The Role of strain and Tilt Measurements in OHP

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The model of plate tectonics provides a large-scale framework for understanding the deformations that occur at plate boundaries. But we have little data which speaks to the details of the processes and, in particular, to the time dependent nature of the activity at either spreading centers or at convergent margins. The Ocean Hemisphere Program includes establishing ocean bottom sites in a large area. Some of those sites, including two already in existence, are close to plate margins. At such sites, we have the opportunity to gain significant understanding of the tectonic activity by including deformation measurements in the deployed instrument package.

At ODP sites 1150 and 1151 (JT1 and JT2), the deployed instrument package comprises 2 three-component seismometers, a strainmeter and a tiltmeter. These sites are on the Tohoku side of the Japan trench and are about 15 km above the subducting pacific plate. This subduction zone produces great earthquakes and is also a region in which less than 30% of the plate motion is released seismically. Episodic slip has been shown to occur following large earthquakes so we know that this zone is capable of producing slow rupture. To date, only very large episodes of slow slip have been detected since the measurements have been limited to the distant land-based sites. By installing and operating strainmeters and tiltmeters so close to the subduction interface, we will obtain data that has the capability of resolving much smaller slow slip episodes. Such information is of critical importance to our understanding of the earthquake process. We know little about the relation between slow earthquakes and regular earthquakes in subduction zones because of the lack of data with adequate sensitivity to such slow slip. The 1960 Chile great earthquake was preceded by a large slow earthquake and there are data that indicate that the 1944 Tonakai and 1946 Nankaido great earthquakes were also preceded by slow events. Data from straimeters and tiltmeters close to the subduction zone, as at JT1 and JT2, provide an unprecedented opportunity to detect any slow events that occur on the subduction interface and to investigate the relation of such events to earthquake occurrence.