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Linking microstructures, petrology and in situ U-(Th)-Pb geochronology to constrain P-T-t-D evolution of the Greather Himalyan Sequences in Western Nepal (Central Himalaya)

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Last advances in forward modelling of metamorphic rocks and into the understanding of accessories minerals behaviour, suitable for geochronology (e.g. zircon and monazite), during metamorphism, bring new insights for understanding the evolution of metamorphic tectonites during orogenic cycles (Williams and Jercinovic, 2012 and reference therein).
One of the best exposure of high- to medium grade- metamorphic rocks, is represented by the Greater Himalayan Sequence (GHS) in the Himalayan Belt, one of the most classic example of collisional orogen.
Recent field work in Mugu Karnali valley, Western Nepal (Central Himalaya), identified a compressional top to the South ductile shear zone within the core of the GHS, named Magri Shear Zone (MSZ), developed in a high temperature regime as testified by quartz microstructures and syn-kinematic growth of sillimanite.
In order to infer the tectono-metamorphic meaning of MSZ, a microstructural study coupled with pseudosection modelling and in situ U-(Th)-Pb monazite geochronology was performed on selected samples from different structural positions.
Footwall sample constituted by (Grt + St $\pm$ Ky) micaschist shows a prograde garnet growth (cores to inner rims zoning), from $\sim$500°C, $\sim$0.60GPa (close to garnet-in curve) to $\sim$580°C, $\sim$1.2 GPa temporal constrained between 21–18 Ma, by medium Y cores to very low Y mantles monazite micro-chemical/ages domain . In this sample garnet was still growing during decompression and heating at $\sim$640°C, $\sim$0.75 GPa (rims), and later starts to be consumed, in conjunction with staurolite growth at 15-13 Ma, as revealed by high Y rims monazite micro-chemical/ages domain.
Hanging-wall mylonitic samples have a porphyroclastic texture, with garnet preserve little memory of prograde path. Garnet near rim isoplets and matrix minerals intersect at $\sim$700°C and $\sim$0.70 GPa. A previous higher P stage, at $\sim$1.10 GPa $\sim$600°C, is testified by cores of larger white mica porhyroclasts. Prograde zoned allanite (Janots et al., 2008) is rarely found within garnet crystal, while monazite found only along mylonitic foliation helps to constrain the age of shearing and hanging-wall rocks exhumation, between 25 Ma (low Y cores interpretd as Aln out product, close to P peak) and 18 Ma (high Y rims interpreted as Grt breakdown/melt crystallization product during decompression).

The present results point out the occurence of a high-temperature shear zone, in the core of the GHS, active before the onset of the Main Central Thrust, responsible of at least a part of the exhumation of the metamorphic rocks.

References

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