



Development of Deep-tow Autonomous Cable Seismic (ACS) for Seafloor Massive Sulfides (SMSs) Exploration.

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Within the EEZ of Japan, numerous surveys exploring ocean floor resources have been conducted. The exploration targets are gas hydrates, mineral resources (manganese, cobalt or rare earth) and especially seafloor massive sulphide (SMS) deposits. These resources exist in shallow subsurface areas in deep waters (>1500m). For seismic explorations very high resolution images are required. These cannot be effectively obtained with conventional marine seismic techniques. Therefore we have been developing autonomous seismic survey systems which record the data close to the seafloor to preserve high frequency seismic energy. Very high sampling rate (10kHz) and high accurate synchronization between recording systems and shot time are necessary. We adopted Cs-base atomic clock considering its power consumption.

At first, we developed a Vertical Cable Seismic (VCS) system that uses hydrophone arrays moored vertically from the ocean bottom to record close to the target area. This system has been successfully applied to SMS exploration. Specifically it fixed over known sites to assess the amount of reserves with the resultant 3D volume.

Based on the success of VCS, we modified the VCS system to use as a more efficient deep-tow seismic survey system. Although there are other examples of deep-tow seismic systems, signal transmission cables present challenges in deep waters. We use our autonomous recording system to avoid these problems. Combining a high frequency piezoelectric source (Sub Bottom Profiler:SBP) that automatically shots with a constant interval, we achieve the high resolution deep-tow seismic without data transmission/power cable to the board. Although the data cannot be monitored in real-time, the towing system becomes very simple. We have carried out survey trial, which showed the systems utility as a high-resolution deep-tow seismic survey system. Furthermore, the frequency ranges of deep-towed source (SBP) and surface towed sparker are 700-2300Hz and 10-200Hz respectively. Therefore we can use these sources simultaneously and distinguish the records of each source in the data processing stage.

We have developed new marine seismic survey systems with autonomous recording for the exploration of the ocean floor resources. The applications are vertical cable seismic (VCS) and deep-tow seismic (ACS). These enable us the recording close to the seafloor and give the high resolution results with a simple, cost-effective configuration.