WA. 6609/7-1. 4(6)

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N O T A T

TRÆNABANKEN
6609/7-1

Abstract

Core description and petrographic analysis has shown that the 6609/7-1 well on the Nordland Ridge probably terminated in metamorphic, Caledonian basement rocks of quartzitic composition.

Introduction

A preliminary core and petrographic description of core no. 1 is given below. Core no. 2, a 0.5 m core taken below is similar in appearance to core no. 1 and is not described here.

Core no. 1 is taken from a rock unit immediately underlying carbonates dated to be of Permian age by IKU. The age of the cored unit will be discussed later.

The core consists mainly of quartzite, in part brecciated and in part very carbonate rich. Some intervals responded to acid in such a way that a first look made it reasonable to think that part of the core consisted of limestone. Later petrographic analysis, however, has shown that this is not the case.

Core description

The core has been divided into an upper brecciated unit and a lower laminated unit. Fig. 1 shows the preliminary description.

Upper unit

The upper unit constitutes the upper 1 m of the core and consists for a great part of quartz breccia. The angular clasts of different sizes (max 5 cm) are held together by a fine grained matrix of quartz and calcite. Some of the matrix is a green micaceous material which was observed on slickensides surfaces as well. XRD analysis of the green filling (see fig. 1 for sample location) has shown that it consists of quartz + mica/illite (10Å) + calcite + K-feldspar. No evidence for chlorite (14Å) or kaolinite (7Å) was observed.

SEM analysis of the material showed a wispy illite-like material forming on mica particles. Veins of calcite are common, whereas quartz veins are less frequent. Slickensides features are commonly observed.

The laminated non-brecciated intervals are also carbonate cemented. A small fold (amplitude 10-15 cm, λ = 5-10 cm) is observed near the base of this unit. In the core below this one, steep inclination of the bedding plane may indicate mesoscopic folds, as well. The fold is cut by a calcite vein which is a clear post-folding event. Indication of axial plane cleavage with growth of white mica is observed, suggesting syntectonic metamorphic influence.

Lower unit

The lower unit resembles the non-brecciated intervals of the upper unit and consists of a laminated micaceous, and carbonate rich quartzite. The lower portion is very carbonate rich. A couple of thin brecciated intervals are also present in this unit. Visible calcite veins are common.

PETROGRAPHY

A total of 6 thin sections (TS on Fig. 1) are taken from the core. Three of these are taken from brecciated intervals. The thin section analysis show a non-porous quartzite with sutured grain boundaries. Micro and macro fractures filled with calcite are everywhere common (Fig. 2a, b, c). Quartz veins are also observed. Beside quartz, light mica is a common mineral. Feldspar is not observed, but occurrence of sericite may originate in earlier feldspars. Tourmaline, (Fig. 2d) often zoned, is a frequent occurring heavy mineral. Zircon is less common. Not identified opaque minerals often occur together with mica.

Sutured, dimentionally oriented quartz grains and white mica define a distinct foliation. This foliation is cut by numerous calcite veins. The calcite in these veins is often found as large well-crystalline minerals. No sedimentary textures are seen.

Beside the possible seritization of earlier feldspar, mica is observed to be altered to an yet udentified micaceous mineral.

Interpretation/Conclusion

The discussion of this well has been very focused upon the age of these rocks, whether they are of upper paleozoic or of caledonian age. The question is not only of academic interest, as the interpretation has great importance for the understanding of the Nordland Ridge.
There is no doubt, however, that these quartzites are former sedimentary rocks. Their mineral content with about 90 % quartz, mica, sericite (from feldspar?) and heavy minerals as tourmaline and zircon corresponds to what can be expected from a quartz arenites to subarkosic arenites.

The rock is now a quartzite with certain metamorphic features, such as sutured quartz grains and foliation defined by mica and orientated quartz grains. None of these observations are, however, diagnostic as they also can be found in non metamorphic rocks.
But the observed fold with evidence of axial plane cleavage should be a good indication for the presence of metamorphism. The mineral assemblage gives no definite clues as to the grade of metamorphism, as the coexistence of quartz and muscovite is recorded from low grade to the beginning of high grade metamorphism. Weak extinction of quartz grains may indicate low grade metamorphism. Dating of the mica in the quartzite may help in identifying the time of metamorphism, and mineral analysis of the mica may help in determining grade of metamorphism.

The present large content of carbonate in the rocks is attributed to a post deposition and post foliation event, since the carbonate is found in calcite veins of different sizes which cut across all other textures. Calcite is also the most important matrix between the breccia clasts. The brecciation and income of calcite may therefore be related to the same event. The origin of the breccia may be tectonic (fault breccia) or it can also be a weathering product. In the latter case carbonate rich solution may have been expelled from the overlying carbonates and later invaded the underlying quartzite.

A following scheme of event can tentatively be set up.

1) Deposition of sandstone
   Age: ? Precambrian - Cambrian

2) Metamorphism/cleavage formation
   Age: Caledonian?

3) Brecciation - income of carbonate rich pore water.
   Weathering effects prior to deposition of carbonates or a later fault breccia.

This explanation thus implies that metamorphic basement is hit in 6609/7-1. It should, however, be mentioned that the studied rock unit may resemble parts of the Holen Formation (Aslagsen, 1981) of assumed Carboniferous age on Andøya. Trænabanken is in addition an unknown area of which we have no record of the deformation history. Metamorphism, if present, may have taken place later than is commonly accepted for onshore areas.

SHEET , OF

CORE DESCRIPTION

SEDIMENTOLOGY DATA SHEET

FIELD/AREA: TROENEBANKEN. WELL NO.: 6609/7-1 SCALE:
UNIT: ? CORE NO.: 1 DATE: 22/7 -83
AGE: ? INTERVAL: 1944.24 - 1946.0. GEOLOGIST: Gibbons, Olavssen, Jacobsen

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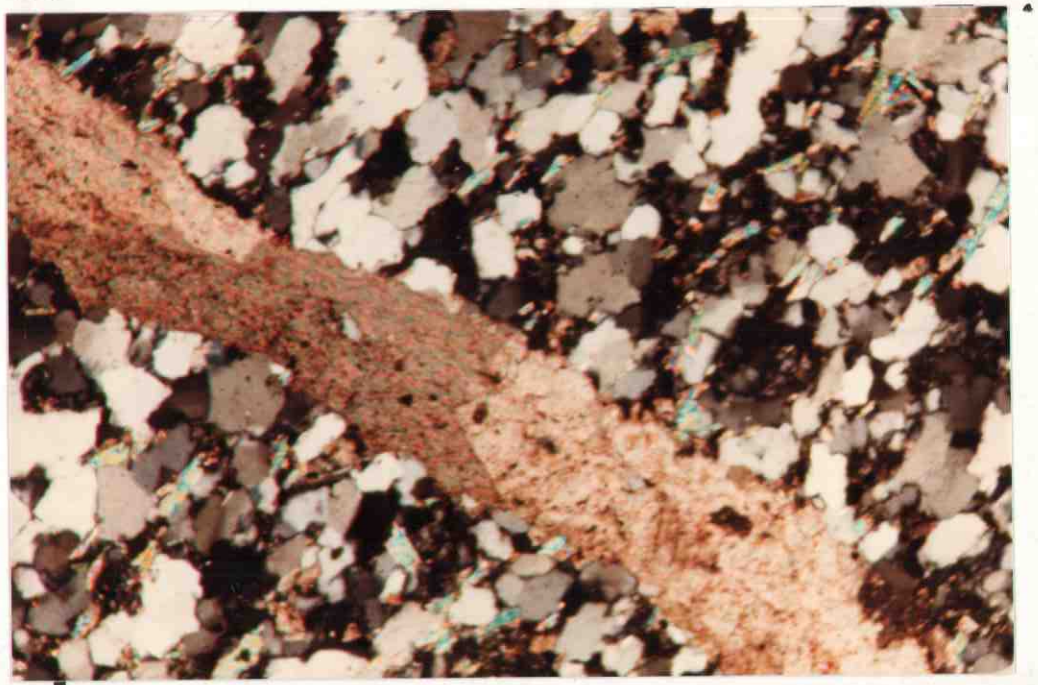
LITHOSTRATIGR. UNIT	RESERVOIR SUBDIV.	CORE DEPTH (m)	CORE NO.	LITHOLOGY	GRAIN SIZE AND SEDIMENTARY STRUCTURES	FACIES/SUBFACIES	DEPOSITIONAL ENVIRONMENT	DESCRIPTION AND INTERPRETATION	PALYNOFACIES
		1944							
	brecciated calcite veins. micaceous quartzite	.25						brecciated quartzite with quartz veins hematite included in quartz veins slick-en-sides quartzite breccia, calcite veining. breccia green filling / veining = illite + muscovite + calcite calcite veins tight folded micaceous quartzite calcite interstial.	
		.50							
		.75							
		1945							
		.25							
	laminated micaceous quartzite with carbonate & illite	.50						laminated micaceous quartzite with calcite in microfractures and interstial highly fractured with calcite in fractures green filling / veining = illite + muscovite + calcite slick ensides schistosity.	
		.75							
		1946							

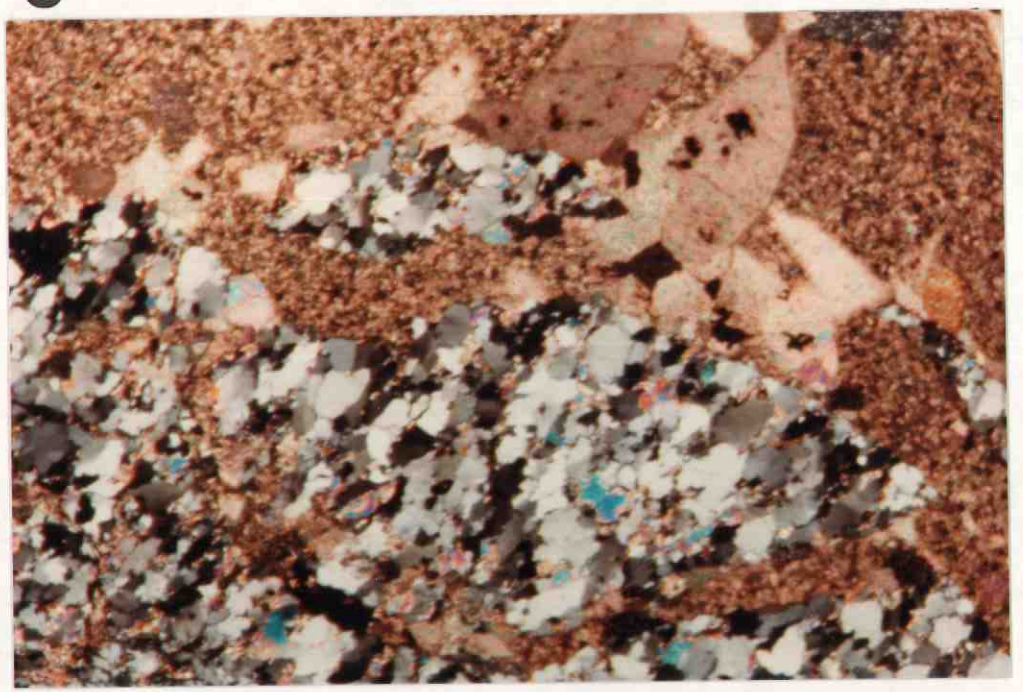
Fig 1

a

b



c



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