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Accretion process of sediments below Kumano basin by analyzing cuttings from IODP Exp.319, the first riser drilling

KAWABATA, Kuniyo[1*], SAKAGUCHI, Arito[2], David Buchs[3], KITAMURA, Yujin[2], SAITO, Saneatsu[2]

[1]Taiwan National Central University, [2]Japan Agency for Marine-Earth Science and Technology, [3]IFM-GEOMAR, Leibniz Institute of Marine Sciences at the University of Kiel

The structure, stress condition and rock properties of accreted sediments in the Nankai Trough have been studied by reflection seismology and deep sea drillings. Accretion processes have been suggested by onland geological studies that the sediments are circulated with undergoing lithification and deformation in shallow subduction zone driven by the plate motion. However the process in the modern Nankai Trough has yet to be elucidated. We discuss the accretion process of the Nankai Trough accretionary prism below Kumano basin by clarifying thermal structure and materials by vitrinite measurement and whole rock chemical analyses, respectively, using cuttings samples from IODP The Nankai Trough Seismogenic Zone Experiment (NanTroSEIZE) the first scientific riser drilling Expedition 319 at Site C0009. We also introduce the use of the cuttings samples for academic research, which becomes important in the upcoming riser drilling expeditions of NanTroSEIZE and in the future ocean drilling in general.

Cuttings were collected with an interval of every 5 m from 703.9 to 1604 m and cores were recovered from 1509.7 m to 1593.9 m below sea floor (mbsf). Due to poor consolidation of drilled sediments, cuttings samples typically consist of sand and silt floating in a matrix of mixed sedimentary and drilling muds, and solid rock chips were not retrieved above 802.7 mbsf. Visual description based on macro- and micro-scopic observation, XRD and XRF analysis, rocks properties and the age of washed cuttings (i.e. grains without mud) were made throughout the hole, which allowed to establish some indexes to estimate lithology. Four lithologic units (Unit I ? IV) were defined at Site C0009 based on compositional and textural variations of cuttings samples, which are believed to closely reflect lithologic changes of drilled sequences, and show good consistency with logging data. Unit IV is believed to be accreted sediment by mainly age and the textural change of sediments. Dissoluble element ratios (Ti/P) and clay content ratios in the samples analyzed by XRF and XRD are different from that in basin sediment, which also might support Unit IV are accreted materials. XRD and XRF analyses on cuttings samples provide useful information to estimate difference of lithology. Comparison of cuttings and cores at corresponding depth indicates compositional and textural differences between the cuttings and core samples, which could reflect mixing of cuttings in drill hole.

Paleop-maximum Temperature (i.e. highest temperature rock experienced) of drilled sediments is estimated by vitrinite reflectance measurement in cuttings and core samples. Vitrinite is common in all units and the results show 0.2 ? 0.3 % in reflectance which are indicative of 50 ? 60 oC when considering sedimentary age. The reflectance (temperature) slightly increases depth-ward. There is no large temperature difference between the units including unconformity, which suggests that the temperature distribution is similar to the past or present gethremal gradient and that the accreted sediments (Unit IV) have not subducted, accordingly. Our attempt further connects to the detailed discussion on ongoing accretion processes when we reach to the greater depth in the planned future expeditions of NanTroSEIZE.

Keywords: Accretionary prism, Vitrinite, Riser drilling, cuttings, NanTroSEIZE