Overview of Hole GT3A: The sheeted dike/gabbro transition

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Hole GT3A (23.11409 N, 58.21172 E) was drilled by the Oman Drilling Project (OmDP) into Wadi Abdah of the Samail ophiolite, Oman and samples the sheeted dike-gabbro transition zone. OmDP is an international collaboration supported by the International Continental Scientific Drilling Program, the Deep Carbon Observatory, NSF, IODP, JAMSTEC, and the European, Japanese, German and Swiss Science Foundations, with in-kind support in Oman from the Ministry of Regional Municipalities and Water Resources, Public Authority of Mining, Sultan Qaboos University, and the German University of Technology. Hole GT3A was diamond cored in February to March 2017 to a total depth of 400 m. The outer surfaces of the cores were imaged and described on site before being curated, boxed and shipped to the IODP drill ship Chikyu, where they underwent comprehensive visual and instrumental analysis.

Hole GT3A recovered predominantly sheeted dikes and gabbros and has been sub-divided into 4 igneous groups based on the abundance of gabbro downhole. Group 1 (Upper Sheeted Dike Sequence), group II (Upper Gabbro Sequence), group III (Lower Sheeted Dike Sequence) and group IV (Lower Gabbro Sequence). Group II and IV are both associated with almost equal proportions of dikes to gabbroic lithologies, whereas group I & III have >95% dikes.

The sheeted dikes were logged as either basalt (46.9 %) or diabase (26.2 %) depending on the predominant grain size of the dike. Gabbroic lithologies include (most to least abundant) gabbro, oxide gabbro and olivine gabbro. Other lithologies present include diorite (7.5%) and tonalite and trondhjemite (1%). Tonalite and trondhjemite are present as cm-sized dikelets and are found within group II and IV. Gabbroic lithologies generally display a varitextured appearance and are characterised by the co-existence of poikilitic and granular domains. Detailed observations of chilled margins and igneous contacts reveal the relative timing of dike and gabbro intrusion, and identify that the Upper Gabbro Sequence intrudes into dikes, whereas the Lower Gabbro Sequence is intruded by dikes. Hydrothermal alteration is recorded throughout the hole and the mean alteration intensity is 54% (range = 10-100%) and mean vein density is 27 veins/m. The intensity of brittle deformation is generally low downhole with restricted intervals associated with fault zones.

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