

**A case study of magmatic Ni-Cu and V-Ti-Fe mineralization
associated with variable fractionation degree**

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Magmatic Ni-Cu and V-Ti-Fe mineralization generally occur in different intrusions which are associated with magmas derived from either different magma source or variable partial melting degrees or oxidation conditions. The Xiangshan intrusion hosts both Ni-Cu and Ti-Fe(V) mineralization. The Ni-Cu sulfide mineralization is associated with ilmenite and olivine gabbro, whereas the Ti-Fe oxide enrichment is associated with ilmenite bearing gabbro (Ti-Fe gabbro). The TiO₂ content (0.5-1 wt%) in early crystallized clinopyroxene in Ti-Fe gabbro is comparable to those of Ni-Cu mineralized rocks and is much lower than most V-Ti deposits, illustrating that the Ti-Fe gabbro of the Xiangshan intrusion is not necessarily associated with high-Ti magmas. The identical Sr-Nd isotopic values between the Ti-Fe gabbro and Ni-Cu related rocks illustrate that their parental magmas were derived from a similar mantle source, probably from the same primitive magma. The oxygen fugacity calculated from the magnetite and ilmenite pairs of the Ti-Fe bearing rocks, combined with the presence of sulfides, suggests a moderate oxidizing condition for the Ti-Fe mineralization (varying from QFM 0 to QFM 2). This is slightly higher than the Xiangshan Ni-Cu mineralization (QFM -1 to QFM 0), but consistent with that of the Ni-Cu deposits regionally. The anorthite content in plagioclase from Ti-Fe gabbro is significantly lower than those from Ni-Cu related rocks. This, together with the abundant occurrence of hydrous minerals, indicates that the Fe-Ti mineralization related parental magma was more fractionated and water rich. Nevertheless, such a feature is consistent with the that of the Ni-Cu mineralization. These findings from the Xiangshan complex illustrate that Ni-Cu and Ti-Fe mineralization in small intrusions may related to the variable degrees of fractional crystallization during ascent.