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On the disappearance of the Greater Himalayan crystalline in the northwestern Himalaya

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The apparent continuity of the major tectonic units and tectonic contacts along the Himalayan orogen is intriguing. Numerous studies substantiate a common first order extrusion history of the crystalline core of the orogen (the Greater Himalayan crystalline) along the length of the orogen, or elucidate second-order lateral variations thereof. However, little is known about the lateral termination of the crystalline core. The major shortening structures below the Greater Himalayan crystalline (Main Central thrust, Main Boundary thrust, and Main Frontal thrust) have been mapped as far west as the Nanga Parbat syntaxis in Pakistan, but significant debate exists as to how far west the Greater Himalayan crystalline crops out at the surface.

In Himachal Pradesh, northwest India, the hanging wall of the Main Central thrust (MCT) consists of chlorite- to biotite-grade metamorphic metasedimentary rocks, which have been interpreted as lower-grade equivalents of the Greater Himalayan crystalline in the framework of both "Channel-flow" and general shear extrusion models. More recently, proponents of a "tectonic wedging" scenario of extrusion challenge this view and contend that the Greater Himalayan crystalline does not surface west of $\sim$ 077°E, except in the Kishtwar tectonic window. However, none of these models account for the observed steep lateral metamorphic gradient from up to migmatite grade ($\geq$ 750 °C) in the Sutlej valley to biotite grade west of the Beas valley, within 100 km along the strike of the orogen.

New muscovite ^{40}Ar/^{39}Ar cooling ages from the Beas valley indicate early Miocene emplacement of the MCT hanging wall in Himachal Pradesh. Emplacement is concurrent with the onset of extrusion of the crystalline core further east. Our cooling ages are significantly older than comparable ages measured in the central and eastern Himalaya, indicating that in Himachal Pradesh, unlike elsewhere, the amount of exhumation since the early Miocene is negligible.

Based on structural mapping and our preliminary thermochronology data, we tentatively propose the existence of a lateral ramp in the Main Boundary thrust (MBT) in Himachal Pradesh. East of the Beas valley shortening between India and Asia has been accommodated by thrusting along the MCT and related faults. Thrusting was in part counteracted by early Miocene normal-sense slip along the South Tibetan detachment, which acted as a passive roof fault to the extruding Greater Himalayan crystalline. West of the Beas valley down-stepping of the MBT across the proposed ramp provided accommodation space for the MCT hanging wall. Extrusion of the Greater Himalayan crystalline is therefore limited to the east of the ramp; post-early Miocene exhumation is negligible west of the Beas, and no passive roof thrust comparable to the South Tibetan detachment developed.