# Paleoproterozoic post-orogenic evolution of the North China Craton: Geochemical and isotopic constraints from the Xiyanghe Group along the southern margin of the North China Craton

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There is now a coherent outline of the timing and tectonic processes involved in the Palaeoproterozoic amalgamation and much intensive knowledge concerning the pre-collisional history of the North China Craton. However, much of the post-collisional history of the craton remains unknown. The Xiyanghe volcanics, together with the Xiong'er volcanics, constitute a large Paleo-Mesoproterozoic volcanic belt along the southern margin of the North China Craton. In this study, we provide geochemical and Sr-Nd isotopic data for the Xiyanghe volcanics, which provide important constraints on their petrogenesis and tectonic environment.

The Xiyanghe volcanics could be subdivided into three units: BA1 (basaltic andesites-1), BA2 (basaltic andesites-2) and andesites, all of which show consistent $\varepsilon_{Nd}(t)$, La/Nb and Th/Nb values irrespectively of $SiO_2$, precluding significant crustal contamination during ascent. Based on the covariation between La and $La/Sm_N$, the basaltic andesites show the trend of partial melting processes with the BA1 unit representing the major products of a magma chamber, whereas the andesites may fractionally crystallize from the BA1. The BA1 rocks and andesites show HSFE enrichments (especially Nb>6 ppm) and high Fe-Ti contents, comparable with Nb-enriched basalts, suggesting that the Xiyanghe volcanics were derived from a melt-metasomatized mantle source. The BA2 unit is characterized with variable Ti/Eu, Zr/Sm and Nb/La ratios, suggesting that amphiboles have been involved in a partial melting process, which implies that the Xiyanghe volcanics were derived from hydrous magma. A large range in initial Sr (0.7039 to 0.7111) and a relatively narrow range in $^{143}Nd/^{144}Nd$ ($\varepsilon_{Nd}$=-6.8~-10) suggest inheritance of the enriched Nd-isotopic composition from the mantle wedge metasomatized by slab derived fluid. On the primitive mantle normalized trace-element diagrams, the Xiyanghe volcanic rocks show enrichments in the LILE and LREE and negative anomalies on the Nb-Ta-Ti, similar to arc-related volcanics produced by the hydrous melting of the metasomatized mantle wedge. The arc-related characteristics of the Xiyanghe volcanic rocks suggest that the southern margin of the North China Craton may have recorded the outbuilding history of the Columbia Supercontinent during Paleo-Mesoproterozoic time.

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# Np(V) coprecipitation with calcite

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The actinide elements U, Np and Pu form oxo-cations ('actinyl-cations') in oxidizing aqueous environments. The environmental behaviour of the actinyl ions U(VI), Np(V) and Pu(V,VI) is to a large extend controlled by sorption reactions (adsorption, coprecipitation / structural incorporation) with minerals. We study the structural incorporation of Np(V) into the host mineral calcite by coprecipitation in mixed flow reactors under steady-state conditions at room temperature. In this way reaction rates and partitioning coefficients can be determined under varying conditions. We found that homogeneous partition coefficients for Np in calcite (0.5 - 11) are significantly higher than those reported for U(VI) (0.01 - 0.2 [1]). The local structural environment of incorporated Np(V) is characterized from the Np L3 EXAFS. Measurements are performed at the INE-Beamline at ANKA (Forschungszentrum Karlsruhe). Our data suggest that the Np(V)-ions occupy calcium lattice sites, but with two missing carbonate groups in the first coordination sphere. The two axial oxygen atoms of the linear neptunyl-ions are likely oriented towards these vacant sites. Consequently, only four carbonates are observed to coordinate the Np(V)-ion. Np-O and Np-C interatomic distances (2,41Å, 3,34Å, respectively) indicate slight structural relaxation of the carbonate groups from their ideal sites. A similar structural model was reported for U(VI) incorporated into natural calcite [2].

## References

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