Petrogenesis of Early to Middle Jurassic granitoid rocks from the Gangdese belt, Southern Tibet: Implications for early history of the Neo-Tethys

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The Gangdese belt, Tibet, records the opening and closure of the Neo-Tethyan ocean and the resultant collision between the Indian and Eurasian plates. Mesozoic magmatic rocks generated through subduction of the Tethyan oceanic slab constitute the main component of the Gangdese belt, and play a crucial role in understanding the formation and evolution of the Neo-Tethyan tectonic realm. U-Pb and Lu-Hf isotopic data for tonalite and granodiorite from the Xietongmen－Nymo segment of the Gangdese belt indicate a significant pulse of Jurassic magmatism from 184 Ma to 168 Ma. The magmatic rocks belong to metaluminous medium-K calc-alkaline series, characterized by regular variation in major element compositions with SiO_2 of 61.35%-73.59%, low to moderate MgO (0.31%-2.59%) with Mg# of 37－45. These magmatic rocks are also characterized by LREE enrichment with concave upward trend in MREE on the chondrite-normalized REE patterns, and also LILE enrichment and depletion in Nb, Ta and Ti in the primitive mantle normalized spidergrams. These rocks have high zircon ε Hf(t) values of +10.94 to +15.91 and young two-stage depleted mantle model ages (TDM_2) of 192 Ma to 670 Ma. The low MgO contents and relatively depleted Hf isotope compositions suggest that the granitoid rocks were derived from the partial melting of the juvenile basaltic lower crust with minor mantle materials injected. In combination with the published data, it is suggested that northward subduction of the Neo-Tethyan slab beneath the Lhasa terrane began by the Late-Triassic, which formed a major belt of arc-related magmatism. We conclude that:

(1) A Jurassic medium K calc-alkaline series of magmatism dominatedby tonalite and granodiorite were produced from 184 to 168 Ma. In combination with the published data, we suggest that magmatic activity may extend from 205 Ma to 152 Ma.

(2) The Jurassic granitoid rocks have a large range in MgO contents (0.31% to 2.59%) and high Mg# (37－45), $(La/Yb)_N$ ratios (1.86－11.0) and $(Gd/Yb)_N$ ratios (0.92－1.35), with highly depleted Hf isotopic compositions (ε Hf(t) = +10.94 to +15.91), indicating that the Jurassic granitoid magmas originated from the partial melting of the juvenile basaltic lower crust with the hornblende and garnet preserved as residuals of the partial melting, and with minor mantle melt input.

(3) The Neo-Tethyan slab subducted northward beneath the Lhasaterrane from the beginning of the late Triassic, which produced the Late Triassic－Jurassic arc magmatism.