High resolution X-ray computed tomography and scanning electron microscopy studies of inclusions in Oman podiform chromitite: implications for rapid cooling in Moho Transition Zone

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High-Cr# (= atomic Cr/[Cr + Al]) chromite has been observed as the lining of inclusions within the host chromite, and has been proposed to have originated as early crystallizing microcrystals[1]. These high-Cr# chromite lining, however, cannot be explained by the host chromite–melt reactions, and consequently its origin remains controversial. Moreover, the genesis and the evolution of the inclusions are poorly understood. In this study, we used high resolution x-ray computed tomography (HRXCT) combined with scanning electron microscope (SEM) to obtain 3D and 2D images of inclusions within chromites from the Samail ophiolite to investigate the evolution of melt inclusions within chromite.

The 3D HRXCT and SEM images showed the spatial distributions of inclusions and the skeletal morphology of the host chromite. Under the rapid cooling, the host chromites grew skeletal crystals to trap melt inclusions [2]. After trapping melt inclusions, the host chromite continued to grow on the inner wall of the inclusions [3]. This overgrowth may be recognized as a high-Cr# chromite lining. Many previous studies of the inclusions in chromites have ignored the influence of the formation of lining [4]. The initial Cr content of the melt inclusions should have been much higher than previously estimated, suggesting that the parental melt for the chromitite may have been highly enriched in Cr, being supersaturated in chromite. Moreover, the 3D distribution of inclusions in host chromite with skeletal morphology implies that the formation of inclusions depended on the cooling rate of chromite-forming melt, implying that the parental melt of the chromitite was rapidly cooled in the Moho Transition Zone.

References

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