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Quantification of progressive deformation localization below the STD shear zone (Himalaya)

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In low angle fault systems it is generally assumed that deformation, initially distributed in the footwall, ultimately localizes along the brittle detachment [e.g., Lister et al., 1989]. However, few studies have demonstrated and / or quantified this hypothesis.
The Nyalam Detachment (ND) is a part of the South Tibet Detachment (STD), a major fault zone that separates the un-metamorphosed Tethyan sedimentary series of Tibet from the underlying gneisses of the Upper Himalayan crystalline series UHCS. West of Ruji series have been tilted to the west, giving the opportunity to observe an exceptionally thick ($\sim$3.5 km) continuous section of the UHCS below the detachment. Intense top to the NNE simple shear is restricted to the $\sim$300 m thick Nyalam mylonitic shear zone immediately below the ND. Further below deformation is closer to pure shear and is absorbed in a more distributed way. In this zone, many leucocratic dykes are stretched and transposed parallel to the schistosity, while some are only slightly deformed or are undeformed. At a given location, dating of sets of deformed and undeformed dykes allow us to constrain the timing for the end of deformation. Deformation ended at $\sim$15.5 and prior to 17.2 Ma, $\sim$1400 m and $\sim$3500 m structurally below the ND respectively. Within the Nyalam shear zone, ductile deformation lasted after 17 Ma, but footwall cooling history implies that the ND stopped at $\sim$13 Ma. These data imply that deformation stopped first at depth, before to end in the shear zone. The same data suggest that the end of deformation migrated regularly towards the STD (upward) at a rate of 0.8$\pm$0.33 mm/yr. We interpret this migration as a progressive localisation of the deformation from a $\geq$3.5 km zone within a $\sim$300m thick shear zone.
This example shows that it is possible to quantify the rate at which deformation localizes in natural shear zones. This parameter should be taken into account when discussing the localization mechanisms.