



Disko Bugt Project 1991, West Greenland

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One of GGU's major field activities in 1991 took place in July and August in the Disko Bugt region of central West Greenland. This was the third year of field investigations under the 'Disko Bugt Project', planned for 1988–1992, with one summer's break in 1990. The project spreads over various activities and over two very different geological provinces: the Archaean–Proterozoic basement east and north-east of Disko Bugt, and the onshore part of the Cretaceous–Tertiary basin in the west, on Disko and the western part of Nûgssuaq (Fig. 1). In 1989, the second year of the project, work was concentrated in the eastern basement part of the study area, and in 1991 this work was brought to conclusion. In 1992 field work (including a shallow core drilling campaign) will be concentrated in the sediments and volcanics on Nûgssuaq and Svartenhuk Halvø to the north. The main aim of the Disko Bugt Project is to provide a background for the evaluation of the economic potential of the region – mineral resources, mainly in the Precambrian basement, and the hydrocarbon potential of the neighbouring basin offshore (see Kalsbeek, 1989, 1990).

The Disko Bugt Project is being carried out in cooperation with staff and students from the University of Copenhagen, and in 1991 scientists from the U.K. and Canada also took part in the investigations. As in earlier years a base camp was established at the abandoned settlement Atâ on the eastern side of Arveprinsen Ejlund. The base camp was manned by GGU personnel, and two helicopters, a Bell 206 'Jet Ranger' and an AS 350 'Ecureuil' were chartered for two months from Greenlandair Charter A/S for transport of personnel and equipment, as well as for geological reconnaissance.

Altogether, 23 geologists and 10 technical staff (including helicopter personnel) took part in the expedition, some persons only during part of the summer. During July the AS 350 helicopter was used jointly with a group from Kort og Matrikelstyrelsen (the Danish National Survey and Cadastre) who carried out gravimetric measurements in the region.

Precambrian rocks

The area east and north-east of Disko Bugt consists largely of Archaean granitoid rocks, gneisses and supra-crustal rocks. North-east of Arveprinsen Ejlund a sequence of Proterozoic sediments has also been recognised (Fig. 2). Prior to the project this area was very poorly known.

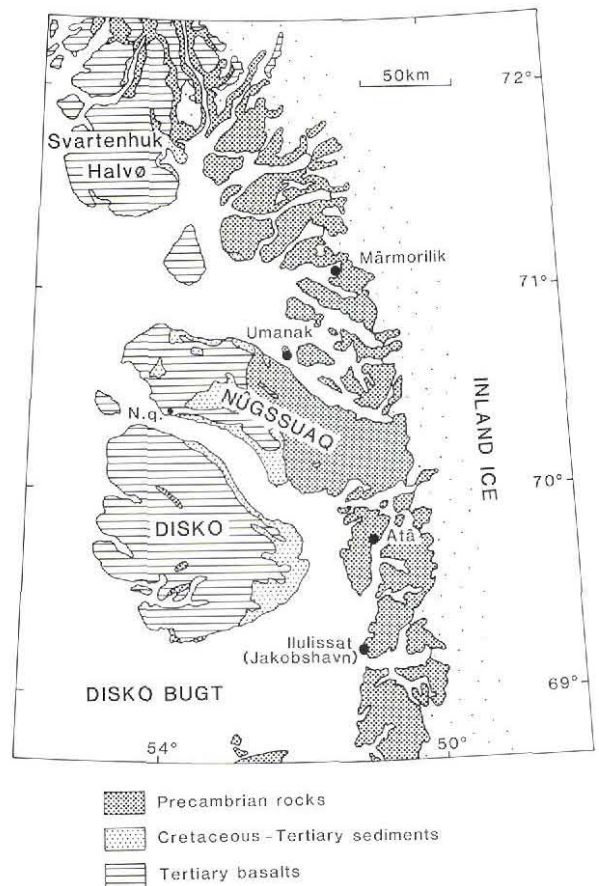
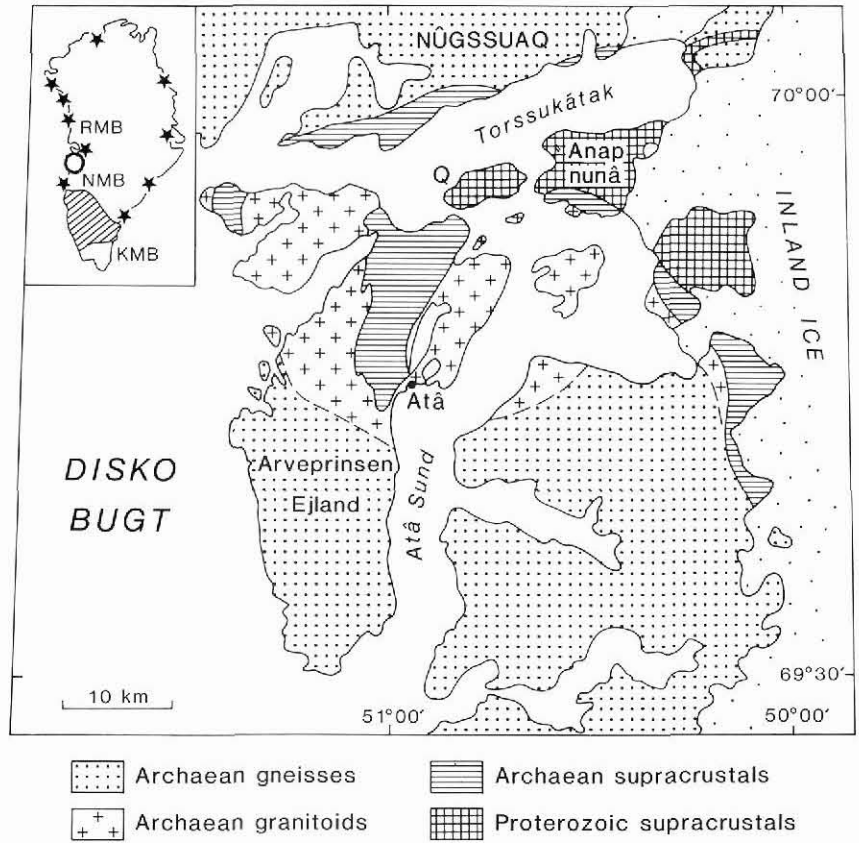


Fig. 1. The Disko Bugt region and areas to the north with the Precambrian basement in the east and the onshore part of the West Greenland basin in the west. N.q. = Nuusap qaqqarssua.

Fig. 2. Geological sketch map of the Precambrian area north-east of Disko Bugt. Q indicates the island Qeqertakavsak. The inset shows the location of the Disko Bugt area (circle) with respect to the Nagsugtoqidian and Rinkian mobile belts of West Greenland (NMB and RMB, respectively). Stars show localities where the presence of Archaean basement rocks has been demonstrated north of the Archaean craton of southern Greenland (ruled). KMB is the Proterozoic Ketillian mobile belt of South Greenland.



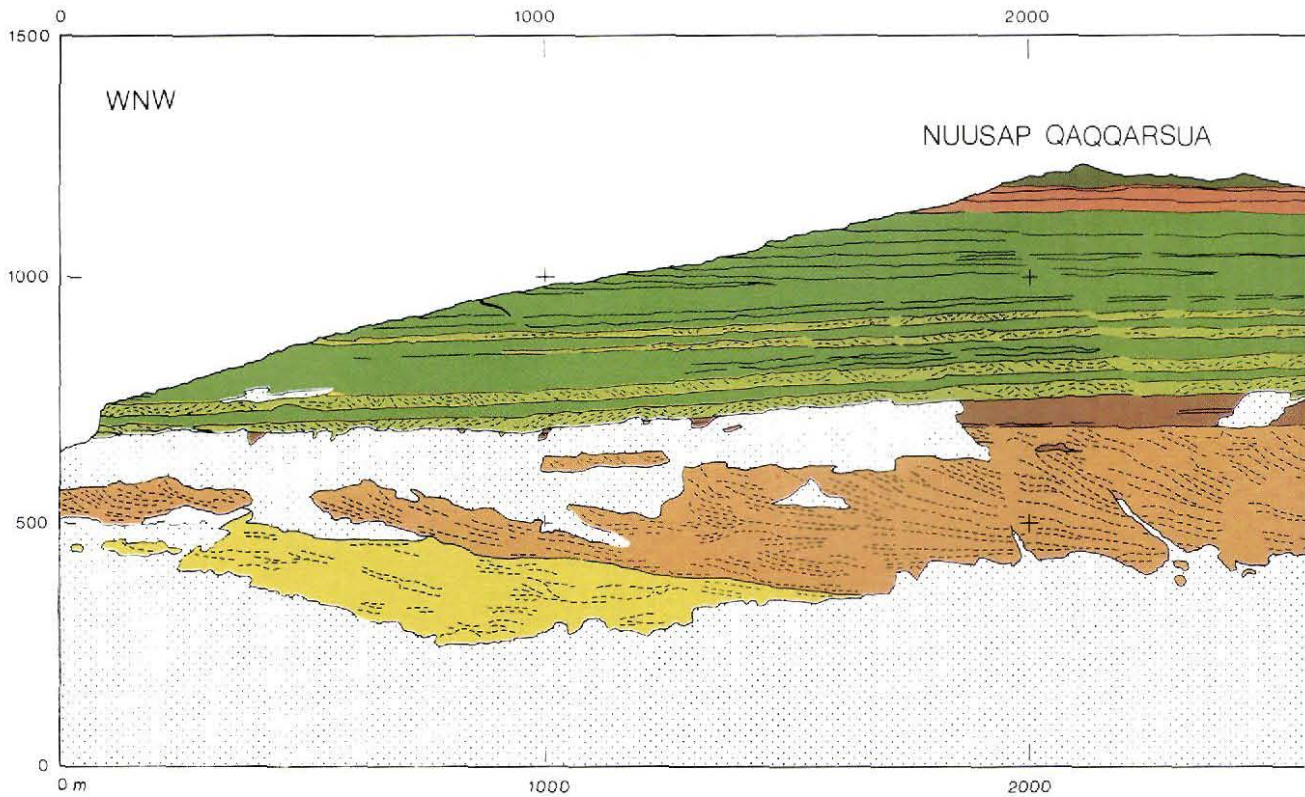
During the project geological reconnaissance was carried out over the entire area between Ilulissat (Jakobshavn) and the north coast of Nūgssuaq; results of this work will be reported in the form of a geological map at 1:250 000. Some preliminary results have been given by Garde & Steenfelt (1989) and Garde & Thomassen (1990). It appears that the Precambrian part of Nūgssuaq consists of a number of thrust sheets, consisting mainly of Archaean gneisses, with local occurrences of Archaean anorthosite, mafic supracrustals and Proterozoic marble interleaved between them. This structure is reminiscent of that reported from the Umanak district to the north (Pulvertaft, 1986).

The area around Atâ has been mapped in more detail (Fig. 2), because it contains a well-preserved Archaean greenstone belt, and it is planned to publish a geological map sheet at 1:100 000 of this terrain. This greenstone belt hosts gold-bearing alteration zones, the best showings containing an average of c. 6 ppm gold in chip samples over a 15 m wide zone. Platinova A/S, Nuuk, Greenland, together with Faxe Kalk, Denmark, hold a concession in this area. The greenstone belt and the overlying Proterozoic sediments have been mapped in greatest detail, whereas the surrounding gneisses and

granitoid rocks have been surveyed in a reconnaissance manner. It appears that the granitoid rocks (the so-called 'Atâ granite') and the greenstones in the northern part of the planned 1:100 000 map sheet have many features in common with other Archaean granite-greenstone terrains, whereas the southern part of the map sheet consists of typical Archaean grey gneisses (cf. Windley, 1984). The distribution of rocks of different metamorphic grades, as well as geochemical mapping within the map sheet area, indicate that the rocks in the northern and southern parts of the map sheet represent different crustal levels, deeper crust being exposed in the southern than in the northern part. In fact, it has been found that the gneisses in the southern part of the map sheet contain a number of thrust sheets that have been transported upwards and to the north-west.

In the central part of the map sheet thin lamprophyric dykes are fairly common (Marker & Knudsen, 1989), and local plugs of lamprophyric rocks are also present. These are akin to olivine lamproites which may carry diamonds (see Larsen, 1991a, b).

A preliminary account of the Archaean supracrustals has been presented by Knudsen *et al.* (1988), and a detailed description of part of the Proterozoic sedi-



mentary sequence is available in the form of an unpublished thesis (Andersen, 1991). Pervasive metasomatic alteration of the Proterozoic sediments and local basic intrusions have been described by Kalsbeek (1991, 1992) and by Thomsen (1991), and an account of one of the lamprophyric plugs with peculiar phlogopite nodules is given by Skjernaa (1992).

Other aspects of the work in the Precambrian basement of the Disko Bugt region comprise a detailed study and sampling of the various mineral showings in the area, acquisition of gravimetric and magnetic data for the preparation of geophysical maps of the area covered by the 1:100 000 geological map (Thorning, 1989), a study of the thrust tectonics in the region and of the composition and character of the Atâ granitoids, and collection and analysis of stream sediment and water samples for the preparation of geochemical maps. It is planned to incorporate results of all these investigations in a special issue of GGU's Report series.

The West Greenland basin

Much of the continental shelf off West Greenland is occupied by Upper Cretaceous–Tertiary sedimentary rocks, exposed onshore on Disko and Nûgssuaq and in coastal areas to the north. These are overlain by a thick

succession of Tertiary plateau basalts. Studies of both the sediments and the basalts and of their mutual relationships are major aims of the Disko Bugt Project.

The onshore sediments in the Disko Bugt area were deposited in deltaic, lacustrine or shallow marine environments, filling in the basin from the south and east. During the Tertiary, contemporaneously with sedimentation from the south and east, the basin was filled from the west by basaltic rocks (Fig. 3), the volcanic activity presumably being related to the opening of Baffin Bay. Marine mudstones are locally intercalated with volcanic hyaloclastites, and a study of microfossils in the mudstones, together with a stratigraphic investigation of the basalts, has permitted a detailed correlation, as well as the determination of the age of the basalts. It appears that Tertiary volcanism in West Greenland started as early as the middle Danian, and had terminated before the onset of Tertiary volcanism in East Greenland (Pia-secki *et al.*, 1992).

The West Greenland basalts are renowned for the occurrence of flows that carry native iron; this is related to the reduction of the magma by reaction with organic material in the sediments. Such reduced basalts are in Siberia associated with significant nickel deposits. Falconbridge Ltd., Canada, in partnership with Platinova A/S, Nuuk, Greenland, hold a concession in the region.

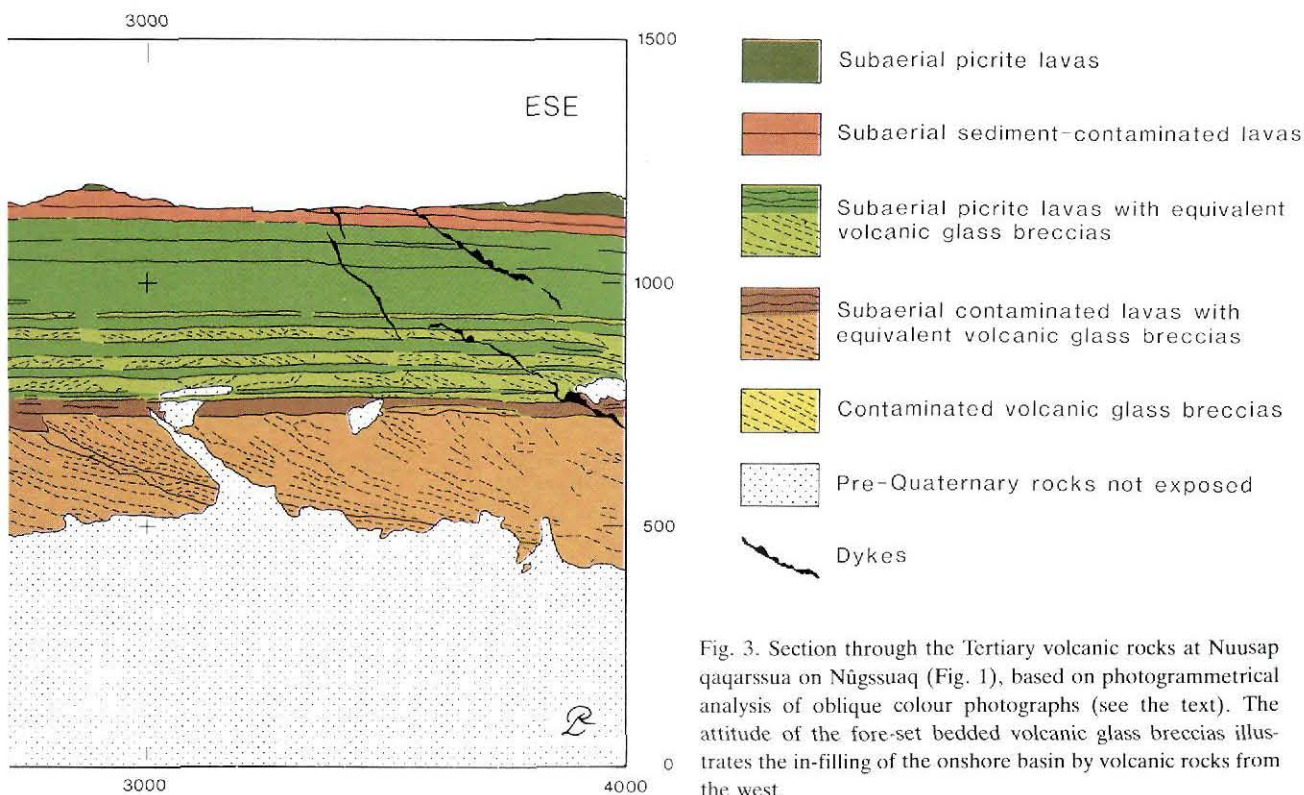


Fig. 3. Section through the Tertiary volcanic rocks at Nussap qaqarsua on Nūgssuaq (Fig. 1), based on photogrammetrical analysis of oblique colour photographs (see the text). The attitude of the fore-set bedded volcanic glass breccias illustrates the in-filling of the onshore basin by volcanic rocks from the west.

The stratigraphy of the basalts is being studied by a combination of field work and photogrammetry (see below), aided by chemical data. Preliminary results of this investigation have been reported by Larsen & Pedersen (1989, 1990), and Pedersen *et al.* (1989).

The photogrammetric work is based on oblique colour photographs (diapositives) taken with a hand-held camera from a helicopter. With the help of advanced multi-model photogrammetric instrumentation and software, developed by K. S. Dueholm at the Technical University of Denmark, it is possible from these photographs to prepare very precise geological maps and sections (Fig. 3), even from localities that are inaccessible on foot (Dueholm & Pedersen, 1990).

Earlier work on the sediments under the auspices of the Disko Bugt Project related mainly to the non-marine strata. Results have been reported by Midtgaard & Olsen (1989), Pedersen & Rasmussen (1989), Olsen (1990), Pedersen & Midtgaard (1990), Olsen & Pedersen (1991), Pedersen & Pulvertaft (in press), and in theses by Hjortkjær (1991), Midtgaard (1991) and Olsen (1991). Pulvertaft (1989) and Pulvertaft & Chalmers (1990) have studied aspects of the tectonic development of the basin.

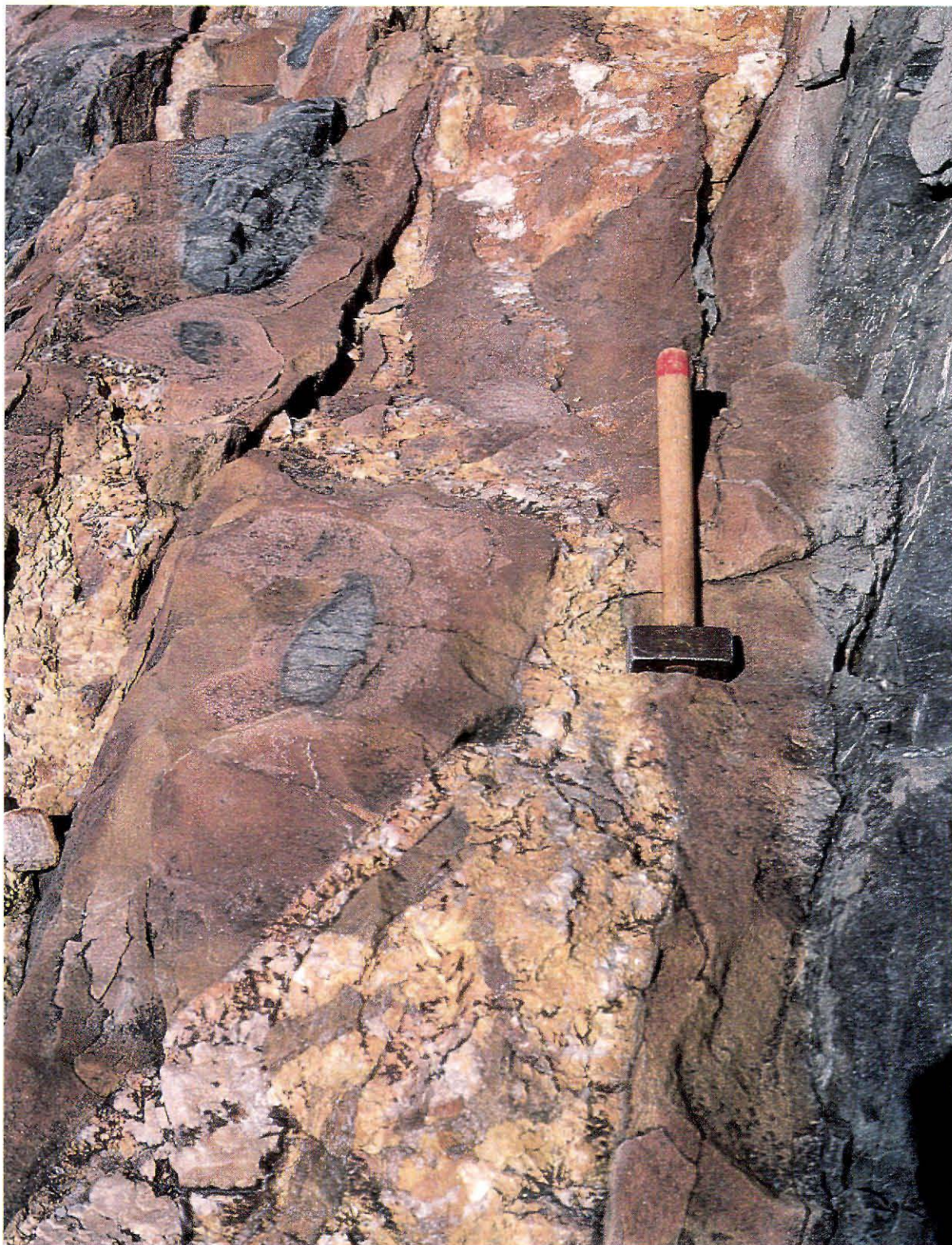
During the summer of 1991, petroleum related studies have been carried out on the marine Cretaceous–

Tertiary sediments in order to provide background data for assessing the exploration potential of the offshore basin (see Christiansen *et al.*, 1992). These studies have concentrated on detailed sedimentological facies analysis, sampling for palynological and organic chemical analyses and structural analysis of key areas. The results are planned to be integrated within a sequence stratigraphic framework, aimed at prediction of the distribution of potential reservoir and source rocks.

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Dolerite (dark grey), altered into carbonate-rich rock (red-brown) along carbonate-quartz veins (yellow and white) on Qeqertakavsak island. During alteration most of the iron was washed out of the dolerite and large amounts of sodium and volatile components were introduced into the rock. Photo: F. Kalsbeek.