the Tisza-Dacia mega-tectonic unit, but also the allochthonous flysch nappes of the Pienides, i.e. the eastern tip of the ALCAPA mega-tectonic unit. Well-documented opposed rotation of the remainder of ALCAPA necessitates a detachment of this eastern tip of ALCAPA after 18.5 Ma. The most likely location for this detachment zone is along the margins of the Transcarpathian depression. During a second (post-12 Ma) stage, counterclockwise rotations of up to 30 ° affected the entire working area. Regarding timing and magnitude, these second stage rotations are similar to rotations documented for the East Slovak basin, but different from those reported from the South Apuseni Mountains and the Central and Inner West Carpathians located west of the East Slovak basin.

First Paleomagnetic Results from the Oligocene Sediments of the Silesian Nappe, Western Outer Carpathians

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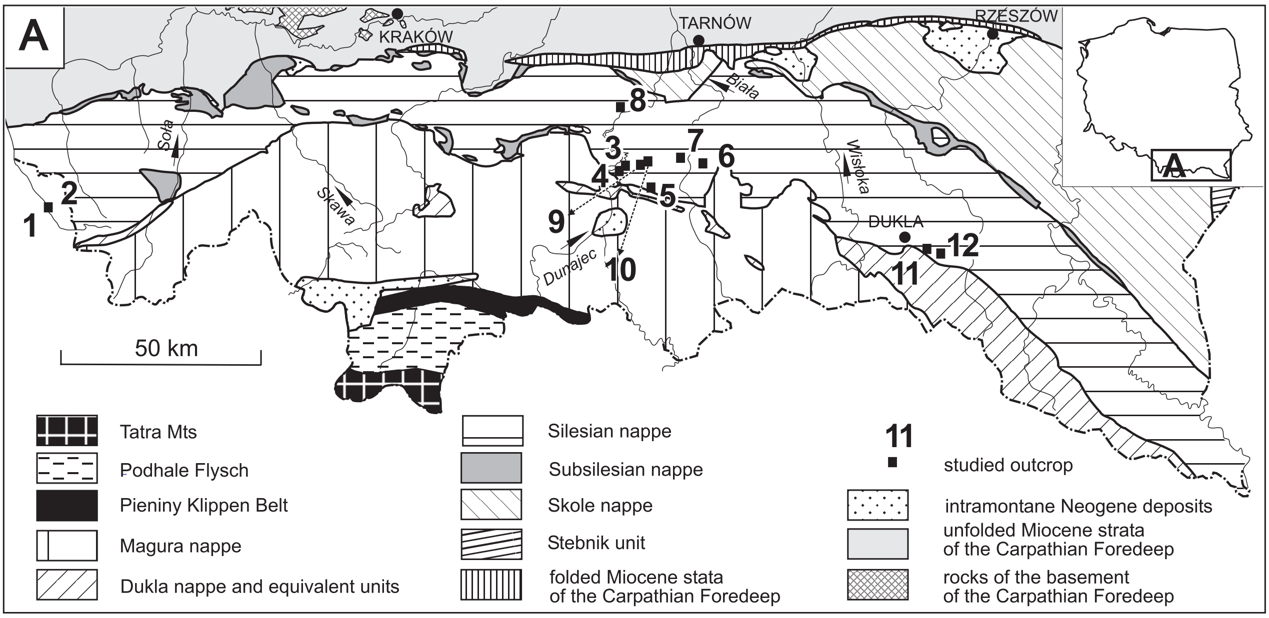
Western Outer Carpathians consist of several north-verging Nappes. The Silesian Nappe, the subject of the present study, is situated between tectonic units from which there are a number of Tertiary paleomagnetic results, the Magura Nappe and the molasse zone of the foredeep. It consists of Late Jurassic – Early Miocene rocks, mostly flysch sediments. The rocks of the Silesian Nappe form an arc, which is gently convex to the north. The regional fold axes are almost parallel to the trace of the frontal thrust of the nappe, thus they are WSW–ENE oriented in the west, E–W striking in the central segment and WNW–ESE oriented in the east. Bending followed regional folding and thrusting, after the mid-Miocene.

Krosno Formation consisting of shales and sandstones in different proportion represents the youngest strata of the Silesian Nappe. We sampled for paleomagnetic study the shaly members at 12 localities (and also a limestone bed at locality 2), distributed along the bend from the Czech–Polish boundary to Krosno. The sampled localities are of Oligocene age.

As a result of standard paleomagnetic measurements and evaluation, 10 localities yielded statistically good paleomagnetic results; for one locality (loc. 7) the statistical parameters are poor but the direction is still in line with the others. Tilt test on regional scale (including 11 localities) is positive, best statistics is obtained at 105 % untilting; the overall mean paleomagnetic direction is D = 310 ° I = 65 ° (k = 30 $\alpha 95$ = 8°). Although the remanence is of pre-folding (tilting) age, there is no correlation between individual declinations and the regional fold axes.

Magnetic fabric is dominantly foliated and is basically of sedimentary character. Yet lineation directions are E–W oriented (exceptions are locality 1, in the western and locality 9, in the central



■ **Fig.1.** Paleomagnetic sampling localities (1–12) in the Silesian Nappe.

segment of the Silesian unit). Variation in the lineation directions is not dependent on the orientation of regional fold axes.

The paleomagnetic and magnetic anisotropy results of the present study suggest that the Silesian Nappe rotated en block in a stress field of uniform direction, after Oligocene. The rotation angle is about 50 °, the sense is counterclockwise. As the paleomagnetic signals are of pre-folding/tilting age, our results do not support the bending origin of the systematic trend in the orientation of the regional fold axes.

Compared to the paleomagnetic results for the Magura Nappe, the present results are superior, since the paleomagnetic signal is better defined and is of pre-folding/tilting age. Yet, the overall rotations are the same. Between the two Nappe systems, there is the Dukla Nappe, which have to be studied in the future before we can explicitly state that Magura and Dukla Nappes rotated as one tectonic body.

An other important aspect of the present results is the originally stable European connection of the study area, since the results characterize the hinterland of the molasse basin, where rotation measured was only 30 °counterclockwise. In this case, there are also missing links, i.e. the Miocene rotations of the Subsilesian and Skole Nappes are not constrained paleomagnetically. Future studies will show if the rotation angle gradually changes from the Silesian Nappe system towards the molasse zone or the change is abrupt at the northern front of the Western Outer Carpathians.

Dating of the Gneiss Clasts from Gródek at the Jezioro Rożnowskie Lake (the Silesian Unit, SE Poland) Based on U-Pb Method

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Zircons from the gravel size gneiss clasts collected in Gródek at the Jezioro Rożnowskie Lake (the Silesian Unit, Western Outer Carpathians) were dated using U-Pb method with the aid of CL images. Previously other geochronological investigations of these samples were reported by Jacher-Śliwczyńska (2004) and Michalik et al. (2004).

Analyses were performed on separated zircon grains from four gneiss samples with use of LA-ICP-MS at the University of Arizona (Tucson, AZ, USA). Cores and rims or tips of zircons were analyzed when possible. 139 analyses were conducted, of which 63 are from cores and 76 are from rims and tips.

Gneisses are composed of quartz, K-feldspar, plagioclase, muscovite and biotite. Fe-Ca garnet, zircon, epidote, apatite, monazite, uraninite, Fe oxides, rutile, pyrite and zinc sulphides are present as accessory minerals. Detailed information about microstructure, alterations and chemical composition of selected minerals as well as whole rocks are given by Michalik et al. (2004).

Zircon forms euhedral to anhedral, doubly-terminated prismatic, <150 μm in size crystals. All grains exhibit complex zoning pattern. Xenocrystic cores (rarely subrounded) mantled by newly grown magmatic zircon commonly occur. Presence of fractures or inclusions is common. U content and U/Th ratio are 75–10092 ppm and 0.4–31.4, respectively, for cores, and 64–4597 ppm and 0.9 to 14.3 for rims. Cores as well as rims have experienced Pb loss.

Cores yield wide spectrum of Precambrian ages – ca. 1250 up to ca. 2747 Ma. Younger ages were obtained from rims. Tight clusters of eight analyses from sample JR-6 and seven analyses from sample JR-12 indicate ages 533 ± 19 Ma and ca. 572 Ma, respectively.

Zircon shapes and internal structures indicate their magmatic origin. Geochronological results are related to at least several magmatic events: older – Precambrian, and younger – Cadomian – early Caledonian. These results are particularly consistent with monazite CHIME ages of the same samples reported by Michalik et al. (2004) and indicate age of the protolith of gneisses. That there are no Variscan zircon U-Pb ages, that might be correlated with previously provided micas K-Ar ages (e.g. Poprawa et al. 2004) or monazite CHIME ages (e.g. Michalik et al. 2004, Poprawa et al. 2005).

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