Association of granitic magmatism in the Songpan-Garze fold belt, eastern Tibet Plateau: Implication for lithospheric delamination

HONG-FEI ZHANG[1] NIGEL HARRIS[2] RANDY PARRISH[3] AND LI ZHANG[1]

[1] Faculty of Earth Sciences, China University of Geosciences (hfzhang@cug.edu.cn; lizhang@cug.edu.cn)
[2] Department of Earth Sciences, The Open University; (n.b.w.harris@open.ac.uk)
[3] NERC Isotope Geosciences Laboratory, British Geological Survey (rrp@nigl.nerc.ac.uk)

The Songpan-Garze fold belt covers a huge triangular area (>200,000 km^2), confined by the South China (Yangtze), the North China and the Tibetan continental blocks. In the northeastern part of the Songpan-Garze fold belt, U-Pb zircon SHRIMP dating establishes magma crystallization ages of 221±4 Ma and 216±6 Ma for the Yanggon and Maoergai granitoids, respectively. These granitoids (SiO_2=66.9-74.15%) are enriched in Sr, but are depleted in Y and HREE. Their REE compositions show strongly fractionated patterns with $(La/Yb)_N$=25.6-70.6 and Eu/Eu*=0.43-0.93. Isotopic ratios, with Isr=0.7061-0.7082 and $\varepsilon_{Nd}(t)$=-6.0 to -9.5, are strongly indicative of a crustal source. The high Sr and low HREE features are characteristic of K-type adakite, suggesting that the magma generation of the Yanggon and Maoergai granitoids resulted from partial melting of thickened lower crust during convergence between the South China, the North China and the Tibetan continental blocks.

In the middle part of the Songpan-Garze fold belt, we have sampled an undeformed biotite-amphibole granite (Nianbaoyech). Using both LA-ICPMS and TIMS U-Pb zircon dating methods, the magma crystallization age of the Nianbaoyech granite was determined to be 211±1 Ma, which is close to an upper age limit of the Triassic K-type adakitic granitoids (216-221 Ma). The Nianbaoyech granite is characterized by high Si, K, Na, Rb, REE, HFSE (Nb, Ta, Zr, Hf) and Ga/Al ratios but is depleted in Al, Mg, Ca, Ba and Sr. The REE compositions show slighly fractionated patterns with $(La/Yb)_N$=2.67-7.54 and Eu*/Eu=0.09-0.34. Geochemical data indicate that the Nianbaoyech granite is A-type granite. Sr-Nd isotopoic compositions for the granite display Isr=0.7090-0.7123 and $\varepsilon_{Nd}(t)$= -2.72 to -4.26, suggesting that the magma could be derived from crustal sources, but some contribution from an enrichment-mantle source can not be ruled out.

Our geochemical and field studies suggest that both groups of granitoids were formed in a post-collisional environment, largely from melting of the lower crust, consistent with a lithospheric delamination model.