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

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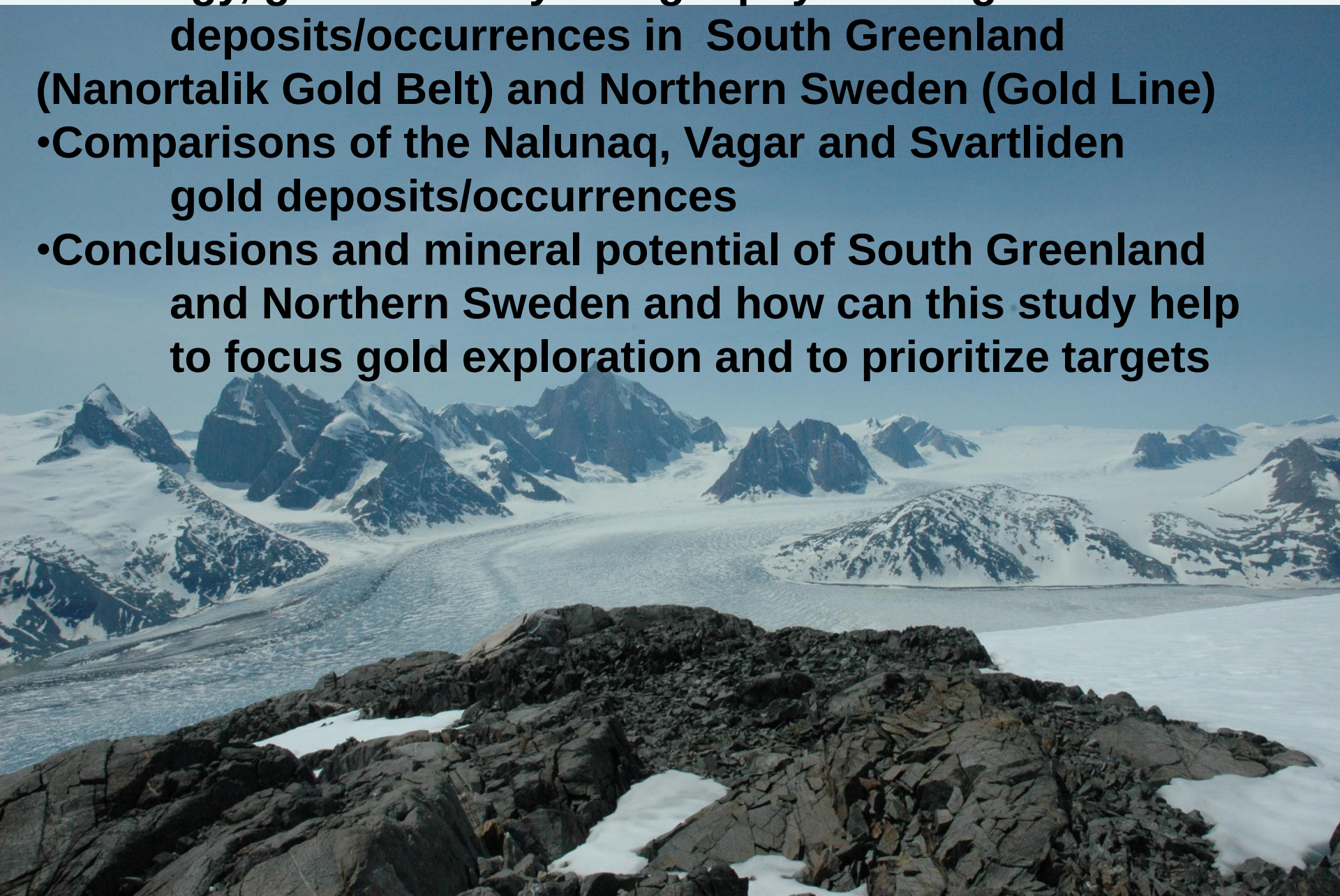
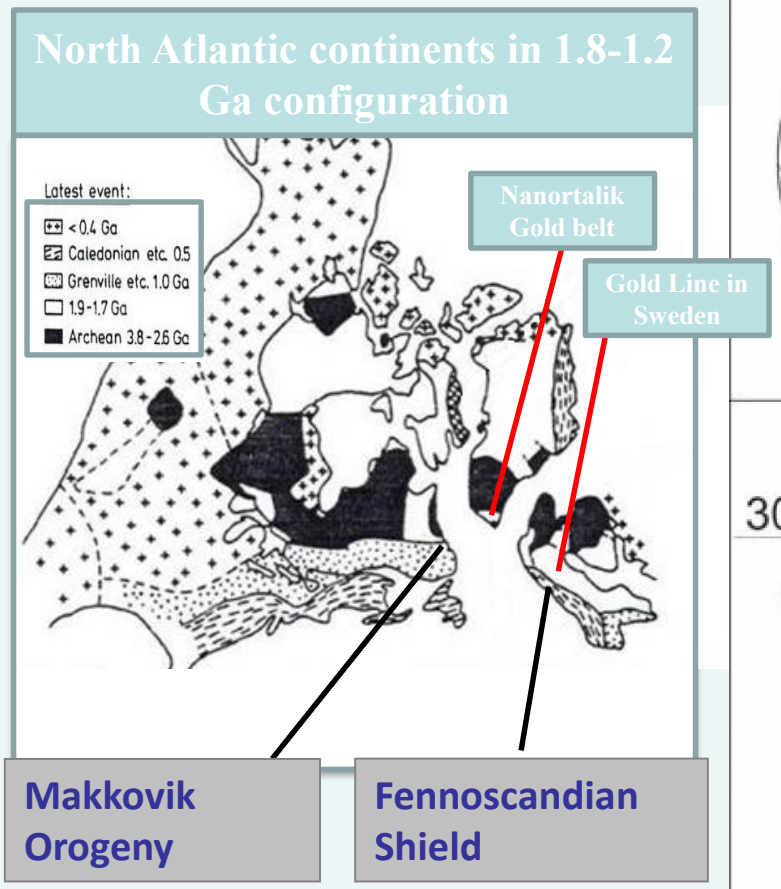
Outline of presentation

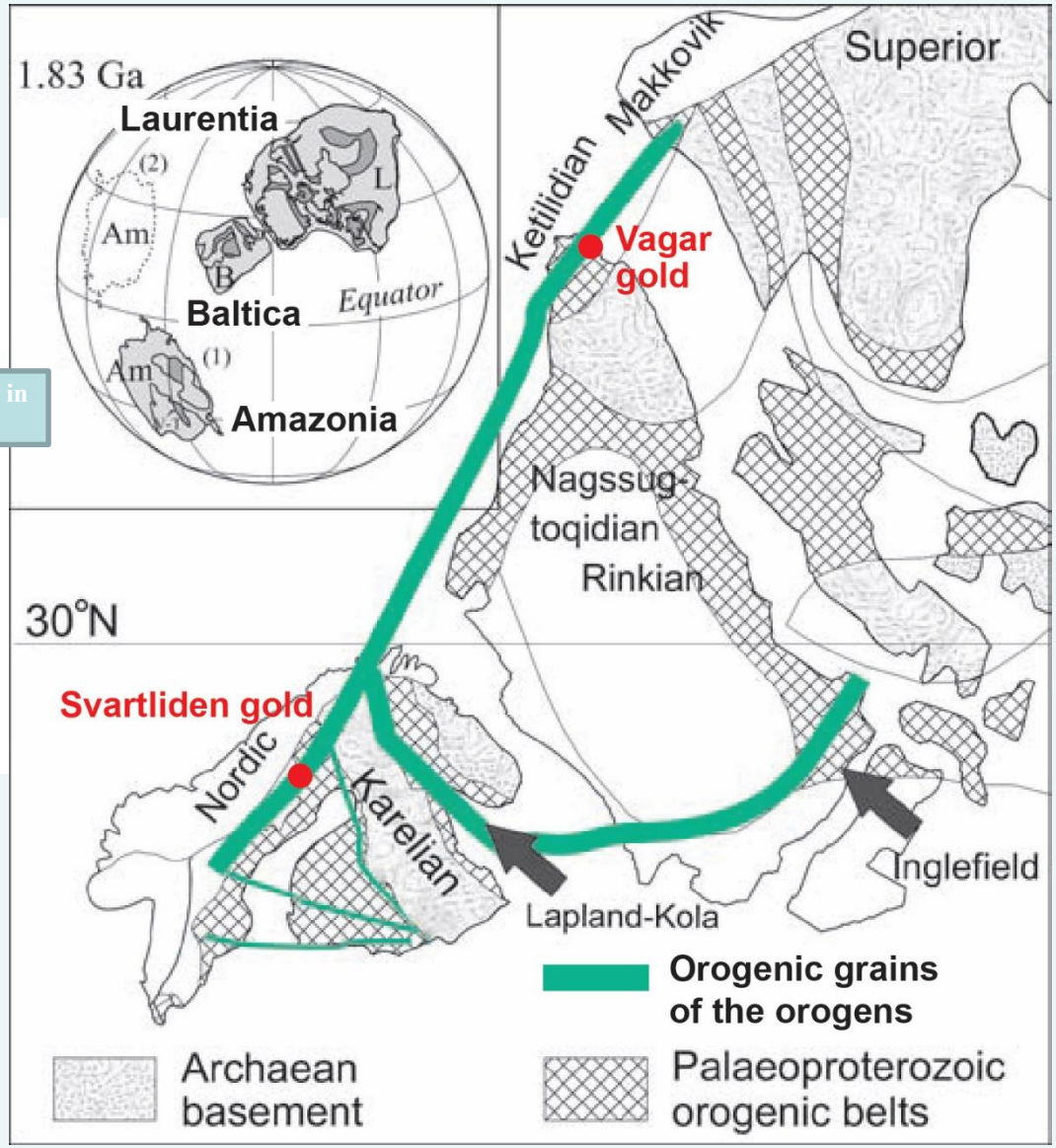
- Geology, geochemistry and geophysics of gold deposits/occurrences in South Greenland (Nanortalik Gold Belt) and Northern Sweden (Gold Line)
- Comparisons of the Nalunaq, Vagar and Svartliden gold deposits/occurrences
- Conclusions and mineral potential of South Greenland and Northern Sweden and how 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



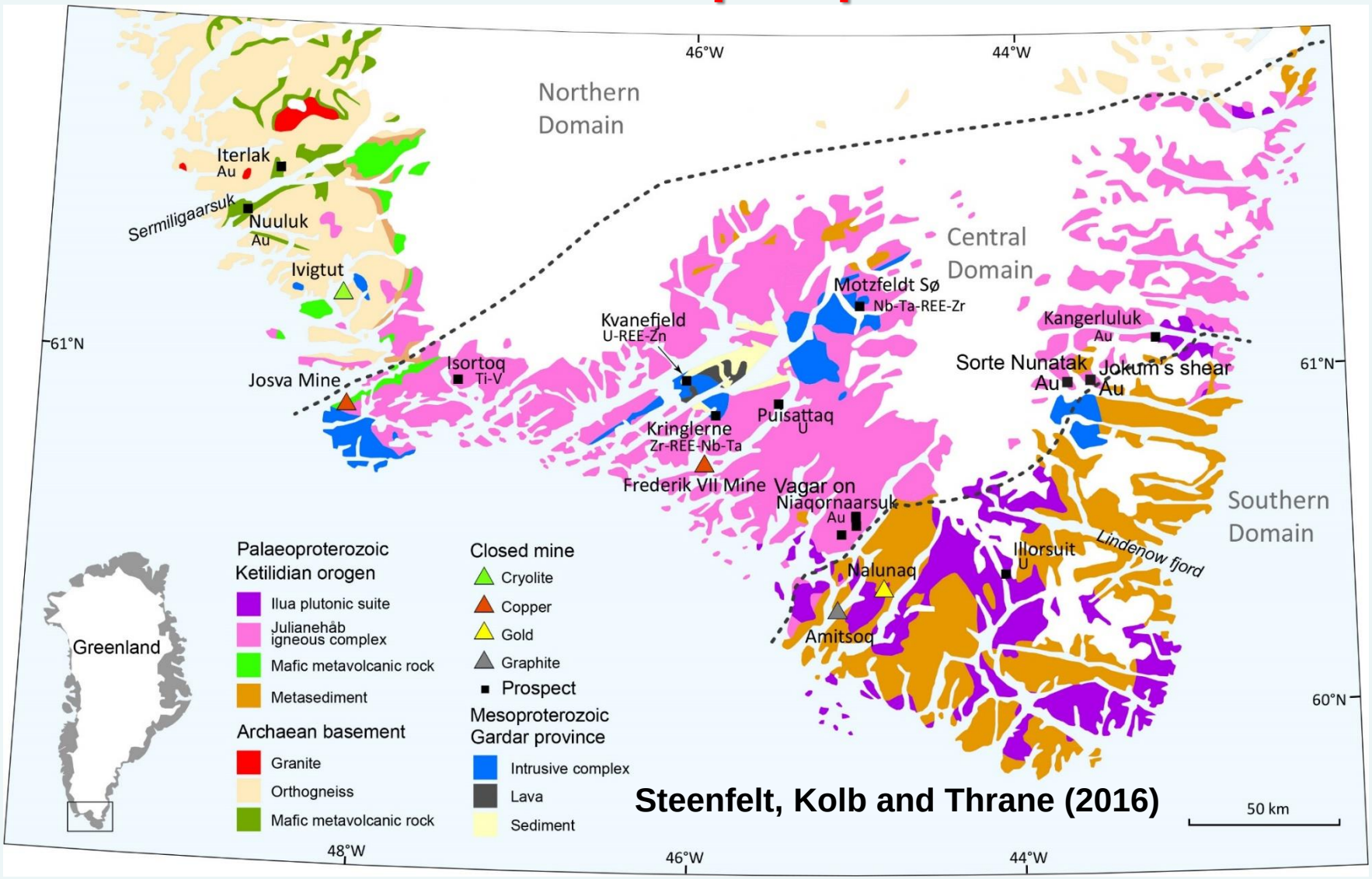
Patchett and Bridgwater, 1984



Lahtinen et al. (2008)

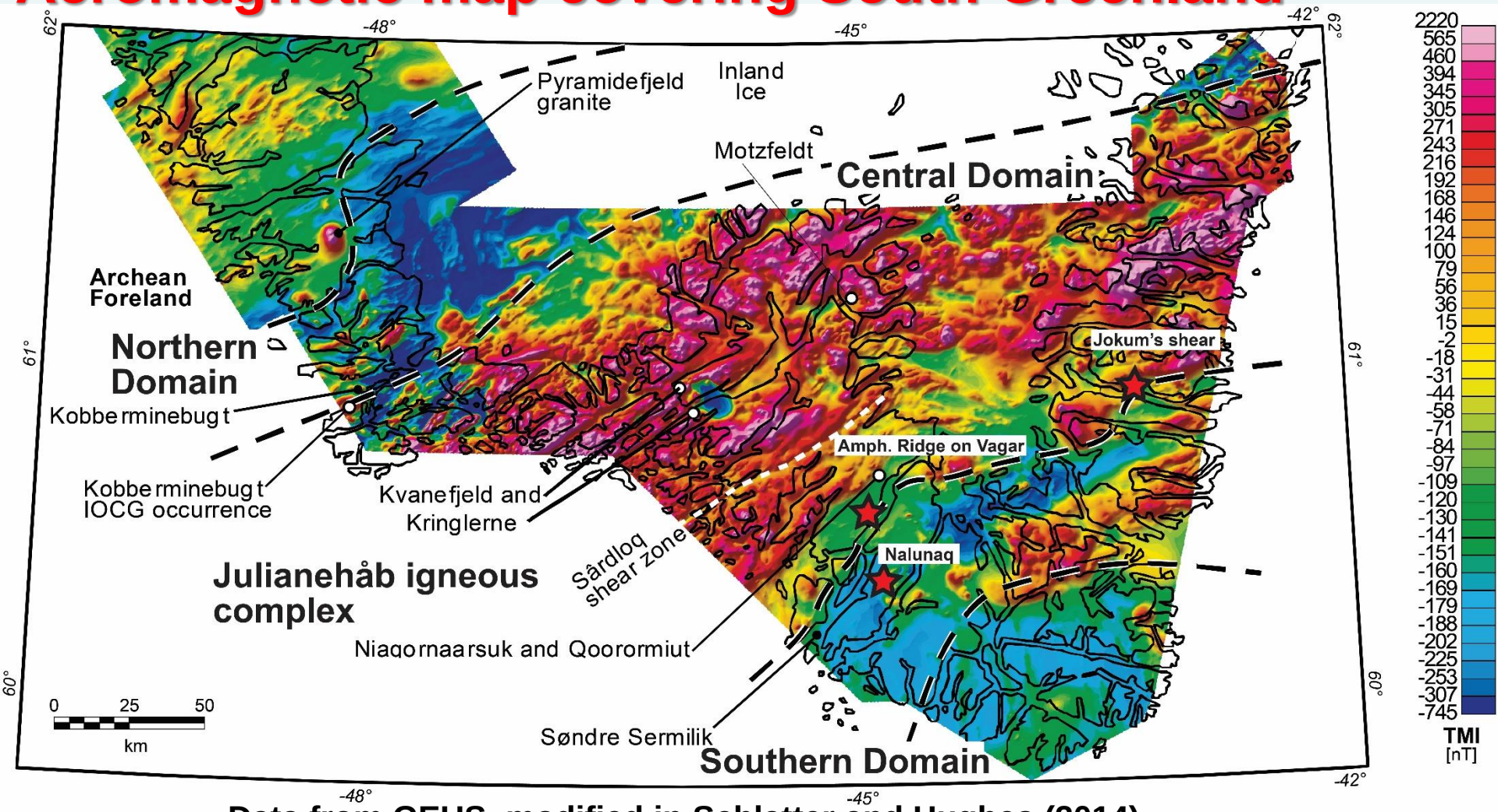
Location of Svecofennian orogeny (Nordic on map) and Ketilidian orogeny

Geology of South Greenland and location of closed mines and mineral prospects



Division into Northern (Meso-Neo Archaean), Central and Southern (Paleo-Mesoproterozoic) domains

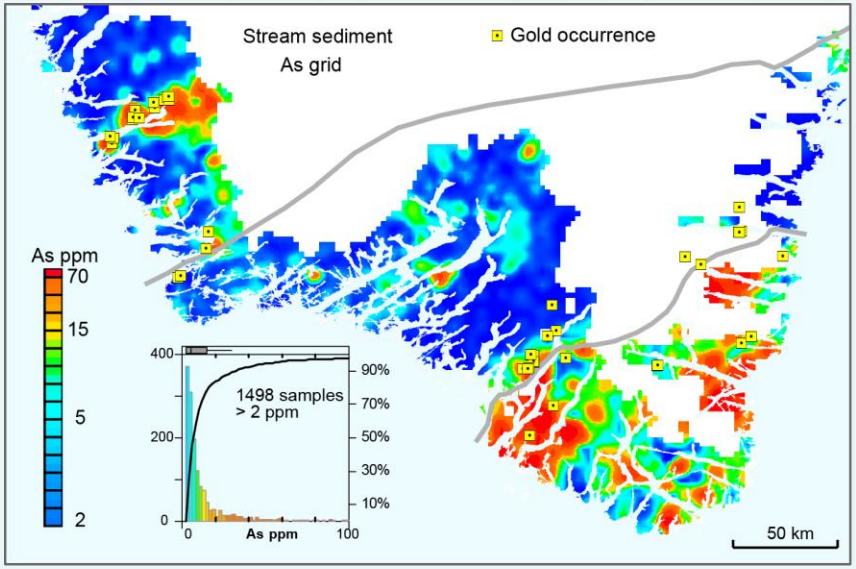
Aeromagnetic map covering South Greenland

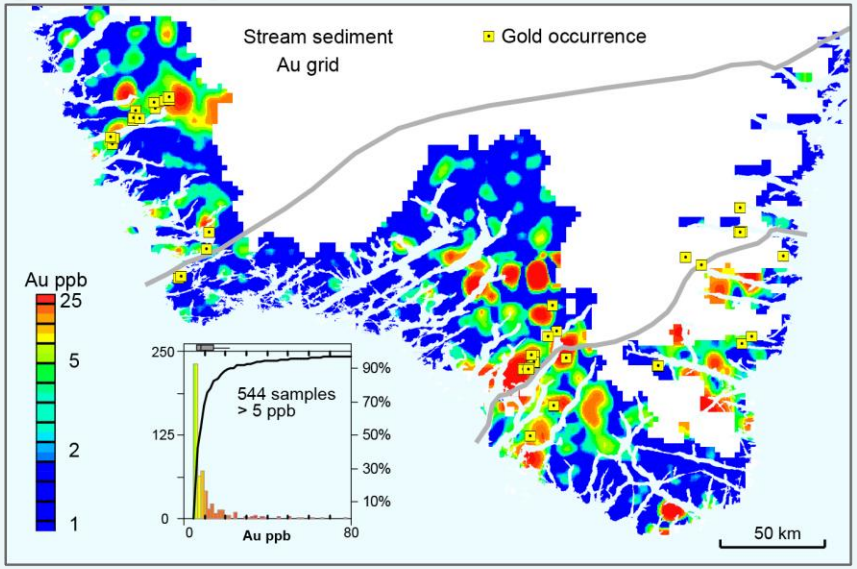


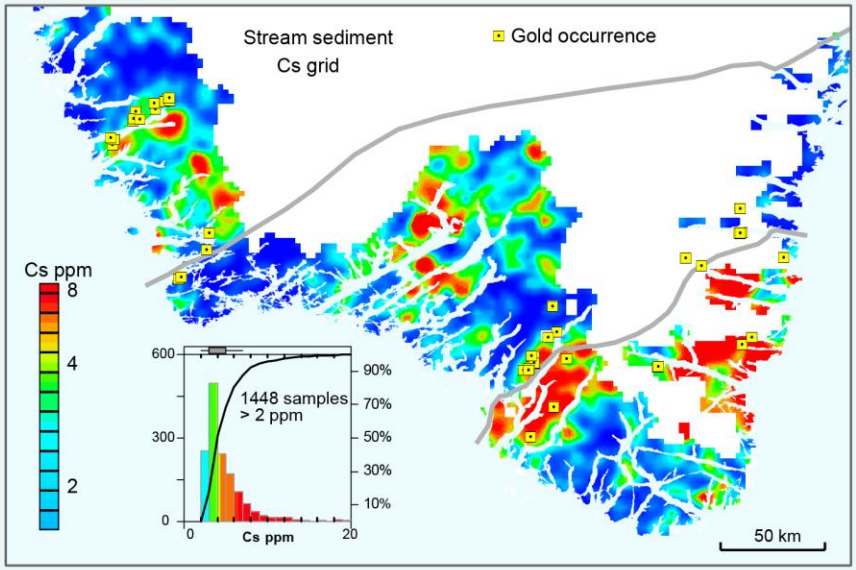
Data from GEUS, modified in Schlatter and Hughes (2014)

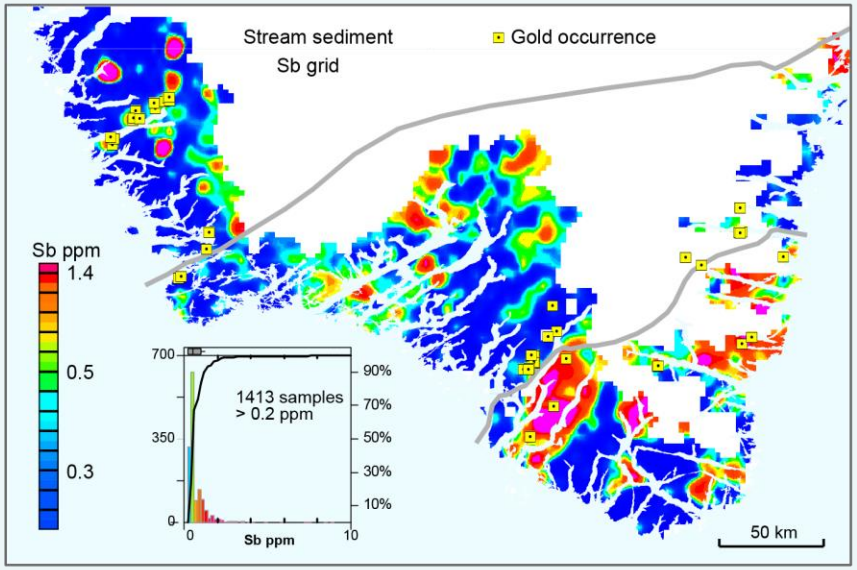
The aeromagnetic survey clearly shows the extend of the Julianehåb igneous complex of the Central Domain and the boundary between the Paleoproterozoic Ketilidian mobile belt and the Archaean North Atlantic craton. Low mag= early Julianahab igneous complex;
High mag= late Julianehab igenous complex

Gridded maps for stream sediment As, Au, Cs, Sb anomalies in South Greenland





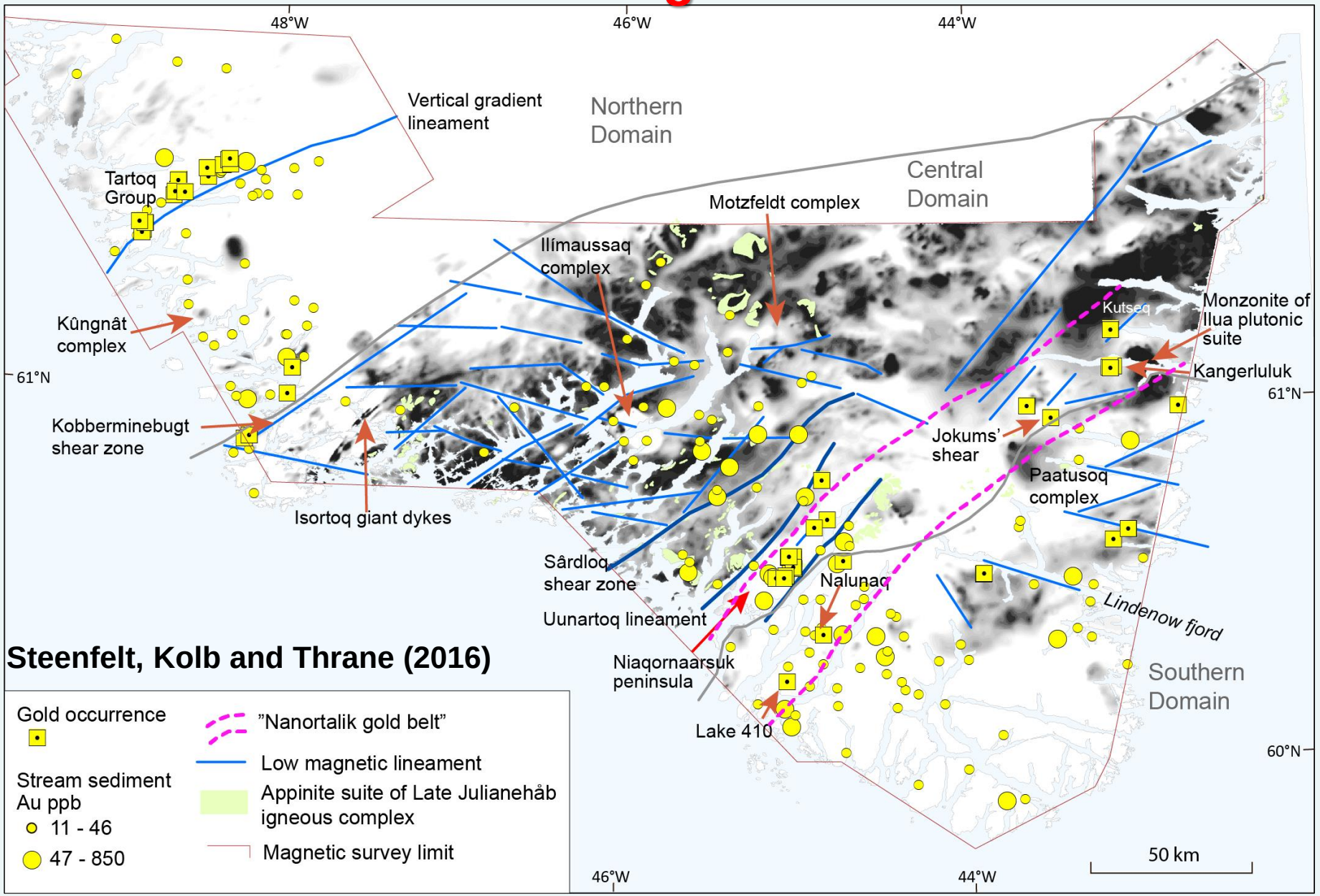




Steenfelt, Kolb and Thrane (2016)

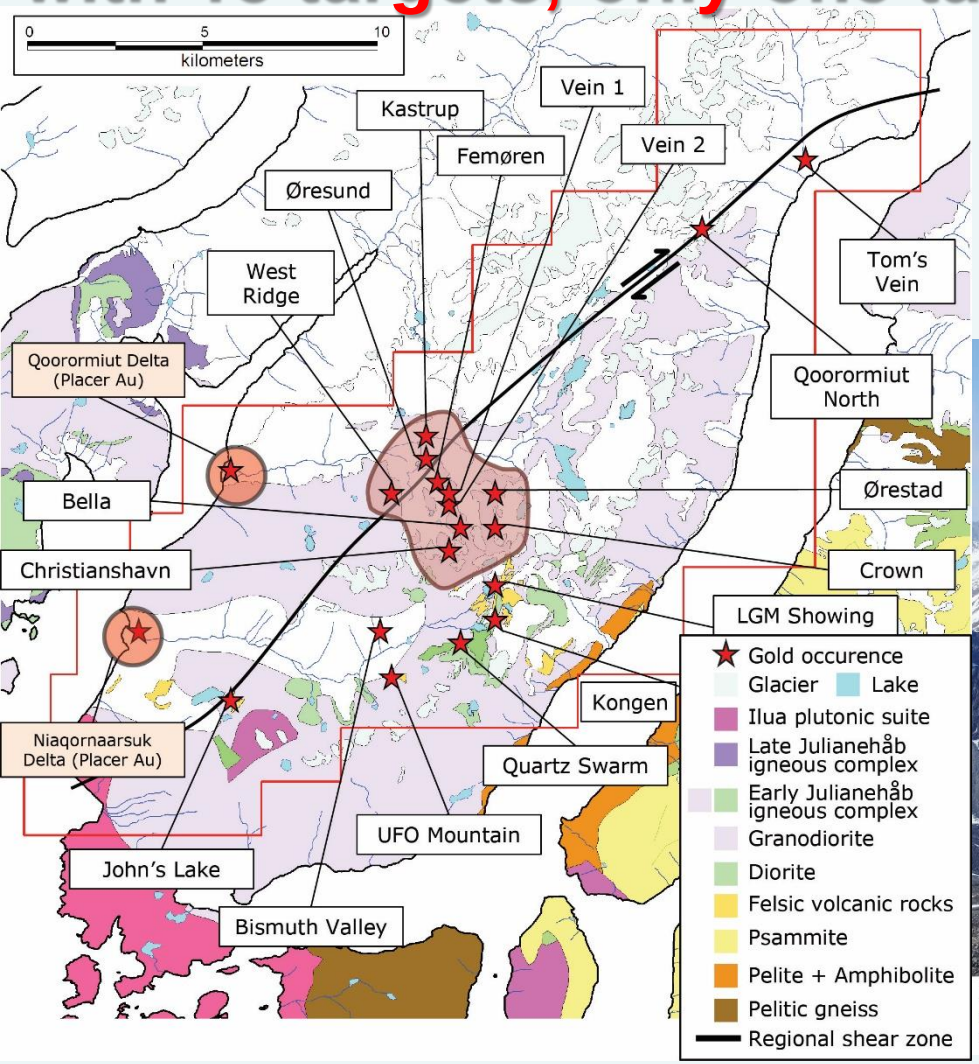
South Greenland is a Au province. Au correlates with As, Sb, Cs. Strongly elevated contents occur at boundary of the Central and Southern Domain

Location of the Nanortalik gold belt and occurrences

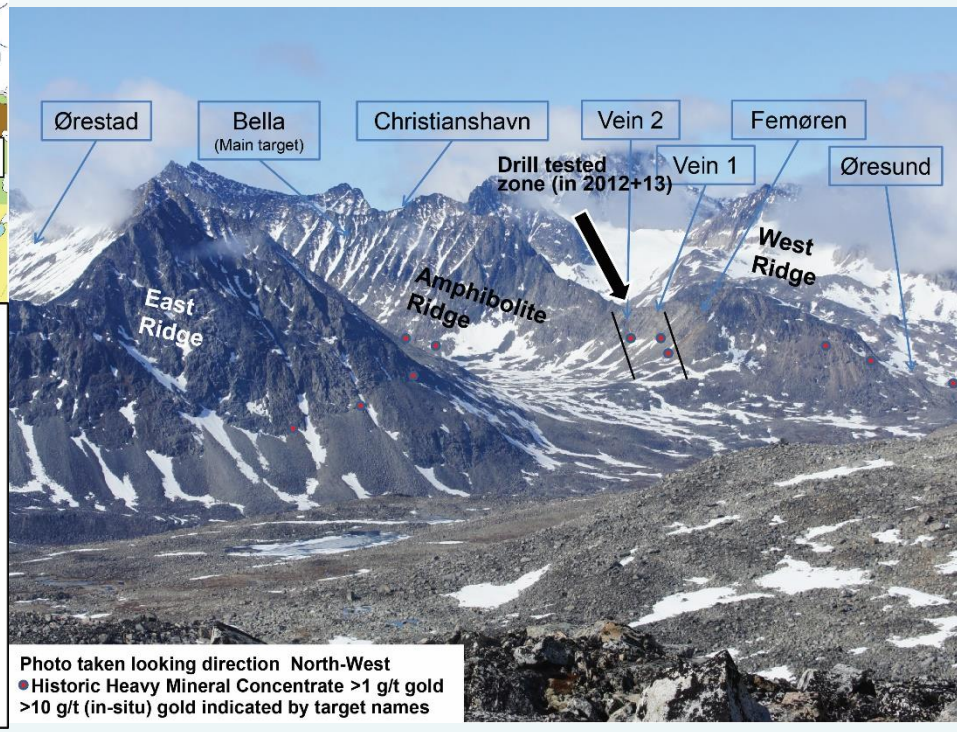


The gold belt is >150 km long and represents an about 35 km wide corridor near the boundary of the Central and Southern domains

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

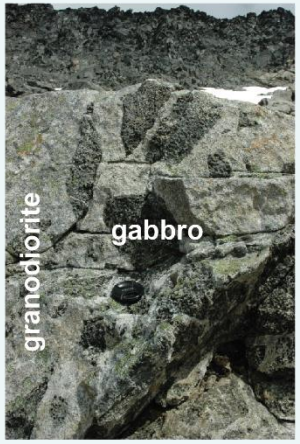


Schlatter and Hughes (2014)

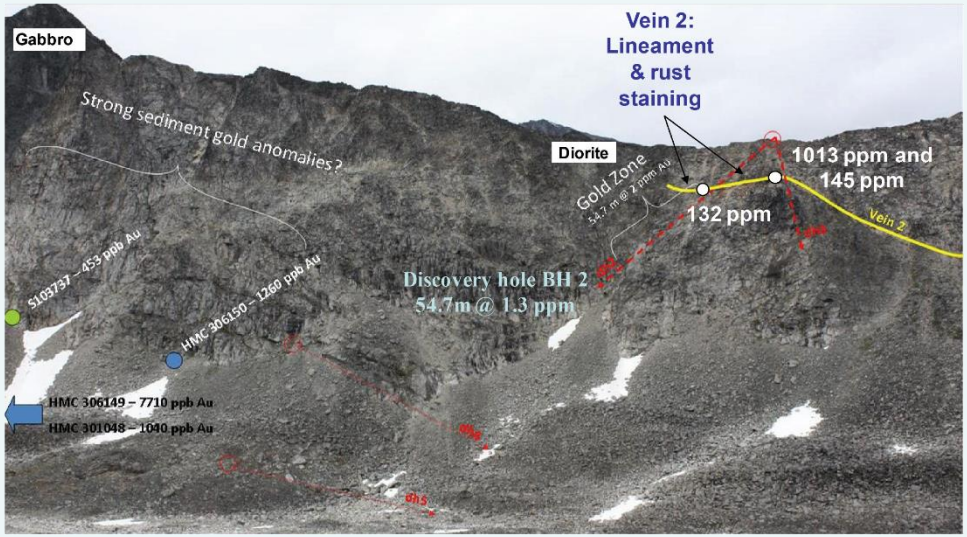


The geology of Vagar is dominated by granitoid rocks and a regional shear zone. Each target shows Au in situ > 10 ppm

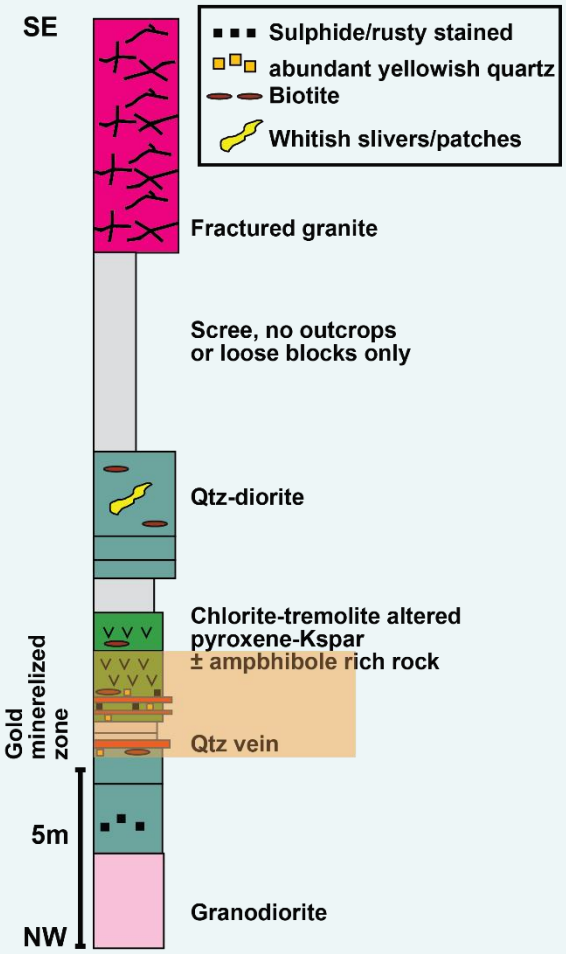
Au occurrences of the Vagar license



Amphibolite ridge

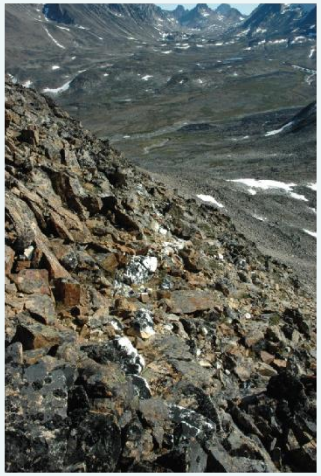


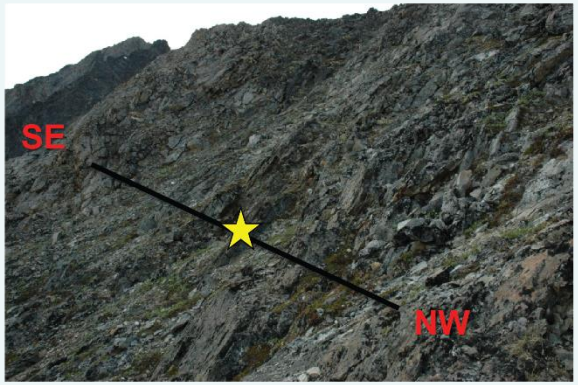
Vein 2 profile at 810m



Quartz swarm

Outcropping auriferous qurtz vein, 0.6m @ 11.9 ppm Au)





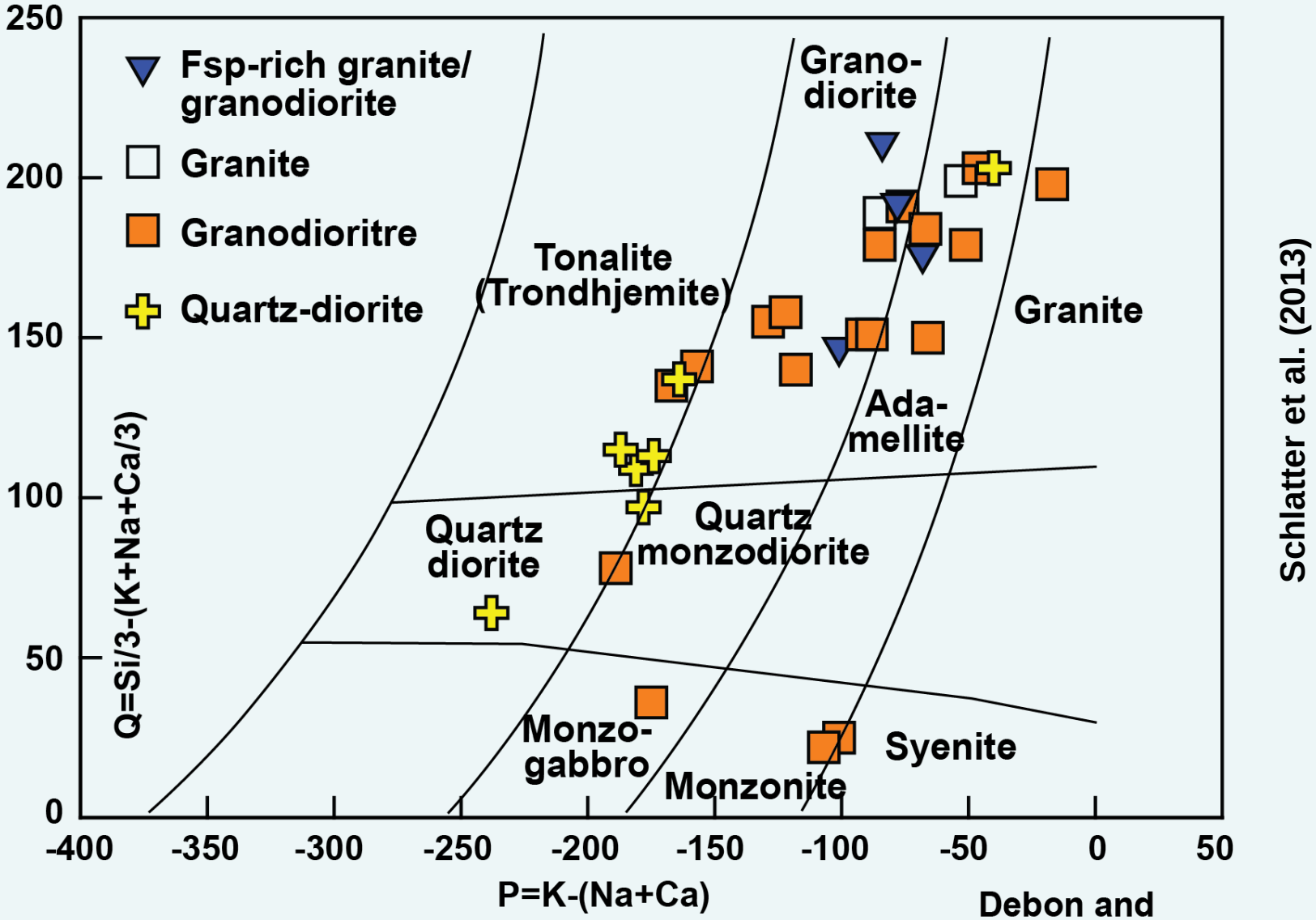
Vein 2: channel samples with up to 11 metres @ 80.2 ppm Au and VG

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

Schlatter and Hughes (2014)

Au mineralization occurs in different host rocks, Au is mainly in Qtz veins

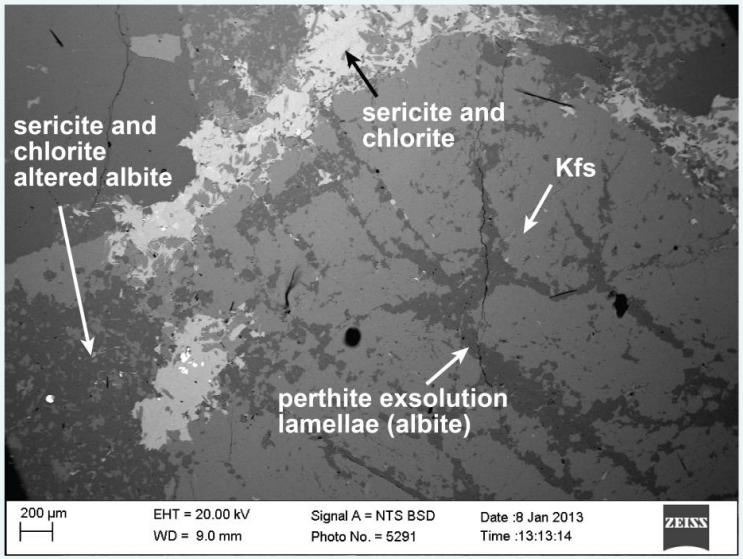
Lithogeochemical results of least to weakly altered granitoids at Vagar



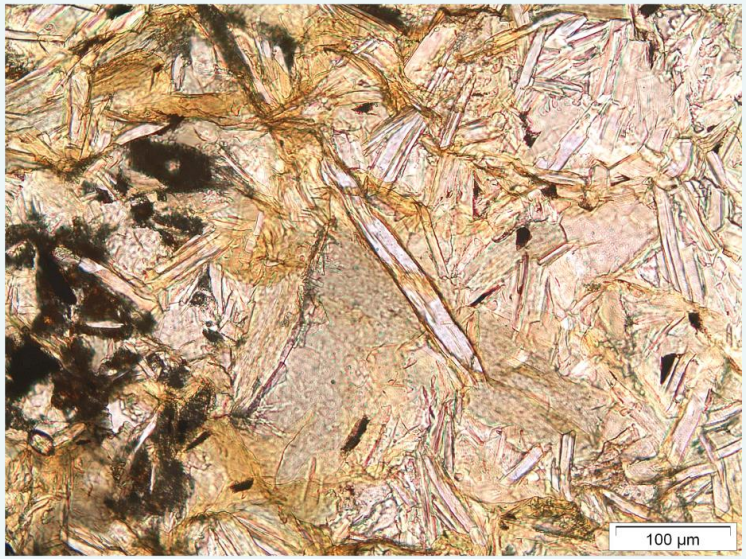
The lithogeochemical classification of least to weakly altered granitoids largely corresponds to the naming of the rocks in the field

Typical Au alteration at Vagar (SEM and microscope)

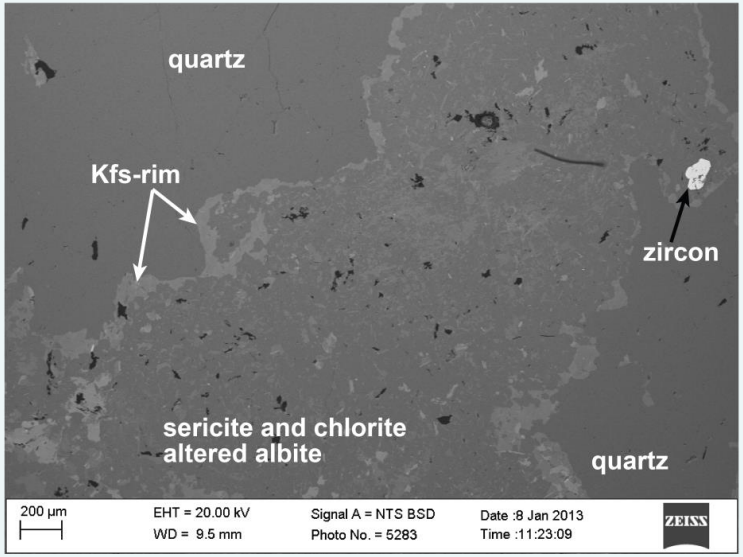
Smpl 196826, distal alteration



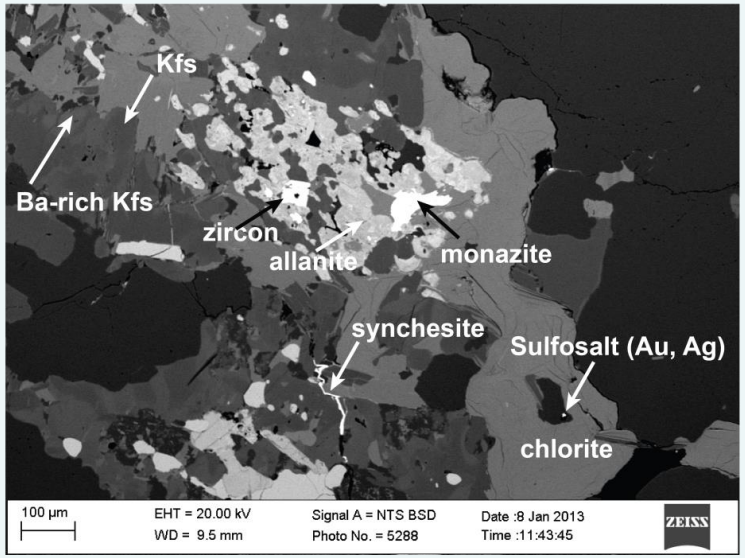
Smpl 196831, proximal alteration



Smpl 196834, proximal alteration



Smpl 196834, proximal alteration

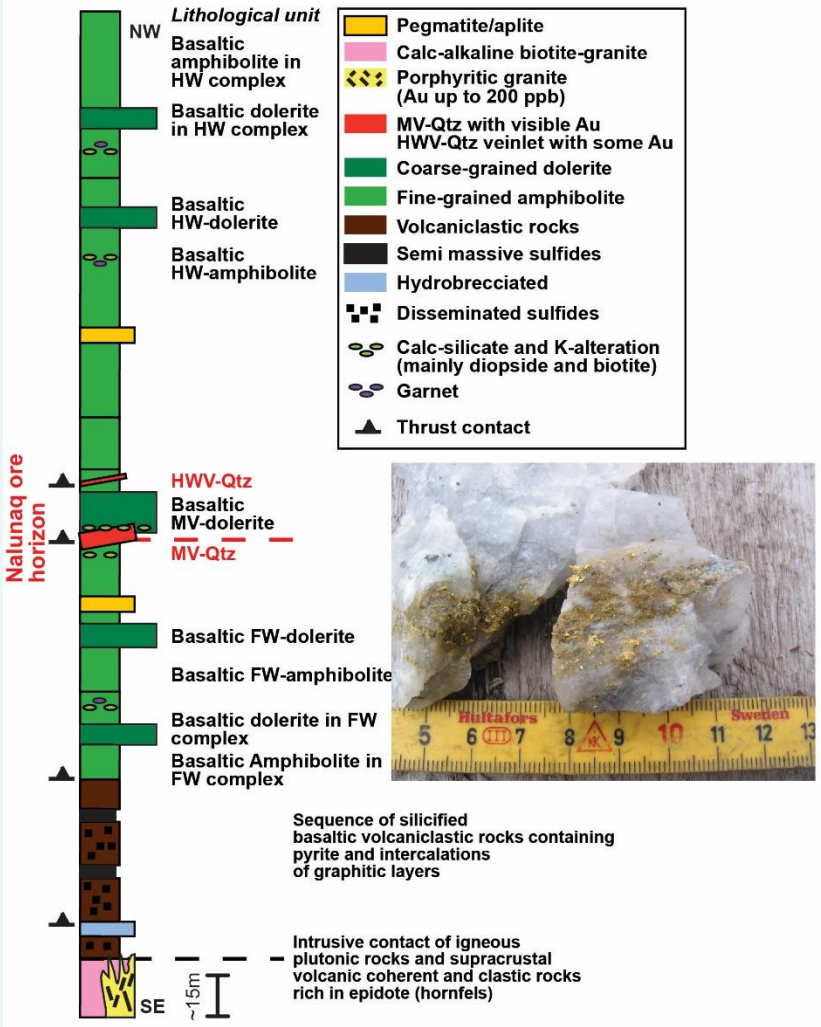


Schlatter et al. (2013)

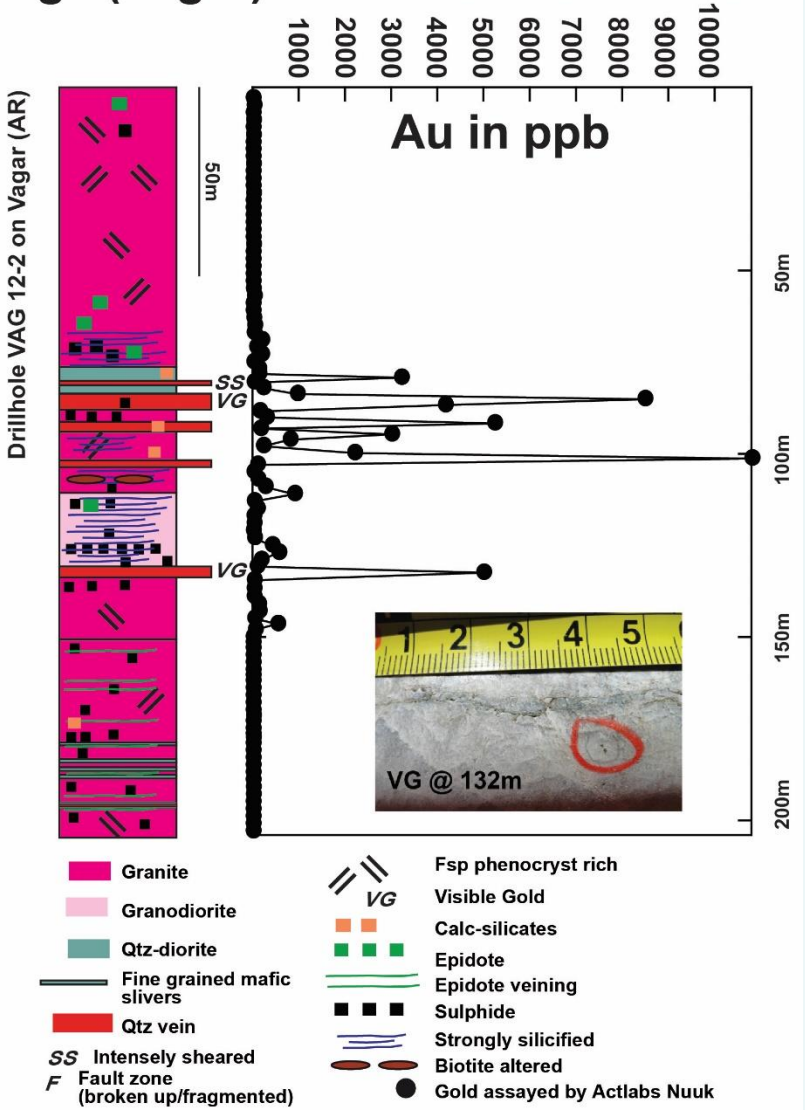
Granitoids are hydrothermally altered. Silicifcation and Qtz veining occurs with Kfs, calc-silicates, sericite, chlorite, biotite and epidote. Au is in Qtz and sulfosalts

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

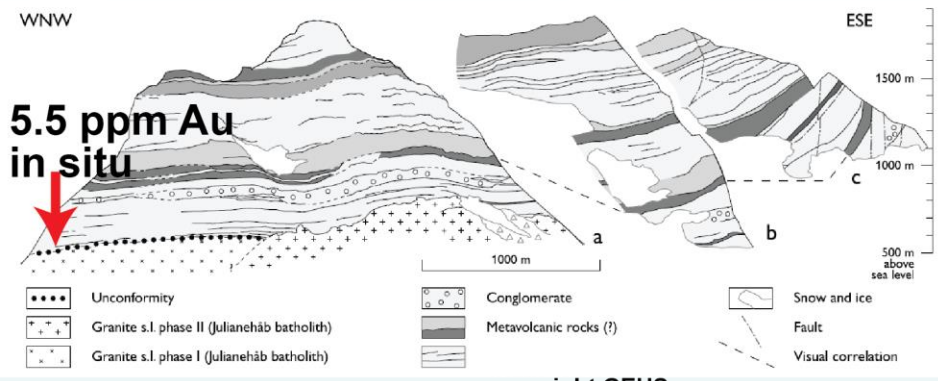


Schlatter and Kolb (2011); Schlatter et al. (2013)

Both deposits are hosted mainly in Qtz veins but in different host rocks; Nalunaq: 10.65 t of gold, 15g/t, 714'000t 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



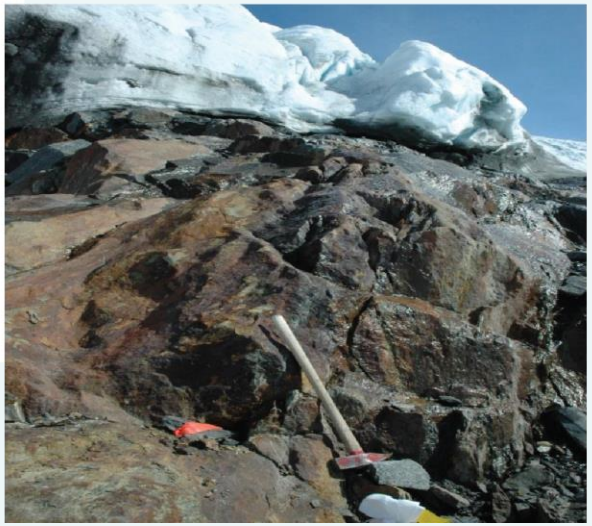
copyright GEUS

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

Kangerluluk

Schlatter and Hughes (2014)

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

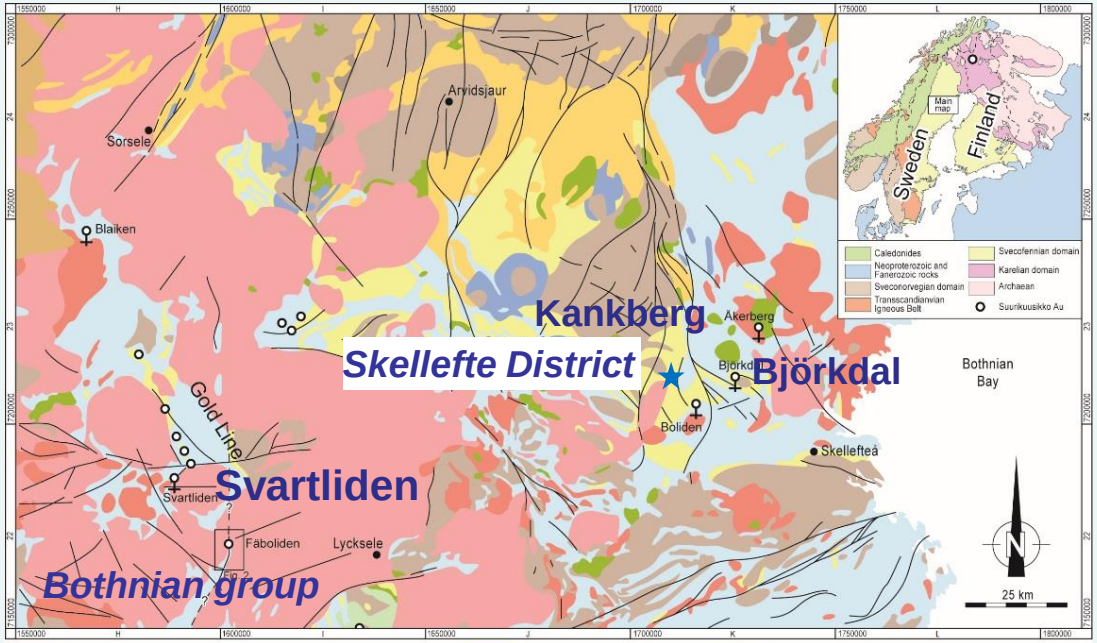


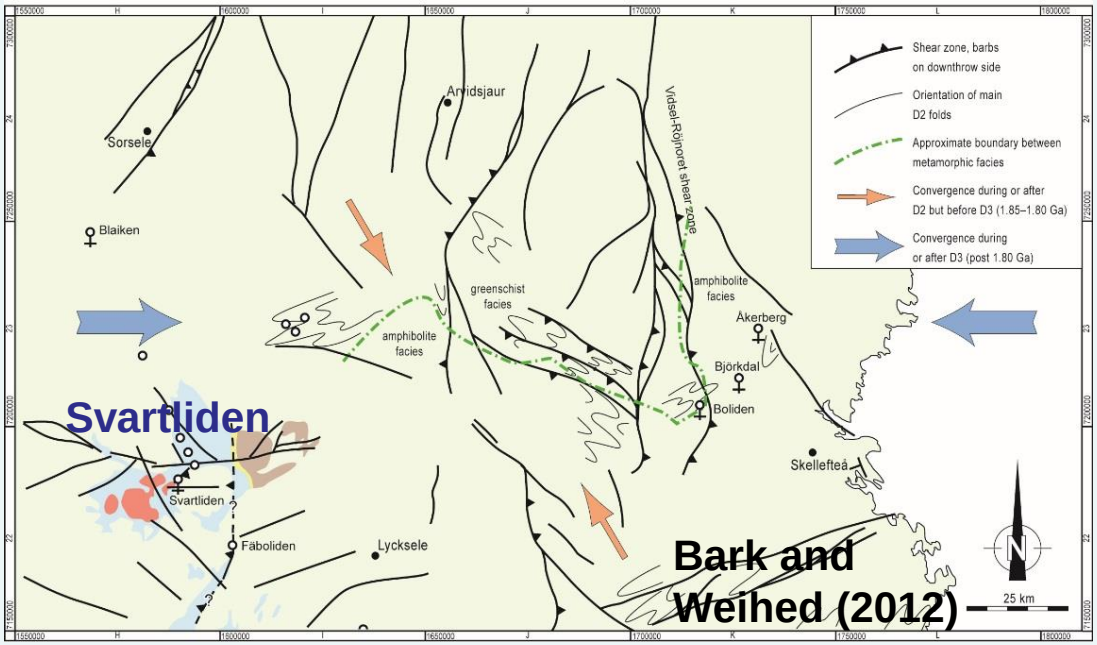
Jokum's shear

3.1 m @ 9.3 ppm Au in silicified and sulphidised rocks

Gold mineralization occur in a variety of different host rocks

Geology of the Bothnian group and Skellefte district and gold mines of the Gold Line





Bark and Weihed (2012)

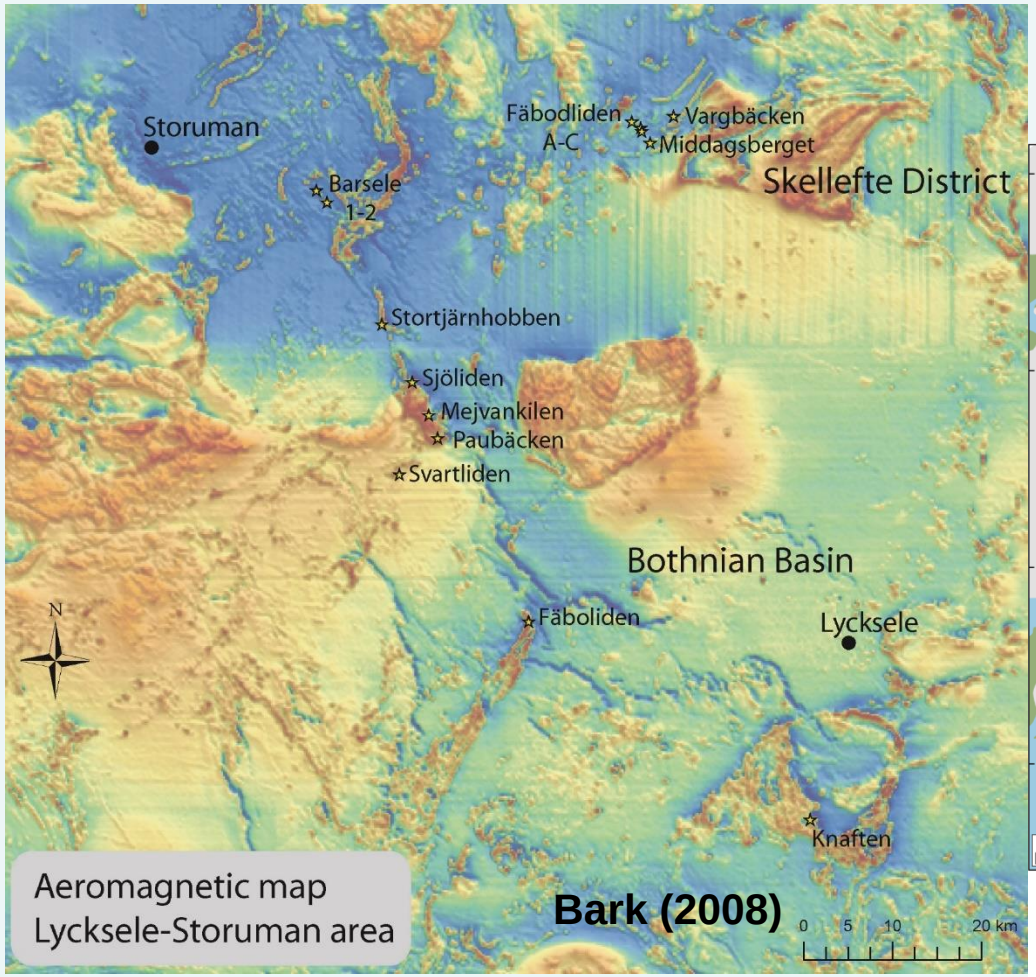
Botnian group (host rocks of Au)
1.96-1.86 Ga
- turbiditic metagreywackes
- graphite-pyrrhotite horizons
- interlayered by acid to mafic metavolcanics

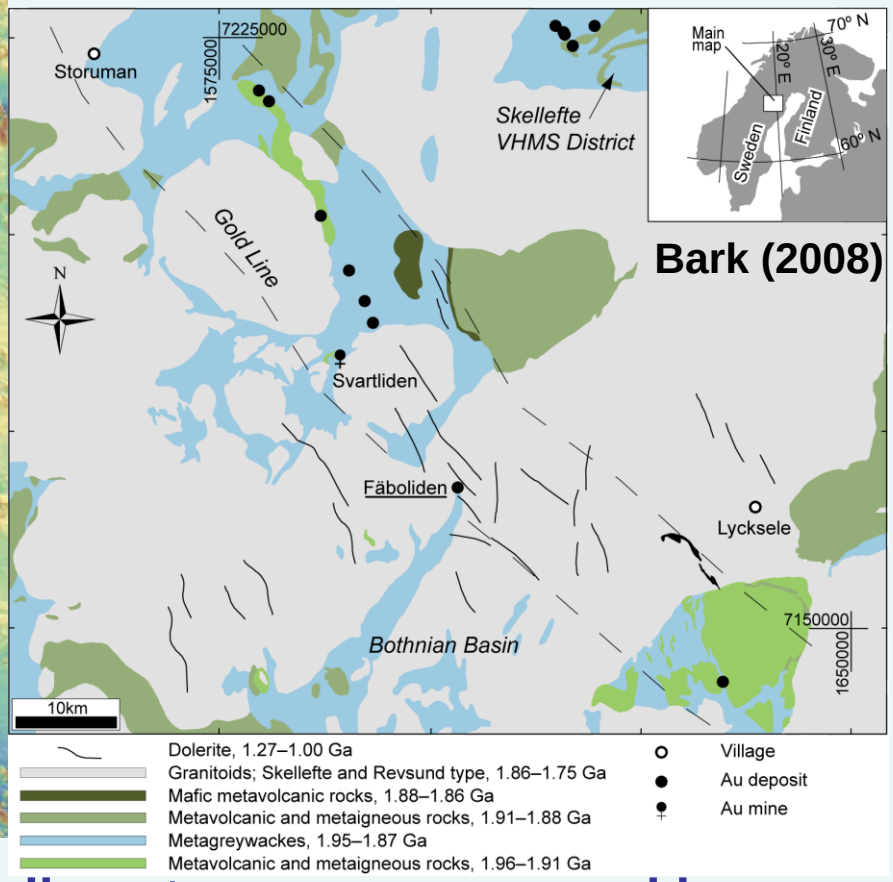
Skellefte district 1.96-1.86 Ga
- acid to mafic subaqueos to subareal metavolcanics
- svecokarelian intrusions
- metagreywackes, mudstones, metaconglomerates etc.

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)

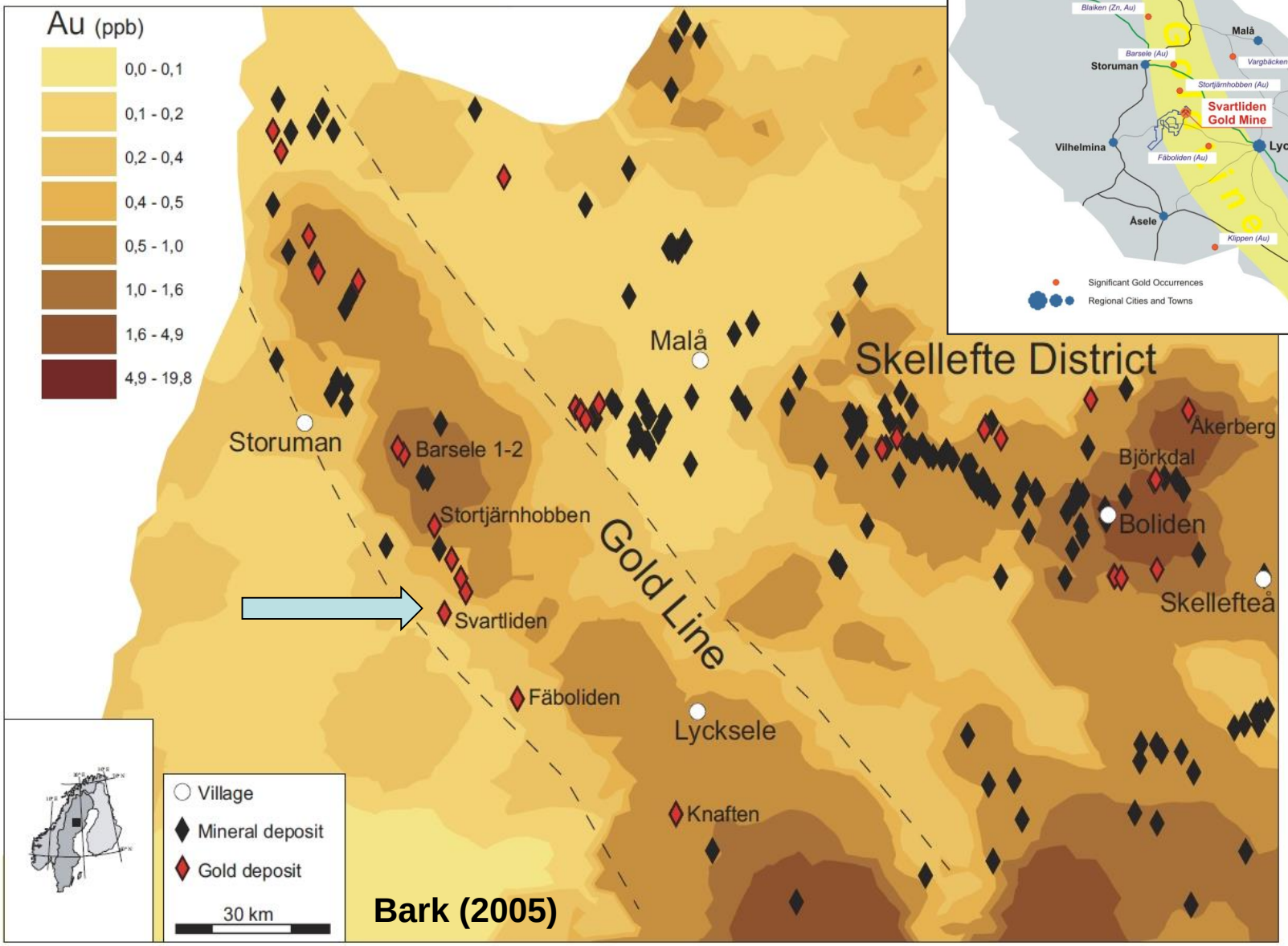
Aeromagnetic survey covering the Bothnian group and the Skellefte District and geological map of the Svartliden area that is dominated by granitoids

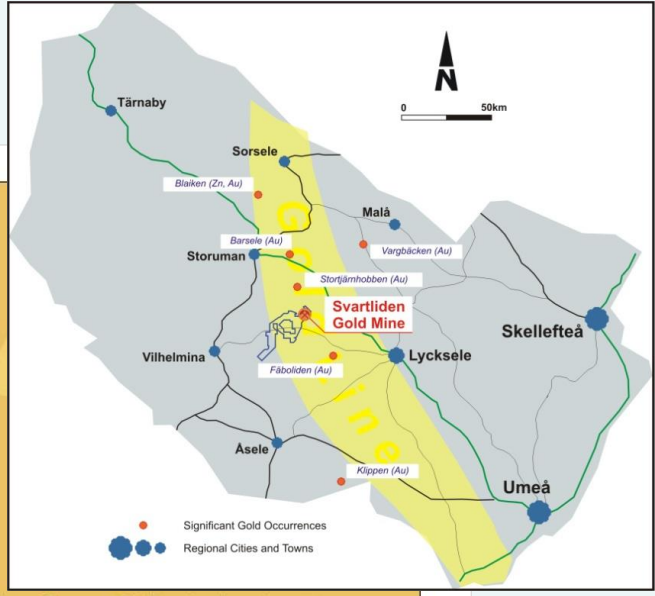




Svartliden is located in metavolcanic-sedimentary sequences and is spatially associated with calc-alkaline granites

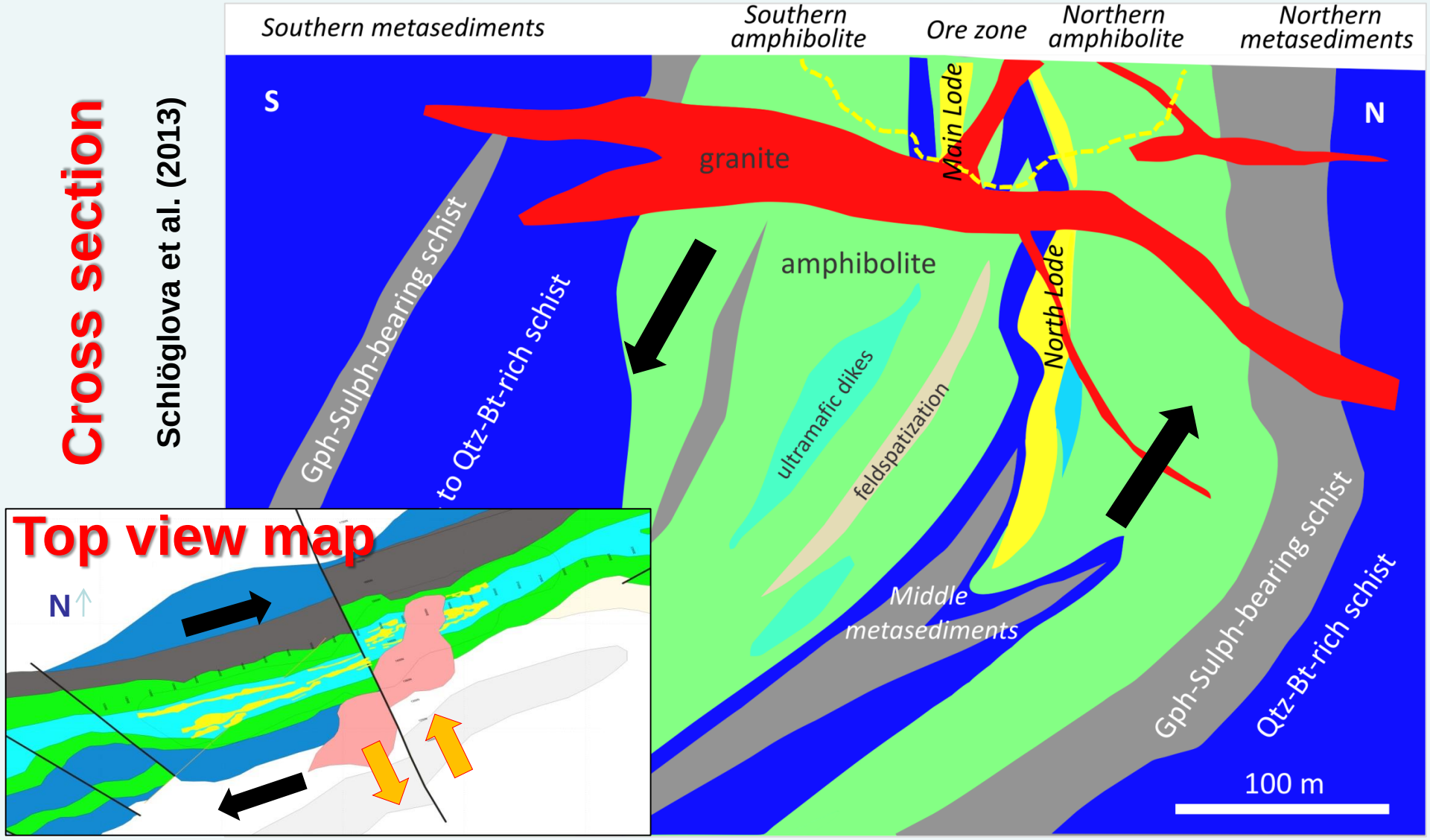
Gold anomalies of till overburden in the Svarliden area





The Gold Line is > 170 km long and about 50 km wide

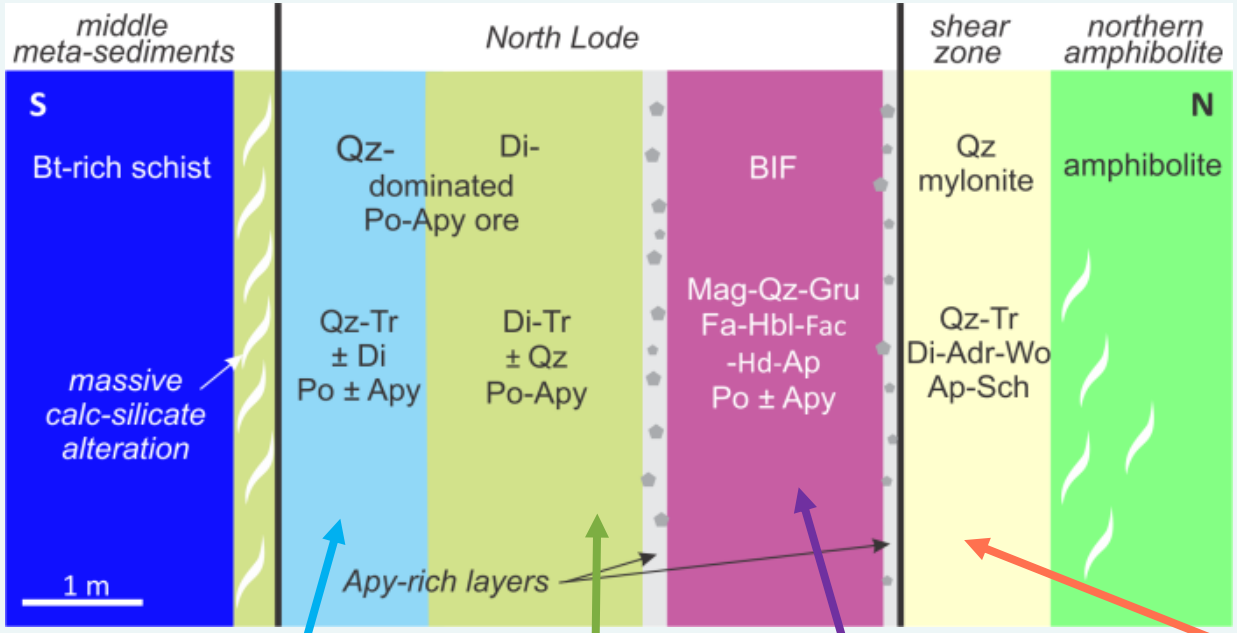
Svartliden Au deposit: 2.97 Mt, 4.26 ppm, >300’000 oz

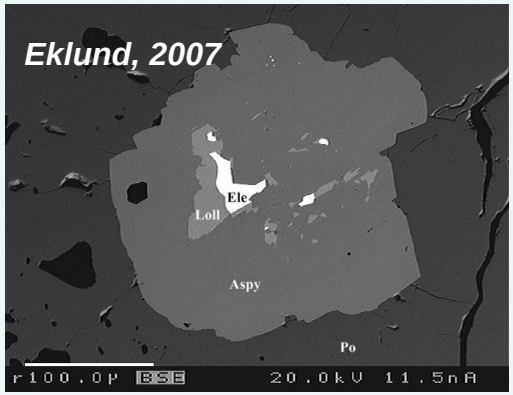


Volcano-sedimentary sequence metamorph. and deformed under ductile amphibolite facies conditions, cross-cut by granite. Hypozonal orogenic Au mineralization at contact of amphibolite and metasediments, and BIF

Cross section of the Svartliden ore lode

Schlöglova et al. (2013)





Au: electrum-löllingite intergrowth in Apy

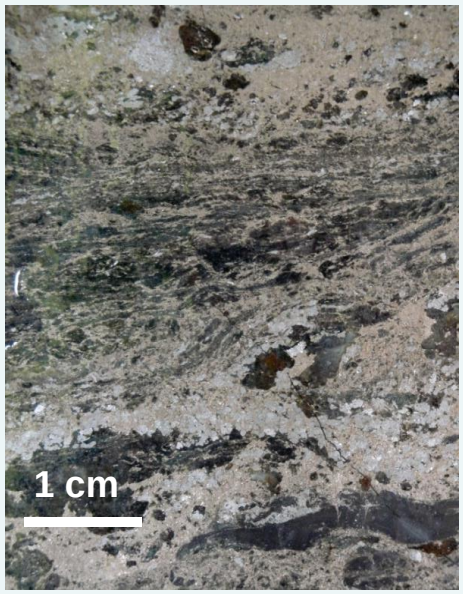
syn-metamorphic mineralization

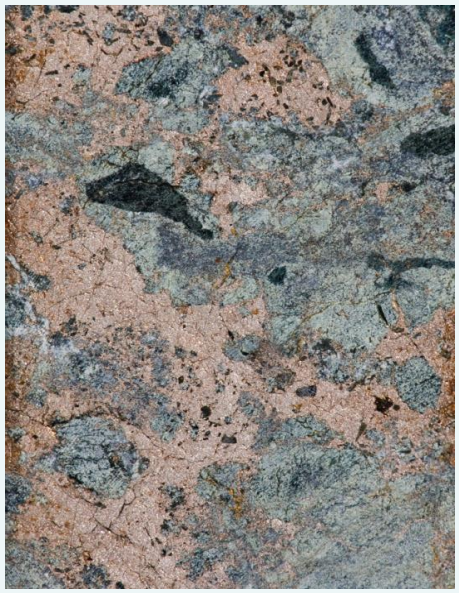
High-grade Qtz-rich arsenopyrite-hosted Au ore

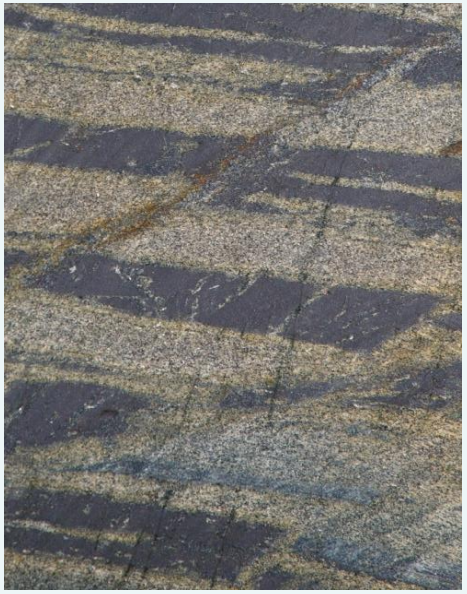
Low-grade diopside-rich pyrrhotite-hosted Au ore

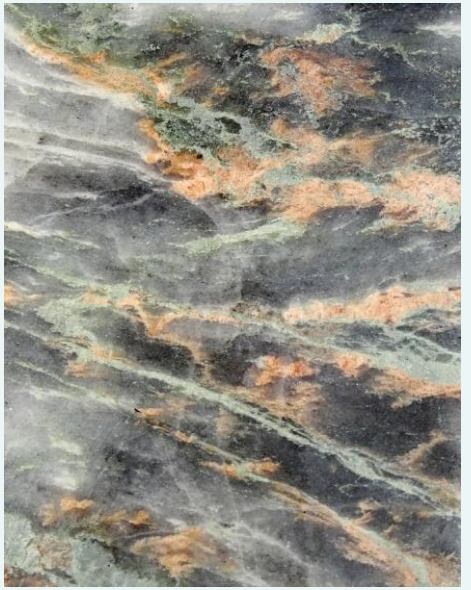
High-grade BIF-hosted Au ore

Barren Qtz-mylonite, shear zone









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

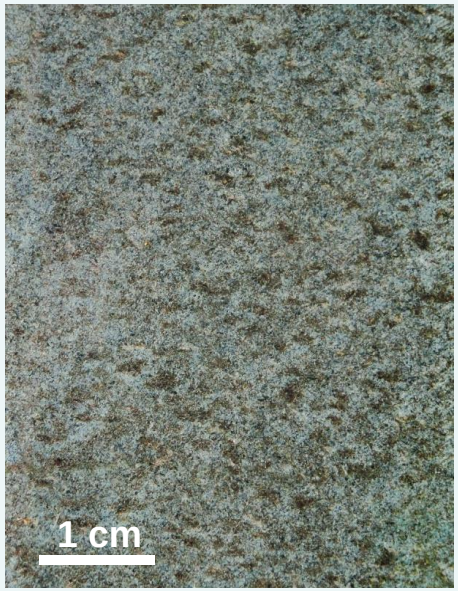
- selective (distal) and pervasive (proximal to the ore zone)
- hosted in amphibolites, metasediments, and the ore zone

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

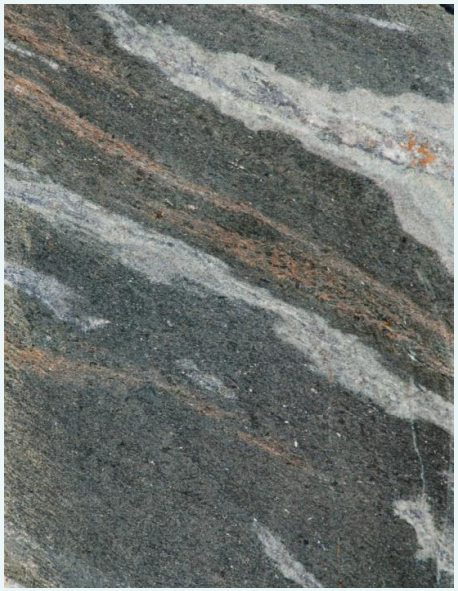
Sulfidation: Apy-Po-Löll in the ore zone, BIF

Schlöglova et al. (2013)

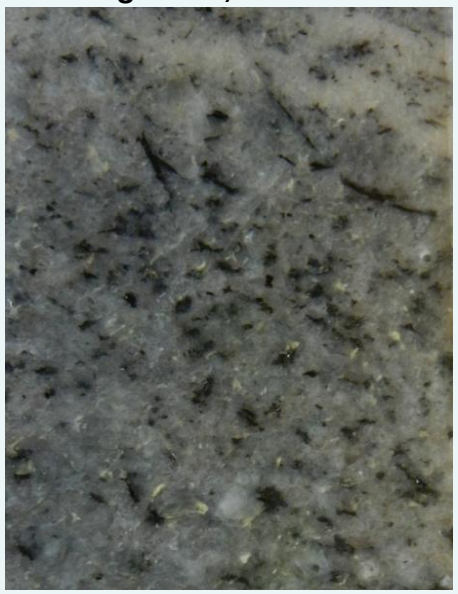
K-alteration in amphibolite



Calc-silicate alteration in amphibolite



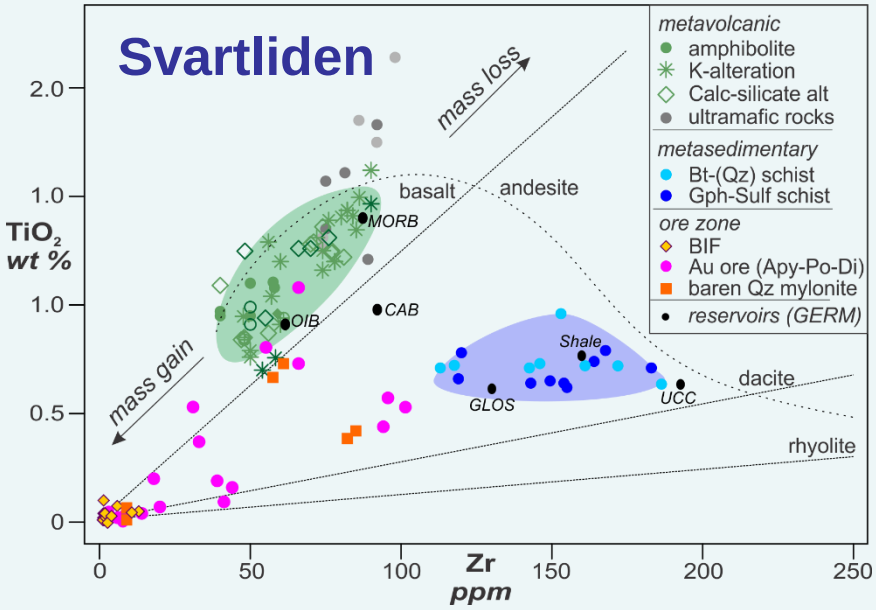
Harnö granite, silicified

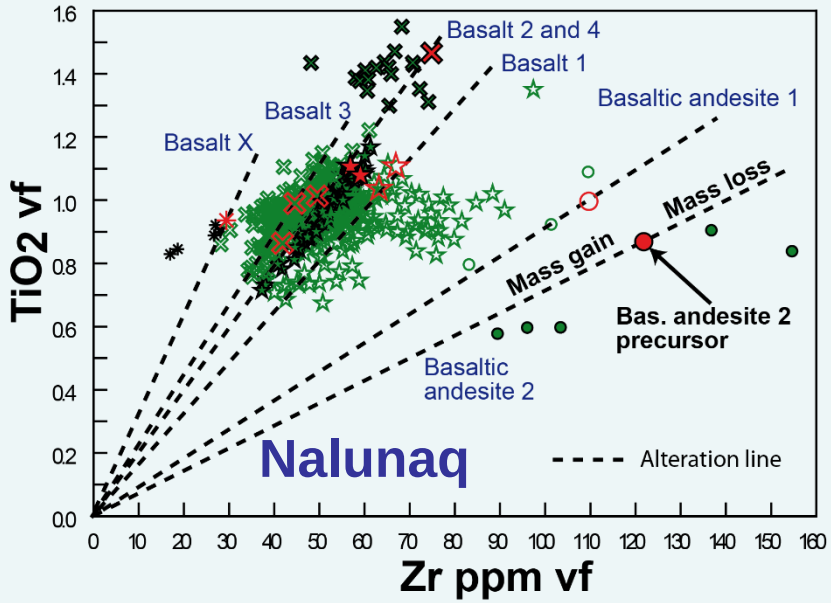


Photos: Dragon Mining AB ©

Comparison of host rocks and hydrothermal alteration of the Svartliden and Nalunaq mines

Schlöglova et al. (2013)





Schlatter and Kolb (2011)

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

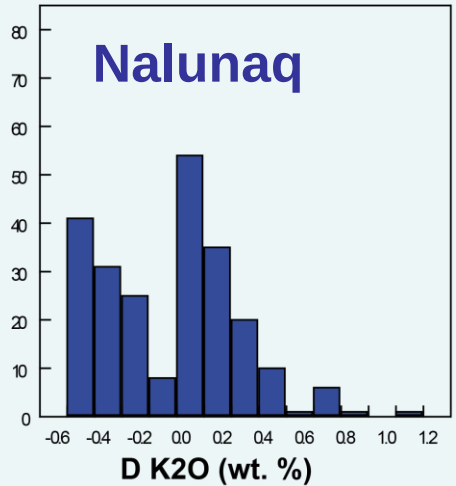
Rocks are basalts and basaltic andesites. In red 12 least altered samples and in green 432 altered samples

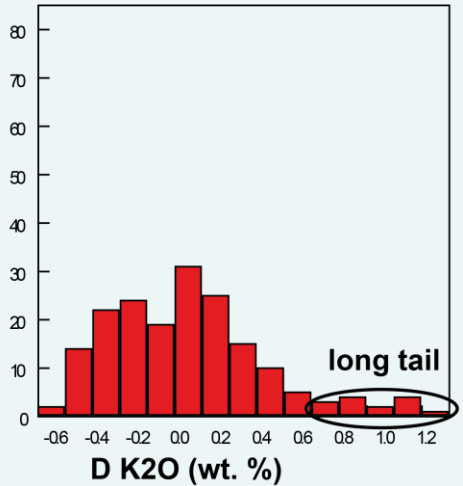
233 mafic rocks with gold ≤ Au 10 ppb

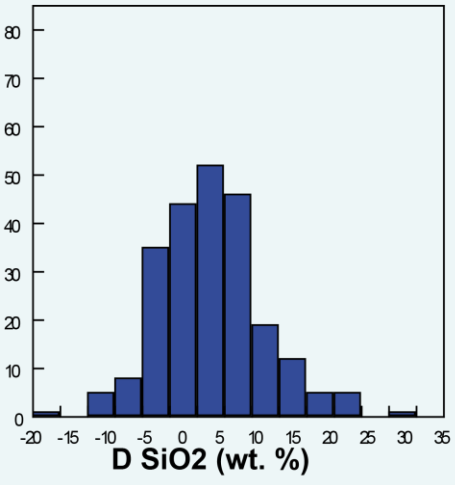
181 mafic rocks with Au > 10 ppb

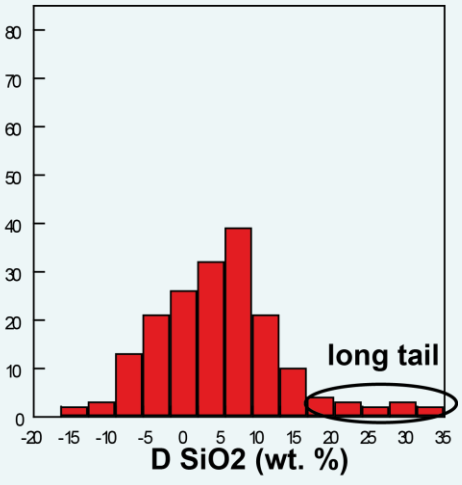
233 mafic rocks with gold ≤ Au 10 ppb

181 mafic rocks with Au > 10 ppb



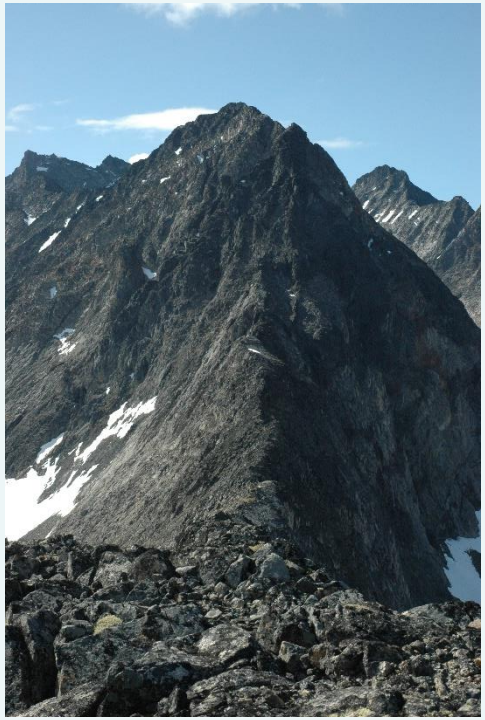


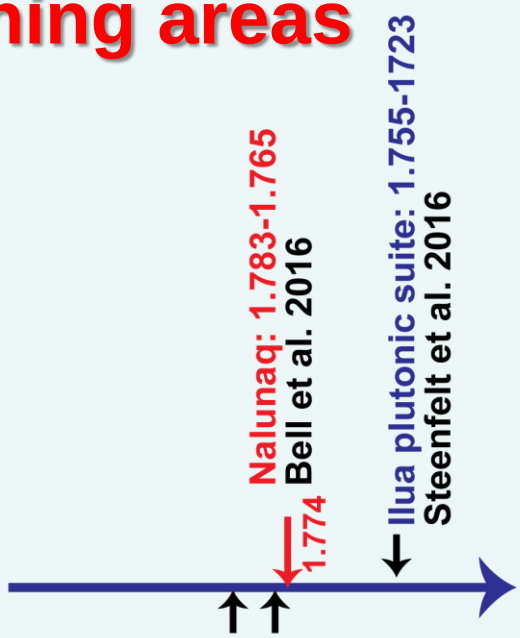




Comparison of granitoid ages of the Svartliden and Nalunaq mining areas

South Greenland

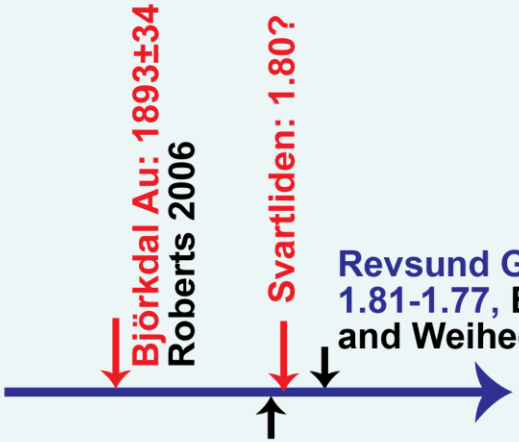


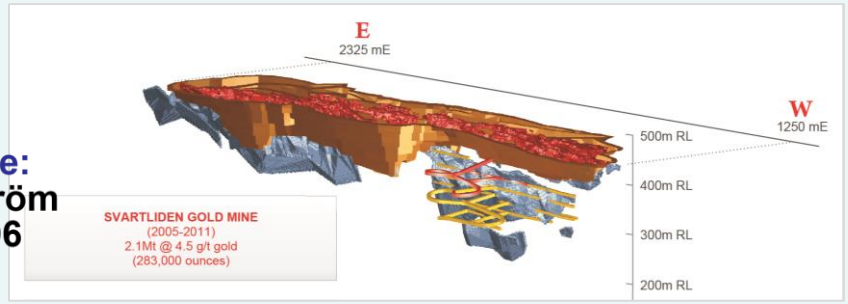


Julianehåb early igneous complex: 1.85-1.83, Steenfelt et al. 2016
Vagar gold host rocks

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

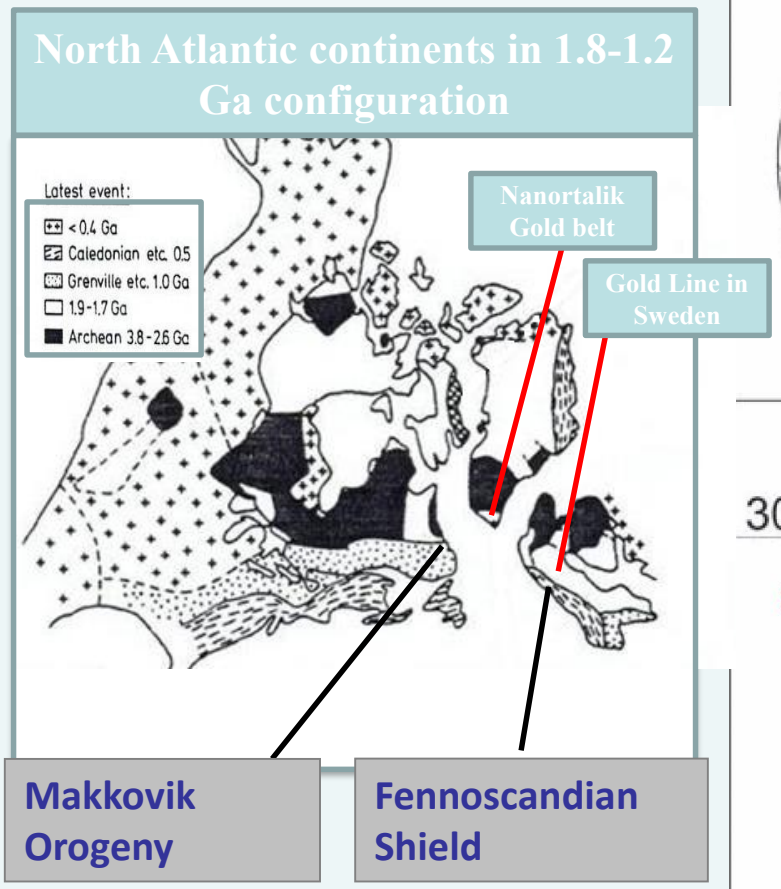
Northern Sweden



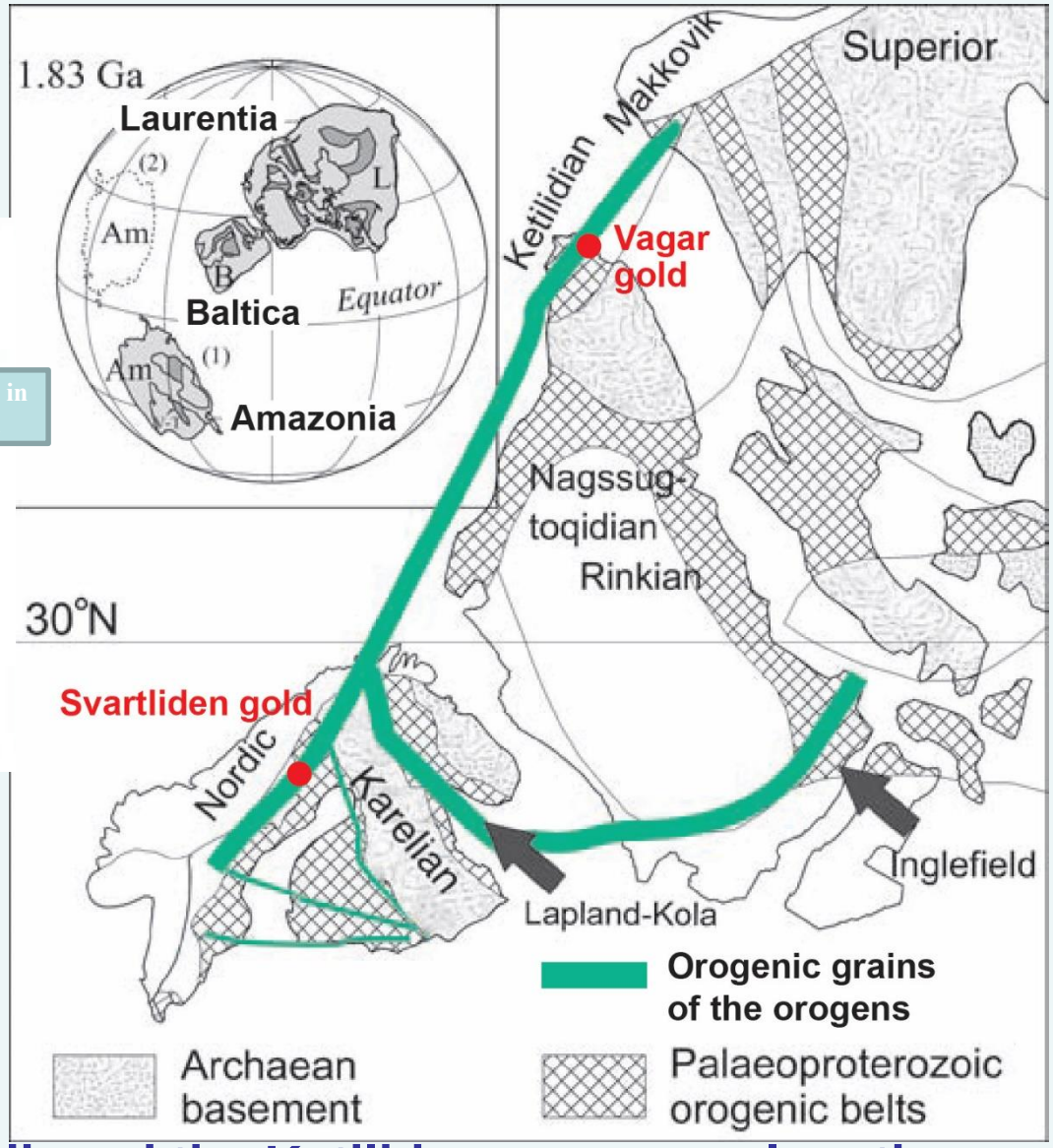


Schlatter et al. (in preparation)

Reconstruction of the c. 1.8 supercontinent and location of Vagar gold on Laurentia and Svartliden gold on Baltica



Patchett and Bridgwater, 1984



Lahtinen et al. (2008)

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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NAC+ 2016

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