Petrography, paragenesis and geochemistry of a new prospect in the world-class Red Dog Zinc-Lead District, northwestern Alaska

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The Red Dog District in northwestern Alaska contains one of the largest zinc mines in the world, producing 5% of global zinc, with the life of mine expected to extend past the year 2030. There are 6 known zinc-lead deposits in the district, all hosted in the black siliceous and carbonaceous mudstones of the Mississippian Kuna formation, and exploration is ongoing in the region.

For this study, 120 samples of drill core from a new prospect in the Red Dog District were cut and the hand specimens were described in detail. A subset of 24 samples was selected to be made into thin sections. These samples mainly comprise ore textures and were examined with transmitted and reflected light microscopy to determine relative timing of mineral phases. Scanning electron microscopy was used to examine ore textures in even greater detail and electron probe microanalysis (EPMA) was used to investigate the minor element chemistry in pyrite and sphalerite. Geochemical data acquired by EPMA was processed using the ioGas software.

Preliminary interpretations indicate 4 stages of mineralization containing multiple phases of iron sulfide (pyrite and marcasite), sphalerite and galena. Pyrite is predominantly early, followed by sphalerite, and galena is late. The earliest stage of mineralization likely formed during early diagenesis. The concentrations of cadmium, antimony, mercury and manganese vary in different sulfide phases. Previous workers have suggested that all mineralization in the Red Dog District formed as one deposit that was subsequently dismembered by thrusting during the Cretaceous Brookian orogeny. The paragenesis and geochemistry of this new prospect will be compared with the literature from other deposits in the District to assess the viability of this hypothesis.