Liquid immiscibility and fractional crystallization in the 1780 Ma Taihang dykes: implications for the genesis of the bimodal Xiong'er volcanics

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Immiscibility is a potential mechanism in the forming of high-Fe-Ti-P rocks; however, whether large-scale segregation and eruption of high-Si lavas can occur in nature has yet to be proven. In this study, the possibility of liquid immiscibility and fractional crystallization in the 1780 Ma cogenetic [1] high-Fe-Ti-P-featured Taihang dykes and bimodal Xiong'er volcanics in North China is investigated.

Mineral and bulk-rock compositions reveal that the large variations in the regular dykes were resulted from a Pl+Cpx-dominated fractional crystallization and density-driving mineral sorting, which have driven the liquids to be poor in Ca-Al but rich in Fe-Ti-P-K and thus chemically immiscible according to [2]. The spatially conjugated interstitial granophyric and ilmenite-rich intergrowths, as well as reactive microstructures especially olivine coronites give petrographic evidence for immiscibility and segregation/migration, similar to those described in [3].

The fractional crystallization and subsequent segregation would be responsible for the compositional diversity of the Taihang dykes and the Xiong'er volcanics: the dacite-rhyolite lavas would be potentially the high-Si counterparts of the high-Ti dykes; whereas the basalt-andesite lavas would be erupted equivalents of the regular dykes. It seems that the segregation has occurred in crustal magma chambers before the ascent of liquid into the pumping system (feeder dykes), and has ultimately generated huge amounts of high-Si lavas, as well as vast high-Fe-Ti-P dykes in an areal extent of over 100, 000 km^2.

[1] Peng *et al* (2008) *Lithos* **101**, 260-280. [2] Charlier *et al* (2013) *Geochimica et Cosmochimica Acta* **113**, 79–93. [3] Holness *et al* (2011) *Journal of Petrology* **52**, 175–222.