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## Precambrian studies in the Buksefjorden region, southern West Greenland

Report on the last field season in the programme 1972–1979

**Brian Chadwick, Kenneth Coe and Allen Nutman**

The 1977 field season was the last in the series of six planned by GGU and the University of Exeter for the mapping of the Buksefjorden region (fig. 23). As in some of the earlier years, operations were mounted from a base at Nordafar. Support was provided by the GGU motor cutter *N. V. Ussing* throughout the season and on four days by helicopter from Greenlandair Charter A/S. We wish to acknowledge the assistance provided by officials at Nordafar, by Mr. Dave Pedersen of Greenlandair Charter A/S and especially by skipper Flemming Nielsen. We also wish to record the valuable contribution made during the season by M. Ramakrishnan of the Geological Survey of India who worked with the group, nominally as an assistant. The weather was exceptionally good and this contributed to the smooth running of the programme.

As a conclusion to a sequence of field seasons, time was spent in correlative work,

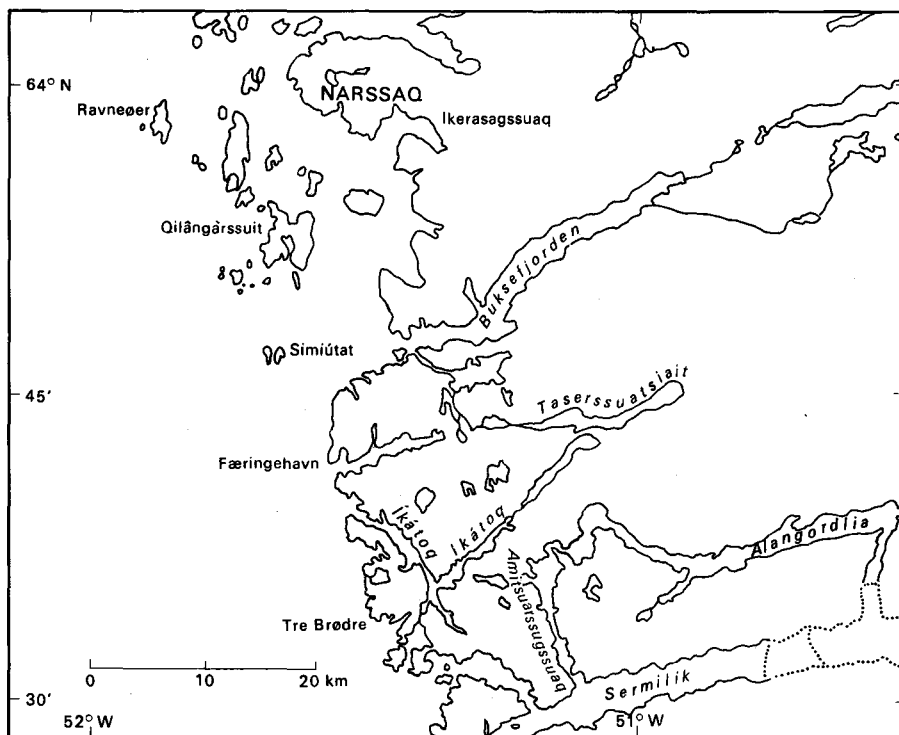


Fig. 23. Sketch map of the Buksefjorden map sheet ( $63^{\circ}30'N$ – $64^{\circ}N$ ) showing localities mentioned in the text.

checking and re-investigation of areas where there were outstanding problems and re-collecting from critical localities as well as completing first mapping of isolated pockets. Thus Nutman worked on the Narssaq peninsula and adjacent islands; Chadwick worked in Qilángårssuit and nearby islands and spent short periods north of Buksefjorden and in the ground between Ikerasagssuaq and Amitsuarssugssuaq; Coe mapped the Ravneøer, ground adjacent to the inner part of Ikatoq and Ikatoq sangujat and revisited inland tracts east of Buksefjorden and near the east end of Taserssuatsiait. Results of these investigations with some closely related laboratory data are presented in this report.

### *Akilia association*

Rocks of this association occur as enclaves in the Amítsoq gneisses, some as large masses up to about 500 m by 150 m. Two main groups have been recognised, the earlier comprising various amphibolites and ultramafic rocks interlayered with iron formations, garnet-biotite and other gneisses, and the later a series of pale, homogeneous to poorly banded amphibolites which intrude the earlier interlayered group, generally as irregular sheets. Main interest centres on the petrology of the earlier group. Some of the gneisses may have been derived

from acid volcanic parents; no primary features survive to indicate the stratigraphy. Preliminary chemical studies support the view expressed by McGregor & Mason (1977) that the earlier interlayered group includes amphibolites and ultramafic rocks with tholeiitic and komatiitic affinities. The ultramafic rocks are completely recrystallised except in a few instances where low deformation has enabled the definition of two types; (a) coarse grained pyroxenites in a saccharoidal quartz matrix or penetrated by pegmatite and (b) ultramafic rocks with laths of olivine, recrystallised or replaced by amphibole, resembling spinifex texture (see also Chadwick *et al.*, 1977). Especially characteristic are the iron formations which include the following assemblages; quartz+magnetite, quartz+magnetite+grunerite; quartz+magnetite+garnet+grunerite or clinopyroxene; quartz+pyrrhotite+garnet+grunerite or clinopyroxene. Hornblende may also be present. The assemblages may reflect original chemical differences of precipitated phases of the parent sediment. Garnet-sillimanite gneisses comparable to those in the Malene supracrustal rocks occur in some enclaves and corundum-mica rock like that at Fiskenæsset (Herd *et al.*, 1973) was noted in one enclave of garnet gneiss and amphibolite.

### *Amîtsoq gneisses*

The intra-Amîtsoq chronology remains problematical. In a previous report (Chadwick *et al.*, 1977) it was recorded that the present extent of the augen gneiss is greater than was originally supposed. In places it becomes so flattened that augen are no longer discernible, and thus original relationships between augen and multiphase gneiss cannot be determined. The two types can be distinguished chemically and in areas of low deformation they can easily be distinguished in the field. Inter-relationships are rarely unambiguous but the balance of evidence favours the interpretation of Chadwick & Coe (1976) that the multiphase gneiss is the older. The chronology has now been further complicated by evidence of a group of banded gneisses younger than the augen gneiss. These banded gneisses differ from Amîtsoq multiphase gneiss in being paler and more homogeneous. Chemical studies in progress should throw light on the relation between the three groups of Amîtsoq gneiss.

### *Amîtsoq gneiss/Malene supracrustal rock relationships*

Equivocal field relations have also led to uncertainties about the relations between Amîtsoq gneisses and rocks of the Malene supracrustal succession. The problem has been discussed in detail (Bridgwater *et al.*, 1974; Chadwick & Coe, 1975; Chadwick & Coe, 1976) but is so fundamental to the understanding of the history of this ground and processes operating in the Archaean that any new observations compel attention.

On Simiútat, Qilángárssuit and adjacent islands Malene banded amphibolites are in places in contact with Amîtsoq gneisses but in some localities the two units are separated by thin seams of pegmatite, fuchsitic quartz-feldspar veins, fuchsitic gneiss, ultramafic rock or a mélange with small pods of hornblendite in a matrix of biotite, quartz and feldspar. Parts of the boundary on Qilángárssuit are tectonic with displacements related either to interleaving in the style suggested by Bridgwater *et al.* (1974) or to the last phase of deformation, but in other places sharp contacts could be interpreted as being due to unconformity or intrusion of

basic sills along pre-existing Malene supracrustal rocks. Mobilisation of the Amîtsoq gneisses after the emplacement of Ameralik dykes took place locally with the injection into Malene amphibolite of pegmatite veins emanating from the older gneiss.

It is recognised that the ambiguous boundary relations are different from the intrusive relations between the Amîtsoq gneisses and extensive masses of Akilia association rocks. Furthermore, it is accepted that the Akilia association rocks are older than the Amîtsoq gneisses and the Malene supracrustal rocks are younger, so that some of the sharp contacts may now be interpreted as representing an old cover/basement relation.

### *Malene metagabbro*

The existence of an unusually large remnant of a Malene metagabbro complex north-east of Taserssuatsiait was recorded in an earlier report (Coe *et al.*, 1976). Further investigations reveal well-developed igneous layering. The complex can be divided into melano-, meso- and leucocratic units with some further subdivisions. Modified cumulate layering is almost always present in meso- and leucocratic varieties, but is usually absent from the melanocratic metagabbro although in places the last grades into ultramafic rock. A curious feature is that the layering is almost entirely colour banding due to sorting of felsic and mafic components not accompanied by gradation of grain size, indeed the leucocratic varieties may be the finest in a sequence. Preliminary mineral determinations show that differentiation has produced feldspar concentrations (the leucocratic varieties) but these are of intermediate plagioclase and hence they contrast with the anorthositic cumulates. No genetic relationship can be envisaged between these feldspar-rich rocks and the main anorthosite bodies despite certain field similarities and a comparable position in the chronology.

### *Nûk gneisses*

Work in progress on the petrology of Nûk gneisses and especially on REE contents suggests that the parents of the gneisses were derived from two different source regions. Two main groups of gneiss are recognised, one including dioritic, tonalitic and possibly trondhjemitic rocks originating from an amphibolite or high-grade basic gneiss parent and the other, a group of grey gneisses, derived from a garnet-rich source, possibly eclogite (P. M. Compton, personal communication, 1977).

A comparable two-fold division has long been recognised in the field and nowhere can this be better seen than in the Ravneøer. An indeterminable but distinct time-gap between an early phase (mafic) and a later phase (more leucocratic) is shown by clear stoping relations where there has been little subsequent deformation. In other places there are indications of an intermingling of the two types. A range in variation has also been produced by two contrasting processes, the first, magmatic with incorporation of amphibolites (including skarn rocks) giving a banding and the second, deformation superimposed on such inhomogeneous rocks as well as the two magmatic phases. The dominance of either process varies throughout the island group. These relations, clear in the Ravneøer, may be common to most other areas underlain by Nûk gneisses. That is, there may have been only two fundamental parents which have given rise to a wide range of lithologies by the various interacting

processes of contamination, deformation and metamorphism. However in the south-west of the Buksefjorden region this may not be the case. In Ikerasagssuaq there is evidence for four parental types (i.e. four types which contrast mineralogically and between which are contacts interpreted as due to primary magmatic intrusion) and in that area and Amitsuarsugssuaq the possibility remains that one of these may have been Amîtsoq gneiss.

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## Drilling programme on the uranium mineralisation at Kvanefjeld, Ilímaussaq alkaline intrusion, South Greenland

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During the summer of 1977 a drilling project was carried out in the uranium mineralisation at Kvanefjeld. The programme comprised 27 drill holes totalling 5000 m of core, a gamma-spectrometric logging of the drill holes and a detailed field gamma-spectrometric survey of the drilling area.

GGU is responsible for organisation and administration of the programme, which was initiated in January 1977 and will be completed by January 1978.