RHEOLOGICAL COLLAPSE OF A BOHEMIAN TIBETAN PLATEAU: THE TEPLÁ-BARRANDIAN UNIT (CENTRAL EUROPEAN VARISCIDES)

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The World Stress Map shows that extensional stresses in recent orogenic belts are largely restricted to regions with high topography (e.g., Tibetan plateau, high Andes, western U.S. Cordillera). This phenomenon is compatible with gravitational collapse of overthickened orogenic crust described in the literature. Collapse-related extensional structures mostly include high-angle brittle and low-angle ductile normal faults, the latter appearing particularly in areas where the amount of extension is markedly high (e.g., Basin & Range province).

The crystalline rocks of the central part of the Bohemian Massif (Central European Variscides) do not show such a structural inventory, although evidence for gravitational collapse is obvious. The most striking feature in the Bohemian Massif is the juxtaposition of high-grade metamorphic rocks (Moldanubian *sensu stricto* unit, MLD; Saxothuringian unit, SAX) against greenschist or even sub-greenschist facies rocks (the Teplá–Barrandian unit, TB) along steep ductile normal faults (the Bohemian shear zone, BSZ). The deviation in the strike of this shear zone is repeatedly 90° indicating nearly radial extensional stresses during its formation in Early Carboniferous times.

The striking contrast in Lower Carboniferous metamorphism between TB (greenschist to sub-greenschist facies) and MLD and SAX (amphibolite to granulite facies) suggests a considerable amount of displacement between both units. From the intrusion depth of well-dated Early Carboniferous plutons, which emplaced into TB and MLD close to BSZ, the minimum throw of BSZ could be determined at 13 km. Taking into account emplacement ages of the plutons and the individual cooling ages of micas, this considerable throw should have occurred in Early Carboniferous times, between 340 and 320 Ma. Since BSZ continues steeply through the entire crust (as is indicated in the seismic profile 9HR, Tomek, pers. comm.), the new results imply that the Moho should have been displaced at the same value (13 km). Consequently, it should be expected that the recent Moho occurs much deeper under TB than under MLD. However, the opposite is true. The MLD crust is much thicker than the TB crust.

A new geodynamic model will be presented that explains the considerable throw between MLD and TB without implying a displacement of the recent Moho. It further takes into account the high heat flow, melt formation and fast uplift of MLD during the middle Carboniferous, and the lack of a recent crustal root beneath the Bohemian Massif.

Subsequent to SE-directed subduction of oceanic lithosphere beneath the Cadomian basement of TB (400 Ma), collision of TB with the Saxothuringian passive margin (and possibly also with MLD) led to considerable thickening of TB crust in Late Devonian times (370 Ma). During this period TB formed a large-scale pop-up plateau underthrusted by lithosphere of both MLD and SAX. This plateau started to collapse already close to the Devonian/Carboniferous boundary (360 Ma). The unmetamorphosed Palaeozoic sediments of the Barrandian syncline, situated in the centre of the collapsing plateau, were largely preserved from erosion. Subsequent delamination *of parts* of the thickened mantle lithosphere (330 Ma) led to: i) isostatically controlled fast uplift of the high-grade eclogite and granulite-bearing rocks of MLD and SAX, ii) a significant rise in heat flow of the lower and middle crust (MLD), iii) anatexis and intrusion of large amounts of plutons partly derived from the mantle. The extremely hot and melt-bearing lower crust (the recent MLD and parts of SAX) behaved as a fluid-like, nearly Newtonian medium, into which the cold and rigid upper crust (TB) could rapidly subside. The rheological contrast between both crustal parts explains the unusually high angle of dip of the boundary shear zones (BSZ) which formed pathways for the invading melts.

The new model suggests that the Teplá–Barrandian unit formed a highly elevated plateau during the Late Devonian and Early Carboniferous similar to the recent Tibetan plateau. This assumption is supported by new seismic results of the INDEPTH project which clearly indicates a partially molten middle crust beneath southern Tibet.