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New podiform chromitites Occurrence from the Masirah Ophiolite, Oman

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The Masirah ophiolite is one of the few true ocean ridge ophiolites that have been preserved (Rollinson, 2017) and lacks any indication that it formed in a subduction environment. The Masirah ophiolite in south-eastern Oman is a different and older ophiolite from the more famous northern Oman ophiolite. Chromite and copper ores comprise large deposits in the Samail ophiolite, northern Oman. In comparison, chromite and copper deposits have not been described in previous reports or previous exploration in Masirah ophiolite. Rollinson (2017) has proposed that the apparent absence of chromitites in the mantle section of Masirah ophiolite is an important discriminant between subduction related and ocean ridge ophiolites. However, during recent studies on the Batain ophiolite mélange, and Masirah ophiolite, several chromitite pods have been discovered. The chromitites occur as separated small concordant, lenticular pods (3–10 m in thickness), which have been extensively altered and deformed, with the host pyroxenite serpentinites serpentinized harzburgites and dunites. The largest chromitite pods found within the pyroxenite and dunite of Masirah are up to 10 m across. Unusual minerals and mineral inclusions (orthopyroxene, clinopyroxene, amphibole, phlogopite, serpentine, native Fe, FeO, alloy, sulfide, calcite, laurite, celestine and halite) within chromite have been observed in the chromitites from the Masirah ophiolites. The existence of hydrous silicate inclusions in the chromite calls for a role of hydration during chromite genesis. Both phlogopite and hornblende were possibly formed from alkali-rich hydrous fluids/melts trapped within the chromite during the chromitite formation. High-T green hornblende and phlogopite included in the chromites is evidence of the introduction of water in the magma at the end of the chromite crystallization. Such paragenesis points to the presence of hydrous fluids during the activity of the shear bands. The chromitites parental magmas are rich in K, Na, LREE, B, Cs, Pb, Sr, Li, Rb and U relative to HREE, reflecting the alkalic fluids/melts that prevailed during the chromitites genesis.

The mineral inclusions in association with host peridotites may have been brought by the uprising asthenosphere at mid-oceanic ridges due to the mantle convection. It appears that this chromite has been formed through reaction between amid-ocean-ridge basalt-melt with depleted harzburgite in the uppermost mantle. The chromitite deposits have similar cr# (55-62% Al-chromitites), mg# Al_2O_3 and TiO_2 contents to spinels found in MORB, and have been interpreted as having formed in amid-ocean ridge setting. This suggests that this chromitites is residual from lower degree, partial melting of peridotite, which produced low-Cr# chromitites at the Moho transition zone, possibly in a mid-ocean-ridge setting. The chemistry of both mineral inclusions and chromite suggests MORB-related tectonic setting for the chromitites that were crystallized at 1000 °C–1300 °C under pressures <3 GPa . The host peridotites were generated during the proto-Indian Ocean MORB extension and emplaced as a result of the obduction of the ophiolite over the Oman Continental margin during Late Cretaceous-Early Paleocene.

Rollinson, H., 2017. Geoscience Frontiers, 8: 1253–1262.