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Glendonites from Mesozoic succession of eastern Barents sea: distribution, genesis and paleoclimatic implications

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Glendonites often used as paleoclimate indicator of cold near-bottom temperature, as these are calcite pseudomorphs of ikaite, a metastable calcium carbonate hexahydrate, precipitates mostly under low temperature (mainly from 0-4°C) and may be stabilized by high phosphate concentrations that occurs due to anaerobic oxidation of methane and/or organic matter; dissolved organic carbon, sulfates and amino acid may contribute ikaite formation as well. Therefore, glendonites-bearing host rocks frequently include glacial deposits that make them useful as a paleoclimate indicator of near-freezing temperature.

Our study is based on material collected from five wells drilled in eastern Barents Sea: Severo-Murmanskaya, Ledovaya – 1,2; Ludlovskaya – 1,2. The studied glendonites, mainly represented by relatively small rhombohedral pseudomorphs (0,5-2 cm) and rarely by stellate aggregates, collected from Middle Jurassic to Lower Cretaceous shallow marine clastic deposits. They scattered distributed throughout succession. Totally 18 samples of glendonites were studied. The age of host-bearing rocks were defined by fossils: bivalves or ammonites, microfossils or dinoflagellate. Bajocian-Bathonian glendonites were collected from Ledovaya – 1 and Ludlovskaya – 1 and 2 wells; in addition to these occurrences Middle Jurassic glendonites are known also in boreholes drilled at Shtockmanovskoe field. Numerous 'jarrowite-like' glendonites of the Middle Volgian (~ latest early Tithonian) age were sampled from Severo-Murmanskaya well. Unique Late Barremian glendonites were found in Ledovaya – 2 well.

$\delta^{18}O$ values of Middle Jurassic glendonite concretions range from – 5.4 to –1.7 ‰ Vienna Pee Dee Belemnite (VPDB); for Upper Jurassic – Lower Cretaceous $\delta^{18}O$ values range from – 4.3 to –1.6 ‰ VPDB; for Lower Cretaceous - $\delta^{18}O$ values range from – 4.5 to –3.4 ‰ VPDB. Carbon isotope composition for Middle Jurassic glendonite concretions $\delta^{13}C$ values range from – 33.3 to –22.6 ‰ VPDB; for Upper Jurassic – Lower Cretaceous $\delta^{13}C$ values range from – 25.1 to –18.4 ‰ VPDB; for Lower Cretaceous - $\delta^{13}C$ values range from – 30.1 to –25.6 ‰ VPDB.

Based on $\delta^{18}O$ data we supposed that seawater had a strong influence on ikaite-derived calcite precipitation. Received data coincide with $\delta^{18}O$ values reported from other Mesozoic glendonites and Quaternary glendonites formed in cold environments. Values of $\delta^{13}C$ of glendonites are close to bacterial sulfate reduction and/or anaerobic oxidation of methane or organic matter.

Glendonites consist of carbonates forming a number of phases which different in phosphorus and magnesium content. Mg-bearing calcium carbonate and dolomite both include framboidal pyrite, which can indicate (1) lack of strong rock transformations activity and (2) presence of sulfate-reduction bacteria in sediments.

To conclude, Mesozoic climate was generally warm and studied concretions indicate cold climate excursion in Middle Jurassic, Upper Jurassic-Early Cretaceous and Early Cretaceous.

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