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Two shallow boreholes, 7418/01-U-01 and 7517/12-U-01, were in 1994 drilled by IKU / SINTEF on behalf of the Norwegian Petroleum Directorate (NPD) northwest of Bjørnøya in the western Barents Sea. These were part of a program totalling nine boreholes at six different locations between Bjørnøya and Svalbard. This area is not opened for petroleum activity, and the shallow boreholes were aimed at providing new data and increased geological knowledge.

The two drill sites are located were reflections are subcropping below the late Neogene and Quaternary overburden, and in two different sub-basins within the Hornsund fault complex. Borehole 7418/01-U-01 was drilled at a water depth of 181.5m. Total depth from seabed was 126.15m and 113.3m of cores were cut. Borehole 7515/12-U-01 was drilled at a water depth of 156m. Total depth from seabed was 200m and 87.8m of cores were cut.

The cores are dated to Paleogene age and show a variety of sedimentary features such as ample bioturbation, ripples and various cross stratifications. The lithology varies from mud to several sandy intervals and thinner beds of conglomerate.

The depositional interpretation and structural setting of the cores provides important information on the paleoenvironment and structural development of the area.

Variation in stacking style of delta-estuary couplets and associated deep-marine fans; an example from the Eocene Central Basin of Spitsbergen

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The Eocene of the Central Basin of Spitsbergen shows a series of eastward building clinothems deposited in a foreland basin. This basin was formed by a westerly active fold and thrust-belt which also acted as provenance area for these shallow-marine sand-wedges. Some of these shallow-marine wedges prograded onto the shelf, whereas some of them reached the shelf-edge and have associated deep-marine sand-lobes.

Three of these clinothems have been studied with focus on depositional environment, lateral facies variations, internal stacking pattern and shoreline trajectory pattern. All of them show a regressive - deltaic, to transgressive - estuary couplet. The transgressive parts of the clinothems consist of estuaries, lagoonal and coastal plain fines, and beach-barrier sand complexes. For the regressive deltaic part, there are clear differences between these three clinothems in terms of the style. The deltaic parts range from a) fluvial and punctuated mass-flow style; b) wave reworked and delta front collapse style; and c) mixed tide and fluvial influenced delta. This variation in deltaic style is interpreted as a function of the shape of the clinothem below. This leads over to how these deltas reached the shelf edge or if they did not. The deltas may reach the shelf-edge and deliver sediments to the basin floor by: a) sea-level fall with shelf-incision and basinward movement of the deltaic system beyond the shelf -break; b) high sediment-supply mechanism at the shelf-edge delta with fex. hyperpycnal flows; and c) having a narrow shelf that allows deltas to travel across and reach the shelf edge. On individual basis, these clinothems can be interpreted with one of these mechanisms above. However, it is interesting to see how the shape and size of each clinothem has a direct effect on the next clinothem that occurs above. This study shows how a volumetrically-limited clinothem enables the next clinothem above, to easily cross the shelf and feed sediments down the shelf slope from a fluvial delta. The two following clinothem faced a wider shelf that first gave a wave-dominated delta and finally a mixed tidal and fluvial delta capped by an estuary.

A different aspect of these clinothems is the mapped skewed thickness distribution of the regressive vs the transgressive unit within one clinothem. This gives a good illustration of the principles of sediment partitioning within sequence stratigraphic methods. In this, the focus of deposition is forced seaward during regression whereas during transgression the focus of deposition is moved landward as sediments are trapped here due to available accommodation space. This relationship is best seen in sequences with an aggradational component. The sediment partitioning concept can be used as a predictive tool and to differentiate the internal facies architecture within sequences with reservoir implications.

The Cenozoic evolution and sedimentary successions of the southwestern Eurasian Basin and the northern Svalbard / Barents Sea continental margin

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The geologic history of the SW Eurasian Basin and the northern Svalbard/Barents Sea continental margin started in Late

Cretaceous / early Tertiary. Since about 50 Ma seafloor spreading has been active in the Eurasian Basin splitting off the Lomonosov Ridge from the northern Eurasian Shelf. Since Miocene, rifting and seafloor spreading have been also established in-between NE Greenland and Svalbard, separating the Moris Jesup Rise and Yermak submarine plateaus and opening the Fram Strait deep-water gateway between the Arctic and North Atlantic oceans.

The subsequent opening of the Eurasia Basin and the Fram Strait associated with the subsidence of the Yermak Plateau led to the formation of accumulation space along the northern Svalbard/Barents Sea continental margin. The Cenozoic sedimentary successions document the early passive margin formation within an enclosed Arctic Ocean Basin, the increasing influence of current-related deposition following the opening of the Fram Strait, and finally the strong imprint of the Quaternary glaciations of the Barents Sea. Beside ocean current activity also mass wasting plays a major role in shaping the continental margin.

During the last decades, several seismic campaigns were carried out along the northern Svalbard/Barents Sea continental margin. Unfortunately, lithological and age information from deep drilling is still very sparse in the study area. In this contribution we will review existing data and discuss implications for the evolution of the northern Barents Sea continental margin.

Turbidites in the Eocene of Spitsbergen: can they tell us something about the Sørvestsnaget Basin?

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The Eocene of Spitsbergen, Svalbard, has received considerable attention in the literature because of its spectacular seismic-scale clinforms exposed along many fiords and valleys. High quality outcrops enables down-dip tracing of facies belts from the proximal shelf through the shelf-edge and down-slope into the basin floor. Previous publications particularly focused on the shelf-edge to slope segment of the clinoforms and demonstrated how shelf-edge deltas played a major role in sediment transport into the deeper parts of the basin. Thick, sandstone-dominated turbidite lobes occur in the toeset of some clinoforms. Few studies have investigated in detail these turbidite deposits. By combining outcrop and core data from central Spitsbergen, this study investigates the sedimentary processes that formed the turbidite lobes. Our previous studies shows that turbidite lobes occur in two basin-wide NW–SE-oriented zones. In areas with multiple stacked turbidite lobes, the lobes show an offset stacking pattern. Internally, lobes shows proximal to distal (or axis to off-axis) facies trends with beds thinning distally, as well as vertical facies trends characterized by an upwards increase in bed thickness and degree of amalgamation. These trends together indicate that the turbidite lobes are progradationally stacked, reflecting the overall progradational nature of the accompanying clinform system. At bed-to-bed scale, many of the turbidites deviates from the classical Bouma-type facies pattern typical of deposition from surge-type, low-density turbidity currents. Many beds instead show a two- or three-fold-division typical of hybrid sediment gravity flows. These beds have a lower sandstone-dominated turbidite division succeeded by a clast- and mudstone-rich debrite division (see inset photo). Some beds also have an upper thin-bedded turbidite division deposited from the dilute tail of the flow. The two-folded bed division indicate that some turbidity flows transformed into slurry flows or debris flows on their way to their final destination on the basin floor. Many of the thicker sandstone beds and bedsets show pervasive soft-sediment deformation and high degrees of amalgamation, particularly in the upper part of most lobes. The latter may be attributed to high sedimentation rates in the proximal and axial regions of the lobes.

Sand-rich turbidite deposits also occur in the middle Eocene of the Sørvestsnaget Basin, western Barents Shelf. Well

Figure 1: Clinoforms in the mountainside of Storvola, central Spitsbergen. The inset show a hybrid event bed.