



Vertical Cable Seismic Survey for Hydrothermal Deposit

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The vertical cable seismic is one of the reflection seismic methods. It uses hydrophone arrays vertically moored from the seafloor to record acoustic waves generated by surface, deep-towed or ocean bottom sources. Analyzing the reflections from the sub-seabed, we could look into the subsurface structure. This type of survey is generally called VCS (Vertical Cable Seismic). Because VCS is an efficient high-resolution 3D seismic survey method for a spatially-bounded area, we proposed the method for the hydrothermal deposit survey tool development program that the Ministry of Education, Culture, Sports, Science and Technology (MEXT) started in 2009. We are now developing a VCS system, including not only data acquisition hardware but data processing and analysis technique.

Our first experiment of VCS surveys has been carried out in Lake Biwa, JAPAN in November 2009 for a feasibility study. Prestack depth migration is applied to the 3D VCS data to obtain a high quality 3D depth volume. Based on the results from the feasibility study, we have developed two autonomous recording VCS systems. After we carried out a trial experiment in the actual ocean at a water depth of about 400m and we carried out the second VCS survey at Iheya Knoll with a deep-towed source. In this survey, we could establish the procedures for the deployment/recovery of the system and could examine the locations and the fluctuations of the vertical cables at a water depth of around 1000m. The acquired VCS data clearly shows the reflections from the sub-seafloor. Through the experiment, we could confirm that our VCS system works well even in the severe circumstances around the locations of seafloor hydrothermal deposits. We have, however, also confirmed that the uncertainty in the locations of the source and of the hydrophones could lower the quality of subsurface image. It is, therefore, strongly necessary to develop a total survey system that assures a accurate positioning and a deployment techniques.

We have carried out two field surveys in FY2011. One is a 3D survey with a boomer for a high-resolution surface source and the other one for an actual field survey in the Izena Cauldron an active hydrothermal area in the Okinawa Trough. Through these surveys, the VCS will become a practical exploration tool for the exploration of seafloor hydrothermal deposits.