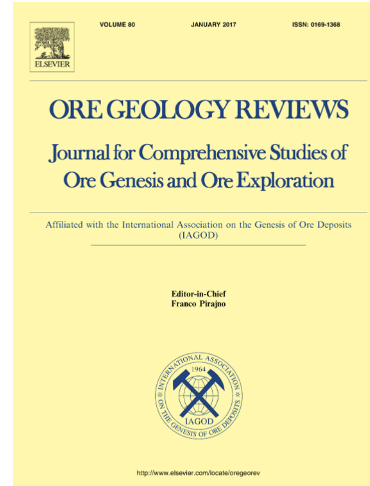

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PII: S0169-1368(17)30970-8
DOI: https://doi.org/10.1016/j.oregeorev.2018.07.003
Reference: OREGEO 2620

To appear in: *Ore Geology Reviews*

Received Date: 15 December 2017
Revised Date: 30 June 2018
Accepted Date: 9 July 2018

Please cite this article as: M.Z. Khedr, S. Arai, Composite origin of magnetite deposits hosted in Oman peridotites: Evidence for iron mobility during serpentinization, *Ore Geology Reviews* (2018), doi: https://doi.org/10.1016/j.oregeorev.2018.07.003

Composite origin of magnetite deposits hosted in Oman peridotites: Evidence for iron mobility during serpentinization

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Abstract We describe mineralogy of magnetite deposits concentrated within a nonconformity surface between Aniba serpentinites and overlying limestones in the Southern Oman ophiolite and discuss their origin to understand iron mobility during serpentinization, with special reference to factors controlling the magnetite-orebody sizes. The Aniba magnetite deposits occur in several forms such as fibrous crystals, oval or rounded grains, strings and cluster shapes, in fine-grained iron-rich chlorite and calcite matrices. The chromian spinel (Cr#= 0.38–0.56) within the magnetite deposits is similar in texture, mode of occurrence and chemical composition to that in the underlying serpentinized harzburgites (chromian spinel Cr#= 0.37–0.50), and plots in the space of abyssal peridotites. The mineral chemistry of chromian spinel, olivine and clinopyroxene (Cpx) suggested that the Aniba harzburgites are refractory residue after high-degree (15–25 %) partial melting and are similar to abyssal harzburgites from a normal ridge segment. This is confirmed by a Cpx trace-element character with high depletion in light rare earth elements (LREE), Ta and Zr relative to heavy REE. The iron of our magnetite deposits was possibly derived from two sources: one is an essentially internal source of iron from the breakdown of Fe-rich serpentines after olivine during low-T serpentinization (<400 °C) and the external source of iron from hydrous fluids. The essential origin of our magnetite deposits is hydrothermal one due to the mobility and leaching of iron from serpentinites and the in-situ selective precipitation of iron within the nonconformity surface. This process was feasible because the nonconformity zone was a weathering surface, a channel for both hydrothermal-fluid flow providing high fluid/rock ratios that enhance iron mobilization in serpentinites and leach iron, besides chromian spinel grains, from the host ultramafic rocks. Chromian spinel grains (up to 10 volume %) in the magnetite deposits were of a residual detrital origin from the underlying serpentinized peridotites on weathering, and acted as a nucleus for magnetite precipitation. The morphology and colloform shape of some magnetite grains reflect their supergene