

70-7 - WAS THE BASAL TETHYAN HIMALAYA DEEPLY BURIED? INSIGHTS FROM THE HIMACHAL HIMALAYA, NW INDIA, IN INVESTIGATING NON-LITHOSTATIC PRESSURE VERSUS PRE-HIMALAYAN METAMORPHISM

 Sunday, September 22, 2024
 3:25 PM - 3:40 PM
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Abstract

Theory suggests the possibility for significant deviations between the total pressure (or dynamic pressure) and lithostatic pressure throughout Earth’s crust. Whether such non-lithostatic pressure conditions are recorded and preserved in the rock record remains unresolved, as direct field confirmation is limited, yet the implications for orogenic reconstruction are profound. Here we investigate the Paleogene Tethyan Himalaya fold-thrust belt in Himachal Pradesh, NW India, which is the structurally highest part of the Himalayan orogen and deforms a ~10–15 km thick Neoproterozoic–Cretaceous passive margin stratigraphic section. Field-based kinematic studies demonstrate relatively moderate shortening strain estimates across the Tethyan Himalaya, yet basal Tethyan strata consistently yield elevated pressure-temperature-time (P-T-t) estimates of 7–8 kbar and ~650°C, indicative of deep burial during Himalayan orogeny (25–30 km depths). These P-T-t conditions can be reconciled by: (1) deep Cenozoic burial along cryptic structures and/or significant flattening of the Tethyan strata; (2) basal Tethyan strata recording pre-Himalayan deformation related to Pan-African orogeny; or (3) non-lithostatic pressure conditions (i.e., tectonic overpressure). To test these models, we systematically mapped the Tethyan fold-thrust belt along the Bhaba Pass-Pin Valley transect in NW India, a classic site for stratigraphic, paleontological, paleoenvironmental, and structural reconstructions. We integrate a multi-method approach combining detailed geologic mapping with quantitative analytical techniques (e.g., finite strain analyses, thermometry, thermobarometry, thermochronology, and geochronology) to quantify the magnitude, kinematics, thermal architecture, and timing of regional deformation, metamorphism, and subsequent exhumation of the Tethyan fold-thrust belt. Our preliminary observations refute deep Cenozoic burial of the Tethyan Himalaya, suggesting either the preservation of non-lithostatic pressures in the rock record or relicts of pre-Himalayan metamorphism. Either scenario demonstrates that caution is required in using Himalayan P-T-t estimates to reconstruct the Cenozoic Himalayan orogeny.

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