



## **Advanced observatory installations in the Nankai Trough Seismogenic Zone Experiment - Results from IODP Exp332**

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One primary objective of the IODP NanTroSEIZE (Nankai Trough Seismogenic Zone Experiment) is to drill and instrument a series of holes across the seismogenic subduction system offshore the Kii Peninsula, Japan. Expedition 332 followed up on initial observatory operations begun during IODP Expedition 319 in Summer 2009. The cruise focused mainly on (1) retrieval of a temporary observatory instrument installed during Expedition 319 at Site C0010, which penetrates the shallow “megasplay” fault in the mid-forearc, and installation of a new suite of temporary sensors, (2) deploy an upgraded temporary observatory at Site C0010, and (3) permanent observatory installation at Site C0002 in the outer Kumano Basin, at the location of planned future deep riser drilling.

First, the focus was on exchanging the SmartPlug temporary “mini-CORK”-observatory with an upgraded GeniusPlug, both attached to a retrievable casing packer above the screened megasplay fault zone at Site C0010. SmartPlug recovery was successful and time series data recovered from the self-contained instrument include seafloor and formation pressure as well as 4 independent temperature records from the fault zone and the overlying seafloor reference. Tentative analysis of those data proves the effective seal of the bridge plug, dampened pressure amplitudes in the tight, slightly overpressured formation, and identification of prominent earthquake and tsunami events in the 15-month record (August 2009 – November 2010). The SmartPlug was then replaced with a GeniusPlug, similar in geometry and equally self-contained, but with an addendum that hosts an Osmo-Sampler for collecting fluids for geochemical analysis and a FLOCS (FLow-through Osmotic Colonization System) for microbiological study. The system was installed at a depth that placed the addendum in the center of the 22 m-wide screened cased section across the “megasplay” fault.

At Site C0002, somewhat upslope of Site C0010, a permanent CORK observatory, comprising a hydrogeological unit measuring pressure at four depth levels as well as a broadband seismometer, volumetric strainmeter, tiltmeter, geophones, and a thermistor string, was deployed. The key goals include pore pressure monitoring in the upper accretionary prism (Unit IV), a series of measurements in the homogeneous sediments of Unit III (strain, tilt, seismicity, pressure) in the transition zone, and temperature and pressure in the overlying Kumano Basin sediments of Unit II. The string of the CORK assembly had a total length of 965 m and was carefully secured during deployment with centralizers, bands and straps to withstand the strong current. VIV was minimized using ropes, and acceleration was monitored during deployment. The lower portion of the assembly is isolated against the overlying ocean body by a swellable packer at 746 mbsf. Part of the instrument string below was cemented (appx. 780-935 mbsf) to couple the strainmeter and seismometer to the formation/casing. The CORK head was revisited prior to and after cementing for system tests of the borehole instruments using the ROV, and all tests were successful. The CORK is working in a self-contained (battery-driven) mode for some of the instruments, while others will be connected to external batteries in spring 2011. The long-term perspective is to connect the system to the real-time seafloor cabled network DONET.