

Structural and exhumational response to oroclinal bending at the Eastern Alps – Western Carpathian transition

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Curvature is an intriguing feature within many mountain belts worldwide. Several proposals have been made for deciphering the origin of curvature, however, there is still significant debate about the bend-forming mechanisms, the consequences as well as on how bending is accommodated within the lithosphere. Only few of the worldwide oroclines have been studied in detail and a variety of alternative controlling factors, such as the role of inherited structures, the rheological coupling between lower and upper plates, the presence of a basement promontory in the foreland and its particular geometry, and lateral orogen-parallel extrusion are likely underestimated or not considered at all.

This study focuses on oroclinal bending at the transition from the W-E trending Eastern Alps to the SW-NE oriented Western Carpathians. There, the orogenic front is concave towards the Alpine foreland and the greatest degree of curvature (ca. 55°) is found adjacent to the Bohemian massif. The oroclinal axis runs from the Bohemian promontory to the South Burgenland high. Various competing mechanisms occurred, i.e. rotation around a stiff foreland promontory and lateral extrusion induced by tectonic escape due to the indentation of a microplate and extensional collapse due to slab-rollback beneath the Carpathians. Little is known for such cases, where bending around as well as overriding of a promontory occurs, particularly on how it controls the exhumational and structural architecture within the orogen itself.

Based on a synthesis of low-T thermochronology and structural data we find a significant impact of oroclinal bending on exhumation and structures: Highest amounts of erosion occur in the immediate vicinity of the Bohemian promontory and along its prolongation in the South Burgenland high, corroborating that shortening and exhumation are most pronounced there and should decrease along-strike of the orogenic front. In the outer bend strong Miocene extensional thinning parallel to the orogen occurred contemporaneously with sediment deposition to the east (Danube basin) and west (Styrian basin) of the oroclinal axis. We speculate that the location of extension at least from the Vienna and Danube basins are in part controlled by Jurassic extensional structures. The central sector along the oroclinal axis is largely overprinted by lateral block extrusion where the influence of oroclinal bending and a protruding promontory in the subsurface has yet to be demonstrated.