west Sudetian clastics can be interpreted as low-grade metamorphosed schists of the recycled orogen with a variable amount of remnants of acid volcanism. Partly exposed parts of the craton should be taken into account as well.

The East Sudetic Culmian in Poland which is a continuous part of the Moravian-Silesian Culmian is characterised by a higher amount of magmatic material and of mesozonal metamorphites.

Variscan Thrusting and Extensional Collapse in the Karkonosze-Izera Massif, West Sudetes: Tectonic, Sedimentary and Magmatic Record

Stanislaw MAZUR

Institute of Geological Sciences, University of Wrocław, pl. Maksa Borna 9, 50-204 Wrocław, Poland

The Karkonosze-Izera Massif in the Western Sudetes comprises the Karkonosze granite pluton together with its metamorphic envelope. The latter consists of three crystalline nappes characterised by contrasting metamorphic paths (Kryza and Mazur 1995, Mazur and Kryza 1996). From base to top these are: Izera-Karkonosze, South Karkonosze and Leszczyniec units. A complete section across the three nappes is exposed in the Rudawy Janowickie metamorphic complex along its boundary with the Intra-Sudetic Basin. In general, a medium pressure (MP) Izera-Karkonosze unit is tectonically overlain by two high pressure (HP), South Karkonosze and Leszczyniec, units.

The MP Izera-Karkonosze unit is composed mainly of the Upper Cambrian - Lower Ordovician (Oliver et al. 1993) Izera granite (in most part subsequently deformed into the Izera gneiss) and of mica schists representing remains of its envelope. The mica schists are, locally, intercalated with variegated metavolcanic rocks of within-plate geochemical signature (Winchester et al. 1995). In the east and south, the Izera granite-gneiss, together with the Upper Proterozoic (?) mica schists of its envelope, are tectonically overlain by (1) the Lower Palaeozoic metasedimentary-metavolcanic sequence of the HP South Karkonosze unit and (2) the Lower Ordovician (Oliver et al. 1993) metabasalts and bimodal igneous rocks of the HP Leszczyniec unit. The igneous rocks of the both units geochemically correspond to magmas of an evolved rift setting (Kryza et al. 1995, Winchester et al. 1995).

The tectonic evolution of the Karkonosze-Izera Massif involved two main events, related to contraction and subsequent extension of the crust (Mazur and Kryza 1996). The contractional event, probably Late Devonian in age, comprised pervasive reverse-displacement shearing, associated with a NW-directed thrusting and concomitant progressive metamorphism, which resulted in tectonic juxtaposition of the MP and HP units. The D_1 event produced widespread deformational fabric consisting in the main foliation S_1 and mostly NW-SE trending stretching lineation with local presence of top-to-the NW shear criteria. The orientation of L_1 stretching lineation in the Leszczyniec unit is NNE-SSW and it differs from the general trend of L_1 in the neighbouring units. Petrological data from the envelope of the eastern contact of the Karkonosze granite (Mazur and Kryza 1995) indicate that Izera gneiss experienced MP metamorphism, generally below the amphibolite facies, whereas the overlying tectonic units were subjected to HP metamorphism prior and partly during D_1 under the blueschists (South Karkonosze unit) and epidote-amphibolite (Leszczyniec unit) facies conditions. The lower time limit of the nappe stacking is constrained by the age of phengites from mafic blueschists of the South Karkonosze unit dated at about 360 Ma (Maluski and Patočka 1997). The upper limit corresponds to the age of the late- to post-tectonic Karkonosze granite estimated at ca. 330 Ma (Duthou et al. 1991).

The subsequent extensional event, probably of Early Carboniferous age, comprised normal to wrench-normal shearing related to ESE-directed extensional collapse (Mazur and Kryza 1996). This event produced stretching lineation L_2, locally oblique to L_1. The extensional displacements were localised in a several kilometres wide dip-slip shear zone along the eastern margin of the Karkonosze-Izera Massif. This N-S trending zone corresponds to the Rudawy Janowickie metamorphic complex outcrop zone which defines a narrow belt between the Karkonosze pluton and the Intra-Sudetic Basin. The deformation changes across this zone from ductile shearing in the foot wall to brittle-ductile and brittle displacements in the rocks adjacent to the hanging wall. The hanging wall of the shear zone corresponds to the western portion of the Intra-Sudetic Basin separated from the Rudawy Janowickie complex by brittle normal faults. A deposition of 5-7 km thick sequence of coarse-clastic sediments in the Intra-Sudetic Basin provide evidence of rapid subsidence during the Visean. The MP unit of the Rudawy Janowickie complex, structurally the lowermost one, is exposed in the innermost part of the foot wall. This unit was subjected to a LP/HT metamorphic event, coeval with the extensional shearing, and was intruded by the granite pluton. The emplacement of the Karkonosze granite was accompanied by regional doming which resulted in reorientation of D_1 structures on flanks of the dome. The age of the extensional event corresponds to the age of the greenschist facies metamorphic overprint dated in blueschists from the Rýchory Mts. at ca. 340 Ma (Maluski and Patočka 1997).

Generally, the Karkonosze granite bears no evidence of solid state deformation. Nevertheless, WNW-ESE trending, non-penetrative lineation, defined by alignment of feldspar megacrysts was recognised in the granite by Cloos (1925). Recent studies of magnetic fabric (Diot et al. 1995) provide evidence of WNW-ESE trending magnetic lineation in the Karkonosze granite. This lineation is interpreted to reflect the direction of magmatic flow. The magnetic lineation of the granite parallels the feldspar lineation of Cloos (1925) and the stretching lineation in the adjacent metamorphic rocks. The parallelism of the lineations developed in the pluton and within its metamorphic envelope indicates a relationship between the granite emplacement and the final phase of extensional collapse. Furthermore, the granite has recorded evidence of a top-to-the ESE sense of shear, indicated by tilting of feldspar megacrysts, characteristic of the extensional deformation event.

References

LOOS H. 1925. Einführung in die tektonische Behandlung magmatischer Erscheinungen (Granittektonik). *I Spez. Teil. Das Riesengebirge in Schlesien*, 194, Berlin.

DIOT H., MAZUR S. and PIN Ch. 1995. Karkonosze batholith (NE Bohemian Massif): the evidence for pluton emplacement during transtentional-extensional collapse. *J. Czech Geol. Soc.*, 40, 62.

DUTHOU J. L., COUTURIE J. P., MIERZEJEWSKI M. P. and PIN C. 1991. Rb/Sr age of the Karkonosze granite on the base of the whole rock method, *Geol., Review*, 2, 75-79.

KRYZA R. and MAZUR S. 1995. Contrasting metamorphic paths in the SE part of the Karkonosze-Izera block (Western Sudetes, SW Poland). *Neues Jahrbuch für Mineralogie, Abhandlungen*, 169, 157-192.

KRYZA R., MAZUR S. and PIN C. 1995: Leszczyniec meta-igneous complex in the eastern part of the Karkonosze-Izera Block, Western Sudetes: trace element and Nd isotope study. *Neues Jahrbuch für Geologie Mineralogie, Abhandlungen*, 170, 59-74.

MALUSKI H. and PATOČKA F. 1997. Geochemistry and ^{40}Ar-^{39}Ar geochronology of the mafic metavolcanic rocks from the Rýchory Mountains complex (West Sudetes, Bohemian Massif): paleotectonic significance. *Geological Magazine*, 134, 703-716.

MAZUR S. and KRYZA R. 1996. Superimposed compressional and extensional tectonics in the Karkonosze-Izera Block, NE Bohemian Massif. In ONCKEN O. and JANSSEN C. (ed.): *Basement Tectonics 11, Europe and Other Regions*, 51-66. Dordrecht, Kluwer.

OLIVER G. J. H., CORFU F. and KROGH T. E. 1993. U-Pb ages from SW Poland: evidence for a Caledonian suture zone between Baltica and Gondwana. *Journal of the Geological Society, London*, 150, 355-369.

WINCHESTER J. A., FLOYD P. A., CHOCYK M., HORBOWY K. and KOZDRÓJ W. 1995. Geochemistry and tectonic environment of Ordovician meta-igneous rocks in the Rudawy Janowickie Complex, SW Poland. *Journal of the Geological Society, London*, 152, 105-115.

The Problem of the Svratka Anticline

Rostislav MELICHAR

Department of Geology and Paleontology, Faculty of Science, Masaryk University, Kotlářská 2, 611 37 Brno, Czech Republic

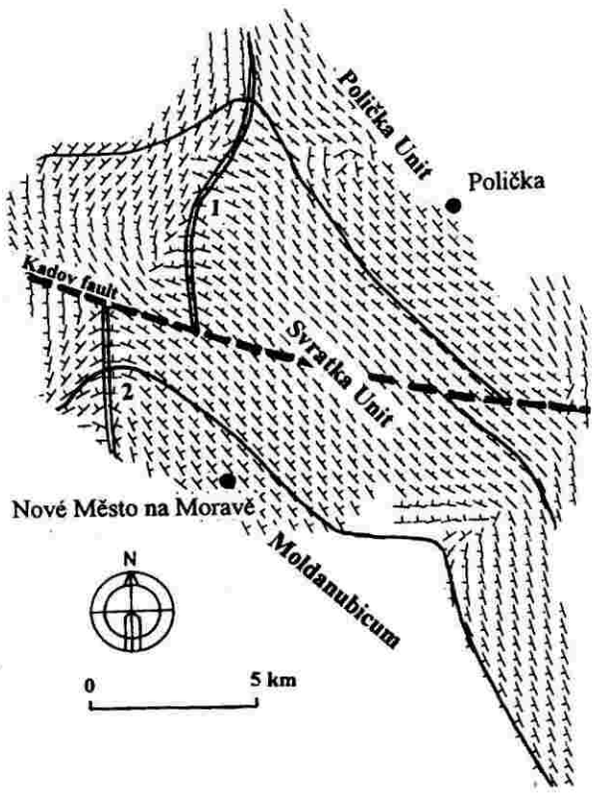

Fig. 1. Map of spatially averaged directional data (foliation) of the Svratka Unit. Rosiwal's (1) and Zrůstek's (2) anticline are two parts of one large anticlinal structure.

The term Svratka Anticline (Die Anticlinale von Swratka) was used for the today's Svratka Unit by Rosiwal (1895). The Svratka Unit is a metamorphic complex consisting of polyphase migmatitic rocks and mica schists with some inclusion of skarns, amphibolite bodies and metasediment intercalations (marbles). It comprises a large deformed intrusion of granites with small apophyses. The Svratka Unit is in contact with the Moldanubicum in the SW and the Polička Unit in the NE.

The dominant small-scale fold system can be recognised almost in the whole unit. The folds are tight to isoclinal and overturned to the SW with axes trending in a NW-SE direction. The study of these small-scale folds and perianticlinal structure in the geological map led Rosiwal (1895) to regard the Svratka Unit as a large isoclinal structure and to correlate the Polička Unit and the Moldanubicum as two opposite limbs of the large fold with the Svratka Unit in the core. This idea was accepted also by Beneš (1962), but there are some arguments opposing this view:

1. Considered perianticlinal structure is developed only in the NW part of the Svratka and Polička Units while it is not developed in the central and eastern parts.
2. The axes of dominant small-scale folds are trending in a little different direction than the axis of the large anticline. It indicates that these two structures are not equivalent.
3. Foliations dipping to the W or NW in the NW part of the unit is younger than the NE-dipping foliation in the central part. Asymmetrical structures connected with younger foliation indicate transtensional slipping, however, the old NE-dipping foliation is without asymmetrical structures.
4. Not only one perianticlinal structure is present. The second one is situated of the NW boundary with the Moldanubicum (Zrůstek 1967). The Moldanubicum is in the core and the Svratka Unit in the envelope of this second anticline. The anticipated perisynclinal structure was not found.