Revisiting role of shear heating in Himalayan inverted metamorphism using thermomechanical models

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Abstract: Whether shear heating can rise temperature significantly in ductile- and brittle shear zones have been worked out [reviews in 1-4]. Recent works on whether shear heating can produce inverted metamorphism in different tectonic settings is contradictory[5,6]. The classic channel flow model[7] presumes a single thermal conductivity magnitude of 2 W m^{-1} K^{-1} for the entire Greater Himalayan Crystallines (GHC). However, zooming in, along few river sections in India and Nepal, the GHC can be divided into a southern schistose/non-migmatitic and a northern migmatitic/granitic melt unit[8]. The southern unit especially contains other rock varieties, either as consistent layers or as inclusions. This work utilizes these lithological heterogeneities of the GHC as much as possible and produce shear heat models for ductile shear, based on our previous works[1,2]. These models follow the first order tectonic constraints of the GHC and presume a Newtonian rheology. The input parameters are: (I) thicknesses of the entire GHC/individual layers, (II) pressure gradient for Poiseuille flow through inclined channel, (III) density, (IV) dynamic viscosity and (V) thermal conductivity of rocks. Parameters III to V have some overlap in range of magnitudes for individual rock types. The thermal profiles show where in channel maximum heating takes place, and that location is compared with the prototype GHC. The models also demonstrate how much thermal/shear heat profiles vary by modifying the magnitudes of parameters I-V corresponding to varieties of lithologies within the prototype

GHC. Refining shear heat models in other collisional terrains would also be interesting to work out.

(Words: 255)

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