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Exhumation of orogenic lower crust and its lateral spreading beneath rigid lid: consequences for modern plateaus

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Recent geophysical studies from the Variscan root domain (Bohemain Massif) show that the horizontal (map view) alternations of orogenic lower crust with mid-crustal belts correspond to deep crustal vertical layering that is imaged by geophysics and that was locally overturned. These diapir-like structures and subsequent spreading of hot orogenic lower crust in supracrustal levels result from vertical material transfer processes (overturns) operating during Carboniferous. The vertical layering of crust is explained by influx of lower crustal low density quartzofeldspathic rocks underneath dense Ordovician mafic lower crust related to Devonian ontinental underthrusting and thickening. Rapid heating of these rocks and subsequent vertical material transfers originated due to radioactive heating of felsic layer blanketed by Ordovician. This model assumes anomalous radioactive heat production of felsic layer, which after thermal incubation leads to melting of both crust and underlying mantle. Mingled crustal and mantle magmas enriched in compatible radioactive elements (Th) were subsequently emplaced in higher crustal levels during vertical crustal transfers. This corroborates results of aerial gamma-ray spectrometry which show exceptional gamma radiation (20 [U+F06D] R.h-1) reflecting high amount of radioactive elements concentrations (e.g. 40 – 50 ppm of Th) in these rocks. Numerical modeling shows that the vanishing of radioactive elements from the residual lower crust is responsible for rapid switch-off of the heat source and for local scale thermal exchange between exhumed lower crust and surrounding middle crustal rocks. The results of models explain transport of partially molten crust underneath orogenic lid and its lateral spreading. Resulting heat flow and metamorphism are compatible with existence of partially molten layer underneath Andean or Tibetan type plateaus.