Annular crustal accretion and reworking around the Yangtze nuclei during Neoproterozoic: A link to the initiation and termination of annular subduction of oceanic crust

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Subduction zones are primary sites of crustal growth and thus subsequent continental accretion on the Earth. In the modern cases, continental crustal growth along subduction zones generally takes place at one side of continental margins. However, the Yangtze Block provides us an annular style for the crustal growth and subsequent continental crust accretion during the late Mesoproterozoic to early Neoproterozoic. A series of lithologic associations at the time, including ophiolites, arc basalts, blueschist-facies metamorphic rocks, S-type and I-type granites, and high-K volcanic rocks, occur along the margins of the Yangtze Block. Hf isotopes in zircons from Neoproterozoic magmatic rocks around the Yangtze Block suggest growth of juvenile crust at ca. 0.95-1.3 Ga, indicating an annular subduction of oceanic crust around the Yangtze nuclei. The arc terranes may be accreted to the margins of the Yangtze Block during arc-continent collision of 0.95-0.86 Ga, with some newly-formed arc-derived rocks immediately remelted to generate syn-collisional volcanic rocks and granites. A subsequent giant reworking event of juvenile and old crustal materials took place at 0.85-0.80, which may be resulted from the upwelling of deep mantle and extension of lithosphere due to the termination of annular subduction. The mafic rocks of 0.85-0.80 Ga generally show geochemical features similar to the typical arc basalts, suggesting their sources may have been metasomatized during early subduction. The 0.95-0.86 Ga arc-continent collision and associated remelting has provided an efficient way not only for growth of continental nuclei during the late Precambrian, but also for chemical differentiation of crustal composition from basaltic to granitic ones.

Nature of mantle lithological heterogenity and its role in generation of ca. 825Ma komatiitic basalts, South China

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We present here a comprehensive Os-Hf-Nd isotopic study of the ca. 825 Ma Yiyang komatiitic basalts in central South China Block. The Yiyang komatiitic basalts are typical plume-originated high-MgO lavas, and characterized by highly radiogenic Os isotopes (γOs(t) = +11 to +133) coupled with relatively high Os contents (mostly > 0.3 ppb). Mass-balance calculations show that such Os isotopic signatures in high-Os concentration samples are reflective of their source characteristics. These lavas are enriched in highly compatible elements (e.g., MgO >10%, Ni >182 ppm, and Cr>667 ppm) with over-saturated silica contents (mostly 50-53% SiO_2), typical of pyroxene-derived melts. The presence of pyroxene in mantle source is also supported by the following tight correlations: (1) γOs(t) vs. elemental (TiO_2, Al_2O_3 and trace elements) abundances; (2) major elements (e.g., Al_2O_3, MgO and FeO^T) vs. highly incompatible trace element ratios (e.g., Nb/U, Nb/La and Nb/Th); and (3) MgO vs. Al_2O_3 and FeO^T. The occurrence of negative Nb-Ta-Ti anomalies in the lavas which show affinities to that of the average of global subducted sediment (GLOSS), and decoupling of Hf and Nd isotopes featured by extremely unradiogenic Nd isotopic compositions (εNd(t) = -1.1 to -3.1) with radiogenic Hf isotopic compositions (εHf(t) = +4.6 to +5.3), together suggest that the Yiyang mantle source contains a recycled continental crust-derived component. The slope of the εHf vs. εNd correlation is shallower for the Yiyang komatiitic basalts than for the Hawaiian island basalts or the global OIB array, which may be due to a variable ratio of recycled sediments in the mantle source. A batch melting simulation also confirmed that the pyroxenitic veins plus recycled sediments played important roles in generating the Yiyang komatiitic basalts. These basalts provide a rare opportunity for the investigation of the exact origin of chemical and isotopic heterogeneity of the Earth's mantle.