

Investigation of shallow gas hydrate occurrence and gas seep activity on the Sakhalin continental slope, Russia

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The Sakhalin continental slope has been a well-known gas hydrate area since the first finding of gas hydrate in 1980's. This area belongs to the southernmost glacial sea in the northern hemisphere where most of the area sea is covered by sea ice the winter season. Very high organic carbon content in the sediment, cold sea environment, and active tectonic regime in the Sakhalin slope provide a very favorable condition for occurring shallow gas hydrate accumulation and gas emission phenomena. Research expeditions under the framework of a Korean–Russian–Japanese long-term international collaboration projects (CHAOS, SSGH-I, SSGH-II projects) have been conducted to investigate gas hydrate occurrence and gas seepage activities on the Sakhalin continental slope, Russia from 2003 to 2015.

During the expeditions, near-surface gas hydrate samples at more than 30 sites have been retrieved and hundreds of active gas seepage structures on the seafloor were newly registered by multidisciplinary surveys. The gas hydrates occurrence at the various water depths from about 300 m to 1000 m in the study area were accompanied by active gas seepage-related phenomena in the sub-bottom, on the seafloor, and in the water column: well-defined upward gas migration structures (gas chimney) imaged by high-resolution seismic, hydroacoustic anomalies of gas emissions (gas flares) detected by echosounders, seafloor high backscatter intensities (seepage structures) imaged by side-scan sonar and bathymetric structures (pockmarks and mounds) mapped by single/multi-beam surveys, and very shallow SMTZ (sulphate-methane transition zone) depths, strong microbial activities and high methane concentrations measured in sediment/seawater samples. The highlights of the expeditions are shallow gas hydrate occurrences around 300 m in the water depth which is nearly closed to the upper boundary of gas hydrate stability zone in the area and a 2,000 m-high gas flare emitted from the deep seafloor.