



General information

Lithostrat. unit	BILLEFJORDEN GP
NPDID lithostrat. unit	11
Level	GROUP

Level below

Lithostrat. unit
BLÆREROT FM
SOLDOGG FM
TETTEGRAS FM

Description

Billefjorden Group

Name

Cutbill & Challinor (1965) introduced the term “Billefjorden Group” for a suite of nonmarine sediments now recognised to be of late Devonian to early Carboniferous age. The type area is in the environs of Billefjorden in central Spitsbergen. The Billefjorden Group is a well-established lithostratigraphic unit and its overall facies development and depositional evolution is well known (e.g. Gjelberg 1981; Steel & Worsley 1984). Lower Carboniferous units in the southern Norwegian Barents Sea are herein also assigned to the group. The offshore development of the group resembles that described from onshore with one major exception: the upper part of the group includes some shallow marine deposits in the southeastern Finnmark Platform. As yet enigmatic red-bed sequences on the Loppa High are also tentatively assigned to the group, but need further investigation (see below).

Offshore reference areas

The Barents Sea subsurface reference area is located on the eastern Finnmark Platform ([Fig 9.1](#) , [9.2](#) , [9.7](#)) , where the Billefjorden Group has been penetrated in its entirety in wells [7128/4-1](#) from 2503 to 2058 m ([Fig 9.8](#)). and [7128/6-1](#) from 2533.5 m to 2150 m ([Fig 9.9](#)). Southwards, towards the Norwegian mainland, the Upper Palaeozoic succession subcrops against the Pliocene/Pleistocene unconformity and the IKU shallow cores 7127/10-U-02, 7127/10-U-03 and 7029/03-U-01 penetrated different intervals of the group (Bugge et al.1995). Present seismic coverage and quality provides reasonable control on the seismic-scale lateral development of the group on the Finnmark Platform.

Thickness

Thicknesses of 445 m and 384 m in wells [7128/4-1](#) and [7128/6-1](#) respectively should be compared to cumulative thicknesses of up to 2500 m in the type area of Billefjorden and of 590 m on Bjørnøya (Dallmann et al. 1999; Worsley et al. 2001). As elsewhere, the group's sediments were deposited in the early phase of a period with active rifting, and both wells are located over the crests of structural highs in the southern part of the Finnmark Platform; seismic data indicate that the group is more than 600 m thick in the adjacent halfgrabens. Well [7120/2-1](#) on the Loppa High penetrated an 847 m thick succession of sediments tentatively assigned herein to the Billefjorden Group; the succession was encountered from 2624 m to 3471 m, before the well was terminated in a possible dolerite ([Fig 9.10](#)), see also discussion in next section).

Lithology

On the Finnmark Platform, medium- to coarse-grained, occasionally conglomeratic,

sandstones and minor siltstones and coals dominate the basal part of the succession represented by the [Soldogg Formation](#). These are overlain by a succession of stacked metre-scale fining-upward cycles of sandstone, siltstone, claystone and coal assigned to the [Tettegras Formation](#). The upper part of the group, represented by the [Blærerot Formation](#), is characterised by a basal unit of fossiliferous limestones, overlain by marine shales and fine- to medium-grained, fluvial and shallow marine sandstones. Sediments tentatively assigned to the group are very differently developed on the Loppa High where well [7120/2-1](#) penetrated 847 m of varicoloured arkosic breccias, conglomerates, ignimbrites and other types of volcanoclastic deposits ([Fig 9.10](#)). The basal 115 m are dominated by brownish siltstone and mudstone. The red nature of these sediments, together with their high content of volcanoclastics, makes them anomalous representatives of the Billefjorden Group in this area, although palynomorphs indicate an early Carboniferous age (Viséan PU to VF Miospore zones from 3467 to 2682 m and early Serpukhovian TK Zone from 2645 to 2630 m) (Lindström, in press). The only other arctic areas where lower Carboniferous red beds have been found are in the northern part of eastern Greenland (Stemmerik et al. 1993), but even there the change to red beds appears to have occurred in the late Tournaisian – i.e. older than the earliest datings on the Loppa High. The Loppa sequence's overall lithology and tectonic setting seems rather to suggest closer affinities to the lowermost clastics of the overlying mid-Carboniferous [Gipsdalen Group](#). More work is clearly needed on this problem, especially in view of this representing the only occurrence of volcanoclastics in the Upper Palaeozoic of the Barents Shelf; we note that dolerite dykes of probable mid- to late Carboniferous age have been reported by Lippard & Prestvik (1997) on Magerøy in Finnmark and mid-Carboniferous volcanics have also been identified on the adjacent Kola peninsula in northern Russia (Ulmishek 1982). In view of these uncertainties, this sequence has not yet been defined as a formational unit, and its assignment to the Billefjorden Group is still tentative.

Lateral extent and variation

The group is generally difficult to map outside the Finnmark Platform and little is known about its regional distribution and variation, although the overall impression is that the Billefjorden Group represents thick siliciclastic-dominated wedges that fill developing Carboniferous half-grabens in the southwestern Barents Sea. On the Finnmark Platform itself seismic mapping of the group suggests pronounced lateral variations in thickness due to infill of local half grabens resulting from Viséan–Serpukhovian rifting. Most of the thickening and probably most of the lateral facies changes are in the uppermost part of the group. The rift event appears to be less pronounced east of approximately 29° 30' on the Finnmark Platform where the base of the group is poorly defined seismically. A possibly pre-Viséan sedimentary succession is present locally in this eastern part of the platform. The group's representatives also seem to infill local half-grabens on the Loppa High and the Norsel High (central Bjarmeland Platform), and deeply buried half-graben systems appear to be also present further to the east on the Bjarmeland Platform. Thick wedge-shaped units corresponding to the Billefjorden Group are observed on seismic lines along the margins of the Nordkapp Basin, suggesting that the basin already formed a major depocentre at that time.

Sediments assigned to the Billefjorden Group are generally separated from the underlying strata by an angular unconformity, as seen in wells [7128/6-1](#), [7128/4-1](#) and core 7029/03-U-01. In [7128/6-1](#), the group rests on Precambrian metasandstones (Røe & Roberts, 1992) at 2533.5 m RKB, with a 45 m thick transitional zone of conglomeratic sandstones interpreted as weathered and reworked basement rocks. These sediments are included in the Billefjorden Group (see definition of [Soldogg Formation](#)). Upwards, they pass into more mature sandstones with rare siltstone and coal beds defined by a sharp upward decrease in bulk density and sonic velocity at 2488.5 m.

Age

The Billefjorden Group has been assigned to the Famennian to Viséan in the onshore areas of Bjørnøya and Spitsbergen (Dallmann et al. 1999; Worsley et al. 2001). The offshore development has been dated to the Viséan to early Serpukhovian. On the Finnmark Platform, palynomorphs suggest that the basal part of the group is of middle to late Viséan age (Bugge et al. 1995), i.e. significantly younger than the Famennian to



Tournaisian age recorded for the basal sediments onshore. The upper part of the group is apparently of late Viséan to early Serpukhovian age (Bugge et al. 1995; Simon-Robertson 1992 and Geochem Group 1994). As noted above - the succession on the Loppa High has been dated to the Viséan to early Serpukhovian (Lindström, in press).

Depositional environments

The Billefjorden Group is characterised by an overall transition from continental fluvially dominated deposits of the [Soldogg](#) and [Tettegras](#) formations into transitional continental to marginal marine deposits of the [Blærerot Formation](#) on the eastern Finnmark Platform. The presence of coal indicates deposition in overall humid climatic conditions in contrast to the overlying [Gipsdalen Group](#) that is characterised by sediments deposited in more arid climates.

Shallow core data from 7029/03-U-01 suggest that the lower parts of the [Soldogg Formation](#) represent basement wash and braided river deposits. These pass upwards into delta/coastal plain sandstones, siltstones, claystones and coals of the [Tettegras Formation](#), and are overlain by marine and transitional continental to marginal marine deposits of the [Blærerot Formation](#) in well [7128/6-1](#). The transitional nature of this upper part is demonstrated by rare coal beds in the lowermost part of the formation at well [7128/6-1](#). The [Blærerot Formation](#) appears to be missing in [7128/4-1](#) either as the result of local uplift and erosion or because the marine transgression never reached the high on which the well was drilled. This depositional area was separated by a major fault southwest of well [7128/4-1](#) from the provenance areas of basement rocks and metasediments towards the Finnmark coast (Gabrielsen et al. 1990). Shallow cores 7127/10-U-02 and 7127/10-U-03 were taken in a proximal position, 2-3 km away from this main fault and record a thick development of Viséan syn-rift fluvial deposits (Bugge et al. 1995).

The succession on the Loppa High apparently represents deposition in alluvial fans and proximal braided river systems in a rapidly subsiding sub-basin. Local volcanic activity is suggested on the basis of the large amount of volcanoclastic material in well [7120/2-1](#). The depositional environments recorded from the Finnmark Platform generally resemble those recognised in the onshore areas of Spitsbergen and Bjørnøya. The most important difference is the evidence of marine flooding of the eastern Finnmark Platform, perhaps suggesting more prevalent marine conditions in the contemporaneous Nordkapp Basin, with transgression from the east. The lithofacies and depositional environments of the Billefjorden Group on Spitsbergen and Bjørnøya are summarised by Gjelberg (1981), Steel & Worsley (1984) and Harland (1997), all emphasising the considerable facies variations related to local variations in tectonic regime. The reservoir potential of the group's sandstones has been noted by several authors (Grønlie et al. 1980, Steel & Worsley 1984, Worsley et al. 2001).

Formations assigned to the group

The Billefjorden Group is represented by three formations on the Finnmark Platform and these are formally defined and described herein. Formational names are selected from land plants found in northern Norway that utilise nourishment from insects that stick to their leaves. The succession in well [7120/2-1](#) on the Loppa High is not yet given any formal formational status.

Source

- Larssen, G. B., Elvebakk, G., Henriksen, L. B., Kristensen, S. E., Nilsson, I., Samuelsen, T. J., Svånå, T. A., Stemmerik, L. and Worsley, D. 2002: Upper Palaeozoic lithostratigraphy of the Southern Norwegian Barents Sea. NPD-Bulletin No. 9, 69 pp.

Wellbores penetrating

Wellbore name	Wellbore completion date	Top depth [m]	Bottom depth [m]
7120/2-1	29.10.1985	2624	3471



7128/4-1	26.02.1994	2058	2503
7128/6-1	08.11.1991	2150	2534
7130/4-1	08.01.2016	2680	3184

Wellbores with cores

Wellbore name	Wellbore completion date	Core length [m]
7120/2-1	29.10.1985	9
7128/4-1	26.02.1994	27
7128/6-1	08.11.1991	27