



# Gold occurrences of the Archean North Atlantic craton, southwestern Greenland: A comprehensive genetic model

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## ABSTRACT

The North Atlantic craton of southwestern Greenland hosts several orogenic gold occurrences, although, to date, none is in production. Four gold provinces are distinguished and include Godthåbsfjord, Tasiusarsuaq, Paamiut, and Tartoq. In the Godthåbsfjord gold province, the hypozonal gold occurrences are aligned along the major ca. 2660–2600 Ma Ivinguit fault. Orogenic gold mineralization correlates temporally with, and is related to, ductile deformation along this first-order structure. The northern part of the Tasiusarsuaq gold province is characterized by small hypozonal gold occurrences that are controlled by 2670–2610 Ma folds and shear zones. Auriferous fluids were focused into the structures in both gold provinces during west-directed accretion of the Kapisilik terrane (2650–2580 Ma) to the already amalgamated terranes of the North Atlantic craton. In the southern part of the Tasiusarsuaq gold province, hypozonal gold mineralization is hosted in back-thrusts (Sermilik prospect) and thrusts (Bjørnesund prospect) that formed at 2740 Ma and 2860–2830 Ma, respectively. The deformation is related to the ca. 2850 Ma accretion of the Sioraq block and the Tasiusarsuaq terrane, and the 2800–2700 Ma accretion of the Tasiusarsuaq terrane and the Færingehavn and Tre Brødre terranes.

Mesozonal orogenic gold mineralization is hosted in an accretionary complex in the Paamiut and Tartoq gold provinces. Gold occurrences cluster over a strike extent of approx. 40 km in thrusts and complex strike-slip settings in lateral ramps. The timing of the E-vergent terrane accretion in both areas is unknown, and could either be at ca. 2850 Ma or 2740 Ma. In the eastern part of the Paamiut gold province, quartz veins and associated alteration zones were overprinted by granulite facies metamorphism and show evidence for partial melting. These outermost parts of the accretionary complex were involved in burial-exhumation tectonics during crustal accretion.

Mainly three different orogenic stages related to gold mineralization are distinguished in the North Atlantic craton between ca. 2850 Ma and 2610 Ma. These are generally accretionary tectonic episodes, and gold mineralization is hosted either in reactivated fault systems between terranes or accretionary complex structures along the deformed cratonic margin. The larger orogenic gold occurrences formed at ca. 2740–2600 Ma that appears to be a period of orogenic gold mineralization globally, although significant gold resources in the North Atlantic craton have yet to be identified.

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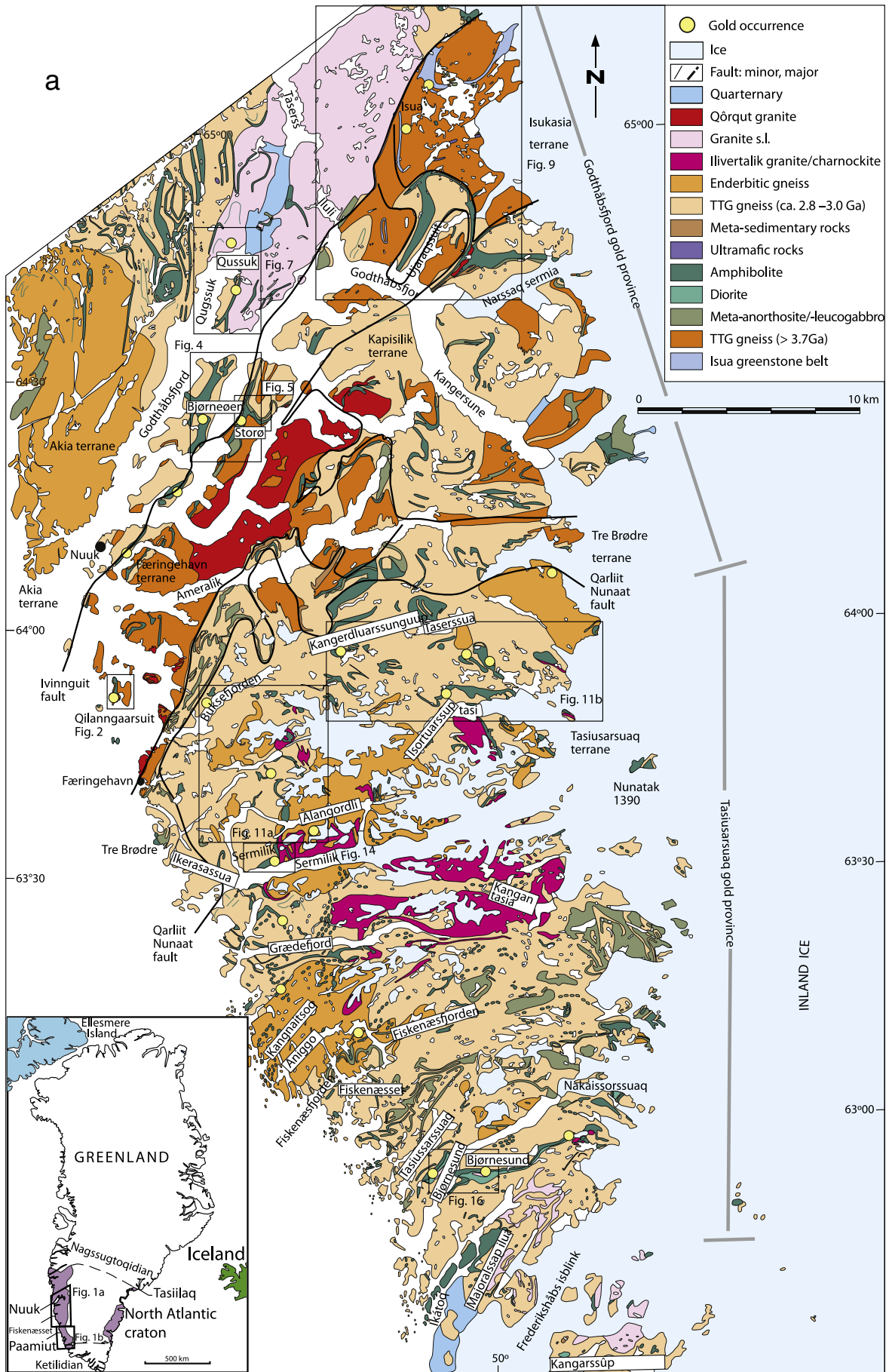
## 1. Introduction

The North Atlantic craton of southern West and South-West Greenland (hereafter southwestern Greenland) has not seen production from orogenic gold deposits, although Archean rocks represent the entire time span from >3600 Ma to ca. 2550 Ma and a major accretionary orogeny was recognized at ca. 2720–2700 Ma (Nutman and Friend, 2007). One reason for the general scarcity of economic gold deposits may be that most of the Archean rocks are at granulite and upper amphibolite facies metamorphic grades ( $T \geq 550^\circ\text{C}$ ), which is above

the typical temperature of their formation (Tomkins and Grundy, 2009), and the general scarcity and small size of greenstone belts (Nutman et al., 2007). Another reason may be climatic, logistical, and infrastructural difficulties in working in Greenland, making mineral exploration and exploitation expensive and relatively high-risk investments. That mineral exploration and exploitation in Greenland can be a successful story, is, however, shown by a number of advanced projects on different deposit types and commodities, such as the Citronen Pb–Zn project (Ironbark Zinc Ltd.), the Malmbjerg Mo project (KGHM Polska Miedź S.A.), the Skaergaard precious metal project (Platina Resources Ltd.), the Kvanefjeld rare metals project (Greenland Minerals and Energy Ltd.), and the Black Angel Pb–Zn mine (roughly 12 million tons produced 1973–1990; Angel Mining Plc.). However, the only known economic gold

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