On the significance of parental magma composition in generating magmatic Fe-Ti oxide ores

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The generation of magmatic Fe-Ti oxide ores in layered mafic-ultramafic intrusions has been attributed to parental magma composition, magma mixing, pressure fluctuation, variation in oxygen fugacity, addition of volatiles from country rocks, silicate liquid immiscibility, and any combinations of them. However, their relative importance remains to be clearly identified within and among the ore-bearing intrusions worldwide. Here we undertake a petrologic and geochemical study of the Marginal zone of the Panzhihua intrusion, one of the major Fe-Ti oxide ore-bearing layered intrusion in the Emeishan large igneous province, SW China, to investigate the importance of parental magma composition among the above factors. Microgabbros, the dominant rock type of the studied Marginal zone, have 40.1–44.9 wt.% SiO_2, 2.6–5.4 wt.% TiO_2, 12.5–18.3 wt.% Fe_2O_3 and 5.2–8.6 wt.% MgO, and trace element, Sr-Nd isotopic and PGE systematics comparable to the HT2 sub-group of the high-Ti Emeishan basalts. The microgabbros are envisaged to be first approximation of the parental magma, and enrichments in TiO_2 and Fe_2O_3, and depletion in SiO_2, might have been responsible for early and abundant crystallization of titanomagnetite. One plausible way to achieve this is enhanced fractionation of clinopyroxene relative to olivine occurring at elevated pressure. I propose that one key prerequisite for the generation of magmatic Fe-Ti oxide ores is efficient extraction of parental magmas with composition capable of crystallizing Fe-Ti oxides in an early and abundant manner.