

# **GEOLOGY OF THE HORSE MESA DAM QUADRANGLE, MARICOPA AND GILA COUNTIES, ARIZONA**

by

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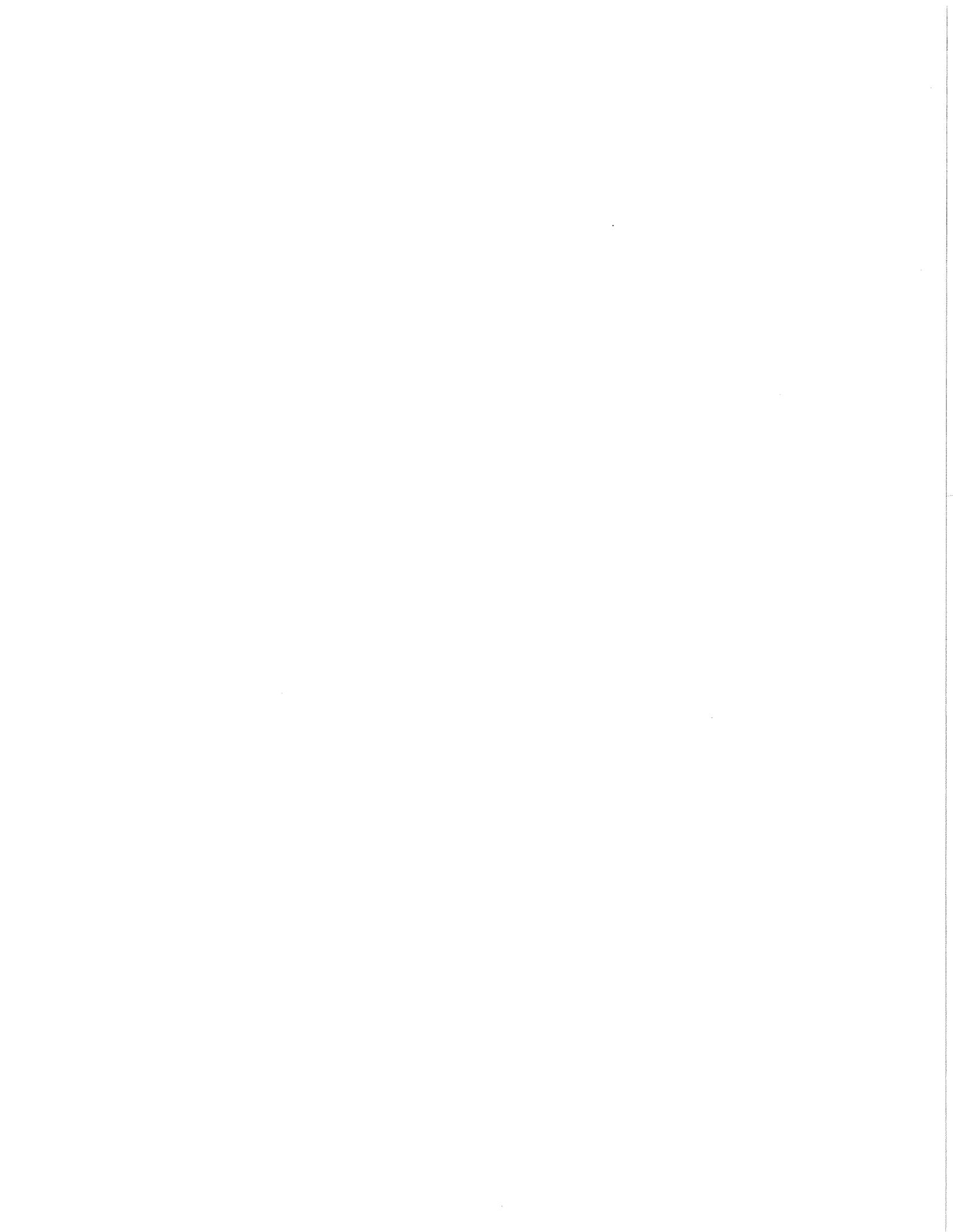
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Includes 14 page text, 1:24,000 scale geologic map,  
cross-sections (3 sheets).

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## INTRODUCTION

The geologic map described in this study covers the Horse Mesa Dam Quadrangle (1:24,000) (Figure 1) (Sheets I-III). The area encompasses part of the northern Superstition Mountains and southern Mazatzal Mountains. Bedrock in this area consists largely of Proterozoic granitic and metamorphic rocks overlain by a thick sequence of early Miocene volcanic rocks. The study is one of a series of related geologic maps from the Arizona Geological Survey that cover the Superstition volcanic field and adjacent areas (Ferguson and Gilbert, 1997; Ferguson and Skotnicki, 1995; Skotnicki and Ferguson, 1995, 1996; Skotnicki and Leighty, 1997; Spencer and Richard, 1995).

The rugged physiography of the area is dominated by drainages of the Salt River Canyon that crosses the north part of the map and is partially filled by Apache Lake. The Apache Trail (Arizona Highway 88) crosses the southern part of the map. The northwest part of the map was reached from Tonto National Forest road FR 401, which ends approximately one kilometer northwest from the northwest corner of the quadrangle.

The study area, together with the adjacent Mormon Flat Dam Quadrangle (Ferguson and Gilbert, 1997) (Figure 1), was mapped at a scale of 1:24,000 by the authors during the fall, winter, and spring of 1996-97. In the Horse Mesa Dam Quadrangle mapping was conducted by foot traverses from the Apache Trail, the Horse Mesa Dam road, and Apache Lake. Local inaccessible areas in the southwest and southeast part of the map were mapped from aerial photographs.

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## PREVIOUS INVESTIGATIONS

Reconnaissance geologic maps that cover parts of the Horse Mesa Dam quadrangle include a study of the Salt River Canyon area by Scarborough (1981a,b) and Peterson and others (1983). These maps and accompanying reports are a useful introduction to the geologic structure and stratigraphy of the area. More detailed geologic mapping by students at Arizona State University include studies of the Fish Creek and Horse Mesa areas by Malone (1972) and Isagholian (1983). Suneson (1976) also mapped the northern and northwestern part of the quadrangle in his study of the northern part of the Superstition volcanic field. Geologic road guides along the Apache Trail by Sheridan (1978, 1987) cover local areas in the west-central part of the quadrangle. A stratigraphic and sedimentological study by Rettenmaier (1984) of the mid-Miocene conglomerate and sedimentary breccia that overlies the Superstition volcanics covers much of the west-central part of the map area.

## SUMMARY OF GEOLOGY

### Stratigraphy

The oldest rocks exposed in the Horse Mesa Dam quadrangle are Early or Middle Proterozoic metavolcanic and metasedimentary rocks (Xv, Xvs, Xva, Xc, Xr, Xt, Xm) exposed of in the northern part of the quadrangle (Sheets I and II). There is a sharp contrast in the intensity of tectonic fabric development between the metavolcanics and metaconglomerate in Ash Creek which is probably due to relative strengths of the two lithologies. The metaconglomerate unit displays consistent south-side-up facing directions (from cross-stratification). The volcanic succession that overlies the conglomerate may therefore be significantly younger, and for this reason, two large zircon geochronology samples were collected and put into storage at the University of Arizona geochronology lab. The basal contact of the conglomerate unit is very sharp, and the contrast in lithology so dramatic that it may represent an unconformity. The metasedimentary and metavolcanic rocks are apparently intruded by foliated, porphyritic granite (XYg). No unequivocal intrusive contact was observed between the two rocks in the study area, but the fact that enclaves of argillaceous schist occur within foliated granite suggest the granite is younger. This granite is undated, but is compositionally similar to the non-foliated granite (Yg) exposed in the eastern part of the map. Just east of the Horse Mesa Dam Quadrangle, this non-foliated granite yielded fission-track and Rb-Sr ages of 1,390 $\pm$ 40 and 1395 $\pm$ 45 m.y., respectively (Stuckless and Naeser, 1972).

Numerous, often confusing, stratigraphic names have been applied to the Tertiary rocks of the Superstition Mountains/Goldfield Mountains area (Trapp, 1996). With few exceptions, we have endeavored to identify rock units solely on the basis of lithologic criteria.

The most volumetrically significant rocks in the Horse Mesa Dam Quadrangle are mid-Tertiary volcanic rocks of the Superstition-Superior volcanic field (Sheets I and II). The oldest of these volcanic rocks are lava flows of basalt, andesite, dacite, and rhyodacite (Tb, Tbs, Td, Tdb, Tdt, Tdp) and these overlie or are interbedded with nonvolcaniclastic sedimentary rocks (Tc) along Apache Lake, particularly near the mouth of Ash Creek. In the eastern part of Horse Mesa these rocks are approximately 2000 feet thick. The thick sequence of dacite breccia (Tdb) in this area suggest that a dacitic volcanic highland was once present immediately south of the Horse Mesa area. A K/Ar whole rock date of 21.40  $\pm$  0.50 Ma (Sheet 1, this report; Scarbrough, 1981) was obtained from a basaltic lava in the eastern part of the quadrangle, which is the oldest volcanic rock in this area.

The Tc unit is a nonvolcaniclastic conglomerate which occurs both at the base of the Tertiary section and interbedded with basalt and dacite lava. The conglomerate represents a pre-volcanic (probable Whitetail Conglomerate equivalent) fluvial system which continued deposition during initial stages of Miocene volcanism.

Overlying and intruding the basaltic and dacitic rocks are a complex series of rhyodacite and

rhyolitic lavas (Trda, Tr, Trx, Trp, Tra, Tri, Tw, Twb) and tuffaceous rocks (Tt, Tts) that represent interfingering rhyolite domes and associated pyroclastic rocks (Plates I and II) that erupted prior to eruption of the Superstition Tuff and subsidence of the Superstition Cauldron. Although tuffaceous units (Tt, Tts) are found in the northeast part of the map, rhyolite lava units are not present there, indicating that rhyolitic volcanic vents are also absent in this area.

The youngest ash-flow tuff unit north of Apache Lake in the Horse Mesa Dam Quadrangle, the Superstition Tuff (Ts), is a remnant of a regional ash-flow unit that erupted from the Superstition Cauldron about 10 km to the south (Sheridan and others, 1970; Stuckless and Sheridan, 1971; Peterson and others, 1983; Ferguson and Skotnicki, 1995; and Skotnicki and Ferguson, 1995; Ferguson and Gilbert, 1997).

The northern margin of the Superstition Cauldron is well exposed just to the west in the southeast corner of the Mormon Flat Dam Quadrangle (Ferguson and Gilbert, 1997). The margin strikes east-west across LaBarge and Boulder canyons and is buried/intruded by the large crystal-rich quartz latite dome complex (Tq, Tqb, Tqv) which covers the southwest corner of this map area (see Sheet 2). The cauldron margin is also concealed in the south-central part of the map area by the volcanoclastic unit (Tcv) which overlaps all known volcanic rocks. The easterly continuation of the margin is only broadly constrained to be between the southernmost exposures of the pre-caldera basalt and dacite lavas along Lewis and Pranty Creek and the northernmost exposure of intracauldron Superstition Tuff along the northeast edge of the southerly adjacent Weavers Needle quadrangle (see Peterson and others, 1983). The intervening area forms a large massif consisting of crystal-poor rhyolite lavas and associated tuffs (Trf, Ttf) whose age relationship to Superstition Tuff is not known. The rhyolites overlie a prominent, south-dipping, slightly discordant unconformity above pre-caldera dacite and basalt lava. The unconformity is mantled by a volcanic/sedimentary tuff, breccia, and conglomerate unit (Tcx) that contains clasts of older volcanics, chiefly dacite lava, but also clasts of rhyolite lava. The unconformity may represent the south-facing topographic scarp of the Superstition Cauldron margin. If so, the south-dipping tuffs, breccias, and conglomerates (Tcx) would be cauldron margin related breccias, and the rhyolite lavas would constitute a large post-caldera dome complex similar to the crystal-rich dome complex (Tq) in the southwest corner of the map area. The rhyolite lavas in question (Trf) are lithologically identical to the pre-cauldron rhyolite lava (Trp) in the northern and central part of the quadrangle. Along the south edge of the map area in the bottom of Fish Creek Canyon the rhyolites (Trf) overlie a crystal-rich lava (Trda) that is identical to the rhyodacite of Apache Gap, the next oldest unit that would be expected in the pre-caldera sequence. So, alternatively, the rhyolite lava (Trf) in the southeast part of the quadrangle may be pre-caldera in age and these rocks may simply unconformably overlie an eroded dacite-basalt volcanic highland. In this case, the cauldron margin would be buried beneath the Tcv and Tq units to the west and the Fish Creek Peak massif rhyolites (Trf) would be outside the cauldron. This problem will hopefully be resolved by a combination of detailed mapping of where these equivocal lavas (Trf) come into contact with intracauldron Superstition Tuff (Dogie Spring member of Stuckless and Sheridan, 1971) to the south, and

by precise  $^{40}\text{Ar}/^{39}\text{Ar}$  geochronology of the relevant units.

The youngest mid-Tertiary rocks in the Horse Mesa Dam Quadrangle are the volcanoclastic epiclastic rocks (Tcv) that form a band up to 2.0 km wide in the southwest part of the quadrangle (Sheet I). These rocks are largely debris-flows shed into a fluvial basin that once probably drained to the northwest.

The coarse-grained, weakly indurated clastic sediments (Tsy) that cap ridges in the northwest part of the quadrangle are part of more extensive exposures of these deposits to the west (Ferguson and Gilbert, 1997). These sediments probably filled a Tertiary basin that is now being incised by modern drainages.

### Structure

Volcanic units in the Horse Mesa Dam Quadrangle are generally gently dipping and reflect weak, if any, folding (Sheets I and III). Two broad WNW-ESE-trending synclines, however, can be mapped in the Goat Mountain-Painted Cliffs area and in the area underlain by volcanoclastic debris flow material (Tcv).

Numerous northwest- and west-northwest-striking, commonly high-angle faults cut mid-Tertiary units. Whereas some of these faults cut the youngest exposed mid-Tertiary units, many are overlain by mid-Tertiary layered units, indicating that much of the faulting in the quadrangle was synvolcanic. Fault separations range from a few to hundreds of meters. With the exception of the prominent fault exposed along the north side of Apache lake, and the fault which bounds the southwest edge of the volcanoclastic basin near Mesquite Flat which display south-side down separation, the general displacement of faults in the quadrangle is southwest-side-down.

Sheridan and others (1970), Stuckless and Sheridan (1971), and Sheridan (1978) identified several cauldrons within the Superstition-Superior volcanic field, including the Tortillia Cauldron that covered part of the southwest part of the Horse Mesa Quadrangle. Structures that suggest the presence of such a cauldron, however, were not mapped in the quadrangle. Isagholian (1983) also shows little or no evidence of this cauldron on his cross-sections of the Fish Creek Canyon area.

The easterly continuation of the Superstition Cauldron margin as mapped by Ferguson and Skotnicki (1995), Skotnicki and Ferguson (1995), and Ferguson and Gilbert (1997) lies beneath the extensive quartz latite dome complex (Tq, Tqb, Tqv) in the southwest part of the map. The authors tentatively project this cauldron margin eastward along the southern margin of the basin exposing unit Tcv, although, as discussed above, the margin may, instead, extend along the prominent angular unconformity that forms the south side of Lewis and Pranty Creek valley. The broad, arcuate change of fault strikes from NNW-striking in the southern part of the quadrangle to WNW- and E-W-striking in the central and northern part of the quadrangle (Plate I) mimics the arcuate trace of the cauldron margin.

## ACKNOWLEDGEMENTS

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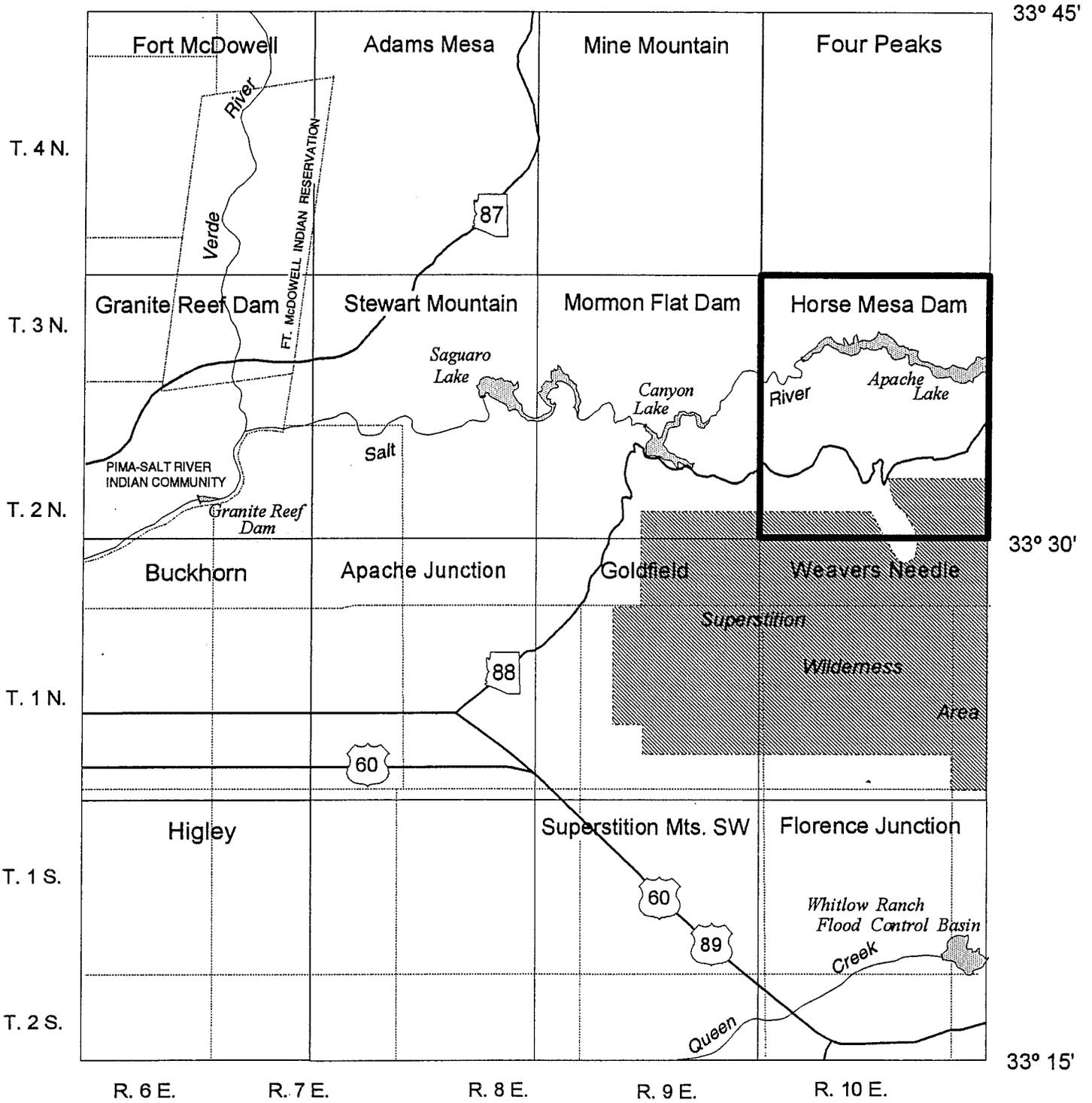
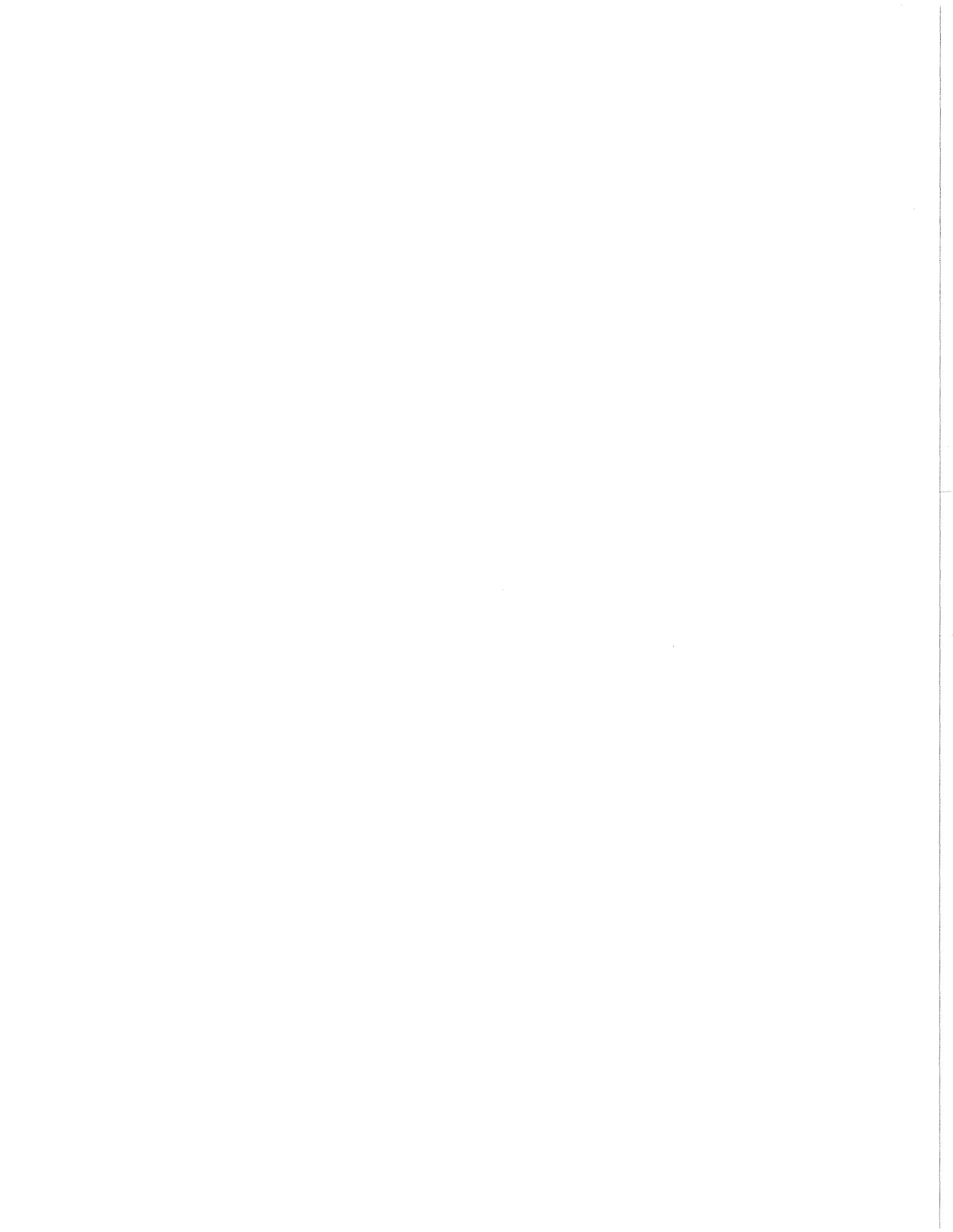


Figure 1 location of the study area.



**UNIT DESCRIPTIONS  
HORSE MESA DAM QUADRANGLE  
MARICOPA AND GILA COUNTIES, ARIZONA**

by  
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JULY, 1997

**QUATERNARY**

- Qa** Alluvium
- Qac** Undifferentiated alluvial and colluvial deposits
- Qc** Talus and colluvium-covered slope deposits
- Qls** Landslides and mass-movement or avalanche deposits. Includes two chaotic terranes along Apache Lake of 2.2 km<sup>2</sup> and 0.4 km<sup>2</sup>, respectively.
- Qoa** Older alluvium, typically preserved along terraces of Salt River and its major tributaries.

**TERTIARY VOLCANIC AND SEDIMENTARY UNITS**

- Tsy** Weakly indurated conglomerate, sandy conglomerate, and pebbly sandstone. Unit is found north of Salt River capping ridges connecting the Mazatzal Mountains with the mesas composed of mid-Tertiary volcanic rocks along north side of Salt River. Unweathered exposures are rare, and maximum clast size is in the boulder range. Clasts are chiefly of Proterozoic metavolcanic rocks, quartzite, and plutonic rocks of the Mazatzal Mountains. Locally, rhyolite lava clasts from the Superstition volcanics comprise up to 50% of the total.
- Tcv** Volcaniclastic conglomerate, pebbly sandstone, sandstone, and breccia. Informally named the Mesquite Flat Breccia by Suneson (1976). The unit ranges from massive, matrix-supported, medium- to very thick-bedded debris flow and hypoconcentrated flood flow deposits, to plane-bedded to cross-stratified, medium- to thin-bedded clast-supported fluvial deposits. North of the Apache Trail Highway the unit is typically thick- to very thick-bedded, massive sedimentary breccia composed of subangular clasts of lavender, crystal-poor rhyolite (Trp) set in a massive, very poorly sorted, rhyolitic sandstone matrix. Locally, lenses of granule to boulder, fluvial conglomerate are interbedded with massive conglomerate and sedimentary breccia. South of the Apache Trail Highway the unit is typically medium- to thick-bedded conglomerate with scattered beds of massive, thick-bedded conglomerate. Subrounded clasts are generally subequal amounts of lavender rhyolite lava and white to yellow rhyolitic crystal tuff. Rare clasts of red granite, red quartzite, greenstone,

and gray schist are present throughout the unit south of the Apache Trail. Interbeds of rhyolite tuff are rarely present at or close to the base of the unit in the southwest part of the map along Tortilla Creek and the south fork of Mesquite Creek. Locally, the base of the unit buries irregular topography.

- Tty** Younger unwelded rhyolite tuff associated with the quartz latite lava.
- Tq** Quartz latite lava. Crystal-rich (>35%), plagioclase, sanidine, quartz, biotite,  $\pm$  hornblende bearing lava. Typical of the Geronimo Head massif in the southeastern corner of the Mormon Flat Dam quadrangle. Quartz phenocrysts are typically large (up to 1.0 cm) and embayed. Includes a basal, flow-front, foreset autobreccia, **Tqb**, that is locally mapped separately. A vitrophyre, **Tqv**, is present in southwest part of the map.
- Tqb** Crystal-rich quartz latite lava breccia
- Tqv** Crystal-rich quartz latite lava vitrophyre
- Tqi** Intrusions of crystal-rich quartz latite lava
- Tcx** A mixed unit consisting of volcanic and epiclastic, monolithic to heterolithic breccia, conglomerate, and bedded, unwelded tuff. The breccia and conglomerate is typically massive or thick-bedded, and the tuff medium- to thin-bedded. The unit is preserved along a south-dipping erosional unconformity between pre-caldera rocks (Tb, Td) and post-Superstition Cauldron lava (Trf). Clasts of all of the older lava types have been identified in the breccia, but Superstition Tuff (Ts) has not. The clast population is similar to that found within the Superstition Tuff mesobreccia unit (see Ferguson and Gilbert, 1997), and these two units are interpreted to be correlative.
- Ts** Superstition Tuff, undifferentiated. Includes large areas of ash-flow tuff north of Apache Lake in the northern part of the quadrangle. Crystal-rich (40-50%), plagioclase, quartz, sanidine, biotite-bearing ash-flow tuff. Ranges from unwelded to densely welded, and it rarely contains more than a few percent lithic fragments. Pumice fragments are generally difficult to see in outcrop. The base and top of this unit are locally medium- or thick-bedded, but the unit is generally massive. Where well exposed, a topographic break reflects a bedding contact that divides the unit into a lower subunit, **Tsl**, and an upper subunit, **Tsu**.
- Tsu** Upper Superstition Tuff
- Tsl** Lower Superstition Tuff

- Tcs** Sandstone and Conglomerate. Present on north side of Goat Mountain and in northwest corner. Unit consists of fluvial, pink-weathering, tan, very coarse-grained sandstone to granule conglomerate containing purple quartzite clasts (10%) set in tuffaceous sandy matrix (90%). Grades into Tt below and Ts above.
- Trf** Rhyolite lavas of Fish Creek Peak. A series of rhyolite lavas indistinguishable from pre-cauldron rhyolite lavas found to the north, and differentiated because they may be post-cauldron in age. The lava flows are generally crystal poor (similar to unit Trp), but locally crystal rich (similar to unit Trx). Age relationship with Tq, Ts, Tw, and Tr unknown. Overlies Tb, Td, and Trda.
- Ttf** Unwelded rhyolite tuff associated with the rhyolite lava of Fish Creek Peak.
- Tw** Whitlow Canyon type rhyodacite lava. A petrographically distinctive, lavender-colored, moderately crystal-rich (10-15%), to crystal-poor ( $\leq 5\%$ ), sanidine, plagioclase, embayed quartz, biotite-bearing lava. Feldspars are typically equant, euhedral and large (up to 0.5cm), and the quartz is also large (0.5 to 1.0 cm) and characteristically embayed. This unit is present in the southwest part of the map and is petrologically similar to, and found at the same stratigraphic position (directly below Superstition Tuff) (Ferguson and Gilbert, 1997) as is a voluminous and areally extensive unit south of the Superstition Cauldron referred to as the rhyodacite of Whitlow Canyon (Ferguson and Skotnicki, 1995). The unit locally is interbedded with monolithic lava breccia, **Twb**, composed of Whitlow Canyon type rhyodacite lava.
- Twb** Whitlow Canyon type rhyodacite lava breccia
- Tbm** In the extreme northwest corner of the quadrangle basalt that is indistinguishable from Tb is interbedded with younger rhyolite lava.
- Tt** Unwelded, bedded lapilli tuff, undifferentiated. Bedded tuff, lapilli tuff, and tuff-breccia, mainly associated with felsic lava flows. Beds vary from a few centimeters to several meters in thickness. The unit consists primarily of ash-flow tuff, ash-fall tuff, and surge deposits. Locally the unit consists of massive, clast-supported block and ash-flow deposits, but these deposits are generally included with the lava flows and domes with which they are associated.
- Tts** Unwelded, bedded tuff with approximately 15% interbeds of conglomerate with subangular clasts of Proterozoic quartzite, metafelsite, and metabasite. Found in the northwest corner.

- Tr** Rhyolite lava undifferentiated. Numerous flows of rhyolite lava occur throughout the area, many exposed on cliff faces and other inaccessible areas so that petrographic characteristics could not always be identified. Three divisions of rhyolite lava map units were recognized based on phenocryst content only: crystal-rich **Trx** (20-7%), crystal poor **Trp** (1-7%), and aphyric **Tra** (<<1%). Phenocrysts in the rhyolite lavas consist of sanidine, plagioclase, biotite,  $\pm$  quartz. In general, the size of the phenocrysts depends on content; small (<2mm) in the more crystal-poor, and bigger (2-5mm) in the more crystal-rich varieties. Plagioclase is generally tabular and sanidine equant. Because of their close genetic and chronostratigraphic relationship to the lava flows, many clast-supported, block and ash-flow deposits were mapped as part of lava flows. In some areas, particularly on cliff-faces, the dip of basal, flow-front, foreset avalanche autobreccias gives clear indication of flow direction and a symbol for this is described in the explanation (sheet 3). In other areas the differentiation of basal and carapace autobreccias was used to define local structures.
- Trx** Crystal-rich rhyolite lava (20-7% phenocrysts)
- Trp** Crystal-poor rhyolite lava (7-1% phenocrysts)
- Tra** Aphyric rhyolite lava (<<1% phenocrysts)
- Tri** Intrusive, rhyolite, in part continuous with extrusive lava flow and/or dome equivalent rocks (Tr).
- Trda** Rhyodacite lava. Crystal-rich (30-60%) lava containing phenocrysts of plagioclase and biotite. Sanidine and quartz are rare to absent. Interpreted to be correlative with similar rocks near Apache Gap in the Mormon Flat Dam Quadrangle. The unit is differentiated from dacite lava (Td) on the basis of lighter color and tendency to have more vitric matrix, and from porphyritic dacite lava (Tdp) on the basis of higher phenocryst content and absence of quartz. These lavas represent a transitional phase in volcanism between the dacite and basaltic lava near the base of the pre-Superstition Tuff lava pile and the rhyolite flows that directly preceded formation of the Superstition Cauldron.
- Td** **Td**--Dacite lava, undifferentiated. Crystal-rich (30-60%) plagioclase, biotite,  $\pm$  hornblende-bearing lava. A wide variety of colors and degrees of vitric preservation and microcrystalline-matrix appearance characterize a thick pile of dacite lava that occurs at or near the base of the volcanic pile. The lava ranges from more mafic, or andesitic, to more felsic or rhyodacitic. In the Horse Mesa area pyroxene basalt and dacite flows containing abundant dioritic magma clots are generally the youngest in the thick pile of dacite lavas of that area. The dacite lava is subdivided locally into three different map units; **Tdp**, **Tdt**, and **Tdb**.

- Tdp** Moderately crystal-rich (15-30%) porphyritic dacite flows that are characteristically more sparsely porphyritic than other dacite and rhyodacite lavas in the area. These lavas are also locally sparsely quartz phyric. Phenocrysts of blocky, euhedral plagioclase and biotite are set in a dark groundmass.
- Tdt** Crystal-rich (chiefly plagioclase and biotite phenocrysts), poorly to unwelded lapilli tuffs, typically containing abundant dacite lava clasts. The unit is typically massive, although locally medium- to thick-bedded.
- Tdb** Dacite lava breccia with matrix ranging from autoclastic, to tuffaceous, or epiclastic and interpreted as lava autobreccia, block and ash-flows or lahars respectively. The lahars occur chiefly in the Horse Mesa and Bronco Butte areas. Locally the contact between this breccia and the dacite tuff unit (**Tdt**) is gradational.
- Tdi** Intrusive dacite that forms three plugs along Lewis and Pranty Creek.
- Tb** Basalt lava containing variable amounts of plagioclase, pyroxene and olivine (typically altered to iddingsite) phenocrysts. Basalt lava generally is found at the base of the volcanic pile, but north of Apache Lake basalt crops out above a sequence of dacite flow breccia (**Tdb**). Basalt flows are commonly massive, or brecciated, but locally include bedded scoria and lapilli tuff.
- Tbi** Basalt dikes and other hyababyssal intrusions.
- Tbs** Basaltic sandstone and pyroclastic rocks. Pyroclastic deposits consist of evenly bedded scoria and/or fall-out lapilli tuff. Epiclastic rocks commonly are dark-red, pebbly sandstone.
- Tc** Arkosic conglomerate, pebbly sandstone, and sandstone. These sedimentary rocks are mostly plane-bedded to cross-stratified, medium to thin-bedded clast-supported fluvial deposits. Ninety percent of the clasts are granules to boulders of granite, diorite, and felsic schist.
- TKa** Andesitic dike. Strongly altered, turquoise-mineralized, intermediate dike of presumed Laramide age (Upper Cretaceous to Paleocene) west of Goat Mountain.

#### **PROTEROZOIC BASEMENT UNITS**

- Yg** K-feldspar porphyritic granite to quartz monzonite. Locally megacrystic.
- YXd** Diabase dikes

- YXg** Variably foliated, sparsely K-feldspar porphyritic granite to quartz monzonite. Foliations are consistently east to northeast-striking and steeply to moderately north-dipping. Foliation is interpreted as tectonic.
- Xr** Welded, rhyolite ash-flow tuff and related volcanoclastic conglomerate and/or breccia. Flattened pumice or fiamme clasts in the welded tuff are cut by a tectonic foliation. Unit directly overlies Xt along Ash Creek.
- Xt** Unwelded tuff. A thin interval (less than 5 meters wide) of thin-bedded, white, crystal-poor unwelded tuff. This tuff is present locally along the contact between Xr and Xc along upper Ash Creek.
- Xc** Metaconglomerate, arkose, and pebbly feldspathic arenite. These rocks display abundant primary sedimentary structures and consistent south-facing stratigraphic facing directions. They are typically non-foliated, in contrast with the strongly foliated metavolcanic rocks they overlie. However, in some areas a weak foliation, sub-parallel to that which is pervasively displayed in the country rocks, is present along the edges of this rock unit.
- Xm** Marble. A thin interval of light-gray weathering, dark-gray, very fine-grained marble, that occurs within the metaconglomerate unit (Xc) along upper Alder Creek.
- Xv** Metafelsite. Lavender to light gray, strongly foliated quartz and feldspar porphyroblastic schist. Crystals are generally less than 5mm and range in abundance from 5 to 40%. The unit is interpreted as a felsic volcanic rock, because it locally contains inclusions that appear to be lithic and pumice clasts.
- Xvs** Argillaceous schist, tectonically interleaved with the metafelsite unit (Xv). Occurs as small, elongate bodies, some of which contain lithic clasts.
- Xva** Amphibolite. Minor bodies (originally intrusive?) of dark green, fine-grained, tectonically foliated amphibolite within the metafelsite unit (Xv).