Generell informasjon

Litostrat. enhet	GIPSDALEN GP
NPDID for litostrat. enhet	51
Nivå	GROUP

Nivå under

Litostrat. enhet
FALK FM
UGLE FM
ØRN FM

Beskrivelse

Gipsdalen Group

Name

Cutbill and Challinor (1965) introduced the term Gipsdalen Group for a suite of rocks of mid-Carboniferous to early Permian age. The group is widely exposed on Svalbard, with its type area in central Spitsbergen. The group's overall geological development is well known onshore, both on Spitsbergen itself (e.g. Steel & Worsley 1984; Dallmann et al. 1999) and on Bjørnøya on the Stappen High (Worsley et al. 2001). The Gipsdalen Group is here extended to cover the offshore mid-Carboniferous to early Permian succession in the southern Norwegian Barents Sea and is there dominated by red-coloured siliciclastics and warm-water, often dolomitised carbonates – also with the significant presence of evaporites and the halite diapirs in the Nordkapp Basin. Wells 7121/1-1R, 7124/3-1 and 7226/11-1 from the margins of the Loppa High and the Bjarmeland Platform record deposition in deeper marine settings than seen onshore. The formational scheme proposed herein is relatively broad and reflects three, easily recognised, highly diachronous stages of development starting with red-bed sedimentation in isolated fault-controlled basins, followed by mixed siliciclastic-carbonate deposition and terminated by carbonate-dominated sedimentation on the platforms and carbonates and evaporites in the basins.

Offshore reference areas

In the Norwegian Barents Sea, 11 wells and 4 shallow cores have penetrated strata assigned to Gipsdalen Group. The subsurface reference area is located on the eastern Finnmark Platform where this succession has been penetrated by 7229/11-1 and 7228/9-1 S on the northern margin and 7128/6-1 and 7128/4-1 in a more central position on the platform (Fig 9.19). Further toward the south, IKU drilled three cores (7029/03-U-02, 7030/03-U-01 and 7129/10-U-02) close to the Finnmark coast where the group's sediments subcrop against the Pliocene/Pleistocene unconformity (Bugge et al. 1995). Additional information on the group's development comes from well 7120/12-4 on the western Finnmark Platform.
The Loppa High also forms an important reference area with good seismic coverage, including a 3D survey, and three wells, viz. 7120/1-1R2, 7120/2-1 and 7121/1-1R, that penetrate the succession in the southern Loppa High area (Fig 9.19 , 9.20) Further to the east, the group was encountered in wells 7124/3-1 and 7226/11-1 on the southern margins of the Bjarmeland Platform. A shallow core and several minicores have also been drilled on the Svalis Dome on the Bjarmeland Platform (Nilsson et al. 1996).

Thickness

The Finnmark and Bjarmeland platforms and the Loppa High formed low-angle ramps

dipping toward the Nordkapp and eastern Hammerfest basins during deposition of the Gipsdalen Group. The thickest drilled succession is from the southern flanks of the Loppa High, where the group is more than 1000 m thick in well 7121/1-1R and seismic data suggest that a further 500 m is present below TD. This is comparable to the up to 1800 m thick successions recorded locally in marked half-graben structures such as Inner Hornsund and Billefjorden on Spitsbergen. In contrast the group's sediments are totally absent on the crest of the Loppa High – as on southern Bjørnøya on the Stappen High – while well 7120/2-1 in a near-crestal position shows a 680 m thick development, similar to the 595 m thick development on northern Bjørnøya.
The group thins from approximately 315 m in well 7128/6-1 to 250 m in 7128/4-1 on the Finnmark Platform; IKU cores suggest comparable thicknesses (Bugge et al. 1995). Further to the west, well 7120/12-4 penetrated the upper 85 m of the group. Wells 7228/9-1 S and 7229/11-1 on the northern Finnmark Platform penetrated only the upper (Moscovian-Sakmarian) part of the group: this interval is 211 m and 333 m thick respectively in these wells - significantly thicker than the corresponding interval in 7128/4-1 and 7128/6-1 further to the south. The group thickens even more towards the northwest and seismic data from the Nordkapp Basin indicate thicknesses of several hundred metres. On the Bjarmeland Platform, the group is more than 800 m thick in well 7226/11-1, where Bashkirian carbonates rest directly on basement. A total thickness of 1000 m is suggested by the 465 m penetrated in 7124/3-1 combined with seismic data from the underlying section. The group is 670 m thick in well 7120/1-1 R2 where it rests on garnet mica schists/gneisses of Caledonian age.

Lithology

The group is composed of metre-thick to rarely tens of metre-thick rhythmic units generally showing shallowing upward trends continental red bed sandstones, siltstones and conglomerates dominate the basal part of the succession. These are overlain by mixed carbonates and siliciclastics where the siliciclastics are grey-coloured marine sandstones, conglomerates and shales and the carbonates include a variety of shallow marine facies. The upper part of the group is dominated by rhythmically bedded limestones and dolomites with occasional small phylloid algal – Palaeoaplysina buildups, and minor evaporites on the platform areas. The biota is of chlorozoan composition and dominated by algae and foraminifers (c.f. Lees & Buller 1972). Seismic data suggest that the shelf carbonates pass into several hundred metre thick successions of stacked buildups in the deeper ramp areas (Elvebakk et al. 2002). These buildups have not been drilled and their internal composition and exact stratigraphic position is therefore unknown. However, similar relationships are described from age equivalent rocks in the Sverdrup Basin where the largest build-ups occur on the basin slope (Beauchamp 1993). Evaporites dominate in the basinal areas; anhydrite occurs interbedded with carbonates near platform margins whereas halite dominates in more distal settings.

Lateral extent and variation

The group's sediments are found throughout the Norwegian Barents Sea. Thickest developments are seen in the Nordkapp Basin and other basinal areas where the succession is dominated by evaporites. The thickest carbonate-dominated successions are found on the distal parts of the platforms, such as the eastern flanks of the Loppa High and the northern margins of the Finnmark Platform. The group thins towards structural highs and mainland Norway: it shows a clearly onlapping development, so that the lower non-marine parts were deposited in isolated half-grabens, while platforms and highs only became part of the depositional basin later, when relative second order sea-level rise led to marine flooding of the entire circum-Arctic region (c.f. onland Spitsbergen, Steel & Worsley 1984). The group's occurrence resting directly on basement in 7226/11-1 (see above) confirms this general pattern. The considerable variations in lithology, both laterally and vertically, reflect the ongoing sea level rise and resultant varying timing of drowning of different siliciclastic provenance areas. A larger proportion of shallow marine siliciclastics are expected updip on the platforms, while carbonate buildups are best developed on basinal margins. The Loppa and Stappen highs experienced several phases of tectonism during deposition of the group, in contrast to the vast bulk of offshore platforms and basins, and onshore exposures on Bjørnøya show interesting analogues for the development expected on the Loppa High

(Worsley et al. 2001).
The boundary between the Gipsdalen Group and the underlying Billefjorden Group is only known with certainty from wells 7128/4-1 and 7128/6-1 on the Finnmark Platform and from 7120/2-1 on the Loppa High. On the Finnmark Platform, the sharp contact between Lower Carboniferous grey fluvial siliciclastics with coals below and red bed facies with caliche above marks a boundary represented by a major regional unconformity in the circum-Arctic and is associated with a significant change in palaeoclimate from warm and humid to warm and arid to semi-arid (Steel & Worsley 1984; Stemmerik & Worsley 1989; Stemmerik 2000).

Age

The basal non-marine red-bed succession contains palynomorphs indicating a general Serpukhovian to Bashkirian age. Fusulinids suggest a late Bashkirian to Sakmarian age for the marine part of the group (Stemmerik et al. 1998; Ehrenberg et al. 1998a). In onshore areas of Svalbard, the group's sediments have been dated to the late Serpukhovian to early Artinskian (Dallmann et al. 1999) (Fig 9.6)

Depositional environments

The basal non-marine red-bed succession of the Ugle Formation was deposited during active rifting in the ?late Serpukhovian to Bashkirian and cores from 7120/2-1 represent alluvial fan and braided river deposits. The overlying Falk Formation marks the transition into shallow marine deposition at a time when there still was siliciclastic supply from emergent highs. The Ørn Formation uppermost in the group was deposited in a variety of shallow to deeper marine carbonate environments during sea level highstands. The presence of extensive subaqueous anhydrite and halite deposits in the basins and sabkha evaporites on the platforms clearly suggests deposition took place in warm semi-arid to arid climates (Steel & Worsley 1984; Stemmerik 2000). The platform succession is characterised by stacked rhythmic shelf deposits often terminated by subaerial exposure surfaces, reflecting deposition during a time period characterised by high frequency and high amplitude fluctuations in sea level (e.g. Stemmerik & Worsley 1989; Pickard et al. 1996; Stemmerik et al. 1998; Ehrenberg et al. 1998a; Samuelsberg & Pickard 1999; Worsley et al. 2001). The depositional environments recorded from the platform areas generally resemble those recognised onshore Spitsbergen and Bjørnøya. The deeper marine, outer ramp and basinal deposits have no counterparts onshore.

Formations assigned to the group

Three formations are formally described below and these are named after birds of prey common to northern Norway. The still poorly known outer platform and basinal succession is provisionally included in the uppermost Ørn Formation.

Source

- Larssen, G. B., Elvebakk, G., Henriksen, L. B., Kristensen, S. E., Nilsson, I., Samuelsberg, 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.

Brønnbaner som penetrerer

Brønnbane navn	Dato for boreslutt	Topp dyp [m]	Bunn dyp [m]
7120/1-1 R2	21.07.1986	3220	3947
7120/2-1	29.10.1985	1945	2624
7120/12-2	11.09.1981	4558	4664
7120/12-4	16.04.1984	2118	2199
7121/1-1 R	23.08.1986	3990	5000
7124/3-1	20.10.1987	4271	4730

7128/4-1	26.02.1994	1820	2058
7128/6-1	08.11.1991	1834	2150
7130/4-1	08.01.2016	2320	2680
7220/6-1	29.03.2005	1138	1483
7220/6-2 R	22.11.2016	1060	1270
7220/6-3	05.10.2017	795	1300
7220/11-1	17.10.2014	1923	2251
7220/11-3	02.09.2015	1849	1923
7220/11-3 A	29.09.2015	2120	2135
7220/11-3 AR	10.10.2016	2124	2600
7220/11-4	17.07.2017	1956	2282
7220/11-4 A	28.08.2017	2252	2392
7220/11-5 S	08.10.2018	1911	3057
7227/11-1 A	24.03.2006	1201	3446
7227/11-1 S	22.02.2006	1201	2590
7228/9-1 S	07.05.1990	4361	4600
7229/11-1	15.12.1993	4282	4630
7234/6-1	19.07.2021	3908	4035
7322/6-1 S	28.05.2021	3454	3850

Brønnbaner med kjerner

Brønnbane navn	Dato for boreslutt	Kjernelengde [m]
7120/2-1	29.10.1985	220
7120/12-4	16.04.1984	17
7128/4-1	26.02.1994	45
7128/6-1	08.11.1991	288
7220/6-1	29.03.2005	55
7220/6-2 R	22.11.2016	40
7220/6-3	05.10.2017	70
7220/11-1	17.10.2014	54
7220/11-3	02.09.2015	95
7220/11-3 AR	10.10.2016	25
7220/11-4	17.07.2017	34
7220/11-4 A	28.08.2017	28
7228/9-1 S	07.05.1990	24
7229/11-1	15.12.1993	21