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Late Triassic granitoids of the eastern margin of the Tibetan Plateau: Evidence for the non-subduction origin of magmas with "adakitic" affinity

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There has been considerable debate over the origins of magmas that have geochemical affinities with what have become known as adakites. The eastern Margin of the Tibetan Plateau experienced extensive plate collision and crustal deformation from the Late Triassic, and records the convergence between the Indian and Eurasian plates. This area is one of the most important windows through which we can examine the processes of continental collision, magmatism and basin evolution. The Songpan-Garzê Fold Belt (SGFB) lies at the junction between three lithospheric plates; the South China Block, the North China Block and the Tibetan Plateau. Here, the Late Triassic granitoids (230 – 220 Ma; LA-ICPMS zircon U-Pb) fall into two petrological groups. Group 1 are high-K calc-alkaline rocks with "adakitic" affinities (K-adakites). These have Sr $>$ 400 ppm, Y $<$ 11 ppm, steep REE patterns ($(La/Yb)_N$= 32-105) and high K_2O/Na_2O ($\approx$ 1). Group 2 are ordinary high-K calcalkaline I-types with lower Sr ($<$ 400 ppm), higher Y ($>$ 18 ppm) and much flatter REE patterns ($(La/Yb)_N < 20$). Rocks of both groups have similar negative Eu anomalies (Eu/Eu* = 0.50 to 0.94) and initial $^{87}Sr/^{86}Sr$ (0.70528 to 0.71086), but group 1 rocks have higher εNd_t (-1.01 to -4.84) than group 2 (-3.11 to -6.71). Calculated initial Pb isotope ratios for both groups are: $^{206}Pb/^{204}Pb$ = 18.343 to 18.627, $^{207}Pb/^{204}Pb$ = 15.610 to 15.705 and

$^{208}Pb/^{204}Pb$ = 38.269 to 37.59. The available evidence, including experimental studies suggests that Group 1 magmas were derived through partial melting of thickened and delaminated TTG-type, eclogitic lower crust, with some contribution from juvenile enriched-mantle melts. The experimental evidence suggests that the crust here had a thickness of up to 60 km, at the time of Group-1 magma generation. The Group 2 magmas were most probably generated by partial melting of lower crustal rocks at shallower levels. The inferred magma sources of both Groups suggest that the basement of the SGFB was similar to the exposed Kangding Complex, and that the SGFB was formed in a similar manner to the South China basement. Here, passive margin crust was greatly thickened and then delaminated, all within a very short time interval ($\sim$ 20 Myr). Such post-collisional crustal thickening could be the tectonic setting for the generation of many magmas of "adakitic" affinity, especially where they occur in regions where no apparent spatial and temporal association with subduction is.