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Combining landscape evolution modelling and low T thermochronology to determine the driving forces of relief rejuvenation

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The Variscan orogeny lasted from the Late Devonian to the Early Permian and resulted in a mountain range whose remnants can be found today in North America, Northern Africa, Europe and Asia. Although the mountain range was almost completely eroded to peneplains in the Permian, today the Variscan massifs (e.g., Appalachians, Massif Central, the Black Forest, Bohemian Massif) feature hilly to mountainous topography with peak elevations exceeding 1500 metres. This indicates surface uplift during the last million years. Clearly, the latest surface uplift is unrelated to the original mountain building phase, but cause, wavelength, timing and rates are still disputed.

Several Variscan massifs are characterised by low relief surfaces, rounded hilltops and graded river profiles with low channel gradients at higher elevations, but deeply incised rivers with migrating knickpoints and steep valley flanks prone to mass wasting at lower elevations near the base level of the receiving streams. This landscape bimodality may indicate temporal and/or spatial variations in uplift rates. Although these massifs have been studied extensively, the driving forces for relief rejuvenation are still unknown.

We investigate relief rejuvenation using two approaches, landscape metrics and low-temperature thermochronometry. This allows us to constrain landscape dynamics on different timescales, with both approaches covering the post-orogenic period. We use the Bohemian Massif as pilot study area, encompassing parts of Germany, Austria, Czech Republic and Poland. First results from the geomorphic analyses allow quantifying the observed landscape bimodality, with highest k_{sn} values at lower reaches of tributaries of the Danube River. Distinct across divide gradients in χ with low χ values on the Danube side indicate that the Danube tributaries feature a higher channel steepness on average than those of the Vltava. Assuming spatially uniform uplift rates and bedrock properties, across-divide gradients in χ may provide evidence for a northward migration of the watershed. In this case, the Danube catchment would grow at the expense of the Vltava catchment.

In addition, we compiled existing cooling ages from the Bohemian Massif to see if similar patterns can be observed on longer timescales. First results show that in the Sudetes in the NE of the

Massif, cooling ages found at high altitude areas are predominantly Late Cretaceous, while in lower areas Late to Middle Paleogene cooling ages prevail. South of the Sudetes, in the Austrian Mühlviertel region, this trend seems to be reversed. Local younger ages (late Mesozoic) are found in the higher reaches, while Jurassic cooling ages dominate in the lower sections. However, the relief rejuvenation identified in the geomorphological analysis does not appear to be reflected in this thermochronological data. To reconcile these findings and determine the spatial extent of the different cooling patterns, more low-T thermochronological data is currently processed.