

# The Precambrian supracrustal rocks in the Naternaq (Lersletten) and Ikamiut areas, central West Greenland

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Naternaq, or Lersletten, in central West Greenland is an extensive Quaternary outwash plain characterised by light grey, silty sediments. Scattered low hills with outcrops of crystalline Precambrian basement rocks protrude from the outwash plain and form the northern part of the Nagssugtoqidian orogen (e.g. Connelly *et al.* 2000). The prominent Naternaq supracrustal belt, at least 25 km long and up to c. 2 km wide, occurs along the north-western margin of Lersletten, bordered on both sides by Archaean orthogneisses and granitic rocks; the supracrustal rocks outline a major fold structure with an irregular and sporadically exposed hinge zone (Fig. 1). The supracrustal rocks, including the fold closure, exhibit a negative signature on the regional aeromagnetic map (Fig. 2). The belt is known for its disseminated and massive iron sulphide mineralisation with minor copper and zinc, which is common in the south-eastern part of the belt.

Study of the Naternaq supracrustal belt was an important objective of the Survey's field work in 2001 (Stendal *et al.* 2002, this volume). Boundaries, contact relationships and principal rock types were established in the western part of the belt (van Gool *et al.* 2002, this volume). Well-exposed parts of the belt were mapped in detail (Fig. 3), and the main lithologies and their mineralisations were investigated and sampled. Preliminary results of the mapping are presented in this report, together with a brief discussion of the depositional environment, likely age, and mineralisation processes of the supracrustal sequence. Large tracts of supracrustal rocks in the adjacent Ikamiut area (Fig. 1) and near Qasigiannguit/Christianshåb some 50 km further to the east may once have been contiguous with the Naternaq supracrustal belt, but further mapping is required to substantiate this.

## Previous work

The earliest coastal geological reconnaissance in central West Greenland was carried out by Noe-Nygaard

& Ramberg (1961), who noted the obvious supracrustal origin of garnet-mica schists at Ikamiut and in the Qasigiannguit area. The Naternaq supracrustal belt itself was outlined by Henderson (1969) on his preliminary map of the Egedesminde–Christianshåb area.

Kryolitselskabet Øresund A/S (KØ) undertook a major base metal exploration programme in the region in 1962–1964, which concentrated on the most extensively mineralised southern part of the Naternaq supracrustal belt, following the discovery of the mineralisation in 1962 (Keto 1962; Vaasjoki 1965). General geological, electromagnetic, magnetic and gravimetric ground surveys were carried out which helped define drilling targets characterised by anomalous electromagnetic signatures and Cu-Zn geochemical anomalies. These were drilled and trenched, and indicate a sulphide resource of 2.4–4.8 million tonnes grading 30–35 wt% Fe and locally up to 2.7% Cu and 3.75% Zn (Vaasjoki 1964, 1965). In 1978 a regional airborne magnetic and electromagnetic survey by KØ covered parts of central West Greenland including Naternaq (Peltonen 1978). In 1990–1993 Nunaoil A/S (now Nuna Minerals A/S) prospected at Naternaq with ground geophysical VLF and magnetic surveys, as well as a regional sediment sampling programme (Gowen 1992; Sieborg 1992; Grahl-Madsen 1994). Nunaoil also re-analysed the KØ drill cores for gold, and found Au values of up to 0.6 ppm over 0.35 m. These exploration programmes only paid limited attention to the genesis and structural evolution of the host rocks and their mineralisation processes.

In 1992 a high resolution aeromagnetic survey was carried out in central West Greenland by Geoterrex Ltd (Canada), financed by Danish and Greenlandic sources (Thorning 1993). Part of the resulting aeromagnetic map is shown in Fig. 2. A regional interpretation of the aeromagnetic data by Schacht (1992) distinguished several areas of supracrustal rocks, including those at Naternaq, as well as other geological features. The Lersletten supracrustal belt stands out as a prominent magnetic low, whereas orthogneisses generally produce banded

Fig. 1. Geological sketch map of the Naternaq–Ikamiut area based on field work in 2001 and reconnaissance data from Henderson (1969). The inset map shows the position in West Greenland (arrow), and the location of Fig. 3 is shown by a red frame.

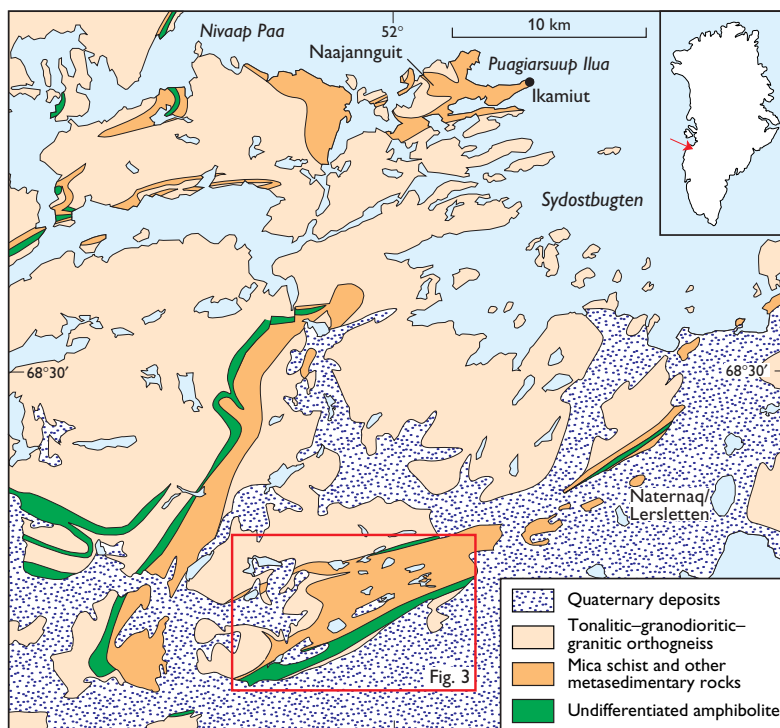
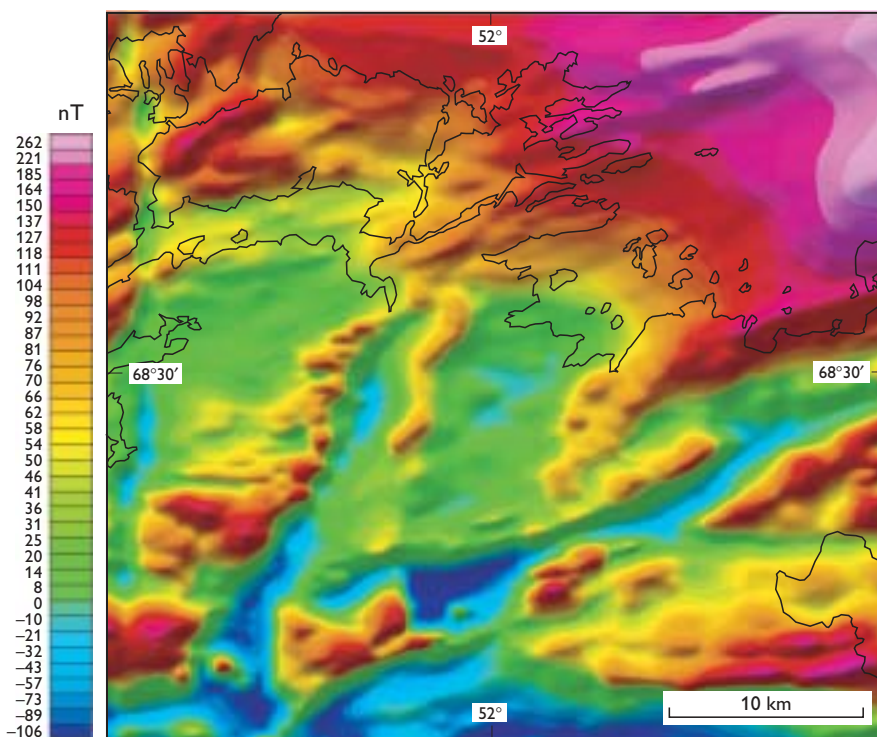


Fig. 2. Magnetic total-field intensity map with shaded relief of the Naternaq–Ikamiut area, the same area as shown on Fig. 1. The magnetic patterns clearly reflect the major fold structure and lithologies evident from Fig. 1. The shading was undertaken with an inclination of 20° and illumination from 330°. Data from the *Aeromag 1992* programme (Schacht 1992; Thorning 1993).



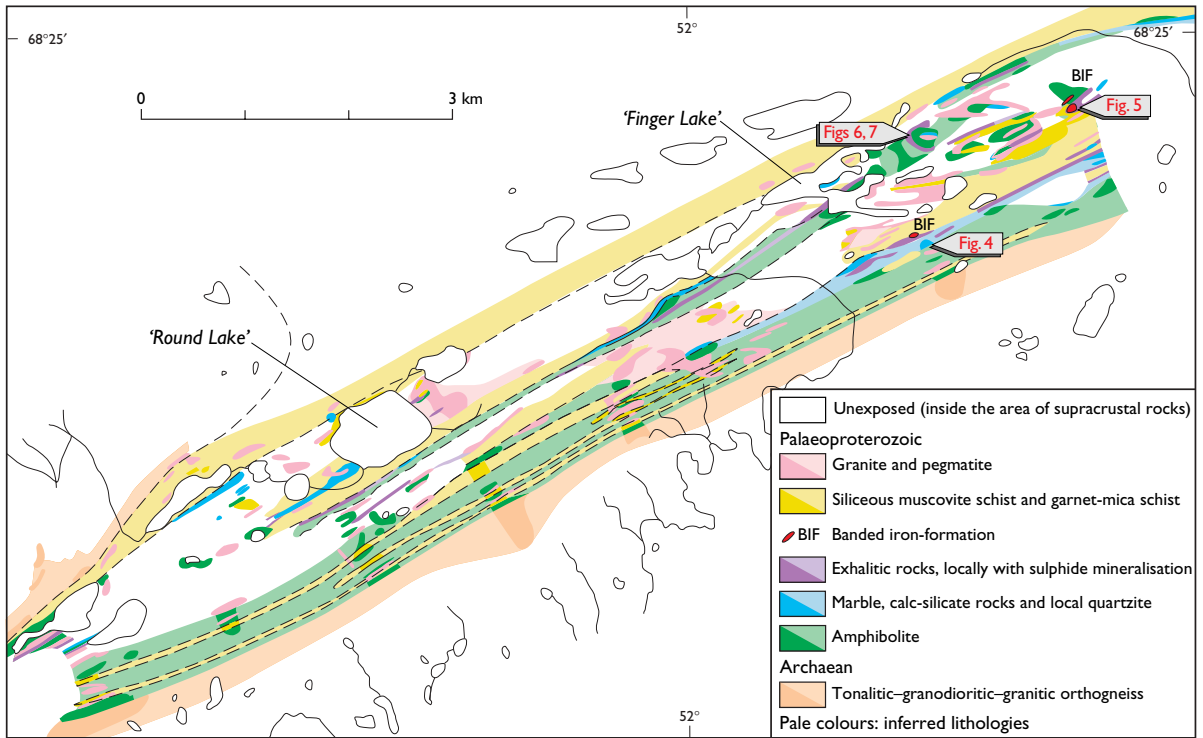


Fig. 3. Detailed geological map from the southern part of the Naternaq supracrustal belt. 'Round Lake' and 'Finger Lake' are informal KØ names (see the main text). The position in the Naternaq area is shown on Fig. 1. Positions of photographs (Figs 4–7) are shown by **arrows**.

linear anomalies of intermediate amplitude. Amphibolite, with intermediate to very high amplitudes, can be difficult to distinguish from orthogneiss. They are both visible as clusters of high amplitude anomalies with half-widths in the order of 1–2 km. Mica schists produce banded linear zones with low magnetic response, whereas granites produce equidimensional, homogeneous zones with high response.

Sparse geochronological data from the Naternaq area suggest that the Naternaq supracrustal belt itself is of Palaeoproterozoic age, whereas the supracrustal rocks at Ikamiut are probably Archaean. Kalsbeek (1993) and Kalsbeek & Taylor (1999) obtained a Palaeoproterozoic Rb-Sr whole-rock age from metasedimentary rocks at Ikamiut which shows that this area was reworked during the Nagssugtoqidian orogeny, but the inferred initial  $^{87}\text{Sr}/^{86}\text{Sr}$  ratio is so high that these rocks were interpreted as Archaean. Ion probe U-Pb age determinations carried out by the Danish Lithosphere Centre in the mid-1990s of a few zircons from one of the granodioritic to granitic orthogneiss bodies that appear to cut the supracrustal belt indicated an emplacement age between 2750 and 2900 Ma (Kalsbeek & Nutman 1996);

however, details of the contact relationships between the orthogneisses and supracrustal rocks were not reported, and the contact may be tectonic. Four zircons were also analysed from a rock interpreted in the field as a meta-andesite, which was collected from the apparent continuation of the Naternaq supracrustal belt 10 km to the east of the area shown in Fig. 1. One of the zircons gave an Archaean age, whereas the three others gave ages of 1900–2000 Ma that could either be metamorphic or protolith ages. Preliminary  $^{207}\text{Pb}/^{206}\text{Pb}$  ages of around 2000 Ma recently obtained from detrital or volcanic zircons in a mica schist near 'Finger Lake' (Fig. 3; J.N. Connelly & K. Thrane, personal communication 2002) support the latter interpretation.

## Naternaq supracrustal belt

The Naternaq supracrustal belt outlines a major, composite, overturned fold with an amplitude of about 25 km and straight limbs (Fig. 1). The thicker, south-eastern limb is up to c. 2 km wide, subvertical, and seems to extend c. 60 km towards the east-north-east; a large part is con-

cealed by the Lersletten Quaternary deposits. The somewhat thinner north-western limb is *c.* 25 km long and has steep south-easterly dips. Axes of small-scale folds in the hinge zone, interpreted as representative for the orientation of the major fold, generally plunge moderately to steeply to the south-east. Steeply west-plunging folds are found within the south-eastern limb, which is commonly intensely folded internally. Outcrop patterns in different parts of the poorly exposed hinge zone suggest that the major fold structure is the result of more than one phase of folding, and refolded folds have been observed at a number of localities. It has, however, not been possible to establish a detailed deformation history. Intensely deformed horizons of supracrustal rocks with a northward concave flexure immediately to the west of the major fold may indicate the presence of a late NNE–SSW-trending (sinistral?) shear zone in this area.

Contacts between the supracrustal rocks and the regional tonalitic–granodioritic orthogneiss along the limbs of the major fold are generally sharp and intensely deformed, but the primary age relationships and nature of the contact are ambiguous. Variably deformed to almost undeformed masses of pink granite-pegmatite are particularly common in the hinge zone and post-date the orthogneiss. They are locally clearly discordant to the intensely deformed marginal part of the supracrustal belt and may have been emplaced during the development of the major overturned fold.

Three main rock types dominate the Naternaq supracrustal belt: amphibolite, fine-grained siliceous quartzo-feldspathic rocks, and garnet-mica schist. Quartzitic rocks, marble and calc-silicate rocks, carbonate and oxide facies iron-formation, and chert-rich layers interpreted as exhalites, are minor constituents. In spite of internal folding and possibly thrusting the supracrustal belt possesses a crude lithological stratigraphy which is interpreted as a primary feature. Amphibolite is consistently found along the outer margin of the major fold, succeeded towards the core by fine-grained siliceous quartzo-feldspathic rocks alternating with garnet-mica schist in which other horizons of amphibolite are intercalated. Where marble is present, mostly intercalated with calc-silicate rocks, it immediately succeeds the marginal amphibolite (Fig. 3).

### Amphibolitic rocks

The amphibolites in most parts of the supracrustal belt are granoblastic to intensely schistose or lineated, mostly very fine-grained rocks primarily composed of hornblende and plagioclase, commonly with minor quartz

and biotite, and locally garnet. Varieties with deformed, 1–5 cm long plagioclase aggregates (possibly former phenocrysts) have also been observed. In places medium-grained, homogeneous, plagioclase-rich ‘grey amphibolite’ and hornblende-quartz rocks occur. The main *c.* 200–400 m thick amphibolite unit at the margin of the belt commonly contains irregular, interconnected calc-silicate bands and lenses which are up to a few centimetres thick and more or less conformable with the main foliation; the adjacent amphibolite is commonly garnet-bearing. Locally, the calc-silicate rich layers are up to *c.* 20 cm thick and may be followed for tens of metres along strike. The fine-grained, calc-silicate banded amphibolites are interpreted as variably spilitised or hydrothermally altered, and subsequently strongly deformed, lavas and breccias. Small bodies of medium-grained, foliated to granoblastic, hornblende- or plagioclase-porphyroblastic varieties of probable intrusive origin also occur. Up to 10 m thick layers of biotite (-garnet) schist are common within the amphibolite. In the westernmost part of the hinge zone, as well as in other parts of the marginal amphibolite, 1–30 cm thick layers of very fine-grained siliceous, muscovite- and biotite-bearing, pale grey metasedimentary or meta-volcanic rocks are interleaved with the amphibolite.

### Chemical sedimentary rocks, banded iron-formation and sulphide mineralisation

In the southern and north-western parts of the supracrustal belt, especially near the lakes designated ‘Round Lake’ and ‘Finger Lake’ by KØ (Fig. 3), the marginal amphibolite is succeeded by an irregular, and in most places intensely deformed sequence of chemical sediments. These mainly consist of marble, with minor carbonate and oxide facies banded iron-formation and cherty exhalites, the latter locally with semi-massive to massive sulphide mineralisation (see below). The detailed map of this area (Fig. 3) shows up to three separate sequences of marble and exhalites with sulphide mineralisation, which is due to repetition of a single original sequence by folding.

The scattered, up to *c.* 100 m thick marble occurrences near ‘Round Lake’ and ‘Finger Lake’ (Fig. 4) mainly consist of impure, greyish to brownish weathering, fine-grained dolomitic marble, commonly with centimetre- to decimetre-thick intercalations of calcite marble and calc-silicate rocks dominated by tremolite-actinolite + diopside ± dolomite and late talc. The lack of forsterite and the presence of sillimanite in adjacent pelitic rocks suggest *P–T* conditions of approximately 650 ± 50°C at



Fig. 4. Dolomitic marble in the southern part of the Naternaq supracrustal belt (location shown on Fig. 3).



Fig. 5. Carbonate-oxide facies banded iron-formation in the southern part of the Naternaq supracrustal belt (location shown on Fig. 3). Hammer: 50 cm.



Fig. 6. Weathered-out chert-sulphide concretions of possible diagenetic origin in sulphide-mineralised host in the southern part of the Naternaq supracrustal belt (location shown on Fig. 3). Hammer: 50 cm.

4.5 ± 0.5 kbar; tremolite-actinolite may have grown during decreasing temperature. A few other marble horizons up to about two metres thick have also been found at approximately the same stratigraphic level, e.g. in the hinge zone of the major fold. The banded iron-formation forms sporadic, 0.5–1 m thick layers on the south-eastern fold flank along strike of the dolomite marble, and consists of alternating centimetre-thick layers of dolomite, magnetite, siderite, quartz and calc-silicate minerals. A single, larger, c. 30 × 40 m fold closure with the same type of banded iron-formation crops out east-north-east of ‘Finger Lake’ (Fig. 5).

A range of variably altered, conformable horizons of very fine-grained siliceous and sulphidic lithologies associated with either amphibolite or marble are interpreted as volcanogenic-exhalitic rocks. Light grey, finely laminated (millimetre-scale) cherty rocks predominate and usually contain up to c. 20% dark, very fine-grained sulphidic seams. The fine lamination, which may be a primary feature, is in most places destroyed by intense secondary alteration characterised in the field by a sulphide-yellow, variably rusty appearance. Seams of fine-grained dolomite and micaceous metasediments are commonly intercalated with the mineralised cherty layers, resulting in composite, rusty weathering outcrops with variable mineralogy.

The largest semi-massive to massive pyrrhotite-rich sulphide mineralised zones are found near ‘Round Lake’ and ‘Finger Lake’ (Fig. 3). Massive sulphides form up to c. 2 m wide and 10 m long lenses (maximum size 2 × 10 m); the mineralised rocks are iron-rich and dominated by pyrrhotite, with minor chalcopyrite and sphalerite (up to c. 3%) and subordinate pyrite, arsenopyrite, magnetite

Fig. 7. Sulphide mineralisation concentrated in the hinge areas of metre-scale angular folds. Southern part of the Naternaq supracrustal belt (location shown on Fig. 3). Hammer: 50 cm.



and graphite. Thinner, conformable horizons containing disseminated to semi-massive sulphides may be followed for up to a few hundred metres. Within one of the mineralised zones at 'Finger Lake', a number of 10–40 cm chert-sulphide concretions were observed in a pyrrhotite-rich, semi-massive sulphidic host rock (Fig. 6). It is considered likely that these concretions were formed during the mineralising event itself, or the subsequent diagenesis. Disseminated sulphides are common in the host amphibolite, marble and mica schist adjacent to the massive and semi-massive sulphide occurrences.

Metre-sized and larger, tight, overturned, angular folds are common in the mineralised areas. Many of the massive sulphide lenses occur in the hinge zones of such small-scale folds (Fig. 7), indicating a certain degree of hydrothermal sulphide remobilisation during the pervasive ductile deformation. However, detailed mapping south-east of both 'Round Lake' and 'Finger Lake' shows that these lenses could be stratigraphically connected with each other. The sulphidic, exhalite horizons are commonly extensively crushed along narrow, secondary fault zones.

### Quartzitic rocks

Discrete, 1–5 m thick, fine-grained quartzitic horizons *s.s.* with thin magnetite-rich seams, presumably of clastic sedimentary origin, are found locally adjacent to the marble. Another quartzitic unit without magnetite seams, but containing dispersed, fine-grained biotite, occurs on the south-eastern limb of the major fold some 15 km east of the area shown in Fig. 3. It has a strike length of *c.* 2 km and is up to 30–40 m thick.

### Fine-grained siliceous and pelitic metasediments

The interior part of the supracrustal belt at Naternaq with respect to the major overturned fold is a *c.* 200–300 m thick succession of mainly siliceous, muscovite schists together with minor biotite-garnet schists and amphibolite. The siliceous schists are generally light grey to light brown in colour and very fine-grained; they commonly have a very massive appearance without much apparent lithological variation, and no primary structures have been observed. In some places they contain up to centimetre-sized porphyroblasts or pseudomorphs of andalusite. Garnet-rich horizons are common adjacent to amphibolite contacts. The origin of the siliceous schists is not clear from their field appearance alone; they may be metasedimentary or metavolcanic rocks, or a mixture of both (see discussion).

Garnet-mica schists, commonly sillimanite-bearing, generally fine- to medium-grained and with a strong penetrative S fabric, are intercalated with the siliceous schist and fine-grained amphibolite in layers from a few centimetres to tens of metres thick. In some areas the schists contain irregular to strongly planar quartzofeldspathic melt veins on a centimetre-scale, which give them a migmatitic appearance.

### Supracrustal rocks of the Ikamiut district

Supracrustal rocks crop out extensively south and west of Ikamiut, the settlement between the bays of Nivaap Paa and Sydostbugten in the south-east corner of Disko

Bugt (Fig. 1; Henderson 1969). The area was mapped in some detail in August 2001, allowing refinement and simplification of Henderson's original map and resolving some of the peculiarities of outcrop pattern that arose from his reconnaissance mapping. The supracrustal rocks are dominated by siliciclastic rocks, with subordinate but important amphibolite horizons.

### Relationships between orthogneisses and supracrustal rocks

The supracrustal rocks are interlayered with granodioritic to tonalitic orthogneisses. As far as could be determined, the interlayering is tectonic. Where contacts between supracrustal rocks and orthogneisses can be observed unambiguously, they are generally marked by high strain and extensive mylonitic developments.

On the west coast of Naajanguit, 5.7 km due west of Ikamiut in the northern part of the area (Fig. 1), a unit of supracrustal rocks is sandwiched between orthogneisses. The contacts on both sides of this supracrustal unit are highly strained and marked by mylonites, indicating tectonic interleaving. The orthogneisses seen here seem to contain an additional phase of deformation to that affecting both the orthogneisses and the supracrustal rocks as a whole.

Relationships between the orthogneisses and supracrustal rocks are somewhat obscure in the central part of the Naajanguit area, where distinction between siliceous and psammitic supracrustal lithologies and orthogneisses is rendered difficult by similarities in composition and partial melting effects. No cross-cutting relationships that would indicate an intrusive relationship have been observed, but such relationships may have been obscured by the deformation. Such extremely limited evidence as there is suggests that the supracrustal rocks were deposited upon the orthogneisses, but this remains to be confirmed. The orthogneisses and metasedimentary rocks are disposed about kilometre-scale open to tight upright folds that fold the penetrative fabric in the rocks as well as the mylonitic contacts between the orthogneisses and the metasedimentary rocks. A strong, penetrative stretching lineation is consistently parallel to the WSW-plunge of the major folds.

### Supracrustal lithologies

The dominant supracrustal lithologies are psammites, micaceous psammites, schistose to gneissose pelites and semipelites. Siliceous psammitic and quartzitic lithologies are also present, and amphibolites form a

subordinate but important component. No unambiguous evidence of younging was found, although possible graded bedding was observed at one locality, suggesting the rocks are the right way up.

The semipelitic and pelitic lithologies are well exposed on the north-western side of Puagiarsuup Ilua. They are coarse, schistose to gneissose migmatitic rocks with ubiquitous thin, centimetre-scale, lenticular quartz-feldspar leucosome veins, commonly with biotite-rich selvages. Garnet is commonly abundant and is wrapped by the penetrative schistose to gneissose fabric. Sillimanite is present locally and, in one or two places, appears to be a pseudomorph after kyanite. Sillimanite is also seen replacing biotite. Locally, coarse quartz-plagioclase pegmatite is abundant, forming metre-thick, lenticular bodies within the micaceous host rock. Local garnet, muscovite and sillimanite in the pegmatites indicate derivation from a metasedimentary source. Other 'pegmatitic' bodies of pale rock in this area are layered internally and may be deformed psammites within the more pelitic rocks.

The psammitic rocks vary from medium- to coarse-grained, dark, micaceous psammites to pale, quartzitic rocks. Contacts with the semipelitic–pelitic lithologies are transitional to sharp. The psammitic rocks are locally garnet-bearing and, where amphibolites occur in adjacent outcrops, may also contain amphibole, suggesting a volcanic input. The more micaceous psammitic rocks are commonly migmatitic, with a quartz-feldspar leucosome. While all the siliceous rocks are likely to be sedimentary in origin, it is possible that some of them may have been acid volcanic rocks.

Although subordinate in volume, there are significant units of amphibolite, some of which contain abundant large garnet porphyroblasts with very fine-grained quartz-plagioclase pressure shadows. The amphibolites are locally massive, but tend generally to be layered and heterogeneous, with diopsidic and plagioclase-rich layers and marginal developments of thinly layered, calc-silicate-bearing units. The amphibolite units are lenticular and of limited lateral extent. A particularly fine sequence of layered calc-silicate-bearing rocks crops out on the peninsula north-west of Ikamiut, where they are characterised by the presence of diopside with some dark brown orthopyroxene. From their lithological character, it is considered that the amphibolites and associated rocks are most likely to be metavolcanic in origin. Sulphide mineralisation occurs locally at the margins of amphibolites, where calc-silicate-bearing units are developed.

## Regional correlation

The Ikamiut supracrustal rocks are, in general, very similar to those described from Naternaq, although no carbonate rocks, marbles, banded iron-formation or layered cherts have been recorded in the Ikamiut area. Thus the Ikamiut rocks are provisionally correlated with those from Naternaq, with a possible continuation to the north-east along strike from Ikamiut.

## Discussion and conclusions

An interpretation of the depositional age and plate-tectonic setting of the Naternaq supracrustal belt is essential for an evaluation of its economic potential. However, the available geochronological data are not sufficient to confidently determine its age. While observations from adjacent areas in 2001 indicate that the orthogneiss precursors are likely to have been intruded into supracrustal packages (van Gool *et al.* 2002, this volume), in the Ikamiut area there are hints of a depositional unconformity.

Age determinations of orthogneisses farther south in the Nagssugtoqidian orogen have shown that almost all are Archaean. The only exception is the *c.* 1900 Ma Arfersiorfik quartz diorite, which was emplaced between the two Archaean continents that collided during the Nagssugtoqidian orogeny and was involved in the ensuing thrust stacking of Archaean and Palaeoproterozoic crust in the central part of the orogen (e.g. Kalsbeek *et al.* 1984, 1987; Connelly *et al.* 2000). Field observations in 2001 by one of the authors (A.A.G.) suggest that the northern limit of the thrust stack straddles 68°N. A preliminary conjecture based on the structural and geochronological data currently available indicates that the orthogneisses in the Naternaq area belong to the northern continent and are late Archaean in age, that large fold structures farther to the south-west and hence also the supracrustal rocks in that area are Archaean, but that the Naternaq supracrustal belt and its fold structures are Palaeoproterozoic.

Due to ubiquitous high strain along the contacts between the Naternaq supracrustal belt and the orthogneisses it is not known with certainty whether the former were deposited on the latter with a primary depositional unconformity, or whether the two units are tectonically interleaved. A third possibility, that the gneiss precursors intruded the supracrustal sequence, seems less likely in view of the recent age determinations of zircons from the supracrustal belt reported

above. This unresolved problem has an important bearing on the evaluation of the economic potential of the supracrustal belt: is this a predominantly clastic epicontinental sequence with a low economic potential, or is it an arc-related, predominantly volcanic, bimodal sequence comprising a lower, basic sequence (the marginal amphibolite) and an upper, acid sequence (the siliceous mica schists), and thus with an interesting base metal and gold potential? Further study of the siliceous mica schists, including geochemistry and more precise age determinations of their zircons, may provide an answer to this question. In addition, future work may show that both Archaean and Palaeoproterozoic supracrustal rock sequences occur side by side in the Naternaq area.

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# A coastal survey in the southern part of the Palaeoproterozoic Rinkian fold belt, central West Greenland

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A brief but potentially important part of the 2001 field investigations in the Precambrian of West Greenland (van Gool *et al.* 2002, this volume) was devoted to the southernmost part of the Palaeoproterozoic Rinkian fold belt east of Disko Bugt (Fig. 1). From 9–17 August the five authors carried out a reappraisal of critical Archaean and Proterozoic relationships and collected samples for precise geochronological studies. The principal aims are to date the main Rinkian tectonic and metamorphic events in this region as precisely as possible and compare them with the evolution of the Nagssugtoqidian orogen to the south (see van Gool *et al.* 2002, this volume, fig. 1). The vessel M/S *Søkongen* provided logistic support; a helicopter provided transport to Nunatarsuaq.

## Geological background

The Archaean continental terrains in West and East Greenland, north-eastern Canada, Scotland and Scandinavia were gradually amalgamated during a series of major Palaeoproterozoic orogenic events to form one of the earliest large continents on Earth. Recent structural and geochronological studies have significantly improved the correlation between the individual orogens and the understanding of the overall plate-tectonic framework (e.g. Clowes *et al.* 1999), but there remain significant geographical, chronological and structural uncertainties. One of these concerns the boundary zone between the Nagssugtoqidian and Rinkian orogenic belts in central West Greenland (van Gool *et al.* 2002, this volume, fig. 1). It is quite possible that the two belts formed contemporaneously within a common, or at least related, plate-tectonic setting. However, the structural styles of the two belts are different; at least one part of the contact region between the two belts only displays very weak Palaeoproterozoic reworking, and only a rudimentary geochronological data base is currently available for the Rinkian belt.

Recent geochronological and structural studies in the southern and central Nagssugtoqidian orogen by the Danish Lithosphere Centre have established an accurate and robust time-frame for the accretion of its Archaean magmatic elements, the Palaeoproterozoic magmatic arc component, its subsequent tectonic accretion, and final stabilisation (Connelly *et al.* 2000; Willigers *et al.* 2002). These insights are being largely corroborated by ongoing work in the northern Nagssugtoqidian orogen (van Gool *et al.* 2002, this volume).

Such constraints are not yet available for the Rinkian fold belt (Henderson & Pulvertaft 1987; Grocott & Pulvertaft 1990; Kalsbeek *et al.* 1998). During the most recent investigations by the Survey conducted in 1988–1991 (Kalsbeek 1999), it was established that Rinkian structural reworking was strong in eastern Nuussuaq, southern Arveprinsen Ejland and areas to the east. In contrast, the intervening Ataa domain was largely unaffected by reworking (Fig. 1; Kalsbeek *et al.* 1988; Escher *et al.* 1999; Garde & Steenfelt 1999a, b; Grocott & Davies 1999). An Ar-Ar and K-Ar geochronological study confirmed this general interpretation but with a broad spread of ages (Rasmussen & Holm 1999). A few ion probe U-Pb zircon ages, whole-rock Pb-Pb and Rb-Sr ages and model Sm-Nd ages showed that both the Atâ tonalite and adjacent supracrustal lithologies in the Ataa domain were magmatically accreted at 2800 Ma (Kalsbeek & Taylor 1999; Nutman & Kalsbeek 1999). However, the age histories of the reworked, supposedly Archaean basement of Nuussuaq and the Palaeoproterozoic reworking north and south of the Ataa domain have yet to be unravelled.

In this contribution, we present a summary of our main objectives in the southern part of the Rinkian fold belt and relate them to the geological problems outlined above. An overview of the southern part of the Rinkian belt can be found in Garde & Steenfelt (1999a).