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# Orogenic gold mineralisation in the Archean North Atlantic craton, southern West and South West Greenland

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The North Atlantic craton of Greenland has no producing gold mine, although Archean rocks represent the entire time span from > 3.6 Ga until ca. 2550 Ma and major accretionary tectonics affected the craton in the Neorchaean. In the recent years, gold exploration in the Godthåbsfjord has identified several gold targets, the most advanced being the Storø and Qussuk gold prospects. In this paper, we present an overview of known and recently discovered orogenic gold occurrences and link their genesis with the regional geological evolution.

The North Atlantic craton is divided into several terranes and blocks, with a complex tectono-metamorphic and magmatic history. The terranes and blocks comprise belts of supracrustal rocks and/or anorthosite complexes that are intruded by TTG gneiss and minor volumes of late-tectonic granites. The rocks are metamorphosed at amphibolite facies to granulite facies grades. Greenschist facies metamorphism is restricted to localities around Isua and the Tartoq Group in the south. Several terrane accretion events are recorded at ca. 2950 Ma, 2840-2830 Ma, 2760-2740 Ma, 2720-2700 Ma and 2670-2600 Ma. As Archean orogenic gold deposits are known to having formed during accretionary tectonics mainly between 2720 Ma and 2620 Ma, the so called "golden window", the region should be suitable for hosting this deposit type.

In the Paamiut area, gold mineralisation is hosted in quartz veins and hydrothermal alteration zones. They are structurally controlled by a fold-and-thrust system that forms a lateral and frontal ramp. The richest mineralisation is situated in the frontal ramp and at structurally complex sites along the lateral ramp. The hydrothermal alteration occurred at or near peak metamorphic grades in the amphibolite facies. The timing of mineralisation is not resolved but is bracketed by the metamorphic ages of ca. 2840 Ma and 2740 Ma.

Gold mineralisation in the Tartoq area is similarly hosted by quartz veins and hydrothermal alteration halos that are controlled by a fold-and-thrust system. Hydrothermal alteration occurred retrograde in the greenschist facies and during the imbrication of greenstones with TTG's. Gold mineralisation is favourably situated in second-order structures related to major thrust zones. The timing of mineralisation is not resolved, but since the structures are very similar to those at Paamiut, a similar timing is conceivable.

At ca. 2740 Ma, gold mineralisation formed at Sermilik in quartz veins and hydrothermal alteration zones in granulite facies wall rocks. The hydrothermal alteration is retrograde in the amphibolite facies. The structures hosting the gold are related to regional-scale thrust zones. A relationship to tectonics in the Paamiut and Tartoq areas can, however, not be resolved.

Although a major terrane accretion event affected the Nuuk region at ca. 2720-2700 Ma, it appears that this event is not related to hydrothermal gold-bearing mineralising systems. In contrast, major hydrothermal orogenic gold mineralisation is related to the final terrane amalgamation around 2670-2600 Ma. For example, the mineralisation at the Strorø gold prospect has been dated at ca. 2630 Ma, and hydrothermal quartz veins in the Tasiusarsuaq terrane further south formed at ca. 2670 Ma. In addition, several major gold occurrences are located close to the major 2670-2600 Ma Ivinnguit fault.

In conjunction, at least two major tectonic events are now recognised that formed a suitable setting for hydrothermal orogenic gold mineralisation in the North Atlantic craton. The related structures are fold-and-thrust belts and major fault zones that are spatially associated with the larger orogenic gold occurrences. This relationship enables a better predictability of gold occurrences during exploration.