

## **Tectonic consequences of partial melting: comparison of the Coast Orogen, British Columbia with the Higher Himalaya Crystallines.**

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The recognition that a small amount of melt greatly weakens rock was first made not far from the site of this conference, in the Coast Orogen of British Columbia. This phenomenon is now recognized as a necessary condition for channel flow to occur. Although many question the concept of channel flow, I believe most of us are persuaded by the preponderance of evidence from the Higher Himalaya Crystallines (HHC) that channel flow occurred there. The question is whether channel flow, as described for the HHC, has occurred in the Canadian Cordillera, or anywhere else. There is no question that melt weakening, even for a few percent melting, is fundamental for controlling deformation and flow of rock, and there is no question that the crystalline cores of British Columbia had been partially melted.

In addition to the role of melt in deformation, a key observation for the Coast Orogen of British Columbia was that the rocks had decompressed by some 4 kbar while they remained at high temperature. Near isothermal decompression is also recognized in the HHC of Bhutan; there, the amount of decompression was 5-7 kbar. In the Coast Orogen, it is now recognized that the decompression resulted from a combination of tectonic and erosional denudation during Eocene crustal scale extension. The extension appears to have created the pressure difference that drove lower crustal flow westward and into the domes, with accompanying decompression.

Because of the similarities of the deformation, metamorphic, and decompression phenomena in the Coast Orogen and of the HHC, it is reasonable to infer common elements in their histories. The Coast Orogen began with crustal thickening and finished with tectonic thinning by whole lithosphere extension. Erosion accompanied the extension. In the Himalayas, erosion certainly now plays a role in the exhumation. Earlier tectonic exhumation is also demonstrated by the north dipping south Tibetan detachment systems. However, a fundamental difference is that the Coast Orogen evolved mainly during transpression and transtension, and the Himalayas are now dominated by orthogonal convergence. Another important difference is that the crustal thickness of western British Columbia, following extension, was 34 km thick, whereas the Himalayas, still growing, are over 70 km thick. The Himalayas and the Tibetan Plateau have yet to collapse to normal crustal thickness. If the future collapse were to be by extension rather than denudation, the HHC would still occur at the surface and would preserve the metamorphic and deformation history of the earlier channel flow event.

In any case, the presence of partial melt, accompanied by isothermal decompression, appears to signal the flow of low viscosity (partially melted) rock toward lower pressures. For the HHC the pressure gradient was from deep under the Tibetan Plateau to the Himalayan mountain front. For the Coast Orogen, the pressure gradient was from the base of the crust east of the axis of the Coast Mountains to the break away caused when top to east normal shear began.