

# Morphostructural Analysis of the Mutual Relationships and Tectonic Influence of the Variscan and Alpine Orogeny in the Northern Part of the Moravosilesian Zone

Radomír GRYGAR and Jan JELÍNEK

*Institute of Geological Engineering, Technical University of Ostrava, tř. 17. listopadu, 708 33 Ostrava-Poruba, Czech Republic*

The Moravosilesian part of the Bohemian Massif represents a unique example of structural interference between two principal tectogens - Variscan and Alpine. A superposition of three structural levels can be found here: Pan-African or Cadomian (Brunovistulicum), Variscan (Renohercynian and Sub-Variscan zones of the Variscan orogeny) and Alpine (nappes of the Outer Carpathians and the Alpine foredeep). Brunovistulicum as the oldest crustal segment - Pan-African terrane - represents a conjunctive foreland of both accretionary wedges: the older Variscan one (with generally NE vergency) and younger Alpine one (with NW to N vergency). The frontlines of both orogenies seem to run almost subparallel in the region of Moravia and Silesia, but in fact they are rather oblique. Structural framework and kinematics of Alpine thrusts of the Outer Carpathians were, without any doubt, influenced by inherited epi-Variscan structures on the southeastern boundary of the Bohemian Massif, including the Brunovistulicum. At the same time, tectonic and gravitational loading of the southeastern slopes of the Bohemian Massif by the thrusts of the Outer-Carpathian nappes of the Subsilesian and Silesian units modified the structural framework of the epi-Variscan fundament considerably, especially due to the rejuvenation of inherited faults and dislocation zones. The Sub-Variscan zone is also a substantial part of the Alpine foreland. It is represented by the Upper Carboniferous coal-bearing molasse of the Upper Silesian basin.

Both Variscan and Alpine orogenic belts were closely studied (see Roth 1980, Dudek 1980, Kumpera 1983, Stráník et al. 1993, Dopita et al. 1997 etc.), also from the viewpoint of their structural-tectonic development. Much less attention has been paid to their mutual relationships, especially to mutual structural influence of both accretionary wedges and outer molasse basins. Even less attention has been paid to deformations under the conditions of brittle tectonics, following the main ductile and brittle-ductile orogenic phases. There are many important regional tectonic structures of the Variscan and Alpine orogeny, whose individual kinematic phases of brittle deformations have not been closely analysed yet, especially in connection with the rejuvenation of inherited faults. The Upper Silesian coal basin is a good example because its structural-tectonic composition is relatively well known, mainly in its exploited part. However, there are practically no studies concerning the Czech part of the basin, which would deal with the influence of the Alpine thrust tectonics on the rejuvenation of inherited structures of the epi-Variscan foreland, a part of which the basin is. On the contrary, several analyses deal in detail with the relationships of the late Variscan and Alpine geodynamics in the Polish part of the Upper Silesian basin (e.g. Jura, 1995, 1997; Jura and Trzeplerczyński 1997, etc.).

The main goal of this contribution is to present preliminary results of our study of the morphotectonic development and mutual structural influence of the Variscan and Alpine orogenic

zones in the Moravosilesian region. By means of a comparative study of the Variscan and Alpine structural levels, we aim to classify and quantify deformational effects of individual Variscan and Alpine tectogenic phases in detail. The most promising region in this respect is the wider area of the Upper Silesian Basin (Variscan autochthon) and nappes of the Silesian and Subsilesian units of the Outer Carpathians (Alpine allochthon) thrust on it in the area of the Moravosilesian Beskydy Mts. and the Sub-Beskydy Hills. The structural and complex geological development of the Upper Silesian Basin is relatively well known, and a number of structural data, map documents and lithofacies studies are available.

Preliminary comparative analyses demonstrate, in a number of factors, a very good geometrical and genetic correlation between the structural framework of the Upper Carboniferous coal-bearing molasse and the buried relief of the epi-Variscan platform. At the same time, it appears that similar thing can be said about the relationship between the morphostructural pattern of the present epi-Alpine relief and the structural framework of the Upper Silesian Basin. This reveals a not negligible and so far unquantified role of the Alpine rejuvenation of the Variscan structures (especially a number of important regional faults and shear zones) in the course of the nappe thrusting of the Outer Carpathians.

These relationships are more intimately studied, using all the possibilities of complex processing of collected databases in the GIS environment, as well as computer graphics (3D visualisation of structural surfaces, landscape reliefs, modelling of virtual reality, etc.). The development of DMT - digital model of landscape and its morphotectonic analysis represent a substantial part. The best results can be achieved with simultaneous and complex confrontation of this approach with classic methods of structural mapping and mesoscale structural field analysis.

## References

- DOPITA M. et al. 1997. Geologie české části hornoslezské pánve. MŽP ČR, 278 pp. Praha.
- DUDEK A. 1980. The crystalline basement block of the Outer Carpathians in Moravia: Bruno-Vistulikum. Rozpr. Čs. Akad. Věd., 90, 8, 1-85.
- JURA D. 1997. Late Variscan and Alpine geodynamics of the Upper Silesian Coal Basin. Prace państw. Inst. Geol. CLVII, Proceed. XIII Inter.Congr. Carbon. Perm., Part 2, 169-176.
- JURA D. and TRZEPIERCZYŃSKI J. 1997. Morphotectonic development of the *Sub-Permian surface along the Upper Silesian Coal Basin*, Prace państw. Inst. Geol. CLVII, Proceed. XIII Inter.Congr. Carbon. Perm., Part 2, 177-182.
- KUMPERA O. 1983. Geologie spodního karbonu jesenického bloku, *Knihovna ÚÚG*, sv. 59, 171 pp. Praha.

ROTH Z. 1980. Západní Karpaty - terciární struktura střední Evropy, *Knihovna ÚÚG*, sv. 55, 128 pp. Praha.

STRÁNÍK Z., DVOŘÁK J., KREJČÍ O., MÜLLER P., PŘICHYSTAL A., SUK M. and TOMEK Č. 1993. The Contact of the North European Epivariscan Platform with the West Car-

pathians, *Journal of Czech Geological Society*, 38, 1-2, 21-29.

This study was supported by the GAČR - Grant Agency of the Czech Republic (Grant Project #205/97/0679).