Mineralogy of a lead-barite occurrence in Kap Henson, Northumberland Island, Greenland

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During a traverse part of the Canadian-German Nares Strait Geocruise 2001 expedition, we came across "vuggy" diabase, a cavity ridden upper part of a regionally extensive diabase sill, with irregular cavities (1–20 cm) and irregular veins (0.5 to 10 cm) partially filled with calcite, barite, minor quartz and sulphides, mainly galena, in crystals up to 2 cm. The locality is at Lat. 77° 22.087' N/Long. 71° 30.568', at 265 m.a.s.l. in Kap Henson of deserted Northumberland Island. The altered and sparsely mineralized rock is exposed in an area of 250 m in an E-W direction, by 35 m NS. Alteration has corroded the phaneritic quartz diorite, and locally the rock is intensely altered and can be dug out with a knife. The permeability for the veining was provided by extensional fractures and the upper contact of the brittle (Proterozoic) sill with grey shales of the (Proterozoic) Dundas Group. Transmitted and reflected light microscopy and electron probe microanalysis indicate that the host rock is a fine grained quartz diabase with pyroxene, amphibole, biotite, plagioclase (sericitized), K-feldspar and minor quartz. Magmatic titanomagnetite is very abundant and pyrite and chalcopyrite occur in accessory amounts; euhedral apatite is conspicuous as relatively large inclusions within the major minerals. The rock is affected to various degrees by alteration dominated by sericitization and chloritization. The main hypogene vein sulphide is galena, with lesser amounts of chalcopyrite, and minor pyrite and rare sphalerite. Calcite and barite (one earlier generation clear, euhedral; one later cloudy, brownish) and minor quartz are the gangue minerals, and the veins are crustified, having formed by open-space filling. Quartz occurs as doubly terminated bipyramids in calcite and barite (early), and in granular veinlets (late). All barite is rich in two-phase (liquid-gas) fluid inclusions, and barite II contains traces of solidified petroleum. Two-phase fluid inclusions homogenize (median Th) as a liquid at 158 ºC (calcite) and 165 ºC (barite) respectively. There is no evidence of boiling of the fluids. Ice-melting temperatures (Tm,ice) of -35 ºC (calcite) and 0 ºC (barite) suggest the involvement of two distinct fluids, one Na-Ca-Mg, probably basinal brines, and the other dilute meteoric water. Hydrocarbons may have played a chemical role in sulphide precipitation. Hydrothermal alteration has produced calcite, epidote and chlorite. Incipient weathering

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has produced covellite, chalcocite, goethite and trace malachite as alteration products of chalcopyrite and/or pyrite. The age of mineralization is clearly post-Proterozoic intrusion and post brittle fracturing. Apatite fission track data indicate that the rocks now at the surface at Kap Henson cooled below ca. 100 ºC in the Triassic, hence the age of base metal deposition is constrained between post-Proterozoic and Triassic. Hot basinal fluids, as well as penetrating meteoric fluids were involved; hence it is possible that mineralization took place during basin inversion.