Initial studies of the petrophysics in the dike and upper gabbro from ICDP Hole GT3A, the Oman Drilling Project Phase I

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We report results on the physical property measurements of the core samples from Oman Drilling Project Hole GT3A (23.11409 N, 58.21172 E) in the Samail Ophiolite, Sultanate of Oman. Cores are mainly composed of basalt and diabase, followed by gabbros (gabbro, olivine gabbro and oxide gabbro), with minor felsic, trondhjemite and tonalite, dikes intruded into the mafic rocks. Shipboard measurements of physical properties were undertaken to characterize recovered core material. During Leg 2 of ChikyuOman expedition (Aug-Sept 2017), whole-round X-ray CT images, natural gamma radiation (NGR), magnetic susceptibility (MS), P-wave velocity (Vp) and electrical resistivity, and half-round point magnetic susceptibility and color spectroscopy were measured for all sections of cores on board. P-wave velocity, bulk/grain density and porosity of discrete cube samples and thermal conductivity on pieces from the working halves of the split core sections were also measured.
Mafic rocks from the Hole GT3A are altered in the various extensions[DAT1] . Compared to the gabbros from the Hole GT1A and GT2A of the Oman Drilling Project, which were described and measured during Leg 1 of ChikyuOman2017 expedition, GT3A cores show much wider range of physical properties. For example, P-wave velocity of the samples from GT3A show a range from 2.2 to 7.1 km/s. There is a clear negative correlation between P-wave velocity and porosity[DAT2] . It is noteworthy that there is a positive correlation between the densities [DAT3] and porosity in more than 1/4 of the samples. Highly altered samples from the GT3A cores show high porosity (up to 12%) and high both bulk and grain densities (up to 3.2 and 3.4 g/cm^3, respectively). It is probably because that the larger volume of epidote with high density (3.39 –3.48 g/cm^3) in the more altered samples. The color spectrums, especially yellowness of the core samples, clearly have correlations with the rock physics of the GT3A samples (Fig.1). The yellowness of the mafic rocks in the GT3A imply their degree of alteration reflected the mode of epidote. In other words, the epidote precipitation during the hydrothermal alteration reduces the volume of a part of oceanic crust and probably causes the higher porosity as previously proposed on a qualitative basis (Harper et al JGR 1988; Bettison-Varga et al. Geology 1992; Harper GSA Spec Papers 1995; Cann et al., Geofuid 2015).

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