

Cruise Summary

1. Cruise Information

Cruise number: YK10-16

Ship name: R/V YOKOSUKA

Title of the cruise: Biogeosciences at the Challenger Deep, the deepest point of the world: relict organisms and their relations to biogeochemical cycles

Chief scientist: Hiroshi Kitazato (Institute of Biogeosciences, Japan Agency for Marine-Earth Science and Technology)

Representative of science party: Hiroshi Kitazato (Institute of Biogeosciences, Japan Agency for Marine-Earth Science and Technology)

Science party on board: Hiroshi Kitazato, Kazumasa Oguri, Takashi Toyofuku, Hidetaka Nomaki, Beatrice Lecroq (BioGeos, JAMSTEC), Ronnie N. Glud, Anni Glud (Univ. Southern Denmark), Mathias Middelboe (Univ. Copenhagen), Frank Wenzhoefer (MPI, Bremen)

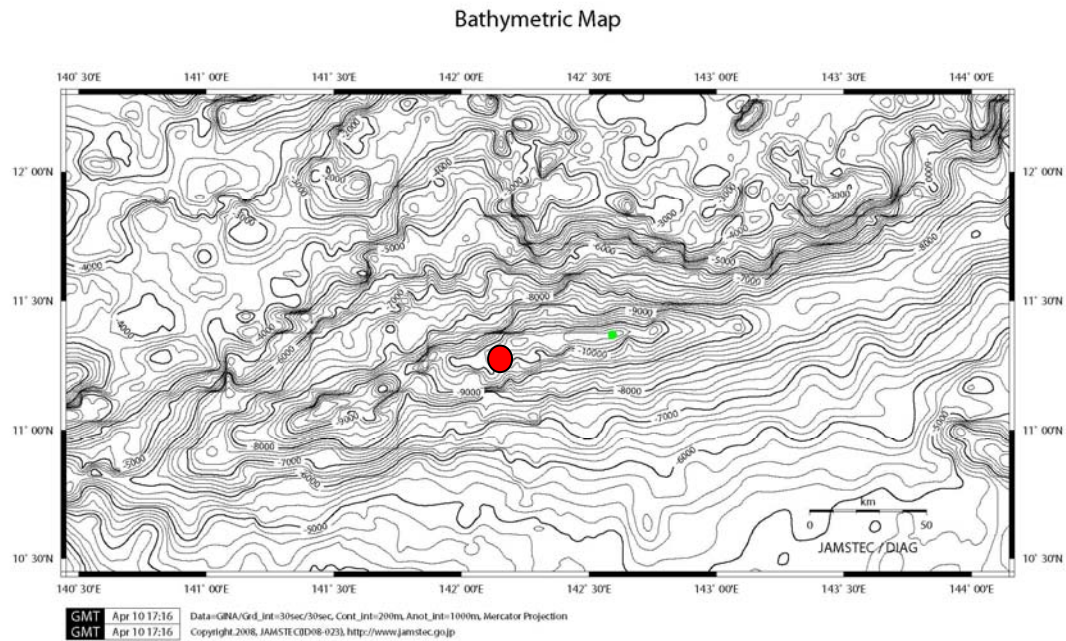
Title of proposal: Biogeosciences at the Challenger Deep, the deepest point of the world: relict organisms and their relations to biogeochemical cycles

Cruise period: November 20 ~ December 6, 2010 (from proposal)

Port call: Apra Harbor, Guam (November 20) ~Apra Harbor, Guam (November 30) ~ JAMSTEC Pier (December 6)

Research area: Challenger Deep area, southern Marianas Trench

Research Map:



2. Overview of Research Cruise

Background Idea for the cruise: The Challenger Deep of the Marianas Trench, western Pacific, is the deepest point of the world ocean. We found that simple foraminiferal community flourishes at the deepest point (Todo et al., 2005). More than 99% of foraminiferal community consists of soft-shelled foraminifera. The foraminiferal genera are belonging to phylogenetically ancestral group of the taxon from the morphological point of view. The group is thought to branch in the beginning of the foraminiferal history, 690-1100 Ma according to molecular phylogeny. We would like to know why simple foraminifera flourish at the deepest point of the world. We would like to examine a hypothesis that the deep trenches play acts as refugia for marine organisms.

Purpose: For the purpose to elucidate above hypothesis, we plan to carry out oceanographic researches at the Challenger Deep (c.a. 10,900m deep).

The series of researches will be carried out at the deep. They are,

- 1) Collect both undisturbed sediment cores and macrobenthos samples by free-fall type coring devices / camera / CTD / baited trap system.
- 2) Measure sediment-water interface O₂ profiles with microelectrodes that are assembled on ultra-deep lander system at the Challenger Deep to estimate oxygen consumption rate in the deep trenches.
- 3) Make DNA / RNA analyses for both foraminifera in cores and macrobenthos in the baited trap samples for molecular phylogeny. Environmental DNA will also be analysed by the massive sequencing method.

For this purpose, we use two mooring systems, free-fall camera / CTD / coring system and ultra deep lander system.

Description of researches: Researches were carried out at two depths, both 6000m and 10850m. Shallower site is located at ocean-side slope of the Challenger Deep. Deeper site locates at western deep of the Challenger Deep where the deepest depth is recorded.

Five deployments of camera system were carried out during the cruise. 15 cores, video records and 208 scavenging amphipods specimens were obtained in the baited traps both at the Challenger Deep and 6000m outer slope areas. Among 15 cores, 6 cores were processed for foraminiferal faunal analyses, specific level foram DNA analyses and environmental DNA analyses. One core was also processed for environmental DNA analyses. Six cores were used for on board oxygen / nitrogen profiles. Microbiological study will be don with the cores. Some chemical analyses will be done for one core. Pb210 analyses plan to be made with one core for calculating mass accumulation rate of sediments at the Challenger Deep.

Four deployments were operated for ultra-deep lander. O₂ profiles at sediment-water interface were gotten at both sites. In situ O₂ measurements at the Challenger Deep were the first attempt in the world. In total, 70 profiles were obtained from the Challenger Deep. 30 profiles were also obtained from the 6000m site.

General video images both at 6000m and 10850m sites show strong

contrast between both sites. Shallower site shows much dense and active benthic organisms, such as fish, amphipods and polychaetes. In contrast, less dense benthic organisms such as amphipods, horothrian and polychaetes, are seen at deeper site. In general, they move very slowly at the Challenger Deep.

Generally speaking, free-fall type camera-lander system works very well for hadal deep researches. It can recover different data and samples. It should be developed for a good platform of researches on hadal depth.