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Metasomatic alteration of chromian-spinels in an Archean ultramafic section, southern India and its implications

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Cr-spinel ((Mg, Fe^{+2}) $(Cr, A1, Fe^{+3})_2O_4$) chemistry is extensively used as a petrogenetic indicator of mafic-ultramafic rocks [1]. In this study, the Cr-spinel chemistry of a metasomatized ultramafic section within Mesoarchean Sargur group[2] of Western Dharwar Craton, southern India, was investigated. The segment comprises of intercalated occurrences komatiite, serpentinite and amphibolite, which are cut-across extensively by magnesite veins. Chromian-spinels were found only to occur in the komatiite and serpentinite, within the matrix, as accessory minerals with their sizes ranging from 400µm-1mm, having no or weak compositional zoning. The Cr-spinels in the serpentinite have high Cr_2O_3 content (43.8-49.75 wt %), low Al_2O_3 (5.9-10.4 wt %) and their Cr# (Cr/(Cr + Al)) values ranging between 0.75-0.85. However, the spinels in the komatiite have very high FeO content (82-91 wt %), very low Cr (5.7- 10.4 wt%) and Al_2O_3 content (0.05-0.39 wt%), which indicates they are ferrit-chromite (Fe^{2+}/Fe^{3+} = 0.99-1.01) or magnetite. It is therefore obvious that the Cr-spinels in the komatiite are highly altered, probably due to the impact of fluid infiltration from the magnesite veins. The composition of the Cr-spinel from the serpentinite falls in to the subduction fields of various conventional discrimination diagrams used to distinguish the original setting of the Cr-spinels. In this given scenario, there lies a pit-fall that the composition of Cr-spinel in the serpentinite are most likely to be interpreted as the ones that preserved their original composition, by overlooking the fact that the rock is serpentinized. A recent study [3] however cautions that late fluids tend to alter the Cr/Al values of the Cr-spinel and is rather a potential sink for fluid-mobile elements. Therefore, it can be concluded that the Cr-spinel in the serpentinite are not pristine, but are also altered products and therefore makes it a good proxy to understand the metasomatic processes.

References

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