Geophysical Research Abstracts
Vol. 12, EGU2010-13007, 2010
EGU General Assembly 2010

Chemical composition of the pile subducting in the Nankai Trough, results from IODP expedition 322

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Integrated Ocean Drilling Program (IODP) Expedition 322 is part of the Nankai Trough Seismogenic Zone Experiment (NanTroSEIZE). The aim of Expedition 322 is to constrain the characteristics of sedimentary pile and igneous basement subducting in the Nankai Trough. The Shikoku Basin, in which the subducting sediments accumulated, formed during the Miocene by seafloor spreading along the backarc of the Izu-Bonin volcanic chain. Coring was conducted at two sites in the Shikoku Basin: Site C0011, located on the northwest flank of a bathymetric high (the Kashinosaki Knoll), and Site C0012, located near the crest of the knoll. Five lithologic units were identified in the 876 meters thick sedimentary sequence drilled at Site C0011. At Site C0012, the basement basalts were reached at 538 meters below sea floor.

We measured major elements on cored units (both sediments and basalts) from sites C0011 and C0012 in order to characterize the changes in composition as a function of depth and/or lithology.

At site C0011, most sediments span relatively small ranges of major element composition, compatible with a dominant crustal composition (high SiO2 and Al2O3). Unit I was characterized by Logging While Drilling data and was not cored so that chemical composition is not available. Unit II is composed of hemipelagic mudstone with interbeds of volcaniclastic and tuffaceous sandstones. This unit shows a decreasing gradient of Al2O3 with depth followed by an abrupt shift to higher Al2O3 which may have been caused by a change in the clay-mineral assemblage. Al2O3 is very constant in Unit III which is consistent with the homogeneous hemipelagic mudstone lithology. Unit IV and V sediments have variable Al2O3 composition consistent with the presence of abundant interbeds of siliciclastic sandstone (Unit IV) and tuffs and tuffaceous sandstone (Unit V) within the dominant hemipelagic mudstone lithology. Sediments including volcanic material are more heterogeneous and have high Na2O compatible with the high proportion of feldspars in these sediments. A few carbonates were present along the pile. These carbonates have very high concentrations of both P2O5 and MnO (up to 8.4% and 11.2% respectively) which can be related to the presence of authigenic apatite and rhodochrosite respectively.

The 38.2 m of igneous basement drilled at Site C0012 consists of (1) pillow lava basalts, (2) basalts, (3) basaltic-hyaloclastite breccia, and (4) mixed rubble pieces of basalt caused by drilling disturbance. Alteration is moderate to very high, Loss on Ignition ranging from 3.1 to 18.0. SiO2 contents ranges from 45.5 to 53.3 wt% and MgO is high with values from 6.6 to 9.0 wt%. Na2O + K2O ranges from 3.6 to 6.9 wt%, these elevated alkaline contents distinguish the Shikoku Basin basalts from typical MORB.

The characterization of the chemical composition of the subducting pile will allow to quantify the input fluxes ingoing the Japan subduction zone.