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Geochronological constraints of the Paleoproterozoic tectonics of northern Indian plate in northern Pakistan

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The northwestern flank of Indian plate is separated from the Kohistan arc by a regionally extensive fault zone named the Main Mantle Thrust (MMT). Two syntaxial curves along MMT, known as the Indus Syntaxis (IS) and the Nanga Parbat Syntaxis (NPS) (Fig. 1), provide the best exposure to Indian basement rocks in northern Pakistan. Here we address the evolution of northern Indian plate margin during Paleoproterozoic using SIMS U-Pb zircon geochronology and whole rock geochemistry. Three samples each from IS and NPS have been analyzed in the current study. Our zircon analyses give precise $^{207}Pb/^{206}Pb$ ages for these rocks ranging between 1850 Ma to 1860 Ma, however, a single sample from IS yielded older age of 2166.3 ± 2.2 Ma (2SE).

One sample from NPS is granitic and other two are granitic gneisses with strong foliation defined by preferential alignment of micaceous grains. The mineralogical compositions are similar in all these samples: quartz, orthoclase, plagioclase, biotite, muscovite, apatite and zircons. Three samples NP3, NP6 and A1 give ages of 1859.8 ± 2.3 Ma, 1858.9 ± 2.7 Ma and 1851.7 ± 5.5 Ma, respectively.

Three samples from the IS are assigned to Dubair granodiorite (DG), Zeezari granite (ZG) and Judba paragneiss (JP) based on their geographic location and their field and textural appearance. The DG and JP yielded 1858.1 ± 2.4 Ma and 1854.1 ± 2.6 Ma age, respectively, whereas ZG is older with a 2166.3 ± 2.2 Ma age. Five of the samples from IS and NPS give similar ages, indicating a synchronous magmatism, only our ZG sample indicated an older event.

Geochemically, all six samples are peraluminous, ferroan and alkalic in composition with trace elements concentration indicative of an A-type affinity. We propose that much of the terrain initially developed as part of large-scale magmatic events associated with the assembly and subsequent rifting of the supercontinents of Columbia to Pangaea. Moreover, due to both their A-type affinity and their high zircon saturation temperature (850 ± 28°C), the crystallization of these granitoids dominating the northwestern margin of Indian plate took place in a post-orogenic setting experiencing an extensional tectonic regime.

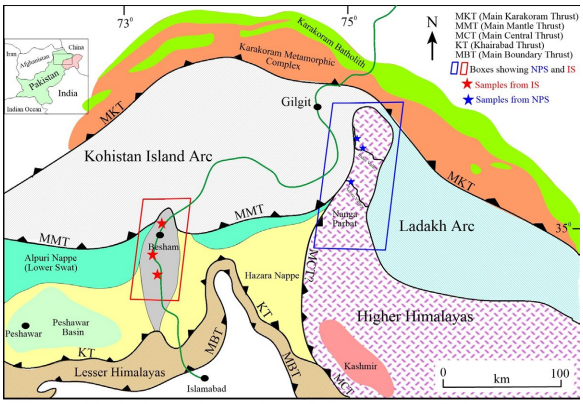

Fig. 1. Map showing tectonic division of northwestern Pakistan