Geophysical Research Abstracts
Vol. 18, EGU2016-2914, 2016
EGU General Assembly 2016

Metamorphic and tectonic evolution of the Greater Himalayan Crystalline Complex in Nyalam region, south Tibet

Jia-Min Wang (1,2), Jin-Jiang Zhang (2), Daniela Rubatto (3,4)

(1) Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing 100029, China (wangjm9595@gmail.com), (2) School of Earth and Space Sciences, Peking University, Beijing 100871, China, (3) Institute of Geological Sciences, University of Bern, 3012 Bern, Switzerland, (4) Research School of Earth Sciences, The Australian National University, Canberra 2601, Australia

Recent studies evoke dispute whether the Himalayan metamorphic core – Greater Himalayan Crystalline Complex (GHC) – was exhumed as a lateral crustal flow or a critical taper wedge during the India-Asia collision. This contribution investigated the evolution of the GHC in the Nyalam region, south Tibet, with comprehensive studies on structural kinematics, metamorphic petrology and geochronology.

The GHC in the Nyalam region can be divided into the lower and upper GHC. Phase equilibria modelling and conventional thermobarometric results show that peak temperature conditions are lower in the lower GHC ($\sim$660–700°C) and higher in the upper GHC ($\sim$740–780°C), whereas corresponding pressure conditions at peak-T decrease from $\sim$9–13 kbar to $\sim$4 kbar northward. Monazite, zircon and rutile U–Pb dating results reveal two distinct blocks within the GHC of the Nyalam region. The upper GHC underwent higher degree of partial melting (15–25%, via muscovite dehydration melting) that initiated at $\sim$32 Ma, peaked at $\sim$29 Ma to 25 Ma, possibly ended at $\sim$20 Ma. The lower GHC underwent lower degree of melting (0–10%) that lasted from 19 to 16 Ma, which was produced mainly via H_2O-saturated melting. At different times, both the upper and lower blocks underwent initial slow cooling (35 ± 8 and 10 ± 5°C/Myr, respectively) and subsequent rapid cooling (120 ± 40°C/Myr). The established timescale of metamorphism suggests that high-temperature metamorphism within the GHC lasted a long duration ($\sim$15 Myr), whereas duration of partial melting lasted for $\sim$3 Myr in the lower GHC and lasted for 7–12 Myr in the upper GHC.

The documented diachronous metamorphism and discontinuity of peak P–T conditions implies the presence of the Nyalam Thrust in the study area. This thrust is probably connected to the other thrusts in Nepal and Sikkim Himalaya, which extends over $\sim$800 km and is named the “High Himalayan Thrust”. Timing of activity along this thrust is at $\sim$25–16 Ma, which is coeval with active timing along the South Tibetan detachment (27–16 Ma) but precedes that along the MCT (16–10 Ma). Comparison between the obtained P–T–t data and model predictions implies that a lateral crustal flow process dominated the exhumation of the high-grade upper GHC migmitites during 25–16 Ma, whereas a critical taper thrusting process dominated the exhumation of the MCT zone nonmigmatites and cooled migmatites in the lower GHC at 16–10 Ma. In other words, at different temporal and spatial scale, both propagating thrusting along large tectonic boundaries and a low-viscosity melting crust could contribute to the exhumation of high-grade metamorphic rocks in Himalaya-like large hot collisional orogens.

KEY WORDS: Greater Himalayan Crystalline Complex; P–T path; U–Pb geochronology; channel flow; tectonic discontinuity

References:

Wang, J.M., Rubatto, D., Zhang, J.J., 2015a. Timing of partial melting and cooling across the Greater Himalayan Crystalline Complex (Nyalam, central Himalaya): in-sequence thrusting and its implications. Journal of Petrology, 56, 1677–1702.

Wang, J.M., Zhang, J.J., Wei, C.J., Rai, S.M., Wang, M., Qian, J.H., 2015b. Characterizing the metamorphic discontinuity across the Main Central Thrust Zone of eastern-central Nepal. Journal of Asian Earth Sciences 101, 83–100.

Wang, J.M., Zhang, J.J., Wang, X.X., 2013. Structural kinematics, metamorphic P–T profiles and zircon geochronology across the Greater Himalayan Crystalline Complex in south-central Tibet: implication for a revised channel flow. Journal of Metamorphic Geology 31, 607–628.