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Strain partitioning, partial melting and mid-crustal flow in the Himalaya

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Mid-crustal rocks exposed in the transition zone between the Tibetan Plateau and Himalaya provide insights into the interactions between anatexis and deformation during crustal flow and subsequent exhumation. Evidence for in situ partial melting is found within mid-crustal rocks exposed along the crest of the range (Greater Himalayan Series; GHS). The duration of melting (26-12 Ma) is similar in the Leo Pargil dome of NW India and Mount Everest region of Eastern Nepal / southern Tibet. During protracted partial melting, a decrease in the viscosity of the crust resulted in mid-crustal flow where strain was partitioned into the melt fraction and distributed over thick sections of crust. Melt migrated and concentrated into injection complexes of leucogranite sills and dikes. Wide shear zones (e.g., Main Central thrust and South Tibetan detachment) that were ultimately responsible for exhumation of the mid-crust localized crustal flow. The geometry of these shear zones was controlled by the kinematics of the orogen that resulted in south-directed extrusion until the middle Miocene. Localized partial melting (13-12 Ma) at deeper structural positions, as exposed in the Ama Drime Massif (ADM), occurred during orogen-parallel extension that post-dates south-directed extrusion and records a younger stage in the kinematic evolution of the orogen. Despite the duration of melting and the kinematic setting (south-directed extrusion or orogen-parallel extension), relatively narrow, solid-state, high-strain zones that bound packages of migmatitic gneiss and/or injection complexes accommodated exhumation following anatexis. These shear zones record a transition from melt-present deformation to solid-state fabric development reflecting the onset of progressively lower temperature deformation mechanisms during exhumation. These observations are consistent with several other areas along orogenic strike where middle Miocene anatexis and south-directed extrusion of the GHS is overprinted by localized late Miocene orogen-parallel extension.