Is it possible to correlate the Paleoproterozoic gold belts of Nanortalik (southern Greenland) and Lycksele-Storuman (northern Sweden)?

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Outline of presentation

• Geology, geochemistry and geophysics of gold deposits/occurrences in South Greenland (Nanortalik Gold Belt) and Northern Sweden (Gold Line)
• Comparisons of the Nalunaq, Vagar and Svartliden gold deposits/occurrences
• Conclusions and mineral potential of South Greenland and Northern Sweden and how can this study help to focus gold exploration and to prioritize targets
Reconstruction of the c. 1.8 supercontinent and location of Vagar gold on Laurentia and Svartliden gold on Baltica

North Atlantic continents in 1.8-1.2 Ga configuration

Lahtinen et al. (2008)

Location of Svecofennian orogeny (Nordic on map) and Ketilidian orogeny

Patchett and Bridgwater, 1984
Division into Northern (Meso-Neo Archaean), Central and Southern (Paleo-Mesoproterozoic) domains
The aeromagnetic survey clearly shows the extent of the Julianehåb igneous complex of the Central Domain and the boundary between the Paleoproterozoic Ketilidian mobile belt and the Archaean North Atlantic craton. Low mag = early Julianehåb igneous complex; High mag = late Julianehåb igneous complex.
South Greenland is a Au province. Au correlates with As, Sb, Cs. Strongly elevated contents occur at boundary of the Central and Southern Domain.
The gold belt is >150 km long and represents an about 35 km wide corridor near the boundary of the Central and Southern domains.
The geology of Vagar is dominated by granitoid rocks and a regional shear zone. Each target shows Au in situ > 10 ppm.

The Vagar license and the gold occurrences on the Niaqornaarsuk peninsula (Central Domain) with 18 targets, only one target was drilled.
Au occurrences of the Vagar license

Quartz swarm

Vein 1: ~1 m thick and samples up to 24 ppm Au and VG

Vein 2: channel samples with up to 11 metres @ 80.2 ppm Au and VG

Schlatter and Hughes (2014)

Au mineralization occurs in different host rocks, Au is mainly in Qtz veins.
The lithogeochemical classification of least to weakly altered granitoids largely corresponds to the naming of the rocks in the field.
Typical Au alteration at Vagar (SEM and microscope)

Smpl 196826, distal alteration

Smpl 196831, proximal alteration

Smpl 196834, proximal alteration

Granitoids are hydrothermally altered. Silicification and Qtz veining occurs with Kfs, calc-silicates, sericite, chlorite, biotite and epidote. Au is in Qtz and sulfosalts.
Comparison of Au settings from S.- + Centr. Domain

Tectonostratigraphic sequence across the Nalunaq Au ore horizon

Drill core log across the Amphibolite ridge (Vagar) ore horizon of vein 2

Both deposits are hosted mainly in Qtz veins but in different host rocks; Nalunaq: 10.65 t of gold, 15g/t, 714,000 t ore, Vagar: 79m with 0.9 g/t Au
Gold occurrences of the Nanortalik gold belt in South East Greenland in the Central Domain

Sorte Nunatak

5.5 ppm Au in situ

Auriferous quartz with 5.5 ppm gold and GEUS sample with 9 ppm Au and 4% Cu

Kangerluluk

Auriferous shear-hosted quartz veins up to 20 m wide; grab samples up to 17.5 ppm Au

Jokum’s shear

3.1 m @ 9.3 ppm Au in silicified and sulphidised rocks

Gold mineralization occur in a variety of different host rocks

Schlatter and Hughes (2014)
Botnian group (host rocks of Au) 1.96-1.86 Ga
- turbiditic metagreywackes
- graphite-pyrrhotite horizons
- interlayered by acid to mafic metavolcanics

Skellefte district 1.96-1.86 Ga
- acid to mafic subaqueous to subareal metavolcanics
- svecokarelian intrusions
- metagreywackes, mudstones, metaconglomerates etc.

Late to post orogenic granites 1.82-1.76 Ga (+/- age of orogenic Au)
- granitoids TIB, Skellefte-Härnö

Active Gold mines are Svarliden, Björkdal and Kankberg (Au+Te)
Aeromagnetic survey covering the Bothnian group and the Skellefte District and geological map of the Svartliden area that is dominated by granitoids

Svartliden is located in metavolcanic-sedimentary sequences and is spatially associated with calc-alkaline granites
Gold anomalies of till overburden in the Svarliden area

The Gold Line is > 170 km long and about 50 km wide
Volcano-sedimentary sequence metamorph. and deformed under ductile amphibolite facies conditions, cross-cut by granite. Hypozonal orogenic Au mineralization at contact of amphibolite and metasediments, and BIF
Cross section of the Svartliden ore lode

Schölglöva et al. (2013)

High-grade Qtz-rich arsenopyrite-hosted Au ore

Low-grade diopside-rich pyrrhotite-hosted Au ore

High-grade BIF-hosted Au ore

Barren Qtz-mylonite, shear zone

Eklund, 2007

Au: electrum-löllingite intergrowth in Apy

syn-metamorphic mineralization
Svartliden host rocks and hydrothermal alteration

Potassic alteration: Biotite
- selective (fluid channels, distal) and pervasive (proximal to the ore zone)
- Hosted in amphibolites, metasediments

Calc-silicate alteration: Cpx-Grt-Qtz-Cc bands or patches
- selective (distal) and pervasive (proximal to the ore zone)
- hosted in amphibolites, metasediments, and the ore zone

Silicification: ore zone (pervasive) and the cross-cutting granite

Sulfidation: Apy-Po-Löll in the ore zone, BIF

Schlöglova et al. (2013)
Comparison of host rocks and hydrothermal alteration of the Svartliden and Nalunaq mines

Ore is hosted by K-, Si- and Ca-altered amphibolite + schist, and BIF, accompanied by barren Qtz-mylonite (fill of the shear zone)

Rocks are basalts and basaltic andesites. In red 12 least altered samples and in green 432 altered samples
Comparison of granitoid ages of the Svartliden and Nalunaq mining areas

Svartliden: 1.80-1.77, Billström and Weihed 1996

Revsund Granite: 1.81-1.77, Billström and Weihed 1996

Skellefte Härnö Granites: 1.80, Persson 2011
Intrudes Svartliden gold

Björkdal Au: 1.893±34
Roberts 2006

Vagar gold host rocks


Julianehåb late igneous complex: 1.80-1.78, Steenfelt et al. 2016

South Greenland

Northern Sweden

Schlatter et al. (in preparation)
Reconstruction of the c. 1.8 supercontinent and location of Vagar gold on Laurentia and Svartliden gold on Baltica

Correlation between Makkovik and the Ketilidan are more clear than correlation between the Ketilidan and the Sveccofenian orogeny
Conclusions

- Svartliden and Nalunaq/Vagar Gold deposits are similar in terms of their ages, deposit styles, and hydrothermal alteration. Gold mineralization occur in a variety of different host rocks in all studies areas.
- Because of these similarities a better understanding of the setting of the gold deposits of the Gold Line in Sweden will help the exploration efforts in remote South Greenland where much less data exist. However the outstanding quality of the outcrops in South Greenland can help to work on a good genetic model of the gold occurrences that might inspire gold exploration in the golden Line.
- The geological continuity between Ketilidian of southern Greenland and the Makkovik Province of Canada is well established but is more difficult to verify the correlation of the Ketilidian (on Laurentia) to the Svecofennian orogeny (on Baltica). This further complicated due to overprinting by the later Caledonian orogeny.
Thank you for your attention!
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