Economic Geology
Vol. 95, 2000, pp. 343-360

Geology and Ore Petrography of Permian Kuroko-Type Volcanogenic Massive Sulfide Deposits of the Bully Hill Area, East Shasta District, California

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Abstract

Kuroko-type volcanogenic massive sulfide (VMS) deposits occur in the Late Permian Bully Hill Rhyolite and the basal part of the overlying Pit Formation in the Bully Hill area. The Bully Hill Rhyolite at Bully Hill consists of three tuffaceous units and a lava unit that overlie the Dekkas Andesite. Two ore host horizons are present, the younger containing the Bully Hill and probably the Copper City deposits, and the older the Rising Star deposit. A large olistostrome in the basal Pit Formation contains disrupted shale, mudstone, and volcanic rock, and includes hydrothermally altered and mineralized material. The host strata are folded into tight anticlines at Bully Hill and Copper City. Distinct zones of hydrothermal alteration, ranging from intense silicification to a quartz-albitechlorite-epidote assemblage, are found within the Bully Hill Rhyolite at Bully Hill. The most intensely silicified rock occurs within the lava unit stratigraphically beneath the known VMS deposits; this rock preserves a stockwork of quartz and barite veinlets, some bearing sulfides, which represent hydrothermal feeders of the syngenetic mineralization. The syngenetic ore has been hydrothermally reworked and is characterized by a paragenetic sequence resembling that of Japanese kuroko-type deposits (Eldridge et al., 1983), with the added complexity of retrograde barite replacing sulfide minerals.