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Subsidence, erosion and thermal history of the West Carpathian Foredeep Basin, Czech Republic

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The present shape of the West Carpathian Foredeep Basin (WCFB) in the Czech Republic is strikingly narrower than the Alpine Molasse Basin in Austria and Carpathian Foredeep in Poland. Our study presents data on heat flow and thermal maturity patterns in the WCFB and compares them with the relevant data in the underlying units and adjacent West Carpathian Flysch Belt in order to evaluate the extent of erosion. In general the heat flow is very low in the Vienna Basin and moderately increases to NE, where the highest values are observed above the coal-bearing Upper Silesian Basin. Lower to Middle Miocene rocks of the WCFB show very mild increase of thermal maturity of kerogen and low decrease in porosity with depth down to 5 km. Organic matter is thermally immature as deep as 4 km where the strata enter early oil window. The underlying Paleogene, Cretaceous, and Jurassic follow a very similar diagenetic trend and suggest only local erosion in incised valleys, where Eocene sediments replaced the removed Mesozoic rocks. Marked offset in thermal maturity is observed between the top of Carboniferous and younger units evidencing regional erosion of 1.8-5 km of Late Paleozoic strata. Significant difference in thermal maturity exists between the Miocene of the WCFB and West Carpathian Flysch Belt (FlB). The application of basin modeling suggests that the deepest burial and catagenesis of the Mesozoic to Tertiary sedimentary rocks occurred prior to imbrication and stacking of the tectonic slices. The uplift and erosion in the FlB increases from the frontal Zdanice and Subsilesian units to Silesian and Raca nappes situated closer to hinterland, while the Bile Karpaty nappe does not follow this rule and is less mature than Raca (Magura). The erosion and transport of sediments to the sink areas of the Vienna and Danube Basins occurred during the final phases of thrust propagation in the Early Miocene and continued to Middle (Upper?) Miocene. The fission track data suggest that about 1 km of the Middle Miocene was removed from the WC Foredeep Basin and transported together with the material from the Flysch Belt in the Miocene to Pliocene Basins of the Danube river basin system.