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EARTH MATERIALS EVALUATION

ARIZONA RARE II AREAS

by

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INTRODUCTION

Knowing that mineral-energy resource evaluation is a three-dimensional problem, we approach this task humbled by the knowledge that the world is full of surprises. We also recognize that the future well-being of all societies will continue to depend upon the search for and discovery of a myriad of earth material resources considered essential to modern civilizations. This will not happen unless we learn more about the earth and unless lands of diverse geologic types are open to investigation by techniques of the times.

Our approach to this immediate task is based upon a simple truth: if one understands something about conditions that prevailed in the past, it is possible to theorize about the materials that may have been generated. As an example, copper and petroleum deposits require dissimilar environments for both their growth and preservation.

If it is true that the future will require some continuing rate of discovery, only the optimistic, providing opportunities are perceived to exist, will have a chance to effect discovery. Those that are right most often are those pessimists that always take the position that "there is nothing there". No, the pessimists will not make the discoveries needed for the future.

We looked at the specific areas involved in this Rare II inventory within a larger regional context of general geologic framework characteristics. This type of overview is presented with each major change in geologic environment and is intended to provide a perspective into which the smaller areas fit. A small scale geologic map of Arizona, with cross-sections, is included for general reference purposes. We have attempted to summarize, in table form, an overview of each area regarding occurrence of: 1) industrial minerals (non-metals), 2) lode deposits (metals) and, 3) energy materials (uranium, petroleum, geothermal). In turn, each of these is treated within three subdivisions: 1) "present" (occurs in area), 2) "nearby" (occurs in proximity to area), and 3) "possible" (geologic circumstances indicative of possible occurrences). Another subdivision rank is used to indicate whether any occurrences have been "produced" or all are "shows", and whether the "possible" occurrences are "blind" (beneath younger covering rock units) or perhaps simply "missed". "Possible" energy resources are classified as either "deep" (petroleum, geothermal), or "shallow" (uranium).

Situations believed to be demonstrably sensitive are indicated in the "remarks" column. However, it should be clearly understood that each area needs to be examined on the ground and thoroughly evaluated prior to final legislative action. Although all Rare II areas are listed in the table only those judged to require elaboration are discussed in the report.

As a matter of philosophy, we are optimists, and therefore, do not automatically consider the absence of information to equate with negative potential. Too, in many cases, the ranking of potential is such an arbitrary and subjective judgment that we feel we should not rank just for the sake of doing it. There are good honest question marks and there is no good purpose served by ignoring this fact. Final decisions, therefore, as so often is the case, will inevitably have to be made in the face of many unanswered questions regarding the important resources - those that cannot be directly observed, yet are discoverable.

Kaibab National Forest

This forest consists of three separate land regions all of which are in the plateau province of northern Arizona. There are eight Rare II areas, six of them in the parcel that is north of the Grand Canyon. However, only three of the eight are still being considered.

The plateau region is Arizona's energy province in that coal, petroleum and uranium are being produced there. Although the Grand Canyon is a detriment to local petroleum potential, it and its tributary canyons are an asset in revealing, by erosion, the so-called "breccia pipe" type of uranium-copper ore deposit. Although known both north and south of the Grand Canyon, exploration for and development of these deposits is notable in the strip country north of the Grand Canyon.

For the most part petroleum potential away from the Grand Canyon is of the routine type and will not be noted unless there is an unusual factor known to be involved (Figure 1).

3-060

This region in general, and the proposed for further study add-on up Snake Gulch in particular, are especially sensitive to mineral potential and mining operations already in progress. In addition to the specific areas there is a larger undefined area bounding wilderness, a buffer zone, that would be affected by wilderness status.

The significance of the above is in the effect that it has, or will have, on legitimate multiple use of lands not far distant. A form of mineralization known as "breccia pipe" is especially important in the Grand Canyon region both north and south of the main canyon. These have been the focus of very competitive exploration. The principal commodity is uranium and relatively new mining here is made possible because of unusually high ore grades being encountered.

The so-called "pigeon pipe" is being developed on the south boundary of the Snake Gulch add-on. Extending wilderness this distance to intrude into this mineral development domain should be questioned.

3-062

This area is about 15 miles long with Saddle Mountain near the south boundary. There is some uranium-copper mineralization that is either just within the area or very close to the south boundary. Additional breccia pipe ore deposits must be given consideration.

3-061

This is the Coconino Rim area that is strongly influenced by a west trending, north dipping, monoclinal fold. The question about this is the influence in the subsurface that this folding has had on the accumulation of petroleum and nonflammable gases (helium, carbon dioxide). The folding is older than the cutting of Grand Canyon therefore there is a chance for preservation within a possible trap situated in the deeper parts of the sedimentary sequence. This

region has not been previously tested by drilling.

Coconino National Forest

This forest includes portions of the Plateau, Rim and Verde Valley to the south and west. It embraces deep canyons cut into the edge of the plateau as well as volcanic features in the San Francisco volcanic field, near Flagstaff. The rocks involved are those of the plateau sedimentary sequence and younger rocks, largely volcanics, of much younger age (Figure 1).

3-043
3-040

The petroleum potential in this general region may be more than that routinely associated with the standard underlying plateau sedimentary sequence. Changes are taking place in the subsurface that could be favorable.

3-059
3-049
3-048

This is volcanic country. Elsewhere in the region, exploited volcanic products include cinders and pumice. Pumice used as pozzolan for Glen Canyon Dam was mined a short distance away along Highway 89. These areas should be carefully evaluated for possible pumice deposits.

3-054
3-045
3-047
3-046

All of these are along the plateau edge and its related canyons. They are being studied by federal agencies, especially the USGS.

They contain the standard plateau sedimentary rocks and overlying, in places thick, volcanics. Known mineralization is present locally (3-046) and represents a special type that likely continues beneath the plateau. Petroleum has to be considered wherever limestones and related sedimentary rocks occur in the subsurface, which is the case in all of these areas.

Available information regarding mineralization suggests that the occurrences in Fossil Creek Canyon (3-046) of copper-uranium, though of interest scientifically, are not of foreseeable direct economic interest.

Petroleum potential is enhanced, up to a point, in direct proportion to distance away from the plateau edge. Only West Clear Cr. (3-047) extends several miles into the plateau. Even so, there is no known reason to think that there is anything unique about this position in the plateau as regards petroleum potential.

3-052

This is an add-on to the southeast tip of Sycamore Canyon Wilderness. It embraces part of Black Mountain, a high lava capped mesa or butte. The young rocks overlie the plateau sedimentary rocks which here include some of the Coconino Sandstone beneath the regional truncation surface. This sandstone is the basis for the Arizona flagstone industry, most of which is to the west and northwest along the Mogollon Rim. Flagstone quarries, now abandoned, dot the northeastern half of

Black Mountain. Surface lode mineralization is not known.

Prescott National Forest - Western Half

The geologic framework of the western half of the Prescott National Forest is dominated by the oldest rocks in Arizona. These are granites and variously metamorphosed sediments and associated volcanic rocks. Locally, these have been intruded by younger igneous plutons. The oldest rocks are of the vintage found at the bottom of Grand Canyon. The famous stack of sedimentary rocks that make up most of the walls of the Grand Canyon has been eroded away south of the Mogollon Rim thus exposing the older rocks beneath (see map and Figure 1). The lower units of the sedimentary stack are last seen in the Juniper Mountains and are absent to the south.

The old rocks (1.7 billion years) are overlain by very young sedimentary and/or volcanic igneous rocks (15 million years) with an extensive irregular erosion surface in between. Some faulting post-dates the younger rocks and very young sediments have been deposited in the lows and along stream valleys in response to continued erosion of the higher topography.

The above framework characterizes the larger so-called transition or central mountain region of Arizona of which the Prescott Forest is but a small part. A look at this larger region reveals an extensive array of metallic mineral occurrences and types including some famous mining camps (Jerome, Iron King, Bagdad, Copper Basin, the various placer gold deposits, etc.).

Much of the mineralization is believed to be intimately associated with the origin and history of the very old rocks (Jerome, Iron King) and an ill-defined amount is associated with igneous intrusives emplaced about 60 m.y. ago (Bagdad, Copper Basin). The younger volcanic flows, and associated sands and gravels beneath, in many places cap these older rocks and hide them from direct observation. The older rocks are exposed only in the higher ranges and along stream canyons where erosion has removed the younger cover. Thus, judging from the numerous metallic mineral occurrences exposed in the older rocks, many more must occur where the old rocks are covered by young ones, or, where access is especially tedious.

In addition to the lode deposits, placers are well known. They can occur wherever mineralized rock containing heavy minerals (tungsten, gold) has been subjected to natural concentrating processes. They could be along any erosion surface, old or young.

The west one-half of Prescott Forest, although not known to have unusual industrial minerals, does have some "common" varieties. Petroleum, coal and geothermal potentials are believed to be minimal. However, it does have hundreds of occurrences of metallic minerals and many of these have been exploited in the past. Consequently, the mineral domain of most interest is that normally exploited by hard rock mining, or placering, for base and precious metal containing minerals.

Specific Areas

3-080

The Juniper Mountains contain the sedimentary rocks found low in the Grand Canyon stack (Figure 1). Limestones are present that, elsewhere, are of economic interest as sources of both lime (Nelson) and cement (Verde Valley). To the north, a massive iron (hematite) deposit is hosted by one of these limestones. The older rocks crop out below these sedimentary rocks. The basal sandstone overlying the older rocks might contain some heavy minerals of interest. There is no known record of interest in the older rocks at this locality. Because access is limited, prospecting might have been minimal. Lode deposits are possible.

3-081

This region is floored largely by the very old granitic rocks. There is no known record of materials of interest. Access is limited, therefore, prospecting might have been minimal. Lode deposits are possible.

3-082

This region is floored by the older granitic and schistose rocks. At or close to its southwest end is a group of tungsten claims (Black Magic Group - Mary "D" claims) from which there has been some production. The tungsten mining area is a part of the larger Eureka Mining District that extends several miles to the southwest. Some of the tungsten-bearing (wolframite) quartz veins can be traced up to 4,000 feet. It seems likely that this area contains additional tungsten potential.

3-083

This larger region consists of the older crystalline rocks with overlying younger mesa-capping volcanics. Erosion is deep and young alluvium floors the main drainages. There is no known record of valuable earth materials. There is lode mineral potential beneath the blanketing volcanics and placer potential in the alluviated drainages.

3-084

There is no record suggestive of interesting mineral potential in Granite Mountains. These are also the very old rocks.

3-085

This region is in the southern part of the Bradshaw Mountains. It is closely surrounded by recognized metallic mineral mining districts. Although it is true that the central granitic region is surrounded by an aureole of schist that hosts much of the known lode mineralization, the granite itself hosts lode type deposits from place to place from which millions of dollars worth of minerals have been extracted. There is a significant potential for the occurrence of deposits of valuable metallic minerals within the older rocks of this region. The relative inaccessibility of this country suggests that past prospecting intensity has been low. It could be viewed as a part of the frontier for future exploration effort.

Pegmatitic veins are prolific in parts of this granite. Muscovite mica has been of interest and could be again.

3-095

This roadless area is floored largely by the very old granite that characterizes much of the higher parts of the Bradshaw Mountains. Lode deposits, prospects and mines tend to closely surround this region. Some of these occur as veins in the granite therefore there is no sound geologic reason for thinking that this rough country has been spared the mineralization history. It should be recognized as being "mineral in character".

Prescott Forest - East One-Half

The Prescott Forest - East half includes portions of the edge of the Colorado Plateau province (Mogollon Rim), the bounding Verde Valley to the south and west, and the mountain-valley country south and west of the Verde Valley (Figure 1).

The plateau edge exposes the sedimentary rock sequence that is time equivalent of the Grand Canyon sedimentary sequence. Young materials, including lake and stream sediments, and volcanics, were deposited in Verde Valley. On the south and west flank of Verde Valley, the lowest part of the Grand Canyon sedimentary stack is exposed as is the underlying much older rock similar to the older rocks discussed in the Prescott Forest - West half. Further south, the sedimentary rocks wedge out so that the mineralized older rocks are at the surface except where covered by relatively young sediments and volcanics.

Both metallic and non-metallic materials have been or are being exploited in this region and there is some petroleum potential where the limestone formations are in the subsurface.

3-094

This is a suggested add-on to the west and southern side of the Sycamore Canyon Wilderness. It is floored by the lower formations of the general Grand Canyon-Plateau sedimentary sequence. There is some faulting and erosional down cutting that disrupts lateral continuity from place to place. Some of these fault blocks raise to view the limestone formations that support the cement plant near Clarkdale. Surface lode mineral occurrence is not known in this geologic setting. However, the older rocks, noted in places for their mineral deposits (Jerome, etc.) everywhere underlie these sedimentary formations. Depending upon the extent of faulting these older rocks come within an estimated 600-700 feet of the surface. However, this potential is totally blind and therefore cannot be evaluated by surface study alone.

3-088

This is Woodchute Mountain. It is a thick sequence of volcanic flow rocks, with minor gravels at the base, overlying remnants of the lower part of the Grand Canyon sedimentary sequence. These, in turn, overlie the old crystalline rocks that host the nearby large-scale mineralization in which the Jerome ore deposits occur (Figure 1). However, whether or not this old mineralization also occurs beneath any or all of Woodchute Mountain, has not been reported. The limestones near the lower parts of the mountain are sources of lime and cement rock elsewhere in the general region.

The metallic mineral potential is totally blind; therefore, it cannot be ranked other than by saying that the geologic setting demands that a potential exists that should not be ignored.

3-092

This country is floored by relatively young post-mineralization volcanic flow and related rocks that blanket older rocks beneath. The older rocks consist of the north to south truncation and wedgeout of the lower section of the Grand Canyon-Rim sedimentary rock sequence and the very old crystalline rocks that underlie these sedimentary formations.

After southward wedgeout, the younger rocks directly overlie the old crystalline rocks. As elsewhere in the central Arizona region, it is these old crystalline rocks that host mineralization of the lode type. Thus, because the old rocks are blanketed by a relatively thin sequence of younger rocks, the mineral potential is blind. However, it is perhaps revealing to note how soon mineralization is encountered in surrounding areas where the underlying old rocks have been uncovered by erosion.

The potential for relatively near-surface minerlization in the underlying older rocks is high. However, there is no way of judging the magnitude of this potential. Again, it is geologic settings like this that represent the exploration frontiers of the future.

Because of the existence of the Verde Hot Springs along the Verde River to the east, a question is raised as to the deep thermal characteristics of this region. However, there is no way of actually judging the eventual significance of this aspect.

3-093

This is an add-on adjacent to the Pine Mountain Wilderness. It is completely covered by the young, post-ore volcanic rocks. Depth to the older host rocks below is not known.

Tonto National Forest

The Tonto National Forest area is intermediate in geologic diversity. The north end contains some of the older sedimentary rocks of the plateau sequence as well as some volcanic cover. Further south the very old crystalline rocks dominate (Figure 3). The canyon of the Verde River is fault controlled and contains lake beds that have been caught up in the faulting (Figure 3).

3-017

These are two small areas adjacent to the Pine Mountain Wilderness area. An evaluation of the mineral resources of the Pine Mountain Primitive (now Wilderness) was completed in 1967 by the U. S. Geological Survey. This report minimizes any mineral resource potential and no doubt influenced the decision to make the area wilderness. About half of this wilderness (about 15 square miles) is floored by the younger rocks that cover the potentially mineralized older crystalline rocks. There is no way, then, that this hidden potential can be evaluated on its own merits. Thus, a lack of information can be looked upon either negatively,

positively, or neturally. Pessimism does not find mineral deposits. Because the odds are always stacked against the possibility of finding something of significant value during exploration, one is never really wrong in saying that discovery is "unlikely". But, with that attitude, much blind potential can be easily overlooked or neglected.

The report, while recognizing the presence of the Devonian limestone in the south-wedging plateau sedimentary sequence, failed to appreciate its commercial use elsewhere. Actually, it is quarried in the Verde Valley and shipped to the sugar beet factory in Chandler, Arizona. In order to appreciate this, one must recognize the fact that the Grand Canyon rock sequence is completely truncated southward such that Maricopa County to the south has no limestone (Figure 1). This is why the cement plant is north in Verde Valley, as is the source of the materials used at the beet factory. It is only in large scale contexts such as this that valid mineral assessments can be made, especially as regards the more common mineral varieties such as limestone.

On the south boundary of the Pine Mountain Wilderness, and very close to 3-017, there is an onyx quarry that is discussed in the report. Although the material was being processed for use as terrazzo, the report hypothesizes that the origin of the material, which is localized in a fault zone, could represent past hot spring activity. This is interesting because the fault zone involved is the major Verde Fault system that strongly influences the location of the Verde River and Verde Hot Springs along the river. Geologically, one would be remiss if he or she failed to wonder about regional geothermal conditions. Here is a focus on a resource potential of unknown significance. Who knows what the future holds in terms of needed scientific studies and exploration frontiers?

These two small areas are not known to have a significant resource potential. However, the older rocks should be closely examined. There must be a direct relationship between the magnitude of potential and total land area involved. There are several proposed wilderness areas in this general region and together with the existing wilderness, constitute a large land area. One must consider how much is enough.

3-016

Associated with the faulting along the Verde River are hot springs that have not been studied, surveyed or evaluated. There is a geothermal system along the river part of 3-016 that should be investigated further. Chalk Mountain, near the southern tip, contains uranium mineralization.

3-020

Lode mineralization is known in the older crystalline rocks. The Magazine Mineral District (copper-silver) very near the west edge of 3-020 is in these rocks. 3-020 also contains a fault protected, large remnant of lake beds along Lime Creek. Locally, these beds are selectively mineralized with uranium and have been mined (Lime Creek Mine).

Much of this country is not readily accessible and therefore may contain potential that is presently unrecognized. 3-020 appears to be more sensitive than does much of 3-016.

3-021

Tonto Creek is cut into northeast trending, steeply tilted very old rocks of the type that hosts "massive sulfide" type mineralization at Jerome, etc. Pranty's Cabin Mineralized District occurs along the southeast edge of 3-021. It, too, is a copper-silver-gold massive sulfide prospect.

3-024
3-025

These areas are floored by the very old rocks. Prospects are known in veins (copper, gold, silver, mercury, manganese) and in pegmatite dikes (tungsten, beryllium and lithium). The country is rugged and likely contains more potential than is now known.

3-018
3-026
3-027
3-028

These areas are adjacent to the Superstition Wilderness and are, basically, similar in general geologic character except that these flank the canyon made by Salt River. The floor rocks are volcanics that are believed to be post-lode mineralization in age. The earth material resource potential appears to be limited to volcanic related products as zeolites (Figure 2).

3-019
3-023
3-022

The Sierra Ancha region is floored by a very old (1.2 billion years) sequence of sedimentary rocks (Apache Group) that have been extensively intruded by an igneous rock in the form of diabase sills. The strata are generally flat-lying and only locally distorted by folding. This flat-lying aspect is important because known mineralization tends to localize at specific horizons. Because of lateral continuity generated by flatness these favorable horizons are laterally extensive and can be traced not only throughout the Sierra Anchas but into adjacent areas where these same rocks are present (Figure 3).

Anomalous radioactivity is widespread in one formation known as the Dripping Spring Quartzite. There are at least 60 principal occurrences of uranium and many minor ones. About 15 of these have had some production and copper is associated with most. Grades are not high and mining costs are. However, future economic conditions and national requirements are not predictable.

Another horizon, the Mescal Limestone, is the host for the well-publicized chrysotile asbestos. There are numerous occurrences in 3-023 along the canyon of Cherry Creek. Some of the highest grade (low iron) chrysotile known in North America occurs in Arizona. The potential importance of this to the nation is not widely appreciated or understood. To dismiss its potential importance on environmental grounds would be a gross error.

3-019 also contains segments of both of these formations therefore there is potential for both uranium and chrysotile deposits.

3-029
3-030

3-029 is in the very old rocks and thus far there is no identified mineral resource potential. However, 3-030 is to the east of the Canyon Cr. Fault which brings the Apache Group sedimentary rocks down to form the canyon walls. There may be both chryotile and uranium potential. The region lacks detailed maps adequate to precisely follow the strata of most interest.

Apache National Forest

3-128 3-131 3-134 3-137
3-130 3-132 3-135 3-139

The Apache Forest is, for the most part, floored by volcanic rocks. Its west boundary is the east boundary of the White Mountain Apache Indian Reservation. The geologic setting embraces the southern edge of the Plateau, the Mogollon Rim, a transition zone, and its south end is just north of the Basin and Range Province north boundary zone.

Because of the huge expanse of volcanic cover, little is directly known of the important geologic subsurface. However, some drilling to the north, geologic mapping to the west where the volcanics terminate, and random observations in the county (Apache), afford an opportunity to make significant generalized interpretations of the geologic framework. Very few geologists have assembled and considered this information (Figure 2).

There are three major resource aspects to consider and all are beneath the surface volcanic cover: 1) geothermal, 2) lode mineralization, and 3) petroleum.

There is a recognized geothermal potential that extends west and south of Alpine near the north end of these areas (3-130). There is a tentative private project to develop a dry-hot-rock thermal electric plant (Figure 2). The idea is to drill into granitic rock that underlies the plateau sedimentary rocks several thousand feet below the surface. Surface water is introduced into the hot rock and converted to steam, etc. Generated electricity would be sold to the regional utility.

The large mining complex at Morenci is close to some of the southern areas (3-135). A potential for buried large-scale lode mineralization is real and needs careful evaluation.

The general region involved represents a frontier area for potential exploration. There are several aspects of the regional geologic setting that combine beneath this region to generate geologic favorability. What is known from regional analysis is that a shoreline exists somewhere beneath this country. Its exact position is not known nor is its nature. However, shorelines are favorable sites for reefing and/or sand build-up capable of providing reservoir rock. The sea involved is Pennsylvanian (300 million years) in age and is similar in age to the one involved in much of the petroleum production in the Four Corners region. Related sedimentary rocks are observed along the Black River where erosion has

exposed them to view. These fossililerous limestones and shales, about 1000-1300 feet thick, represent the petroleum source rocks beneath the volcanic cover to the northeast where they must encounter the landmass (Figure 2). Holes north of Alpine demonstrate that these sedimentary rocks disappear somewhere beneath the volcanic cover by wedging against a granitic landmass. In the petroleum business this edge effect would be called a "trend".

Because boundaries cannot now be precisely drawn around areas of greatest resource potential some consideration could be shown for how much the surface needs to be classed as wilderness. In this regard, the original Forest Service proposal seems both reasonable and responsible.

Coronado National Forest

The Coronado National Forest embraces a number of isolated mountain ranges in southeast Arizona and each range is geologically different. The forest is totally within the Basin and Range Province (see map).

In the Basin-Range Province, mineralization history is generally different than it is in the central mountain region. The difference is that in the former, much younger mineralization prevails such that the definition of what is "pre ore", therefore susceptible to being mineralized, is very different. Whereas in the central region much mineralization is older than a billion years, in the Basin and Range Province, it is usually younger than 100 million years and older than 25 million years. The explanation for this difference is in the fact that these regions responded differently to overall geologic history. Another example is that although the plateau rocks are generally older than 100 million years, none of the younger Basin and Range type mineralization history is known there.

The use of "old" rocks in the Basin and Range Province is intended to mean pre-mineralization in age.

Pinaleno Mountains - 3-123; 3-127

Much of this mountain range appears to be devoid of materials of recognized economic potential. However, on the southwest (3-127), there is a fault zone along which uranium mineralization has been emplaced. These occurrences appear to be significant and represent a locale for future exploration and possible development.

To the northwest, in granitic terrain at lower elevations just off of area 3-123, minerals of interest are known: 1) tungsten in pegmatites; 2) lead-zinc-copper-gold-quartz veins in granite; 3) manganese veins in breccias; and 4) some niobium thorium-rare earths in pegmatites. Although none of these is known to be large, they do indicate that some potential likely exists in country difficult of access providing that similar geology prevails.

Santa Teresa Mountains

3-121

This area consists largely of granitic rock that intrudes older rocks along its

borders. These border rocks contain lode deposits that surround 3-121. Although the granite itself is not known to be significantly mineralized, it should be carefully evaluated.

Galiuro Mountains

The Galiuro Mountains are characterized by younger volcanics overlying a variety of older rocks. The older rocks are exposed along the more deeply eroded west flank. Although most of the known mineralized areas (Copper Creek District, etc.) are associated with the older rocks, some (Rattlesnake Gold District) are known to occur in veins cutting the younger volcanics (Powers, Knothe, and Gold Mountain Properties).

3-124

This volcanic area is at the north end of the Forest and flanks the large mineralized region of older rock that lies to the west. Favorable geology could underlie the volcanics and, if so, might represent a future frontier locality for exploration.

3-901

This region consists of three strips on the west, center and east part of the forest. The center strip involves the Rattlesnake Gold District which is already hemmed in by exisiting wilderness.

Winchester Mountains

3-122

These mountains consist of volcanic rocks not known to contain lode deposits. Volcanic related products, such as zeolites, are possible.

Chiricahua Mountains

These mountains are analogous to the Galiuro's in that younger, relatively undeformed volcanics overlie older, much deformed and, in places mineralized, older rocks. The scenic values are related to the landscape caused by the erosion of the younger volcanics. The older rocks are exposed along the northeast and northern portions of the range. The Hilltop region is a well known mining district developed in the older rocks.

3-112

This area is dominated by the older rocks and associated geologic complexity. Limestones are present and have been converted to marble in places. Flanking localities have been exploited for marble. Although not known to contain materials of high current interest, the region has a diverse potential that requires careful evaluation.

3-109

This is a series of add-ons surrounding existing wilderness. The area represented by these is at least three times the size of the existing wilderness. For the most part the new areas are the younger volcanics that cover an older terrain of potentially mineralized rocks that cannot be seen or investigated directly.

Peloncillo Mountains

3-110
3-200

These areas are largely volcanic covered and believed to be poorly mineralized. Some mangenese is known near 3-200 and zeolites should be evaluated.

Dragoon Mountains

3-201

These mountains consist exclusively of so-called pre-ore rocks. This is to suggest that the rocks were present when the main pulse of mineralization emplaced most of the metallic minerals for which southern Arizona is famous.

There is a conflict at the southern margin with the Middle Pass Mining District. Although large deposits have not been discovered, the region is frontier for more sophisticated exploration.

The Dragoon Mining District embraces much of the northern part of this region. Lead, zinc, copper, gold, and silver have been produced from lode deposits emplaced into reactive limestones. Granitic intrusions beneath and flanking the region are believed to have produced the mineralizing fluids. Again, although production has not been large, there is potential for large, deeper deposits that will require both more expense and additional geologic understanding to locate.

Whetstone Mountains

3-120

These mountains consist largely of old, pre-mineral rocks that include granites and sedimentary rocks containing limestones and gypsum. In addition to gypsum at the south margin, fluorospar, uranium, silver, tungsten, and some gold have been produced along the northern and eastern section.

A gypsum deposit containing many millions of tons of high-grade gypsum occurs at the south boundary. Limestones are abundant and need to be studied for their lime contents, especially those most easily accessible. The central mountain mass is rugged and no doubt has seen little exploration effort. However, there is some potential for lode deposits.

Huachuca Mountains

3-117

The Huachuca Mountains are characterized by older rocks that have complex geologic histories. This complexity combined with poor general accessibility leads to gross ignorance as to ultimate earth material resource potential. Tungsten, gold, silver, copper, lead, and zinc ores have been produced in small amounts from at least 24 properties. These are evidence of mineralization history and the fact that large producers have not been found does not preclude their existence and eventual discovery as knowledge is increased.

Santa Rita Mountains

3-113

The Santa Rita Mountains also contain the older, mineralized rocks that characterize the ranges with complex geologic histories.

The area in question is a part of the Wrightson and Tyndall Mining Districts in which at least 40 properties are known to have given up base and precious metals. This record is indicative of mineralization history. Again, the region is a prime candidate for future study, exploration, discovery, and development.

Pajarito Mountains

3-116
3-115
3-114

Area 3-116 is close to known mining properties in the Pajarito Mining District where some high-grade silver (41,000 ozs.), lead, gold, copper, zinc, and uranium have been produced. In addition, fluorine, molybdenum, vanadium, mercury, and manganese-bearing minerals are known.

Geologic similarity to the district suggests that there is mineral potential that has yet to be investigated and explored within this area.

Area 3-115 is, for the most part, covered with volcanic rocks of post mineralization age. The older mineralized rocks, however, are exposed in or near its east and west edges. The western edge is bounded by the Oro Blanco Mining District in which at least 29 properties had production of base and precious metals (126,000 ozs., gold; 4.6 million ozs., silver; 30,000 tons, lead; 26,000 tons, zinc; 2,600 tons, copper).

Not only is it likely that mineralized older rock underlies this area at unknown depths, the existence of wilderness would influence what could be done with adjacent land that has direct mineral potential.

Area 3-114 is largely a post-mineral volcanic region that covers the older rocks with variable volcanic rock thicknesses. Its south end, however, is in older rock that should be carefully examined for indications of mineral potential.

3-125

3-125 is largely granitic with pegmatite bands containing uranium and rare earth minerals. These are heavy and occur also in local stream gravels. The potential needs closer scrutiny.

Roadless and Underdeveloped Area Evaluation II - RARE II Map, 1979, scale 1:1,000,000 is available from the U.S. Dept. of Agriculture, Forest Service

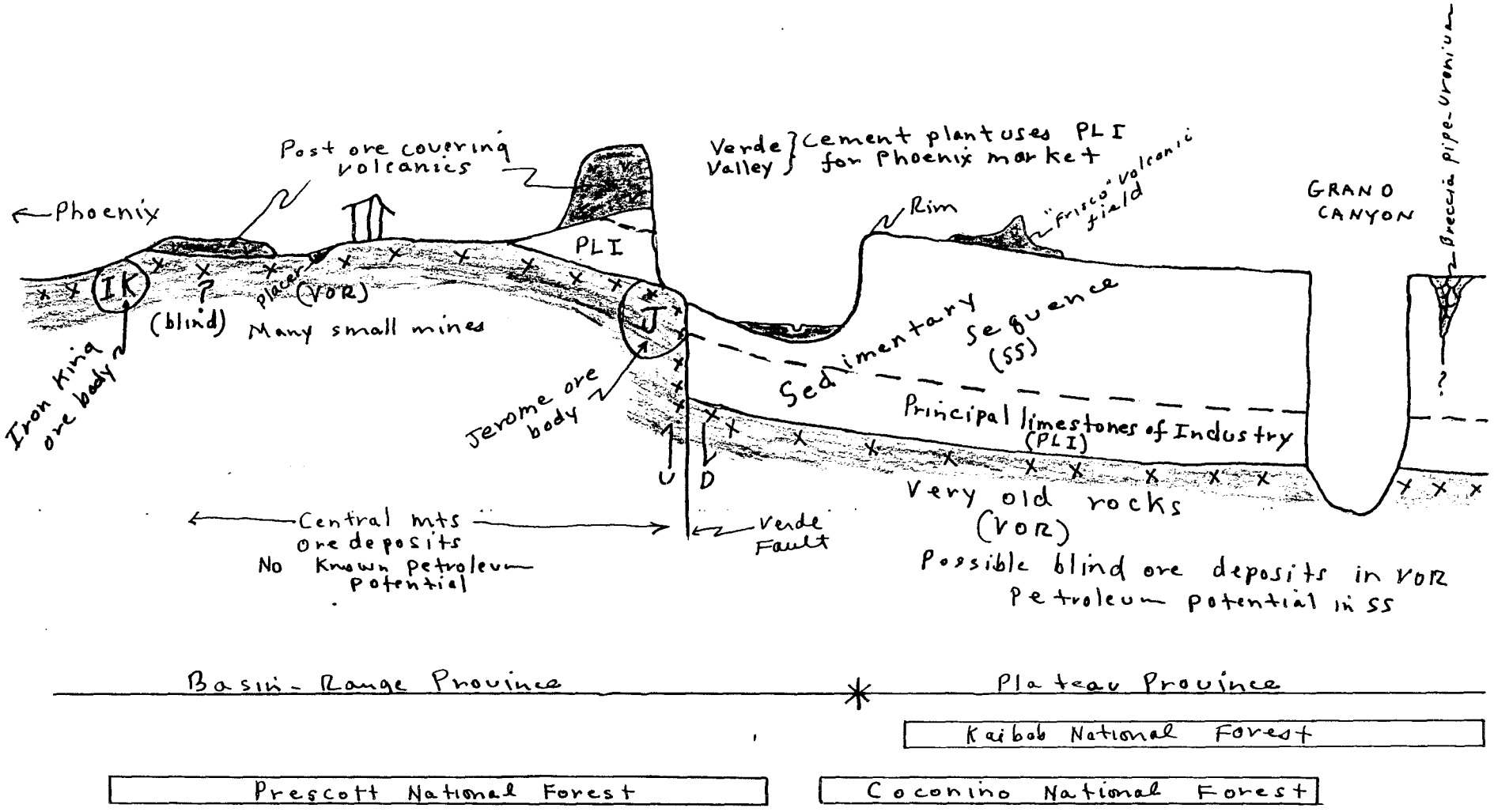
Phoenix
Post ore covering volcanics
Verde Valley
Cement plant uses PLI for Phoenix market
Rim
Frisco volcanic field
GRAND CANYON
Breccia pipe-Uranium
PLI
IK
?
(blind)
placer
(VOR)
Many small mines
Iron King ore body
Jerome ore body
J
U
D
Sedimentary sequence (SS)
Principal limestones of Industry (PLI)
Very old rocks (VOR)
Central mts ore deposits
No Known petroleum potential
Verde Fault
Possible blind ore deposits in VOR
Petroleum potential in SS
Basin - Range Province
Plateau Province
Kaibab National Forest
Prescott National Forest
Coconino National Forest

FIGURE 1

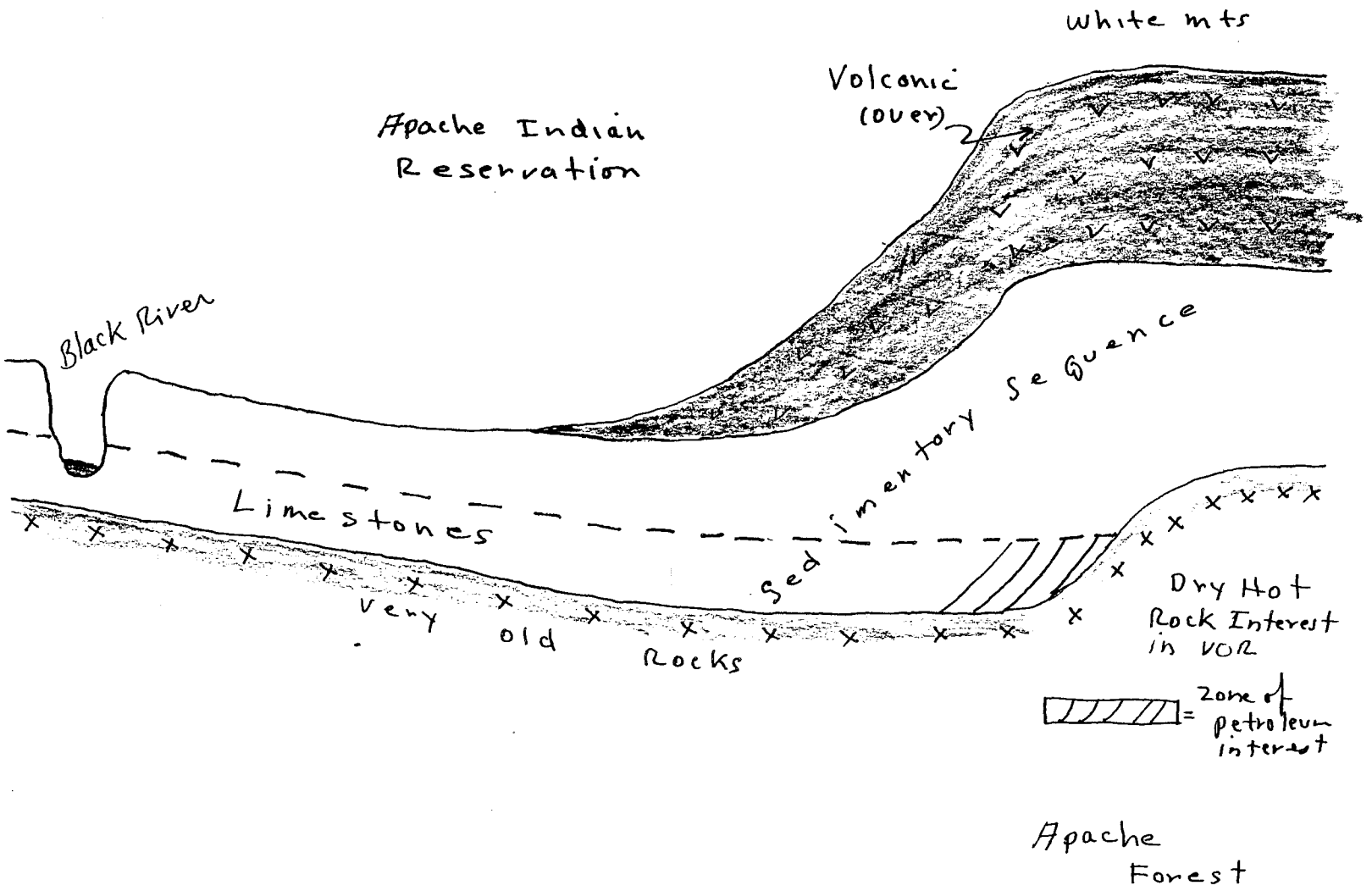
White mts
Volconic
(over)
Apache Indian
Reservation
Black River
Limestones
sed imentory Se Quence
very old Rocks
Dry Hot
Rock Interest
in VOR
= Zone of
petroleum
interest
Apache
Forest

Figure 2

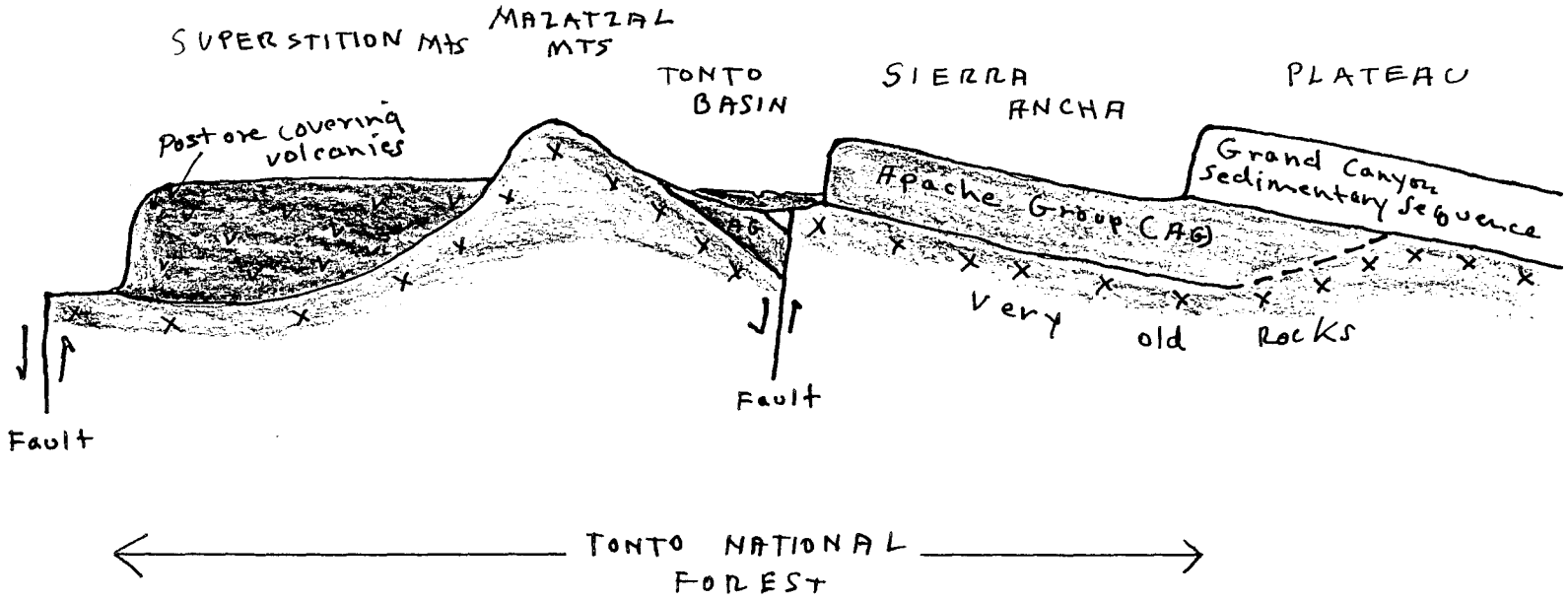
SUPERSTITION MTS
MAZATZAL MTS
TONTO BASIN
SIERRA ANCHA
PLATEAU
Post ore covering volcanics
Apache Group (AG)
Grand Canyon Sedimentary Sequence
Very old Rocks
Fault
Fault
TONTO NATIONAL FOREST

Figure 3