Himachal Himalaya: shallowest and oldest exposure of the orogenic metamorphic core

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An intriguing feature of the Himalayas is the apparent continuity of the major tectonic units and tectonic contacts along the entire strike of the mountain range from the eastern to the western syntaxes. Shallower levels of the orogen's metamorphic core are, however, exposed in the western compared to the central and eastern part. These different levels of exposure reflect the evolution of the Himalayas and provide an opportunity to investigate the interactions between the main structures of the orogen in space and time, and thus to study some of the fundamental mechanisms of mountain building.

In Himachal Pradesh, northwest India, the Main Central thrust (MCT) separates the low-grade rocks of the Lesser Himalayan sequence (LHS) from greenschist to amhibolite-grade metamorphic rocks of the Haimanta unit. The Haimanta has been interpreted as part of the Greater Himalayan crystalline (GHC; e.g. Steck, 2003, Searle et al., 2007). However, other authors correlate the Haimanta with the Tethyan Himalayan sequence (e.g., Thakur, 1998, Webb et al., 2007) and propose that the GHC in northwest India is limited to a narrow band around the Kishtwar and Kulu-Rampur tectonic windows. Related to this controversy are the questions of: (1) How does the South Tibetan detachment (STD) continues west of the Sutlej valley?, (2) How much top-to-the-Northeast displacement related to the emplacement of the GHC is present in Himachal Pradesh, and (3) Where is the GHC located?

To answer these questions we examine a number of possible geodynamic scenarios for northwest India and compare these regarding their respective predictions on geometry of metamorphic isograds, cooling paths, and deformation histories of rocks throughout the MCT hanging wall.

We present new SHRIMP-RG U/Pb zircon ages that record ~485 Ma emplacement of Deo Tibba and other granitic rocks in the MCT hanging wall with only one sample showing a Miocene metamorphic overprint. New LA-MC-ICPMS Th/Pb ages of metamorphic allanite from samples of the Haimanta unit constrain the timing of peak metamorphic conditions. New $^{40}Ar/^{39}Ar$ cooling ages from the Beas and Chandra valleys are interpreted as early Miocene ductile extrusion and emplacement of the GHC.

Raman spectroscopy on carbonaceous material on samples from the Bajaura nappe (LHS), structurally immediately above the base of MCT deformation, indicates peak temperatures of 500 - 550 °C. One sample from the Haimanta unit ca. 500 m above the MCT yields indistinguishable peak temperatures of 550 °C. Although preliminary in nature, these data further constrain the inverse metamorphic gradient recorded within the GHC (650 to 700 °C; Wyss, 2007), and are consistent with the equivalent data obtained further west in the Garwhal Himalaya.

References

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