on the rock fabric, but recrystallization has only affected matrix sericite and quartz and polygonized some larger quartz crystals.

Comments on Genesis: A sedimentary conglomerate environment appears to have encountered an influx of rhyolitic volcanic detritus or activity to produce this rhyolite matrix and fragment conglomerate containing abundant sedimentary material.

Rock Name: foliated, sericitic rhyolite-chert conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: M 1 **Sample Number:** 154030 **Code:** A 110

Location: Lower Slate Creek **Scintillometer Counts:** 90 cps

Quadrangle: Kayler Butte **U Value (U by NT) ppm :** 0.80

Sec., Twp, Ra.: S7, 9N, 10E **Coordinates:** 33° 57' 50"; 111° 22' 50"

Geologic Unit: grit to quartzite

Stratigraphic Group: Alder Group

SITE GEOLOGY :
In the purple slates of the Slate Creek divide area are a series of quartzite units, generally infrequently bearing conglomerate, but these are typical sandy and gritty sediments in the Alder Group. A series of pale maroon to sandy brown quartzites over 300m thick were sampled along the old Slate Creek road. They are moderately well bedded, occasionally cross bedded, and interbedded with slate, siltstone, wacke and rare limestone. The quartzites, grits and conglomerates here are slightly more hematitic than is normal for the Alder Group.

Variability:
Surprising uniformity of structure, grain size, and texture is the rule within these quartzite-conglomerate units.

Sedimentary Structures:
bedding, cross bedding, channels, lodes, rare grading.

Depositional Environment:
Moderately shallow water marine, or possibly fluvial, although interbedded limestone makes the latter unlikely.

SAMPLE DESCRIPTION :
The sample is a pale maroon, poorly bedded, medium to coarse grained quartzite of about 90% quartz grains, 3% disseminated or earthy hematite, possibly 1% jasper grains, perhaps 1-2% detrital specularite, and the remainder argillaceous material (now altered sericite).

Sampler: P. Anderson **Date:** 25th September 1979

THIN SECTION DESCRIPTION

Site Number: M1 **Sample Number:** 154030 **Code:** A110

Percent Fragments: 7% **Percent Matrix:** 88%

Percent Heavies & Mafics: 5% **Stain:** pale maroon

Rock Type: grit to quartzite **Stratigraphic Group:** Alder Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	98%	3-1.3 mm	rounded	1:2
rhyolite	1%	1.4 mm	rounded	1:3
quartzite	1%	1.3 mm	subrounded	1:2

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	79%	1.3-.04 mm	subrounded, sutured, partially recrystallized
chert	5%	1.3-0.1 mm	subangular to subrounded
jasper	2%	1.3-0.9 mm	subangular
rhyolite	<1%	1.1 mm	rounded
quartzite	3%	.57-.04 mm	subangular to rounded, shredded
specularite	3%	.27-.08 mm	subrounded, detrital
specularite	1%	.17-.02 mm	recrystallized
hematite	3%	.005-powdery	red crystals to massive
sericite	4%	.06-.02 mm	thin blades around grains, felted masses
zircon	<1%	.08 mm	rounded detrital

Cement: Mainly recrystallized quartz.

Interstitials: Sericite, hematite, recrystallized quartz, recrystallized specularite.

Textures and recrystallization: Quartz is interlocking, interpenetrating and sutured in quartz-rich layers; in sericite-rich layers both quartz and specularite show original detrital grain shapes; quartz grain sizes are seriate; sericite is concentrated in interstitial patches between grains.

Structures: Lines of specularitic concentrations outline small trough cross-bed sets that are pervasive throughout the quartzite; elongate fragments parallel bedding planes; coarse grains occur in miniature lenses of trough cross beds.

Comments on Genesis: Essentially a first-generation quartzite in that there appears to be little rock fragments in the source terrain that were incorporated into this quartzite; source is specularite rich.

Rock Name: Specularite cross-bedded quartzite to grit

SITE AND SAMPLE DESCRIPTION

Site Number: M 2 Sample Number: 154031 Code: A 103

Location: Lower Slate Creek Scintillometer Counts: 140 cps

Quadrangle: Kayler Butte U Value (U by NT) ppm : 2.2

Sec., Twp, Ra.: S7, 7N, 10E Coordinates: 33°57'40"; 111°22'55"

Geologic Unit: Alder pebble conglomerate

Stratigraphic Group: Alder Group

SITE GEOLOGY : This section is composed of a series of interbedded quartzites, conglomeritic quartzites and phyllitic slates. All of the layers are impure and poorly-sorted, though the finer-grained and better sorted layers tend to be concentrated toward the top of the section. This sample was the coarsest conglomerate found in the Slate Creek area.

Variability: Conglomerate layers contain fragments which vary in size from grit to boulder, but are commonly pebble to cobble.

Sedimentary Structures: Obscured by deformation.

Depositional Environment: Rapid changes in environment are indicated by the wide variety of rock types and grain sizes. Possibly a fluvial but more likely shallow-water marine because of adjacent rocks.

SAMPLE DESCRIPTION : A maroon micaceous matrix supports rounded pebbles in a matrix to fragment ratio of 3:1. The matrix is composed of mostly maroon medium-grained quartz, some sericite, and minor volcanic rock fragments. Hematite stains grain edges and occupies some interstices. Fragments average 10-43mm in length. Rounded jasper and white platy phyllitic (?) grains are the dominant fragment type. Some fragments of chert, slate, quartz, and quartzite are also present in lesser amounts. The presence of a poorly-developed foliation and flattened micaceous fragments indicates that shearing has affected the rock's texture.

Sampler: K. Wirth Date: 25 September 1979

THIN SECTION DESCRIPTION

Site Number: M2 **Sample Number:** 154031 **Code:** A103

Percent Fragments: 39% **Percent Matrix:** 58%

Percent Heavies & Mafics: 3% **Stain:** maroon hematite stain

Rock Type: conglomerate **Stratigraphic Group:** Alder Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
chert	44%	11-2 mm	angular	1:4
jasper	36%	11-2 mm	angular	1:7-1:3
rhyolite	20%	12-2 mm	subangular	1:2

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	59%	2-0.1 mm	sub-angular, strained, polygonized
chert	11%	2-0.7 mm	angular
sericite	14%	0.4-0.1 mm	felted matrix masses and around grains
specularite	7%	0.2-.08 mm	rounded detrital, some partially recrystallized
jasper	4%	2-0.5 mm	angular
quartzite	1%	2-0.3 mm	subrounded
hematite	4%	powdery	red earthy matrix cement
limonite	<1%	.1-.04 mm	pseudomorphs (after specularite?)
clay	<1%	.01-.005 mm	interstitial matrix material

Cement: Mainly earthy red hematite; some recrystallized quartz.

Interstitials: Cavity fillings of radiating feldspars or zeolites, hematite, clay, specularite, recrystallized quartz.

Textures and recrystallization: Recrystallized sericite and quartz show subparallel alignment; most quartz grains are partially sutured and show undulose extinction, are coated with sericite needles and retain subangular shapes where matrix is sericite rich; texture essentially unmetamorphosed.

Structures: Bedding and cross-bedding planes are well defined by concentrations of specularite and by the subparallel alignment of fragments, as well as concentrations of coarse-grained quartz in the matrix.

Comments on Genesis: A source terrain rich in chert, jasper, rhyolite and specularite -- i.e., volcanic source -- is indicated for this conglomerate; although recrystallized somewhat by deformation, metamorphic grade appears to be zeolite facies.

Rock Name: dark maroon jasper-chert-rhyolite pebble conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: M3 **Sample Number:** 154034 **Code:** A 103

Location: S. of Pine Butte **Scintillometer Counts:** 120 cps

Quadrangle: Reno Pass **U Value (U by NT) ppm :** 1.90

Sec., Twp, Ra.: S9, 7N, 9E **Coordinates:** 33° 58' 56"; 111° 26' 15"

Geologic Unit: jasper-chert-quartz pebble conglomerate

Stratigraphic Group: Alder Group

SITE GEOLOGY :
At Pine Mountain, a quartz-phenocrystic rhyolite in the Alder Group complexly intrudes purple slates and conglomeratic, jasper-bearing sediments, quartz wackes, volcanic wackes, volcanic sandstones and tuffs. A quartz bearing, but dominantly jasper-chert pebble conglomerate right near the rhyolite contact was sampled as representative of the conglomeratic sediments at this locality. The rocks here carry abundant hematite.

Variability:
Fragment type, size and degree of deformation (flatness of fragments) are quite variable in this unit.

Sedimentary Structures:
None except bedding observed

Depositional Environment:
Difficult to evaluate as the conglomerate lies enclosed within purple slates; probably relatively deep-water marine.

SAMPLE DESCRIPTION :
A purplish to maroon-matrix rock contains flattened fragments of dark to bright red jasper, pink to red chert, and dark purple slate chips (all about 1-3mm long), with smaller white quartz and chert granules (3-10mm long) and quartz grit, in a ground mass of sericitic, argillaceous or slaty material and quartz. The pebble to granule size fragments total about 30% and are matrix supported. The conglomerate is best described as seriate in sizing and impure in composition of matrix.

Sampler: P. Anderson **Date:** 25th September 1979

THIN SECTION DESCRIPTION

Site Number: M3 **Sample Number:** 154034 **Code:** A103

Percent Fragments: 40% **Percent Matrix:** 55%

Percent Heavies & Mafics: 5% **Stain:** maroon hematite stain

Rock Type: granule conglomerate **Stratigraphic Group:** Alder Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
cherty rhyolite	65%	18-4 mm	subangular	1:6-1:2
quartz	12%	5.0-2.0mm	subrounded	1:1.5
chert	10%	6.0-2.0 mm	subrounded	1:1.5
quartz wacke	8%	5.5-2.0 mm	subangular	1:2
jasper	5%	4.5-2.0 mm	subangular	1:2

(rhyolite is aphanitic, generally red, and resembles a sericitic chert)

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	46%	2-.01 mm	clear large grains, recrystallized fines
chert	7%	2-.3 mm	subrounded
jasper	11%	2.0-0.2 mm	banded and specularitic
specularite	5%	0.7-.08 mm	rounded detrital and recrystallized
hematite	2%	powdery	with specularite and sericite
sericite	26%	.03-.006 mm	felted masses and needles
zircon	<1%	.07-.02 mm	rounded detrital
limonite	1%	powdery	stain along slip lines
clay	2%	--	most recrystallized to sericite

Cement: Recrystallized quartz and sericite.

Interstitials: Clay, sericite, recrystallized quartz, specularite and hematite.

Textures and recrystallization: Large aphanitic fragments virtually unrecrystallized but matrix quartz and clay extensively recrystallized to interlocking quartz mosaics and felted sericite mats along slip lines and around large grains.

Structures: Recrystallization is by deformation of matrix material; bedding defined by differing fragment densities in different layers and by subparallel orientation of fragments.

Comments on Genesis: An aphanitic cherty rhyolite terrain with varying amounts of specularite is indicated because in this thin section it is virtually impossible to distinguish between rhyolite, chert, and jasper.

Rock Name: rhyolite-chert-jasper granule conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: M 4 **Sample Number:** 154035 **Code:** V 004

Location: Pine Mtn. Rd. **Scintillometer Counts:** 190 cps

Quadrangle: Reno Pass **U Value (U by NT) ppm :** 4.70

Sec., Twp, Ra.: S17, 7N, 9E **Coordinates:** 33° 57' 46"; 111° 27' 06"

Geologic Unit: altered rhyolitic conglomerate or agglomerate

Stratigraphic Group: Alder Group

SITE GEOLOGY :

Close to the previous sample is a distinctive rhyolitic fragmental unit which was sampled because of its high radiometric reading and because it is representative of most of the felsic volcanic fragmental units in the Alder Group in this area. The quartz-phenocrystic rhyolite fragments are closely related origin to the Pine Mountain intrusive porphyry body itself, but other polymict fragments do occur in the volcanic conglomerate.

Variability:

Fragment sizes are completely seriate from 5x20cm fragments down to 3x5mm fragments; slate chips tend to be smaller and more erratic in occurrence.

Sedimentary Structures:

No sedimentary structures are apparent apart from a flattened, bedded structure.

Depositional Environment:

Volcaniclastic deposit locally centered over curved rhyolitic domes. Relatively deeper water submarine.

SAMPLE DESCRIPTION :

The rock is unusually striking in appearance because bright pink to orange, flattened and elongate, pebble-size rhyolitic fragments are sheared out in a bright sericitic to apple-green, altered rhyolitic matrix. The fragments are altered K-feldspar, quartz and hematitic altered glass material, whereas the matrix is pervasively sericitized and possibly, in part, chloritically altered. Purple, 1x0.5cm slate chips are also spotted throughout the rock, and also show a tectonic lineation.

Sampler: P. Anderson **Date:** 25th September, 1979

THIN SECTION DESCRIPTION

Site Number: M4 **Sample Number:** 154035 **Code:** V004

Percent Fragments: 84% **Percent Matrix:** 15%

Percent Heavies & Mafics: 1% **Stain:** flesh color

Rock Type: rhyolitic conglomerate **Stratigraphic Group:** Alder Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
rhyolite	100%	14.0-3.0 mm	subangular (augen shaped)	1:3.5

(rhyolite fragments are sericitic, characterized by granular quartz-feldspar matrix, and contain a few well-twinned feldspar phenocrysts and quartz phenocrysts)

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
feldspar	17%	0.03-.005 mm	finely ground material of low relief
quartz	30%	0.1-.06 mm	finely ground quartz grains
sericite	50%	0.1-.001 mm	felted, foliated birefringent mats
specularite	1%	0.7-0.1 mm	as crystals in fragments and matrix
hematite	2%	powdery	stain on foliation slip lines

(estimates)

Cement: Recrystallized quartz, sericite, feldspar.

Interstitials: Sericite, recrystallized quartz and feldspar.

Textures and recrystallization: The matrix is simply very finely ground material of identical composition to fragments; it is dominated by sericite mats interweaving between fragments.

Structures: Rock structure is flesh colored augen-shaped rhyolitic fragments interlaced by shear planes of finer greenish matrix material.

Comments on Genesis: Rock is essentially a rhyolitic tuff or conglomerate with endogenous fragments and matrix; no exotic fragments are present.

Rock Name: sheared rhyolitic conglomerate or tuff

SITE AND SAMPLE DESCRIPTION

Site Number: M 5 **Sample Number:** 154040 **Code:** A 110

Location: West of Ord Mine **Scintillometer Counts:** 140 cps

Quadrangle: Reno Pass **U Value (U by NT) ppm :** 1.0

Sec., Twp, Ra.: S14, 9E, 7N **Coordinates:** 33°57'25"; 111°24'02"

Geologic Unit: Alder quartzite to grit

Stratigraphic Group: Alder Group

SITE GEOLOGY : This section consists of a 10-meter-thick layer of resistant quartzite which has a nearly vertical bedding attitude. It is composed of thin layers of fine, medium, and coarse sands which sometimes contain grit.

Variability: The quartzite is heavily dissected by veins of remobilized and recrystallized white quartz.

Sedimentary Structures: Cross-bedding sets average 3-10cm in thickness.

Depositional Environment: Fluvial or shallow-water marine.

SAMPLE DESCRIPTION : The sample is a poorly sorted light purple to pink quartzite to grit. Layers, 10-20mm thick, are of gray, fine- to medium-grained sand- and grit-size grains of mostly quartz, some jasper and minor chert. Minor amounts of specularite are concentrated on some bedding and cross-bedding planes. Grains are well-packed, well-cemented, and partly recrystallized.

Sampler: K. Wirth **Date:** 27 September 1979

THIN SECTION DESCRIPTION

Site Number: M 5 **Sample Number:** 154040 **Code:** A 110

Percent Fragments: 75% **Percent Matrix:** 20%

Percent Heavies & Mafics: 5% **Stain:** pale pink hematitic stain

Rock Type: gritty quartzite **Stratigraphic Group:** Alder Group

FRAGMENTS : **(percentages are based on 100% fragments)**

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
Quartz	88%	2.5 - 0.4mm	Sub-rounded	1:2
Chert	5%	2.1 - 0.4mm	Sub-angular	1:2
Jasper	6%	3.0 - 0.4	Sub-angular	
Rhyolite (?)	1%	0.4 - .25mm	Sub-rounded	1:2
Feldspar (?)	1%			

MATRIX & HEAVIES : **(percentages are based on 100% matrix & heavies)**

Type & color	Percentage	Size range	Description
Quartz	55%	0.3 - .09mm	Recrystallized, polygonized, shredded
Specularite	10%	0.7 - 0.2mm	Sub-rounded detrital grains
Specularite	5%	0.2 - .07mm	Acicular and platy crystals, regrowths
Hematite	1%	0.4 - .07mm	with recrystallized specularite
Sericite	20%	0.2 - 0.7mm	Interstitial to and foliated around quartz grains and in clumps up to 0.3mm
Chert	4%	.4 - 0.1mm	
Clay (?)	(5%)	.01mm	in matrix and altered feldspar fragments
Biotite	1%	0.4 - 0.2mm	Recrystallized

Cement: earthy hematite cement locally present near jasper

Interstitials: Most sericite is interstitial, detrital & recrystallized specularite is interstitial

Textures and recrystallization: most grains interlocking and sutured, quartz shows undulose extinction, is recrystallized and some grains are polygonized; some polygonal triple points are present; rock texture is about 40% recrystallized

Structures:
Specularite concentrated on bedding and cross-bedding planes; jasper and coarser quartz grains concentrated in 10mm bedded units

Comments on Genesis: quartzite and grit were originally well-bedded and interbedded with minor concentrations of heavies on cross beds; rock is weakly deformed and metamorphosed and some specularite is recrystallized to acicular crystals in matrix and fragments.

Rock Name: partially recrystallized quartz - jasper grit to quartzite

SITE AND SAMPLE DESCRIPTION

Site Number: M 6 **Sample Number:** 154041 **Code:** U 203

Location: West of Ord Mine **Scintillometer Counts:** 190 cps

Quadrangle: Reno Pass **U Value (U by NT) ppm :** 2.0

Sec., Twp, Ra.: S14, 7N, 9E **Coordinates:** 33°57'25"; 111°24'02"

Geologic Unit: Volcanic pebble conglomerate

Stratigraphic Group: Alder Group

SITE GEOLOGY : This section is located below site M 5 and is separated from it by approximately 30 meters of cover. The rocks are impure and conglomeritic quartzites to pebble conglomerates in which it is difficult to say whether the fragments are of volcanic or sedimentary origin because of the moderate to strong shearing.

Variability: Conglomerate layers are thin and highly variable in character.

Sedimentary Structures: None are visible due to deformation.

Depositional Environment: Either a shallow-water marine or fluvial environment as indicated by impurity and poor sorting.

SAMPLE DESCRIPTION : The sample is composed of a strongly foliated purple matrix of sericite and medium sand-sized grains supporting sub-angular elongate fragments in a ratio 3:2. The dark silver-grey matrix consists of mostly sericite and quartz and minor amounts of jasper, rhyolite, and volcanic rock fragments. Fragments averaging 12-34mm in length are commonly elongate, sub-angular jasper, maroon rhyolite and white quartz, as the main fragment types, with lesser chert and volcanic rock fragments. The well-developed foliation has destroyed all traces of original bedding structures.

Sampler: K. Wirth **Date:** 27 September 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 7 **Sample Number:** 154115 **Code:** M 101

Location: Malpais Spring **Scintillometer Counts:** 66 cps

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** .90

Sec., Twp, Ra.: S36, 9N, 8E **Coordinates:** 34°04'53"; 111°29'05"

Geologic Unit: Mazatzal grit

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : The section near Malpais Spring is composed of well-cemented, medium-grained quartzite. Some cross-beds near the base of the 15m-thick section contain quartz-rich grit layers. Quartzite is maroon near the base and becomes light purple and finally tan to yellow at the top of the section.

Variability: Grain size, composition, and sorting show little variation across the section. Hematite percent decreases up section.

Sedimentary Structures: Planar cross-beds average 2-10cm in thickness and sometimes contain grit.

Depositional Environment: Possibly a near-shore marine environment as indicated by the grain size and well sorted character of the rock.

SAMPLE DESCRIPTION : Medium maroon, coarse-grained quartzite containing layers of grit is characteristic of the sample. Matrix grains are fine to medium sand-size and rounded. Quartz and minor amounts of chert are present as matrix grains and as small grit, 1-2mm long, in cross-bedded lenses. Very minor amounts of jasper and rhyolite (?) were also observed at the sample site. The quartzite is well-cemented.

Sampler: K. Wirth **Date:** 6 November 1979

THIN SECTION DESCRIPTION

Site Number: M7 **Sample Number:** 154115 **Code:** M101

Percent Fragments: 2% **Percent Matrix:** 97%

Percent Heavies & Mafics: 1% **Stain:** minor hematitic red

Rock Type: Mazatzal quartzite **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : **(percentages are based on 100% fragments)**

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	90%	4.0 - 1.3 mm	sub-rounded	1:1.5
jasper	5%	2.1 - 1.3 mm	sub-angular	1:2
quartzite	3%	3.4 - 1.3 mm	sub-rounded	1:1.5
chert	2%	3.0 - 2.0 mm	sub-angular	1:2

MATRIX & HEAVIES : **(percentages are based on 100% matrix & heavies)**

Type & color	Percentage	Size range	Description
quartz	90%	1.3 - .15 mm	sub-rounded detrital, recrystallized
jasper	1%	1.3 - .8 mm	sub-rounded detrital
quartzite	1%	1.3 - .9 mm	sub-rounded detrital
chert	1%	1.3 - .7 mm	sub-rounded detrital
clay	5%	.02 - .005 mm	recrystallized masses
sericite	2%	.09 - .02 mm	recrystallized plates and masses
hematite	<1%	powdery	stain and alteration of specularite
specularite	<1%	0.9 mm	rounded detrital grains
leucoxene	<1%	powdery	alteration product
zircon	<1%	0.1 - .04 mm	rounded detrital

Cement: Recrystallized quartz, clay, minor hematite.

Interstitials: Shredded and recrystallized quartz, clay, sericite, hematite, leucoxene.

Textures and recrystallization: Quartz grain boundaries show suturing and recrystallization; quartz shows undulose extinction and polygonization; matrix quartz consists of a recrystallized interlocking mosaic of grains.

Structures: No bedding structures are defined in this sample because of good sorting, and although most grains are strained, there is no defined foliation.

Comments on Genesis: Fairly well-sorted sand and small grit were deposited and later weakly deformed and metamorphosed, causing minor recrystallization of quartz, clay and sericite, without foliation or strong shearing.

Rock Name: Slightly recrystallized quartzite.

SITE AND SAMPLE DESCRIPTION

Site Number: M 8 **Sample Number:** 154116 **Code:** M 102

Location: S of Bear Spring **Scintillometer Counts:** 68 cps

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 0.90

Sec., Twp, Ra.: S1, 8N, 8E **Coordinates:** 34°04'07"; 111°28'49"

Geologic Unit: Mazatzal quartz-jasper-chert granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Medium to fine-grained quartzite dips nearly vertically at this site. Color varies from deep maroon to earthy red and grey. Conglomerate layers average 1-3cm in thickness and are evenly interbedded with equal amounts of quartzite. Detrital specularite is present on cross-bedding planes. Some liesegang bands are also present.

Variability: Conglomerate layers with grit have fragments composed of mostly quartz whereas granule layers have fragments composed of quartz, jasper, chert, and rhyolite.

Sedimentary Structures: Planar cross-bedding is abundant in 4-8cm-thick sets.

Depositional Environment: Interbedded and cross-bedded sand and granule layers may indicate a shallow water, near-shore marine environment. Periods of lower energy are indicated by fine sand and silt layers.

SAMPLE DESCRIPTION : The sample is a light maroon granule conglomerate with a medium-grained matrix supporting an equal amount of sub-rounded fragments in sub-parallel alignment. The matrix is mostly quartz, with some chert, jasper, rhyolite and minor amounts of detrital specularite. Hematite stain coats surfaces and is present in some interstices. Fragments, averaging 3-12mm in length, are composed of mostly quartz, jasper, and chert, with lesser rhyolite and specularite-rich fragments. Conglomerate fragments are contained within planar cross-bed layers of 4-8cm thickness.

Sampler: K. Wirth **Date:** 6 November 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 9 **Sample Number:** 154117 **Code:** M 101

Location: Mazatzal Divide Trail **Scintillometer Counts:** 80 cps

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 1.1

Sec., Twp, Ra.: S31, 9N, 9E **Coordinates:** 34°04'15"; 111°28'28"

Geologic Unit: Mazatzal chert-jasper-quartz grit

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : This sample site is located at the base of the Mazatzal quartzite near its contact with the underlying Maverick shale. The quartzite is mostly red to maroon and fine to medium-grained. Occasional lenses of grit averaging 1-3cm thick are interbedded near the base of the section. Higher up, sediments are better-sorted, ripple marked, and have mud cracks.

Variability: Grain size varies from silt to medium sand and occasionally to grit.

Sedimentary Structures: Abundant ripple marks, mudcracks and shaley rip-up layers.

Depositional Environment: A wide variety of energy conditions are indicated by interbedded grit, quartzite, and shale, but all are indicative of a shallow-water, near-shore marine to intertidal environment.

SAMPLE DESCRIPTION : The sample is composed of red-maroon quartzite supporting rounded grit and occasional granules in a ratio of 2:1. Fine- to medium-grained quartz, chert, and jasper are interbedded in 4-7cm thick sets. Interstitial spaces are filled with hematite and silt. Supported in the matrix are grit-sized fragments of mostly quartz, lesser jasper, chert, and maroon to pink rhyolite.

Sampler: J. Trembly and K. Wirth **Date:** 6 November 1980

THIN SECTION DESCRIPTION

Site Number: M9 **Sample Number:** 154117 **Code:** M101

Percent Fragments: 37% **Percent Matrix:** 55%

Percent Heavies & Mafics: 8% **Stain:** hematitic red

Rock Type: Mazatzal grit **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : **(percentages are based on 100% fragments)**

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	32%	4.5 - 1.0 mm	rounded	1:1.5
jasper	20%	6 - 1.0 mm	sub-rounded	1:1.5
chert	30%	5.5 - 1.0 mm	sub-rounded	1:1.5
quartzite	6%	4.2 - 1.0 mm	rounded	1:2
rhyolite	12%	3.5 - 2.0 mm	rounded	1:1.5

(rhyolite is aphanitic and hematitic)

MATRIX & HEAVIES : **(percentages are based on 100% matrix & heavies)**

Type & color	Percentage	Size range	Description
quartz	62%	1.0 - .09 mm	rounded to subangular detrital
chert	11%	1.0 - .17 mm	sub-rounded to rounded
jasper	5%	1.0 - .20 mm	sub-rounded, hematite bedded
quartzite	4%	1.0 - .13 mm	rounded, polygonized
hematite	17%	powdery	red to opaque interstitial masses
clay	1%	<.01 mm	fine crystalline interstitials
leucoxene	<1%	powdery	alteration clots

Cement: Recrystallized quartz, hematite, recrystallized clay.

Interstitials: Mainly dark red to opaque hematite.

Textures and recrystallization: Quartz grains show slight undulose extinction and minor recrystallization; recrystallized clay. Primary abraded edges of many quartz and jasper fragments and matrix grains are preserved.

Structures: Bedding planes are defined by differing fragment densities in different layers and variations in grain size of matrix quartz. Primary shape and elongation of matrix quartz parallels bedding.

Comments on Genesis: Bimodal grain size of rounded red jasper, red chert, quartz and hematitic rhyolite fragments in a quartz matrix of detrital grains indicates a strongly hematitic source terrain, high energy marine depositional environment and little recrystallization.

Rock Name: Hematitic jasper-rich granule conglomerate.

SITE AND SAMPLE DESCRIPTION

Site Number: M 10 **Sample Number:** 154118 **Code:** M 101

Location: N of Chilson Camp **Scintillometer Counts:** 60 cps

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 0.60

Sec., Twp, Ra.: S25, 9N, 8E **Coordinates:** 34°05'34"; 111°24'33"

Geologic Unit: Mazatzal quartz-rich grit

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : At this site, the lower red unit of the Mazatzal quartzite is thrust over the upper white unit. The lower Mazatzal strata here are characterized by a light purple to white color and contain little grit. Color changes upward into earthy-hematite red and finally dark maroon across the fault at the "top" of the 50 meter thick section. Grit layers and lenses are most common in the upper 30 meters. Associated with grit layers is a noticeably higher percentage of silty material.

Variability: Fragment size and density increase toward the "top" of the section. Hematite is present only as stain in the white quartzite layers below, and appears as interstitial fillings and stain in maroon layers in the middle and upper plates.

Sedimentary Structures: Cross-bedded lenses of 4-7cm thickness contain grit. These are interbedded with medium- to coarse-grained quartzite. Some cross-bed layers have concentrations of specularite on their bedding planes.

Depositional Environment: Minor periodic or frequent fluctuations in energy conditions in a shallow-water marine, near-shore or intertidal environment.

SAMPLE DESCRIPTION : Rounded grit occurs in a hematite-stained, medium- to coarse-grained quartzite in which the matrix is composed of mostly quartz with minor amounts of chert and jasper. Interstitial spaces are filled with hematite and other cementing material. Grit-sized fragments average 1-4mm in length, but may reach 6.5mm. Quartz is the main constituent and is accompanied by minor amounts of chert and jasper. Bedding planes are defined by differing fragment sizes and densities. Conglomerate layers lense out laterally.

Sampler: K. Wirth **Date:** 7 November 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 11 **Sample Number:** 154119 **Code:** M 001

Location: Upper North Fork **Scintillometer Counts:** 110 cps

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :**0.70

Sec., Twp. Ra.:S24, 9N, 8E **Coordinates:** 34°05'57"; 111°29'37"

Geologic Unit: Mazatzal quartz-rich grit

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Site M 11 lies above site M 12 and below M 13. This 2 meter thick section is made up of a fairly consistent coarse-sand to grit-size qurtzite which is well-cemented. Below it, the quartzites grade into poorly cemented hematite-red silts and sands. Above the section, quartzites grade into white-quartz grit conglomerate with finer interstitial material.

Variability: Grain size and density remains fairly constant throughout the section. Some layers contain black interstitial (recrystallized?) specularite rather than red hematite.

Sedimentary Structures: Are not well-defined.

Depositional Environment: The well-sorted and consistent nature of the sample is characteristic of relatively constant energy conditions. Possibly, a near-shore marine environment, definitely shallow water.

SAMPLE DESCRIPTION : This sample is characterized by well-sorted coarse-grained to grit-size quartz grains supporting a minor amount of silt-size quartz and hematite. The grains are rounded and average 2-3mm in length, but occasionally reach 4mm. Fractures are filled with recrystallized specularite. The qurtzite, in general, is well-cemented and appears to be moderately re-crystallized.

Sampler: K. Wirth **Date:** 7 November 1979

THIN SECTION DESCRIPTION

Site Number: M11 **Sample Number:** 154119 **Code:** M001

Percent Fragments: 63% **Percent Matrix:** 33%

Percent Heavies & Mafics: 4% **Stain:** patchy hematitic red

Rock Type: Mazatzal grit **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	90%	5 - 2 mm	sub-rounded	1:1.5
jasper	3%	5 - 2 mm	sub-angular	1:2
chert	4%	5 - 2 mm	sub-angular	1:2
quartzite	3%	5 - 3 mm	sub-angular	1:3

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	66%	2 - .2 mm	sub-rounded, polygonized, recrystallized
jasper	5%	2 - .3 mm	sub-rounded
chert	21%	2 - .18 mm	sub-rounded
clay	7%	<.01 mm	fine crystalline interstitials
hematite	1%	powdery	small interstitial grains

Cement: Recrystallized quartz, hematite, cryptocrystalline silica and clay.

Interstitials: Recrystallized quartz and clay, hematite.

Textures and recrystallization: Quartz grains show undulose extinction, strain twinning and grain boundary suturing; recrystallized clays occur in clumps around patches of crypotcrystalline interstitial silica, and also in masses parallel to bedding.
Structure: : Bedding structures are defined by the sub-parallel alignment of elongate grains and trains of finer grained matrix material. Interstitial silica and hematite appear to fill primary cavities.

Comments on Genesis: Very well sorted, mature quartz-rich sediment with primary cavities between grains suggest possibly wind-blown sand origin rather than subaqueous environment.

Rock Name: Quartz-rich, mature grit to granule conglomerate.

SITE AND SAMPLE DESCRIPTION

Site Number: M 12 **Sample Number:** 154120 **Code:** M 110

Location: Upper North Fork **Scintillometer Counts:** 72 cps

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 1.1

Sec., Twp, Ra.: S25, 9N, 8E **Coordinates:** 34°06'01"; 111°29'46"

Geologic Unit: Mazatzal quartzite

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : This section is composed of approximately 75-100 meters of white quartzite, light maroon quartzite with grit, and interbedded shales. The top of the section consists of light-colored quartzite and siltstone. Some hematite stain and occasional 1-4mm long, rounded quartz fragments are present. The middle part of the section is composed of light maroon fine-grained quartzite containing grit. Interbedded with these are micaceous, earthy hematite-red shales of 3-6cm thickness. The sample was collected from the middle of this section. The base of the section is similar to the upper part.

Variability: Upper parts of the section are poorly cemented and grains are fairly easily disaggregated. Above this, and in the middle of the section, grains are better cemented. Scintillometer counts vary from 72 cps in the sampled horizon to 110 cps at the top of the section.

Sedimentary Structures: Conglomerate layers are cross-bedded in 4cm thick sets. Shales are thinly laminated.

Depositional Environment: Interbedded shales, sands, and grit are indicative of environments with fluctuating energy conditions: shallow-water marine, possibly near-shore or intertidal.

SAMPLE DESCRIPTION : Light maroon-colored fine- to medium-grained quartzite contains varying amounts of quartzite grit in ratios from 3:1 to 1:3. Both grit and smaller sand-sized grains are composed of mostly quartz and only minor jasper. Grains are well-rounded and fragments average 1-3mm in length. Hematite stains grain, outcrop, and fracture surfaces, but no heavy minerals were observed. Beds are commonly of 1-5cm thick.

Sampler: K. Wirth **Date:** 7 November 1979

THIN SECTION DESCRIPTION

Site Number: M 12 **Sample Number:** 154120 **Code:** M110

Percent Fragments: 4% **Percent Matrix:** 94%

Percent Heavies & Mafics: 2% **Stain:** minor hematitic red

Rock Type: Mazatzal grit **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	98%	4 - 2 mm	rounded	1:1.5
quartzite	2%	2 mm	rounded	1:1.5

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	81%	2 - .08 mm	rounded, polygonized, recrystallized
chert	3%	1.4 - .2 mm	rounded
jasper	1%	1.6 - .4 mm	rounded
clay	5%	<.005 mm	finely crystalline interstitials
sericite	2%	.21 - .03 mm	recrystallized from clay
specularite	<1%	.2 - .01 mm	altered to hematite
hematite	1%	powdery	mainly stain
quartzite	6%	2.0 - .03 mm	strongly shredded quartz

Cement: Primarily recrystallized quartz and clay; minor hematite and sericite.
Interstitials: Clay, sericite, hematite and recrystallized quartz.

Textures and recrystallization: Interstitial clay and silica fill primary cavities between larger quartz grains. Most quartz is polygonized and somewaht strained whereas quartz in quartzite fragments is strongly shredded. Suturing is obvious.
Structures: Very well-sorted with no obvious bedding structures; elongate grains show no preferred alignment.

Comments on Genesis: Very well sorted, extremely mature and rounded quartz sand with primary cavities now filled with mainly clay suggest possibly a wind-blown sand origin for the quartzite rather than shallow water marine, or else could be wind reworked.

Rock Name: Pale pink quartz-rich grit to quartzite.

SITE AND SAMPLE DESCRIPTION

Site Number: M 13 **Sample Number:** 154121 **Code:** M 101

Location: Upper North Fork **Scintillometer Counts:** ND

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** .60

Sec., Twp, Ra.: S24, 9N, 8E **Coordinates:** 34°06'00"; 111°29'33"

Geologic Unit: Mazatzal quartz-jasper-chert granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : The sample was collected from a local drainage at the base of a 30m-high cliff and is thought to be representative of the section exposed in that cliff. This area could represent one of the low-angle reverse or thrust faults in the Mazatzal quartzite because red to maroon-colored quartz jasper-bearing conglomerate typical of the lower part of the Mazatzal forms the cliff and therefore lies on white quartzite.

Variability: Varies considerably from maroon to red color and from well-bedded and cross-bedded quartzites to conglomerate.

Sedimentary Structures: Cross bedding present.

Depositional Environment: Possibly a near shore marine environment with minor changes in energy conditions as indicated by the presence of sparse conglomerates in medium-grained quartzites.

SAMPLE DESCRIPTION : Fine to medium-grained sands, with hematite concentrations on bedding planes, support minor amounts of grit in a ratio of 10:1. Matrix grains and grit are primarily composed of quartz, and also minor amounts of jasper and chert. Grit fragments, averaging 2-5mm in length, are rounded and slightly ellipsoidal in shape. Hematite concentrates occur in 0.3-10m thick cross beds. Another sample is of chert-jasper-quartz fragment-rich granule conglomerate in a clean, well-sorted matrix of quartz and hematite.

Sampler: J. Trembly **Date:** 7 Novembe! 1979

THIN SECTION DESCRIPTION

Site Number: M 13 **Sample Number:** 154121 **Code:** M101

Percent Fragments: 7% **Percent Matrix:** 91%

Percent Heavies & Mafics: 2% **Stain:** pale hematitic

Rock Type: Mazatzal grit **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	100%	4.5 - 2.0	sub-rounded	1:1.5

(large quartz grains are internally polygonized to resemble quartzite)

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	88%	2 - .04 mm	sub-rounded, sutured, recrystallized
chert	2%	.7 - .18 mm	sub-rounded
jasper	<1%	.4 mm	sub-rounded
clay	4%	<.005 mm	finely crystalline interstitials
sericite	<1%	.09 - .01 mm	recrystallized plates and masses
specularite	<1%	<.09 mm	interstitial, detrital
hematite	5%	powdery	interstitial to matrix quartz

Cement: Mainly recrystallized quartz, clay, hematite and sericite.

Interstitials: Recrystallized quartz, clay, sericite, hematite and specularite.

Textures and recrystallization: Most quartz grains show undulose extinction and grain boundary suturing; some quartz grains are composite or polygonized; interstitial hematite and specularite preserve primary detrital shapes of matrix quartz grains.
Structures: Size differences in fragment and matrix quartz define bedding parallel to layers of hematite and specularite concentration.

Comments on Genesis: Very pure quartz-rich sediment with tightly packed matrix quartz grains filled interstitially by hematite and specularite suggest shallow water marine depositional environment, as in M7.

Rock Name: Pale pink quartz-rich grit.

SITE AND SAMPLE DESCRIPTION

Site Number: M 14 **Sample Number:** 154122 **Code:** M 101

Location: West of Chilson Camp **Scintillometer Counts:** 70 cps

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 0.70

Sec., Twp, Ra.: S36, 9N, 8E **Coordinates:** 34°04'57"; 111°29'47"

Geologic Unit: Mazatzal quartz-rich grit

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : At this site, Mazatzal quartzite is characterized by dark hematitic-purple, fine-grained quartzite. Cross-beds of 3-8cm thickness contain lenses of quartz-rich grit. Several 1-2cm-thick specularite-rich beds are present throughout.

Variability: Grit and heavy mineral concentrations vary from layer to layer; scintillometer counts show no increase in specularite-rich layers, but average 70 cps throughout the section.

Sedimentary Structures: Cross-bed sets of 3-8cm thickness contain grit and sometimes have 1-2cm-thick beds of heavy minerals concentrated in them.

Depositional Environment: A near-shore marine environment is indicated by the consistency of the sediment sorting and sedimentary structures.

SAMPLE DESCRIPTION : The rock is a grit rich in larger (2-4mm) quartz grains with about 20% finer-grained quartz and a white clayey material interstitial to the quartz grains. Some grit fragments are chert or jasper but 70% of the coarser grains are quartz. The quartz grains are well rounded and spherical in shape, while jasper is less-rounded and more elongate.

Sampler: K. Wirth **Date:** 8 November 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 15 **Sample Number:** 154123 **Code:** M 102

Location: Upper Barnhardt Canyon **Scintillometer Counts:** 80 cps

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm:** 1.1

Sec., Twp, Ra.: S28, 9N, 9E **Coordinates:** 34°05'30"; 111°27'07"

Geologic Unit: Mazatzal chert-jasper granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Along the Barnhardt Canyon Trail, dark red brown to light maroon-colored granule to pebble conglomerates typical of the lower red unit of the Mazatzal quartzite are found. These are overlain normally by the upper, paler-colored parts of the upper Mazatzal section.

Variability: Individual layers are well sorted and are dominated by one fragment size. However, fragment size in different layers ranges from grit to pebble-size. Conglomerate layers vary from 1-10cm in thickness.

Sedimentary Structures: Conglomerate layers appear to be laterally consistent and do not lens out in the exposed section.

Depositional Environment: Conglomerate layers represent higher energy influxes into a shallow-water near-shore marine environment.

SAMPLE DESCRIPTION : Sub-rounded granules 5-12mm long, of mostly jasper, pink and maroon rhyolite, chert, some quartz and minor quartzite, are found in an equal amount of light purple, fine- to medium-grained quartz-rich matrix. The matrix is mostly quartz, minor jasper and chert. About 2-3% hematite is present, mainly as stain, but black chert fragments make the rock look more hematitic. Conglomerate layers are commonly of 1-10cm thickness. Fragments, which are commonly elongate, show no preferred orientation.

Sampler: J. Trembly **Date:** 8 November 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 16 **Sample Number:** 154125 **Code:** D 103

Location: Barnhardt Canyon **Scintillometer Counts:** 130 cps

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 4.50

Sec., Twp, Ra.: S29, 9N, 9E **Coordinates:** 34° 05' 37"; 111° 26' 48"

Geologic Unit: specularitic Deadman conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY :

In Barnhardt Canyon there are excellent exposures of the most hematitic and most coarsely conglomeratic material in the Deadman unit. One sees conglomerates with cobble-to pebble-size, vesiculer rhyolite, flow banded rhyolite, aphanitic rhyolite and slate, all highly hematitic and specularitic, interbedded with quartz-hematite grit, granule conglomerate and quartz-jasper-quartzite pebble conglomerate. These basal units are overlain by pink to whiter quartzite and grit, showing good cross bedding.

Variability:

Fragment type and size are variable from bed to bed, as is the hematite content. Hematite and conglomerate content generally decrease up section.

Sedimentary Structures:

Abundant cross bedding in upper units; pebble imbrication, and well developed bedding throughout.

Depositional Environment:

Shallow water, fluvial; river channel deposit defining the main east-west Deadman conglomerate paleochannel.

SAMPLE DESCRIPTION :

Very dark metallic gray-red-brown to black, the conglomerate consists of a patchwork of smoother flattened fragments sheared among a gritty to sand matrix. The fragments vary from 1 to 5cm and include specularitic iron formation, hematitic banded iron formation, specularite-quartz pebbles, hematic rhyolite, hematitic slate, hematitic quartzite, pink and maroon chert, as well as a variety of softer fragments whose identities are masked by the high hematite content. The matrix is quartz, argillaceous material, finer grained rock fragments and hematite, to make a total hematite content for the rock of greater than 30%.

Sampler: P. Anderson **Date:** 9th November, 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 17 **Sample Number:** 154126 **Code:** D 201

Location: Barnhardt Canyon **Scintillometer Counts:** 47 cps

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 1.30

Sec., Twp, Ra.: S28, 9N, 9E **Coordinates:** 34° 05' 48"; 111° 26' 53"

Geologic Unit: Quartz-jasper grit in Deadman unit

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY :
The top of the Deadman outcrop in Barnhardt Canyon consists of pale maroon, well cross-bedded quartzite with quartz-jasper grit layers. The cross beds show concentrations of specularite on them and at their bases, identical to that seen in Mazatzal quartzites. Except for knowing the stratigraphic position below the Maverick shale, these outcrops of Deadman are difficult to distinguish for some Mazatzal quartzite outcrops, although these have generally a higher hematite content and are blacker.

Variability:
Grit layers are discontinuous and highly variable both in grain size and thickness.

Sedimentary Structures:
Graded bedding within grit layers; abundant cross bedding with specularite concentrations.

Depositional Environment:
Shallow water, fluvial or possibly beach environment.

SAMPLE DESCRIPTION :
The sample is stained black by the specularite content, with only the coarser grit layers showing white quartz grains. Stratification units, 6cm thick, grade from 2-5mm grit-size quartz grains up through corase-sand to fine-sand sizes at their tops. Specularite is concentrated interstitially within the coarse grit layers and more fully dispersed hematite is found in the upper sandy portions. The matrix grains throughout are relatively well sorted with little argillaceous component.

Sampler: P. Anderson **Date:** 9th November, 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 18 **Sample Number:** 154128 **Code:** M 101

Location: Barnhardt Canyon **Scintillometer Counts:** 80 cps

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 1.30

Sec., Twp, Ra.: S29, 9N, 9E **Coordinates:** 34° 05' 55"; 111° 27' 09"

Geologic Unit: grit layers in Mazatzal quartzite

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY :
In the basal 50m of Mazatzal quartzite in the cliffs above Barnhardt Canyon are a series of grit layers 10 to 100cm thick which were collectively sampled. On the undersides of the more shaly and silty layers in the quartzite, one sees abundant ripple marks which change in orientation up to 90° for every 2-5cm-thick layer of quartzite in parts of the section. All of the rocks are a brick red color from dispersed hematite. Rock proportions are 90% quartzite, 5% grit, 5% conglomerate. Grain size is stratigraphically controlled; no grading but grit units are abruptly truncated by trough cross-bedding planes.

Variability:

Sedimentary Structures:
Oscillation ripple marks, current ripple marks, cross bedding, thin laminations, good sorting and sizing.

Depositional Environment:
Variable current directions from oscillation and current ripple marks positively indicate a shallow-water beach environment where the current directions are highly variable and frequently changing.

SAMPLE DESCRIPTION :
One sample consists of well sorted, cross bedded, quartz (2-0.5mm) jasper (4.05mm) and chert (3.05mm) grit in 50:35:15 proportions. Matrix is well sorted coarse sand, generally free from argillaceous material. Overlying brick red quartzite is finely laminated medium-to coarse-sand sizes. Another sample is a coarser grained grit to granule conglomerate of specularitic jasper, dark red chert and quartz in a brick red to maroon coarse quartz-jasper matrix.

Sampler: P. Anderson **Date:** 9th November 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 19 **Sample Number:** 154129 **Code:** D 203

Location: N. of Barnhardt Canyon **Scintillometer Counts:** 100 cps

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 2.80

Sec., Twp, Ra.: S28, 9N, 9E **Coordinates:** 34° 05' 47"; 111° 26' 36"

Geologic Unit: basal conglomerate of Deadman unit

Stratigraphic Group: Mazatzal Unit

SITE GEOLOGY :
Same as M 17, except further up hill, east along strike. The pebble to cobble conglomerate contains red and white volcanic fragments, possibly some quartzite fragments, but no jasper.

Variability:
Sample is of a coarser pebble conglomerate, but cobble conglomerate is abundant in outcrop

Sedimentary Structures:
Foliation obscures primary structures.

Depositional Environment:
Shallow water, river channel type deposit, same as M 17

SAMPLE DESCRIPTION :

The sample consists of a great diversity of dark reddish brown (color of hematite streak) rhyolitic volcanic fragments, and lighter colored (from sericite content) rhyolitic volcanic fragments, both of which are strongly flattened, in a foliated, hematitic, volcanic-to impure-wacke matrix. Conglomerate is framework supported with 65% fragments and somewhere between 15 and 30% hematite.

Sampler: P. Anderson **Date:** 9th November, 1979

THIN SECTION DESCRIPTION

Site Number: M19 **Sample Number:** 154129 **Code:** D203

Percent Fragments: 68% **Percent Matrix:** 17%

Percent Heavies & Mafics: 15% **Stain:** dark reddish brown

Rock Type: Deadman conglomerate **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : **(percentages are based on 100% fragments)**

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
hematitic claystone	99%	41 - 1.0 mm	angular	1:5
quartz	1%	1.2 - 1.0 mm	sub-rounded	1:1.5

MATRIX & HEAVIES : **(percentages are based on 100% matrix & heavies)**

Type & color	Percentage	Size range	Description
clay	39%	<.005 mm	partially recrystallized to sericite
hematite	18%	powdery	interstitial networks
specularite	5%	1 - .02 mm	rounded detrital grains
specularite	14%	.05 - .01 mm	recrystallized with hematite
quartz	6%	1.0 - .02 mm	rounded grains and recrystallized
sericite	6%	.13 - .04 mm	recrystallized plates around clay mats
clay fragments	11%	1.0 - .28 mm	angular hematite-rich fragments
zircon	1%	.04 - .01 mm	rounded detrital grains

Cement: Mainly hematite, clay, recrystallized specularite and sericite.

Interstitials: Angular quartz, sericite, specularite, hematite, clay.

Textures and recrystallization: Specularite, hematite and quartz are concentrated in the matrix, whereas clay is concentrated in fragments; specularite and hematite form a black interconnected matrix network outlining primary elongate fragment shapes; quartz grains are angular and unrecrystallized.

Structures: Differing concentrations of heavies and the parallel alignment of different elongate fragments define bedding planes; there is no indication in thin section that the elongation is a tectonic one associated with extensive recrystallization.

Comments on Genesis: Nearly all of the fragments are derived from hematite-clay sediments, probably earlier hematitic muds as the highly flattened fragment shapes suggest that they were deposited as soft fragments in an environment concentrating hematite.

Rock Name: Dark reddish-brown hematitic-claystone conglomerate.

SITE AND SAMPLE DESCRIPTION

Site Number: M 20 **Sample Number:** 154159 **Code:** M 101

Location: "The Park" **Scintillometer Counts:** ND

Quadrangle: North Peak **U Value (U by NI) ppm :** 0.90

Sec., Twp, Ra.: S1, 9N, 8E **Coordinates:** 34° 09' 17"; 111° 29' 25"

Geologic Unit: Mazatzal quartzite

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY :
Outcrops are of maroon, fine grained, cross bedded quartzite, with thin grit conglomerate layers. Sample is taken from grit layers containing 20% jasper, 10% rhyolite (chert?) and 70% quartz. Clasts are fairly well rounded and sorting is good within beds.

Variability:
Abundant fracturing, secondary quartz and variable hematite content.

Sedimentary Structures:
No ripples or mud cracks seen in the limited outcrop of about 5 meters.

Depositional Environment:
Presumed to be shallow water marine.

SAMPLE DESCRIPTION : (by P.A.)
One sample consists of interbedded fine grained, medium grained, and coarse grained, brick-red quartzite. Coarser layers show small chert, jasper and abundant quartz grains in a well sorted matrix. Stratification units are about 2-3cm thick. A second sample is a dark maroon quartzite to grit containing pink chert, red jasper and white quartz in a matrix of quartz and bedded specularite.

Sampler: J. Trembly **Date:** November 13, 1979

THIN SECTION DESCRIPTION

Site Number: M20 **Sample Number:** 154159 **Code:** M101

Percent Fragments: 28% **Percent Matrix:** 68%

Percent Heavies & Mafics: 4% **Stain:** hematitic maroon

Rock Type: Mazatzal grit **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : **(percentages are based on 100% fragments)**

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	33%	3.8 - 2.0 mm	rounded	1:1.5
jasper	24%	4.3 - 2.0 mm	sub-rounded	1:2
chert	37%	4.5 - 2.0 mm	sub-rounded	1:1.5
rhyolite	2%	3.5 - 2.0 mm	rounded	1:1.5
quartzite	4%	4.0 - 2.5 mm	rounded	1:1.5

MATRIX & HEAVIES : **(percentages are based on 100% matrix & heavies)**

Type & color	Percentage	Size range	Description
quartz	64%	2.0 - .03 mm	rounded, seriate grain sizes
chert	18%	2.0 - .01 mm	rounded
jasper	5%	2.0 - 1.3 mm	rounded
quartzite	6%	2.0 - 1.0 mm	rounded
clay	2%	<.005 mm	fine crystalline interstitials
hematite	4%	<.005 mm	fine interstitial grains and clumps
leucoxene	<1%	powdery	alteration clots
zircon	<1%	.09 mm	rounded detrital
specularite	<1%	.09 mm	rounded detrital
specularite	1%	<.01 mm	recrystallized with hematite

Cement: Recrystallized quartz and clay, cavity fillings of chalcedony, hematite.
Interstitials: Shredded and recrystallized quartz, clay, hematite, leucoxene.

Textures and recrystallization: Quartz grains show slight undulatory extinction, grain boundary suturing and polygonization; interstitial hematite and specularite perserve primary shapes of detrital matrix quartz whereas larger quartz grains are sutured.
Structures: Sedimentary bedding structures are not well-defined in thin section except presence or absence of grit defines larger scale bedding. Colloform banded chalcedony and silica fill several small cavities.

Comments on Genesis: Larger quartz, chert, jasper and quartzite grains are very well rounded, more so than would be expected from the moderately well-sorted, seriate-size matrix population. Mature marine sediment with abundant current action.

Rock Name: Maroon chert-jasper-quartz grit.

SITE AND SAMPLE DESCRIPTION

Site Number: M 21 **Sample Number:** 154160 **Code:** D 102

Location: E of North Peak **Scintillometer Counts:** ND

Quadrangle: North Peak **U Value (U by NT) ppm:** 3.1

Sec., Twp, Ra.: S31, 9½N, 9E **Coordinates:** 34°09'45"; 111°28'01"

Geologic Unit: specularitic Deadman granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Where Deadman quartzite wraps around the northeast side of North Peak from generally flat-lying attitudes in the north to vertical attitudes in the east, there is a series of complex fold patterns, with lower parts of the Deadman possibly structurally overlying upper parts. The granule conglomerate was collected at the base of the exposed cliffs of Deadman but this may not be the true base.

Variability: Conglomerate ranges from dense grit layers to sparse granule layers. Bedding sets vary in thickness from 1-3cm for the granule layers, to 5-8cm for the grit layers.

Sedimentary Structures: Planar cross-bed sets averaging 3-6cm in thickness contain minor concentrations of hematite and/or specularite on their bedding planes.

Depositional Environment: Relatively consistent energy conditions interrupted by higher energy conditions depositing the conglomerate layers took place either in a fluvial setting or at the base of a transgressive marine deposit.

SAMPLE DESCRIPTION : The rock is a dark maroon, specularite-rich granule to pebble conglomerate containing matrix-supported fragments of quartz, jasper, and specularite-rich rock. The matrix is mainly quartz, with hematite stain in interstitial cavities and on grain surfaces. Average grain size is fine- to medium-sand size, but some coarse-sand and grit sizes are present. Subrounded fragments, averaging 5-14mm in length, are composed of nearly equal amounts of jasper, white quartz, and black to red specularite-rich fragments. The hematite-specularite-rich fragments are flatter than either the jasper or quartz fragments, and may represent lower hematite-rich layers ripped up into this sample.

Sampler: K. Wirth **Date:** 13 November 1979

THIN SECTION DESCRIPTION

Site Number: M21 **Sample Number:** 154160 **Code:** D101

Percent Fragments: 67% **Percent Matrix:** 31%

Percent Heavies & Mafics: 2% **Stain:** pale maroon hematite

Rock Type: Deadman conglomerate **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : **(percentages are based on 100% fragments)**

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	84%	5.7 - 1.0 mm	rounded	1:1.5
chert	3%	2.6 - 1.0 mm	sub-rounded	1:2
jasper	6%	4.5 - 1.0 mm	sub-angular	1:2
quartzite	4%	2.7 - 1.0 mm	rounded	1:1.5
specularite-quartz	3%	3.5 - 2.0 mm	sub-rounded	1:1.5

MATRIX & HEAVIES : **(percentages are based on 100% matrix & heavies)**

Type & color	Percentage	Size range	Description
quartz	81%	1.0 - .02 mm	rounded detrital and recrystallized
chert	3%	1.0 - .4 mm	rounded detrital
specularite	4%	.2 - .06 mm	rounded detrital grains
zircon	<1%	.13 - .07 mm	rounded detrital
sericite	4%	<.07 mm	recrystallized plates and masses
muscovite	<1%	.33 - .1 mm	primary
clay	2%	.01 - .001 mm	interstitial matrix material

Cement: Recrystallized quartz, hematite, sericite, clay.

Interstitials: Recrystallized quartz, hematite, sericite and specularite.

Textures and recrystallization: Some larger quartz grains are internally polygonized, matrix quartz is sutured and partly recrystallized; hematite-specularite rich areas preserve primary rounded to angular detrital nature of quartz grains; matrix grains locally form a strongly interlocking network.
Structures: Aligned concentrations of hematite and detrital specularite with angular quartz-specularite fragments define bedding planes.

Comments on Genesis: Relatively mature for Deadman but distinctive in its dark maroon color from detrital specularite, as opposed to earthy hematite in the Mazatzal, and relative paucity of jasper. Matrix is slightly impure, but a generally quartz-rich terrain is the source.

Rock Name: Specularitic quartz-granule conglomerate.

SITE AND SAMPLE DESCRIPTION

Site Number: M 22 **Sample Number:** 154261 **Code:** M 001

Location: Upper North Fork **Scintillometer Counts:** ND

Quadrangle: Table Mtn. **U Value (U by NT) ppm :** 0.90

Sec., Twp, Ra.: S23, 9N, 8E **Coordinates:** 34° 06' 05"; 111° 30' 09"

Geologic Unit: Upper White Mazatzal quartzite

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY :
The upper white unit of the Mazatzal quartzite contains well rounded and supermature quartz grits, a series of which were sampled on a knoll above the north fork of Deadman Creek. The rocks are generally non hematitic and the matrix is poorly indurated as the quartz grains are well-rounded and rarely broken.

Variability:
Grit layers appear to be continuous over the outcrop area and variability is stratigraphically controlled.

Sedimentary Structures:
Both quartzite and grits are well-bedded and cross-bedded

Depositional Environment:
Mature beach sand deposit, shallow water.

SAMPLE DESCRIPTION :
The rock is a white, to slightly pink (iron-stained) grit of very well rounded quartz and chert grains 2 to 5mm in diameter set in a matrix of quartz and either very minor clay or carbonate cement. Variable grain sizes and grain packing define bedding planes.

Sampler: P. Anderson **Date:** 12 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 23 **Sample Number:** 154161 **Code:** M 101

Location: NE cliff of North Peak **Scintillometer Counts:** 75 cps

Quadrangle: North Peak **U Value (U by NT) ppm :** 1.6

Sec., Twp, Ra.: S6, 9N, 9E **Coordinates:** 34°09'22"; 111°28'21"

Geologic Unit: Mazatzal grit

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : This sample site is located at the base of the Mazatzal quartzite unit and includes a stratigraphic thickness of about 20 meters of quartzite. The quartzite at the base of the section is fine-grained and red to orange in color. Up section, the quartzites are more maroon in color and medium-grained. Small lenses of grit are present near the top of the section.

Variability: Detrital specularite on cross-bedding planes is commonly associated with conglomerate layers.

Sedimentary Structures: Planar cross-beds average 3-6cm in thickness. Occasional ripple marks occur near the base of the section.

Depositional Environment: Probably a shallow-water near-shore marine environment that may be part of a transgressive marine sequence.

SAMPLE DESCRIPTION : A dirty maroon to white, fine-grained quartzite supports sub-angluar fragments of jasper, quartz, and chert. The matrix grains are composed of mostly quartz, with some jasper and chert. Grit and occasional granule-size fragments, averaging 2-10mm in length, consist of nearly equal amounts of jasper and quartz, with some chert. Jasper fragments are sub-angular and black, while quartz and chert tend to be sub-rounded and more spherical. The matrix to fragment ratio is 12:1. Hematite and specularite are concentrated in some bedding plane layers up to 3cm thick.

Sampler: K. Wirth **Date:** 13 November 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 24 **Sample Number:** 154162 **Code:** K 002

Location: NE cliff of North Peak **Scintillometer Counts:** ND

Quadrangle: North Peak **U Value (U by NT) ppm :** 1.4

Sec., Twp, Ra.: S31, 9½N, 9E **Coordinates:** 34°09'27"; 111°28'24"

Geologic Unit: Maverick chert-jasper granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : One of the green-matrix granule conglomerates that are rare in the Maverick shale, but characteristic of the unit was found as local talus in a poorly exposed section of Maverick near North Peak. Sampled material is probably very close to, or just below outcrop.

Variability: Most of the Maverick consists of dark green to greenish yellow, partly pyritic shales. Conglomerate such as in the sample is rare, but distinctive of one part of the unit.

Sedimentary Structures: Planar cross-beds of 3-6cm thickness.

Depositional Environment: Within the transgressive marine, shallow water Mazatzal sequence, the Maverick represents a relatively quiet, possibly back-bay environment. Conglomerate in this might represent a local storm wash.

SAMPLE DESCRIPTION : Nearly equal amounts of green fine-grained matrix and grit-size fragments of jasper, chert, rhyolite, and quartz make up the bulk of this sample. The matrix is composed of silt- to shale-size grains and green micas, possibly chlorite or a pre-chlorite phase. Limonitic (from pyrite?) alteration spots are sparsely distributed throughout the matrix. Grit-size fragments average 1.5-7mm in length and are commonly sub-angular to sub-rounded. Bright red jasper, green and yellow chert, and quartz are the main fragment types. Minor amounts of dark red rhyolite are also present. Detrital specularite grains are concentrated in conglomerate layers.

Sampler: K. Wirth **Date:** 13 November 1979

THIN SECTION DESCRIPTION

Site Number: M24 **Sample Number:** 154162 **Code:** K002

Percent Fragments: 60% **Percent Matrix:** 35%

Percent Heavies & Mafics: 5% **Stain:** greenish chlorite, yellow limonite

Rock Type: Maverick conglomerate **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : **(percentages are based on 100% fragments)**

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	14%	6.0 - 2.0 mm	sub-rounded	1:1.5
jasper	22%	6.5 - 2.0 mm	sub-rounded	1:2
chert	34%	5.0 - 2.0 mm	sub-rounded	1:2
siltstone	20%	25.0 - 2.0 mm	angular	1:2
quartzite	2%	4.5 - 2.0 mm	sub-rounded	1:1.5
sericite (rhyolite?)	8%	8.5 - 2.0 mm	sub-angular	1:1

MATRIX & HEAVIES : **(percentages are based on 100% matrix & heavies)**

Type & color	Percentage	Size range	Description
quartz	32%	2.0 - .045 mm	sub-angular to sub-rounded; recrystallized
jasper	13%	2.0 - .4 mm	sub-rounded to sub-angular
chert	35%	2.0 - .6 mm	sub-rounded
siltstone	12%	2.0 - .09 mm	sub-rounded
clay	14%	<.005 mm	fine iron-stained interstitials
specularite	<1%	<.005 mm	recrystallized with hematite
hematite	1%	powdery	fine interstitial grains and stain
limonite	<1%	powdery	fine interstitial grains and stain
chlorite	5%	.2 - .18 mm	in fragments and matrix
sericite	<1%	<.007 mm	recrystallized plates and masses

Cement: Mostly recrystallized quartz, clay, minor hematite, limonite and specularite.
Interstitials: Recrystallized quartz, chlorite, clay, hematite and sericite

Textures and recrystallization: Larger fragments are unstrianed, not sutured, not polygonized but sericite rhyolite fragments are foliated; matrix material is impure, interlocking, recrystallized and highly variable; radial chalcedony growths fill several cavities between grains.
Structures: Matrix and larger grains are cut by tension-gash veins of recrystallized quartz perpendicular to bedding which is defined by elongation of tabular fragments.

Comments on Genesis: Abundance of chlorite, clay and silt matrix material and less resistant rock fragments indicate a less mature conglomerate of mixed volcanic, sedimentary and resistant rock-fragment provenance.

Rock Name: Chloritic green jasper-chert-siltstone granule conglomerate.

SITE AND SAMPLE DESCRIPTION

Site Number: M 25 **Sample Number:** 154163 **Code:** D 201

Location: North Peak Trail **Scintillometer Counts:** 140 cps

Quadrangle: North Peak **U Value (U by NT) ppm :** 4.70

Sec., Twp, Ra.: S31, 9½N, 9E **Coordinates:** 34° 10' 12 "; 111° 28' 08"

Geologic Unit: basal hematitic Deadman granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY :
The basal contact of the Mazatzal Group on North Peak Trail is very black from abundant (up to 30% in places) black specularite. The basal part containing quartz-jasper rounded-granule conglomerate is about 8m thick and is overlain by 3m of strongly hematitic shale. Less than 13m from the basal unconformity, the Deadman resumes its usual character of pink to maroon, thinly bedded quartzites and dark planar-cross-bedded quartzites with specularite concentration on the bases of foreset units. Specularite shows strong concentrations to the base of the Deadman; granule conglomerate is erratically distributed but is confined to the zones high in hematite.
Variability:

Sedimentary Structures:
Black hematite is well bedded and cross bedded;
Abundant mud cracks, ripple marks and cross beds in quartzites and siltstones.

Depositional Environment:
Shallow water, fluvial river channel deposit or basal part of transgressive marine sequence.

SAMPLE DESCRIPTION :
Rock is a very dark maroon to nearly black, specularite-rich, medium-grained quartzite with a basal layer of sparse-granule conglomerate. The 3-10mm chert, rhyolite, jasper (?) and hematite granules are either completely rimmed or made up mostly of black, crystalline specularite. Detrital specularite grains and recrystallized aggregates of specularite are also seen in this 35mm basal layer. Chert and quartz are more abundant in the upper, clean, hematite-rich quartzite layers.

Sampler: P. Anderson and J. Trembly **Date:** November 13, 1979

THIN SECTION DESCRIPTION

Site Number: M25 **Sample Number:** 154163 **Code:** D201

Percent Fragments: 18% **Percent Matrix:** 67%

Percent Heavies & Mafics: 15% **Stain:** dark reddish brown

Rock Type: Deadman conglomerate **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : **(percentages are based on 100% fragments)**

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	15%	1.8 - 1.0 mm	sub-rounded	1:1.5
specularite fragments	58%	8 - 3.0 mm	sub-angular	1:2
chert	20%	3.5 - 1.0 mm	sub-rounded	1:2
rhyolite	5%	10 - 2.0 mm	sub-rounded	1:1.5
jasper	2%	4.0 - 1.0 mm	sub-angular	1:2

(rhyolite is quartz phenocrystic; both rhyolite and jasper are dark reddish brown)

MATRIX & HEAVIES : **(percentages are based on 100% matrix & heavies)**

Type & color	Percentage	Size range	Description
quartz	63%	1.0 - .02 mm	rounded detrital, sutured
jasper	2%	1.0 - .2 mm	sub-rounded
chert	3%	1.0 - .18 mm	sub-rounded
specularite	2%	.14 - .07 mm	rounded detrital grains
specularite	12%	.05 - .005 mm	recrystallized interstitial masses
hematite	10%	powdery	opaque interstitial fillings, stain and grains
clay	6%	<.006 mm	partially recrystallized to sericite
sericite	2%	.08 - .03 mm	overgrowths
zircon	<1%	.12 - .06 mm	rounded detrital

Cement: Hematite, clay, quartz, specularite and sericite.

Interstitials: Quartz, specularite, sericite, hematite and clay.

Textures and recrystallization: Primary detrital character of matrix quartz grains is well preserved by interstitial hematite, specularite and clay; specularite is concentrated with angular quartz locally in bulbous masses that are encased in a rind of hematite and specularite.
Structures: Bedding planes are defined by the sub-parallel alignment of elongate fragments and by bulbous layers of quartz and specularite encased by a rind of hematite plus specularite (probably disturbed bedding).

Comments on Genesis: Rock is generally poorly recrystallized and a good example of the rounded bulbous specularite-rich "balls" that are commonly found in specularite-rich basal parts of the Deadman unit, presumably as a primary depositional feature.

Rock Name: Specularite-rich, sparse hematite-fragment conglomerate.

SITE AND SAMPLE DESCRIPTION

Site Number: M 26 **Sample Number:** 154164 **Code:** D 112

Location: North Peak Trail **Scintillometer Counts:** 75 cps

Quadrangle: North Peak **U Value (U by NT) ppm :** 1.40

Sec., Twp, Ra.: S36, 9½N, 8E **Coordinates:** 34° 04' 32"; 111° 24' 02"

Geologic Unit: Deadman quartzite and grit

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY :
Between North Peak Trail and 6215' hill, the top of the Deadman quartzite is a brownish maroon quartzite, abundantly ripple marked, which contains layers of interformational rip-up conglomerate whereby shaly hematite parts of the lower Deadman unit have been included in the upper quartzites as sparse, 1-3cm-size hematitic slate chips. Also throughout the medium-to coarse-grained, cross-bedded quartzite, there are very characteristic and abundant, sparse pebble to granule conglomerate, which, like the shaly rip-up layers, are relatively uniform across their outcrop extent.

Variability:

Sedimentary Structures:
Oscillation ripple marks, planar cross bedding.

Depositional Environment:
Planar cross bedding, oscillation ripples and stratigraphic uniformity suggest shallow water, transgressive marine environment.

SAMPLE DESCRIPTION :
The sample is a pale maroon gritty quartzite with bedding planes every 1cm defined by basal hematite concentrations. The coarser grains are mainly chert, and reddish rhyolite or jasper, but the most abundant grains are coarse-sand-size quartz. Dark brownish black, specularitic, flat shaly chips 1 to 4 cm long are concentrated in some layers. More typical Deadman quartzite in this area is thinly layered (1-3mm) dark brownish maroon, hematite-bedded medium-to fine-grained quartzite.

Sampler: P. Anderson **Date:** 13 November 1979

THIN SECTION DESCRIPTION

Site Number: M26 **Sample Number:** 154164 **Code:** D112

Percent Fragments 15% **Percent Matrix:** 82%

Percent Heavies & Mafics: 3% **Stain:** pale maroon hematite

Rock Type: Deadman quartzite **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : **(percentages are based on 100% fragments)**

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
hematitic claystone and siltstone	100%	38 - 3.0 mm	sub-angular	1:6

MATRIX & HEAVIES : **(percentages are based on 100% matrix & heavies)**

Type & color	Percentage	Size range	Description
quartz	84%	1.7 - .02	rounded detrital with overgrowths
chert	3%	1.3 - .13 mm	sub-rounded, hematitic
specularite	1%	1.1 - .7 mm	sub-rounded detrital
specularite	2%	powdery	intergranular network
hematite	2%	powdery	opaque interstitial fillings and stain
hematitic claystone	2%	3.0 - 2.1 mm	sub-angular
sericite-clay	5%	<.03 mm	recrystallized interstitial masses
feldspar	1%	1.3 - .08 mm	perthitic, altered to clay and hematite
zircon	<1%	.09 - .05 mm	rounded detrital

Cement: Hematite, recrystallized quartz, clay and sericite.

Interstitials: Recrystallized quartz, hematite, specularite, sericite.

Textures and recrystallization: Quartz is abundantly polygonized, sutured and interconnected by overgrowths of recrystallized quartz where interstitial matrix material is lacking, but primary rounded detrital texture is preserved where there is matrix sericite and hematite.

Structures: Alternating layers of fine-grained specularite-hematite-rich quartz, coarser grained quartz with interstitial sericite-clay, and coarser grained interlocking quartz without interstitials define bedding parallel to alignment of hematitic claystone fragments.

Comments on Genesis: Matrix is typically more clay-rich, impure and more poorly sorted than Mazatzal quartzites.

Rock Name: Hematitic claystone conglomerate.

SITE AND SAMPLE DESCRIPTION

Site Number: M 27 **Sample Number:** 154165 **Code:** M 111

Location: Mineral Creek **Scintillometer Counts:** 65 cps

Quadrangle: North Peak **U Value (U by NT) ppm :** 2.00

Sec., Twp, Ra.: S31, 9½N, 9E **Coordinates:** 34° 09' 58"; 111° 28' 52"

Geologic Unit: Mazatzal quartz-jasper-chert grit

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY :
A faulted knob of Mazatzal quartzite overlying Maverick shale, contains clean, well-sorted, poorly bedded, maroon quartzite, fine-grained quartz-jasper-chert grit to coarse-grained quartzite, brick red to maroon, poorly bedded but well cross-bedded quartzite and grit, the coarser parts of which were collectively sampled. The lower 70m of section is the more brick red, better bedded and cross-bedded units, the middle 100m is thinly and poorly bedded, poorly cross-bedded and somewhat massive fine-to medium-grained quartzite, and the upper 60m is white to pink well-bedded and cross-bedded quartzite.

Variability:

Sedimentary Structures:
Cross bedding generally small or mini-trough style as opposed to planar cross beds in Deadman.

Depositional Environment:
Moderate energy, fairly shallow water marine or fluvial

SAMPLE DESCRIPTION :
Grit to granule conglomerate layers 1 to 20cm thick occur in pale maroon to reddish brown quartzite. The grit is made up dominantly of white subangular quartz grains, red and pink chert fragments (up to 10mm), sparse jasper and occasional specularite clasts. Reddish brown hematite is dispersed throughout the matrix as interstitial cement.

Sampler: P. Anderson **Date:** 13 November 1979

THIN SECTION DESCRIPTION

Site Number: M27 **Sample Number:** 154165 **Code:** M111

Percent Fragments: 15% **Percent Matrix:** 76%

Percent Heavies & Mafics: 9% **Stain:** hematite

Rock Type: Mazatzal grit **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : **(percentages are based on 100% fragments)**

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	53%	5.0 - 2.0 mm	sub-rounded	1:1.5
chert	29%	3.0 - 2.0 mm	rounded	1:1.5
jasper	18%	4.3 - 2.0 mm	sub-rounded	1:1.5

MATRIX & HEAVIES : **(percentages are based on 100% matrix & heavies)**

Type & color	Percentage	Size range	Description
quartz	74%	2.0 - .045 mm	sub-rounded and recrystallized
chert	10%	2.0 - .17 mm	sub-rounded
jasper	3%	2.0 - .2 mm	sub-rounded
specularite	3%	<.01 mm	recrystallized masses with hematite
hematite	6%	powdery	fine interstitial grains
specularite	4%	2.0 - 0.5 mm	concentrations of originally detrital grains

Cement: Mainly recrystallized specularite and hematite; also minor recrystallized quartz.
Interstitials: Specularite and hematite, minor clay and chalcedonic fillings.

Textures and recrystallization: Quartz grains show slight undulatory extinction. Some are sutured and composite; some primary detrital grain shapes are preserved.

Structures: Bedding is well defined by lenses of specularite-rich quartz-jasper-chert grit 3 to 10 mm wide interspersed with 5 to 20 mm wide layers of quartzite, indicating cross-bedding structures.

Comments on Genesis: Detrital specularite is concentrated with coarser quartz grit in cross beds indicating higher energy conditions favor its deposition. Matrix is very clean suggesting wave action.

Rock Name: Pink to pale maroon, cross-bedded, specularitic quartz-jasper-chert grit and quartzite.

SITE AND SAMPLE DESCRIPTION

Site Number: M 28 **Sample Number:** 154166 **Code:** D 211

Location: Mineral Creek **Scintillometer Counts:** 65 cps

Quadrangle: North Peak **U Value (U by NT) ppm :** 4.30

Sec., Twp, Ra.: S30, 9½N, 9E **Coordinates:** 34° 10' 25"; 111° 28' 35"

Geologic Unit: grit and quartzite in Deadman unit

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY :
Steeply dipping Deadman quartzite contains no conglomerate, only grit to coarse-grained quartzite. The top 30m of the quartzite is pure white, but the bottom 30m is dark maroon to black and quite specularitic. Not only does hematite content of the quartzite decrease up section, but also amount of coarse material, scintillometer counts, purple shaly interbeds and specularite + hematite content all decrease to the west.

Variability:
Lateral and vertical variations represent facies change away from main central channel (conglomerate zone) area.

Sedimentary Structures:
Specularite concentrations well displayed on cross beds.

Depositional Environment:
Shallow-water marine transgressive sequence; possibly deltaic or fluvial channel deposit.

SAMPLE DESCRIPTION :
Where fine grained, the quartzite is a very dark maroon to blackish brown color from hematite content; where coarser grained, there are paler maroon quartz-chert grit layers 1 to 5cm thick, interbedded with darker maroon to brownish black specularite-rich quartzite. Much of the grit material is set on forests of cross-bed units.

Sampler: P. Anderson **Date:** 13 November 1979

THIN SECTION DESCRIPTION

Site Number: M28 **Sample Number:** 154166 **Code:** D211

Percent Fragments: 7% **Percent Matrix:** 90%

Percent Heavies & Mafics: 3% **Stain:** black to pale maroon

Rock Type: Deadman grit **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : **(percentages are based on 100% fragments)**

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	94%	4.5 - 2.0 mm	sub-rounded	1:1.5
chert	4%	3.1 - 2.0 mm	sub-rounded	1:1.5
jasper	2%	s.0 mm	sub-angular	1:1.5
quartzite	<1%	2.1 mm	rounded	1:2

MATRIX & HEAVIES : **(percentages are based on 100% matrix & heavies)**

Type & color	Percentage	Size range	Description
quartz	73%	2.0 - .02 mm	rounded grains and recrystallized
chert	5%	2.0 - .5 mm	sub-rounded grains
jasper	2%	2.0 - .7 mm	sub-rounded grains
specularite	7%	.5 - .05 mm	interstitial recrystallized masses
hematite	8%	powdery	opaque interstitials, grains and stain
quartzite	2%	2.0 - .4 mm	rounded grains
clay-sericite	3%	<.13 mm	partly recrystallized
zircon	<1%	.15 - .07 mm	rounded detrital grains

Cement: Recrystallized quartz and clay; locally hematite and specularite.

Interstitials: Recrystallized quartz, specularite, hematite and clay.

Textures and recrystallization: Quartz grains have primary detrital shapes in specularite-rich beds, elsewhere are interlocking, sutured, polygonized, strain twinned and locally have overgrowths.

Structures: Bedding planes are defined by concentrations of hematite and recrystallized specularite; larger quartz grains are also elongate parallel to bedding.

Comments on Genesis: Paucity of jasper, chert, and quartzite, abundance of quartz largely of volcanic origin, silt and clay-rich matrix, as well as dark specularite stain are distinctive of this weakly to moderately recrystallized Deadman quartzite.

Rock Name: Specularite Deadman quartzite to grit.

SITE AND SAMPLE DESCRIPTION

Site Number: M 29 **Sample Number:** 154167 **Code:** M 001

Location: N. Central Mazatzal Peaks **Scintillometer Counts:** ND

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 1.00

Sec., Twp, Ra.: S18, 9N, 9E **Coordinates:** 34° 07' 05"; 111° 28' 18"

Geologic Unit: Upper White Mazatzal quartzite

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY :
In the upper white quartzite unit of the Mazatzal, a traverse just east of 7559' Peak revealed clean, well-bedded, sparse quartz-chert-jasper granule conglomerate to grit. This occurs in sparse 10-100cm interbeds and cross beds in the white quartzite, especially in the lower 100m of the unit.

Variability:
Hematite content is higher in the grit layers than in adjacent quartzite, although is generally low.

Sedimentary Structures:
Upper 100m of quartzite is abundantly trough cross-bedded in criss-crossing fashion.

Depositional Environment:
Well-washed, cleaned and sorted sands imply beach conditions with higher energy conditions needed to bring in hematite.

SAMPLE DESCRIPTION :
An almost pure-white gritty quartzite contains pale pink to red chert (10%) grains up to 4mm long, clear quartz (30%) grains up to 3mm long and sparse gray (chert?) grains in a pure white quartz matrix (60%). The coarser grains are disposed in layers defining either bedding or cross-bedding planes 2cm wide. Finer grained quartzite is devoid of chert, whereas coarser granule conglomerate contains 10-15% red jasper grains 8-4mm long and 2% black chert chips 3mm long.

Sampler: P. Anderson **Date:** 17th November 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 30 **Sample Number:** 154168 **Code:** M 111

Location: N. Central Mazatzal Peaks **Scintillometer Counts:** ND

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 2.50

Sec., Twp, Ra.: S18, 9W, 9E **Coordinates:** 34° 07' 23"; 111° 28' 22"

Geologic Unit: Mazatzal grit and quartzite

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY :
Below 7559' Peak is a good section down through white quartzite into hematitic red quartzite below; the transition is very abrupt, and marked by a concentration of hematite on cross beds and bedding planes for 12cm at the top of the red unit. Hematitic grit and quartz-chert-jasper granule conglomerate layers were collectively sampled. The gritty units are pink to pale maroon to brick red quartzites whereas the top zone where hematite is concentrated is a dark brownish black, laminated, fine-grained quartzite.

Variability:
Grit and granule conglomerate layers are discontinuous and cut off by cross-bed sets.

Sedimentary Structures:
Trough cross bedding, ripple marks. Major bedding planes occur every 4 to 8m.

Depositional Environment:
Shallow water, wave action, probably beach environment rather than fluvial.

SAMPLE DESCRIPTION :
The coarse-grained layers are pink to pale brick-red, sparse grit to granule conglomerates with mainly quartz and chert grains larger than 4mm; jasper tends to be 2-3mm and the matrix is fine-to coarse-grained, well sorted and clean quartz sand. More typical quartzite is a medium-to fine-grained orangy brown quartzite with thin laminae (0.5 to 1.0mm) of brick-red-stained hematite layers. A rock from the upper zone where hematite is concentrated is similar to this but dark brownish black in color from more than 10-15% specularite in the quartzite. The specularite is preferentially concentrated in the finer grained layers.

Sampler: P. Anderson **Date:** 17th November 1979

THIN SECTION DESCRIPTION

Site Number: M30 **Sample Number:** 154168 **Code:** M111

Percent Fragments: 14% **Percent Matrix:** 82%

Percent Heavies & Mafics: 4% **Stain:** Minor hematitic pink

Rock Type: Mazatzal grit **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : **(percentages are based on 100% fragments)**

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	40%	5.5 - 2.0 mm	rounded	1:1.5
chert	5%	3.0 - 2.0 mm	rounded	1:2
jasper	3%	6.5 - 2.0 mm	sub-rounded	1:2
quartzite	2%	5.0 - 3.0 mm	sub-rounded	1:2

MATRIX & HEAVIES : **(percentages are based on 100% matrix & heavies)**

Type & color	Percentage	Size range	Description
quartz	85%	2.0 - .1 mm	rounded, sutured and recrystallized
chert	3%	2.0 - .4 mm	rounded
jasper	1%	2.0 - .8 mm	sub-rounded
clay	6%	<.01 mm	fine crystalline masses
hematite	2%	powdery	interstitial grains and stain
sericite	1%	.23 - .05 mm	recrystallized plates and small masses
specularite	2%	1.0 - 0.1 mm	mainly altered to hematite

Cement: Mainly recrystallized quartz, clay, minor hematite and sericite

Interstitials: Clay, specularite, recrystallized quartz, hematite and sericite.

Textures and recrystallization: Quartz is polygonized, recrystallized and sutured in part, but elsewhere, interstitial heavies preserve primary detrital quartz grain shapes; quartzite fragments are unfoliated mosaics; most grain boundaries are interpenetrating.
Structures: Slight elongation of larger fragments and specularite plus clay interstitial concentrations are parallel to bedding.

Comments on Genesis: Relatively mature, well sorted and rounded quartz-rich sediment, either a beach or aeolian sand.

Rock Name: Pink quartz-rich grit to sparse granule conglomerate.

SITE AND SAMPLE DESCRIPTION

Site Number: M 31 **Sample Number:** 154169 **Code:** M 102

Location: Central Peak Ridge **Scintillometer Counts:** ND

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 2.00

Sec., Twp, Ra.: S19, 9N, 9E **Coordinates:** 34° 06' 44"; 111° 28' 15"

Geologic Unit: Jasper-quartz-chert pebble to granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY :
On 7571' peak a thrust fault has brought up lower conglomeratic parts of the Mazatzal quartzite to be exposed at high elevations. Here the rock is a striking jasper-quartz-chert pebble conglomerate with grains averaging 8-10mm, but with some up to 25mm. The rock is moderately well bedded, with some cross-bedded specularite or hematitic beds beneath it.

Variability:
Pebbles constant in size, but types vary to dark red volcanic and dark green volcanics locally. Conglomerate layer is persistent along strike.

Sedimentary Structures:
Some grading, cross bedding and lodes are seen.

Depositional Environment:
Higher energy, shallow water, probably part of transgressive marine sequence in a beach environment.

SAMPLE DESCRIPTION :
Conglomerate is brick red in color and consists of about 40% fragments, dominantly bright red jasper, dark red chert, and darker red to greenish-black volcanics from 50 to 15mm long. White quartz grains represent a smaller sized population from 10 to 2mm long and gradational down to matrix material. The matrix is composed of quartz, chert, jasper and a significant (5%) argillaceous component.

Sampler: P. Anderson **Date:** 17 November 1979

THIN SECTION DESCRIPTION

Site Number: M31 **Sample Number:** 154169 **Code:** M102

Percent Fragments: 38% **Percent Matrix:** 58%

Percent Heavies & Mafics: 4% **Stain:** brick red hematitic

Rock Type: Mazatzal conglomerate **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : **(percentages are based on 100% fragments)**

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
jasper	45%	10 - 2.0 mm	rounded	1:1.5
chert	17%	8.0 - 2.0 mm	rounded	1:1.5
quartz	32%	4.5 - 2.0 mm	rounded	1:1.5
quartzite	1%	5.0 mm	rounded	1:1
rhyolite	4%	8.0 - 3.0 mm	sub-rounded	1:1.5

(both hematitic and sericitic rhyolite types.)

MATRIX & HEAVIES : **(percentages are based on 100% matrix & heavies)**

Type & color	Percentage	Size range	Description
quartz	70%	2.0 - .08 mm	subangular detrital grains
jasper	9%	2.0 - .4 mm	sub-rounded
chert	8%	2.0 - .38 mm	rounded
specularite	3%	.28 - .08 mm	rounded detrital grains
hematite	3%	powdery	finely crystalline interstitials
zircon	<1%	.4 - .092 mm	well-rounded detrital grains
ilmenite	<1%	.2 - .13 mm	well-rounded detrital grains
clay	4%	<.005 mm	interstitial fillings
quartzite	3%	1.5 - 0.5 mm	recrystallized quartzite and siltstone

Cement: Mainly hematite, also recrystallized quartz and clay.

Interstitials: Fine grained recrystallized quartz, clay, hematite and specularite.

Textures and recrystallization: Larger quartz grains show undulose and strain twinning; matrix grains show primary detrital shapes but are internally recrystallized; matrix quartz is tightly packed and filled by interstitial specularite, hematite and clay.

Structures: Rhyolite fragments show spherulitic or foliated texture, jasper fragments are well bedded, but rock bedding is only crudely defined by fragment concentration.

Comments on Genesis: High energy environment; jasper-rich source area with minor rhyolite; well sorted and a concentration of heavy minerals is present with coarse fragments.

Rock Name: Red jasper-chert granule conglomerate.

SITE AND SAMPLE DESCRIPTION

Site Number: M 32 **Sample Number:** 154170 **Code:** M 001

Location: Central Peaks ridge **Scintillometer Counts:** 68 cps

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 1.1

Sec., Twp, Ra.: S20, 9N, 9E **Coordinates:** 34°05'57"; 111°27'16"

Geologic Unit: Mazatzal grit

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : The quartzite at this location is white to light pink in color and fine- to medium-grained. It is generally well sorted, and composed almost wholly of quartz, with the exception of the conglomerate layers containing chert and jasper near the base of the section. Concentration appears to increase from the base of the section toward the top. Several dark, earthy red layers of fine-grained quartzite containing specularite are interbedded at the base of the section.

Variability: Most grains throughout the section are composed of quartz except in the grit layers where chert and jasper are also present in minor amounts.

Sedimentary Structures: Abundant planar cross-beds averaging 2-6cm in thickness are present.

Depositional Environment: Possibly near-shore marine, shallow water as indicated by grain size, sorting, and cross-bedding.

SAMPLE DESCRIPTION : The rock is dominantly a grit of well-packed quartz grains interbedded with finer grained grit to quartzite layers. The matrix consists of mostly quartz grains which are not well cemented. Interstitial spaces contain a white powdery substance, probably clay. No hematite or detrital heavies are visible. Conglomerate fragments range from 6 to 1mm in length and show good graded bedding. Quartz and minor amounts of jasper make up the bulk of the fragments and are well rounded and spherical in shape. Within the conglomerate layers, the matrix to fragment ratio is 1:5. Matrix rich layers contain only about 5% fragments.

Sampler: K. Wirth **Date:** 17 November 1979

THIN SECTION DESCRIPTION

Site Number: M32 **Sample Number:** 154170 **Code:** M001

Percent Fragments: 65% **Percent Matrix:** 35%

Percent Heavies & Mafics: <1% **Stain:** none

Rock Type: Mazatzal grit **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : **(percentages are based on 100% fragments)**

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	75%	4.5 - 2.0 mm	sub-rounded	1:1.5
chert	16%	3.3 - 2.0 mm	sub-rounded	1:2
quartzite	8%	3.0 - 2.0 mm	sub-rounded	1:2
jasper	1%	3.2 - 2.0 mm	sub-angular	1:1.5

MATRIX & HEAVIES : **(percentages are based on 100% matrix & heavies)**

Type & color	Percentage	Size range	Description
quartz	74%	2.0 - .02 mm	sub-rounded, sutured and recrystallized
chert	10%	2.0 - .09 mm	sub-rounded
jasper	5%	2.0 - .13 mm	sub-rounded
quartzite	7%	2.0 - .17 mm	rounded detrital grains
clay	3%	<.005 mm	finely crystalline interstitials
sericite	<1%	.17 mm	recrystallized plates
hematite	<1%	powdery	interstitial

Cement: Clay and silica fills interstitial cavities between grains.

Interstitials: Recrystallized quartz, clay, sericite.

Textures and recrystallization: Quartz grains are sutured and interpenetrating, show undulose extinction, a poorly defined foliation and are composite; most grains are recrystallized and sutured; clay and cryptocrystalline silica fill primary interstitial cavities between larger grains.

Structures: Bedding is defined by 15-25 mm-thick layers of fine-grained quartz alternating with layers of quartz-rich grit. Foliation of quartz grains is more or less parallel to bedding.

Comments on Genesis: Although sand and grit material is very well sorted and mature it is not well rounded, but much of the angularity could be due to deformation. Primary open cavities filled by clay suggest sand and grit is partly of eolian origin.

Rock Name: Recrystallized quartz-rich white grit to quartzite.

SITE AND SAMPLE DESCRIPTION

Site Number: M 33 **Sample Number:** 154171 **Code:** M 002

Location: Central Peaks Ridge **Scintillometer Counts:** 62 cps

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 0.60

Sec., Twp, Ra.: S20, 9N, 9E **Coordinates:** 34°06'22"; 111°27'43"

Geologic Unit: Mazatzal granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : The site geology here is similar to that described in the site M 32 description. Conglomerates were sampled from a 20cm thick layer which lenses out laterally. The quartzites are generally very evenly bedded and cross-bedded in 4-8cm-thick sets.

Variability: Quartzites in this section are darker in color than those described in site M 32.

Sedimentary Structures: Planar cross-beds average 4-8cm thick and occasionally contain grit.

Depositional Environment: Near-shore marine, shallow water conditions indicated by the sorting and roundness of grains, grain size and cross-bedding.

SAMPLE DESCRIPTION : This sample is similar to the sample taken at site M 32. White, fine-grained quartz supports rounded grit-size quartz in a ratio of 3:1. The finer grained quartzite layers consist mainly of quartz, sometimes locally stained by red hematite. Conglomerate fragments average 3.5-7.0mm, are rounded and spherical and are mainly quartz with lesser jasper and chert. Detrital specularite was not observed, but hematite is present in some beds and clots.

Sampler: K. Wirth **Date:** 17 November 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 34 **Sample Number:** 154172 **Code:** M 102

Location: Central Peaks ridge **Scintillometer Counts:** 68 cps

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 2.2

Sec., Twp, Ra.: S19, 9N, 9E Coordinates: 34°06'37"; 111°28'10"

Geologic Unit: Mazatzal granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : This section is a continuation of the one described in site M 33. The quartzite is generally well-cemented and sorted, evenly bedded in 3-4cm thick sets, and contains sparse layers of grit. Near the top of the section grain size decreases and the rocks become dark earthy red. At the top of the section is the granule conglomerate described below.

Variability: Quartzite and matrix grains show a general decrease in size up section. Hematite and specularite both increase up section.

Sedimentary Structures: Planar cross-beds are abundant and occur in evenly bedded sets of 2-4cm thick. Elongate fragments show sub-parallel alignment.

Depositional Environment: Probably a near-shore marine environment.

SAMPLE DESCRIPTION : The rock is a striking conglomerate of bright red jasper and red to black chert fragments packed into a pink quartz-rich matrix. The coarse-grained grit-size matrix involves abundant white quartz grains with lesser amounts of chert and jasper. Detrital specularite and hematite are evenly distributed throughout the sample. Conglomerate fragments, 2-18mm long, but averaging 5-14mm, are well-packed, elongate to sub-rounded pink, red and black chert, red jasper, minor white quartz and uncommon dark red to pink rhyolite.

Sampler: K. Wirth **Date:** 17 November 1979

THIN SECTION DESCRIPTION

Site Number: M34 **Sample Number:** 154172 **Code:** M102

Percent Fragments: 50% **Percent Matrix:** 47%

Percent Heavies & Mafics: 3% **Stain:** pale pink hematite

Rock Type: Mazatzal conglomerate **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : **(percentages are based on 100% fragments)**

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
jasper	40%	15.0 - 2.0 mm	sub-rounded	1:2
quartzite	12%	13.0 - 2.0 mm	rounded	1:1.5
quartz	8%	5.0 - 2.0 mm	rounded	1:1.5
chert	15%	5.0 - 2.0 mm	rounded	1:2
rhyolite	25%	8.0 - 2.0 mm	sub-rounded	1:1.5

(highly hematitic and contains embayed rectangular quartz phenocrysts)

MATRIX & HEAVIES : **(percentages are based on 100% matrix & heavies)**

Type & color	Percentage	Size range	Description
quartz	70%	2.0 - .02 mm	polygonized, with deformation lamellae
jasper	9%	2.0 - .14 mm	banded to "spherulitic"
chert	9%	2.0 - .11 mm	internally recrystallized
quartzite	2%	2.0 - .35 mm	rounded
hematite	2%	powdery	interstitial fillings
specularite	2%	.1 - .04 mm	rounded detrital grains
zircon	<1%	.19 - .02 mm	rounded detrital grains
chalcedony	1%	radial crystals	growths in cavities
rhyolite	3%	2.0 - .2 mm	sericite altered
clay	1%	--	interstitial fillings

Cement: Mainly recrystallized quartz, minor hematite

Interstitials: Shredded and recrystallized quartz, hematite

Textures and recrystallization: Larger chert and quartz grains internally recrystallized, jasper and rhyolite unaffected; matrix quartz shows mostly detrital rounded shapes, some recrystallized and sutured; hematite patches show interstitial texture.

Structures: Detrital specularite and hematite concentrated in matrix to crudely define bedding; no alignment of larger fragments; several fracture lines cut the rock.

Comments on Genesis: Both hematitic fragments and much of the matrix quartz is of volcanic origin; source terrain involves rhyolite, chert, jasper, specularite and quartzite and depositional environment is high energy marine with bimodal grain size population.

Rock Name: Jasper-rhyolite-chert pebbel conglomerate.

SITE AND SAMPLE DESCRIPTION

Site Number: M 35 **Sample Number:** 154173 **Code:** M 101

Location: Divide S. of North Peak **Scintillometer Counts:** ND

Quadrangle: North Peak **U Value (U by NT) ppm :** 0.70

Sec., Twp, Ra.: S7, 9N, 9E **Coordinates:** 34° 08' 14"; 111° 28' 23"

Geologic Unit: Mazatzal grit and quartzite

Stratigraphic Group: Mazatzal group

SITE GEOLOGY :
From divide south of North Peak down the ridge to the east, a section through the middle strata of the Mazatzal quartzite is obtained. The quartzite is typically pale pink to red, well-bedded and cross-bedded, well-laminated, somewhat sandy-appearing, and shows darker patches and layers of dark purple stain from hematite weathering out of detrital specularite patches. Most of the rock is pale pink to red quartzite with some darker specularite-rich layers. Gritty layers are just a coarser grained equivalent of the quartzite and contain quartz, jasper and chert fragments.

Variability:

Sedimentary Structures:
Mini-trough cross bedding, specularite bedding and cross bedding.

Depositional Environment:
Shallow water, marine, probably close to wave action

SAMPLE DESCRIPTION :
Quartz and jasper grit with some larger (5-8mm) chert grains are disposed as 1-3cm-thick beds or 1-0.5cm-thick layers on cross beds in a coarse-grained, relatively clean-matrix quartzite. The finer grained quartzite is stained from the normal pinkish cast to a dark purple color by hematite weathering from specularite concentrations. The specularite occurs in discreet patches as if there were pieces of a lower quartzite unit that was ripped up and incorporated into this rock.

Sampler: P. Anderson **Date:** 18 November 1979

THIN SECTION DESCRIPTION

Site Number: M35 **Sample Number:** 154173 **Code:** M101

Percent Fragments: 17% **Percent Matrix:** 81%

Percent Heavies & Mafics: 2% **Stain:** pale pink hematite

Rock Type: Mazatzal grit **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : **(percentages are based on 100% fragments)**

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	80%	5.3 - 2.0 mm	rounded	1:1.5
quartzite	11%	5.1 - 2.8 mm	rounded	1:1.5
jasper	2%	3.2 - 2.0 mm	sub-rounded	1:1.5
chert	7%	3.0 - 2.0 mm	rounded	1:1.5

MATRIX & HEAVIES : **(percentages are based on 100% matrix & heavies)**

Type & color	Percentage	Size range	Description
quartz	83%	2.0 - .035 mm	rounded
chert	5%	2.0 - .2 mm	rounded
jasper	3%	2.0 - .34 mm	rounded
specularite	4%	.4 - .02 mm	rounded detrital grains
hematite	2%	powdery	large interstitial patches
leucoxene	1%	.2 - .005 mm	crystalline plates and powder
clay-rich material	<1%	2.0 mm	altered feldspar or rhyolite
quartzite	2%	1.3 - .7 mm	rounded detrital grains
zircon	<1%	.08 mm	rounded detrital grains

Cement: Mostly hematite and minor recrystallized quartz.

Interstitials: Hematite, recrystallized quartz, minor leucoxene.

Textures and recrystallization: Quartz grains show deformation twin lamellae, are internally polygonized, but retain primary rounded detrital shapes; matrix quartz is sutured locally with interstitial hematitic powder outlining primary grain boundaries; rock is about 10-15% recrystallized.

Structures: Differing grain size and densities define 3-4 cm-thick bedding units.

Comments on Genesis: Moderately well sorted, relatively mature quartz-rich grit and sand with some interstitial clay material suggests marine depositional environment.

Rock Name: Slightly recrystallized quartz-rich grit and quartzite.

SITE AND SAMPLE DESCRIPTION

Site Number: M 36 **Sample Number:** 154174 **Code:** M 001

Location: Divide S. of North Peak **Scintillometer Counts:** ND

Quadrangle: North Peak **U Value (U by NT) ppm :** 0.70

Sec., Twp, Ra.: S7, 9N, 9E **Coordinates:** 34° 08' 18"; 111° 28'30 "

Geologic Unit: Mazatzal grit

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY :
Over a 130m stratigraphic interval, upper pink quartzite grades upwards into white quartzite. Over this zone the lowest grits are pale pink, with 30% quartz and 5% jasper grains, the upper ones are white quartz (15% coarse grains) grit, and the top-most grits are much sparser with the same 2-5mm-size grit grains. The upper white quartz grits are collectively sampled over a 200m section (about 50m stratigraphic).

Variability:
Pebbles get sparser up section

Sedimentary Structures:
Cross bedding, ripple marks

Depositional Environment:
Shallow water, marine, close to wave action - probably near beach conditions.

SAMPLE DESCRIPTION :
A pale pink to white grit of packed 1-4mm-size quartz grains, occasional 2-5mm chert grains and rare jasper, contains little to no fine matrix quartz such that the interstitial material between quartz grains is a whitish-yellow clay.

Sampler: P. Anderson **Date:** 18 November 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M37 **Sample Number:** 154175 **Code:** M 002

Location: Divide S. of North Peak **Scintillometer Counts:** ND

Quadrangle: North Peak **U Value (U by NT) ppm :** 0.80

Sec., Twp, Ra.: S7, 9N, 9E **Coordinates:** 34° 08' 22"; 111° 28' 43"

Geologic Unit: Upper White Mazatzal granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Above the transition zone, into the white quartzites proper, there is an increase in the amount of grit and coarser material forming granule conglomerates. The most abundant granule type is quartz, but the largest is a pale pink to rose-colored quartzite granule, probably from underlying Mazatzal strata. The conglomerate lies in the lower 80m of this unit as 1-2m-thick beds in mainly coarse-grained white quartzite. The conglomerate beds thin upwards to 15cm in medium-grained quartzite, until finally all of the section is fine-to medium-to corase-grained quartzite with only rare grit and granule conglomerate.

Variability:

Sedimentary Structures:
Trough cross bedding, planar cross bedding, some ripple marks

Depositional Environment:
Shallow water marine, probably near shore beach environment.

SAMPLE DESCRIPTION :
A dominantly white grit contains seriate sizes of quartz from fine matrix material up to 3 to 5mm. Little argillaceous material is present and few other fragments but quartz are seen. In one layer there is a 15mm long subangular grain of pink to rose quartzite, 5 to 10mm rounded quartz grains and subrounded chert. Characteristically the matrix breaks around the edges of the fragments.

Sampler: P. Anderson **Date:** 18 November 1979

THIN SECTION DESCRIPTION

Site Number: M37 **Sample Number:** 154175 **Code:** M001

Percent Fragments: 7% **Percent Matrix:** 93%

Percent Heavies & Mafics: <1% **Stain:** none

Rock Type: Mazatzal grit **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : **(percentages are based on 100% fragments)**

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	75%	5.2 - 2.0 mm	sub-rounded	1:1.5
quartzite	10%	3.3 - 2.0 mm	rounded	1:1.5
chert	15%	2.8 - 2.0 mm	sub-angular	1:2

MATRIX & HEAVIES : **(percentages are based on 100% matrix & heavies)**

Type & color	Percentage	Size range	Description
quartz	85%	2.0 - .02 mm	sutured, shredded, recrystallized
quartzite	5%	2.0 - .25 mm	sub-rounded
chert	6%	2.0 - .22 mm	sub-rounded
hematite	<1%	<.005 mm	fine interstitial grains
leucoxene	<1%	<.01 mm	alteration powder
sericite	3%	<.13 mm	recrystallized plates and masses
clay	<1%	--	interstitial fillings

Cement: Mostly recrystallized quartz, minor hematite and sericite.

Interstitials: Shredded and recrystallized quartz, hematite, sericite, leucoxene.

Textures and recrystallization: Most quartz grains show moderate to strong undulose extinction and grain-boundary suturing. Some quartz grains are polygonized or have deformation twin lamellae; shredded and recrystallized quartz in the matrix; rock texture is about 35% recrystallized.
Structures: Bedding is weakly defined by differing grain sizes and densities, particularly of the larger grit grains.

Comments on Genesis: Pure and mature quartz-rich sediment, possibly in part wind-blown, but deformation is too strong here to detect any primary porosity.

Rock Name: Recrystallized white quartz-rich grit.

SITE AND SAMPLE DESCRIPTION

Site Number: M 38 **Sample Number:** 154176 **Code:** M 101

Location: N. North Peak Ridge **Scintillometer Counts:** 68 cps

Quadrangle: North Peak **U Value (U by NT) ppm :** 0.90

Sec., Twp, Ra.: S6, 9N, 9E **Coordinates:** 34°09'15"; 111°28'28"

Geologic Unit: Mazatzal grit

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : This section is located below the red-white quartzite contact in the upper part of the Mazatzal quartzite. Most of the section is composed of well-rounded and sorted, fine- to medium-grained and nearly pure maroon quartzite. Occasional small lenses of grit are present. Heavy mineral concentrates are absent.

Variability: The only change, recognizable in hand sample, throughout the section is color. The base of the section is red to maroon and grades into light pink and white, sometimes with a yellow stain.

Sedimentary Structures: Poorly defined planar cross-beds sometimes containing grit.

Depositional Environment: Relatively stable energy conditions, shallow water, possibly near-shore marine environment.

SAMPLE DESCRIPTION : The rock is dominantly a grit to fine-granule framework-supported conglomerate with about 30% quartz matrix grains separated by interstitial fillings of hematite. Grit, measuring 1.5-4mm in length, is composed of mostly quartz and minor amounts of jasper and chert. Most fragments are well rounded and nearly spherical in shape. Conglomerate fragments are fairly evenly distributed throughout, and the matrix has a uniform pale maroon stain from the interstitial hematite content.

Sampler: K. Wirth **Date:** 18 November 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 39 **Sample Number:** 154177 **Code:** M 002

Location: North Peak **Scintillometer Counts:** 68 cps

Quadrangle: North Peak **U Value (U by NT) ppm :** 1.0

Sec., Twp, Ra.: S6, 9N, 9E **Coordinates:** 34°09'07"; 111°28'34"

Geologic Unit: Mazatzal granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : This section lies above the red-white quartzite contact and is stratigraphically above site M 38. Except for their white color, the quartzites at this site are similar to those at the previous site. Layers of grit and granule conglomerate are slightly more abundant, and generally coarser grained as the sample indicates.

Variability: Grit and granule conglomerate layers are more continuous in the white units.

Sedimentary Structures: Good bedding and local cross-bedding is present.

Depositional Environment: Possibly a near-shore marine, shallow water environment of deposition.

SAMPLE DESCRIPTION : A white, coarse-grained quartzite matrix supports 25% sub-rounded granules of quartz, chert, and red jasper. The well-sorted matrix of fine grit to coarse-grained quartzite is composed of mostly quartz and lesser amounts of chert. Detrital specularite and hematite are absent. Granules, averaging 7-10mm in length, are composed of mostly quartz, some grey and red chert, minor pink quartzite and red jasper. Fragments are sub-rounded, elongate and some show sub-parallel alignment.

Sampler: K. Wirth **Date:** 18 November 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 40 **Sample Number:** 154178 **Code:** M 101

Location: Ridge S. of North Peak **Scintillometer Counts:** MD

Quadrangle: North Peak **U Value (U by NT) ppm :** 5.00

Sec., Twp, Ra.: S18, 9N, 9E **Coordinates:** 34° 07' 36"; 111° 28' 48"

Geologic Unit: Mazatzal White Grit

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : On hill 7388', most outcrop is a white fine to coarse grained, cross-bedded quartzite, relatively clean, with grain size alternating by beds, and good sorting within beds. A few rare jasper clasts are found in coarser layers. Some hematite staining is visible with the hand lens. Sericitic, maroon hematitic siltstone beds contain conglomerate and grit layers 2-10cm thick. Enough grit is found in the siltstone for a sample. Most grains in the grit are quartz with 5% jasper and rhyolite (chert?) fragments

Variability:

Sedimentary Structures:
Abundant cross bedding, but no mud cracks or ripple marks

Depositional Environment:
Alternating energy conditions in a shallow water environment

SAMPLE DESCRIPTION : (by P.A.)
The rock is a non-hematitic, fine-grained, well-sorted grit of dominantly (85%) 1-3mm quartz grains, lesser (14%) 2-4mm pink to rose chert grains, and rare (1%) 2mm jasper grains. Matrix is mainly fine grained quartz rather than clay, and hematitic shaly partings are evident at the top of the grit bed.

Sampler: J. Trembly **Date:** 18 November 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 41 **Sample Number:** 154179 **Code:** M 101

Location: Ridge S. of North Peak **Scintillometer Counts:** ND

Quadrangle: North Peak **U Value (U by NT) ppm :** 0.76

Sec., Twp, Ra.: S7, 9N, 9E **Coordinates:** 34° 07' 41"' 111° 28' 22"

Geologic Unit: Mazatzal grit

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Uphill from previous sample is a grit conglomerate with both light hematite and dark maroon hematite staining in bands through the rock. This is interlayered with fine-grained maroon quartzite. Clasts in the grit are composed of quartz, jasper, dark and pink chert. Some grains are mostly specularite. Sorting is poor in the grit and fair in the finer layers.

Variability: The rock has a very mottled appearance

Sedimentary Structures: Cross beds are present, but no ripple marks or mud cracks.

Depositional Environment: Fairly shallow water, probably marine or intertidal

SAMPLE DESCRIPTION : (by P.A.)
The rock is well bedded on the scale of 2 cm and consisting of pale pink to orange coarse-grit to granule-conglomerate layers of mainly quartz and chert, interbedded with fine grit to coarse sand-size layers of mainly quartz and detrital specularite

Sampler: J. Trembly **Date:** 18 November 1979

THIN SECTION DESCRIPTION

Site Number: M41 **Sample Number:** 154179 **Code:** M101

Percent Fragments: 42% **Percent Matrix:** 53%

Percent Heavies & Mafics: 5% **Stain:** patchy maroon hematite

Rock Type: Mazatzal grit **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : **(percentages are based on 100% fragments)**

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	82%	4.3 - 2.0 mm	rounded	1:1.5
jasper	3%	3.5 - 2.0 mm	sub-rounded	1:3
quartzite	15%	2.8 - 2.0 mm	rounded	1:1.5

MATRIX & HEAVIES : **(percentages are based on 100% matrix & heavies)**

Type & color	Percentage	Size range	Description
quartz	81%	2.0 - .02 mm	sutured and recrystallized
jasper	1%	1.3 mm	sub-rounded detrital grains
quartzite	6%	2.0 - .6 mm	rounded
specularite	8%	<.01 mm	recrystallized masses with hematite
hematite	4%	<.01 mm	fine interstitial grains
sericite	<1%	<.17 mm	recrystallized plates and masses

Cement: Mostly recrystallized quartz throughout; recrystallized specularite and hematite in some layers.
Interstitials: Shredded, recrystallized quartz; sericite, hematite, recrystallized specularite.
Textures and recrystallization: Quartz grains are internally recrystallized with prominent deformation lamellae; grain boundaries are mostly sutured and interpenetrating except where matrix hematite preserves primary grain shapes.

Structures: Rock has an incipient foliation with several strain-slip lines of recrystallized quartz developed oblique to the prominent 2 to 4 cm thick beds that are defined by hematite concentrations and grain-size differences.

Comments on Genesis: Although about 35% recrystallized and deformed, the rock was clearly a moderately sorted quartz-rich grit with abundant specularite and hematite concentrated in some layers.

Rock Name: Maroon recrystallized quartz-rich grit.

SITE AND SAMPLE DESCRIPTION

Site Number: M 42 **Sample Number:** 154180 **Code:** M 102

Location: Mazatzal Peak **Scintillometer Counts:** ND

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 1.60

Sec., Twp, Ra.: S6, 8N, 9E **Coordinates:** 34° 04' 12"' 111° 28' 08"

Geologic Unit: lower hematitic Mazatzal granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : On the N.W. ridge of Mazatzal Peak, there are series of 0.2 - 1-2m-thick layers of granule conglomerate containing 5-20mm jasper, quartz, red chert and pink quartzite grains in a strongly hematitic brick-red matrix. Most of the enclosing material is brick red to dark maroon, cross-bedded, planar cross-bedded, graded quartzites with conglomerate concentrated into the base of the cross-bedded units.

Variability: Bed thickness, type of conglomerate fragments and sorting highly variable up section

Sedimentary Structures: Abundant trough cross beds, planar cross beds and ripple marks

Depositional Environment: High energy, shallow-water marine with abundant winnowing action as in a beach environment

SAMPLE DESCRIPTION : Brick-red granule conglomerate consists of tightly packed quartz, jasper, chert, rhyolite and specularite fragments 2-14mm in size in a matrix of impure sandy, silty and hematitic clayey material. The finer grained sample has a seriate grain size distribution from 6 to 0.2mm whereas the coarser grained conglomerate has a distinctly bimodal distribution with dark specularitic jasper, dark red rhyolite, lesser chert and quartz comprising the coarser grains, and fine sand, silt, hematite and clay making up the matrix.

Sampler: P. Anderson **Date:** 19 November 1979

THIN SECTION DESCRIPTION

Site Number: M42 Sample Number: 154180 Code: M102

Percent Fragments: 35% Percent Matrix: 58%

Percent Heavies & Mafics: 7% Stain: brick red hematite

Rock Type: Mazatzal conglomerate Stratigraphic Group: Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	15%	3.8 - 2.0 mm	rounded	1:1.5
jasper	32%	9.0 - 2.0 mm	sub-rounded	1:2.5
chert	20%	7.9 - 2.0 mm	sub-rounded	1:2
quartzite	12%	6.3 - 2.0 mm	sub-rounded	1:2
rhyolite	21%	8.7 mm	sub-rounded	1:2

(rhyolite is hematitic red and quartz phenocrystic)

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	39%	2.0 - .005 mm	rounded detrital grains, undulose
jasper	21%	2.0 - .2 mm	sub-rounded
chert	12%	2.0 - .13 mm	sub-rounded
quartzite	6%	2.0 - .33 mm	rounded
specularite	7%	.43 - .08 mm	rounded detrital grains
hematite	5%	powdery	fine interstitial grains and stain
zircon	<1%	.14 - .02 mm	rounded
clay	6%	<.009 mm	interstitial patches
specularite	4%	powdery	recrystallized interstitially

Cement: hematite, recrystallized quartz, clay and specularite.

Interstitials: Specularite, hematite, fine-grained quartz.

Textures and recrystallization: Except for minor internal polygonization and suturing of quartz grains, all primary rock textures are preserved: rounded to subangular grain shapes are outlined by matrix hematite; interstitial cavities are filled with clay, hematite, specularite and fine grained quartz.

Structures: Parallel alignment of elongate fragments defines bedding.

Comments on Genesis: Moderately well sorted and mature conglomerate derived from a rhyolite-quartzite-chert-jasper terrain. Some of the hematite fragments may be hematitic siltstone to claystone; interstitial clay indicates poorer sorting, lower energy than many other conglomerates.

Rock Name: Brick red jasper-hematitic rhyolite granule to pebble conglomerate.

SITE AND SAMPLE DESCRIPTION

Site Number: M 43 **Sample Number:** 154182 **Code:** M 103

Location: Mazatzal Peak **Scintillometer Counts:** ND

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 2.00

Sec., Twp, Ra.: S6, 8N, 9E **Coordinates:** 34°04'10"; 111°28'06"

Geologic Unit: Mazatzal granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : About 100m above M 42 is a sparser matrix-supported granule conglomerate with a paler maroon matrix and sparser and larger fragments. Red jasper is not specularitic as in previous sample; the jasper, red chert, orange quartzite, quartz and dark red rhyolite fragments are up to 2cm long and the matrix is coarse grained sand to grit. This unit was sampled for radiometric comparison to M 42, to see if subtle changes in hematite content and grain size resulted in any drastic difference in radiometric results.

Variability: Variability of pebble size and type is stratigraphically controlled.

Sedimentary Structures: Abundant cross beds, generally trough style but some planar.

Depositional Environment: Relatively shallow water high energy with not a great deal of reworking to preserve the volcanic fragments from the rhyolite source terrain.

SAMPLE DESCRIPTION : Interbedded with maroon quartzite are 2 to 20cm-thick layers of grit and granule conglomerate, with coarser grains aligned along cross-bed planes and lines of specular hematite concentrated along the base of the crossbed sets. The largest grains (10-15mm long) are jasper, dark red rhyolite, red chert, orange quartzite, whereas the smaller grains (4-8mm long) are quartz, dark red and white-altered volcanics and chert. The matrix is clean, well sorted, and quartz rich.

Sampler: P. Anderson **Date:** 19 November, 1979

THIN SECTION DESCRIPTION

Site Number: M43 **Sample Number:** 154182 **Code:** M103

Percent Fragments: 54% **Percent Matrix:** 43%

Percent Heavies & Mafics: 3% **Stain:** pale maroon hematite

Rock Type: Mazatzal conglomerate **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	68%	5.5 - 2.0 mm	rounded	1:1.5
jasper	6%	12.0 - 2.0 mm	sub-rounded	1:2
chert	12%	4.5 - 2.0 mm	sub rounded	1:2
quartzite	2%	2.3 - 2.0 mm	rounded	1:1
rhyolite	8%	4.0 - 2.5 mm	sub-rounded	1:2
hematitic siltstone	2%	5.0 mm	sub-angular	1:1.5

(rhyolite fragments are hematitic, sericitic and quartz phenocrystic).

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	75%	2.0 - .01 mm	rounded, polygonized, recrystallized
jasper	7%	2.0 - .23 mm	sub-rounded
chert	8%	2.0 - .17 mm	sub-rounded
quartzite	5%	2.0 - .27 mm	rounded
specularite	2%	.3 - .08 mm	detrital grains with sutured boundaries
hematite	2%	powdery	interstitial patches
zircon	<1%	.18 - .06 mm	rounded detrital grains
clay	<1%	<.008 mm	recrystallized in masses

Cement: Recrystallized quartz, hematite and clay.

Interstitials: Specularite, hematite, quartz, clay.

Textures and recrystallization: Large rounded grains generally weakly cemented by recrystallized quartz; most quartz strained or weakly recrystallized in some way; primary rounded detrital shapes only apparent for larger grains.

Structures: Bedding structures are not defined in thin section; fracture planes from an interconnected network between larger grains, chalcedony and quartz form cavity fillings.

Comments on Genesis: Farily well sorted, mature quartz-rock fragment conglomerate is fragment packed with little finer grained cementing material. Good sorting and clean matrix is consistent with shallow-water marine depositional environment.

Rock Name: Pale maroon quartz-rock fragment granule conglomerate.

SITE AND SAMPLE DESCRIPTION

Site Number: M 44 **Sample Number:** 154183 **Code:** M 101

Location: Mazatzal Peak **Scintillometer Counts:** ND

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 4.20

Sec., Twp, Ra.: S6, 8W, 9E **Coordinates:** 34°04'09"; 111°27'57"

Geologic Unit: Mazatzal grit

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Above M 42 and M 43 is a thrust which brings the lowermost brick-red Mazatzal quartzite and conglomerate strata high up onto the flank of Mazatzal Peak. The main rock type is a bright brick red, fine-grained quartzite with shaly and silty partings on well-developed bedding planes. In this sequence there are a series of 5-10cm-thick interbeds of jasper-rhyolite-chert-quartz grit which were sampled as representative of the lowermost grit units in this area.

Variability: Proportion of oxidized hematite is invariably high here but grain size alternates rapidly from shale to grit, averaging fine-grained sand size.

Sedimentary Structures: Some planar cross bedding, ripple marks, possibly mud cracks.

Depositional Environment: One of shallow water marine, possibly intertidal to account for fine and coarse material.

SAMPLE DESCRIPTION : The grit sample is an aggregate of fine-grained grit 1 to 3mm in size, consisting of dark red chert and rhyolite, bright red jasper and white quartz in a matrix of strongly hematitic sand grains. Cementation is weak because breakage planes go around the grit grains. Some larger 10-15mm clasts of orangy pink quartzite suggest rip up of earlier quartzite beds during deposition.

Sampler: P. Anderson **Date:** 19 November, 1979

THIN SECTION DESCRIPTION

Site Number: M44 **Sample Number:** 154183 **Code:** M101

Percent Fragments: 48% **Percent Matrix:** 50%

Percent Heavies & Mafics: 2% **Stain:** brick red to pink

Rock Type: Mazatzal grit **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	69%	2.0 - .75 mm	rounded	1:1.5
jasper	18%	2.0 - .75 mm	rounded	1:2
chert	11%	2.0 - .75 mm	rounded	1:2
quartzite	2%	1.1 - .78 mm	rounded	1:1

(many quartz fragments show rounded internal and marginal embayments)

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	85%	.75 - .01 mm	rounded polygonized
jasper	6%	.75 - .90 mm	rounded
chert	3%	.75 - .07 mm	rounded
specularite	3%	.09 - .04 mm	rounded detrital grains
hematite	3%	powdery	interstitial grains and minor stain
clay	<1%	<.008 mm	alteration of grains and interstitial

Cement: Recrystallized quartz, hematite and clay.

Interstitials: Specularite, recrystallized quartz, hematite, clay.

Textures and recrystallization: Quartz grains show slight undulose extinction; grain boundaries are partially sutured; most quartz is internally clear, unpolygonized and of volcanic origin; some acicular hematite needles in quartz grains, very well rounded detrital character of grains in an interstitial quartz-rich matrix is clearly preserved.
Structures: Iron-stained patches containing acicular needles of hematite occur around jasper fragments and specularite-rich parts of the matrix.

Comments on Genesis: Although quartz rich, the grit is derived mainly from a felsic volcanic terrain with jasper and chert probably as reworked components. Recrystallization is slight and the primary rock texture is essentially unaffected.

Rock Name: Red quartz-jasper-chert grit.

SITE AND SAMPLE DESCRIPTION

Site Number: M 45 **Sample Number:** 154184 **Code:** M 102

Location: Mazatzal Peak **Scintillometer Counts:** ND

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 1.60

Sec., Twp, Ra.: S6, 8N, 9E **Coordinates:** 34°04'08"; 111°27'48"

Geologic Unit: middle Mazatzal quartzite and grit

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Above the 80m of bright red quartzite and grit there is a further 100m of dark maroon to purple quartzite rich in jasper-chert-quartz-specularite grit layers 0.3 to 1m thick, possibly stragigraphically equivalent to M 42 but in a separate overlying thrust plate. This dense purple grit and granule conglomerate is overlain by 25m of paler maroon, cross-bedded quartzite with sparser quartz-jasper-chert granule conglomerate, possibly also the stratigraphic equivalent of M 43, but in the upper thrust plate. Both these two units are incorporated into this M 45 sample.

Variability:

Sedimentary Structures: Abundant trough cross bedding, giving way to planar cross bedding up section.

Depositional Environment: Shallow water marine, moderate energy, probably beach deposit; might possibly be fluvial braided network, but not as likely.

SAMPLE DESCRIPTION : A very dark maroon-purple grit grades into black specularite-rich grit at its base where the hematite content is up to 15%. Fragments are 2-10mm, most 6mm, long and consist of abundant dark red chert, rhyolite, black specularitic rhyolite, jasper, gray chert, quartz and red quartzite. The matrix is medium to fine quartz sand, clean of argillaceous material, but the rock is relatively poorly sorted. Specularite is the main interstitial.

Sampler: P. Anderson **Date:** 19 November 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 46 Sample Number: 154186 Code: M 001

Location: Suicide Ridge Scintillometer Counts: 60 cps

Quadrangle: Mazatzal Peak U Value (U by NT) ppm : 0.50

Sec., Twp, Ra.:S32, 9N, 9E Coordinates: 34°04'28"; 111°27'08"

Geologic Unit: Mazatzal grit conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : At this site, the quartzite is relatively poorly cemented and is friable on weathered surfaces. Most grains are rounded and composed of quartz, with minor amounts of jasper and rhyolite present in conglomerate layers. Hematite and heavy minerals are absent so the quartzite is white to tan or grey in color.

Variability: Individual layers are well sorted, but average grain size varies from medium-sand size to grit from one bed to the next.

Sedimentary Structures: Planar and trough cross-bedding are common; some show good graded bedding. Bedding sets average 3-6cm thick.

Depositional Environment: Near-shore marine, shallow water as indicated by the size and sorting of grains and cross-bedding.

SAMPLE DESCRIPTION : Troughs of yellow-stained, medium- to coarse-grained quartzite truncate troughs of grit and coarse-grained quartzite at 30° angles in a generally upward-fining series of intersecting cross-bed sets 3-4cm thick. The medium- to coarse-grained matrix is well sorted and composed of mostly quartz. Specularite and hematite are not visible, but orange hematite stain is present on weathered surfaces. Coarse-sand to grit-size fragments average 1-3mm in length, are well rounded, and consist of quartz, chert, and minor jasper. Graded bedding is present but poorly defined.

Sampler: K. Wirth Date: 19 November 1979

THIN SECTION DESCRIPTION

Site Number: M46 **Sample Number:** 154186 **Code:** M001

Percent Fragments: 43% **Percent Matrix:** 57%

Percent Heavies & Mafics: <1% **Stain:** none

Rock Type: Mazatzal grit **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	91%	3.2 - 1.5 mm	rounded	1:1.5
chert	8%	4.4 - 1.5 mm	rounded	1:2
jasper	<1%	1.5 mm	rounded	1:2
quartzite	<1%	2 mm	rounded	1:1.5

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	92%	1.5 - .01 mm	sutured, strained, recrystallized
jasper	1%	1.5 - .11 mm	rounded
chert	3%	1.5 - .09 mm	rounded
quartzite	1%	1.5 - .23 mm	rounded
clay	1%	<.012 mm	alteration of grains and interstitial
zircon	<1%	.13 - .06 mm	rounded detrital
hematite	<1%	powdery	fine interstitial grains and stain
sericite	1%	.09 - .01 mm	recrystallized plates

Cement: Recrystallized quartz, clay and sericite.

Interstitials: Shredded and recrystallized quartz, sericite, clay, hematite.

Textures and recrystallization: Quartz grains are sutured, interpenetrating and recrystallized; fragments and matrix are interlocking; silt material, clay and some sericite fill interstitial cavities.

Structures: Alternating beds of 5 to 6 cm-thick quartz grit layers and 1 cm-thick quartz sand layers define bedding, which is obliquely cut by slight foliation.

Comments on Genesis: Well-sorted, mature, but not very well-rounded quartz material of probably reworked origin makes up the rock, some angularity may be due to recrystallization--primary cavities may indicate wind-blown origin.

Rock Name: White quartz-rich grit and quartzite.

SITE AND SAMPLE DESCRIPTION

Site Number: M 47 Sample Number: 154186 Code: M 202

Location: Suicide Ridge Scintillometer Counts: 65 cps

Quadrangle: Mazatzal Peak U Value (U by NT) ppm : 20

Sec., Twp. Ra.: S4, 8N, 9E Coordinates: 34°04'17"; 111°26'20"

Geologic Unit: Mazatzal jasper-rhyolite-chert pebble to granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : At this site over 500 meters of quartzite is exposed. The lower 200 meters are dark red maroon, fine- to medium-grained, conglomeritic and contain ripple marks. The overlying 30 meters are pink to light purple in color, fine grained and contain abundant liesegang bands. Above this is 100 meters of cliff-forming quartzite burnt yellow in color and medium-grained. The upper 175 meters are composed of poorly cemented, medium- to coarse-grained white quartzite (Site M 46).

Variability: The character and composition of the conglomerate is fairly uniform throughout the section except for changes in color. This appears to be due to the percentage of specular hematite in the rock.

Sedimentary Structures: The rocks are well bedded in 6-12 cm thick sets. Conglomerate layers show fairly wide lateral continuity and are not lensoidal.

Depositional Environment: Shallow water near-shore marine, possibly fluvial is indicated by the high percentage of conglomerate in the section.

SAMPLE DESCRIPTION : A black to dark maroon conglomerate is packed with red rock fragments in an equal amount of dark specularite matrix. The medium-grained matrix is well-sorted and composed of mostly quartz with the interstitial spaces filled by concentrations of detrital specularite, recrystallized specularite (?) and hematite. Differing concentrations of heavy minerals result in the interbedded black and maroon colored layers. Fragments are sub-rounded and 3-18mm long, commonly average 6-14mm, and consist of red jasper, rhyolite, and chert in nearly equal amounts, with less quartz and pink quartzite. White quartzite and black specular hematite-rich fragments are present in minor amounts.

Sampler: K. Wirth Date: 19 November 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 48 Sample Number: 154187 Code: M 202

Location: Suicide Ridge Scintillometer Counts: ND

Quadrangle: Mazatzal Peak U Value (U by NT) ppm : 1.5

Sec., Twp. Ra.: S4, 8N, 9E Coordinates: 34°04'13"; 111°26'18"

Geologic Unit: Mazatzal granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Same as site M 47 although this site occurs about 250m downslope from M47.

Variability:

Sedimentary Structures:

Depositional Environment: Identical repetitions of high-energy depositional conditions are consistent with shallow-water marine or fluvial environment.

SAMPLE DESCRIPTION : The character sample is identical to that described in D 47. Either the same stratigraphic unit is repeated by low-angle reverse faulting, or identical conglomerate units occur about 200m stratigraphically apart.

Sampler: K. Wirth Date: 19 November 1979

THIN SECTION DESCRIPTION

Site Number: M48 Sample Number: 154187 Code: M202

Percent Fragments: 46% Percent Matrix: 46%

Percent Heavies & Mafics: 8% Stain: dark red specularite

Rock Type: Mazatzal conglomerate Stratigraphic Group: Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	30%	7.7 - 1.3 mm	sub-rounded	1:1.5 to 1:2
jasper	35%	8.7 - 1.3 mm	sub-angular	1:2
chert	22%	9.6 - 1.3 mm	sub-rounded	1:1.5
quartzite	7%	3.2 - 1.8 mm	rounded	1:2
rhyolite	6%	3.0 - 2.0 mm	rounded	1:1.5

(also carbonaceous, angluar quartz grit, rhyolite, granophyre and siltstone fragments)

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	65%	1.3 - .02 mm	rounded, polygonized
jasper	6%	1.3 - 1.2 mm	hematite recrystallized
chert	7%	1.3 - .06 mm	recrystallized, with hematite acicles
rhyolite	2%	1.3 - 0.5 mm	rounded
specularite	4%	.17 - .06 mm	rounded detrital grains
specularite	10%	powdery	recrystallized interstitial network
hematite	3%	powdery	fine interstitial grains and stain
clay	2%	<.02 mm	recrystallized in masses
zircon	<1%	.17 - .06 mm	rounded detrital
apatite	<1%	.1 - .06 mm	rounded detrital
sericite	1%	.05 mm	recrystallization of clay

Cement: Recrystallized quartz, specularite, clay and hematite.

Interstitials: Sericite, clay, recrystallized quartz and specularite, hematite, zircon.

Textures and recrystallization: Hematite- and Specularite-rich matrix, mainly as a recrystallized interstitial network, strikingly emphasizes the angular to rounded nature of matrix quartz and primary detrital shapes of fragments; larger quartz and chert fragments are polygonized or recrystallized.

Structures: Bedding planes are defined by the sub-parallel alignment of elongate fragments and by differing concentrations of heavy minerals. Banded chalcedony fills some large 5 - 10 mm cavities.

Comments on Genesis: A mixed volcanic and resistant sedimentary source terrain with much of the quartz possibly of volcanic origin; sedimentary rock fragments are from a diverse terrain; little post-depositional recrystallization.

Rock Name: Red jasper-chert-quartz pebble conglomerate.

SITE AND SAMPLE DESCRIPTION

Site Number: M 49 Sample Number: 154188 Code: M 101

Location: Suicide Ridge Scintillometer Counts: ND

Quadrangle: Mazatzal Peak U Value (U by NT) ppm : 0.80

Sec., Twp, Ra.: S28, 9N, 9E Coordinates: 34°05'11"; 111°26'10"

Geologic Unit: Mazatzal grit and quartzite

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Down Suicice Ridge, just below white quartzite unit, section is hematitic, red, fine-to coarse-grained quartzite with some fine-grained grit conglomerate, which was sampled. Sorting is good within individual beds. The clasts are well-rounded and over 95% quartz with occasional fragments of jasper and possibly some rhyolite or chert.

Variability: Color of section varies, becoming darker red down section.

Sedimentary Structures: Cross beds are plentiful but no ripples or mud cracks are seen.

Depositional Environment: Presumably shallow water marine, fluctuating energy for grit layers.

SAMPLE DESCRIPTION : (P.A.)
Sample is a pale maroon to pink well-bedded and cross-bedded quartzite with both bedding and cross-bedding planes demarcated by thin planes (1-0.5mm) of specularite concentrations. Within the quartzite is a 2cm-thick bed of cross-bedded grit consisting almost entirely of closely packed 1-3mm quartz grains in a red hematitic, partly specularitic matrix.

Sampler: J. Trembly Date: 19 November 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 50 Sample Number: 154189 Code: M 001

Location: Suicide Ridge Scintillometer Counts: ND

Quadrangle: Mazatzal Peak U Value (U by NT) ppm : .80

Sec., Twp, Ra.: S33, 9N, 9E Coordinates: 34°04'39"; 111°26'39"

Geologic Unit: upper white Mazatzal grit

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Uphill and to the N.E. of Suicide saddle is white quartzite with abundant cross beds, fine to coarse-grained, well-rounded quartz grains, and good sorting in individual beds. A grit conglomerate from the coarsest portion of the section is sampled. Its clasts are dominantly quartz with minor amounts of jasper, and pink and purple chert, as usual in this unit.

Variability: Grain sizes are variable from bed to bed.

Sedimentary Structures: Cross bedding, but no ripples or mud cracks seen.

Depositional Environment: Shallow water marine, probably.

SAMPLE DESCRIPTION : (by P.A.)
The white quartzite sample is a series of cross-bedded layers of alternating coarse sand-size and grit-size quartz grains. In the coarser grit layers, up to 10% pink chert grains are apparent, and although no jasper is present, a dark gray to black specularitic fragment type (possibly specularitic black chert) makes up about 2% of the grains. The quartz grains are 3-5mm long and fairly tightly packed and cemented with matrix quartz such that breakage planes cut through the grains.

Sampler: J. Trembly Date: 19 November 1979

THIN SECTION DESCRIPTION

Site Number: M50 **Sample Number:** 154189 **Code:** M001

Percent Fragments: 13% **Percent Matrix:** 87%

Percent Heavies & Mafics: <1% **Stain:** none

Rock Type: Mazatzal grit **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	92%	3.8 - 1 mm	rounded	1:1.5
chert	6%	4.1 - 1 mm	sub-rounded	1:2
quartzite	2%	2.2 - 1.6 mm	sub-rounded	1:2

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	86%	1.0 - .018 mm	rounded, sutured and recrystallized
chert	1%	1.0 - .26 mm	sub-rounded
hematite	<1%	powdery	local interstitial networks
clay	13%	<.005 mm	fine yellow-stained interstitials
sericite	<1%	.4 - .01 mm	recrystallized plates and masses
zircon	<1%	.22 - .08 mm	rounded to euhedral
biotite	<1%	.09 - .02 mm	primary euhedral grains
muscovite	<1%	.4 - .18 mm	detrital

Cement: Recrystallized quartz, clay and sericite.

Interstitials: Sutured and recrystallized quartz, clay, sericite.

Textures and recrystallization: Quartz grains interpenetrating, polygonized, strain twinned and locally shredded; limonite-stained clays fill interstitial cavities; primary rounded grain boundaries preserved only locally near interstitial hematite.

Structures: Differing grain sizes and fragment densities define bedding planes.

Comments on Genesis: Mature quartz-rich, possibly reworked sediment, probably originally well-rounded grains, now forming a recrystallized network; primary open spaces in the rock are filled by clay material.

Rock Name: Recrystallized white gritty quartzite.

SITE AND SAMPLE DESCRIPTION

Site Number: M 51 **Sample Number:** 154190 **Code:** M 001

Location: Mazatzal Peak **Scintillometer Counts:** ND

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 2.50

Sec., Twp, Ra.: S5, 8N, 9E **Coordinates:** 34°03'51"; 111°27'38"

Geologic Unit: upper hematitic Mazatzal grit

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : At the top of the N.W. ridge leading up to Mazatzal Peak, immediately above where the quartzite continues to become paler pink, until finally it is white, there is a reversion to a thin (20m) zone where specularite is strongly concentrated, before all of the upper sequence is white. Stratigraphically, this is equivalent to M 30. There are abundant quartz-chert grit layers here in a sandy brown to black, specularite-rich matrix. Some 5 to 10cm layers of intensely black detrital specularite are present in the broadly cross-bedded quartzites, and are included in the sample.

Variability: A decrease in the hematite content and therefore paling color of the quartzites is noted systematically up to this point.

Sedimentary Structures: The unit is abundantly cross-bedded on a huge scale, in broad planar and flat trough-cross beds. The appearance and scale of the cross-beds is very similar to those found in a wind-blown beach sand.

Depositional Environment: The shallow water, marine, beach environment of deposition for most of the Mazatzal quartzite could have become exposed as subaerial beach dunes in the upper white section, accounting for the hematite concentrate at the base of the dunes and absence of it above.

SAMPLE DESCRIPTION :

Character sample is of one of the specularite-rich layers at the base of the hugh cross-bed sets. It contains 30% grit-size quartz and pink chert grains 2 to 5mm long, loosely packed in a matrix of 50% medium-to fine-grained quartz and 20% fine-grained, detrital and interstitial specularite. Out of the black layers, the specularite content decreases to nothing, leaving a sandy brown, medium-to coarse-grained quartzite without grit. Coarser grit-size particles and specularite content are therefore closely linked together.

Sampler: P. Anderson **Date:** 19 November, 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 52 **Sample Number:** 154191 **Code:** D 102

Location: S. Cactus Ridge **Scintillometer Counts:** ND

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 1.80

Sec., Twp, Ra.: S19, 8N, 9E **Coordinates:** 34°01'46" 111°28'23"

Geologic Unit: red upper Deadman granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : At the top of the furthest south extremity of the Deadman quartzite of Cactus Ridge, a dark brick-red, coarse-grained Deadman quartzite contains grit and granule conglomerate layers, characteristically different from Mazatzal grit and conglomerate. Conglomerates of this sample are very poorly sorted aggregates of 2 to 20mm-size, angular fragments of red rhyolite, red chert, jasper and hematite-stained quartz, all of which have virtually no rounding. The large size range of fragments and pink oxidation spots are characteristic.

Variability: Section changes downward from 30m of pink quartzite to 80m of deep maroon to purple, pink-spotted quartzite, then into brick red quartzite with coarse conglomerate at its top.

Sedimentary Structures: Enclosing quartzite is well-bedded on 1 to 2m planes, thinly bedded on 2-3cm layers and very well-cross-bedded in some layers. The abundant 1-2mm, finer-scale laminations in cross-bedded sections are quite distinct from Mazatzal above. Asymmetric ripples are present.

Depositional Environment:
Relatively shallow water, but a less well sorted, less mature sediment than Mazatzal, hence probably sub-littoral, non-beach environment.

SAMPLE DESCRIPTION : The sample is a granule conglomerate where the dark red fragments are virtually indistinguishable from the dark, brick-red matrix, except upon close inspection. Angular 5-15mm dark red rhyolite, dark chert, jasper, specularitic flow-banded rhyolite, and much smaller (1-4mm, volcanic?) quartz grains are suspended in a matrix of medium to fine-sand size quartz, feldspar, and chert with an interstitial network of argillaceous material and brick red hematite.

Sampler: P. Anderson **Date:** 20 November, 1979

THIN SECTION DESCRIPTION

Site Number: M52 **Sample Number:** 154191 **Code:** D102

Percent Fragments: 45% **Percent Matrix:** 50%

Percent Heavies & Mafics: 5% **Stain:** dark brick red

Rock Type: Deadman conglomerate **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
rhyolite	76%	22.0 - 2.0 mm	sub-angular	1:2
chert	12%	7.0 - 2.0 mm	sub-angular	1:2
jasper	7%	11 - 2.0 mm	sub-angular	1:2
quartz	5%	4.5 - 2.0 mm	sub-rounded	1:1.5

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	70%	2.0 - .04 mm	sub-rounded and recrystallized
chert	7%	2.0 - .5 mm	sub-rounded
jasper	4%	2.0 - .5 mm	sub-rounded
rhyolite	8%	2.0 - .5 mm	sub-angular and phenocrystic
specularite	3%	1.0 - .05 mm	recrystallized with hematite
hematite	6%	powdery	massive interstitial filling and fine grains
leucoxene	<1%	powdery	alteration clots
zircon	<1%	.045 mm	rounded grains
sericite	8%	<.05 mm	recrystallized from interstitial clay

Cement: Mainly sericite; minor recrystallized quartz, specularite and hematite.

Interstitials: Recrystallized quartz sericite, specularite, hematite.

Textures and recrystallization: Primary angularity of many fragments and matrix quartz is well preserved by argillaceous cement and interstitial hematite, only larger quartz fragments are polygonized and strained, the remainder is euhedral or interstitial.

Structures: Rhyolite fragments are well flow-banded, some have granophyric texture, elongate matrix quartz grains are crudely aligned parallel to bedding.

Comments on Genesis: Most of the rock including quartz fragments and matrix grains appear to have been derived by erosion of rhyolitic volcanic material, with jasper and chert forming recycled components.

Rock Name: Brick red rhyolite pebble conglomerate.

SITE AND SAMPLE DESCRIPTION

Site Number: M 53 **Sample Number:** 154192 **Code:** D 203

Location: S. Cactus Ridge **Scintillometer Counts:** ND

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 3.60

Sec., Twp, Ra.: S19, 8N, 9E **Coordinates:** 34°01'46"; 111°28'15"

Geologic Unit: red Deadman pebble conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Down section from M 52, the Deadman unit contains a cobble to pebble conglomerate of all types of rhyolite fragments - quartz phenocrystic, feldspar phenocrystic, aphanitic, flow banded - plus red quartzite and pink chert fragments in a brick red, hematitic to specularitic quartzite matrix. The conglomerate is mostly framework supported by the brick red rhyolite and ignimbrite clasts up to 20-30cm in size that give the rock its red color. Most of the material sampled is pebble size (20-30mm).

Variability: Coarsest fragments confined to one stratigraphic horizon here; both up and down section, fragment size is smaller or rock is all quartzite.

Sedimentary Structures: Some cross bedding in adjacent strata. Sampled horizon is very poorly bedded with some lode casts and cut and scour features.

Depositional Environment: High energy influx of poorly sorted volcanic and sedimentary detritus, the last before relatively uniform, shallow water, quiet conditions.

SAMPLE DESCRIPTION : Sample is a pebble conglomerate of closely packed, angular to sub-rounded, brick-red rhyolite clasts 10-23mm long, red quartzite clasts 12-30mm long, pink chert 4-12mm long, and finer grained (2-4mm) quartz and feldspar in an interstitial matrix of quartz, hematite, specularite and argillaceous material. Fragments make up 70% of the rock, and are lighter brick red than the dark maroon to red, specularitic matrix.

Sampler: P. Anderson **Date:** 20 November, 1979

THIN SECTION DESCRIPTION

Site Number: M53 **Sample Number:** 154192 **Code:** D203

Percent Fragments: 65% **Percent Matrix:** 30%

Percent Heavies & Mafics: 5% **Stain:** muddy brick red

Rock Type: Deadman conglomerate **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : **(percentages are based on 100% fragments)**

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
rhyolite	99%	28 - 2.0 mm	sub-rounded	1:2
quartz	1%	2.5 - 2.0 mm	sub-rounded	1:1.5

(Rhyolite fragments are abundantly quartz phenocrystic, locally contain feldspar phenocrysts completely altered to sericite, and contain a great variety of flow banded fabrics; they consist of 90% quartz, 10% sericite, to 90% sericite, 10% quartz.)

MATRIX & HEAVIES : **(percentages are based on 100% matrix & heavies)**

Type & color	Percentage	Size range	Description
rhyolite	18%	2.0 - .4 mm	sub-rounded, flow-banded, phenocrystic
quartz	68%	2.0 - .03 mm	sub-rounded, embayed (volcanic)
sericite	6%	<.02 mm	recrystallized interstitial fillings
specularite	3%	.38 - .09 mm	rounded grains
hematite	10%	powdery	massive interstitial filling and grains

Cement: Hematite and sericite.

Interstitials: Hematite, sericite.

Textures and recrystallization: Euhedral, partly abraded, unstrained volcanic quartz, hematite and sericite form interstitial fillings between a framework-supported array of flow-banded rhyolite fragments; essentially no recrystallization is apparent.

Structures: A great variety of flow-banded and granophyric textures are seen in the rhyolite fragments that are generally aligned parallel to bedding.

Comments on Genesis: Abraded and partly rounded matrix quartz grains are unstrained, have euhedral edges and embayments and are clearly of volcanic origin. Thus essentially all of the conglomerate components--rhyolite fragments, matrix quartz, sericite and hematite are derived by erosion of a rhyolitic terrain.

Rock Name: Red rhyolite pebble conglomerate.

SITE AND SAMPLE DESCRIPTION

Site Number: M 54 **Sample Number:** 154193 **Code:** D 103

Location: S. Cactus Ridge **Scintillometer Counts:** ND

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 3.90

Sec., Twp, Ra.: S19, 8N, 9E **Coordinates:** 34°01'43"; 111°28'12"

Geologic Unit: basal Deadman conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Immediately at base of Deadman sequence on this part of Cactus ridge is a coarse rhyolite-boulder conglomerate (30-100cm fragments), intruded by a rhyolite sill. Above the rhyolite sill, the fragments are smaller and comprise a series of hematitic, rhyolite-pebble conglomerates interbedded with brick red siltstones and quartzites. The pebble conglomerate was sampled because it gave the same scintillometer response as the coarse boulder conglomerate and made a better quality sample.

Variability: The basal 30m of the Deadman below the sill is interbedded coarse boulder conglomerate, boulder, cobble and pebble conglomerate whereas the upper 20m above the sill is interbedded pebble conglomerate, grit, quartzite and siltstone.

Sedimentary Structures: Prominent bedding, but cross bedding not present in basal conglomerate sequence.

Depositional Environment: Either the basal conglomerate of a transgressive marine sequence or a high-energy fluvial channel deposit.

SAMPLE DESCRIPTION : Sample consists of relatively well sorted and sized, rounded to subangular red and sericitic-white 10-15mm rhyolite pebbles, red to pink, angular, 5-12mm chert pebbles, darker green volcanic fragments and 1-5mm quartz grains in a brick red matrix of rhyolite and chert grains, quartz, volcanic detritus, hematite and clay. Fragments are matrix supported and compose 30-40% of the rock. Some dark brick-red siltstone layers are interleaved with the conglomerate.

Sampler: P. Anderson **Date:** 20 November, 1979

THIN SECTION DESCRIPTION

Site Number: M54 **Sample Number:** 154193 **Code:** D103

Percent Fragments: 33% **Percent Matrix:** 60%

Percent Heavies & Mafics: 7% **Stain:** muddy brick red

Rock Type: Deadman conglomerate **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
rhyolite	100%	9.0 - 2.0 mm	sub-angular	1:2
quartz	<1%	2.1 - 2.0 mm	sub-rounded	1:1.5

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
rhyolite	51%	2.0 - .3 mm	sericite-altered, flow-banded, phenocrystic
quartz	15%	2.0 - .02 mm	sub-rounded and embayed (volcanic)
sericite	24%	<.05 mm	recrystallized plates and masses
specularite	3%	.17 - .08 mm	rounded detrital grains
specularite	1%	.08 - .01 mm	recrystallized plates and patches
hematite	6%	powdery	interstitial fillings and stain

Cement: Hematite, sericite, recrystallized specularite.

Interstitials: Hematite, sericite and specularite.

Textures and recrystallization: Angular broken to euhedral matrix quartz and rhyolitic fragments are supported in an interstitial mass of fine-grained sericite. Virtually no grains are recrystallized.

Structures: Bedding is defined by elongation of largest to smallest rhyolitic fragments and thin "shard"-like chips of rhyolite as well as matrix sericite.

Comments on Genesis: As in M53, the rock is derived by the erosion of solely a hematitic rhyolite terrain.

Rock Name: Red rhyolite pebble to granule conglomerate.

SITE AND SAMPLE DESCRIPTION

Site Number: M 55 Sample Number: 154194 Code: D 103

Location: S. Cactus Ridge Scintillometer Counts: ND

Quadrangle: Mazatzal Peak U Value (U by NT) ppm : 5.9

Sec., Twp, Ra.: S8, 8N, 9E Coordinates: 34°02'43"; 111°27'10"

Geologic Unit: Deadman rhyolite-pebble conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : This sample location is very close to the top of the Deadman quartzite and its appearance is quite similar to that of the basal portion of the Mazatzal quartzite. The quartzite in the upper portions of the Deadman is well sorted, purple in color, and generally free of conglomerate. Lower in the section, hematite and specularite content increases, grain size increases, and conglomerate fragments become more abundant.

Variability: The hematite and specularite content of the quartzite is highly variable and is responsible for most of the color changes.

Sedimentary Structures: Planar and trough cross-bedding.

Depositional Environment: Possibly a near-shore marine or fluvial environment as indicated by poor sorting and by the size of the fragments.

SAMPLE DESCRIPTION : This conglomerate is matrix-supported, but has a strikingly different grain-size population: large (2-4cm) dark red hematite aphanitic rhyolite fragments are interspersed by 4-10mm-long, rounded, white quartz and chert grains in a coarse-grained quartzite to grit-size matrix. Fracture surfaces are coated with abundant red hematite stain from the high content of hematite and specularite of the matrix. Detrital specularite is especially concentrated around the edges of the larger rhyolite fragments. The rock is about 40% flat rhyolite pebbles, 20% quartz granules, 30% matrix and about 10% specularite.

Sampler: K. Wirth Date: 20 November 1979

THIN SECTION DESCRIPTION

Site Number: M55 **Sample Number:** 154194 **Code:** D103

Percent Fragments: 89% **Percent Matrix:** 6%

Percent Heavies & Mafics: 5% **Stain:** muddy brick red hematite

Rock Type: Deadman conglomerate **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
rhyolite	100%	45 - 2.0 mm	sub-rounded	1:1.5

(rhyolite fragments are sericitic, flow banded and quartz phenocrystic with patches or layers of granophyric crystallinity and layers of strong hematite concentration)

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
rhyolite	35%	2.0 - .2 mm	sub-rounded, somewhat elongate
quartz	20%	.21 - .02 mm	broken embayed euhedral volcanic crystals
specularite	5%	.11 - .06 mm	rounded grains
specularite	13%	powdery	recrystallized with hematite
hematite	27%	powdery	massive opaque interstitials and fine grains
sericite	4%	<.04 mm	recrystallized plates and masses

Cement: Hematite and recrystallized sericite and specularite.

Interstitials: Hematite, sericite and recrystallized specularite.

Textures and recrystallization: Broken euhedral quartz matrix crystals and sericitic rhyolite fragments lie in an interstitial matrix of dark reddish brown to black hematitic material with no recrystallization.

Structures: Bedding structures are not defined in this section because of large fragment sizes; the matrix fills essentially only one cavity between three large rounded rhyolite pebbles.

Comments on Genesis: As in M53 and M54 but even more obvious in this case, all of the matrix material is derived from weathering of rhyolitic material the same as the fragments, except with concentrations of heavies in the matrix.

Rock Name: Red hematitic rhyolite pebble conglomerate.

SITE AND SAMPLE DESCRIPTION

Site Number: M 56 Sample Number: 154195 Code: D 102

Location: S. Cactus Ridge Scintillometer Counts: ND

Quadrangle: Mazatzal Peak U Value (U by NT) ppm : 2.5

Sec., Twp, Ra.: S8, 8N, 9E Coordinates: 34°02'40"; 111° 27'05"

Geologic Unit: Deadman granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : This sample site lies stratigraphically below sample site M 55. The quartzite is dark purple in color and medium-grained. Ripple marks, cross-beds and hematite-stained (reduction?) spots are present throughout the section.

Variability: See sample description for Site M 57.

Sedimentary Structures: Some ripple marks, planar and trough cross-beds in 8-12cm thick sets.

Depositional Environment: Relatively shallow-water, high energy environment, either fluvial or base of transgressive marine sequence with coarse channel deposits.

SAMPLE DESCRIPTION : A granule to pebble conglomerate contains 5-35mm long angular rhyolite fragments in a medium to coarse-grained matrix of mainly quartz and minor amounts of rhyolite. Interstitial to matrix grains are thick fillings of hematite and specularite. Fragment types are either large (1-4cm) elongate dark red rhyolite and specularitic rhyolite, or smaller more spherical 5-12mm long quartz, pink hematitic rhyolite or chert, and some jasper. Layers of elongate, soft hematitic clayey material partly define bedding and may represent rip-up layers from lower, more hematitic, strata.

Sampler: K. Wirth Date: 20 November 1979

THIN SECTION DESCRIPTION

Site Number: M56 **Sample Number:** 154195 **Code:** D102

Percent Fragments: 13% **Percent Matrix:** 85%

Percent Heavies & Mafics: 4% **Stain:** pale, muddy brick red

Rock Type: Deadman grit **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
rhyolite	99%	5.0-2.0 mm	subrounded	1:2
quartz	1%	3.2 mm	subrounded	1:1.5

(rhyolite is either cherty or granophyric, not phenocrystic, and is locally hematitic)

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
rhyolite	14%	2.0-.3 mm	subrounded, phenocrystic
quartz	74%	1.6-.02 mm	subrounded
sericite	6%	<.04 mm	recrystallized plates and masses
specularite	1%	powdery	recrystallized plates and masses
hematite	5%	powdery	interstitial grains and masses

Cement: Hematite, recrystallized sericite and specularite.

Interstitials: Hematite, sericite and specularite.

Textures and recrystallization: Rounded quartz grains and polycrystalline quartzose rhyolite fragments contact and are sutured to partly interlocking with an interstitial matrix of either sericite or hematite.

Structures: Bedding is poorly defined because of the lack of segregation of different grain sizes, but quartz is aligned in bedding trains. Essentially unfoliated.

Comments on Genesis: Relatively pure quartzose sediment with rhyolite and hematite from the hematitic rhyolite source terrain.

Rock Name: Hematitic quartzose rhyolite-fragment grit.

SITE AND SAMPLE DESCRIPTION

Site Number: M 57 Sample Number: 154196 Code: D 203

Location: S. Cactus Ridge Scintillometer Counts: ND

Quadrangle: Mazatzal Peak U Value (U by NT) ppm : 2.8

Sec., Twp, Ra.: S17, 8N, 9E Coordinates: 34°02'41"; 111°27'07"

Geologic Unit: Deadman pebble conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Same as site M 56

Variability:

Sedimentary Structures:

Depositional Environment:

SAMPLE DESCRIPTION : Except for the presence of strong foliation or shearing, this sample is similar in appearance to the one sampled at Site M 55. This sample does not contain the smaller generation of quartz grit that is present in the Site 55 sample. Instead, pink to red-colored rhyolite fragments occur as fragments ranging from 1-50mm in length. Fragments are sub-angular and are significantly flattened by deformation. Recrystallized quartz is seen around the edges of some fragments, and elsewhere, white quartz material represents deformed quartzite fragments.

Sampler: K. Wirth Date: 20 November 1979

THIN SECTION DESCRIPTION

Site Number: M57 **Sample Number:** 154196 **Code:** D203

Percent Fragments: 60% **Percent Matrix:** 36%

Percent Heavies & Mafics: 4% **Stain:** muddy brick red hematite

Rock Type: Deadman conglomerate **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
rhyolite	100%	24.0-2.0	subangular	1:2

(rhyolite fragments are sericitic to siliceous and granophyric, quite patchy and mottled, but not phenocrystic)

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
rhyolite	5%	2.0-.3 mm	subrounded, altered to sericite
quartz	55%	1.1-.02 mm	subrounded, clear volcanic crystals
sericite-clay	27%	<.03 mm	recrystallized plates and masses
specularite	7%	powdery	recrystallized with hematite
hematite	5%	powdery	interstitial grains and massive
zircon	1%	<.05 mm	altered

Cement: Hematite, specularite, sericite.

Interstitials: Hematite, specularite, sericite, some clay.

Textures and recrystallization: Sericite with hematite and recrystallized specularite are foliated around matrix quartz grains to give an "augen" effect, which is part of the foliated character of the rock. Quartz is strained, polygonized and sutured but not strongly recrystallized.
Structures: Rhyolite fragments are sheared and flattened into subparallel alignment with foliated matrix material as a result of deformation.

Comments on Genesis: Conglomerate is totally a product of the erosion of a rhyolite terrain, with little transportation, rounding or alteration of the volcanic fragments or matrix material, and it contains no exotic clasts.

Rock Name: red rhyolite fragment conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: M 58 **Sample Number:** 154197 **Code:** D 103

Location: S. Cactus Ridge **Scintillometer Counts:** 150 cps

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 3.20

Sec., Twp, Ra.: S18, 8N, 9E **Coordinates:** 34°02'01"; 111°27'41"

Geologic Unit: basal Deadman conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Down the ridge from 7579' Peak, the base of the Deadman is a hematitic conglomerate made up almost entirely of angular to slightly rounded rhyolite fragments in a very fine grained matrix, either silt or volcanic material. The fine grained layers are well sorted but the conglomerate layers are very poorly sorted. Quartzite and jasper pebbles are almost non-existant in the basal few meters.

Variability: Clasts range from silt to pebble size
Quartz and specularite veins cut the outcrop

Sedimentary Structures: No sedimentary structures other than bedding are visible.

Depositional Environment: Presumably base of marine sequence or river channel deposit.

SAMPLE DESCRIPTION : (by P. A.)
The sample is a striking conglomerate of highly angular fragments of red, siliceous flow banded rhyolite exactly the same as the flow-banded, siliceous rhyolite in outcrop immediately below the conglomerate at this point; hence the conglomerate is residual, not transported. A variety of pale red to maroon angular rhyolite clasts from 13 to 45mm long are supported in a matrix of broken, angular, 5 to 0.1mm rhyolitic material. The increased hematite content of the matrix (5-10% hematite, 50% matrix) gives it a much darker, brick red appearance.

Sampler: J. Trembly **Date:** 20 November, 1979

THIN SECTION DESCRIPTION

Site Number: M58 **Sample Number:** 154197 **Code:** D103

Percent Fragments: 55% **Percent Matrix:** 37%

Percent Heavies & Mafics: 8% **Stain:** brick red hematite

Rock Type: Deadman conglomerate **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
rhyolite	100%	31.5-2.0 mm	subangular	1:2

(rhyolite fragments are a peculiar spotty type of aphanitic rhyolite with some dispersed hematite and unusual radial growth of small quartz clusters)

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
rhyolite	18%	2.0-.3 mm	subangular
quartz	63%	1.6-.02 mm	subrounded
sericite-clay	3%	<.02 mm	recrystallized plates and masses
specularite	4%	.26-.06 mm	rounded
specularite	1%	powdery	recrystallized with hematite
hematite	11%	powdery	interstitial grains and masses

Cement: Hematite, recrystallized sericite and specularite.

Interstitials: Hematite, sericite, recrystallized specularite.

Textures and recrystallization: Matrix is fine-grained rounded to subangular, partly polygonized but little-recrystallized quartz in a matrix of abundant red hematite, cryptocrystalline silica and clay. Sericite occurs at fragment edges.

Structures: Neither matrix nor fragments appear bedded or foliated; a specularite vein cuts through the sample.

Comments on Genesis: Except for stronger concentration of hematite in the matrix, the fragments and matrix are close in composition and the rock appears to have been wholly derived by erosion of a rhyolite terrain.

Rock Name: hematitic rhyolite pebble conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: M 59 **Sample Number:** 154198 **Code:** D 102

Location: S. Cactus Ridge **Scintillometer Counts:** 75 cps

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 3.70

Sec., Twp, Ra.: S18, 8N, 9E **Coordinates:** 34°02'01"; 111°27'41"

Geologic Unit: Deadman conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Above the basal conglomerate of M 58 is a series of interbedded siltstones and conglomerates ranging in color from specularitic black, to hematitic red, to a pale orange. Grain sizes range from silt to cobble; bed thickness ranges from 5-50cm. Most clasts are of pink, maroon and pale rhyolite, some are pebble to granule-size quartzite (about 20%), and less than 5% are jasper.

Variability: Sorting and rounding of pebbles vary from bed to bed.

Sedimentary Structures: Hematite and specularite banding outlines bedding. Above the sample, cross beds and ripple marks are present.

Depositional Environment: A shallow water environment beginning with residual conglomerate and grading upwards to a beach environment with wave action.

SAMPLE DESCRIPTION : (by P. A.)
Conglomerate consists of subrounded dark brick-red to orange and pink rhyolite clasts 8-20mm long supported in a siliceous or cherty matrix (60% of rock) of quartzo-feldspathic, lighter-colored rhyolitic material. Interstitial and detrital specularite is concentrated into planes parallel to bedding or cross bedding. The conglomerates are locally in contact with strongly hematitic-stained, brick-red siltstones.

Sampler: J. Trembly **Date:** 20 November, 1979

THIN SECTION DESCRIPTION

Site Number: M59 Sample Number: 154198 Code: D 102

Percent Fragments: 45% Percent Matrix: 53%

Percent Heavies & Mafics: 2% Stain: muddy brick-red hematite

Rock Type: Deadman conglomerate Stratigraphic Group: Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
rhyolite	100%	55-4 mm	angular to subrounded	1:15 to 1:1.5

(rhyolite is highly sericitic, fine grained, somewhat quartz phenocrystic and hematite stained; some is hematite-specularite banded)

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
rhyolite	15%	2.0-0.5 mm	aphanitic quartz-sericite
quartz	31%	1.0-0.01 mm	subrounded, broken euhedral volcanic
sericite	48%	.01-.005 mm	interstitial matrix mat
hematite	2%	powdery	stain around rhyolite fragments
specularite	1%	.3-.08 mm	subrounded detrital
feldspar	3%	.5-.1 mm	poorly twinned, probably albite-orthoclase
zircon	<1%	.07 mm	subhedral

Cement: Sericite.

Interstitials: Sericite, quartz, feldspar, hematite.

Textures and recrystallization: Texture dominantly jaspery, hematite-stained, flow banded rhyolite fragments supported in a matrix of sericite; most fragments are aphanitic quartz-sericite, matrix is overwhelmingly a mass of interlocking sericite grains; essentially unrecrystallized.

Structures: Fragments show no obvious subparallel alignment; matrix not bedded or foliated.

Comments on Genesis: Derived by erosion solely of a nearby sericitic rhyolite terrain in which the rhyolite was hematite-stained, specularitic, flow banded, quartz phenocrystic, and contained altered feldspar and zircon.

Rock Name: Hematitic rhyolite-fragment conglomerate.

SITE AND SAMPLE DESCRIPTION

Site Number: M 60 **Sample Number:** 154199 **Code:** D 103

Location: S. Cactus Ridge **Scintillometer Counts:** 75 cps

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 2.20

Sec., Twp, Ra.: S18, 8N, 9E **Coordinates:** 34°02'11"; 111°27'49"

Geologic Unit: upper Deadman conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : In the upper 35m of the cliffs below 7579 peak, 25m of pinkish-purple, cliff forming quartzites are overlain by a pebble conglomerate of dominantly pink and purple subrounded rhyolite clasts with about 10% white, rounded quartz and less than 5% jasper. The matrix is medium grained quartz sand with some specularite layers. Bedding is good, sorting poor.

Variability: Conglomerate is found in 5-10cm thick beds with 1-3cm thick beds of quartzite between.

Sedimentary Structures: Conglomerate does not appear to be imbricated, but cross beds are visible; no ripples or mud cracks are visible.

Depositional Environment: Shallow water, fluctuating energy conditions, near-shore marine or fluvial.

SAMPLE DESCRIPTION : (by P. A.)

A whitish matrix of coarse sand-to grit-size quartz and finer grained, detrital but sparkly specularite supports 40% fragments, consisting mainly of 20-30mm dark to brick red rhyolite, 8-12mm quartz and uncommon pinkish quartzite. The specularite is well concentrated into 1-3mm layers, interstitially between rhyolite clasts, and in poorly developed cross-bed planes. The quartz matrix where non-specularitic is pink and obviously much more mature than the previous two samples at lower stratigraphic positions.

Sampler: J. Trembly **Date:** 20 November, 1979

THIN SECTION DESCRIPTION

Site Number: M60 **Sample Number:** 154199 **Code:** D103

Percent Fragments: 18% **Percent Matrix:** 74%

Percent Heavies & Mafics: 8% **Stain:** pale pink hematite

Rock Type: Deadman conglomerate **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
rhyolite	47%	14-2.0 mm	angular	1:2
quartz	38%	7.8-2.0 mm	subangular	1:1.5
chert	15%	4.5 mm	angular	1:2

(rhyolite fragments are hematitic, aphanitic and sericitic).

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	65%	2-.02 mm	subrounded and recrystallized
chert	2%	2-.4 mm	subrounded
rhyolite	6%	2-.6 mm	subangular
specularite	8%	.9-.05 mm	rounded grains
hematite	<1%	powdery	fine interstitial grains and stain
zircon	<1%	.18-.08	rounded
sericite-clay	18%	<.04 mm	recrystallized plates and masses

Cement: Mainly recrystallized sericite and quartz, minor hematite.

Interstitials: Sericite, recrystallized quartz and hematite.

Textures and recrystallization: Quartz is undulose, sutured and somewhat polygonized; specularite shows rounded detrital texture; sericite and clay fill the interstices and sometimes interfinger with recrystallized quartz and sutured grains.
Structures: Bedding planes are well defined by thin beds of specularite concentrations and by layers of conglomerate alternating with moderately well-sorted quartzite.

Comments on Genesis: A specularite-rich rhyolite source terrain is indicated; deposited under marine or fluvial conditions to account for cross beds and bedded specularite layers; little deformed.

Rock Name: specularite bedded rhyolite-quartz conglomerate and grit

SITE AND SAMPLE DESCRIPTION

Site Number: M 61 **Sample Number:** 154200 **Code:** D 203

Location: S. Cactus Ridge **Scintillometer Counts:** ND

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 2.80

Sec., Twp, Ra.: S18, 8N, 9E **Coordinates:** 34°02'10"; 111°27'50"

Geologic Unit: upper Deadman conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Below 7579 Peak, near the stratigraphic equivalent of M 60 is a strongly specularitic zone right at the top of pebble-to cobble-size, sparse conglomerate in a grit to coarse-grained sand-size quartz-rich matrix. Within the specularitic zone there are some large cobbles of specularitic quartzite, possibly ripped up from underlying Deadman strata. Most of the fragments are either black, specularite-rich ones, or bright red, phenocrystic rhyolite.

Variability: The grit and granule conglomerate varies from 60% red jasper-like rhyolite, 30% quartz and 10% specularite fragments, to areas where only rhyolite and quartzite pebbles from the underlying strata are seen.

Sedimentary Structures: Good bedding, well developed graded bedding, and heavy-mineral concentrations on bedding and cross-bedding planes.

Depositional Environment: Higher energy near-shore marine or fluvial (river channel) deposit to cause ripping up of lower layers.

SAMPLE DESCRIPTION : Angular, 7-13mm red rhyolite fragments, subangular, 5-10mm white quartz grains, 8-25mm flat maroon slate chips and highly variable size (5-60mm) dark reddish-brown to black specularite fragments compose the fragments in a pebble conglomerate that is 55% white quartz, specularite and small rock-chip matrix. Most pebbles in some layers are flat (1:10 ratios) suggesting that they represent ripped up beds of subjacent strata. The specularite pebbles and cobbles range from about a 50% specularitic quartzite, to pure specularite.

Sampler: P. Anderson **Date:** 20 November, 1979

THIN SECTION DESCRIPTION

Site Number: M61 **Sample Number:** 154200 **Code:** D203

Percent Fragments: 26% **Percent Matrix:** 42%

Percent Heavies & Mafics: 32% **Stain:** dense brick red

Rock Type: Deadman conglomerate **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
jasper	30%	14 - 4.5 mm	sub-angular	1:3
quartz	20%	4.5 - 2.0 mm	sub-rounded	1:1.5
specularite	50%	22 - 5.0 mm	sub-angular	1:4

(specularitic fragments are black whereas jasper is bright brick red)

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	49%	2.0 - .03 mm	sub-angular grains
specularite	8%	.38 - .09 mm	rounded detrital grains
specularite	28%	.1 - .01 mm	interstitial mat containing detrital specularite
hematite	9%	powdery	with recrystallized specularite
clay-sericite	6%	<.009 mm	interstitial matrix masses
zircon	<1%	.08 mm	rounded grains

Cement: Mainly hematite and specularite.

Interstitials: Hematite, recrystallized quartz, specularite and clay.

Textures and recrystallization: Angular to sub-rounded quartz grains are supported in a matrix of opaque hematite and specularite as disconnected grains with little or no recrystallization; locally interstitial clay and silty material are found in the matrix.

Structures: The rock is made up of a 2 cm-wide bed of specularite, jasper and larger, more rounded quartz grains with little interstitial matrix material, and 5 to 6 cm thick beds of finer grained hematite-quartz-specularite material without fragments.

Comments on Genesis: Poorly sorted angular nature of matrix and finer grains contrast to Mazatzal quartzites, high specularite and hematite content indicate an environment concentrating heavy minerals.

Rock Name: Specularite-rich quartzite and conglomerate.

SITE AND SAMPLE DESCRIPTION

Site Number: M 62 Sample Number: 154201 Code: D 202

Location: Y-Bar Basin Scintillometer Counts: ND

Quadrangle: Mazatzal Peak U Value (U by NT) ppm : 1.20

Sec., Twp, Ra.: S7, 8N, 9E Coordinates: 34°02'45"; 111°28'02"

Geologic Unit: uppermost Deadman granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : In the core of the synformal fold of Deadman quartzite of Y-Bar Basin, at the uppermost Deadman strata, there are several 20-60cm-thick layers of granule conglomerate that were sampled because of their greater maturity, sorting and roundness than lower Deadman conglomerates. The granule to pebble conglomerates here contain abundant quartz, chert, rhyolite and jasper in a hematitic grit-to coarse sand-size quartz-rich matrix.

Variability: Grain size distribution is typically bimodal regardless of bed. Some larger pebbles of specularite-rich grit are present in the conglomerate to indicate a rip-up origin for these pebbles.

Sedimentary Structures: Trough and planar cross bedding common; no ripple marks noted.

Depositional Environment: Fluctuating energy conditions in a shallow water marine or braided-stream fluvial environment, with higher energy pulses causing rip-up of lower strata.

SAMPLE DESCRIPTION : Dark reddish brown and white, 6 to 18mm-size rounded, relatively equant pebbles lie in a pale maroon quartz-hematite matrix. The darkest reddish brown to black fragments are specularitic quartzite, specularite, and specularitic or hematitic, aphanitic rhyolite. Bright red fragments are hematitic soft rhyolite and jasper, both of which are more angular and elongate. The gray to white, pale-colored pebbles are chert and vein quartz, both of which are gradational into the grain-size range of the quartz-rich gritty matrix material.

Sampler: P. Anderson Date: 20 November, 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 63 Sample Number: 154202 Code: R 004

Location: S. Cactus Ridge Scintillometer Counts: ND

Quadrangle: Mazatzal Peak U Value (U by NT) ppm : 3.4

Sec., Twp, Ra.: S8, 8N, 9E Coordinates: 34°02'41"; 111°27'04"

Geologic Unit: Rhyolite pebble conglomerate

Stratigraphic Group: Red rock rhyolite (Alder Group)

SITE GEOLOGY : The sample site is at the base of the Deadman quartzite. Bedding in the quartzite strikes N 30° E and dips 65° NW and is unconformable on the underlying flow-banded rhyolite which strikes N 10° W and dips 60° SW.

Variability: The rhyolite can be divided into three main types: (1) pink ignimbrite with aphanitic, elongate 20-30mm-long flattened, pummice fragments; (2) agglomerate or conglomerate with 20-30mm-long, angular pink fragments of flow-banded rhyolite in a red rhyolitic matrix (which was sampled); and (3) flow-banded rhyolite of 1-5mm-thick alternating layers. Plunge of minor fold axes in the rhyolite is N 28° W at 65°.

Sedimentary Structures: A marked discordance of bedding attitudes is found across the unconformity.

Depositional Environment: Subaqueous or subaerial, intravolcanic.

SAMPLE DESCRIPTION : The rhyolite conglomerate or agglomerate consists of broken angular 1-6cm fragments of pink, finely flow-banded rhyolite, lesser pale aphanitic rhyolite and white rhyolite granophyre in a red matrix of rhyolitic material including broken fragments of flow-banded rhyolite, bright red aphanitic rhyolite, volcanic feldspars, quartz and hematite-stained, altered rhyolitic glass material.

Sampler: K. Wirth Date: 20 November 1979

THIN SECTION DESCRIPTION

Site Number: M63 **Sample Number:** 154202 **Code:** R004

Percent Fragments: 78% **Percent Matrix:** 18%

Percent Heavies & Mafics: 4% **Stain:** orange to red-brown hematite

Rock Type: rhyolite breccia **Stratigraphic Group:** Red Rock rhyolite

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
rhyolite	100%	15 - 2.0 mm	angular	1:1.5

(fragments are pale orange, aphanitic to locally feldspar-micro-phenocrystic rhyolite fragments, now entirely a fine-grained mosaic of quartz, sericite and clay, including phenocrysts).

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
sericite and clay	68%	.05 - .001 mm	massive interstitial angular networks of fine crystal mats
quartz	20%	1.0 - .05 mm	fine grained interstitial grain networks
hematite	12%	powdery	earthy hematite concentrated on fracture networks

Cement: Hematite.

Interstitials: Sericite, clay and quartz.

Textures and recrystallization: Rhyolite fragments completely recrystallized to a finely textured, weakly foliated mosaic of quartz, clay, sericite and hematite; concentrations and segregations of quartz, sericite, clay and hematite comprise the matrix.

Structures: Dark hematite-stained matrix material forms an interlaced network between angular breccia fragments.

Comments on Genesis: An autogenous (self-generated) rhyolitic breccia of identical composition matrix and fragments with the matrix more strongly altered.

Rock Name: Hematitic autogenous rhyolitic breccia.

SITE AND SAMPLE DESCRIPTION

Site Number: M 64 **Sample Number:** 154203 **Code:** K 012

Location: N. 4-Bar Basin **Scintillometer Counts:** 66 cps

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 1.0

Sec., Twp, Ra.: S8, 8N, 9E **Coordinates:** 34°03'26"; 111°26'57"

Geologic Unit: altered Maverick grit

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : On the saddle north of Y-Bar basin the Maverick shale unit contains one of the characteristic jasper-chert-quartz grit units that are usually a distinct green. The grit layers here are black and appear dark-colored to possibly specularitic. More likely though is that the grit is altered and carbon-bearing, either by later volcanic processes or during burning in an Indian Pinyon burn mound. The sample is taken to see if the alteration has affected the U values or trace elements.

Variability: The grit is a variant of thinly bedded shale.

Sedimentary Structures: None apparent except for bedding.

Depositional Environment: Quiet-water marine or lacustrine, likely a back-bay deposit in a near-shore marine environment.

SAMPLE DESCRIPTION : Layers 1cm thick of fine-grained gray sandstone to siltstone are interbedded with thicker layers of conglomerate, 2-4mm grit-size fragments of red jasper, quartz, chert, and black fragments. The black color of these fragments and the general gray color of the rock is believed to be caused by later alteration.

Sampler: K. Wirth and P. Anderson **Date:** 21 November 1979

THIN SECTION DESCRIPTION

Site Number: M64 **Sample Number:** 154203 **Code:** K112

Percent Fragments: 35% **Percent Matrix:** 59%

Percent Heavies & Mafics: 6% **Stain:** blackish brown

Rock Type: Maverick conglomerate **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	33%	4.5 - 2.0 mm	sub-rounded	1:1.5
jasper	11%	4.5 - 2.0 mm	sub-angular	1:2
chert	15%	3.5 - 2.0 mm	sub-angular	1:2
hematitic siltstone	31%	3.4 - 2.0 mm	sub-rounded	1:2
specularitic fragments	10%	3.5 - 2.0 mm	sub-angular	1:2

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	76%	2.0 - .02 mm	sub-rounded and recrystallized
jasper	3%	2.0 - .4 mm	sub-rounded
chert	9%	2.0 - .2 mm	sub-rounded
hematite-rich fragments	2%	2.0 - .3 mm	sub-angular
specularite	<1%	.4 - .11 mm	rounded grains
specularite	1%	powdery	recrystallized with hematite
hematite	6%	powdery	fine interstitial grains and stain
zircon	<1%	.16 - .1 mm	rounded grains
sericite	3%	<.02 mm	recrystallized plates and masses

Cement: Recrystallized quartz, sericite, specularite, and hematite.

Interstitials: Angular quartz, sericite, specularite, and hematite.

Textures and recrystallization: Most quartz is unrecrystallized, some chert is recrystallized, some larger quartz fragments are composite; matrix quartz displays primary angular grain habit with interstitial sericite and hematite.

Structures: A 1 cm-thick bed of siltstone, a 2 cm-thick bed of fragment-packed conglomerate and 2 to 3 cm of sparse-fragment conglomerate make up well-defined bedding.

Comments on Genesis: The fine-grained silt-size matrix and argillaceous nature is typical of Maverick unit; polymictic poorly sorted fragments also characterize Maverick conglomerate; coloration may be because of burning.

Rock Name: Polymictic granule conglomerate and siltstone.

SITE AND SAMPLE DESCRIPTION

Site Number: M 65 **Sample Number:** 154204 **Code:** D 203

Location: N. Cactus Ridge **Scintillometer Counts:** 245 cps

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 13.20

Sec., Twp, Ra.: S8, 8N, 9E **Coordinates:** 34°03'23"; 111°26'51"

Geologic Unit: specularitic Deadman conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : The Deadman quartzite north of Y-Bar Tanks contains pebble conglomerate layers 3 to 6m thick that are strongly specularitic and very dark brick red to reddish brown to black in color. Nearly all of the 1-2cm-size fragments and all of the matrix are strongly specularitic, making it difficult to see the pebbles from a distance.

Variability: The conglomerates are interbedded with deep maroon to dark reddish brown quartzites, all of which is generally high in hematite. Grain size is stratigraphically controlled.

Sedimentary Structures: Cross beds abundant; some ripple marks, possibly mud cracks in hematitic siltstones and shales.

Depositional Environment: Shallow water, near-shore marine, possibly intertidal; also possibly fluvial, braided channel deposit with abundant specularite in source area.

SAMPLE DESCRIPTION : Large dark reddish brown, highly hematitic rhyolite or specularite-rich fragments have a 1-2mm rind of black specularite recrystallized around them. These and other, less hematitic, lighter red chert, rhyolite or jasper fragments (total fragments 45%) are supported in a specularite-hematite rich, brick-red matrix of quartzose, cherty, rhyolitic and hematitic material of medium-to coarse-grained sand sizes. Fragments are angular to rounded and poorly sorted.

Sampler: P. Anderson **Date:** 21 November, 1979

THIN SECTION DESCRIPTION

Site Number: M65 Sample Number: 154204 Code: D203

Percent Fragments: 37% Percent Matrix: 41%

Percent Heavies & Mafics: 22% Stain: dark red-brown specularite

Rock Type: Deadman conglomerate Stratigraphic Group: Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
hematitic rhyolite	60%	13.0-2.0 mm	rounded to subangular	1:3
hematitic siltstone	15%	6.0-4.0 mm	subrounded	1:1.5
specularitic conglomerate	25%	14.0-3.0 mm	subrounded	1:2.5

(rhyolite is quartz phenocrystic to granophyric, aphanitic and highly specularitic)

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	56%	2.0-.08 mm	clear, angular to rounded, embayed volcanic crystals with nonvolcanic grains
sericite	12%	.2-.005 mm	interstitial fillings between quartz grains
specularite	10%	1.0-.03 mm	rounded detrital grains
specularite	15%	.01-.005 mm	finely recrystallized masses over detrital grains
hematite	6%	.1 mm-powdery	stain of fragments, matrix and as recrystallized masses
zircon	1%	.07-.005 mm	detrital, subhedral

Cement: Hematite, specularite, sericite, quartz.

Interstitials: Specularite, sericite, quartz, hematite, zircon.

Textures and recrystallization: Highly unusual texture in that specularite is concentrated around fragment peripheries as detrital grains and finely recrystallized masses; detrital quartz shapes are perfectly preserved by matrix specularite, sericite is interstitial.

Structures: Fragments are crudely aligned to form bedding; peculiar conglomerate fragments consist of fragments and matrix encased in a bail of recrystallized specularite.

Comments on Genesis: Rock derived mostly by erosion of highly specularite-rich rhyolite terrain, specularitic conglomerate fragments are intraformational and result from slumping of dense and specularite-rich layers.

Rock Name: Specularite-fragment granule conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: M 66 **Sample Number:** 154205 **Code:** D 203

Location: N. Cactus Ridge **Scintillometer Counts:** 120 cps

Quadrangle: Mazatzal Peak U Value (U by NT) ppm : 7.60

Sec., Twp, Ra.: S8, 8N, 9E **Coordinates:** 34°03'26"; 111°26'42"

Geologic Unit: specularitic Deadman conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Close to M 65, and with the same general site geology are other specularite rich areas where hematitic iron-stain migration fronts are seen to cut through cross bedding of some units. This is similar to the specularite-rich rinds on fragments in M 65 where parts of the rocks are so iron rich that hematite is mobile in the oxidizing surface environment. However, elsewhere, fragments rich in bedded specularite material indicate primary specularite-rich beds. These are now broken, twisted, rolled and fragmented by sedimentary action to form an intra-formational, rip-up specularite-fragment conglomerate. This material is sampled as M 66. The dominance of rhyolite fragments with high specularite suggests that the specularite came from the rhyolite source terrain.

Variability:

Sedimentary Structures: Good bedding, disturbed bedding and scour-channel structures are seen in the unit.

Depositional Environment: Relatively shallow water, high energy depositional environment, either near shore marine or fluvial braided-channel deposit.

SAMPLE DESCRIPTION : One sample is over 50% hematite and consists of 3 x 10 to 8 x 30mm, flat, dark red rhyolite or hematitic slate chips in a granular matrix of coarse sand-to grit-size black specularite and white quartz.

The other sample shows very elongate, siliceous, flow-banded rhyolite and dark red hematitic to specularitic, more equant, angular 1-2cm-size rhyolite pebbles to a total of 30% of the rock, set in a matrix of dark maroon to reddish brown hematitic, quartz-rich grit. Through the middle of the sample, a 1-2cm thick bed of detrital specularite containing rhyolite and quartzite fragments, itself broken up, is seen.

Sampler: P. Anderson **Date:** 21 November 1979

THIN SECTION DESCRIPTION

Site Number: M66 **Sample Number:** 154205 **Code:** D203

Percent Fragments: 23% **Percent Matrix:** 32%

Percent Heavies & Mafics: 45% **Stain:** dark reddish-brown hematite

Rock Type: Deadman conglomerate **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
rhyolite	83%	10-2.0 mm	subangular	1:2
jasper	14%	3.5-2.0 mm	subangular	1:2
quartz	3%	3.2-2.0 mm	subrounded	1:1.5

(rhyolite fragments are sericitic, hematitic and flow banded)

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	32%	2.0-.02 mm	well-rounded embayed volcanic grains
rhyolite	5%	2.0-.8 mm	subangular
specularite	5%	1.3-.25 mm	rounded detrital grains
specularite	38%	powdery	recrystallized plates and masses
hematite	11%	powdery	massive opaque interstitial filling and grains
sericite	9%	<.008 mm	recrystallized plates and masses

Cement: Mainly hematite, recrystallized specularite and sericite; also minor recrystallized quartz.
Interstitials: Hematite, sericite, recrystallized quartz and specularite.

Textures and recrystallization: Quartz grains are strikingly clear, well-rounded embayed volcanic crystals set in a black hematite-specularite matrix; sericite is a minor interstitial; to locally abundant matrix component.

Structures: Bedding planes are defined by differing concentrations of heavy minerals and by the subparallel alignment of elongate fragments.

Comments on Genesis: An origin from erosion of a rhyolitic volcanic terrain is obvious for the fragments and matrix quartz grains, and therefore it must be concluded that the specularite is also of this origin.

Rock Name: specularite-rich rhyolitic grit to conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: M 67 Sample Number: 154209 Code: D 101

Location: S. of "The Park" Scintillometer Counts: 70 cps

Quadrangle: North Peak U Value (U by NT) ppm : 0.60

Sec., Twp, Ra.: S11, 9N, 8E Coordinates: 34°08'23", 111°29'57"

Geologic Unit: Deadman grit conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : At this sample site the total thickness of Deadman quartzite is very thin compared to most other exposures, with only the upper portion of the Deadman exposed at this site. It is fine-grained and pink to maroon in color, with some interbedded layers of grit, siltstone, and coarser grained quartzite.

Variability: The unit is highly variable and some areas show brecciation, recrystallization, and quartz remobilization.

Sedimentary Structures: Recrystallization, shearing, and the remobilization of quartz has disrupted original bedding structures.

Depositional Environment: Near-shore marine or fluvial.

SAMPLE DESCRIPTION : A dark hematite-rich quartzite supports grit and small granules in a ratio of 2:1. The matrix of quartz and hematite is poorly sorted and contains minor amounts of coarser grained quartz throughout. Fragments, averaging 2-20mm in length, are composed of mostly subrounded quartz and minor amounts of angular red jasper. Several angular pink quartzite fragments are present throughout the sample and are thought to be breccia fragments.

Sampler: K. Wirth Date: 27 November, 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 68 Sample Number: 154210 Code: M 101

Location: S. of "the Park" Scintillometer Counts: 70 cps

Quadrangle: North Peak U Value (U by NT) ppm : .70

Sec., Twp, Ra.: S12, 9N, 8E Coordinates: 34°08'11"; 111°29'35"

Geologic Unit: Mazatzal grit conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : This sample site is stratigraphically above sample site M 67. Mazatzal quartzite is fine grained, light purple to maroon and contains occasional quartz grit. This grades up section into poorly cemented medium-grained white quartzite. Above this the quartzite becomes red once again and quartz grit is more abundant (M 68).

Variability: Grain size varies from silt to fine- and medium-sand.

Sedimentary Structures: Abundant planar cross-beds.

Depositional Environment: Possibly near-shore marine as indicated by the well-sorted character and grain sizes of the sediments in the section.

SAMPLE DESCRIPTION : Interbedded red to maroon, fine- to medium-grained quartzite and grit has its matrix composed of mostly quartz, minor jasper and chert, and has interstitial fillings of hematite and specularite. Fragments are sub-rounded to rounded, are 1-6mm long, but average 2-4mm and are mostly quartz, minor jasper and chert. The fragments occur in layers in a matrix-to-fragment ratio of 4:1. Several singular fragments are dispersed throughout the finer grained quartzite layers in a ratio of 1 part fragment per 20 parts of matrix. Cross beds are defined by lenses of grit.

Sampler: K. Wirth Date: 27 November 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 69 **Sample Number:** 154211 **Code:** M 101

Location: Maverick Basin **Scintillometer Counts:** ND

Quadrangle: Table Mtn. **U Value (U by NT) ppm :** 0.60

Sec., Twp, Ra.: S14, 9N, 8E **Coordinates:** 34°07'28"; 111°30'18"

Geologic Unit: Mazatzal grit

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : The middle maroon unit of the Mazatzal here is cross bedded with abundant grit conglomerate layers. Interbeds are medium-to-fine-grained, well-rounded and well-sorted and consist mainly of quartz grains. Grit conglomerate contains well-rounded grains of mostly monocrystalline quartz with about 20% jasper and pink chert. Sorting is fair. Rock is very similar to those in the Chilson Camp area.

Variability: Variation in grain sizes is related to cross-bed sets.

Sedimentary Structures: Cross bedding abundant but no ripple marks are visible.

Depositional Environment: Shallow water marine or fluvial.

SAMPLE DESCRIPTION : Sample is a pale maroon to pink, well-bedded sedimentary rock with grit layers and coarse-grained quartzite closely interbedded on 1-3cm-thick layers. Grit layers consist of 60% quartz grains 1-3mm long, 20% pink to red to orange chert grains 1-3mm long, and 20% quartz-sand matrix. All grains are well-rounded, quartz has high sphericity and sorting is good.

Sampler: J. Trembly **Date:** 27 November 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 70 Sample Number: 154212 Code: M 202

Location: W. of Chilson Camp Scintillometer Counts: 80 cps

Quadrangle: Table Mtn. U Value (U by NT) ppm : 1.30

Sec., Twp, Ra.: S35, 9N, 8E Coordinates: 34°04'40"; 111°30'05"

Geologic Unit: specularitic Mazatzal granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : On ridge SW of Chilson Camp towards the south fork of Deadman Creek, red and white Mazatzal quartzite is thrust over white Mazatzal quartzite. Below the pink quartzite transition zone from white down into maroon and brick-red quartzite there are layers with up to 15% detrital specularite interstitial between quartz grains. Here grit to granule conglomerate layers contain quartz, jasper, chert and specularitic clasts, a series of which were sampled over a 100m stratigraphic interval.

Variability: Presence of grit and conglomerate is stratigraphically controlled but not predictable as they occur in cross-bed sets and discontinuous lenses.

Sedimentary Structures: Cross bedding, cut, scour, channel and truncation features.

Depositional Environment: Moderate energy near-shore marine environment close to wave action or else fluvial braided-channel network.

SAMPLE DESCRIPTION : Lenses of granule conglomerate occur in brick red to maroon to specularitic-black gritty quartzite. The granules are made up predominantly of rounded quartz grains of low to moderate sphericity 3 to 10cm long, pink to gray chert grains of about the same size, altered volcanic fragments 18mm long, and equant specularite chips 4mm long. Up to 20% specularite in one sample is concentrated along cross-bedding planes and occurs as an interstitial anhedral mosaic to matrix quartz.

Sampler: P. Anderson Date: 27 November 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 71 **Sample Number:** 154213 **Code:** D 201

Location: Maverick Basin **Scintillometer Counts:** 105 cps

Quadrangle: Cypress Butte **U Value (U by NT) ppm :** 1.40

Sec., Twp, Ra.: S11, 9N, 8E **Coordinates:** 34°07'53"; 111°30'18"

Geologic Unit: Deadman granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : West of 6402' ridge in the upper Deadman Creek drainage, both Maverick shale and Deadman quartzite are tectonically thinned. Most Deadman here is fine-grained, thinly bedded to cross-bedded, orange to maroon quartzite with only one significant granule conglomerate layer, which was sampled. The conglomerate contains specularitic fragments, hematitic quartz-jasper rock-fragment grit and rhyolitic to blackish shaly chips.

Variability: Deadman is strongly deformed here and quartzites are locally busted into tectonic breccias of pink, fine-grained, angular quartzite fragments in a white vein-quartz and manganese-stained matrix.

Sedimentary Structures: Cross bedding, possibly some intra-formational rip-ups.

Depositional Environment: Lack of basal conglomerate here and thinness of Maverick could indicate a primary depositional lap-out, close to edge of basin. Shallow water, most probably marine conditions.

SAMPLE DESCRIPTION : A grit-to granule-size conglomerate consists of mostly white quartz, pink chert, red jasper and black specularite chips in a pale maroon to metallic red-black, specularite-rich matrix. Fragments occupy about 50% of the rock, but the matrix varies from 50% medium-grained pink quartz grains to almost 30% detrital specularite. Specularitic fragments could come from disruption of such layers or could relate to the occasional chips of dark reddish-brown rhyolite in the conglomerate.

Sampler: P. Anderson **Date:** 29 November 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 72 **Sample Number:** 154214 **Code:** M 101

Location: Deadman Creek **Scintillometer Counts:** 70 cps

Quadrangle: Table Mtn. **U Value (U by NT) ppm :** 1.50

Sec., Twp, Ra.: S14, 9N, 8E **Coordinates:** 34°07'28"; 111°30'21"

Geologic Unit: Jasper-quartz granule conglomerate in Mazatzal

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Mazatzal quartzite on the cliffs facing Deadman Creek has sparse jasper-quartz granule conglomerate layers about 2cm wide in dark maroon to brick red quartzites near the base of the Mazatzal quartzite sequence. A series of these sparse granule-conglomerate layers, usually only one or two granules thick, was sampled.

Variability: Presence of granule layers are related to cross beds.

Sedimentary Structures: Cross-bedding, no ripple marks or graded bedding noted.

Depositional Environment: Most probably shallow-water marine, near-shore beach environment as this commonly has sands with just a few larger granules.

SAMPLE DESCRIPTION : A dark maroon to reddish brown, densely packed and recrystallized, medium grained quartzite contains 10% randomly distributed granules 4 to 12mm long of bright red jasper, milky white quartz, pink chert and white chalcedony (or rhyolite?) in areas where the quartzite is a little coarser grained or gritty.

Sampler: P. Anderson **Date:** 29 November 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 73 **Sample Number:** 154215 **Code:** D 202

Location: Deadman Creek **Scintillometer Counts:** 150 cps

Quadrangle: Table Mtn. **U Value (U by NT) ppm :** 12.70

Sec., Twp, Ra.: S14, 9N, 8E **Coordinates:** 34°06'50"; 111°31'04"

Geologic Unit: hematitic Deadman basal conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : On the east side of Deadman creek, a highly hematitic basal conglomerate of the Deadman rests unconformably on highly hematitic, dark-red aphanitic to black rhyolite. Within 10m of the base, in thinly bedded, medium-grained pink to white to maroon quartzite, is a conglomerate layer containing 35 to 50% red hematite (oxidized specularite) in which there are pebble-size fragments and rip-ups of hematitic mud and the maroon quartzites.

Variability: Thin unit changes laterally and vertically into less hematitic rocks.

Sedimentary Structures: Rip-up layers, good bedding and some cross bedding in quartzites.

Depositional Environment: Probably a basal hematite concentration in a transgressive marine sequence where heavies from the unconformity are concentrated.

SAMPLE DESCRIPTION : An intensely dark red-brown to shiny bluish-gray metallic colored conglomerate in which a quartzose hematitic matrix supports poorly-defined, flat and angular hematitic-to specularitic-mud chips which show shiny reflective surfaces of specularite. Fragments vary from granule to pebble size. The intense color of the rock masks its internal structure of well-defined beds of 100% specularite in between layers of fragments and disrupted beds. This structure is seen only on a cut face.

Sampler: P. Anderson **Date:** 29 November 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 74 **Sample Number:** 154216 **Code:** D 204

Location: Deadman Creek **Scintillometer Counts:** 205 cps

Quadrangle: Table Mtn. **U Value (U by NT) ppm :** 5.40

Sec., Twp, Ra.: S22, 9N, 8E **Coordinates:** 34°07'06"; 111°30'53"

Geologic Unit: Deadman basal cobble conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Further south along the flanks of Deadman creek, the basal 10m of Deadman quartzite is an angular rhyolite-cobble to pebble conglomerate in which the 3 to 10cm-long fragments are poorly sorted and packed in a matrix of hematite, specularite and quartz. Angular fragments of pink Deadman quartzite also occur in the conglomerate, just as they did in the previous sample.

Variability: There is a sequence of maroon quartzites about 50m thick separating this sample from the following one.

Sedimentary Structures: Good laminar bedding in quartzites, little else.

Depositional Environment: This cobble conglomerate defines a coarse channel deposit similar to, if not continuous with, the channel in Barnhardt Canyon. A fluvial-channel depositional environment is therefore inferred.

SAMPLE DESCRIPTION : Highly angular, dark red rhyolite and pink to maroon quartzite fragments 1 to 6cm long, lie, almost touching, in a matrix of dark reddish brown to black-metallic specularite, quartz, smaller rock fragments and patches of white chalcedonic material. Quartzite fragments indicate that quartzites have been eroded from basal Deadman strata in a flanking environment and deposited in this central channel. Dark red phenocrystic to aphanitic and specularitic rhyolite is probably the source of the hematite.

Sampler: P. Anderson **Date:** 30 November 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 75 **Sample Number:** 154217 **Code:** D 203

Location: Deadman Creek **Scintillometer Counts:** 300 cps

Quadrangle: Table Mtn. **U Value (U by NT) ppm :** 14.00

Sec., Twp, Ra.: S22, 9N, 8E **Coordinates:** 34°06'47"; 111°31'03"

Geologic Unit: upper Deadman hematitic conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Higher up than M 74 in the Deadman stratigraphy is another rhyolite-pebble conglomerate containing abundant, closely-packed, angular, flow-banded rhyolite clasts, and infrequent specularite clasts. Hematitic-specularitic quartzite, not so strongly hematite-stained as the coarser material, is interbedded with the conglomerate. The radiometrically hottest parts of the conglomerate were sampled.

Variability: Just above this sample site, the usual character of Deadman quartzites commences, which is well and thinly laminated, 0.3 to 0.6 m bedded, black specularite-bedded and laminated quartzite with interbedded shale.

Sedimentary Structures: Some cross bedding, but generally good bedding and fine laminations.

Depositional Environment: Shallow water marine or fluvial with high energy periods possibly representing a brief return to the conditions forming the basal channel deposit.

SAMPLE DESCRIPTION : Highly angular to rounded 5-32mm fragments of pinkish red, microphenocrystic rhyolite and pale pink rhyolite with specularite clots or replaced phenocrysts, are supported in a darker hematitic-red to specularitic matrix of finer grained rhyolite, hematite (altered specularite ?) and a white, interstitial chalcedony-type silica. There is very little detrital reworked quartz in the rock, but much of the finer material could be quartz and feldspar broken down from the volcanic rocks.

Sampler: P. Anderson **Date:** 30 November 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 76 **Sample Number:** 154218 **Code:** M 202

Location: Deadman Creek **Scintillometer Counts:** 70 cps

Quadrangle: Table Mtn. **U Value (U by NT) ppm :** 2.80

Sec., Twp, Ra.: S22, 9N, 8E **Coordinates:** 34°06'34"; 111°30'57"

Geologic Unit: hematitic Mazatzal quartz-jasper granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Talus slopes at the base of vertical 300m-high cliffs of lower Mazatzal red quartzites contain a variety of quartzites, grits and granule conglomerates exposed in the cliffs above. The coarsest material from these cliffs was sampled. Most is a hematite-rich granule conglomerate of jasper and quartz pebbles in a specularite-rich, maroon-colored matrix of quartz grains.

Variability: Variations from grit to granule conglomerate, brick red medium-grained quartzite to fine-grained maroon quartzite are stratigraphic.

Sedimentary Structures: Cross bedding with specularite concentrations on the cross beds are abundant in the coarser layers.

Depositional Environment: Shallow water, near-shore marine, probably various types of beach sands; fluvial environment is also possible.

SAMPLE DESCRIPTION : Character samples vary from: (a) pale maroon to pink, quartz-rich grit of closely packed, rounded quartz grains in a clay-rich or sericitic interstitial matrix showing specularite concentrations on bedding planes; to (b) a granule conglomerate containing bright red, banded jasper fragments, pink, flow-banded, red phenocrystic and dark red aphanitic rhyolite, pink chert and quartz in a dark reddish brown, specularite-rich matrix of detrital quartz and finer grained rock fragments. Rock is 40% matrix-supported fragments varying between 5 and 20mm in length.

Sampler: P. Anderson **Date:** 30 November 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 77 **Sample Number:** 154219 **Code:** D 203

Location: N. Fork of Deadman Cr. **Scintillometer Counts:** 165 cps

Quadrangle: Table Mtn. **U Value (U by NT) ppm :** 10.30

Sec., Twp, Ra.: S22, 9N, 8E **Coordinates:** 34°06'16"; 111°31'00"

Geologic Unit: basal hematitic Deadman conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : In North Fork canyon most of the Deadman is well-bedded (30cm beds) dark maroon quartzite. Only in the basal meter is there a 20cm-thick hematite-specularite-rich pebble conglomerate right in contact with the underlying rhyolite. The unconformity is knife-sharp with fragments of rhyolite, banded specularite and highly hematitic rhyolite essentially sitting in a specularite-rich matrix right on the main mass of rhyolite.

Variability: Conglomerate grades upward over a short interval into brick red and maroon quartzites.

Sedimentary Structures: Residual conglomerate-unconformity surface with local undulations and pockets.

Depositional Environment: Basal conglomerate formed in situ at base of transgressive marine sequence; could alternatively be the edge of the main channel deposit immediately to the north.

SAMPLE DESCRIPTION : The sample is an impressive conglomerate of angular to sub-rounded brick-red aphanitic rhyolite fragments 5 to 32mm long, and some metallic blue-black, banded-specularite fragments 15mm long, in a sparkly metallic-black to red matrix of specularite, quartz, fine-grained rock fragments and chalcedony (?). The fragments make up 65% of the rock, the conglomerate is framework-supported, and the specularitic matrix shown an interstitial texture.

Sampler: P. Anderson **Date:** 30 November 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 78 **Sample Number:** 154220 **Code:** K 001

Location: S. Fork of Deadman Cr. **Scintillometer Counts:** 85 cps

Quadrangle: Table Mtn. **U Value (U by NT) ppm :** 1.10

Sec., Twp, Ra.: S27, 9N, 8E **Coordinates:** 34°05'10"; 111°31'55"

Geologic Unit: chert-jasper-quartz grit in Maverick shale

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : A ridge of Maverick shale between South Fork and Deadman Creek contains a characteristic grit unit in thinly laminated, greenish yellow pyritic shales. The grit is 35cm thick, is underlain by specularitic and hematitic shales, and is overlain by only 3m of shales below the base of the Mazatzal quartzite. The grit consists of uniform 2-3mm-size, rounded quartz, jasper and chert grains in a greenish, sericitic matrix as is typical of Maverick conglomerates.

Variability: A variant of the usual greenish-matrix Maverick grit is present at this locality: it is a black, specularitic-matrix, chert-jasper-quartz grit, which except for hematite content and color is otherwise the same as the usual green grit.

Sedimentary Structures: Absence of higher-energy structures is characteristic. Sequence is well-bedded.

Depositional Environment: A brief period of higher energy conditions in a quiet basin, possibly reducing back-beach basin, may herald shallower water, higher energy conditions depositing Mazatzal.

SAMPLE DESCRIPTION : The main sample of Maverick grit is a pale yellow to pale green, bimodal grain-size rock of well-rounded 2-3mm quartz grains, lesser jasper and chert, supported in a sericitic or argillaceous pale green matrix. The specularitic variant is a black to dark reddish brown grit of mainly 2-4mm quartz, jasper, pink, red, yellow and white chert supported in 30% matrix of specularitic argillaceous material. In both samples, the bimodal grain sizes, uniform sizes of grit grains and the distinctive appearance of the grit are characteristic of Maverick conglomerates.

Sampler: P. Anderson **Date:** 1 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 78 A **Sample Number:** 154245 **Code:** K 210

Location: S. Fork of Deadman Cr. **Scintillometer Counts:** 100 cps

Quadrangle: Table Mtn. **U Value (U by NT) ppm :** 1.80

Sec., Twp, Ra.: S27, 9N, 8E **Coordinates:** 34°05'10"; 111°31'55"

Geologic Unit: hematite-specularite-rich siltstone in Maverick shale

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Immediately under the grit of M 78 are two beds of specularite-rich and hematite-specularite-rich siltstone, both of which were collectively sampled to see whether the higher U values would be associated with hematite-rich rock or coarser-grained deposits where the two are closely associated with one another in a setting where neither are common rock types (i.e. in shales).

Variability: One bed is more hematitic, the other more specularitic.

Sedimentary Structures: bedding

Depositional Environment: Influx of hematite is related to the higher energy conditions bringing in grit into the shaley environment. This means that a hematitic terrain is still the source material during Maverick deposition, but higher energy is needed to bring hematite into the shaley reducing basin.

SAMPLE DESCRIPTION :

The rock is a very dark reddish brown to almost black, hematite-rich siltstone containing as much as 35% specularite and hematite. Grain size is uniformly fine without fragments.

Sampler: P. Anderson **Date:** 1 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 79 **Sample Number:** 154221 **Code:** M 102

Location: S. Fork of Deadman Cr. **Scintillometer Counts:** 140 cps

Quadrangle: Table Mtn. **U Value (U by NT) ppm :** 1.30

Sec., Twp, Ra.: S27, 9N, 8E **Coordinates:** 34°05'06"; 111°35'54"

Geologic Unit: slate-chip conglomerate in Mazatzal quartzite

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Immediately above sample M 78, at the base of the Mazatzal quartzite, is a brick-red to maroon, hematitic quartzite containing shale chips ripped up from an immediately-underlying hematitic shale layer. The clasts are 1-4cm-long, 2-3mm-thick, flat sericitic shale and siltstone containing 10-30% hematite in a matrix of maroon to red quartzite.

Variability: Rip-up layers are poorly-defined and irregular in the quartzite

Sedimentary Structures: Rip-up layers; cross bedding in overlying units

Depositional Environment: Shallow water marine or possibly fluvial conditions in a transgressive sequence of increasing energy

SAMPLE DESCRIPTION : A pale maroon to reddish maroon quartzite contains thin plates of brick-red, hematitic shale. These are generally round in plan and 10-30mm long, but in cross section are only 1-2mm thick and slightly imbricate. Both the slate chips and the matrix are slightly sericitic.

Sampler: P. Anderson **Date:** 1 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 80 **Sample Number:** 154222 **Code:** D 211

Location: S. Fork of Deadman Cr. **Scintillometer Counts:** 100 cps

Quadrangle: Table Mtn. **U Value (U by NT) ppm :** 2.80

Sec., Twp, Ra.: S27, 9N, 8E **Coordinates:** 34°05'16"; 111°32'01"

Geologic Unit: basal specularitic Deadman quartzite

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : In the Deadman cliffs below sample M78, the Deadman quartzite rests in knife-sharp angular uncomformity with underlying rhyolites. Conglomerate is notably absent here at the base, in contrast to other basal Deadman samples further north. This defines the edge of the paleochannel and indicates that out of it, quartzites are deposited directly on rhyolite.

Variability: Some sparse grit fragments are present in the quartzite. Hematite content decreases upwards.

Sedimentary Structures: Good bedding

Depositional Environment: Base of transgressive marine sequence with heavy minerals concentrated at the uncomformity in the absence of residual fragments.

SAMPLE DESCRIPTION : A moderately (5%) sericitic, extremely dark red-brown to black, well-bedded, hematite-rich (20-30%) medium-to coarse-grained quartzite contains sparse 4-6mm fragments of red rhyolite in an otherwise finer grained matrix of hematite-specularite, quartz, volcanic detritus and sericite.

Sampler: P. Anderson **Date:** 1 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 81 Sample Number: 154223 Code: M 202

Location: S. Fork of Deadman Cr. Scintillometer Counts: 70 cps

Quadrangle: Table Mtn. U Value (U by NT) ppm : 2.9

Sec., Twp, Ra.: S27, 9N, 8E Coordinates: 34°05'42"; 111°31'19"

Geologic Unit: Mazatzal quartz-jasper granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Talus at the base of vertical cliffs of lower red Mazatzal quartzite includes quartz-jasper grit and granule conglomerates that are typically found in layers in the quartzite. The granule conglomerate layers (coarsest material) were sampled and are known to have come from the cliffs above, but the exact site geology is not known.

Variability: The density of conglomerate fragments is highly variable between layers.

Sedimentary Structures: Conglomerate layers and bedding sets average 4-12cm in thickness.

Depositional Environment: Near-shore marine or fluvial.

SAMPLE DESCRIPTION : A dark maroon matrix is supported by closely-packed red jasper and white quartz fragments in a ratio of 2:1. This matrix is fairly well sorted and composed of mostly quartz, some jasper and rhyolite. Cross-bedded layers 2-3cm thick contain interstitial heavy mineral concentrates. Grit- and granule-size fragments average 2-7mm in length and occasionally reach 12mm in length. Quartz, the most common fragment type, is rounded and usually the smallest of grains. Rhyolite, sometimes containing quartz phenocrysts, and red jasper are less common fragment types and tend to be sub-rounded to sub-angular and larger than quartz grains.

Sampler: K. Wirth Date: 1 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 82 Sample Number: 154224 Code: K 001

Location: S. Fork of Deadman CrScintillometer Counts: 90 cps

Quadrangle: Table Mtn. U Value (U by NT) ppm : 1.1

Sec., Twp, Ra.: S27, 9N, 8E Coordinates: 34°05'49"; 111°21'24"

Geologic Unit: Maverick quartz-chert-jasper grit

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : This sample site is situated in the middle of the Maverick shale. The section is composed of mostly yellow-green shale with minor interbedded siltstone, quartzite and grit conglomerate.

Variability: Conglomerates can be divided into two main types: 1) a polymictic fragment-rich grit as in the sample description and 2) a sparse grit of jasper and chert in white coarse-grained quartzite matrix.

Sedimentary Structures: Shales and siltstones are thinly laminated and bedded. Coarser-grained layers are bedded in 4-15cm-thick sets.

Depositional Environment: A back bay environment is indicated by the thick section of shales and silt. The grit layers may represent surges of higher energy, possibly a storm or transgression.

SAMPLE DESCRIPTION : Red, green, and white sub-rounded grit supports a fine-sand to silt-size pink to pale green matrix of mostly quartz with finer interstitial micas and clays. No heavy minerals or stain are present. Fragments are 1-4mm long and are composed of mostly green fine-grained siltstones or chert, some white quartz, lesser red jasper and white chert.

Sampler: K. Wirth Date: 1 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 03 Sample Number: 154225 Code: D 202

Location: S. Fork of Deadman Cr. Scintillometer Counts: 120 cps

Quadrangle: Table Mtn. U Value (U by NT) ppm : 1.3

Sec., Twp, Ra.: S27, 9N, 8E Coordinates: 34°05'50"; 111°31'35"

Geologic Unit: Deadman intraformational conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Deadman quartzite rests, in slight uncoformity, on hematitic red flow-banded and quartz-phenocrystic rhyolite. The basal portion of the Deadman quartzite is dark brick red and evenly bedded in 10-20cm thick sets. The characteristic basal conglomerate is not present at this site and is replaced by medium-grained quartzite. Upper portions of the quartzite are similar, but orange to white in color.

Variability: A small conglomerate layer 4-20mm in thickness was sampled approximately 15 meters above the base of the quartzite.

Sedimentary Structures: Ripple marks and shale rip-ups were observed in the upper portions of the quartzite.

Depositional Environment: Near-shore marine or fluvial as indicated by grain size and sedimentary structures.

SAMPLE DESCRIPTION : Angular fine-grained hematite-rich fragments are supported in interbedded white and dark quartzite in a ratio of 3:2. The medium- to fine-grained matrix is mostly quartz in the white layers and quartz plus interstitial hematite in the darker layers. Angular fragments are 3-27mm long, average 5-12mm and consist of dark, fine-grained, hematite-rich aphanitic rhyolite or ferruginous chert. Most have axial ratios of 1:1:2 and show sub-parallel alignment. One small green siltstone or chert fragment was also observed.

Sampler: K. Wirth Date: 1 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 84 **Sample Number:** 154226 **Code:** D 113

Location: S. Fork of Deadman **Scintillometer Counts:** ND

Quadrangle: Table Mtn. **U Value (U by NT) ppm :** 1.40

Sec., Twp, Ra.: S33, 9N, 8E **Coordinates:** 34°04'20"; 111°32'37"

Geologic Unit: Upper red Deadman quartzite and granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Further south than M 80 at the top of the Deadman cliff-forming outcrop is a pinkish-orange to pale purple-red, fine to medium-grained quartzite. Within this are sparse grit and granule-conglomerate fragments of red rhyolite, but over 90% of the rock is medium-grained quartzite.

Variability: Chert clasts are found in places.

Sedimentary Structures: Trough cross beds are abundant.

Depositional Environment: Probably shallow water marine, possibly fluvial

SAMPLE DESCRIPTION : A well bedded pinkish, reddish orange, medium-to coarse-grained quartzite contains sparse rhyolite and chert grains which are very elongate but well-rounded (1-5mm wide, 6-13mm long). These occur in layers where there is a predominance of coarser-grained, well-rounded quartz.

Sampler: J. Trembly **Date:** 1 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 85 Sample Number: 154227 Code: D 101

Location: N. of Barhardt Canyon Scintillometer Counts: 58 cps

Quadrangle: Mazatzal Peak U Value (U by NT) ppm : 1.0

Sec., Twp, Ra.: S21, 9N, 9E Coordinates: 34°06'18"; 111°25'55"

Geologic Unit: Deadman grit conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : At this location approximately 35 meters of quartzite comprises the whole Deadman quartzite section. The lower portion is a hematitic and specularite-rich siltstone. This grades upward into purple, pink, and white fine- and medium-grained quartzites. Thin grit layers occur near the top of the unit.

Variability: Hematite- and specularite-rich quartzite and more pure quartzite form alternating beds 2-5mm thick.

Sedimentary Structures: Grit layers average 2-5mm in thickness.

Depositional Environment: Near-shore marine or fluvial as indicated by the relatively well-sorted character of the quartzite.

SAMPLE DESCRIPTION : A quartz-rich white grit to granule conglomerate contains mostly quartz and rare jasper fragments in a pink to dark maroon quartzite matrix of poorly sorted quartz and minor jasper. Detrital specularite is present throughout the matrix as interstitial grains concentrated on cross-bedding planes in layers 1-12mm thick. Grit- ize fragments are 1-7mm long, average 2-4mm, and include sub-angular to sub-rounded quartz as well as minor amounts of elongate and sub-angular jasper. Hematitic stain is present as a trace constituent.

Sampler: K. Wirth Date: 4 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 86 **Sample Number:** 154228 **Code:** D 202

Location: N. of Barnhardt Canyon **Scintillometer Counts:** ND

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 3.4

Sec., Twp, Ra.: S21, 9N, 9E **Coordinates:** 34°06'07"; 111°26'04"

Geologic Unit: Deadman granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Deadman quartzite is highly sheared and cut by many dikes of diabase. The quartzites are generally muddy and poorly sorted with occasional grit and granule conglomerate layers interbedded throughout the section. Hydrothermal alteration and copper mineralization appear to be related to the diabase dikes.

Variability: Deadman quartzite appearance varies from muddy, silty, and micaceous to nearly pure quartzite.

Sedimentary Structures: Shearing and deformation have destroyed original sedimentary structures.

Depositional Environment: Possibly fluvial as indicated by the poorly sorted and relatively immature nature of the rocks in the section.

SAMPLE DESCRIPTION : This is a typical sample of Deadman conglomerate where a dark purple to black fine-grained matrix is supported by large, similarly colored, dark purple fragments in approximately equal amounts. The matrix is composed of fine-grained quartz grains with lesser amounts of earthy red hematite and specularite. The overall appearance of the matrix is of a poorly sorted dirty hematitic mud. Fragments are angular to sub-angular 6-30mm, and occasionally 40mm long, and appear to be composed of hematite-rich varieties of aphanitic and quartz-phenocrystic rhyolite.

Sampler: K. Wirth **Date:** 4 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 87 **Sample Number:** 151229 **Code:** D 203

Location: N. of Barnhardt Canyon Scintillometer Counts: 163 cps

Quadrangle: Mazatzal Peak U Value (U by NT) ppm : 4.6

Sec., Twp, Ra.: S21, 9N, 9E Coordinates: 34°05'55"; 111°26'10"

Geologic Unit: Deadman pebble conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Same as site M 86. A separate sample was taken here because of the much larger fragments.

Variability: Conglomerate fragments are well sorted in each layer, but vary from granule to boulder sizes in different layers.

Sedimentary Structures: Deformation has destroyed sedimentary structures.

Depositional Environment: Possibly fluvial as indicated by poor sorting and the large size of fragments.

SAMPLE DESCRIPTION : Very typical of sheared Deadman conglomerate, this sample is more foliated and micaceous and has larger fragments than the sample from site M 86. Here also it is difficult to discern sheared and platey fragments from the micaceous and foliated matrix due to their similar color and stain. The matrix is a sheared mass of fine-grained quartz, sericite, hematite and some detrital specularite. Fragments are angular and discoidal to ellipsoidal in shape. Fragments are 5-40mm long (commonly 8-25mm) and are composed of hematite-rich rhyolite and minor quartz.

Sampler: K. Wirth **Date:** 4 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 88 **Sample Number:** 154230 **Code:** M 102

Location: N. of Barnhardt Canyon **Scintillometer Counts:** 70 cps

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 1.3

Sec., Twp, Ra.: S28, 9N, 9E **Coordinates:** 34°05'45"; 111°26'02"

Geologic Unit: Mazatzal granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : This section consists of a small faulted wedge of Mazatzal quartzite surrounded by Maverick shale, Deadman quartzite, and diabase. The Mazatzal quartzite appears to be recrystallized and is cut by many veins of remobilized quartz. Interbedded fine- and medium-grained quartzite, sometimes containing grit or granules, comprise the section.

Variability: Grit conglomerate layers are mostly quartz with minor chert and jasper. Granule conglomerate layers include equal amounts of quartz, jasper, and dark red silicic material.

Sedimentary Structures: Planar cross-beds are 3-6cm thick.

Depositional Environment: Near-shore marine or fluvial.

SAMPLE DESCRIPTION : Quartz and jasper grit support a fine- to medium-grained matrix in a ratio of 3:1. The matrix is mostly quartz with earthy-red hematite interstitial fillings. Fragments are generally sub-angular, average 2-4mm, and consist of white quartz, red jasper, and dark red hematite-rich volcanic rock (probably of rhyolitic composition) in nearly equal proportions. Small veins of remobilized quartz are present throughout.

Sampler: K. Wirth **Date:** 4 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 89 Sample Number: 154231 Code: D 103

Location: NE Cactus Ridge Scintillometer Counts: 130 cps

Quadrangle: Mazatzal Peak U Value (U by NT) ppm : 4.3

Sec., Twp, Ra.: S33, 9N, 9E Coordinates: 34°04'12"; 111°25'50"

Geologic Unit: Deadman granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : This sample site is near the top of the Deadman quartzite unit. Approximately 15 meters of quartzite comprises this section exposed below the Maverick shale. The quartzites are moderately pure in that they do not contain a high percentage of clays like the basal Deadman quartzite. Several conglomerate layers of mostly quartz and rhyolite occur at the base of this part of the section and were sampled.

Variability: Color, which appears to refelct heavy mineral content, ranges from white to dark maroon.

Sedimentary Structures: Well-developed graded bedding. The base of each graded sequence is made up of 1-2cm thick layers of conglomerate. These grade upward into 2-4cm of micaceous silty material.

Depositional Environment: Either shallow-water, near-shore marine of fluvial with periodic influxes of graded sediments.

SAMPLE DESCRIPTION : Medium- to coarse-grained gritty quartzite supports granules and small pebbles of rhyolite, jasper, and quartz. Beds average 4cm thick and show good grading from a dense granule conglomerate to sparser grit at the base, fining upwards to coarse-, medium-, and fine-grained quartzite finally to siltstone and shale at the top. The uppermost 2-4mm of each graded sequence is the most hematitic rock (micaceous dark maroon shale with about 10% earthy hematite). Fragments are usually restricted to the lower half of each graded sequence, though occasional grit is sometimes present in the finer-grained upper portions. Fragments average 3-25mm in length and are commonly sub-rounded white quartz, lesser earthy red rhyolite and minor jasper.

Sampler: K. Wirth Date: 6 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 90 Sample Number: 154232 Code: D 203

Location: NE Cactus Ridge Scintillometer Counts: 110 cps

Quadrangle: Mazatzal Peak U Value (U by NT) ppm : 1.7

Sec., Twp, Ra.: S4, 8N, 9E Coordinates: 34°04'10"; 111°25'50"

Geologic Unit: Deadman pebble conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : This sample is a down-section continuation from the previous one, where obvious conglomerates are again present in the quartzites.

Variability: Quartz grains and specularite-rich fragments of lower Deadman material are present here in contrast to most other Deadman conglomerates.

Sedimentary Structures: Possible mud crack or shale rip-up layers.

Depositional Environment: Fluvial or near-shore marine.

SAMPLE DESCRIPTION : A light maroon to purple, poorly sorted matrix supports rounded quartz fragments and angular, elongate, black rip-up fragments in a ratio of 3:1. The matrix is composed of mostly quartz and minor jasper and rhyolite. Matrix grains grade from fine-grained sand to grit-size fragments. The conglomerate fragments consist of pebble- to granule- to grit-size fragments of quartz (40%), pink and dark sub-angular rhyolite (30%), sub-angular red jasper (10%) and specularite-hematite-rich fragments (20%). The specularite-hematite-rich fragments are angular and elongate with axial ratios ranging from 1:2:4 to 1:4:20. These may be rip-up fragments from previously deposited layers.

Sampler: K. Wirth Date: 6 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 91 **Sample Number:** 154233 **Code:** D 204

Location: NE Cactus Ridge **Scintillometer Counts:** 75 cps

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 4.8

Sec., Twp, Ra.: S4, 8N, 9E Coordinates: 34°04'10"; 111°25'50"

Geologic Unit: Deadman cobble conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Still lower down in the same Deadman section, much coarser fragments are found and sampled. At this point, red rhyolite becomes the dominant fragment type, and both jasper and quartz fragments are noticeably absent from the lower parts of the Deadman section.

Variability: Detrital specularite varies from nearly absent to approximately 10% in different layers.

Sedimentary Structures: Obscured by deformation.

Depositional Environment: Possibly a fluvial deposit as indicated by poor sorting, large fragments, and local rhyolite provenance.

SAMPLE DESCRIPTION : A light purple hematite-stained matrix is interstitial to large sub-angular to sub-rounded cobbles and pebbles of rhyolite. The matrix consists of coarse sand- to grit-size pink-stained grains of quartz and minor rhyolite. Neither detrital specularite nor hematite is present in moderate amounts, but outcrop and individual grain surfaces are often stained purple or yellow. Conglomerate fragments are commonly sub-angular to sub-rounded, average 15-14cm long, occasionally up to 22cm, and consist dominantly of purple, phenocrystic rhyolite as in sample M 63.

Sampler: K. Wirth **Date:** 6 December 1979

THIN SECTION DESCRIPTION

Site Number: M91 **Sample Number:** 154233 **Code:** D204

Percent Fragments: 28% **Percent Matrix:** 61%

Percent Heavies & Mafics: 11% **Stain:** dark reddish brown hematite

Rock Type: Deadman conglomerate **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : **(percentages are based on 100% fragments)**

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
rhyolite	99%	38 mm	subrounded	1:2
quartz	1%	2.3-2.0 mm	subrounded	1:1.5

(quartz phenocrysts in siliceous rhyolite fragments are rounded rectangular and embayed, and are identical to quartz grains in the matrix).

MATRIX & HEAVIES : **(percentages are based on 100% matrix & heavies)**

Type & color	Percentage	Size range	Description
quartz	77%	2.0-.02 mm	clear rounded volcanic grains
chert	3%	1.3-.09 mm	subrounded
rhyolite	2%	1.6-.14 mm	subrounded
specularite	1%	.2-.13 mm	rounded grains
specularite	5%	powdery	recrystallized with hematite
hematite	6%	powdery	massive interstitial filling and fine grains
sericite-clay	5%	<.02 mm	recrystallized plates and masses
zircon	<1%	.09 mm	rounded grains
jasper	<1%	.7-.2 mm	subrounded

Cement: Hematite, recrystallized specularite and quartz, and sericite

Interstitials: Hematite, recrystallized specularite and quartz, and sericite

Textures and recrystallization: Matrix quartz is clear rounded to subangular, well-packed volcanic quartz grains in a black hematitic and specularitic, finer grained matrix; sericite-clay forms interstitial fillings only in hematite-poor layers.

Structures: Bedding planes are defined by differing concentrations of heavy minerals, and variation between hematite-rich layers and lighter colored clay-rich layers.

Comments on Genesis: Interlamination of hematite in some matrix layers with sericite-clay in other layers indicates that powdery hematite is a primary detrital interstitial component and not just a stain. Derived by erosion of a specularitic rhyolite source terrain.

Rock Name: specularitic rhyolite-pebble conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: M 92 **Sample Number:** 154234 **Code:** D 203

Location: NE Cactus Ridge **Scintillometer Counts:** 123 cps

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 3.5

Sec., Twp, Ra.: S4, 8N, 9E **Coordinates:** 34°04'10"; 111°25'48"

Geologic Unit: Deadman pebble conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : The basal portion of the Deadman quartzite below the spherulitic rhyolite sill consists of interbedded conglomerate and quartzite. As a whole, the section is poorly sorted and matrix material is very impure. Fine earthy red hematite stain is present throughout the section and may have been derived from the underlying rhyolite.

Variability: Conglomerate fragments are absent in some layers, and comprise as much as 40% of the rock in other layers.

Sedimentary Structures:

Depositional Environment: Possibly fluvial as indicated by the poor sorting and immaturity of the sediments.

SAMPLE DESCRIPTION : The sample is a dark maroon conglomerate in which the maroon rhyolite fragments are almost indistinguishable from the maroon rhyolitic matrix. The matrix consists of quartz and rhyolite with heavy interstitial concentrations of earthy red hematite. Conglomerate fragments are composed of mostly sub-angular pink to purple rhyolite, and average 10-30mm in length. Most fragments show sub-parallel alignment, but their elongation and alignment are related to deformation.

Sampler: K. Wirth **Date:** 6 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 93 **Sample Number:** 154236 **Code:** D 202

Location: NE of Cactus Ridge **Scintillometer Counts:** 150 cps

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 3.8

Sec., Twp, Ra.: S3, 8N, 9E **Coordinates:** 34°04'10"; 111°25'44"

Geologic Unit: Deadman granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Same as the site M 92 description, this sample was collected significantly lower in the section to warrant a separate site.

Variability: Some layers contain small pink fragments which appear to be a different type of rhyolite.

Sedimentary Structures: Hematite cemented breccia may be a sedimentological or local tectonic breccia.

Depositional Environment: Fluvial as indicated by the poor sorting and immaturity of the sediments.

SAMPLE DESCRIPTION : Earthy-red hematite specularite and fine quartz matrix material is supported by sub-angular to sub-rounded granules and pebbles of red hematitic rhyolite. The fine-grained quartz and lesser rhyolite matrix contains high concentrations of detrital specularite and interstitial hematite. Sorting is poor and bedding structures are not defined. Conglomerate fragments average 4-30mm in length and are composed of mostly red, grey, and dark specularite-rich rhyolite. Though most fragments are elongate, commonly having axial ratios of 1:2:3, they show no preferred orientation.

Sampler: K. Wirth **Date:** 6 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 94 **Sample Number:** 154237 **Code:** M 202

Location: NE Cactus Ridge **Scintillometer Counts:** ND

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 1.5

Sec., Twp, Ra.: S33, 9N, 9E **Coordinates:** 34°04'30"; 111°2 '58"

Geologic Unit: Mazatzal granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Sampled from same stratigraphic horizon as samples M 47 and M 48, this dark maroon Mazatzal conglomerate is distinctly different from Deadman conglomerates because of the abundance of rounded quartz, jasper, and dark gray chert fragments in the Mazatzal.

Variability: Some layers are composed of mostly specularite or hematite rich fragments which may be either ferruginous chert or rhyolite.

Sedimentary Structures: Bedding and cross bedding, but not in conglomerate layers.

Depositional Environment: Shallow water, higher-energy influx into a marine or perhaps a fluvial environment.

SAMPLE DESCRIPTION : This sample is very dark because of the abundant dark gray chert fragments, dark grey to black, specularite rich fragments, dark red hematitic rhyolite, and dark red chert that are abundant in the framework-supported conglomerate. Bright red jasper and clear quartz fragments are also present. The matrix is quartz, hematite and specularite rich, clean and well sorted and medium to coarse grained. Fragment sizes vary from 5 to 20mm.

Sampler: K. Wirth **Date:** 6 December 1979

THIN SECTION DESCRIPTION

Site Number: M94 **Sample Number:** 154237 **Code:** M202

Percent Fragments: 60% **Percent Matrix:** 35%

Percent Heavies & Mafics: 5% **Stain:** hematite

Rock Type: Mazatzal conglomerate **Stratigraphic Group:** Mazatzal Group

FRAGMENTS : **(percentages are based on 100% fragments)**

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartz	8%	4.5 - 1.7 mm	rounded	1:1.5
chert	41%	9 - 1.7 mm	sub-rounded	1:2
jasper	36%	5.6 - 1.7 mm	sub-rounded	1:2
quartzite	2%	1.3 - 1.7 mm	sub-rounded	1:1
chalcedony	13%	9 - 2.7 mm	well-rounded	1:2

MATRIX & HEAVIES : **(percentages are based on 100% matrix & heavies)**

Type & color	Percentage	Size range	Description
quartz	72%	1.7 - .02 mm	angular, unrecrystallized
chert	4%	1.7 - .2 mm	angular to rounded
clay	15%	<.005 mm	interstitial + grain-edge mats
sericite	1%	.04 - .015 mm	recrystallized plates and masses
specularite	3%	.11 - .04 mm	rounded detrital
hematite	5%	powdery	fine interstitial grains
zircon	<1%	.14 - .06 mm	rounded

Cement: Recrystallized quartz, clay, sericite, hematite.

Interstitials: Specularite, recrystallized quartz, clay, sericite, hematite.

Textures and recrystallization: Impure matrix preserves primary angular matrix grain shapes; quartz grains somewhat undulose and sutured; some quartz strongly recrystallized in strain shadows between larger grains.

Structures: Bedding planes may parallel general elongation of the larger chert fragments.

Comments on Genesis: Relatively impure, argillaceous-rich angular-quartz matrix and abundant chert suggests local rhyolitic, cherty source terrain; nearly all primary textures preserved.

Rock Name: Chert-jasper pebble conglomerate.

SITE AND SAMPLE DESCRIPTION

Site Number: M 95 **Sample Number:** 154162 **Code:** D 203

Location: W of Mazatzal Peak Scintillometer Counts: 130 cps

Quadrangle: Mazatzal Peak U Value (U by NT) ppm : 3.6

Sec., Twp, Ra.: S7, 8N, 9E Coordinates: 34°03'10"; 111°28'30"

Geologic Unit: Deadman pebble conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Deadman quartzite rests unconformably on rhyolite. The rhyolite is very fragmental and is often hard to distinguish from basal Deadman quartzite. Both contain cobble and boulder-size angular fragments of rhyolite and have high hematite contents. Bedding in the basal portion of the quartzite strikes W 40° W and dips 14° NE while the contact between the rhyolite and quartzite strikes N 55° W and dips 21° NE.

Variability: Fragments decrease in size up section until they are absent approximately 15 meters above the rhyolite-quartzite contact.

Sedimentary Structures: The conglomerate layers are generally very massive in appearance.

Depositional Environment: In situ residual conglomerate deposited at the base of a transgressive marine seuqence or possibly in a fluvial system.

SAMPLE DESCRIPTION : Cobble to boulder size fragments of earthy red rhyolite occur in an equal amount of coarse-grained rhyolitic detritus of similar color. The coarse-grained matrix is composed of mostly rhyolite and traces of quartz. Interstices are filled with heavy concentrations of hematite and specularite. Fragments average 80-210mm in length and are composed of either dark hematite-red and quartz-phenocrystic rhyolite, or thinly flow-banded rhyolite.

Sampler: K. Wirth **Date:** 10 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 96 **Sample Number:** 154263 **Code:** D 203

Location: W of Mazatzal Peak **Scintillometer Counts:** 120 cps

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 4.4

Sec., Twp, Ra.: S7, 8N, 9E **Coordinates:** 34°03'17"; 111°28'35"

Geologic Unit: Deadman pebble conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Same as site M 95, but this sample was taken 400m further west along strike of the basal unconformity.

Variability: The conglomerate horizon averages 10-15 meters in thickness at this site and thins to 6 meters thick to the north.

Sedimentary Structures: Bedding is not well defined because of the massive depositional character of the sediments.

Depositional Environment: This sample is essentially a rhyolite grus and could represent either a fluvial or marine deposit which preserved the decomposed material on the paleo-erosion surface.

SAMPLE DESCRIPTION : This sample is very similar in composition and appearance to the one described in the site M 95 sample description. The major difference between the two is that the fragments in M 96 show slightly better rounding than those in M 95.

Sampler: K. Wirth **Date:** 10 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 97 **Sample Number:** 154264 **Code:** D 203

Location: W of Mazatzal Peak **Scintillometer Counts:** 105 cps

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 7.4

Sec., Twp, Ra.: S7, 8N, 9E **Coordinates:** 34°03'20"; 111°28'30"

Geologic Unit: Deadman pebble conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Same as site descriptions M 95 and M 96 except this sample was taken higher up in the section and west of M 96.

Variability: Fragment size is highly variable up and down section.

Sedimentary Structures: Bedding too coarse to be seen clearly.

Depositional Environment: Basal debris deposit on erosion surface, either shallow water marine transgressive or fluvial.

SAMPLE DESCRIPTION : Generally similar to samples from sites M 95 and M 96, this sample consists of very large, well-rounded, dark brick red to maroon, hematite-rich, aphanitic rhyolite fragments 5 to 12 cm long with interstitial material of red rhyolitic detritus making up only 15% of the sample.

Sampler: K. Wirth **Date:** 10 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 98 Sample Number: 154265 Code: R 102

Location: W of Mazatzal Peak Scintillometer Counts: ND

Quadrangle: Mazatzal Peak U Value (U by NT) ppm : 5.5

Sec., Twp, Ra.: S7, 8N, 9E Coordinates: 34°03'20; 111°28'33"

Geologic Unit: Rhyolite conglomerate

Stratigraphic Group: Alder Group (red rock rhyolite)

SITE GEOLOGY : Same as site M 95, but the sample was taken of the rhyolite immediately under the Deadman unconformity, for geochemical comparisons.

Variability: This rhyolitic conglomerate appears to be preserved only right at the top of the Red Rock unit, unless yellow agglomerates further south are correlative with less hematite in them.

Sedimentary Structures: NA

Depositional Environment: Subaerial or subaqueous, intravolcanic

SAMPLE DESCRIPTION : A wide variety of angular fragments of rhyolitic composition are supported by a fine-grained hematite-red matrix in a ratio of 3:1. The matrix is very fine-grained and contains numerous subhedral volcanic quartz grains approximately .5-2mm in length. Some layers contain higher concentrations of hematite and are flow-banded in appearance. Fragments averaging 9-33mm in length are composed of flow-banded rhyolite, quartz-phenocrystic rhyolite and aphanitic rhyolite. Less abundant fragments which appear to be of granophyric composition are also present. Due to the wide variety of fragment compositions and fine-grained nature of the matrix, it is often difficult to distinguish Deadman rhyolite conglomerate from rhyolite agglomerates at the contact.

Sampler: K. Wirth Date: 10 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 99 **Sample Number:** 154266 **Code:** D 102

Location: W of Mazatzal Peak **Scintillometer Counts:** 144 cps

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 4.1

Sec., Twp, Ra.: S7, 8N, 9E **Coordinates:** 34°03'25"; 111°28'23"

Geologic Unit: Deadman granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Same as site M 95, except conglomerate fragments are smaller at this location, furthest to the west.

Variability: In the upper part of the basal conglomerate section where fragment size is decreasing.

Sedimentary Structures: None apparent.

Depositional Environment: A paler-erosion surface deposit, either fluvial or near shore, shallow water marine.

SAMPLE DESCRIPTION : Angular yellow to maroon fragments of rhyolite occur in a maroon to earthy hematite red matrix, also of rhyolite composition. The matrix is poorly-sorted and composed of silt to sand-sized grains, all of rhyolitic composition. Hematite is present, but detrital specularite is absent. Occasional small volcanic quartz grains are also present. Fragments average 2-15mm in length, are commonly elongate chips of aphanitic rhyolite whereas smaller grains are arcuate or shard-like in appearance. The texture could be primary, or due to shearing. The sedimentary conglomerate is essentially of rhyolitic composition (i.e., a rhyolite grus) and is very difficult to distinguish from a volcanic conglomerate.

Sampler: K. Wirth **Date:** 10 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 100 **Sample Number:** 154267 **Code:** D 212

Location: Upper S. Fork of Deadman **Scintillometer Counts:** 140 cps

Quadrangle: Table Mtn. **U Value (U by NT) ppm :** 13.00

Sec., Twp, Ra.: S11, 8N, 8E **Coordinates:** 34°03'09"; 111°30'28"

Geologic Unit: hematitic Deadman slate conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : On the ridge south of South Fork, Deadman is in sharp but sheared contact with underlying rhyolites and dips 85° to the west. The Deadman contains no conglomerate here, only specularite-rich (greater than 30%) layers of quartzite and hematitic shale rip-up layers, the latter of which was sampled. These hematitic layers are a local radiometric anomaly of 140 cps over the usual 70-80 cps for the rest of the specularitic quartzite. Most of the Deadman here is thinly bedded, poorly cross-bedded, medium- to fine-grained quartzite, dark maroon in color, with local sparse rip-up conglomerate of hematitic mud chips in the upper parts.

Variability: Most chips are flat plates 0.2 x 1 x 2 cm in size.

Sedimentary Structures: Rare cross bedding, shaley rip-ups.

Depositional Environment: Probably shallow-water marine, fluctuating energy conditions.

SAMPLE DESCRIPTION : A medium-grained, dark to black, strongly specularitic and hematite-stained quartzite, with about 5% white interstitial sericite (?), leucoxene or argillaceous material in the matrix contains a 1-cm thick dark red hematitic shaley layer which is about 30% hematite. Total iron content of the rock is 15-25%, made up of finer grained red hematitic shaley material interspersed with blacker specularitic quartzite.

Sampler: P. Anderson **Date:** 10 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 101 **Sample Number:** 154268 **Code:** M 102

Location: Upper S. Fork of Deadman **Scintillometer Counts:** 100 cps

Quadrangle: Table Mtn. **U Value (U by NT) ppm :** 1.10

Sec., Twp, Ra.: S11, 8N, 8E **Coordinates:** 34°03'12"; 111°30'32"

Geologic Unit: Mazatzal quartz-jasper grit to pebble conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Just west of sample M 100 on the same ridge, Mazatzal quartzite is exposed west of about 75m of sheared Maverick shale. Quartz-jasper grit and sparse quartz-pebble conglomerate is interlayered with thinly bedded brick-red basal Mazatzal quartzite. Hematite content is appreciable (5%) in the lower 60m of section and decreases rapidly up section.

Variability: Rock is generally well sorted grit to coarse sand-size grains except for anomalous large quartz pebbles very sparsely distributed in the grit layers.

Sedimentary Structures: Cross bedding poorly developed.

Depositional Environment: Shallow-water, probably near-shore marine with strong enough current action to bring in a few large fragments.

SAMPLE DESCRIPTION : A strongly brick-red stained grit of well-rounded, well-sorted quartz (50%), jasper (10%), chert (15%) and dark brick-red rhyolite (25%) grains 2-6mm long contains a few larger (1-4cm) rounded fragments of white milky quartz, pink quartzite, and pink cherty rhyolite supported by the grit matrix. Hematite is the main grain cement, leaving some layers poorly indurated so that the matrix breaks away from the rounded fragments.

Sampler: P. Anderson **Date:** 10 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 102 **Sample Number:** 154269 **Code:** D 203

Location: Upper S. Fork of Deadman **Scintillometer Counts:** 140 cps

Quadrangle: Table Mtn. **U Value (U by NT) ppm :** 8.10

Sec., Twp, Ra.: S11, 8N, 8E **Coordinates:** 34°03'16"; 111°30'10"

Geologic Unit: specularitic Deadman rhyolite-pebble conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Half way down into South Fork, the Deadman shows the first signs of a basal hematitic residual conglomerate. This conglomerate thins rapidly to the south and thickens to the north, suggesting a primary lap-out on the M 100 ridge site. The specularite-rich conglomerate is about 1-2m wide and underlies maroon Deadman quartzite; it represents a 2x radiometric anomaly over the quartzite (140 cps compared to 70 cps) but gives lower values than the subjacent rhyolite (160 cps).

Variability: The specularitic conglomerate contains large pebbles to cobbles (3-6cm) of the underlying rhyolites (well-rounded pink to red feldspar-phenocrystic rhyolite) but in the hand sample and thin section, no fragments were intersected.

Sedimentary Structures: Obscured by heavy iron stain.

Depositional Environment: Base of transgressive marine sequence, or fluvial channel deposit concentrating heavy minerals at the base of the deposit.

SAMPLE DESCRIPTION : The sample is a dark reddish brown to black-stained, very heavy rock showing shiny metallic specularite layers and patchy fragments on the water-worn surface. A cut face reveals the rock to be about 20% finely laminated black specularite, 40% intergranular silicates (mainly clastic quartz grains), 20% hematitic red, specularite-rich fragments (possibly broken up specularite layers) and 10% chalcedonic silica filling interstices of the conglomerate or intraformational breccia. In this respect it is very much like, if not identical to, M 73.

Sampler: P. Anderson **Date:** 10 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 103 **Sample Number:** 154270 **Code:** D 202

Location: Upper S. Fork of Deadman **Scintillometer Counts:** 135 cps

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 1.80

Sec., Twp, Ra.: S11, 8N, 8E **Coordinates:** 34°03'20"; 111°29'50"

Geologic Unit: hematitic Deadman quartz-granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : From the previous M 102 sample site, going down into South Fork, the basal conglomerate thickened, then pinched out, the basal Deadman unconformity cut down from the red rhyolites and conglomerate into underlying yellow rhyolite, such that, at this site maroon Deadman quartzite containing quartz-granule conglomerate rests directly on quartz-rich rhyolite.

Variability: Layers of finer to coarser quartz-jasper grit alternate with granule conglomerate beds and hematitic quartzite. Grain size, type, sorting and roundness are stratigraphically controlled.

Sedimentary Structures: Well bedded but not noticeably cross bedded--some graded bedding in grit and granule layers.

Depositional Environment: Shallow-water, possibly near shore marine, also possibly fluvial environment.

SAMPLE DESCRIPTION : Well-packed grit to granule to fine pebble-size (2-8mm, average 4mm long) fragments of white quartz (60%) red aphanitic rhyolite (25%), chert (10%) and black specularite (5%) support a very clean, well-sorted matrix of brick-red to maroon-stained coarse-grained quartz and interstitial detrital black specularite. The framework-supported conglomerate shows incipient foliation and weak recrystallization of fragments.

Sampler: P. Anderson **Date:** 10 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 104 **Sample Number:** 154271 **Code:** M 101

Location: W. of Malpais Spring **Scintillometer Counts:** ND

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 0.70

Sec., Twp, Ra.: S36, 9N, 8E Coordinates: 34°04'45"; 111°29'37"

Geologic Unit: Mazatzal maroon quartzite and grit

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Outcrops surrounded by alluvial cover between Chilson Camp and South Fork involve a series of reverse faults where lower red to maroon Mazatzal quartzite has been pushed up over pink and white, upper Mazatzal quartzites. The westerly outcrop is red grit conglomerate where the conglomerate layers in the quartzite are thinner and sparser than usual. Conglomerate covers a good deal of the bedding face here and not much jasper is seen.

Variability:

Sedimentary Structures: Ripple marks are visible on bedding surfaces.

Depositional Environment: Presumably shallow-water, near-shore marine,

SAMPLE DESCRIPTION : Red to maroon medium-grained, slightly sericitic quartzite with about 10% argillaceous or sericitic material and hematite contains well-sorted and rounded quartz grains. It is in contact with a quartz grit layer which consists of 2-4mm long subrounded quartz grains, minor chert and rare yellow, altered rhyolite fragments. The grains are supported in a matrix of finer ground quartz (same size as the adjacent quartzite), specularite and some argillaceous and carbonate material.

(by P.A.)

Sampler: J. Trembly **Date:** 10 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 105 **Sample Number:** 154272 **Code:** M 101

Location: Brody Seep **Scintillometer Counts:** ND

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 1.0

Sec., Twp, Ra.: S36, 9N, 8E **Coordinates:** 34°04'28"; 111°29'32"

Geologic Unit: maroon Mazatzal grit to granule conglomerate

Stratigraphic Group: Mazatzal group

SITE GEOLOGY : Southeast of and stratigraphically above the previous sample is similar quartz grit and granule conglomerate but conglomerate layers are thicker and more abundant. Jasper appears to be slightly more abundant here. Specularite banding is visible on the outcrop face.

Variability: Going southeast the color lightens and conglomerate becomes sparser.

Sedimentary Structures: Abundant trough cross beds but no apparent ripple marks.

Depositional Environment: Shallow water, presumably near-shore marine although fluvial is possible.

SAMPLE DESCRIPTION : Sample is a sparse quartz granule to grit conglomerate of 3-7mm long, rounded milky white quartz (some blue-stained quartz also present) (85%), pink chert (10%) and red jasper (5%) fragments in a well recrystallized and interlocking pale maroon to pink coarse-grained quartz matrix. Color is characteristic here of middle maroon part of Mazatzal quartzite, which it is therefore presumed to represent.

(by P.A.)

Sampler: J. Trembly **Date:** 10 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 106 **Sample Number:** 154273 **Code:** M 001

Location: Brody Seep **Scintillometer Counts:** ND

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 0.80

Sec., Twp, Ra.: S36, 9N 8E **Coordinates:** 34°04'21"; 111°20'30"

Geologic Unit: upper White Mazatzal grit and quartzite

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Further southwest the rocks change into the white unit of Mazatzal quartzite with no discontinuities seen so far, so presumably this is the upper part of the Mazatzal. Grit conglomerate is found in thin beds in a white, fine- to medium-grained, cross-bedded quartzite, and consists of over 90% well-rounded quartz grains, with less than 10% pink and greenish-grey chert.

Variability: Jasper is rarely present.

Sedimentary Structures: Well layered, and abundant trough cross-beds.

Depositional Environment: Shallow-water marine, probably near-shore or possibly sand-dune deposit; fluvial cannot be ruled out.

SAMPLE DESCRIPTION : A white quartzite stained yellowish orange in patches by surface limonite stain, contains 35% grit-size quartz grains larger than 2mm (but smaller than 4mm) supported in a 65% coarse-grained quartzite matrix. Rounding and sorting are both very good, with the only dark material being infrequent dark gray to pink, well-rounded chert grains. Rock is cemented by recrystallized quartz, and the matrix has no argillaceous component.

Sampler: J. Trembly **Date:** 10 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 107 **Sample Number:** 154274 **Code:** M 101

Location: Brody Seep **Scintillometer Counts:** ND

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 0.80

Sec., Twp, Ra.: S36, 9N, 8E **Coordinates:** 34°04'15"; 111°29'27"

Geologic Unit: Mazatzal quartz grit

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Further southeast along the outcrop line a thrust or reverse fault is encountered so that the sequence is apparently a repeat of that between M 104 and M 106. This locality appears to be similar to site M 105; a maroon grit conglomerate occurs in cross-bedded quartzite.

Variability: Conglomerate layers are thin and not very abundant.

Sedimentary Structures: Cross bedding and ripple marks.

Depositional Environment: Shallow-water, probably near-shore marine, intertidal, although fluvial cannot be ruled out.

SAMPLE DESCRIPTION : A dark reddish maroon medium- to coarse-grained quartzite matrix cemented by recrystallized quartz and hematite contains 1-4mm bedding lines of detrital specularite concentrations and supports 30% grit- to granule-size (3-5mm), well-rounded quartz and chert grains in preferentially higher concentrations in some gritty layers. Detrital specularite is also concentrated interstitially in these same gritty zones, about 1-2cm wide.

(by P.A.)

Sampler: J. Trembly **Date:** 10 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 108 **Sample Number:** 154275 **Code:** M 111

Location: Upper S. Fork of Deadman **Scintillometer Counts:** ND

Quadrangle: Table Mtn. **U Value (U by NT) ppm :** 0.60

Sec., Twp, Ra.: S2, 8N, 8E **Coordinates:** 34°04'06"; 111°30'16"

Geologic Unit: pink Mazatzal quartzite and quartz grit

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Just east of Club Ranch trail a knob of quartzite close to the transition from red to white quartzite in the Mazatzal sits in thrust relation on an underlying slice of white quartzite. Bedding in the pink qurtzite is outlined by darker lines at the top of subtly graded stratification units, representing zones absent in red hematite (possibly specularite is present). The graded units are from 4 to 15cm thick (commonly 6-8cm) and start with a pink and white quartz-jasper grit which fines upwards into medium- to coarse-grained quartzite, then in some places to an upper fine-grained quartzite with sparse grit, in other places just fine-grained quartzite to dark siltstone at the top. Lower grit material is sampled.
Variability:

Sedimentary Structures: Abundant rhythmic graded bedding showing soft-sediment deformation, flame structures, swirly horseshoe-shaped contorted bedding planed off at the top by another bedding layer; amplitudes disharmonic and flaming upwards.
Depositional Environment: Possibly deeper water marine, although shallow water features are still present; perhaps a local slope in a neritic environment subject to local turbid disruption of bedding.

SAMPLE DESCRIPTION : Basal units of the graded grit-quartzite sequence are 2-4cm thick layers of rounded-fragment, quartz-rich, chert and jasper-poor grit (1-4mm long) interbedded with well-sorted, well-rounded, clean, pink medium-to coarse-grained quartzite. Limonite locally stains partings between the top of one layer and the bottom of the succeeding layer. The upper parts of the graded quartzites are more intensely pink to pale maroon, medium- to fine-grained quartzites containing mostly hematite at the base of graded sequences and a hematite-free, blackish upper part which could contain detrital specularite.

Sampler: P. Anderson **Date:** 11 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 109 **Sample Number:** 154276 **Code:** M 201

Location: Upper S. Fork **Scintillometer Counts:** ND

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 2.30

Sec., Twp, Ra.: S2, 8N, 8E **Coordinates:** 34°03'45"; 111°29'56"

Geologic Unit: Specularitic, hematitic Mazatzal granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : On the north side of South Fork an easterly traverse onto the Mazatzal Peak quad intersects abundant dark maroon quartzite without conglomerate or grit; higher up section thin 3-4cm grit layer and granule conglomerate increases up section until a highly specularitic zone with patchy specularite concentrations (rip-up fragments?) is encountered. This material and the granule conglomerate is sampled.

Variability: Abundance of specularite is generally correlated with abundance of grit and granule conglomerate.

Sedimentary Structures: Good cross bedding and graded bedding with grit at the base of each sedimentation unit.

Depositional Environment: Near-shore marine, sub-littoral, probably neritic but fluvial cannot be entirely ruled out.

SAMPLE DESCRIPTION : A maroon to blackish red, color-banded coarse-grained quartzite to grit supports 15 to 20% larger rounded quartz and chert grains 4 to 6mm long in a banded, partly hematitic, partly specularitic, clean, well-sorted, quartz-rich matrix.

Sampler: P. Anderson **Date:** 11 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 110 **Sample Number:** 154277 **Code:** M 201

Location: Upper S. Fork **Scintillometer Counts:** ND

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 1.40

Sec., Twp, Ra.: S2, 8N, 8E Coordinates: 34°03'40"; 111°29'45"

Geologic Unit: Specularitic Mazatzal grit

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : At the east edge of the outcrop ridge of Mazatzal on the north side of South Fork, thinly bedded and laminated quartzite in contact with specularitic grit layers are overlain by upside-down cross beds, indicating that the steeply dipping Mazatzal strata here are slightly overturned. The Specularitic grit is the basal part of a graded sequence 7m thick.

Variability: Specularitic content highly variable in quartzites but generally decreasing up section.

Sedimentary Structures: Cross bedding, graded bedding.

Depositional Environment: Shallow water to deeper water marine sequence, possible density currents on a gentle slope.

SAMPLE DESCRIPTION : A dark maroon to reddish black grit consists of 5% jasper, 10% chert and 25% quartz grains, rounded and well-sorted, 2 to 3mm long, supported in a clean matrix of 55% hematite-stained coarse-grained quartz grains and 5% specularite and hematite. Overlying the grit is pinkish orange to black quartzite layered on 2 to 4mm scale in which there ar also specularite concentrations.

Sampler: P. Anderson **Date:** 11 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 111 **Sample Number:** 154278 **Code:** M 202

Location: Upper S. Fork **Scintillometer Counts:** ND

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 2.30

Sec., Twp, Ra.: S1, 8N, 8E **Coordinates:** 34°03'48"; 111°29'30"

Geologic Unit: Mazatzal quartz-rhyolite granule to pebble conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : The lowest part of the Mazatzal quartzite sequence exposed north of South Fork contains abundant granule and pebble conglomerate of the type typically found in the Mazatzal quartzite. Beds 0.1 to 1m thick contain somewhat more angular jasper, chert, rhyolite and quartz fragments packed in an interstitial specularitic, brick red to black quartzite matrix.

Variability: Size and fragment proportions highly variable from bed to bed but the three fragment types are always present.

Sedimentary Structures: Bedding, graded bedding, ripple marks.

Depositional Environment: Shallow water, probably near-shore marine; possibly but less likely fluvial.

SAMPLE DESCRIPTION : A tightly packed mosiac of pebble- to granule-size (5-25mm) subangular to subrounded grains of white quartz (50% and 3 to 8 mm long), red to pinkish red, microcrystalline to aphanitic rhyolite (25% and 25 to 8cm long), pink chert (20% and 3 to 12mm long) and red jasper (5% and 6-9mm long). These occur in a clean matrix of medium-grained quartz-rich quartzite to grit containing hematite and specularite as the only two visible interstitial components.

Sampler: P. Anderson **Date:** 11 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 112 **Sample Number:** 154279 **Code:** M 101

Location: S. of Brody Seep **Scintillometer Counts:** 55 cps

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 1.00

Sec., Twp, Ra.: S1, 8N, 8E **Coordinates:** 34°04'02"; 111°29'00"

Geologic Unit: Mazatzal Grit

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : East of M 107, vertically dipping Mazatzal quartzite is brick red with red shaley interlayers. Some grit layers also occur in the section. Grit layers here are 5-10cm thick and sparsely scattered. Jasper is relatively abundant compared to M 104 to M 107 samples, making up over 5% of the grit. The area sampled is just below the purplish maroon quartzite.

Variability: Conglomerate or grit layers are highly variable.

Sedimentary Structures: Symmetrical oscillation ripple marks trough and planar cross-beds, shale rip-up layers.

Depositional Environment: Shallow-water marine, intertidal.

SAMPLE DESCRIPTION : Quartz-rich grit and coarse-grained quartzite are interbedded in 1-2cm thick layers. The quartz (96%), chert or rhyolite (3%) and jasper (1%) grains are 1-2, rarely 3mm long, exceptionally well sorted and remarkably well rounded such that they form a buckshot-appearing grit where the matrix breaks around the rounded grains. Hematite appears to be the only cement.

(by P.A.)

Sampler: J. Trembly **Date:** 11 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 113 **Sample Number:** 154280 **Code:** M 101

Location: S of Brody Seep **Scintillometer Counts:** 57 cps

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 0.80

Sec., Twp, Ra.: S1, 8N, 8E **Coordinates:** 34°04'07"; 111°29'00"

Geologic Unit: Mazatzal quartz grit to granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Between sites M 112 and M 107, in the maroon quartzite above the red quartzite unit sampled at M 112 site, granule conglomerate to grit occurs as talus immediately below a series of steep cliffs. This material is collected as representative of grit layers in the cliffs above.

Variability: Conglomerate and grit layers were not located in outcrop.

Sedimentary Structures: Good bedding, cross bedding in quartzites.

Depositional Environment: Shallow water, near-shore marine, presumably.

SAMPLE DESCRIPTION : A dark maroon grit to granule conglomerate contains closely packed, sub-angular to sub-rounded grains of dominantly quartz, lesser red rhyolite, jasper and pink chert 3 to 6mm long in a subordinate dark hematitic to specularitic, medium- to coarse-grained quartzite matrix. Some layers in the conglomerate contain friable grit identical to M 112 sample description.

(by P.A.)

Sampler: J. Trembly **Date:** 11 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 114 **Sample Number:** 154281 **Code:** M 101

Location: W of Brody Seep **Scintillometer Counts:** 62 cps

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 1.3

Sec., Twp, Ra.: S2, 8N, 8E **Coordinates:** 34°04'02"; 111°24'47"

Geologic Unit: Mazatzal quartz-rich grit

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : South of W 31 on the cliffs of red quartzite east of Club Ranch trail, a jasper-poor, quartz-rich grit occurs in the Mazatzal. It is well bedded and of variable grain sizes.

Variability: Specularite banding is present in outcrop.

Sedimentary Structures: Cross beds are present, but no ripple marks.

Depositional Environment: Presumably shallow water marine.

SAMPLE DESCRIPTION : A well-bedded pale maroon rock consists of medium- to coarse-grained hematitic quartzite beds 3 to 4cm thick interbedded with 3-3cm thick grit layers. The grits (2-4mm long) are wholly of rounded to subrounded quartz grains in a coarse-grained quartz matrix relatively rich in (detrital?) specularite.

Sampler: J. Trembly **Date:** 11 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 115 **Sample Number:** 154282 **Code:** D 102

Location: W of Mazatzal Peak Scintillometer Counts: ND

Quadrangle: Mazatzal Peak U Value (U by NT) ppm : 6.3

Sec., Twp, Ra.: S1, 8N, 8E Coordinates: 34°03'35"; 111°28'53"

Geologic Unit: Deadman granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : West of previous Deadman sample M 99 on the southwestern extension of Deadman as it folds southward into South Fork. Conglomerate some distance above the main basal conglomerate contains large, flat, soft, shaley-appearing, angular rhyolite clasts which are distinguished by their abundant clear glassy quartz phenocrysts.

Variability: Fragment size is highly variable.

Sedimentary Structures: Not well bedded, poorly sorted, not abundant evidence of water working.

Depositional Environment: Probably a fluvial, or possibly near-shore marine environment.

SAMPLE DESCRIPTION : A dark earthy red hematite-rich, fine-grained matrix supports angular pink and red rhyolite fragments in a ratio of 5:3. The matrix is composed of silt-size grains with high concentrations of hematite. Fragments range in size from 1-70mm long. Small, 1-13mm long fragments are composed of angular, elongate pink rhyolite. A few clear volcanic quartz phenocrysts are also present. Larger fragments, 15-70mm in length, are composed of mostly sheared, hematite-rich, quartz-phenocrystic rhyolite. Most fragments show sub-parallel alignment, but this may be in part due to deformation.

Sampler: K. Wirth **Date:** 11 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 116 **Sample Number:** 154284 **Code:** D 102

Location: W of Mazatzal Peak **Scintillometer Counts:** ND

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 4.6

Sec., Twp, Ra.: S1, 8N, 8E **Coordinates:** 34°03'37"; 111°28'53"

Geologic Unit: Deadman rhyolite-pebble conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY :This sample is taken close to the previous one but between samples M 115 and M 99. Basically the same type of conglomerate

Variability: Fragments are smaller than in the previous sample and not so quartz phenocrystic.

Sedimentary Structures: As in M 115.

Depositional Environment: Fluvial or near-shore marine.

SAMPLE DESCRIPTION : Angular pink and red rhyolite granules and pebbles support a fine-grained hematite-rich matrix in a ratio of 3:2. The matrix is poorly sorted and has a muddy hematitic appearance. Supporting it are angular fragments averaging 3-26mm in length. Pink and red rhyolite, mostly aphanitic, but sometimes quartz-phenocrystic, are the only fragment types. The matrix appears to have a poorly developed foliation, and this may be responsible for the sub-parallel elongation of fragments. Some fragments break cleanly away from the matrix.

Sampler: K. Wirth **Date:** 11 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 117 **Sample Number:** 154285 **Code:** D 103

Location: W of Mazatzal Peak **Scintillometer Counts:** ND

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 5.7

Sec., Twp, Ra.: S1, 8N, 8E Coordinates: 34°03'30"; 111°28'40"

Geologic Unit: Deadman red rhyolitic conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Near M 116 is a finer-grained type of rhyolitic conglomerate in which the fragments and matrix are so much alike that they are virtually indistinguishable from one another. Fragments are a pink to red, cherty, aphanitic rhyolite with highly angular tabular shapes, and show good planar alignment. The matrix is slightly more granular and peppery than the fragments.

Variability: Surprisingly uniform.

Sedimentary Structures: Not well bedded as in M 115.

Depositional Environment: Fluvial or near-shore marine.

SAMPLE DESCRIPTION : Angular and elongate pink rhyolite fragments, of grit to pebble size, support a fine-grained hematite-rich matrix in a ratio of 2:1. The matrix grains are silt to fine sand-size and appear to be composed of quartz and rhyolite fragments. Detrital specularite is not present, however, hematite is earthy red and abundant and supports matrix grains. The fragments are very angular and blocky, averaging 3-30mm in length. The only fragment type observed was pink to grey aphanitic rhyolite, sometimes with quartz phenocrysts. A poorly developed foliation dominates the matrix structure and may be responsible for the alignment of fragments.

Sampler: K. Wirth **Date:** 11 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 118 **Sample Number:** 154286 **Code:** M 202

Location: E of Club Ranch **Scintillometer Counts:** ND

Quadrangle: Table Mtn. **U Value (U by NT) ppm :** 5.80

Sec., Twp, Ra.: S10, 8N, 8E **Coordinates:** 34°02'37"; 111°31'02"

Geologic Unit: Specularitic Mazatzal pebble conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : In the upper reaches of Mazatzal Wash, southwest of M 101 site, there is no grit or conglomerate in the Mazatzal, suggesting deeper quieter water submarine deposition (further offshore). Only at the very base of the sequence is a 12cm-thick pebble to granule conglomerate. As elsewhere, here the specularite concentrations come in with the coarser grained sediments.

Variability: Unit is thin and lateral variability not detected. Up section the pebbles and granules get sparser over 2m and are absent above this.

Sedimentary Structures: Hematite-specularite cross bedding.

Depositional Environment: Deeper water, for the offshore marine environment, possibly sub-neritic, but not likely. Definitely sub-littoral.

SAMPLE DESCRIPTION : A patchy-stained conglomerate varies from pale red to pink where hematite-stained to black where specularitic. It consists essentially of a bimodal grain size population, one of fragments 6 to 15mm long and the other of medium sand-size quartz grains and specularite grains, in about equal proportions. The larger fragments are mainly white quartz, pink and yellow chert, red jasper and black specularite fragments, possibly broken up from an adjacent specularitic quartzite bed. Iron content of the rock is about 10%.

Sampler: P. Anderson **Date:** 13 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 119 **Sample Number:** 154287 **Code:** D 201

Location: E of Club Ranch **Scintillometer Counts:** ND

Quadrangle: Table Mtn. **U Value (U by NT) ppm :** 3.50

Sec., Twp, Ra.: S15, 8N, 8E **Coordinates:** 34°02'27"; 111°31'02"

Geologic Unit: Specularitic Deadman grit

Stratigraphic Group. Mazatzal Group

SITE GEOLOGY : The Deadman section exposed below Maverick shale is quite variable in color from black near Maverick to muddy brick red below this, then to dark maroon, and then finally it pales down section until a grit layer is encountered near the base of the unit. The grit bed is a quartz-jasper-rhyolite fragment rock rich in bedded specularite and looks very much like the previous M 118 sample in Mazatzal.

Variability: Similar color changes and grit as in Mazatzal above but a very thinly and well-banded, dark to light color-banded character distinguishes the Deadman quartzites.

Sedimentary Structures: Ripple marks and cross beds in muddy layers.

Depositional Environment: Shallow-water marine, probably not near-shore, probably sub-littoral.

SAMPLE DESCRIPTION : A pale maroon to reddish brown to black, well-bedded gritty quartzite contains occasional large (1-2cm-long) fragments of aphanitic muddy red-brown rhyolite, red jasper, pink chert, white quartz and quartzite. Most of the material is interbedded quartz-rich grit in maroon coarse-grained quartzite beds, and specularite-rich (up to 30%) beds 4cm thick wherein grit fragments of jasper, chert, and rhyolite are preferentially concentrated. Specularite-rich layers definitely suggest the higher energy environment of the two bed types.

Sampler: P. Anderson **Date:** 13 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 120 **Sample Number:** 154288 **Code:** M 101

Location: E of Club Ranch **Scintillometer Counts:** ND

Quadrangle: Table Mtn. **U Value (U by NT) ppm :** 0.90

Sec., Twp, Ra.: S16, 8N, 8E **Coordinates:** 34°02'03"; 111°32'21"

Geologic Unit: Mazatzal quartz grit to granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : At the ridge crest between Davenport and Mazatzal Washes in the pink quartzite unit is quartz-pebble grit and granule conglomerate with concentrations of specularite on bedding and cross bedding planes. Some specularite rich fragments occur in the conglomerates suggesting that the specularite and coarser material are both concentrated by the same higher energy process.

Variability: Conglomerate and grit is sparser both below in the maroon quartzite and above in the whiter quartzite.

Sedimentary Structures: Bedding and cross bedding.

Depositional Environment: Shallow-water marine, possibly beach or dune.

SAMPLE DESCRIPTION : Medium- to coarse-grained pink, relatively pure quartzite is interbedded with layers of quartz grit to granule conglomerate of 2-5mm long, well-rounded quartz grains, hematitic quartzite and specularite-rich fragments and minor red chert. These support a 40% clean, medium-grained quartzite matrix of orange-stained, well-cemented quartz grains. Sorting and rounding are both excellent and the sediment is very pure (97%) and mature, except for specularitic fragments which could be incorporated from adjacent strata.

Sampler: P. Anderson **Date:** 13 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 121 **Sample Number:** 154289 **Code:** K 001

Location: NE of Club Ranch **Scintillometer Counts:** ND

Quadrangle: Table Mtn. **U Value (U by NT) ppm :** 1.40

Sec., Twp, Ra.: S9, 8N, 8E **Coordinates:** 34°03'22"; 111°32'10"

Geologic Unit: quartz-jasper grit in Maverick shale

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : On the Club Ranch trail northeast of Club Ranch the Maverick shale contains interbedded quartzite and grit layers. A grit conglomerate was collected from 5-10cm-thick, coarser-grained layers that are spaced every meter or two in this area. Conglomerate is well rounded, well sorted, with 90% quartz clasts, lesser jasper, and pink and yellow chert grains.

Variability: Rock is well cemented suggesting that secondary silica cement may be present.

Sedimentary Structures: Possibly ripple marks on some bedding planes.

Depositional Environment: Shallow water, restricted-basin conditions of deposition with grit representing a higher-energy influx of sediment.

SAMPLE DESCRIPTION : The Maverick grit contains 60% quartz grains, 5% red jasper and chert which are well-rounded and well-sorted touching grains 2 to 4mm long supporting a clay-rich matrix with the typical pale green cast of the Maverick grits. The matrix consists of whitish recrystallized quartz and argillaceous or sericitic material which has well-cemented the conglomerate.

Sampler: J. Trembly **Date:** 13 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 122 **Sample Number:** 154290 **Code:** M 101

Location: NE of Club Ranch **Scintillometer Counts:** ND

Quadrangle: Table Mtn. **U Value (U by NT) ppm :** 0.80

Sec., Twp, Ra.: S9, 8N, 8E **Coordinates:** 34°03'14"; 111°32'10"

Geologic Unit: red Mazatzal grit

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : About 50m above the Maverick shale in the lower brick red unit of the Mazatzal there is only wretchedly fine-grained grit which seems to be more like material that usually occurs higher in the section. Grit occurs in 1cm-thick layers that delineate many of the cross beds, and is abundant throughout the outcrop.

Variability: Specularite is not abundant, and only obviously present in coarser grained cross-bedded layers.

Sedimentary Structures: Abundant trough cross beds.

Depositional Environment: Deeper water, lower energy marine than that which is normal for Mazatzal this low in the section.

SAMPLE DESCRIPTION : A pale brick-red to brownish black grit consists of interbedded coarse-grained quartzite and fine-grained, quartz-rich, jasper and chert-poor grit defining 3 to 4cm thick beds. The grit layers are darker stained from their interstitial specularite and somewhat cellular because of the well-rounded 1-2mm quartz grains are less well cemented in these layers.

(by P.A.)

Sampler: J. Trembly **Date:** 13 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 123 **Sample Number:** 154291 **Code:** M 101

Location: NE of Club Ranch **Scintillometer Counts:** ND

Quadrangle: Table Mtn **U Value (U by NT) ppm :** 0.70

Sec., Twp, Ra.: S9, 8N, 8E **Coordinates:** 34°03'00"; 111°32'04"

Geologic Unit: red Mazatzal quartz-rich grit

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : East of previous sample site coarser-grained grit conglomerate occurs as 2-5cm thick lenses in a purple to maroon quartzite unit that is about 10 to 15m thick. The layers occur above the purplish barren quartzite and below specularite-banded purplish quartzite. Conglomerate is moderately well rounded and sorted, with 90% quartz clasts and 10% chert and specularite clasts.

Variability: This unit lies stratigraphically above the previous site in a zone where there is coarser grained conglomerate.

Sedimentary Structures: Conglomerate occurs in cross-bedded (?) lenses.

Depositional Environment: Deeper water, lower energy marine than is usual for the Mazatzal quartzite at this level.

SAMPLE DESCRIPTION : Contacting thinly bedded, purplish maroon, specularite-layered medium-grained quartzites is a layer of red to maroon grit consisting mostly of well-rounded quartz grains 2-4mm long, lesser rounded specularite clasts 4-5mm long and pink to red, subangular chert grains 3 to 5mm long. These fragments support a 20% matrix of mostly recrystallized quartz, interstitial specularite, and hematite.

(by P.A.)

Sampler: J. Trembly **Date:** 13 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 124 **Sample Number:** 145292 **Code:** M001

Location: NE of Club Ranch **Scintillometer Counts:** ND

Quadrangle: Table Mtn **U Value (U by NT) ppm :** 0.70

Sec., Twp, Ra.: S16, 8N, 8E Coordinates: 34°02'30"; 111°32'10"

Geologic Unit: White Mazatzal quartzite to grit

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Above Club Ranch, white Mazatzal quartzite is overlain by a faulted slice of lower red quartzites. Fine-grained quartzite is gradational into white grit of mainly quartz and chert with no jasper. Rock is well-sorted and grains are well-rounded.

Variability: Grit conglomerate tends to be in lenses.

Sedimentary Structures: Abundant trough cross-beds are present.

Depositional Environment: Shallow water, near shore, possibly beach or dunes.

SAMPLE DESCRIPTION : Medium- to fine-grained sugary white quartzite is in curved contact (scoured or fluted bedding?) with a layer of quartz grit. The grit layer contains 2-4mm long, well-rounded and well-sorted, white quartz grains, and minor red chert in a fine-grained quartzite matrix equal in proportion to the fragments.

(by P.A.)

Sampler: J. Trembly **Date:** 13 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 125 **Sample Number:** 154293 **Code:** D 102

Location: NW of Club Ranch **Scintillometer Counts:** 122 cps

Quadrangle: Table Mtn. **U Value (U by NT) ppm :** 5.4

Sec., Twp, Ra.: S5, 8N, 8E **Coordinates:** 34°03'42"; 111°33'22"

Geologic Unit: Deadman granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : The lower portion of the section is composed of muddy and hematitic red siltstone and quartzite. Its highly sheared and muddy character makes it difficult to distinguish fragments or other sedimentary features. This grades upward into a more pure quartzite which is better cemented. The sample was taken from a 40cm-thick conglomerate layer near the top of the quartzite horizon.

Variability: Scintillometer counts average slightly higher in the lower portion of the section. This is probably due to a higher percentage of rhyolitic material in the quartzite.

Sedimentary Structures: Bedding sets average 1-2cm thick and are defined by concentrations of heavy minerals.

Depositional Environment: Fluvial or near-shore marine.

SAMPLE DESCRIPTION : Sub-angular pebbles, grit and granules of dark red rhyolite are supported by a dark maroon fine-grained matrix in a ratio of 4:1. The matrix is composed of mostly fine sand-size quartz grains. Interstitial hematite is present throughout and is concentrated on some cross-bedding planes with specularite. Sub-angular conglomerate fragments average 3-14mm in length and are composed of hematite-rich aphanitic rhyolite. Some darker red rhyolite fragments range up to 25mm long.

Sampler: K. Wirth **Date:** 13 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 126 **Sample Number:** 154294 **Code:** D 103

Location: NW of Club Ranch **Scintillometer Counts:** 180 cps

Quadrangle: Table Mtn. **U Value (U by NT) ppm :** 4.9

Sec., Twp, Ra.: S5, 8N, 8E Coordinates: 34°03'37"; 111°33'34"

Geologic Unit: Deadman pebble conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : At this site only 1.5 meters of Deadman quartzite is left exposed above the rhyolite because the upper strata are eroded away. The whole quartzite section is conglomeratic and mostly composed of large angular fragments of rhyolite. Fragment size and density decrease up section and quartz grains become more abundant.

Variability: Some conglomerate fragments reach cobble to boulder size (60-200mm in length).

Sedimentary Structures: Very massive and sheared.

Depositional Environment: The composition of this sample is essentially that of a rhyolite grus, indicating a fluvial or paleo-erosion-surface deposit.

SAMPLE DESCRIPTION : Deep earthy-hematite red rhyolite fragments support a similarly colored silty matrix in a ratio of 7:1. The silt size material comprising the matrix are grains of mostly rhyolite and minor quartz. Detrital specularite is absent, but hematite is strongly concentrated in the interstices. Fragments are quite angular and blocky in shape, averaging 12-60mm in length. All fragments are composed of quartz-phenocrystic and hematite-rich rhyolite.

Sampler: K. Wirth **Date:** 13 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 127 **Sample Number:** 154295 **Code:** D 102

Location: NW of Club Ranch **Scintillometer Counts:** 180 cps

Quadrangle: Table Mtn. **U Value (U by NT) ppm :** 4.0

Sec., Twp, Ra.: S8, 8N, 8E **Coordinates:** 34°03'31"; 111°33'34"

Geologic Unit: Deadman granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Same as site M 126, except at the southernmost extremity of Deadman outcrop on this ridge.

Variability: Same interbedded 1-3cm thick hematitic silt layers.

Sedimentary Structures: Bedding sets average 1-3cm thick.

Depositional Environment: A slightly more mature sediment than sample M 126. Fluvial or near-shore marine environment of deposition.

SAMPLE DESCRIPTION : This sample is basically a finer-grained equivalent of the sample described from site M 126. The main difference is that there is more matrix (matrix to fragment ratio is 3:2), fragments are smaller (averaging 3-9mm in length) and quartz grains are more abundant in the matrix. Matrix grains are still of silt to fine-sand size. Also, the blackish specularite nature of many of the rhyolite fragments is more apparent here as many of the more tabular fragments have a peppery texture.

Sampler: K. Wirth **Date:** 13 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 128 **Sample Number:** 154296 **Code:** D 103

Location: NW of Club Ranch **Scintillometer Counts:** 110 cps

Quadrangle: Table Mtn. **U Value (U by NT) ppm :** 2.6

Sec., Twp, Ra.: S5, 8N, 8E **Coordinates:** 34°03'57"; 111°33'02"

Geologic Unit: Deadman pebble conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Approximately 20 meters of quartzite remain exposed above the rhyolite. The lower 6-8 meters are composed of fine- to medium-grained, hematite-rich quartzite. The two distinct units, conglomerate and quartzite, are separated by a 1m-thick layer of hematitic siltstone.

Variability: Fragment size decreases up section, then a sharp break in grain size.

Sedimentary Structures: None except bedding are well-defined.

Depositional Environment: Possibly a fluvial to near-shore marine transition, or at least a more mature fluvial environment, as indicated by a rapid upward fining.

SAMPLE DESCRIPTION : Fragments throughout the section are generally subrounded and vary from grey, light orange, and pink to dark red rhyolite. Some fragments consist of hematitic quartzite, apparently of Deadman quartzite origin, but most are quartz-phenocrystic and flow-banded rhyolite. Their average size is 6-35mm in the lower part of the section and 8-25mm in the upper part of the section. Matrix grains are fine-sand size and composed of mostly quartz with interstitial clays and hematite. This grades upward into a quartz grit and coarse-sand matrix near the top. Minor amounts of feldspathic grit and quartzite are also present with minor hematite interstitial fillings. Matrix to fragment ratios are 2:1 throughout the section.

Sampler: K. Wirth **Date:** 13 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 129 **Sample Number:** 154297 **Code:** D 103

Location: Bear Creek **Scintillometer Counts:** ND

Quadrangle: Table Mtn. **U Value (U by NT) ppm :** 1.80

Sec., Twp, Ra.: S17, 8N, 8E **Coordinates:** 34°01'45"; 111°33'10"

Geologic Unit: Deadman pebble conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Near the southernmost extremity of Deadman in Mazatzal Wash area a rhyolite pebble conglomerate is found in the Deadman within 5m of the rhyolite contact. Flat elongate pebbles occur in 3-10cm thick beds interbedded with finer-grained quartzite layers. Matrix of the conglomerate consists of medium-grained, well-rounded quartz.

Variability: Specularite bands are found in the quartzite but not usually in the conglomerate.

Sedimentary Structures: Cross beds are present.

Depositional Environment: Shallow-water, near-shore marine or fluvial.

SAMPLE DESCRIPTION : The samples are of a polymictic conglomerate of flat pebbles supported in a medium- to coarse-grained matrix of pink quartzite. Interbedded in the quartzite are layers of specularite concentrations. The fragments are generally angular to subrounded, typically 3x as long as they are wide, vary from 2 to 4cm long in one sample and 5 to 12mm long in the other and consist of purple and red aphanitic rhyolite, pink phenocrystic rhyolite, dark maroon Deadman quartzite, and black specularitic Deadman quartzite. Secondary chalcedony and sericite are common interstitial fillings.

(by P.A.)

Sampler: J. Trembly **Date:** 14 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 130 **Sample Number:** 154298 **Code:** D 103

Location: Bear Creek **Scintillometer Counts:** ND

Quadrangle: Table Mtn. **U Value (U by NT) ppm :** 4.40

Sec., Twp, Ra.: S17, 8N, 8E **Coordinates:** 34°01'47"; 111°33'27"

Geologic Unit: Specularitic sheared Deadman pebble conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : On the main knob of Deadman above Mazatzal Wash there is tectonic activity and faulting to form pink silica-cemented dark purple-fragment breccias of Deadman quartzite and cause Deadman to lie apparently up section from Maverick shale. Thinly specularite-bedded and laminated dark purple quartzites near the base of the Deadman contain layers of pebble conglomerate which were sampled. The conglomerate layers are high in specularite, are poorly sorted and contain flattened, well-rounded clasts of rhyolite and quartzite.

Variability: Fragment size ranges from pebble to boulder.

Sedimentary Structures: Bedding, minor cross bedding.

Depositional Environment: Shallow-water, near-shore marine or fluvial, possible paleo-erosion-surface deposit.

SAMPLE DESCRIPTION : Thinly bedded pink to purple to black, cross-bedded quartzites are in contact with a sheared pebble conglomerate layer. Rounded grains of detrital specularite are concentrated at the contact (base of the conglomerate layer). The conglomerate consists of black to dark purplish and sericitic quartzite and aphanitic rhyolite fragments 1 to 5cm long in a sheared, strongly specularitic black matrix of mainly specularite, rhyolitic detritus and quartz. Foliation planes show a pronounced 2 to 1 elongation of fragments.

Sampler: J. Trembly and P. Anderson **Date:** 14 December 1980

SITE AND SAMPLE DESCRIPTION

Site Number: M 131 **Sample Number:** 154299 **Code:** D 204

Location: Davenport Wash **Scintillometer Counts:** ND

Quadrangle: Table Mountain **U Value (U by NT) ppm :** 4.20

Sec., Twp, Ra.: S8, 8N, 8E **Coordinates:** 34°02'38"; 111°33'03"

Geologic Unit: Specularitic pebble conglomerate, base of Deadman

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : The Deadman outcrops close to Davenport Wash are mostly a brick red to maroon medium-grained glassy quartzite which is very well bedded and about 40m thick. At its base is a 12m-thick boulder conglomerate, high in specularite, which was sampled. Deadman here forms a N-S trending channel because it thickens from 25m in Mazatzal Wash to 30m on the M132 knob between Mazatzal and Davenport Washes to about 70m at the west end of outcrop in Davenport Wash. Conglomerate at its base also thickens and fragment size increases from about 5m of pebble conglomerate on the ridge to almost 15m of boulder conglomerate in Davenport Wash. Coarse bouldery material was sampled at this site as well as pebble and matrix material.

Variability:

Sedimentary Structures: Bedding and cross bedding are present in overlying quartzites but not in the basal conglomerate.

Depositional Environment: Fluvial; a well-defined river channel deposit.

SAMPLE DESCRIPTION : The conglomerate contains large 35-40cm boulders of: 1) dark reddish brown, partly greenish-altered rhyolite containing euhedral glassy quartz phenocrysts; 2) specularitic quartzite consisting of a 45% medium-grained quartz mosaic with 55% dark reddish brown to black specularite. These fragments occur as boulders to pebbles, strongly reddish brown-stained, in a black matrix that is about 60% fine-grained detrital and crystalline specularite and the remainder probably fine-grained quartz. Broken surfaces show the typical dark-brick red stain (color of hematite streak) found in high-specularite rocks. Apparently M 130 is the same horizon as this sample.

Sampler: P. Anderson **Date:** 14 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 132 **Sample Number:** 154300 **Code:** D 202

Location: Mazatzal Wash **Scintillometer Counts:** 150 cps

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 1.9

Sec., Twp, Ra.: S17, 8N, 8E **Coordinates:** 34°02'12"; 111°33'23"

Geologic Unit: Deadman granule to pebble conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : On the ridge between Davenport and Mazatzal Washes, Deadman quartzite and conglomerate is about 30m thick. See site geology of M 131 for variations from this.

Variability: Matrix grains are well-sorted within each layer, but vary from fine to coarse-grained from one layer to the other.

Sedimentary Structures: Bedding sets average 10-30mm thick.

Depositional Environment: Fluvial, river channel as in M 131.

SAMPLE DESCRIPTION : A wide variety of differently colored rhyolite pebbles to granules are found in a fine-grained red to maroon matrix with matrix:fragment ratios varying from 1:1 to 3:1. The fine sand-size matrix grains are composed of mostly quartz with minor amounts of rhyolite. Hematite is present in moderate proportions throughout, but detrital specularite is absent. Granule-size fragments, averaging 3-12 mm in length, are occasionally as long as 30mm. Color varies from pink to orange, grey, maroon and red, but all are of rhyolitic composition, being either aphanitic or quartz-phenocrystic. Elongate fragments are aligned and define bedding directions.

Sampler: K. Wirth **Date:** 14 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 133 **Sample Number:** 154301 **Code:** D 203

Location: Mazatzal Wash **Scintillometer Counts:** 190 cps

Quadrangle: Table Mtn. **U Value (U by NT) ppm :** 3.4

Sec., Twp, Ra.: S17, 8N, 8E **Coordinates:** 34°02'10"; 111°33'23"

Geologic Unit: Deadman pebble conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Over 30 meters of Deadman quartzite are exposed above the rhyolite. The lower 10 meters are composed of nearly pure medium-grained quartzite. Above this lies 20 meters of coarse grit and pebble to cobble conglomerate (M 133 type). At the top of the section is a conglomerate similar to that sampled at site M 132.

Variability: Conglomerate is locally not present at the base of the Deadman here but is to the east and west.

Sedimentary Structures: Bedding sets average 15-30cm in thickness.

Depositional Environment: Fluvial or near-shore marine; could be part of the paleochannel system but conglomerate is not present at the base here.

SAMPLE DESCRIPTION : This sample consists of very poorly sorted grit to cobble size rhyolite fragments supporting a sand-size matrix of rhyolitic material in a ratio of 5:1. The fine-grained matrix appears to be composed of mostly quartz and rhyolitic detritus. Hematite is present in the interstices and stains outcrops and individual grain surfaces. Clear volcanic quartz phenocrysts are present throughout the matrix in small amounts. Fragments range from 2-70mm in length and are commonly 4-30mm long. All are sub-rounded to sub-angular and composed of red to maroon quartz-phenocrystic rhyolite. Elongate fragments show no preferred orientation. White remobilized siliceous material often fills fragment interstices.

Sampler: K. Wirth **Date:** 14 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 134 **Sample Number:** 154307 **Code:** D 202

Location: Front Deadman Quartzite **Scintillometer Counts:** ND

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm** 4.9

Sec., Twp, Ra.: S21, 9N, 9E **Coordinates:** 34°06'41"; 111°26'35"

Geologic Unit: Deadman granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : North of Barnhardt Canyon in the tributaries of Rock Creek the Deadman unit is highly deformed and appears to form several disconnected knobs as it goes around a major fold, but the eastern knob, sampled here, may be continuous with the others. This section is composed of mostly relatively pure quartzites with thin interbeds of grit- and granule-size conglomerate layers.

Variability: Grain size varies from fine to coarse-grained in the matrix. Fragment size varies from grit to small pebble.

Sedimentary Structures: Bedding well defined, some cross-bedding in quartzites.

Depositional Environment: Possibly a near-shore marine or fluvial environment of deposition.

SAMPLE DESCRIPTION : Abundant quartz, lesser chert, jasper, and rhyolite granules to pebbles are deformed but generally appear to be supported by an equal amount of matrix. The coarse sand-size matrix grains are mainly quartz, minor rhyolite, chert and jasper which is interstitially connected by hematite and minor recrystallized specularite. Fragments are sub-rounded, average 2-15mm, but one is 28mm long. White quartz is the most common fragment type (75%) and is accompanied by maroon quartz-phenocrystic rhyolite (15%) and red jasper (10%). This sample of Deadman conglomerate is more mature than most samples from this geoligic unit and is more like basal Mazatzal quartzite in appearance.

Sampler: K. Wirth **Date:** 16 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 135 **Sample Number:** 154308 **Code:** D 201

Location: Front Deadman Quartzite **Scintillometer Counts:** ND

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 2.2

Sec., Twp, Ra.: S16, 9N, 9E **Coordinates:** 34°06'57"; 111°26'32"

Geologic Unit: Deadman grit conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : This section is similar to that of M 134 except that here fragments are smaller in size and more rounded. There is also a dramatic increase in the specularite content from site M 134 to M 135.

Variability: The quartzite is cut in many places by veins and tension scars filled with remobilized quartz.

Sedimentary Structures: Bedding and cross-bedding sets average 10cm in thickness.

Depositional Environment: Near-shore marine or fluvial.

SAMPLE DESCRIPTION : A dark maroon to black-stained, medium-grained, cross-bedded, specularite-rich grit consists of mostly quartz grains and interstitial specularite. Rounded, medium sand-size grains of mostly quartz, jasper, and specularite comprise the matrix. Lenses of grit are 1-4cm-thick crossbeds composed of quartz grit grains 1 to 3mm long, with lesser chert.

Sampler: K. Wirth **Date:** 16 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 136 **Sample Number:** 154309 **Code:** D 202

Location: Front Deadman Quartzite **Scintillometer Counts:** ND

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 5.0

Sec., Twp, Ra.: S16, 9N, 9E **Coordinates:** 34°06'55"; 111°26'50"

Geologic Unit: Deadman granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Silty and muddy appearing quartzites make up most of the section. They contain high concentrations of hematite and detrital specularite. Thin layers of sparse granule conglomerate are interbedded with the quartzites. Locally fragments reach pebble size.

Variability: Specularite content generally appears to be increasing westward, although this may be stratigraphically controlled.

Sedimentary Structures: Beds average 3-10mm in thickness.

Depositional Environment: Either fluvial or shallow-water marine, near-shore base of transgressive sequence.

SAMPLE DESCRIPTION : The sample is a sparse granule to pebble conglomerate of rounded quartz grains, larger more angular aphanitic red rhyolite fragments and chert in a black coarse-grained, specularite-rich quartz matrix. The coarse-size matrix grains are composed of mostly quartz and have thick interstitial fillings of dark maroon to black specularite. Fragments are sub-rounded and are 50% elongate, 3-20mm-long, dark red hematitic rhyolite fragments (but also possibly specularitic quartzite fragments) and 50% rounded, 1-8mm fragments of ellipsoidally shaped white quartz.

Sampler: K. Wirth **Date:** 16 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 137 **Sample Number:** 154310 **Code:** D 202

Location: Front Deadman Quartzite **Scintillometer Counts:** ND

Quadrangle: Mazatzal Peak **U Value (U by NT) ppm :** 1.9

Sec., Twp, Ra.: S7, 9N, 9E **Coordinates:** 34°07'00"; 111°27'23"

Geologic Unit: Deadman granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Conglomerate fragments are restricted to a 3 meter thick layer. It is underlain and overlain by layers of better-sorted quartzite which shows good cross-bedding.

Variability: Conglomerate layer could be lensoidal as it is not present to the north.

Sedimentary Structures: Cross-bedding sets in the quartzite layers average 3-12cm in thickness.

Depositional Environment: Fluvial channel-type deposit or near-shore marine.

SAMPLE DESCRIPTION : The sample of Deadman is broken tectonically so that most grains are cracked or deformed. The rock is a coarse-grained grit to granule conglomerate of mostly quartz (90%) and rhyolite fragments, in which there are several much larger quartz and rhyolite fragments 2-3cm in size. Apart from these, most grains are less than 5 to 10 mm and appear quite angular. The matrix is mostly coarse-grained quartz cemented by specularite and hematite, but most of the specularite has now been altered to hematite.

Sampler: K. Wirth **Date:** 16 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 138 **Sample Number:** 154311 **Code:** D 102

Location: Front Deadman Quartzite **Scintillometer Counts:** 75 cps

Quadrangle: North Peak **U Value (U by NT) ppm :** 1.80

Sec., Twp, Ra.: S8, 9N, 9E **Coordinates:** 34°08'12"; 111°28'07"

Geologic Unit: Specularitic Deadman quartz granule conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY :On a complexly folded and faulted vertical rib of Deadman at the front face of the Mazatzal Mountains, partway down a ridge there are layers of quartz-granule conglomerate interbedded with specularite-bedded and cross-bedded pale maroon Deadman quartzites. Specularite is concentrated in the grit both as clasts and layers, possibly the base of cross-bed sets.

Variability: Granule conglomerate layers are 10 to 20cm wide, decreasing in abundance along strike and up section, but exist here over 20m of stratigraphy.

Sedimentary Structures: Specularite concentrations on cross-bedding planes

Depositional Environment: Shallow-water, near-shore marine or fluvial

SAMPLE DESCRIPTION : The sample consists of well-packed, somewhat elongate 8-20mm, well-rounded fragments of white quartz (35%), pink chert (3%), red jasper (2%), red rhyolite (5%), and blackish brown specularite (15%) in a 40% matrix of pink to pale maroon, coarse-grained quartz, detrital specularite and finer grained rock fragments. Some argillaceous material fills interstitial matrix positions and chalcedony is also present. Elongation of fragments is parallel to the bedding plane defined by a 7mm layer of specularite transecting the middle of the sample.

Sampler: P. Anderson **Date:** 16 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 139 **Sample Number:** 154312 **Code:** D 203

Location: Front Deadman Quartzite **Scintillometer Counts:** 190 cps

Quadrangle: North Peak **U Value (U by NT) ppm :** 18.90

Sec., Twp, Ra.: S8, 8N, 8E **Coordinates:** 34°08'03"; 111°27'28"

Geologic Unit: specularitic Deadman pebble conglomerate

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : South of the previous sample the Deadman goes through a tight fold closure where it is overturned and older andesitic volcaniclastics and tuffs locally overlie the Deadman. Right at the basal unconformity there is a thin (50cm), highly specularitic, black-pebble conglomerate that was sampled. It consists of black specularite fragments in a reddish brown to black specularite matrix, making the total specularite content of the rock close to 75%.

Variability: The basal specularite unit is immediately overlain by reddish brown to maroon well-bedded, locally cross-bedded quartzites typical of the Deadman quartzite.

Sedimentary Structures: Cross bedding, thinly bedded and laminated specularite concentrations.

Depositional Environment: Basal heavy-mineral concentrate in fluvial or near-shore marine environment.

SAMPLE DESCRIPTION : A black to reddish brown-stained, extremely dense rock shows (30%) rounded black specularitic "fragments" of almost pure specular hematite in a clastic matrix of maroon-stained, rounded quartz grains (35%) and granular specularite (35%). The matrix is coarse - sand to grit size and the "fragments" range from 3mm to a common size of 1-2cm up to as large as 4cm. The "fragments" are unusual in that they show spherical fracture lines similar to exfoliation planes in a granite boulder. This suggests that the black fragments are broken-up and rolled-up pieces of material that was thinly laminated specularite layers.

Sampler: P. Anderson **Date:** 16 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 140 Sample Number: 154313 Code: V 003

Location: East Verde River Scintillometer Counts: 120 cps

Quadrangle: Wet Bottom Mesa U Value (U by NT) ppm : 2.20

Sec., Twp, Ra.: S4, 10N, 7E Coordinates: 34°14'43"; 111°39'30"

Geologic Unit: polymictic granule conglomerate

Stratigraphic Group: Alder Group

SITE GEOLOGY : At the far western edge of the East Verde River canyon just west of the Mazatzal Wilderness boundary, below the Limestone Hills is a series of hematitic conglomerates containing a variety of volcanic and sedimentary rock types in an oxidized, poorly indurated red matrix. These rocks postdate the main part of Alder Group deposition but are grouped with it here for sake of simplicity.

Variability: Conglomerate varies from 1 to 50m thick, fragments vary from boulder size to granule size, and fragment composition varies from dominantly sedimentary and plutonic to dominantly volcanic.

Sedimentary Structures: Poorly defined bedding

Depositional Environment: Shallow water fluvial, lacustrine or subaerial fluvial environment.

SAMPLE DESCRIPTION : A pink to greenish gray granule conglomerate contains rounded to very angular fragments of mainly fine-grained volcanic siltstone material, with lesser quartz, chert, red jasper and probably altered greenish dioritic material. These make up a seriate grain-size population from 2cm down to matrix sizes of 1-2mm. The conglomerate is poorly lithified, very immature, the matrix is full of unstable altered volcanic or plutonic material and abundant reworked volcaniclastic and plutonic fragments, many of them difficult to identify.

Sampler: P. Anderson and K. Wirth Date: 18 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 141 Sample Number: 154314 Code: V 103

Location: East Verde River Scintillometer Counts: 150 cps

Quadrangle: Cane Springs U Value (U by NT) ppm : 1.80

Sec., Twp, Ra.: S36, 10N, 7E Coordinates: 34°15'32"; 111°36'40"

Geologic Unit: Oxidized hematitic red-pebble conglomerate

Stratigraphic Group: Alder Group

SITE GEOLOGY : Down in the East Verde River, the same rock sequence described in M 140 site geology is exposed as coarse pebble to boulder conglomerate containing, in addition to dominant red mudstone fragments, abundant boulders of Payson diorite, upon which this conglomerate rests.

Variability: Coarse boulders and Payson diorite fragments tend to be concentrated at the base of the sequence and give out upwards in the dominantly fining-upwards conglomerate.

Sedimentary Structures: Bedding is poorly defined, possibly local grading, lode casts.

Depositional Environment: Shallow water fluvial, lacustrine or subaerial fluvial conditions.

SAMPLE DESCRIPTION : A brick red conglomerate consists of 60%, seriate-sized (25 to 4mm) angular, red mudstone chips packed in more or less subparallel alignment. These and lesser dark greenish gray volcanic siltstone fragments 1-3cm long support a very poorly sorted, angular and very immature matrix of red mudstone fragments, some cherty and siliceous (chalcedonic?) material. All hematite in the rock has been oxidized to a brick red color. Some of the red fragments may be of rhyolite composition.

Sampler: P. Anderson & K. Wirth Date: 18 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: M 142 Sample Number: 154315 Code: V 003

Location: East Verde River Scintillometer Counts: 85 cps

Quadrangle: Cypress Butte U Value (U by NT) ppm : 2.20

Sec., Twp, Ra.: S6, 10N, 7E Coordinates: 34°14'21"; 111°34'30"

Geologic Unit: Volcanic-siltstone pebble conglomerate

Stratigraphic Group: Alder Group

SITE GEOLOGY : On the steep hill slopes south of the East Verde River in the Mazatzal Wilderness there are abundant outcrops of completely undeformed and unmetamorphosed volcanic siltstone and conglomerates made of angular siltstone fragments in a volcanic siltstone matrix.

Variability: Rock units are highly variable in all respects except their color, which is a uniform gray to pale brown.

Sedimentary Structures: Graded bedding, disturbed bedding, minor cross bedding.

Depositional Environment: Deep-water marine, distant from an intermediate volcanic center, receiving its volcaniclastic detritus.

SAMPLE DESCRIPTION : A very poorly sorted matrix of mainly gray and sandy brown feldspathic and volcaniclastic detritus contains and supports numerous size fragments from thin 0.5 x 6mm black slatey chips, to a common size of elongate, 1-2cm, angular volcanic siltstone fragments up to huge boulders of microcrystalline andesitic material. The rock is 30% fragments and 70% matrix although proportions can vary significantly. A greenish chlorite-rich matrix and epidote-chlorite clots (altered fragments in places, elsewhere filled cavities) characterize the rock in some places. The fragments record a great diversity of variously textured and structured volcanic material from flows to tuffs to laminated siltstones to chert and jasper.

Sampler: P. Anderson and K. Wirth Date: 18 December 1979

SITE AND SAMPLE DESCRIPTION

Site Number: H 1 **Sample Number:** 154339 **Code:** V 003

Location: Salt River - Hess Canyon **Scintillometer Counts:** 240 cps

Quadrangle: Haystack Butte **U Value (U by NT) ppm :** 3.90

Sec., Twp, Ra.: S6, 4N, 16E **Coordinates:** 33° 42' 45"; 110° 43' 01"

Geologic Unit: volcanic conglomerate - tuff breccia

Stratigraphic Group: Alder Group

SITE GEOLOGY : At the junction of Hess Canyon with the Salt River is a thick sequence of dark-colored volcano-sedimentary tuffs and rhyolitic agglomerates similar to the tuffs and agglomerates in the East Verde River section. H 1 is a sample of a whitish, feldspathic crystal-lithic rhyolite tuff and agglomerate that underlies Hess Canyon quartzites and is separated from them by rhyolitic ignimbrite. This feldspar-crystal, rhyolitic tuff-agglomerate is underlain by a darker green volcanic conglomerate-agglomerate unit sampled as H 2.

Variability: Sequence and contacts are highly variable in detail but consistent and uniform on a broad scale.

Sedimentary Structures: Abundant graded bedding of the finer grained crystal-lithi tuffs, and other features found in a volcanic depositional environment.

Depositional Environment: Probably relatively deep water, rapid dumping of volcanic clastic detritus on the flank of, or in a basin distal to,a volcanic center.

SAMPLE DESCRIPTION : Pale greenish brown to gray on weathered surface, and greenish brown "cherty" appearing on fresh surface, the rock consists of flattened or elongate darker angular volcanic fragments in a matrix of paler green rhyolitic volcanic material (broken feldspar crystals, lithophysae, and devitrified, altered, glassy matrix). The matrix and fragments are cogenetic in that both are feldspathic rhyolitic material, only fragments have a darker alteration here.

Sampler: P. Anderson **Date:** 5th March 1980

SITE AND SAMPLE DESCRIPTION

Site Number: H 2 **Sample Number:** 154340 **Code:** V 002

Location: Salt River - Hess Canyon **Scintillometer Counts:** 160 cps

Quadrangle: Haystack Butte **U Value (U by NT) ppm :** 4.00

Sec., Twp, Ra.: S6, 4N, 16E **Coordinates:** 33° 42' 47"; 110° 43' 01"

Geologic Unit: volcanic conglomerate to agglomerate

Stratigraphic Group: Alder Group

SITE GEOLOGY : Underlying the rhyolite tuff-agglomerate of H 1, is a darker green volcaniclastic unit with large boulders of volcanic material set in a graded-bedded, volcanic "sandstone" matrix. Quartz is notably absent and the sandstone is made up solely of feldspathic volcanic detritus. Sequence contains dark green slaty fragments, pale green to black cherty fragments, and feldspar-phenocryst-crowded rhyolite fragments.

Variability: Fragment type highly variable, but all are either feldspathic volcanic, chert or slate fragments.

Sedimentary Structures: Graded bedding, fragment alignment, lode features and disrupted or scoured bedding are evident.

Depositional Environment: Rapid dumping, without reworking, of poorly-sorted volcaniclastic detritus into a basin flanking a main volcanic center is indicated.

SAMPLE DESCRIPTION : Rock is a pale-green to sandy brown volcanic-sandstone matrix of small broken feldspar crystals, sericitic and clay material, and unmetamorphosed aphanitic volcaniclastic material containing a great diversity of fragment types. Most fragments are less than 40mm, but some are up to 50cm long. Dark green, feldspathic volcanic fragments range from 10 to 40mm in size; pale green, clear and black, angular chert fragments are 10 to 4mm long; and darker gray to black aphanitic volcanic chips are 2-7mm long. Some cogenetic volcanic siltstone fragments up to 15mm long are also set in the sand-to grit-size volcanic sandstone matrix.

Sampler: P. Anderson **Date:** 5th March 1980

SITE AND SAMPLE DESCRIPTION

Site Number: H 3 **Sample Number:** 154341 **Code:** M 120

Location: Hess Canyon **Scintillometer Counts:** 120 cps

Quadrangle: Haystack Butte **U Value (U by NT) ppm :** 2.10

Sec., Twp, Ra.: S8, 4N, 16E **Coordinates:** 33° 42' 22"; 110° 42' 08"

Geologic Unit: quartzites

Stratigraphic Group: probable Mazatzal Group correlative

SITE GEOLOGY : Quartzites of Hess Canyon area are generally non-hematitic but interbedded repetitiously with hematitic shales and siltstones. These rocks have few of the characteristics of Mazatzal Group, to which they have been correlated. Deformation and metamorphism renders interbedded quartzites and shales to appear like conglomerates, but they are not. The only conglomerates in the sequence are thin (10-40cm thick) rip-up zones of softer, darker shaly fragments in siltstone and quartzite.

Variability: Counts range from 60 to 90 in pure white massive quartzite to 150 to 180 in hematitic and pyritic silty to shaly quartzites. Grain size highly variable, hematite content positively correlated to finer grain sizes.

Sedimentary Structures: Abundant cross bedding, oscillation and current ripple marks, mud cracks, cut, fill and scour channels well developed.

Depositional Environment: Every indication points to a shallow water depositional environment, probably marine and varying from intertidal to littoral and neritic.

SAMPLE DESCRIPTION : H 3 is a composite of the lower 100 stratigraphic meters of quartzites taken up Hess Canyon from the lowest (massive, lavender) quartzite to 35 m. below the main pure white ("White Ledges") quartzite. Character samples of the composite are variously: (1) a brick-red, hematitic, well-bedded fine-grained sugary quartzite; (2) pale lavender, well-bedded, massive (recrystallized) quartzite showing faint hematite concentrations on bedding planes; (3) brick-red, well-bedded, flaggy, highly hematitic, partly sericitic siltstone; and (4) a patchy quartzite with pale pink and dark maroon patches appearing like a rip-up conglomerate unit. Elongate yellow-white sericite chips (volcanic fragments?) are also present in this sample.

Sampler: P. Anderson **Date:** 5 March 1980

SITE AND SAMPLE DESCRIPTION

Site Number: H 4 **Sample Number:** 154342 **Code:** M 110

Location: Hess Canyon **Scintillometer Counts:** 80 cps

Quadrangle: Haystack Butte **U Value (U by NT) ppm :** 0.70

Sec., Twp, Ra.: S8, 4N, 16E **Coordinates:** 33° 42' 27"; 110° 43' 52"

Geologic Unit: quartzites and hematitic conglomerates

Stratigraphic Group: probable Mazatzal Group correlative

SITE GEOLOGY : See description of sample H 3.
H 4 is a composite sample beginning 35meters below the main massive white ("White Ledges") quartzite and continuing up to about 50meters stratigraphically above main white quartzite unit. In this section, pyritic zones, more hematitic siltstone, shaly rip-up layers, ripple marks and mud cracks, and hematitic shaly interbeds are more abundant than in H 3 section.

Variability: Same as H 3

Sedimentary Structures: Same as H 3

Depositional Environment: Same as H 3

SAMPLE DESCRIPTION :
Character sample is of the pure white massive quartzite unit. The white quartzite is so fine grained, recrystallized and massive that the surface is dominated by perlitic cracks. Small darker hematitic spots and layers could define bedding planes or be weathering spots from detrital hematite grains. Grain size is fine sand to silt, and appearance of the quartzite is sugary.

Sampler: P. Anderson **Date:** 5th March, 1980

SITE AND SAMPLE DESCRIPTION

Site Number: F 1 **Sample Number:** 154343 **Code:** M 010

Location: South Peak of Four Peaks **Scintillometer Counts:** ND

Quadrangle: Four Peaks **U Value (U by NT) ppm :** 1.10

Sec., Twp, Ra.: S21, 4N, 10E **Coordinates:** 33° 40' 14"; 111° 19' 55"

Geologic Unit: Four Peaks quartzite and conglomerate

Stratigraphic Group: probable Mazatzal Group correlative

SITE GEOLOGY : Mostly massive white, well-bedded but poorly cross-bedded quartzites making up the synform of Four Peaks unconformably overlie amphibolite-grade pelitic metasediments. Correlation of the Four Peaks quartzite to Mazatzal Group is neither obvious nor warranted, except at the base of the 4th peak where F 1 sample was taken. Here the quartzite is somewhat hematitic near the base with possible grit and conglomerate suggested by black fragments. Some quartzites are deep pale maroon to pale purple, bedded, cross-bedded, specularite-bedded and cross-bedded and thus are very much like Mazatzal-type quartzite.

Variability: The sample, with 0.5 to 3% disseminated specularite throughout and a distinct hematitic maroon cast, is a variant of the main type of white quartzite making up 95% of Four Peaks.

Sedimentary Structures: Bedding and cross bedding are common, and specularite concentrations on bedding and cross-bedding planes are also present. Ripple marks and mini-trough cross beds are characteristic.

Depositional Environment: Quartzites here have been deposited in fairly quiet, lower-energy beach or marine conditions away from strong wave action.

SAMPLE DESCRIPTION : Sample is a dark maroon to blackish-brown, fine-grained quartzite containing abundant black, fine-grained specularite. Some white recrystallized quartz material is present, as is iron stain on weathered surfaces. Some beds are non-hematitic and white, where the tightly interlocking mosaic of recrystallized quartz grains that compose the quartzite are clearly seen. Another sample is a fine grained white quartzite of tightly interlocking 0.2 to 0.5mm quartz grains, containing sparse blackish spots (fragments?) where specularite is concentrated.

Sampler: P. Anderson **Date:** 6 March 1980

SITE AND SAMPLE DESCRIPTION

Site Number: B 138 **Sample Number:** 154345 **Code:** M 203

Location: Granite Creek **Scintillometer Counts:** 85 cps

Quadrangle: Chino Valley North **U Value (U by NT) ppm :** 1.40

Sec., Twp, Ra.: S5, 16N, 1W **Coordinates:** 34°47'26"; 112°22'40"

Geologic Unit: Mazatzal quartz-jasper cobble conglomerate (upper)

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : On the east end of Mazatzal exposures in Chino Valley the upper part of the section consists of maroon to purple, variously hematite-stained bedded and cross-bedded quartzites and abundant granule to cobble conglomerates, both sparse and densely-packed. A variety of conglomerate types representative of this part of the Mazatzal were sampled, including: (1) white quartz-pebble conglomerate in a dark specularitic matrix; (2) brick-red hematitic, quartz, chert, jasper, rhyolite, quartzite and specularite-pebble conglomerate; (3) red shale-chert-jasper pebble conglomerate, and (4) sparse granule conglomerate interbedded with 2-6cm-thick well-bedded layers of detrital specularite. Conglomerate varies from 75 to 30% fragments, and makes up about 40% of the section here. The change fr
Variability: abundant quartz-pebble conglomerate to polymictic conglomerate occurs over 3-5 meters.

Sedimentary Structures: Detrital specularite fills cavities interstitial to large quartz pebbles. Abundant 7-20cm-thick trough cross-beds truncate one another. The cross-beds usually contain a great diversity of grain sizes.

Depositional Environment: Large fragments and abundant cross bedding suggest a high-energy fluvial environment such as a braided-river system.

SAMPLE DESCRIPTION : One sample is a striking aggregate of large (2-5cm) very well-rounded white quartz pebbles in a dark blue-black, metallic specularite-rich matrix. The pebbles are hematite stained on their peripheries and are of vein quartz material. The matrix is relatively coarse, but poorly sorted quartz, lesser chert and jasper, with abundant (5-10%) specularite. Rock is partly framework supported. Another sample is quite different in the pervasive red-brown hematite stain and diversity of banded jasper, quartzite, chert, hematitic quartzite, siltstone, red shale, banded iron formation, rhyolite and chalcedonic pebbles 1-4cm long in a poorly-sorted quartz, hematite, rock fragment-rich matrix. Other samples are gradational between these two types.

Sampler: P. Anderson & K. Wirth **Date:** March 2, 1980

SITE AND SAMPLE DESCRIPTION

Site Number: B 140 **Sample Number:** 154347 **Code:** M 203

Location: Granite Creek **Scintillometer Counts:** 80 cps

Quadrangle: Chino Valley North **U Value (U by NT) ppm :** 2.50

Sec., Twp, Ra.: S31, 17N, 1W **Coordinates:** 34° 48' 50"; 112° 19' 00"

Geologic Unit: Mazatzal quartz-jasper pebble conglomerate (lower)

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Near the base of the Mazatzal Group in Granite Creek is 59 meters of quartzite overlain by 60 meters of conglomerate. The lower quartzites are maroon, pink to pale brown, medium-grained, trough cross-bedded and show some graded bedding. Conglomerate commences abruptly up section with granule to pebble-size quartz, chert, jasper, shale and rhyolite in a poorly-sorted, coarse-grained quartzite matrix. Upper parts of the conglomerate unit contain the same fragment types as coarse as boulders.

Variability: Small cyclical conglomerate layers fine up section, but the overall conglomerate unit is reversely graded. Cross beds diminish in thickness from 10-30cm to 5-15cm at the top of the unit.

Sedimentary Structures: Trough cross beds containing various-size conglomerate fragments are common; complex grading patterns are present.

Depositional Environment: Fluctuating cyclical changes in energy building to a high-energy peak, suggests a shallow water fluvial system with flooding or braided-stream conditions.

SAMPLE DESCRIPTION : The conglomerate is a pale pink to light brownish rock of 65% coarse-grained, barely-hematitic, quartz-rich matrix supporting rounded, elongate and bedded white quartz and red jasper pebbles 1-4cm long. The matrix is interesting in that it contains a significant amount of sericite and other, possibly detrital, micaceous material, making the dominantly quartz-plus-specularite matrix impure compared to the upper conglomerate unit of B 138. Shale and rhyolite fragments, both dark red and hematitic, occur in some conglomerate layers.

Sampler: P. Anderson & K. Wirth **Date:** March 2, 1980

SITE AND SAMPLE DESCRIPTION

Site Number: B 140 **Sample Number:** 154347 **Code:** M 203

Location: Granite Creek **Scintillometer Counts:** 80 cps

Quadrangle: Chino Valley North **U Value (U by NT) ppm :** 2.50

Sec., Twp, Ra.: S31, 17N, 1W **Coordinates:** 34° 48' 50"; 112° 19' 00"

Geologic Unit: Mazatzal quartz-jasper pebble conglomerate (lower)

Stratigraphic Group: Mazatzal Group

SITE GEOLOGY : Near the base of the Mazatzal Group in Granite Creek is 59 meters of quartzite overlain by 60 meters of conglomerate. The lower quartzites are maroon, pink to pale brown, medium-grained, trough cross-bedded and show some graded bedding. Conglomerate commences abruptly up section with granule to pebble-size quartz, chert, jasper, shale and rhyolite in a poorly-sorted, coarse-grained quartzite matrix. Upper parts of the conglomerate unit contain the same fragment types as coarse as boulders.

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Sampler: P. Anderson & K. Wirth **Date:** March 2, 1980

SITE AND SAMPLE DESCRIPTION

Site Number: S-1 **Sample Number:** 154112 **Code:** L 403

Location: Young Road **Scintillometer Counts:** 120 cps

Quadrangle: McFadden Peak **U Value (U/NT) ppm:** 1.2

Sec., Twp, Ra.: S13, 7N, 13E **Coordinates:** 33°56'64", 110°58'22"

Geologic Unit: Mescal limestone

Stratigraphic Group: Apache Group

SITE GEOLOGY : Relatively poor exposure, 300 feet long in road cut of lower part of upper unit of Mescal limestone, possibly 10 to 20 feet thick. Red to purple, brown to white angular chert breccia or conglomerate of chert fragments in a brown matrix.

GR 310 Spectrometer: total counts 69.1 cps; 3.44 cps K , 2.63 cps Th, 2.38 cps U. Equivalents = 0.23% K , 63.42 ppm Th, 5.65 ppm U.

Variability:

Sedimentary Structures:

Depositional Environment:

SAMPLE DESCRIPTION : (by P.A.)

Yellow to red brown limonite stained (from pyrite) chert breccia. Also some bluish-white to orangy-yellow stain from other types of sulfides. Breccia consists of angular fragments from 30 mm to 2 mm , the larger are clear gray chert, the smaller are white altered chert or feldspar. Matrix is limonite-stained.

Sampler: J. D. Loghry **Date:** Nov. 1 ,1979

SITE AND SAMPLE DESCRIPTION

Site Number: S-2 Sample Number: 154113 Code: U102

Location: Bryant Canyon Scintillometer Counts: 150

Quadrangle: Young U Value (U/NT) ppm: 1.7

Sec., Twp, Ra.: S2, 8N, 13E Coordinates: 34°01'40", 110°59'00"

Geologic Unit: Dripping Spring quartzite

Stratigraphic Group: Apache Group

SITE GEOLOGY : Dripping spring quartzite is exposed in 100 foot-high cliffs above covered Scanlan conglomerate. Section is mainly red-brown sandstone with several 2 inch to 2 foot thick pebble conglomerate and conglomeratic sandstone beds near the base. A 2 foot thick conglomerate bed (dipping gently 3°) with red-brown stain, angular quartz and dark gray chert pebbles, rounded quartzite pebbles, brown chert and abundant orange-pink K-feldspar crystals in the matrix, was sampled. Medium-grained, light red-brown sandstone lies above and well-bedded, fine-grained dark brown sandstone with other pebble-conglomerate beds lie below. GR310 Spectrometer, total counts = 80.85 cps; 6.51 cps K; 1.18 cps U; 0.72 cps Th. Equivalents = 6.38%K, 4.56ppmU, 1.35 ppm TH.
Variability:

Sedimentary Structures:

Depositional Environment: Alluvial

SAMPLE DESCRIPTION : (by P.A.)

Poorly cemented purple granule conglomerate of diverse angular to sub-rounded fragments in a hematite-rich matrix. Fragments are 15 to 5mm sub-rounded pink to gray quartz + K-feldspar-phenocrystic rhyolite, 10-4mm yellow-ish-white chert and 5-2mm angular quartz. The matrix contains abundant 4 to 0.5mm broken pink feldspar crystals from the Young granite, angular quartz, chert and chalcedony grains in a cement of purplish-red hematite-stained material.

Sampler: J. D. Loghry Date: 11-2-79

THIN SECTION DESCRIPTION

Site Number: S2 **Sample Number:** 154113 **Code:** U102

Percent Fragments: 32% **Percent Matrix:** 57%

Percent Heavies & Mafics: 11% **Stain:** brownish pink

Rock Type: Dripping Spring conglomerate **Stratigraphic Group:** Apache Group

FRAGMENTS : **(percentages are based on 100% fragments)**

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
rhyolite	32%	15-2.0 mm	subrounded	1:2
quartz	27%	7.8-2.0 mm	subangular	1:1.5
quartzite	18%	10-2.0 mm	subrounded	1:2
feldspar	23%	5.5-2.0 mm	subangular	1:2

(rhyolite fragments have large embayed quartz phenocrysts and altered K-feldspar phenocrysts, and distinct needle-like growth of matrix)

MATRIX & HEAVIES : **(percentages are based on 100% matrix & heavies)**

Type & color	Percentage	Size range	Description
quartz	50%	2.0-.02 mm	angular to rectangular, embayed volcanic
quartzite	1%	2.0-1.6 mm	subrounded
rhyolite	17%	2.0-.2 mm	subangular quartz phenocrystic
feldspar	15%	2.0-.4 mm	hematite-altered, perthitic
specularite	1%	.2-.08 mm	rounded
specularite	3%	powdery	recrystallized with hematite
hematite	11%	powdery	fine interstitial grains and masses; stain
sericite	2%	<.005	recrystallized masses

Cement: Mostly hematite; minor recrystallized specularite and sericite.

Interstitials: Hematite, sericite, recrystallized specularite.

Textures and recrystallization: K-feldspars and pink from hematite staining, contain patchy and exsolution-lamellae perthitic structure; quartz crystals are large, unstrained, broken volcanic phenocrysts; angular grains are preserved in a matrix of nearly opaque clay, hematite, specularite and cryptocrystalline material.
Structures: Both fragments and matrix show no bedding or preferred orientation in thin section.

Comments on Genesis: Conglomerate is a completely unrecrystallized aggregate of a unique rhyolite type as well as all types of material in the underlying terrain: Young-granite K-feldspars; rhyolite fragments and quartz crystals from Haigler-type rhyolites; quartzite and other matrix material probably from Alder sedimentary rocks.

Rock Name: pink K-feldspar-bearing rhyolite-quartzite conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: S-3 **Sample Number:** 154114 **Code:** U 103

Location: Young Highway **Scintillometer Counts:** 120

Quadrangle: McFadden Peak **U Value (U/NT) ppm:** 3.0

Sec., Twp, Ra.: S19, 8N, 14E **Coordinates:** 34°,01',40", 110°57'50"

Geologic Unit: Upper Dripping Spring siltstone

Stratigraphic Group: Apache

SITE GEOLOGY : Fifteen-feet thick bed of angular chert-pebble conglomerate lies on upper member of Dripping Springs quartzite, 10-20 feet above the contact of the middle member of the Dripping Springs quartzite. Hematite, goethite-stained matrix. GR-310 Spectrometer: Total count 57.05 cps; 6.54 cps K; 1.3 cps U; 0.92 cps Th. Equivalents = 6.19 % K; 4.59 ppm U; 7.89 ppm Th. Sandstone below is 65 cps total count, sandstone above is 80-85 cps total count. Angular gray-black chert pebbles are similar to Mescal Limestone conglomerates.

Variability: 20-40 mm pebbles; few cobbles to 150 mm

Sedimentary Structures:

Depositional Environment:

SAMPLE DESCRIPTION : (by P.A.)

Seriate pebble to granule conglomerate contains large (4cm) subrounded fragments of maroon laminated siltstone, reddish brown chert, gray and yellow iron-stained chert in a blackish-gray carbonate-bearing siliceous matrix. Matrix is largely aphanitic silica but some 0.5 mm clear volcanic quartz crystals are evident. Some hematitic, specularitic and black silty fragments are less abundant than the dominant angular chert fragments.

Sampler: J. D. Loghry **Date:** 11-2-79

SITE AND SAMPLE DESCRIPTION

Site Number: S-4 **Sample Number:** 154134 **Code:** S 103

Location: Juniper mountain **Scintillometer Counts:** 140

Quadrangle: Picture Mountain **U Value (U/NT) ppm:** 3.1

Sec., Twp, Ra.: S22, 7N, 11E **Coordinates:** 33°,55'47", 111°12'39"

Geologic Unit: Scanlan Conglomerate

Stratigraphic Group: Apache Group

SITE GEOLOGY : Basal boulder-cobble supported conglomerate resting on granite contains a matrix of hematitic-red grit and sandstone and pink K-feldspar crystals. Abundant rounded white quartzite cobbles and boulders (15-30cm), red shale fragments, minor tabular schist pebbles, and rare jasper pebbles make up the fragments. Scanlan boulder conglomerate 20 foot-thick is overlain by: 3 inch-thick red-brown siltstone; 3 foot-thick cobble conglomerate with sandstone beds; 1/2 inch red siltstone; 20 foot-thick sandy pebble conglomerate (Sample S-5); 3 foot-thick red brown siltstone unit (150-160cps); then the Dripping Spring quartzite middle-member sandstone (110 cps)

Variability:

Varies from grit size fragments to 30cm boulders

Sedimentary Structures:

Depositional Environment: alluvial

SAMPLE DESCRIPTION : (By P.A)

Coarse-grained pebble conglomerate of diverse subangular to rounded rock fragments in a purple hematitic matrix characterized by Young granite pink K-feldspar crystals. Large fragments are rounded specularite-leucoxene-rich Deadman quartzite, Mazatzal quartzite, pink to white chert, white quartz and quartzite, purple hematitic siltstone and claystone (40mm to 5mm size range). Matrix is dark quartz, chert, rock fragments and characteristic-pink Young granite K-feldspar crystals in a purplish hematite cement. Source terrain was mostly the Mazatzal Group.

Sampler: J. D. Loghry **Date:** 11-10-79

SITE AND SAMPLE DESCRIPTION

Site Number: S-5 **Sample Number:** 154135 **Code:** U 113

Location: Juniper mountain **Scintillometer Counts:** 160

Quadrangle: Picture Mountain **U Value (U/NT) ppm:** 3.3

Sec., Twp, Ra.: S22, 7N, 11E **Coordinates:** 33°55'46", 111°12'39"

Geologic Unit: Dripping Spring Quartzite, arkose member or middle member

Stratigraphic Group: Apache Group

SITE GEOLOGY : Red-brown sandy quartz-pebble conglomerate, 3 to 10mm rounded quartz pebbles, 2 to 5 mm angular K-Feldspar pebbles in a 20 foot-thick unit - a quartz-pebble conglomerate which grades toward the top to a coarse sandstone with quartz pebbles.

Variability: 3-10mm quartz pebbles

Sedimentary Structures:

Depositional Environment: alluvial

SAMPLE DESCRIPTION : (by P.A.)

An angular granule conglomerate of broken K-feldspar crystals and quartz fragments, aligned in a matrix of darker green rock fragments, quartz and minor purple hematite cement. The pink K-feldspar fragments are characteristically of Young granite type and are broken and elongate and 8 to 1mm long, broken clear quartz fragments are 5 to 2mm long and could also have come from erosion of the Young granite. Quartz, chert, feldspar and dark green chips in hematitic cement make up the matrix. Rock could be derived entirely from Young granite.

Sampler: J. D. Loghry **Date:** 11-10-79

SITE AND SAMPLE DESCRIPTION

Site Number: S - 6 **Sample Number:** 154136 **Code:** S 203

Location: Juniper Spring **Scintillometer Counts:** 130

Quadrangle: Picture Mountain **U Value (U/ NT). ppm:** 2.6

Sec., Twp, Ra.: S26, 7N, 11E **Coordinates:** 33°55'08", 111°12'00"W

Geologic Unit: Scanlan Conglomerate Member

Stratigraphic Group: Apache

SITE GEOLOGY : Quartzite pebble conglomerate, gray to dark gray.

Variability: 40mm average pebble size to boulders maximum diameter 140mm.

Sedimentary Structures:

Depositional Environment: alluvial

SAMPLE DESCRIPTION : (by P.A.)

A large-fragment quartz-chert-volcanic rock fragment conglomerate, fragment-supported, in a dark gray, siliceous matrix. Fragments are rounded milky quartz (40 to 5mm), rounded pink to maroon quartzite (10-30mm) of Mazatzal quartzite derivation, subangular white to pink to red chert (50 to 5mm), pink to orange, specularitic, aphanitic rhyolite fragments (20 to 50mm) of pre-Mazatzal derivation, dark green sericitic, amygdaloidal dacite fragments (15 to 40mm), broken, elongate, pink Young granite K-feldspars (30 to 5mm) and other fragment types. Matrix is dark greenish gray (reduced?), contains quartz, pink K-feldspar, detrital specularite, chert, quartzite, rock chips and abundant argillaceous matrix material.

Sampler: J. D. Loghry **Date:** 11-10-79

THIN SECTION DESCRIPTION

Site Number: S6 **Sample Number:** 154136 **Code:** S203

Percent Fragments: 15% **Percent Matrix:** 68%

Percent Heavies & Mafics: 17% **Stain:** brownish orange to pink

Rock Type: Scanlan conglomerate **Stratigraphic Group:** Apache Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
rhyolite	39%	8.2-2.0 mm	subrounded	1:2
quartz	28%	9.8-2.0 mm	subrounded	1:1.5
quartzite	33%	13-4.3 mm	subrounded	1:1.5

(rhyolite is generally sericitic, locally specularitic, and aphanitic)

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
rhyolite	37%	2.0-.35 mm	specularitic, sericite-foliated
quartz	28%	2.0-.02 mm	clear, angular broken volcanic crystals
chert	2%	.9-.43 mm	subangular
specularite	7%	.71-.03 mm	rounded, detrital
specularite	2%	powdery	recrystallized with hematite
hematite	6%	powdery	iridescent pleochroic masses and stain
sericite	7%	<.005 mm	fine matrix masses
quartzite	3%	2.0-.7 mm	subrounded
clay	8%	--	hematite-stained matrix material

Cement: Mostly sericite, hematite, recrystallized quartz and specularite.

Interstitials: Sericite, hematite, clay, fine-grained quartz and specularite.

Textures and recrystallization: Matrix is an unrecrystallized aggregate of hematite-stained clay material, sericite and quartz in which detrital volcanic quartz, detrital specularite and various rounded fragments lie; hematite is crystalline here, showing red iridescence and pleochroism.
Structures: Fragment elongation, layers of differing hematitic clay matrix contents, and layers of concentrated detrital specularite define bedding.

Comments on Genesis: This differs from S2 Dripping Spring conglomerate thin section in abundance of detrital specularite and lack of pink feldspar (pink fragments are rhyolite). Rock is an aggregate of specularite, rhyolite, quartzite, quartz wacke and volcanic quartz material, all from underlying terrain.

Rock Name: specularitic rhyolite-quartzite conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: S - 7 **Sample Number:** 154137 **Code:** U 213

Location: Del Shay Basin **Scintillometer Counts:** 130

Quadrangle: Picture Mountain **U Value** (U/NT) ppm: 1.1

Sec., Twp, Ra.: S2, 8N, 11E **Coordinates:** 34°00'12", 111°12'00"

Geologic Unit: Dripping Spring Quartzite middle or arkose member

Stratigraphic Group: Apache Group

SITE GEOLOGY : Traverse east from Del Shay cabin, collect float and 3 outcrops of four to perhaps 7 conglomerate and conglomeratic sandstones in the middle or arkose member of the Dripping Spring Quartzite; 1 1/2 - 5 feet thick beds (120-140cps) in a 200 or more foot-thick massive red-brown sandstone (160 - 200 cps); beds plunging 7-15°E. Upper siltstone unit is 120-140cps. This is one area where middle member radioactivity exceeds that of upper member, is probable reason for AEC Del Shay Basin aerial-radiometric anomaly. Rhyolite at cabin is 140-180cps.

Variability:

Sedimentary Structures:

Depositional Environment:

SAMPLE DESCRIPTION : (by P.A.)

A diverse-fragment, dark greenish-gray matrix-supported conglomerate consisting of large 20-40mm vuggy white quartz pebbles, specularite cross-bedded Mazatzal quartzite pebbles, pink specularitic quartz-phenocrystic rhyolite fragments (25-20mm) and long, pink K-feldspar broken crystals, and dark greenish slaty to altered-volcanic fragments in a matrix of quartz, chert, specularitic rock fragments, detrital specularite and dark greenish gray clay material. White feldspar-lath dacite fragments are of Alder volcanic derivation, shaly chips of Alder sedimentary origin, specularite and rhyolite of pre-Mazatzal derivation, quartzite of Mazatzal origin and K-feldspar from the Young granite.

Sampler: J. D. Loghry **Date:** 11 - 11 - 79

THIN SECTION DESCRIPTION

Site Number: S7 **Sample Number:** 154137 **Code:** DSM

Percent Fragments: 48% **Percent Matrix:** 54%

Percent Heavies & Mafics: 6% **Stain:** blackish brown to pink

Rock Type: Dripping Spring conglomerate **Stratigraphic Group:** Apache Group

FRAGMENTS : **(percentages are based on 100% fragments)**

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartzite	13%	34 mm	subrounded	1:2
quartz	55%	28-18 mm	subrounded	1:1.5
rhyolite	32%	31-6.4 mm	subangular	1:2

(rhyolite is sericitic and quartz phenocrystic; quartzite could be recrystallized polygonized vein quartz in part; quartz is clear, broken volcanic crystals)

MATRIX & HEAVIES : **(percentages are based on 100% matrix & heavies)**

Type & color	Percentage	Size range	Description
quartz	41%	3.2-.02 mm	subangular, broken volcanic crystals
rhyolite	17%	4.1-.4 mm	subangular, sericitic
feldspar	13%	2.8-.1 mm	altered, subangular perthite
sericite	17%	<.01 mm	recrystallized plates and masses
specularite	4%	.9-.01 mm	rounded
specularite	<1%	powdery	recrystallized with hematite
hematite	3%	powdery	fine interstitial grains and stain
limonite	1%	powdery	fine interstitial grains and stain
clay	4%	--	hematite-stained matrix material

Cement: Recrystallized sericite, quartz.

Interstitials: Sericite, hematite, limonite, clay, quartz, specularite.

Textures and recrystallization: Most matrix clay material is slightly recrystallized to sericite and cherty silica; feldspar, sericite and quartz are interstitial to angular detrital volcanic quartz, specularite and rhyolite fragments.

Structures: Large fragments obscure bedding in thin section.

Comments on Genesis: Derived from a complex source terrain of vein quartz, quartzite, sericitic quartz-phenocrystic rhyolite, pink K-feldspar from Young granite, and specularite-rich rock.

Rock Name: quartz-quartzite-rhyolite pebble conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: S - 8 **Sample Number:** 154138 **Code:** L 103

Location: N. of Bear Head Mountain **Scintillometer Counts:** 70cps

Quadrangle: Copper Mountain **U Value** (U/NT) **ppm:** 0.80

Sec., Twp, Ra.: S21, 7N, 12E **Coordinates:** 33°56'33", 111°07'17"

Geologic Unit: Mescal Limestone lower member

Stratigraphic Group: Apache

SITE GEOLOGY :

Gray chert breccia with goethite after pyrite, 3 foot thick flat ledge, lowest Mescal unit present, presumably the Founder breccia of Shride (1967).

The basal sandstone of the Mescal was not observed during this study.

Variability:

Sedimentary Structures:

Depositional Environment: Founder or collapse breccia of lagoonal sediments.

SAMPLE DESCRIPTION :

No hand specimen available

Sampler: J. D. Loghry **Date:** 11-12-79

SITE AND SAMPLE DESCRIPTION

Site Number: S-9 **Sample Number:** 154140 **Code:** L 003

Location: NE of Bear Head Mtn. **Scintillometer Counts:** 230

Quadrangle: Copper Mountain **U Value (U/NT) ppm:** 2.1

Sec., Twp, Ra.: S15, 7N, 12E **Coordinates:** 33°56'54", 111°06'20"

Geologic Unit: Mescal Limestone, lower member

Stratigraphic Group: Apache

SITE GEOLOGY : Gray silicified chert breccia, limonite-stained; areas of yellow, yellow-brown, orange-brown transported limonite have highest count. A 4 or more foot ledge of Mescal breccia lies on Dripping Springs upper siltstone whose beds plunge 18° east.

Variability: From 120 to 135 cps with 350 cps maximum in section

Sedimentary Structures:

Depositional Environment: Founder or collapse breccia of lagoonal sediments.

SAMPLE DESCRIPTION : (by P.A.)

A coarse, angular, broken-fragment breccia of 5 to 12 cm pale grayish brown chert fragments (some quartz recrystallization) in an interstitial, pink vuggy matrix of quartzofeldspathic or argillaceous material. Orange-brown limonitic stain suggests either pyrite in matrix or oxidized iron solutions circulating through permeable parts of breccia.

Sampler: J. D. Loghry **Date:** 11-12-79

SITE AND SAMPLE DESCRIPTION

Site Number: S-10 **Sample Number:** 154141 **Code:** L 103

Location: NE of Bear Head Mtn. **Scintillometer Counts:** 450

Quadrangle: Copper Mountain **U Value (U/NT) ppm:** 1.5

Sec., Twp, Ra.: S14, 7N, 12E **Coordinates:** 33°56'57", 111°06'12"

Geologic Unit: Mescal Limestone, lower member

Stratigraphic Group: Apache

SITE GEOLOGY : Chert breccia unit 6-10 feet thick. Gray and red (hematite stained) banded chert breccia, middle of road, highest count observed in Sierra Ancha conglomerates, 350 to 550 cps over 50 cps background.

Variability: 350-550 cps variation

Sedimentary Structures:

Depositional Environment: Founder or collapse breccia of lagoonal sediments.

SAMPLE DESCRIPTION : (by P.A.)

A chert breccia consisting of 4 to 18 cm-size chert fragments in a brecciated, unfilled or leached, broken chert-silica matrix. Some breccia fragments are white to pale pink and hematitic. Others are strongly red-iron-stained, with either colloform banding or alteration rims to some breccia fragments.

Sampler: J. D. Loghry **Date:** 11-12-79

SITE AND SAMPLE DESCRIPTION

Site Number: S-11 **Sample Number:** 154 142 **Code:** L 104

Location: NE of Bear Head Mtn. **Scintillometer Counts:** 200

Quadrangle: Copper Mountain **U Value (U/NT) ppm:** 1.1

Sec., Twp, Ra.: S22-23, 7N, 12E **Coordinates:** 33°56'08", 111°06'13"

Geologic Unit: Mescal Limestone, lower member

Stratigraphic Group: Apache

SITE GEOLOGY : Gray angular chert-pebble breccia with yellow-brown limonite; poorly exposed unit is 3 or more feet thick.

Variability: 140 to 250 cps

Sedimentary Structures:

Depositional Environment:

SAMPLE DESCRIPTION : (by P.A.)

Highly altered breccia of angular, white, bleached clay-altered fragments 5 to 50mm in size, in a pink to brown, leached cellular matrix. Both fragments and matrix appear to be the same material with different stains. Neither are calcareous but seem to be fine grained sandstones or siltstones of quartz and clay, now strongly altered and vuggy in a local breccia unit.

Sampler: J. D. Loghry **Date:** 11-12-79

SITE AND SAMPLE DESCRIPTION

Site Number: S - 12 **Sample Number:** 154143 **Code:** L 003

Location: Pine Mountain **Scintillometer Counts:** 220

Quadrangle: McFadden Peak **U Value (U/NT) ppm:** 1.8

Sec., Twp, Ra.: S14, 7N, 13E **Coordinates:** 33°57'12", 110°59'02"

Geologic Unit: Mescal Limestone

Stratigraphic Group: Apache

SITE GEOLOGY : Red-brown, brownish white chert-pebble breccia, angular brownish-white banded chert pebbles, silicified clay fragments, rounded non-banded brown hematitic chert fragments. Basal unit of upper argillite member of Mescal limestone.

Variability: 140 to 300 cps

Sedimentary Structures:

Depositional Environment:

SAMPLE DESCRIPTION : (by P.A.)

Rock was originally a laminated, banded chert whose 3 to 7mm alternating white and gray layers have been broken up in local zones (here 10cm wide) to form a swirly-fragment chert breccia. Chert fragments are somewhat altered, but matrix is very vuggy and abundantly limonite-stained from either in-situ pyrite or solution-flow in permeable zones.

Sampler: J. D. Loghry **Date:** 11-13-79

SITE AND SAMPLE DESCRIPTION

Site Number: S-13 **Sample Number:** 154144 **Code:** S 103

Location: Walnut Creek **Scintillometer Counts:** 130

Quadrangle: Picture Mountain **U Value (U/NT) ppm:** 1.3

Sec., Twp, Ra.: S1, 6N, 11E **Coordinates:** 33°53'46", 111°11'20"

Geologic Unit: Scanlan Conglomerate

Stratigraphic Group: Apache

SITE GEOLOGY : Remnant ledge of Scanlan to 4 feet thick lies on Precambrian granite. Dark gray to red quartz - quartzite pebble conglomerate, sandstone matrix.

Variability:

Sedimentary Structures:

Depositional Environment:

SAMPLE DESCRIPTION : (by P.A.)

Pebble to cobble conglomerate consisting mainly of various colors of Mazatzal sericitic fragments in a darker sericit arkosic matrix of residual micas, feldspar and quartz from the underlying granite. Quartzite pebbles range from 7 to 3 cm; some quartz pebbles and sericitic, possibly volcanic fragments are present. Conglomerate is fragment-supported. Matrix is mainly disaggregated granite, altered biotite-hornblende, altered feldspar, quartz, sericite and argillaceous material.

Sampler: J. D. Loghry **Date:** 11 - 14 - 79

SITE AND SAMPLE DESCRIPTION

Site Number: S-15 **Sample Number:** 154146 **Code:** B 103

Location: JR Ranch Road **Scintillometer Counts:** 115

Quadrangle: Copper Mountain **U Value (U/NT) ppm:** 1.1

Sec., Twp, Ra.: S30, 7N, 13E **Coordinates:** 33°55'15", 111°03'07"

Geologic Unit: Barnes Conglomerate

Stratigraphic Group: Apache

SITE GEOLOGY : Pebble conglomerate-sandstone, light brown, low-angle dip, 15 or more feet thick unit.

Variability:

Sedimentary Structures:

Depositional Environment: Alluvial

SAMPLE DESCRIPTION : (by P.A.)

Rounded quartz-pebble conglomerate with prominent pinkish coloration on freshly broken surfaces and orange-brown limonitic stain on altered faces; sufficiently well lithified to break through fragments and matrix. Fragments are: dominantly dark gray to maroon Mazatzal quartzite (55% of fragments) 8-45 mm long and well rounded; abundant white quartz pebbles (30%) well rounded 40-15mm long with high sphericity; lesser dark red hematitic quartzite and chert (15%)25-5 mm long. About 45% fragments in 55% matrix-supported conglomerate; matrix contains abundant quartz and pink K-feldspar with lesser dark green chert and other rock fragments. Feldspar is of Young-granite origin.

Sampler: J. D. Loghry **Date:** 11-17-79

THIN SECTION DESCRIPTION

Site Number: S15 **Sample Number:** 154146 **Code:** B103

Percent Fragments: 66% **Percent Matrix:** 31%

Percent Heavies & Mafics: 3% **Stain:** brown to pink to orange

Rock Type: Barnes conglomerate **Stratigraphic Group:** Apache Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
rhyolite	32%	11-2.0 mm	subrounded	1:1.5
quartz	21%	17-2.0 mm	subrounded	1:2
quartzite	34%	25-2.0 mm	subrounded	1:2
chert	13%	12-2.0 mm	subrounded	1:2

(rhyolite contains phenocrysts of specularite and altered mafics (possibly hornblende) and is generally aphanitic)

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
rhyolite	9%	2.0-.31 mm	subrounded
quartz	55%	2.0-.02 mm	subrounded, some are embayed volcanic
quartzite	13%	2.0-.7 mm	subrounded
chert	3%	2.0-.35 mm	subrounded
feldspar	4%	1.9-.33 mm	subangular, subhedral
specularite	1%	.7-.1 mm	rounded detrital
specularite	1%	powdery	recrystallized with hematite
hematite	2%	powdery	fine interstitial grains and stain
limonite	2%	powdery	fine-grained masses with hematite
clay	19%	<.01 mm	fine interstitial grains
sericite	1%	<.02 mm	recrystallized with clay

Cement: Mostly clay and sericite; minor limonite, hematite and recrystallized specularite.
Interstitials: Clay, sericite, limonite, hematite, recrystallized specularite.

Textures and recrystallization: Texture is dominated by fragments and larger matrix grains which are well rounded and of generally high maturity, in a matrix of essentially unrecrystallized, hematite-stained clay material.

Structures: The subparallel alignment of elongate fragments defines bedding planes.

Comments on Genesis: A more mature aggregate, but with bimodal grain size population, of the complex rhyolite-granite-quartz-quartzite source terrain of Alder, Mazatzal and rhyolitic rocks.

Rock Name: Rhyolite-quartz-quartzite pebble conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: S-15B **Sample Number:** 154246 **Code:** B 103

Location: JR Ranch road **Scintillometer Counts:** 100 cps

Quadrangle: Copper Mountain **U Value (U/NT) ppm:** 1.5

Sec., Twp, Ra.: S29, 7N, 13E **Coordinates:** 33°55'20", 111°02'50"

Geologic Unit: Barnes Conglomerate

Stratigraphic Group: Apache

SITE GEOLOGY : Light brown quartz-pebble conglomerate, sandstone matrix, low-angle dip. Contact is covered by soil but unit apparently lies on purple quartzite (Pioneer shale), near diabase.

Variability:

Sedimentary Structures:

Depositional Environment: alluvial

SAMPLE DESCRIPTION : (by P.A.)

Same as description for sample S15, exept some K-feldspars in matrix are larger (fragments up to 10 mm), more abundant white quartzite pebbles, and orange limonitic stain more prominent.

Sampler: J. D. Loghry **Date:** 11-17-79

SITE AND SAMPLE DESCRIPTION

Site Number: S-16 **Sample Number:** 154147 **Code:** S 103

Location: S of Coffeepot Cabin **Scintillometer Counts:** 140

Quadrangle: Sheep Basin Mountain **U Value (U/NT) ppm:** 3.2

Sec., Twp, Ra.: S26, 8N, 11E **Coordinates:** 34°00'35", 111°12'35"

Geologic Unit: Scanlan Conglomerate

Stratigraphic Group: Apache

SITE GEOLOGY : Gray to dark gray boulder conglomerate with dark gray sandstone matrix derived from adjacent older Precambrian metasediments, quartz pebbles, rare vein-quartz pebbles.

Variability:

Sedimentary Structures:

Depositional Environment: Alluvial

SAMPLE DESCRIPTION : (by P.A.)

An unusual variant of Scanlan conglomerate derived by erosion of locally outcropping rocks such as Deadman quartzite, Coffeepot siltstones and Alder quartz wackes that normally would not survive high energy environment or long transport. Fragments are commonly 45 to 15cm and are mainly dark greenish gray to purplish gray Alder quartz wackes (quartz-sericite semischist) hematitic quartzites and siltstones, some specularite-rich quartzite, fractured vein quartz, and altered (pyritic?) micaceous quartzite. Matrix is dominantly goethitic-altered feldspar, quartz and abundant argillaceous material to make a very impure conglomerate.

Sampler: J. D. Loghry **Date:** 11-20-79

SITE AND SAMPLE DESCRIPTION

Site Number: S - 17 **Sample Number:** 154158 **Code:** U 102

Location: S of Coffeepot Cabin **Scintillometer Counts:** 175 cps

Quadrangle: Sheep Basin Mountain **U Value (U/NT) ppm:** 1.0

Sec., Twp, Ra.: S26, 8N, 11E **Coordinates:** 34°00'34", 111°12'31"

Geologic Unit: Dripping Spring, lower middle arkose member

Stratigraphic Group: Apache

SITE GEOLOGY : red-brown arkosic-sandstone conglomerate, three, approximately 2 foot-thick units in about 100 feet of Dripping Spring which overlies 30(?) feet of Scanlan conglomerate

Variability:

Sedimentary Structures:

Depositional Environment: alluvial

SAMPLE DESCRIPTION : (by P.A.)

The large, bright orange aphanitic rhyolite fragments in this conglomerate are diagnostic of the Dripping Spring unit. Only large fragments (20-25mm) are of the bright orange aphanitic rhyolite, smaller fragments are of gray cherty rhyolite, green-altered volcanic material, volcanic quartz, in a matrix of finer-grained pink to greenish sericitic-altered volcanic lithic-crystal tuff material. This unit is one of the best rhyolitic tuff horizons in the Dripping Spring that was sampled, and shows the danger of calling pink conglomerates "arkosic" (e.g. Shride, 1967).

Sampler: J. D. Loghry **Date:** 11-20-79

SITE AND SAMPLE DESCRIPTION

Site Number: S-18 **Sample Number:** 154247 **Code:** S004

Location: Juniper Canyon **Scintillometer Counts:** 120

Quadrangle: Picture Mountain **U Value (U/NT) ppm:** 1.3

Sec., Twp, Ra.: S25, 7N, 11E **Coordinates:** 33°53'31", 111°11'06"

Geologic Unit: Scanlan conglomerate

Stratigraphic Group: Apache

SITE GEOLOGY : Pebble-cobble conglomerate with dark gray sandstone matrix and pink K-feldspar fragments. Rounded gray quartz pebbles and cobbles are commonest, less common are more rounded white quartzite conglomerate pebbles and cobbles with specularite. Conglomerate/Precambrian granite contact plunging 45°NE, part of a fault sliver. Granite - 225 cps.

Variability: 20-40mm, cobbles to 160mm

Sedimentary Structures:

Depositional Environment: alluvial

SAMPLE DESCRIPTION : (by P.A.)

Coarse pebble to boulder, fragment-supported conglomerate of large (20-60mm) medium grained, gray to pale, specularitic Mazatzal quartzite pebbles and minor hematitic chert or rhyolite pebbles in an interstitial (15%) matrix of interlocking quartz, pink K-feldspar and sericite. Recrystallization of matrix quartz, K-feldspar and sericite suggests some metamorphism, as rock breaks uniformly across matrix and fragments.

Sampler: J. D. Loghry **Date:** 11-21-79

SITE AND SAMPLE DESCRIPTION

Site Number: S-19 **Sample Number:** 154248 **Code:** S 003

Location: Walnut Creek **Scintillometer Counts:** 110

Quadrangle: Picture Mountain **U Value (U/NT) ppm:** 2.5

Sec., Twp, Ra.: S1, 6N, 11E **Coordinates:** 33°53'21", 111°11'14"

Geologic Unit: Scanlan conglomerate

Stratigraphic Group: Apache

SITE GEOLOGY : round cobble conglomerate, maximum thickness to 10 feet, remnant on Precambrian granite (225 cps).

Variability:

Sedimentary Structures:

Depositional Environment: alluvial

SAMPLE DESCRIPTION : (by P.A.)

Coarse pebble conglomerate of quartz and quartzite pebbles (55-30mm) in a pale greenish impure argillaceous, quartz , rock-fragment and specularite rich matrix. Clear fractured vein quartz, yellow sandy Mazatzal(?) quartzite, pink hematitic stained quartzite, dark gray specularitic Mazatzal quartzite and possible altered volcanic-rock fragments are supported in a greenish-gray matrix of quartz, specularite, altered white feldspar, possibly altered biotite-horneblende,and argillaceous and sericitic material. Fragments generally oxidized whereas matrix is reduced, but non-pyritic.

Sampler: J. D. Loghry **Date:** 11-21-79

SITE AND SAMPLE DESCRIPTION

Site Number: S-20 **Sample Number:** 154249 **Code:** T 103

Location: Board Plank road **Scintillometer Counts:** 160

Quadrangle: McFadden Peak **U Value (U/NT) ppm:** 3.2

Sec., Twp, Ra.: S5, 7N, 14E **Coordinates:** 33°58'17"; 110°56'45"

Geologic Unit: Troy Quartzite, Chediski sandstone member

Stratigraphic Group: Apache

SITE GEOLOGY : Light brown pebble conglomerate, brown medium-grained sandstone and gray and brown siltstone matrix with rounded quartz and oxidized altered rhyolite (?) porphyry pebbles. Sample lower of two conglomerate beds, 7-8 feet thick in light brown massive sandstone under red, green, gray shale unit. Sample beds strike N42°W, dip 22°NE, attitude affected by N50°W, 72°SW normal faults with 2-5 feet throw and N23E ± 90° normal faults, many N-N10°E, 20-30°E normal slips.

Variability: 20-40 mm pebbles, maximum 110mm

Sedimentary Structures:

Depositional Environment: alluvial

SAMPLE DESCRIPTION : (by P.A.)

Poorly lithified, well-rounded fragment conglomerate of dominantly quartz and quartzite pebbles in a dark reddish-brown to grayish-green matrix rich in argillaceous material and fine-grained volcanic rock fragments. Most fragments are 10-35mm well-rounded white quartzite, red Mazatzal quartzite, and orange to pink quartz-and K-feldspar-phenocrystic rhyolite fragments of either pre-Mazatzal or Dripping Spring rhyolite ages. Abundant pink to orange rhyolite fragments, volcanic-feldspar laths and volcanic-quartz crystals in the usual quartz-argillaceous matrix suggests that Dripping Spring rhyolitic volcanism was the dominant contributor, by erosion.

Sampler: J. D. Loghry **Date:** 11-29-79

SITE AND SAMPLE DESCRIPTION

Site Number: S-21 Sample Number: 154250 Code: L003

Location: Board Plank road Scintillometer Counts: 225

Quadrangle: McFadden Peak U Value (U/NT) ppm: 4.1

Sec., Twp, Ra.: S8, 7N, 14E Coordinates: 33° 57' 40", 110° 56' 34"

Geologic Unit: Mescal Limestone, probably basal unit of upper (argillite) member.

Stratigraphic Group: Apache

SITE GEOLOGY : Green-gray quartz pebble conglomerate, 10 ft. thick, 20 - 100mm rounded, broken pebbles, green-gray to white shale matrix and two carbonaceous (?) green-black shale horizons 6 - 12 inches thick, one at base, one 7 ft. above base. Weak local serpentinization, no asbestoes seen. Overlain by diabase sill. Underlain by 10 foot massive light gray tuff (200 cps) and + 30 ft. of thin-bedded gray limestone (60-70 cps).

Variability: 20 - 100 mm.

Sedimentary Structures:

Depositional Environment:

SAMPLE DESCRIPTION : (by P.A.)

Pale greenish gray chert breccia of large (3 - 10 cm) gray chert fragments in an interstitial matrix of greenish serpentinized or antigorite-type material that may have originally been calcite and quartz. Like all the chert breccias, the fragments are very angular and broken, and the matrix is very vuggy with primary cavities still remaining.

Sampler: J. D. Loghry Date: 11-29-79

SITE AND SAMPLE DESCRIPTION

Site Number: S-22 **Sample Number:** 154251 **Code:** U403

Location: Cherry Creek Road **Scintillometer Counts:** 110

Quadrangle: McFadden Peak **U Value (U/NT) ppm:** 2.2

Sec., Twp, Ra.: S3, 6N, 14E **Coordinates:** 33° 53' 20", 110° 54' 24"

Geologic Unit: Barnes (?) Conglomerate; Dripping Spring Conglomerate

Stratigraphic Group: Apache Group

SITE GEOLOGY : Light brown sandstone-pebble conglomerate with arkose matrix, little or no hematite. Barnes conglomerate 30 (?) ft. thick, on end, overturned ? strike +/- N40W, dip 85°E. Dripping Spring siltstones to west are low angle 20° southwesterly - assume fault or sharp fold. No Scanlan seen; 100 feet of steeply dipping Pioneer Shale exposed.

Variability:

Sedimentary Structures:

Depositional Environment: Alluvial

SAMPLE DESCRIPTION : (by P.A.)

Rock is a medium-grained quartz-quartzite pebble conglomerate in a purplish brown (argillaceous) to pinkish (feldspathic and rhyolitic) matrix. Fragments are mainly 20 to 40 mm well-rounded Mazatzal quartzite and quartz pebbles; smaller fragments are white quartzite, chert, dark hematitic quartzite, broken pink (Young granite) K-feldspars and distinctive bright orange aphanitic rhyolite. The matrix consists of abundant pink feldspar and orange rhyolitic material, quartz, epidote, pyrite, and green-altered argillaceous material. The feldspathic and dirty argillaceous nature of the matrix would suggest that the rock is part of the Dripping Spring formation and this is strongly supported by the presence of orange aphanatic rhyolitic chips.

Sampler: J. D. Loghry **Date:** 11-29-79

THIN SECTION DESCRIPTION

Site Number: S22 **Sample Number:** 154251 **Code:** B013

Percent Fragments: 65% **Percent Matrix:** 33%

Percent Heavies & Mafics: 2% **Stain:** pale tan to brown

Rock Type: Dripping Spring conglomerate **Stratigraphic Group:** Apache Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartzite	65%	37-2.0 mm	rounded	1:2
quartz	22%	20.5-2.0 mm	subrounded	1:2
rhyolite	13%	11.0-2.0 mm	subangular	1:2

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartzite	8%	2.0-.7 mm	rounded
quartz	52%	2.0-.02 mm	subrounded
rhyolite	6%	2.0-.2 mm	subangular, phenocrystic and microlitic
chert	3%	.9-.25 mm	subrounded
feldspar	11%	.7-.2 mm	altered, subangular, microcline and perthite
specularite	<1%	powdery	recrystallized with hematite and limonite
limonite	3%	powdery	alteration clots
hematite	1%	powdery	with specularite
chlorite	5%	<.02 mm	recrystallized plates and masses
clay	11%	<.01 mm	interstitial matrix mass
zircon	<1%	.07 mm	rounded detrital

Cement: Recrystallized mica; minor hematite, limonite and recrystallized specularite.

Interstitials: Mica, hematite, limonite, clay, recrystallized specularite.

Textures and recrystallization: Matrix is hematite-stained clay partly recrystallized to chlorite and sericite, preserving subangularity of many matrix quartz grains in contrast to well-rounded nature of larger fragments.

Structures: Bedding is defined by the subparallel alignment of elongate fragments.

Comments on Genesis: The matrix of this conglomerate is too immature to be a Barnes conglomerate, as reported in the field, but the composition is consistent with Dripping Spring conglomerate. There is a distinct contrast in grain size between the large fragments and a fine-grained matrix material, with a unique rhyolite type present.

Rock Name: rhyolite-quartz-quartzite pebble conglomerate

SITE AND SAMPLE DESCRIPTION

Site Number: S-23 **Sample Number:** 154253 **Code:** B003

Location: Cherry Creek **Scintillometer Counts:** 90

Quadrangle: McFadden Peak **U Value (U/NT) ppm:** ND

Sec., Twp, Ra.: S3, 6N, 14E **Coordinates:** 33° 53' 13", 110° 54' 10"

Geologic Unit: Scanlan (?) conglomerate; Barnes Conglomerate

Stratigraphic Group: Apache

SITE GEOLOGY : Light brown sandstone pebble conglomerate, little hematite, well-rounded 10-150 mm quartz pebbles, average 40mm. Clean, light brown quartzite matrix, local hematite stain. Blocks of pebble conglomerate float in Quaternary alluvium east of, under (?) Pioneer Shale. No Scanlan seen in place along Cherry Creek -- Pioneer or diabase lies on Precambrian granite.

Variability: 10- 150mm

Sedimentary Structures:

Depositional Environment: Alluvial

SAMPLE DESCRIPTION : (by P.A.)

This is almost certainly a Barnes conglomerate as the large pebbles are extremely well rounded discoidal to ellipsoidal vein quartz and white quartzite that have some tendency to break away from the matrix. Fragment-matrix population is strongly bimodal with the matrix consisting solely of well rounded 1 - 0.2mm quartz and feldspar grains, with no argillaceous material. All the characteristic attributes of Barnes are seen in hand specimen.

Sampler: J. D. Loghry **Date:** 11-29-79

SITE AND SAMPLE DESCRIPTION

Site Number: S-24 **Sample Number:** 154253 **Code:** B103

Location: Cherry Creek **Scintillometer Counts:** 175

Quadrangle: McFadden Peak **U Value (U/NT) ppm:** 2.3

Sec., Twp, Ra.: S3, 6N, 14E **Coordinates:** 33° 53' 13", 110° 54' 15"

Geologic Unit: Barnes conglomerate

Stratigraphic Group: Apache

SITE GEOLOGY : Red-brown quartz-pebble conglomerate with 10 - 120mm ovoid pebbles in hematitic arkose matrix. Poor exposure, 15 foot of Barnes conglomerate. Underlying adjacent Pioneer shale to east strikes N 23° W, dip 55 - 60° W. West of Barnes is Dripping Spring siltstone which strikes N 23° W, Dip 7° w, so a fault or fold is assumed.

Variability: 10 - 120mm.

Sedimentary Structures:

Depositional Environment: Alluvial

SAMPLE DESCRIPTION : (by P. A.)

Pebble conglomerate contains well-rounded, but somewhat triangular shaped fragments of white to pink quartzite and vein quartz in a very clean and well-sorted matrix of rounded quartz and feldspar grains, no clay material. Some larger abraded pink K-feldspars from the Young granite, and less marked, a bimodal grain population is apparent, but is still clearly Barnes conglomerate.

Sampler: J. D. Loghry **Date:** 12-6-79

SITE AND SAMPLE DESCRIPTION

Site Number: S-25 **Sample Number:** 154254 **Code:** L002

Location: Cherry Creek **Scintillometer Counts:** 90

Quadrangle: McFadden Peak **U Value (U/NT) ppm:** 1.7

Sec., Twp, Ra.: S3, 6N, 14E **Coordinates:** 33° 53' 11", 110° 53' 49"

Geologic Unit: Mescal Limestone

Stratigraphic Group: Apache

SITE GEOLOGY : Gray chert breccia with angular 10mm chert fragments. Mescal-breccia algal unit. Argillite immediately above breccia is 225 cps, below that, 180 cps.

Variability: little

Sedimentary Structures:

Depositional Environment: lagoonal

SAMPLE DESCRIPTION : (by P.A.)

Sample shows a normally bedded chert of 5mm to 15mm alternating white to light gray to dark gray, non-calcareous chert beds which have been locally broken up, probably intraformationally into angular chert-fragment breccias with the same colored matrix. Limonite to goethite stain is seen on some rock faces.

Sampler: J. D. Loghry **Date:** 12-6-79

SITE AND SAMPLE DESCRIPTION

Site Number: S-26 **Sample Number:** 154255 **Code:** U102

Location: Cherry Creek **Scintillometer Counts:** 180

Quadrangle: McFadden Peak **U Value (U/NT) ppm:** 1.8

Sec., Twp, Ra.: S10, 6N, 14E **Coordinates:** 33° 52' 28", 110° 53' 49"

Geologic Unit: Barnes(?) Conglomerate; Dripping Spring Conglomerate

Stratigraphic Group: Apache

SITE GEOLOGY : Small pebble conglomerate, arkose-sandstone matrix, minor local hematite in matrix. Hematite appears to be inversely proportional to radioactivity. This is highest count recorded for Barnes. Poorly exposed outcrop, thickness of unit unknown.

Variability: 10 - 40mm, pebbles.

Sedimentary Structures:

Depositional Environment: alluvial

SAMPLE DESCRIPTION : (by P. A.)

Sample has characteristics typical of Dripping Spring conglomerates rather than Barnes. Seriate sized fragments from 15 to 2mm are dominantly pink to dark orange aphanitic (and microphenocrystic) rhyolite typical of Dripping Spring unit, white quartz, some pink young granite feldspar, dark gray to black specularitic Mazatzal quartzite, altered sericitic fragments and black, partly decomposed specularite fragments. Other types of dark (volcanic?) fragments are present. Matrix sizes are gradational from fragments, and grains consist mostly of quartz, pink rhyolite and feldspathic material and specularite. Matrix has a distinctly pink, poorly-sorted character, also not found in Barnes.

Sampler: J. D. Loghry **Date:** 12-6-79

THIN SECTION DESCRIPTION

Site Number: S26 **Sample Number:** 154255 **Code:** B013

Percent Fragments: 31% **Percent Matrix:** 65%

Percent Heavies & Mafics: 4% **Stain:** orange to red hematite

Rock Type: Dripping Spring conglomerate **Stratigraphic Group:** Apache Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartzite	38%	9.0-2.0 mm	subrounded	1:1.5
quartz	18%	7.5-2.0 mm	subangular	1:1.5
rhyolite	44%	16.5-2.0 mm	subrounded	1:2
feldspar	<1%	2.8-2.0 mm	angular	1:1

(rhyolite is aphanitic with sparse quartz phenocrysts and contains thin feldspar needles distinct from any rhyolites in the underlying source terrain)

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartzite	13%	2.0-.5 mm	subrounded
quartz	35%	2.0-.02 mm	subangular, some are embayed (volcanic)
rhyolite	17%	2.0-.6 mm	subrounded phenocrystic and microlitic
feldspar	20%	2.0-.2 mm	altered subhedral perthite and microline
specularite	1%	.4-.1 mm	rounded detrital
specularite	<1%	powdery	recrystallized with hematite
hematite	4%	powdery	interstitial stain and recrystallized
clay	9%	--	hematite-stained matrix material
sericite	1%	<.005 mm	recrystallized plates and masses
zircon	<1%	.17-.08 mm	rounded
leucoxene	<1%	.3-.1 mm	alteration clots

Cement: Hematite, limonite, recrystallized sericite and specularite.

Interstitials: Hematite, limonite, sericite, recrystallized specularite.

Textures and recrystallization: Poorly sorted clay, hematite and quartz matrix is interstitial to angular quartz and pink feldspar matrix grains. Rhyolite fragments are characterized by microlitic texture of tiny feldspar laths.

Structures: None defined in thin section.

Comments on Genesis: Thin section data inconsistent with field classification of a Barnes conglomerate. The orange to red, aphanitic rhyolite fragments characterized by feldspar microlites and sparse phenocrysts of quartz and altered feldspar are unique to the Dripping Spring conglomerates, occur in no other unit, and are not derived from a preexisting source terrain.

Rock Name: aphanitic rhyolite-fragment conglomerate.

SITE AND SAMPLE DESCRIPTION

Site Number: S-27 **Sample Number:** 154256 **Code:** B103

Location: Pueblo Canyon **Scintillometer Counts:** 120

Quadrangle: McFadden Peak **U Value (U/NT) ppm:** 1.5

Sec., Twp, Ra.: S24, 6N, 14E **Coordinates:** 33° 50' 39", 110° 52' 34"

Geologic Unit: Barnes

Stratigraphic Group: Apache

SITE GEOLOGY : Red-brown pebble conglomerate, hematitic arkose-sandstone matrix.

Variability:

Sedimentary Structures:

Depositional Environment: alluvial

SAMPLE DESCRIPTION : (by P.A.)

Once again, Barnes in this sample is typified by well rounded quartz and quartzite pebbles, here approaching spheres, that tend to fall away from the matrix. Many of the quartzite are identifiable as slightly specularitic Mazatzal fragments. Pebbles 25 to 10mm lie in a fine-grained (less than 1mm) matrix of well-rounded quartz and K-feldspar, with some specularite and possibly argillaceous material (or oxidation of matrix) in this case.

Sampler: J. D. Loghry **Date:** 12-6-79

THIN SECTION DESCRIPTION

Site Number: S27 **Sample Number:** 154256 **Code:** B113

Percent Fragments: 62% **Percent Matrix:** 33%

Percent Heavies & Mafics: 5% **Stain:** pale reddish brown hematite

Rock Type: Barnes conglomerate **Stratigraphic Group:** Apache Group

FRAGMENTS : (percentages are based on 100% fragments)

Type & color	Percentage	Grain length variation	Roundness	Axial ratios
quartzite	60%	24.0-13.0 mm	well-rounded	1:2
quartz	33%	20.5-13.0 mm	well-rounded	1:1.25
chert	7%	10.0 mm	well-rounded	1:1.5

MATRIX & HEAVIES : (percentages are based on 100% matrix & heavies)

Type & color	Percentage	Size range	Description
quartz	45%	.7-.02 mm	subangular
quartzite	2%	2.0-.65 mm	well-rounded
feldspar	42%	.7-.2 mm	subhedral microcline and perthite
specularite	3%	.3-.1 mm	rounded
specularite	1%	powdery	recrystallized with hematite
sericite	<1%	<.01 mm	recrystallized plates and masses
zircon	<1%	.25-.09 mm	rounded detrital
clay	2%	<.005	hematite-stained matrix

Cement: Clay, sericite, hematite and recrystallized specularite.

Interstitials: Clay, sericite, hematite, recrystallized specularite.

Textures and recrystallization: Matrix quartz, feldspar, specularite and other heavy minerals are a well-sorted, well-packed aggregate in which large, very well-rounded and mature pebbles lie in distinct bimodal contrast.

Structures: Bedding structures are poorly defined by the subparallel alignment of elongate fragments.

Comments on Genesis: A high-energy environment to round and sort mature pebbles is required. Matrix is consistent with such a high-energy environment, but a source terrain rich in feldspar is required.

Rock Name: Mature pebble conglomerate.

SITE AND SAMPLE DESCRIPTION

Site Number: S-28 **Sample Number:** 154257 **Code:** B003

Location: Devil's Chasm **Scintillometer Counts:** 175

Quadrangle: McFadden Peak **U Value (U/ NT) ppm:** 2.0

Sec., Twp, Ra.: S36, 6N, 14E **Coordinates:** 33° 49' 24", 110° 51' 40"

Geologic Unit: Barnes Conglomerate

Stratigraphic Group: Apache

SITE GEOLOGY : Red-brown quartz-pebble conglomerate, arkose matrix, common goethite, some beds have hematite. Two exposures of Barnes occur in Devil's Chasm, a repeat by faulting. The lowest exposure near Cherry Creek road was sampled: GR-310 spectrometer; Total count 93.79 cps; 5.45 cps K; 1.64 cps U; 0.98 cps Th (100 sec.)

Variability:

Sedimentary Structures:

Depositional Environment: alluvial

SAMPLE DESCRIPTION :

Large 30 to 40mm well-rounded ellipsoidal quartzite and vein quartz in this sample tend to break away cleanly from a well sorted and clean matrix of rounded 1mm quartz grains. Matrix is somewhat feldspathic and hematitic though the rock color is a yellowish stained, pale tan color. Some specularitic quartzite fragments are clearly of Mazatzal origin.

Sampler: J. D. Loghry **Date:** 12-7-79

SITE AND SAMPLE DESCRIPTION

Site Number: S-29 **Sample Number:** 154258 **Code:** B103

Location: Cold Spring Canyon **Scintillometer Counts:** 110

Quadrangle: Mc Fadden Peak **U Value (U/NT) ppm:** 1.4

Sec., Twp, Ra.: S25, 6N, 14E **Coordinates:** 33° 50' 05", 110° 52' 16"

Geologic Unit: Barnes Conglomerate

Stratigraphic Group: Apache

SITE GEOLOGY : Red-brown hematitic and light brown non-hematitic pebble conglomerate horizons present, arkosic sandstone matrix.

Variability:

Sedimentary Structures: no imbrication of flattened fragments.

Depositional Environment: alluvial

SAMPLE DESCRIPTION : (by P.A.)

Well-rounded discoid to ovoid, hematite-stained pebbles of fine grained quartzite and vein quartz in a very well sorted, clean but partly iron-stained quartz-grain matrix; little or no feldspar but cellular limonite from hematite. Bimodal character of grain sizes, free-breaking-away nature of fragments and clean matrix typical of Barnes.

Sampler: J. D. Loghry **Date:** 12-7-79

SITE AND SAMPLE DESCRIPTION

Site Number: S-30 **Sample Number:** 154259 **Code:** B103

Location: Oak Creek **Scintillometer Counts:** 120

Quadrangle: Mc Fadden Peak **U Value (U/NT) ppm:** 0.90

Sec., Twp, Ra.: S27, 6N, 15E **Coordinates:** 33° 50' 18", 110° 48' 17"

Geologic Unit: Barnes Conglomerate

Stratigraphic Group: Apache

SITE GEOLOGY : Red-brown 11-foot quartz-pebble conglomerate, arkosic sandstone matrix, some hematite and specularite, rounded quartz and quartzite pebbles. Section going down is: Dripping Springs, middle (arkose) member, no conglomerate, contact strikes N-N10°W, 5° - 7° E; 3 foot quartz pebble conglomerate (110 cps); 4 foot fine-grained, light brown arkosic sandstone (120 cps); 11 foot sample horizon (Barnes); 40 or more feet of Pioneer purple - gray argillite; diabase.

Variability: 15 - 60mm pebbles, max. 120mm.

Sedimentary Structures:

Depositional Environment: alluvial

SAMPLE DESCRIPTION : (by P.A.)

Strongly discoid, flat but not imbricate, well-rounded pebbles of quartzite and vein quartz in a fine-grained, quartz-rich clean matrix which is strongly hematite stained to a deep maroon or purple color. Typical of Barnes conglomerate characteristics, but strong hematite stain uncommon. Related sandstone has the same pale maroon to purplish color, and consists of quartz, feldspar and specularite showing well-defined bedding and concentration of heavy minerals.

Sampler: J. D. Loghry **Date:** 12-8-79

SITE AND SAMPLE DESCRIPTION

Site Number: S-31 **Sample Number:** 154260 **Code:** B103

Location: Oak Creek **Scintillometer Counts:** 140

Quadrangle: Mc Fadden Peak **U Value (U/NT) ppm:** 2.2

Sec., Twp, Ra.: S17, 6N, 15E **Coordinates:** 33° 57' 28", 110° 48' 17"

Geologic Unit: Barnes Conglomerate

Stratigraphic Group: Apache

SITE GEOLOGY : Red-brown quartz-pebble conglomerate. Possible 100 foot section, lower part is conglomerate with thin shale and sandstone lenses, upper part is arkosic sandstone and conglomerate. Pioneer siltstone under Barnes, gentle unconformable contact is irregular, less than 6" relief close to strike-dip of Pioneer beds which plunge 3° N 22° E.

Variability: variable counts 120 to 160 cps.

Sedimentary Structures:

Depositional Environment: alluvial

SAMPLE DESCRIPTION : (by P.A.)

Large well-rounded flat discoid pebbles 45 x 30 x 15mm of rose and white quartz, Mazatzal quartzite and smaller, darker feldspathic fragments lie in a matrix of well-rounded small (less than 1mm) quartz grains, euhedral feldspar crystals (rounding along cleavage planes) and pervasive purple to deep maroon hematite stains typify this sample of Barnes conglomerate. Bimodal character, matrix pebbles, clean matrix and excellent sorting typify this Barnes. Strong hematite stain may be a hematitic faces of the Barnes.

Sampler: J. D. Loghry **Date:** 12-8-79

SITE AND SAMPLE DESCRIPTION

Site Number: S-32 **Sample Number:** 154330 **Code:** B 003

Location: Coon Creek Butte **Scintillometer Counts:** 50cps.

Quadrangle: McFadden Peak **U Value (U/NT) ppm:** 0.60

Sec., Twp, Ra.: S21, 5N, 14E **Coordinates:** 33°45'39"; 110°54'59"

Geologic Unit: Barnes Conglomerate

Stratigraphic Group: Apache Group

SITE GEOLOGY : On west side of Coon Creek Butte, stratigraphic section is poorly exposed but Barnes conglomerate is found just south of wilderness-boundary fence, S end of Sierra Ancha mountains. A diabase dike about 300 feet thick lies south of the sample site. Conglomerate contains rounded pebble-to cobble-size quartz and quartzite clasts.

Variability: Conglomerate is lithologically uniform

Sedimentary Structures: Distrupted bedding is due to intrusive sills, dikes and younger faulting.

Depositional Environment: High energy beach, lacustrine or near shore fluvial

SAMPLE DESCRIPTION : Typical white-matrix, white-fragment, well-sorted, pure, quartz-pebble conglomerate that characterizes Barnes. Very well-rounded pebbles lie in matrix-supported aggregate of rounded, medium-grained quartz grains plus interstitial clays. Matrix to fragment ratio is 3:2. Fragments are 6-30mm long with axial ratios of 1:3 and are composed mostly of quartz. Minor green sericite or clay-rich fragments are present. No heavy minerals or stain is seen.

Sampler: W. E. Heinrichs **Date:** Dec. 13, 1979

SITE AND SAMPLE DESCRIPTION

Site Number: S 33 **Sample Number:** 154331 **Code:** S 103

Location: S.E. of Coon Creek Butte **Scintillometer Counts:** 150-250 cps

Quadrangle: Rockinstraw Mountain **U Value (U/NT) ppm:** 2.3

Sec., Twp, Ra.: S34, 5N, 15E **Coordinates:** 33°43'35"' 110°50'38"

Geologic Unit: Scanlan conglomerate

Stratigraphic Group: Apache Group

SITE GEOLOGY : Scanlan is exposed here in a classic basal uncomformity on a peneplaned surface of Precambrian porphyritic quartz monzonite. Locally the unconformity surface is rolling with 1 to 5 feet of granite grus to in-situ decomposed granite. Scanlan comprises steep bluffs and cliff-like exposure on upper west side of Cherry Creek Valley. Section is gently dipping to horizontal. Conglomerate matrix contains abundant decomposed feldspar and quartz from the granite.

Variability: Fragments vary from 35-40cm cobbles down to fine sand and silt size.

Sedimentary Structures: Local minor faulting and slumping only. No sedimentary structures were observed.

Depositional Environment: Fluvial, near shore lacustrine or outwash fan.

SAMPLE DESCRIPTION : A fragment-supported conglomerate of rounded pebbles and cobbles occur in a grey matrix in a ratio of 3:2. The coarse-sand to grit matrix is composed of quartz and K-feldspar with minor hematitic siltstone and specularite. Fragments, averaging 8-72mm in length, are composed of mostly purple quartzite, some white quartz and minor chert and K-feldspar. Fragments with axial ratios varying from 1:2 to 1:3, show no preferred alignment.

Sampler: W. E. Heinrichs **Date:** Dec. 13, 1979

SITE AND SAMPLE DESCRIPTION

Site Number: S-34 **Sample Number:** 154332 **Code:** B 103

Location: SE of Coon Creek Butte **Scintillometer Counts:** 100-150 cps

Quadrangle: Rockinstraw Mtn. **U Value (U/NT) ppm:** 1.1

Sec., Twp, Ra.: S26, 5N, 15E **Coordinates:** 33°44'18"; 110°50'52"

Geologic Unit: Barnes conglomerate

Stratigraphic Group: Apache Group

SITE GEOLOGY : One quarter of a mile north of S-33 Site, Barnes conglomerate is exposed in cliffs above a good road-cut section of Pioneer shale. Capped by Dripping Spring and Troy quartzite at higher elevations. Dominant rounded fragments are 15 to 40mm in diameter. Some stratification of coarser and finer fractions is observed.

Variability: Barnes outcrop varies from medium grained sandstone to coarse pebble conglomerate, only conglomerate was sampled.

Sedimentary Structures: Moderate to well-developed cross bedding.

Depositional Environment: Well sorted, cleanly washed, high-energy beach, lacustrine or near-shore marine.

SAMPLE DESCRIPTION : Strongly red hematitic-stained to dark brown matrix lies interstitial to well-rounded, hematite-stained pebbles in a fragment-supported conglomerate where pebbles break cleanly away from the matrix. Matrix to fragment ratio is 1:2. Dark red-brown matrix is fine- to medium-grained quartz, chert and jasper with abundant interstitial hematite. Hematite-stained fragments average 12 to 90mm long and are composed mostly of white quartz, minor rose quartz and infrequent jasper.

Sampler: W. E. Heinrichs **Date:** Dec. 13, 1979

SITE AND SAMPLE DESCRIPTION

Site Number: S 35 **Sample Number:** 154333 **Code:** U 420

Location: Bull Canyon **Scintillometer Counts:** 800 cps at surface

Quadrangle: McFadden Peak **U Value (U/NT) ppm:** 462.8

Sec., Twp, Ra.: S24, 5N, 14E **Coordinates:** 33°45'21"; 110°51'35"

Geologic Unit: Dripping Springs Siltstone

Stratigraphic Group: Apache Group

SITE GEOLOGY : Cliffs on south side of upper reaches of Bull Canyon approximately 200 to 300 feet above obvious Pioneer shale is the main U-Bearing siltstone member of the Dripping Spring. Contact of siltstone is flat lying with underlying stratigraphy covered by talus. Siltstone is yellowish to red and black, banded and variegated, fractured, pyritic and altered.

Variability: Varies from fine sand-size fractions to almost amorphous silica. Minor coarse sand or fine grit sizes.

Sedimentary Structures: Well bedded, thinly laminated, soft sediment slumps, lode casts, soft-sediment bedding disruption and graded bedding

Depositional Environment: Reducing pyritic, shallow water, restricted environment.

SAMPLE DESCRIPTION : Thinly laminated beds of .5-2mm thickness are composed of yellow-stained grey-green siltstone. Interbedded with the siltstones are 3-8mm-thick beds of fine-to medium-grained quartz sand. Lenses and clots of hematite and limonite are also interbedded. These may have originally been concentrations of sulfides. The dark color of some layers appears to be related to a higher carbonaceous content.

Sampler: W. E. Heinrichs **Date:** Dec. 13, 1979

SITE AND SAMPLE DESCRIPTION

Site Number: S 36 **Sample Number:** 154334 **Code:** B 003

Location: Bull Canyon **Scintillometer Counts:** 50 cps

Quadrangle: McFadden Peak **U Value (U/NT) ppm:** 0.90

Sec., Twp, Ra.: S2, 5N, 14E **Coordinates:** 33°45'21"; 110°51'35"

Geologic Unit: Dripping Spring conglomerate

Stratigraphic Group: Apache Group

SITE GEOLOGY : Heavy soil cover and foliage in gully cover most outcrop except for resistant Dripping Spring quartzite outcrops above the sample locality. Conglomerate is well sorted and better rounded than Scanlan.

Variability: Good sorting and uniform grain size in most outcrops.

Sedimentary Structures:

Depositional Environment: Fluvial or near-shore marine

SAMPLE DESCRIPTION : Rounded pebbles occur in an equal amount of grey and pink matrix. The matrix is composed of fine-to medium-grained quartz and K-feldspar. Fragments, averaging 20-48mm in length, are composed of mostly grey quartzite, some white quartz and possible pink-brown feldspathic rhyolite. Fragments with axial ratios from 1:2 to 1:4, show sub-parallel alignment.

Sampler: W. E. Heinrichs **Date:** Dec. 14, 1979

SITE AND SAMPLE DESCRIPTION

Site Number: S 37 **Sample Number:** 154335 **Code:** U 420

Location: Workman Creek **Scintillometer Counts:** 1000 cps

Quadrangle: McFadden Peak **U Value (U/NT) ppm:** 109.9

Sec., Twp, Ra.: S24, 6N, 13E **Coordinates:** 33°50'49"; 110°58'23"

Geologic Unit: Dripping Spring siltstone

Stratigraphic Group: Apache Group

SITE GEOLOGY : Sample is in the vicinity of coarse boulders of Dripping Spring conglomerate but siltstone is the only outcrop. An adit is driven southerly on a mineralized seam in massive, blocky,fine grained shale, marl or siltstone. The seam pitches, swells and undulates steeply and probably represents faulting. Probably correlative to the main U-bearing pyrite member of the Dripping Spring siltstone. Color is grey, yellow to brown-red conglomeratic shale or siltstone.

Variability:

Sedimentary Structures: Some intraformational shale rip-ups.

Depositional Environment: Shallow marine, restricted basin environment, anaerobic to reducing.

SAMPLE DESCRIPTION : The uniformly fine-grained siltstone is pale grey to pink in color. Weathered surfaces are stained yellow-green in color, a characteristic of this horizon in the Dripping Spring siltstone. This may be due to the alteration of disseminated syngenetic sulfides.

Sampler: Walter E. Heinrichs **Date:** Dec. 14, 1979

SITE AND SAMPLE DESCRIPTION

Site Number: S 38 **Sample Number:** 154336 **Code:** S 103

Location: Cherry Creek **Scintillometer Counts:** 80-100 cps

Quadrangle: McFadden Peak **U Value (U/NT) ppm:** 2.80

Sec., Twp. Ra.: S7, 5W, 15E **Coordinates:** 33°47'40"' 110°50'44"

Geologic Unit: Scanlan conglomerate

Stratigraphic Group: Apache Group

SITE GEOLOGY : Midway up on west side of Cherry Creek Valley below Moody Point but just above outcrop of porphyritic quartz monzonite and below Pioneer Shale are large-size blocks of Scanlan conglomerate. Dripping Spring quartzite talus is from cliffs high above the Scanlan. Fragments vary from 15 cm down to sand size with lots of hematitic cement.

Variability:

Sedimentary Structures: Some crude bedding

Depositional Environment: Fluvial, fan or near-shore marine

SAMPLE DESCRIPTION : Rounded white and purple pebbles and cobbles support a pink to gray matrix in a ratio of 2:1. The medium sand-sized matrix is composed of quartz, pink K-feldspar, interstitial hematite and specularite. Ellipsoid-shaped fragments of mostly purple quartzite and white quartz have axial ratios of 1:3 and 1:6. Fragment length varies from 8-110mm and is commonly 30-80mm. Fragments commonly weather clear of the matrix leaving behind a smooth pocket.

Sampler: W. E. Heinrichs **Date:** Dec. 15, 1979

SITE AND SAMPLE DESCRIPTION

Site Number: S 39 **Sample Number:** 154337 **Code:** B 103

Location: Cherry Creek **Scintillometer Counts:** 100 cps

Quadrangle: McFadden Peak **U Value (U/NT) ppm:** 4.90

Sec., Twp, Ra.: S7, 5W, 15E **Coordinates:** 33°47'46"; 110°51'02"

Geologic Unit: Barnes conglomerate

Stratigraphic Group: Apache Group

SITE GEOLOGY : Same as site S 38, except about 100 meters higher in the section. Little or no Pioneer shale float and almost all quartzite talus, apparently Dripping Spring quartzite.

Variability: Large blocks of conglomerate contain 30-70mm-long fragments grading to sand-sized fragments with hematite stain and much dark specularite

Sedimentary Structures: Bedding apparent

Depositional Environment: Fluvial or near-shore marine

SAMPLE DESCRIPTION : Well-rounded white, pink and purple pebbles support a brown matrix in a ratio of 3:2. Fragments commonly weather free of the matrix, leaving the outcrop surface pitted with many smooth hollows. The matrix is medium-grained in size and composed of nearly equal amounts of quartz and K-feldspar. Grain intersticies are filled with limonite and hematite, giving the rock a generally red-brown color. Fragments, averaging 20-60mm in length, are composed of pink and purple quartzite and white quartz. Fragments are elongate with an axial ratio of 1:3 and show sub-parallel alignment.

Sampler: W. E. Heinrichs **Date:** Dec. 15, 1979

SITE AND SAMPLE DESCRIPTION

Site Number: S 40 **Sample Number:** **Code:** U 003

Location: Cherry Creek **Scintillometer Counts:** none taken

Quadrangle: McFadden Peak **U Value (U/NT) ppm:** 1.60

Sec., Twp, Ra.: S8, 5W, 15E **Coordinates:** 33°47'35"; 110°50'30"

Geologic Unit: Dripping Spring quartzite

Stratigraphic Group: Apache Group

SITE GEOLOGY : From Moody point trail Canyon, same locality as S 38 and S 39 but higher up section, is a calcite-cemented breccia of bright pink to reddish quartzite fragments in a white carbonate matrix. Breccia is typical of units in Dripping Spring elsewhere that give high scintillometer counts but here it is float that has come off the hillslope.

Variability: Only variations in breccia fragment sizes were observed.

Sedimentary Structures: Not applicable.

Depositional Environment: Not applicable

SAMPLE DESCRIPTION : The sample is composed of mostly angular breccia fragments in a small amount of carbonate matrix. The fragments, averaging 12-40mm in length are composed of pink to purple fine-grained quartzite. Fragments are separated from each other by 3-6mm thick fillings of white carbonate, most probably calcite. Several vugs lined with euhedral carbonate crystals are present also.

Sampler: W. E. Heinrichs **Date:** Dec. 15, 1979

SITE AND SAMPLE DESCRIPTION

Site Number: S 41 Sample Number: 154316 Code: U 003

Location: Roosevelt Lake Dam Scintillometer Counts: 165 cps

Quadrangle: Theodore Roosevelt Dam U Value (U/NT) ppm: 1.90

Sec., Twp, Ra.: S19, 4W, 12E Coordinates: 33°40'07"; 111°09'57"

Geologic Unit: Dripping Spring conglomerate

Stratigraphic Group: Apache Group

SITE GEOLOGY : at this location the whole Apache Group section is exposed. The sample was taken in the middle of the Dripping Spring member. Below the conglomerate layer, the Dripping Spring is composed of nearly pure fine-grained quartzite. This grades into a pink-colored quartzite above the conglomerate layer. The top of the section is composed of the Mescal Limestone member. Except for the conglomerate layer that was sampled, the quartzites are free of fragments.

Variability: The quartzites of the Dripping Spring consistently run about 250 cps on the scintillometer. The conglomerate layer runs lower at about 165 cps. There is little compositional or textural variation in the section except for the conglomerate horizon.

Sedimentary Structures: The quartzites are thinly bedded (2-7cm) and some show good planar cross-bed sets. The conglomerate horizon is more thickly bedded (5-20cm).

Depositional Environment: The thick sequence of fine-grained mature sands appear to indicate a near-shore environment. This was interrupted by a period of higher energy depositing a conglomerate. Possibly a near-shore beach or fluvial environment.

SAMPLE DESCRIPTION : The maroon-colored matrix is composed of poorly sorted medium- to coarse-grained quartz, feldspar, chert and specularite. It supports sub-angular to sub-rounded fragments in a matrix:fragment ratio of 3:2. Fragments, averaging 10-70mm in length, are composed of mostly white quartz and purple quartzite, minor dark shales and red jasper. Rounded pink K-feldspar phenocrysts and yellow limonitic weathering clots are also present throughout. Most fragments are ellipsoidal to cigar-shaped and show parallel orientation. The matrix is well lithified and has a vitreous luster on fresh surfaces.

Sampler: K. Wirth Date: Feb. 7, 1980

SITE AND SAMPLE DESCRIPTION

Site Number: S 42 Sample Number: 154317 Code: S 004

Location: Roosevelt Dam Scintillometer Counts: 140 cps

Quadrangle: Theodore Roosevelt Dam U Value (U/NT) ppm: 3.40

Sec., Twp, Ra.: S30, 4W, 12E Coordinates: 33°39'47"; 110°10'10"

Geologic Unit: Scanlan conglomerate

Stratigraphic Group: Apache Group

SITE GEOLOGY :

Gently north-easterly dipping basal Scanlan conglomerate rests unconformably on the Roosevelt gneiss in the Salt River below the Roosevelt Lake Dam. Above the approximately 6-meter-thick unit of Scanlan is about 150 meters of nearly pure orange to pink, medium-to fine-grained quartzite. A thin 30cm-thick shaley unit separates the two. The lower part of the conglomerate horizon was sampled.

Variability: The underlying plutonic rocks consistently run between 140 and 160cps on the scintillometer, while the Scanlan conglomerate horizon averages between 90 and 150cps. Quartzites above run between 200 and 250cps. There is a reduction in fragment size and density toward the top of the unit.

Sedimentary Structures: There is a lack of good bedding structures, though elongate fragments show sub-parallel alignment.

Depositional Environment: The large sized fragments, dense and poorly-sorted character of the conglomerates, together with the presence of feldspars, appear to indicate an immature fluvial-type deposit with a nearby granite source. Overlying medium-grained quartzites indicate a lower-energy environment, possibly a change to a near-shore marine environment.

SAMPLE DESCRIPTION :

Rounded pebble-to cobble-sized fragments support a matrix in a matrix:fragment ratio of 1:2. The matrix is light purple in color and composed of very poorly lithified coarse sand of quartz, chert, jasper and K-spar phenocrysts. It also appears to contain interstitial clays or micas. Fragments are composed of mostly well-rounded 30-200mm-long Mazatzal quartzite, lesser amounts of Alder-type quartzites, and white quartz. Minor amounts of 7-60mm-long fragments of dark chert, red rhyolite, jasper and dark shale are also present. All fragments are ellipsoidal to cigar-shaped, except for jasper which is blocky in shape.

Sampler: K. Wirth Date: Feb. 7, 1980

SITE AND SAMPLE DESCRIPTION

Site Number: S 43 **Sample Number:** 154318 **Code:** U 203

Location: South of Roosevelt **Scintillometer Counts:** 160 cps

Quadrangle: Theodore Roosevelt Dam **U Value (U/NT) ppm:** 2.70

Sec., Twp, Ra.: S28, 4W, 12E **Coordinates:** 33°39'10"; 111°07'48"

Geologic Unit: Dripping Spring Conglomerate

Stratigraphic Group: Apache Group

SITE GEOLOGY : K-feldspar-red to orange-colored fine-grained quartzite approximately 4 meters thick is the main rock type in the section. The lower two meters contain some 20-40cm thick beds of very dark carbonaceous layers. The upper two meters contain rounded granule-to cobble-size fragments. It is this conglomerate that was sampled. Diabase intrudes the Dripping Spring member and is present about 40 meters below the sample site. A small fault with approximate 2 meter offset was noticed at this stratigraphic level 60 meters to the south.

Variability: The base of the conglomerate unit contains the largest and most abundant K-spar and rhyolite fragments. Upper parts have larger fragments and other fragment types occur in higher percentages. The diabase averages 50 cps, while dark layers in lower quartzite average 250 cps. The conglomerate layer averages 160 cps. Pink-orange quartzite outcrops above the conglomerate.

Sedimentary Structures:
Nearly pure quartzite layers are thinly (4-10cm thick) bedded. No other bedding structures are visible.

Depositional Environment: Well-sorted fine-grained quartzite layers indicate near-shore marine environments of deposition. A period of higher energy is indicated by the 2m thick conglomerate unit, possibly representative of a near-beach environment or near-shore fluvial system.

SAMPLE DESCRIPTION :

Well-rounded granule-to cobble-sized fragments are supported in an equal amount of orange matrix. Matrix grains are fine-to medium-grained and well sorted. Quartz, lesser k-feldspar and rhyolite and minor specularite are the main matrix components visible in hand specimen. Ellipsoidally-shaped fragments, 3-100 mm long, of equal amounts of white quartz, pale red siltstone and pink rhyolite, with lesser amounts of grey quartzite, k-feldspar and jasper show sub-parallel alignment. No heavy mineral concentrations were sighted.

Sampler: K. Wirth **Date:** Feb. 8, 1980

SITE AND SAMPLE DESCRIPTION

Site Number: S 44 **Sample Number:** 154319 **Code:** S 004

Location: South of Roosevelt **Scintillometer Counts:** 130 cps

Quadrangle: Theodore Roosevelt Dam **U Value (U/NT) ppm:** 2.60

Sec., Twp, Ra.: S29, 4W, 12E **Coordinates:** 38°39'28"; 111°08'42"

Geologic Unit: Scanlan conglomerate

Stratigraphic Group: Apache Group

SITE GEOLOGY : Approximately 5 meters of Scanlan is exposed at this location. All fragments are well-rounded and large, averaging 20-150mm in length and as long as 200mm. The Scanlan rests uncomformably on the granite. The sample was collected across the whole section.

Variability: The Scanlan horizon consistently runs about 130 cps on the scintillometer, while the granite runs 200cps. The conglomerate layer shows little compositional variation, but does show a reduction in fragment-size and density near the top of the section.

Sedimentary Structures: Elongate fragments show nearly perfect alignment, defining bedding planes. No other sedimentary structures were observed.

Depositional Environment : The large size of the fragments and coarse matrix indicate a relatively high energy environment. Possibly an immature fluvial type of environment. Its proximity to a granite source is reflected in the high percentage of K-feldspar fragments.

SAMPLE DESCRIPTION :

A coarse-grained matrix is supported by 8-200mm-long rounded fragments in a ratio of 2:3. The coarse-sand matrix appears, in hand specimen, to be composed of nearly equal amounts of rounded quartz and pieces of sub-rounded K-feldspar phenocrysts. Fragments are composed of mostly well-rounded fine-grained quartzite, lesser coarse-grained to conglomeritic quartzite, jasper and white quartz. Minor amounts of pink rhyolite and K-feldspar are also present as fragments.

Sampler: K. Wirth **Date:** Feb. 8, 1980

SITE AND SAMPLE DESCRIPTION

Site Number: S 45 **Sample Number:** 154320 **Code:** U 203

Location: E. of Hicks Wash **Scintillometer Counts:** 95 cps

Quadrangle: Rockinstraw **U Value (U/NT) ppm:** 2.0

Sec., Twp, Ra.: S18, 2W, 15E **Coordinates:** 33°31'02"; 110°52'25"

Geologic Unit: Dripping Spring conglomerate

Stratigraphic Group: Apache Group

SITE GEOLOGY : The conglomerate sampled at this site is at the top of the exposed section. Stratigraphically below it, are over 75m of pink to brick-orange-colored fine-grained quartzites. They are thinly bedded, 3-15cm thick. Cross-bedding structures are not visible, due to the well-sorted character of the quartzites. Below this, the diabase interfingers into the section.

Variability: Fragment size and composition show little variation. The matrix in the conglomerate horizon alternates in color between pink,orange and dark grey. This appears to be due to the presence, or lack of it, of a dark detrital mineral, possibly specularite. The lighter-colored layers were not included in the sample.

Sedimentary Structures: No sedimentary structures were observed in the conglomerate layer. Thin bedding sets are characteristic of the underlying quartzite.

Depositional Environment: The thick sequence of well-sorted, fine-grained quartzite indicates a mature marine-type deposit, possibly near-shore. The conglomerate layer is indicative of higher energy conditions. Possibly a near-shore beach deposit or fluvial channel deposit.

SAMPLE DESCRIPTION :

A fine to medium-grained matrix is supported by well-rounded cobbles and pebbles, in a ratio of 3:7. The matrix is composed of equal amounts of quartz, k-feldspar and a black mineral. Fragments, rounded to well-rounded are commonly ellipsoidal in shape. Fine-grained quartzite is the most common fragment. Lesser amounts of white quartz jasper and chert, and minor quartzite conglomerate fragments are also present. Rare, dark, fine-grained, possibly specularitic-chert fragments or clots were also observed.

Sampler: K. Wirth **Date:** Feb. 8, 1980

SITE AND SAMPLE DESCRIPTION

Site Number: S 46 **Sample Number:** 154321 **Code:** B 003

Location: West of Hicks Wash **Scintillometer Counts:** 120 cps

Quadrangle: Rockinstraw **U Value (U/NT) ppm:** 0.90

Sec., Twp, Ra.: S13, 2W, 14E **Coordinates:** 33°31'00"' 110°53'22"

Geologic Unit: Barnes conglomerate

Stratigraphic Group: Apache Group

SITE GEOLOGY : The conglomerate unit sampled is at the top of the exposed section at this site. 8 meters of white conglomerate-quartzite rest on approximately 10 meters of maroon to red shale (Pioneer Shale member). The base of the shale is in fault contact with Ruin Granite. Diabase interfingers into the section and occupies a stratigraphic horizon above this unit.

Variability: The conglomerate horizon shows litle variation in composition, fragment size or density, or scintillometer counts.

Sedimentary Structures: No heavy mineral concentrations were observed in the conglomerate layer and cross-beds were not recognized. Elongate fragments show parallel alignment. Underlying shales are thinly laminated.

Depositional Environment: The shales underlying the conglomerate layer indicate relatively low energy conditions, possibly an off-shore marine deposit. The conglomerates indicate much higher energy conditions, possibly a transition to a near-shore marine or fluvial channel-type of environment.

SAMPLE DESCRIPTION :

A well-sorted and white, medium-to coarse-grained matrix is supported by well-rounded fragments in a ratio of 3:5. The matrix grains are composed of quartz. A fine white powdery substance, possibly clay, occupies some interstitial spaces, others are empty. Extremely well-rounded fine-grained quartzite, white, green, pink, purple and red in color, comprise about half of the fragment types. Well-rounded white quartz makes up about a third of the fragment types and well-rounded jasper and conglomerate fragments make up the remainder. Nearly all fragments are ellipsoid in shape and show nearly parallel alignment.

Sampler: K. Wirth **Date:** Feb. 8, 1980

SITE AND SAMPLE DESCRIPTION

Site Number: S 47 **Sample Number:** 154322 **Code:** U 002

Location: Knoll NW of Chrome Butte **Scintillometer Counts:** 120 cps

Quadrangle: Chrome Butte **U Value (U/NT) ppm:** 2.30

Sec., Twp, Ra.: S17, 2W, 16E **Coordinates:** 33°30'50"; 110°43'18"

Geologic Unit: Dripping Spring conglomerate

Stratigraphic Group: Apache Group

SITE GEOLOGY : Approximately 2 meters of moderately sparse granule conglomerate are exposed below 15 meters of quartzite. The upper 3 meters of quartzite are fully bedded and grey-white in color. Below this is 11 meters of pink to brick-orange, fine-grained quartzite. One meter of well-lithified and pure white quartzite separates the orange quartzite from the conglomerate layer that was sampled. The base of the sampled conglomerate is at the top of the site S 48 section.

Variability: The section shows remarkable consistency, except for the 2 meter-thick conglomerate layer.

Sedimentary Structures: Trough cross-beds of sand and granule conglomerate truncate each other. These average 5-30 cm in thickness and are about 1-3 meters long.

Depositional Environment: Near-shore marine-type environments prevailed as indicated by well-sorted quartzites. This was interrupted by a short period of higher energy beach facies, depositing a sparse granule conglomerate.

SAMPLE DESCRIPTION : A grey-yellow, fine-to medium-grained matrix supports fragments in a ratio of 4:1. The matrix is composed of mostly quartz, some rhyolite fragments and limonitic alteration clots. Fragments are sub-angular to sub-rounded and tend to be blocky in shape. Average size is 5-21mm long, though fragments as small as 2mm and as large as 25mm do occur. Pink, quartz-phenocrystic rhyolite is the most common fragment type. Lesser amounts of grey quartzite and minor white quartz are also present.

Sampler: K. Wirth **Date:** Feb. 10, 1980

SITE AND SAMPLE DESCRIPTION

Site Number: S 48 **Sample Number:** 154323 **Code:** U 003

Location: Knoll NW of Chrome Butte **Scintillometer Counts:** 85 cps

Quadrangle: Chrome Butte **U Value (U/NT) ppm:** 0.80

Sec., Twp, Ra.: S20, 2W, 16E **Coordinates:** 33°30'45"' 110°43'13"

Geologic Unit: Dripping Spring Conglomerate

Stratigraphic Group: Apache Group

SITE GEOLOGY : Approximately 5 meters of pink to orange quartzite separate the Site S 47 conglomerate from the underlying conglomerate which was sampled in this section S 48. The quartzite is relatively well-sorted and mature, except for a few rare rhyolite fragments. The sampled conglomerate layer is 7 meters thick. It rests on purple to maroon, thinly laminated shales, which are interbedded between the Barnes conglomerate (S 49) and the S 48 conglomerate horizon.

Variability: The conglomerate horizon shows high variation in cementation. The matrix near the top of the unit is very friable and grains are disaggregated easily. Cementation increases down section. Near the base of the section, the matrix shows solutioning and recrystallization, evidenced by 1-5mm euhedral quartz crystals growing in cavities between the pebble fragments.

Sedimentary Structures:
Elongate pebble-to cobble-sized fragments show sub-parallel alignment.

Depositional Environment: The upper quartzites appear to indicate a near-shore marine environment of deposition. This was preceded by a period of higher energy following a time of much lower energy conditions, conducive to depositing thinly-bedded shales.

SAMPLE DESCRIPTION : A matrix of poorly-sorted sand-sized grains supports rounded fragments in a ratio of 2:5. Matrix grains range from fine-to coarse-sand size and are composed of quartz and pink rhyolite grus, with some yellow limonite stain. Grey to light purple quartzite, well-rounded and measuring 5-60mm in length, is the most common fragment type. Lesser amounts of white quartz and minor jasper and conglomeritic quartzite are also present. Most fragments are ellipsoidal in shape, though jasper tends to be less rounded and more blocky. Elongate fragments show sub-parallel alignment.

Sampler: K. Wirth **Date:** Feb. 10, 1980

SITE AND SAMPLE DESCRIPTION

Site Number: S 49 **Sample Number:** 154324 **Code:** B 003

Location: Chrome Butte Area **Scintillometer Counts:** 95 cps

Quadrangle: Chrome Butte **U Value (U/NT) ppm:** 1.30

Sec., Twp, Ra.: S19, 2W, 16E **Coordinates:** 33°30'20"; 110°43'27"

Geologic Unit: Barnes Conglomerate

Stratigraphic Group: Apache Group

SITE GEOLOGY : Approximately 9 meters of white quartz-pebble conglomerate is exposed at this site. Within it are several 8-30cm beds of nearly pure fine to medium-grained quartzite. Total thickness of interbedded quartzite does not exceeed 1 meter. Below the conglomerate horizon is exposed approximately 60-80 meters of maroon to green shales and siltstones (Pioneer Shale?). Diabase is in contact with the base of these shales.

Variability: Some layers in the conglomerate horizon have a higher rhyolite-fragment content in the matrix, which gives the matrix a very pink hue. Scintollometer counts vary from 90-100 cps in the conglomerate to 150-175 cps in the underlying shales.

Sedimentary Structures: No bedding structures were observed in the conglomerate The shales are thinly bedded in 2-6mm-thick sets.

Depositional Environment: A change in deposition from shale to pebble conglomerate clearly indicates a change from relatively low energy conditions to a higher energy environment. The conglomerate possibly is indicative of a fluvial environment.

SAMPLE DESCRIPTION : Fine-to medium-grained sands of quartz and clay (?) interstitials compose the matrix which makes up slightly less than half of the total rock. Suspended in it, with no apparent preferred orientation, are nearly equal amounts of well-rounded, 10-50mm-long fragments of grey quartzite and white quartz. Rare jasper fragments, 4-30mm-long and irregularly-shaped, are also present. All other fragments are ellipsoids in shape. Some layers show poor cementation, though most are well lithified. Concentrations of specularite are absent except at the base of the conglomerate horizon.

Sampler: Karl Wirth **Date:** Feb. 10, 1980

SITE AND SAMPLE DESCRIPTION

Site Number: S 50 **Sample Number:** 154325 **Code:** U 110

Location: Cactus 1 & 2 prospects (U) **Scintillometer Counts:** 285 cps

Quadrangle: Windy Hill **U Value (U/NT) ppm:** 1.80

Sec., Twp, Ra.: S6, 4W, 13E **Coordinates:** 33°42'56"; 111°04'05"

Geologic Unit: Dripping Spring quartzite

Stratigraphic Group: Apache Group

SITE GEOLOGY : About 50 meters of fine-grained pink to brick-orange quartzite are exposed. No other units were found within it or in contact with it.

Variability: The rock unit sampled shows no variation.

Sedimentary Structures: Thin 2-6cm-thick bedding sets were the only structures observed.

Depositional Environment: Relatively low energy conditions compared to coarse-grained quartzites and conglomerates. Possibly a marine off-shore environment.

SAMPLE DESCRIPTION : Thin beds of 2-6cm-thickness of pink to brick-orange fine-grained quartzite make up the sample. No varities in composition, grain size or color were observed anywhere in the section. Much of the outcrop and joint surfaces are covered with black manganese stain.

Sampler: K. Wirth **Date:** Feb. 12, 1980

SITE AND SAMPLE DESCRIPTION

Site Number: S 51 **Sample Number:** 154326 **Code:** S 203

Location: Dutchwoman Butte **Scintillometer Counts:** ND

Quadrangle: Armer Mtn. **U Value (U/NT) ppm:** 1.30

Sec., Twp, Ra.: S15, 5W, 12E **Coordinates:** 35°46'18"; 111°06'33"

Geologic Unit: Scanlan conglomerate

Stratigraphic Group: Apache Group

SITE GEOLOGY : Site geology is not known precisely as sample was taken from talus at the base of a precipitous vertical cliff. However, only a restricted part of the Scanlan cliff exposure could have been the source for the conglomerate, as indicated by coordinates above.

Variability: Not known.

Sedimentary Structures: Not known.

Depositional Environment: Based on the large size of the conglomerate fragments, one would conclude that relatively high energy conditions were present. Possibly a fluvial channel-type environment of deposition.

SAMPLE DESCRIPTION : A grey matrix of medium-sized sand grains is supported by pebble-to cobble-sized fragments in a ratio of 1:3. The matrix is composed of quartz, slightly less k-feldspar phenocrysts and specularite. The 23-80mm-long fragments are rounded and ellipsoidal in character. They are composed of mostly grey to maroon quartzite (Mazatzal?) sometimes containing grit, lesser white quartz, minor jasper and rare grey rhyolite with quartz phenocrysts. Elongate fragments show sub-parallel alignment.

Sampler: Karl Wirth **Date:** Feb. 12, 1980

SITE AND SAMPLE DESCRIPTION

Site Number: S 52 **Sample Number:** 154327 **Code:** U 203

Location: Dutchwoman Butte **Scintillometer Counts:** ND

Quadrangle: Armer Mtn. **U Value (U/NT) ppm:** 1.10

Sec., Twp, Ra.: S15, 5W, 12E **Coordinates:** 33°46'17"; 111°06'15"

Geologic Unit: Dripping Spring conglomerate

Stratigraphic Group:

SITE GEOLOGY : Site geology is not precisely known as sample was taken from talus at base of a vertical cliff of Dripping Spring conglomerate. Only a restricted outcrop of Dripping Spring could have been the source, as the coordinates indicate.

Variability: Some variation was observed in larger boulders of talus. Conglomerate layers vary in composition and fragment size from mostly orange rhyolite-granule conglomerate to mostly white quartz-pebble conglomerate.

Sedimentary Structures: Not known.

Depositional Environment: Relatively moderate energy levels as indicated by the pebble-sized fragments showing a crude alignment. Possibly a river-channel environment of deposition.

SAMPLE DESCRIPTION : A poorly sorted fine-coarse sand matrix supports rounded fragments in a ratio of 3:1. The matrix is composed of quartz, slightly less orange rhyolite, some white clays (?) and limonite stain. It is not well-cemented. Fragments are composed of mostly white quartz, rounded, ellipsoidal and 6-60mm in length. Some small 4-20mm-long sub-rounded and irregularly-shaped fragments of orange rhyolite are also present. Elongate fragments show sub-parallel alignment.

Sampler: Karl Wirth **Date:** Feb. 12, 1980

SITE AND SAMPLE DESCRIPTION

Site Number: S 53 **Sample Number:** 154328 **Code:** U 203

Location: Salome Mtn. **Scintillometer Counts:** ND

Quadrangle: Greenback Creek **U Value (U/NT) ppm:** 1.30

Sec., Twp, Ra.: S16, 5N, 12E **Coordinates:** 33°46'49"; 111°07'54"

Geologic Unit: Dripping Spring conglomerate

Stratigraphic Group: Apache Group

SITE GEOLOGY : The site geology is not known as sample was collected from talus at the base of a cliff. Coordinates indicate the probable source of the talus on the cliff of Dripping Spring conglomerate.

Variability: Not known due to nature of sample

Sedimentary Structures: Not known

Depositional Environment: Rounded pebble-size fragments, showing sub-parallel alignment may be indicative of a river channel deposit.

SAMPLE DESCRIPTION : A pale purple to green matrix is supported by rounded pebbles in a ratio of 1:2. The medium-sized matrix grains are composed of mostly quartz, some rhyolite and k-spar fragments and minor clay or sericite and specularite. Rounded and ellipsoid-shaped fragments average 6-50mm in length. They are composed of light purple to grey quartzite (Mazatzal ?) lesser white quartz, dirty orange rhyolite with quartz phenocrysts, minor jasper and large K-feldspar fragments. The rhyolite, k-spar and jasper fragments tend to be less rounded and more blocky than other fragments.

Sampler: Karl Wirth **Date:** Feb. 12, 1980

SITE AND SAMPLE DESCRIPTION

Site Number: S 54 **Sample Number:** 154329 **Code:** U 203

Location: 3.4 mi. S. of Pinal Pass **Scintillometer Counts:** 110 cps

Quadrangle: Pinal Peak **U Value (U/NT) ppm:** 0.60

Sec., Twp, Ra.: S34, 2S, 15E **Coordinates:** 33°32'51"; 110°47'39"

Geologic Unit: Dripping Spring conglomerate

Stratigraphic Group: Apache Group

SITE GEOLOGY : The base of the section is composed of thinly bedded maroon shale approximately 30 meters thick. Some layers are very dark and may be carbonaceous. Above this lies the conglomerate horizon that was sampled. It has a total thickness of about 9 meters. The top of the conglomerate horizon grades into a medium- to coarse-grained quartzite containing numerous geothitic oxidation clots, some k-feldspar fragments and occasional quartz granules or pebbles.

Variability: The base of the conglomerate horizon is composed of much longer fragments which are more densely packed. A general reduction in size and packing density is noticeable up section. The conglomerate unit runs about 110 cps while the shale averages 250 on the scintillometer.

Sedimentary Structures: The shales are bedded in thin 10-23mm-thick sets and conglomerate fragments show sub-parallel orientation.

Depositional Environment: A period of quieter conditions depositing a shale, interrupted by a period of higher energy depositing a conglomerate. Possibly a river channel deposit. A reduction in energy level following the conglomerate is indicated by a reduction in fragment size and density.

SAMPLE DESCRIPTION :

The matrix to fragment ratio is approximately 1:1. The medium-grained matrix is composed of equal amounts of quartz and k-spar fragments, lesser white clay or sericite interstitials and minor geothitic alteration clots. Fragments, averaging 6-63mm in length, are rounded and ellipsoidal in shape. Maroon quartzite, sometimes containing grit, and white quartz are the most common fragment types. Rare fragments of jasper are also present. Minor specularite is present in the matrix.

Sampler: K. Wirth **Date:** Feb. 10, 1980

SITE AND SAMPLE DESCRIPTION

Site Number: S 55 **Sample Number:** 154348 **Code:** U 420

Location: Red Bluff Mine dumps **Scintillometer Counts:** 9000

Quadrangle: Rockinstraw Mtn. **U Value (U by NT) ppm :** 338.4

Sec., Twp, Ra.: S31, 5N, 14E **Coordinates:** 35° 44' 58"; 110° 56' 23"

Geologic Unit: Dripping Springs Siltstone

Stratigraphic Group: Apache Group

SITE GEOLOGY : Dump material is presumed to have come from the Red Bluff Uranium mine, but this is not as important as the nature of occurrence of the mineralization. The pink and black, laminated pyritic siltstones record the simultaneous deposition of two complementary and independent components: a pink to orange siliceous material and a black, carbonaceous slaty material, both of which contain syngenetic, bedded and disseminated pyrite. With this on the dump is pink to white, laminated and bedded volcaniclastic material which is a finely bedded, siliceous and feldspathic, rhyolitic tuff.

Variability: Black and orange to pink layers of siltstone are interbedded in some rocks; in others one component may be absent. Some beds carry more carbonaceous and pyritic material than others. In places, layers of pyrite are found parallel to bedding, and in other places pyrite is disseminated within a discreet bedding unit.

Sedimentary Structures: Some of the thin 1-20mm beds lens out laterally. In some places there are lode and scour features, bedding slump structures, contorted bedding, and cut-off, small-scale cross beds. The pink to orange and black beds are almost always graded from pink-orange siliceous material at the base to black, carbonaceous material at the top.

Depositional Environment: A reducing environment with relatively low energy conditions; either an offshore, quiet marine environment, or restricted basin condition contemporaneous with rhyolitic tuffaceous volcanism is indicated.

SAMPLE DESCRIPTION : The sample is composed of clay and silt-sized grains. These are thinly bedded in black to gray-green and pink to orange layers. Darker layers have a high carbonaceous content. Pyrite grains are disseminated throughout some beds, and are elsewhere concentrated in layers. Thin carbonaceous laminations tend to lens out laterally and some show soft sediment deformation. One of the most characteristic features of the rock is the repetitious nature of the graded beds, starting out with 5-15mm of pink-orange siliceous material at the base, and grading upwards into 1-10mm of black carbonaceous material at the top. Often the pyrite layers occur right at the top of of one of the graded cycles, or else pyrite is disseminated in the upper carbonaceous zone. Occasionally it is disseminated in the lower pink-orange material. This lighter colored siliceous material strongly resembles siliceous rhyolitic tuff and is likely to be a volcanic contribution to the sediment, otherwise it would be carbonaceous like the rest of the clastic material.

Sampler: P. Anderson & K. Wirth **Date:** Feb. 28, 1980

SITE AND SAMPLE DESCRIPTION

Site Number: S 56 **Sample Number:** 154349 **Code:** S003

Location: Armer Mountain **Scintillometer Counts:** 135 cps

Quadrangle: Armer Mountain **U Value (U/NT) ppm:** 3.0

Sec., Twp, Ra.: S9, 5W, 13E **Coordinates:** 33°47'26"; 111°01'14"

Geologic Unit: Scanlan conglomerate

Stratigraphic Group: Apache Group

SITE GEOLOGY : Approximately 6 meters of pebble to boulder Scanlan conglomerate rests directly on the Ruin Granite. Above the conglomerate unit is approximately 33 meters of medium-grained quartzite. This upper unit shows some trough cross-bedding and occasional planar cross-beds. The quartzite is of nearly the same composition as the conglomerate matrix, but grains show better sorting and rounding and are smaller.

Variability: The conglomerate horizon contains several trough cross beds of coarse-sand material 10-80cm thick. Occasional planar cross-beds of 1-3cm k-feldspar fragments are present in the quartzite overlying the conglomerate. Scintillometer counts average 135cps in conglomerate and 240-260 cps in the granite.

Sedimentary Structures: The conglomerate horizon contains some 10-80cm trough cross-beds of nearly pure coarse sand. Medium-grained quartzites overlying the conglomerate are trough cross-bedded with some planar cross beds.

Depositional Environment: A river channel-type of environment is indicated by trough cross-beds and large conglomerate fragment sizes. The proximity of the granite source is refelected in the high k-feldspar content in the matrix.

SAMPLE DESCRIPTION : The coarse sand matrix is supported by pebble to cobble-size fragments in a ratio of 1:4. The composition of the poorly-sorted matrix is near that of a granite grus, being composed of nearly equal amounts of feldspar and quartz. Feldspars are very angular and fresh. Fragments are composed of mostly purple to grey quartzite, some white quartz and very rare rhyolite. Some nearly euhedral k-feldspar fragments are 3-12mm in length.

Sampler: K. Wirth **Date:** Feb. 29. 1980

SITE AND SAMPLE DESCRIPTION

Site Number: S 57 **Sample Number:** 154350 **Code:** U 103

Location: Lake Roosevelt Road **Scintillometer Counts:** 200 cps

Quadrangle: Theodore Roosevelt Dam **U Value (U/NT) ppm:** 3.2

Sec., Twp, Ra.: S13, 4N, 11E **Coordinates:** 33°41'37"; 111°10'55"

Geologic Unit: Dripping Springs conglomerate

Stratigraphic Group: Apache Group

SITE GEOLOGY : Approximately three meters of intra-formational conglomerate rest on hematitic-red shales and is overlain by yellow-grey gritty quartzites. The shales are thinly laminated and the overlying quartzites are trough and planar cross-bedded in 5-6 cm-thick sets.

Variability: The conglomerate horizon averages 200 cps on the Scintillometer, while the underlying shales average 225-275cps.

Sedimentary Structures: Trough and planar cross-bed sets of 5-6 cm thickness are present in upper quartzite horizon. Some fragments in conglomerate are imbricate, most are well-bedded.

Depositional Environment: Short-term high energy conditions probably were responsible for intra-formational conglomerate in a shallow water marine or fluvial sequence.

SAMPLE DESCRIPTION : A coarse-grained, poorly lithified matrix supports angular flat-lying fragments in a ratio of 2:1. The matrix is of poorly-sorted fine- to coarse-sized quartz grains. Hematite is present in high concentrations as an interstitial (?) and stain. Fragments average 20-60mm in length and are flat and angular in shape. Purple shale fragments are the most common fragment type, some yellow siltstone and yellow to white quartzite are also present. Quartz grit and granules are also present in the matrix. Some fragments are imbricate, most are well-bedded.

Sampler: K. Wirth **Date:** March 4, 1980

SITE AND SAMPLE DESCRIPTION

Site Number: G 1 **Sample Number:** 154029 **Code:** G

Location: E. of Granite Tank **Scintillometer Counts:** 225 cps.

Quadrangle: Young **U Value (U/NT) ppm:** 1.10

Sec., Twp, Ra.: S22, 9N, 13E **Coordinates:** 34°06'59"; 110°59'53"

Geologic Unit: pink medium-to coarse-grained granite

Stratigraphic Group: Young granite

SITE GEOLOGY : Young granite is sampled because it is a nearby and potentially good source for U in both the Apache Group and the Mazatzal Group that uncomformably overlie the granite. Young granite is very uniform and everywhere pink K-feldspar-rich and quartz-rich so could provide radioactive U,Th or K to conglomerates.

Variability: Varies from medium to coarse grained, not porphyritic

Sedimentary Structures:

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Depositional Environment:

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SAMPLE DESCRIPTION :

Sample is an interlocking mosaic of anhedral medium-grained clear polygonal quartz grains and medium-to coarse-grained pink alkali-feldspar grains. Most of the feldspars are perthitic with the strongest hematitic pink stain emphasizing the perthite lamellae and grain borders. Some minor albitic crystals are strongly sericite-altered at their margins, whereas minor sericite, magnetite and open cavities are part of the interstitial matrix between interlocking quartz grains. The rock is 55% feldspar, 40% quartz, 5% sericite plus magnetite plus altered plagloclase, and is maficless.

Sampler: P. Anderson **Date:** Sept. 22, 1979

SITE AND SAMPLE DESCRIPTION

Site Number: G 2 **Sample Number:** 154351 **Code:** G

Location: W. of Star Valley **Scintillometer Counts:** 150 cps

Quadrangle: Payson North **U Value (U by NT) ppm :** 2.70

Sec., Twp, Ra.: S31, 11N, 11E **Coordinates:** 34°15'08"; 111°16'19"

Geologic Unit: Payson granite

Stratigraphic Group: Payson granite

SITE GEOLOGY : Between Payson and Star Valley on highway 260, fresh outcrops of Payson granite were sampled. This granite is representative of the material that apparently contributed to Mazatzal sedimentation in the Pine area, to Apache Group in the Christopher Mountain area and possibly to Apache Group sediments further south.

Variability: Compositionally uniform, but texturally variable at any given locality from coarse-grained to medium-grained to granophyric. Aplitic dikes are common.

Sedimentary Structures: N.A.

Depositional Environment: N.A.

SAMPLE DESCRIPTION : The rock is a coarse-grained aggregate of pink, partly perthitic K-feldspar (45%), whitish albitic plagioclase (20%), clear quartz (25%) and greenish black hornblende (10%) with possibly biotite intergrown with the hornblende. Quartz and hornblende range up to 8mm grains whereas the feldspars are as large as 20mm. Hornblende is euhedral whereas the remainder of the grains are anhedral. The rock has a distinct pinkish cast from the hematite-stained K-feldspar.

Sampler: P. Anderson **Date:** February 28, 1980

SITE AND SAMPLE DESCRIPTION

Site Number: G 3 **Sample Number:** 154352 **Code:** R

Location: Haigler Creek **Scintillometer Counts:** 140 cps

Quadrangle: Young **U Value (U by NT) ppm :** 0.80

Sec., Twp, Ra.: S13, 10N 13E **Coordinates:** 34°12'30"; 110°58'13"

Geologic Unit: quartz-phenocrystic rhyolite

Stratigraphic Group: Haigler rhyolite

SITE GEOLOGY : Near Haigler Creek north of Young on the Chamberlain Trail are very fresh outcrops of an intrusive or flow phase of the Haigler rhyolite, which were sampled. This quartz-phenocrystic rhyolite is representative of a huge area of rhyolitic volcaniclastic strata and ignimbrites of the same composition which occupy the eastern Diamond Butte area. These contributed in small part to Mazatzal quartzite deposition in this area, but in large part to the volcanic detritus in the Apache Group to the south.

Variability: None in outcrop, but fragmental and flow banded to ignimbritic phases are abundant.

Sedimentary Structures: N.A.

Depositional Environment: N.A.

SAMPLE DESCRIPTION : The rhyolite is dark grayish pink to orange when freshly broken or white to orange when weathered. It shows abundant (15-20%) euhedral glassy volcanic quartz crystals 2 to 4mm in diameter in an aphanitic pink cherty matrix which breaks into blocky rather than conchoidal fracture patterns. A high percentage of K-feldspar is therefore presumably in the matrix.

Sampler: P. Anderson **Date:** February 28, 1980

SITE AND SAMPLE DESCRIPTION

Site Number: G 4 **Sample Number:** 152353 **Code:** G

Location: Armer Mtn. **Scintillometer Counts:** 250 cps

Quadrangle: Armer Mtn. **U Value (U by NT) ppm :** 7.80

Sec., Twp, Ra.: S9. 5N 13E **Coordinates:** 33°47'50"; 111°01'22"

Geologic Unit: porphyritic quartz monzonite

Stratigraphic Group: Ruin batholith

SITE GEOLOGY : Virtually all of the southern exposures of Apache Group south of Salome Canyon are underlain by porphyritic quartz monzonites of the Ruin batholith (1400 m.y. old). It contributed abundantly to the Scanlan basal conglomerate, usually in the form of a residual granitoid grus, but apparently did not significantly contribute to any of the higher strata, except possibly Barnes conglomerate and Troy quartzite.

Variability: Phenocrysts of perthitic microcline range up to 8cm long in places.

Sedimentary Structures: N.A.

Depositional Environment: N.A.

SAMPLE DESCRIPTION : This is a somewhat finer grained, more-altered, and less-phenocrystic variety of Ruin porphyritic quartz monzonite than is usual. It consists of coarse-grained and porphyritic pink K-feldspar (35%), white to green-altered (sericitized here) albitic plagioclase (35%), hematite-stained quartz (20%) and altered biotite-hornblende (10%--now chlorite). Grain size varies from 4mm up to 4cm as the largest K-feldspar phenocryst. Most grains are anhedral, well fractured (except for phenocrysts) and hematite stained. This is attributed in large part to Apache-age weathering as the sample is about 35m below the Apache Unconformity.

Sampler: F. Anderson **Date:** February 29, 1980

SITE AND SAMPLE DESCRIPTION

Site Number: G 5 **Sample Number:** 154354 **Code:** G

Location: Salome Creek **Scintillometer Counts:** 180 cps

Quadrangle: Armer Mtn. **U Value (U by NT) ppm :** 2.20

Sec., Twp, Ra.: S15, 5N, 12E **Coordinates:** 33°46'19"; 111°07'06"

Geologic Unit: porphyritic red granite

Stratigraphic Group: Ruin batholith

SITE GEOLOGY : An unusual border phase or fine-grained variant of the Ruin batholith exists along its northern border in the drainages of Salome Creek. The feldspars in this rock are strongly hematite-stained, thus giving the rock a pinkish orange color almost identical to that of the Young Granite. This is unfortunate, because just north of the sample site (hidden contact) this presumably intrudes the Young Granite.

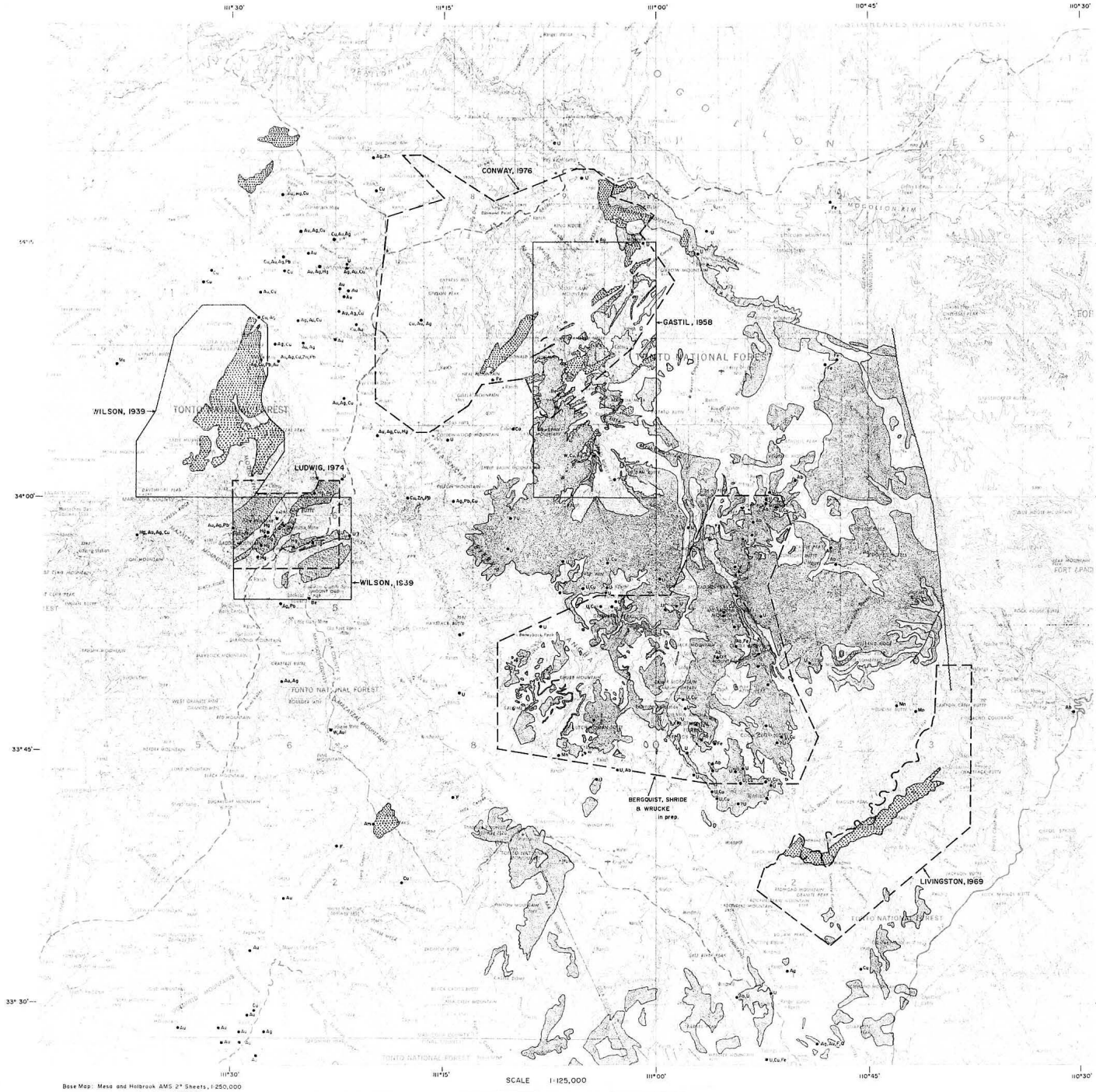
Variability: Variable over 1km from coarsely porphyritic to coars[illegible]ined but non-porphyritic.

Sedimentary Structures: N.A.

Depositional Environment: N.A.

SAMPLE DESCRIPTION : The rock is a strongly pink to orange-stained granite of coarse-grained matrix K-feldspar (20%), quartz (20%), biotite (12%) and altered chloritic material (3%), with the large perthitic crystals (orthoclase + plagioclase) also being pink-orange-stained (40%). These phenocrysts range up to 4cm in length whereas most of the other coarse, anhedral grains are less than 1cm. Some of the phenocrysts appear to be fresh orthoclase or microcline, so the pink-stained matrix feldspar could be plagioclase (i.e. 20%).

Sampler: P. Anderson **Date:** February 25, 1980



EXPLANATION

Mineral Deposits

- mining locality

Commodity

Ab - Asbestos
Ag - Silver
Am - Amethyst
Au - Gold
Be - Beryl
Cu - Copper
F - Fluorite
Fe - Iron
Hg - Mercury
Mn - Manganese
Mo - Molybdenum
Pb - Lead
Q - Quartz
U - Uranium
W - Tungsten
Zn - Zinc

Geology

generalized geologic contacts

Conglomerate - Grit bearing units of Precambrian age indicated in previous study areas

Apache Group

Mazatzal Group

Alder Group

Previous Studies

Early "pioneering" studies

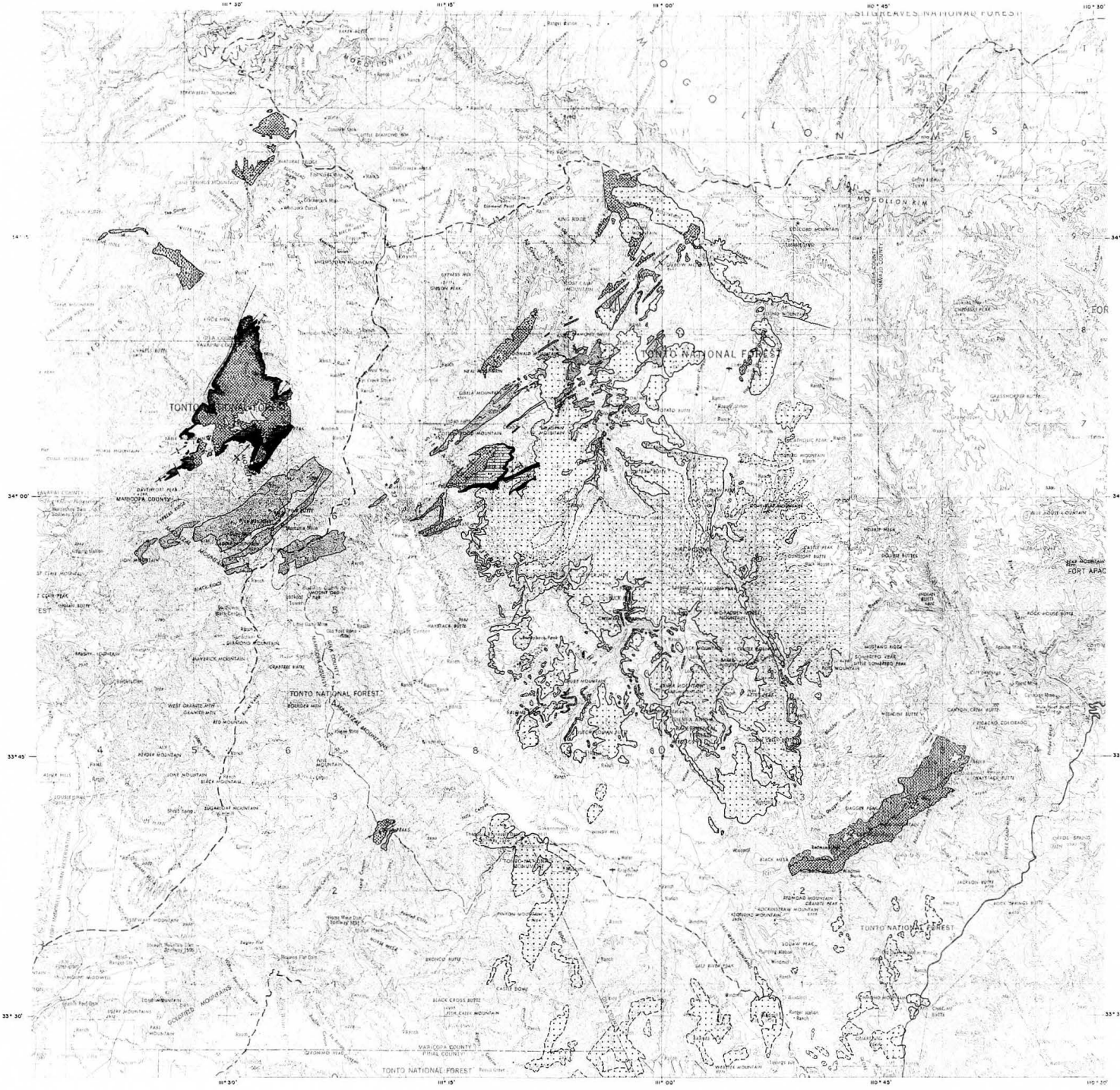
Recent study areas

All other geology estimated from Wilson, Moore and Cooper's 1969 Geology of Arizona map, 1:500,000

Figure 2:

CENTRAL ARIZONA ARCH STUDY AREA:

I: COMPILATION OF MINERAL DATA AND PREVIOUS GEOLOGIC STUDIES



Base Map prepared at
1:125,000 enlargement of AMS
Holbrook & Mesa, 2° Sheets

- lineation with plunge
- foliation attitude
- bedding attitude

APACHE GROUP
- conglomerate, siltstone, shale, sandstone, limestone

unconformity

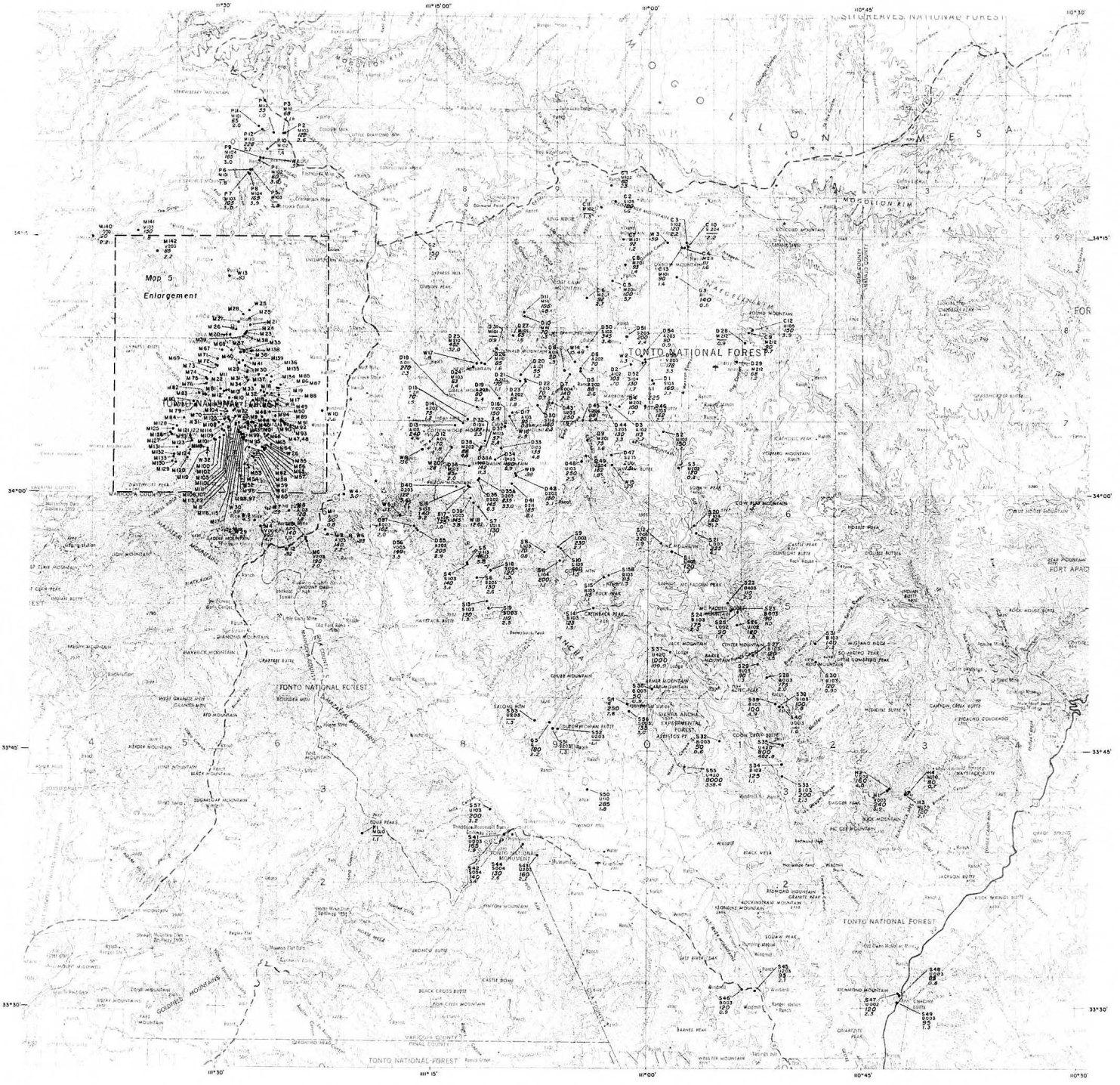
MAZATZAL GROUP
- Mazatzal quartzite and conglomerate
- Maverick shale, siltstone and quartzite
- Deadman conglomerate and quartzite

unconformity

ALDER GROUP
- mainly sedimentary rocks
- mainly volcanic rocks

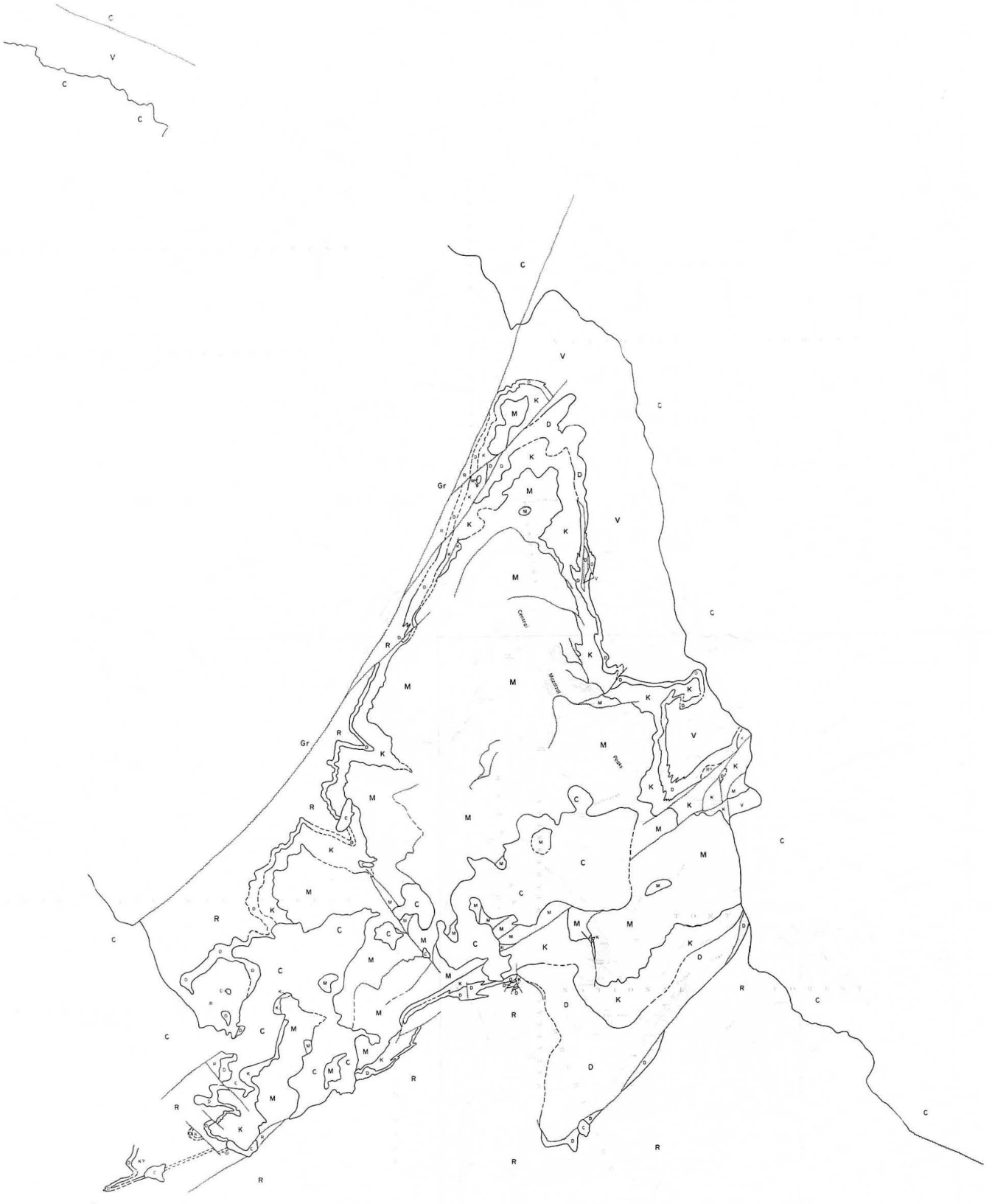
CENTRAL ARIZONA ARCH STUDY AREA : II GEOLOGY OF PRECAMBRIAN CONGLOMERATES by Philip Anderson

Figure 3



CENTRAL ARIZONA ARCH STUDY AREA: III. GEOCHEMICAL SAMPLES AND RESULTS

Figure 4



Base Map = Cypress Butte, North Peak, Mazatzal Peak & Table Mountain 7.5' quadrangles

0 .5 1 2 miles
0 1000 2000 feet
0 1 2 kilometers
SCALE 1:24,000

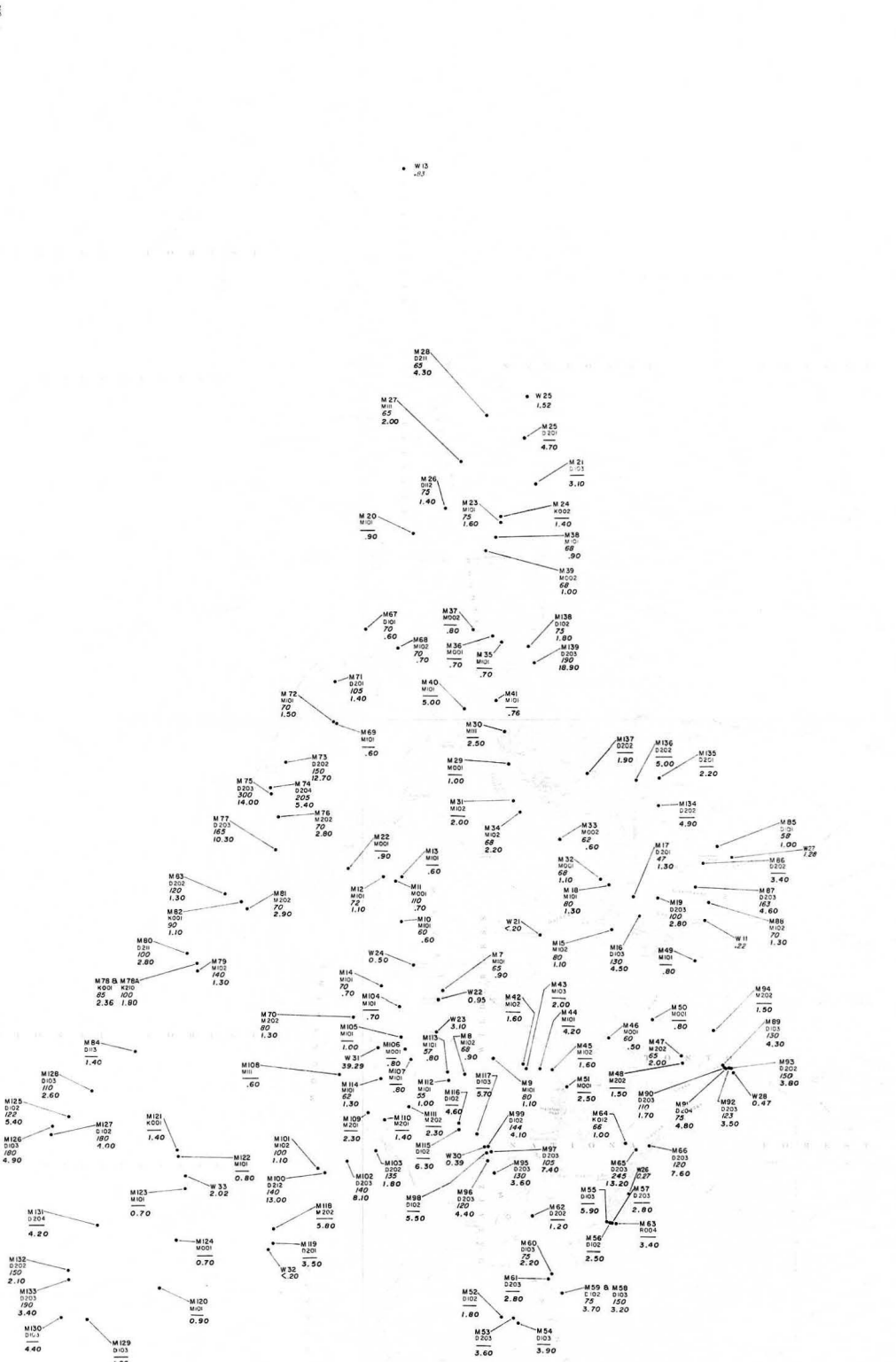
Faults, normal, reverse, thrust

C Younger cover
M Mazatzal quartzite
K Maverick shale
D Deadman quartzite & conglomerate
R Rhyolitic rocks
V Volcanosedimentary rocks
Gr Granite

Figure 5

MAZATZAL WILDERNESS STUDY AREA: PRELIMINARY GEOLOGIC MAP OF MAZATZAL GROUP OUTCROPS

by Philip Anderson, 1980



Base Map - Cypress Butte, North Peak, Mazatzal Peak & Table Mountain (7.5' quadrangles)

0 .5 1 2 miles
0 1000 2000 6000 feet
0 1 2 kilometers
SCALE 1:24,000

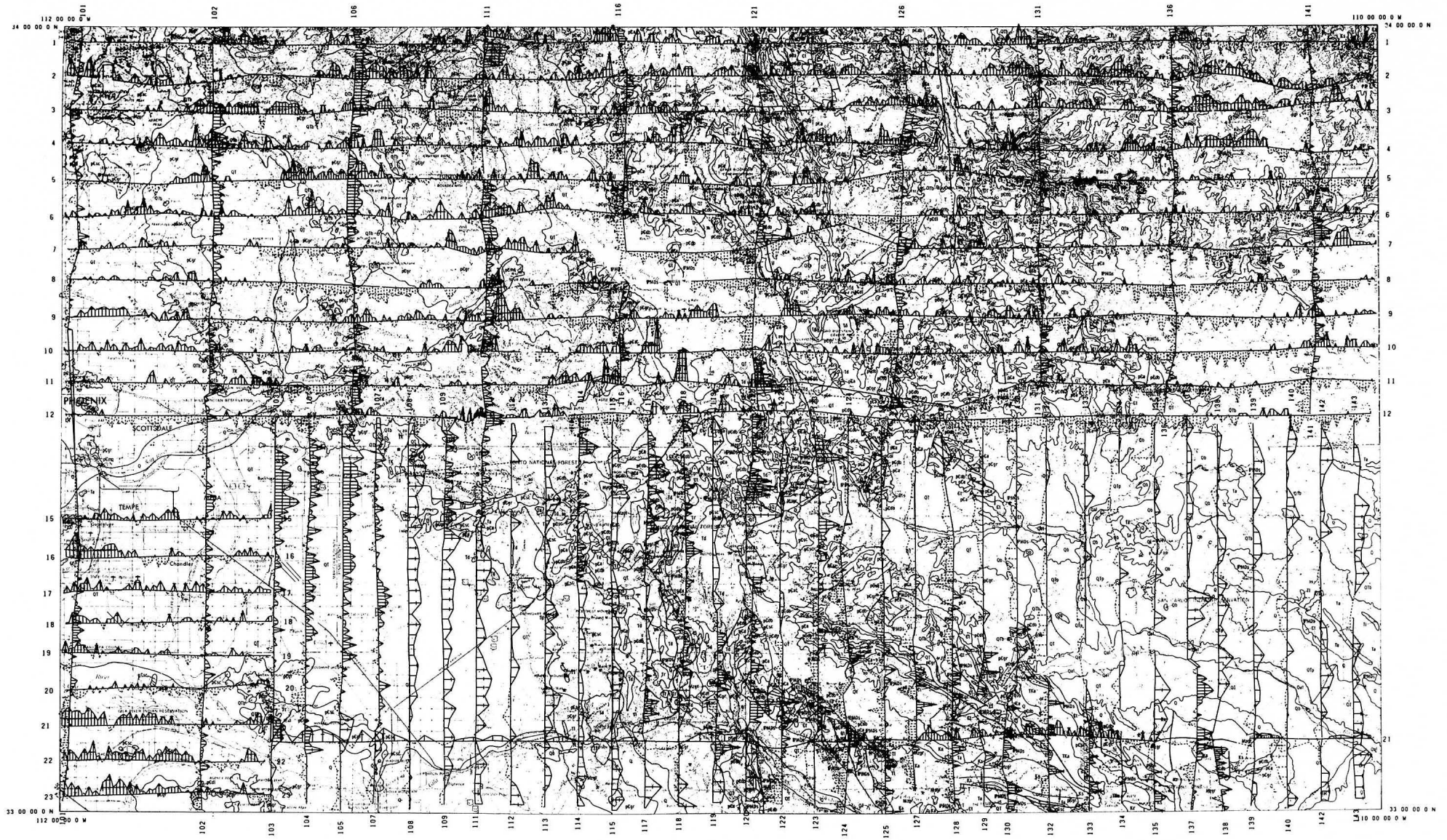
Water sample readings are UF values in ppb

M126 - Sample Number
D103 - Geologic Unit Code
180 - Scintillometer Reading in cps
4.90 - Uranium (U-NT) value in ppm

MAZATZAL WILDERNESS STUDY AREA: GEOCHEMICAL SAMPLES AND RESULTS

Figure 6

MESA NI12-8 UTAH-ARIZONA SURVEY 1978



PROFILE MAP URANIUM 6.0 S.D./IN. TEXAS INSTRUMENTS

MILES 5 0 5 10 15

KILOMETERS 10 0 10 20 30

LEGEND: POSITIVE SIGNIFICANCE FACTORS—SOLID LINES
NEGATIVE SIGNIFICANCE FACTORS—DOTTED LINES

PREPARED BY
TEXAS INSTRUMENTS INCORPORATED
DALLAS, TEXAS

WORK PERFORMED UNDER
BENDIX FIELD ENGINEERING CORPORATION
SUBCONTRACT NO. 78-090-L
PREPARED FOR
U.S. DEPARTMENT OF ENERGY

M-2

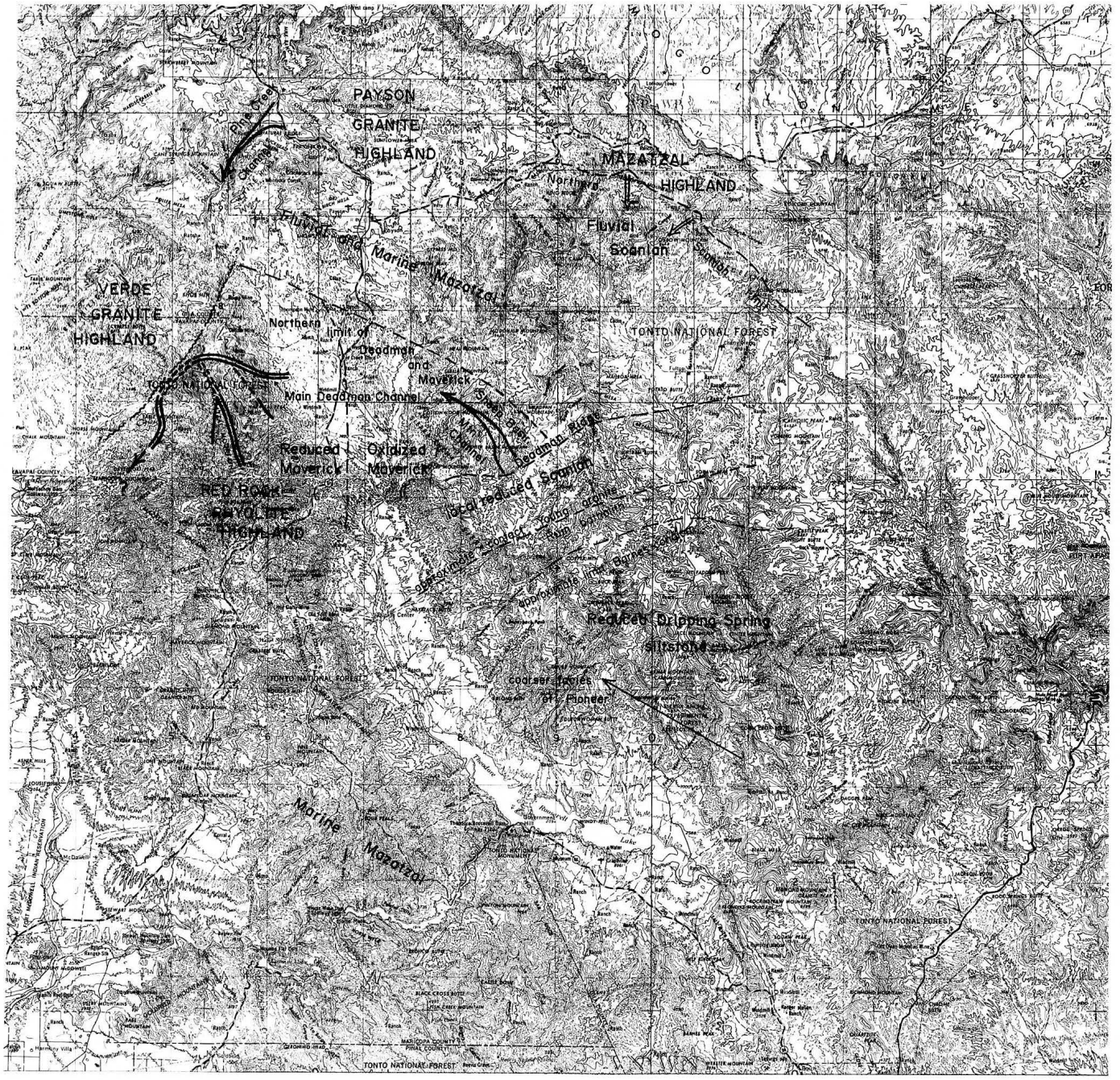


Figure 32

CENTRAL ARIZONA ARCH STUDY AREA : PRECAMBRIAN PALEOGEOGRAPHIC SETTING by Phillip Anderson, 1980