Nature and Evolution of Crust in Southern Lhasa, Tibet: Transformation from Microcontinent to Juvenile Terrane

LIN MA[12], ANDREW C. KERR[2], QIANG WANG[1]

[1] State Key Laboratory of Isotope Geochemistry, Guangzhou Institute of Geochemistry, Chinese Academy of Sciences, Guangzhou 510640, China. E-mail: malin@gig.ac.cn

[2] School of Earth and Ocean Sciences, Cardiff University, Cardiff, Wales CF10 3AT, United Kingdom

The continental crust is the primary archive of Earth history and provides a synoptic view deep into Earth history. However, information on the origin and evolution of continental crust, in addition to the rate of growth, is fragmented, as large volumes of continental crust have been reworked and recycled back into the mantle by a variety of processes.

The nature and pre-Cenozoic evolution history of crust in southern Lhasa, which is crucial for our understanding of continental collision and Tibetan uplift during the Cenozoic, remains controversial due to a “missing” pre-Mesozoic magmatic record. In this contribution, we report petrological and geochemical data for newly identified Paleozoic bimodal magmatism in the Zhengga area of southern Tibet. The magmatism comprises Late Devonian–Early Carboniferous (366–353 Ma) amphibolite and two-mica gneissic granite. The protoliths of the Zhengga amphibolite were gabbro and diorite with low SiO_2 and high MgO, Cr and Ni contents with high $\varepsilon_{Nd}(t)$ values of +3.3–+8.0, variable and positive zircon $\varepsilon Hf(t)$ of +0.9–+11.2 and low zircon $\delta^{18}O$ of 5.7±0.2‰. These protoliths are proposed to have formed by decompression melting of asthenosphere during intra–continental back–arc extension. In contrast, the granite has relatively high SiO_2 and low MgO contents with much lower $\varepsilon_{Nd}(t)$ of -8.6 to -7.3, variable and negative zircon $\varepsilon Hf(t)$ of -10.4 to -1.3 and high zircon $\delta^{18}O$ of 9.4±0.2‰ values and was most likely derived from an ancient metasedimentary source. This magma subsequently underwent recharge with minor amounts mafic magma followed by fractional crystallisation of K-feldspar in mid-upper crust (~10–20 km) magma chambers.

Using our new data, in combination with Nd-Hf isotopes, we present the first comprehensive model of crustal evolution in southern Lhasa. The southern Lhasa sub-block is likely to have been a microcontinent that underwent extensive Phanerozoic crustal reworking and growth, rather than a Mesozoic–Early Tertiary juvenile accretionary arc terrane.