Crustal Boudins, Gondwanan Rifting, and Himalayan metamorphism

Abstract: Several continental slivers rifted off the northern leading edge of the Indian plate and sequentially collided with the Asian margin – the Paleocene India-Asia collision being the last and strongest collision. Recent high definition seismic profiling of rifted margins indicates crustal or lithospheric scale boudins in all parts of the world. While the upper crust is highly boudinaged, a thinned and sheared lower crust fills the inter-boudin areas, which also have high thermal anomaly.

The Himalayan Mountain, south of the Indus suture, consists of three parallel high grade metamorphic belts analogous to boudin necks separated by unmetamorphosed or lowly metamorphosed sedimentary sequences, analogous to boudins. Characteristics of Himalayan metamorphism are: a. presence of inverted metamorphism along the southern margin of the Himalayan crystalline belts. b. While the southern bounding faults of the crystallines are thrust-like, the northern boundary has ocean-ward dipping normal faults.

Models explaining Himalayan metamorphism are 1. Hot iron, 2. Tectonic wedge, and 3. Channel Flow model. All three relate Himalayan metamorphism to India-Asia collision and the metamorphism is thus post-collisional and post-thrusting. The present model proposes that prolonged extension from rifting of Gondwanan fragments led to development of normal-fault-bounded lithospheric-scale continental boudins along the passive India margin. Boudin necks experienced extreme extension and thinning, had high thermal anomaly, and were filled with ductile and sheared middle to lower crustal rocks. Early high-grade metamorphism, formation of Himalayan foliation, migmatisation, and the formation of the earlier anatectic granites took place in these boudin necks. The extensional phase came to end with the India-Asia collision at around 50 Ma. The collision localized intense deformation at the boudin necks, which were filled with hot and ductile material. Overturned folding of the rocks already metamorphosed during the extensional stage produced the inverted metamorphic sequences of the central crystalline and of the lesser Himalayan crystalline belts. This Miocene deformation and thrusting caused crustal thickening, superposition of hot and thinned crust, and rapid exhumation of the thickened crust resulting in the second phase of metamorphism and production of a second generation of anatectic granites. The present model is supported by field, isotopic, and PTt data and does not require mechanisms of channel flow or allochthonous nappes to explain Himalayan metamorphism and tectonics.

Featuring

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3:00 p.m. Friday, September 13th, 2019
Wertheim Conservatory: WC-130
Modesto Maidique Campus
11200 SW 8 Street, MIAMI FL 33199

This event is free and open to the public

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