Mid-Miocene infiltration of meteoric water in the South Tibetan Detachment (Mt Everest, Himalaya)

A. GEBELIN[1], M. JESSUP[2], C. TEYSSIER[3], M. A. COSCA[4], R. D. LAW[5], M. BRUNEL[6], A. MULCH[7]

[1]SoGEES, Plymouth University, PL4 8AA, UK (*correspondence: aude.gebelin@plymouth.ac.uk)
[2]Dept. Earth & Planetary Sciences, University of Tennessee, Knoxville, TN 37996, USA (mjessup@utk.edu)
[3]Earth Sciences, University of Minnesota, Minneapolis, MN 55455, USA (teyssier@umn.edu)
[4]USGS, Central Mineral & Environmental Ressources Science Center, Denver, USA (mcosca@usgs.gov)
[5]Department of Geosciences, Virginia Tech, Blacksburg, Virginia 24061, USA (rdlaw@vt.edu)
[6]Geosciences Montpellier, Université Montpellier 2, 34095 Montpellier, France (brunelmaurice@gmail.com)
[7]Senckenberg Biodiversity & Climate Research Centre (BiK-F), 60438 Frankfurt, Germany (andreas.mulch@senckenberg.de)

The South Tibetan Detachment (STD) is a fundamental structure within the Himalayan orogenic belt that juxtaposes low-grade Tethyan Himalayan Sequence sedimentary rocks over high-grade metamorphic rocks of the Himalayan crystalline core. We document infiltration of D-depleted meteoric fluids ($\delta D_{water} < -120$ ‰) in the STD mylonitic footwall over a minimum duration of ca. 2 Myr between 17 and 15 Ma where recrystallized hydrous minerals equilibrated with evolved meteoric water and therefore recorded the hydrogen isotope composition of water present during deformation.

We determined the origin of fluids and the timing of fluid flow by using a combination of hydrogen isotope (δD) and $^{40}Ar/^{39}Ar$ geochronology measurements performed on hydrous minerals from mylonites collected over 200 m of structural section in the STD footwall at Rongbuk Valley, near Mount Everest.

Migration of fluids from the Earth's surface to the active mylonitic detachment footwall may have been achieved via steep normal faults that developed during syn-convergent extension of the upper Tethyan Himalayan plate, while at the same time high heat flow sustained buoyancy-driven fluid convection. Low δD values in synkinematic fluids are indicative of precipitation-derived fluids sourced at high-elevation and document that the ground surface above this section of the STD had already attained similar-to-modern topographic elevations at ~15 Ma.