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Discussion

A-type granite and adakitic magmatism association in Songpan-Garze fold belt, eastern Tibetan Plateau: Implication for lithospheric delamination: Comment

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There is intensive debate on the tectonic nature and evolution of the Songpan-Garze terrane, a main tectonic unit in central China. It has been proposed that it evolved during the Late Triassic as a remnant oceanic basin (e.g., Zhou and Graham, 1996), an oceanward extension of the passive continental margin of the Yangzi craton (e.g., Nie et al., 1994; Zhang, 1997; Zhang et al., 2006), a back-arc basin (e.g., Zhang et al., 1984), or a continental block extruded from between the North and South China blocks along the Qinling suture (Zhang, 2001, 2002). We consider that a main reason for such a variety of discrepancies is poor accumulation of data in this area.

Recently, Zhang et al. (2007) reported the occurrence of an A-type granite dated at 211±1 Ma, as well as Triassic adakitic granitoids (216–221 Ma) in the Songpan-Garze terrane. Furthermore, based on geochemical data and U–Pb zircon ages, as well as regional studies, they concluded that the association of A-type granite and adakitic granitoids in the Songpan-Garze terrane was produced in post-collisional tectonic environment. That is, melting to produce the A-type granite and adakitic magmatism association may have resulted from Triassic lithospheric delamination after Triassic crustal thickening of the Songpan-Garze terrane due to convergence between the Yangtze, North China and North Tibet continental blocks.

The chronological, geochemical, and isotopic data of the Triassic magmatism in the Songpan-Garze terrane presented by Zhang et al. (2007) are excellent and timely, however, we doubt their conclusions that such association of A-type granite and adakitic granitoids was related to a post-collisional tectonic environment, mainly based on the following two reasons.

(1) It is generally accepted that the Songpan-Garze terrane accumulated a flysch turbiditic succession with an average thickness of up to 10 km during Ladinian through Norian times (~230–203 Ma;

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e.g., Huang and Chen, 1987). This has been confirmed by broad paleontological investigations (e.g., Huang and Chen, 1987; Qinghai Bureau of Geology and Mineral Resources, 1991; Sichuan Bureau of Geology and Mineral Resources, 1991). Recent studies of detrital white mica $^{40}Ar/^{39}Ar$ ages and detrital zircon U/Pb ages of the flysch turbiditic succession support that the flysch sequence was deposited throughout most of the Songpan-Garze area until the end of the Triassic (e.g., Bruguier et al., 1997; Weislogel et al., 2006; Enkelmann et al., 2007). This Triassic flysch turbiditic succession was accumulated conformably on the Triassic–Paleozoic passive continental margin or its oceanward extension (e.g., Huang and Chen, 1987; Qinghai Bureau of Geology and Mineral Resources, 1991; Sichuan Bureau of Geology and Mineral Resources, 1991). It is generally accepted that North China collided with South China along the Qinling (-Kunlun) suture during the early Mesozoic in a scissor-like pattern, and the Qinling (-Kunlun) Tethys did not close in the Songpan-Garze segment until the Early–Middle Jurassic (e.g., Zhang, 1997). Likewise, there is evidence that the Jinsa Paleo-Tethys on the south of the Songpan-Garze terrane did not close until the Early Jurassic (e.g., Yin and Harrison, 2000; Zhang et al., 2002, 2006). Therefore, we believe that there is no continent–continent or arc–continent collisional event(s) occurring around the Songpan-Garze terrane through Triassic time. Moreover, such collisional event must have been accompanied with an instantaneous termination of the Triassic flysch turbiditic deposition in the Songpan-Garze terrane, because, as Zhang et al. (2007) postulated, such compressional event must have resulted in intense crustal thickening and thus strong relief elevation. However, as stated above, such an instant termination of the turbidite deposition was not observed.

(2) Neither A-type granite nor adakitic magmatic rocks undoubtedly define a post-collisional tectonic environment related to lithospheric delamination after crustal thickening. A-type granites usually form in an extensional environment, and often occur in an anorogenic setting (e.g., Barbarin, 1999) or in a postorogenic environment within 10 to 20 million years of an orogenic event (subduction or continent–continent collision) (e.g., Eby, 1992). As originally defined, adakitic magmatic rocks represent products of partial melting of subducting oceanic crust (Defant and Drummond, 1990). These adakitic rocks often have distinct geochemical and isotopic signals of continental materials, as revealed in the Japanese arc (Shimoda et al., 1998) and in Antarctica (Vaughan et al., 1997). Therefore, alternatively, we consider that these Songpan-Garze adakitic magmatic rocks as well as the A-type granite could be related to the northward subduction of the Jinsa Tethys (Zhang et al., 1984).

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