GEOLOGY OF THE CARBONATE-HOSTED OMAR COPPER PROSPECT, BAIRD MOUNTAINS, ALASKA*

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ABSTRACT

Copper and iron sulfides occur in discordant veinlets, blebs, and stringers, and are strata bound within a Devonian dolostone. This commonly brecciated dolostone is part of a Paleozoic sequence of folded and faulted carbonate rocks in the western Baird Mountains quadrangle. Sulfides, sparry dolomite, and less commonly calcite and quartz locally form the matrix surrounding the angular clasts. Bornite and chalcopyrite are the dominant copper sulfides, and chalcopyrite forms coherent exsolution lamellae and noncorent blebs and dots within bornite or tetrahedrite. Sulfides surround euhedral dolomite rhombs in veinlets and small cavities, indicating that sulfide precipitation postdated euhedral dolomite growth. Dissolution of the host dolostone created the open spaces, which were filled in turn by dolomite, sulfide, and quartz prior to metamorphism and deformation associated with the Middle Jurassic to Cretaceous Brooks Range orogeny. Mineralization at Omar was similar in mineralogy and style to the carbonate-hosted Ruby Creek copper deposit 180 km to the east in the Ambler River quadrangle.

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STRATIGRAPHIC SETTING AND MINERALOGY OF THE ARCTIC VOLCANOGENIC MASSIVE SULFIDE PROSPECT, AMBLER DISTRICT, ALASKA*

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ABSTRACT

The Arctic prospect is the largest (36 million metric tons) volcanogenic massive sulfide deposit known within the Ambler district in northwestern Alaska. These deposits are hosted by the low-greenschist-grade, Devonian-Mississippian Ambler sequence (informal name) of bimodal, basaltic, and rhyolitic volcanic and volcaniclastic rocks, pelitic, graphitic, and calcareous metasediments. Detailed field mapping, core logging, petrography, X-ray diffractometry, and electron microprobe and whole-rock analyses of hydrhthermally altered rocks were used to determine the emplacement history and setting of sulfide deposition. The Arctic prospect contains mineralization at three separate stratigraphic intervals. The largest and most economically important of these three intervals, termed the Main horizon, contains 90 to 95 percent of the known ore reserves. Main horizon mineralization consists of one to possibly as many as 14 semimassive sulfide lenses within a well-developed, horizontally stratified sequence of alteration types, including pyritic (pyrite-phengite-calcite) and chloritic (chlorite-quartz) alteration, dolomite, phlogopite, albite, talc, and white mica. These alteration types together form a pervasively altered zone (0.02 km^3) which is asymmetric to the vent area for the ore fluids.

The deposit is high in Cu and barite, has moderate amounts of Zn and Ag, and is low in pyrite, Fe, Pb, and Au. Ternary plots of Cu, Pb, and Zn abundances are very similar to those of massive sulfides formed at divergent plate boundaries, with total metal content at Arctic in the top 1 percent (Cu), 3 percent (Zn), and 4 percent (Pb and Ag) of volcanogenic massive sulfides worldwide. Strong lateral zonation of metals (Cu overlying the vent area, Zn intermediate, and Pb and Ag distal) parallels, but is offset from, an asymmetric distribution of alteration. Most sulfides were deposited not over the vent but on a relatively flat area and in topographic channels between an elongate vent area paleohigh and a carbonaceous mud-bearing basin to the northwest.

No single volcanic unit can be genetically tied to mineralization. The onset of hydrothermal activity was apparently related to fault activity in the vent area and continued during emplacement of subsequent (postore) rhyolites. Mineralization at Arctic took place along a synvolcanic fault in a tectonically and volcanically active basin within a rifting continental margin, possibly related to an active oceanic rift. Jurassic(?) to Cretaceous, low-greenschist-grade (chlorite-muscovite subfacies) regional metamorphism was essentially isochemical on a macroscopic scale and preserved many primary features of the deposit and its host rocks.

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Alaskan North Slope Geology, Volumes I and II, 1987
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