Petrogenesis of Indosinian volcanic rocks in Songpan-Garze fold belt, Western China: New evidence for lithospheric delamination

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In the Songpan-Garze fold belt, an Indosinian lithospheric delamination model has been proposed based on previous investigation on widespread granitoids. This presentation reports U-Pb zircon LA-ICP-MS ages, geochemical and Sr-Nd-Hf isotopic compositions from the Aba and Wasai volcanic rocks in the central Songpan-Garze fold belt. These volcanic rocks are calc-alkaline andesites. Obtained magma crystallization ages are 210±3 Ma for the Aba andesite and 205±1 Ma for the Wasai andesite, which are consistent with magma crystallization ages of the Late Indosinian granitoids in the Songpan-Garze fold belt. They formed in a post-collisional tectonic setting. The Aba and Wasai andesites are distinct in geochemical singnatures. The former has higher Al_2O_3, K_2O, Rb but lower Na_2O, Ba and Sr contents, suggesting their different magma evolution. The Aba andesites have I_{Sr} values of 0.7070~0.7076 and ε_{Nd} (t) values of -3.90 to -5.34, and the Wasai andesites have initial $^{87}Sr/^{86}Sr$ ratios (I_{Sr}) of 0.7075~0.7077 and ε_{Nd} (t) values of -3.55 to -3.92. Zircon Hf isotopic data show ε_{Hf} (t) values of -3.7 to +0.3 for the Aba andesites and -2.7 to +5.5 for the Wasai andesites. Geochemical and Sr-Nd-Hf isotopic compositions indicate that fractional crystallization and crustal assimilation processes are not key roles for their magma evolution, implying that their chemical compositions would be those of primary melts. We suggest that the magma of the Aba andesites were dominantly originated from a crustal source, with minor mantle-derived component. The magma generation location is likely at the boundary between crust and mantle. The magma of the Wasai andesites resulted from partial melting of lithospheric mantle, which was probably metasomatized by amphibole-bearing fluid. The petrogenesis of the Aba and Wasai andesites provides an additional evidence for the lithospheric delamination in the the Songpan-Garze fold belt, indicating that the lithospheric delamination invoked mantle asthenosphere upwelling and resulted in the partial melting of residual lithospheric mantle.

U-Pb zircon dating of coesite-bearing eclogites from the Dulan area of the North Qadiam HP/UHP terrane, northwestern China: New constraints on ages of UHP metamorphism and protoliths

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Coesite- and kyanite-bearing eclogites from the Dulan UHP metamorphic unit, North Qaidam Mountains of western China, contain zircons that record protolith crystallization and UHP metamorphism. Most of the zircons are weakly zoned or unzoned, and some zircons contain CL-dark and oscillatory zoned cores, surrounded by unzoned, CL-grey or -bright rims. SHRIMP and LA-ICPMS U-Pb analyses from zircon cores in coesite-bearing eclogite yield scattered $^{206}Pb/^{238}U$ ages of 436-758Ma with an upper intercept age of 838 ± 50 Ma, and 8 concordant analyses from oscillatory zoned cores in kyanite-bearing eclogite gave $^{206}Pb/^{238}U$ ages ranging from 804 ± 9Ma to 866 ± 7 Ma with a weighted mean age of 832 ± 20 Ma. These zircon cores yield steep HREE slopes and negative Eu anomalies that suggest a magmatic origin. We thus interpret >800Ma as the eclogite protolith age. Unzoned zircons and zircon rims from four samples yield weighted mean ages of 430-446 Ma, flat HREE patterns without Eu anomalies, and contain inclusions of garnet, omphacite, rutile, phengite, and rare coesite. We thus interpret these ages to record HP/UHP eclogite facies metamorphism. These new data suggest that, similar to eclogites in other HP/UHP units of the North Qaidam Mountains and South Altyn Tagh, eclogites in the Dulan HP/UHP metamorphic unit formed in a continental setting during the Neoproterozoic, and then subducted to mantle depth together with continental materials during the Early Paleozoic.