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Tectonic control on long-term landscape development: the example of the Elbe Zone in the northern Bohemian Massif (Germany)

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The Bohemian Massif in the northern Alpine foreland consists of an array of basement blocks consolidated during the Variscan orogeny. Two major tectonic structures intersect the northern Bohemian Massif: the Eger Graben and the Elbe Zone. While the Eger Graben, an ENE–WSW oriented volcanotectonic zone, came into evidence first during the Oligocene, the WNW–ESE-striking Elbe Zone is known as having been active already in the Paleozoic and is supposed to have been repeatedly reactivated.

Thermochronological data in proximity of the Elbe Zone reveal denudation of the northern Bohemian Massif since the Late Jurassic. In the Erzgebirge, SW of the Elbe Zone, apatite fission track data indicate two stages of accelerated cooling in the Late Jurassic-Late Cretaceous and in the late Cenozoic, respectively. The first cooling stage corresponds to denudation of 1.5–5.9 km related to wrench tectonics along the Elbe Zone during Pangaea break-up. In Lausatia, E of the Elbe Zone, new fission track data comprising ages of 72–87 Ma and mean track lengths of $\sim$14 μm with standard deviations of $\sim$1.4 μm point to cooling during the Late Cretaceous–early Cenozoic without subsequent reheating to temperatures in excess of 60°C. Assuming a geothermal gradient of 20°–30°C/km, Late Cretaceous cooling implies denudation of 1.7 to 2.5 km in response to compressional reactivation of the Elbe Zone linked to inversion tectonics. In contrast, Late Cenozoic denudation 5.6 km and associated heat-flow increase observed in the Erzgebirge are likely connected to the formation of the Eger Graben starting from the Oligocene, as a result of the late Alpine orogenic phases.