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The Trans-European Suture Zone: origin and tectonomagmatic events in late Variscan times

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An important feature of Europe is the Trans-European Suture Zone (TESZ) which links the East European Platform (Baltica) and the West European Platform. Being concealed under Permo-Mesozoic and Cenozoic deposits, it is mainly imaged by seismic data and poorly constrained by geological observations, thus debated. With our new data, we support the view that the TESZ developed over an attenuated, ~200 km wide margin of Baltica [1]. Attenuation occurred during rifting and break-up of Rodinia in Ediacaran times. Upon the thinned margin, parallel to the TESZ, were sequentially deposited: (1) rift-related and (2) passive-margin sediments, then overridden by (3) an accretionary prism of East Avalonia and (4) allochthonous units of the Variscan foreland, all finally covered with (5) Permian through Cenozoic sediments. These five sedimentary/tectonic units contributed to the low-velocity, 15–20 km thick crustal layer, documented on the seismic profiles, generally confined to the once thinned margin of Baltica. Such structural template of the TESZ resulted in relative weakness of the whole zone and allowed for repeated activity of the NW-trending dextral strike-slip faults, which controlled magmatic intrusions/extrusions in the Late Carboniferous-Early Permian. This mechanism brought about magmatic centers identified at the Dolsk Fault Zone and the Kraków-Lubliniec Fault Zone that defined the SW border of the TESZ [3, 4].

An essential circumstance was that the TESZ partly overlapped with the distant Variscan foreland in central Europe, where orogenic thickening continued up to ~307–306 Ma. The process led to temperature increase, contributed to partial melting of lithologically diversified crust and caused rheological weakening especially of the lower crust [2]. Eventually, the dextral wrenching on the TESZ, which resulted from the Variscan collision between Laurussia and Gondwana was accompanied by igneous intrusions, initially granitoids [4], that gave rise to magmatic centers. The magmatic edifices commenced at ~302 Ma with poorly evolved granites, which carried both suprasubduction and anorogenic signatures, then followed by more evolved and fractionated rhyolites and ignimbrites (up to 293 Ma). Both the geochemistry of all these rocks and the zircons inherited by them suggest that the

acid magmas were mainly derived from the upper crustal sources which comprised Sveconorwegian and older Baltican crust of pelitic/greywacke/felsic composition, with some mantle component.

Transcurrent movements on the TESZ faults along with the post-orogenic extension facilitated an onset of the North German-Polish Basin which was predisposed there by the heterogeneous crust with Baltica basement in the lower crust. Such structure of the TESZ might make it more susceptible to transient effects of late/post-orogenic extension, decompressional melting and mantle upwelling by the end of the Variscan orogeny, which eventually resulted in a short episode of the 'flare-up' magmatism in the North German-Polish Basin that ceased before mid-Permian times.

References:

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