

THE BLACK SEA MUD VOLCANISM. ITS LITHOLOGY, GEOCHEMISTRY AND ORIGIN

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In summer 1991 and 1993 aboard the R/V "Gelendzhik". the geological-geophysical investigations were carried out in the context of the UNESCO's Training and Education in Marine Science (TREDMAR) programme in the central part of the Black Sea.

Based on carrying out a number of analyses of sampled sediments and interpretation of geophysical data morphological features of the area, depositional environments, geochemistry, mineralogy and lithology of sediments and mud volcano breccia were studied.

The area of development of mud volcanism in the central part of the Black Sea is a very well displayed in relief through volcanic upbuildings of different shapes; the largest one are MSU and Yuzhmorgeologiya mud volcanoes (2.0 and 2.5 km in diameter, respectively).

The pelagic sediment shows the normal stratigraphic and lithological sequence of the deep-water Black Sea sediments, but at the same time displays a relationships with mud volcanism in this region, which is shown by the presence of slide and slump structures in sediments.

According to the morphological patterns of volcanoes, ages (by $\Delta^{14}\text{C}$ AMS) of halt of their activity and the lithological characteristics of breccia of mud volcanoes, at least two types of mud volcanoes in investigated area can be distinguished.

The first type is Tredmar type mud volcano which is active to-day and characterised by eruption of finer material (not coarser than sand fraction, less than 1mm) with dominance of minerals in breccia up to 90% of the sand fraction and high carbonate contents (10-12% CaCO_3).

The second type is MSU and other studied volcanoes. They are characterised by mainly Upper Pleistocene and Holocene activity, the breccia mainly contains rock fragments which are represented by the coarse fraction (up to cobbles). In addition, the breccia contains a lowcarbonate content (usually less than 1% of CaCO_3).

The rock fragments from mud volcano breccia are represented by siltstones, sandstones and carbonate rocks. The dating by microfossil, pollen and spore and lithological analysis shows that siltstones were probably derived from the Maikopian formation (Oligocene-Lower Miocene) and sandstones may originate from Cretaceous (?) till Recent age.

The sediments from some cores were extremely gas-saturated and contained gas hydrates. The result of gas analysis demonstrate that methane makes up to 98% of the total gas composition. Supposedly, it is probably young biogenic gas that may be derived from Maikopian strata, which is extremely saturated by organic matter. The isotopic analyses of gas hydrates demonstrate stable volumes of $\Delta^{13}\text{C}$ from -63.3 to -61.8‰, which also indicates the biogenic origin of gas hydrates.

All data show that this area of mud volcanism is active today and that the mud volcanoes located near to each other have different patterns of activity and sediment composition.

Finely, some idea of the mud volcanoes origin in the studied area is given.