Mantle Evolution from Plate Subduction to Post-orogenic Extension: Evidence from Permo-Triassic Mafic Dike Swarms in Northern Tibet Plateau

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Five large mafic dike swarms have been discovered within the ~270 km-long Xiangride-Golmud segment of the East Kunlun belt, Northern Tibet Plateau, which are named, from east to west, the Balong, Binggou, Xiaomiao, Bairiqili and Nanshankou dyke swarms. The number of dikes in a given swarm can vary from 10 to 42, and the width of individual dikes ranges from 0.1 to 5 m. Most of the dikes trend N-S. The widest dikes are clearly banded with coarser textures and more phenocrysts in the middle portions than in the margins. Most of the dikes are porphyritic diabase with the coarser-grained varieties grading into diorites. All of the mafic dikes are composed chiefly of clinopyroxene, plagioclase and amphibole.

Based on the field relationships, hornblende Ar-Ar and zircon U-Pb dating we consider that the dike swams were formed in three episodes; Early Permian, late Permian and Triassic to Late Triassic. The Xiaomiao (277 Ma) and Binggou (225 Ma) mafic dikes are calc-alkaline in composition with low ∑REE (＜100 ppm) and relatively flat, chondrite-normalized REE patterns with no Eu anomalies. These rocks also have low Ni, Cr and V but are enriched in Rb, K, Pb and P, and depleted in Nb and Ta. In contrast, the Balong dike swarms (253 Ma) have high ∑REE (~100 to >150 ppm） and are enriched in HREE, with higher trace element contents than the other dikes. The Xiaomiao and Binggou dike swarms have similar Sr-Nd isotopic characteristics with ISr = 0.707-0.711 and εNd(t) ranges from -3.4 to 3.9, whereas the Bairiqili (251 Ma) and Balong dikes have somewhat more enriched and variable compositions, with ISr = 0.709-0.719 and εNd(t) ranging from -7.8 to -3.6. The geochemical similarities of the Permin –Triassic East Kunlun, South Qiangtang and north Himalaya dike swarms and basalts indicate that the north boundary of Gondwana reached the East Kunlun block at that time.

Further study of these dike swarms should lead to a better understanding of the influence of subducted slabs on the mantle source and subduction mechanics during the evolutionary stage between the Paleo-Tethyan oceanic plate subduction and post-orogenic extension.

Heterogeneous mantle sources of the alkaline-tholeiitic intraplate basalts from the Aleppo Plateau, NW Syria

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Mantle-derived magmas are characterised by considerable chemical and isotopic variability that is difficult to reconcile with partial melting of a peridotite mantle alone. This reflects the presence of heterogeneities in the mantle, originated from, for instance, recycled oceanic crust or metasomatised lithosphere [1, 2, 3]. Identification of such heterogeneities and thus the mineralogy of the mantle source becomes more ambiguous because both crustal contamination and crystal fractionation may mask important source characteristics.

We present age, chemical and isotopic data to constrain the source and the chemical evolution of the continental alkaline-tholeiitic intraplate magmas from the Aleppo Plateau and vicinity, NW Syria. With the aid of new $^{40}Ar/^{39}Ar$ ages, two phases of volcanism have been recognised in the Miocene, ~19-18 Ma (Phase 1) and ~13.5-12 Ma (Phase 2), in the studied area. The chemical and isotopic compositions [$^{87}Sr/^{86}Sr$ = 0.7036-0.7051, $^{143}Nd/^{144}Nd$ = 0.51269-0.51287 and $(^{187}Os/^{188}Os)_t$ = 0.151-0.453] of the lavas reflect the unequivocal influence of crustal assimilation and fractional crystallisation. However, it is interpreted that the two phases of volcanism likely sampled a mineralogically heterogeneous source, as reflected by their compositional variations seen in the most-primitive, least contaminated magmas. Such variations are: (1) relatively high Si, low Ti and trace-element contents in the Phase 1 lavas, consistent with partial melting of a largely peridotitic mantle source; (2) relatively low Si, high Ti, Fe, Ca, P, alkalis, and L-MREE/HREE, plus sub-chondritic Th-(U)/Nb, Pb/Ce and Zr/Sm in the Phase 2 lavas, approaching compositions of experimental melts of amphibole-rich metasomatic veins [3]. Thus, it is inferred that the Syrian lithosphere had been pervasively metasomatised and contained veins of amphibole-rich cumulates shortly before volcanism, and that the changing compositions of the Phase 1 to Phase 2 lavas (increasing Si-undersaturation) reflected an increasing contribution from the metasomatic vein-derived melts.

[1] Hofmann (1997) *Nature* **385**, 219-229. [2] Jackson & Dasgupta (2008) *EPSL* **276**, 175-186. [3] Pilet *et al*. (2008) *Science* **320**, 916-919.