Late Permian bimodal volcanic rocks in the northern Qiangtang, central Tibet: Evidence for the interaction between Emeishan plume and Paleo-Tethyan subduction system

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Many studies provide compelling evidence for a fossil mantle plume beneath the Late Permian Emeishan large igneous province located near the southeastern margin of the central Tibetan Plateau, a region characterized by the development of the Paleo-Tethyan subduction system. However, little is known about whether direct plume–subduction interaction occured in the Late Permian. Here, we report the geochronological, mineralogical, geochemical, and Sr–Nd–Hf–O isotopic data for the Late Permian (ca. 259–256 Ma) bimodal volcanic rocks (BVRs) in the northern Qiangtang Terrane (NQT), central Tibet. These BVRs consist mainly of basalts, rhyolites, and rhyolitic tuffs. The rhyolites with A-type affinity were generated by partial melting of newly underplated basalts. Geochemical and isotopic tracing suggests that two components (ocean island basalt [OIB]-type mantle and subducted sediment-derived fluid) have been involved in the generation of the basalts in extensional back-arc region. Combined with the Permian tectonic evolution of the NQT, we propose that this enriched OIB component within mantle wedge prior to subduction modification, relative to the Paleo-Tethyan depleted upper mantle, most likely originated from the Emeishan-plume source material, which flows westward from the South China Block to the nearby NQT driven by slab rollback-induced counterflow. The presence of high-temperature A-type rhyolites in bimodal back-arc magmatism also coincides with a special subduction setting influenced by a nearby plume. Thus, the Late Permian BVRs may be a manifestation of the interaction between the Emeishan plume and Paleo-Tethyan subduction system.