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B. Volcanogenic Massive Sulphide Deposits and Related Studies

Comparative geochemical studies of the Upper Triassic Windy Craggy and modern Guaymas basin deposits: a contribution to the understanding of massive sulphide formation in volcano-sedimentary environments.

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Guaymas Basin in the Gulf of California contains a seafloor hydrothermal system at a sediment-covered spreading ridge. Study of the carbonate and sulphide minerals has identified distinct sulphur and carbon isotope variations with geographical location. The study of hydrocarbon-bearing and adjacent aqueous inclusions indicates that they were formed at relatively low temperatures (116°C to 226°C) from a mixture of ambient seawater and hydrothermal fluid. ¹⁴C dating of liquid hydrocarbon within the hydrothermal precipitates gave extremely young ages (<5000 years) that indicate only the upper tens of metres of sediment were the source for these hydrocarbons. Windy Craggy is an unusually large Cu-Co-Au massive sulphide deposit

in a volcano-sedimentary sequence in extreme northwestern British Columbia. The deposit has similarities with Guaymas Basin and consists of several sulphide lenses, each with a variably developed footwall stockwork zone. Predominant sulphides include pyrrhotite, pyrite, chalcopyrite, and sphalerite; gangue minerals are quartz, chlorite, magnetite, calcite, siderite, and stilpnomelane. Two types of alteration of the footwall rocks have been recognized: chloritization and silicification. Sulphur isotope measurements of sulphides indicate that sulphur was derived mainly from the underlying basalts. Stable carbon isotope analyses of carbonates suggest that the source of carbon was predominantly dissolved marine carbonate. Fluid inclusion microthermometric measurements of primary, two-phase inclusions in stockwork quartz veins gave homogenization temperatures ranging from 220°C to 380°C. Salinities are significantly higher than for seawater (9 eq.wt% to 17 eq.wt% NaCl). The host basalt flows and sills are transitional tholeiites, with LILE and LREE-enrichment. A mature back-arc basin is the most likely paleotectonic setting for Windy Craggy. The host argillites contain a component of hydrothermal activity during intermittent turbidite sedimentation. Ferruginous cherts associated with the massive sulphides have REE contents that are very similar to those of modern seafloor hydrothermal vent fluids.