

**GEOLOGIC MAP OF THE STATE ROUTE 88 CORRIDOR
FROM PINAL CREEK TO PINTO CREEK,
GILA COUNTY, ARIZONA**

by

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INTRODUCTION

The purpose of this study is to provide detailed geologic information about the area between Pinal Creek and Pinto Creek, north of Globe, to facilitate the relocation of State Highway 88. The map area lies mostly within the 1:24,000 scale U.S.G.S. Salt River Peak 7.5' quadrangle and a small section of the eastern part of the Two Bar Mountain 7.5' quadrangle. Field work was carried out during November and December, 1997.

PREVIOUS INVESTIGATIONS

Ransome (1903 and 1904) created a geologic map of the Globe 15' quadrangle at 1:62,500 scale and a 1:12,000 scale map of the Globe copper district. Peterson and others (1953) produced a 1:24,000 scale map of the Inspiration quadrangle south of the map area. Peterson (1954) produced a 1:24,000 scale map of the Globe 7.5' Quadrangle and, later, a 1:12,000 scale map of the Globe-Miami District (Peterson, 1962) and a 1:24,000 scale map of the Pinal Ranch Quadrangle. Reconnaissance geologic mapping was included in the Geologic Map of Arizona (Wilson and others, 1969), and in the most recent Geologic Map of Arizona (Reynolds, 1988).

Wrucke (1989), though not specifically mentioning this study area, described in detail the rocks of the Apache Group which are exposed in the area. Silver and others (1980) determined a uranium-lead date from zircons from the Ruin Granite.

This study is a continuation of a previous study along State Highway 88 to the south (Skotnicki, S.J., 1995).

GEOLOGIC SETTING

The Ruin Granite is the oldest rock in the study area. It has been well-dated using the uranium-lead technique at several places, with an age of 1440 ± 20 Ma (Silver, 1980). Nonconformably overlying the granite are rocks of the Late Proterozoic Apache Group, including, from bottom to top; Scanlan Conglomerate, Pioneer Formation, Barnes Conglomerate, Dripping Spring Quartzite, and Mescal Limestone. All units have been intruded by diabase, dated by several authors at between about 1040 Ma and 1150 Ma (Wrucke, 1989), which commonly intrudes near the base of the Dripping Spring Quartzite, effectively removing the Pioneer Formation and creating hills composed solely of quartzite and diabase. The only Apache Group rocks exposed in the map area is in the southeast corner, where Pioneer Formation, the Barnes Conglomerate, and Mescal Limestone are in fault contact with granite.

North of Salt River Peak bedded conglomerate containing clasts of Apache Group rocks, diabase, and granite nonconformably overlies the Ruin granite. The conglomerate thickens to the north and northeast outside the map area. It is probably Tertiary in age and is likely equivalent to the Whitetail Conglomerate to the south as defined by Ransome (1903). The Apache Leap Tuff unconformably overlies granite, rocks of the Apache Group, and the Whitetail Conglomerate. In the map area it is exposed in northeast-dipping tilt-blocks at Salt River Peak and a hill to the south. Dark grey-tan andesite lava overlies and intrudes the Apache Leap Tuff. In the southern part of the map three small dike-like andesite bodies intrude granite.

A thick sequence of sandstones and conglomerates unconformably overlie the Apache Leap Tuff and andesite. Near the south-central part of the map area the deposits form a northeast-dipping fanning-dip sequence. These deposits are composed of at least four mappable members. Probably the oldest member is map unit Tss, which underlies most of the lower, northwest part of the study area.

This member is composed almost entirely of very fine sandstone and minor siltstone and contains larger well-rounded pebbles to cobbles which weather out and mantle the surface. The other three members are conglomeratic and more resistant, forming the steep dissected terrain in the south-center of the study area. They reflect alluvial fans containing material derived from different sources. The members probably interfinger at depth.

STRUCTURE

The State Highway 88 parallels a valley between two northeast-dipping fault blocks composed primarily of Apache Leap Tuff, andesite, and overlying sediments. The major structure in the area is the north-south striking fault that displaces basin-fill sediments on the west down against granite on the east. This fault does not cut middle Pleistocene alluvial fan deposits. Along the southern part of the fault, sedimentary and volcanic rocks dip between about 15° and 60° northeast. The dips are less steep to the north and northeast, and along the central and northern sections of the fault bedding dips only about 5° to the west-northwest. At least the southern part of the fault was active during deposition of the basin-fill sediments, and caused the fanning dips. It is not clear if the northern section of the fault was active during deposition because no steep bedding was observed in the sediments there. On the south side of Blevens Wash, just outside the map, basin-fill sediments dip up to about 30° northeast. On the north side of the wash bedding dips less than 10° north-northwest. The northwest strike of the fault block south of Blevens Wash suggests that there may be a northwest-striking, south-dipping normal fault buried beneath or just north of Blevens Wash.

Aplite and leucocratic muscovite granite dikes fill fractures in the Ruin Granite near the fault in the center of the map that have attitudes similar to that of the fault. This suggests that the dikes may be Tertiary in age if they were intruded along fractures created during movement on the fault.

In the western part of the study area several small and one large fault cut the basin-fill sediments. The smaller faults dip to the west, whereas the large fault dips to the east. Along the larger fault the basin-fill sediments are folded. Also along the fault are the only exposures of light grey marl interbedded with the sandstones. It is not clear why the only exposures of marl are along the fault.

MINERALIZATION

Locally, specular and fine-grained hematite fills fractures in the granite and within the eastern segment of the fault in the south-center of the map. Outside the map one small pit in diabase contains chrysocolla on fracture surfaces, and another pit dug in a fault on the east side of Pinal Creek contains manganese within fractured granite. No other mineralization was seen.

ENGINEERING GEOLOGY

No evidence for Quaternary faulting nor collapsing soils was seen. Mechanically weak zones are confined mostly to the friable purple shales of the Pioneer Formation and the crumbly outcrops of the diabase and Ruin Granite. All three formations erode readily.

Within the map area there are two visible springs. The first is along the fault cutting basin-fill sediments in the west part of the map. Here a cement catch basin has been built among several large trees and dense brush. The second is about one mile northwest of the intersection of highways 88 and 288, on the south side of Poison Springs Wash (!). Here there is thick vegetation and locally small seeps.

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UNIT DESCRIPTIONS FOR THE STATE ROUTE 88 CORRIDOR BETWEEN PINAL CREEK AND PINTO CREEK

Stream deposits

- Qyr** **Holocene stream deposits (0 to 10 ka)**--These deposits are weakly to unconsolidated and contain poorly sorted, subangular to well-rounded clasts of all rock types from sand to small boulders, including rhyolite and Pinal Schist. Most larger clasts are cobble size. There are at least two levels of these deposits which probably reflects downcutting of the main channel (where it exists) relatively recently. There is only weak soil development on some of the older surfaces which are colonized by dense thickets of Mesquite. Qyr deposits are highly permeable and have high water infiltration rates. This unit is exposed in Pinto Creek.
- Qlr** **Late Pleistocene stream deposits (10 to 250 Ka)**--These deposits are weakly consolidated to unconsolidated and contain subangular to well-rounded, sand- to boulder-size clasts of all rock types in the map area, including rhyolite and Pinal Schist. The unit is exposed in only a few small terraces along Pinto Creek. The largest size boulders are smaller than those in the middle and early Pleistocene stream deposits.
- Qmr** **Middle Pleistocene stream deposits (250 to 750 ka)**--These weakly consolidated deposits contain poorly sorted, subangular to well-rounded clasts of Apache Group rocks, diabase, granite, Apache Leap Tuff, basalt, rhyolite, and minor Pinal Schist, all in a sandy to grussy matrix. The large clasts are commonly Apache Leap Tuff, which reach over a meter wide locally. Imbrication is common. The upper surfaces are relatively flat and are locally covered by a thin mantle of fan alluvium. Clasts on surface show weak to moderate varnish. Forms flat terrace remnants along Pinto Creek.
- Qor** **Early Pleistocene stream deposits (750 ka to 2 Ma)**--Contains poorly sorted, subrounded to well-rounded sand to boulders of all rock types in the study area, as well as rhyolite and Pinal Schist. Clasts of Apache Leap Tuff and granite up to one meter or more are common. The lower part is coarser than the upper part. The contact with the underlying sandstones and siltstones (map unit Tss) is very sharp. This unit crops out as isolated, resistant knobs on the highest hills along Pinto Creek. The deposits are locally at least about 10 meters thick, rather thick for a stream terrace deposit.

Alluvial fan deposits

- Qy** **Holocene alluvial surfaces (0 to 10 ka)**--These deposits form large washes and small fans originating from some of the smaller drainages. These deposits are unconsolidated to poorly consolidated and contain silt, sand, gravel and cobbles originating from the local bedrock. There is little to no soil development and the water infiltration rate is high.
- Ql** **Late Pleistocene alluvial fan deposits (10 to 250 ka)**--These deposits are exposed in the eastern part of the map area where they flank the steeper slopes. They contain mostly subangular to subrounded granite clasts with minor clasts of Apache Leap tuff, andesite, and the Apache Group, all in a grussy matrix. Clasts on the surface have a light varnish, and there is slight clay development.
- Qm** **Middle Pleistocene alluvial fans (250 to 750 ka)**--Unconsolidated to moderately consolidated deposits consisting of thinly stratified interbedded sandstone and conglomerate. Beds are typically from a few centimeters to tens of centimeters thick and are generally moderately sorted such that finer-grained sand and gravel layers are interbedded with coarser gravel and cobble layers. Clasts are composed of all rock types

but primarily granite and range in size from sand to 1 meter, although most are sand- to cobble-size. All layers contain abundant granite grus. Matrix contains no carbonate. Upper meter or so contains about 10-20% clay, but sand and silt dominate. Upper surface is covered by an open pavement of subrounded to subangular cobbles comprising less than 30% of the surface and are surrounded by much granite gruss. The cobbles exhibit a weak varnish on some clasts. Deposits near Highway 288 locally contain dense black cobbles of almost pure hematite.

- Qm₂** Younger member of middle Pleistocene alluvial fan deposits.
Qm₁ Older member of middle Pleistocene alluvial fan deposits.

Tertiary rocks

- Tcg** **Conglomerate, granite clasts (Tertiary)**--This unit contains only poorly sorted, angular to subrounded clasts of granite up to the size of small boulders. Most of the larger clasts are fine-grained leucocratic felsite derived from dikes intruding the Ruin Granite. Immediately west of The Summit a streamcut in the tributary of Blevens wash has exposed thinly bedded granite gruss with few large clasts. Other than this one exposure no bedding is visible. The unit can be distinguished from the granite clast-rich map unit Tcm by its slight orange color and minor soil development. Also, Tcg is weakly consolidated whereas map unit Tcm is moderately to strongly consolidated.
- Tca** **Conglomerate, Apache Group clasts (Miocene or Pliocene)**--This unit contains mostly subrounded to rounded pebbles to cobbles of Apache Group rocks and diabase, with less abundant Apache Leap Tuff (Tta), light grey flow-foliated crystal-poor rhyolite, and minor granite and Pinal Schist. The sandy matrix locally contains granitic grus. This unit is resistant and forms steep, dissected, grey hills in the center of the map area. The deposits appear to interfinger with map unit Tcm near the word "NATIONAL" on the map, where lenses of conglomerate containing Apache Group clasts are interbedded with beds containing primarily granite clasts.
- Tcm** **Conglomerate, mixed clasts (Miocene or Pliocene)**--This unit contains mostly subangular to subrounded sand- to cobble-size clasts of granite, with minor clasts of Apache Leap Tuff (map unit Tta) and basalt, all in a sandy, grussy matrix. The deposits are strongly consolidated to the southwest where they are steeply tilted (just outside the map area) and are moderately to strongly consolidated closer to the contact with Tcg. Farther to the southeast, clasts of andesite (map unit Ta) are more abundant.
- Tss** **Sandstone and siltstone with minor conglomerate (Miocene or Pliocene)**--This unit is dominantly thinly bedded fine-grain tan sandstone and siltstone, with minor lenses of conglomerate. Exposures along Pinto Creek show that at least locally the unit grades upward from thinly bedded siltstone to sandstone containing small pebble lenses. Exposures east of Pinto Creek are fairly homogeneous. Clasts in the conglomerate lenses are mostly Apache Group rocks, with minor Apache Leap Tuff, basalt, and rare granite. Most of the clasts are less than 10 cm wide and are subrounded to well-rounded and resemble river cobbles. Clasts are commonly isolated and surrounded by sandy matrix or are in pebble beds. As the finer material erodes the clasts remain on the surface as a dense lag gravel that gives the deposits the deceptive appearance of a coarse conglomerate. Along the north-northwest striking fault in the western part of the map area is an interbedded 10 cm-thick bed of light grey marl which locally contains silicified plant fossils.
- Tax** **Andesite breccia (Miocene or Pliocene)**--This unit contains mostly very poorly sorted,

- subangular to subrounded clasts of andesite (map unit Ta) from boulders to cobbles, and less abundant clasts of Apache Leap tuff and granite, all in a tan sandy matrix.
- Talx Breccia of Apache Leap Tuff (Miocene or Pliocene)**--This unit contains poorly sorted, subangular pebble- to boulder-size clasts of welded Apache Leap Tuff, in a sandy autoclastic matrix. Nonwelded tuff crops out locally along the fault contact with granite, suggesting that, even though the rock is highly brecciated, it may have slid downhill as a relatively coherent mass.
- Ta Andesite (Miocene)**--Contains about 5-10% light grey anhedral to subhedral plagioclase, < 1% pyroxene mostly altered to red opaques, minor unaltered thin laths of hornblende, and possibly trace quartz, all < 2mm wide in a purple-tan aphanitic matrix. At Salt River Peak the lower part is brecciated and contains many vesicular clasts. The upper part is massive. The rock forms a resistant peak. In the southeast part of the map andesite appears to intrude Apache Leap Tuff.
- Tta Apache Leap Tuff (Miocene)**--Welded ash-flow tuff containing 1-4 mm wide phenocrysts of subhedral, rounded, partially resorbed clear quartz, subhedral and commonly broken clear to light grey feldspar, and fresh subhedral biotite, all in a light cream-colored aphanitic matrix. The unit commonly displays eutaxitic foliation commonly defined by 1-10 cm augen-like cavities from weathered pumice, or incipient eutaxitic foliation defined by weak lineation on weathered surfaces. Subrounded xenoliths of diabase 1-5 cm wide are not abundant yet widespread. Locally, the bottom 1-3 meters are vitrophyric and strongly welded, containing 1-10 cm long compressed black crystal-rich pumice fragments. The tuff weathers into resistant, tan-colored ridges with rounded boulders separated by deep joints. At the outcrop scale, individual rocks break easily with one hammer blow and rapidly disintegrate into sand.
- Tt Bedded tuff (Miocene)**--This unit is the non-welded base of the Apache Leap Tuff. It is light grey to white and contains subhedral phenocrysts of partially resorbed clear quartz, clear to white feldspar, and biotite in a light grey to white aphanitic matrix. Bedding is visible locally and is parallel to foliation in the Apache Leap Tuff. The unit is discontinuous and crumbles easily with one hammer blow.
- Tco Whitetail Conglomerate (Miocene or older)**--This unit contains poorly sorted, angular to subrounded, sand- to boulder-size clasts of Apache Group rocks, granite, diabase, and Paleozoic limestone, all in a tan sandy matrix. The unit is almost everywhere covered by a thin lag gravel derived from itself, so no bedding is visible in the map area. The unit thickens to the north and northwest and pinches out to the south near Salt River Peak.

Proterozoic rocks

- Yds Dripping Spring Quartzite (Proterozoic)**--Light tan to pink and white thinly bedded metamorphosed sandstone, locally siltstone and rarely gravel-size conglomerate. The unit is generally well-sorted, containing moderately sub-rounded sand-size grains of quartz and light pink feldspar in a siliceous matrix. Cross-beds are abundant. Ripple marks are rare. Metamorphosed to quartzite but highly fractured and locally brecciated, especially adjacent to faults. Locally slightly folded. Commonly breaks along bedding planes to form step-like, blocky outcrops. The unit is resistant and forms steep rounded hills and small cliffs. Breaks with 3-4 hammer blows. The quartzite in the north of the study area contains a 5-8 meter thick layer of purple to tan, thinly bedded shale and minor sandstone near the base (above the mapped marker bed. Locally the shale layer contains rounded, green-yellow disk-shaped clasts up to several centimeters wide. The layer thickens northward, and is not visible to the south. The Dripping Spring Quartzite east of the

study area also contains an interbedded quartzite 0-3 meters thick.

Ydsb Barnes Conglomerate (Proterozoic)--Grey to tan conglomerate containing moderately well sorted, well rounded pebbles and cobbles of white vein quartz, and grey, red and tan quartzite and jasper, all in a tan to grey sandy, arkosic siliceous matrix. Imbrication is visible locally (not measured). The unit is typically between 1-3 meters thick and forms small cliffs and ledges. It is exposed in the southeast corner of the map south of Highway 88 near Hicks Wash. The unit is fractured but generally resistant. Some of the fractures have healed with a silica cement.

Yp Pioneer Formation (Proterozoic)--This unit consists of thinly bedded purple, and locally tan, shales and siltstones metamorphosed to slate. The lower part is locally interbedded with a dark grey to tan quartzite layer which is exposed north of the study area and rapidly thins southward. Mud cracks are abundant and ripple marks are visible locally (very limited data suggests current direction was to the northeast). The unit is highly fractured and erodes easily into smooth, dark-colored slopes. Just east of the study area, south of Dagger Spring the Pioneer Formation contains an intercalated conglomerate layer which is laterally continuous with the Scanlan Conglomerate.

Yg Ruin Granite (Proterozoic)--Coarse-grained, K-spar porphyritic granite containing 1-10 mm wide anhedral to subhedral phenocrysts of white to milky quartz and plagioclase, about 5% 1-5 mm subhedral biotite, and 1-5 cm anhedral to subhedral pink megacrysts of orthoclase. Plagioclase is commonly altered to a white chalky substance. The granite is rarely resistant and forms rounded boulders, but almost everywhere it is highly fractured and erodes easily into low crumbly hills with an orange-brown color. In most areas it is covered with grass and sandy silt from a few centimeters to 1-2 meters thick. Below the grass the rock is highly weathered and crumbles easily when struck by a hammer. West of The Summit the Ruin Granite is intruded by aplite and fine-grained leucocratic muscovite granite dikes. The dikes are about one meter thick and strike parallel to the basin-bounding fault, and hence may be as young as Tertiary.