Drilling the Crust-Mantle Transition at Oman Drilling Project Sites CM1 and CM2

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The oceanic crust-mantle transition was drilled by the Oman Drilling Project at Sites CM1 and CM2 in the Wadi Tayin massif of the southern Oman ophiolite. The drilling campaign (November 2017-March 2018) recovered 700 m of cores recovering the lower 150 m of the layered gabbro section, a ~150 m thick dunite horizon and more than 150 m of the uppermost mantle harzburgites. The gabbroic section was drilled in Hole CM1A and is principally composed of fine grained olivine gabbros with less abundant wehrlitic, dunitic and olivine-free gabbroic layers and sills. Coarse grained olivine gabbro with harrisitic textures is present at ~35 m depth in association with a fracture zone, which may have favored faster cooling rate in this layer. Minor subpegmatitic gabbronorite is present as intrusions with variable orientations oblique to the igneous layering.

The dunitic transition zone was drilled in both Holes CM1A and CM2B. The top of this section is very homogeneous, made almost exclusively of completely serpentinised fine grained dunite. Rare gabbroic thin intrusions, Cr-spinel-rich layers and dispersed plagioclase impregnations make up less than 1% of this section. The lower 60 m of the dunitic section contain large gabbroic intrusions making 15 to 30% of the core. These intrusions display faulted contacts with the host dunite, with the contact zones completely rodingitised in Hole CM1A but strongly deformed with moderate alteration in Hole CM2B. These observations suggest that gabbros were injected into the dunite contemporaneously with the faulting. Both rocktypes are strong altered and the faults may have facilitated fluid circulation down to the crust-mantle transition.

The boundary with the mantle sequence is defined by the appearance of the first harzburgite layer within dunite. Dunite is still present throughout the drilled mantle but becomes less abundant with depth in the mantle sequence. The upper 100 m contains

more than 60% of dunite (in Hole CM1A) although the thicker mantle sequence in Hole CM2B contains only 20% dunite. Minor (<2%) magmatic dykes and patches are irregularly present throughout the cored mantle sequence. Both Hole CM1A and CM2B terminate in highly deformed and metasomatized zones, and the lowest 10 m are made of carbonated peridotites.