



New constraints on the tectonic and thermal evolution of the Central-Western Carpathians

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The Central-Western Carpathians have been studied for long time but they are a still matter of discussion. In addition, they are one of the principal East European targets for oil and gas exploration. Understanding the tectonic evolution and the spatial and temporal variation of the thermal regime is crucial for this purpose. This orogen formed after the collision between the European Platform and the ALCAPA and Tisza-Dacia microplates from the Upper Jurassic to the Neogene. The widely accepted interpretation suggests the occurrence of the oceanic lithosphere subducting under the two microplates and the development of the oceanic suture in the Pieniny Klippen Belt area during the Paleocene. The subduction ends when the accretionary wedge reaches its present-day position on top of the southern border of the European Platform. The Carpathian arc can be subdivided into three tectonic domains:

- Outer Carpathians made up of Upper Jurassic to Lower Miocene siliciclastic deposits intercalated with shales and sandstones;
- Pieniny Klippen Belt formed by Mesozoic olistoliths and olistostromes in a sandy-clay Cretaceous sheared matrix;
- Inner Carpathians consisting in Variscan allochthonous crystalline basement with its Mesozoic cover involved in the late Cretaceous folding and thrusting. These deposits are unconformably overlain by the undeformed Central Carpathian Paleogene Basin successions.

Cross-section balancing and sequential restoration integrated with low-temperature thermochronometry (apatite fission track and apatite (U-Th-Sm)/He analysis) can better constrain the tectonic evolution of this area and, in particular, its exhumation history. Seven balanced sections have been constructed across the Polish and Ukrainian Carpathians. The sequential restoration shows a thick-skinned tectonics during the Upper Cretaceous, involving the Inner Carpathian basin. The erosion of the Mesozoic basement cover and the sedimentation of these deposits in the foreland basin, north of the Inner Carpathian belt, formed the waldflysch outcropping in the Pieniny Klippen Belt area. The Outer Carpathian successions are involved in thin-skinned tectonics from the Oligocene up to the Middle Miocene. Our structural and thermal modelling highlight different timings, exhumation processes and amounts of shortening for the Polish and Ukrainian Carpathians. In the western Polish Carpathians exhumation is mainly syn-thrusting, starting from the Late Oligocene. The shortening is around 50% increasing eastwards. In the borderland between Poland and Ukraine the shortening gets lower (48%). In this area thrusting is followed by extension due to low-angle normal faults. This is confirmed by post-thrusting cooling ages and higher erosion rates (0.4-1.1mm/yr). On the other hand the Ukrainian Carpathians are characterized by a constant amount of shortening (51%) and exhumation controlled by erosion during post-collisional regional uplift.