Post-collision Controls on Himalayan Deformation

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Post-collisional shortening began as India collided with Asia. The shortening between 60-25 Ma is not well known; however, the minimum shortening since ~25 Ma is well known in the Himalayan thrust belt. To determine why some thrust sheets in Greater and Lesser Himalayan parts of the thrust belt are >100 km long and others <35 km, we analyzed the properties of the collision. We determine that early-stage broad leucogranite melting from ~30-20 Ma weakened the mid-lower crustal strength, which produced a supercritical wedge. This promoted across-strike lengthening of the low-elevation Himalayan taper accommodated by detachment faulting on the South Tibetan Detachment system and the far-traveled long basal thrust sheets from ~30–25 Ma to 20-15 Ma, the Main Central and Ramgarh-Munsiari thrust sheets. Melt-removal and extraction coeval with widespread leucogranite intrusion during ~20-10 Ma substantially strengthened the mid-lower crust, which transitioned the wedge from supercritical to subcritical states. This maintained the growing high-elevation taper and shifted the deformation mode from long thrust sheets to foreland-propagated short imbrication/duplex thrust sheets. Beginning at ~20-15 Ma, the Lesser Himalayan duplex began to form and continued until ~5 Ma when the thrust belt propagated southward into the Subhimalayan rocks. Thus, the transition from melt-presence to melt-removal caused the transition from long thrust sheets to shorter thrust sheets in the Himalayan thrust belt.