A new discovery of chromite-hosted inclusions from chromitites of the Samail ophiolite of Oman

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Podiform chromitites have provided us valuable information on various mantle processes, including melt-mantle reaction, deep-seated magmatic evolution, and mantle dynamics. Varied podiform chromitites have been researched in Oman ophiolite, including the Maqsad chromitite(Arai and Miura, 2016). Many kinds of inclusions have been found in podiform chromitite, Oman ophiolite, such as platinum group element minerals, silicate minerals, even ultra-high pressure minerals, moissanite (Ahmed and Arai, 2003; Trumbull and Yang et al., 2009). The main silicate minerals are hydrous minerals, such as Na-Cr pargasite, aspidolite and so on (Borisova and Ceuleneer et al., 2012; Rospabé and Ceuleneer et al., 2017).

We studied ore samples from a chromitite mine in the north of Maqsad. The ore samples are massive and banded, mainly consist of disseminated subhedral olivine (0.3~0.5mm) and chromite (0.3~0.5mm), grossular and sulfides are uncommon. Ores are less than 5% alteration, however, some serpentine and native copper and copper carbonate, oxide have been observed in fracture of wall rock dunite. The chemical compositions of chromites range narrow, Cr# (=Cr/[Cr+Al] atomic ratio) is from 0.50 to 0.52, Mg# (=Mg/[Mg+Fe2+] atomic ratio) is from 0.57 to 0.64, TiO2 is from 0.3% to 0.5% which average is 0.4%, FeO is from 17.0% to 22.1%. Different types of inclusions were found in chromites. The silicate inclusions range in diameter from 5 μm to 200 μm, contain pargasite, aspidolite, high Cr# (Cr#>60) chromite, diopside, enstatite, forsterite, grossular, anorthite (An=99), titanite, pentlandite, chlorite. The chemical compositions of chromites may represent the melt composition from which they formed, the inferred parental melt composition in equilibrium with the chromitites has high Al_2O_3 content (14.9–15.4 wt.%), which is very similar to MORB magmas (Al_2O_3 –15wt.%; Kamenetsky et al., 2001). Considering the magmatic anorthite is a typical mineral of gabbro in the arc setting (Beard, 1986), it may indicate the chromite record MORB-like and arc-like melts. Moreover, the hydrous silicate inclusions homogenized experiment has been carried out, at 900℃, 1100℃, 1150℃, 5mm cube samples are heated by muffle furnace, keep the temperature for 2 min then quenching by water; at 1300℃, chromite grains are heated by thermal gravimetric analyzer, cooling by air. Homogenized volume of inclusions increased with temperature such as 5% (2 homogenized inclusions), 10% (5 homogenized inclusions), 50% (only pargasite, diopside still exist), 100% from 900℃ to 1300℃, respectively. Moreover, the compositions of homogenized inclusions are various, the contents of SiO2, FeO and TiO_2 range from 14% to 71%, from 0.6% to 40.4%, from 0.2% to 6%, respectively, which indicates the heterogeneity of the silicate melt when they were trapped by chromite. It can be inferred that more than one simple melt interacted with the mantle sequences. Further investigation is required to prove this hypothesis.

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