

Baijuhuajian A-type granites in the western Zhejiang Province, SE China: Geochemical and zircon U-Pb and Hf isotope compositions and tectonic implications

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A Late Jurassic A-type granitoid, named Baijuhuajian granite in western Zhejiang Province, SE South China, emplaced along the Jiangshan-Shaoxing fault zone and intruded an Early Jurassic anticline volcanic basin bounded by Sinian sedimentary strata composed of sandstone and siltstone. The granite exhibits a porphyritic texture and is composed of alkaline feldspar phenocrysts, and groundmass of K-feldspar, plagioclase, quartz and biotite. The granite is peraluminous ($A/CNK > 1.1$) and shows A-type geochemical signatures. The granite is characterized by high contents of SiO_2 (>75%), total alkalis ($Na_2O + K_2O \geq 6.3\%$), total REE (223 – 438ppm), HFSE as well as high FeO/MgO ratios (15 – 25). It is also characterized by low contents of CaO (0.57 – 1.02 %) and extremely low contents of P_2O_5 (<0.01%), TiO_2 (0.06 – 0.14%) and Sr (7.23 – 38.81ppm). The fine-grained groundmass with perthite indicates shallow-depth emplacement of a relatively high temperature dry magma. The granite falls into within-plate field in various discrimination diagrams and can be classified as A_2 -type granites, which is indicative of emplacement in a post-collisional setting. These features are similar to the A-type granites from the Lachlan Fold Belt, Southeastern Australia.

U-Pb zircon dating constrains the age of this granite to be 141Ma. Slightly negative $\epsilon_{Nd}(T)$ (-2.46) and negative to positive zircon $\epsilon_{Hf}(T)$ (-0.3 to 4.56) suggest binary mixing of possibly mantle-derived magma and crustal materials.

The tectonic regime was compressional in the Mesozoic prior to the emplacement of the Baijuhuajian granite, resulted from the subduction of Paleo-Pacific plate underneath the SE South China Block. Our results suggest that the tectonic regime in SE South China changed at ~141 Ma, from collisional to extensional settings, leading to upwelling of the asthenosphere and mantle-derived magma interacted with crustal materials before the emplacement along the Jiangshan-Shaoxing fault zone in SE South China.

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Fe-FeS-silicate partitioning of chalcophile and siderophile elements: Implications for core formation

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The concentrations of weakly siderophile and chalcophile elements in the primitive mantle provide important constraints on the conditions of accretion and terrestrial core formation, in particular the possible role of late sulphide addition and of late volatile loss.

In order to explore the possible impacts of these processes, we have determined the partitioning of V, Cr, Cu, Zn, Ga, Nb, Ag, Tl and Pb between Fe-FeS liquids and a range of liquid silicate compositions at 1.5-14 GPa and temperatures of 1280-2300 °C.

Many of the observed variations in partition coefficient are consistent with the known properties of Fe-alloys. For pure Fe metal coexisting at 1700 °C with a silicate melt of mantle FeO content, the metal/silicate partition coefficients are as follows: V(0.12), Cr(0.3), Cu(36), Zn(0.9), Ga(6), Nb(0.015), Ag(20), Tl(1.1) Pb(3.5). Adding C (at graphite saturation) to the metal increases Metal/silicate partition coefficients of Nb by an order of magnitude, those of V and Cr by a factor of 3, has small negative effects on Cu and Zn and larger negative effects on Ag and Pb partitioning. On going from Fe to FeS liquid the sulphide/silicate partition coefficients change approximately to: V(0.6), Cr(0.9), Cu(100), Zn(2), Ga(3), Nb(0.4), Ag(100), Tl(40), Pb(35).

Using these and literature data, a protracted period of accretion under reducing conditions appears to be required to satisfy the observed V and Cr contents of the mantle. This type of accretion path leads to around 30% of earth's Nb residing in the core. Application of these constraints to the other elements indicates that late sulphide addition to the core can explain the Pb and Tl contents of the mantle and their isotopic signatures, but the amount required (1.5-2%) seems precluded by the strongly chalcophile nature of Cu.