Nanoscale structure of high-temperature Ru-Os sulphides

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This work provides the first ever nano-scale characterization of the zonation of Ru-Os sulphides of the solid solution series laurite (RuS_2)-erlichmanite (OS_2) in nature. These sulphides were found as solid inclusions within unaltered chromite forming chromitite ores of the Ojén ultramafic massif (Spain) and the Monte Bueno chromite deposit (Cuba). The zoned laurite-erlichmanite grains are <10 µm size and exhibit variable micron-scale structure of zoning under FESEM, including simple zoning made up of cores of Os-poor laurite surrounded by Os-rich laurite, and complex oscillatory characterized by alternating bands of Os-rich and Os-poor laurite and/or erlichmanite.

Lamellas about 80nm in thickness were obtained from two different zoned laurite-erlichmanite crystals by means of FIB and studied under High Ressolution Transmission Electron Microscopy (HRTEM). HRTEM images coupled with High Angle-Annular Dark Field (HAADF) and Precession Electron Diffraction (PED) analysis revealed that zoning in laurite-erlichmanite exists not only at the micro-scale but also at the nanoscale realm. More important is the nanoscale observation of the Os-rich rims and bands of laurite, as detected by conventional micro-analytical techniques (FE-SEM and EMPA); they consist of homogenous laurite matrix hosting fringes (<20 nm in thickness) of pure erlichmanite (OsS_2). Our unprecedented observation highlight the importance of nanoscale studies for a better understanding on the genesis of platinum-group minerals in magmatic systems.