

Implementation of the new hydrographic technologies for bottom topography and seafloor gas venting investigations in the russian northern seas

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The report examines modern hydrographic technologies for the Russian northern seas investigations. The new hydro acoustics methods for seabed study are discussed. It presents stages of seafloor relief studies in the Russian Arctic seas since the 1950s and the obtained results. At the beginning of the 21st century an entirely new phase of bathymetric investigations began with the use of Multibeam Echosounders (MB) and modern hydrographic software. The software tools to process and analyze the bathymetry, and more recently to characterize the seabed from the backscatter, are available in a majority of modern sonar systems. Besides the bathymetry and sonar data, modern MB can produce water

column images. These hydrographic technologies provide the possibility to achieve a high level of the seafloor topography. The latest generation of hydrographic MB now has the ability to provide the water column images along with the seafloor. The gas seeps from multibeam water column data can be distantly discerned against the seabed relief background with the aid of the Fledermause software package ("FMMidwater" module). The ability to integrate the water column data with the seafloor and other information, in an integrated geospatial and temporal environment, enhanced the analysis and interpretation of the data which is essential for marine geological research and investigations.

The modern hydrographic equipment presents the ability to integrate the MB digital relief models (DTM) and sub bottom profiler data. This provides the possibility to obtain not only the detailed seabed topography, but also the additional information concerning the structure of under bottom soil layers and presence of the endogenous objects in near bottom environment.

The importance of the hydrographic software tools needed to process and analyze the bathymetry and water column data are emphasized. The practical importance of the water column and bottom profiler data processing for the submarine gas-hydrates survey is stated. The attention is paid to the implementation of the parametric sub bottom profilers – the low frequency sonar for the sea bottom vertical section investigation. The ability for the integrated presentation of the multibeam bathymetry and vertical curtains in the 3D environment are discussed. As an example of the modern swath survey results achieved with Kongsberg EM2040CD MB and hydrographic information technology QINSy/ Fledermause, are discussed and presented. This survey was performed for the RosNeft company in the Kara sea.

Recommendations for the implementation of the multi beam echo sounder and parametric sub bottom profiler for the combined hydrographic and submarine gas-hydrates survey in the Russian northern seas are delivered. The gas-hydrate survey guidelines using MB and QINSy/Fledermause software are provided.

The hydrographic software tools used to process and analyze the bathymetry can create the seafloor DTM with the high degree of resolution and provide 3D visualization. These new possibilities provide such realistic view of the sea bottom relief and environment that can be characterized as the marine landscapes. Thus it became possible to investigate the relief morphological peculiarities and obtain the information about the relief genesis. This opens the new opportunities for using the acoustic techniques for various types of marine activity including the bottom environmental study.

The appearance of the bottom thermokarst activity derived from the high resolution DTM generated from the real time MB data is presented. The bottom thermokarst provides the potential threat for underwater pipelines and other submarine communications. The arctic bottom relief peculiarities are also covered including grounded hummock traces and dome-shaped elevations. The investigation of such bottom land forms has become possible recently as the result of implementing the wide swath survey methods. Such unique relief features are in general related to seabed gas venting in the form of the submarine gas-hydrates seeps. The opportunities for investigation of the

morphological relief peculiarities and getting the new information is important also for various types of marine activity including the marine ecology study. The arctic sea specific microrelief images are provided to show the

abnormality of the bottom surface. The main attention is paid to specific and bottom features such as trenches the grounded hummock traces and dome-shaped elevations of the Pingo-type-unique forms of microrelief usually confined to the bottom gas flow in the form of methane emissions.

The attention is also paid to the consequences of the global climate change and its influence on the bottom sole.

Key words: hydrographic technologies, hydro acoustics methods, swathe survey, sea bottom vertical section, submarine gas-hydrates, submarine permafrost, seafloor gas venting, multi beam echo sounder, parametric sub bottom profiler.