

Anatomy of a diffuse cryptic suture zone exemplified by European Variscan belt: a new concept of continental tectonics called diffuse supra-subduction orogeny

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Abstract

The plate tectonics paradigm has offered a link between the horizontal movement of lithospheric plates, closure of intervening oceanic basin and formation of oceanic suture zone preserved even during continental collision. On the example of the Bohemian Massif we document the evolution of Andean type orogen involved in continental collision. Based on combined geological data and geophysical imagery a fully scaled thermomechanical modelling is performed to introduce a new class of orogenic system called here diffuse supra-subduction orogen. The characteristic feature of the model proposed for the Variscan orogen in the Bohemian Massif is the convergence of two contrasting domains of lithosphere, leading to subduction of an attenuated felsic metaigneous crust under the rifted (Gondwana) margin formed by a dense sequence of metasedimentary and metabasic rocks. The relamination of refractory light material rich in radioactive elements underneath the relatively dense upper plate is responsible for the gravitational instabilities that lead to the overturns in the thickened crust. This mechanism results in the formation of a diffuse cryptic suture zone, i.e., a wide zone in which materials from the lower and upper plates are mixed to form a hybrid continental crust. The diffuse cryptic suture zone remains the only evidence of the original plate boundary repeatedly re-appearing within the orogen. We propose that this model may have a general validity and possible link to modern orogens exemplified by comparison of Variscan and Tibetan orogenic systems is proposed based on petrological characteristics and similarities in geophysical signatures. This work is a result of Centre for Lithospheric Research (Prague) project of Czech government and two French ANR projects "LFO in orogens" and currently running "DSP Tibet".