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MINERALIZATION IN THE NORTHERN QUITMAN MOUNTAINS, HUDSPETH COUNTY, TEXAS

DAVID H. MURRY
McAnulty and McAnulty, Geologists
220 Stratus Road
El Paso, Texas 79912

INTRODUCTION

The northern Quitman Mountains are in southern Hudspeth County, Texas, about 130 km southeast of El Paso. They are a conspicuous northwest-trending range 3 to 7 km wide and 12 km long that rise with a strong slope break over 600 m above the surrounding bolsons. Quitman Peak, with an elevation of 2030 m, is the highest point in the range. The area exhibits typical Chihuahuan Desert climate and vegetation.

Von Streeruwitz (1889, 1890, 1892) published the earliest geologic studies on the Quitman Mountains. Brief accounts of various aspects of the geology of the range are found in Osann (1892), Simonds (1902), Hill and Udden (1904), Baker (1927), Sellards and Baker (1934), Udden (1941), Evans (1943), Kerr (1946), Albritton and Smith (1949), Holser (1959), McAnulty (1971) and McAnulty, (1976). Comprehensive geologic reports on the northern Quitman Mountains have been authored by Huffington (1943), and Albritton and Smith (1965). Regional aspects of the area are discussed by DeFord (1969), Barker (1977, 1979), and Seager and Morgan (1979). Intrusive rocks in the range were studied in detail by Gieger (1965), volcanic rocks by Hobbs (1979), and mineralization by Laux (1969). This paper is based on a master's thesis by the author (Murry, 1979).

GENERAL GEOLOGY

The northern Quitman Mountains are a volcanic cauldron that has been superimposed across Laramide-deformed Paleozoic and Mesozoic marine strata of the Chihuahua Trough. The cauldron is expressed as a thick, areally restricted sequence of ash flow tuffs encircled and intruded by a composite granitic ring dike with a stock at its northern end. Separating the ring dike from the volcanic pile on the north and east is an arcuate septum of Cretaceous limestone that has been deformed into an anticline (fig. 1).

The volcanic pile has been deformed into a northwest-trending asymmetrical syncline. Beds of the western limb dip 33° E to vertical, while beds of the western limb dip 18° to 23° W. Aggregate thickness of the volcanic rocks, named the Square Peak volcanic series by Huffington (1943), is 1100 m. Hobbs (1979) divided the sequence into nine units; he determined that the top and bottom of the sequence were composed of welded vitric to lithic rhyolitic ash flow tuffs, whereas the middle of the sequence was composed of welded crystal andesitic to latitic ash flow tuffs.

The ring dike encircles an area 7 km wide and 12 km long, elongated northwest-southeast. Its western arc is well-defined, whereas the eastern arc is poorly developed. Gieger (1965) recognized five broad petrologic types, and local variations are common. These are: diorite, monzonite, plagioclase-rich syenite (greater than 15 percent plagioclase), plagioclase-poor syenite (less than 15 percent plagioclase) and granite. Diorite occurs as xenoliths in the other rock types, especially in the monzonite. The monzonite, which locally grades into quartz monzonite, is the most abundant rock type, constituting most of the northern stock area and the northern part of the ring dike. The remainder of the ring dike consists of syenite and small plugs and irregularly-shaped masses of granite.

The first four rock types are equigranular to slightly porphyritic, while the granite is a porphyry. Plagioclase in all rock types tends to be sodic and generally is rimmed with anorthoclase. Quartz is irregularly distributed, except in the granite, which contains 25 to 30 percent quartz phenocrysts. The most common mafic mineral is hornblende, followed by biotite, then magnetite. Augite, apatite, zircon, sphene, epidote and calcite occur as minor constituents.

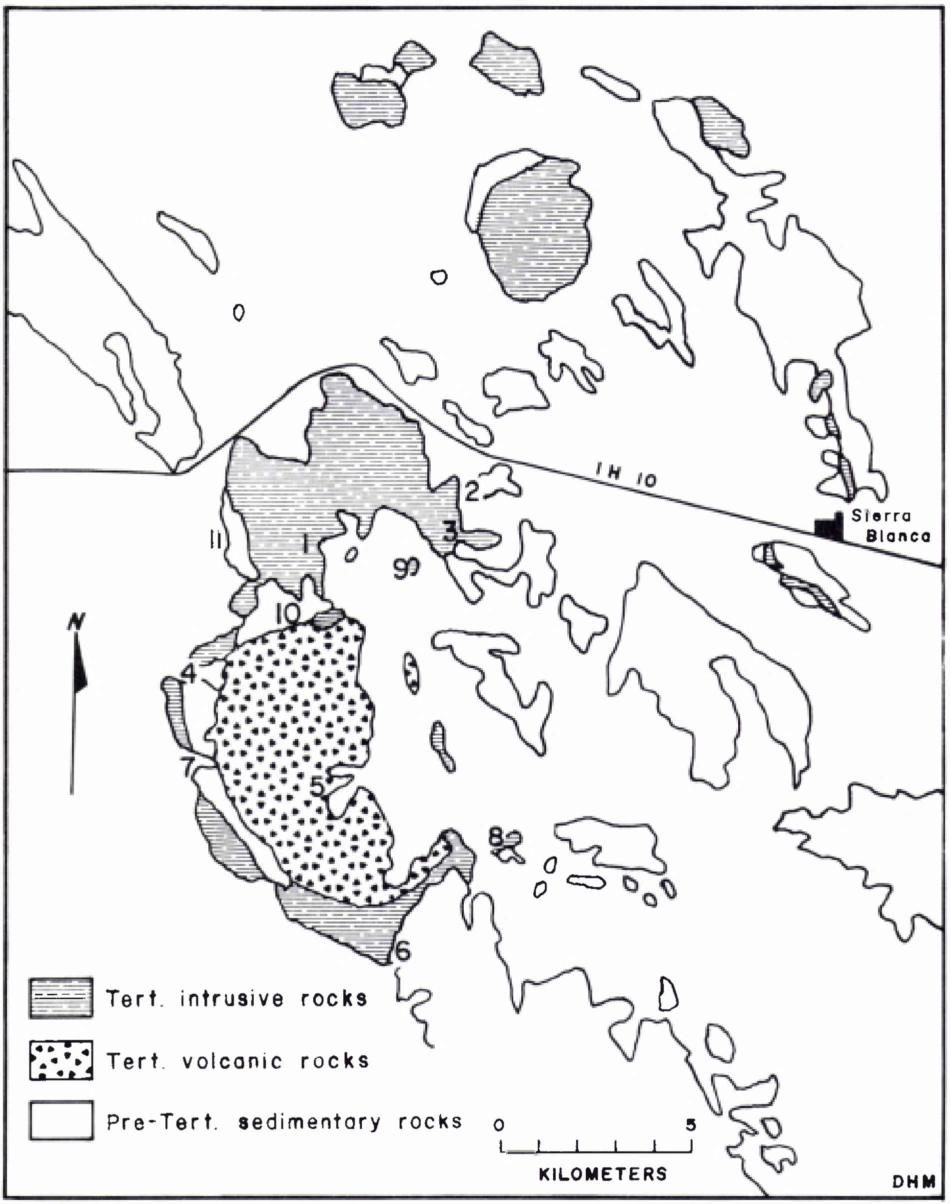
Several intrusive breccias were found in the southern part of the cauldron. They occur as dikes, pipes and irregularly shaped masses within or bordering the ring dike. Breccia compositions are diverse, although within individual breccias clasts tend to be homogeneous, with few exotic clasts. Most tend to be silicic, with aplites and granites common. Alteration is weak and erratic, and the only observed mineralization was weak to moderate pyritization in some of the clasts. No distinct geochemical signature was detected for the breccias.

The asymmetrical nature of the volcanic pile, along with the well-defined western arc of the ring dike suggest that the cauldron is of the trap-door variety, hinged on the east. The outcrop of Cretaceous strata that lies between the volcanic rocks and the ring dike on the west side of the cauldron is interpreted to be a manifestation of resurgence (Murry, 1979). After subsidence along the western margin of the cauldron block, resurgent uplift re-elevated this western edge. During this uplift the outer edge of the block broke loose and was displaced upwards relative to the eastern part of the block. The anticlinal form of the Cretaceous block and the synclinal form of the volcanic rocks are due, at least in part, to drag folding that resulted from this preferential uplift of the western edge of the cauldron block.

MINERALIZATION

Mineralization associated with the Quitman Mountain cauldron can be divided broadly into hydrothermal veins and contact metasomatic skarn deposits. The hydrothermal veins occur as 1) east-west, steeply dipping veins with Ag-Pb-Zn-Cu-Mo mineralization (locations 1-4, fig. 1); 2), north-south, steeply to moderately dipping veins of magnetite or barite (locations 6 and 10, fig. 1); and 3) an east-west, steeply dipping vein of fluorspar (location 5, fig. 1). Veins occur in sedimentary, volcanic and plutonic rocks, with the stronger mineralization in the northern part of the cauldron. Contact metasomatic deposits occur as 1) banded, iron-rich Be-bearing skarns (locations 8-10, fig. 1); 2) a scheelite-bearing skarn (location 11, fig. 1); and 3) a copper-garnet-magnetite skarn (location 10, fig. 1). The scheelite and copper-garnet-magnetite skarns are associated with the monzonite phase of instrusion, while the Be-bearing skarns are associated with the later granite phase.

Of course, skarns are restricted to intrusive-carbonate contacts; no contact metasomatic deposits were found in volcanic rocks. Metasomatic replacement was the chief method of formation,



Mineral Occurrences

1. Bonanza Zone
2. Tarantula Hills vein
3. Milby Peak veins
4. Silver King Canyon veins
5. Cowan Ranch fluorite vein
6. Quitman Gap magnetite veins
7. Intrusive breccia
8. Granite Hill beryllium skarn
9. Tremble Hill beryllium skarn
10. Zimpleman Pass veins and skarns
11. Love Tank scheelite skarn

Figure 1. Generalized geology and mineralization in the northern Quitman Mountains, Hudspeth County, Texas.

although some veining occurred. Veins occur as simple fissure- fillings. Replacement of the wallrock is minimal, even where veins cut carbonate rocks. The two types of deposits are similar geochemically. Both have abundant Fe and Si with few exceptions. Ag, Pb, Cu, Zn and Mo are common in the veins and also occur as common trace elements in the skarns. The elements Sn and W, which are common in the skarns, occur as trace elements in the veins. Both the veins and skarns show trace amounts of Ti and Zr. The notable difference is the occurrence of Be and rare earth elements in the skarns and their absence in the veins.

With few exceptions, the veins trend between N 70° E to N 70° W. Concentric faults associated with the cauldron have no obvious control on the veins, and other typical cauldron-related structures, such as radial faults and resurgence-related apical grabens are not evident. Instead, the vein system appears to have been superimposed across the cauldron, having no apparent relation to its development.

With local variations and exceptions, the paragenetic sequence in the veins is 1) early-formed quartz-pyrite-magnetite, 2) chalcopyrite-sphalerite-argentiferous galena, and 3) barite-calcite. The one fluorspar vein exhibited an early stage of formation of variously colored fluorite, and a later stage of barite-sugary quartz formation.

The copper-garnet-magnetite skarn is composed of abundant garnet with magnetite and other iron oxides. Secondary copper minerals occur in the skarn as well to moderately developed fracture coatings. The Be-bearing skarns are similar to those described by Jahns (1944a, 1944b) in the Iron Mountain district, Sierra and Socorro Counties, New Mexico. The skarns are composed of "ribbon rock," which is thin bands of fine-grained magnetite that alternate with bands of calc-silicate minerals. Beryllium minerals are associated with the magnetite bands.

Alteration associated with the veins is a local feature, seldom extending more than a few meters into the country rock. Argillization is common in the intrusive rocks, and commonly is pervasive and strong. Where veins cut limestone or other sedimentary rocks, however, little alteration occurs. Silicification is common, but generally is confined to within a few centimeters of the vein walls. At the Love Tank scheelite prospect (location 11, fig. 1), the monzonite intrusion created a contact zone that extends over 65 m outward from the intrusive contact. Garnet, the most abundant contact mineral, occurs in beds up to 45 cm thick. The garnet varies from reddish-brown to yellow, with local light-green patches. Crystals are euhedral to subhedral. Outward from the garnet zone are aggregates of light-green actinolite sheaths that replace limestone country rock. In places, garnets are intergrown with actinolite. Epidote is ubiquitous, as is specular hematite, although the former is more abundant. Scheelite occurs as disseminated grains and in thin veinlets in carbonate rock. Metamorphic effects elsewhere are less spectacular, but most of the intrusive contacts display at least weak calc-silicate alteration.

For the sake of brevity, not all individual deposits are discussed herein, as many are similar in character. For more complete descriptions the reader is referred to Laux (1969) and Murry (1979). The following two descriptions are typical of those for vein and skarn mineralization in the northern Quitman Mountains.

Bonanza Mine

The Bonanza Mine is in the northern part of the area, within the northern stock (location 1, fig. 1). It and two other smaller mines, the Alice Ray and the Queen Anne, are along the Bonanza fissure zone. This is an east-west zone up to 100 m wide. It is bounded on the north by a rhyolite porphyry dike up to 15 m wide that crops out continuously from the Bonanza Mine westward to the alluvial contact. Its southern boundary is marked by another rhyolite porphyry dike, but this one is discontinuous and only crops out along the western end of the zone. Fractured rock within the zone exhibits weak argillization and moderate iron staining, with erratic quartz veining. At the Bonanza Mine, the zone is capped by a gossan.

The Bonanza Mine has four levels: 32 m, 50 m, 69 m and 85 m. All are connected by a main shaft and an exploration shaft, and a ventilation shaft opens to the first level. The main shaft is badly caved, and the others are filled with debris. The lower levels reportedly are flooded. During 1977-1978, Precious Metal Processors of Dallas, Texas sank a decline to the first level and drove a drift 213 m westward into the mountain. The portal of this drift is just south of the old main shaft. No ore was encountered.

The only recorded production from the area is from the Bonanza Mine. It produced 1,488,479 pounds of zinc, which represents the total zinc production of the state of Texas (Sellards and Baker, 1934). Early mining, however (ca. 1880's), was for silver. Based on von Streeruwitz's report of 1889, Murry (1979) inferred that 50,000 to 75,000 ounces of silver were taken from the Bonanza Mine.

Mineralization is confined to a 3- to 75-cm-wide vein that averages 20 cm in width. The principal ore minerals are argentiferous galena and ferruginous sphalerite. Minor copper occurs as chalcopyrite and secondary copper minerals, and wulfenite has been reported (McAnulty, 1971). These occur in a gangue of barite, pyrite, iron oxides and quartz. The vein exhibits a crude zonation: quartz occurs as comb structure along the outer part of the vein, while inward, a gangue of iron oxides encloses a central zone of sphalerite and galena that contains pods of barite and siderite. Downward, galena gives way to sphalerite.

A sample of the ore contained several percent, each, of lead and zinc, over 500 ppm Ag, 520 ppm Cu, 475 ppm Mo, 480 ppm Cd and 5 ppm Ni. The cadmium probably occurs in the mineral greenockite. Uranium content is as great as 0.073 percent (Albritton and Smith, 1965).

Granite Hill

Granite Hill is a small granite porphyry knob that crops out just east of the main projection of the ring dike (location 8, fig. 1). The workings consist of a few shallow pits. Several exploration holes have been drilled in the area, but data from them are unavailable.

The granite porphyry intrudes Cretaceous limestone beds. The intrusive contact locally is sharp, but generally is poorly exposed. Along the northern part of the contact, limestone xenoliths up to several feet long can be found. Ribbon-rock skarns associated with the intrusion are well developed, but seldom are greater than 3 m wide. The skarns consist of fine-grained magnetite bands that alternate with bands of calc-silicate minerals and some fluorite. The bands are cut by stringers of nontronite. Country rock peripheral to the skarn is weakly epidotized and silicified along fractures. Laux (1969) recognized phenacite in the skarns, and Dow Chemical personnel identified helvite, phenacite, bromellite and euclase(?). The helvite approaches danalite in composition. X-ray fluorescence and emission spectrometer analyses of skarn samples by Dow Chemical showed several percent, each, of Ca, Fe, Al, Na and Si, up to 2.0 percent Sn, up to 0.63 percent Be, up to 0.4 percent W, and trace amounts of Mn, Zn, Sr, Ti, Mg, Mo, Zr and Cu. Quantitative analysis of one sample by Dow Chemical indicated 1.1 percent Nb, which was in the mineral pyrochlore.

ECONOMIC POTENTIAL

Although the area has sustained no substantial mineral production, it does offer several encouraging possibilities. Iron, occurring in both the veins and skarns, conceivably could be exploited for heavy-media stock to be used in sink-float milling operations. Two linear gossans which are unexplored at depth in the Silver King Canyon area may cap mineralized rock such as was found in the Bonanza zone. A large granite porphyry mass at the southern end of the ring dike, which has poorly exposed contacts, may have associated ribbon-rock skarns. The possibility of skarn-type copper deposits in the Zimpleman Pass area is indicated by the copper-garnet-magnetite skarn. The composite intrusion and its Sn-W-Mo geochemistry suggests a favorable environment for disseminated molybdenum deposits. Clearly, the economic potential of the northern Quitman Mountains deserves further consideration.

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