Abstracts

The Canadian Beaufort Sea is one of the most prominent areas to study geologic features related to gas hydrate in association with permafrost environment because the continental shelf experienced subaerial cold conditions during the Last Glacial Maximum (LGM) and long-term warming occurred since then. Expedition ARA04C using IBRV Araon was carried out in the Canadian Beaufort Sea during September 6-24, 2013 as part of a Korea/Canada/USA international cooperative research program. During the expedition several attempts to measure geothermal gradients using a 5-m-long heat probe were made at a total of eight sites: 1) the inside/outside of a flat-topped mud volcano where fluid expulsion was observed by echosounder, 2) along the eastern slope of the Mackenzie Trough where permafrost below the seafloor degrades basinward, and 3) at a background location close to sites of IODP pre-proposal #753 on the continental slope, where no permafrost below the seafloor is expected and also no vertical fluid expulsion features occur. Results from our measurements on the flat top of the mud volcano seem to support the evidence that warm methane-rich fluid has intermittently been emitted through sediments into the ocean. For instance, we find: 1) a much higher geothermal gradient than that from the outside of the mud volcano as well as the background value from the regular seafloor, 2) a much higher seafloor temperature compared with bottom water temperature, and 3) a significantly high methane concentration from the water samples. On the other hand, both substantial variability in the geothermal gradients and seafloor temperatures equilibrated with surrounding water from the eastern slope of the Mackenzie Trough area indicate a possible geothermal perturbation by permafrost. Unfortunately, in-situ thermal conductivity was not measured due to instrument malfunction. Further detailed heat flow analysis together with sediment core analysis may improve our understanding of the nature of methane expulsion emitted from marine sediments in connection with the degradation of permafrost over the arctic shelf.

1. Expedition ARA04C (Arctic Aranon Exp. 94 Leg C)

1.1 Expedition ARA04C locates ~320 mbsl.


2.1 Heat probe penetraion (~4.5 m)

3. Observed Geothermal Gradient & Seafloor Temperature

4. Intermittent Methane Fluid Expulsion from Mud Volcano at 420 mbsl

5. Conclusions & Future Plan

6. Acknowledgments & Notice

7. References