

Evaluation of the site occupancy of iron in majoritic garnet and silicate perovskite, using an electron channelling spectroscopy.

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Majoritic garnet and silicate perovskite assemblages synthesized from natural pyroxene in the multi-anvil press were studied by X-ray energy dispersive spectroscopy (XEDS) and electron energy-loss spectroscopy (EELS) in a transmission electron microscope (TEM) to quantify the composition and oxidation state of iron. In these assemblages of the (Mg,Fe)SiO₃-Al₂O₃ system, Fe³⁺ has a much stronger affinity to silicate perovskite than to majoritic garnet at the same pressure, temperature and oxygen fugacity. To determine the site occupancy of iron in majoritic garnet and silicate perovskite, we have also performed both spectroscopic techniques (XEDS and EELS) under channelling conditions. Fe in silicate perovskite appears to occupy the pseudo-dodecahedral site. To a certain amount, Al prefers to occupy the octahedral site, charge-balanced by Fe³⁺ in the pseudo-dodecahedral site. This initial result suggests that two different cation sites in silicate perovskite might be qualitatively distinguished with a channeling-enhanced microanalysis in TEM.