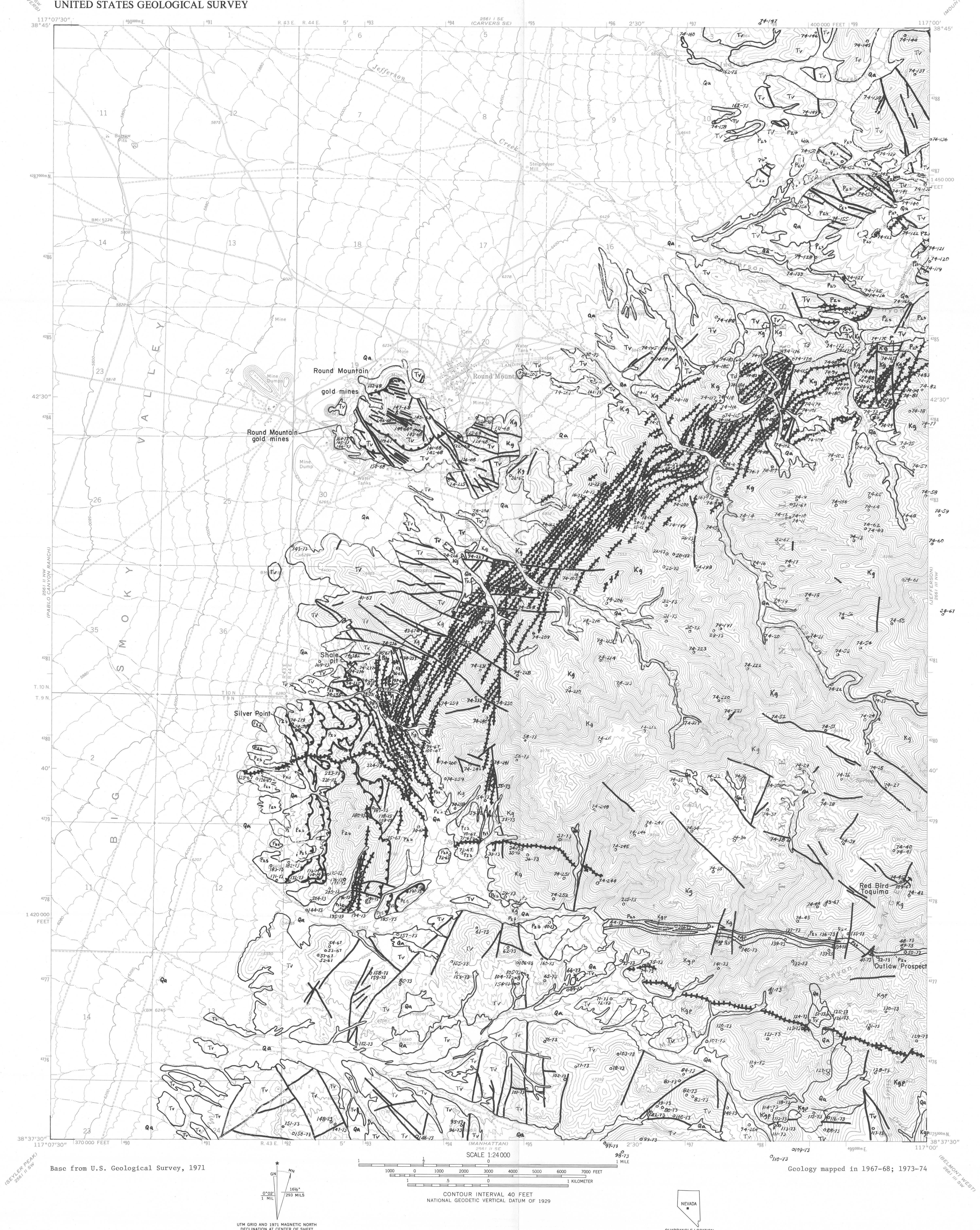
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES MAP MF-833
ROUND MOUNTAIN QUAD., NEVADA



Base from U.S. Geological Survey, 1971

Geology mapped in 1967-68; 1973-74

PRELIMINARY GENERALIZED GEOLOGIC MAP OF THE ROUND MOUNTAIN QUADRANGLE, NYE COUNTY, NEVADA

By
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1977

EXPLANATION

Qa	ALLUVIUM (QUATERNARY)
Tv	VOLCANIC ROCKS (TERTIARY)
Td	DIORITE (TERTIARY)
	RHYOLITE (TERTIARY)
Kg	GRANITE (CRETACEOUS)
Kgp	PORPHYRITIC GRANITE (CRETACEOUS)
Pzs	SEDIMENTARY ROCKS (PALEOZOIC)
	HIGH-ANGLE FAULT
	LOW-ANGLE FAULT
	CONTACT
123-73	SAMPLE LOCALITY

DISCUSSION

The Round Mountain 7½ minute quadrangle which contains the well-known Round Mountain gold district is located about 50 mi (80 km) north of Tonopah, and is on the west edge of the Toquima Range in northern Nye County, Nevada. The district produced about $7,850,000 in gold prior to the end of 1940 (Kral, 1951, p. 146); most was from the lode deposits on Round Mountain, a small conical hill southwest of the town of Round Mountain at the east side of Big Smoky Valley and 2 mi (3 km) west of the west flank of the Toquima Range. In the period 1950-59 about $5,250,000 in gold was mined from placer deposits adjacent to Round Mountain (Bergendahl, 1964, p. 94). Koschmann and Bergendahl (1968, p. 194) have indicated that the total gold production from Round Mountain through 1959 was about 537,000 ounces. Minor amounts of silver, tungsten, mercury, and other metals have been mined within the Round Mountain quadrangle. Gold mining has been virtually suspended since 1959. The Copper Range Exploration Company and Associates, however, are currently (1976) preparing for the large-scale production of low-grade ore that occurs as abundant closely spaced lode deposits (called sheeted zones) in rhyolite on Round Mountain.

I mapped the Round Mountain quadrangle during parts of the summers of 1967, 1968, 1973, and 1974 with the assistance of Scott R. Shawe, Roland Grygo, and Philip H. Close. The work was done as part of a project to evaluate regional structural, stratigraphic, and igneous rock controls on the distribution of mineral deposits in the Basin-range province. This preliminary generalized geologic map, and maps showing distribution of selected elements in the Round Mountain quadrangle, are being published as Miscellaneous Field Studies Maps (MF) to make available data that may be useful in mineral exploration. A favorable geologic setting and anomalously high amounts of several elements in hydrothermally altered rocks suggest the possibility of undiscovered porphyry copper-molybdenum and other mineral deposits near Round Mountain.

Cambrian and Ordovician marine sedimentary rocks in the quadrangle were intruded in Cretaceous time by a large pluton of granite. In middle Tertiary time the granite and sedimentary rocks were intruded by a swarm of rhyolite dikes. Subsequently a small diorite stock intruded the granite and rhyolite. All of these rocks were then eroded and in late Tertiary time covered with latitic and rhyolitic ash-fall and ash-flow volcanic rocks. In late Cenozoic time, the Toquima Range was uplifted during block faulting and was extensively eroded; a variety of alluvial deposits formed locally in the mountains and widely throughout the Big Smoky Valley.

Sedimentary rocks of probable Cambrian age are found along Jefferson Canyon (Ferguson, 1921, p. 386) in the northeast corner of the Round Mountain quadrangle. They consist of limestone, quartzite, siltite, and phyllitic shale. Limestone is gray and brownish gray, thin bedded, and silty or shaly; locally the impure limestone has been silicified so that alternating thin layers have the appearance of chert. In a few places the limestone appears to be completely silicified. Quartzite is commonly light olive brown, silty, and interlayered in places with thin phyllitic shale beds. Siltite layers interbedded with quartzite are olive brown and locally show phyllitic shaly surfaces on bedding planes. Olive-brown phyllitic shale is thin bedded. Close to the intrusive contact with granite it is a knotted schist. These probable Cambrian rocks are correlated with the type Gold Hill Formation at Manhattan 12 mi (19 km) south of Round Mountain (Ferguson, 1924, p. 18-20; Ferguson and Cathcart, 1954).

Ordovician sedimentary strata of the transitional assemblage consist of phyllitic shale with subordinate limestone, chert and quartzite; they are exposed in the low hills 2-4 mi (3-6 km) south of Round Mountain, in the vicinity of Jefferson Canyon in the northeast corner of the quadrangle, and in a thin septum separating two intrusive phases of the Cretaceous granite in the southeast part of the quadrangle. Limestone is light to medium gray, thin to medium bedded; some layers are silty or shaly. Some dark-gray thin-bedded limestone is silty and rich in organic material, and in places the thin-bedded limestone is cherty. Phyllitic shale is gray to dark gray and thin bedded to massive; graded bedding is evident in some parts of the shale. Close to the granite intrusive contact, the shale has been metamorphosed to a knotted schist; the septum of Ordovician strata in granite in the southeast part of the quadrangle is mostly knotted schist Locally the limestone about 3 mi (5 km) south of Round Mountain has been tremolitized strongly; similar limestone in places near Jefferson Canyon contains epidote and garnet. Dark-gray to black chert in thin to thick layers in places is interbedded with limestone and shale, as in the low hills 2-4 mi (3-6 km) south of Round Mountain. The chert, however, may have formed as a result of silicification of dark silty shale. Quartzite is light gray to black, thin to thick bedded; some is silty.

Ferguson (1921, p. 386) reported Ordovician graptolites in strata about 4 mi (6 km) south of Round Mountain. Sections of phyllitic shale--which is knotted schist where metamorphosed by granite intrusive--more than about 100 ft (30 m) thick are correlated with the Mayflower Schist of Ordovician(?) age at Manhattan (Ferguson, 1924, p. 20-21). Sequences of strata that are dominantly limestone are correlated with the Zanzibar Limestone of Ordovician(?) age at Manhattan (Ferguson, 1924, p. 21-22). As a result of regional stratigraphic studies, F. G. Poole (oral commun., 1973), believes the Mayflower Schist in the Manhattan district may be Cambrian in age, and the Zanzibar Limestone is mostly, if not all, Ordovician in age. Sequences of strata consisting of interbedded quartzite, phyllitic shale, chert, and limestone are correlated with the Toquima Formation of Ordovician age at Manhattan (Ferguson, 1924, p. 22-25). The stratigraphic succession Mayflower-Zanzibar-Toquima is not clearcut in the Round Mountain quadrangle because the Ordovician rocks are disrupted by numerous thrust faults. A complete stratigraphic sequence of Ordovician strata may not be present in the quadrangle. Also, because of the incomplete sections and disruption due to faulting, the proposed correlations may not be entirely valid.

Cretaceous granite occupies a large area in the central and eastern parts of the Round Mountain quadrangle; the exposed pluton approaches batholithic proportions, extending southeastward beyond Belmont which is located on the east side of the Toquima Range 13 mi (21 km) southeast of Round Mountain. The granite is cut by numerous aplite and pegmatite dikes and quartz veins. In places iron-oxide stain is intense; numerous limonite pseudomorphs after cubic pyrite suggest that most of the iron stain represents weathered hydrothermally altered granite.

The granite typically is a coarse grained, granular textured light-gray rock that contains quartz, microcline, orthoclase, sodic plagioclase, biotite, and muscovite. Accessory minerals are monazite, apatite, and iron-titanium oxide minerals. Fluorite and tourmaline are present locally. Some rocks of the pluton are quartz monzonite and granodiorite rather than granite. South of the septum of Ordovician schist the granite is porphyritic and contains large microcline crystals mostly 2-8 cm long. The porphyritic phase appears to be older than the nonporphyritic phase; it constitutes much of the granite exposed between the Round Mountain quadrangle and Belmont 13 mi (21 km) southeast of Round Mountain.

Much of the granite is foliated, especially near the pluton's border, and foliation which is manifested chiefly by alined biotite and muscovite plates, is conformable with the contact.

The date of emplacement of the granite based on Rb/Sr isotopic studies on whole rocks and minerals by R. W. Kistler (written commun., June 1969) is 90-100 m.y. ago. This date is corroborated by uranium and thorium isotope dilution studies of monazite separated from a sample of granite collected in Shoshone Canyon about 2 mi (3 km) southeast of Round Mountain. T. W. Stern (written commun., July 1971) reported calculated ages of the monazite as follows: Pb^{206}/U^{238}, 94 m.y.; Pb^{207}/U^{235}, 112 m.y.; Pb^{208}/Th^{232}, 88 m.y. Mineral ages determined by the K/Ar method are substantially younger than these dates. Krueger and Schilling (1971, p. 10, 11) reported that biotite from porphyritic quartz monzonite 6 mi (10 km) northwest of Belmont has an age of 79.6±2.0 m.y., and biotite from quartz monzonite porphyry that intrudes the porphyritic quartz monzonite in the same area has an age of 76.4±2.8 m.y. Edwards and McLaughlin (1972, p. 5) reported a K/Ar age of 77.3+1.5 m.y. and a Rb/Sr age of 75±6 m.y. on biotite from coarse-grained granite about 4 mi (6 km) southwest of Belmont. M. L. Silberman of the U.S. Geological Survey (written commun., 1968) reported ages of 78.4±2.2 m.y. and 78.0+2.5 m.y. on muscovite from pegmatites in the pluton near Belmont, and R. F. Marvin of the U.S. Geological Survey (written commun., 1968) reported an age of 77.4±1.9 m.y. for muscovite from a huebnerite-bearing quartz vein in Shoshone Canyon about 2 mi (3 km) southeast of Round Mountain.

The geologic relations and isotopic age data indicate that the granitic pluton was emplaced in middle Cretaceous time (90-100 m.y. ago) and was then metamorphosed (foliated) and invaded by pegmatites and tungsten-bearing quartz veins in Late Cretaceous time (about 78 m.y. ago).

Numerous rhyolite dikes intrude Cretaceous granite and lower Paleozoic sedimentary rocks in a northeast-striking swarm nearly 1 mi (1.6 km) wide and 7 mi (11 km) long that passes about 1.5 mi (2.5 km) southeast of Round Mountain. Two rhyolite dikes striking about S. 70° E. lie between the southwest end of the dike swarm and the southeast corner of the quadrangle. In general, the dikes intruded the border zone of the Cretaceous granite pluton. The dikes are mostly about 5-25 ft (1.5-7.5 m) wide and the longest one is more than 2 mi (3 km) long. In granite they are steeply dipping and moderately straight whereas in the sedimentary rocks they commonly are irregular, show flatter dips, and locally are sill like.

Rhyolite in the dikes ranges from almost phenocryst-free felsite to rhyolite porphyry containing numerous quartz and sanidine phenocrysts 1-5 mm across in a felsitic groundmass; some contain biotite phenocrysts. Some dikes are light gray and appear to be fresh and unaltered, whereas many are light yellowish brown and have been extensively altered hydrothermally. Some dikes in the northeast part of the quadrangle have been strongly tourmalinized.

Marvin, Mehnert, and McKee (1973, p. 4) reported a K/Ar age of 34.3±0.9 m.y. (early Oligocene) for sanidine from a sample of a rhyolite sill in Ordovician strata about 3 mi (5 km) south of Round Mountain.

A small stock of diorite was intruded at the north edge of the granite pluton about 2 mi (3 km) east of Round Mountain. The stock is irregular in shape and somewhat more than 1 mi (2 km) long. The stock is probably Oligocene in age as it cuts rhyolite dikes of Oligocene age and appears to be overlain by lower Miocene volcanic rocks.

The diorite appears to vary in composition locally as it consists of fine- and medium-grained rock of various shades of gray and dark greenish gray. Some of the variant rock may be dikes intruded into the stock. Andesite dikes (not shown on the map) intrude the diorite, granite, and rhyolite.

The diorite is made up mostly of intermediate plagioclase and lesser amounts of biotite, augite, and hornblende. Some parts contain substantial interstitial quartz. Accessory minerals are iron-titanium oxides, sphene, apatite, and zircon.

Granite and rhyolite within about 1 mi (1.6 km) of the diorite stock locally have been tourmalinized strongly. I infer that the tourmaline mineralization was related to emplacement of the diorite stock.

Volcanic rocks occur in the south part of the quadrangle, in the vicinity of Round Mountain, and in the northeast corner of the quadrangle.

The stratigraphically lowest volcanic rocks in the quadrangle are megabreccias, in part interpreted as a volcanic mélange. In the south part of the quadrangle, a local unit consists of volcanic tuff containing granite fragments of great size range, from crystal fragments to blocks 30 ft (10 m) across. Part of this unit contains as much as 80 percent granite fragments that are believed to have been derived from the nearby Cretaceous pluton.

In the north part of the quadrangle, between Round Mountain and Jefferson Canyon, a volcanic mélange unit is widespread. The unit consists of ash-tuff matrix enclosing a great variety of types and sizes of rock fragments, including Cretaceous granite, Cambrian quartzite, Ordovician carbonate, schist, shale, and quartzite, and Tertiary felsic tuff, diorite, and rare basalt, the source of which has not been recognized in or near the quadrangle. The enclosed lithic fragments commonly are bounded by a chill-rind of volcanic glass. Some fragments in the mélange are immense; one quartzite block in tuff on the south side of Jefferson Canyon is about 600 ft (180 m) across. Foreign blocks locally make up most of the unit, and consequently the tuff matrix is volumetrically minor.

The lower part of the volcanic section consists of interlayered latitic ash-fall and ash-flow tuff units in much of the area of exposed volcanic rocks in the south part of the Round Mountain quadrangle. The latite generally is composed of sanidine, plagioclase, and minor biotite phenocrysts, commonly broken, and pumice and lithic fragments set in a devitrified ash matrix. Iron-titanium oxides, zircon, and apatite are accessory minerals. Some units in the latitic sequence contain quartz and are classified as quartz latite. Rhyolite constitutes a small proportion of the sequence.

The latitic volcanic rocks are correlated with the Round Rock Member of the Esmeralda Formation at Manhattan described by Ferguson (1924, p. 44-46). Ferguson however indicated that the Round Rock in the Manhattan district is dominantly rhyolitic. Ferguson (1924, p. 54-55) considered the Round Rock Member to be late Miocene in age, which on present evidence may be too young.

A series of rhyolitic ash-flow tuff layers overlies the latitic volcanic rocks in the south part of the quadrangle, and is extensively exposed in the vicinity of Round Mountain and above the volcanic mélange in the northeast corner of the quadrangle. Thin volcanic sandstone beds are found locally at the base of the rhyolitic rocks and interlayered between ash-flow units. Some ash-fall material is present.

The rhyolite consists of abundant crystals of quartz and sanidine in a poorly to strongly welded matrix of broken glass shards and pumice fragments. Plagioclase is present in virtually all the rocks, and minor biotite and hornblende were seen in some. Accessory minerals are iron-titanium oxides, zircon, and apatite. Many of the quartz phenocrysts are smoky dipyramids that serve as a distinctive criterion in the recognition of the rhyolitic volcanics.

Locally, as in the southeast corner of the quadrangle and elsewhere, the rhyolite has been sericitized strongly.

The rhyolitic volcanic rocks are correlated with the Diamond King Member of the Esmeralda Formation at Manhattan described by Ferguson (1924, p. 46-48), and with the rhyolite tuff of Mt. Jefferson northeast of the Round Mountain quadrangle. According to Kleinhampl and Ziony (1967) tuffs comprising the Mt. Jefferson sequence of rhyolites were emplaced about 25-26 m.y. ago. Marvin, Mehnert, and McKee (1973, p. 4) reported K/Ar ages of 24.7±0.7 m.y. on sanidine and 26.1±0.8 on biotite from the tuff of Mt. Jefferson. However, P. P. Orkild reported K/Ar ages of 21.6±1.2 m.y. on sanidine and 15.0±0.8 m.y. on biotite from the tuff of Mt. Jefferson (Marvin and others, 1973, p. 4). Silberman and others (1975, p. 1) reported an age of 26.1±0.8 m.y. determined on sanidine from rhyolite ash-flow tuff at Round Mountain. A date of about 26 m.y. which may be late Oligocene, Oligocene-Miocene, or early Miocene depending on the time-scale followed is probably correct for the age of the Diamond King in the Round Mountain quadrangle, and Ferguson's correlation of the Diamond King with part of the Esmeralda Formation (upper Miocene) in the vicinity of Tonopah (Ferguson, 1924, p. 53-55) seems invalid.

A variety of surficial deposits of alluvium are found in the Round Mountain quadrangle. Older high level deeply weathered gravels that contain much granitic debris are found in the southeast corner of the quadrangle, and older gravels that contain abundant rhyolitic welded ash-flow material are found in the northeast corner of the quadrangle. Intermediate-age gravels are extensive throughout Big Smoky Valley in the west part of the quadrangle, and they extend eastward into the mountains along many of the major drainages. Younger gravels and finer grained detritus occur in the bottoms of all the drainages in the mountains and westward on the valley floor. The alluvium is considered here to be Quaternary in age, although some of the older high-level gravels could be late Tertiary in age.

Structures in the Round Mountain quadrangle include thrust faults in the lower Paleozoic sedimentary rocks, a broad dome formed by the intrusion of the Cretaceous granite, and high- and low-angle faults that are younger than the granite and the Tertiary volcanic rocks.

The thrust faults in lower Paleozoic rocks, many of which are subparallel to bedding, may have formed during the Late Devonian-Mississippian Antler Orogeny that widely affected the Basin-range province.

Cambrian and Ordovician strata along the granite contact dip away from the granite pluton and locally are penetrated by fingers (sills) of granite. On the north side of the pluton, rocks dip moderately northward, and on the west and southwest boundary of the granite they dip westward and southwestward; the screen of Ordovician schist in the granite in the southeast part of the quadrangle dips southward.

Several northwest-striking high-angle faults lie along and near the contact between lower Paleozoic sedimentary rocks and Tertiary volcanic rocks in the northeast corner of the quadrangle. This fault set may be part of a regional system of northwest-trending faults, or it may be part of a ring-fracture system that encircles a caldera structure related to the pile of rhyolitic ash-flow tuffs of Mt. Jefferson northeast of the quadrangle.

A few north- and northeast-striking faults lie about 1 mi (1-2 km) south of Jefferson Canyon.

A set of northwest-striking high-angle faults extends from Round Mountain hill and the hill south of it southeastward to the east boundary of the quadrangle. Offsets of the rhyolite-granite contact and nearly horizontal mullions and rolls on some faults at Round Mountain suggest strike-slip movement.

Rocks in the south part of the quadrangle are cut by several north-striking and some northeast- and northwest-striking high-angle faults.

A north-dipping low-angle fault and a south-dipping low-angle fault in rhyolite on Round Mountain may have been offset by faults of the northwest-trending strike-slip(?) set.

The primary gold deposits on Round Mountain were controlled by both northwest-striking faults and low-angle faults. According to Ferguson (1921, p. 401), rich ores were mined from intersections of the high-angle and the flat faults. The veins are mostly quartz containing irregular amounts of iron oxides (pyrite where unweathered), manganese oxides, adularia, alunite, fluorite, and sparse realgar (Ferguson, 1921, p. 391; Ferguson and Cathcart, 1954). A K/Ar age determination on adularia from a northwest-striking vein at the top of Round Mountain hill was 25.2±0.8 m.y. according to Silberman and others (1975, p. 2) thus suggesting that faulting and gold mineralization occurred in the rhyolite welded ash-flow tuff shortly after its emplacement nearly 26 m.y. ago.

Tungsten deposits in granite in the vicinity of Shoshone Canyon, about 2 mi (3 km) east of Round Mountain, have yielded a small production. Huebnerite occurs in quartz veins along with muscovite and small amounts of fluorite and autunite (Ferguson, 1921, p. 389; Kral, 1951, p. 154). As previously stated, muscovite from one of the tungsten veins gave a K/Ar age of about 77 m.y.

At the Shale Pit, also known as the Steigmeyer property (Kral, 1951, p. 155) and as the Gold Shale lode claim (Eng. and Mining Jour., July 1950, p. 107), carbonaceous silty carbonate rock (equivalent to Zanzibar Limestone of Ordovician(?) age) has been mined for gold. This deposit is similar in setting to the Carlin gold deposit in Eureka County, Nevada.

Quartz veins that dip moderately to the southwest at Silver Point, 2.5 mi (4 km) south-southwest of Round Mountain, have produced minor quantities of silver. These veins are sulfide bearing, and vein material on the dumps contains secondary copper minerals.

Several small silver-bearing veins (sulfide-bearing quartz) in Ordovician sedimentary rocks of Silver Point have been prospected.

Quartz-chalcedony-barite veins in granite at the Red Bird Tqouima deposit, previously known as the Senator Mine (Bailey and Phoenix, 1944, p. 136-137), located 5 mi (8 km) southeast of Round Mountain, have yielded a small mercury production. The most produc- rock appears to be barite that contains cinnabar and metacinnabar. Pyrite, muscovite, and jarosite(?) are also present in the veins (Bailey and Phoenix, 1944, p. 137). Smaller but similar mercury-bearing veins occur 1 mi (1.6 km) northwest and 2 mi (3 km) west of the Red Bird Toquima.

The Outlaw prospect, located 0.6 mi (1 km) south of the Red Bird Tquima mine in the bottom of Mariposa Canyon, is the site of a quartz vein along part of the Ordovician schist screen in granite. The quartz vein contains muscovite, fluorite, chalcopyrite, molybdenite, pyrite, and benjaminite ($Pb(Cu, Ag)Bi_2S_4$?) according to Palche, Berman, and Frondel (1944, p. 441-442); sphalerite is also present. As reported by Fleischer (1975, p. 11), bejaminite is a mixture of berryite ($Pb_2(Cu, Ag)_3Bi_5S_{11}$) and other sulfosalts.

Small workings have prospected veins for lead (galena) and other metals along faults in lower Paleozoic and Tertiary rocks in the northeast corner of the quadrangle.

Hydrothermally altered rocks are widespread in the Round Mountain quadrangle. Paleozoic rocks have been silicified, tremolitized, calc-silicated, or sulfidized in many places south of Round Mountain and in the vicinity of Jefferson Canyon. Cretaceous granite is locally intensely iron stained (from oxidized pyrite) and strongly altered, particularly in the vicinity of the Oligocene rhyolite dike swarm and the upper Oligocene(?) diorite stock 2 mi (3 km) east Round Mountain. Tertiary volcanic rocks have been hydrothermally altered in several places, strongly so along the northwest-striking faults in the northeast corner of the quadrangle and locally on Round Mountain.

Several episodes of mineralization and hydrothermal alteration are recognized in the quadrangle. The earliest was formation of tungsten-bearing quartz in granite about 77 m.y. ago. This event is noteworthy owing to the fact that the tungsten veins formed along (10-20 m.y.) after emplacement of granite, and apparently at the time the granite was metamorphosed (biotite and muscovite recrystallized in foliation planes).

The second identifiable episode of mineralization was tourmalinization in the vicinity of the diorite stock east of Round Mountain, probably in late Oligocene time. Evidence that metallization was related to this event is not clear.

The latest documented mineralization took place in early Miocene or late Oligocene time (25 m.y. ago) shortly after emplacement of the rhyolitic ash-flow tuffs of the Diamond King, when the gold deposits at Round Mountain were formed.

Most of the mineral deposits and occurrences, as well as hydrothermally altered rocks, are close to the swarm of Oligocene rhyolite dikes, where the small diorite stock also was emplaced. Probably, significant mineralization was related to emplacement of the dikes; some mineralization may have taken place as a result of the intrusion of igneous bodies into the dike-swarm zone after the swarm formed (possibly after the Miocene volcanic rocks were deposited). A possible buried stock near the southwest end of the dike swarm (beneath Ordovician rocks) is suggested by an aeromagnetic anomaly centered 2 mi (3.5 km) south of Round Mountain (U.S. Geological Survey, 1971).

REFERENCES

Bailey, E. H., and Phoenix, D. A., 1944, Quicksilver deposits in Nevada: Nevada Univ. Bull. v. 38, no. 5, Geol. and Min. ser. 41, 206 p.

Bergendahl, M. H., 1964, Gold, in Mineral and water resources of Nevada: Nevada Bur. Mines Bull. 65, p. 87-100.

Edwards, George, and McLaughlin, W. A., 1972, Shell list No. 1--K/Ar and Rb/Sr age determinations of California, Nevada, and Utah rocks and minerals: Isochron/West, no. 3, p. 1-7.

Engineering and Mining Journal, 1950, This Month in Mining: Eng. and Mining Jour., v. 15, no. 7, p. 107.

Ferguson, H. G., 1921, The Round Mountain district, Nevada: U.S. Geol. Survey Bull. 725-I, p. 383-406.

______, 1924, Geology and ore deposits of the Manhattan district, Nevada: U.S. Geol. Survey Bull. 723, 163 p.

Ferguson, H. G., and Cathcart, S. H., 1954, Geology of the Round Mountain quadrangle, Nevada: U.S. Geol. Survey Geol. Quad. Map GQ-40.

Fleischer, Michael, 1975, 1975 glossary of mineral species: Bowie, Maryland, Mineralogical Record, Inc., 145 p.

Kleinhampl, F. J., and Ziony, J. I., 1967, Preliminary geologic map of northern Nye County, Nevada: U.S. Geol. Survey Open-file report.

Koschmann, A. H., and Bergendahl, M. H., 1968, Principal gold-producing districts of the United States: U.S. Geol. Survey Prof. Paper 610, 283 p.

Kral, V. E., 1951, Mineral resources of Nye County, Nevada: Nevada Univ. Bull., v. 45, no. 3, Geology and Mining Ser. 50, 223 p.

Krueger, H. W., and Schilling, J. H., 1971, Geochron/Nevada Bureau of Mines K/Ar age determinations--List 1: Isochron/West, no. 1, p. 9-14.

Marvin, R. F., Mehnert, H. H., and McKee, E. H., 1973, A Summary of radiometric ages of Tertiary volcanic rocks in Nevada and eastern California, Part III--Southeastern Nevada: Isochron/West, no. 6, p. 1-30.

Palache, Charles, Berman, Harry, and Frondel, Clifford, 1944, The system of mineralogy of James Dwight Dana and Edward Salisbury Dana, Volume 1, Elements, sulphides, sulfosalts, oxides, 7th Edition: New York, John Wiley and Sons, 834 p.

Silberman, M. L., Shawe, D. R., Koski, R. A., and Goddard, B. B., 1975, K-Ar ages of mineralization at Round Mountain and Manhattan, Nye County, Nevada: Isochron/West, no. 13, p. 1-2.

U.S. Geological Survey, 1971, Aeromagnetic map of parts of the Tonopah and Millet 1° by 2° quadrangles, Nevada: U.S. Geol. Survey Geophys. Inv. Map GP-752.

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