Structural Features of Atlantis Massif Core Complex, Mid-Atlantic Ridge: Preliminary Results from IODP Expeditions 304 and 305

Takehiro Hirose[1]; Katsuyoshi Michibayashi[2]; Natsue Abe[3]; Eric S. Andal[4]; Shunsaku Awaji[5]; Satoko Ishimaru[6]; Jinichiro Maeda[7]; Tatsunori Nakagawa[8]; Toshio Nozaka[9]; Yasuhiko Ohara[10]; Akihiro Tamura[11]; Masako Tominaga[12]; Toru Yamasaki[13]; Yasuhiko Ohara IODP Expedition 304/305 Shipboard Scientific Party[14]

[1] Dept. Geol. & Mineral., Kyoto Univ.; [2] Inst. Geosciences, Shizuoka Univ; [3] DSR, IFREE, JAMSTEC; [4] Dept. Earth Sci., Kanazawa Univ.; [5] Geosystem Eng., Univ. of Tokyo; [6] Kanazawa Univ.; [7] Earth and Planetary Sci., Hokkaido Univ.; [8] Tohoku Univ. MPEG; [9] Earth Sci., Okayama Univ.; [10] Hydrographic and Oceanographic Dept.of Japan; [11] Earth Sci. Kanazawa Univ.; [12] Dept. of Oceanography, TAMU; [13] Earth & Planet. Sci., Hokkaido Univ.; [14] -

Integrated Ocean Drilling Program (IODP) Hole 1309D was drilled on Atlantis Massif, the western flank of the Mid-Atlantic Ridge at 30N during Expeditions 304 and 305 to investigate the processes that control formation of oceanic core complexes. The hole was located on a corrugated surface interpreted to be a low angle detachment fault exposed near seafloor. Drilling and logging during two expeditions were mainly focused on a footwall site of the detachment fault. Here, we present onboard results of core descriptions of structural aspects.

Structural features observed from coring Hole U1309D, which penetrated 1300 m below seafloor (mbsf), can be summarized as follows:

1) A sequence of gabbroic intrusions with minor amount of ultramafic rocks and basaltic dikes was observed (see details for the presentation by Maeda et al. in this session). The most boundaries between these lithologic zones were coincident with ultramafic intervals indicating that the ultramafic bodies were zones of weakness during the late exhumation history of the massif.

2) Deformation is localized on several narrow fault zones deformed in the greenschist facies regime zones at depths up to 400 mbsf. Several aspects of the recovered rock change across these faults: the nature of the intrusive sequence and its alteration history, the intensity of deformation and veining, the types of veins and the average paleomagnetic inclination angle. Deformation zones below 400 mbsf are mostly associated with local processes, so that no clearly-bound, distinct zones with different deformation regimes or history are recognized above 1200 mbsf.

3) Mineral assemblages in the core indicate that deformation occurs under granulite to zeolite facies conditions. High temperature shear zones, usually less than 30 cm in thickness were mainly distributed from 35 to 85 mbsf. Low temperature cataclastic deformation was more pervasive throughout the cores, and was associated with the faults and dikes above 170 mbsf and with the intrusion of late leucocratic melt below 170 mbsf. A thick zone of more intense plastic foliation, magmatic foliation, cataclasitc deformation and veining is present between 650 and 770 mbsf, within a gabbro section.

4) Neither plastic nor brittle deformation showed evidence of high displacement. Very high strains, if they occurred at all, cannot be ruled out in the upper 20-30 m of the footwall.