Robl, Jörg[1]; Stüwe, Kurt[2]; Dremel, Fabian[1]; Fabel, Derek[3]; von Hagke, Christoph[1]; Hergarten, Stefan[4]

Old orogen - young topography: lithology governs landscape evolution in the uplifting Bohemian Massif

[1]Department of Environment and Biodiversity, Division of Geology and Physical Geography, University of Salzburg, 5020 Salzburg, Austria;
[2]Institute for Earth Sciences, University of Graz, 8020 Graz, Austria;
[3]Scottisch Environmental Research Center SUERC, East Kilbride, United Kingdom;
[4]3Institute of Earth and Environmental Sciences, Albert-Ludwigs-Universität Freiburg, Freiburg, Germany; *joerg.robl@plus.ac.at*

Although the topography of the Variscan orogen was largely leveled in the Permian, outcrops of Variscan rocks occur in the form of several low mountain ranges that form tectonic windows framed by Neogene sediments. The Bohemian Massif is one of these low mountain ranges and consists of high-grade metamorphic rocks and magmatic intrusions that dip southward below the weakly consolidated Neogene sediments of the Molasse Basin.
The timing and rates of Neogene uplift of the region are largely unconstrained, but the occurrence of marine sediments several hundred meters above sea level is a clear indication of significant surface uplift during the last few million years. Morphologically, the Bohemian Massif is characterized by rolling hills and extensive plains above 500 m, contrasting with deeply incised canyons with steep and morphologically active valley flanks. The central ridge of the Bohemian Massif forms a continental divide with the Vltava River and the Danube River draining the northern and southern parts of the mountain range. To constrain the pattern of landscape change and its rates, we calculated topographic metrics and determined catchment-wide erosion rates from the concentration of cosmogenic ^{10}Be in river sands.
Morphometric analysis reveals a landscape out of equilibrium. Longitudinal profiles of the river show an abundance of knickpoints at elevations of about 500 m, separating steep channel segments at lower elevations from less steep channel segments at higher elevations. Hypsometric maxima near knickpoint elevations, along with high and low values in geophysical relief downstream and upstream of major knickpoints, indicate a bimodal landscape. The continental divide has a pronounced asymmetry expressed by across-divide gradients in channel steepness. The higher average channel steepness in the southern Danube catchment predicts the northward migration of the Danube-Vltava divide. Erosion rates of 20 to 50 m per million years in the 20 catchments studied are very low compared to the Alps and seem to contradict the steep topography close to the receiving streams. The lowest erosion rates occur in catchments with a large proportion of low relief areas at medium altitudes. The highest erosion rates occur in the elongated catchments of the Danube tributaries, although these catchments also have a large proportion of low gradient topography.
Based on our results, we suggest that the Bohemian Massif was affected by low but long-lasting uplift without significant gradients between the Bohemian Massif and the nearby Molasse Basin. In our model, the presence of contrasting bedrock properties between the Neogene sediments of the Molasse Basin and the crystalline basement represents the overriding control on the topographic evolution of the entire region. As river incision progresses, there is a transition from highly erodible sediments to the much less erodible crystalline rocks below, which abruptly reduces the ability of a river to incise. As a result, relief forms and channel gradients increase until the erosion rate can balance the uplift rate. We propose that the Bohemian Massif is currently in such a transient state, expressed by landscape bimodality, where the two contrasting landscape types are separated by upstream migrating knickpoints.

Session: *Pangeo workshop: Earth Surface Dynamics*
Keywords: *Bohemian Massif, erosion rate, landscape evolution, contrasting lithology, young uplift*