The Early through Middle Miocene dynamics of the Polish Carpathian Foredeep

Nestor Oszczypko[1]

[1]*Institute of Geological Sciences, Jagiellonian University, Oleandry 2a, 30-063 Kraków, Poland*

The Polish Carpathian Foredeep (PCF) has developed as a peripheral foreland basin related to the moving front of the Western Flysch Carpathians. The Flysch (Outer) Carpathians are built up of stack of nappes and thrust-sheets, showing a different lithostratigraphy and structure. The Outer Carpathians are composed of the Late Jurassic to Early Miocene, mainly turbidite (flysch) deposits, completely upro-

oted from their basement. The main decollement surfaces are located at different stratigraphic levels. All the Outer Carpathian nappes are flatly overthrust onto the Miocene deposits of the Carpathian Foredeep. However, along the frontal Carpathian thrust a narrow zone of folded Miocene deposits, was developed (Stebnik (Sambor–Rozniatov) and Zgłobice units).

The basement of the Carpathian Foredeep represents the epi-Variscan platform and its cover. The depth of the platform basement, recognised by boreholes, oscillates from a few hundred metres in the marginal part of the foredeep up to more than 7,000 m beneath the Carpathians. The magneto-telluric soundings in the Polish Carpathians revealed a high resistivity horizon connected with a consolidated–crystalline basement. The depth of magneto-telluric basement varies from 3–5 km in the northern part of the Carpathians and dips to approximately 15–20 km at its deepest point then peaks at 8–10 km in the southern part. The axis of the basement coincides more or less with the axis of gravimetric minimum. South of the gravimetric minimum, and more or less parallel to Pieniny Klippen Belt, the zone of zero values of the Wieses vectors was recognised by geomagnetic soundings. This zone is probably connected with the boundary between the North European Plate and the Central Western Carpathians (Slovak Block).

The PCF can be subdivided into the outer and inner foredeep. The outer foredeep (outside the Carpathians) is filled up with the Middle Miocene (Badenian and Sarmatian) marine deposits, from few hundred metres in thickness in its northern-marginal part up to 3,500 m in south–eastern part. The inner foredeep which is located beneath the Carpathian nappes is probably more than 50 km wide and is composed of the Lower to Middle Miocene autochthonous deposits up to 1500 thick. The Lower Miocene deposits are mainly terrestrial in origin, whereas the Badenian and Sarmatian deposits are marine. The oldest known deposits (Ottnangian–Karpatian), up to 1000 m thick, have been pierced in the drilling Zawoja–1. The deposits are composed of conglomerates passing upwards into variegated claystones and mudstones and containing a 200 m thick, flysch-derived olistoplaca. The Middle Miocene began from the broad Early Badenian marine transgression which flooded both the foredeep and marginal part of the Carpathians. In the foredeep, the Badenian deposits rest directly on the platform basement, with the exception of the SE part of the inner foredeep where they cover Lower Miocene deposits.

The Carpathian Foredeep began to form during the Ottnangian, simultaneously with folding, overthrusting and inversion of the Outer Carpathians. The subsidence of the foredeep was initiated by overriding of the Carpathians onto the foreland plate, and then was controlled both, by the sediment and thrust-induced load. The periods of intensive subsidence in PCF correspond with periods of progressive emplacement of the Western Carpathians onto foreland plate. It makes possible to conclude that the main driving force of the tectonic subsidence was emplacement of the nappe load. During the Early–Middle Miocene time the loading effect of the thickening Carpathian wedge on the foreland plate increased and caused progressive increase of the total subsidence. At that time the mean rate of the Carpathian overthrusting reached 7,7–12,3 mm/a. During the Late Badenian–Sarmatian time the rate of advance of the Carpathian wedge was probably less than that of pinch-out migration and, as a result, the basin widened. The Miocene convergence of the Carpathian wedge resulted in the migration of depocenters and onlap of successively younger deposits onto foreland plate.