

Petrology and chemistry of rodingite dykes in the mantle section of the Oman ophiolite

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Dykes in the mantle section of the Oman ophiolite are very common. Most of them are of gabbroic and pyroxenitic nature, and are the relics of the melt that circulated through the mantle and fed the crust. Some dykes have a hydrothermal origin and are composed of pure diopside rarely in association with pure anorthite.

The Oman mantle is more or less altered. Along some large fracture zone, the mantle may be extensively serpentinised and the dykes it contains rodingitised at various degree. The rodingites show a typical mineralogical composition, with major grossular garnet, chlorite and prehnite; diopside, clinozoisite, tremolite and accessory minerals are sporadically present. Two types of rodingite are observed according to their protolith: low-Ca type which formed from gabbroic and pyroxenitic dykes and high-Ca type stemming from the hydrothermal dykes. The first type (type-I) is characterised by its abundance clinozoisite and chlorite, anhedral grossulars are crystallising in veins, and cross-cutting a primary lithology composed of clinozoisite and chlorite. Tremolite-rich veins are present within the dyke. Diopsides are scarce, and, when present, show a chemical composition depleted in Ti and Cr, extremely variable in Al and Mg# (ranging from 0.88 to 0.97). The second rodingite type (type-II) is rich in euhedral diopside and anhedral grossular and hydrogarnet. Reaction zones between diopside and garnet/hydrogarnet are frequent, chlorite appears only in these zones. The diopside is sometimes destabilised and transformed into tremolite, while hydrogarnet crystallise as coronae around the grossular. The chemical composition of the diopside is depleted in Ti, Na, Cr and Fe, with a Mg# always above 0.975, and extremely variable in Al.

Both rodingite types occur in highly serpentinised harzburgite where only small relics of olivine remains from the primary lithology. Orthopyroxenes are totally transformed into serpentine (bastite) in the host of the type-I, and into tremolite in the Type-II rodingite wall rock. Type-I rodingites show a whole rock Ca-contents similar to that of the gabbroic dykes, while this parameter is unusually high in type-II rodingites. On the other hand, SiO₂ and Fe_{total} are lower in the type-I rodingites than in the type-II ones. Rodingites are formed by the reaction of gabbroic dykes and bodies with a fluid which composition is buffered by the serpentinisation reaction with the mantle peridotites. The mineralogical and chemical variations between the two type of rodingites observed in the Oman ophiolite express not only that their protoliths were different, but also that there were two distinct fluids leading to their genesis. Type-I rodingite probably result from a classical alteration-rodingitisation process. A fluid (i.e. sea or meteoritic water) penetrated the mantle along fracture zone, was slightly enriched in Ca by the breakdown of the pyroxenes into serpentine, and became undersaturated in Si as a result of the global serpentinisation. When this fluid react with a gabbroic body within or in contact with the mantle, type-I rodingite formed, principally characterised by rather low Si content. On the other hand, the genesis of type-II rodingite involves a Ca-rich, Fe-undersaturated hydrothermal fluid leading to the alteration of pyroxenes into tremolites, a global enrichment in Ca and the progressive removing of Fe as well in

the serpentinised mantle as in the rodingite dykes.

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