



Borehole Seismic Observatories for Monitoring Crustal Processes

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Since 1991 the Ocean Drilling Program (ODP) and its successor the Integrated Ocean Drilling Program (IODP) have developed an observatory technology to monitor hydrological processes (temperature, pressure, and pore fluid sampling) in boreholes drilled on the deep seafloor. The borehole observatory equipment is called Circulation Obviation Retrofit Kit (CORK). Adding seismometers to CORKs (SeisCORKs) would enable monitoring of small earthquake events (mb about -2 or -3) associated with the hydrological processes. For example: 1) After an earthquake event fluid may flow in the formation in response to the changing stress regime. Down to what magnitude of event do the pressure transients in the well respond? 2) Fluid flow causes small earthquakes. One mechanism for example is by changing the temperature of the rocks which expand and contract, altering the stress regime. 3) Laboratory studies of rock deformation show that shear fracture is preceded by the coalescence of interacting tensile microcracks which are observed as "acoustic emissions". By placing high frequency geophones (up to 2000sps sampling) next to faults it may be possible to observe these "acoustic" precursors to rock failure. SeisCORKs will acquire micro- and nano-earthquake information that is simultaneous and co-located with the pressure, temperature, pore water chemistry and pore water biology measurements in the seafloor.