

**Geologic map of the Picketpost Mountain  
and the southern part of the Iron  
Mountain 7 1/2' Quadrangles, Pinal  
County, Arizona**

by

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## Introduction

The Picketpost Mountain and Iron Mountain 7.5' quadrangles are located east of the Phoenix metropolitan area and are within the Basin and Range physiographic and tectonic province of southwestern North America (Figure 1). Mapping represented on Plate 1 was done by the authors during the fall and winter of 1994-1995 or was derived from Peterson (1966) for Picketpost Mountain or from field sheets of the Quail Spring area provided by Steve Skotnicki and Charles Ferguson. Most map units are those used in adjacent USGS geologic maps (Peterson, 1960, 1969; Theodore and others, 1978; Creasey et al., 1983; Peterson and Jinks, 1983).

### Pre-Cenozoic rocks

The oldest rocks in the map area form a basement complex of early Proterozoic Pinal schist ( $\approx 1.7$  Ga) intruded by early to middle Proterozoic granitoids ( $\approx 1.7$ - $1.4$  Ga) (Figure 2). Unfoliated porphyritic granites are possibly related to the 1.4 Ga Ruin granite (Silver et al., 1980). These rocks are overlain by the middle Proterozoic Apache Group, which consists of siltstone, quartzite, limestone, and minor conglomerate and basalt (Wrucke, 1989). The Apache Group is intruded by the middle Proterozoic Apache diabase ( $\approx 1.1$  Ga). (The Proterozoic Troy Quartzite was not recognized in the quadrangle.) The Apache Group is depositionally overlain by Paleozoic strata that are typical of widespread Paleozoic strata in east-central Arizona. Conglomerate that locally forms the base of the Cambrian Bolsa Quartzite rests depositionally on Apache diabase in upper Roblas Canyon. Paleozoic strata include units as young as the Mississippian Escabrosa Limestone. There are no known rocks younger than Mississippian and older than middle Tertiary in the map area except for a small exposure of a Laramide granitoid just north of Picketpost Mountain that was dated by Balla (1972).

### Tertiary rocks and faulting

Little evidence of Mesozoic or early Cenozoic deformation or magmatism was recognized in the map area. Widespread Oligo-Miocene extensional faulting began in an area of gently dipping to flat lying, largely unfaulted Paleozoic and middle Proterozoic strata. Restoration of a cross section across the middle of the map area and extending eastward into the adjacent Superior Quadrangle (cross section A-A' on Plate 1, azimuth  $106^\circ$ ; Superior Quadrangle data from Peterson, 1969) indicates that an area now 10.3 km across was initially  $5.2 \pm 1.0$  km wide (Figure 3). The west-dipping Concentrator fault (Peterson, 1969) and the herein named, southwest-dipping Roblas Canyon fault (Plate 1) accommodated virtually all of the extension. These faults are part of a normal fault system that extends southward across the Teapot Mountain Quadrangle (Creasey et al., 1983; Dickinson, 1995) to connect with the Ripsey fault that is related to a southwest-dipping normal fault system in the San Pedro Valley (Dickinson, 1991). Pre-Tertiary basement, the basal conglomerate, and local, overlying basalt are all overlain by a widespread and commonly thick sequence of tuffs and lava flows. Normal faulting and tilting ended after volcanism and during deposition of conglomerate and sandstone (unit Tcg).

Apache group rocks are shattered in the Millsite-Hewett canyon area. In many fault blocks, particularly in lower Millsite canyon, it is difficult to determine if Apache Group outcrops are rock avalanche deposits that preserve the stratigraphy, or are shattered, but essentially in place. In several fault blocks (e.g. just northeast of Quail Spring) the section appears to have been attenuated by deformation associated with the brecciation and shattering. Field and map relations suggest that the shattering is related to distributed brittle deformation. The strain significance of this deformation is uncertain.

Bedding in basal Tertiary strata in the Hewett-Millsite canyon area is generally concordant with Mescal Limestone and Apache diabase, which underlie the Tertiary strata throughout this area. Faults cutting the tilted strata appear to lose displacement upward into the felsic volcanic rocks, and the ridge-capping lava flows do not appear to be tilted as steeply as underlying units. These relationships suggest that some tilting occurred during eruption of the felsic volcanic rocks.

Pre-Apache group structure in the Pinal Schist was not studied in detail. Northeast of the Roblas Canyon fault, the schist consists mostly of pelitic schist. The oldest foliation recognized in the schist along a traverse northeast from the Roblas Canyon Fault is compositional banding, which reflects a combination of metamorphic differentiation and original bedding. This fabric is strongly folded and cre-nulated and a generally N to NW-trending, east dipping  $S_2$  cleavage is axial planar to the folds. In high-strain zones,  $S_2$  develops into a differentiated foliation very much like  $S_1$ . Near Reevis Trail Canyon,  $S_2$  becomes penetrative and dips gently to moderately SW.

Southwest of the Roblas Canyon fault, the Pinal Schist grades from pelite to mostly psammite from north to south along lower Hewett Canyon. Psammite along Quail Creek is characterized by complex small-scale refolded folds in a compositional layering that appears to be original bedding. Northeast-trending upright folds with a moderately to steeply SE-dipping axial surface cleavage become progressively tighter to the SE towards a steep, NE-trending high-strain zone containing unusual calcsilicate and phyllitic schist. Within and adjacent to this zone, fabric in the psammitic schist is relatively planar and only one generation of fabric can generally be observed due to complete transposition of older fabric. South of the high-strain zone, the Pinal schist consists of mixed psammite and pelite. Fabric is generally steep and ENE-trending, but zones of folded schist with polyphase fabrics are common. Axial surface cleavages to folds in the dominant compositional layering in the southern part of the map area generally strike N to NNE and dip moderately to the west.

### Mineral deposits

Small magnetite skarn deposits are common where Apache diabase intrudes Mescal Limestone. Apache diabase locally intrudes along small-displacement faults that cut Apache Group strata, and local mineralization along these faults may be related to diabase intrusion. A mineral deposit along one northwest striking fault in Whitford Canyon, adjacent to the stream bed, contains massive cuprite mantled by malachite (R. Bideaux, written communication, 1995).

An alteration zone is mapped on Plate 1 around the Reevis Trail pluton in the NE part of the map area. Close to the pluton, Pinal Schist is silicified and iron stained such that the metamorphic fabrics in the schist are obliterated, and the rock is a gray, iron-stained hornfels. Further from the pluton, the schist is less silicified, and retains its original fabric, but the rock is abundantly iron stained and more fractured that is typical in unaltered rock. One small bulldozer cut was made into a small, SE dipping fault zone with minor copper oxide mineralization (NE 1/4, NE 1/4, sec. 8, T. 1 S., R. 12 E.). No other copper mineralization was observed.

A zone of abundant quartz veining and iron staining is also present on the south side of the YXgd unit in southeast part of map (SE sec. 17 and SW sec. 16, T. 2 S., R. 11 E.). Some oxidized pyrite was observed in Pinal Schist in this area.

A number of prospects were observed near contact of the coarse hornblendite (YXh) in the south central part of the map area. Mineralization in these consists of quartz-sericite and black earthy iron-manganese oxides along brittle shear zones. The mineralized rock in some prospects is brecciated and recemented with silica and hematite. Quartz crystals and rare specular hematite line some open spaces in these breccias. Traces of copper oxide minerals are present in several of the prospects.

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## MAP UNITS

### Upper Cenozoic deposits

- d **Disturbed ground (Holocene)**--Unconsolidated surficial deposits consisting of mine waste and land fill produced by human activity.
- Qs **Undivided surficial deposits (Quaternary)**--Slightly to moderately consolidated alluvial deposits forming dissected and undissected surfaces, and unconsolidated sand and gravel in washes and streambeds.
- Qtc **Talus and colluvium (Quaternary)**--unconsolidated sediment on hillsides.
- Qal **Unconsolidated alluvium (Quaternary)**--Unconsolidated sand and gravel in unvegetated or sparsely vegetated active stream channels and forming vegetated flats up to 2 m above adjacent stream channels.
- Qoa **Old alluvium (Quaternary)**--Weakly consolidated cobble to boulder conglomerate capped by surfaces generally 2-5 m above active stream channels. Geomorphic surface on deposit is generally well preserved.
- Qls **Active landslide deposits (Quaternary)**--Unconsolidated massive boulder conglomerate produced by landsliding. Landslides mapped as Quaternary are those with visible scarps in the headwall of the landslide.
- QTls **Older landslide deposits (Quaternary or Tertiary)**--similar to Qls, but scarps in headwall of the landslide are degraded and revegetated. Typically these are much larger landslides that Qls deposits, involving entire mountain sides, particularly in upper Reevis Trail Canyon.
- QTs **Older alluvium. (early Quaternary to late Tertiary)** Coarse, gravel and generally subrounded cobbles to boulders, with minor amounts of finer-grained material, that form deeply (5-10 m) incised surfaces near major drainages).

### Middle Tertiary rocks

- Tcg **Conglomerate (middle Tertiary)**--Coarse, gravel and generally subrounded cobbles to boulders, with minor amounts of finer-grained material, that form deeply (5-10 m) incised surfaces near major drainages). Clasts consist of Pinal Schist, granitoids, Apache Group, Paleozoic carbonate and clastic strata, and Tertiary volcanic rocks. Intra-unit dash-dot contact at east edge of southern part of map area marks base of conglomerate that is similar to Tcg, elsewhere but contains conspicuously more detritus derived from the Apache Group, principally Dripping Spring Quartzite, which gives slopes on the unit a tan color as opposed to the gray color typical of Tcg.

- Tss Sandstone (middle Tertiary)**--Tan to pale brown, poorly sorted and poorly bedded medium to fine grained sandstone that grades stratigraphically upward into conglomerate of map unit Tcg. Contact placed at base of area where conglomerate constitutes greater than 50 % of outcrop.
- Tb Basalt (middle Tertiary)**--Basalt lava flows and flow breccias near Queen Creek in southern part of map area.
- Tvx Volcanogenic breccia (middle Tertiary)**--Described by Peterson (1966) as "angular blocks and fragments of tuff and other lithic material such as diabase, rhyolite, and schist in a heterogeneous pyroclastic matrix. The breccia forms a steep dike that has intruded along the contact between tuff and rhyolite and cuts across tuff beds at nearly right angles." Exposed only on the north flank of Picketpost Mountain.
- Tql Quartz latite (middle Tertiary)**--Described by Peterson (1966) as lava flows and shallow vent-filling intrusion that forms the top of Picketpost Mountain and a small plug on the northwest flank. Quartz latite is flow banded to brecciated and contains 25 to 30% phenocrysts of plagioclase, quartz, biotite, sanidine, and minor hornblende. (See Peterson [1966] for detailed description). Biotite from this unit yielded a K-Ar date of  $18.4 \pm 0.5$  Ma (Shafiqullah et al., 1980).
- Tp Perlitic aphyric rhyolite (middle Tertiary)**--Pale gray, glassy, aphyric rhyolite, tan weathering, with spheroidal weathering texture that probably reflects devitrification. Layered character on weathered surfaces and parallel fractures on fresh surfaces vary from planar to convoluted and may be disrupted by what appears to be flow brecciation. Layering and parallel fractures are inferred to reflect flow of lava.
- Tal Apache Leap tuff (Miocene)**--Massive, moderately to strongly welded crystal-rich ash-flow tuff. Crystals of biotite, plagioclase, quartz and minor sanidine. Fiamme are typically obscure except near the base of the unit. Pink gray color. Densely welded vitrophyre locally present at base. Overlies lavas of unit Tf, Apache Group, and Pinal schist on a surface with significant (10's of m) topographic relief and even greater structural relief.
- Tr Spherulitic rhyolite (middle Tertiary)**--light gray weathering, crystal-poor rhyolite(?), with very well developed flow banding, and abundant gas cavities and spherulitic devitrification. Typically caps volcanic sequence in the Millsite-Hewett canyon area. Relationship to Apache Leap tuff unknown
- Tt Tuff (middle Tertiary)**--Massive and bedded tuff that may contain phenocrysts of biotite, quartz, sanidine, and hornblende and variable amounts of volcanic lithic fragments. Locally spheroidal weathering and typically weathers to tan to orangish brown color. Tuff in central part of map area that underlies aphyric perlitic rhyolite contains up to 40% lithic fragments that include Pinal Schist and quartzose sandstone.
- Tf Felsic volcanic rocks, undivided (middle Tertiary)**--Massive and flow banded, aphyric to porphyritic rhyolite to, possibly, dacite lavas. Variable phenocryst content of porphyritic varieties commonly includes biotite and sanidine. Vitrophyre present locally and brecciated character in some areas may be product of devitrification. Unit locally includes interbedded tuffaceous rocks. The unit was not studied in detail. It appears to consist of several thick, but not widely distributed lava flows with associated auto breccia and block and ash deposits.
- Tfp Crystal poor felsic volcanic rocks (middle Tertiary)**--strong flow banding, with very few phenocrysts



- Tfa **Andesitic volcanic rocks (middle Tertiary)**--dark red brown lavas with plagioclase, biotite and pyroxene crystals; commonly flow banded.
- Tbl **Lower basalt (middle Tertiary)**--Basaltic flows and flow breccias with 1-3% 1-3mm pits containing iron oxides that probably represent relict olivine, and 1% 2-4 mm dark green clinopyroxene(?). Aphyric vesicular basalt at east edge of map rests concordantly on Mescal Limestone and is possibly, but not likely, middle Proterozoic.
- Tx **Rock avalanche or talus breccia (middle Tertiary)**--Clast supported monolithologic breccia with subangular clasts up to 50 cm diameter, exposed west of Quail Spring at west edge of quadrangle. Breccia consists of a lower unit of quartzite clasts and an upper unit of diabase clasts.
- Tw **Whitetail conglomerate**--Poorly sorted, crudely bedded to massive conglomerate containing subrounded to subangular clasts up to 40 cm diameter of Apache Group rocks and Paleozoic carbonates and quartzites. Reddish brown sandy matrix is poorly cemented.
- Tdf **Felsic dikes (middle or early Tertiary or Cretaceous)**
- Tda **Aphanitic felsic to intermediate dikes (middle Tertiary)**
- Tdb **Basaltic dikes (middle Tertiary)**
- Tg **Granite (middle Tertiary)**--Identified as the Wood Camp Canyon aplitic granite by Shafiqullah et al. (1980) who derived a K-Ar biotite date of  $18.35 \pm 0.4$  Ma from this unit.
- Tgx **Intrusive breccia (middle Tertiary)**

### Cretaceous rocks

- Kd **Quartz diorite (Latest Cretaceous)**--Quartz diorite of Arnett Creek identified by Balla (1972) and dated at  $73.5 \pm 2.3$  Ma by K-Ar on biotite (Balla, 1972).

### Paleozoic rocks

- Me **Escabrosa Limestone (Mississippian)**--Bluff forming, resistant, thick bedded to massive dolomitic limestone and limestone. Lower part is dolomitic, grades upward into pale gray to bluish gray, slightly cherty limestone with small crinoid columnals.
- Dm **Martin Limestone (Devonian)**--West of peak 3013 on the east side of Roblas Canyon, Martin Limestone consists, in ascending order, of (1) 2-4 m of tan dolomite, (2) several meters of gray petroliferous limestone, (3) approximately 10-15 m of light gray, slightly cherty limestone, (4) 2-3 m of tan dolomite, (5) 2-4 m thick graded sandstone bed with very well rounded quartz grains, coarse at base and fine at top, (6) well bedded, fossiliferous gray limestone containing crinoids, shells, and coral, grades over 20 to 30 m into thick bedded limestone. Some coral forms 1 cm diameter cylinders with well defined longitudinal ridges, 1-2 mm thick, on outside and inside of cylinders. Inside ridges may be relicts of radial septa. Some cylinders are in clusters.
- Cb **Bolsa Quartzite (Cambrian)**--Coarse to fine grained to locally silty, well-bedded, blocky weathering, typically cross bedded quartzite. Color is dark and light brown to dark brownish red to orangish

tan, and color banding is typical. Degree of sorting varies greatly. Some beds that contain coarse grains are so poorly sorted they are best described as grit. Crossbeds are common, range from a few cm to perhaps 50 cm thick, and locally contain very coarse (up to 8mm) quartz grains and sparse, 2-4 mm pink potassium(?) feldspar grains. In general, at lower stratigraphic levels the Bolsa Quartzite is darker colored, with chocolate brown the darkest color, and contains locally abundant magnetite laminations and local dark lithic fragments probably derived from Apache diabase. Abundant magnetite was probably derived from erosion of Apache diabase, and the dark colors are attributed to magnetite and iron oxides derived from magnetite and perhaps from lithic fragments of Apache diabase. Much of the Bolsa Quartzite contains tan, medium to coarse quartz-rich sandstone massive or crudely graded beds interbedded with medium to fine grained, cross bedded and plane bedded sandstone with dark tan to brown laminations. Upper Bolsa Quartzite tan to light gray to pinkish light gray, medium to fine grained to locally coarse grained orthoquartzite without dark laminations.

A boulder conglomerate deposited on Apache diabase is exposed at the base of the Bolsa Quartzite on both sides of the stream bed in Roblas Canyon just west of peak 2998. Boulder bed is up to >5 m thick, is overlain by a 3 m cobble and pebble bed that is in turn overlain by sandstone. Subrounded boulders consist almost entirely of quartzose sandstone, with rare clasts of diabase (one seen), rhyolitic metavolcanic(?) rocks (one seen), basalt (several), and possible magnetite skarn. Associated sandstone is chocolate brown with abundant magnetite laminations.

A very localized, 90° unconformity within lowermost Bolsa Quartzite, placing brown sandstone over cobble conglomerate and sandstone, probably reflects caving of the bank of a stream channel. Cobbles consist of quartzite, vein quartz, and sparse felsic volcanic rocks, and associated sandstone is quartz poor with much feldspar and magnetite. Conglomerate below unconformity strikes N60°W, dips 80°NE. This unconformity is located in upper Roblas Canyon about 420m N59°W from peak 3013.

## Middle Proterozoic rocks of the Apache Group and associated diabase

- Yd Diabase (middle Proterozoic)**--Abundant 1-3mm plagioclase crystals in black groundmass. Locally crude layering is defined by variation in ratio of plagioclase to groundmass and in size of plagioclase crystals. Generally is highly fractured and typically forms fragments less than 20 cm diameter. In many areas is deeply weathered to form a characteristic red-brown granular soil with no exposed rock.
- Ym Mescal Limestone (middle Proterozoic)**--Massive to wavy laminated, light gray limestone.
- Yds Dripping Spring Quartzite, undivided (middle Proterozoic)**
- Ydsu Dripping Spring Quartzite, upper unit (middle Proterozoic)**--Reddish brown to brownish red, thin bedded to laminated siltstone and very fine grained sandstone that readily parts along bedding planes. Locally the middle part is a black, laminated argillite. Some red-brown units contain 1-2 cm diameter light tan or gray reduction spots, similar to those in the Pioneer Formation, but in the upper Dripping Spring, the spots tend to be larger in diameter and less abundant than in the Pioneer.
- Ydsl Dripping Spring Quartzite, lower unit (middle Proterozoic)**--Tan to pink medium to thin bedded feldspathic quartz arenite or feldspathic quartzite. Low- to moderate-angle trough cross beds are common. Ranges from coarse- to fine-grained, forming a fining upward sequence. In western ex-

posures (west of Hewett Canyon) basal 5-10 meters consists of pale orange, medium to coarse grained, well bedded, partially cross bedded (10-40 cm thick cross bedded beds) quartzose sandstone with sparse, typically isolated quartzite pebbles and cobbles up to 5 cm diameter. Local pebble beds contain subrounded to rounded clasts of bull quartz, tan to brown quartzite, red jasper(?), and, possibly, brown silicic metavolcanic rocks. Prominent bluffs form top of this unit in Whitford Canyon. Barnes conglomerate; typically shattered in Millsite-Hewett canyon area

- Yp Pioneer Shale (middle Proterozoic)**--Reddish brown to purple siltstone and fine grained sandstone with basal Scanlon conglomerate that is 20 to 200 cm thick and consists of clasts of underlying Pinal Schist. Ubiquitous, light gray circular or elliptical reduction spots, generally less than 1 cm in diameter, distinguish sandy parts of the Pioneer from the upper Dripping Spring Quartzite.
- Ypt Tuff in Pioneer Formation (middle Proterozoic)**--Pale tan to pale gray, hard, massive, very fine grained siliceous hornfels. Contains sparse 1-2mm feldspar phenocrysts. This resistant unit forms a prominent ledge in outcrop where it is present. The bed is 2-5 m thick in the Whitford Canyon area, thinner or absent in the western part of the map area.

### Early to middle Proterozoic plutonic and metamorphic rocks

- Yg Ruin granite (middle Proterozoic)**
- YXg Granite (early or middle Proterozoic)**--Equigranular, unfoliated, medium to fine grained granite or granodiorite with local marginal aplitic zones. Generally contains 7-10% mica, including both biotite and muscovite, but their relative abundance varies greatly. More muscovite-rich granite, common south of Queen Creek, appears to have assimilated more Pinal Schist and is generally associated with gradational assimilation zones and broader contact aureoles. The northeast-trending elongate body in the northeast part of the map area generally has sharp contact with a few screens of schist near the contact, and no apparent contact metamorphic aureole. The granite near the contacts in this pluton is slightly foliated.
- YXgd Granodiorite (early or middle Proterozoic)**--Similar to YXg, but contains more abundant biotite and has slightly darker color index.
- YXd Diorite (early or middle Proterozoic)**--Fine to medium grained dark gray equigranular diorite, composed of hornblende or pyroxene and plagioclase.
- YXh Hornblendite (early or middle Proterozoic)**--fine to coarse grained hornblendite, consisting of 70-90% hornblende with anhedral plagioclase, and common secondary(?) epidote. Rock is black.
- YXgm Mixed schist and granite (early or middle Proterozoic)**--YXg or YXgd with abundant screens and pendants of Pinal Schist.
- Xp Pinal Schist, undivided (early Proterozoic)**--Dominantly phyllitic schist in northern areas and dominantly psammitic schist in southern exposures. Metamorphic grade appears to be higher in northern areas where metamorphic very fine grained to microcrystalline phyllosilicates impart a reflective sheen and schistosity to phyllitic rocks, whereas phyllitic schist in southern areas is only slightly higher grade than a slate.

Northern exposures generally consist of bluish gray, fine grained, phyllosilicate-rich schist with numerous, variably folded hydrothermal quartz stringers. Foliation is defined by compositional layering, phyllosilicate orientation, and quartz segregations. Quartz stringers are commonly irregu-

lar but are commonly approximately parallel to fabric defined by phyllosilicate orientation. Thickened quartz fold hinges locally form rods visible on foliation surfaces and may be parallel to crenulation fold axes. Randomly orientated, 0.5-2 cm long blades of unidentified dark minerals or mineraloids are pseudomorphs possibly produced by retrograde metamorphism of post-deformation andalusite. Weak lineation is in some areas an intersection lineation between dominant  $S_1$  foliation and axial planes of overprinting crenulation, and in other areas by the hinges of isoclinal folds and collinear mineral lineation that appear to be associated with  $S_1$  fabric generation.

Southern exposures generally consist of medium to fine grained, psammitic schist in which bedding is locally visible. Sand grains consist primarily of quartz with sparse to very sparse lithic fragments. Protolith is inferred to be thin bedded, quartz rich siltstone to medium grained sandstone.

- Xps **Pelitic schist (early Proterozoic)**
- Xpm **Psammite facies (early Proterozoic)**
- Xpc **Calc-silicate facies (early Proterozoic)**
- Xpcs **Calc-silicate and schist facies (early Proterozoic)**
- Xpq **Quartzite layers (early Proterozoic)**
- Xpp **Pinal Schist, phyllite facies (early Proterozoic)**--Platy, gray to silvery gray, slightly schistose phyllite.

01

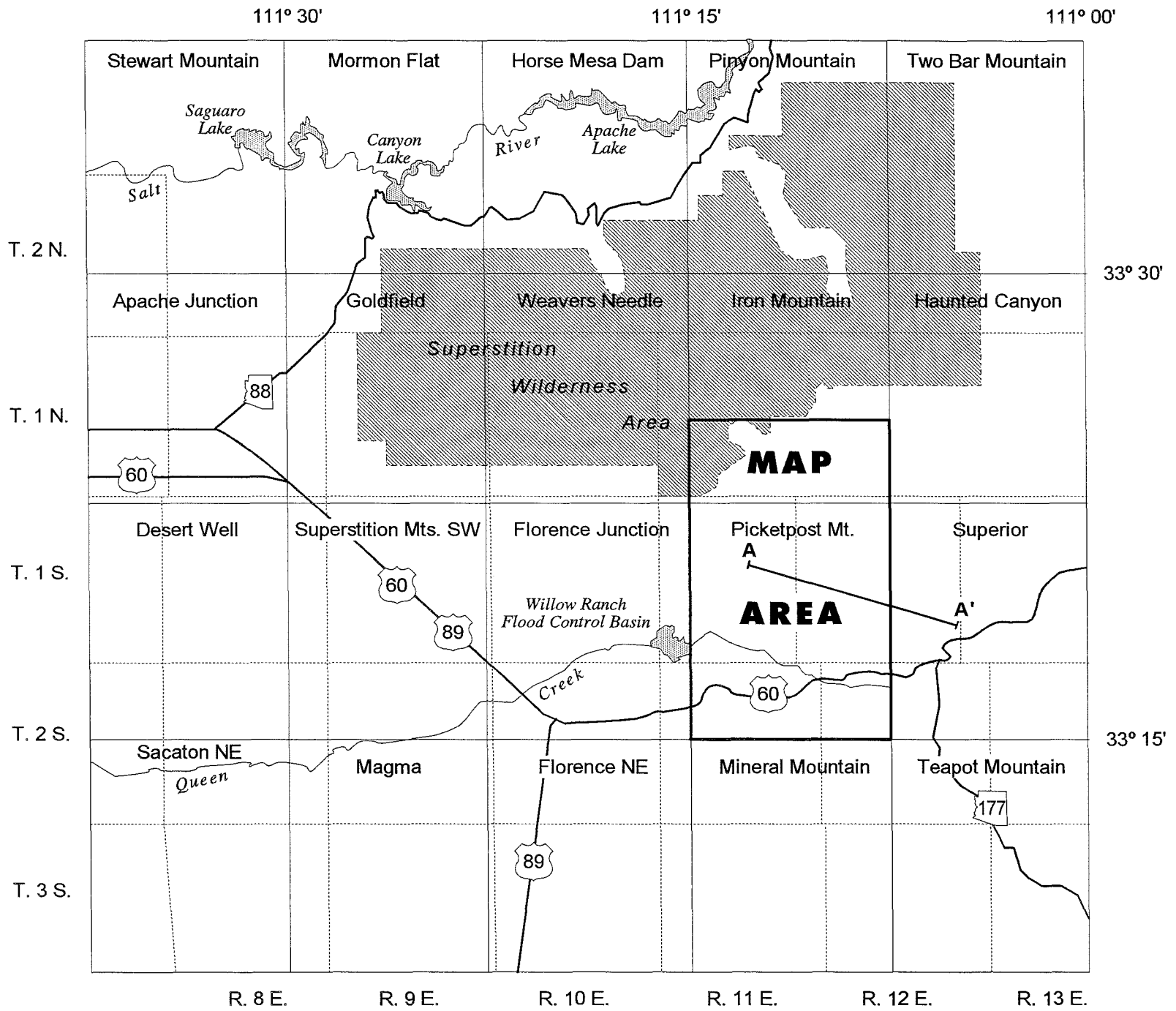


Figure 1

# Picketpost Mountain quadrangle STRATIGRAPHIC CORRELATION DIAGRAM (Tertiary dikes not shown)

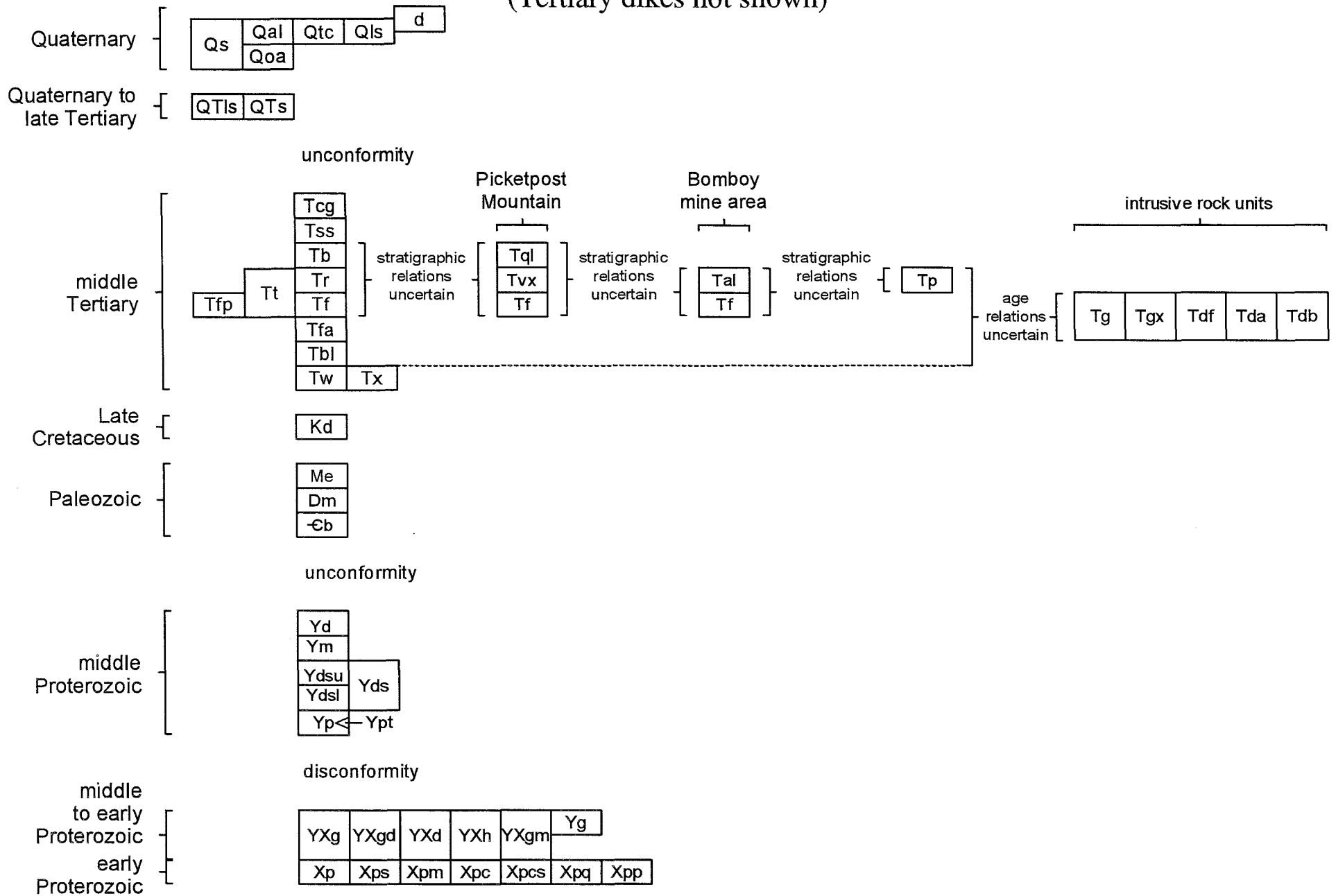


Figure 2

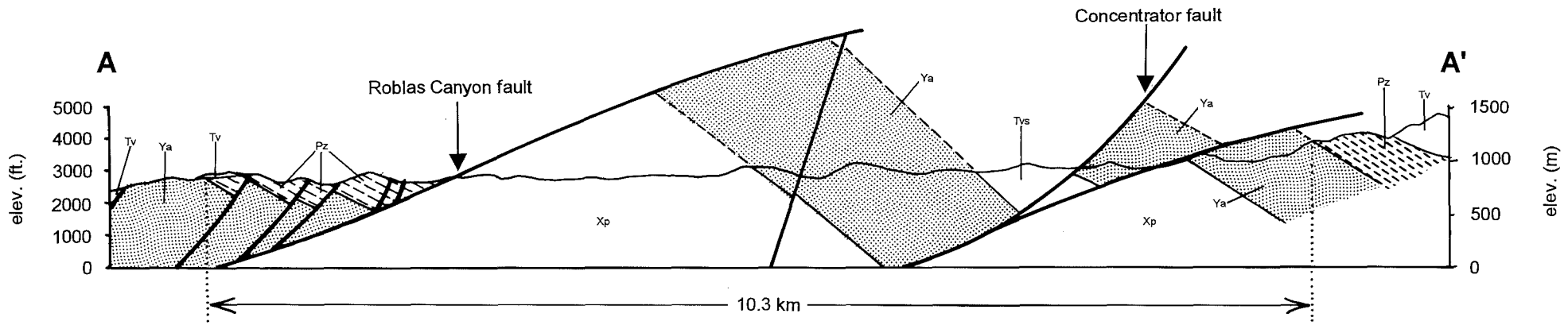


Figure 3

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