Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.36469

Minor and Trace Element Concentrations in Chromites.

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Major and minor element concentrations in chromite have long been used to interpret composition of the liquid from which they crystallize and the fO2. However, Fe-Mg exchange with mafic minerals subsolidus make Fe# and Fe+3/FeT unreliable indicators of both. Minor and trace elements (Sc, Ti, V, Mn, Co, Ni, Zn, Ga, Zr, Sn and Hf) can now routinely be determined by LA-ICP-MS, and canbe used to consider magma composition, fO2 and subsolidus exchange.

Based on geothermometry the closure temperatures of Cr# and Fe# for chromites from volcanic rocks are close to liquidus temperatures for Cr# and subsolidus for Fe#. The +3 and +4 ions follow Cr# and can be used in estimating liquid compositions. Sc, Ti, V and Ga variations with Cr# separate MORB, ARC, komatiite and picrites. V can be used to estimate fO2. The +2 ions follow Fe# and thus and do not reliably reflect magma composition.

In plutonic rocks the long cooling time and repeated magma replenishments could lead to changes in chromite composition. However, the large volume of chromite in chromitites may buffer the composition of the chromite. Comparisons of Cr# and Fe# from chromitites chromites (of the Bushveld and Stillwater intrusions) with results from high temperature experiments show that the chromitite chromites reflect liquid compositions. However, as is the case for volcanic chromites, chromite from the margins of chromitites show higher Fe# and are richer in the +2 ions indicating subsolidus equilibration. The Cr# and +3 and +4 ions concentration of marginal chromites from Stillwater are similar to chromitite chromites. But, at the Bushveld Cr# and the concentrations of Ti and V are higher and Sc, Ga, Zr, Hf are lower in the marginal chromites than in the chromitite chromites. The difference may be due to the Bushveld interstitial liquid being more fractionated than the Stillwater interstitial liquid. Alternatively, the Bushveld may have cooled more slowly resulting in more diffusion. In plutonic rocks the composition of chromitite chromites can be used to consider liquid compositions and fO2, but the concentrations of in chromites the host silicate rocks may not represent high temperature conditions.