

Geochemical constraints on tectonic settings for emplacement of Guposhan-Huashan plutons in South China

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Guposhan-Huashan granite occurs as an assemblage of intrusive units as a result of multiple pulses of magma emplacement. Geochemical analysis shows that the granite has N_2O+K_2O content of 6.7%-9.3%, A/CNK values of 1.1-1.5, total REE of 181.5-426.6 ppm, and LREE/HREE values of 2.3-13.2. As a typical plutonic composite, it began with low-K calc-alkaline Niumiao emplacement followed by subsequent emplacement of high-K calc-alkaline Yangmeishan, Lisong, Wanggao, and Xinlu units, and lastly alkaline Baishuidai and Huamei units, at ca.163-148 Ma.

On Hf-Rb/30-Ta \times 3 diagram, each unit is plotted in the post-collision field. On R_1 - R_2 diagram, Niumiao falls in the post-collision uplift field while the rest in the late-orogenic field except that the Baishuidai and Huamei clusters around the boundary between the late-collision and non-orogenic fields. On (Y+Nb)-Rb and Y-Nb diagrams, early units fall in the post-collision field whereas Baishuidai and Huamei in the syn-collision field and clusters around the boundary between the volcanic-arc/syn-collision and intraplate fields. On SiO₂ versus lg(CaO/(K₂O+Na₂O)), Niumiao falls in the contraction field while the rest in the overlap between the contraction and extension fields except for the youngest Baishuidai and Huamei that are in the field of extension. Tectonic discrimination analyses indicate that the composite is of post-collision and emplaced during tectonic transition from a collision regime probably associated with the westward Paleo-Pacific plate subduction below Asian continent, to a continental extension regime. It coincided with the transition from the EW Tethys tectonic domain to the NNE Western Pacific tectonic belt.

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Imaging cation adsorption at aqueous-mineral interfaces

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A fundamental understanding of aqueous-mineral interface reactivity is essential for developing robust predictive models that describe elemental mobility and transport in the near-surface environment. I will describe our recent observations of cation adsorption and uptake at the muscovite- and orthoclase-electrolyte interfaces that were observed using resonant anomalous x-ray reflectivity (RAXR), an element-specific structural tool for imaging vertical cation distributions with sub-Å resolution. The results reveal a surprisingly complex interfacial behaviour in which cations adsorb as a distribution between inner-sphere (IS) and outer-sphere (OS) complexes with an IS:OS fractionation that is controlled by a number of factors including the charge and hydration of both the cation and mineral surface, and solution pH. In particular, systematic observations of a broad range of cations (Rb⁺, Sr²⁺, Pb²⁺, Hg²⁺, Ni²⁺, Zn²⁺, and Cu²⁺) and solution conditions show that the ion hydration enthalpy exerts a systematic control over IS:OS partitioning. Additional measurements of cation uptake and competitive adsorption provide direct insight into the cation adsorption free energy and changes to the cation adsorption geometry with pH and ion concentration.

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