Precambrian geology of the northern Nagssugtoqidian orogen, West Greenland: mapping in the Kangaatsiaq area

Jeroen A.M. van Gool, G. Ian Alsop, Uni E. Árting, Adam A. Garde, Christian Knudsen,
Adam W. Krawiec, Stanislaw Mazur, Jeppe Nygaard, Sandra Piazolo, Christopher W. Thomas and
Kristine Thrane

The Nagssugtoqidian orogen and its transition into the Rinkian orogen to the north were the main focus of the field activities of the Geological Survey of Denmark and Greenland (GEUS) in West Greenland in the summer of 2001. This work was carried out within the framework of the Survey's three-year programme of bedrock mapping and mineral resource evaluation to enhance the understanding of the Archaean and Palaeoproterozoic crustal evolution in the transition zone between the Nagssugtoqidian and Rinkian orogens (Fig. 1). The work in the field season of 2001 comprised geological mapping of the 1:100 000 Kangaatsiaq map sheet described in this paper (Fig. 2), an investigation of the supracrustal rocks at Naternaq / Lersletten (Østergaard *et al.* 2002, this volume), a geochronological reconnaissance of the southern Rinkian orogen in the northern Disko Bugt region (Garde *et al.* 2002, this volume), a resource evaluation of the Nagssugtoqidian orogen (Stendal *et al.* 2002, this volume), a synthesis and interpretation of geophysical data of the central part of the Nagssugtoqidian orogen (Nielsen *et al.* 2002, this volume) and a report on investigations of the kimberlites and related intrusive rocks in the southern Nagssugtoqidian orogen and its foreland (Jensen *et al.* 2002, this volume).

The present investigations build on recent previous activities in the region. The Disko Bugt project of the former Geological Survey of Greenland investigated the geology and evaluated the resource potential of the southern part of the Rinkian orogen between Nuussuaq and Jakobshavn Isfjord from 1988 to 1992 (Fig. 1; Kalsbeek 1999). The Danish Lithosphere Centre (DLC) led a research project from 1994–1999 into the tectonic evolution of the Nagssugtoqidian orogen concentrating on the southern and central segments of the orogen between Sukkertoppen Iskappe and Nordre Strømfjord (Marker *et al.* 1995; van Gool *et al.* 1996, in press; Mengel *et al.* 1998; Connelly *et al.* 2000). Previous activity in the area between Nordre Strømfjord and Jakobshavn Isfjord (Fig. 1) included reconnaissance mapping by Noe-Nygaard & Ramberg (1961), 1:250 000 scale mapping by Henderson (1969), and visits to key localities during the DLC project (Marker *et al.* 1995; Mengel *et al.* 1998) from which a few reconnaissance age determinations are known (Kalsbeek & Nutman 1996). Most of this area was known from coastal exposures, while map information for large parts of the inland areas was based only on photogeological interpretation. The mineralised parts of the Naternaq supracrustal belt were investigated in detail by Kryolitselskabet Øresund A/S from 1962–1964 (Keto 1962; Vaasjoki 1965). Immediately south of latitude 68°N the 1:100 000 scale Agto (Attu) map sheet was published by Olesen (1984), and the adjacent Ussuit map sheet to the east is in preparation (Fig. 1). Mapping in 2001 concentrated on the Kangaatsiaq map sheet area and the Naternaq area (Østergaard *et al.* 2002, this volume), while mapping activity for 2002 is planned between Naternaq and Jakobshavn Isfjord (Fig. 1).

The field work in 2001 was supported by M/S *Søkongen* as a floating base from which field camps were established. The shoreline exposures are excellent and the many islands and extensive fjord systems in the map area provide easy access. Limited helicopter support was available for establishment of a few inland camps and reconnaissance in areas far from the coast.

The Nagssugtoqidian orogen

The Nagssugtoqidian orogen is a 300 km wide belt of predominantly Archaean gneisses which were reworked during Palaeoproterozoic orogenesis. It is characterised by E–W-trending kilometre-scale folds and ENE–WSW-trending linear belts. It is divided into three tectonic segments: the southern, central and

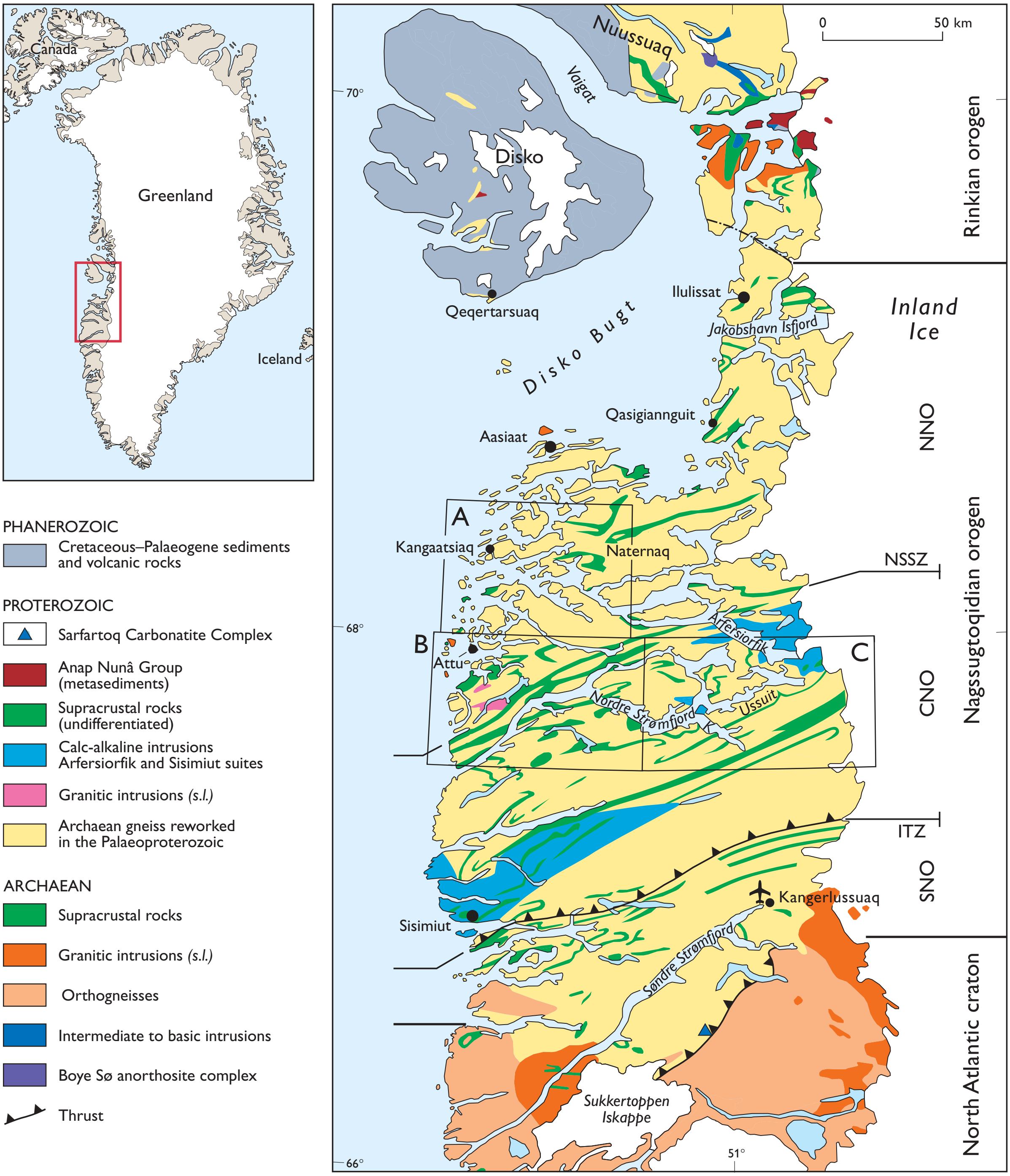

Fig. 1. Geological map of southern and central West Greenland, showing the divisions of the Nagssugtoqidian orogen and the boundaries with the North Atlantic craton to the south and the Rinkian orogen to the north. Outlined areas indicated **A**, **B** and **C** are, respectively, the Kangaatsiaq, Agto (Attu) and Ussuit 1:100 000 map sheets. **ITZ**: Ikertôq thrust zone. **NSSZ**: Nordre Strømfjord shear zone. **SNO**, **CNO** and **NNO** are, respectively, the southern, central and northern Nagssugtoqidian orogen. Modified from Escher & Pulvertaft (1995) and Mengel *et al.* (1998).

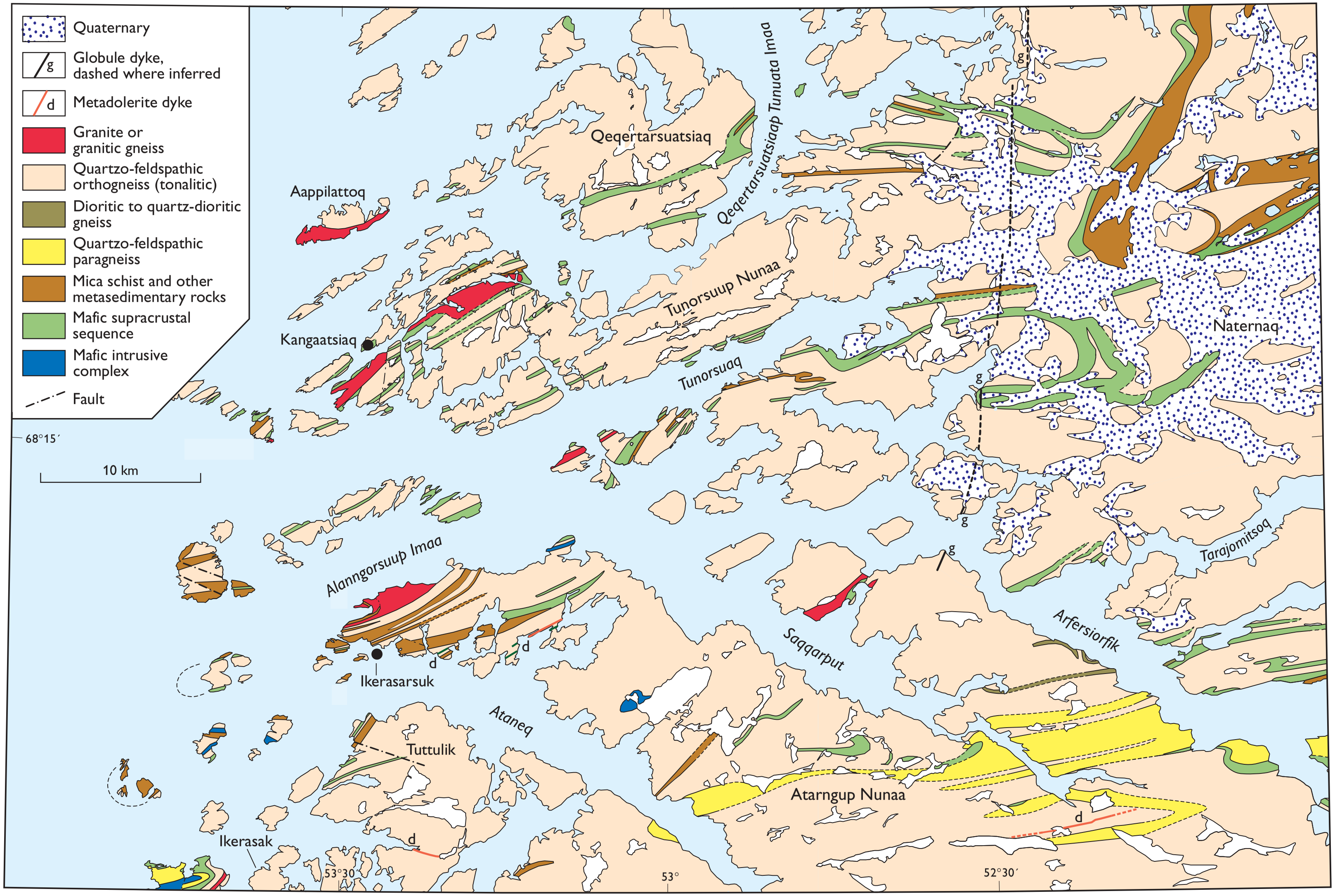

Fig. 2. Simplified geology of the Kangaatsiaq map sheet. For location, see Fig. 1, frame A.

northern Nagssugtoqidian orogen (SNO, CNO and NNO, Fig. 1; Marker *et al.* 1995). These segments are interpreted by van Gool *et al.* (2002) as, respectively, a southern parautochthonous foreland zone, a central collisional core of the orogen and a northern transition zone to the Rinkian orogen. Archaean granulite-facies gneisses of the North Atlantic Craton, which forms the southern foreland, were reworked in the SNO at amphibolite facies during south-directed thrusting and folding. The CNO comprises, besides Archaean gneisses, two main bodies of Palaeoproterozoic calc-alkaline intrusive rocks: the Sisimiut charnockite suite in the south-west and the Arfersiorfik intrusive suite in the north-east (Kalsbeek & Nutman 1996; Whitehouse *et al.* 1998), which are interpreted as remnants of magmatic arcs associated with subduction (Kalsbeek *et al.* 1987). Palaeoproterozoic metasedimentary rocks are known from narrow belts in the CNO and in the northern part of the SNO. In the northern part of the CNO they are intruded by quartz diorite and tonalite of the Arfersiorfik intrusive suite (Kalsbeek & Nutman 1996; van Gool *et al.* 1999). This association of Palaeoproterozoic intrusive and supracrustal rocks was interleaved with Archaean gneisses by NW-directed thrust stacking during early stages of collision (van Gool *et al.* 1999, 2002; Connelly *et al.* 2000). Thrust stacks and associated fabrics were subsequently folded in several generations of folds, the latest forming shallowly east-plunging upright folds on the scale of tens of kilometres. The CNO is largely at granulite facies, with the exception of its north-eastern corner which is at amphibolite facies. Its northern boundary is formed by the Nordre Strømfjord shear zone (Fig. 1; Marker *et al.* 1995; Hanmer *et al.* 1997).

The NNO is the least known part of the orogen. Tonalitic orthogneisses of Archaean age are interleaved with supracrustal rocks of both volcanic and sedimentary origin, most of which form belts up to 500 m wide (Mengel *et al.* 1998). Supracrustal rocks are less common than in the CNO, but the up to 2 km wide Naternaq supracrustal belt in the north-east is one of the largest coherent supracrustal belts in the orogen (Fig. 1). The main deformational features are a regional foliation, large-scale ENE–WSW-trending folds and several ductile high-strain zones, both steeply and shallowly dipping. The metamorphic grade is predominantly amphibolite facies, but increases southwards to granulite facies around Attu (Mengel *et al.* 1998; Connelly *et al.* 2000). ^{40}Ar/^{39}Ar age determinations on hornblende from the NNO indicate that Nagssugtoqidian metamorphic temperatures of at least 500°C prevailed as far north as Ilulissat (Willigers *et al.* 2002). Nagssugtoqidian deformation in the Nordre Strømfjord shear zone at the southern boundary of the NNO resulted in a penetrative gneissic high-grade fabric, large-scale upright folds and localised shear zones, as seen in the deformation of Palaeoproterozoic intrusive and sedimentary rocks (Hanmer *et al.* 1997; Mengel *et al.* 1998; van Gool *et al.* 2002). It is not clear to what extent the structures and lithologies in the NNO can be correlated with those in the Nordre Strømfjord shear zone or further south.

Geology of the Kangaatsiaq area

The Kangaatsiaq map sheet covers a large part of the western half of the NNO (Figs 1, 2). Supracrustal rocks were previously recognised in a zone trending from the north-eastern to the south-western quadrant of the map where they outline major fold structures. The south-central and south-eastern parts were indicated as homogeneous orthogneiss due to lack of observations (Escher 1971). A quartz-diorite body was distinguished in the south-eastern part of the map area by Henderson (1969). A few minor occurrences of granite were known, of which that at Naternaq is the largest (Figs 1, 2).

During field work in 2001, twelve lithological units were distinguished, of which several were previously unknown. Ten of these rock types are represented on the map in Fig. 2, while occurrences of the others are too small for the scale of the map. Relative age relationships were established for most of the rock types but absolute ages are still largely unknown. The few available geochronological data are discussed in a separate section below. The Naternaq supracrustal sequence is described by Østergaard *et al.* (2002, this volume). The other lithological units are described below from oldest to youngest.

Mafic intrusive complexes

Dismembered, layered mafic to ultramafic intrusive complexes are dominated by medium- to coarse-grained, massive to moderately foliated, homogeneous amphibolite, but locally igneous layering is preserved (Fig. 3). The rocks contain hornblende and plagioclase, with or without clinopyroxene, orthopyroxene, biotite, quartz or garnet. The protolith rock types include gabbro, gabbro-norite, ultramafic rocks (mostly pyroxenite and hornblendite), and rarely thin anorthosite sheets occur. This association occurs within the domi-

Fig. 3. Well-preserved metamorphosed layered gabbro in an outcrop of the mafic intrusive complex on the island of Ikerasak in the south-western corner of the map area.

nant tonalitic orthogneisses mainly as lenses up to tens of metres in diameter, but also forms larger bodies up to 2 km across. The rocks are cut by tonalitic and granitic intrusive sheets and veins and occur often strongly agmatised. The mafic lenses contain remnants of a foliation and subsequent folding, which predate the intrusion of the regional orthogneisses. The mafic intrusive complexes are most abundant in the southern part of the map area.

Mafic supracrustal sequences

Thinly layered mafic to intermediate sequences with thin felsic intercalations are interpreted as supracrustal, predominantly meta-volcanic sequences (Fig. 4). They are layered on a millimetre- to centimetre-scale and contain variable amounts of hornblende and plagioclase, with or without clinopyroxene, biotite, garnet and quartz. Isolated, thin quartzo-feldspathic layers, *c.* 5 to 20 cm thick, are interpreted as psammitic incursions in which presumed granule and pebble-sized detrital grains were observed north-east of Kangaatsiaq. These rocks are intruded by the dominant tonalitic gneiss and occur both as up to 500 m thick, laterally extensive sequences and as smaller xenoliths. In several cases the boundary between the tonalitic gneiss and the supracrustal sequence is tectonically reworked. The age relationship between the mafic supracrustal and mafic intrusive rocks could not be established. The mafic supracrustal rocks are common in a *c.* 20 km wide belt that extends from the south-

Fig. 4. Mafic supracrustal sequence consisting of layered (meta-volcanic) amphibolite alternating with thin layers of psammite and quartzite. Outcrop is located 18 km south-east of Kangaatsiaq. Lens cap, centre, is 7 cm in diameter.

western to the north-eastern corner of the map area (Fig. 2). The mafic supracrustal sequences contain rare, up to 5 m thick layers of medium-grained, forsterite-humite marble or medium- to coarse-grained, diopside-rich calc-silicate rocks.

Mica schist

Sequences of mica-rich rocks vary from biotite-rich semi-pelitic schists to biotite, garnet- and sillimanite-bearing schists and gneisses, which are intercalated with thin quartzo-feldspathic layers and some quartzite. In the northern part of the area the gneisses locally contain muscovite, kyanite or cordierite. The schists are generally associated with mafic supracrustal rocks, and rarely form isolated occurrences. They are especially abundant in a belt in the central part of the map area and in the Naternaq area (Østergaard *et al.* 2002, this volume).

Quartzo-feldspathic paragneisses

Quartzo-feldspathic gneisses form 2–3 km thick sequences in the south-eastern part of the map area where they are interpreted as metapsammitic rocks. These grey, medium-grained paragneisses are rather homogeneous, often quartz-rich and poor in biotite, and may contain abundant small (1–2 mm) garnets. Local rounded quartz and feldspar grains up to 1 cm across are interpreted as pebbles. The quartzo-feldspathic paragneisses are interlayered with 5–100 cm wide amphibolite layers, which are probably of volcanic origin. Slightly discordant, deformed mafic dykes (see below) have also been observed. Rare, biotite-rich micaceous layers locally contain garnet and sillimanite. Contact relationships with the surrounding grey orthogneisses and their relative ages are uncertain, and locally these two litholigical units can be difficult to distinguish in the field.

Dioritic to quartz-dioritic gneiss

This unit consists of medium-grained, uniform, dark-grey migmatitic or agmatitic orthogneisses, containing hornblende, plagioclase, quartz and minor biotite. It occurs mainly as small lenses in the tonalitic orthogneiss unit and only seldom forms larger, mappable bodies in the south. The largest bodies and layers of quartz-diorite are up to 50 m wide and occur in the Arfersiorfik area (Fig. 2). Contact relationships with the tonalitic gneisses are not clear everywhere, but a few dioritic bodies occur as xenoliths. None of the quartz-diorite bodies have so far been correlated with the Palaeoproterozoic Arfersiorfik quartz diorite (Kalsbeek *et al.* 1987) that occurs in the eastern end of Arfersiorfik and Nordre Strømfjord (Fig. 1). However, this correlation cannot be ruled out for at least some of the occurrences, and geochemical analyses and possibly geochronology will be used to test this. The large body of quartz-dioritic gneiss north and south of the fjord Tarajomitsoq in the eastern part of the map area, indicated by Henderson (1969), could not be confirmed.

Fig. 5. Tonalitic gneiss with amphibolite lenses, presumed to be mafic dyke remnants. Pink granitic veins give the rock a migmatitic texture. Near Alanngorsuup Imaa.

Tonalitic and associated quartzo-feldspathic orthogneiss

The predominant orthogneiss unit comprises a wide range of lithologies, which in most cases lack sharp mutual contacts and cannot be mapped out as separate units. Grey, fine- to medium-grained biotite-bearing tonalitic gneiss predominates (Fig. 5). Tonalitic gneiss with abundant medium-grained hornblende occurs commonly in the proximity of mafic inclusions, and a plagioclase-porphyric, hornblende-bearing tonalitic gneiss, characterised by up to 2 cm large clusters of hornblende occurs mainly in the north-western part of the map area. In places, the orthogneiss is migmatitic, containing up to 30% coarse-grained, K-feldspar-rich melt veins up to 5 cm thick (Fig. 5). Another less common melt phase intruding all varieties of the grey orthogneiss consists of leucocratic, white, medium- to coarse-grained granodiorite to granite and occurs predominantly in the south. It forms veins and larger coherent bodies up to one metre wide and can locally form up to 30% of the rock volume.

High-grade, mafic dyke relics

These metadolerite dyke relics are homogeneous, fine- to medium-grained, and consist of hornblende, plagioclase and clinopyroxene, with or without orthopyroxene, biotite and quartz. Garnet is seen rarely at the margins. Commonly the dykes are intensely deformed, foliated and lineated, boudinaged, or transformed to mafic schlieren which can be difficult to identify as dykes (Fig. 5). The less deformed dykes are commonly about 20 cm thick, but can reach 50 cm. Discordant relationships can be preserved in areas of low strain, but angles of discordance are always small. The dykes are widespread and locally form up to 25% of the rock volume, but they do not form a map unit that can be depicted on the scale of Fig. 2. They were commonly observed in the southern part of the map area, where they form dense swarms in the grey orthogneisses (Fig. 6).

Granite and granitic gneiss

Numerous small and large intrusive bodies of granite with a wide range of lithological appearances and different states of deformation were mapped. Coarse-grained, homogeneous pink granite predominates and may grade into megacrystic granite, sometimes with rapakivi-textures, pink microgranite, or pegmatite. White, leucocratic granite is also observed. Based on their deformational state and contact relationships the granite bodies fall into two main categories (not distinguished on the map): foliated granites with gradational boundaries to their host rocks, and relatively undeformed granites with obvious intrusive contacts. The contact zones between tonalitic orthogneiss and the granites can be tens to hundreds of metres wide, beginning with a few thin granitic veinlets in the orthogneiss, grading into granite or granitic gneiss with abundant orthogneiss inclusions, and ending with almost inclusion-free granite. The gneissic fabric in the inclusions is commonly cut by the granites, which may nevertheless themselves be strongly foliated.

Fig. 6. Cliff exposing orthogneisses invaded by a dyke swarm which is boudinaged and folded. Vertical dark streaks are caused by water flowing over the cliff. Height of cliff is about 50 m. The outcrop is located at the southern boundary of the map area, 6 km east of the fjord Ataneq.

Pegmatite

Several generations of pegmatite have been observed, often cross-cutting and in different stages of deformation. They are commonly coarse-grained, rich in pink K-feldspar, and contain quartz and plagioclase with or without biotite. In general, two main types can be distinguished. The older pegmatites are slightly discordant, commonly irregular in shape and can be folded and strongly sheared, resulting in porphyroclastic, mylonitic textures. They appear to be associated with the granitic gneisses described above. Some of these pegmatites can be shown to be syn-kinematic with the latest fold phase (see below). The second, younger group consists of conjugate sets of late, straight-walled pegmatites. They are undeformed and commonly associated with steep brittle faults that have offsets which are consistent with north–south compression. These pegmatites may be younger than the metadolerite dykes described below.

Metadolerite dykes

Massive, 1–20 m wide metadolerite dykes occur mainly in the southern part of the map area. They cut the regional gneissic fabric and most have E–W trends. Foliation is only well developed in the dyke margins although a weak linear fabric can be observed locally in the unfoliated cores. The dykes have metamorphic mineral assemblages of fine- to medium-grained hornblende, plagioclase and clinopyroxene, with or without orthopyroxene, garnet and rarely biotite. In contrast to the older foliated dyke remnants they always occur as isolated bodies.

Globule dyke

A single, N–S-trending, 20–50 m wide composite dolerite dyke with unusual globular structures was described by Ellitsgaard-Rasmussen (1951). The name for the dyke was based on the local presence of spheres with igneous textures that comprise plagioclase and pyroxene phenocrysts in the core, surrounded by glassy mantles. Several locations were revisited and showed the dyke to be undeformed and to consist of a *c.* 10 m thick central dyke with thinner multiple intrusions on both sides which have glassy, chilled margins. The dyke is exposed in a few outcrops along a 60 km long stretch from the entrance of the fjord Arfersiorfik northwards to the coast east of Aasiaat. On the aeromagnetic map of the NNO (Thorning 1993) this trace is clearly visible, with several right-lateral steps as depicted in Fig. 2.

Geochronology

U-Pb zircon age determinations have been carried out on six samples from the map area (Kalsbeek & Nutman 1996). Archaean ages in the range 2.7–2.8 Ga were derived from four biotite orthogneiss samples. A porphyric granite yielded zircons of *c.* 2.7 Ga, indistinguishable in age from a gneiss which forms the host rock at the same location. It is uncertain whether these two lithologies are indeed of approximately the same age, or whether the granite contains locally derived inherited zircons. One of two samples from the Naternaq supracrustal sequence contained Proterozoic detrital zircons, suggesting that at least part of the sequence is of Proterozoic age (Østergaard *et al.* 2002, this volume).

Kalsbeek *et al.* (1984) derived an Archaean Pb-Pb isochron age of 2653 ± 110 Ma for a granite that is intrusive into the regional gneisses just south of the map area. An undeformed granite sampled near Aasiaat just north of the map area yielded an intrusive age of 2778^{+7}_{-3} Ma (TIMS U-Pb on zircon, Connelly & Mengel 2000). Preliminary LAM-ICPMS Pb-Pb reconnaissance analyses on detrital zircons from a felsic layer of a dominantly mafic supracrustal sequence north-east of Kangaatsiaq have yielded Archaean ages.

The available isotope data establish that the regionally dominant tonalitic gneisses have Archaean protolith ages, and that at least some granites in the NNO are also Archaean. The ages of the younger pegmatites and of the metadolerite dykes are at present uncertain. A regional dating programme of rocks in the northern Nagssugtoqidian orogen and southern Rinkian orogen is underway to establish the ages of the main lithologies and tectonic events (Garde *et al.* 2002, this volume).

Metamorphism

The map area is dominated by upper amphibolite facies, medium-pressure mineral assemblages, but has been affected by granulite facies metamorphism south of the fjords Arfersiorfik and Alanngorsuup Imaa (Fig. 2). Mineral assemblages in metapelites include garnet-biotite-sillimanite in most of the area, with minor kyanite or cordierite observed locally north-east of Kangaatsiaq. Muscovite is stable in the northernmost part of the map area. Partial melt veins occur in most of the region giving the gneisses a migmatitic texture. Relic granulite facies rocks occur as patches in the south within areas of amphibolite facies. The granulite facies grade is reflected in the weathered appearance of the rocks, but orthopyroxene is seldom visible in hand specimen. It does, however, appear as relics in thin section. The age of the granulite facies metamorphism is uncertain, but Palaeoproterozoic rocks in the nearby Nordre Strømfjord shear zone (Fig. 1) are also at granulite facies, and were retrogressed to amphibolite facies in high-strain zones during a late phase of Nagssugtoqidian orogenesis.

Structure

Detailed field observations combined with the map pattern show that at least four generations of regionally penetrative structures are recorded in the dominant orthogneisses, while an even older penetrative planar fabric and isoclinal folds are preserved in mafic inclusions. The regional gneissosity dips to the NNW or SSE at steep to moderate angles, and carries a subhorizontal, ENE–WSW-trending mineral grain lineation or aggregate lineation. It is a high-temperature fabric, and commonly migmatitic veins are developed parallel to it. Locally the gneissosity is axial planar to isoclinal, often rootless, folds. The main gneissosity is a composite fabric, heterogeneously developed either progressively over an extended period of time or in several phases before and after intrusion of the mafic dyke swarm in the south.

At least two phases of folding affected the area. The early isoclinal folds have no consistent orientation and may represent several generations of folds, as reported from the Attu area by Sørensen (1970) and Skjernaa (1973). Map-scale isoclinal folds are most obvious in the north-eastern and south-western map quadrants, outlined by the supracrustal sequences. At several locations the isoclinal folding resulted in interleaving of ortho- and paragneisses. It is also possible that some interleaving occurred by thrust repetition, as reported from the Attu area (Skjernaa 1973) and from south of the Nordre Strømfjord shear zone (van Gool *et al.* 1999), but so far no unambiguous evidence for thrust repetition has been found in the map area. Shear zones are uncommon and of local extent, mainly associated with the reworking of intrusive contacts between supracrustal rocks and orthogneisses and lacking consistent kinematic indicators. Their relative age with respect to the fold phases is uncertain.

Parasitic folds associated with the youngest, major phase of upright folds are sub-horizontal to moderately plunging, with predominantly WSW-plunging axes. Near the hinges of kilometre-scale folds the parasitic folds are commonly steeply inclined, plunging to the south. Mineral lineations are commonly parallel to sub-parallel with the axes of parasitic folds. Sets of late, steeply dipping conjugate fractures trend NE–SW and NW–SE and some of these are filled with a pegmatitic melt phase.

Summary and conclusions

The Kangaatsiaq region in the northern Nagssugtoqidian orogen predominantly consists of Archaean orthogneisses. It includes a major ENE–WSW-trending belt with abundant supracrustal rocks, which runs from south of Kangaatsiaq to the southern part of Naternaq. A second, previously unknown but extensive belt of quartzo-feldspathic paragneisses, presumably of Archaean age, occupies part of the south-eastern corner of the map area.

The main events in the geological evolution of the area comprise:

1. intrusion of mafic igneous complexes and deposition of mafic and associated supracrustal rocks;
2. formation of a foliation and isoclinal folds;
3. intrusion of the main tonalitic and associated granitoid rocks;
4. formation of the regional gneissic fabric;
5. intrusion of a mafic dyke swarm in the south;
6. further deformation, probably associated with isoclinal folding and intensification of the regional gneissosity;
7. intrusion of granite and pegmatite;
8. formation of a foliation and gneissosity in the granites, in part during their intrusion and associated with upright folding;
9. intrusion of the E–W-trending, isolated metadolerite dykes;
10. formation of upright brittle fractures during intrusion of pegmatite.

At present, an evaluation of the tectonic evolution of the Kangaatsiaq area in a regional perspective is difficult, since the absolute ages of several lithological units and deformational events are still unknown. It is uncertain to what extent the Palaeoproterozoic tectonic events known from south of the Nordre Strømfjord shear zone can be correlated with those of the Kangaatsiaq area. The map area lacks the abundance of Proterozoic supracrustal sequences intruded by quartz-diorite and the shear zones associated with their emplacement, that are typical for the central Nagssugtoqidian orogen (van Gool *et al.* 1999). The most likely candidate for a Palaeoproterozoic supracrustal sequence in the map area is the Naternaq supracrustal belt. Furthermore, the shear zones in the Kangaatsiaq area are not of regional extent. The lack of consistent kinematic indicators in the shear zones suggests that deformation may have been dominated by pure shear. Coincidence of the orientation and style of the youngest upright, E–W-trending folds in the Kangaatsiaq area with similar structures of Palaeoproterozoic age to the south (Sørensen 1970; Skjernaa 1973; van Gool *et al.* 2002) and in the Disko Bugt area to the north (several papers in Kalsbeek 1999) was suggested by Mengel *et al.* (1998) as a possible indication for direct correlation.

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Authors' addresses

J.A.M.v.G., A.A.G., C.K., J.N., S.P. & K.T., *Geological Survey of Denmark and Greenland, Øster Voldgade 10, DK-1350 Copenhagen K, Denmark.* E-mail: *jvg@geus.dk*

G.I.A., *School of Geography & Geosciences, University of St. Andrews, St. Andrews, Fife, KY16 9AL, UK.*

U.E.Á., *Geological Institute, University of Copenhagen, Øster Voldgade 10, DK-1350 Copenhagen K, Denmark.*

A.W.K., *Department of Geological Sciences, University of Texas at Austin, Austin, TX, 78712, USA.*

S.M., *Institute of Geological Sciences, University of Wroclaw, Pl. Maxa Borna 9, 50–204 Wroclaw, Poland.*

C.W.T., *British Geological Survey, Murchison House, West Mains Road, Edinburgh, EH9 3LA, UK.*