

Borehole Geophysical Observatories in the Western Pacific

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Geophysical networks provide data for better understanding of the dynamics in the Earth. However, a great limitation on existing networks is the uneven distribution of stations, especially lack of stations in the ocean such as the Pacific. For uniform distribution of stations on the Earth, we need to construct observatories in the sea. The western Pacific area has been selected for installation of ocean-bottom observatories because it is ideal for problems related to plate subduction. Boreholes are considered to give best environment for geophysical observations in the sea. Four borehole geophysical observatories at three areas have been installed during ODP Leg186, 191 and 195. Two stations (JT-1 and JT-2) are located on the landward side of the Japan Trench. JT-1 was located above the seismogenic zone where large interplate earthquakes recur and JT-2 is positioned above an aseismic region in the landward slope. JT-1 and JT-2 greatly improve understanding of the dynamics of the plate subduction in the Japan Trench. The observatories WP-1 and WP-2 are effectively located to complete a 1000-km span network in the western Pacific area. The WP-1 site is in the west Philippine Basin west of the Kyushu-Palau Ridge. The WP-2 observatory is situated in the northwestern Pacific Basin. Both the stations fill gap for global seismic networks.

The observatories are designed to last for many years as a stand-alone system. The system configurations for four stations are almost the same. The JT-1 and JT-2 have a strainmeter, a tiltmeter, and two broadband seismometers. Two identical seismometers (CMG-1T) are used for the WP-1 and WP-2. The borehole sensors are permanently cemented in as required for the strainmeter operation and to assure good coupling for the other sensors. The signals from the sensors are sent to sea floor. The data are stored to a hard disk of a recorder unit in a digital format. The recorder unit is retrieved by an ROV. All the electric power is supplied from the large capacity lithium batteries. In addition, the WP-2 is also supplied the power from the sea-water battery system.

The JT-1 and JT-2 were activated by an ROV in September, 1999. However, both the systems were found to have problems. The acquirement of data was started from the end of 2001 after fixing the problems using several dives of ROVs. The WP-1 observatory was activated in March 2002 using an ROV and long-term observation started. In June 2006, an ROV dived to the WP-1 (fourth visit) and recovered the data. At this visit, data recording was discontinued. At present, seismic records of 692-days (Mar. 2002 - Feb, 2004) have been obtained from the WP-1. The WP-2 observatory was activated in October 2000 using an ROV. In June 2005, an ROV made fourth visit to the WP-2 and recovered the data. Recording at the WP-2 has been suspended from the fourth ROV visit. In total, 436-days data (Oct. 2000 - Jan. 2001, Aug. 2001 - July 2002) were retrieved.