

Model of the authigenic carbonates formation in the gas hydrate bearing mud volcanoes of the Lake Baikal (Eastern Siberia)

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Lake Baikal (Eastern Siberia) is the largest and deepest rift lake in the world and the only one freshwater basin containing gas hydrates. The authigenic carbonates have been recently discovered in the two gas-hydrates bearing mud volcanoes: Malenky (Southern subbasin) and K-2 (Kukuy canyon, Central subbasin). They are represented by the soft varieties in the K-2 and hard tiles in the Malenky. Mineralogically carbonates correspond to rhodochrosite-siderite phase.

The heavy carbon isotopic values of carbonates (+3.3 to +7.3 per mil PDB at Malenky, +17.7 to +21.6 per mil PDB at K-2) testify their formation due to generation of methane and carbon dioxide gases during bacterial fermentation of organic matter (acetate). Calculations of equilibrium temperatures using oxygen isotopic data have shown that the soft carbonates of structure K-2 (oxygen values -13.4 to -14.2 per mil PDB) have been formed in situ by adopting the surrounding pore waters. The firm carbonate tiles at Malenky structure (oxygen values -11 to -11.4 per mil PDB), on the contrary, were generated from the water enriched in isotopically-heavy oxygen having composition closed to hydrate water. Thus, the firm tiles carbonates were generated from the water delivered after gas hydrates decomposition. The latter event could occur below zone of the hydrate stability, probably, as a result of tectonic activity and subsequent thermal pulse (De Batist et al., 2002). Later, carbonates have been raised on a surface of mud volcano Malenky as a part of mud breccias.