Paper Number: 420

LA-MD-ICPMS zircon U-Pb age and Hf isotopic studies of the Lohit Plutonic Complex, Arunachal Pradesh, India

Pebam, J.[1], Ghosh, J.G[2] and Kamalakannan D.[1]

[1]Geochronology and Isotope Geology Division, Geological Survey of India, Kolkata -700016

[2]Geological Survey of India, Faridabad, Haryana, India -121001

The subduction of Tethyan oceanic lithosphere below the Asian plate and the subsequent Indian-Asian plate collision created a spectacular mountain range –the Himalaya. Associated with the subduction are numerous Trans-Himalayan batholiths extending from Kohistan batholith in Pakistan to the Lohit Plutonic complex in the Eastern Arunachal Pradesh (1). These Andean type magmatic bodies in the Arunachal Pradesh of northeast India comprise multi-variant plutonic rocks of gabbro-norite-diorite, varieties of deformed and undeformed granites, and amphibolites and leucogranites. Within this granitoid several enclaves of high grade meta-sedimentary rocks are preserved. Field relationships between the different granitic bodies indicate polyphase magmatic events in the Lohit plutonic complex.

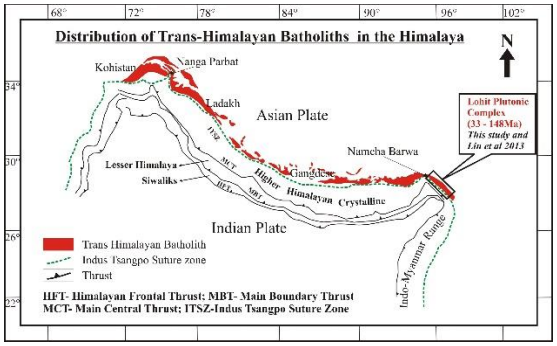

Figure 1: Sketch showing the distribution of the Trans-Himalayan batholith and tectonic frame work of the Himalaya. Modified from Yin, 2006(3).

U-Pb dating and Hf isotopic studies for the Lohit Plutonic complex were carried out as part of Geological Survey of India's field season programme using a newly commissioned LA-MC-ICPMS. Euhedral zircons from two diorite samples from Lohit valley gave weighted mean $^{206}Pb/^{238}U$ age of 101.4 ± 1.6 Ma and 116.93 ± 0.77 Ma with a U-Pb concordia lower intercept age of 101.3 ± 2.6 Ma and 116.85 ± 0.86 Ma, respectively. These results contrast with zircon U-Pb ages ranging from 96-148 Ma, reported earlier (2). A leucogranite of Tuting granite in the Siang Valley yielded a weighted mean $^{206}Pb/^{238}U$ age 32.5±1.5 Ma with a lower intercept (Terra Wasserberg) age of 33.2±2.5 Ma, reporting the first Oligocene magmatism in the Indian sector of the eastern Transhimalaya. The zircons of Lohit Valley yielded high positive $\varepsilon_{Hf}(t)$ values of +12 to +17, indicating a juvenile depleted mantle source. The zircon standard Plesovice during the analytical session gave a weighted mean $^{206}Pb/^{238}U$ age of 334.3±6.4 Ma and a $^{176}Hf/^{177}Hf$ ratio of 0.282472 ± 0.000011, which agrees with the result reported by Salma et al 2008 (5).

The geochronological age, Hf isotopic results and tectonic setting of these plutons in the entire trans-Himalayan range show a similar trend (1,2,3 & 4 and references there in). However, the magmatic evolution of these batholiths are episodic (1) and have been grouped into Triassic - Jurrasic, Cretaceous, Paleocene-Eocene and Oligocene-Miocene granitoids (4 & 6). From the available age and current study it is concluded that the Cretaceous plutons represents the most prominent phase of magmatism in Arunachal trans-Himalaya. Plutons from 148 Ma to 33 Ma ages preserve signatures of depleted mantle.

References:

1. A. K. Jain (2014) When did India–Asia collide and make the Himalaya? Current Science. 106, 2 (25).
2. Lin, T.H. et al (2013) Linking a prolonged Neo-Tethyan magmatic arc in South Asia: Zircon U-Pb and Hf isotopic constraints from the Lohit Batholith, NE India. Terra Nova, 25, 453–458.
3. Yin, A. (2006) Cenozoic tectonic evolution of the Himalayan orogeny as constrained by along strike variation of structural geometry, exhumation history, and foreland sedimentation. Eart. Sci. Rev.,76,1–31.
4. Ravikant, V. et al (2009) Zircon U–Pb and Hf isotopic constraints on petrogenesis of the Cretaceous–Tertiary granites in eastern Karakoram and Ladakh, India. Lithos, 110, 153–166.
5. Salma et al (2008) Plesovice zircon - A new natural reference material for U-Pb and Hf isotopic microanalysis. Chemical Geology, 249(1-2) 1-35.
6. Ji, W.Q. et al (2009) Zircon U–Pb geochronology and Hf isotopic constraints on petrogenesis of the Gangdese batholith, southern Tibet. Chemical Geology 262, 229–245.