GEOLOGIC MAP OF THE PIÑON POINT QUADRANGLE, IRON COUNTY, UTAH

By Mary A. Siders
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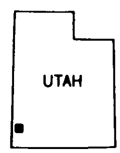

UTAH GEOLOGICAL AND MINERAL SURVEY
a division of
UTAH DEPARTMENT OF NATURAL RESOURCES
MAP 84 1985

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ABSTRACT

Mapping of the Piñon Point quadrangle reveals that the area is dominated by volcanic rocks of Oligocene through Miocene age. Previously unmapped and undescribed volcanic units have been studied and defined in order to provide a geologic base map upon which future studies can expand. Field mapping was supplemented by aerial photography, and descriptions of the volcanic rocks include petrographic and geochemical data, as well as observational data from the field. Results of the study define the occurrence of both calc-alkaline and bimodal (basalt plus rhyolite) magmatism within the quadrangle. A thick sequence of volcaniclastic rocks, which host silver mineralization in the adjacent Beryl Junction quadrangle, are poorly exposed and bounded by faults in the east-central portion of the Piñon Point quadrangle. The surficial geology within the quadrangle lacks evidence of extensive hydrothermal alteration and no geochemical anomalies have yet been documented. Although data are scarce, at the present time no geothermal prospects or anomalies are known to occur in the quadrangle.

INTRODUCTION

The Piñon Point quadrangle is located in southwestern Iron County on the southern edge of the Escalante Desert. It lies within the Basin and Range physiographic province and is about 4 miles (6.4 km) northwest of the town of Enterprise. Tertiary volcanic rocks dominate the area and form a series of low hills that are buried by alluvium of the Escalante Desert on the northern portion of the quadrangle. The quadrangle is situated along the northern edge of the east-northeasterly trending Delamar-Iron Springs Mineral Belt, although there are no known mineral occurrences or deposits within the quadrangle.

Previous published work in the Piñon Point area includes the 1:250,000 geologic map of southwestern Utah (Hintze, 1963). Blank's (1959) thesis study of the Bull Valley district provides the most detailed study of an adjacent area. Blank's field work and mapping extended into the Hebron quadrangle, adjacent to and due south of the Piñon Point quadrangle. Cook's (1960a) study of the geology of Washington County likewise covers the area south of the Piñon Point quadrangle.

The opening of the Escalante Silver mine (1981) in the adjacent Beryl Junction quadrangle has stimulated a greater interest in the Piñon Point quadrangle. Mining geologists for Hecla (producers of the Escalante Silver mine) have mapped the areas adjacent to the mine and several M.S. theses have been done on the deposit concerning the mineralogy and paragenesis of the ore (Arentz, 1978; Allen, 1979; Woodward, 1982; Fitch and Brady, 1982). Other recent work includes that of M.G. Best (1984) who has mapped and studied the area north of Modena and in the Hamlin Valley.

STRATIGRAPHY

Rocks exposed in the Piñon Point quadrangle consist mainly of local volcanic units but also include one regional ash-flow tuff sheet (Racer Canyon Tuff). They range in age from latest Oligocene/early Miocene (about 24 m.y.) to late Miocene/early Pliocene?. Local Miocene lavas include andesite, dacite, low-silica and high-silica rhyolite, quartz latite and a bimodal assemblage of basalt and rhyolite. Quaternary alluvial deposits form the youngest units in the area.

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TERTIARY VOLCANIC UNITS (latest Oligocene to mid-Miocene)

Andesite of Enterprise (24.2 ± 1.2 m.y.) Ta

A thick sequence of moderately porphyritic andesite flows and intercalated monolithologic (andesitic) debris flows are located in the southeast corner of the Piñon Point quadrangle. The unit attains a thickness of at least 800 feet and is fairly resistant so that it forms abundant pointed ridges and steep-sided hills. The andesite occurs as prominent blocky outcrops and only rarely exhibits flow layering. Many of the flows contain black acicular hornblende up to one quarter of an inch long and plagioclase laths in a gray aphanitic matrix. The matrix may also be reddish-brown to purplish-gray. Thin section study of these porphyritic andesite flows reveals phenocrysts of plagioclase, hornblende, clinopyroxene, orthopyroxene, Fe-Ti oxides ± biotite set in an intergranular groundmass of plagioclase microlites and granular Fe-Ti oxides. Whereas many flows have conspicuous hornblende phenocrysts, others contain predominantly clinopyroxene and orthopyroxene in sub-equal amounts with only a trace of hornblende.

A sequence of similar hornblende andesite flows was reported by Best (1984) from the area north of Modena (approximately 15 miles (24 km) northwest of the Piñon Point quadrangle). Best bracketed the age of the andesite between 22-25 m.y. based on stratigraphic relations. The potassium-argon (K-Ar) age of hornblende from the andesite in the Piñon Point quadrangle (Ta) is 24.2 ± 1.2 m.y. (this report, analysis by F. Brown, University of Utah). Andesite along the northern edge of the outcrop area borders the volcaniclastic sequence (Tv) along a faulted contact. Here the andesite is propylitically altered and generally greenish-gray in color due to the alteration of ferromagnesium minerals to chlorite and/or epidote.

Dacite of Piñon Park Wash (21.7 ± 3.3 m.y.) Td

Scattered outcrops of a strongly porphyritic dacite are exposed in the south-central portion of the Piñon Point quadrangle, just north of the east-trending rhyolitic complex of Piñon Point (Trp, Tcp). The dacite occurs as a flow or flow-dome sequence up to 500 feet (150 m) in thickness. It forms low rounded outcrops or ledgy slopes with cliffs of the dacite flows interspersed with talus slopes. The dacite weathers to a coarse grus that is distinctive in its high crystal content and large phenocryst size. Small plugs or towers of dacite are also found within the unit. The dacite lies adjacent to the andesite lavas (Ta) in the southeastern corner of the quadrangle, and also occurs adjacent to the Racer Canyon Tuff (Tr) and the quartz latite (Tl) along faulted contacts. Megascopically, the dacite contains large blocky plagioclase phenocrysts (up to 4.5 mm) as well as euhedral biotite books (up to 2.0 mm) set in a reddish, gray or lavender felsic to glassy matrix. Thin section study reveals large, oscillatory-zoned plagioclase along with biotite, clinopyroxene (augite), Fe-Ti oxides, and quartz, as well as a trace of sanidine and hornblende, and accessories of apatite and zircon. The matrix texture ranges from intergranular to hyalopilitic with perlitic cracks. The average modal analysis is quite similar to that of the Harmony Hills Tuff, although any genetic relationship is uncertain. The K-Ar age on biotite from the dacite is 21.5 ± 3.3 m.y. (this report, analysis by F. Brown, University of Utah). However, lithologically similar dacite east of Hamlin Valley underlies a sequence of hornblende andesite lavas (Best, 1984).

Racer Canyon Tuff (about 19 m.y.) Tr

The Racer Canyon Tuff is represented by three small outcrops in the Piñon Point quadrangle. Considerable stratigraphic confusion exists between the lithologically and petrographically similar Hiko and Racer Canyon tuffs. Dolgoff (1963) defined the Hiko Tuff from exposures in Nevada, which Cook (1965) correlated with the Racer Canyon Tuff of southwestern Utah. Of the two members of the Racer Canyon Tuff that Blank (1959) defined, one may have been the Hiko Tuff. More recent work by Noble and others (1968), Noble and McKee (1972), and Ekren and others (1977) has shown that the Hiko Tuff and Racer Canyon Tuff are units of similar lithology and age with probable origins in the Caliente cauldron complex of southeastern Nevada. However, as stated by Noble and McKee (1972, p. 17), "The Racer Canyon Tuff of Cook, although similar in appearance to the Hiko Tuff, lacks hornblende and sphene, which are present in appreciable amounts in the Hiko Tuff." Other workers however (M.G. Best, personal communication, 1983), have used the presence of sphene as a criterion by which to recognize the Racer Canyon Tuff. Noble and McKee (1972, p. 19) concluded that "the units are not correlative but rather are two distinct ash-flow sheets of about the same (about 19 m.y.) age."

In the Piñon Point quadrangle this unit is bordered by an apparent fault contact with the phenocryst-rich dacite (Td) and is partly buried elsewhere by older alluvium (QTag). Some of these areas of crystal tuff were mapped as Quichapa Group (probably taken to be the Leach Canyon Tuff, which also resembles the Racer Canyon Tuff) on the 1:250,000 map of southwestern Utah (Hintze, 1963). Megascopically, the Racer Canyon and Hiko tuffs are both moderately welded tuffs that contain quartz bipyramids, plagioclase, sanidine, biotite books, pumice, and sparse lithic fragments in a pale gray to very pale pink matrix. Petrographic study of tuff samples from the Piñon Point quadrangle reveals about 40 percent total phenocrysts which are, in order of decreasing abundance, quartz, plagioclase, sanidine, biotite and less than 1 percent of Fe-Ti oxides, hornblende, sphene, apatite and zircon. More work is in progress to resolve the problem of stratigraphic correlation for the Racer Canyon and Hiko tuffs.

Quartz Latite Lava Tl

A virtually aphyric to sparsely porphyritic sequence of lava flows of quartz latitic composition forms a series of hills extending west-southwest from the main outcrop area of the rhyolite of Beryl Junction (Trbu, Trbe, Trbm, Trbl).

The trachytic texture of these quartz latite lavas imparts a strong foliation to the rocks, which weather into reddish-brown to reddish-gray plates that form extensive colluvium and talus mantles. Locally the matrix may be comprised of black glass that weathers to form resistant boulders. In thin section this glassy phase reveals the same trachytic texture as the rest of the quartz latite flows, but with a much finer groundmass of feldspar microlites. All samples contain sparse phenocrysts of plagioclase, pyroxene and Fe-Ti oxides.

Tuffs, Undivided Tt

Vitric-lithic-crystal tuffs of white, tan, or pale pink color crop out in the east-central portion of the Piñon Point quadrangle. Crystal content in this series of weakly to moderately welded tuffs is generally less than 10 percent. Conspicuous pumice fragments are pale yellow, pink, or white. Lithic fragments are generally reddish-purple to red or gray, felsic volcanic rocks. These tuffs form broad flat outcrops with locally good exposures but are covered by older dissected alluvium (QTag) in the central portion of the map area. The average Tt unit is composed of the following: matrix + pumice-56.1 percent, lithic fragments-36.8 percent, sanidine-4.8 percent, plagioclase-1.4 percent, quartz-0.5 percent, Fe-Ti oxides-0.2 percent, sphene-trace, zircon-trace, biotite-trace, pyroxene-trace.

Correlation of these tuffs with any other tuff in the Pinon Point quadrangle is very tentative at this time, however it is possible that they are related to the 12.8 m.y.-old rhyolitic complex of Piñon Point.

Rhyolite of Piñon Point

A rhyolitic complex composed of lavas extruded from east-trending fissures, numerous small coalescing domes, and associated pyroclastic tuff-breccias is located in the southwestern corner of the Piñon Point quadrangle. This complex appears to represent the felsic member of a bimodal suite, related to 10.8 ± 0.6 m.y.-old (Best and others, 1980) olivine-augite basalt (Tb) that immediately overlies the rhyolite. Rhyolitic rocks with ages of 12-13 m.y. occur elsewhere in southwestern Utah, including the topaz rhyolite of the Steamboat Mountain Formation (Best, 1981). The K-Ar age of the rhyolite of Piñon Point is 12.8 ± 0.6 m.y.

The rhyolite of Piñon Point is mapped as two units; a pyroclastic tuff-breccia unit (Tcp) resulting from early explosive eruptions of gas-charged magma, and rhyolitic lavas and flow domes (Trp) that immediately overlie and are surrounded by the tuff-breccia. Flow layering in these rhyolitic lavas exhibits a dominant east-west trend for the strike (see figure 1), although both strike and dip can exhibit a wide range of attitudes from outcrop to outcrop.

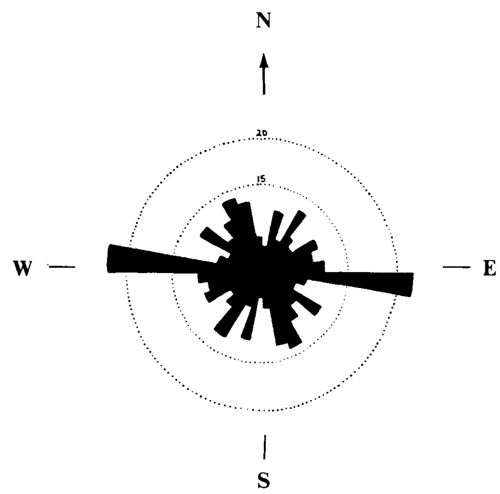


Figure 1. Rose diagram depicting the strike direction of flow laminations as measured for flows within the rhyolitic complex (Trp) of the Piñon Point quadrangle (126 measurements).

Clastic Member Tcp: The clastic member of the Piñon Point rhyolitic complex includes a tuff-breccia that contains pumice fragments and angular reddish-purple to purplish-gray rhyolite lithic fragments in a pale yellow tuffaceous matrix, as well as spherulitic and brecciated vitrophyres that are transitional both to intact vitrophyres and to the lava flows proper. The term "tuff-breccia" is used here to describe a volcanic rock in which dominantly rhyolitic clasts are contained in a tuffaceous matrix of fine fragments (less than 4 mm in diameter) that comprises 25 to 75 percent of the rock by volume (Lydon, 1968). Outcrops of the tuff-breccia generally form broad, flat terraces on the slopes of the rhyolitic complex and locally form cliffs. During the explosive activity that created the tuff-breccia, blebs of rhyolitic magma were aerially ejected to form obsidian nodules. Trace element analysis of these obsidian nodules indicates that they are identical to clasts found in streambeds south of Modena and in adjacent areas in Nevada (F. Nelson, personal communication, 1984). This type of obsidian has been found as local archeological specimens and may represent a newly discovered obsidian source locality in Utah.

Rhyolite Lava Flow Member (12.8 ± 0.6 m.y.) Trp: The flow-layered rhyolitic lavas occur as sparsely porphyritic flows, some of which exhibit abundant spherulites and lithophysae, and range in color from mottled pinkish- to purplish-gray to buff. Flow margins are often marked by greenish-black to reddish-purple vitrophyres or zones of auto-brecciation. Black basal vitrophyres up to 15 feet thick (4.6 m) underlie some of the lavas and in turn rest atop the clastic member (Tcp) of the rhyolitic complex. The rhyolite flows weather to massive, rounded outcrops and form the highest hills in the quadrangle. Sparse phenocrysts of potassium feldspar and quartz are visible in hand sample. Thin section study reveals phenocrysts (commonly less than 5 percent total) of sanidine, quartz, plagioclase, scattered

Fe-Ti oxides, accessory zircon and xenocrystic olivine contained in a hyalopilitic matrix, much of which has been devitrified to spherulites. Olivine xenocrysts are typically corroded and rimmed with iddingsite or granular Fe-Ti oxides. Plagioclase phenocrysts are often found enclosed by sanidine overgrowths that have apparently protected the plagioclase from reaction with the magma. Unprotected plagioclase typically shows the effects of resorption. The K-Ar age of sanidine from the Trp lavas in the adjacent Mount Escalante quadrangle is 12.8 ± 0.6 m.y. (Siders, UGMS map in progress; analysis by Geochron Laboratories, sample F-7075).

Rhyolite of Beryl Junction

Low, sagebrush-covered hills in the northeastern corner of the quadrangle are comprised of lava flows and domes of rhyolitic composition. This complex, termed "the rhyolite of Beryl Junction," can be broken into at least three distinct members. Throughout most of the area the different members are distinguishable and can be mapped as separate units.

Early (High-Silica) Rhyolite Member Trbe: These rhyolite flows have a chemical composition (major oxides) virtually identical to the rhyolite of Piñon Point (Trp), except that the Trbe rhyolite is very depleted in fluorine (less than 50 ppm as compared to the more typical values of 440 to 670 ppm for rhyolitic lava flows from Piñon Point complex). The isolated flows and domes of Trbe generally exhibit mild to moderate alteration (e.g., orangish iron staining, bleaching, sericitization), and the highly volatile fluorine may have been released during the alteration processes. It is possible that the Trbe lavas may represent the northern extent of the 12.8 m.y.-old rhyolitic magmatism of the Piñon Point rhyolitic complex, however, the data necessary to establish the relationship are inconclusive.

Rhyolite Flow Member (10.8 ± 0.5 m.y.) Trbm: Rhyolitic lava flows containing anorthoclase-sanidine or sanidine as the prominent phenocryst phase and mean SiO_2 = 70.07 percent (analyses recalculated to 100 percent, loss-free) occur in the northeast quadrant of the map area. The dense, reddish lavas contain small, sparse potassium feldspar phenocrysts and also exhibit irregular flow streaks that impart a foliation to the rocks. The gray to gray and red mottled lavas weather to form rounded massive outcrops whereas the foliation in the reddish lavas often forms a parting or fracture surface that results in distinctive platy to blocky fracturing outcrops. Black to brick-red flow-layered vitrophyres underlie some of the flows and are chemically identical to the non-vitrophyric lavas of this unit. In some areas the lavas are sericitized and are bleached to a pinkish-tan color. Orangish iron staining also occurs locally. A K-Ar age on these lavas is 10.8 ± 0.5 m.y. (Siders, 1985; analysis by Geochron Laboratories, sample F-7075).

Volcaniclastic Facies Member Trbu: Low hills of fragmental rhyolite and matrix-supported volcaniclastic rocks occur along the northern margin of the Trbm rhyolite flows, just south of highway 56. The fragmental rocks may be the result of auto-brecciation during extrusion of the viscous rhyolite lavas, or they may represent erosional shedding from the adjacent rhyolitic complex. Rocks consisting of angular rhyolitic fragments contained in a devitrified quartzo-feldspathic matrix represent the most common rock type. Rocks of this facies are locally silicified and iron stained. This clastic facies probably spans the entire period of rhyolitic activity (about 13 to 10 m.y.).

Later, Gray Rhyolite Member Trbl: Gray rhyolitic lavas containing sanidine as the prominent phenocryst phase occur as restricted flows and plugs which intrude and overlie the lavas of Trbm. The apparent volume of the Trbl rhyolite is small.

Limestone of Quartz Hill Ta

Outcrops of silicified lacustrine limestone and sandy limestone occur just southeast from the main exposure of the rhyolite of Beryl Junction (Trbe, Trbm, Trbl, Trbu). The bedded limestone sequence is informally named after a prominent hill in the adjacent Beryl Junction quadrangle, known locally as "Quartz Hill." Pervasive alteration to chalcedonic quartz or jasperoid is such that little of the original carbonate remains intact. Typically the chalcedonic quartz is milky-white or orange where stained by iron oxides. Silicification of the limestone beds may have resulted from hot springs activity associated with the adjacent magmatism. The beds have a general west-northwesterly strike and southerly dip of 20 to 30 degrees, and are overlain along their southern margin by volcaniclastic rocks of the "mine series" (Tv).

Mine Series Volcaniclastic Rocks (10-18 m.y.) Tv

The "mine series" consists of a heterogeneous assortment of crudely bedded volcanic conglomerates or breccias, interbedded with water-lain volcanic sandstones and other tuffaceous sediments. Conglomerates and breccias of this unit are comprised of light gray to reddish, felsic volcanic clasts, including fragments from the rhyolite of Beryl Junction (Trbm), set in a matrix of reworked glassy material and volcanic sandstone. These poorly sorted volcanic conglomerates are typically a reddish-brown color in outcrop and form gently dipping beds that are covered by older alluvium (QTag) in the central portion of the map area. The interbedded volcanic sandstones are generally poorly to moderately sorted and contain angular to subrounded lithic fragments, feldspar (sanidine) grains, quartz grains, Fe-Ti oxides, a trace of hornblende, ragged biotite grains, and accessory sphene and zircon. Hematite cement predominates, with patches of secondary calcite scattered throughout the rock. The sandstone locally exhibits cross-bedding in outcrop. In the adjacent Beryl Junction quadrangle this unit (Tv) hosts silver mineralization at the Escalante Silver Mine. Adularia from the Escalante vein gave a K-Ar age of 11.6 m.y. (Siders, 1985; analysis by Geochron Laboratories, sample F-7076).

Olivine-Augite Basalt Tb

Dark gray, olivine-augite basaltic lavas occur as isolated remnants of flows in the southern and western portions of the Piñon Point quadrangle. These lavas typically overlie the rhyolite of Piñon Point (Trp) and commonly form the capping unit on the hills and mesas in this area. A morphologically similar olivine basalt south of Modena has an age of 10.8 ± 0.6 m.y. (Best and others, 1980). In outcrop, the basalt occurs as gray to black, blocky-fracturing flows that form abundant slope debris. Thin sedimentary interbeds of siltstone are contained between some flows. Plagioclase and greenish-black pyroxene are visible in hand sample. Petrographically the lavas contain plagioclase, olivine, clinopyroxene and scattered Fe-Ti oxides in seriate to intergranular to subophitic textures, with local patches of secondary, interstitial calcite. Glomeroporphyritic aggregates of the phenocryst phases are common. The plagioclase exhibits both Carlsbad and albite twinning, with overall normal compositional zoning. Using the Michel-Levy method, the plagioclase ranges from labradorite to andesine (core to rim). Olivine occurs as euhedral to embayed phenocrysts, up to 2.0 mm in length, that show minor to extensive alteration to iddingsite.

Local Volcanic and Sedimentary Basin-Fill Deposits Tvs

This unit consists of a heterogeneous assemblage of fine, light-colored, tuffaceous sediments and non-welded air-fall tuff, as well as quartzitic sandstone and siltstone. The bedded portions of this formation have northwesterly strikes and northerly dips of 25 to 56 degrees. These rocks rest adjacent to the rhyolite of Piñon Point (Trp, Tcp) along a faulted contact. This unit is similar in lithology and stratigraphic position (Late Miocene to Pliocene?) to the "Muddy Creek Formation" of southern Nevada that Cook (1960a) tentatively correlated with similar rocks in southwestern Utah. However, the recent work of Machette (1982, 1985) suggests that many of the Late Tertiary basins were isolated systems and that it is not accurate to extend a formational name out of the local basin where it was originally established. Future work planned for areas west and south of the Piñon Point quadrangle should better establish the nature and extent of these young volcanic and sedimentary basin-fill deposits.

QUATERNARY UNITS

Oldest Quaternary Alluvium QTag

Alluvial deposits consisting of poorly sorted, unconsolidated sand and bouldery beds of heterogeneous composition occur in the central portion of the Piñon Point quadrangle. These are the oldest alluvial deposits in the map area and are currently undergoing dissection due to a change in base level. The base level change may be due to climatic and/or tectonic factors. Many of the rock types found in outcrop in the Piñon Point quadrangle are represented in the QTag clasts.

Alluvial Fans and Slope Wash Deposits Qag

Younger alluvial deposits in the Piñon Point quadrangle include coarse, poorly sorted slope wash that lacks fan morphology, and better-sorted sands on alluvial plains (but not including the currently active channels). Qag also includes sand, gravel and boulder deposits that exhibit fan morphology. These deposits have compositions that reflect the local sources.

Alluvial Plain Sands Qas

Alluvial sands forming broad, flat plains in the northern portion of the quadrangle are mapped as Qas. The sand composition is dominated by quartz grains derived from large areas of quartz-rich crystal tuff that crop out in the adjacent Mount Escalante quadrangle. Lesser amounts of feldspar and accessory minerals (sphene, zircon, Fe-Ti oxides) are also found in these sands.

Alluvium in Active Stream Channels Qal

The youngest alluvial deposits in the area are those that occur in active, ephemeral stream channels. These deposits are generally fine grained and consist of silt and silty sand, much of it derived from reworking of earlier alluvial deposits.

STRUCTURE AND GENERAL GEOLOGY

The Piñon Point quadrangle lies within the Basin and Range physiographic province. This province is a characterized by extensional tectonics, thin crust and high heat flow. The Basin and Range province extends west from the edge of the Colorado Plateau province across western Utah and through Nevada to the Sierra Nevada Range. Within this area, the most recent extensional faulting has produced a series of isolated fault-block mountain ranges, set apart by alluvium-filled graben valleys.

The Piñon Point quadrangle also lies within the east-trending zone known as the Timpahute lineament. Ekren and others (1976) defined this lineament, which extends across Lincoln County, Nevada and into southwestern Utah, on the basis of an alignment of topographic features, magnetic anomalies, faults, igneous intrusive and extrusive masses, hot springs, and mineralized and hydrothermally altered rocks. The Timpahute lineament, which is inferred to be a deep-seated structure, is also marked by "contrasting structural styles to the north and south" (Ekren and others, 1976). It was noted that to the north of the lineament the topography is dominated by discrete north-trending basins and ranges, whereas a broad platform of volcanic rocks lies to the south. They also observed that "numerous igneous intrusive masses occur on or near the feature," ranging from the granite of Tempiute in the Timpahute Range to the intrusives of the Chief Range near Caliente. Farther to the east, and extending into southwestern Utah, are large, east-trending rhyolite masses that "were undoubtedly fed from east-trending fissures." The "Piñon Point rhyolitic complex" (Trp, Tcp) described in this report is a part of these easterly elongated rhyolite masses. The Timpahute lineament also corresponds roughly to the Delamar-Iron Springs Mineral Belt, which defines a zone of mineralization and mineralized districts. The quadrangle is also along the trend of known geothermal resource areas (KGRA) in Utah. However, no hot or warm springs are known to occur within the quadrangle, and geothermal test wells that were drilled in the nearby Escalante Desert failed to uncover any marked geothermal anomalies.

The Piñon Point quadrangle lies within the extensive "ignimbrite province" of the Great Basin, which consists of a thick veneer of Tertiary ash-flow tuff sheets and related rocks that overlie the pre-Tertiary basement. M.G. Best of Brigham Young University examined the cuttings of two geothermal test wells that were drilled in the Escalante Desert, one of which is located near the town of Beryl. This well is about 8 miles NNE of the northeast corner of the Piñon Point quadrangle, in section 18, T. 34 S., R. 16 W., Iron County, Utah. Alluvial fill extends down to 2,270 feet (692 m), whereupon a great thickness (1,430 feet) (436 m) of the Bauers Tuff Member (early Miocene, about 22 m.y.) of the Condor Canyon Formation (Blank, 1959) is encountered. Below the Bauers tuff, the densely welded ash-flow tuff sheet of the Isom Formation (late Oligocene to earliest Miocene) is encountered for a short interval, then the hole continues through a sequence of mostly altered andesite lava. Carbonate rocks extend from 4,600 to 4920 feet (1402 to 1500 m), where a mixed sequence of limestone and altered andesite continues to 4,990 feet (1520 m). From 4,990 to 5,320 feet (1520 to 1622 m), carbonate rocks again dominate until another mixed sequence of carbonate and igneous (10-90 percent) rocks is encountered. At 6,110 feet (1862 m) the well bottoms out in a sequence of unidentified sedimentary rocks. The second well is located in Section 8, T. 34 S., R. 13 W., Iron County, just east of Table Butte and 24 miles (38 km) ENE of the northeast corner of the Piñon Point quadrangle. Valley alluvium continues to a depth of 2,930 feet (893 m), whereupon a uniform red-brown siltstone is encountered. The interval 3,980 to 4,160 feet (1213 to 1268 m) consists of red-brown siltstone. A rhyolitic ash-flow tuff, possibly the Racer Canyon (18-20 m.y.) or the Leach Canyon (24-25 m.y.), dominates the interval from 4,540 to 5,530 feet (1384 to 1686 m). Underlying brown siltstone extends down to 5,740 feet (1750 m), where a pink ash-flow tuff, possibly the Isom Formation, continues to 5,710 feet (1740 m) (M.G. Best, unpublished data, 1985).

An east-trending basin or volcano-tectonic depression, in which at least 1,200 feet (366 m) of crudely bedded volcaniclastic deposits accumulated, is located in the east-central portion of the Piñon Point quadrangle. This feature extends eastward into the Beryl Junction quadrangle where it is terminated along a north-trending basin-range fault.

Faulting within the quadrangle is generally obscured due to well-developed alluvial and colluvial cover. However, most faults appear to trend either northwest or northeast. The timing of faulting within the quadrangle is difficult to determine, mainly due to the lack of radiometric ages for some of the volcanic rock units and the lack of exposure. In general, the northeast- and northwest-trending faulting can be bracketed to have occurred between 24 m.y. to about 7 m.y. ago. The entire area has been uplifted along a north-trending basin-range fault that occurs just a few miles east of the quadrangle. Major displacement along this fault probably occurred less than 10 m.y. ago and perhaps as recently as less than 5 m.y. ago. Faults cutting Quaternary deposits were not observed in the quadrangle.

GEOLOGIC HISTORY

Following the uplift and deformation associated with the late Cretaceous Sevier Orogeny, a broad basin formed across much of southwestern Utah. During this time, from latest Cretaceous through the early Tertiary, the sedimentary beds of the Iron Springs and Claron Formations were deposited in this basin. Widespread calc-alkaline volcanism was marked by the eruption of ash-flow tuffs of the Oligocene-age Needles Range Formation (30 m.y.). Other calc-alkaline volcanic rocks, including other ash-flow tuffs and intermediate-composition stratovolcano complexes, were erupted between 35 to 21 m.y. ago. The transition from calc-alkaline to bimodal (basalt plus rhyolite) volcanism occurred approximately 20 to 21 m.y. ago, marking the onset of extensional tectonics.

Calc-alkaline volcanic rocks of intermediate composition that crop out in the Piñon Point quadrangle include the andesite of Enterprise (Ta) and the dacite of Piñon Park Wash (Td). The andesite of Enterprise (Ta) in the Piñon Point quadrangle represents the remnants of a larger andesitic volcanic field. Hills of andesite extend southward into the Enterprise and Hebron quadrangles. It is not known if the andesite occurs west of the Piñon Point quadrangle. The K-Ar ages of the andesite (Ta) and the dacite (Td) in the quadrangle are 24.2 m.y. and 21.7 m.y. respectively. Rowley and others (1979) state that: "post-Needles Range Formation calc-alkaline volcanic rocks in southwestern Utah comprise two general facies that differ markedly in form and distribution. Central-vent volcanoes (stratovolcanoes, shield volcanoes, and volcanic domes) were concentrated in two generally east-trending igneous belts, the Pioche-Marysvale belt to the north and the Delamar-Iron Springs belt to the south." The latter lineament passes directly through the Piñon Point quadrangle, and the andesite of Enterprise (Ta) may be related to this belt. The strongly porphyritic dacite of Piñon Park Wash (Td) occurs in close proximity to the andesite (Ta) and also has calc-alkaline affinities.

Following the extrusion of the dacite flows and plugs and andesitic lavas, which must have formed a highland barrier or buried some of the 24 to 20 m.y. old ash-flow tuffs of the Quichapa Group, ash-flows of the approximately 19 m.y.-old Racer Canyon Tuff entered the area. Remnants of this moderately welded, crystal-rich tuff occur only as three small, isolated patches in the Piñon Point quadrangle.

The age of the quartz latite (Tl) is unknown but can be bracketed between 19 and 13 m.y. based on field relationships with units of known age. The gray, aphyric lavas of quartz latite composition overlie an outcrop of Racer Canyon Tuff (Tr, 19 m.y.) and in turn are overlain by rhyolitic lavas (Tcp, Trp, 12.8 m.y.).

High-silica rhyolites (SiO_2 greater than 74 percent) in the Piñon Point quadrangle are part of the bimodal assemblage and include the high-silica rhyolite member (Trbe) of the rhyolite of Beryl Junction, and the rhyolite of Piñon Point (Trp, Tcp), located in the southwestern corner of the quadrangle. A sequence of undivided vitric-lithic tuffs (Tt) may also be related to this period of rhyolitic activity. The lavas of the Piñon Point rhyolitic complex (Trp, Tcp) were extruded from east-trending fissures and scattered vents. This 12.8 m.y.-old volcanic activity commenced with the explosive eruption of gas-charged magma that formed beds of tuff-breccia. Rhyolitic lavas and domes were later extruded over these beds of tuff breccia.

Lava flows of the middle rhyolite flow member (Trbm, low-silica), of the rhyolite of Beryl Junction, were extruded in the northeastern portion of the map area. This rhyolite (Trbm) has an age of 10.8 ± 0.5 m.y. Both the quartz latite (Tl) and the rhyolite (Trbm) were extruded in the area north of the andesitic (Ta) and dacitic (Td) lava pile. The quartz latite (Tl) and the rhyolite of Beryl Junction (Trbe, Trbm, Trbl, Trbu) appear to be local units that occur mainly in the Piñon Point and Beryl Junction quadrangles.

Sometime before, during, or after the extrusion of the Trbm and Trp rhyolites, a depression formed in the Piñon Point and Beryl Junction quadrangles. Drill core data from the Escalante Silver Mine (located in the adjacent Beryl Junction quadrangle) reveal over a 1,200 foot (366 m) thickness of fine-grained to conglomeratic volcaniclastic rocks that were deposited in this basin. Judging from the thickness and composition of the "mine series" volcaniclastic sequence (Tv) that occurs here, the basin, possibly a volcano-tectonic depression, is thought to have been a long-lived structure. Constrained by the K-Ar age of adularia from the Escalante vein and by the types of lithic fragments contained in the basin fill, the age of the basin and its contents is estimated to be 11 m.y., but it may be older or younger. The adularia has an age of 11.6 ± 0.5 m.y., whereas Trbm clasts in the volcaniclastic beds are known to be 10.8 ± 0.5 m.y. The upper parts of this volcaniclastic sequence overlie a restricted area of pervasively silicified fossil-bearing limestone beds (Tq).

Rhyolitic activity in the southwestern portion of the Piñon Point quadrangle was followed by the extrusion of olivine-augite basalt (Tb) which represents the mafic member of a bimodal suite. The K-Ar age of an olivine-augite basalt flow south of Modena is 10.8 ± 0.6 m.y., and a 7.7 ± 0.2 m.y. age was determined for basaltic lavas south of the quadrangle (Best and others, 1980). The basalt in the Piñon Point quadrangle is morphologically and petrographically similar to the Modena basalt and is suspected to be of similar age, although it may be as young as the 7.7 m.y.-old Enterprise Basalt. Following the extrusion of the basaltic lavas (Tb) in the Piñon Point quadrangle, a heterogeneous sequence of volcanic and sedimentary basin-fill beds (Tvs, Miocene/Pliocene?), which are exposed in the extreme southwestern corner of the quadrangle, were deposited. Since this time, basin-range faulting and erosive processes have affected the Piñon Point area.

Throughout the Quaternary, erosion has resulted in the formation of several generations and types of alluvial deposits in the Piñon Point quadrangle. Poorly sorted conglomeratic deposits containing clasts of most of the volcanic units in the quadrangle form the oldest of these deposits (QTag). After deposition of QTag, climatic changes, local uplift or perhaps breaching of a bedrock threshold resulted in a change in base level in the Piñon Point area. Consequently, the deposits of QTag were eroded and dissected, forming a second generation of Quaternary alluvium (Qag). These later deposits consist of generally finer grained pebbly sands and sands, partly from the reworking of the QTag deposits. The youngest alluvial deposits in the Piñon Point quadrangle are designated as Qal. These generally fine-grained deposits occur in currently active, ephemeral stream channels. Deposition of alluvial fan gravels (Qag) and alluvial plain sands (Qas) is considered to span the time from QTag through Qal.

ECONOMIC GEOLOGY

There are no active or abandoned mines in the Piñon Point quadrangle and very little evidence of assessment work except for one or two shallow pits in the northeastern and east-central edges of the area adjacent to the Beryl Junction quadrangle. A number of claims have been staked in the northeastern corner of the Piñon Point quadrangle, but geochemical sampling represents the extent of physical prospecting. Although the Escalante Silver Mine is located several miles east of the Piñon Point quadrangle, there is a lack of hydrothermally altered rocks or geochemical anomalies within the quadrangle.

The spatial and genetic association between high-silica topaz rhyolites and subsurface porphyry deposits has been noted by various authors (Burt and others, 1982) and warrants further study of such rhyolitic complexes. The rhyolite of Piñon Point (Trp, Tcp) has low abundances of fluorine and lithophile elements (Be, Li, Mo, Sn, etc.), does not exhibit "porphyry-type" alteration assemblages, and cannot be classified as a "topaz rhyolite." Rhyolitic complexes that are not of the "topaz rhyolite" variety are generally barren (Burt and others, 1982) and do not represent encouraging targets for exploration.

Non-metallic resources in the Piñon Point quadrangle include alluvial sands and gravels. However, the alkali reactivity and low mechanical strength of most weathered felsic volcanic rocks makes them less desirable than limestone, sandstone or quartzite for use as concrete aggregate. The material may be useful as borrow or to provide road metal for local roads.

Known geothermal resource areas (KGRA) occur to the east (Newcastle) and northeast (Lund) of the Piñon Point quadrangle. However, a test well drilled in the Escalante Desert near Beryl failed to uncover any geothermal prospects. The Newcastle KGRA is located near a major range-boundary fault that is laterally extensive, has a large amount of displacement, and has been active recently enough to offset Quaternary fan deposits of the Antelope Range. This range-boundary fault, which appears to control the geothermal activity, does not pass through the Piñon Point or adjacent quadrangles. There are insufficient data at this time to adequately assess the geothermal potential in the quadrangle, however heat flow assessment along the southern edge of the Escalante Desert (Clement, 1980) does suggest a low geothermal potential for the area.

Exploration oil and gas well log data are not available for the area.

WATER RESOURCES

No perennial streams flow through the Piñon Point quadrangle, although summer cloudbursts may result in flash floods. The area is, for the greater part, utilized as rangeland and a number of small dams have been built for use as water catchment basins for livestock.

GEOLOGIC HAZARDS

Landslide potential within the Piñon Point quadrangle is rated as low or highly improbable. There is no great difference in slope stability between the various rock units. The possibility of property damage or personal injury is low due to the relatively gentle topography as well as the sparsely populated nature of the area. Rockfall and debris flow potential are considered to be negligible for similar reasons.

The Soil Conservation Service (SCS) report for the area dates back to 1952, although the SCS is currently re-evaluating the area. According to the 1952 report, a large portion of the quadrangle consists of "rough broken and stony land associations", and "nearly all of these soils are shallow or very shallow over bedrock." The new report, as of yet unpublished, indicates that soils in the area have moderate to low shrink-swell potential, neutral to alkali pH (6.6-9.0), high corrosive reactivity with steel and moderate reactivity with concrete. Much of the area has severely cemented hardpans below shallow soil, or severe seepage and a deep water table. Also, many of the soils have low mechanical strength and occur on slopes unsatisfactory for construction of dwellings, (G. Crandall, SCS, personal communication, 1985).

The flooding hazard, while not high, does exist for areas adjacent to and downstream of the Shoal Creek drainage. Heavy summertime cloudbursts may result in arroyo flash floods. Areas affected are mainly rangeland in the Dixie National Forest and some farmland in the Escalante Valley. Overall, the flooding hazard resulting in property damage and personal injury is considered to be low.

The Seismic Safety Advisory Committee rated the the general area as U-1 and U-2 zones for construction (U-4 is the highest hazard), and ground acceleration was rated UBC-2 (0.10g) (Ward, 1979). Since 1850, only two earthquakes with a magnitude greater than 4.0 on the Richter scale have been recorded for the area (Ward, 1979). Potential earthquake hazard is rated as low for the area, although small-magnitude earthquakes are possible and could cause minor damage to some structures. Figure 2 illustrates the locality and magnitude of the earthquakes since 1850.

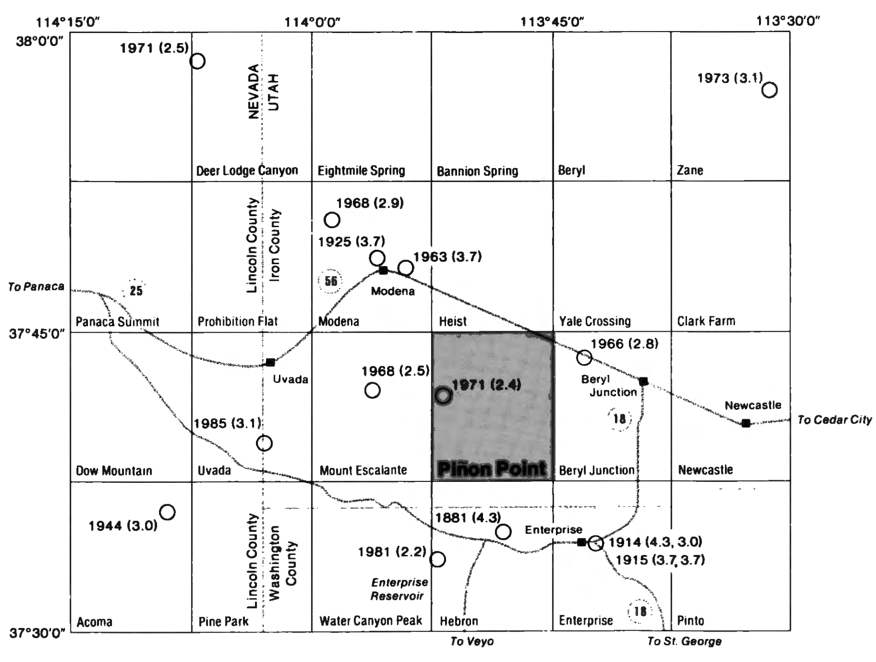
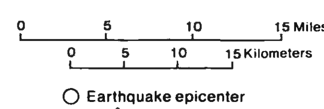


Figure 2. Earthquake epicenter location map.



ACKNOWLEDGMENTS

Study of the Piñon Point quadrangle has benefited from discussions with the geologists at the Escalante Silver mine (M. Malkoski in particular). Discussions with M. G. Best and the use of Dr. Best's laboratory facilities at the Geology Department of Brigham Young University (BYU) have been most helpful. M.G. Best also kindly reviewed this report. Conversations and correspondence with D. Foley of Earth Science Laboratory, University of Utah Research Institute and P.D. Rowley of the U.S. Geological Survey provided helpful insights into caldera structures and deposits as well as the regional structure and geology of the Basin and Range province of southwestern Utah. Thanks also go to C.G. Oviatt, who spent a day in the field with the author describing various aspects of the Quaternary geology, and G.C. Willis who assisted with fusion of sample powders and geochemical analysis by x-ray fluorescence (XRF). Dr. Frank Brown (University of Utah) performed the K-Ar dating of two samples; PP 6-24 (Ta), PP 8-2 (Td).

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MODAL ANALYSES OF SOME UNITS IN THE PIÑON POINT QUADRANGLE

*Olivine-augite basalt (Tb) * (n=2)
(Listed as approximate percentages that include both phenocryst and groundmass phases of minerals. This was done to eliminate the effects of variable amounts of groundmass in the different sections.)
NOTE: Basalt flows of similar morphology, which occur just south of Modena, are 10.8 ± 0.6 m.y. old, whereas other flows are 7.7 ± 0.2 m.y. (Best et al, 1980).

	Plagioclase	Olivine	Clinopyroxene	Fe-Ti oxides	Glass
1)	60%	13.5%	13.5%	10%	5%

*Andesite of Enterprise (hornblene andesite) (Ta) * (n=3)

	Matrix	Plag	Cpx	Opx	Fe-Ti	Hb	Biot	01
2)	61.4%	22.0%	4.4%	2.0%	4.0%	4.8%	0.8%	0.6%
3)	58.5%	26.7%	4.2%	5.3%	2.3%	3.0%	T	T
4)	59.8%	26.4%	2.0%	2.4%	3.0%	6.4%	T	–
X̄=	59.9%	25.0%	3.5%	3.2%	3.1%	4.7%	T	T

*Andesite of Enterprise (2 pyroxene andesite) (Ta) * (n=3)

	Matrix	Plag	Cpx	Opx	Fe-Ti	Hb	Biot	01	Xenos
5)	60.0%	24.8%	5.2%	5.4%	3.4%	–	–	T	1.2%
6)	49.7%	37.3%	3.6%	5.0%	3.6%	0.8	T	T	–
7)	56.2%	32.0%	6.4%	2.6%	2.8%	T	–	–	–
X̄=	55.3%	31.4%	5.1%	4.3%	3.3%	T	T	T	T

*Dacite of Piñon Park Wash (Td) * (n=3)

	Matrix	Plag	San	Qtz	Biot	Cpx	Fe-Ti	Hb	Zirc	Apat
8)	57.1%	31.2%	0.2%	0.5%	5.7%	3.3%	2.0%	T	T	T
9)	52.0%	27.2%	0.2%	1.8%	10.4%	5.6%	1.8%	T	T	T
10)	69.1%	20.1%	T	0.5%	2.8%	5.6%	1.1%	0.8%	T	T
X̄=	59.4%	26.2%	0.2%	0.9%	6.3%	4.8%	1.6%	T	T	T

*Racer Canyon Tuff (Tr) * (n=3)

	Matrix	Qtz	Plag	San	Lithic	Biot	Hb	Fe-Ti	Sph	Zirc	Apat
11)	54.0%	16.0%	13.0%	6.0%	5.0%	3.0%	1.4%	1.0%	0.6%	T	T
12)	54.8%	17.2%	11.2%	5.4%	6.2%	3.8%	T	1.0%	0.4%	T	T
13)	61.0%	11.0%	11.2%	8.0%	3.8%	4.4%	0.4%	0.2%	T	T	T
X̄=	56.6%	14.7%	11.8%	6.5%	5.0%	3.7%	0.6%	0.7%	0.4%	T	T

*Quartz latite (Tl) * (n=8)

	Groundmass	Plag	Pyroxene	Fe-Ti
14)	93.0%	4.7%	1.3%	1.0%
15)	95.8%	T	2.5%	1.0%
16)	96.2%	T	2.5%	1.3%
17)	93.6%	0.2%	5.0%	1.2%
18)	92.6%	2.9%	1.9%	2.6%
19)	95.2%	3.8%	0.7%	0.3%
20)	89.8%	7.0%	1.5%	1.7%
21)	95.3%	0.7%	2.7%	1.3%
X̄=	93.9%	2.4%	2.3%	1.3%

*Tuffs, undivided (Tt) * (n=5)

	Pumice + matrix	Lithics	San	Plag	Qtz	Fe-Ti	Sph	Biot	Zirc	Pyx
22)	82.8%	36.8%	9.2%	–	T	0.6%	T	–	–	–
23)	43.0%	51.4%	4.1%	0.9%	0.2%	0.4%	T	T	T	T
24)	56.9%	34.8%	5.5%	2.3%	0.4%	0.1%	T	T	T	–
25)	47.5%	45.5%	4.3%	1.4%	1.1%	T	T	T	T	–
26)	50.5%	45.0%	0.9%	2.5%	0.7%	T	T	T	T	–
X̄=	56.1%	42.7%	4.8%	1.4%	0.5%	0.2%	T	T	T	T

*Rhyolite of Piñon Point (Trp) * (n=4)

	Glass matrix	Sanidine	Trid	Qtz	Plag	Fe-Ti	01
27)	89.0%	3.9%	2.7%	2.5%	1.4%	0.5%	T
28)	95.7%	2.5%	T	1.0%	0.4%	0.4%	T
29)	91.4%	0.6%	7.0%	0.2%	0.4%	T	0.4%
30)	94.0%	3.0%	T	2.8%	–	0.2%	–
X̄=	92.5%	2.5%	2.4%	1.6%	1.0%	0.3%	T

*Middle flow member of the rhyolite of Beryl Junction (Trbm) * (n=9)

	Groundmass	K-spar	Fe-Ti	Pyx	Qtz (vesicle-fill)
31)	88.5%	8.0%	2.8%	T	0.7%
32)	88.5%	5.5%	4.0%	T	1.5%
33)	89.0%	7.0%	2.0%	T	2.0%
34)	87.3%	8.0%	2.0%	0.2%	2.5%
35)	89.7%	5.0%	1.2%	0.3%	3.8%
36)	89.3%	9.7%	6.0%	T	–
37)	89.7%	5.6%	1.2%	0.2%	3.3%
38)	88.8%	5.0%	1.2%	0.5%	3.0%
39)	91.9%	5.1%	2.5%	T	0.5%
X̄=	89.2%	6.5%	2.5%	0.2%	1.9%

Sample numbers corresponding to sample numbers on the list: 1)=PP 12-1 & PP 17-6, 2)=PP 8-8, 3)=PP 13-2, 4)=PP 6-24, 5)=PP 6-23, 6)=PP 8-4, 7)=PP 31-1, 8)=PP 7-12, 9)=PP 8-2, 10)=PP 14-26, 11)=PP 6-20, 12)=PP 11-15, 13)=PP 6-27, 14)=PP 7-5, 15)=PP 4-19, 16)=PP 11-3, 17)=PP 5-2, 18)=PP 7-3, 19)=PP 12-10, 20)=PP 11-13, 21)=PP 11-14, 22)=PP 4-5, 23)=PP 5-14, 24)=PP 4-10, 25)=PP 4-7, 26)=PP 1-8, 27)=PP 12-9, 28)=PP 12-7, 29)=PP 7-19, 30)=PP 15-9, 31)=PP 4-23, 32)=PP 28-3, 33)=PP 9-10, 34)=BJ 1-4, 35)=PP 1-10, 36)=PP 4-17, 37)=PP 1-1, 38)=PP-1, 39)=PP 4-13.

AVERAGE ANALYSES FOR SOME ROCK UNITS IN PIÑON POINT QUADRANGLE

N=	2	3	5	10	2	6	1
	Ta	Td	Tl	Trbm	Trbe	Trp	Tb
SiO_2	56.03 (1.27)	61.60 (2.37)	68.02 (2.50)	70.07 (0.49)	74.32 (0.23)	74.75 (0.67)	48.87
TiO_2	1.03 (0.29)	0.85 (0.16)	0.44 (0.08)	0.25 (0.04)	0.12 (0.00)	0.10 (0.02)	2.30
Al_2O_3	16.19 (0.88)	15.29 (0.50)	15.18 (0.77)	14.58 (0.42)	11.94 (0.22)	12.65 (0.45)	15.29
Fe_2O_3	8.11 (1.02)	6.16 (1.10)	3.28 (1.07)	2.59 (0.17)	1.55 (0.01)	1.31 (0.10)	11.91
MnO	0.08 (0.00)	0.06 (0.00)	0.05 (0.00)	0.02 (0.00)	0.02 (0.00)	0.02 (0.00)	0.22
MgO	5.20 (0.62)	3.63 (0.21)	1.62 (0.35)	1.22 (0.47)	1.74 (0.32)	0.98 (0.38)	6.68
CaO	7.17 (0.22)	5.26 (0.71)	1.76 (0.63)	0.89 (0.26)	1.63 (0.26)	0.84 (0.17)	8.17
Na_2O	2.82 (0.25)	2.94 (0.11)	4.53 (0.23)	4.62 (0.48)	3.98 (0.04)	4.39 (0.53)	3.64
K_2O	2.68 (0.38)	3.85 (0.13)	4.96 (0.25)	5.65 (0.55)	4.62 (0.16)	4.85 (0.35)	1.81
P_2O_5	0.72 (0.13)	0.36 (0.06)	0.17 (0.09)	0.12 (0.05)	0.11 (0.04)	0.13 (0.03)	1.12

Analyses by x-ray fluorescence spectrometry using the Norrish and Hutton (1969) method. Analyses recalculated to 100%, loss-free, with total iron as Fe_2O_3. Pressed pellets of pure rock powder used for Na_2O analyses. Standard deviations in parentheses below mean values. "N" denotes the number of sample analyzed for each unit.

NOTE: MgO levels seem higher than expected except for Tb, but have not been corrected.

RADIOMETRIC AGES OF SELECTED VOLCANIC ROCKS IN SOUTHWESTERN UTAH

Olivine basalt (Enterprise basalt)			
	7.7 ± 0.2 m.y.	Best and others, 1980	
Olivine basalt (south of Modena)			
	10.8 ± 0.6 m.y.	Best and others, 1980	
Rhyolite of Beryl Junction, middle flow member (Trbm)			
	10.8 ± 0.5 m.y.	Siders, 1985	
Rhyolite of Piñon Point, flow member (Trp)			
	12.8 ± 0.6 m.y.	Siders, map in progress	
Ox Valley Tuff			
	12.6 ± 0.3 m.y.	Noble and McKee, 1972	
	15.4 ± 0.4 m.y.	Noble and McKee, 1972	
Hiko Tuff			
	20.1 ± 0.5 m.y.	Noble and McKee, 1972	
	18.1 ± 0.6 m.y.	Armstrong, 1970	
	18.2 ± 1.0 m.y.	Armstrong, 1970	= 18.2 m.y.
	18.4 ± 0.4 m.y.	Armstrong, 1970	isochron
Racer Canyon Tuff			
	18.7 ± 0.5 m.y.	Noble and McKee, 1972	
	20.8 ± 0.5 m.y.	Noble and McKee, 1972	
Dacite of Piñon Park Wash			
	21.5 ± 3.3 m.y.	this report	
Andesite of Enterprise			
	24.2 ± 1.2 m.y.	this report	
Leach Canyon Tuff			
	22.9 ± 0.5 m.y.	Armstrong, 1970	
	24.6 ± 0.5 m.y.	Armstrong, 1970	= 24.6 m.y.
	26.7 ± 1.0 m.y.	Armstrong, 1970	isochron
Isom Formation			
*Hole-in-the-Wall	25.7 ± 0.5 m.y.	Armstrong, 1970	
Tuff member	25.2 m.y.	Hausel and Nash, 1977	
*Baldhills Tuff	25.7 m.y.	Hausel and Nash, 1977	
member	25.7 m.y. (best estimate)	Fleck and others, 1975	
Needles Range Formation			
	30.5 m.y. (isochron)	Armstrong, 1970	

NOTE: All K-Ar ages published prior to 1976 have been revised to the new constants, following the tables of Dalrymple (1979).

UTAH GEOLOGICAL AND MINERAL SURVEY

606 Black Hawk Way
Salt Lake City, Utah 84108-1280

THE UTAH GEOLOGICAL AND MINERAL SURVEY is one of eight divisions in the Utah Department of Natural Resources. The UGMS inventories the geologic resources of Utah (including metallic, nonmetallic, energy, and ground-water sources); identifies the state's geologic and topographic hazards (including seismic, landslide, mudflow, lake level fluctuations, rockfalls, adverse soil conditions, high groundwater); maps geology and studies the rock formations and their structural habitat; provides and disseminates educational materials concerning the geology of Utah; and provides information to decisionmakers at local, state, and federal levels.

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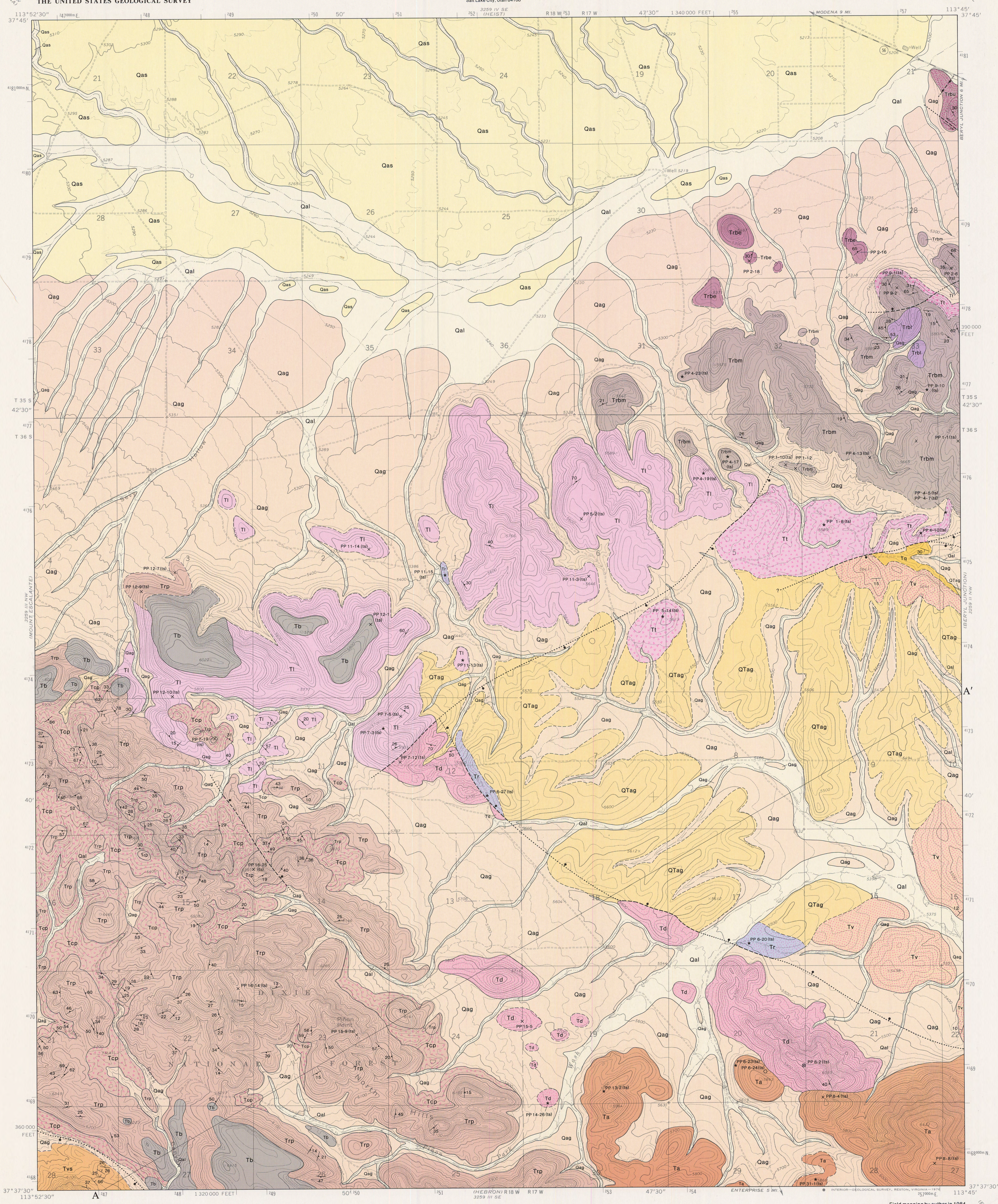


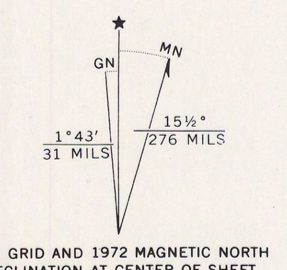
Base from U.S. Geological Survey Piñon Point Quadrangle, 1972

SCALE 1:24 000

1 MILE
7000 FEET
1 KILOMETRE

CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 10-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

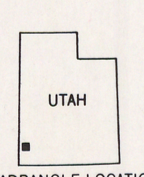
Field mapping by author in 1984
J. Parker, Cartographer



UTM GRID AND 1972 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

GEOLOGIC MAP OF THE PIÑON POINT QUADRANGLE, IRON COUNTY, UTAH

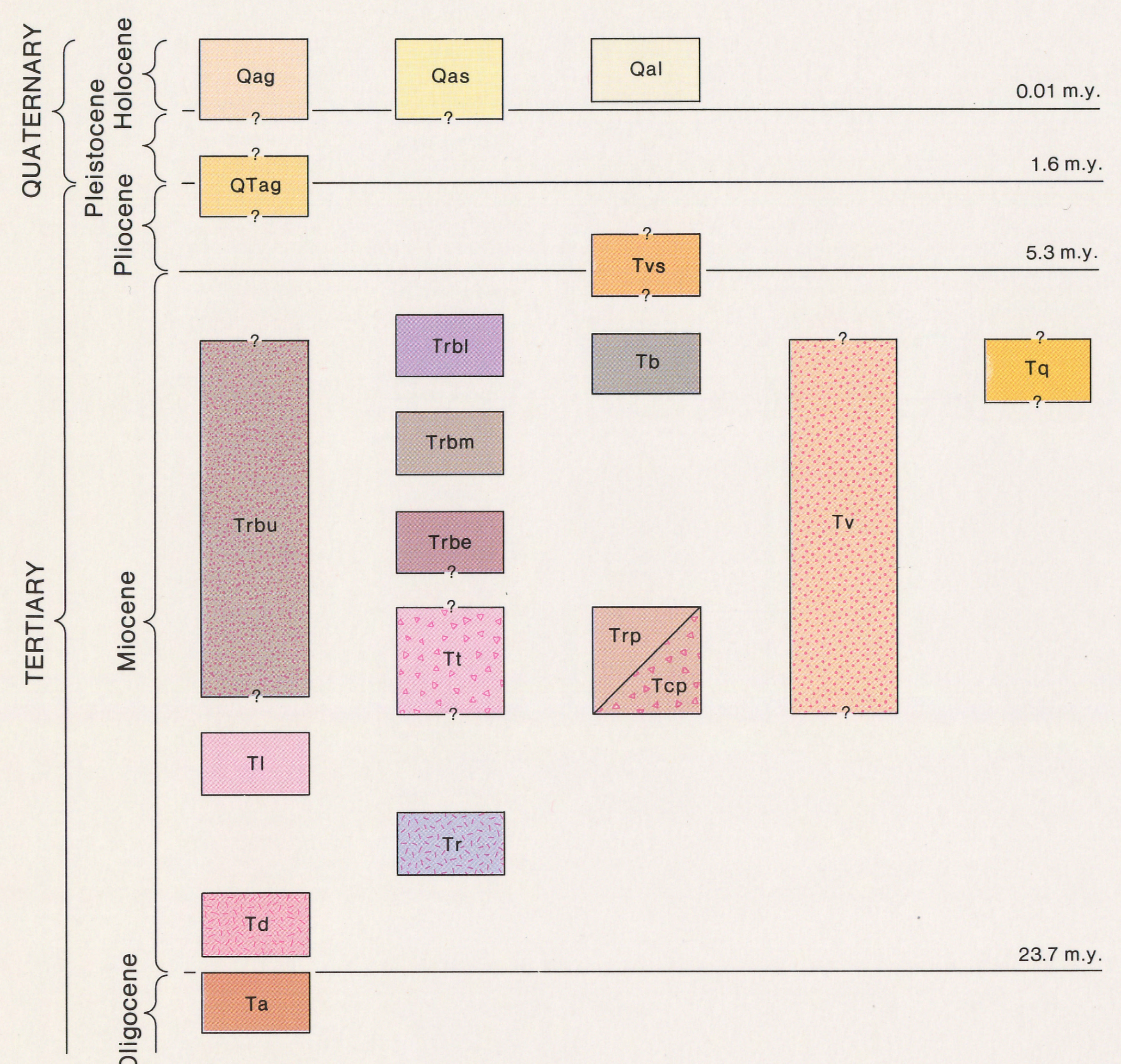
by
Mary A. Siders
Utah Geological and Mineral Survey

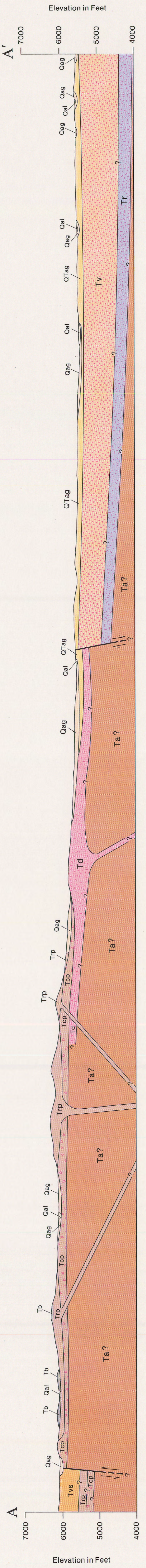


QUADRANGLE LOCATION

1985

CORRELATION OF MAP UNITS





DESCRIPTION OF MAP UNITS

Qal Alluvium (Holocene) — *Unconsolidated sand and silt in ephemeral stream channels.*

Qag Alluvium (Holocene and Pleistocene?) — *Unconsolidated sand and gravel covering slopes and plains. Also includes sand, gravel and boulder deposits with fan morphology.*

Qas Alluvial plain sand (Holocene and Pleistocene) — *Mostly quartz-rich sands.*

QTag Older dissected alluvium (Holocene, Pleistocene, and Pliocene?) — *Older slope and plain alluvium presently being eroded. These deposits are found mainly within the graben basin in the east-central portion of the quadrangle.*

Tvs Local volcanic and sedimentary basin-fill deposits (Pliocene?) — *0-400 ft. Volcanic sandstone, air-fall tuffs, tuffaceous sediments, and quartz-rich sandstone.*

Tb Olivine-augite basalt (Miocene) — *0-200 ft. Dark gray to black, coarse-grained basaltic lavas that contain plagioclase, olivine, augite and Fe-Ti oxides. (10.8 ± 0.6 m.y., Best and others, 1980).*

Tv "Mine Series" volcaniclastic rocks (Miocene) — *0-1,200 ft. Crudely bedded volcanic breccias and conglomerates, volcaniclastic sandstones and tuffaceous sediments. The exposed thickness ranges from 100 to 150 feet, although over 1,200 feet have been drilled in the vicinity of the Escalante Silver Mine about two miles east of the map area. The K-Ar age of adularia from the Escalante vein is 11.6 ± 0.5 m.y. (Siders, 1985), although deposition of the entire "Mine Series" sequence probably spans a range ± several million years from this date.*

Tq Limestone of Quartz Hill (Miocene) — *0-200 ft. Chalcedonic quartz to jasperoid beds resulting from pervasive silicification of lacustrine limestones beds. The beds contain sparse plant fossils and have an exposed thickness of 50 to 80 feet in the Piñon Point quadrangle.*

Rhyolite of Beryl Junction (Miocene)

Trbl Later gray rhyolite member — *0-100 ft. Gray, flow-layered rhyolitic lavas that occur in only minor amounts as small plugs or flows.*

Trbu Volcaniclastic facies member — *0-200 ft. Includes matrix-supported volcaniclastic rocks, that contain dominantly rhyolitic lithic fragments as well as silicified and/or iron-stained and hydrothermally-altered, fragmental, rhyolitic lavas. Deposition probably spans the entire time of Trbe to Trbl.*

Trbm Rhyolitic flow member — *0-400 ft. Includes both dense, reddish-purple lavas with sparse anorthoclase-sanidine feldspar phenocrysts and irregular gray flow streaks as well as generally gray-colored to gray- and red-mottled rocks that contain medium-sized sanidine. The former contains an average of 6.5% anorthoclase-sanidine, 2.5% Fe-Ti oxides, 0.2% clinopyroxene. Anhedral interlocking quartz grains, which occur as "stringers," comprise 1.9% The latter contains similar mineral abundances except that the potassium feldspar is sanidine rather than anorthoclase-sanidine. K-Ar age of a feldspar mineral separate is 10.8 ± 0.5 m.y. (Siders, 1985).*

Trbe Early high-silica rhyolite member — *0-200 ft. Flow-layered rhyolitic lavas that are chemically identical to the rhyolites of Piñon Point (Trp). These lavas, as well as the tuffs (Tt) underlying them and Trbm, may be related to the 12.8 m.y. rhyolites of Piñon Point.*

Rhyolite of Piñon Point (Miocene)

Trp Rhyolite flow member — *0-600 ft. Sparsely porphyritic, flow-layered rhyolitic lavas that contain an average of 2.5% sanidine, 1.6% quartz, 1.0% plagioclase and 0.3% Fe-Ti oxide phenocrysts. K-Ar age of a feldspar mineral separate is 12.8 ± 0.6 m.y. (Siders, Mount Escalante quadrangle, map in progress).*

Tcp Clastic member — *0-300 ft. Includes a yellowish tuff-breccia and brecciated vitrophyres. This deposit immediately underlies and is adjacent to the rhyolitic flows (Trp).*

Tt Vitric-lithic-crystal tuff, undivided (Miocene) — *0-150 ft. Poorly welded vitric-lithic tuffs of white, tan to pale pink color, that contain yellowish pumice and gray to reddish-purple lithic fragments as well as crystals of sanidine, quartz, Fe-Ti oxides, sphene, and zircon. These tuffs may be related to the 12.8 m.y. old rhyolite of Piñon Point (Tcp, Trp).*

Tl Quartz latite lava (Miocene) — *0-400 ft. Weakly porphyritic lavas with well-developed trachytic texture that commonly exhibit platy-fracturing in outcrop. Contains an average of 2.4% plagioclase, 2.3% clinopyroxene and 1.3% Fe-Ti oxides.*

Tr Racer Canyon tuff (Miocene) — *0-80 ft. Pale gray, moderately welded, crystal tuff containing an average of 14.7% quartz, 11.8% plagioclase, 6.5% sanidine, 5.0% lithic fragments, 3.7% biotite, 0.7% Fe-Ti oxides and trace amounts of hornblende, sphene, apatite and zircon. (About 19 m.y., Noble and McKee, 1972).*

Td Dacite of Piñon Park Wash (Miocene) — *0-500 ft. Strongly porphyritic dacite containing an average of 26.2% plagioclase, 6.3% biotite, 4.8% pyroxene, 1.6% Fe-Ti oxides, 0.9% quartz and trace amounts of sanidine, hornblende, zircon and apatite. K-Ar age of a biotite mineral separate is 21.7 ± 3.3 m.y. (Siders, this report).*

Ta Andesite of Enterprise (Miocene) — *0-800 ft. Porphyritic hornblende andesite and two pyroxene andesite lavas containing 22.0-37.3% plagioclase, 0-6.4% hornblende, 2.0-6.4% clinopyroxene, 2.0-5.4% orthopyroxene, 2.3-4.0% Fe-Ti oxides and trace amounts of biotite, olivine and xenolithic fragments. K-Ar age of a hornblende mineral separate is 24.2 ± 1.2 m.y. (Siders, this report).*

SYMBOLS

CONTACT
Dashed where location inferred

NORMAL FAULT
Bar and ball on downthrown side; dashed where location inferred; dotted where covered

STRIKE-SLIP FAULT
Arrows show relative movement; dashed where location inferred; dotted where covered

STRIKE AND DIP OF BEDDING
23
Inclined — Vertical

STRIKE AND DIP OF IGNEOUS FOLIATION
45
Inclined — Vertical

LOCATION OF ROCK SAMPLE
× Geochemical — ○ K-Ar — ⊗ Both

★ Thin section only
(ts) = thin section

OTHER SYMBOLS
Vein
Prospect — Shaft — Adit