[EJ] Evening Poster | M (Multidisciplinary and Interdisciplinary) | M-IS Intersection

[M-IS08]Drilling Earth Science

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"Earth Drilling Science" session aims to exchange the latest information and scientific achievements in Ocean/Continental drilling projects and to promote the interdisciplinary science. The session covers a wide range of drilling sciences, earth dynamics, environments, and the drilling-related technologies. The overview of the recent scientific drillings as well as future projects of any types of scientific drilling will be reported.

[MIS08-P09]Deformation structures in the Nankai inner accretionary wedge integrating seismic data and borehole information

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We investigated deformation structures in the inner accretionary wedge using seismic data off Kumano, and borehole information at NanTroSEIZE C0002 site.

- Seismic data

We conducted advanced seismic imaging by applying up-to-date technologies, and the high quality seismic images were obtained from reprocessing of the 3D seismic data. Just below the Kumano forearc basin, an anticline is clearly visible at northwest side of the C0002 hole, and several folded structures are observed as well. Beneath those folded structures, fragmented reflectors and dipping reflectors are imaged. Further deep area around the edge of the megasplay fault of strong amplitude, steeply-dipping reflectors continuing to other curved reflectors in the hanging wall side and gradually-dipping reflectors in the foot wall side are observed. Additionally, we computed semblance-based coherence cube to extract structural features from the 3D image volume. Deformation patterns due to faulting or folding which are almost parallel to the trough axis are visible. On the other hand, the new velocity model for prestack-depth migration of the seismic data imply the existence of thick high-velocity zone just above the megasplay fault. This high velocity zone is consistent with that in the velocity profile derived by full waveform inversion from OBS wide-angle seismic data (Kamei et al. 2013), although the thickness and maximum values are slightly different.

- Logging data

Logging while drilling (LWD) data were collected in several holes of C0002 site. We investigate several major parameters reflecting structural features: velocity, resistivity, gamma ray, and bedding dip. The bedding dips are generally high (70 – 90 degrees.) in the accretionary sediments, but several decreases down to 30 – 60 degrees can be observed. These variations may imply the local dip changes due to faulting or folding. Variations of other logs indicate short period lithology changes. These characteristics are comparable to interpretable reflectors or fault locations on the seismic section.

- Cuttings and cores

Paleo-geothermal structure was reconstructed via vitrinite reflectance analysis using mainly cuttings, and it indicates generally increasing trend with depth and several reversals. The reversals suggest the thrust faults, and one of those thrust faults with a vertical offset ~700 m is inferred around 2400–2600 m below sea floor (Fukuchi et al. 2017). The structural features in the seismic images are comparable to the paleo-geothermal variation and the characteristics of the logging curves. In addition, veins and cemented sand were observed in cuttings and cores (Tobin et al. 2015). This fact implies that the possibility of the existence of thick high-velocity zone caused by environment of fluid migration and mineralization in the accretionary sediments.

- Integrated interpretation

The anticline and fragmented reflectors may imply development of the fold and minor fault population due to any major fault activity, which are similar to the fold-and-thrust observed in the outer wedge (e.g. Kimura et al. 2011). The deep layer structures around the edge of megasplay fault might imply that the original accretionary sediment layers were separated by the megasplay fault as like fault-bend folding (Suppe 1983). Between the shallow fold-and-thrust structure and the deep fault-bend fold structure, there might be well-developed thrust fault to build such two-storied structure, and that might be a reason for the thick inner accretionary sediments. The thickening process due to thrust faults can be observed in analogue model experiments with granular materials (Yamada et al. 2006). In addition, the high velocity zone might be caused by petrophysical alteration due to the possible deep fluid flow in the faults or fractures within the deep sediments under the specific temperature-pressure condition. The strong negative amplitude along the megasplay fault might reflect the fluid flow via the megathrust fault zone.