Tethyan anhydrite preserved in the lower crust of the Samail ophiolite? Evidence from Oman Drilling Project Holes GT1A and 2A.

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Anhydrite is important in mid-ocean ridge hydrothermal systems because of the high concentrations of calcium and sulfate in modern seawater and anhydrite's retrograde solubility. Because anhydrite hosts many powerful tracers of fluid-rock interactions ($^{87}Sr/^{86}Sr$, $d^{18}O$, $d^{34}S$, trace elements, fluid inclusions) it is useful phase for tracing the chemical evolution of hydrothermal recharge fluids and estimating time-integrated fluid fluxes.

Anhydrite can form from heated seawater (>100˚C), through water-rock reaction, or by mixing of seawater and hydrothermal fluids. Although abundant in active hydrothermal mounds, and predicted to form from downwelling, warming fluids during convection, anhydrite is rare in drill core from seafloor lavas, sheeted dikes and upper gabbros, with only minor amounts in ODP Holes 504B and 1256D. Because anhydrite can dissolve during weathering, its occurrence in ophiolites is unexpected. Instead, gypsum is present in Macquarie Island lavas and Miocene gypsum fills cavities within the Cretaceous Troodos ore deposits. Thus, the occurrence of numerous anhydrite veins in cores from the gabbroic lower crust of the Samail ophiolite in Oman was unanticipated. To our knowledge, anhydrite in Oman gabbros has not been previously reported.

Oman Drilling Project Holes GT1A and GT2A were drilled into the Wadi Gideah section of the Wadi Tayin massif. Both recovered 400 m of continuous core from sections of layered gabbros (GT1) and the foliated-layered gabbro transition (GT2). Anhydrite is present throughout both holes, some in vein networks but more commonly as isolated 1–110 mm veins (>60 mm ave). Anhydrite is mostly the sole vein filling but can occur with greenschist minerals such as epidote, quartz, chlorite and prehnite. Anhydrite commonly exhibits prismatic and bladed textures but can also be capriciously microcrystalline. Though definitive cross cutting relationships are elusive, anhydrite veins cut across some greenschist veins. Anhydrite is deformed in faults with asymmetries consistent with normal senses of shear, suggestive of formation near the ridge, or at least before obduction. Gypsum is also present in both holes, but is clearly late stage and cuts across all earlier vein sets and deformation features. Notably, anhydrite was not observed in core from Hole GT3, in the dike-gabbro transition.

Keywords: Samail ophiolite, Sultanate of Oman, anhydrite, hydrothermal circulation

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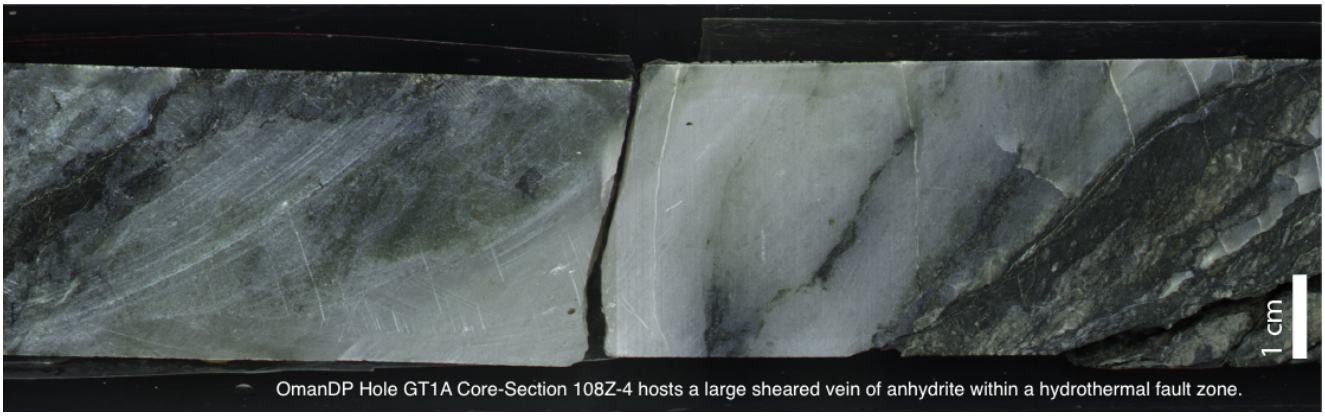

OmanDP Hole GT1A Core-Section 108Z-4 hosts a large sheared vein of anhydrite within a hydrothermal fault zone.

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