



A comparison between Himalaya-Tibet orogen with the European Variscan belt. Insights from petrology and numerical modeling

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The European Variscan orogeny can be compared to the Tibetan–Himalayan system for three main reasons: 1) The Variscan belt originated through progressive amalgamation of Gondwanan blocks that were subsequently squeezed between the Laurussia and Gondwana continents. Similarly, the Tibetan–Himalayan orogen results from amalgamated Gondwanan blocks squeezed between Asia and India. 2) The duration of the collisional period and the scale of the two orogens are comparable. 3) In both cases the collisional process resulted in formation of a thick crustal root and long lasting high-pressure granulite facies metamorphism. Recent petrological data allow a more detailed comparison pointing to similarities also in the mid-crustal re-equilibration of the granulites and their association with specific (ultra-)potassic magmatic rocks. In both orogens, the origin of the granulites was attributed to re-lamination and thermal maturation of lower-crustal allochthon below upper-plate crust. Later evolution was explained by mid-crustal melting eventually leading to extrusion of the high-grade rocks. We propose that the lower and middle crustal processes in hot orogens are connected by gravity overturns. Such laterally-forced gravity-driven exchanges of material in the orogenic root were already documented in the Variscides, but the recent data from Tibet and Himalaya show that this process may have occurred also elsewhere. Using numerical models we show that the exchange of the lower and middle crust can be efficient even for a minor density inversion and various characteristics of the crustal layers. The modeled pressure–temperature paths are compatible with two-stage metamorphism documented in Tibet and Himalaya.