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Mid-Neoproterozoic magmatic evolution in the northeastern margin of the Indochina block, SW China: Geochronological and petrogenetic constraints and implications for Gondwana assembly

Qi, X.X.¹, Zhu, L.H.², Zhao, Y.H.³, Zhang, C.⁴, Ji, F.B.¹ and Wei, C.¹

¹Institute of Geology, Chinese Academy of Geological Sciences, Beijing 100037, China.

E-mail: qxuex2005@163.com

²Guangdong nonferrous metals geological exploration, Gongzhou 510080, China

³Nanjing Institutes of Geology and Mineral Resources, CGS, Nanjing 210016, China

⁴Tanjing Institutes of Geology and Mineral Resources, CGS, Tanjing 300170, China

The mid-Neoproterozoic medium- to high-K calc-alkaline magmatic rocks in the northeastern margin of the Indochina block, SW China, provide important insights into the relationship of the Indochina block with the Gondwana supercontinent. Here we report zircon LA-ICP-MS U-Pb data from the early and late stage plutons which yield weighted mean $^{206}\text{Pb}/^{238}\text{U}$ ages of 754-769Ma and 732-739Ma suggesting mid-Neoproterozoic emplacement. The zircon $\varepsilon_{\text{Hf}}(t)$ values show a range of -7.9 to +8.2 with T_{DM}^{C} of 1128 to 1870 Ma for the early plutons, and -5.4 to +5.1 with T_{DM}^{C} of 1366 to 1985 Ma for late plutons. Both groups show similar geochemical characteristics including high $\text{Mg}^{\#}$, enrichment of LILE and LREE, slight negative Eu anomalies, and strongly negative Nb, Ta, (P) and Ti anomalies, with all the samples falling within the continental/island arc field in tectonic discrimination diagrams. Besides, an arc affinity is strongly supported by the features of high-alumina basalt and abundant hornblende in a large hornblende-gabbro sill for the early plutons.

The Hf isotopic data and geochemical signatures compare the early and late stage magmatic rocks with typical calc-alkaline magmas generated by the mixing of mantle-derived magma and crust-derived magma in different proportion in active continental margins within a subduction-related continental-arc tectonic setting. The linear zoning and roughly parallel distribution of the two generations of intrusions with a hiatus of 20 Ma might suggest an episode of ridge subduction with asthenosphere upwelling through the slab window that generated the second phase of plutons.

The extensive subduction-related mid-Neoproterozoic igneous suites reported from along the northwestern margin of Greater India, and the mid-Neoproterozoic protolith of the Precambrian HP metamorphic rocks from the North Lhasa terrane, marking the collisional zone between northeastern Africa and northwestern India, are similar to those in the northeastern margin of the Indochina, suggesting a similar history and synchronous episode of crustal growth/recycling during that time. Especially, the age distribution patterns of pre-Carboniferous detrital zircons from Indochina blocks are similar to those from the Greater India also. We thus propose the juxtaposition of Greater India and Indochina in the Gondwana reconstruction.

