tion between as many volcanic members and their time-equivalent sedimentary members as possible. This is particularly so when the sediments can be dated by their content of marine fossils.

The occurrences of petrographically strikingly similar tuffs containing both orthopyroxene-porphyritic graphite-andesite and picrite at one single level in the lower part of the Vaigat Formation at several localities on Disko and Nûgssuaq lead us to the conclusion that they can all be assigned to the Asuk Member (Pedersen, 1985). This correlation can be extended to include the similar tuffs of the Abraham Member in the Agatdal Formation.

The graphite-rich andesite lava and scorias from Nûk kitdleq have earlier been correlated with the Asuk Member on the basis of lithology (Larsen & Pedersen, 1988).

In conclusion, we can now extend the Asuk Member of the Vaigat Formation from northern Disko across the Vaigat Strait into southern Nûgssuaq and along the northern part of the Auvfarssuaq valley.

The fact that the Asuk Member tuffs in Ilugigsoq overlie more than 250 m of volcanics while they are near the bottom of the volcanic pile in Qilakitsoq 6 km east of Ilugigsoq, and are interbedded with a marine shale sequence in Agatdalen 16 km north-east of Ilugigsoq, has implications for the tectonic evolution of the basin which will be pursued in future work.

The extension of the tuffs of the Asuk Member into the marine fossiliferous sediments of the Abraham Member of the Agatdal Formation will lead to a much needed palaeontological dating of a well-defined, widespread and mappable volcanic unit formed in the early part of the development of the volcanic province of West Greenland.

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New geological investigations in eastern Disko: redeposited volcanoclastic sediments with rhyolite from the Nordfjord Member

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During field work in 1988 in eastern Disko we encountered redeposited volcanoclastic sediments with acid rocks at several localities between Rensdyrdalen and Charles Polaris Dal within lava sequences from the Nordfjord Member of the Maligât Formation. Some of the sediments were only observed during helicopter reconnaissance of steep inaccessible walls and corries, while other sites provided detailed information and samples through field visits. Fig.1 shows the area with newly discovered acid volcanic rocks in eastern Disko. Localities 1 and 2 denote localities investigated in some detail.

In north-western Disko peraluminous rhyolite tuffs and conglomerates with almandine-bearing rhyolite blocks occur as widespread but minor deposits in the Nordfjord Member (Pedersen, 1977; Hansen & Pedersen, 1985; Pedersen & Pedersen, 1987). The acid rocks contain graphite and scarce sediment xenoliths and they

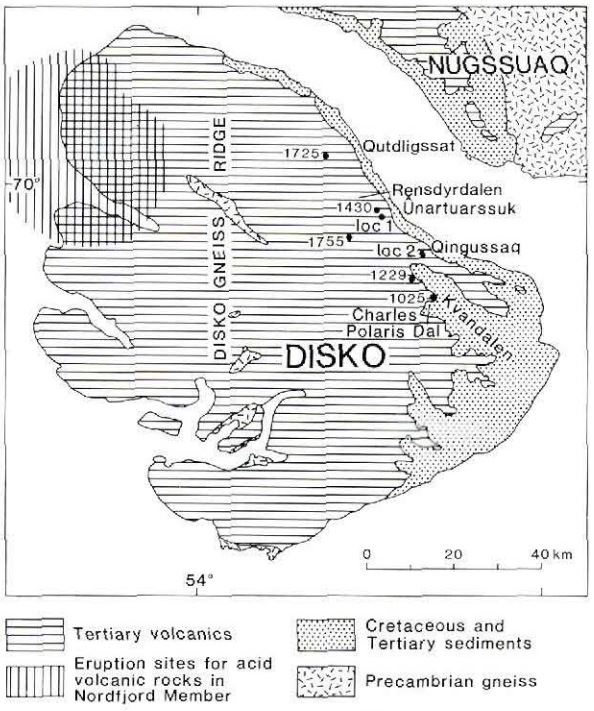

Fig. 1. Generalized geological map of Disko.

are associated with contaminated basalts, andesites and dacites, some of which carry native iron. The distribution of airfall rhyolite tuff shows that the acid rocks were erupted somewhere in north-western Disko or in the present shallow sea west of this area. No eruption sites are exposed at present.

Nordfjord Member in eastern Disko

Within the area with acid tuffaceous sediments in eastern Disko the Nordfjord Member is developed as a sequence of lava flows with very subordinate intercalations of sediments of volcanic origin. The base of the member is an eroded lava surface of a feldsparphyric basalt from the underlying Rinks Dal Member. The uneven lava surface is covered by a deposit of yellow-brown claystone up to a metre thick, which may contain minor fragments of fossil plants. The claystone differs markedly from the red lateritic sediment which is the characteristic interbasaltic soil deposit of the Maligât Formation. The lava flows in the Nordfjord Member are usually feldsparphyric basalts characterized by common plagioclase phenocrysts more than 5 mm in size. Some of these basalts are enriched in silica by magma-sediment reactions, but most are ordinary tholeiitic basalts.

A native-iron bearing lava flow with many shale xenoliths is the only strongly sediment-contaminated volcanic unit from the member erupted in eastern Disko (Pedersen & Larsen, 1987). The field work in 1988 has shown that this lava covers an east–west trending belt over a distance of at least 22 km from the northern entrance of Kvandalen to Charles Polaris Dal (fig. 1) and that it may originally have covered well over a hundred square kilometres with more than a cubic kilometre of lava.

Tuffaceous sediments with acid rocks

During the field work, airborne observations of acid tuffaceous sediments were made just west of point 1725 at Qutdligssat, north-east of point 1755 at Rensdyrdalen, around point 1229 and between this point and point 1025 in the inner part of Kvandalen (fig. 1). Ground investigations made at localities 1 and 2 show that acid rocks occur at at least two levels within the Nordfjord Member. The two localities are described below.

Near Unartuarssuk (loc. 1). The locality is situated on the edge of the steep basalt wall where the hill of point 1430 flattens to form a sub-horizontal plateau towards the south-east. Here the Nordfjord Member consists of about ten lava flows. In its lower part a section is exposed through a former river bank and a redeposited tuffaceous sandstone and conglomerate deposit which is more than 15 m thick (fig. 2). The river has cut deeply into the lowermost lava flow from the Nordfjord Member. This lava is a basalt characterized by 6 to 8 mm plagioclase phenocrysts and scattered cognate gabbroic inclusions up to several centimetres in size. The flow can be recognised for more than 12 km towards the south-east. North-west of the river bank this lava flow has been entirely eroded away, and the river sediments have been deposited on the eroded surface of the uppermost basaltic lava from the Rinks Dal Member. The tuffaceous sediments are intruded by a basaltic sill about 30 m thick. Towards the south-east this sill can be observed to be a basaltic lava flow with oxidised and vesiculated flow top, resting directly on the top of the lowest Nordfjord Member lava. This lava-sill unit is interpreted as an invasive lava which has flowed in from the south and invaded the unconsolidated clastic tuffaceous sediments to form a sill.

The sediments show considerable lateral variation. They are least disturbed by the sill close to the former river bank, and here 3–4 m of yellow-brown claystone is observed, which includes clasts of laterite and fragments of fossil plants. This is covered by at least 11 m of varying beds of tuffaceous conglomerate, sandstone and claystone (fig. 3). On top of the sill up to 9 m of tuffaceous sediment is exposed. The upper 3–4 m of this

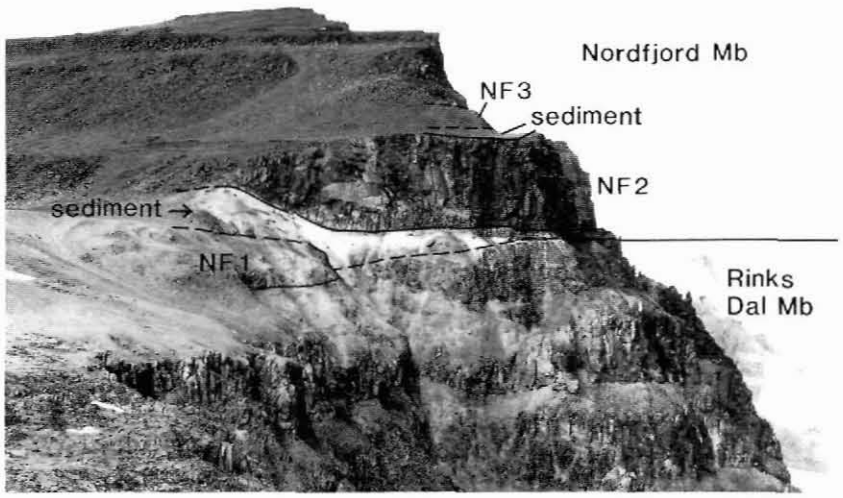

Fig. 2. The south-eastern shoulder of point 1430 with a thick river deposit of tuffaceous sandstone and conglomerate (white). The first lava in the Nordfjord Member (NF 1) is eroded away in the river bed, whereas the second lava (NF 2) has invaded the sediment and formed a local sill chilled toward the sediment at both bottom and top.

sediment is dominated by claystone with subordinate clast-rich beds. Lateritic soil forms the top of the sediment which is covered by a 4 m thick lava flow of feldsparphyric basalt.

The clasts in the sediment represent a variety of igneous rock types. The conglomerate blocks include feldsparphyric basalt, aphyric basalt, andesitic to ?dacitic rocks with magma-modified sediment xenoliths, and several varieties of rhyolite. These varieties include mafic rhyolite transitional to dacite, with plagioclase, quartz, pyroxene, biotite and several millimetre-sized almandine garnets (type A), two-feldspar pitchstone with quartz, biotite and occasional tiny almandines (type B) and flow-laminated microcrystalline rhyolite (type C). Type B is by far the most common of the acid rocks, particularly so in the gravel to sand fraction which also contains abundant clasts of partly decomposed acid pumice. The acid rocks of types A to C are all well known from north-western Disko, as outlined below and in fig. 4.

Another type of acid rock present at the locality is grey glassy rhyolite formed *in situ* by melting of the tuffaceous sediment by the hot basaltic sill intrusion. This glassy rock has preserved parts of the sedimentary structures and resembles glassy welded tuffs produced by ash flows. Parts of the glassy rock contain layers of reddish grey glass derived from clay with laterite. The zone of melting varies in thickness and may locally exceed 1 m.

Qíngussaq (loc. 2). A complete section through the Nordfjord Member is exposed on the steep basalt wall facing Kvandalen on the south-western side of the mountain Qíngussaq. Here the member consists of 9 or 10 basaltic lava flows and very subordinate sediment layers, shown in fig. 4. The lowermost lava flow rests on an eroded lava surface covered by brown claystone and laterite. This flow is also eroded on the top and is

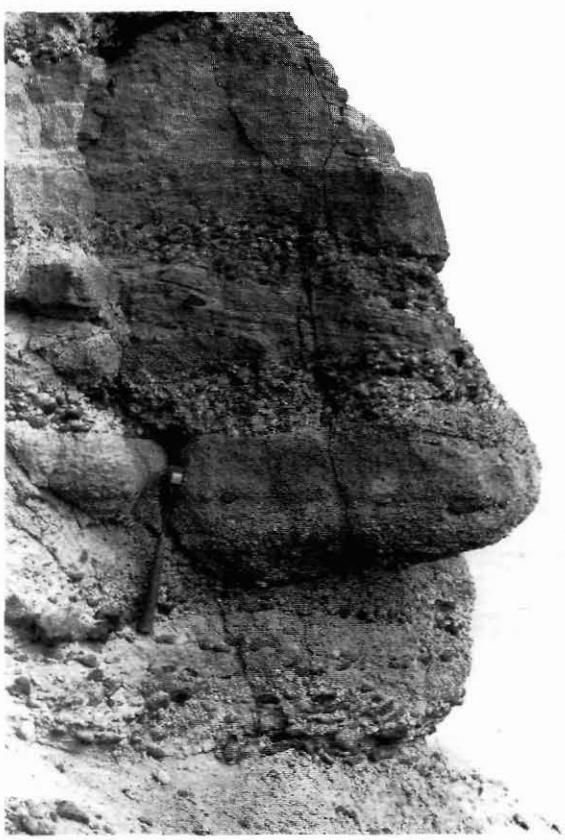

Fig. 3. Stream-deposited beds of tuffaceous sandstone and conglomerate with rhyolite blocks.

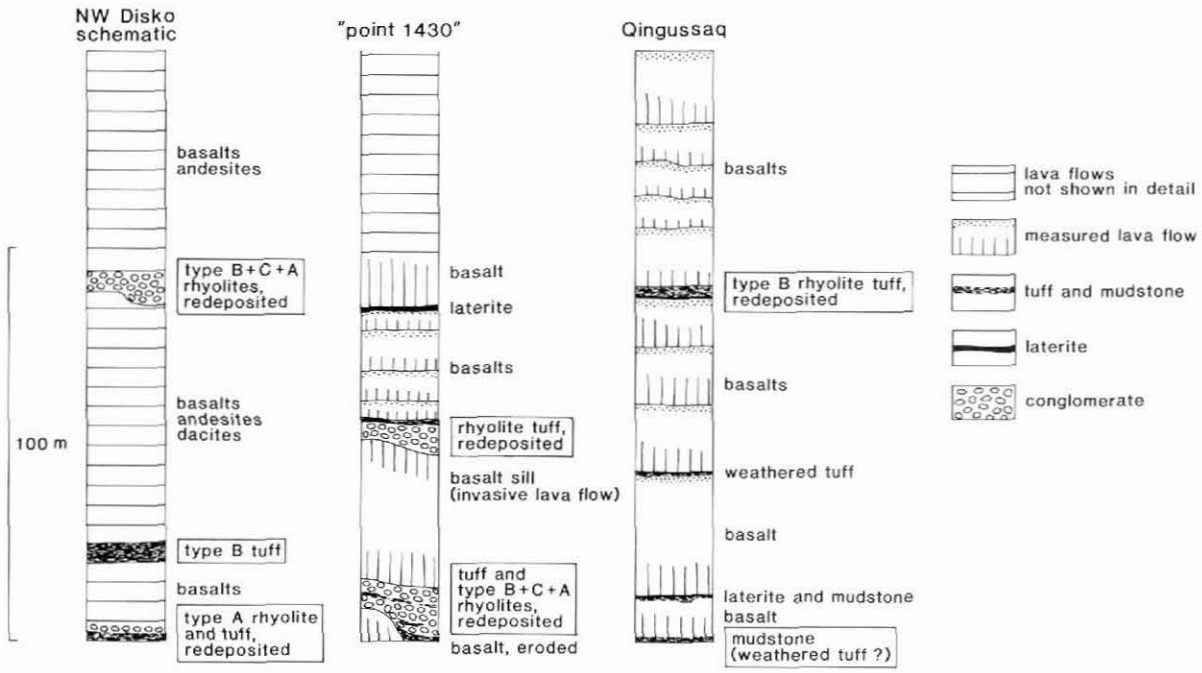

Fig. 4. Schematic profiles of the Nordfjord Member in north-western Disko and in eastern Disko at localities 1 and 2 described in the text.

partially covered by brown claystone and laterite. The second lava flow has scooped up patches of these sediments which are now found enclosed both in the basal and the top parts of the flow. Up to a few decimetres of tuffaceous sediments are deposited on the irregular top zone of the second lava. These sediments have locally been remelted by the third lava flow to a glass rock up to 10 cm thick. The fifth lava flow has a strongly eroded top upon which 1.5–2 m sediment has been deposited. This consists of 1–1.5 m of red lateritic soil, followed by 0.5–1 m of acid tuffaceous sediment melted to a dark grey to bluish grey glass rock by the overlying basalt flow. Within the glass rock many sedimentary laminae characterized by varying grain size can be discerned. Most characteristic are bands of strongly flattened white-grey former pumice clasts up to 4 cm in length. The pumices contain phenocrysts of quartz, feldspar and subordinate biotite. The uppermost 20 cm of the glass rock is reddish grey and contains pseudomorphs of plant fossils resembling rushes. The top of the sediment is a red sandy soil which, despite strong thermal metamorphism, did not form a coherent glass. Despite the deformed and melted state of the tuffaceous material, the rhyolitic material can be assigned to type B of locality 1.

The overlying part of the Nordfjord Member does not show any traces of rhyolitic tuffaceous sediments, and the same holds for the overlying Niaqussat Member.

Nordfjord Member in north-western Disko

In north-western Disko the time sequence shown in fig. 4 has been established. Rhyolitic material was produced at three levels: (1) the base of the member is in some areas marked by the eruption of type A material (plagioclase-quartz-pyroxene-biotite-almandine rhyolite) followed by erosion and redeposition of conglomerates with type A clasts; (2) following some basic lavas numerous layers of acid pumice of type B material (two-feldspar-quartz-biotite rhyolite) were erupted; (3) in the upper part of the formation conglomerates occur with rhyolite blocks dominantly of type B and type C (flow-laminated rhyolite), and with or without subordinate blocks of type A. The lava flow from which the type C blocks were derived has not been identified.

Interpretation

The occurrences of rhyolitic rocks in east Disko must be interpreted in context with the evidence from north-western Disko.

The field evidence indicates that the production sites for the rhyolitic rocks in the Nordfjord Member were situated in north-western Disko and the adjacent shelf areas. In eastern Disko the rhyolitic blocks of types A, B and C in the thick river deposit must have been transported over a distance of more than 70 km from

the WNW. The same most probably holds for the acid tuffaceous matrix material. The high concentration of acid rocks in the river deposit is remarkable in view of the fact that these rocks only constitute a very small volume of the Nordfjord Member. The acid volcanoes must have produced large bodies of subaerial pyroclastic rocks which were later eroded away and redeposited.

The river conglomerate of locality 1 in eastern Disko was deposited between Nordfjord Member lavas 1 and 2 in the area (fig. 4). Nonetheless the river has sampled a considerable range of the Nordfjord Member volcanics in the north-west, i.e. at least the sequence from A to B in the schematic profile in fig. 4 and probably even higher. This indicates a much higher productivity, and possibly an earlier start of this member in north-western than in eastern Disko.

At both locality 1 and 2 in eastern Disko, the Nordfjord Member starts with yellow-brown claystone very different from the normal interbasaltic laterite horizons, and it is possible that these claystones are thoroughly altered acid tuffs. The horizon would correlate with either the type A or the type B tuff horizons in north-western Disko (fig. 4). At locality 2 (Qíngussaq) the younger acid horizon, with redeposited tuffaceous type B material and no solid fragments, was probably also waterlain but at a later time than the river conglomerate and under conditions which only allowed the transport and deposition of light components such as pumice and fine-grained pyroclastic material. The material is probably transported from north-western Disko; it is very unlikely that it was derived from airfallen material in eastern Disko because the member in north-western Disko contains no large pumice deposits at the appropriate high levels.

Tectonic implications

Hald (1976) investigated the distribution of volcanic rocks and sediments from the upper part of the Maligât Formation in western Nûgssuaq. He concluded that at the time of formation of these rocks the continental margin had started to subside and was tilted towards the west. The rhyolitic blocks in eastern Disko were transported from the west toward the east, indicating that the terrain surface on Disko had an easterly slope. Detailed investigations of the volcanic stratigraphy, including the present one, have demonstrated a higher volcanic productivity in the western than in the eastern area. At the time of formation of the Nordfjord Member, the volcanic productivity outpaced the subsidence of the continental margin and allowed a river to transport high-energy sediments for more than 70 km from west to east across the buried Disko gneiss ridge.

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