

Shallow reservoir processes in magma plumbing system could be critical hub of the continental arc differentiation

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Magmatic plumbing system implies that has undergone complex processes during its ascent from the mantle to shallower crustal levels. However, little unknown as to how are the shallow reservoir processes in the magma plumbing system regulate the continental arc differentiation. Those well-developed early-Cretaceous hornblendites, gabbros, diorites, granodiorites, and high-silica granites in the SE Tibetan Plateau are the ideal natural target to better understand continental arc differentiation in magma plumbing system. High-precisely SIMS zircon U-Pb data indicates that the gabbro (ca. 130.7 ± 1.2 Ma, N=46), diorite (ca. 134.0 ± 1.1 Ma, N=64), granodiorite (ca. 131.2 ± 0.4 Ma, N=57) and high-silica granite (ca. 131.6 ± 0.9 Ma, N=37) could be formed within ca. 4 Ma, although hornblendite could be late (ca. 127.3 ± 0.4 Ma, N=137). Thermobarometer result of hornblendes and clinopyroxenes indicates that both hornblendites, gabbros, diorites and granodiorites are crystallization at shallow mid-upper crustal magma reservoirs (ca. 700-850°C and 2-5 kbar). Bulk geochemistry data from mafic gabbros to felsic granites are well similar to those of typical calc-alkaline continental arc magmas. In situ zircon Hf-O isotopes from gabbros to granites show typical ancient crustal signatures, implying the primitive magmas could be derived from an enriched lithosphere mantle that metasomatized by ancient recycling crustal sediments. This could be supported by high Th/La and Th/Yb but low Lu/Hf ratios in the gabbros-diorites. The decreasing Dy_N/Yb_N ratios and Eu and Sr content implied the hornblende- and plagioclase-dominated fractional crystallization processes during their ascent and evolution. The presence of high $X_{An}(30-70)$ plagioclase and variable Eu anomalies (0.4-1.6) in the high-silica granites could be the result of the entrainment of plagioclase from mafic magmas during high-silica melt extraction. This well proved that the high-silica granitic magmas could be directly differentiated from mantle-derived magmas. This study demonstrates that, besides low-crustal magma reservoirs in the deep, the shallow mid-upper crustal reservoirs could be another important hub to regulate the continental arc differentiation and composition variation in the trans-crustal magmatic plumbing system.