



Pockmarks of the eastern Gulf of Finland (Baltic Sea) – geology, morphology and genesis.

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Geological and acoustic survey carried out during last decade in the eastern Gulf of Finland allowed discovering widespread occurrence of pockmarks. It was found that pockmarks, located within the areas of Holocene silty-clayey sedimentation in the central part of the gulf are formed by gas-seepage because of active transformation of organic matter by microbiological processes. The pockmarks of other type were found in Kopora and Vyborg bays within the areas where the Holocene mud thickness does not exceeds 20-40 cm, that exclude the possibility of pockmarks formation as a result of recent biogenic gas-seepage. The sediments, outcropping here are represented mainly by clays of the Baltic Ice Lake covered by thin layer of unsorted silty sand. These clays are usually characterized by absence or very low content of organic matter. However in some samples of glacial-lacustrine clays collected within pockmarks rings the methane content risen sharply reaching 10840 mkl/dm³ that supposed gas methane inflow from underlying sediment horizons. Seismic profiling revealed a number of reflecting boundaries, the character of which suggests that they are possibly associated with gas accumulations in the geological section. Side-scan sonar and multibeam profiling undertaken by VSEGEI in 2012-2013 allowed finding within relatively small area in the Kopora Bay more than 150 pockmarks of different size. The average pockmark's diameter is in the range of 10-20 m, relative depth can achieves 1 m. Morphology of pockmarks indicates the different age (relict, not active, active) and pulsating character of the fluid emission. Hydrochemical analysis of bottom waters in the area of pockmarks occurrence showed significant variations in the concentrations of some major elements. Concentrations of Ca, Mg, K and Na in the bottom waters sampled at the various sites within the pockmarks field differ sometimes more than twice and essentially higher than their background values for the surrounding area. The depth of the sea only slightly varies in this area; accordingly, variation of element concentrations cannot be explained by natural variations in bottom water salinity. Significant increasing of concentration was also fixed for Cr, Ni, As, Se and deficit for Pb, La, Cd. Most probably, that Kopora Bay pockmarks are formed because of groundwater discharge from the Vendian aquifer system. From other hand, it is possible to find some spatial correlation of pockmarks field with tectonic faults distribution and rock fracturing zone.