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Large plates and small blocks: The Variscan orogeny in the Bohemian Massif

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The Bohemian Massif of the Central European Variscides consists of several late Proterozoic / early Paleozoic low-strain crustal units, namely the Bruno-Vistulian continental block of the Laurussian plate that is juxtaposed with the Tepla-Barrandian Unit and the Lausitz block of the Gondwana plate. These pre-Variscan low-strain units are separated by high-strain zones that contain the mid- and lower crustal record of the Variscan orogeny (400-300 Ma), with nappes reflecting successive subduction exhumation events, voluminous migmatites and a wide range of geochemically contrasting granites. Although the principal constraints are undisputed, there is no consensus regarding the general tectonics of this area. Here we present a plate tectonic model explaining the Bohemian Massif as an orogenic wedge with a Gondwana pro-wedge and a Laurussia retro-wedge area. The principal formation steps are as follows. Subduction of the oceanic crust of the Gondwana plate, i.e. the southern part of the Rheic Ocean eventually followed by continental subduction of the distal Peri-Gondwana shelf produced the early Devonian (U)HP complexes now exposed in the uppermost allochthonous units. The arrival of the Tepla-Barrandian Cadomian block initiates a flip of subduction polarity, leading to the complete closure of the Rheic Ocean in the late Devonian coeval with the exhumation of the early Variscan (U)HP units. Caused by the Lausitz block entering the plate boundary zone in the early Carboniferous, this early subduction accretion stage was followed by continent continent collision. The resulting orogenic wedge is characterized by an intra-continental subduction zone in the pro-wedge area superimposed by the crustal stack of early and mid-Variscan accreted units. Due to heating of the subducted slab in the mantle, the isothermal exhumation of this deeply buried continental crust caused HT-LP metamorphism during the final transpressional stage. Lateral extrusion tectonics coeval with the juxtaposition of different crustal levels along steeply inclined shear zones finally accounts for the distribution of low-strain and high-strain domains. The model works with NE-SW oriented plate convergence. Perpendicular NW-SE shortening coeval with dextral strike slip tectonics reflects escape tectonics during the late Variscan transpression. The abundance of pre-orogenic microcontinental blocks within a collisional orogen does not provide evidence for independent lithospheric microplates.