CLAY MINERALS OF NORWEGIAN SEA (OFFSHORE BEAR ISLAND) SEABED SEDIMENTS AS INDICATORS OF SEDIMENTARY ENVIRONMENTS

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Integrated geological and geophysical study of seabed sediments of the Bear Island region, southwestern margin of the Barents Sea, allowed to characterise sediments of various types related to the action of hydrocarbon fluids, hemipelagic sedimentation, slope processes and combined influence of all these factors. Relatively homogeneous sediments are subdivided into several sedimentary types based on the grain size distribution. Ratios of clay minerals, as well as their morphological and structural characteristics, are described for each type. Clay minerals include illite, chlorite, kaolinite, smectite, illite-smectite and chlorite-smectite mixed layers.

Hemipelagic sediments are characterised by high illite content (60–70%) and low content of smectite and mixed layer minerals (less than 10%). Hemipelagic interval, characterised by increased silt content (interval B) also had higher content of mixed layer minerals. It is concluded that episode of formation of the interval B coincided with an additional source of material supply probably related to the discharge of ice-rafted material. Such intervals are usually bedded.

According to published data, roots of the Haakon Mosby mud volcano are located at a depth of about 3000 m. From the Pliocene the Bear Island region was receiving sediments formed in the areas of erosion on the Barents Sea shelf and subsequently transported downslope. A major part of the Barents Sea area was dominated by sediments with the illite content higher than 60%. Sediments collected from the mud volcano are characterised by high (40–50%) contents of smectites and illite-smectite mixed layer clay minerals. Mixed layer clay minerals of the illite-smectite series are probably formed as a result of the transformation of illite under the influence of hydrocarbon fluids. Such transformations are thought to take place in sediments affected by mud volcanoes, clay diapirs, and fluid discharge.

The clay mineral composition of sediments collected from different slopes of a local high of unknown origin is very similar to that of hemipelagic sediments including low-density turbidites and probably contourites. Grain size distribution indicates the nepheloid character of sediments. The high appears to be different from other similar structures in the area formed by clay diapirs and is thought to be a headwall of a large submarine slide.

Based on the mixed layer clay minerals (illite-smectite series)/kaolinite ratio, diapiric structures are divided into the smectite (early) and kaolinite (late) generations. The Haakon Mosby mud volcano is related to the late generation.

The obtained results demonstrate that hemipelagic sediments have often undergone redeposition and were incorporated in turbidites and contourites. Redeposited diapiric and hemipelagic material detected in nepheloid sediments suggests that they were derived from slopes of local highs represented by diapirs or structures like slide headwalls.

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