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Alteration Mechanism of Chromite in Podiform Chromitites from two Metamorphosed Ophiolitic Complexes: Golyamo Kamenyane (Bulgaria) and Tapo (Peru)

Fernando Gervilla (1), Isabel Fanlo (2), Thomas N. Kerestedjian (3), Ricardo Castroviejo (4), Jose Maria Gonzalez-Jimenez (5), Jose Alberto Padron (1), and José Feliciano Rodrigues (6)

(1) University of Granada, Faculty of Sciences, Mineralogy and Petrology, Granada, Spain (gervilla@ugr.es), (2) University of Zaragoza, Department of Earth Sciences, Zaragoza, Spain, (3) Geological Institute, Bulgarian Academy of Sciences, Sofia, Bulgaria, (4) Escuela Superior de Ingenieros de Minas, Universidad Politecnica de Madrid, Madrid, Spain, (5) GEMOC ARC National Key Centre, Department of Earth and Planetary Sciences, Macquarie University, Sidney, Australia, (6) Departamento de Engenharia de Minas, Facultade de Engenharia da Universidade do Porto, and LNEG, Laboratorio nacional de energía e Geología, Portugal

Chemical zoning related with alteration of chromite from podiform chromitites in metamorphosed ophiolites from Golyamo Kamenyane (Rhodope Mountains, SE Bulgaria) and Tapo (Eastern Cordillera, Peru) reveals similar, distinct, two stages of alteration: 1) mass loss of chromite under reducing conditions and 2) addition of magnetite component. During the first stage, chromite looses Al2O3 by reaction with associated serpentine to form chlorite and Fe2O3 is reduced to FeO. Because the volume of chromite grains does not change, Al2O3 loss led to development of porous texture in chromite. Most of these pores are filled by chlorite. The second stage must take place under relatively oxidizing conditions and involves the addition of magnetite component to the altered, porous chromite giving rise to what is known as ferritchromite (or ferrian chromite). This process is associated with lowering the pores volume of chromite and the replacement of chlorite by antigorite. Since chromite grains preserve their original shape and volume the amount of magnetite component that can be added to the porous chromite generated in the first stage is limited by its pores volume. Further addition of magnetite would result in the formation of a magnetite-rich, ferritchromite shell overgrowing chromite-ferritchromite grains. This ferritchromite shell either shows subhedral shape (in chromite-rich disseminated chromitites) or evolves into a mosaic-like texture with straight grain boundaries and triple points (in nearly massive chromitites).
The unusual chemical trends of altered chromite in podiform chromitites from the two studied, metamorphosed ophiolitic complexes suggest that this type of alteration should be related with the metamorphic evolution suffered by such rocks. In fact, the Golyamo Kamenyane massif is hosted by high-pressure, metamorphic rocks (at least 650-750ºC and 8-12kb; Mogessie et al., 2008) and recent geothermometric data indicate that the Tapo massif also suffered similar pressure and temperature conditions (around 535ºC and 12.5kb; Willner et al., 2010).

References:
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