Analysis of methane gushing range using underwater acoustic device

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In surface layer methane hydrate bearing sea areas, seeping of methane of 3mm to 5mm in diameter have often been observed from gushing points at seafloor from holes that are smaller than 1cm in diameter. Seeping methane bubbles are immediately covered with methane hydrate at methane hydrate stability zone as they rise from seafloor. This state can be confirmed using a camera equipped ROV (remotely operated vehicle).
On the other hand, this state can be visualized as methane plumes on the monitor using an underwater acoustic device, such as quantitative echosounder. At this point, the relation between methane gushing and methane plume cannot be confirmed because the ultrasound waves transmitted from quantitative echosounder expand as the distance increases.
The purpose of this study is to confirm the relation between the methane gushing range and methane plume. Two investigations were conducted at Umitaka Spur, offshore Joetsu in the Sea of Japan, to observe the methane seepage.
The first investigation was conducted on a ROV-equipped Kaiyo Maru No. 1(KAIYO ENGINEERING), on June 11th and 12th, 2019.
The second was conducted on a quantitative echosounder-equipped Shinyo Maru (Tokyo University of Marine Science and Technology), on July 24th and 25th, 2019.
In the first observation, the author confirmed the number of methane gushing points in the footprint of the quantitative echosounder acquired with a frequency of 200kHz. This echosounder was attached to the ROV with the sound axis set at the horizontal direction. The ROV was rotated 360degrees in the vicinity of methane gushing points in a horizonal direction (The author gave this presentation in the poster session at AGU Fall Meeting 2019).
In the second observation, the author attempted to confirm the location of methane gushing points in the footprint using the Fish Detect function of quantitative echosounder EK80.
As a result, Fish Detect function was found to be effective in confirming the locations of methane gushing points.
The final goal of this study is to contribute to the estimation of the amount of natural methane seeps simply by acoustic observations to understand the total amount of methane seeps in the surrounding sea areas of Japan.
Furthermore, this method can be applied when a large amount of methane seep is confirmed, once the collection of surface layer methane hydrate actually begins.

Keywords: Methane hydrate, Methane plume, underwater acoustic device

