Inverse ductile thinning and fold-induced doming in the West Carpathian Cretaceous collisional wedge

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Continental core complexes are generally interpreted as a result of extensional doming due to gravity driven up-flow of lower crust. However, the Vepor Dome is characterized by the lack of inverted density profile and relatively low metamorphic field gradient which precludes activation of Rayleigh-Taylor instability. Instead, the crustal structure of the Vepor Unit is marked by the presence of dense and weak metapelites in the deeper part of the crust and the presence of light and more competent quartz-feldspatic gneisses and granitoids within the upper crust. This structure is believed to be inherited from Variscan nappe tectonics. We show that the Cretaceous tectonic evolution of the Vepor Dome is controlled by the dynamics of two mechanically strong continental blocks represented by the overthrusting supra-crustal Gemer Unit from the south and the underthrusting Fatric basement from the north. Based on structural, metamorphic and geochronological data, the following tectonic scenario is proposed: (1) The Early Cretaceous northward propagating crustal thickening caused by an internal deformation of the Gemer Unit together with upper crustal folding within the Vepor Unit led to the progressive development of an orogenic front parallel pressure gradient. The instantaneous response of the lower crustal and low viscosity metapelites led to the development of a lateral lower crustal flow accompanied by a prograde Barrovian type metamorphism called here inverse ductile thinning. (2) As the southward underthrusting of the Fatric basement propagated to greater depths, these generally top-driven processes switched to bottom-driven. Consequently, an exhumation of lower crust occurred via a polyharmonic folding associated with doming and vertical extrusion. This process was accompanied by the upper crustal detachment faulting and eastward unroofing of the Vepor dome.