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Mediterranean detachment zones : thermicity vs heritage.

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Even if the seminal comprehensive descriptions of Metamorphic Core Complexes (MCCs) in the American Cordillera mentionned lower plates constituted of gneiss and intruded by granites (e. g. Snake Range, Whipple Mountains), the actual definition of MCCs : « Cordilleran metamorphic core complexes appear to be bodies from the middle crust that have been dragged out from beneath fracturing and extending upper crustal rocks, and exposed beneath shallow-dipping (normal slip) faults of large areal extent » {as in Lister & Davis, 1989, Journal of Structural Geology, v. 11, pp. 65-94} refers to rocks exhumed from the middle crust whatever their thermal history. The fundamental property of this middle crust resides in its ability fo flow lateraly toward the forming dome, to accommodate stretching of the upper plate and preserve a relatively flat moho. Even though thermal reequilibration can induce weakening of the lower crust, a similar strength profile can also be inherited from pre-extension evolution of the continental crust and promote development of the original structure of MCCs : their detachment. In order to unravel the rheological meaning of detachments, we propose here a review of extensional shear zones described as detachments in the Mediterranean realm, and establish a three end-members typology with « hot MCCs » as one end-member, and two cold MCC end-members with a weak middle crust due to stacking of high pressure metapelitic nappes or a strong upper crust responsible for the strength contrast exaggeration between the upper and lower crust. New fully coupled thermo-mechanical modeling experiments together with a review of comparable published results allow to test this three end-member typology and determine the critical strength constrast for the perennial development of a detachment zone. A 1000 ratio between the strength at the brittle-ductile transition and the strength at the base of the crust seems a boundary value between localized extensional modes and ditributed modes. An exaggeration of one order of magnitude (100 to 1000) of the strength contrast between the upper and lower crust appears to be sufficient to promote the development of a MCC, whatever the cause of this exaggeration. For large Mediterranean Core Complexes (Menderes, Cyclades, Betics for instance) evolution through time is also compatible with a progressive prevalence of thermicity over herited contrasts.