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Quartz-Tourmaline Veins in the Northern Sierra Nevada Area

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Tourmaline-bearing quartz veins and replacement deposits, commonly copper- and gold-bearing, are found in unusual concentration in northwestern Nevada and adjacent northeastern California in Triassic and Jurassic arc rocks and in the Cretaceous plutons that intrude them. Mines and prospects that exploit the tourmaline-bearing deposits are found in a zone approximately 70 miles long and 50 miles wide. Many copper-bearing quartz- tourmaline veins contain appreciable gold ñ silver, but early miners were commonly discouraged by the difficult-to-treat sulfide ores encountered below the free-milling gold ore in the oxidized zone. Tourmaline-bearing aplite/pegmatite dikes, associated with Late Cretaceous plutons are also relatively common in the area, suggesting a genetic relationship between plutons and mineralization. A group of copper-bearing veins in the Genesee mining district near Taylorsville, California is probably also a related mineralization type. Tourmaline is known to occur in only a few of these mines, but there has been little recent work on them, and more widespread tourmaline may not have been recognized by early workers.

The quartz-tourmaline veins are usually mineralogically simple. In addition to black tourmaline (probably schorlite) and milky to clear quartz, the veins contain pyrite + bornite and/or chalcopyrite, ñ magnetite, and very rarely chalcocite, pyrrhotite, molybdenite, arseno-pyrite, tetrahedrite, sphalerite, and galena. Sulfide-mineral content may be 10% or more in major veins, and locally massive sulfide bodies occur, but minor prospects and occurrences often have very low sulfide-mineral contents. Epidote occurs in veins and is common as concentrations in the wall rock. Garnet is quite rare, occurring only in clearly skarn-related mineralized areas, often adjacent to plutons. There are sericitic alteration envelopes around some veins; chlorite is concentrated in the walls at others. The minor prospects and occurrences are often rather obscure, and few have been described in the literature, or when described, tourmaline was not recognized or reported.

Most of the wall rocks for the veins are intermediate-composition metavolcanic rocks of Triassic and Jurassic age; at a few localities, the host is metarhyolite or silicic metaignimbrite. Granodiorite, commonly of Late Cretaceous or presumed Late Cretaceous age, is the host for a significant number of deposits.

Ages of most of the quartz-tourmaline veins are not known with certainty. However the occurrence of a number of veins in Late Cretaceous granodioritic rocks in western Nevada places a lower limit on their ages. Also, a K-Ar age on sericite in altered wall-rock fragments in a vein from the Flying Dutchman mine south of Chilcoot, California suggests that at least the veins in that area are Late Cretaceous (89 Ma; E. H. McKee, written commun., 1990), and are closely related in age to nearby plutons. In the Meadow Lake mining district, 6 miles north of Cisco Grove, California, numerous gold- and copper-bearing quartz- tourmaline veins cut the 151 Ma (E. H. McKee, oral commun., 1990) French Lake granodiorite. The mineralization is most likely related to late-stage fluids associated with this Late Jurassic pluton, but could be related to an adjacent Cretaceous (100 Ma) pluton. Near Taylorsville, California, tourmaline-bearing vein and porphyry-style mineralization occur in and adjacent to a granitic Cretaceous(?) stock (the Lights Creek stock; Putman, 1975); somewhat similar copper-gold mineralization to the south in the Genesee district may be of similar age. The Walker mine in the southern part of this district has been considered by some workers (Kilbreath and Leger, 1978; Kilbreath, 1979) to be a metamorphosed volcanogenic exhalative deposit. The mine was not examined during this study, but it has many features similar to other nearby hypogene tourmaline- bearing copper-

gold quartz veins.

The numerous occurrences and wide distribution over a large area of quartz-tourmaline veins and tourmaline-bearing pegmatites suggest a boron-enriched province. Although there is evidence that many of the deposits are Late Cretaceous, others may be Jurassic. It appears that most of the quartz- tourmaline veins should be considered high temperature or hypothermal. Lindgren (1933, p. 770) listed copper-tourmaline deposits as one type of hypothermal veins, and gave the Meadow Lake veins as one example. Replacement appears to have been a significant mineralization process in vein formation, as open-space textures characteristic of lower temperature veins are generally absent. Tourmaline is generally considered a high- temperature mineral, as is the commonly associated magnetite. Some of the quartz-magnetite- tourmaline mineralization (e.g., on Peavine Peak and at the Bessemer mine in the Delaware district south of Carson City) is skarn-like and apparently a variant of, or part of a continuum with, the gold- and copper-bearing quartz-tourmaline veins. Additionally, fluid-inclusion and experimental petrology studies on hydrothermal tourmalines formed in the Larderello geothermal field suggest that most of them are formed at 400 to 600C (Cavarretta and Puxeddu, 1990). Some vein wall-rock alteration and non-vein mineralization are definitely skarn-like (e.g., the Red Metals mine in the Peavine district, where strong epidotization occurs with sparse garnet). Sericite occurs as a wall-rock alteration product adjacent to some veins.

The quartz-tourmaline veins have some remarkable similarities (but some differences as well) to porphyry copper/molybdenum deposits and related skarns. Although there is no evidence of any porphyry-style mineralization in the vicinity of many of the veins, the vein mineralization can be viewed as a related type, developed in and adjacent to mainly granodioritic plutons. Possibly the veins represent somewhat weaker mineralization, without the development of the large hydrothermal cells necessary for porphyry mineralization. Bowman (1983) suggested that vein deposits like those at Meadow Lake may be the lowermost part of porphyry copper systems, or the manifestation of a deeply emplaced mineralized pluton which might have formed a porphyry copper deposit had it come to rest at a higher, subvolcanic level. The presence of black tourmaline-bearing aplite and pegmatite dikes in the vicinity of many of these deposits also suggests high-temperature, intrusion-related mineralization.

References

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