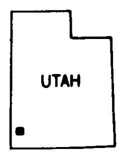
GEOLOGIC MAP OF THE BERYL JUNCTION QUADRANGLE, IRON COUNTY, UTAH

By Mary A. Siders
Utah Geological and Mineral Survey



UTAH GEOLOGICAL AND MINERAL SURVEY
a division of
UTAH DEPARTMENT OF NATURAL RESOURCES
MAP 85 1985

GEOLOGIC MAP OF THE BERYL JUNCTION QUADRANGLE, IRON COUNTY, UTAH

By Mary A. Siders [1]

ABSTRACT

Mapping of the Beryl Junction quadrangle reveals that the area includes volcanic rocks of Oligocene through Miocene age, as well as a thick volcaniclastic sequence and a variety of Quaternary deposits. 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 assisted by the use of aerial photographs, and descriptions of the volcanic rocks include petrographic and geochemical data as well as observational data from the field. Epithermal veins within the volcaniclastic sequence ("mine series") contain silver mineralization that is exploited by the Escalante silver mine. The main silver vein breaks into several smaller veins at its southern end. The northeasterly trend of the vein is truncated by a normal fault trending N 30° W (noted in seismic studies employed by Hecla, 1985), and a complementary portion of the vein may be shallowly buried under alluvium. A more major north-trending normal fault probably truncates this complementary portion of the vein, which may continue at depth under the alluvium of the Escalante Desert. Although the quadrangle is extensively staked and numerous prospect pits have been dug in other parts of the quadrangle, the silver mineralization is only known to occur within the Escalante vein and its offshoots.

INTRODUCTION

The Beryl Junction quadrangle is located in southwestern Iron County, north of the Bull Valley Mountains and on the southern edge of the Escalante Desert. It lies within the Basin and Range physiographic province and is about 3.5 miles (5.6 km) northwest of the town of Enterprise. The quadrangle is situated along the northern edge of the east-northeasterly trending Delamar-Iron Springs Mineral Belt. However, aside from the veins of the Escalante silver mine, no other areas of economic mineralization are known to occur within the quadrangle. Tertiary volcanic rocks dominate the area and form a series of low hills that are buried under alluvium of the Escalante Desert on the northern portion of the quadrangle.

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

Renewed interest in the Beryl Junction quadrangle has resulted from the opening of the Escalante silver mine (1981). 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 mineralogy and paragenesis of the ore (Arentz, 1978; Allen, 1979; Woodward, 1982; Fitch and Brady, 1982).

STRATIGRAPHY

Rocks exposed in the Beryl Junction quadrangle consist mainly of local volcanic units of latest Oligocene to Miocene age, as well as small areas of silicified limestone and a thick sequence of volcaniclastic rocks. Quaternary alluvial deposits form the youngest units in the area.

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 southwest corner of the Beryl Junction quadrangle. The unit attains a thickness of at least 800 feet (244 m) and is fairly resistant so that it forms abundant

[1] Mapping geologist, Utah Geological and Mineral Survey

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 20 miles (32 km) northwest of the Beryl Junction quadrangle). Best bracketed the age of the andesite between 22-25 m.y. based on stratigraphic relations. The K-Ar age of hornblende (Ta) in the adjacent Piñon Point quadrangle is 24.2 ± 1.2 m.y. (Siders, 1985; analysis by F. Brown, University of Utah). Andesite along the northern edge of the outcrop area borders the volcaniclastic rocks (Tv) along the southern boundary fault. Here the andesite is propylitically altered and is generally greenish-gray in color due to alteration of ferromagnesium minerals to chlorite and/or epidote.

Tuffs, undivided Tt

Vitric-lithic tuffs of white, yellow, to pale pink color crop out in the western portion of the Beryl Junction quadrangle. Crystal content in this series of weakly 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 in the adjacent Piñon Point quadrangle, but are mostly covered by later units in the Beryl Junction quadrangle. Correlation of these tuffs with any other tuff in adjacent quadrangles is very tentative at this time, however they may be associated with the extrusion of the 12.8 m.y.-old rhyolites of Piñon Point (Trp, Tcp).

Rhyolite of Beryl Junction

Low, sagebrush-covered hills in the northwestern corner of the quadrangle are comprised of lava flows and domes of rhyolite. These rocks, which are rather latitic in appearance, are termed "rhyolites" on the basis of major oxide chemistry (Nockolds, 1954). These rhyolitic lavas 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.

High-silica rhyolite member Trbe—Lavas of this unit occur in the adjacent Piñon Point quadrangle but were not found in the Beryl Junction quadrangle.

Rhyolitic flow member (10.8 ± 0.5 m.y.) Trbm—Rhyolitic lava flows containing anorthoclase-sanidine or sanidine as the prominent phenocryst phase, with mean SiO_2 = 70.7 percent (analyses recalculated to 100 percent, loss-free), occur in the northwest quadrant of the map area. The dense, reddish lavas contain small, sparse potassium feldspar phenocrysts and also exhibit irregular flow layering that imparts a foliation to the rocks. The 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 vitrophyres underlie some of the flows and are chemically identical (major oxides) to the non-vitrophyric lavas of this unit. In some areas the lavas are sericitized and bleached to a pale pinkish-tan color. Orangish iron-staining also occurs locally. A K-Ar age of a feldspar mineral separate from these lavas is 10.8 ± 0.5 m.y. (This report; 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 rhyolitic lavas, or they may represent erosional shedding off the adjacent rhyolitic domes and flows. Angular rhyolitic fragments contained in a devitrified quartzo-feldspathic matrix comprise the bulk of the fragmental rhyolites. Both the volcaniclastic and fragmental rocks of this unit (Trbu) 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—Lavas of Trbl occur in minor amounts as small plugs or flows. These lavas are generally light gray, but may also be brilliant orange due to iron staining. Large sanidine or sanidine plus quartz phenocrysts are contained in these lavas.

Limestone of Quartz Hill Tq

Outcrops of silicified lacustrine limestone and sandy limestone occur just south of the main exposure of the rhyolite of Beryl Junction (Trbm). The bedded limestone sequence is informally named after a prominent hill in the 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 may have resulted from hot springs activity associated with the adjacent magmatism. The resistant chalcedonic quartz remains as tilted beds that locally contain abundant plant fossils (Equisetum stems ? or striated palm roots ?). The beds have a general west-northwesterly strike and southerly dip of 20 to 30 degrees. These limestone beds may have been deposited in a local intragraben lake associated with the volcano-tectonic depression related to the extrusion of the nearby rhyolites. A small patch of an unidentified, fine-grained tuff occurs at the summit of Quartz Hill. Volcaniclastic rocks of the "mine series" (Tv) overlie the limestones along the southern edge of the outcrop.

Volcaniclastic "mine series" Tv (about 11 to 13 m.y.)

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 the middle rhyolite flow member (Trbm) of the rhyolite of Beryl Junction, 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. Interbedded volcanic sandstones are also generally poorly 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. Silver mineralization hosted by this unit is exploited by the Escalante silver mine. Adularia from the mineralized rock of the Escalante vein gives a K-Ar age of 11.6 $\pm$ 0.5 m.y. (This report; analysis by Geochron Laboratories, sample F 7076). Although this sequence is tentatively estimated to be 11 to 13 m.y. old, it could be as old as 18 m.y..

QUATERNARY UNITS

Oldest Quaternary alluvium QTag

Alluvial deposits consisting of poorly sorted unconsolidated sand and bouldery beds of heterogeneous composition occur in the west-central portion of the Beryl Junction 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 Beryl Junction and Piñon Point quadrangles are represented in the QTag clasts.

Sands and gravels of ancestral Shoal Creek Qags

Fluvial cross-bedded sands and gravels deposited by ancestral Shoal Creek are mapped as a broad band extending northward across the eastern part of the Beryl Junction quadrangle. Gravel pits adjacent to the Beryl Junction airstrip, and in other localities, offer excellent exposures of these deposits. The surface soil on Qags is strongly developed, suggesting that the deposits may be late Pleistocene in age.

Shoal Creek, which drains the northern Bull Valley Mountains south and west of Enterprise, flows northward until it percolates downward into the alluvial fill of the Escalante Valley and disappears. Fluvial deposits, which are located three to five miles north of the present-day terminus of Shoal Creek, suggest that there was greater runoff and possibly a higher ground water table during the deposition of Qags.

Although an arm of Lake Bonneville has been mapped as extending southward into the Escalante Valley almost to the town of Enterprise (Gilbert, 1890; Anderson and Bucknam, 1979), no stratigraphic or geomorphic evidence for the lake has been observed in the Beryl Junction quadrangle. Lake Bonneville probably did not extend this far south (Crittenden, 1963; Dennis, 1944, Currey, 1982), and Shoal Creek and other streams, with their increased runoff during the period of wetter or cooler climate coincident with Lake Bonneville, dominated sedimentation in the Escalante Valley.

Playa lake basins Qpm

Small lake basins adjacent to the dune fields (Qed) are the sites of ephemeral lakes.

Sand dunes Qed

White- to buff-colored sand dunes are comprised of calcium carbonate, quartz, and clay aggregates that were precipitated in a playa lake environment. The amplitude of the dunes is two to ten feet, and most are stabilized by grasses, sagebrush and other shrubs. They appear to have a modified barchan dune form, and some peripheral portions of the dune fields have been leveled and incorporated into adjacent farmlands.

Alluvial fans and slope wash deposits Qag

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

Alluvium in active stream channels Qal

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

Tailings pond Qft

Tailings pond for waste water from the mill at the Escalante silver mine. A man-made earthen dam contains the waste material.

STRUCTURE AND GENERAL GEOLOGY

The Beryl Junction quadrangle lies within the Basin and

Range physiographic province, a known area of 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. 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 Beryl Junction quadrangle also lies along the northern edge of the intermountain seismic zone and 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 Delamar-Iron Springs Mineral Belt corresponds roughly to this lineament. 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). They also note 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.

The Beryl Junction area contains mainly local volcanic units, and no regional ash-flow tuff sheets are found in the quadrangle. The western third of the quadrangle has been uplifted along a north-trending basin-range fault. Other faulting within the quadrangle is generally obscured due to the well-developed alluvial and colluvial cover. However, most faults appear to trend either northwest or northeast. In the northwestern corner of the quadrangle, strike-slip faulting is inferred from en echelon tensional fractures, although no strike-slip displacement could be documented. Black calcite veins now occupy these fractures.

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 6.5 miles (10.5 km) north of the northern edge of the Beryl Junction quadrangle, in Section 18, T. 34 S., R. 16 W., Iron County, Utah. Alluvial fill extends down to 2,270 feet, (690 m) whereupon a great thickness (1,430 feet; 435 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 (1402-1500 m), where a mixed sequence of limestone and altered andesite is encountered down to 4,990 feet (1520 m). From 4,990 to 5,320 feet (1520-1621 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 20 miles (32 km) northeast of the northeast corner of the Beryl Junction quadrangle. Valley alluvium continues to a depth of 2,930 feet (893 m), whereupon a uniform red-brown siltstone is encountered until 3,920 feet (1195 m) where the siltstone occurs together with a rhyolitic tuff (Racer Canyon or Leach Canyon ?). The interval 3,920 to 4,540 (1195-1384 m) again 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 (1384-1686 m). Underlying brown siltstone extends down to 5,740 feet (1750 m), where a pink ash-flow tuff, possibly the Isom Formation, continues to 5,790 feet (1765 m), (M.G. Best, unpublished data, 1985).

An east-trending basin, in which at least 1,200 feet (366 m) of crudely bedded, volcanic sandstones, conglomerates and breccias were deposited, is located in the west-central portion of the Beryl Junction quadrangle. This basin also extends westward into the Piñon Point quadrangle. Arcuate and linear features in the area, such as the path of Shoal Creek and the east-trending rhyolitic complex of Piñon Point, are suggestive of caldera-related features, but no related ash-flow tuff is found in the area. This suggests that the basin is more likely the result of faulting (graben), perhaps due to tectono-volcanic subsidence related to the extrusion of rhyolitic lavas.

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 extensive colluvial and alluvial deposits that obscure relationships between some units. In general, the northeast- and northwest-trending faulting can be bracketed to have occurred between 24 m.y. to about 7 m.y. ago. Major displacement on the north-trending basin-range fault probably occurred less than 10 m.y. ago and perhaps as recently as less than 5 m.y. ago. About 12 miles east of the Beryl Junction quadrangle, north-trending range-front faults along the Antelope Range are seen to offset Quaternary fan deposits. However, faults cutting Quaternary deposits were not observed in the Beryl Junction 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 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 the 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) magmatism occurred 20 to 21 m.y. ago, marking the onset of extensional tectonics.

Calc-alkaline volcanic rocks of intermediate composition that crop out in the Beryl Junction quadrangle include the andesite of Enterprise (Ta). These lavas predate the transition to extensional tectonism and bimodal magmatism that began about 21 to 20 m.y. ago. The andesite of Enterprise (Ta) in the Beryl Junction quadrangle represents the remnants of a larger andesitic volcanic field. Hills of andesite extend westward and southward into the Piñon Point, Enterprise, and Hebron quadrangles. K-Ar dating of the andesite (Ta) in the adjacent Piñon Point quadrangle yielded an age of 24.2 m.y. (Siders, 1985). 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 Beryl Junction quadrangle, and the andesite of Enterprise (Ta) may be related to this belt.

The extrusion of the andesitic lavas (Ta) and related dacitic lavas (Td, exposed in the Pinon Point quadrangle) must have buried the earliest member or formed a highland barrier to later members of the 24 to 20 m.y.-old ash-flow tuffs of the Quichapa Group, as none of these tuffs crop out in the Beryl Junction quadrangle, even though they are found in surrounding areas (Williams, 1967).

Subsequent events that occurred in the Beryl Junction quadrangle are more speculative but are probably associated with the eruption of the 12.8 m.y.-old rhyolite of Pinon Point (Trp, Tcp). Vitric-lithic tuffs (Tt) and high-silica rhyolite (Trbe), which have a chemical composition (major oxides) virtually identical to the rhyolite of Piñon Point (Trp), occur in the northwest portion of the Beryl Junction quadrangle. Following these tuffs and lavas, lava flows of the rhyolitic flow member of the rhyolite of Beryl Junction (Trbm) were extruded in the northwestern portion of the area. K-Ar dating of potassium feldspar from these sparsely porphyritic lavas (Trbm) gives an age of 10.8 $\pm$ 0.5 m.y. Sometime before or during the extrusion of these rhyolites, a thick sequence of volcaniclastic rocks was deposited in the Beryl Junction and Piñon Point quadrangles. Drill core data from the Escalante silver mine reveal over a 1,200 foot (366 m) thickness of this fine-grained to conglomeratic volcaniclastic sequence. Judging from the thickness and composition of the "mine series" volcaniclastic sequence that occurs here, the basin in which they accumulated, 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 the types of lithic fragments contained in the basin-fill, the age of the basin and its volcaniclastic contents is estimated to be 11 m.y., but it may be older or younger. The adularia age is 11.6 $\pm$ 0.5 m.y., whereas Trbm clasts, found in the upper beds of the volcaniclastic sequence, are known to be 10.8 $\pm$ 0.5 m.y. in age. The upper parts of this volcaniclastic sequence overlie a restricted area of pervasively silicified fossil-bearing limestone beds (Tq). Geologic evidence suggests that these limestones formed in a local intra-basin lacustrine setting.

Subsequent to this volcanic activity, basin-range faulting and erosive processes have affected the Beryl Junction area. A north-trending basin-range fault occurs within the western third of the Beryl Junction quadrangle. Accessory strike-slip faulting is inferred from a series of en echelon tension fractures that now contain vein-filling black calcite. Geochemical anomalies for some elements have been detected in this area (M. Malkoski, personal communication), however no significant or economic mineralization has been discovered to be associated with these calcite veins.

Throughout the Quaternary, erosion has resulted in the formation of several generations and types of alluvial deposits in the Beryl Junction 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 Beryl Junction area. Consequently, the deposits of QTag were eroded and dissected, forming part of 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. Fluvial cross-bedded sands and gravels (Qags) were deposited by the ancestral Shoal Creek, which flowed during a wetter or cooler climatic period, and are speculated to be Pleistocene in age. Broad areas of dune sands (Qed) are located along the northern margin of the quadrangle. X-ray diffraction examination of a sand sample reveals calcium carbonate, quartz and a binding clay. No gypsum or sulfates were found in the sand. The grains probably formed by precipitation in a playa lake environment and were subsequently transported from the desiccated playas by aeolian processes to form the dune fields. Deposits of generally fine-grained alluvium, which are found in active channels of ephemeral streams, represent the youngest deposits in the Beryl Junction quadrangle.

ECONOMIC GEOLOGY

The Escalante silver mine, Utah's largest primary silver mine, is located within the Beryl Junction quadrangle. Extensive claim blocks have been staked over much of the quadrangle, and numerous prospect pits and a number of shafts have been dug. Prospecting for mineralization near the present-day Escalante mine dates back to about 1896. Since then, the property has passed through a series of ownerships. In 1975, Ranchers Inc. acquired the lease on the property and conducted exploratory drilling. Full mine development began in 1980 and a newly constructed mill began processing the ore by August 29, 1981. The Hecla Mining Company merged with Ranchers Inc. in late 1984, and they currently control the Escalante silver mine. According to reports from the previous operating company (Ranchers), "the silver deposit is in a relatively wide and continuous quartz vein that outcrops partially and forms a gentle ridge in an area of low rolling hills." The vein strikes

N 27° E and has dips that vary from vertical on the south end to 70° W in the main part of the vein. The vein extends about 5,100 feet (1554 m) along the strike, with an average grade of 11 ounces per ton. The total production since the opening of the mine in 1981 is on the order of 1.1 millon tons of ore. This yielded approximately 9 millon ounces of silver. In 1985, the annual ore production was approximately 300,000 tons, at an average grade of 10 to 10.5 ounces silver per ton of ore (personal communication, 1985). Drilling is proposed along the northern and southern extent of the vein (personal communication, 1985). The truncation of the northern end of the vein by normal faulting has lead to speculation of an extension of the mineralized zone. However, a high water table and expensive dewatering costs (the mine's major operating expense) may make a deeply buried vein cost-prohibitive at the present time. An increase in silver prices may warrant the additional dewatering expense.

Silver mineralization, which is hosted by the volcaniclastic "mine series" unit (Tv), is associated with finely disseminated hematite, and occurs mainly in the quartz-rich portion of the vein. Calcite, fluorite and barite are locally abundant. The silver minerals, which are not visible in hand specimen, range from less than 10 microns to more than 200 microns. The principal ore minerals include argentite, acanthite-jalpaite, cerargyrite-embolite and traces of native silver (Fitch and Brady, 1982). Tables at the end of this text list the species and the relative abundances of the various minerals found in or near the Escalante silver vein. The K-Ar age of adularia from the Escalante vein is 11.6 ± 0.5 m.y. The vein is an epithermal vein deposit, probably related to hydrothermal systems generated by the nearby magmatic activity. No other distinct mineralized vein systems have been discovered to date, making the Escalante vein the only known economic mineralization in both the Beryl Junction and adjacent Piñon Point quadrangles.

Non-metallic resources in the Beryl Junction 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 fill or to provide road metal for local roads. Several gravel pits have been developed in the Qags unit (fluvial deposits) out in the Escalante Valley, and these appear to be the preferred source of gravel for local consumption.

Known geothermal resource areas (KGRA) occur to the east (Newcastle) and northeast (Lund) of the Beryl Junction quadrangle. However, a test well drilled in the Escalante Desert near Beryl failed to uncover any geothermal prospects. The Newcastle KGRA is controlled by a laterally extensive range-boundary fault that defines the western edge of the Antelope Range. Movement along the fault has been recent enough to offset Quaternary fan deposits from that range. There is no evidence for similar faults within the Beryl Junction quadrangle or its immediate vicinity, and heat flow assessment along the southern edge of the Escalante Desert (Clement, 1980) suggests a low geothermal potential for the area.

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

GEOLOGIC HAZARDS

Landslide potential within the Beryl Junction quadrangle is rated as low or highly improbable. There is no great difference in slope stability between the various hard 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 hazards are considered low 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 can result in arroyo flash floods that may overspill stream banks in the distal portions of Shoal Creek. Areas affected are mainly farmland in the Escalante Valley and some rangeland in the Dixie National Forest. Overall, the flooding hazard resulting in severe 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). Since 1850, only two earthquakes with a magnitude greater than 4.0 on the Richter scale have been reported in the area (Ward, 1979). Although small-magnitude earthquakes could cause minor damage to some structures, the overall earthquake hazard for the area is rated as low. Figure 1 illustrates the locality and magnitude of earthquakes since 1850.

WATER RESOURCES

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

ACKNOWLEDGMENTS

Study of the Beryl Junction quadrangle has benefited from discussions with the geologists at the Escalante Silver mine (M. Malkoski in particular, who also collected the mineralized sample EM-1 for K-Ar dating). 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). Gordon Crandell of the Soil Conservation Service (SCS) in Cedar City provided unpublished data from a recent soil survey of Iron County, Utah. Geochron Laboratories performed K-Ar dating on samples of Trbm (sample no. Tr-2 = BJ 33-11; Geochron sample F 7074), and vein adularia (sample no. EM-1; Geochron sample F 7076).

SELECTED REFERENCES

Allen, D.R., 1979, Geology and geochemistry of the Escalante Silver vein, Iron County, Utah: University of Utah, unpublished M.S. thesis, 72 p.

Anderson, R.E., and Bucknam, R.C., 1979, Two areas of probable Holocene deformation in southwestern Utah: Tectonophysics, v. 52, p. 417-430.

Arentz, S.S., 1978, Geology of the Escalante Mine, Iron County, Utah, in Shawe, D.R., editor, Guidebook to mineral deposits of southwestern Utah: Utah Geological Association, publication 7, p. 59-63.

Armstrong, R.L., 1963, K-Ar ages of volcanics in southwestern Utah and adjacent Nevada, in Heylmun, E.B., editor, Guidebook to the geology of southwestern Utah: Intermountain Association of Petroleum Geologists, Twelfth Annual Field Conference, p. 79-80.

Armstrong, R.L., 1970, Geochronology of Tertiary igneous rocks, eastern Basin and Range Province, western Utah, eastern Nevada, and vicinity, U.S.A.: Geochimica et Cosmochimica Acta, v. 34, no. 2, p. 203-232.

Bates, R.L., and Jackson, J.A., editors, 1980, Glossary of geology (second edition): American Geological Institute, 749 p.

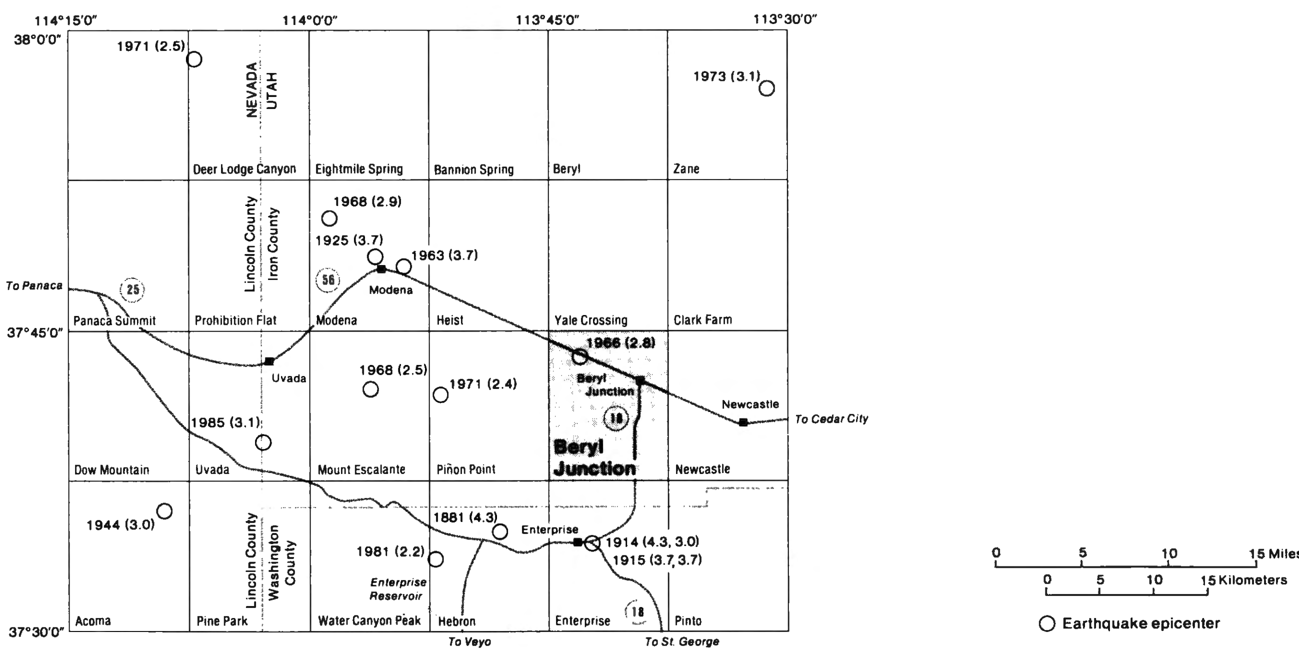


Figure 1. Earthquake epicenter location map.

Best, M.G., 1984, Preliminary geologic map and sections of the area between Hamlin Valley and Escalante Desert, Iron County, Utah: U.S. Geological Survey Open-file Report 84-154, scale 1:50,000.

Best, M.G., Mehnert, H.H., Keith, J.D., and Naeser, C.W., 1983, Miocene magmatism and tectonism in and near the southern Wah Wah Mountains and Needle Range, southwestern Utah (abstr.) Abstracts with programs: Geological soceity of America, v. 15, no. 5, p. 402.

Best, M.G., McKee, E.H., and Damon, P.E., 1980, Space-time-composition patterns of late Cenozoic mafic volcanism, southwestern Utah and adjoining areas: American Journal of Science, v. 280, p. 1035-1050.

Blank, H.R., Jr., 1959, Geology of the Bull Valley district, Washington County, Utah: unpublished Ph.D. thesis, University of Washington, 177 p.

Blank, H.R., and McKee, E.H., 1969, Chemical variations and K-Ar ages of volcanic rocks in the Bull Valley district, Utah: Geological Society of America Abstracts with Programs, Cordilleran Section, 65th Annual Meeting, p. 7.

Burt, D.M., Sheridan, M.F., Bikun, J.V., and Christiansen, E.H., 1982, Topaz rhyolites - distribution, origin, and significance for exploration: Economic Geology, v. 77, p 1818-1836.

Christiansen, R.L., 1979, Cooling units and composite sheets in relation to caldera structure: Geological Society of America Special Paper 180, p. 29-42.

Christiansen, R.L., and Lipman, P.W., 1972, Cenozoic volcanism and plate tectonic evolution of the western United States; II, Late Cenozoic: Philosophical Transactions of the Royal Society of London, Series A271, p. 249-284.

Clement, M.D., 1980, Escalante Desert: heat flow and geothermal assessment of the Oligocene/Miocene volcanic belt in southwestern Utah: University of Utah M.S. thesis, 118 p.

Cook, E.F., 1960a, Geologic atlas of Utah—Washington County: Utah Geological and Mineral Survey Bulletin 70, 119 p.

Cook, E.F., 1960b, Great Basin Ignimbrites, in Boettcher, J.W., and Sloan, W.W., Jr., editors, Guidebook to the geology of east-central Nevada: Intermountain Association of Petroleum Geologists, Eleventh Annual Field Conference, p. 134-141.

Cook, E.F., 1965, Stratigraphy of Tertiary volcanic rocks in eastern Nevada: Nevada Bureau of Mines Report, no. 11, 61 p.

Crittenden, M.D., Jr., 1963, New data on the isostatic deformation of Lake Bonneville, U.S. Geological Survey Professional Paper 454-E, 31 p.

Currey, D.R., 1982, Lake Bonneville: selected features of relevance to neotectonic analysis: U.S. Geological Survey Open-file Report 82-1070, 30 p.

Dalrymple, G.B., 1979, Critical tables for conversion of K-Ar ages from old to new constants: Geology, v. 7, no. 11, p. 558-560.

Dennis, P.E., 1944, Shorelines of the Escalante Bay of Lake Bonneville: Utah Academy Science Proceedings, v. 19-20, p. 121-124.

Dolgoff, A., 1963, Volcanic stratigraphy of the Pahranagat area, Lincoln County, Nevada: Geological Society of America Bulletin, v. 74, p. 875-900.

Ekren, E.B., Bucknam, R.C., Carr, W.J., Dixon, G.L., and Quinlivan, W.D., 1976, East-trending structural lineaments in central Nevada: U.S. Geological Survey Professional Paper 986, 16 p.

Ekren, E.B., Orkild, P.P., Sargent, K.A., and Dixon, G.L., 1977, Geologic map of the Tertiary rocks, Lincoln County, Nevada: U.S. Geological Survey Miscellaneous Investigations Map I-1041, 1:250,000.

Fitch, D.C., and Brady, M.W., 1982, Northwest Mining Association, Spokane, Washington, 99th Annual Convention.

Fleck, R.J., Anderson, J.J., and Rowley, P.D., 1975, Chronology of mid-Tertiary volcanism in High Plateaus region of Utah: Geological Society of America Special Paper 160, p. 53-62.

Gilbert, G.K., 1890, Lake Bonneville: U.S. Geological Survey Monograph 1, 438 p.

Hausel, W.D., and Nash, W.P., 1977, Petrology of Tertiary and Quaternary volcanic rocks, Washington County, southwestern Utah: Geological Society of America Bulletin, v. 88, p. 1831-1842.

Hintze, L.F., compiler, 1963, Geologic map of Utah, Southwestern quarter: Utah State Land Board, 1:250,000.

Irvine, T.N., and Baragar, W.R.A., 1971, A chemical classification of igneous rocks: Canadian Journal of Earth Sciences, v. 8, p. 523-548.

Lipman, P.W., Prostka, H.J., and Christiansen, R.L., 1972, Cenozoic volcanism and plate tectonic evolution of the western United States; I. Early and Middle Cenozoic: Philosophical Transactions of the Royal Society of London, A 271, p. 217-248.

Lydon, P.A., 1968, Geology and lahars of the Tuscan Formation, California: Geological Society of America Memoir 116, p. 441-476.

Mackin, J.H., 1960, Structural significance of Tertiary volcanic rocks in southwestern Utah: American Journal of Science, v. 258, no. 2, p. 81-131.

McKee, E.H., 1979, Ash-flow sheets and calderas: Their genetic relationship to ore deposits in Nevada: Geological Society of America Special Paper 180, p. 205-211.

Noble, D.C., McKee, E.H., Hedge, C.E., and Blank, H.R., Jr., 1968, Reconnaissance of the Caliente depression, Lincoln County, Nevada (abs): Geological Society of America Special Paper 115, p. 435-436.

Noble, D.C., and McKee, E.H., 1972, Description and K-Ar ages of volcanic units of the Caliente volcanic field, Lincoln County, Nevada, and Washington County, Utah: Isochron/West, no. 5, p. 17-24.

Nockolds, S.R., 1954, Average chemical compositions of some igneous rocks: Geological Society of America Bulletin, v. 65, p. 1007-1032.

Norrish, K., and Hutton, J.T., 1969, An accurate x-ray spectrographic method for the analysis of a wide range of geologic samples: Geochimica et Cosmochimica Acta, v. 33, p. 431-453.

Ross, C.S., and Smith, R.L., 1961, Ash-flow tuffs: Their origin, geologic relations and identification: U.S. Geological Survey Professional Paper 366, 81 p.

Rowley, P.D., Anderson, J.J., and Williams, P.L., 1975, A summary of Tertiary volcanic stratigraphy of the southwestern High Plateaus and adjacent Great Basin, Utah: U.S. Geological Survey Bulletin 1405-B, 20 p.

Rowley, P.D., Steven, T.A., Anderson, J.J., and Cunningham, C.G., 1979, Cenozoic stratigraphic and structural framework of southwestern Utah: U.S. Geological Survey Professional Paper 1149, 22 p.

Scott, R., 1966, Origin of chemical variations within ignimbrite cooling units: American Journal of Science, v. 264, no. 4, p. 273-288.

Sheridan, M.F., 1979, Emplacement of pyroclastic flows: A review: Geological Society of America Special Paper 180, p. 125-136.

Siders, M.A., 1985, Geologic map of the Piñon Point quadrangle, Iron County, Utah: Utah Geological and Mineral Survey Map 84.

Smith, R.L., and Bailey, R.A., 1968, Resurgent cauldrons: Geological Society of America Memoir 116, p. 613-662.

Solomon, M., 1963, Counting and sampling errors in modal analysis by point counter: Journal of Petrology, v. 4, p. 367-382.

Stewart, D.C., 1975, Crystal clots in calc-alkaline andesites as breakdown products of high-Al amphiboles: Contributions to Mineralogy and Petrology, v. 53, p. 195-204.

Stewart, J.H., Moore, W.J., and Zietz, I., 1977, East-west patterns of Cenozoic igneous rocks, aeromagnetic anomalies, and mineral deposits, Nevada and Utah: Geological Society of America Bulletin, v. 88, p. 67-77.

Ward, D.B., 1979, Seismic zones for construction in Utah. Report issued by the Seismic Safety Advisory Council, State of Utah, 13 p.

Williams, P.L. 1967, Stratigraphy and petrography of the Quichapa Group, southwestern Utah and southeastern Nevada: Seattle, University of Washington, Ph.D. thesis, 139 p.

Win Pe, 1980, Gravity survey of the Escalante desert and vicinity in Iron and Washington Counties, Utah: M.S. thesis, University of Utah.

Woodward, L.A., 1982, Stratigraphy and rock units at the Escalante Mine, Utah,: Unpublished Ranchers Company report.

ESCALANTE SILVER MINE

Table of Minerals Identified

Ore Minerals	**Approximate Abundance**
argentite	common
acanthite-jalpaite	common
cerargyrite	common
ambolite (chlorian bromargyrite)	common
native silver	rare
Lead Minerals	
galena	common
cerrussite	common
mimetite	common
leadhillite	rare
Zinc Minerals	
willemite	minor-common
sphalerite	common
hemimorphite	minor
smithsonite	rare
Copper	
copper silicate (unidentified)	minor
malachite	minor
descloizite	minor
chrysocolla	minor
Other	
gold	trace
hematite	abundant
geothite	abundant
pyrolusite	rare to common
Gangue Minerals	
quartz	abundant
calcite	locally abundant
barite	locally abundant
fluorite	locally abundant

From: Fitch and Brady, 1982

AVERAGE MODAL ANALYSES FOR SOME UNITS IN THE BERYL JUNCTION QUADRANGLE

ANDESITE OF ENTERPRISE (hornblende andesite) (Ta) (n = 4)

No.	Matrix	Plag	Cpx	Opx	Fe-Ti	Hb	Biot	Lithic	Qtz	Apa	Zir
1)	77.1%	14.2%	3.5%	0.9%	2.0%	0.6%	1.2%	0.5%	T	T	—
2)	73.3%	17.6%	2.1%	0.4%	1.7%	1.3%	3.2%	T	0.4%	T	—
3)	72.1%	15.3%	1.3%	0.7%	1.7%	3.9%	4.0%	1.0%	—	T	T
4)	66.2%	21.5%	0.9%	0.8%	1.4%	8.5%	0.7%	T	T	T	—
$\bar{X}$ =	**72.2%**	**17.2%**	**2.0%**	**0.7%**	**1.7%**	**3.6%**	**2.3%**	**T**	**T**	**T**	**T**

TUFFS, UNDIVIDED (Tt) (n = 1)

No.	Pumice + matrix	Lithics	San	Plag	Qtz	Fe-Ti	Sph	Biot	Zirc	Pyx
5)	96.5%	1.1%	2.3%	—	T	T	—	T	—	

MIDDLE MEMBER OF THE RHYOLITE OF BERYL JUNCTION (Trbm) (n = 10)

No.	Groundmass	K-spar	Fe-Ti	Pyx	Qtz	Zirc	Apa	Mafic
6)	87.3%	8.5%	1.3%	T	2.9%	T	—	—
7)	85.3%	1.9%	1.3%	0.1%	11.3%	0.1%	—	—
8)	92.8%	6.4%	0.7%	0.1%	—	—	T	—
9)	89.9%	2.7%	0.3%	0.1%	6.3%	T	—	0.8%
10)	95.5%	2.6%	0.7%	—	1.2%	T	T	—
11)	89.9%	2.8%	0.9%	T	6.4%	T	—	—
12)	91.9%	7.7%	0.4%	—	—	T	—	—
13)	90.3%	8.9%	0.7%	0.1%	—	T	T	—
14)	88.6%	5.4%	0.5%	T	5.4%	T	—	—
15)	84.4%	9.4%	—	—	6.2%	T	—	—
$\bar{X}$=	**89.6%**	**5.6%**	**0.7%**	**T**	**4.0%**	**T**	**T**	**T**

LATE FLOW MEMBER OF THE RHYOLITE OF BERYL JUNCTION (Trbl) (n = 2)

No.	Matrix	San	Fe-Ti	Cpx	Zirc	Qtz	Biot	Sphene
16)	68.7%	21.9%	T	2.3%	T	7.1%	—	—
17)	87.7%	10.4%	0.3%	—	T	1.5%	T	T
$\bar{X}$ =	**78.2%**	**16.2%**	**0.2%**	**1.1%**	**T**	**4.3%**	**T**	**T**

VOLCANICLASTIC FACIES OF THE RHYOLITE OF BERYL JUNCTION (Trbu) (n = 2)

No.	Matrix	San	Qtz	Fe-Ti	Hb	Biot	Zirc	Sph	Lithic	Apa
18)	62.0%	3.1%	3.7%	0.8%	T	T	T	T	30.4%	—
19)	78.1%	3.0%	—	0.9%	—	—	T	—	17.9%	T
$\bar{X}$ =	**70.1%**	**3.1%**	**1.8%**	**0.9%**	**T**	**T**	**T**	**T**	**24.2%**	**T**

"MINE SERIES" VOLCANICLASTIC SEQUENCE (Tv) (data from drill core)

No.	Groundmass	Lithic	Calcite	San	Qtz	Fe-Ti	Plag	Biot	Zirc	Apa
20)	74.5%	—	—	7.3%	7.3%	1.6%	8.2%	1.1%	T	T
21)	13.5%	41.7%	24.6%	10.9%	6.2%	2.5%	0.6%	T	T	T
22)	31.4%	44.8%	1.0%	9.9%	4.3%	7.6%	1.0%	T	T	—
23)	33.6%	23.5%	18.7%	2.4%	10.9%	0.8%	9.7%	0.3%	0.1%	—
24)	59.9%	25.3%	6.7%	6.9%	0.3%	0.5%	0.4%	T	T	T
$\bar{X}$ =	**42.6%**	**33.8%**	**12.8%**	**7.5%**	**5.8%**	**2.6%**	**4.0%**	**0.3%**	**T**	**T**

Sample numbers corresponding to numbers on the list; 1) = BJ 12-10, 2) = BJ 12-11, 3) = BJ 12-12, 4) = BJ 12-13, 5) = BJ 32-5, 6) = BJ 19-21, 7) = BJ 19-16, 8) = BJ 15-1, 9) = BJ 10-3, 10) = BJ 23-22, 11) = BJ 22-1, 12) = BJ 32-1, 13) = BJ 32-8, 14) = BJ 10-32, 15) = BJ 1-4, 16) = BJ 10-7, 17) = BJ 15-12, 18) = BJ 15-18, 19) = BJ 19-36, 20) = BJ-357, 21) = BJ-421, 22) = BJ-504, 23) = BJ-1098, 24) = BJ B-1066.

RADIOMETRIC AGES OF SELECTED VOLCANIC ROCKS IN SOUTHWESTERN UTAH

Unit	Age	Reference	
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.	This report, 1985	
"Mine series" volcaniclastic sequence (Tv) (mineralization hosted by Tv)			
	11.6 ± 0.5 m.y.	This report, 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.	Siders, 1985	
Andesite of Enterprise			
	24.2 ± 1.2 m.y.	Siders, 1985	
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).

AVERAGE ANALYSES FOR SOME ROCK UNITS IN THE BERYL JUNCTION QUADRANGLE

	SiO^2	TiO^2	Al^2O_3	Fe^2O_3	MnO	MgO	CaO	Na^2O	K^2O	P^2O_5
Ta	56.03	1.03	16.19	8.11	0.08	5.20	7.17	2.82	2.68	0.72
(n=2)	(1.27)	(0.29)	(0.88)	(1.02)	(0.00)	(0.62)	(0.22)	(0.25)	(0.38)	(0.13)
Trbm	70.07	0.25	14.58	2.59	0.02	1.22	0.89	4.62	5.65	0.12
(n=10)	(0.49)	(0.04)	(0.42)	(0.17)	(0.00)	(0.47)	(0.26)	(0.48)	(0.55)	(0.05)
Trbe	74.31	0.12	11.94	1.55	0.02	1.74	1.63	3.98	4.62	0.11
(n=2)	(0.23)	(0.00)	(0.22)	(0.01)	(0.00)	(0.32)	(0.26)	(0.04)	(0.16)	(0.04)

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 samples analyzed for each unit.

Note: M_gO levels seem higher than expected but have not been corrected.

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.

THE UGMS is organized into five programs. Administration provides support to the programs. The Economic Geology Program undertakes studies to map mining districts, to monitor the brines of the Great Salt Lake, to identify coal, geothermal, uranium, petroleum and industrial minerals resources, and to develop computerized resource data bases. The Applied Geology Program responds to requests from local and state governmental entities for site investigations of critical facilities, documents, responds to and seeks to understand geologic hazards, and compiles geologic hazards information. The Geologic Mapping Program maps the bedrock and surficial geology of the state at a regional scale by county and at a more detailed scale by quadrangle.

THE INFORMATION PROGRAM distributes publications, and answers inquiries from the public and manages the UGMS library. The UGMS Library is open to the public and contains many reference works on Utah geology and many unpublished documents about Utah geology by UGMS staff and others. The UGMS has begun several computer data bases with information on mineral and energy resources, geologic hazards, and bibliographic references. Most files are not available by direct access but can be obtained through the library.

THE UGMS PUBLISHES the results of its investigations in the form of maps, reports, and compilations of data that are accessible to the public. For future information on UGMS publications, contact the UGMS Sales Office, 606 Black Hawk Way, Salt Lake City, Utah 84108-1280.

UTAH GEOLOGICAL AND MINERAL SURVEY
UTAH DEPARTMENT OF NATURAL RESOURCES
in cooperation with
THE UNITED STATES GEOLOGICAL SURVEY

Published and sold by
UTAH GEOLOGICAL AND MINERAL SURVEY
Genevieve Atwood, Director
606 Black Hawk Way
Salt Lake City, Utah 84108

Plate 1
Utah Geological and Mineral Survey Map 85
Geologic Map of the Beryl Junction Quadrangle

Base from U.S. Geological Survey Beryl Junction Quadrangle, 1972

SCALE 1:24 000

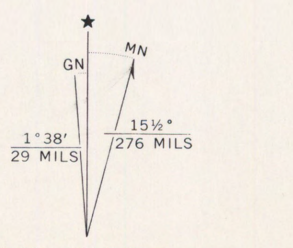
1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 KILOMETRE

CONTOUR INTERVAL 10 FEET
DOTTED LINES REPRESENT 5-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Field mapping by author in 1984
J. Parker, Cartographer

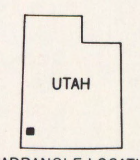


UTM GRID AND 1972 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

GEOLOGIC MAP OF THE BERYL JUNCTION QUADRANGLE, IRON COUNTY, UTAH

by
Mary A. Siders
Utah Geological and Mineral Survey

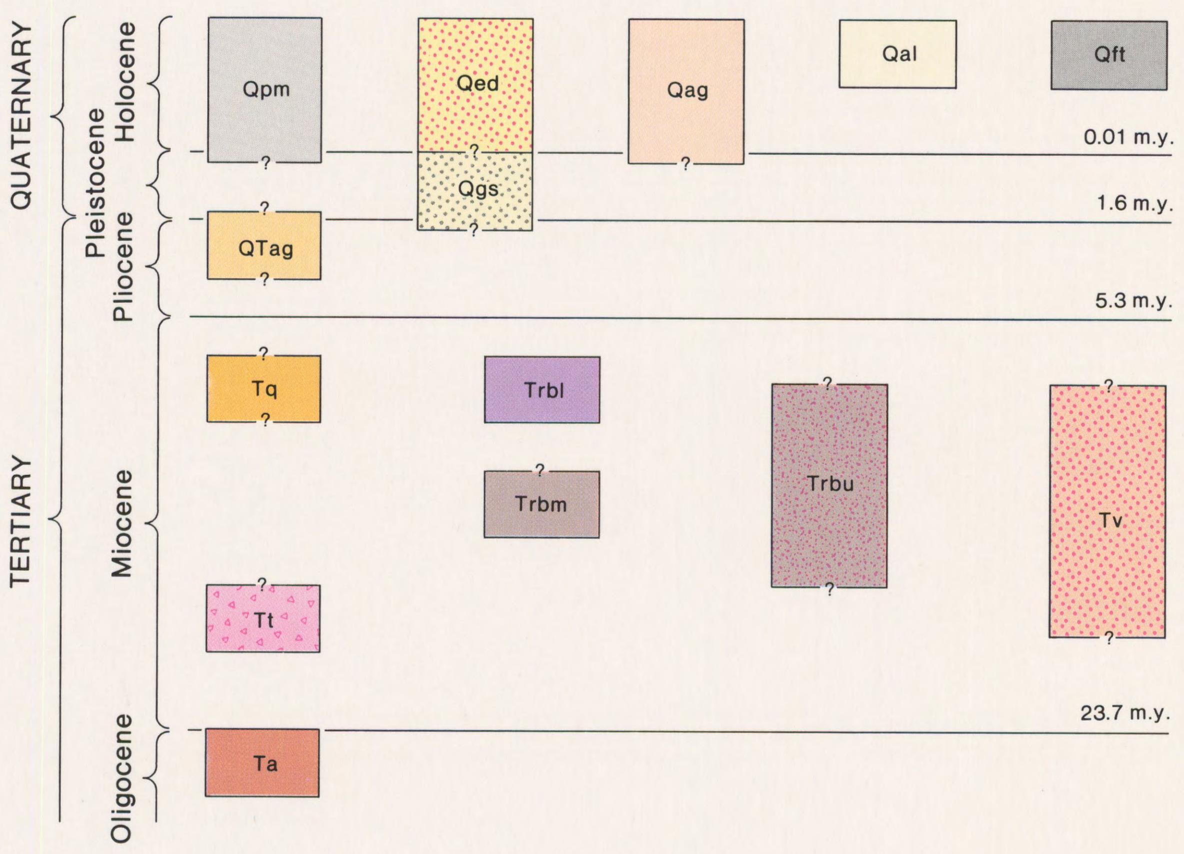
1985



QUADRANGLE LOCATION

UTAH GEOLOGICAL AND MINERAL SURVEY
UTAH DEPARTMENT OF NATURAL RESOURCES
in cooperation with
THE UNITED STATES GEOLOGICAL SURVEY

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

Qft Tailings pond (Recent) — *Tailings pond containing waste water from the Escalante Silver Mine mill.*

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.*

Qed Dune sand (Holocene and Pleistocene?) — *Calcium carbonate, quartz and clay grains deposited in a playa lake environment and transported by eolian processes.*

Qpm Playa lake basin (Holocene and Pleistocene?) — *Flat pans that contain shallow ephemeral lakes.*

Qgs Sands and gravels of ancestral Shoal Creek (Holocene and Pleistocene?) — *Cross-bedded sands and gravels as well as soil horizons, now well exposed in gravel pits.*

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 west-central portion of the quadrangle.*

Tv "Mine Series" volcaniclastic rocks (Miocene) — *0-1200 ft. Crudely bedded volcanic breccias and conglomerates, volcaniclastic sandstones and tuffaceous sediments. The exposed thickness ranges from 100 to 150 feet, although 1,200+ feet have been drilled in the vicinity of the Escalante Silver Mine. A mineralized sample from this unit has a K-Ar age on adularia of 11.6 ± 0.5 m.y. (Siders, this report), 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. Limestone beds that have been replaced by chalcedonic quartz. Beds contain locally abundant plant fossils.*

Rhyolite of Beryl Junction (Miocene)

Trbl Later rhyolite flow member — *0-100 ft. Gray, flow-layered rhyolites 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 chiefly rhyolitic lithic fragments, and silicified and/or iron-stained and otherwise hydrothermally altered rhyolitic lavas and vitrophyres. This undivided collection of fragmental lavas and volcaniclastic rocks probably spans the entire time of deposition 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, and rhyolites of generally gray- and red-streaked or mottled appearance that contain sanidine. The former contains an average of 6.5% anorthoclase-sanidine, 2.5% Fe-Ti oxides, and 0.2% clinopyroxene. Anhedral interlocking quartz grains, which occur as "stringers," comprise 1.9%. The latter rhyolite contains similar mineral abundances except that the potassium feldspar is sanidine rather than anorthoclase-sanidine. A K-Ar age on feldspar from these lavas is 10.8 ± 0.6 m.y. (Siders, this report).*

Tt Tuffs, undivided (Miocene) — *0-150 ft. Poorly welded vitric-lithic-crystal tuffs of white, yellow 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, plagioclase, sphene and zircon. These tuffs may be related to the 12.8 m.y.-old rhyolites of Piñon Point (Trp, Tcp), which occur in the adjacent Piñon Point quadrangle.*

Ta Andesite of Enterprise (Latest Oligocene/Miocene) — *0-800 ft. Porphyritic to nearly aphyric 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. A K-Ar age on hornblende from these andesites in the adjacent Piñon Point quadrangle is 24.2 ± 1.2 m.y. (Siders, 1985).*

SYMBOLS

CONTACT
Dashed where location inferred

STRIKE AND DIP OF BEDDING
23
Inclined — Vertical

STRIKE AND DIP OF IGNEOUS FOLIATION
45
Inclined — Vertical

85
NORMAL FAULT
Bar and ball on downthrown side; dashed where location inferred; dotted where covered; dip indicated

LOCATION OF ROCK SAMPLE
Geochemical — K-Ar
Thin section only
(ts) = thin section

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

OTHER SYMBOLS
Vein
Prospect — Shaft — Adit