Transitional amphibolite-granulite facies granites, diorites and metavolcanic amphibolites in the Isukasia map sheet, southern West Greenland

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Detailed mapping of the north-west quadrant of the 1:100 000 scale Isukasia geological map sheet was begun in 1981 (fig. 16). The area was previously visited during the 1977 helicopter reconnaissance mapping programme (Allaart *et al.*, 1978) and from this work the stratigraphy was known only in the broadest of terms. The 1981 work has shown that the area is comprised of five principal lithostratigraphic units, listed in Table 3.

The oldest recognizable rocks in the area are a suite of amphibolites for which a metavolcanic origin is clearly indicated by the presence of locally well preserved pillow structures. These are commonly lineated and become deformed into compositionally banded 'striped' amphibolites (cf. Hall, 1980). The amphibolites are associated with ultrabasic lenses, but metasedimentary gneisses are very rare. These rocks probably correspond to the Malene supracrustal rocks of the Godthåbsfjord region.

The second generation of rocks in the area is a complex of diorites. These are commonly associated with the amphibolitic horizons and the discordant intrusive contacts of the diorites are clearly preserved. Locally, discrete diorite dykes cut the metamorphic banding within the amphibolitic rocks and elsewhere banded amphibolites occur as xenoliths within larger massive dioritic horizons. The size of the xenoliths in such horizons varies from several metres in diameter to only a few tens of millimetres. Striking 'agglomeratic' units comprised of lithologically variable 100 millimetre-scale amphibolitic and ultrabasic xenoliths tightly packed within a dioritic matrix occur in a few localities (fig. 17). The xenoliths are usually angular and are elongate because of their well foliated and banded character. They are well aligned and the resultant strong linear fabric of the composite lithology probably reflects the streaming of an injection breccia (modified by subsequent deformation). One example of similar brecciated rocks with an ultramafic matrix and one with a granitic matrix were also found.

In the large amphibolite mass in the south-west of the area, large diorite sheets and banded amphibolites are interleaved and this inter-sheeting has been exaggerated by tight folding. A large body of diorite with no associated amphibolite occurs in the eastern part of

Table 3. Simplified stratigraphy of the north-west quadrant of the Isukasia map sheet

5	MD dykes (faulting)
4(?)	Taserssuaq granodiorite (deformation, metamorphism, faulting)
3	Granitic gneiss (deformation, metamorphism)
2	Diorite complex (deformation, granulite facies metamorphism)
1	Metavolcanic amphibolites (deformation, metamorphism)

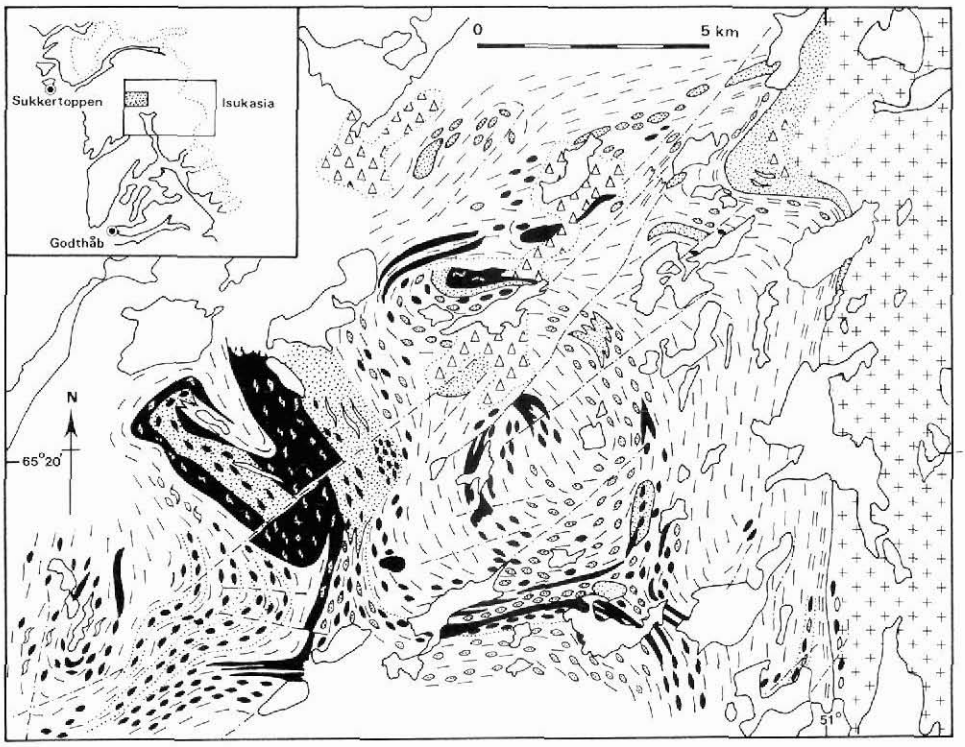

Fig. 16. Simplified geological map of the north-west quadrant of the Isukasia map sheet. Key to shading: black: metavolcanic amphibolites and ultrabasic rocks; stipple: large body of diorite; dashed line ornament: granitic gneiss, indicating strike direction; crosses: Taserssuaq granodiorite; triangles: moraine. MD dolerite dykes omitted.

the area. It is a massive and homogeneous unit occupying the core of a large scale, north-east plunging synform and is surrounded by a disseminated series of 500 metre-scale diorite bodies. The extent of this complex of abundant large diorite bodies was not recognized during the helicopter reconnaissance work.

Both the metavolcanic amphibolites and the large body of diorite are cut and agmatized by the regionally predominant massive, coarse-grained granitic gneiss, which probably corresponds to the Nûk gneisses of the Godthåbsfjord region. They vary from poorly foliated granite to weakly banded gneisses.

All of the enclaves within the diorites and the granitic gneisses have a variably banded metamorphic fabric which is cut by the intrusive rock and thus periods of deformation and metamorphism can be inferred between the intrusive events. However, whether these represent a single or several tectono-magmatic events is not certain.

The eastern boundary of the area is occupied by rocks of the Taserssuaq granodiorite complex which exhibit nebulitic variation from leuco- to mafic, fine to coarse and biotite to hornblende-bearing varieties. The contact relationships between these rocks and the granitic

Fig. 17. 'Agglomeratic' injection breccia unit of the large diorite complex composed of tightly packed lithologically variable banded amphibolite and ultrabasic xenoliths aligned by streaming within a dioritic matrix.

gneisses to the west are equivocal. The interleaving of homogeneous Taserssuaq granodiorite with well banded gneisses in the south-east corner of the area suggests that the granitic gneisses predate the Taserssuaq granodiorites. However, it is possible that the Taserssuaq granodiorite is related to the diorites and may thus predate the granitic gneisses. Enclaves of homogeneous diorite/granodiorite occurring within the granitic gneisses are difficult to distinguish from the lithologically similar diorite body described here and Taserssuaq granodiorites.

One of the major problems in the area has been the recognition of distinct metamorphic facies indicators. Large areas of granulite facies rocks were recognized during the previous reconnaissance work (Allaart *et al.*, 1978). However, the closer examination of the area has not been able to corroborate the reconnaissance subdivision of the amphibolite and granulite facies rocks. Granulite facies assemblages were most frequently found in the more basic rocks. Both the amphibolites and the diorite complex frequently contain abundant hypersthene, although what appear to be amphibolite and granulite facies varieties often occur in very close proximity. Local small scale variation in the metamorphic facies is very well illustrated within the metavolcanic amphibolites. The homogeneous and finely banded rocks commonly contain orthopyroxene while intimately associated pillow structured horizons are of epidote-amphibolite facies. The pillows often contain abundant epidote, garnet and diopside although these minerals, and particularly epidote are generally rare in the area. Similarly, while the basic and intermediate assemblages may indicate granulite facies, the granitic gneiss in which they are swamped, although often being brown, greasy weathering and possessing pegmatitic veins with blue quartz and brown feldspar, almost always contain biotite or (less commonly) hornblende as the mafic phases. Orthopyroxene is very rare in the granitic gneisses. Thus, it appears that either the granitic gneisses have re-equilibrated during retrogression or they were injected during the waning stages of the major granulite facies event or that granulite facies was only just attained in these rocks and its effects are only seen in the more reactive basic assemblages.

References

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Further work on the early Archaean rocks of the Isukasia area, southern West Greenland

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Work in 1981 on the early Archaean rocks of the Isukasia area (Allaart, 1976) was an integral part of GGU's mapping programme of northern Godthåbsfjord, Fiskefjord and adjacent areas to the north-east. Within the Isukasia area, there was close co-operation with Minik Rosing who was making detailed studies of certain aspects of the Isua supracrustal belt.

The object of this summer's field work was to complete the study of the supracrustal belt and the central gneisses that was started last year (Nutman *et al.,* in press), and to see as much as possible of the gneisses between the supracrustal belt and 65°N (fig. 18). For the mapping of the supracrustal belt, manuscript maps drawn by J. H. Allaart were an invaluable starting point. Besides regional mapping, detailed studies were made of the nature of the lithological units and the relationships between them; see Table 4 for chronology. Suites of rocks were collected for isotopic and geochemical studies. In connection with this, H. Baadsgaard spent 10 days working with the author in the area, as a guest of GGU.

The results reported here supplement those given by Nutman *et al.* (in press).

Supracrustal rocks

The stratigraphic sequence for the Isua supracrustal belt (fig. 19), erected on the basis of the part visited in 1980, is applicable throughout the belt. For Sequence A, the upper and middle parts are predominantly banded felsic rocks (some demonstrably of detrital origin) and chemical sediments. The lowest parts, which are only well-developed in the west, are predominantly banded amphibolites, probably of volcanogenic origin. In the far north-east