

A New Application of Marine Controlled Source Electromagnetic for Methane Hydrate

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For many years, there was mostly an academic interest to studying the resistivity structure of oceanic crust and upper mantle using marine controlled source electromagnetic (CSEM). Recently, the industry is trying to apply this technology to hydrocarbon and methane hydrate explorations on the continental slope offshore. The technique is not new but the capability to resolve relatively thin resistive intervals in the depth offers new promise to lower the risk through direct methane hydrate indicators in conjunction with modern seismic methods.

One of the objectives of our presentation is a better understanding of methane hydrate spatial distribution and its content in seafloor sediments using marine CSEM. The zones and the depth interval of methane hydrate distribution are controlled by the temperature and pressure. Methane hydrate, like ice, is electrically insulating. Deposits of hydrate in porous sediment cause an increase in the formation resistivity, which may allow the use of electrical resistivity measurements to estimate the amounts of methane hydrate concentrated in the sediment pore spaces.

In our presentation, we discuss the capability of marine CSEM method towards methane hydrate exploration by numerical studies and case study. A simple 1-D analysis suggests that the resistive targets in sedimentary host rock will be sensitive to a CSEM system with its source-receiver separation larger than several km. 2.5-D synthetic study also shows that marine CSEM might allow us to understand methane thin hydrate layer with irregular shape. Besides, example of Marine CSMT survey, conducted by Scripps Institute of Oceanography at Hydrate Ridge, Oregon, the USA, is introduced. The detail of this experiment is described in Weitemeyer, K. A., et al (2006). 25 EM receivers were deployed with 600m spacing in linear array. The electric current of 5Hz was induced into seawater.

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REFERENCES

Weitemeyer, K. A., Constable, S.C., Key, K. W., and Behrens, J. P., 2006, First results from a marine controlled-source electromagnetic survey to detect gas hydrates offshore Oregon, *Geophysical Research Letters*, 33, L03304