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Gold in the fine fraction of stream sediments from supracrustal sequences in West Greenland

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GRØNLANDS GEOLOGISKE UNDERSØGELSE
The Geological Survey of Greenland
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ABSTRACT

The fine fraction of 334 stream sediment samples from regional geochemical surveys covering supracrustal rocks in Archaean and Proterozoic terrains are analysed for gold. 120 of the samples give values above the detection limit (c. 5 ppb) ranging up to 280 ppb, and their distribution outlines districts with gold potential.

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GOLD IN THE FINE FRACTION OF STREAM SEDIMENTS FROM SUPRACRUSTAL SEQUENCES IN WEST GREENLAND

Agnete Steenfelt

The fine fraction of stream sediment samples is the commonly used medium in regional geochemical exploration and mapping in Greenland (Steenfelt, 1987). The samples are typically analysed by XRF routine programs comprising a number of major and trace elements depending on the laboratory or instruments used. However, gold was not included in these programs, and a number of samples from three areas in West Greenland were analysed for gold in order to test the applicability of the fine fraction of stream sediment in gold exploration.

Location and geological setting

The samples are derived from regional geochemical exploration surveys covering supracrustal belts in the following areas (fig.1): Disko Bugt, Godthåbsfjord, and Nanortalik district.

In the Disko Bugt area the supracrustals are enclosed by Archaean granitoid and gneiss (Kalsbeek et al., 1987). At least parts of the volcano-sedimentary sequences are Archaean in age, whereas other parts may be Proterozoic in age. The supracrustal rocks form a c. 60 km long, curved belt (fig.2) comprising an at least 4 km thick sequence of quartzites, pelitic schists, marble and mafic metavolcanic flows, sills, and tuffs (Escher & Burri, 1967, Knudsen et al., in press). The degree of metamorphism varies from greenschist to amphibolite facies.

In the Godthåbsfjord area the Malene supracrustal rocks form disrupted layers stratigraphically emplaced between the early Archaean Amîtsoq gneiss and mid-Archaean Nûk gneiss (McGregor, 1969,1973). At the Ivisârtoq peninsula, inner Godthåbsfjord (fig. 3), where a detailed sampling was performed, the supracrustal sequence is about 3 km thick and dominated by mafic and

ultramafic amphibolites including komatiites (Chadwick, 1986). Layers and lenses of calc-silicate rocks occur as well as sheets of peridotite. The rocks are metamorphosed to high grade, but commonly retrogressed. Sulphide-rich fuchsite bearing metasedimentary horizons occur, and scheelite mineralisation is widespread (Appel, in press).

The Nanortalik district is situated within the so-called folded migmatite zone of the Proterozoic Ketilidian mobile belt (Allaart, 1976). Supracrustal rocks form an at least 3 km thick succession comprising from bottom to top: pelitic to semipelitic gneisses, basic metavolcanics, arkosic quartzites and felsic volcanics, and basic metavolcanics (Allaart, 1970). The rocks are folded, migmatised, and metamorphosed in amphibolite facies. Sulphides and/or graphite bearing horizons occur in the pelitic to semipelitic units. Disseminated pyrite pyrrhotite and minor chalcopyrite is locally observed in the metavolcanic units.

Sampling and analysis

The samples were obtained in regional geochemical exploration programmes (Steenfelt in prep, Armour-Brown et al., 1982, Armour-Brown et al., 1983). Each sample of 200 to 300 g represents a composite of 3 to 5 sites along a stream section of ca. 50 m. The samples were dry-sieved in the laboratory and the minus 0.1 mm fraction analysed. The 53 samples from the Disko Bugt area and 43 samples from the Godthåb area were analysed at Bondar-Clegg, Canada, for Au by neutron activation techniques. The 238 samples from South Greenland were analysed at X-ray Assay Laboratories for Au using fire assay combined with direct current plasma emission spectrometry.

Evaluation of the results

Experience with gold exploration using stream sediment samples shows that in order to obtain representative and reproducible results, it is necessary to use large samples or heavy mineral concentrates of large samples. The reason for this is partly the irregular distribution of the small and heavy gold particles in a stream bed, and partly the analytical difficulties of determining very small amounts of gold in a sample. It is known that values of gold concentration may vary 100 % or more on repeated sampling and analysis, and the results obtained in the present study from the fine fraction of

relatively small samples should, therefore, be regarded as qualitative only. The significant information lies in the geographical distribution of samples with concentrations above the detection limit, and not in the absolute value of individual samples.

According to the literature, exploration surveys using inorganic sample material, stream sediment, soil or till, background values for gold are usually in the order of 5 or 10 ppb, i.e. close to the analytical detection limits for the methods used in this study. Hence values above that may be regarded as indicative of gold mineralisation.

The location of the samples and the result of the analyses are shown for each area in Figs. 2 to 4.

In the Disko Bugt area the few samples with detectable gold indicate, although not strongly, that gold mineralisation may be associated with some units within the supracrustal rocks. The southeastern area appears the most favourable and, in fact, up to 12 ppm gold has recently been detected in surface samples of a sulphide bearing, partly silicified, semi-concordant breccia within that area (Knudsen et al., in press). The stream sediment data further suggest the presence of gold mineralisation on the peninsula east of Torssukatak (3 samples).

The stream sediment samples from Ivisârtoq in the Godthåbsfjord region give weak response for gold, and little support for a gold potential in the Malene Supracrustals. A few surface bedrock samples from the area only yielded traces of gold (10 samples with maximum 31 ppb). However the geological environment is considered favourable for gold mineralisation and more samples (panned concentrates and rock specimens) collected in 1987 are being analysed (Appel, in press).

In the Nanortalik district samples containing gold are distributed over the entire area, and contents are considerably higher than in other areas, reaching a maximum of 280 ppb. It is worth noting that the method of analysis used for the samples from Nanortalik is different from the one used for the other areas. Therefore, it is possible that the generally higher background level obtained in Nanortalik can be ascribed to the analytical method. However the large number of samples with contents considerably above 20 ppb must be considered significant as a regional feature indicating a gold potential.

The anomalous samples are derived from streams draining a variety of geological units and are not, as might be assumed, restricted to greenstone belts. At this stage it is difficult to make assumptions as to the nature of the possible gold mineralisations causing the anomalies in the streams. The known mineralisations comprise sulphide and graphite occurrences in both

metavolcanic and metasedimentary sequences and disseminated and massive sulphides with Ni, Pt and Au in ultramafic intrusive bodies (Berrangé, 1970; Schønwandt, 1972; Nielsen, 1973).

Conclusion

Gold analysis of the fine fraction of stream sediment samples from three areas in Greenland have shown that the gold concentrations are high enough to be determined and that the results can be used to outline districts with gold potential, although individual analytical values are subject to large errors due to sampling and analysis.

Each of the three areas contain samples with gold concentrations above an assumed background level of 5 to 10 ppb, but the Nanortalik district in particular stands out as a large prospective target for further gold exploration.

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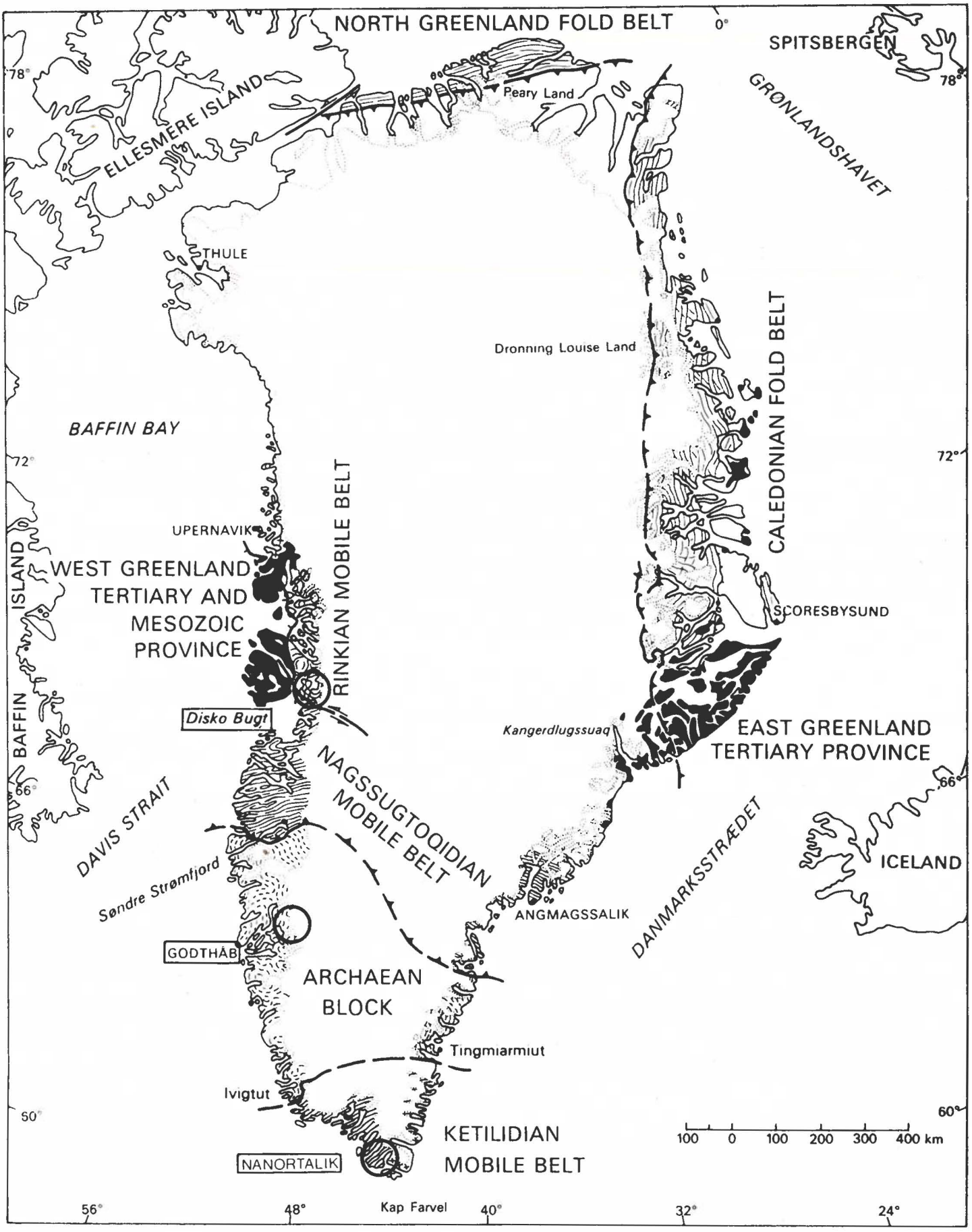
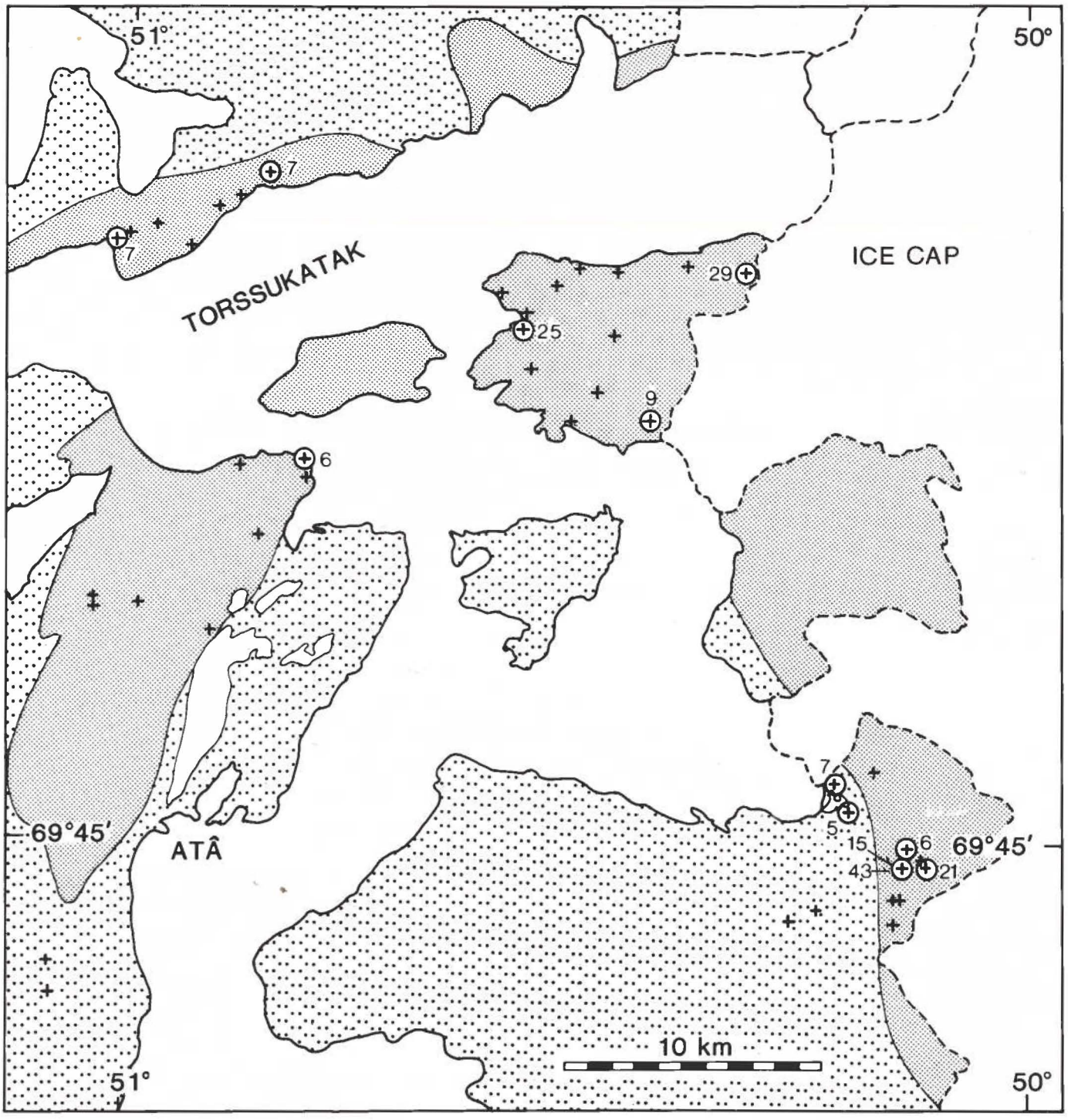

NORTH GREENLAND FOLD BELT
SPITSBERGEN
ELLESMERE ISLAND
Peary Land
GRØNLANDSHAVET
THULE
Dronning Louise Land
CALEDONIAN FOLD BELT
BAFFIN BAY
UPERNAVIK
RINKIAN MOBILE BELT
WEST GREENLAND TERTIARY AND MESOZOIC PROVINCE
ISCORESBYSUND
BAFFIN ISLAND
Disko Bugt
Kangerdlugssuaq
EAST GREENLAND TERTIARY PROVINCE
NAGSSUGTOQIDIAN MOBILE BELT
DAVIS STRAIT
Søndre Strømfjord
ANGMAGSSALIK
DANMARKSSTRÆDET
ICELAND
GODTHÅB
ARCHAEAN BLOCK
Tingmiarmiut
Ivigtut
KETILIDIAN MOBILE BELT
NANORTALIK
100 0 100 200 300 400 km
Kap Farvel

Fig. 1

DISKO BUGT

STREAM SEDIMENT 1986



Samples analysed for Au by INAA

\+ < 5 ppb

⊕ > 5 ppb, concentration indicated

Supracrustal rocks

Gneiss and granite (s.l.)

Fig. 2

IVISARTOQ PENINSULA, GODTHÅBSFJORD

STREAM SEDIMENT 1986

Samples analysed for Au by INAA

\+ < 5 ppb

⊕ > 5 ppb, concentration indicated

Lake

Supracrustals

Granite

Gneiss

Fig. 3

NANORTALIK DISTRICT

Stream sediment 1979

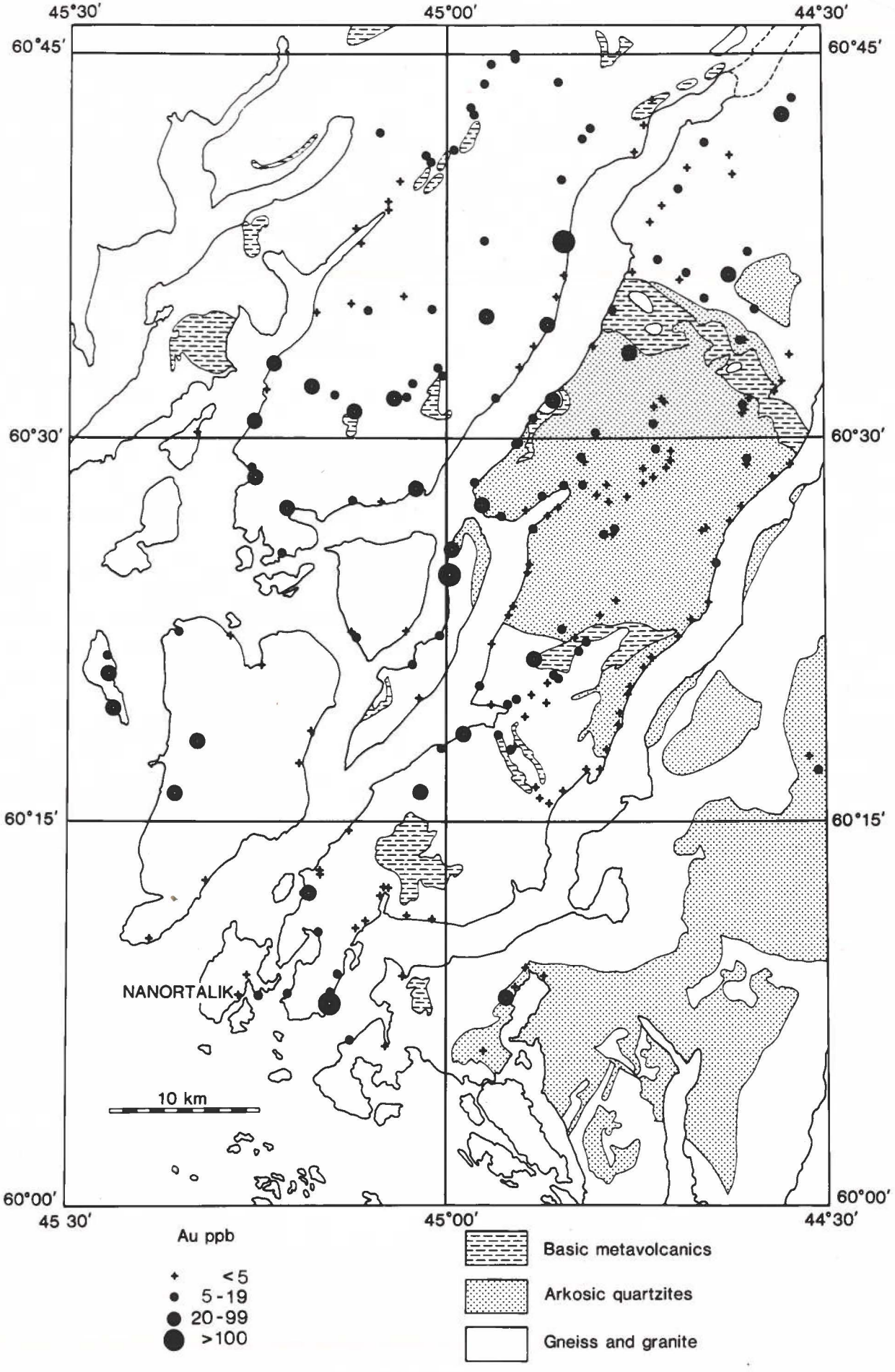


Fig. 4