Geophysical Research Abstracts
Vol. 18, EGU2016-4371, 2016
EGU General Assembly 2016

Duration of inverted metamorphic sequence formation across the Himalayan Main Central Thrust (MCT), Sikkim

Stefania Cioldi (1), Evangelos Moulas (2), Lucie Tajcmanová (2), and Jean-Pierre Burg (1)

(1) Geological Institute, ETH Zurich, Zurich, Switzerland (stefania.cioldi@erdw.ethz.ch), (2) Inst. of Geochemistry and Petrology, ETH Zurich, Zurich, Switzerland

Collision between the Indian and Eurasian plates since the Eocene (50 Ma) caused the closure of the Neo-Tethys and the underthrusting of India beneath the Tibetan Plateau, generating the 2500 km extended Himalayan belt.
The Main Central Thrust (MCT) marks the boundary of the underlying Midland Lower Himalaya metasediments zone (LH) in the south from the overlying high grade metamorphic Higher Himalaya (HH) in the north.
Several models considering petrochronology, geothermobarometry and structural geology have been discussed to explain the inverted metamorphic gradient in the LH metasediments without reaching a common agreement.

This study investigates the tectonic setting and the timescale of inverted isograds related to crustal-scale thrusting at the MCT in the Sikkim region, northeast India. The aim is to contribute to the understanding of the link between mechanical and thermal evolution of major thrust zones and to clarify the nature and the origin of orogenic heat applying garnet geospeedometry.

Garnets provide a sensitive record of metamorphic conditions and are potential chronometer. Their compositional zoning is used as a gauge for rate estimates of element diffusion within the mineral and allows estimating the absolute time of the thermal evolution.
Inverse-fitting numerical model considering FRactIonation and Diffusion in GarnEt (FRIDGE) calculates garnet composition profiles by introducing P-T-t paths and bulk-rock composition of a specific sample. P-T conditions were estimated by convectional geothermobarometry supported by phase equilibria modelling and measured garnet chemical compositions. Simulation were compared with measured garnet profiles.

Simple step function and FRIDGE preliminary results of Fe-Mg – Ca – Mn garnet fractionation-diffusion modelling indicate very short timescale (between 3 and 6 Ma) for peak metamorphic conditions in the northeast Himalayan collisional system. This duration does not allow thermal re-equilibration. It is an important parameter for preservation of inverted metamorphic gradients in crustal thrust zones like the MCT in the Himalayas.