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Partial melting of the mélange for the growth of andesitic crust indicated by the Early Cretaceous arc dioritic/andesitic rocks in southern Qiangtang, central Tibet

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Deciphering the petrogenesis of andesitic/dioritic rocks is fundamental to understanding the formation of the continental crust. Here we present the detailed petrology, geochronology, major and trace element, Sr–Nd–Hf–O isotope data for the Early Cretaceous (ca. 122 Ma) dioritic rocks in the Bizha area in southern Qiangtang, Tibet. The dioritic rocks are characterized by large ion lithophile elements, Pb and light rare earth elements but depletion of high field strength elements with slightly enriched and variable εNd(t) values of -0.01 to -3.31 and initial 87Sr/86Sr isotopic ratios of 0.7053 to 0.7062. They also have variable magmatic zircon Hf-O isotope compositions (εHf(t) = -5.3 to +3.6 and δ18O = 7.3 to 9.5 ‰. Combined with contemporary andesitic lavas in southern Qiangtang, we suggest that the intermediate magmatic rocks in this area were most probably derived by partial melting of the mélange, which is a mixture of the middle oceanic ridge basalts (MORBs), sediments and mantle wedge peridotites, formed along the interface between the subducted slab and the overlying mantle wedge in a subduction channel before $\sim$ 124 Ma. The mélange diapir melting was triggered by the asthenospheric upwelling and hot corner flow caused by roll-back of the northward subducted Bangong-Nujiang oceanic slab during the Early Cretaceous. The Early Cretaceous intermediate magmatic rocks in southern Qiangtang have an overall continental crust-like andesitic composition. Therefore, partial melting of the mélange provides an important support for the generation of andesitic magmas in continental arcs and the “andesite model” for crustal growth.