Geophysical Research Abstracts
Vol. 16, EGU2014-9626, 2014
EGU General Assembly 2014

Compare and contrast cuttings and core: characterizing the deep accretionary wedge of the Nankai Trough, Japan

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IODP Expedition 348 (part of the Nankai Trough Seismogenic Zone Experiment program – NanTroSEIZE) is the first scientific riser-drilling project to access the deep interior of an active accretionary wedge. One major objective for the primary riser hole at IODP Site C0002 was to understand the tectono-stratigraphic evolution of the wedge beneath the Kumano forearc basin by characterizing lithological and structural variations with depth using cuttings, core, and logging while drilling (LWD) measurements. Cuttings were described at ten-meter intervals from 875 to 3058 mbsf, and cores were recovered from 2163 to 2217 mbsf. As core availability was restricted to a short interval, the study of cuttings was crucial to interpret the lithostratigraphy throughout the drilled interval. The reliability of data acquired from cuttings is often questioned, due to significant artifacts related to the drilling process. The main issues encountered with the use of cuttings are (1) the mechanical deformation of rock chips and disaggregation of less consolidated lithologies caused by the drilling bit, (2) stratigraphic mixing of cuttings within the drilling mud column during their ascent from the bottom of the well to surface or due to collapse/cavings, and (3) contamination and alteration of the natural mineral and chemical signatures by the drilling fluids. The identification of sedimentary and natural deformation structures is limited in cuttings fragments, and features such as grain-size gradation, oriented bedding and faults are only observed in cores. However, cuttings can be used to assess rock textures, mineralogy, geochemistry and fossil content, and to recognize laminations, bioturbation, unoriented micro-fault textures, shear-related striations, small-scale deformation bands and vein mineral precipitation. In Hole C0002NP, the main lithologies observed in both core and cuttings consist of fine-grained turbiditic mudstones with coarser silty and sandy interbeds. The relative proportion of these lithologies in cuttings samples, combined with their mineralogical and geochemical analysis permitted the definition of three lithological units, exhibiting good depth consistency with the unit boundaries determined from the logging data. The difficulties associated with the study of cuttings can be partially overcome by the analysis of different size rock fragments, and integration of logging data and cores of intervals of interest. Despite having some limitations in their use, our results show that drill cuttings are a viable alternative to coring.