Miocene rainfall in the South Tibetan Detachment as a proxy of tectonic regime and past topography

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The South Tibetan detachment (STD) parallels the east-trending axis of the Himalayan range over > 1500 km and represents an untapped source of information to understand the Cenozoic evolution of coupled climatic and tectonic processes of the world's highest mountain range.
Various tectonic models have been proposed to explain "extrusion" of the Himalayan crystalline core (HCC) above the MCT and below the STD in Miocene time. These models predict different timing and structural contexts, but all consider that exhumation of the HCC occurred in a convergent tectonic setting.
Here, we present hydrogen isotope (dD) geochemistry and $^{40}Ar/^{39}Ar$ geochronology data from NW India to Mt Everest that document infiltration of meteoric fluids into the active STD footwall at ~24 Ma (Zanskar) and ~15 Ma (Everest) when recrystallized hydrous minerals equilibrated with low-dD water during high-temperature deformation (~550±50°C). The presence of surface-derived water at depth suggests that such fluids have penetrated the mylonitic STD footwall by the combined effects of porosity and permeability pathways in the overlying Tethyan Himalayan Sequence (THS). High heat flow emanating from the metamorphic footwall may have driven convection of these meteoric fluids, resulting in large fluxes of fluids that likely interacted with the top few hundred meters of the footwall. From these data, we propose that exhumation of the HCC during the early-mid Miocene was coeval with: a) migration of Earth's surface fluids down to the ductile crust during diachronous (W-E younging) synconvergent extension of the THS, b) high thermal gradients at depth and, c) high topography.
In addition, such meteoric fluids can be used as palaeoelevation proxies if they can be temporally and kinematically linked to the evolution of the STD. Our results demonstrate the power of shear-zone based paleoaltimetry in eroded mountain belts and suggest that the South Asian monsoon may have started during the early Miocene.

Mots-Clés : South Tibetan Detachment ; Meteoric fluid-rock interaction ; Hydrogen isotope ; ^{40}Ar-^{39}Ar geochronology ; Miocene elevation, Synconvergent extension

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