‘Exposing’ the Granulites of the Eastern Ghats Belt, India - Implications for Exhumation of Uht Terranes,

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The Eastern Ghats Belt (EGB) is a Proterozoic mobile belt that fringes the eastern extremity of the Archaean Indian craton. The terrane is characterized by granulite facies metamorphism, though a few late mafic dykes appear to have been metamorphosed only in the amphibolite facies. Detailed studies from various parts of the belt indicate that peak metamorphic temperatures may have exceeded 900 °C, at pressures of 9-10 kbars. These pressures correspond to the base of a continental crustal block of normal thickness. Since the EGB crust today is 30 km thick, the crust during granulite metamorphism may have been abnormally thick, as in present-day continental collision zones. However, granulite formation during collision would imply that temperatures at the base of the crust at the metamorphic peak would be unrealistically high. On the other hand, if the temperature profile in the lower part of the crust was inverted during UHT metamorphism, as suggested in some models, this part of the crust would experience high pressure, low temperature metamorphism. This would cause an increase in density that would subdue surface topography and inhibit exhumation.

An alternative to this process is that UHT conditions were initially achieved by a thermal perturbation at the base of a crust of normal thickness, and waned with the associated thermal anomaly. The exhumation of these granulites was achieved in a later orogeny during which the present-day EGB was underplated by continental crust of entirely distinct affiliation. Evidence of the latter can be seen in the northern part of the EGB, where the crust appears to have been uplifted by extensional processes following the granulite peak. Uplift in the northernmost EGB culminated with the intrusion of late granitoids and complete exhumation of the granulites. New sediments were subsequently deposited on the granulite basement. The entire package, including the granulites, was then reworked in a new orogenic cycle that peaked under amphibolite facies conditions, necessitating another phase of exhumation and uplift. Available dates indicate that the entire process occurred in the Neoproterozoic. The results suggest that exhumation, rather than formation of UHT metamorphism may have been associated with continental collision process.

Keywords: Eastern Ghats Belt; granulite exhumation; crustal reworking.