Geophysical Research Abstracts
Vol. 14, EGU2012-6463, 2012
EGU General Assembly 2012

Simple, Affordable and Sustainable Borehole Observatories for Complex Monitoring Objectives

A. Kopf (1), S. Hammerschmidt (1), E. Davis (2), D. Saffer (3), G. Wheat (4), A. LaBonte (2), R. Meldrum (2), M. Heesemann (2), H. Villinger (1), T. Freudenthal (1), V. Ratmeyer (1), J. Renken (1), M. Bergenthal (1), and G. Wefer (1)

(1) University Bremen, MARUM, Bremen, Germany (akopf@marum.de, +49 421 218 65805), (2) Pacific Geoscience Centre, Geological Survey of Canada, British Columbia, Canada, (3) Department of Geosciences, Pennsylvania State University, Pennsylvania, USA, (4) Global Undersea Research Unit, University of Alaska Fairbanks, Alaska, USA

Around 20 years ago, the scientific community started to use borehole observatories, so-called CORKs or Circulation Obviation Retrofit Kits, which are installed inside submarine boreholes, and which allow the re-establishment and monitoring of in situ conditions. From the first CORKs which allowed only rudimentary fluid pressure and temperature measurements, the instruments evolved to multi-functional and multi-level subseafloor laboratories, including, for example, long-term fluid sampling devices, in situ microbiological experiments or strainmeter.
Nonetheless, most boreholes are still left uninstrumented, which is a major loss for the scientific community. In-stallation of CORKs usually requires a drillship and subsequent ROV assignments for data download and instru-ment maintenance, which is a major logistic and financial effort. Moreover, the increasing complexity of the CORK systems increased not only the expenses but led also to longer installation times and a higher sensitivity of the in-struments to environmental constraints.
Here, we present three types of Mini-CORKs, which evolved back to more simple systems yet providing a wide range of possible in situ measurements. As a regional example the Nankai Trough is chosen, where repeated subduction thrust earthquakes with M8+ occurred. The area has been investigated by several drilling campaigns of the DSDP, ODP and IODP, where boreholes were already instrumented by different CORKs. Unfortunately, some of the more complex systems showed incomplete functionality, and moreover, the increased ship time forced IODP to rely on third party funds for the observatories. Consequently, the need for more affordable CORKs arose, which may be satisfied by the systems presented here.
The first type, the so-called SmartPlug, provides two pressure transducers and four temperature sensors, and monitors a hydrostatic reference section and an isolated zone of interest. It was already installed at the Nankai Trough accretionary prism during IODP Exp. 319 and successfully recovered during IODP Exp. 332, both cruises being part of NanTroSEIZE (Nankai Trough Seismogenic Zone Experiment). The 15-months long data showed transients related to the arrival of seismic waves, storms and can further be used for detection of seismogenic strain events. Moreover, based on tidal signals in the pressure data, it was possible to make assumptions regarding the elastic properties of the surrounding formation.
The SmartPlug was exchanged by an enhanced version, the GeniusPlug, which provides additional fluid sampling devices and microbiological experiments during the monitoring period. Its recovery is planned for 2013.
Going one step further in simplicity, a Mini-CORK has recently developed especially designed for the portable seafloor drill rig MeBo (MARUM, Univ. Bremen, Germany), which can be installed without a drillship and which, due to its telemetric unit, makes costly recovery operations obsolete. The MeBo can be operated from any re-search vessel and allows coring to a depth of 70 m, which may be followed by instrumentation of the borehole with the MeBo-CORK. Two designs are available: the first design allows in situ measurement of pressure and temperature solely, whereas the second design consists of a seafloor unit including additional mission specific sensors (osmo-samlers for geochemistry and microbiology, etc.). A first field test for the MeBo-CORKs into mud volcanoes in the Kumano forearc basin is envisaged for summer 2012 to complement IODP project NanTroSEIZE.