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D/V *Chikyu* IODP scientific ocean drilling achievements and the beyond

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Figure 1: D/V *Chikyu*. Riser equipped scientific ocean drilling vessel.

Scientific Ocean Drilling Vessel *Chikyu* (Fig.1) has been constructed in 2005 and started her scientific ocean drilling under the international program, IODP (Integrated Ocean Drilling Program; 2003-2013, International Ocean Discovery Program; from 2013), since 2007, operated by JAMSTEC (Japan Agency for Marine-Earth Science and Technology). *Chikyu* has been exploring in the Nankai Trough, Okinawa Trough, Japan Trench and the continental slope off Tohoku, Japan, under the IODP. Those expeditions are focused on seismogenic zones, a hydrothermal system, marine resources and sub-seafloor biosphere which are high priority science targets described in the IODP science plan. *Chikyu* equipped riser system including BOP (Blow Out Preventer) and most accurate DP (Dynamic Position) system same as the high-end industrial drilling vessels. *Chikyu*'s unique facility is the state-of-the-art laboratory on board. There are 4 floors and relatively large instruments like a X-CT scanner, ICP-MS, magnetic shield room are prepared for the most advanced research on board as quick as possible right after drilling/coring.

Since scientific operation started in 2007, the *Chikyu* has been established several world records in operation. The *Chikyu* drilled about 850m below sea floor from 6,900m water depth, the drill strings was extended more than 7,750m, off Tohoku of large seismic slip was occurred during the 2011 Tohoku earthquake. The *Chikyu* has been reached to 3,050m below sea floor by riser drilling under high speed current circumstances in the Nankai Trough. The *Chikyu* drilled/logged under high temperature (over 300 degree C) environment at hydrothermal vent areas of the Okinawa Trough. Also complex borehole observatories are installed at several sites and LWD and large size wire-line logging operations were really challenging and successfully done.

According to those operational challenges, the *Chikyu* achieved significant scientific results. The Nankai trough and the off-Tohoku seismogenic zones expeditions gave us a new insight of nature of seismic/tsunami-genetic faults near the trench axes [1-3]. Our traditional understanding on "a-seismic zone" was completely request re-consider us the behavior based on our drilling results. It may force us to over write our textbooks. Subseafloor image of active hydrothermal vent area also request us to renew our traditional images according to our drilling results at the Okinawa trough. Rich biosphere are recognized at off Tohoku in coal bed zone [4]. There are extremely long-life and interesting life style microbes are sampled and cultivated. This presentation will briefly show the scientific results and the engineering developments of *Chikyu*/IODP operations. D/V *Chikyu* will continue to explore the deep

earth where we never reached yet. Our future scientific and engineering targets and the way to go will show in briefly based on our international workshop results, Chikyu+10, held in Japan in 2013.

References:

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- [3] Fulton et al. (2013) Science, v. 342, 1214-1217.
- [4] Inagaki et al. (2015) Science, v. 349, 420-424.

