Highly Metamorphosed Iron Formation on Arcedeckne Island, Boothia Peninsula, Arctic Canada, and the Paragenesis of Harrisonite, $Ca(Fe,Mg)_6(SiO_4)_2(PO_4)_2$

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Summary

A layered quartz-iron silicate body, ca. 700 m x 200 m, bordered concordantly by Paleoproterozoic, granulite facies, supracrustal gneisses, outcrops on Arcedeckne Island, off northern Boothia Peninsula, Nunavut and is the type locality of the rare silico-phosphate mineral harrisonite (Roberts et al. 1993; Grice and Roberts 1993).

Layers and lenses, up to 0.7 m thick, of massive garnetite are intercalated with microscopically layered quartz-orthopyroxene (or, rarely, olivine)-garnet granofels and subordinate, graphitic biotite-orthopyroxene-garnet metapelite. Contacts among the three rock types are commonly gradational.

Apatite is a near-ubiqitous constituent of the rocks, which are anomalously rich in phosphorus. Garnet has mol % almandine of 84-92 in garnetite and granofels and 76-80 in metapelite. Orthopyroxene composition is Fs_{71-83} in garnetite and granofels, Fs_{59-63} in metapelite. In the two most iron-rich rocks analyzed, olivine Fo_{5-7} has crystallized in place of orthopyroxene. Although variable in composition, biotite is consistently rich in iron and titanium. Ilmenite is the sole oxide phase identified throughout the Arcedeckne body; pyrrhotite is a sparse accessory mineral in garnetite.

Harrisonite occurs widely, in amounts ,4% by volume, as a late mineral in the garnetite and granofels. It forms a limited Fe-Mg solid solution (Fe/Mg 6-12) and has crystallized discretely and as rims on silicate grains adjacent to apatite; rim harrisonite is richer in Fe than discrete harrisonite.

The Arcedeckne body represents Fe- and P-rich, shaly sediments of marine origin metamorphosed in granulite facies in a reducing environment.

References

Grice, J.D. and Roberts, A.C. 1993, Harrisonite, a well-ordered silico-phosphate with a layered crystal structure: Canadian Mineralogist, 31, 781-785.

Roberts, A.C., Stirling, J.A.R., Grice, J.D., Frisch, T., Herd, R.K., and Jambor, J.L., 1993, Harrisonite, a new calcium iron silicate-phosphate from Arcedeckne Island, District of Franklin, Arctic Canada: Canadian Mineralogist, 31, 775-780.