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Mineralogical study of rodingitized microgabbros and associated chromitite seams from the Nain ophiolite, Central Iran

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The Nain-Dehshir-Baft Ophiolitic Belt (NDBOB), which crops out along the Nain-Baft fault, around the Central Iranian Microcontinent (CIM), comprises a set of dismembered ultramafic, mafic and sedimentary complexes. The northernmost branch of this ophiolitic belt is known as “Nain ophiolitic mélange” and hosts small chromitite bodies, as pods and lenses, within completely serpentinized peridotites.
The focus of the present study is the interaction between a 50 cm thick chromitite lens and a crosscutting rodingite dyke. For this purpose, a full transect across chromitite, rodingite and serpentinite was continuously sampled and studied in reflected and transmitted light microscopy. Mineral chemistry of sulfides, silicates, carbonates and oxydes was determined through EMP analyses.
Rodingite shows a calc-silicate assemblage with an association of clinopyroxene, xonotlite, chlorite, garnet, vesuvianite, titanite, hornblende and chromite. Chromitite has 60-80% modal chromite, that sporadically shows a slight Fe-chromitization. Silicate assemblage is dominated by serpentine with relics of olivine and, occasionally, diopside, enstatite, hornblende and phlogopite. Later calcite veins crosscut both rodingite and chromitite, extending within serpentinite too.
Rodingite shows a widespread range of copper sulfides, the most common ones being chalcocite, followed by native copper, digenite, geerite, and few spotted grains of possible yarrowite and sponkiopite. As secondary Cu oxydes and hydroxydes tenorite and spertiinite were found.
In chromitite, close to the upper contact with rodingite, usual secondary sulfides like heazlewoodite and millerite were found together with shandite. Close to the lower rodingite contact, the presence of pyrrhotite, native iron and pentlandite was detected. Very close to the lower contact, again an unusual sulfide assemblage was found, with bornite and galena.
Within rodingite clinopyroxenes show both diopside and augite compositions, with XMg ((Mg/(Mg+Fe2+)) of 0.93-0.96 for the former and 0.82-0.86 for the latter. Garnets are grossular and hydrogrossular in the upper rodingite, to which andradite is added in the lower rodingite. Chlorite shows a wide range of compositions with XMg increasing towards the contact with chomitite from 0.47 to 0.60. Very close to the contact XMg of chlorite ranges between 0.67 and 0.94. Chromite accessory grains have XMg ranging between 0.52 and 0.68 and XCr (Cr/(Cr+Al)) ranging between 0.75 and 0.80.
Chromite in chromitite has XMg ranging between 0.65 and 0.71 and XCr ranging between 0.68 and 0.71. Olivine is forsteritic with XMg ranging between 0.95 and 0.97 and orthopyroxene is enstatitic with XMg around 0.94-0.95. Chlorite is very rare and has around 3.5 wt% $Cr2O_3$.
Rodingite intrusion postdates serpentinization of mantle assemblage and did not affect the chomite+silicate chromitite assemblage. The effect on sulfide variety and distribution was instead remarkable. At least lead and copper were introduced in the contact zone within chromitite to form shandite and bornite. Reducing conditions during rodingite emplacement are witnessed by the abundance of native copper and the presence of native iron. The effect of interaction in rodingite is mainly recorded by the wide range of chlorite compostions that increases its Mg content towards chromitite.