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The Eger Graben: rift, failed rift or phantom rift ?

Jan Tomasek, Jonas Kley, and David Hindle

Georg-August-University Goettingen, Geoscience Center, Structural Geology and Geodynamics, Goettingen, Germany (jan.tomasek@uni-goettingen.de)

The Eger Graben in the northwestern Czech Republic is considered part of the European Cenozoic Rift System and is therefore usually called Eger Rift. It exhibits a strongly uplifted NW shoulder, known as the Erzgebirge, and is associated with earthquake swarms, voluminous CO_2 outgassing and Quaternary mantle-derived volcanism. The main graben is delineated by two faults: (1) the ENE-striking Erzgebirge Fault, which delimits the northwestern shoulder of the Eger rift and has accommodated tilting and uplift of the Erzgebirge, creating a present day elevation difference of 700 m and (2) the Czech Low Mountains Fault which separates the basin from the southern rift shoulder, creating a present day elevation difference of 250 m.

Nevertheless, the Eger Graben contains a Cenozoic volcano-sedimentary infill no thicker than 500 m while contemporary systems exhibit much more prominent records. As widely accepted, the Erzgebirge uplift in Plio-Quaternay times ensues the 'rift formation' (Eocene to Pliocene), but the relations among them are not yet fully understood. Due to its short lifespan and low subsidence rates other authors implied a rift, failed at an early stage.

Particularly by means of new apatite (U-Th)/He dataset (AHe) and flexural models we present a new tectonic interpretation of the Eger Graben evolution.

The ENE-striking rift axis roughly parallels a major crustal inhomogeneity, interpreted as a Variscan suture between the Saxothuringian and Tepla-Barrandian and Moldanubian terranes, which we assume to have formed a weak zone (a break) in the lithosphere, reactivated in Cretaceous/Tertiary times.

Broken-plate flexure modelling is an approach to unravel Erzgebirge uplift, match basin geometries and constrain applied forces. Our models can reproduce the asymmetric subsidence and shoulder uplift of the Eger Rift, which can be explained by a slightly thicker crust, 3-5 km, or a thinner mantle lithosphere under the Erzgebirge and Eger Rift. Seismic profiles across the Eger Rift show P-wave velocity contrasts, interpreted by previous authors as high-velocity bodies due to magmatic underplating (Mullick et al. 2015, Hrubcova et al. 2017). We assume that the late reactivation of the break in Oligocene time may reflect the loss of a sub-crustal load (remnant slab?) induced by e.g. mantle upwelling, mimicking some classic rift characteristics along a reactivated suture zone. We call it a 'phantom rift'.