Initial studies on the physical property measurement of listvenite, serpentinite and the metamorphic sole from ICDP Oman Drilling Project Hole BT1B

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We report results on physical property measurements of core samples from the Oman Drilling Project (OmanDP) Hole BT1B drilled at the Samail Ophiolite, Sultanate of Oman. Cores are mainly composed of listvenite and serpentinite above the basal thrust, and greenstone/greenschist below the basal thrust. The basal thrust of the ophiolite is the trace of a Cretaceous subduction zone, where hundreds of kilometers of oceanic crust and overlying sediments were subducted beneath the ophiolite prior to its emplacement on the Arabian continental margin.

During Leg 2 of the Chikyu-Oman expedition, whole-round X-ray CT image, 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.

Listvenite, completely carbonated former peridotite, is the main lithology in Hole BT1B also found in some ophiolite bodies. It is characterized by high thermal conductivity, significantly higher than that of all other lithologies from Hole BT1B, and greater than or equal to that of a typical peridotite. This is due to the high thermal conductivity of the constituent minerals in listvenite (e.g., quartz, magnetite, hematite). There is a systematic gradient in the thermal conductivity and redness of the color spectrum in listvenite at the top of the hole. This could indicate more abundant Fe-oxyhydroxide minerals near the top of the hole, and more abundant carbonate minerals and fuchsite, (Cr-mica formed by the hydrothermal metasomatism involving fluids from subducting metasediments and metabasalts similar to the greenschist/greenstone lithologies in the metamorphic sole\ below the basal thrust. Serpentinite intervals were characterized by lower density, P-wave velocity and resistivity, and higher porosity and MS than those of other lithologies in Hole BT1B. NGR is generally low (<1 counts/s, cps, on average) in listvenites and serpentinites above the basal thrust at 196 m in BT1B, except in a few sections where narrow intervals or veins have significantly higher counts (up to ~8 cps), probably related to concentrations of chromian mica. NGR increases up to 38 cps below the basal thrust, due to the presence of high K in the metasediments and metamorphosed alkali basalts in the metamorphic sole.

Relationships between P-wave velocity and the porosity of BT1B cube samples show two different trends. Listvenite and some greenschist samples have a trend similar to that of gabbroes from Holes GT1A and GT2A, while greenschist and greenstone samples show an inverse relationship similar to the trend in serpentinites from Mid-Atlantic Ridge.

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