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Gold in an Archean greenstone belt on Storø, West Greenland

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In the 1990'ies gold was discovered on Storø in Godthåbsfjorden, West Greenland. The gold occurrence is situated in a mid- to late Archean greenstone belt, which consists of amphibolites, garnet-mica schists ± sillimanite and minor bands of iron formation. The rocks have been metamorphosed up to amphibolite facies. Diamond drilling has revealed gold grades up to 32 ppm over 4 metres. The present study shows the results of investigations of polished thin sections of drill cores from Storø in transmitted and reflected light microscopy. The most common ore minerals are pyrrhotite ($Fe_{1-x}S$), ilmenite ($FeTiO_3$), arsenopyrite (FeAsS), loellingite ($FeAs_2$), and chalcopyrite ($CuFeS_2$). Visible gold is seen in the three associations: In loellingite-arsenopyrite-pyrrhotite, in altered plagioclase, and in late quartz veins. The gold in the different associations has widely different silver contents. The silver content of gold in loellingite and arsenopyrite is about 14-17 wt%, while in altered plagioclase and quartz veins the silver content is much lower, approximately 3-7 wt%. Tellurides are often seen in arsenopyrite, loellingite, and silicates, the most common being bismuth tellurides such as wehrlite (BiTe) and silver tellurides such as hessite (Ag_2Te). A few grains of melonite ($NiTe_2$) have been found. Native bismuth has also been encountered.

The textural relationships of loellingite-arsenopyrite-pyrrhotite on Storø closely resemble high-grade gold occurrences described elsewhere e.g. the Challenger deposit in Eastern Australia [1]. The model suggested for the Challenger deposit seems to fit the events recorded on Storø. Arsenopyrite was probably the first gold-bearing ore mineral. However, the gold occurred in solid solution in arsenopyrite. During increasing metamorphic conditions arsenopyrite broke down to loellingite and pyrrhotite. The gold remained in loellingite, partly as visible gold. During decreasing metamorphic conditions loellingite reacted with pyrrhotite and formed arsenopyrite. The gold in the loellingite could not be accommodated in the arsenopyrite but was concentrated in loellingite as discrete grains and as thin gold films around loellingite grains.

Loellingite, arsenopyrite and pyrrhotite have been replaced by garnet, and grains of visible gold are seen in the garnet. The gold is thus likely to be pre-metamorphic (pre-garnet formation). Presently we have no evidence showing how long time prior to metamorphism the gold was introduced; neither do we presently have any clues to the origin of the gold.

References

[1] Tomkins, A. G., Mavrogenes, J. A. (2001) *Econ.Geol.* **96**, 525-534.