DANMARKS OG GRØNLANDS GEOLOGISKE UNDERSØGELSE RAPPORT 2017/4

Orogenic gold potential in Greenland

Reporting the mineral resource assessment workshop, 19 - 21 November 2014

Jochen Kolb, Holger Paulick, Lars Lund Sørensen,
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Executive summary

Within the framework of the Global Mineral Resource Assessment Project. Greenlandic orogenic gold resources were estimated to a depth of 1 km. Twenty-eight permissive tracts, covering an area of 254,324 km^2, were assessed using what was identified as an appropriate grade/tonnage model, the recently compiled grade-tonnage model from the Finnish Geological Survey (GTK).

The statistical mean estimate number of unknown orogenic gold deposits, in all tracts, is of 66, which are estimated to contain a total of 1,150 metric tons of Au. Among these, 28 undiscovered gold deposits, accounting for an estimated 490 metric tons of Au, are estimated to exist in only six tracts, covering only 11,988 km^2. These tracts, with the highest unknown deposit density, correspond to the Tartoq Gold Province (5 unknown deposits and 0.0057 unknown deposits per km^2), the Paamiut Gold Province (3 unknown deposits and 0.0036 unknown deposits per km^2), the contact of the Central and Southern domains of the Ketilidian Orogen in Western Greenland (6 unknown deposits, and 0.0035 unknown deposits per km^2), the contact of the Central and Southern domains of the Ketilidian Orogen in Eastern Greenland (2 unknown deposits, and 0.0023 unknown deposits per km^2), the Godthåbsfjord Gold Province (8 unknown deposits, and 0.0016 unknown deposits per km^2), and the Ataa Gold Province (4 unknown deposits, 0.0016 unknown deposits per km^2).

Another 18 unknown orogenic gold deposits, estimated to contain a total of 319 metric tons of Au, are estimated to be present in the four large Caledonian Orogen tracts in East Greenland, extending over an area of 107,919 km^2.

While the assessment process is formalised into models and methodology in order to reduce bias, and make these results comparable with those obtained elsewhere, the estimated total should be used with caution and should be regarded as a statistical estimate that reflects the present level of knowledge and investigations that have been undertaken in the assessed tracts. New information, new discoveries, new investigations etc. within a tract should thus, whenever possible, be taken into account while evaluating an area, as this could either decrease or increase its estimated potential.

Introduction

Quantitative information on the availability of mineral resources and their regional distribution is required among decision makers in governmental agencies and the private sector. For this reason, the United States Geological Survey (USGS) launched the 'Global Mineral Resource Assessment Project' (GMRAP) in 2002 aimed at identifying undiscovered mineral resources down to a depth of one kilometre globally. The GMRAP makes use of geological, geochemical, geophysical and exploration data in the context of modern quantitative statistical grade-tonnage models for various deposit types. The GMRAP is conducted on a regional and multinational basis for selected deposit types and commodities on a global scale by compiling information from the regional assessments.

The Ministry of Mineral Resources in the Government of Greenland (MMR) and the Geological Survey of Denmark and Greenland (GEUS) participate in GMRAP. Workshops have been held assessing the copper, rare earth elements, sediment-hosted zinc, magmatic nickel and tungsten potential in Greenland since 2009. In the same framework, GEUS on behalf of MMR organised a workshop assessing the orogenic gold potential in Greenland that took place in Copenhagen the 19. – 21. November 2014. In this report, we summarise the geological background, the discussion in the expert panel and the results of the assessment in order to demonstrate the prospectivity for orogenic gold deposits in Greenland.

Orogenic gold deposits

Orogenic gold deposits are hydrothermal deposits formed during focused fluid flow in an orogen during metamorphism and deformation (Groves et al., 1998a; McCuaig and Kerrich, 1998; Goldfarb et al., 2005). The majority of orogenic gold deposits formed in a PT window at 1-3 kbar and 250-400°C (mesozonal) in greenschist to lower amphibolite facies, but lower (epizonal) and especially higher temperature (hypozonal) counterparts have also been recognised (Groves et al., 1998a; Kolb et al., 2015b). These gold deposits are collectively characterised by their common structural control in faults and shear zones and similar hydrothermal alteration (Si, K, Rb, Ba, Li, Cs, Tl, S, H_2O, CO_2 enrichment) and metal (Au-Ag ± As, Sb, Te, W, Mo, Bi) association (Table 1) (McCuaig and Kerrich, 1998). This uniform geochemical footprint suggests only little variation in the hydrothermal ore fluid composition (Groves et al., 2003). The hydrothermal alteration assemblage varies, however, with host rock type and PT conditions of mineralization (Groves et al., 1998a). The gold is hosted in quartz vein systems, altered mylonites and brecciae and the proximal hydrothermal alteration zones (Groves et al., 1998a; McCuaig and Kerrich, 1998; Goldfarb et al., 2005).

The genetic concept of the orogenic gold mineral system is based on the crustal continuum model that describes orogenic gold deposits, forming at different PT conditions equivalent to lower greenschist to lower granulite facies levels over an interval of 20-25 km in the middle to upper crust (Groves et al., 1998a; McCuaig and Kerrich, 1998; Goldfarb et al., 2005). The model proposes the syn-metamorphic upward migration of auriferous fluids from deep-seated sources along structural conduits such as shear and fault zones ((Colvine, 1989; Groves, 1993). Phanerozoic orogenic gold deposits formed in accretionary orogens such as the North American Cordillera in fore-arc to back-arc settings (Goldfarb et al., 1998). Similar geotectonic models are used to explain Precambrian orogenic gold deposits (Kerrich et al., 2000). Although other genetic models are discussed in academia, this does not affect the key questions of the orogenic gold mineral system (Table 1):

- What was the geodynamic setting, tectonic and metamorphic history;
- What was the size and 3D crustal architecture;
- What was the nature of fluid sources and reservoirs;
- What were the drivers and pathways for fluid migration; and
- What were the metal transport and depositional mechanisms of ore formation?

In geological terms the critical factors are: (1) orogens characterised by terrane accretion; (2) long-lived, polyphase shear and fault zones at continental margins that transect the lithosphere; (3) complex, smaller scale deformation zones that are spatially associated with permeability barriers and rocks of contrasting competency; (4) PT windows in the mesozonal field and larger scale PT gradients; (5) regional hydrothermal alteration and granite magmatism; and (6) heterogeneous host rocks with a large chemical gradient or chemically reactive rocks that would be in disequilibrium with the ore fluid (McCuaig et al., 2010). During the assessment workshop in Copenhagen, these key questions and criteria were used in the prospectivity evaluation of a given tract (Table 1).

Method

In the workshop "Assessment of the orogenic gold potential in Greenland", the standardised methodology of the 'Three-Part Form' mineral resource assessment approach developed for GMRAP was followed (Singer, 1993; Singer & Menzie, 2010):

- Delineation of tracts of land where the geology is permissive for hosting orogenic gold deposits;
- Selection of an appropriate grade-tonnage model; and
- Estimation of the number of undiscovered orogenic gold deposits in each tract consistent with the grade-tonnage model. The obtained number of deposits is combined with the grade-tonnage model to assess the total undiscovered orogenic gold endowment.

Tracts of land in entire Greenland were defined using the key criteria for the orogenic gold system by an internal GEUS assessment group consisting of Jochen Kolb, Holger Paulick, Diogo Rosa, Bo Møller Stensgaard and Lars Lund Sørensen (Fig. 1). The data used for the definition of the tracts was the seamless 1:500,000 scale geological map of Greenland, aeromagnetic maps, stream sediment anomaly maps and maps of described orogenic gold occurrences. The difficulty was the general absence of structural data in the geological map as one of the key criteria missing from the data base. Large-scale structures and continental margins were extrapolated from the description of the orogenic evolution in the various tracts. Some of the predefined tracts were modified during the workshop, because the assessment panel found this useful for a sound prospectivity evaluation. All tract outlines are defined in a GIS environment where other digitally accessible data relevant for the assessment is compiled.

Figure 1. *Tracts assessed for undiscovered orogenic gold deposits during the November 2014 workshop.*

Defining an appropriate grade-tonnage model was challenging, because published models by the USGS are from the early 1990's and Greenland has only one orogenic gold deposit that has been mined (Klein & Day, 1994; Singer et al., 1993). The Nalunaq deposit in South Greenland produced 10.7 t Au from ~714,000 t of ore at a grade of 15 g/t Au during 2004-2013. The tonnage of orogenic gold deposits varies largely and the largest orogenic gold deposits are the Golden Mile deposit in Western Australia with 1,800 t Au and the Hollinger-McIntyre deposit in Ontario, Canada with 987 t Au. Historically, the average grade of orogenic gold deposits has been at approx. 5-15 g/t Au until the start of the new century. Since then cut-off grades decreased due to increasing gold prices and currently even deposits with less than 1 g/t Au on average are mined in places. Therefore, the USGS data from the 1990's was not used, and we used a recently compiled grade-tonnage model from the Finnish Geological Survey (GTK) for their own orogenic gold assessment workshop. This grade-tonnage data set consists of data from 21 Fennoscandian and 52 Australian Precambrian orogenic gold deposits (Appendix A). This is considered reasonable, because most of the Greenlandic tracts are of Precambrian age. GTK tested the data set statistically and no significant correlation between grade-tonnage and geographic location or deposit age was found. Key literature on the orogenic gold deposit models and the assessment procedure as well as the tract outline was forwarded to the expert panel members prior to the workshop (Appendix B). The expert panel during the workshop consisted of 15 geologists from the GEUS, GTK, MMR, RWTH Aachen University, USGS and exploration and consulting companies. The individuals are experts on aspects of Greenlandic geology or the orogenic gold mineral system:

- Stefan Bernstein (Avannaa Resources Ltd.)
- Annika Dziggel (RWTH Aachen University)
- Pasi Eilu (GTK)
- Richard J. Goldfarb (USGS)
- Joshua Hughes (NunaMinerals A/S)
- Søren L. Jensen (Scandinavian Highlands A/S)
- Jochen Kolb (GEUS, scientific guide)
- Holger Paulick (GEUS, recorder)
- John Pedersen (Private consultant)
- Diogo Rosa (GEUS)
- Denis M. Schlatter (Helvetica Exploration Services GmbH)
- Agnete Steenfelt (GEUS)
- Henrik Stendal (MMR)
- Bo M. Stensgaard (GEUS, facilitator)
- Claus Østergaard (21st North)

The first day of the workshop was used to present and discuss the workshop procedure, the orogenic gold mineral system and the grade-tonnage model (Appendix C). The second and third days were reserved for the assessment. Each tract assessment started with presentations on the regional geological framework with respect to the key parameters in the orogenic gold system (Table 1), the exploration history, the data coverage and the orogenic gold occurrences (Appendix C). After a general discussion, each of the panel members was asked to provide an independent estimate on how many deposits of median grade-tonnage characteristics could be found in the tract under the best possible circumstances, in the uppermost 1 km of the crust and at the 90%, 50%, 10%, 5% and 1% probability levels. The estimates from all panel members were compiled and subsequently discussed, resulting in a consensus estimate for the tract. After the workshop, each of the consensus estimates were modelled in a series of Monte Carlo simulations using the EMINERS software (Duval, 2012, Bawiec & Spanski, 2012), which combines the probability distribution of the estimated number of undiscovered deposits and the grade-tonnage characteristics in order to obtain the probability distribution of undiscovered ore and metal tonnage in each tract.

Table 1. *Main characteristics and assessment criteria for orogenic gold deposits.*

Economic and geological characteristics of orogenic gold deposits		
Economic characteristics		
Typical size	A few thousand tonnes to > 100 Mt	
Typical grades	5 to 15 g/t, lower in recent open pit or large-scale operations	
Greenland	Nalunaq: 714,000 t at 15 g/t Au	
International	Golden Mile: 119 Mt at 10.7 g/t Au Hollinger-McIntyre: 101 Mt at 9.9 g/t Au Barberton: 27 Mt at 10.7 g/t Homestake: 148 Mt at 10.7 g/t Fäboliden: 90 Mt at 1 g/t	
Geological characteristics		**Assessment criteria**
Tectonic context	Accretionary orogen, Archaean granite-greenstone belts	Orogenic setting
Age	Neoarchaean (2.74-2.54 Ga), Palaeoproterozoic (2.1-2.0 and 1.91–1.77 Ga), Neoproterozoic (700–600 Ma), Silurian to Carboniferous (430–300 Ma), Cretaceous to early Palaeogene (120–50 Ma)	Terrane age was used where data was available
Structure	Terrane boundary, major crustal-scale shear zone	Major shear zone (if data available)
Metamorphism	Mainly greenschist facies and lower amphibolite facies	Greenschist facies and amphibolite facies, also retrograde from granulite facies
Lithology	Metamorphic, often chemically reactive and heterogeneous metamorphic rocks	Chemically reactive rocks and heterogeneous sequences as additional positive argument
Alteration	Mainly localised tens of metres-scale halo around auriferous zones, including carbonates, sulphides, micas and amphiboles	Alteration halo as additional positive argument (if data available)
Geochemistry	Si, K, Rb, Ba, Li, Cs, Tl, S, H_2O, CO_2 enrichment	Not used
Metal association	Au-Ag ± As, Sb, Te, W, Mo, Bi	Anomalies in stream sediment and whole rock data (where available)

Assessment of undiscovered orogenic gold deposits in Greenland

A total of 28 tracts covering an area of 254,324 km^2 were defined and assessed during the workshop (Fig. 1). They cover most of Greenland, except the far north and the central east. Each tract was given a unique number during the process of tract definition neither considering geological systematics nor a ranking (Table 2). Only tracts that fulfil at least one of the critical assessment criteria for orogenic gold (Table 1) have been chosen and extracted as geo-referenced polygons. Since orogenic gold deposits form primarily in accretionary orogens, the tracts define the Archean, Paleoproterozoic and Paleozoic orogens in Greenland. In the following, we discuss the assessment results for the tracts in the orogens starting with the youngest Greenlandic orogen.

Table 2. *Overview of the individual tracts that were assessed for undiscovered orogenic gold deposits at the workshop.*

Tract name	Tract area (km^2)	Consensus bid on number of undiscovered orogenic gold deposits at different confidence levels					Summary statistics		
		N90	N50	N10	N05	N01	Number of unknown deposits	Deposit density	Mean estimate of undiscovered orogenic gold (metric tons)
1	702	1	2	4	7	10	3	0.0036	44
2	866	2	5	7	11	13	5	0.0057	87
3+10	1,543	0	1	2	4	6	1	0.0008	22
4	1,961	0	0	2	3	5	1	0.0004	14
5	2,078	4	6	10	16	23	6	0.0035	110
6	787	0	2	3	4	5	2	0.0023	32
7	205	0	0	0	1	3	0	0.0007	3
8+9+15+26+27	12,277	0	0	2	5	7	1	0.0001	15
11	4,367	0	0	1	2	3	0	0.0001	7
12	4,402	1	2	4	6	8	2	0.0005	41
13	635	0	0	0	1	3	0	0.0002	2
14	7,967	0	0	2	4	6	1	0.0001	15
16a	19,297	0	2	10	20	50	6	0.0003	96
16b	14,985	1	2	3	5	10	2	0.0002	40
16c	65,921	1	3	8	16	36	5	0.0001	91
17+18	7,716	2	4	8	12	20	5	0.0007	92
19	8,728	0	1	2	4	6	1	0.0001	23
20	2,344	2	4	5	8	10	4	0.0016	67
22	5,733	0	1	2	5	7	1	0.0002	24
23	3,238	0	0	2	4	6	1	0.0003	13
24	543	0	0	2	3	5	1	0.0014	13
25	751	0	0	2	2	4	1	0.0009	12
28	5,191	0	0	2	3	6	1	0.0001	14
30+31	5,206	0	1	3	6	9	2	0.0003	29
32	5,211	4	7	11	20	33	8	0.0016	150
33a	29,440	0	2	6	11	15	3	0.0001	55
33b	25,338	0	0	2	3	5	1	0.0001	12
37	16,892	0	1	3	5	7	2	0,0001	28

The Paleozoic Caledonian Orogen in eastern Greenland

The Caledonian Orogen in Greenland covers a 1300 km long and up to 300 km wide area along the east coast, which is comparatively poorly known in terms of orogenic gold endowment (Fig. 2; Harpøth et al., 1986; Henriksen and Higgins, 2008).

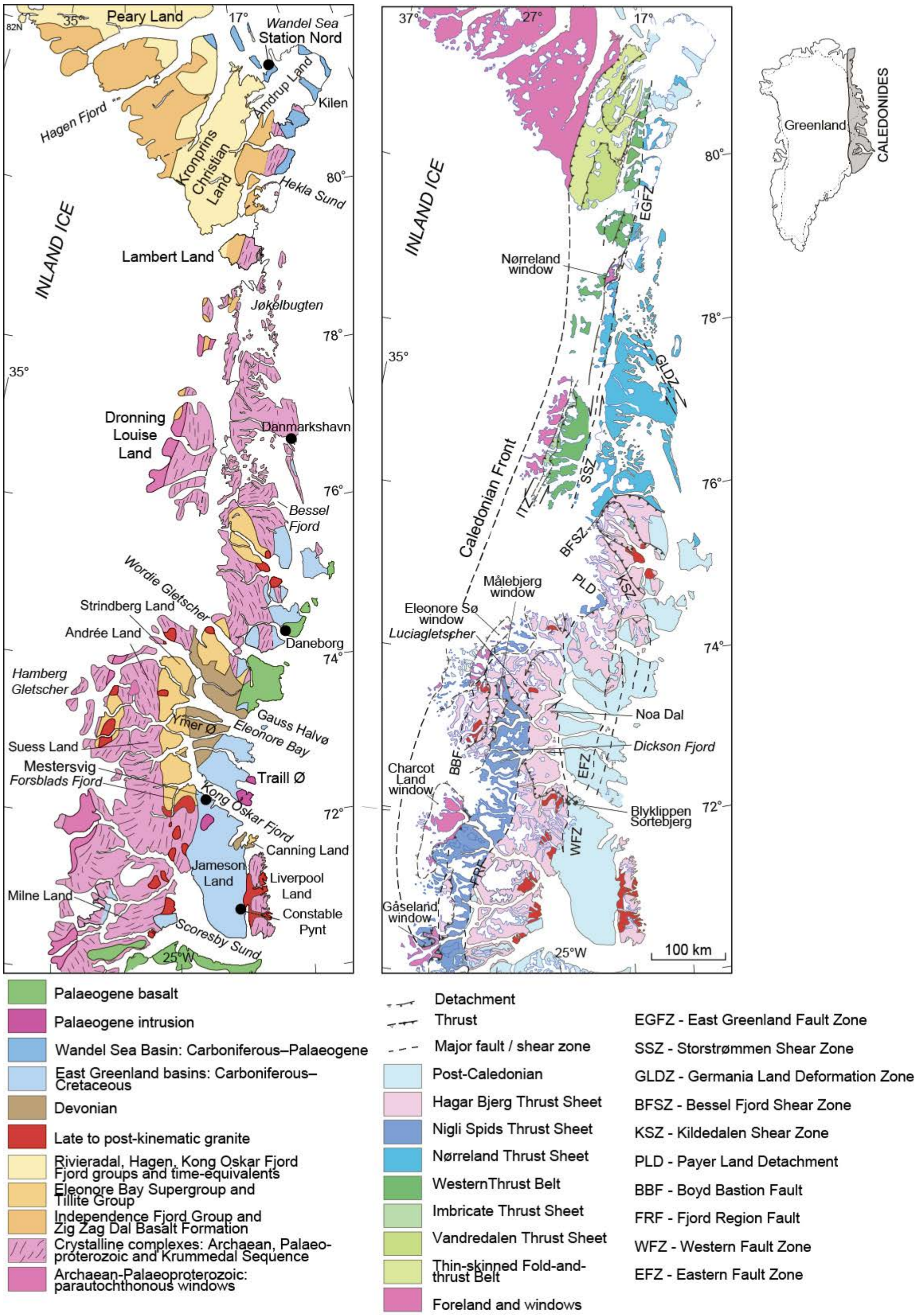

Figure 2. *Geological and structural maps of the Caledonian Orogen in eastern Greenland (modified after: Higgins et al., 2004; Higgins and Leslie, 2008).*

Other Caledonian areas such as in the British Islands and in Norway have not produced any big gold deposits and only one gold occurrence in outcrop is known from Greenland (Harpøth et al., 1986; Goldfarb et al., 2001). The Caledonian Orogen is interpreted as a collisional orogen between Baltica and Laurentia. It is in Greenland characterized by west-vergent nappes separated by low-angle thrust zones, where accretionary tectonics, the favourable setting for orogenic gold mineralization, have not been described (Higgins and Leslie, 2008). On the other hand, Archean and Paleoproterozoic basement is exposed at the base of Caledonian thrusts and in tectonic windows (Fig. 2; Kalsbeek et al., 2008b), which potentially host older mineralization as for example in Norway.

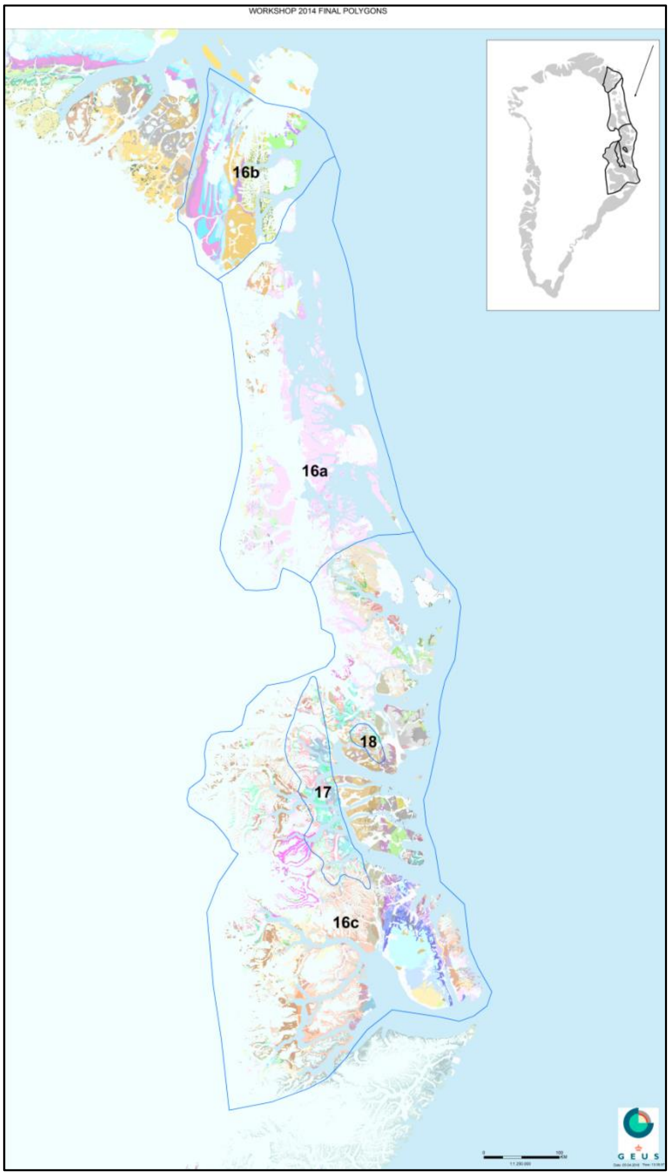

Figure 3. *Tracts assessed for undiscovered orogenic gold deposits in the Paleozoic Caledonian Orogen.*

Only three tracts were defined before the workshop, but the expert panel agreed on redefining them. Tract 16 was subdivided into three tracts (16a-c) based on variable complexity in geology and tracts 17 and 18 were joined, because they contain gold occurrences in a similar setting (Fig. 3).

Tract 16b – northern Caledonian Orogen

The northern area of the Caledonian Orogen is characterized by metamorphosed siliciclastic rocks of the Paleo-Mesoproterozoic Independence Fjord Group and basalts of the Mesoproterozoic Zig Zag Dal Formation in west-vergent nappe structures (Fig. 2; Collinson et al., 2008; Smith and Rasmussen, 2008; Sønderholm et al., 2008). The thrusts and shear zones trend NNE, form internal duplex and fold structures and show a few km displacement (Fig. 2; Leslie and Higgins, 2008). Metamorphism is in the greenschist to sub-greenschist facies (Gilotti *et al.*, 2008).

The 14,985 km^2 are only poorly explored, however a few stream sediment samples returned gold during panning. The geology is relatively complex with extensional and compressional structures and metamorphism in the greenschist facies, which are favourable for orogenic gold systems. The area is not significantly explored and studied for orogenic gold mineralization. Based on that, the tract was considered prospective for orogenic gold mineralization and the expert panel came to the conclusion that at least one undiscovered orogenic gold deposit would be hosted in the tract at 90% confidentiality level (Table 3).

Table 3. *Undiscovered deposit estimates, deposit numbers, tract area, and deposit density for tract 16b. [NXX - Estimated number of undiscovered deposits at a certain level of confidence expressed in %; N_{und} – expected number of undiscovered deposits, s – standard deviation, Cv% - coefficient of variance, N_{known} – number of known deposits in the tract that are included in the grade and tonnage model, N_{total} – total number of expected deposits plus the known deposits, area – area of permissive tract in square kilometers, density – deposit density reported as the total number of deposits per km^2. N_{und}, S, and Cv% are calculated using a regression equation (Singer and Menzie, 2005). In cases where individual estimates were tallied in addition to the consensus estimate, individual estimates are listed].*

Consensus undiscovered deposit estimates					Summary statistics					Tract area (km^2)	Deposit density (N_{total}/km^2)
N90	N50	N10	N05	N01	N_{und}	s	Cv%	N_{known}	N_{total}		
1	2	3	5	10	2.20	1.80	82.0	0	2.20	14,985	0.000150

Estimator	Estimated number of undiscovered deposits				
	N90	N50	N10	N05	N01
Individual 1	0	10	50	100	1000
Individual 2	5	12	25	50	80
Individual 3	0	0	1	2	5
Individual 4	0	1	2	3	4
Individual 5	0	0	0	2	5
Individual 6	0	0	0	2	4
Individual 7	0	0	0	2	4
Individual 8	0	1	5	7	10
Individual 9	0	0	0	0	2
Individual 10	2	5	10	50	100
Individual 11	0	0	0	0	3
Individual12	0	0	2	3	3
Individual 13	0	0	3	6	8
Individual 14	1	2	3	4	5
Individual 15	0	0	0	1	4
Individual 16	0	0	3	3	5
Consensus	**1**	**2**	**3**	**5**	**10**

Table 4. Results of Monte Carlo simulations of undiscovered resources in tract 16b. [T- metric tons, Mt – million metric tons]

Material	Probability of at least the indicated amount						Probability of	
	0.95	0.9	0.5	0.1	0.05	Mean	Mean or greater	None
Au (T)	0	1	13	98	200	40	0.21	0.06
Rock (Mt)	0	0	6	58	180	27	0.18	0.06

Tract 16a – central Caledonian Orogen

The central part in the East Greenland Caledonides is mainly underlain by Archean to early Neoproterozoic gneisses and only locally by the Paleo-Mesoproterozoic Independence Fjord Group (Fig. 2; Kalsbeek et al., 2008b). The geology is much simpler than in other parts of the orogen, but major NNE-trending thrust and strike-slip faults are mapped (Fig. 2; Leslie and Higgins, 2008). Metamorphism is mainly in the eclogite facies along the coast with narrow units in amphibolite facies and greenschist facies in the west (Gilotti *et al.*, 2008).

The tract (19,297 km^2) is generally underexplored and very little is known in terms of economic geology (Harpøth *et al.*, 1986). Although a few stream sediment samples and rock samples are anomalous in gold in the greenschist facies areas, no investigation was directed towards orogenic gold systems. The expert panel found this tract less prospective than tract 16b, estimated two undiscovered orogenic gold deposits at a 50% confidentiality level, but more at lower confidentiality level (Table 5). This indicates the difficulty in assessing these tracts covering large areas with only very little data available on mineralization in general.

Table 5. *Undiscovered deposit estimates, deposit numbers, tract area, and deposit density for tract 16a.*

Consensus undiscovered deposit estimates					Summary statistics					Tract Area (km^2)	Deposit density (N_{total}/km^2)
N90	**N50**	**N10**	**N05**	**N01**	N_{und}	**s**	**Cv%**	N_{known}	N_{total}		
0	2	10	20	50	5.5	9.40	170.0	0	5.50	19,297	0.000280

Estimator	Estimated number of undiscovered deposits				
	N90	**N50**	**N10**	**N05**	**N01**
Individual 1	3	50	1000	5000	20000
Individual 2	5	12	30	60	100
Individual 3	0	0	0	1	3
Individual 4	0	0	0	3	4
Individual 5	0	0	0	5	10
Individual 6	0	0	10	20	30
Individual 7	0	1	2	3	5
Individual 8	3	10	35	60	150
Individual 9	0	0	0	0	2
Individual 10	2	10	50	100	500
Individual 11	0	0	0	0	1
Individual12	0	0	1	2	2
Individual 13	1	3	6	8	12
Individual 14	0	1	2	3	4
Individual 15	2	4	6	20	50
Individual 16	0	2	4	6	10
Consensus	**0**	**2**	**10**	**20**	**50**

Table 6. *Results of Monte Carlo simulations of undiscovered resources in tract 16a.*
[T- metric tons, Mt – million metric tons]

Material	Probability of at least the indicated amount						Probability of	
	0.95	0.9	0.5	0.1	0.05	Mean	Mean or greater	None
Au (T)	0	0	19	280	500	96	0.23	0.20
Rock (Mt)	0	0	9	240	370	67	0.21	0.20

Tract 16c – southern Caledonian Orogen

The southern Caledonian Orogen is characterized by Archean and Paleoproterozoic orthogneiss, marble and metamorphosed siliciclastic rocks of the Meso-Neoproterozoic Krummedal sequence and the Neoproterozoic-Ordovician Eleonore Bay Supergroup and Tillite Group, and Caledonian granite (Fig. 2; Kalsbeek et al., 2008a; Kalsbeek et al., 2008b; Smith and Rasmussen, 2008; Sønderholm et al., 2008). Metamorphism is at eclogite and granulite facies grades mainly in the eastern parts and in the amphibolite facies further inland to the west (Gilotti et al., 2008). Greenschist facies bands are associated with extensional faults trending NW and N further west (Gilotti and McClelland, 2008). The tract is structurally complex with W-vergent thrusts and different extension faults as well as a Devonian basin (Fig. 2; Larsen et al., 2008; Leslie and Higgins, 2008). The various thrust sheets are internally deformed in duplex and fold structures. Gold anomalies are recorded in stream sediment samples, heavy mineral concentrates and rock samples, however their origin cannot unequivocally be determined. Gold mineralization is known to be associated with poly-metallic veins related to Caledonian granites and, thus, not necessarily related to orogenic gold mineral systems (Harpøth *et al.*, 1986; Stendal and Frei, 2008). There has no exploration or investigation of orogenic gold mineralization been done in this tract, but from the data available, the expert panel found the area prospective and more investigations of orogenic gold systems would be needed (Tables 7, 8).

Table 7. *Undiscovered deposit estimates, deposit numbers, tract area, and deposit density for tract 16c.*

Consensus undiscovered deposit estimates					Summary statistics					Tract Area (km^2)	Deposit density (N_{total}/km^2)
N90	N50	N10	N05	N01	N_{und}	s	Cv%	N_{known}	N_{total}		
1	3	8	16	36	5.0	6.70	130.0	0	5.00	65,920	0.000076

Estimator	Estimated number of undiscovered deposits				
	N90	N50	N10	N05	N01
Individual 1	1	3	10	50	100
Individual 2	6	14	35	60	130
Individual 3	0	1	2	3	4
Individual 4	0	0	3	4	5
Individual 5	0	1	3	5	7
Individual 6	1	2	20	40	80
Individual 7	0	1	2	3	5
Individual 8	4	7	15	40	120
Individual 9	0	0	0	1	2
Individual 10	0	1	5	10	50
Individual 11	1	2	5	10	20
Individual12	0	0	2	3	3
Individual 13	1	4	10	12	15
Individual 14	1	2	3	4	5
Individual 15	1	3	6	10	20
Individual 16	1	4	4	6	8
Consensus	**1**	**3**	**8**	**16**	**36**

Table 8. *Results of Monte Carlo simulations of undiscovered resources in tract 16c.*
[T- metric tons, Mt – million metric tons]

Material	Probability of at least the indicated amount						Probability of	
	0.95	0.9	0.5	0.1	0.05	Mean	Mean or greater	None
Au (T)	0	2	29	270	410	91	0.24	0.07
Rock (Mt)	0	0	13	220	310	63	0.22	0.07

Tracts 17 and 18 – southern central Caledonian Orogen

Three gold occurrences are known from the southern Caledonian Orogen (Harpøth et al., 1986) and are summarized in tracts 17 and 18, which are evaluated together (Fig. 3). The general geology is similar to tract 16c. The gold occurrences are located in the N-S-striking décollement between Mesoproterozoic schist and migmatite of the Central Metamorphic Complex, and Neoproterozoic sedimentary rocks of the Eleonore Bay Supergroup (Fig.2; Harpøth et al., 1986):

1. Forsblads Fjord, Lyell Land: Gold mineralization is hosted in tourmaline-arsenopyrite-quartz veins along a N-S-striking décollement. This décollement has been interpreted to correspond to an original unconformity overprinted by Caledonian thrusting, metamorphism and late-kinematic Caledonian granite intrusion.
2. Noa Dal, Ymer Ø: A float of brecciated dolomitic shale and quartzite, possibly of the Eleonore Bay Supergroup, hosts auriferous stibnite-arsenopyrite and wolframite-arsenopyrite-fluorite-quartz veinlets. The mineralization has been interpreted to be related to deep-seated oblique strike-slip deformation in the basement, during late Caledonian compression.
3. Luciagletcher, Andrée Land: Pyrrhotite-pyrite-gold-bismuth-quartz veins in granitic and meta-sedimentary rocks are found as float in Mesoproterozoic quartzite, gneiss, mica schist and calc-silicate rocks metamorphosed at amphibolite facies grades and late Caledonian granite. Gold mineralization is interpreted to be related to the late Caledonian granite intrusions.

The two tracts (17+18) span over 7,716 km^2 and were evaluated as prospective for orogenic gold deposits, including two undiscovered deposits at a 90% confidentiality level (Table 9 & 10). The expert panel based its positive evaluation on the fact that this is the area with known Au occurrences and N-S striking structures. The gold mineralization could be the late orogenic Caledonian analogues to the British Islands. The recommendation from the panel is to study the gold mineral system and determine its age in order to better be able to evaluate the potential for Caledonian orogenic gold systems in East Greenland.

Table 9. *Undiscovered deposit estimates, deposit numbers, tract area, and deposit density for tract 17+18.*

Consensus undiscovered deposit estimates					Summary statistics					Tract Area (km^2)	Deposit density (N_{total}/km^2)
N90	N50	N10	N05	N01	N_{und}	s	Cv%	N_{known}	N_{total}		
2	4	8	12	20	5.0	4.10	81.0	0	5.00	7,716	0.000650

Estimator	Estimated number of undiscovered deposits				
	N90	N50	N10	N05	N01
Individual 1	2	6	1000	5000	10000
Individual 2	2	5	8	16	50
Individual 3	4	8	14	20	30
Individual 4	0	1	2	2	2
Individual 5	1	1	2	2	5
Individual 6	0	1	2	4	8
Individual 7	1	2	4	5	7
Individual 8	3	6	10	15	20
Individual 9	0	1	2	3	5
Individual 10	2	5	10	50	100
Individual 11	0	1	2	4	6
Individual12	1	2	3	3	3
Individual 13	4	8	12	18	22
Individual 14	1	2	3	4	5
Individual 15	3	6	10	15	20
Individual 16	2	4	4	6	8
Consensus	**2**	**4**	**8**	**12**	**20**

Table 10. *Results of Monte Carlo simulations of undiscovered resources in tract 17+18.*
[T- metric tons, Mt – million metric tons]

Material	Probability of at least the indicated amount						Probability of	
	0.95	0.9	0.5	0.1	0.05	Mean	Mean or greater	None
Au (T)	2	7	40	250	370	92	0.27	0.04
Rock (Mt)	1	3	20	220	310	64	0.24	0.04

Orogenic gold mineralization in the Archean and Paleoproterozoic in eastern Greenland

The eastern Greenlandic coast south of Blosseville Kyst is underlain by Archean and Paleoproterozoic rocks along approx. 1000 km. The geology is divided into different large-scale terranes, from north to south the Rae Craton, the Nagssugtoqidian Orogen and the Thrym Complex of the North Atlantic Craton (Nutman et al., 2008b; St-Onge et al., 2009;

Bagas et al., 2013; Kolb et al., 2013b; Kolb, 2014). Based on this tripartition, three tracts were defined, which are discussed in detail below (Fig. 4).

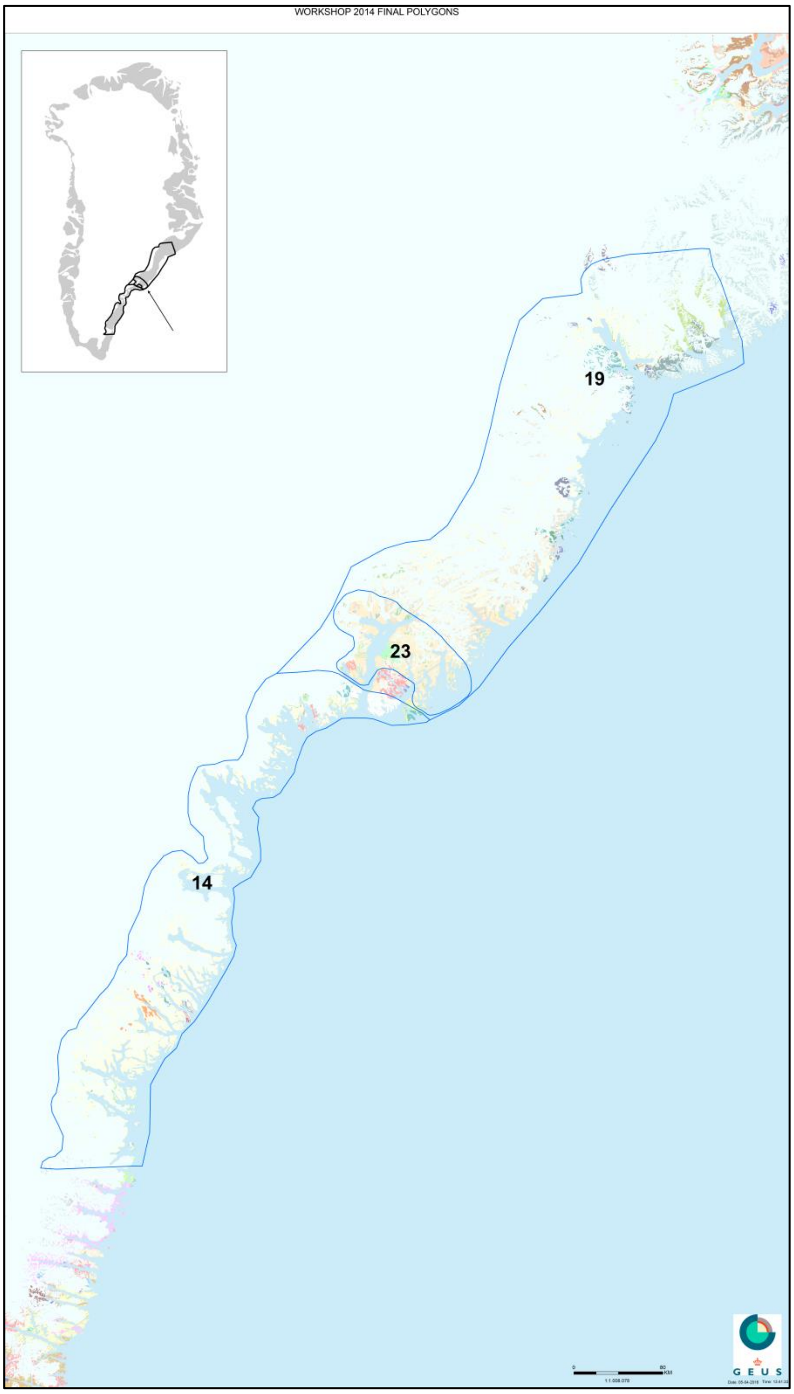

Figure 4. *Tracts assessed for undiscovered orogenic gold deposits in eastern Greenland*

Tract 19 – Rae Craton in eastern Greenland

The poorly known Archean craton consists of tonalitic to granodioritic orthogneiss with bands and narrow belts of paragneiss, mafic granulite, amphibolite and layered gabbro-anorthosite complexes (Bridgwater *et al.*, 1978). The structure is characterized by large-scale NE-ENE-trending recumbent folds and coaxial younger upright open folds in the granulite facies inland, and near-vertical NW-trending foliation in higher strain amphibolite facies coastal areas (Bridgwater *et al.*, 1978; Kays *et al.*, 1989). Intrusion ages of the precursors of polyphase orthogneiss are Meso- to Neoarchean and retrograde metamorphism in the south is Neoarchean, suggesting no major Paleoproterozoic overprint (Leeman et al., 1976; Kays et al., 1989; Kalsbeek et al., 1993; Nutman et al., 2008b).
This tract is only poorly studied in terms of its Precambrian story (it includes the Tertiary Skaergaard intrusion and others) and no geochemical gold anomalies are recognized. It contains only narrow belts of supracrustal rocks and is mainly at granulite and amphibolite facies metamorphic grades. However, one gold occurrence was discovered during reconnaissance exploration approx. 35 km north of Skaergaard at Sortekap in the Kangerlussuaq Fjord area (Holwell *et al.,* 2013). Auriferous quartz veins of ≤2.7 g/t Au are hosted along ~2.5 km in amphibolite (Holwell *et al.*, 2013). The auriferous quartz veins are up to 10 m wide and dip steeply to the south parallel to the foliation in the amphibolite (Holwell et al., 2013). The veins have a cm-scale wide alteration halo of actinolite-clinozoisite-muscovite-titanite-arsenopyrite-löllingite-pyrite-gold-(chalcopyrite-scheelite) (Holwell *et al.*, 2013). The hydrothermal gold mineralization formed on the retrograde path at mesozonal conditions during late ENE-trending folding at ~350-400°C and 3-6 kbar from an aqueous-carbonic fluid (Holwell *et al.,* 2013).

Although the Sortekap gold occurrence shows the potential for typical orogenic gold mineralization in this 8,728 km^2 tract, the expert panel found this area not very prospective based on the generally high metamorphic grade and the lack of documented major structural breaks (Tables 11, 12). It was decided that there may be one undiscovered gold deposit at a 50% confidence level.

Table 11. *Undiscovered deposit estimates, deposit numbers, tract area, and deposit density for tract 19.*

Consensus undiscovered deposit estimates					Summary statistics					Tract Area (km^2)	Deposit density (N_{total}/km^2)
N90	N50	N10	N05	N01	N_{und}	s	Cv%	N_{known}	N_{total}		
0	1	2	4	6	1.2	1.4	120.0	0	1.2	8,728	0.000140

Estimator	Estimated number of undiscovered deposits				
	N90	N50	N10	N05	N01
Individual 1	0	5	10	20	50
Individual 2	0	1	4	6	10
Individual 3	0	0	1	2	3
Individual 4	0	0	0	1	3
Individual 5	0	1	2	4	6
Individual 6	1	2	4	6	8
Individual 7	0	0	0	2	3
Individual 8	0	0	3	10	20
Individual 9	0	0	0	2	3
Individual 10	0	1	2	3	4
Individual 11					
Individual12	0	0	0	1	2
Individual 13	0	0	0	1	2
Individual 14	0	0	2	4	6
Individual 15	0	0	3	5	10
Individual 16	0	2	2	2	6
Consensus	**0**	**1**	**2**	**4**	**6**

Table 12. *Results of Monte Carlo simulations of undiscovered resources in tract 19.*
[T- metric tons, Mt – million metric tons]

Material	Probability of at least the indicated amount						Probability of	
	0.95	0.9	0.5	0.1	0.05	Mean	Mean or greater	None
Au (T)	0	0	4	49	110	23	0.19	0.30
Rock (Mt)	0	0	2	30	79	16	0.15	0.30

Tract 23 – Nagssugtoqidian Orogen in eastern Greenland

The 3,238 km^2 tract is underlain by the Kuummiut terrane of the Paleoproterozoic Nagssugtoqidian Orogen (Figs. 4, 5; Kolb, 2014). The terrane is characterized by Meso- to Neoarchean orthogneiss with narrow belts and lenses of ultramafic rocks and mafic rocks retrogressed from the eclogite facies (Nutman et al., 2008b; Kolb, 2014). Paleoproterozoic rocks are amphibolite facies paragneiss and amphibolite that form narrow belts interleaved with Archean rocks in thin-skinned thrust sheets that are subsequently refolded (Nutman et al., 2008b; Kolb, 2014). Late orogenic Paleoproterozoic intrusions comprise granite and diorite (Nutman et al., 2008b; Kolb, 2014). The tract is cut by a major NW-trending, transcrustal structure, a possible suture, and several near-vertical strike-slip faults (Fig. 5; Kolb, 2014).

The stream sediment samples record numerous Au anomalies that commonly correlate with anomalous As. Several samples with gold in the ppm-range were discovered by local prospectors during the mineral hunt program Ujarassiorit. The most recent sample from 2011 contains 11.1 ppm Au. The auriferous sample is pyroxene-garnet gneiss consisting of garnet, pyroxene, biotite, pyrrhotite, quartz, plagioclase and graphite (Baden, 2016). However, the 2014 sampling program following a gold-pyroxene-garnet skarn model was not successful in repeating high gold grades and only one quartz vein returning ~0.5 ppm Au was found, suggesting the gold is related to quartz veins, rather than skarns. Numerous hydrothermal quartz veins with biotite-pyrrhotite-chalcopyrite-graphite alteration halos are structurally controlled by the larger near-vertical shear zone systems. Quartz veins and alteration zones returned, however, < 20 ppb Au in all cases (Baden, 2016). Although GEUS recently had comprehensive field investigations in the area, the source for the Au-As enrichment in the stream sediment samples could not be detected. In spite of the stream sediment anomalies, abundant shear zones and the orogenic setting, the expert panel evaluated this tract as not very prospective for orogenic gold (Tables 13, 14). This evaluation is based on the eclogite facies nature of the terrane and the unsuccessful effort by GEUS geologists to identify gold mineralization.

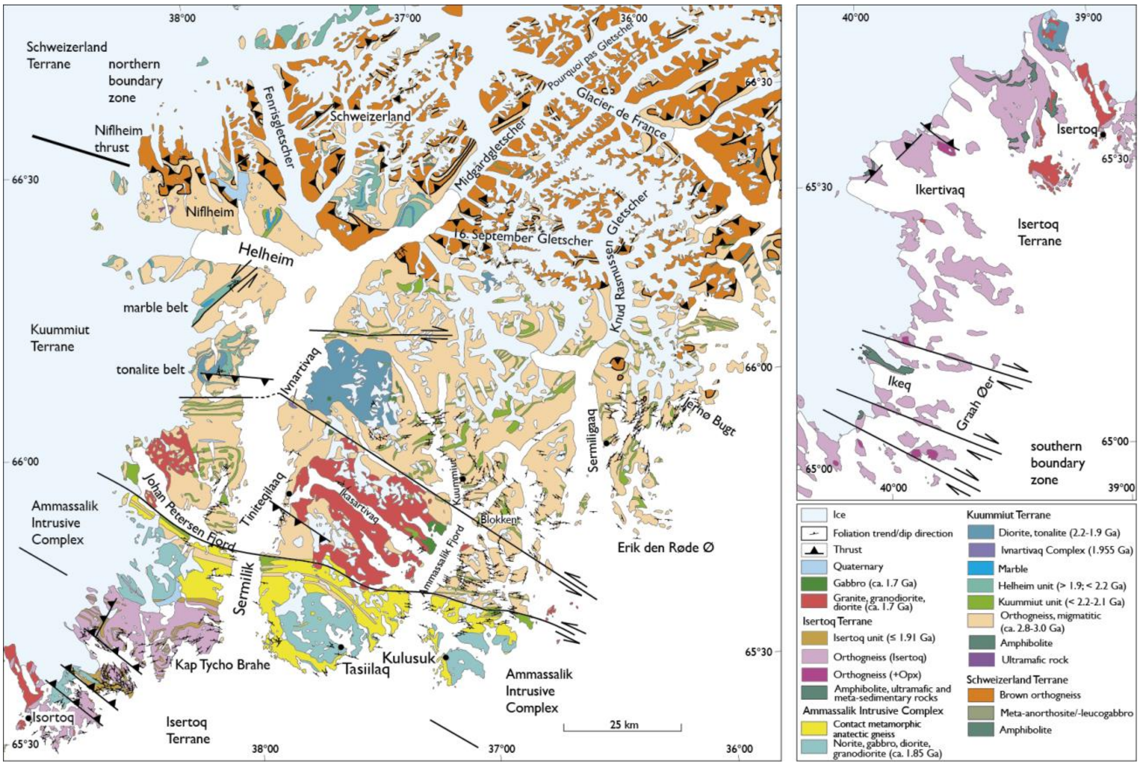

Figure 5. *Schematic geological map of the Nagssugtoqidian Orogen in the Tasiilaq area of South-East Greenland showing major structures present (modified after, Escher, 1990; Kolb, 2014).*

Table 13. *Undiscovered deposit estimates, deposit numbers, tract area, and deposit density for tract 23.*

Consensus undiscovered deposit estimates					Summary statistics					Tract Area (km^2)	Deposit density (N_{total}/km^2)
N90	N50	N10	N05	N01	N_{und}	s	Cv%	N_{known}	N_{total}		
0	0	2	4	6	0.81	1.50	190.0	0	0.81	3,238	0.000250

Estimator	Estimated number of undiscovered deposits				
	N90	N50	N10	N05	N01
Individual 1	0	3	6	10	20
Individual 2	0	0	2	4	8
Individual 3	0	0	2	5	10
Individual 4	0	1	2	2	3
Individual 5	0	0	4	5	6
Individual 6	0	0	2	4	6
Individual 7	0	0	2	4	6
Individual 8	0	0	0	1	3
Individual 9	0	0	2	2	5
Individual 10	0	0	1	2	3
Individual 11					
Individual12	0	0	1	2	3
Individual 13	0	0	1	2	4
Individual 14	0	1	2	4	6
Individual 15	0	3	4	5	6
Individual 16	0	1	1	2	4
Consensus	**0**	**0**	**2**	**4**	**6**

Table 14. *Results of Monte Carlo simulations of undiscovered resources in tract 23.*
[T- metric tons, Mt – million metric tons]

Material	Probability of at least the indicated amount						Probability of	
	0.95	0.9	0.5	0.1	0.05	Mean	Mean or greater	None
Au (T)	0	0	0	27	62	13	0.17	0.60
Rock (Mt)	0	0	0	14	40	9	0.12	0.60

Tract 14 – North Atlantic Craton in eastern Greenland

Tract 14 comprises the Archean Thrym Complex of the North Atlantic Craton and has 7,967 km^2 (Fig. 4). The Thrym Complex consists of Meso- to Neoarchean orthogneiss and narrow belts of (1) mafic granulite or amphibolite with ultramafic rocks and (2) mafic granulite or amphibolite with meta-sedimentary rocks (Fig. 6; Bagas et al., 2013; Kolb et al., 2013b). In the Skjoldungen area, the rocks are at granulite facies grades, whereas there are amphibolite facies rocks in the north and south (Kolb *et al*., 2013b). These rocks are intruded by the

Neoarchean Skjoldungen Alkaline Province, mainly granite, syenite, monzonite and minor carbonatite, and Proterozoic mafic dykes (Fig. 6; Blichert-Toft et al., 1995; Kolb et al., 2013b). The Thrym complex is structurally coherent with a doubly folded early foliation, but lacks major shear zone systems or structural breaks (Fig. 6; Kolb et al., 2013b). Based on the lack of feasible structures, the high metamorphic grade and the lack of geochemical Au anomalies, the expert panel evaluated this tract as not very prospective for orogenic gold deposits (Tables 15, 16).

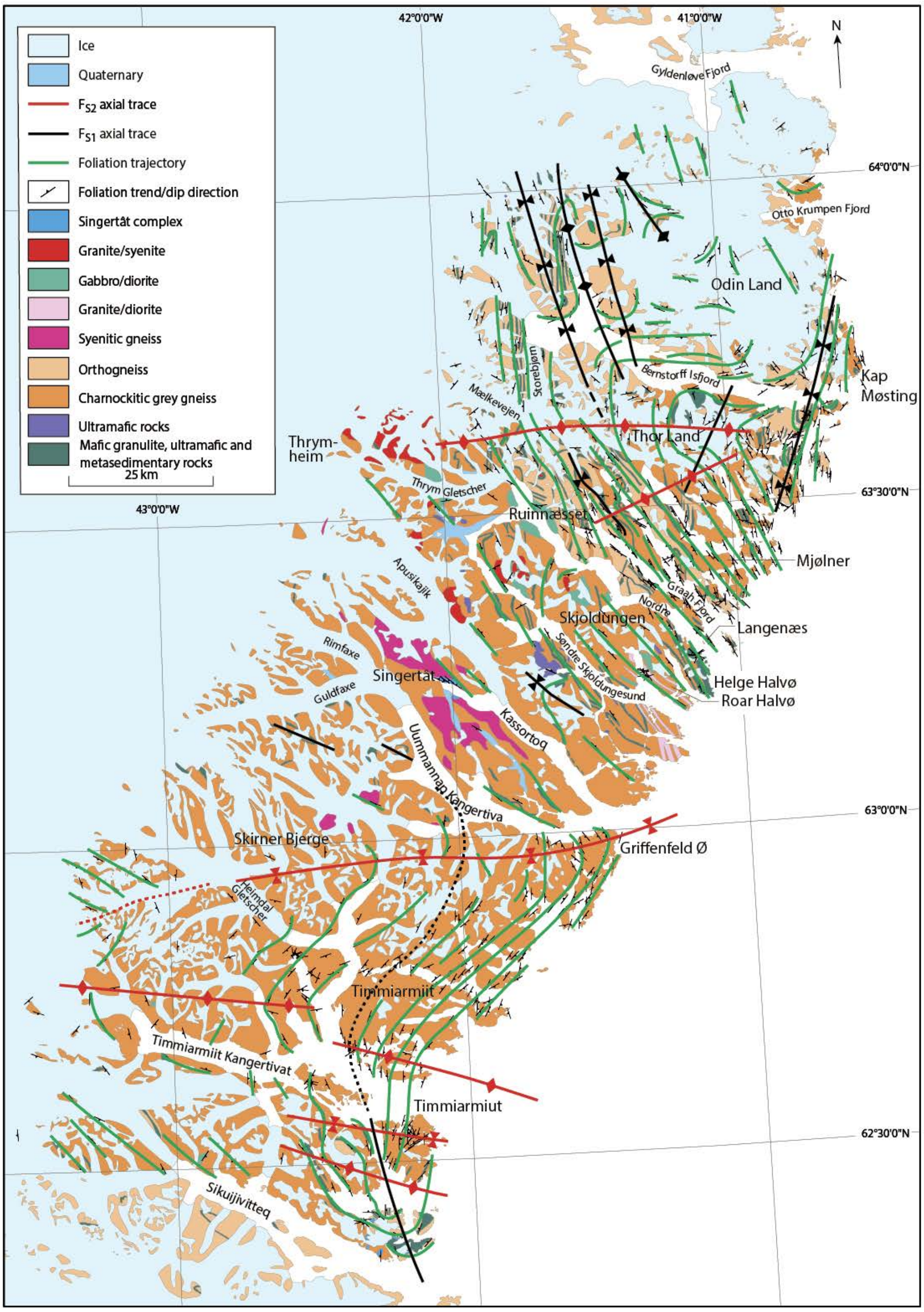

Figure 6. *Schematic geological map of the Trym Complex, with structural data and interpreted foliation trajectories and axial traces (modified after: Kolb, 2014).*

Table 15. *Undiscovered deposit estimates, deposit numbers, tract area, and deposit density for tract 14.*

Consensus undiscovered deposit estimates					Summary statistics					Tract Area (km^2)	Deposit density (N_{total}/km^2)
N90	N50	N10	N05	N01	N_{und}	s	Cv%	N_{known}	N_{total}		
0	0	2	4	6	0.81	1.50	190.0	0	0.81	7,967	0.000100

Estimator	Estimated number of undiscovered deposits				
	N90	N50	N10	N05	N01
Individual 1	0	4	10	15	25
Individual 2	0	2	4	7	10
Individual 3	0	0	0	1	3
Individual 4	0	0	0	0	3
Individual 5	0	0	2	3	4
Individual 6	0	0	1	2	3
Individual 7	0	0	0	2	3
Individual 8	0	0	4	10	15
Individual 9	0	0	3	5	7
Individual 10	0	0	1	2	3
Individual 11					
Individual12	0	0	0	2	3
Individual 13	0	0	1	2	4
Individual 14	0	1	2	3	4
Individual 15	0	0	0	5	10
Individual 16	0	0	0	1	4
Consensus	**0**	**0**	**2**	**4**	**6**

Table 16. *Results of Monte Carlo simulations of undiscovered resources in tract 14.*
[T- metric tons, Mt – million metric tons]

Material	Probability of at least the indicated amount						Probability of	
	0.95	0.9	0.5	0.1	0.05	Mean	Mean or greater	None
Au (T)	0	0	0	28	66	15	0.16	0.60
Rock (Mt)	0	0	0	15	42	10	0.12	0.60

Orogenic gold mineralization in the Paleoproterozoic Ketilidian Orogen of South Greenland

The Ketilidian Orogen is subdivided into three lithological and structural domains (Fig. 7; Steenfelt et al., 2016): (1) the Northern Domain; (2) the Central Domain; and (3) the Southern Domain. This division is largely followed by the definition of the tracts, where only the Central Domain is further subdivided based on geological complexity (Fig. 8). The Northern Domain is represented by tracts 3+10 in the west and 7 in the east. The Southern Domain is summarized under tract 12. Tracts 11 and 13 mark the northern part of the Central Domain, which is dominated by ca. 1818-1799 Ma granite (Figs. 7, 8; Østergaard et al., 2002). Tract 4 covers a buffer zone around the ca. 1800 Ma major Sârdloq Shear Zone, a near-vertical shear zone cutting the granite-gneiss terrane of the Central Domain (Fig. 7; Steenfelt et al., 2016). Tracts 5 and 6 represent the contact between the Central and the Southern domains, which hosts the Nalunaq gold deposit and numerous prospects and orogenic gold occurrences (Fig. 7; Stendal and Frei, 2000a).

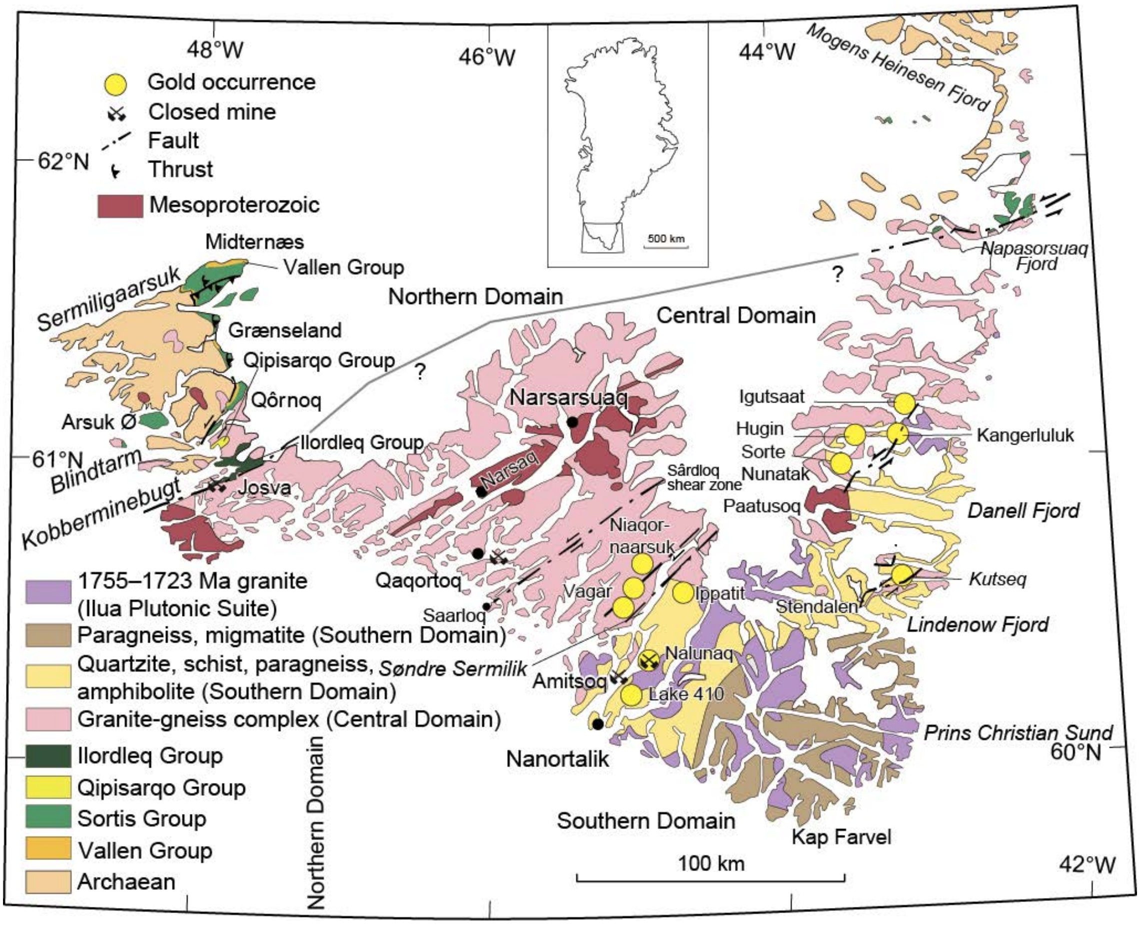

Figure 7. *Geological map of the Ketilidian Orogen and its foreland in South Greenland with orogenic gold occurrences.*

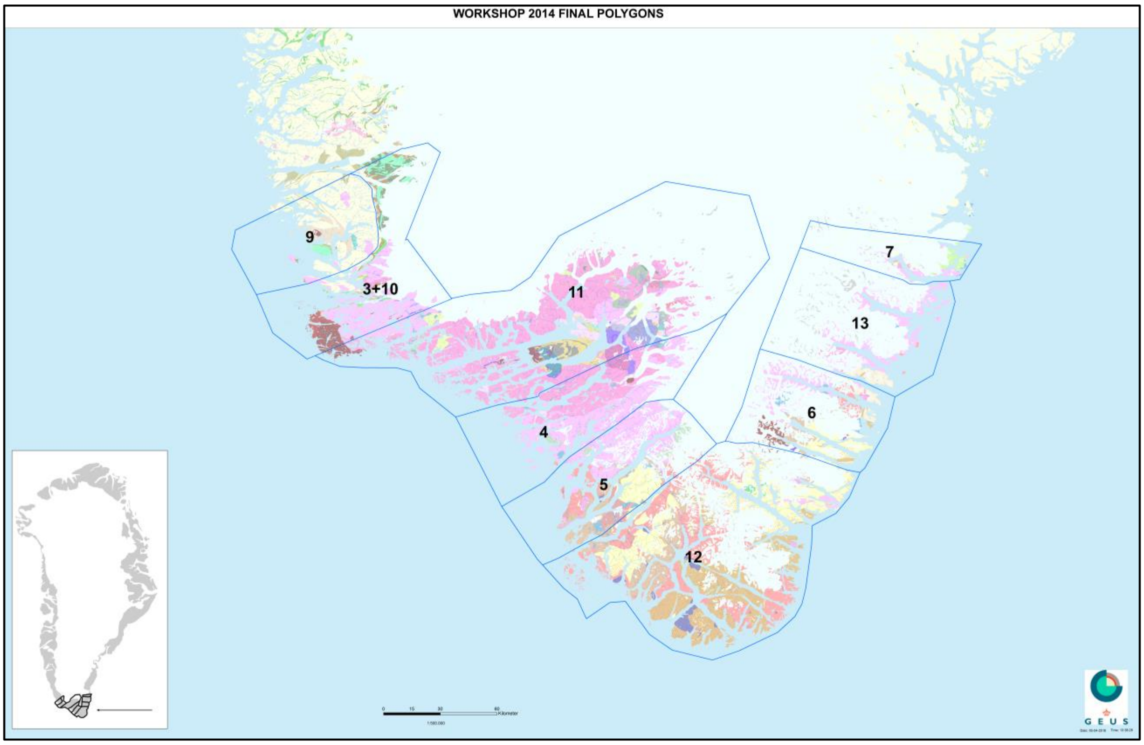

Figure 8. *Tracts assessed for undiscovered orogenic gold deposits in southern Greenland.*

Tract 7 – Northern Domain of the Ketilidian Orogen in eastern Greenland

The Border Zone in tract 7 (205 km^2) is only poorly known and mainly defined by Archean orthogneiss of the Thrym Complex that is intruded by Paleoproterozoic granite and unconformably overlain by sedimentary rocks (Fig. 7; Østergaard et al., 2002). The metamorphic grade is not documented in detail, but is thought to be in the greenschist to lower amphibolite facies. Several NE-trending shear zones crosscut the area (McCaffrey *et al.*, 2004), but no geochemical Au anomalies are recorded in the stream sediment data (Steenfelt, 2000; Steenfelt et al., 2016). The Northern Domain is interpreted as the foreland of the Ketilidian Orogen, which is not very prospective for orogenic gold mineralization. Based on this, the evaluation panel considered tract 7 not prospective (Tables 17, 18).

Table 17. *Undiscovered deposit estimates, deposit numbers, tract area, and deposit density for tract 7.*

Consensus undiscovered deposit estimates					Summary statistics					Tract Area (km^2)	Deposit density (N_{total}/km^2)
N90	N50	N10	N05	N01	N_{und}	s	Cv%	N_{known}	N_{total}		
0	0	0	1	3	0.14	0.56	420.0	0	0.14	210	0.000660

Estimator	Estimated number of undiscovered deposits				
	N90	N50	N10	N05	N01
Individual 1	0	0	2	3	3
Individual 2	0	0	1	2	4
Individual 3	0	0	0	0	2
Individual 4	0	0	0	0	2
Individual 5	0	0	0	1	2
Individual 6	0	0	1	2	2
Individual 7	0	0	0	1	2
Individual 8	0	0	1	1	4
Individual 9	0	0	0	1	3
Individual 10	0	0	2	3	5
Individual 11	0	0	0	0	1
Individual12	0	0	0	0	0
Individual 13	0	0	0	1	2
Individual 14	0	0	1	2	3
Individual 15	0	2	3	4	6
Individual 16	0	0	0	2	4
Consensus	**0**	**0**	**0**	**1**	**3**

Table 18. *Results of Monte Carlo simulations of undiscovered resources in tract 7.*
[T- metric tons, Mt – million metric tons]

Material	Probability of at least the indicated amount						Probability of	
	0.95	0.9	0.5	0.1	0.05	Mean	Mean or greater	None
Au (T)	0	0	0	0	7	3	0.06	0.92
Rock (Mt)	0	0	0	0	2	2	0.05	0.92

Tract 3+10 – Northern Domain of the Ketilidian Orogen in western Greenland

The Northern Domain as the orogenic foreland in the west is characterized by granite, diorite and sedimentary rocks of the Paleoproterozoic Vallen, Sortis, Qipisarqo and Ilordleq groups (Fig. 7; Østergaard et al., 2002; Steenfelt et al., 2016). An early ca. 1845 Ma SW-vergent fold-and-thrust structure is overprinted by N-vergent fold-and-thrust structure and late open folds (Garde *et al.*, 1998).

The N-vergent structures juxtapose amphibolite facies rocks on top of lower metamorphic to unmetamorphosed rocks (Garde *et al*., 1998). The Kobberminebugt shear zone system trends NE, formed as sinistral strike-slip zone ca. 1845 Ma and was reactivated at least once at ca. 1800 Ma as dextral strike-slip zone (Fig. 7; Garde et al., 2002a). The Kobberminebugt shear zone system was initially separated as tract 3 from the other areas, but the expert panel decided to evaluate the shear zone in the context of the surrounding rocks in tract 10 (Fig. 8). The name "Kobberminebugt" is derived from the two mines, Josva and Lilian, that produced not more than 2252 t of ore returning 60 t Cu, 50 kg Ag and 0.5 kg Au in the early 20st Century (Harry and Oen, 1964; Ghisler, 1968; Secher and Kalvig, 1987). The polymetallic sulfide mineralization occurs in veins, brecciae, foliation-parallel stringers and vugs in a hydrothermally altered shear zone (Harry and Oen, 1964). The genesis of the mineralization is unclear and magmatic or IOCG systems are discussed (Harry and Oen, 1964; Stensgaard *et al*., 2011).

The general setting of the terrane in the orogenic foreland and the presence of other hydrothermal mineral systems than orogenic gold led the expert panel to be not too optimistic in their evaluation. However, multiple overprint of hydrothermal systems is recognized elsewhere and the generally low metamorphic grade, below middle amphibolite facies conditions, Au anomalies in the stream sediments (Steenfelt, 2000; Steenfelt et al., 2016) as well as major shear zone systems were considered as positive, resulting in an estimation of at least one undiscovered orogenic gold deposits in the 1,543 km^2 tract at a confidence level of 50% (Tables 19, 20).

Table 19. *Undiscovered deposit estimates, deposit numbers, tract area, and deposit density for tract 3+10.*

Consensus undiscovered deposit estimates					Summary statistics					Tract Area (km^2)	Deposit density (N_{total}/km^2)
N90	N50	N10	N05	N01	N_{und}	s	Cv%	N_{known}	N_{total}		
0	1	2	4	6	1.20	1.40	120.0	0	1.20	1,543	0.000780

Estimator	Estimated number of undiscovered deposits				
	N90	N50	N10	N05	N01
Individual 1	2	2	5	20	50
Individual 2	3	6	10	15	30
Individual 3	0	0	1	2	3
Individual 4	0	2	2	3	4
Individual 5	1	1	1	2	4
Individual 6	0	0	2	3	4
Individual 7	0	0	2	3	4
Individual 8	0	1	2	3	5
Individual 9	0	1	1	2	3
Individual 10	1	2	3	5	10
Individual 11	0	1	2	3	3
Individual12	0	0	1	2	3
Individual 13	1	3	6	10	12
Individual 14	0	1	2	3	4
Individual 15	0	1	2	4	8
Individual 16	0	2	3	3	5
Consensus	**0**	**1**	**2**	**4**	**6**

Table 20. *Results of Monte Carlo simulations of undiscovered resources in tract 3+10.*
[T- metric tons, Mt – million metric tons]

Material	Probability of at least the indicated amount						Probability of	
	0.95	0.9	0.5	0.1	0.05	Mean	Mean or greater	None
Au (T)	0	0	4	49	100	22	0.18	0.30
Rock (Mt)	0	0	2	28	64	15	0.15	0.30

Tract 13 – northern part of the Central Domain, Ketilidian Orogen in eastern Greenland

The Central Domain in this tract is not well-studied and consists mainly of calc-alkaline, medium-grained to weakly porphyritic granite, granodiorite and orthogneiss interpreted as magmatic arc (Figs. 7, 8; Østergaard et al., 2002; Steenfelt et al., 2016). Metamorphism is in the amphibolite facies. The structures are near-vertical NE-trending with local higher strain zones at cm- to 1.5 km-scale (McCaffrey *et al.*, 2004). The setting in the magmatic arc of an orogen is not typical for orogenic gold deposits, and the 635 km^2 tract lacks geochemical Au anomalies (Steenfelt, 2000; Steenfelt et al., 2016). Based on this, tract 13 was considered only weakly prospective of orogenic gold deposits (Tables 21, 22).

Table 21. *Undiscovered deposit estimates, deposit numbers, tract area, and deposit density for tract 13.*

Consensus undiscovered deposit estimates					Summary statistics					Tract Area (km^2)	Deposit density (N_{total}/km^2)
N90	N50	N10	N05	N01	N_{und}	s	Cv%	N_{known}	N_{total}		
0	0	0	1	3	0.14	0.56	420.0	0	0.14	635	0.000210

Estimator	Estimated number of undiscovered deposits				
	N90	N50	N10	N05	N01
Individual 1	0	0	1	2	2
Individual 2	0	0	1	2	4
Individual 3	0	0	0	1	3
Individual 4	0	0	0	0	2
Individual 5	0	0	0	1	2
Individual 6	0	0	0	0	1
Individual 7	0	0	0	1	2
Individual 8	0	0	1	2	5
Individual 9	0	0	0	1	3
Individual 10	0	0	0	0	1
Individual 11	0	0	0	0	1
Individual12	0	0	0	1	2
Individual 13	0	0	1	2	4
Individual 14	0	0	1	2	3
Individual 15	0	1	4	5	7
Individual 16	0	0	0	1	4
Consensus	**0**	**0**	**0**	**1**	**3**

Table 22. *Results of Monte Carlo simulations of undiscovered resources in tract 13.*
[T- metric tons, Mt – million metric tons]

Material	Probability of at least the indicated amount						Probability of	
	0.95	0.9	0.5	0.1	0.05	Mean	Mean or greater	None
Au (T)	0	0	0	0	5	2	0.06	0.93
Rock (Mt)	0	0	0	0	2	2	0.05	0.93

Tract 11 – northern part of the Central Domain, Ketilidian Orogen in western Greenland

This tract of 4,367 km^2 is characterized by the younger ca. 1800 Ma granites of the Julianehåb Batholith (Figs. 7, 8; Østergaard et al., 2002; Steenfelt et al., 2016). The age and the geochemistry of these rocks are known, but details on the structural or metamorphic evolution are lacking. Geochemical Au anomalies in stream sediment samples and heavy mineral concentrates are known (Steenfelt, 2000; Steenfelt et al., 2016). A local prospector discovered visible gold in a quartz vein from this tract. A half-day reconnaissance in the area didn't return high gold grades, but detected abundant quartz veins in granite associated with propylitic alteration (Kolb and Bagas, 2013). The orogenic gold potential of the tract remains thus unclear and different types of gold mineral systems may have been active. The setting in the magmatic arc and the lack of record of major structural breaks were considered as main arguments against evaluating this tract as prospective for undiscovered orogenic gold deposits (Tables 23, 24). Magmatic arc terranes are only locally prospective for orogenic gold at their margins (see Tract 5).

Table 23. *Undiscovered deposit estimates, deposit numbers, tract area, and deposit density for tract 11.*

Consensus undiscovered deposit estimates					Summary statistics					Tract Area (km^2)	Deposit density (N_{total}/km^2)
N90	N50	N10	N05	N01	N_{und}	s	Cv%	N_{known}	N_{total}		
0	0	1	2	3	0.41	0.82	200.0	0	0.41	4,367	0.000093

Estimator	Estimated number of undiscovered deposits				
	N90	N50	N10	N05	N01
Individual 1	0	0	0	0	3
Individual 2	0	0	1	3	8
Individual 3	0	0	0	1	2
Individual 4	0	0	0	1	2
Individual 5	0	0	1	2	4
Individual 6	0	0	1	2	3
Individual 7	0	0	0	1	2
Individual 8	0	0	0	2	4
Individual 9	0	0	1	1	2
Individual 10	0	0	0	0	1
Individual 11	0	0	0	1	3
Individual12	0	0	0	2	3
Individual 13	0	0	1	2	4
Individual 14	0	1	2	3	4
Individual 15	0	1	2	3	6
Individual 16	0	0	0	2	4
Consensus	**0**	**0**	**1**	**2**	**3**

Table 24. *Results of Monte Carlo simulations of undiscovered resources in tract 11.*
[T- metric tons, Mt – million metric tons]

Material	Probability of at least the indicated amount						Probability of	
	0.95	0.9	0.5	0.1	0.05	Mean	Mean or greater	None
Au (T)	0	0	0	12	24	7	0.14	0.71
Rock (Mt)	0	0	0	5	14	5	0.10	0.71

Tract 4 – Sârdloq Shear Zone in the Central Domain of the Ketilidian Orogen in western Greenland

This tract comprises 1,961 km^2 around the NE-trending Sârdloq Shear Zone cutting across the granite-gneiss terrane (Figs. 7, 8). The shear zone is a ca. 1816 Ma near-vertical sinsitral strike-slip zone that has ductile fabrics of deformation in the amphibolite facies (Østergaard et al., 2002). Stream sediments and heavy mineral concentrates return anomalous gold contents locally (Steenfelt, 2000; Steenfelt et al., 2016). The Sârdloq Shear Zone represents a major structure in an arc terrane represented by the granite-gneiss terrane of the Central Domain (Julianehåb Batholith in the older literature), which is not a preferable setting for orogenic gold deposits. Based on this, the lack of variable possible host rocks and relative high metamorphic grades, the expert group found this tract not very prospective for orogenic gold mineralization (Tables 25, 26).

Table 25. *Undiscovered deposit estimates, deposit numbers, tract area, and deposit density for tract 4.*

Consensus undiscovered deposit estimates					Summary statistics					Tract Area (km^2)	Deposit density (N_{total}/km^2)
N90	N50	N10	N05	N01	N_{und}	s	Cv%	N_{known}	N_{total}		
0	0	2	3	5	0.74	1.30	180.0	0	0.74	1,961	0.000370

Estimator	Estimated number of undiscovered deposits				
	N90	N50	N10	N05	N01
Individual 1	0	2	5	20	50
Individual 2	0	0	3	6	10
Individual 3	0	0	0	1	2
Individual 4	0	0	2	2	3
Individual 5	0	0	1	2	3
Individual 6	0	0	1	2	3
Individual 7	0	0	0	1	2
Individual 8	0	0	1	2	3
Individual 9	0	0	1	2	3
Individual 10	0	1	2	3	5
Individual 11	0	0	1	1	2
Individual12	0	0	0	0	0
Individual 13	0	0	1	3	4
Individual 14	0	1	2	3	4
Individual 15	0	2	3	4	5
Individual 16	0	0	1	1	4
Consensus	**0**	**0**	**2**	**3**	**5**

Table 26. *Results of Monte Carlo simulations of undiscovered resources in tract 4.*

Material	Probability of at least the indicated amount						Probability of	
	0.95	0.9	0.5	0.1	0.05	Mean	Mean or greater	None
Au (T)	0	0	0	27	59	14	0.17	0.60
Rock (Mt)	0	0	0	13	39	9	0.13	0.60

Tract 5 – Contact of the Central and Southern domains of the Ketilidian Orogen in western Greenland

This tract is structured around the contact of the Central and Southern domains with 2,078 km^2, hosting the Nalunaq gold deposit and numerous orogenic gold occurrences and prospects (Figs. 7, 8; Stendal and Frei, 2000a). In the north, the tract is underlain by ca. 1840 Ma granodioritic gneiss (Østergaard et al., 2002), which is transected by a near-vertical NE-trending shear zone on the Niaqornaarsuk peninsula (Fig. 7). To the south, the Southern Domain has tectonic and unconformable contacts with the Central Domain (Fig.

7; Østergaard et al., 2002; Steenfelt et al., 2016). The Southern Domain is characterized by < 1793 Ma meta-sedimentary and meta-volcanic rocks of metamorphic grades ranging from granulite facies in the southeast to greenschist-lower amphibolite facies in the north (Østergaard et al., 2002; Steenfelt et al., 2016). The meta-sedimentary rocks are siliciclastic rocks and ca. 1808 Ma meta-volcanic rocks are tholeiitic lava flows and subaqueous pyroclastic rocks probably formed during rifting in an island-arc setting (Mueller *et al.*, 2000; Mueller *et al.*, 2002). In the south, the rocks are amphibolite, paragneiss and migmatite (Fig. 7; Østergaard et al., 2002; Steenfelt et al., 2016). Deformation affected the rocks of the Southern Domain in different stages of folding at all scales where an early SE-vergent deformation is followed by NE-vergent deformation in discrete shear zones such as the auriferous structure in Nalunaq (Bell and Kolb, 2013). The tract is intruded by granites, the Ilua Plutonic Suite (Rapakivi Granite in earlier literature), late during the tectonic history (Fig. 7; Østergaard et al., 2002; Steenfelt et al., 2016).

Vagar Gold Prospect

Gold mineralization was identified *in-situ* on the Niaqornaarsuk Peninsula in 1991 by Nunaoil A/S and in the following explored by NunaMinerals A/S by surface mapping, stream sediment and rock sampling, drilling and assaying (Fig. 9). The auriferous quartz veins are hosted in granite and granodiorite mainly at the contact with quartz diorite, gabbro and felsic metavolcanic rocks (Hughes *et al.,* 2013). The hydrothermal alteration assemblage consists of quartz, K-feldspar, muscovite, chlorite, biotite, epidote, calcite, monazite, pyrite, pyrrhotite, bismuth tellurides, sulfosalt minerals, fluorite and gold (Hughes *et al.*, 2013; Schlatter *et al.*, 2013). Elements enriched during the hydrothermal alteration are Bi, Au, Ag, Ga, W, As, Te and Ba (Schlatter *et al.*, 2013). Fluid inclusions in quartz veins are aqueous-carbonic and carbonic. The gold mineralization formed at 200-400°C and 0.5-1.5 kbar as estimated from fluid inclusions (Dyreborg, 1998).

The Vagar Prospect on the Niaqornaarsuk Penisnula comprises the 3x4 km large locality Greater Amphibolite Ridge (GAR), where several gold occurrences are located (Fig. 9). Channel sampling across an auriferous quartz vein returned up to 13 m at 70.1 ppm Au, and drill core intersections of altered host rock yield 0.96 ppm Au over 79 m including 23.3 m at 2.47 ppm Au (Hughes *et al.*, 2013). Auriferous quartz veins with visible gold are associated with two steeply dipping shear zones (Schlatter *et al.*, 2013).

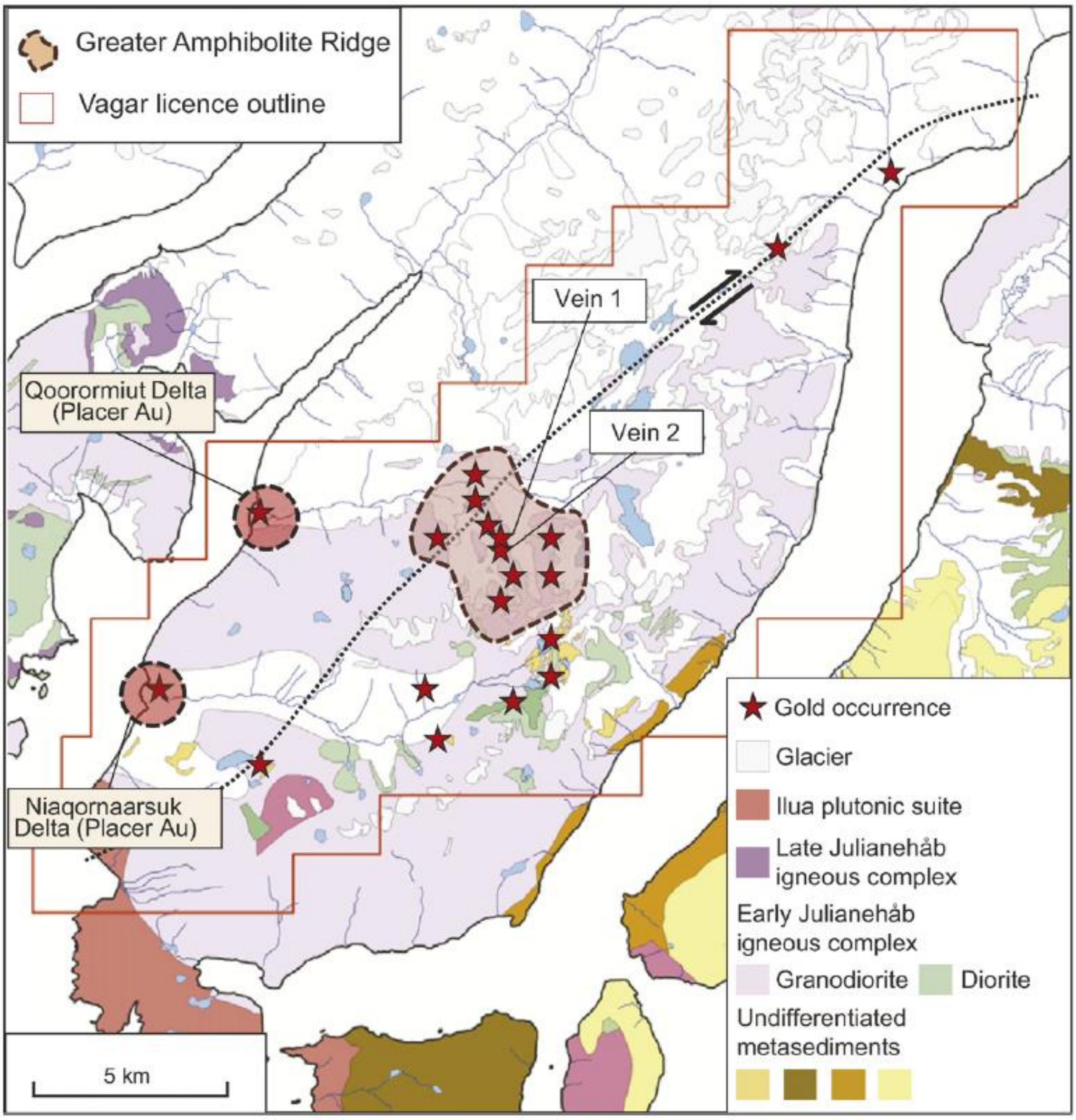

Figure 9. *Orogenic gold occurrences on Niaqornaarsuk peninsula, Vagar prospect (for location compare Fig. 7) (after: Steenfelt et al., 2016).*

Nalunaq Gold Deposit

The Nalunaq mine exploited approx. 714,000 t of ore at an average grade of 15 g/t Au from a 1700 m long and 0.1-2.0 m wide auriferous quartz vein, yielding 10.7 t gold metal. The auriferous vein is hosted in a moderately SE-dipping shear zone in hydrothermally altered amphibolite (Kaltoft *et al*., 2000; Bell and Kolb, 2013). The auriferous vein forms flexures where the wall rock changes in composition and grain size, and the gold grade is highest where the vein is steepest. The auriferous quartz veins have a 20-30 cm wide alteration halo consisting of quartz, plagioclase, biotite, actinolite, calcite, tourmaline, muscovite, arsenopyrite, löllingite, pyrrhotite, gold, maldonite, Bi-sulfosalts and pyrite (Kaltoft *et al*., 2000; Bell and Kolb, 2013). The hydrothermal alteration zone is enriched in Si, K, Au, As, Ag, Sb, Bi and W (Schlatter and Kolb, 2011). Gold is concentrated into three ore shoots plunging 20–25° SW, which correspond to the South, Target and Mountain blocks of the Nalunaq gold mine. The auriferous quartz veins cut an early ca. 1785 Ma clinopyroxene-garnet-plagioclase alteration around plagioclase-quartz veins and are intruded by ca. 1745 Ma granite (Bell and Kolb, 2013). Fluid inclusions are aqueous to aqueous-carbonic, moderate to high salinity (14-26 wt% $NaCl_{equiv.}$) inclusions (Kaltoft *et al.*, 2000), but a clear distinction between different inclusion generations has not been made. Arsenopyrite geochemistry is variable, leading to temperature estimates of 300-600°C (Kaltoft *et al.*, 2000). Stable D, O and S isotopes have a typical orogenic gold signature and indicate either metamorphic or magmatic fluid systems. Gold mineralization formed during the retrograde metamorphic path of the host rocks in a shear zone (Bell and Kolb, 2013). The tectonic setting at the contact between a supracrustal terrane and an arc-like granite-gneiss terrane is similar to the tectonic setting for Phanerozoic orogenic gold mineralization.

Other Gold Occurrences

Gold is hosted in two parallel, ≤ 2 m wide, locally laminated quartz veins that show pinch-and-swell structures and in altered amphibolite at Lake 410 a few kilometres south of Nalunaq (Olsen and Petersen, 1995; Porritt, 2004). Gold mineralization is structurally controlled by a set of moderately S/SE-dipping reverse shear zones in amphibolite and at the footwall contact of amphibolite with meta-arkose and paragneiss (Olsen and Petersen, 1995). The quartz veins are hosted in amphibolite with hydrothermal graphite-arsenopyrite-chalcopyrite-pyrite alteration. They contain as much as 2.22 ppm Au over 2 m in drill core intersections (Porritt, 2004), and mylonitic, altered amphibolite contains up to 4.8 ppm Au over 2 m in chip samples (Olsen and Petersen, 1995).

At Ippatit, gold mineralization (≤ 832 ppb Au) is hosted in up to 2 m wide, laminated quartz veins in biotite schist associated with a graphite-quartz-biotite-sulfide alteration assemblage (Olsen and Petersen, 1995). Similar quartz veins occur in amphibolite and meta-volcaniclastic rocks, which are separated by a S-dipping shear zone from the biotite schist. This shear zone is characterized by a quartz-graphite-pyrrhotite alteration assemblage.

Further gold anomalies in stream and whole rock samples in the 0.5-1 ppm-range are known from Kirkespiret valley close to the Nalunaq deposit and from Usuk east of Nanortalik and Tasermiut fjord, but those were not further investigated due to the relatively low gold grades.

This tract is rich in orogenic gold occurrences in either NE-trending near-vertical shear zone systems on the Niaqornaarsuk Peninsular and moderately SE-dipping shear zones to the south. Hydrothermal alteration assemblages including actinolite, biotite, K-feldspar and löllingite suggest gold mineralization at lower amphibolite facies conditions. Although no major shear zone is mapped at the contact between the Central and Southern domains and no aeromagnetic anomaly is observed, this contact appears to represent a large-scale control of orogenic gold mineralization in South Greenland. This setting at the contact of variably deformed plutonic rocks of an arc system and a meta-sedimentary and meta-volcanic terrane is typical of Phanerozoic orogenic gold systems (Groves et al., 1998b). Based on this, the expert panel estimated the tract to be very prospective for orogenic gold and that there could be at least four undiscovered orogenic gold deposits at a 90% confidence level (Tables 27, 28).

Table 27. *Undiscovered deposit estimates, deposit numbers, tract area, and deposit density for tract 5.*

Consensus undiscovered deposit estimates					Summary statistics					Tract Area (km^2)	Deposit density (N_{total}/km^2)
N90	N50	N10	N05	N01	N_{und}	s	Cv%	N_{known}	N_{total}		
3	6	9	13	20	6.30	3.90	62.0	1	7.30	2,078	0.003500

Estimator	Estimated number of undiscovered deposits				
	N90	N50	N10	N05	N01
Individual 1	2	5	10	15	20
Individual 2	4	8	15	30	50
Individual 3	4	6	10	15	20
Individual 4	2	6	7	10	15
Individual 5	5	7	9	10	15
Individual 6	5	10	15	20	30
Individual 7	5	6	7	8	10
Individual 8	4	6	15	25	40
Individual 9	3	3	10	15	20
Individual 10	3	5	10	20	30
Individual 11	2	3	4	4	4
Individual12	3	4	5	6	7
Individual 13	6	10	15	25	30
Individual 14	2	4	7	10	20
Individual 15	3	4	10	15	25
Individual 16	5	10	15	20	30
Consensus	**4**	**6**	**10**	**16**	**23**

Table 28. *Results of Monte Carlo simulations of undiscovered resources in tract 5.*
[T- metric tons, Mt – million metric tons]

Material	Probability of at least the indicated amount						Probability of	
	0.95	0.9	0.5	0.1	0.05	Mean	Mean or greater	None
Au (T)	5	12	57	300	420	110	0.29	0.03
Rock (Mt)	2	5	29	250	330	78	0.26	0.03

Tract 6 – Contact of the Central and Southern domains of the Ketilidian Orogen in eastern Greenland

This tract represents the eastward continuation of tract 5 along the contact of the Central Domain (Figs. 7, 8), an arc-like granite-gneiss terrane, and the Southern Domain, a terrane of metamorphosed sedimentary and volcanic rocks of a possible fore arc (Østergaard et al., 2002). The granite-gneiss terrane has protolith intrusion ages of granite and granodiorite between 1855 and 1835 Ma (Østergaard et al., 2002). Younger granite and granodiorite was emplaced ca. 1800-1790 Ma (Østergaard et al., 2002). Amphibolite facies paragneiss and anatectic granite of the Southern Domain occur along the east coast (Østergaard et al., 2002).

The 200 to 300 m thick Kangerluluk supracrustal sequence of ca. 1808 Ma metavolcanic and metasedimentary rocks on both sides of the Kangerluluk fjord and Sorte Nunatak is deformed and metamorphosed at lower amphibolite facies conditions (Fig. 7; Stendal, 1997; Mueller et al., 2000; Mueller et al., 2002). The sequence contains four lithofacies: (1) 2-40 m thick conglomerate–sandstone; (2) 1-50 m thick pyroclastic rocks; (3) 2-100 m thick volcanic rocks; and (4) 1-30 m peperite. The volcanic rocks form shallow-water breccia and pillow flows of feldspar-phyric or feldspar-pyroxene-phyric tholeiitic rocks. Mafic dykes intruded in wet unconsolidated pyroclastic rocks, resulting in the formation of peperite (Mueller *et al.*, 2000; Mueller *et al.*, 2002). The mafic volcanic and volcaniclastic rocks show an epidote-rich alteration interpreted as seafloor alteration (Stendal *et al.*, 2001). The geodynamic setting is interpreted as extension of a magmatic arc late in the tectonic evolution of the Ketilidian Orogen (Mueller *et al.*, 2000; Mueller *et al.*, 2002). This tract hosts several prospects and smaller orogenic gold occurrences (Fig. 7).

Kangerluluk gold mineralization and Hugin prospect

Gold mineralization at Kangerluluk and in NunaMinerals A/S Hugin prospect is hosted by NE/NNE- and ESE-trending shear zones and quartz veins in the Kangerluluk supracrustal sequence (Stendal, 1997; Stendal *et al.*, 2001). The shear zones are up to 1 km long and 20 m wide, and host locally en echelon, 1-2 m wide quartz veins that are 3-10 m long and have up to 40 cm wide alteration halos (Stendal *et al.*, 2001). The hydrothermal alteration assemblage varies with the host rock and is (1) quartz, pyrrhotite, pyrite in conglomerate and sandstone; and (2) epidote, quartz, chlorite, muscovite, apatite, pyrite, chalcopyrite in mafic volcanic and volcaniclastic rocks. Grab samples have as much as 118 ppm of gold and a 5 m chip sample returned 7.5 ppm gold (Stendal et al., 2001). The chalcopyrite-rich alteration zones contain 1.1-3.3 ppm gold and 1.6 wt.% copper over 0.5 m (Stendal et al., 2001). Lead and Nd isotopes suggest a juvenile mineralizing fluid that variably interacted with the wall rocks (Stendal et al., 2001). Locally, this orogenic style of gold mineralization was overprinted by a skarn-type garnet, epidote, amphibole, chalcopyrite, bornite, chalcocite alteration assemblage, which contains on average 1.8 wt.% copper and 0.1-1.0 ppm gold with a single sample returning 6.2 ppm gold (Stendal *et al.*, 2001).

Further north in Igutsaat Fjord, the small Igutsait gold occurrence is hosted by a quartz vein in sheared amphibolite and granitic gneiss. The hydrothermal alteration assemblage consists of quartz-albite-pyrite-pyrrhotite-arsenopyrite-magnetite-gold (Stendal and Frei, 2000b).

Jokum's shear gold prospect and Sorte Nunatak mineralization

Gold mineralization at Jokum's shear is hosted in a NE-trending shear zone that possibly continues along strike in the auriferous shear zone at Kangerluluk (Schlatter and Hughes, 2014). The shear zone is several tens of meters wide and can be followed over 1.5 km along strike in diorite and gabbro wall rocks. Hydrothermal alteration is characterized by quartz and carbonate, and gold mineralization is at 9.3 ppm gold over 3.1 m in a chip sample (Schlatter and Hughes, 2014).

A few kilometres to the west, gold-copper mineralization occurs at Sorte Nunatak in metamorphosed volcanic and volcaniclastic rocks with an epidote-carbonate-quartz alteration assemblage. The nature of the mineralization remains unclear but contains up to 9 ppm gold and 4 wt.% copper (Swager *et al.*, 1995).

Tract 6 is a relatively small tract of 787 km^2 in an area with extreme topography and ice cover (Fig. 8). Although there are auriferous shear zones in gold prospects and this tract represents the eastward continuation of the prospective tract 5, the expert panel was not very optimistic in their evaluation (Tables 29, 30). The potential for orogenic gold mineralization was acknowledged and two deposits may be found at a 50% confidence level, but the difficult geographic situation makes the discovery of an economic orogenic gold deposit less likely than in other similar prospective areas.

Table 29. *Undiscovered deposit estimates, deposit numbers, tract area, and deposit density for tract 6.*

Consensus undiscovered deposit estimates					Summary statistics					Tract Area (km^2)	Deposit density (N_{total}/km^2)
N90	**N50**	**N10**	**N05**	**N01**	N_{und}	**s**	**Cv%**	N_{known}	N_{total}		
0	2	3	4	5	1.80	1.40	77.0	0	1.80	787	0.002300

Estimator	Estimated number of undiscovered deposits				
	N90	**N50**	**N10**	**N05**	**N01**
Individual 1	0	2	2	4	6
Individual 2	0	1	2	4	8
Individual 3	1	2	3	4	5
Individual 4	0	0	1	2	2
Individual 5	2	3	3	4	5
Individual 6	0	0	1	2	2
Individual 7	1	2	3	4	5
Individual 8	1	2	4	7	13
Individual 9	0	0	2	3	3
Individual 10	1	2	3	4	5
Individual 11	0	0	1	2	2
Individual12	0	1	3	4	5
Individual 13	1	3	4	6	8
Individual 14	0	1	1	2	3
Individual 15	1	2	3	4	6
Individual 16	0	2	3	3	5
Consensus	**0**	**2**	**3**	**4**	**5**

Table 30. *Results of Monte Carlo simulations of undiscovered resources in tract 6.*
[T- metric tons, Mt – million metric tons]

Material	Probability of at least the indicated amount						Probability of	
	0.95	0.9	0.5	0.1	0.05	Mean	Mean or greater	None
Au (T)	0	0	10	72	150	32	0.21	0.19
Rock (Mt)	0	0	4	45	140	22	0.18	0.19

Tract 12 – Southern Domain of the Ketilidian Orogen in South Greenland

This tract comprises 4,402 km^2 of the Psammite and Pelite zones at the southern tip of Greenland (Fig. 8). It is mainly underlain by amphibolite to granulite facies meta-sedimentary and locally meta-volcanic rocks with increasing metamorphic grade to the southeast. Peak metamorphism in the north is estimated at 580°C and ~ 3 kbar and in the southeast at > 800°C and ~ 5 kbar (Garde *et al.*, 2002a). Anatectic granite was emplaced during metamorphism at ca. 1780-1790 Ma (Garde *et al.*, 2002a). Five deformation stages are distinguished (Garde *et al.*, 2002a). During D_1 tight, upright, NE-plunging folds and axial planar foliation formed. The folds are SE-vergent and interpreted to be formed by SE-directed deformation. The ca. 1792 Ma D_2 stage is characterized by a foliation and mineral stretching lineation formed during NE-vergent deformation and plunging gently SW and NE due to later folding. The intensity of D_2 fabrics increases eastward together with metamorphic grade (Garde *et al.*, 2002a). During ca. 1786-1778 Ma, large-scale, close to tight, NE-trending D_3 folds formed at high metamorphic grades and are overturned to the NW (Garde *et al.*, 2002a). D_4 folds are kilometre-scale open to tight, upright folds with NE trends and formed ca. 1736 Ma. D_5 folds are open, kilometre-scale, basin-like fold structures. Granites of the Ilua Plutonic Suite were emplaced between 1755–1723 Ma at approx. 2 kbar (van Breemen *et al.*, 1974; Hutton *et al.*, 1990; Windley, 1991; Hutton and Brown, 2000; Garde *et al.*, 2002b), mainly as extensive flat-lying sheets during N-S extension and normal S-vergent deformation (Hutton et al., 1990; Hutton and Brown, 2000). Gold mineralization is known from a narrow amphibolite horizon in Kutseq Fjord (Fig. 7), where to the south a larger pluton of 1792 ± 1 Ma hornblende granite occurs (Garde *et al.*, 2002a).

Kutseq gold mineralization

At Kutseq, orogenic gold mineralization is hosted in shear zones in massive and banded amphibolite. The amphibolite forms an approx. 100 m thick unit in paragneiss in a WSW-trending, 6 km long antiform (Østergaard, 1998). At the southern limb of the antiform, near-vertical, E-trending shear zones are developed at scales ranging from 10-20 cm width and 10-12 m strike length to 12 m width and 500-600 m width. Gold is hosted in quartz veins and hydrothermally altered amphibolite. Ore minerals in the vein and alteration zones are arsenopyrite, pyrrhotite, löllingite and gold with up to 38.5 ppm gold and 6 wt.% arsenic (Østergaard, 1998). Arsenopyrite geothermometry indicates temperatures for gold mineralization of 440-560°C (Østergaard, 1998).

Tract 12 is only weakly explored and no major shear zones are mapped. Geochemical anomalies are scarce and the metamorphic grade is high, in particular in the southeast. There may be, however, retrograde shear zones and orogenic gold mineralization like the Kutseq occurrence, probably most likely in the northern part of the tract where Kutseq also is located (Fig. 7). The expert panel considered this part prospective with one undiscovered orogenic gold deposit present at 90% confidence level (Tables 31, 32). This positive evaluation is based on the facts that tract 12 is underlain by a polymetamorphic, highly deformed, accreted terrane that locally hosts orogenic gold occurrences and represents the southward continuation of the highly prospective tract 5. Notably, the ore mineralogy of the Kutseq gold occurrence is similar to the Nalunaq gold deposit several tens of kilometres WSW.

Table 31. *Undiscovered deposit estimates, deposit numbers, tract area, and deposit density for tract 12.*

Consensus undiscovered deposit estimates					Summary statistics					Tract Area (km^2)	Deposit density (N_{total}/km^2)
N90	**N50**	**N10**	**N05**	**N01**	N_{und}	**s**	**Cv%**	N_{known}	N_{total}		
1	2	4	6	8	2.40	1.90	76.0	0	2.40	4,402	0.00550

Estimator	Estimated number of undiscovered deposits				
	N90	**N50**	**N10**	**N05**	**N01**
Individual 1	0	5	10	25	50
Individual 2	1	4	8	12	25
Individual 3	0	0	3	6	8
Individual 4	0	0	2	2	2
Individual 5	1	1	2	2	4
Individual 6	1	2	4	4	5
Individual 7	0	1	2	4	5
Individual 8	2	2	3	7	10
Individual 9	0	1	3	3	5
Individual 10	1	2	5	10	20
Individual 11	1	2	3	3	3
Individual12	0	0	2	3	4
Individual 13	1	3	4	6	8
Individual 14	1	2	3	4	5
Individual 15	2	3	4	6	10
Individual 16	0	0	3	5	7
Consensus	**1**	**2**	**4**	**6**	**8**

Table 32. *Results of Monte Carlo simulations of undiscovered resources in tract 12.*
[T- metric tons, Mt – million metric tons]

Material	Probability of at least the indicated amount						Probability of	
	0.95	0.9	0.5	0.1	0.05	Mean	Mean or greater	None
Au (T)	0	1	15	110	200	41	0.22	0.07
Rock (Mt)	0	0	6	63	190	28	0.19	0.07

Orogenic gold deposits in the North Atlantic Craton of western Greenland

The North Atlantic Craton is subdivided into several terranes and blocks with different tectonometamorphic history in the Archean (Fig. 10; Friend et al., 1996; Friend and Nutman, 2001; Nutman and Friend, 2007; Kolb et al., 2012; Dziggel et al., 2014). These terranes and blocks are commonly separated by major shear zones, which locally are prospective for orogenic gold mineralization (Fig. 10; Kolb et al., 2013a). Most of the North Atlantic Craton is underlain by orthogneiss with only narrow belts of mafic-ultramafic rocks and metasedimentary rocks at upper amphibolite-granulite facies. Exceptions are the Isukasia Terrane with the Isua Greenstone Belt at upper greenschist-lower amphibolite facies, the Kvanefjord Amphibolite in the Paamiut Block at mid-amphibolite facies and most of the Tartoq Group of the Sermiligaarsuk Block at greenschist facies metamorphic grades (Fig. 10; Kolb et al., 2013a). Based on the subdivision into terranes and blocks, the metamorphic grade and known gold occurrences, the North Atlantic Craton of western Greenland was subdivided into 12 tracts (Fig. 11). The expert panel decided to evaluate several tracts together because of similar geology. A detailed description of the geology of the North Atlantic Craton of western Greenland and orogenic gold mineralization is given in Kolb *et al.* (2013a), which is printed as a complete copy in appendix D.

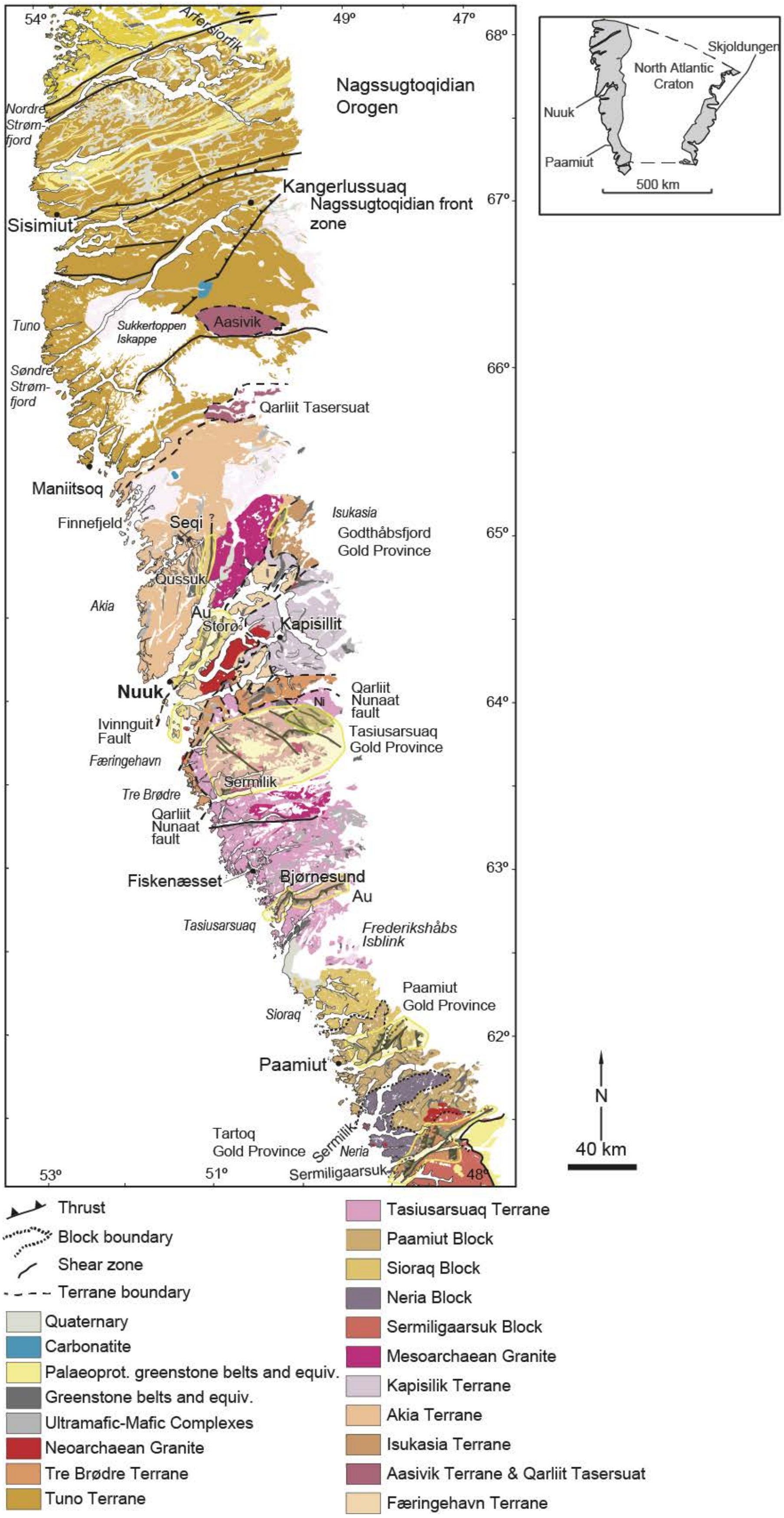

Figure 10. *Geological map of the North Atlantic Craton in western Greenland with gold provinces outlined (modified after: Kolb et al., 2013a; Kolb et al., 2015a).*

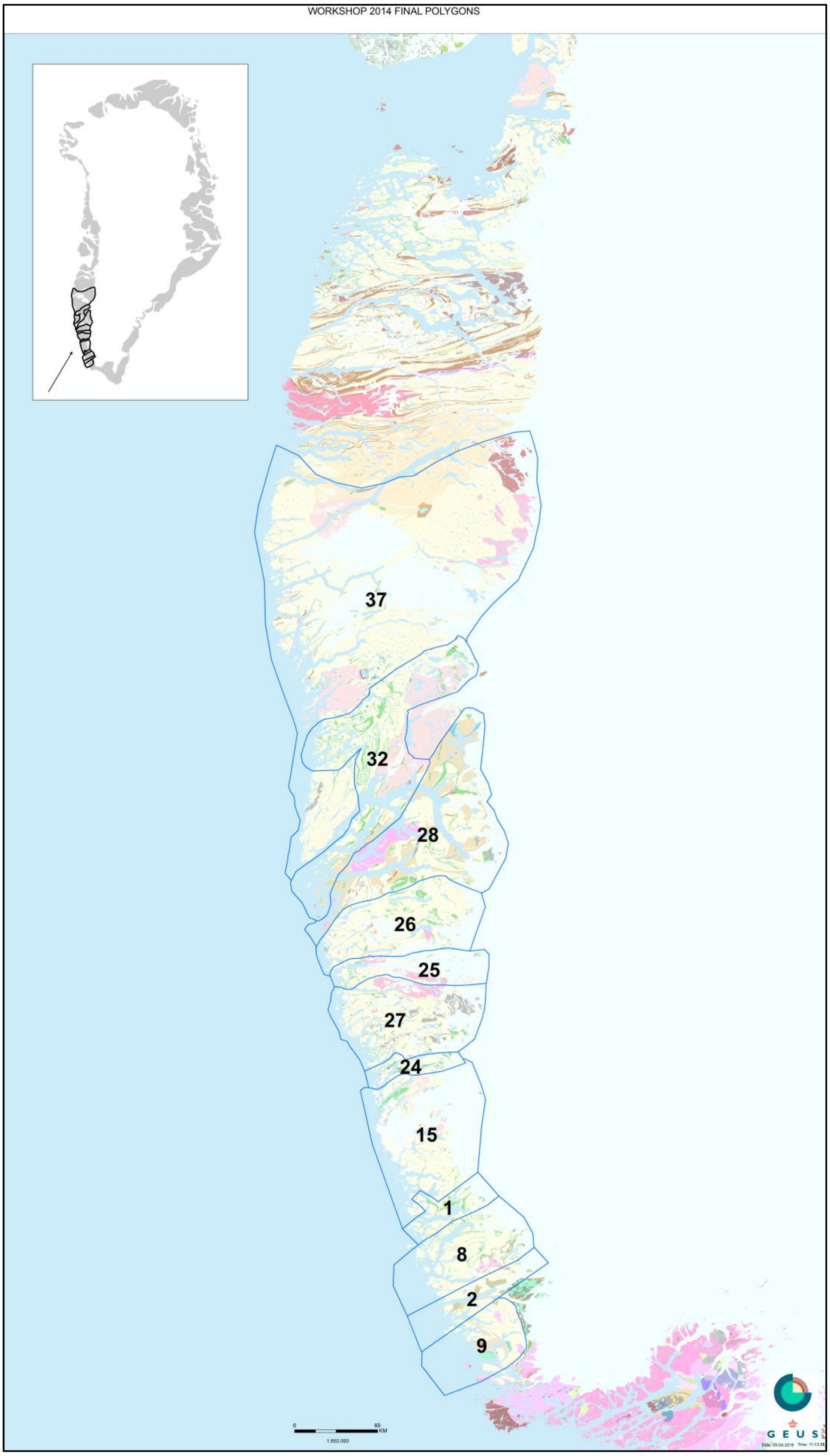

Figure 11. *Tracts assessed for undiscovered orogenic gold deposits in south western Greenland.*

Tracts 8, 9, 15, 26, 27 – North Atlantic Craton dominated by orthogneiss

These tracts cover different Meso- to Neoarchean terranes, which are dominated by orthogneiss and lack gold anomalies (max. 500 ppb) in the available data set (Figs 10, 11). The tract area covers 12,277 km^2 and was not considered prospective for orogenic gold deposits with only 2 undiscovered deposits estimated at 10% confidence level (Tables 33, 34).

Table 33. *Undiscovered deposit estimates, deposit numbers, tract area, and deposit density for tract 8, 9, 15, 26, 27.*

Consensus undiscovered deposit estimates					**Summary statistics**					**Tract Area (km^2)**	**Deposit density (N_{total}/km^2)**
N90	**N50**	**N10**	**N05**	**N01**	**N_{und}**	**s**	**Cv%**	**N_{known}**	**N_{total}**		
0	0	2	5	7	0.89	1.70	190.0	0	0.89	12,277	0.000072

Estimator	**Estimated number of undiscovered deposits**				
	N90	**N50**	**N10**	**N05**	**N01**
Individual 1	0	2	10	15	20
Individual 2	0	2	5	10	15
Individual 3	0	0	0	1	3
Individual 4	0	0	0	1	5
Individual 5	0	1	2	3	5
Individual 6	0	0	2	4	6
Individual 7	0	0	0	1	3
Individual 8	0	0	5	15	25
Individual 9	0	1	1	3	3
Individual 10	0	1	2	3	4
Individual 11					
Individual12	0	1	1	2	3
Individual 13	0	0	0	2	4
Individual 14	0	1	2	4	8
Individual 15	0	0	1	5	10
Individual 16	0	0	3	5	5
Consensus	**0**	**0**	**2**	**5**	**7**

Table 34. *Results of Monte Carlo simulations of undiscovered resources in tract 8, 9, 15, 26, 27.* [T- metric tons, Mt – million metric tons]

Material	**Probability of at least the indicated amount**						**Probability of**	
	0.95	**0.9**	**0.5**	**0.1**	**0.05**	**Mean**	**Mean or greater**	**None**
Au (T)	0	0	0	33	78	15	0.17	0.60
Rock (Mt)	0	0	0	17	48	11	0.13	0.60

Tract 2 – Tartoq Gold Province

The Tartoq Gold Province covers several greenstone belts with six known gold occurrences, where two occurrences have already been drill-tested during exploration but with a volcanic massive sulfide (VMS) exploration model. Abundant shear zones that host gold quartz veins and a pervasive chlorite-ankerite-pyrite alteration make this tract the most prospective tract for orogenic gold deposits in Greenland after the evaluation by the expert panel (Tables 35, 36). The assessment resulted in the estimation of 2 undiscovered deposits at 90% confidence level and 5 deposits at 50% confidence level in this only 866 km^2 tract.

Table 35. *Undiscovered deposit estimates, deposit numbers, tract area, and deposit density for tract 2.*

Consensus undiscovered deposit estimates					Summary statistics					Tract Area (km^2)	Deposit density (N_{total}/km^2)
N90	N50	N10	N05	N01	N_{und}	s	Cv%	N_{known}	N_{total}		
2	5	7	11	13	4.90	2.90	58.0	0	0.89	866	0.005700

Estimator	Estimated number of undiscovered deposits				
	N90	N50	N10	N05	N01
Individual 1	3	8	15	25	50
Individual 2	1	3	5	8	15
Individual 3	1	2	3	7	10
Individual 4	0	2	2	3	4
Individual 5	4	8	10	15	20
Individual 6	2	4	6	8	10
Individual 7	1	2	3	4	8
Individual 8	2	7	10	20	40
Individual 9	2	4	4	5	10
Individual 10	2	5	10	15	20
Individual 11					
Individual12	1	2	3	3	3
Individual 13	3	4	5	8	10
Individual 14	2	2	4	5	6
Individual 15	3	5	6	7	8
Individual 16	8	16	25	25	35
Consensus	**2**	**5**	**7**	**11**	**13**

Table 36. *Results of Monte Carlo simulations of undiscovered resources in tract 2.*
[T- metric tons, Mt – million metric tons]

Material	Probability of at least the indicated amount						Probability of	
	0.95	0.9	0.5	0.1	0.05	Mean	Mean or greater	None
Au (T)	2	8	43	240	340	87	0.27	0.04
Rock (Mt)	1	3	21	210	290	61	0.24	0.04

Tract 1 – Paamiut Gold Province

The Paamiut Gold Province covers an area of 702 km^2, which is underlain by several greenstone belts at mid-amphibolite facies grades with several shear zone systems cross-cutting. Stream sediment samples with up to 2 ppm Au and six gold occurrences are known, which have not been explored in detail. Based on this favourable geology, the expert panel estimated this tract to be very prospective for orogenic gold mineralization, with one undiscovered deposit at 90% confidence level (Tables 37, 38). The potential assessed for this tract is similar to tract 5, which covers the Nalunaq Gold Deposit and the Vagar occurrence in South Greenland.

Table 37. *Undiscovered deposit estimates, deposit numbers, tract area, and deposit density for tract 1.*

Consensus undiscovered deposit estimates					Summary statistics					Tract Area (km^2)	Deposit density (N_{total}/km^2)
N90	N50	N10	N05	N01	N_{und}	s	Cv%	N_{known}	N_{total}		
1	2	4	7	10	2.50	2.20	85.0	0	2.50	702	0.003600

Estimator	Estimated number of undiscovered deposits				
	N90	N50	N10	N05	N01
Individual 1	3	8	15	25	50
Individual 2	1	3	5	8	15
Individual 3	1	2	3	7	10
Individual 4	0	2	2	3	4
Individual 5	4	8	10	15	20
Individual 6	2	4	6	8	10
Individual 7	1	2	3	4	8
Individual 8	2	7	10	20	40
Individual 9	2	4	4	5	10
Individual 10	2	5	10	15	20
Individual 11					
Individual12	1	2	3	3	3
Individual 13	3	4	5	8	10
Individual 14	2	2	4	5	6
Individual 15	3	5	6	7	8
Individual 16	8	16	25	25	35
Consensus	**2**	**5**	**7**	**11**	**13**

Table 38. *Results of Monte Carlo simulations of undiscovered resources in tract 1.*
[T- metric tons, Mt – million metric tons]

Material	Probability of at least the indicated amount						Probability of	
	0.95	0.9	0.5	0.1	0.05	Mean	Mean or greater	None
Au (T)	0	1	14	110	220	44	0.23	0.07
Rock (Mt)	0	0	6	66	200	30	0.19	0.07

Tract 24 – Bjørnesund Greenstone Belt, Tasiusarsuaq Gold Province

The Bjørnesund Greenstone Belt hosts three minor gold occurrences in retrograde shear zones. Although up to 570 ppb Au are recorded and stream sediments are anomalous in gold, the expert panel didn't rate this 543 km^2 sized tract very prospective for orogenic gold deposits, because of the size of the known anomalies and the lack of major regional structures and alteration (Fig. 10; Tables 39, 40).

Table 39. *Undiscovered deposit estimates, deposit numbers, tract area, and deposit density for tract 24.*

Consensus undiscovered deposit estimates					Summary statistics					Tract Area (km^2)	Deposit density (N_{total}/km^2)
N90	N50	N10	N05	N01	N_{und}	s	Cv%	N_{known}	N_{total}		
0	0	2	3	5	0.74	1.30	180.0	0	0.74	543	0.001400

Estimator	Estimated number of undiscovered deposits				
	N90	N50	N10	N05	N01
Individual 1	0	0	4	8	12
Individual 2	0	0	2	4	6
Individual 3	0	0	0	1	3
Individual 4	0	0	0	2	2
Individual 5	1	3	7	10	15
Individual 6	0	0	1	2	3
Individual 7	0	0	0	1	3
Individual 8	0	0	1	2	4
Individual 9	0	1	3	3	10
Individual 10	0	1	2	3	4
Individual 11					
Individual12	0	1	2	2	3
Individual 13	0	0	1	2	4
Individual 14	0	0	2	4	6
Individual 15	0	1	2	3	4
Individual 16	0	0	1	3	5
Consensus	**0**	**0**	**2**	**3**	**5**

Table 40. *Results of Monte Carlo simulations of undiscovered resources in tract 24.*

Material	Probability of at least the indicated amount						Probability of	
	0.95	0.9	0.5	0.1	0.05	Mean	Mean or greater	None
Au (T)	0	0	0	27	59	0	0.17	0.61
Rock (Mt)	0	0	0	13	37	0	0.12	0.61

Tract 25 – Sermilik Greenstone Belt, Tasiusarsuaq Gold Province

The Sermilik Greenstone Belt is a small belt at upper amphibolite facies grades with small retrograde shear zones and folds, locally hosting gold quartz veins with up to 6 ppm Au (Fig. 10). The 751 km^2 large tract was not considered very prospective for deposit-sized orogenic gold mineralization, based on the described small orogenic gold occurrences (Tables 41, 42).

Table 41. *Undiscovered deposit estimates, deposit numbers, tract area, and deposit density for tract 25.*

Consensus undiscovered deposit estimates					Summary statistics					Tract Area (km^2)	Deposit density (N_{total}/km^2)
N90	N50	N10	N05	N01	N_{und}	s	Cv%	N_{known}	N_{total}		
0	0	2	2	4	0,66	1.10	170.0	0	0.66	751	0.000880

Estimator	Estimated number of undiscovered deposits				
	N90	N50	N10	N05	N01
Individual 1	0	0	2	4	6
Individual 2	0	0	1	2	4
Individual 3	0	0	0	0	3
Individual 4	0	0	2	2	3
Individual 5	1	2	5	7	10
Individual 6	0	1	2	4	6
Individual 7	0	0	0	0	2
Individual 8	0	0	1	2	3
Individual 9	0	0	1	1	4
Individual 10	1	2	3	4	5
Individual 11					
Individual12	0	0	0	1	2
Individual 13	0	0	0	0	2
Individual 14	0	0	2	3	4
Individual 15	0	1	3	4	5
Individual 16	0	0	2	2	3
Consensus	**0**	**0**	**2**	**2**	**4**

Table 42. *Results of Monte Carlo simulations of undiscovered resources in tract 25.*
[T- metric tons, Mt – million metric tons]

Material	Probability of at least the indicated amount						Probability of	
	0.95	0.9	0.5	0.1	0.05	Mean	Mean or greater	None
Au (T)	0	0	0	22	50	12	0.17	0.60
Rock (Mt)	0	0	0	12	31	8	0.12	0.60

Tract 28 – Tasiusarsuaq Gold Province

Tract 28 (5,191 km^2) covers the northern part of the Tasiusarsuaq Gold Province, where gold mineralization of up to 500 ppb Au is hosted in amphibolite facies shear zones in granulite facies orthogneiss, ultramafic rocks and mafic granulite (Figs. 10, 11). The Neoarchean shear zones trend NW and have a regular spacing of 2-6 km. Gold mineralization is however weak, narrow and dispersed along the shear zones. Based on this, the expert panel evaluated tract 28 not very prospective for orgenic gold deposits (Tables 43, 44).

Table 43. *Undiscovered deposit estimates, deposit numbers, tract area, and deposit density for tract 28.*

Consensus undiscovered deposit estimates					Summary statistics					Tract Area (km^2)	Deposit density (N_{total}/km^2)
N90	**N50**	**N10**	**N05**	**N01**	N_{und}	**s**	**Cv%**	N_{known}	N_{total}		
0	0	2	3	6	0.77	1.40	190.0	0	0.77	5,191	0.000150

Estimator	Estimated number of undiscovered deposits				
	N90	**N50**	**N10**	**N05**	**N01**
Individual 1	0	0	2	5	10
Individual 2	0	0	1	2	4
Individual 3	0	0	1	3	5
Individual 4	0	0	0	2	3
Individual 5	0	0	0	5	10
Individual 6	0	0	2	4	6
Individual 7	0	0	0	1	3
Individual 8	0	0	4	6	8
Individual 9	0	2	3	3	5
Individual 10	0	0	1	2	3
Individual 11					
Individual12	0	0	1	2	3
Individual 13	0	0	2	4	5
Individual 14	0	1	3	5	8
Individual 15	0	0	2	4	6
Individual 16	0	1	2	2	4
Consensus	**0**	**0**	**2**	**3**	**6**

Table 44. *Results of Monte Carlo simulations of undiscovered resources in tract 28.*
[T- metric tons, Mt – million metric tons]

Material	Probability of at least the indicated amount						Probability of	
	0.95	**0.9**	**0.5**	**0.1**	**0.05**	**Mean**	**Mean or greater**	**None**
Au (T)	0	0	0	26	60	14	0.16	0.61
Rock (Mt)	0	0	0	13	39	10	0.12	0.61

Tract 32 – Godthåbsfjord Gold Province

Tract 32 includes 5,211 km^2 and several Neoarchean gold projects and two in an advanced state of exploration, namely Storø and Qussuk (Figs. 10, 11). The geology of this tract is complex with several Eo- to Mesoarchean terranes that were assembled in two Neoarchean orogenies. The complex set of shear zones hosts various orogenic gold occurrences with amphibolite facies alteration zones, thus belonging to the hypozonal group of deposits. A major shear zone, the NE-trending Ivinnguit Fault was reactivated several times and most of the gold occurrences cluster around this shear zone, mainly located in greenstone belt equivalents that form narrow belts between granite-gneiss domes. The expert group discussed a possible analogy to the well-endowed Neoarchean Southern Cross Greenstone Belt in Western Australia and similar settings in Finland with producing gold mines. The expert panel was optimistic and evaluated tract 32 very prospective for hypozonal orogenic gold deposits with as many as 4 undiscovered deposits at 90% confidence level and 7 undiscovered deposits at 50% confidence level (Tables 45, 46).

Table 45. *Undiscovered deposit estimates, deposit numbers, tract area, and deposit density for tract 32.*

Consensus undiscovered deposit estimates					Summary statistics					Tract Area (km^2)	Deposit density (N_{total}/km^2)
N90	N50	N10	N05	N01	N_{und}	s	Cv%	N_{known}	N_{total}		
4	7	11	20	33	8.10	6.10	75.0	0	8.10	5,211	0.001600

Estimator	Estimated number of undiscovered deposits				
	N90	N50	N10	N05	N01
Individual 1	4	10	15	20	30
Individual 2	3	6	8	12	25
Individual 3	1	2	4	7	10
Individual 4	2	2	5	8	10
Individual 5	5	7	9	18	25
Individual 6	5	10	15	20	30
Individual 7	2	4	6	9	12
Individual 8	5	20	50	100	200
Individual 9	4	6	15	15	25
Individual 10	5	8	10	15	20
Individual 11					
Individual12	2	2	3	4	5
Individual 13	3	6	10	12	14
Individual 14	3	4	8	10	15
Individual 15	6	10	12	15	20
Individual 16	5	15	25	40	50
Consensus	**4**	**7**	**11**	**20**	**33**

Table 46. *Results of Monte Carlo simulations of undiscovered resources in tract 32.*
[T- metric tons, Mt – million metric tons]

Material	Probability of at least the indicated amount						Probability of	
	0.95	0.9	0.5	0.1	0.05	Mean	Mean or greater	None
Au (T)	8	17	77	390	540	150	0.30	0.02
Rock (Mt)	3	7	41	310	380	100	0.29	0.02

Tract 37 – Akia Terrane

The Akia Terrane is characterized by granulite facies orthogneiss, narrow greenstone belt equivalents and mafic-ultramafic intrusions that host nickel mineralization (Fig. 10; Garde, 1990, 1991, 1997, 2007; Garde et al., 2013; Kolb et al., 2015a). The terrane in general is poorly mapped and poorly understood. Recent investigations suggest a possible regional-scale impact structure in the northwestern part of the terrane (Garde et al., 2012; Garde et al., 2013). Stream sediment samples, locally, are anomalous in gold in particular in the Fiskefjord area, where possible gold-quartz vein mineralization was studied. Tract 37 is with 16,892 km^2 one of the larger tracts with a largely unresolved Neoarchean history, and was therefore evaluated as being relatively prospective for orogenic gold deposits with 1 undiscovered deposit at 50% confidence level (Tables 47, 48).

Table 47. *Undiscovered deposit estimates, deposit numbers, tract area, and deposit density for tract 37.*

Consensus undiscovered deposit estimates					Summary statistics					Tract Area (km^2)	Deposit density (N_{total}/km^2)
N90	N50	N10	N05	N01	N_{und}	s	Cv%	N_{known}	N_{total}		
0	1	3	5	7	1.50	1.80	120.0	0	1.50	16,892	0.00089

Estimator	Estimated number of undiscovered deposits				
	N90	N50	N10	N05	N01
Individual 1	2	5	20	30	50
Individual 2	0	1	4	6	8
Individual 3	0	1	2	3	5
Individual 4	0	0	0	2	3
Individual 5	0	0	2	4	6
Individual 6	0	1	2	4	6
Individual 7	0	0	1	3	5
Individual 8	0	0	7	15	30
Individual 9	0	0	1	3	3
Individual 10	1	2	3	4	5
Individual 11					
Individual12	0	0	1	2	3
Individual 13	0	1	2	3	5
Individual 14	1	2	3	4	5
Individual 15	0	0	3	5	10
Individual 16	0	2	4	18	12
Consensus	**0**	**1**	**3**	**5**	**7**

Table 48. *Results of Monte Carlo simulations of undiscovered resources in tract 37.*
[T- metric tons, Mt – million metric tons]

Material	Probability of at least the indicated amount						Probability of	
	0.95	0.9	0.5	0.1	0.05	Mean	Mean or greater	None
Au (T)	0	0	5	62	140	28	0.20	0.30
Rock (Mt)	0	0	0	0	0	19	0.20	0.30

Orogenic gold mineralization in the Nagssugtoqidian and Rinkian orogens of western Greenland

The Nagssugtoqidian Orogen is subdivided into the northern (NNO), central (CNO) and southern (SNO) segments (van Gool *et al.*, 2002a), and evaluated as a whole in tract 33b (Figs. 12, 13). The NNO consists of Archean orthogneiss that is at granulite facies grades in the south, decreasing to amphibolite facies to the north (van Gool *et al.*, 2002a). Narrow belts composed of paragneiss and mafic granulite/amphibolite are not discriminated and of either Archean or Paleoproterozoic age (Fig. 13; van Gool et al., 2002a). These belts form large-scale fold structures dominating over shallow-dipping and near-vertical shear zones (van Gool *et al.*, 2002a). Paleoproterozoic, <1904 ± 8 Ma mica schist, BIF, chert and amphibolite are preserved in SE/S-plunging synclines (Fig. 13; Thrane and Connelly, 2006; Garde and Hollis, 2010).

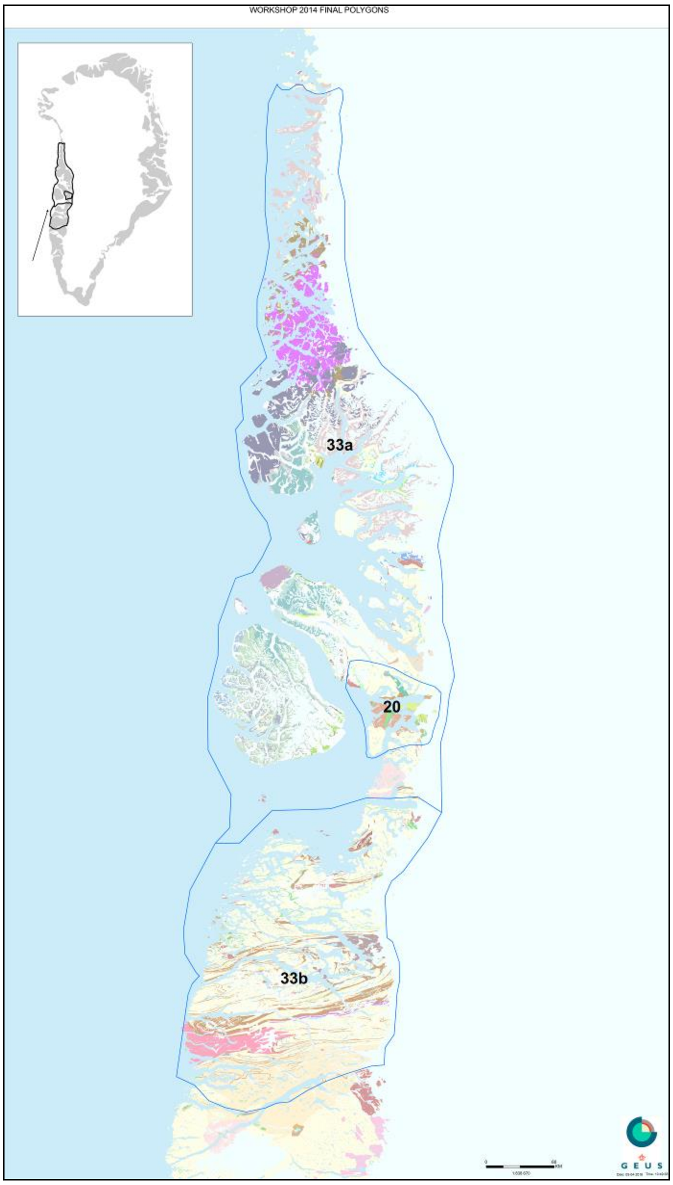

Figure 12. *Tracts assessed for undiscovered orogenic gold deposits in central western Greenland.*

The structural evolution is characterised by WNW-ESE compression during ca. 1860-1840 Ma associated with an oblique collision of the Rae and North Atlantic cratons and high-grade metamorphism, which resulted in WNW-vergent thrusts in the central orogen and ESE-vergent structures in its southern hinterland (Fig. 13; van Gool et al., 2002b). At ca. 1825 Ma, N-S oriented compression resulted in large-scale eastward trending folds formed at peak metamorphic conditions (van Gool *et al.*, 2002b). The subsequent evolution is characterised by ca. 1775 Ma sinistral strike-slip shear zones (Fig. 13; van Gool et al., 2002b).

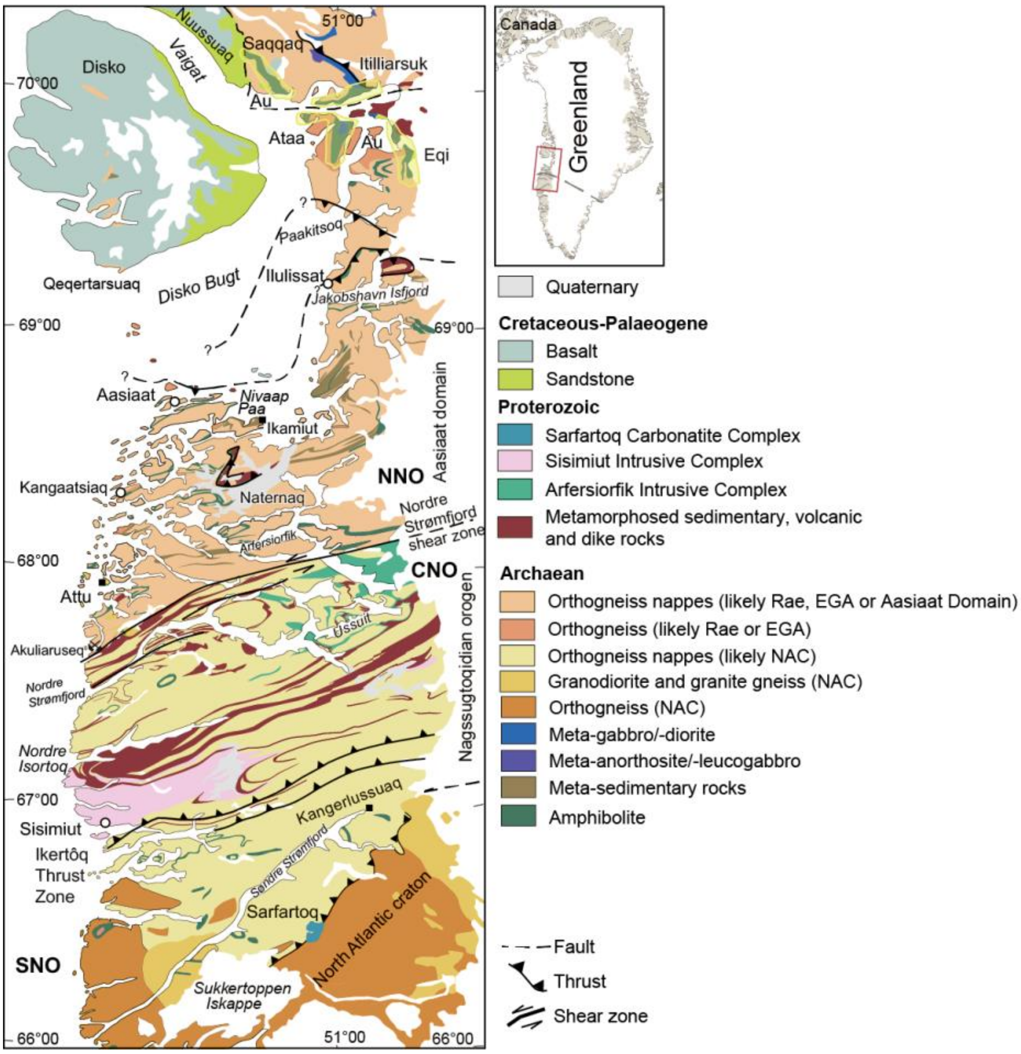

Figure 13. *Geological map of the Nagssugtoqidian Orogen in western Greenland with orogenic gold occurrences in Archean rocks (modified after: Kolb et al., 2016).*

The Rinkian belt represents the northern extension of the Paleoproterozoic Nagssugtoqidian Orogen that continues west in the Trans-Hudson Orogen of Canada (Connelly and Thrane, 2005; Connelly *et al.*, 2006; St-Onge *et al.*, 2009). The Rinkian belt extends from the Nuussuaq area to north of Read Head along the western coast of Greenland (Pulvertaft, 1986; Grocott and Pulvertaft, 1990) and comprises the tracts 33a and 20. In the south, complexely folded Paleoproterozoic rocks of the Mârmorilik Formation (Karrat Group) unconformably overly Archean orthogneiss in a recumbent syncline with ESE-WNW-trending axis (Pulvertaft, 1986).

Tract 20 represents an area of exposed Archean rocks close to Nuussuaq probably of the Rae craton. To the north in the Agpat and Marmorilik areas, Archean orthogneiss is thrust on top of the Mârmorilik Formation in large-scale W-WNW-vergent nappe structures (Pulvertaft, 1986). In the north, tight folds are refolded by overturned folds into large-scale dome structures (Pulvertaft, 1986). A whole rock Pb-Pb age of Mârmorilik Formation marble yields 1881 ± 20 Ma for regional metamorphism (Taylor and Kalsbeek, 1990). Undeformed pegmatite was dated at 1842 +4/-3 Ma by U-Pb zircon analysis yielding a minimum age of Paleoproterozoic deformation (Connelly *et al.*, 2006).

In the Disko-Nuussuaq area, Meso- to Neoarchean orthogneiss is intercalated with greenstone belts (Fig. 6; Garde and Steenfelt, 1999; Connelly et al., 2006). Three greenstone belts, namely Saqqaq, Itilliarsuk and Arveprinsen-Eqi greenstone belts, are distinguished (Garde and Steenfelt, 1999). The contact between orthogneiss and the Arveprinsen-Eqi and Itilliarsuk greenstone belts is intrusive, suggesting that at least these belts are Mesoarchean (Garde and Steenfelt, 1999). The Saqqaq greenstone belt forms a > 500 m thick NW-trending anticlinal structure and consists of biotite-garnet schist, amphibolite and minor ultramafic rocks (Garde et al., 1999). The Itilliarsuk greenstone belt is approx. 2.5 km thick and consists of quartz-biotite schist, staurolite-muscovite schist, metaconglomerate, amphibolite, metagabbro, BIF and calc-silicate rocks (Garde and Steenfelt, 1999; Rasmussen and Pedersen, 1999; Haugaard et al., 2013). A felsic schist was dated at 2847 ± 4 Ma (Connelly et al., 2006). The rocks are isoclinally folded, stacked by NW- and NE-vergent thrust systems and folded into upright open folds (Rasmussen and Pedersen, 1999). The contact to orthogneiss is always tectonic (Haugaard et al., 2013). Main and trace element geochemistry suggests that metasedimentary rocks have a greywacke signature, amphibolites are tholeiitic and that the greenstone belt likely formed in a back-arc setting (Rasmussen and Pedersen, 1999; Haugaard et al., 2013). The BIF contains 25-30 vol.% magnetite besides quartz, amphibole, biotite, chlorite, epidote and plagioclase. The geochemical data shows a seawater signature and indicates significant terrigenous input for the BIF (Haugaard et al., 2013). Dioritic orthogneiss and augen gneiss are dated at 3030 +8/-5 Ma and 2947 ± 23 Ma (U-Pb zircon), respectively. The age data are interpreted as Mesoarchean emplacement ages (Connelly et al., 2006). The Arveprinsen-Eqi greenstone belt forms a complex regional-scale fold structure consisting of 3-4 km thick metasedimentary and metavolcanic rocks at upper greenschist to lower amphibolite facies grades. The rocks are greenstone with local pillow structures, quartz- and feldspar-phyric metavolcanic rock, metagabbro, BIF, phyllite and metadolerite (Garde and Steenfelt, 1999). The metagabbro forms a tholeiitic to komatiitic sill complex in the greenstone belt (Marshall and Schønwandt, 1999). Both the metagabbro and the quartz and feldspar porphyry have a volcanic arc geochemical signature (Marshall and Schønwandt, 1999; Stendal et al., 1999). The orthogneiss consists of tonalite, trondhjemite, granodiorite, granite and diorite with local leucosomes (Garde and Steenfelt, 1999). Zircons from three orthogneiss samples were dated by SHRIMP U-Pb indicating intrusion ages of ca. 2800 Ma (Nutman and Kalsbeek, 1999). An undeformed granite yields 2758 ± 2 Ma as emplacement age largely postdating metamorphism and deformation (Nutman and Kalsbeek, 1999). Orthogneiss in the Rodebay area is dated at ca. 2835-2785 Ma by U-Pb zircon ages, suggesting Meso- to Neoarchean emplacement, whereas zircon rims yield ca. 2800-2760 Ma for metamorphism largely contemporaneous with granite emplacement (Connelly et al., 2006).

Tract 33a - Rinkian

This tract includes the Rinkian belt, extending from the Nuussuaq area to the north of Read Head along the western coast of Greenland (Pulvertaft, 1986; Grocott and Pulvertaft, 1990), exc for the area of the Ataa gold province (covered by tract 20).
Despite its extensive area, of 29.440 km^2, the expert panel found this area not very prospective (Tables 49, 50). It was decided that there may be two undiscovered gold deposits at a 50% confidence level.

Table 49. *Undiscovered deposit estimates, deposit numbers, tract area, and deposit density for tract* 33a.

Consensus undiscovered deposit estimates					**Summary statistics**					**Tract Area (km^2)**	**Deposit density (N_{total}/km^2)**
N90	**N50**	**N10**	**N05**	**N01**	**N_{und}**	**s**	**Cv%**	**N_{known}**	**N_{total}**		
0	2	6	11	15	3.10	3.70	120.0	0	3.10	29,440	0.000110

Estimator	**Estimated number of undiscovered deposits**				
	N90	**N50**	**N10**	**N05**	**N01**
Individual 1	0	10	50	100	250
Individual 2	1	3	5	10	15
Individual 3	0	2	4	6	8
Individual 4	1	2	3	3	4
Individual 5	0	0	1	2	3
Individual 6	0	0	1	2	3
Individual 7	0	1	2	4	5
Individual 8	0	0	1	5	10
Individual 9	0	0	3	3	5
Individual 10	0	1	3	5	10
Individual 11	0	1	3	5	5
Individual12	1	2	3	3	3
Individual 13	1	3	4	9	12
Individual 14	1	2	3	4	5
Individual 15	0	3	6	10	20
Individual 16	1	3	5	6	7
Consensus	**0**	**2**	**6**	**11**	**15**

Table 50 Results of Monte Carlo simulations of undiscovered resources in tract 33a.
[T- metric tons, Mt – million metric tons]

Material	**Probability of at least the indicated amount**						**Probability of**	
	0.95	**0.9**	**0.5**	**0.1**	**0.05**	**Mean**	**Mean or greater**	**None**
Au (T)	0	0	15	160	280	55	0.24	0.19
Rock (Mt)	0	0	7	110	250	39	0.21	0.19

Tract 33b – Nagssugtoqidian in western Greenland

The Nagssugtoqidian Orogen was evaluated as a whole in tract 33b (Figs. 12, 13). Despite its extensive area, of 25.3380 km2, the expert panel found this area to hold very limited prospectivity (Tables 51, 52). It was decided that there may be only two undiscovered gold deposits at a 10% confidence level.

Table 51. *Undiscovered deposit estimates, deposit numbers, tract area, and deposit density for tract* 33b.

Consensus undiscovered deposit estimates					Summary statistics					Tract Area (km^2)	Deposit density (N_{total}/km^2)
N90	N50	N10	N05	N01	N_{und}	s	Cv%	N_{known}	N_{total}		
0	0	2	3	5	0.74	1.30	180.0	0	0.74	25,340	0.000029

Estimator	Estimated number of undiscovered deposits				
	N90	N50	N10	N05	N01
Individual 1	0	0	2	2	10
Individual 2	5	10	20	30	60
Individual 3	0	0	0	1	2
Individual 4	0	0	1	1	2
Individual 5	0	0	0	3	5
Individual 6	0	0	1	2	3
Individual 7	0	0	0	2	4
Individual 8	0	0	3	5	10
Individual 9	0	0	2	2	3
Individual 10	0	0	0	1	2
Individual 11	0	0	1	2	3
Individual12	0	0	1	2	3
Individual 13	0	1	4	6	10
Individual 14	0	1	2	3	4
Individual 15	1	2	3	5	6
Individual 16	0	1	3	3	5
Consensus	**0**	**0**	**2**	**3**	**5**

Table 52 Results of Monte Carlo simulations of undiscovered resources in tract 33b.
[T- metric tons, Mt – million metric tons]

Material	Probability of at least the indicated amount						Probability of	
	0.95	0.9	0.5	0.1	0.05	Mean	Mean or greater	None
Au (T)	0	0	0	25	57	12	0.17	0.60
Rock (Mt)	0	0	0	13	34	9	0.13	0.60

Tract 20 - Archean basement and Ataa Gold Province

In the Disko-Nuussuaq area, orogenic gold mineralization occurs in the Ataa gold province. Two Archean greenstone belts, the Saqqaq-Itilliarsuk and the Arveprinsen-Eqi belts, are separated by the Torsukattak shear zone and host three gold occurrences (Figs. 5, 6; Stendal, 1998; Garde et al., 1999; Stendal et al., 1999). Shear zone-hosted copper mineralization was identified during regional reconnaissance and geophysical investigations in the 1960s and 1970s, and explored 1980-1986 by Kryolitselskabet Øresund A/S, but was not investigated further. The company recognized gold-silver mineralization in quartz-carbonate veins by mapping and ground-based geophysical investigations, which was further investigated by Platinova Resources Ltd and Faxe Kalk A/S during 1988-1992, NunaOil A/S and NunaMinerals A/S from 1995 until 2001 and Avannaa Exploration Ltd from 2008 until 2012.

At Saqqaq, gold mineralization is hosted in the Saqqaq shear zone, separating serpentinite and laminated amphibolite from overlying garnet-mica schist (Figs. 6, 7a). The mineralization is tabular, 2-5 m wide and semicontinuous for at least 1200 m, with intermittent mineralization for another 1000 m. Gold grades are 1.8-4.2 ppm Au and on average 1 ppm over 2.5 m thickness. Higher-grade zones occur in the shear zone along strike with as much as 11.4 ppm Au over 2.2 m thickness and are well documented by bulk samples. Hydrothermal alteration is characterized by quartz, garnet, fuchsite, biotite, chlorite, actinolite, titanite, tourmaline, pyrrhotite, arsenopyrite, gold, niccolite, wolframite and scheelite (Garde et al., 1999; Della Valle, 2009b).

At Itilliarsuk, near-vertical shear zones host discontinuous auriferous quartz veins in banded iron formation, amphibolite and biotite schist (Fig. 6). Six auriferous zones with maximum strike length of 500 m contain as much as 15.1 ppm Au over 2.8 m thickness in channel samples and 41 ppm Au in quartz vein grab samples (Della Valle, 2009a).

In the Arveprinsen-Eqi greenstone belt, gold mineralization occurs in a near-vertical, NW-trending shear zone at the contact between metamorphosed basalt, komatiite and felsic volcanic rocks (Eqi or Eqe/Eqip) (Fig. 6; Stendal et al., 1999; Hanghøj and Jørgensen, 2011). The contact is characterized by a 100-200 m wide hydrothermal alteration zone consisting of ankerite, chlorite, fuchsite, tourmaline and pyrite as a typical mesozonal alteration assemblage (Fig. 7; Stendal et al., 1999). Centimeter-wide quartz veins are ubiquitous, locally forming ~10 m wide brecciae (Stendal et al., 1999). The ore mineral assemblage is pyrrhotite, pyrite, chalcopyrite, sphalerite, bismuth, bismuthinite, arsenopyrite and gold. As much as 12 ppm Au over 3.2 m thickness in a channel sample and 60 ppm Au in a grab sample are recorded (Hanghøj and Jørgensen, 2011). A small occurrence on Qeqertaa peninsula contains up to 760 ppm Au in a malachite-quartz-carbonate-sulfide breccia (Fig. 6; Hanghøj and Jørgensen, 2011).

Abundant shear zones that host gold quartz veins and a pervasive chlorite-ankerite-pyrite alteration make this tract prospective for orogenic gold deposits, according to the evaluation by the expert panel (Tables 53, 54). The assessment resulted in the estimation of 2 undiscovered deposits at 90% confidence level and 4 deposits at 50% confidence level in this only 2.344 km^2 tract.

Table 53. *Undiscovered deposit estimates, deposit numbers, tract area, and deposit density for tract* 20.

Consensus undiscovered deposit estimates					Summary statistics					Tract Area (km^2)	Deposit density (N_{total}/km^2)
N90	N50	N10	N05	N01	N_{und}	s	Cv%	N_{known}	N_{total}		
2	4	5	8	10	3.90	2.00	52.0	0	3.90	2,344	0.001600

Estimator	Estimated number of undiscovered deposits				
	N90	N50	N10	N05	N01
Individual 1	2	2	5	5	10
Individual 2	4	8	14	25	50
Individual 3	1	2	4	7	10
Individual 4	1	2	3	3	4
Individual 5	2	3	5	5	8
Individual 6	3	3	4	5	6
Individual 7	2	3	4	5	7
Individual 8	3	3	4	5	7
Individual 9	3	4	5	5	6
Individual 10	1	2	5	10	20
Individual 11	3	5	5	5	5
Individual12	1	1	2	2	2
Individual 13	3	5	10	12	15
Individual 14	1	2	3	4	5
Individual 15	2	4	6	10	12
Individual 16	2	3	3	3	5
Consensus	2	4	5	8	10

Table 54 Results of Monte Carlo simulations of undiscovered resources in tract 20.
[T- metric tons, Mt – million metric tons]

Material	Probability of at least the indicated amount						Probability of	
	0.95	0.9	0.5	0.1	0.05	Mean	Mean or greater	None
Au (T)	1	6	31	170	280	67	0.27	0.04
Rock (Mt)	0	2	15	160	250	47	0.23	0.04

Orogenic gold mineralization in Melville Bugt and Inglefield Land areas in north-west Greenland

Tract 22 - Melville Bugt area

In the northernmost Melville Bugt area, tonalitic to granitic orthogneiss, paragneiss, quartzite, amphibolite and ultramafic rocks from the Thule mixed gneiss complex have only sporadically dated at Neoarchean ages (Fig. 5; Dawes, 2006; Nutman et al., 2008a). A paragneiss sample yields a ca. 2.91 Ga Sm–Nd model age (Dawes, 2006). The rocks are metamorphosed at amphibolite facies grades increasing to granulite facies in the north (Dawes, 2006). Large-scale isoclinal folds are refolded in recumbent to overturned fold structures (Dawes, 2006). In the Smithson Bjerge area, the Thule mixed gneiss complex is intruded by two layered anorthosite-ferrodiorite-granite complexes, namely the Qaqujârssuaq anorthosite and Heilprin Gletscher complex (Nutman, 1984; Dawes, 2006). The Qaqujârssuaq anorthosite includes only little leucogabbro and gabbro, and shows compositional layering on a cm-scale (Nutman, 1984). The igneous rocks have a layer-parallel foliation, elongated plagioclase rods and are metamorphosed at granulite facies grade (Nutman, 1984). The Heilprin Gletscher complex consists of metamorphosed sheets of ferrodiorite and granite, which locally show igneous layering in the more mafic units (Nutman, 1984). Both complexes occupy the cores of antiforms of west-trending, south-vergent fold structures (Nutman, 1984). Metamorphosed gabbro-tonalite-granite representing the Kap York metaigneous complex may be of similar age and yield imprecise ca. 2700 Ma Rb-Sr ages (Dawes, 2006). To the south, the Neoarchean Melville Bugt orthogneiss complex has an imprecise Rb-Sr age of ca. 2700 Ma and a Sm-Nd whole rock age of 2840 Ma (Dawes, 2006). The complex is dominated by polyphase granitic to dioritic orthogneiss, metagabbro, ultramafic rocks and mafic granulite, which are retrogressed from the granulite facies and intensely deformed (Dawes, 2006). Retrogression occurred during Paleoproterozoic overprint (Dawes, 2006). Rocks of the ca. 2700 Ma Lauge Koch Kyst supracrustal complex (imprecise Rb-Sr age) form discontinuous layers and lenses in orthogneiss (Dawes, 2006). The complex consists of biotite-garnet schist, garnet gneiss, biotite-muscovite schist, amphibolite, quartzite, BIF and chlorite-muscovite-talc schist (Dawes, 2006). The rocks have generally amphibolite facies mineral assemblages and are variably deformed (Dawes, 2006).

The Rae Craton in the northwestern Greenland Melville Bugt contains BIF, which are explored in the Melville Bugt iron ore project by Nama Greenland Ltd since 2011 (Figs. 5, 8). Prospective BIF was mapped over 19 km strike including coarse-grained magnetite and hematite BIF, using ground-based mapping and aeromagnetic and radiometric data. The Havik deposit was found most prospective and an inferred resource of 67 Mt at 31.4 wt.% Fe magnetite iron ore was defined (Fig. 5; Red Rock Resources Plc, 2016). The orebody forms a tight fold structure that is crosscut by a later fault. Hematite BIF is enriched and locally contains >70 wt.% Fe (Red Rock Resources Plc, 2016). Several targets of possible BIF-hosted orogenic gold mineralization have also been identified by Nama Greenland Ltd. At Ironstone Fjeld, quartz veins are hosted in orthogneiss and biotite schist with sulfide alteration and as much as 2.8 g/t Au and 44 g/t Ag (Smith and Campbell, 1971).

The expert panel found this area not very prospective (Tables 55, 56). It was decided that there may be one undiscovered gold deposit at a 50% confidence level.

Table 55. *Undiscovered deposit estimates, deposit numbers, tract area, and deposit density for tract* 22.

Consensus undiscovered deposit estimates					Summary statistics					Tract Area (km^2)	Deposit density (N_{total}/km^2)
N90	N50	N10	N05	N01	N_{und}	s	Cv%	N_{known}	N_{total}		
0	1	2	5	7	1.30	1.60	130.0	0	1.30	5,730	0.000220

Estimator	Estimated number of undiscovered deposits				
	N90	N50	N10	N05	N01
Individual 1	0	0	2	5	5
Individual 2	3	5	8	15	25
Individual 3	0	0	1	2	3
Individual 4	0	0	0	1	1
Individual 5	0	0	0	2	4
Individual 6	0	0	1	2	3
Individual 7	0	1	2	3	4
Individual 8	2	3	5	10	20
Individual 9	0	0	0	1	3
Individual 10	0	0	0	1	2
Individual 11	0	0	0	1	3
Individual12	0	0	1	1	1
Individual 13	2	5	8	12	18
Individual 14	1	2	3	4	5
Individual 15	0	0	2	4	8
Individual 16	0	0	1	2	3
Consensus	**0**	**1**	**2**	**5**	**7**

Table 56 Results of Monte Carlo simulations of undiscovered resources in tract 22.
[T- metric tons, Mt – million metric tons]

Material	Probability of at least the indicated amount						Probability of	
	0.95	0.9	0.5	0.1	0.05	Mean	Mean or greater	None
Au (T)	0	0	4	49	120	24	0.18	0.30
Rock (Mt)	0	0	2	30	85	17	0.15	0.30

Tract 30 + 31 – Inglefield Land

Inglefield Land is a 7000 km^2 ice-free area underlain by a Palaeoproterozoic basement overlain by Mesoproterozoic and Cambrian cover rocks. The basement is composed of high-grade, intensely polydeformed and polymetamorphosed rocks, which can be divided into supracrustal rocks (Etah Group), intruded at all scales by a polyphase igneous suite (Etah meta-igneous complex). The Etah Group consists of marble and calc-silicate rocks, semi-pelitic and pelitic gneisses, commonly referred to as paragneisses, with some amphibolite and pyroxenite units. The Etah meta-igneous complex contains homogeneous to gneissic rocks of felsic to ultramafic composition.

Certain basement lithologies, e.g. graphite-bearing, garnet paragneisses, host widespread zones of iron sulphide oxidation, characterised by red and yellow colours, informally named rust zones. These rust zones locally contain strongly deformed layers or lenses of semi-massive to massive pyrrhotite with minor pyrite and traces of chalcopyrite. Iron and copper sulphides also occur in metacarbonate units and mafic–ultramafic rocks, and scattered in quartz and pegmatite veins. Magnetite, disseminated and as thin seams, is common in the Etah meta-igneous complex.

The expert panel found this area not very prospective (Tables 57, 58). It was decided that there may be one undiscovered gold deposit at a 50% confidence level.

Table 57. *Undiscovered deposit estimates, deposit numbers, tract area, and deposit density for tract* 30+31.

Consensus undiscovered deposit estimates					Summary statistics					Tract Area (km^2)	Deposit density (N_{total}/km^2)
N90	N50	N10	N05	N01	N_{und}	s	Cv%	N_{known}	N_{total}		
0	1	3	6	9	1.60	2.10	130.0	0	1.60	6,330	0.000250

Estimator	Estimated number of undiscovered deposits				
	N90	N50	N10	N05	N01
Individual 1	0	0	0	1	3
Individual 2	0	1	2	3	4
Individual 3	0	0	1	2	4
Individual 4	1	1	2	2	3
Individual 5	0	1	2	4	8
Individual 6	0	0	2	4	8
Individual 7	0	0	1	2	3
Individual 8	0	0	0	5	10
Individual 9	0	1	2	3	3
Individual 10	0	0	10	30	50
Individual 11					
Individual12	0	0	1	2	5
Individual 13	0	1	2	3	5
Individual 14	0	0	3	5	10
Individual 15	0	0	10	25	35
Individual 16	0	1	3	3	6
Consensus	**0**	**1**	**3**	**6**	**9**

Table 58 Results of Monte Carlo simulations of undiscovered resources in tract 30+31. [T- metric tons, Mt – million metric tons]

Material	Probability of at least the indicated amount						Probability of	
	0.95	0.9	0.5	0.1	0.05	Mean	Mean or greater	None
Au (T)	0	0	6	71	140	29	0.20	0.29
Rock (Mt)	0	0	2	44	130	20	0.16	0.29

Conclusions

In the course of the workshop a total of 28 tracts were assessed for orogenic gold deposits, in strict accordance with the guidelines provided by the USGS. The grade/tonnage model from the Finnish Geological Survey (GTK), which includes data from 21 Fennoscandian and 52 Australian Precambrian orogenic gold deposits, was considered.

The statistical mean estimate number of undiscovered orogenic gold deposits is of 66, estimated to contain 1,150 metric tons of Au. The tracts with highest unknown deposit density correspond to the Tartoq Gold Province (5 unknown deposits and 0.0057 unknown deposits per km^2), the Paamiut Gold Province (3 unknown deposits and 0.0036 unknown deposits per km^2), the contact of the Central and Southern domains of the Ketilidian Orogen in Western Greenland (6 unknown deposits, and 0.0035 unknown deposits per km^2), the contact of the Central and Southern domains of the Ketilidian Orogen in Eastern Greenland (2 unknown deposits, and 0.0023 unknown deposits per km^2), the Godthåbsfjord Gold Province tract (8 unknown deposits, and 0.0016 unknown deposits per km^2), and the Ataa Gold Province (4 unknown deposits, 0.0016 unknown deposits per km^2). Despite their low deposit density, the four large Caledonian Orogen tracts in East Greenland should also be highlighted, with a total of 18 unknown deposits, of which the Central Caledonian Orogen tract was estimated to hold 6.

Considering the scarce information available for most of the tracts, which is mainly because of logistical constraints of undertaking exploration in Greenland, the estimate on the number of deposits and their gold endowment can be considered significant. This warrants further exploration efforts which, it appears, should focus on the Tartoq, Paamiut, Ataa and Godthåbsjord gold provinces and the contact of the Central and Southern domains of the Ketilidian Orogen. More greenfield exploration potential is held by the Caledonian Orogen

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Appendix A: Grade-tonnage data used in the assessment

The grade-tonnage model used in the Eminers software was compiled and made available by Pasi Eilu from GTK. The model includes data from Finland, Sweden and the Northern Territory in Australia (Table 1). The FINGOLD database of GTK (Eilu & Pankka, 2009), the Fennoscandian Ore Deposit Database (FODD 2011) and a compilation of mineral deposits and metallogenic belts in the Fennoscandian shield (Eilu, 2012) were the main data source for orogenic gold deposits and occurrences in Finland and the Fennoscandian shield. Where possible, the grade and tonnage data were updated from company reports and publications. Data for orogenic gold deposits from elsewhere was taken from Ahmad et al. (2009) and updated with data from web pages for the presently active mines and mine development projects. These data were considered equally reliable and of consistent quality.

Grade and tonnage data from several other sources were also assessed, including data for the Bendigo Zone in Victoria, Australia (Lisitsin et al., 2007), for the Southern Cross greenstone belt in Western Australia, gold deposits in Zimbabwe (Hokka, 2011 and references therein) and available global gold deposit databases. However, these sources were not used in the grade-tonnage model, as the data was considered inconsistent: there is too high and variable cut off grades, confusion of old production and recent resource data, and uncertainty in genetic gold deposit type as well as total pre-mining deposit size.

Only orogenic gold deposits that are considered well-known, wholly delineated and with complete data sets on ore tonnage or gold grade are accepted in the grade-tonnage model. The model contains five Archean and 10 Proterozoic deposits from Finland, six Proterozoic deposits from Sweden and 52 Proterozoic deposits from Australia (Table 1).

Table 1. *Orogenic gold deposits included in the grade-tonnage model. The resources include past production and remaining well-known resources. Copyright GTK 2014.*

Deposit	Country	Age	Status	Tonnage (Mt)	Au (g/t)
Suurikuusikko	Finland	Proterozoic	Mine	58.159	4.18
Laivakangas	Finland	Proterozoic	Mine	23.700	1.79
Hirsikangas	Finland	Proterozoic	Deposit	5.675	1.25
Osikonmäki	Finland	Proterozoic	Deposit	4.838	1.99
Ängesneva	Finland	Proterozoic	Deposit	3.850	1.19
Saattopora	Finland	Proterozoic	Mine	2.163	2.91
Jokisivu	Finland	Proterozoic	Mine	1.911	5.65
Pampalo	Finland	Archean	Mine	1.858	3.9
Valkeasuo	Finland	Archean	Deposit	1.077	2.8
Pahkalampi	Finland	Archean	Deposit	0.590	3.5
Satulinmäki	Finland	Proterozoic	Deposit	0.360	2.34
Sikakangas	Finland	Proterozoic	Deposit	0.171	1.32
Pirilä	Finland	Proterozoic	Deposit	0.150	8.9
Pahkosuo	Finland	Archean	Deposit	0.100	1.6
Kuikkapuro	Finland	Archean	Deposit	0.045	14.6
Fäboliden	Sweden	Proterozoic	Deposit	90.190	1.04
Svartliden	Sweden	Proterozoic	Mine	2.967	4.26
Vargbäcken	Sweden	Proterozoic	Deposit	2.100	1.54

Pahtohavare	Sweden	Proterozoic	Mine	1.720	0.9
Långtjärn	Sweden	Proterozoic	Deposit	0.560	0.9
Harnäs	Sweden	Proterozoic	Mine	0.071	4.6
Mount Todd	Australia	Proterozoic	Mine	300.740	0.82
Rustlers Roost	Australia	Proterozoic	Mine	54.400	1.03
Callie-Ghan	Australia	Proterozoic	Mine	35.500	5.30
Union Reefs	Australia	Proterozoic	Mine	20.754	1.50
Pine Creek Goldfield	Australia	Proterozoic	Mine	17.316	2.27
Cosmo Howley-Cosmo Deeps	Australia	Proterozoic	Mine	15.727	3.37
Spring Hill	Australia	Proterozoic	Mine	12.750	0.80
Maud Creek 1	Australia	Proterozoic	Mine	10.378	3.03
Golf-Golf West-Tollis	Australia	Proterozoic	Deposit	8.760	0.85
Woolwonga	Australia	Proterozoic	Mine	8.500	2.83
Moline Dam-Hercules	Australia	Proterozoic	Mine	7.443	2.71
Dead Bullock Soak	Australia	Proterozoic	Mine	7.321	3.47
Brocks Creek	Australia	Proterozoic	Mine	6.080	1.85
Quigley's-Regatta	Australia	Proterozoic	Mine	5.539	1.73
Groundrush	Australia	Proterozoic	Mine	5.330	5.31
Oberon	Australia	Proterozoic	Deposit	4.520	3.10
Jims Find	Australia	Proterozoic	Mine	4.145	2.58
Titania	Australia	Proterozoic	Deposit	4.110	2.60
Goodall	Australia	Proterozoic	Mine	4.095	1.99
Shoe	Australia	Proterozoic	Mine	3.800	5.15
Western Arm	Australia	Proterozoic	Deposit	3.383	1.10
Bullakitchie	Australia	Proterozoic	Mine	2.800	6.50
Rising Tide	Australia	Proterozoic	Mine	2.466	1.37
Quorn	Australia	Proterozoic	Mine	2.290	3.23
Yam Creek-Princess Louise	Australia	Proterozoic	Mine	2.115	1.30
Fountain Head-Tally Ho	Australia	Proterozoic	Mine	2.024	2.11
Bridge Creek	Australia	Proterozoic	Deposit	1.796	1.20
Golden Dyke	Australia	Proterozoic	Mine	1.710	4.05
Kazi	Australia	Proterozoic	Deposit	1.580	2.10
Coyote	Australia	Proterozoic	Mine	1.524	8.34
Minotaur	Australia	Proterozoic	Mine	1.495	2.73
Tom's Gully	Australia	Proterozoic	Mine	1.469	9.62
Beawer Creek-Bonsai-Banjo	Australia	Proterozoic	Mine	1.450	3.86
Kookaburra	Australia	Proterozoic	Mine	1.440	2.02
Sandpiper	Australia	Proterozoic	Mine	1.279	4.06
Howley Ridge	Australia	Proterozoic	Deposit	1.210	1.34
Bunkers Hill	Australia	Proterozoic	Mine	1.150	3.06
Tregony	Australia	Proterozoic	Deposit	1.100	1.57
Ios	Australia	Proterozoic	Deposit	0.810	1.60
Bon's Rush	Australia	Proterozoic	Deposit	0.805	2.30
Crusade	Australia	Proterozoic	Deposit	0.800	2.90
Rhodes	Australia	Proterozoic	Deposit	0.770	1.88
Glencoe	Australia	Proterozoic	Mine	0.753	1.93
Mount Porter	Australia	Proterozoic	Deposit	0.355	3.00
Tumbling Dice	Australia	Proterozoic	Mine	0.300	2.60
Sundance	Australia	Proterozoic	Mine	0.236	5.48
Califrey	Australia	Proterozoic	Deposit	0.225	1.10
Pebbles	Australia	Proterozoic	Deposit	0.076	2.50
Davies 2	Australia	Proterozoic	Mine	0.050	2.89
Kindergarden	Australia	Proterozoic	Mine	0.050	3.00
Langleys	Australia	Proterozoic	Mine	0.050	3.90
Maud Creek 5	Australia	Proterozoic	Deposit	0.020	3.10

Mine = Deposit has been mined or is being mined. Deposit = Deposit has not been mined.

Tonnes are rounded to full thousands.

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Appendix C: CD-ROM - Presentations from the workshop

Presenter	Title	Presentation number (on CD-ROM)
Bo M. Stensgaard (GEUS)	Outline of the objectives of the workshop and the procedure for the assessment of tungsten deposits in Greenland	1
Richard Goldfarb (USGS)	Keynote talk: Orogenic gold: Geology, geochemistry, exploration, global distribution, and changing definition of ore	2
Pasi Eilu (GTK)	Keynote talk: Orogenic gold: Alteration geochemistry & lithogeochemical exploration	3
Pasi Eilu (GTK)	Keynote talk: Orogenic gold: Alteration	4
Jochen Kolb (GEUS)	Keynote talk: Orogenic gold in amphibolite and granulite facies terranes	5
Agnete Steenfelt (GEUS)	Overview of stream sediment geochemistry data with focus on gold and its pathfinders	6
Bo M. Stensgaard (GEUS) & Björn Heincke (GEUS)	Overview of geophysical data with focus on gold and its pathfinders	7
Kristine Thrane (GEUS)	Geological history and setting of the Caledonian Orogen	8
Bjørn Thomassen (Avannaa Resources) & John Pedersen (Private consultant)	Gold mineralization in the Caledonian Orogen, central East Greenland	9
Stefan Bernstein (Avannaa Resources)	Gold mineralization in Archaean supracrustal belts NE Disko Bay region	10
Bjørn Thomassen (Avannaa Resources)	Archaean of the Thule Region, NW Greenland - Fe, Cu and Au mineralization	11
Bo M. Stensgaard (GEUS)	Geology of the Nagssugtoqidian-Rinkian orogen and it's gold mineralization	12
Jochen Kolb (GEUS)	The Ketilidian Orogen	13
Robin-Marie Bell (GEUS)	Nalunaq gold deposit	14
Joshua Hughes (NunaMinerals A/S)	The Vagar and Hugin Gold Projects, South Greenland	15
Jochen Kolb (GEUS)	Geology of the North Atlantic Craton and orogenic gold mineralization	16
Adam Garde (GEUS)	Are orogenic gold deposits metamorphic or metamorphosed? An example from the 3 Ga, metamorphosed volcanogenic-epithermal gold mineralization at Qussuk in West Greenland	17
Jesper Kofoed (Greenland Resources Inc.)	The Storø Gold Project	18

Denis Schlatter (Helvetica Exploration Services GmbH)	The Qilanngaarsuit, Bjørnesund and Tartoq gold occurrences	19
Bjørn Thomassen (Avannaa Resources)	Cu-Au mineralization in Inglefield Land, NW Greenland	20

Appendix D: link to manuscript

Link to: Kolb, J., Dziggel, A. & Schlatter, D.M. 2013: Gold occurrences of the Archean North Atlantic craton, southwestern Greenland: A comprehensive genetic model. Ore Geology Reviews **54**, p. 29-58
http://www.sciencedirect.com/science/article/pii/S0169136813000310