Geochemistry of the Wutai granitoids: Constraints on the tectonic evolution of the Trans-North China Orogen

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As the largest basement exposure across the Trans-North China Orogen, the Hengshan-Wutai-Fuping mountain belt is probably the most promising area for investigating the magmatic-tectonic history of the orogen. The belt consists of the high-grade Hengshan and Fuping Complexes and the intervening low- to medium-grade Wutai Complex in which the Wutai granitoids (2550-2520 Ma) occur as one of the most important components. The Wutai granitoids are composed predominantly of granodiorite and monzogranite, with minor tonalite and trondhjemite. The geochemistry of these rocks indicates that they were derived from middle to high potassium calc-alkaline granitic magma. They exhibit the LILE enrichments and higher Rb/Sr ratios, relatively lower Sr/Y and (La/Yb)n ratios, Nb/Ta and Zr/Hf ratios similar to those of Chondrite, right inclined REE patterns, and depletion in Nb, Ta and Ti. In addition, they have a neodymium T_{DM}=2.54~2.72Ga and pronounced positive $\varepsilon_{Nd}(t)$ values. These geochemical features suggest that the Wutai granitoids formed under an oceanic island arc environment, derived from the partial melting of a juvenile basaltic crust. Comparatively, the Hengshan and Fuping TTG gneiss (2520-2450 Ma) show relatively higher Al_2O_3, Na_2O/K_2O, Sr/Y, (La/Yb)n values, and negative Nb, Ta, Ti and P depletion, similar to other Archean TTG gneisses in the world. Based on these data, we propose a tectonic model for the evolution of the Hengshan-Wutai-Fuping mountain belt.

In the late Archean to Paleoproterozoic, the Hengshan-Wutai-Fuping region was part of a continental margin arc along the western margin of the Eastern Block, which was separated from the Western Block by an old ocean, with subduction of the oceanic lithosphere beneath the western margin of the Eastern Block. At 2550-2520 Ma, the deep subduction caused partial melting of the medium-lower crust, producing large amounts of granitoid magma that was intruded into the upper levels of the crust to form the Wutai granitoids. At 2520-2450 Ma, the subduction beneath the Hengshan-Wutai island arc caused the further partial melting of the lower crust to form large amounts of TTG magmatism that formed the Hengshan and Fuping TTG suites.

Boninitic magmatism in the vicinity of Meso-Neoproterozoic epicratonic Chattisgarh basin, Central India

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Proterozoic mafic dikes near the South-Central margin of Chattisgarh basin, Bastar Craton, Central India have diagnostic petrological and geochemical signatures of boninites such as: presence of small primocrysts of elongate, Mg-rich pigeonite (X_{Mg}=0.81), augite (X_{Mg}=0.79) preserved within a microcrystalline quenched groundmass of ilmenite, (FeO=40.72%,TiO_2=54.09%), quartz and dendritic plagioclase (An_{60-64}); high MgO, Cr, Ni, CO, intermediate SiO_2 contents, high $Mg^{\#}$ (MgO/MgO+FeO*), Al_2O_3/TiO_2 and Zr/Hf/middle REE ratios; low TiO_2, REE and high-field-strength-element contents, and U shaped primitive mantle-normalized trace element patterns. However, unlike modern and ancient boninitic rocks that are typically associated with intraoceanic realms, those from the Chattisgarh region are a part of an intracontinental setting. A northward subduction of oceanic crust into the Bundelkhand craton is proposed. The generation of boninitic magmatism requires unique thermal and petrological conditions such as shallow melting, elevated geothermal gradient and subducted slab flux. On the basis of field geological, petrological and geochemical data on the Chattisgarh Boninitic dykes, a two-stage melting model and derivation from a strongly depleted mantle sources enriched later by metasomatic events is suggested