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Characterising hydrothermal alteration in the dike/gabbro transition zone: OmanDP Hole GT3A

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The accretion of the lower crust at mid ocean ridge has two long standing end member models, the gabbro glacier and multiple sills models. These models differ primarily in the location and distribution of crystallisation of the lower crust and therefore heat release. Resolving the depth and magnitude of deep hydrothermal circulation would be a major step forward in understanding the formation of the ocean crust. Testing these models is one of the key objectives of the Oman Drilling Project. OmanDP has successfully cored three boreholes, each to 400 m depth, in the Samail ophiolite that sample key horizons in the lower crust and includes Hole GT3A that samples the dike/gabbro transition zone.

The dike/gabbro transition zone is a critical boundary within the ocean crust, representing the interface between the upper and lower crust and importantly separates the upper crustal hydrothermal system from the magmatically accreting lower crust. Hydrothermal alteration in Hole GT3A is extensive and is dominated by greenschist facies alteration assemblages. A combination of petrology and whole rock and hydrothermal mineral geochemistry are used to characterise and quantify the hydrothermal alteration recorded in Hole GT3A. Samples dominated by epidote and/or chlorite rich assemblages consistently show depletions in base metals relative to fresh samples indicating that the dike/gabbro transition zone is a source of base metals to the hydrothermal system. Major element chemical changes (e.g SiO_2, CaO, MgO) can also be correlated with the alteration assemblage and extent of alteration.