- Tertiary (collision of the European and the Carpatho-Pannonian plate);
- Mesozoic (shortening within the frame of the Central Western Carpathians plate with the rise of two main paleoalpine tectonic units - the Tatricum and the Veporicum);
- Paleozoic (the crystalline basement of the last mentioned Alpine tectonic units comprise relicts of three main Hercynian lithotectonic units, being mutually overthrusted during continental collision in the mesohercynian stage).

The pre-Alpine crust of the Central Western Carpathians originated as a result of the Hercynian continental collision. Reconstruction of the pre-collisional situation is difficult because reliable structural and geochronological data for the early Hercynian stages and fragments of the Cadomian consolidated crust either are lacking. The stage of continental (microcontinental) Hercynian collision was preceded by subduction since in certain segments of the Western Carpathians crystalline relicts presumably of an oceanic crust and higher pressure metamorphic rocks are present. Consolidated continental crust was formed in the collisional stage (after early Paleozoic subduction) as an amalgamated cluster of the Precambrian fragments, the early Paleozoic metamorphic rocks and granitic intrusions. This crust was later affected by extension in the late Hercynian stage.

CRUSTAL STRUCTURE STUDY OF THE EUROPEAN PLATE PASSIVE MARGIN BENEATH THE WESTERN CARPATHIANS BASED ON GRAVITY DATA

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The Carpathians are included in the northern branch of the European system of the Alpides. Together with the Eastern Alps and the Dinarides they are the result of a Mesozoic and Cenozoic continental collision between Europe and several continental fragments to the south, including Africa.

Gravity models show changes in the degree of continental convergence in the Eastern Alpine and Western Carpathian region. Analysis of the continental collision zone incoporates a kinematic model of ocean basin closure, whereby gravity anomalies and topography are viewed as part of a continuum of continental crustal shortening, erosion and isostatic rebound. Thick crust and high topography in the Eastern Alps along with a broad Bouguer anomaly of -140 mGal amplitude, are consistent with about 175 km of crustal shortening, followed by 10 km of isostatic rebound. Eastward, crustal thicknesses and gravity anomaly widths and amplitudes are less, so that only about 50 km of continental crustal shortening and 4 km of rebound occurred in the Western Carpathians.

Analysis of deflection, topographic and gravity data illustrate that the lithosphere in the Western Carpathians behaves elastically and flexural bulge of topography in foreland can be described in terms of the flexure of an elastic lithosphere acted upon by a vertical force and a bending moment. The Western Carpathian fold belt is characterized by a positive - negative anomaly "couple", as in the case of the Alps and the Appalachians. For the determination of the effective elastic plate thickness and effective flexural rigidity of the continental lithosphere beneath the Western Carpathians thin elastic plate theory was used. The elastic thickness varies from 24 km to 35 km. It seems to be that the origin of lithosphere deflection is the result of both, surface and subsurface loading. A long-wavelength asymmetric gravity low is associated with the flexure basin and/or in other words with the basement deformation of the passive margin of the European underthrusting plate. The gravity high that is unrelated to the topographic relief and surface geology has to be associated with the burried loads.

This suggestion is also supported by some lithospheric cross sections. The gravity modells predicts that the depth to Moho progressively increases from the foreland to the Inner Western Carpathians units. In fact, the maximum depth to Moho is in between the thrust front and the obducted crustal block (subsurface load). Towards the Pannonian Basin the Moho shallows. The crustal thinnning of the underriding plate beneath the flysch nappes is interpreted as a remnant of crustal thinning along the Mesozoic passive continental margin of Europe. Double crustal and lithosphere thinning is associated with Pannonian Basin extension. Note that shallowing lithosphere/astenosphere boundary has propagated beyond the Carpathians into the European Platform. But crustal thinning appears to be confined to the Carpathian interior, so that crustal structure in the Eastern Alps and Outer Carpathians is a remnant of the earlier collision orogen.

PALEOGEOGRAPHIC CONTROL OF GEOTHERMAL CAUSED VARIABILITY IN A LITHOSPHERE SECTION

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At the bottom of the lithosphere the temperature is close to 1200 °C. The isostatic equilibrium is consistent with the normal geothermal situation. But anomalous geothermal conditions were caused by the alpidic metamorphism and tectonics. Anomalous geothermal fields cross the alpidic front. The paleoisotherms of the Bohemian Massif should go up in these cases. The Bohemian Massif gets isostatic uplifts in these times of melting of the barysphere.