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MAJOR AND TRACE ELEMENT COMPOSITIONS OF CR-SPINEL FROM SERPENTINIZED FOREARC MANTLE PERIDOTITES: INSIGHTS ON GEOCHEMICAL PROCESSES DURING MELT EXTRACTION AND METAMORPHISM

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Cr-spinel is a useful petrological indicator mineral as it is resistant to alteration, but minor and trace element data of spinel are scarce in the literature. Thus, we examined major and trace element compositions of Cr-spinel from serpentinized forearc mantle peridotites from the Dominican Republic, Marianas, and Himalayas, using EPMA and LA-ICP-MS. In the Marianas, hydrated peridotites protrude as serpentinite diapirs from the base of the mantle wedge in the outer 100 km of the forearc. Himalayan serpentinites have a similar origin and were exumed with Tso Morari UHP metasedimentary rocks along the subduction plane (Guillot and Hattori, 2000). Dominican Republic samples are located along the Septentrional Fault Zone which allowed the protrusion of serpentinites from the base of the mantle wedge during regional transpression (Saumur et al., 2010). Cores of Cr-spinels in all three areas have high Cr# (Cr/[Cr+Al]=0.47-0.76) and low YFe^{3+} (Fe^{3+}/[Fe^{3+}+Al+Cr]= 0.01-0.10), which is consistent with their derivation from depleted mantle. Ga and Al are positively correlated, with Ga/Al ratios of 2.1-4.2 x 10^{-4}, similar to the primitive mantle value of 1.6 x 10^{-4}, suggesting the two behave coherently. However, Zr/Y (20-180) and Sc/Y (700-3900) are surprisingly high compared to primitive mantle values (2.4 and 3.8, respectively), suggesting that spinel contributes to the fractionation of high-field strength elements during melt extraction in the mantle. Cr-spinels from the Dominican Republic are zoned: rims contain lower Al Mg, and Zn, and higher Fe (II), Fe(III), Cr, Ti, Mn, Ni and V. However, values of YFe^{3+}(0.03-0.35) in rims are low compared to those for typical ferritchromit (>0.5) which occurs in metamorphosed spinel at temperatures above 400°C. Furthermore, the serpentine in the samples is predominantly lizardite, which is stable up to temperatures of 300°C, and high temperature antigorite is absent. We interpret that the zoning represents the onset of ferritchromit alteration, and is due to a short lived thermal event possibly associated to the upward protrusion of the serpentinites through the hot mantle wedge interior. Such compositional zoning is not observed in the Marianan and Himalayan samples: the lack of such alteration appears to suggest that the development of ferrtitchromit requires late heating.

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