Ore texture and titanomagnetite composition of the Hongge Fe-Ti-V oxide deposit, SW China: implications for the origin of the deposit

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9h. Trace elements in oxide minerals from ore deposits: Petrogenetic interpretation and implications for exploration

The Hongge magmatic Fe-Ti-V oxide deposit in the Panxi region, SW China, is hosted in a layered mafic-ultramafic intrusion. The 2.7-km-thick, lopolith-like intrusion consists of the Lower, Middle and Upper zones, which are mainly composed of olivine clinopyroxenite, clinopyroxenite and gabbro, respectively. Abundant oxide layers mainly occur in the Middle zone and the lower part of the Upper zone.

There are net-textured, massive and disseminated Fe-Ti oxide ores. Fe-Ti oxides include Cr-rich and Cr-poor titanomagnetites and granular ilmenite. Both Cr-rich and Cr-poor titanomagnetites contain ilmenite lamellae. Cr-rich titanomagnetite is usually enclosed in olivine and clinopyroxene of disseminated ores in the lower parts of both the Lower and Middle zones and contains 1.89 to 14.9 wt.% Cr_2O_3 and 3.20 to 16.2 wt.% TiO_2, whereas Cr-poor titanomagnetite typically occurs in net-textured and massive ores of the Middle and Upper zones and contains <0.4 wt.% Cr_2O_3 and 0.11 to 18.2 wt.% TiO_2.

Cr-rich titanomagnetite of the disseminated ores is clearly an early crystallized phase, whereas Cr-poor titanomangetite of the net-textured and massive ores crystallized later. Occurrence of Cr-poor titanomagnetite, granular ilmenite and apatite as clusters in the net-textured ores may have formed from Fe-Ti-(P) rich melts. We propose that these Fe-Ti-(P) rich melts were immiscible in silicate magmas similar to the formation of magmatic sulfide ores and that immiscibility occurred because of oversaturation of Fe, Ti and P during the crystallization of silicate minerals. The segregation of dense Fe-Ti-(P) rich melts behaved like a heavy mineral that settled downward in a silicate crystal mush to form net-textured and massive Fe-Ti oxide ores as part of the cumulate sequence.

The co-evolution of prokaryotes-eukaryotes and ocean chemistry on the North China Craton during Mesoproterozoic (1.6–1.3 Ga)

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The North China Craton is one of the representative research regions for revealing the co-evolution of life and ocean environment during the early-middle Mesoproterozoic (1.6–1.3Ga). Here, we report the results of a comprehensive study including biomarkers, C-S-isotopic and trace elemental compositions, based on high-resolution geochemical sampling from 6 sections and 4 core-drills.

The Mesoproterozoic sedimentary successions on North China Craton record a suit of negative $\delta^{13}C_{carb}$ values, averaging from -2.4‰ to -1.7‰ for the carbonate sequences, which are more negative than the uniform $\delta^{13}C_{carb}$ values (0.0–1.0‰) of the Mesoproterozoic sedimentary successions worldwide [1]. It may suggest that the primary production and organic carbon burial in the North China Carton were extremely low during the Mesoproterozoic, which are probably the main constraints for sustaining an intermediate redox state in the oceans during the Mesoproterozoic Era. The $\delta^{13}C_{org}$ values of the three organic-rich sequences (Gaoyuzhuang, Hongshuizhuang and Xiamaling Fm) are -34.1‰, -32.7‰ and -31.5‰ in avereage, respectively. Likewise, the $\delta^{13}C_{org}$ values are highly homogeneous in each Formation, and present a well coupling with $\delta^{13}C_{carb}$ in the secular variation.

The carbonate sediments usually present eukaryotic biomarker assembly including C_{26}–C_{29} regualr steranes, 4- and 3-m-steranes as well as very lower concentrations of dinosteranes, but the shales have no detectable steranes. Our biomarker data reveal well co-evolutions of eukaryotes/prokaryotes and ocean environments on the North China Craton during the Mesoproterozoic.

Mo concentrations are 4.7, 42.1 and 17 ppm, and Mo/TOC values are 5.0, 8.9 and 5.2 (ppm/wt%) in average for Gaoyuzhuang, Hongshuizhuang and Xiamaling Fm, respectively. The Mo-lean figures are consistent with the Mo enrichment pattern in Mesoproterozoic black shales [2, 3]. The $\delta^{34}S$ values of sulfides decrease from 7.1–20.6‰ in Gaoyuzhuang Fm to -6.3–7.7‰ in Xiamaling Fm, indicating an enhanced S geochemical cycling during Xiamaling period (1.4–1.3Ga).

[1] Frank et al. (2003) *Geol. Mag.* **140**, 397–420. [2] Scott et al. (2008) *Nature* **452**, 456-459. [3] Lyons et al. (2009) *Annu Rev Earth Planet Sci* **37**: 507–534.