

Initial results of the physical property measurement, ChikyuOman2017, the Omand Drilling Project Phase I

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We report the results on the physical property measurements of core samples from Oman Drilling Project Phase I Holes GT1A, GT2A, GT3A and BT1B drilled in the Samail Ophiolite, Sultanate of Oman. Cores from Holes GT1A and GT2A in the lower crust section of the ophiolite are mainly composed of gabbros (gabbro and olivine gabbro), with small amounts of ultramafic rocks (wehrlite and dunite), whereas those from Hole GT3A at the boundary between the sheeted dikes and gabbro are mainly composed of basalt and diabase, followed by gabbros (gabbro, olivine gabbro and oxide gabbro). Minor felsic trondhjemite and tonalite dikes intrude the mafic rocks. In contrast, Hole BT1B penetrated from mantle section through the basal thrust and into the metamorphic sole. The total length of 1500 m cores is the almost twice the previous record of hard rock drilling by JOIDES Resolution for 2 months (IODP Exp. 305) onboard core logging.

Shipboard measurements of physical properties were undertaken to characterize recovered core material fully using on-board facilities of D/V Chikyu. During the ChikyuOman expedition, whole-round X-ray CT images, natural gamma radiation (NGR), magnetic susceptibility (MS), were routinely measured for all cores during Leg 1 (GT1A and GT2A), with additional measurements of P-wave velocity (V_p), gamma ray attenuation density (GRA), and electrical resistivity made on all sections of cores during Leg 2 (BT1B, GT3A). Half-round point magnetic susceptibility and color spectroscopy were also measured for all sections of cores on board. P-wave velocity, bulk/grain density and porosity of more than 600 discrete cube samples and thermal conductivity on 230 pieces from the working halves of the split core sections were also measured.

The 100% continuous core recovery and the large amount of the cores reveal many new observations. The GT3A cores show wider range of physical properties compared to the gabbros from the Holes GT1A and GT2A. P-wave velocity of the GT3A samples, for example, show a wide range of 2.2 –7.1 km/s. The color spectrums, especially yellowness of the core samples, clearly have correlations between the rock physics of the GT3A samples. The yellowness of the mafic rocks in the GT3A imply their degree of alteration reflected the mode of epidote.

Listvenite, completely carbonated former peridotite, is the main lithology in the Hole BT1B and a distinctive lithology in some ophiolite bodies. Listvenites are characterized by high thermal conductivities that are significantly higher than measured for other rocktypes from Hole BT1B and gabbros from Hole GT1 and GT2, and are similar to or slightly higher than that of unaltered peridotite. The comparison of P-wave velocity and porosity measurements from BT1B cube samples reveals two different trends.

Listvenite and some greenschist samples show similar trend to that of the gabbros from GT1A and GT2A, whereas some mainly greenschist and greenstone samples show similar trend to that of the serpentinite from Mid-Atlantic Ridge.

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