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Deformation of Creataceous Complex in the Eastern Part of the Intra-Sudetic Basin and Nysa Graben (SW Poland) – a Geological Map Analysis

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Cretaceous complex in eastern part of the Intra-Sudetic Basin and Nysa Graben (SW Poland) is dominantly composed of sandstones and calcareous mudstones and claystones, interpreted as a littoral-to-shelf succession which formed between the Upper Cenomanian and Santonian (Wojewoda, 1997). Its present thickness varies from about 350 m in the Góry Stołowe Mts. area up to 1200 m in the Nysa Trough. The thickness variation of the complex is due to differences in paleotopography of the Cretaceous basin and its variable capability of sediment accommodation in different parts, as well as to subsequent tectonic deformation and erosion. As a result of the latter, the complex is locally discontinuous, cut by faults and locally rotated up to vertical position or even overturned (Don B. and Don J., 1960, Don J., 1996). In the area studied, Cretaceous deposits overlie both crystalline and older sedimentary rocks.

Based on information on the strike and dip of Cretaceous beds displayed on the detailed geological maps of the Sudetes at the scale of 1:25,000, the orientation of beds was analysed and its dependence on basement type and depicted tectonic structures was studied. The interpolation of dip values allowed to plotting isolines of equal inclination of beds. The accuracy of this interpolation depended upon the amount and correctness of the bed orientation measurements, therefore it varies between the map sheets.

The Cretaceous complex is dominantly flat-lying, dipping at the angle of 0–15 . Only in a few localities anticlinal or synclinal structures of a broad width and small height are remarkable. Beds steepen significantly, up to vertical or overturned position, at most of mapped contacts with exposed crystalline basement, suggesting fault boundaries with the latter and the steepening being due to fault drag. This is also supported by a remarkable congruence of high angle isolines with strikes of major faults plotted on the maps and a higher inclination of beds in the vicinity of those faults. The trends of high angle isolines may, thus, indicate the position of fault zones within and around the Cretaceous complex. In places where the complex borders (on the ground surface) on older sedimentary complexes, no bed steepening is observed.

Most of the steeply inclined areas of the analysed structural unit corresponds to the occurrences of fine-grained sediments, i.e., calcareous mudstones and claystones. Sandstone bodies lie generally flat – in places even close to fault boundaries of the complex. This may imply that during tectonic deformation coarse-grained sediments responded in a more brittle way in comparison to fine-grained ones. Besides the fault zones, the deposits remain flat both on the crystalline and sedimentary rock basement. This suggests that the Cretaceous complex has been displaced vertically together with the individual fault-separated blocks of the basement at different heights and, as a result, it was eroded at different structural levels. The latter is confirmed by varying isoline values at the mapped boundaries between the complex and its basement.

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AMS and Deformation Patterns in The Jawornickie Granitoids, Rychlebske Hory – Preliminary Data

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During the last two decades, a number of studies has shown that the magnetic properties of rocks, especially anisotropy of magnetic susceptibility (AMS), can be used as a tool for grain fabric characteristic (Richter et al., 1993), as a strain indicator (Borra-

daile, 1991) and for the quantitative analysis of magmatic fabrics and recognition of multiple deformation episodes in granitoids (Bouchez et al., 1990; Benn et al., 1993).

AMS analyses are applied here to the Jawornickie granitoids which were emplaced into rocks of the Złoty Stok – Skrzynka shear zone(ZSSsz). The ZSSsz is of great interest because it may possibly provide important clues to understanding character of the boundary between Lugicum and Moravo-Silesicum. This area provides also a good opportunity for analyzing the relationships between the development of shear zones and the emplacement of granitic bodies. The ZSSsz is an 10 km long (minimum length) near vertical shear zone, in northern part terminated by Sudetic Boundary Fault and by H. Cloos (1922) was linked with the Niemcza shear zone, located about 20 km farther to the north. The ZSSsz is comprised of medium-grade metasediments, gneisses and amphibolites with a polyphase deformation history and is intruded by a string of elongate plutons defining the Jawornickie Granitoids. These sheeted-bodies are interpreted as dykes and sills injected parallel to the shear zone and dykes evolving into sills are observed locally. The absolute time of intrusion and its relationship to shear deformation are unknown. The aim of the study is to help validate the field criteria currently used to ascertain tectonic environments of the Jawornickie granitoids injection and also the relationship between dyke magmatism and pre-existing structural architecture of the surrounding country rocks. It represents a particularly intractable problem in the area where the country rocks have undergone many cycles of deformation and metamorphism.

Jawornickie granitoids are characterized by macroscopically poor-defined, heterogeneously distributed lithological variations. Fine-grained, biotite-bearing granodiorites is the dominant rock type, but hornblende-bearing granodiorites, tonalities and monzonitic granites are common (Burchart, 1958). Biotites and hornblendes, accompanied by less obvious shape preferred orientation of feldspars and quartz ribbons usually form a weak foliation plan in the rocks. Only in some samples a strong biotite foliation is developed. At the regional scale, the margins of the main dyke, 1–1.5 km thick, and smaller granitoid dykes parallel the country rock foliation. However, at the mesoscale these dykes locally crosscut the main foliation in the country rocks. A penetrative, homogeneous mesoscopic-scale foliation is distinguished in many granite outcrops. Foliation strikes mainly SW-NE that is parallel to the main planar structure of the country rocks. Microstructures in the Jawornickie granitoids point to a magmatic to submagmatic development of the fabric with minor solid-state overprint.

The sampling for AMS studies was performed for the 53 sites localized mostly within main granitoid dyke, and for a few sites within thin lens-like granitoid veins located west of it. Some additional samples were collected within the surrounding gneisses and amphibolites. AMS fabric was determined for about 400 cylindrical specimen from 97 hand samples with KLY-3S and KLY-2 kappabridges (Agico, Brno, Czech Republic). Magnetic susceptibility and AMS are mostly controlled by the dia- and paramagnetic minerals with typical bulk susceptibilities of $50 - 150 * 10 - 6$ Si vol and show substantial uniformity on the hand sample scale. AMS mean tensor was calculated for each of the handsamples with Jelinek's (1978) algorithm and AMS principal axes for granites are very well grouped on the hand sample scale (with confidence cones of up to 10–15°). The AMS fabric mean directions calculated for the site are less uniform – the angular differences in AMS principal axes between handsamples in one site are of up to 20–30°. These differences may reflect some local heterogeneity of the deformation on the site scale.

In general mean AMS foliations for handsamples dip at moderate to steep angles to N-NW for granitoids and gneisses. AMS lineations in the surrounding gneisses plunge subhorizontally to NE-SW that may correspond to the regional NE-SW shearing components. Magnetic lineations for sites within the main granitoid body plunge at low angles (mostly from S to W) but with more varying trends between sites.

At the site' scale AMS planar fabric show good correlation with mezoscopic tectonic foliations that are recordable only in 50% of sites. The moderate uniformity of AMS fabric on the site scale and high AMS anisotropy within all sites (P of 1.05–1.30, T of 0.3–0.6 on average) suggest syntectonic generation of granitoids. Further interpretations of the AMS and tectonic fabrics will be performed when more microtectonic studies and chemical analyses results are available.

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