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The Magnetic Fabric of the Veľká Fatra Mts. Part Two: Emplacement Mode of the Hercynian Granitic Pluton and its Relation to the Alpine Sedimentary Rocks, Based on AMS Study

Dagmar GREGOROVÁ[1], František HROUDA[2] and Milan KOHÚT[3]

[1] *Geophysical Institute, Slovak Academy of Sciences, Bratislava, Slovakia*
[2] *Institute of Petrology and Structural geology Charles University, Prague, Czech Republic*
[3] *Dionýz Štúr Institute of Geology, Mlynská dolina 1, 817 04 Bratislava, Slovakia*

The anisotropy of magnetic susceptibility (AMS) is one of the most powerful tools for study of rock fabrics. It has widely been used in the Central Western Carpathians (CWC); the basic results of magnetic fabric study and/or magnetic susceptibility from nearly all granitic plutons of the CWC are available in Hrouda et al. (2002) and Gregorová et al. (2003a). The magnetic fabrics are often coaxial in granitic, metamorphic and covering sedimentary rocks, being partly or entirely deformational in origin within most of Core Mountains CWC (Hrouda et al., 2002). However, the first AMS data from various granite types of the Ľubochňa pluton in the Veľká Fatra Mts. displayed non-coaxial pattern (Gregorová et al., 2003b). The Veľká Fatra Mountains typifying the Core Mountains of the Tatricum, a major tectonic unit in the CWC consists of crystalline basement, Mesozoic cover unit, overthrust by two nappes – the Krížna and Choč ones. The crystalline basement is represented by the Ľubochňa granitoid massif, consisting of four principal Hercynian granitic rock types building a multistage composite pluton, and of orthogneisses – the older sheared granites – that are preserved at the eastern border. The Smrekovica tonalite (ST) is represented by fine to medium-grained biotite tonalite with scarce xenoliths of wall rocks paragneisses. The Kornietov granodiorite (KGD) typify medium-grained, porphyric biotite and muscovite-biotite granodiorite, whereas slightly porphyric medium-grained two mica granites represent the Lipová granite (LG). The Ľubochňa leucogranite (LLG) is typical fine- to medium-grained felsic muscovite granite. Field study as well as petrological and geochemical investigations revealed relative independence of the above granite types (Kohút, 1992) that reflect differences in the evolution of the Hercynian orogeny in the study area. The Lower Carboniferous ages of magmatism were determined for the KGD – 340 ± 2 Ma and LG – 356 ± 25 Ma (Kohút et al., 1997) or – 337 ± 9 Ma (Poller et al., 2000). On the contrary, an Upper Carboniferous age – 304 ± 2 Ma was detected for the ST (Poller et al., l.c.).

The present AMS study was performed on 741 oriented samples, collected at 64 localities from the crystalline basement and Mesozoic sedimentary rocks. The measurements were carried out on the KLY-3S Kappabridge (Jelínek and Pokorný, 1997). The mean values of the bulk susceptibility decrease in order:

ST (2,378×10^{-6} [SI], suggesting I-type character of this granitoid); KGD (520×10^{-6} [SI] – suggesting S-type granites); LG (144×10^{-6} [SI]) and OG (140×10^{-6} [SI]). Bulk magnetic susceptibility of Mesozoic rocks ranges according to the variable rock type from –12 to 334×10^{-6} [SI].

The planar magnetic fabric prevails over the linear in all investigated rock types. Generally, the degrees of magnetic lineation as well as these of magnetic foliation are relatively low in the majority of granitic samples. The highest values with average of 1.043 (lineation degree) respectively 1.055 (foliation degree) are displayed by ST; the KGD and LG have these values slightly lower. The obvious macroscopic planar fabric of OG is reflected in concordant orientation and the greater degree (mean of 1.107) of magnetic foliation. The degrees of magnetic lineation as those of magnetic foliation in the Mesozoic rocks differ according to the rock type and deformational grade – from 1.004 to 1.142 by lineation, respectively from 1.002 to 1.175 by foliation.

Even though, due to local tectonic structures, the orientations of magnetic lineation as well as these of foliation slightly vary also within the localities in the individual geological unit, there is marked difference in the predominant orientations between different rock types. Lineation of ST moderately plunges to ESE; of KGD to the E up to NE; of LG vary between W and SW; of OG between NE and SE and lineations of Mesozoic are oriented to the NNE, or more rarely to the SSW. Dips of magnetic foliations are low to moderate; only in OG they are steeper. The predominant directions of the magnetic foliation dips are these: in ST to the N up to NE; in KGD vary between SE and NE, in LG between W and NW; in OG to the SE and in the Mesozoic cover prevail the orientation of magnetic foliation dips to the NE.

In some Mesozoic localities (in the Tatricum as well as in the nappes) the magnetic fabrics and observed macroscopic bedding are conformable, but mostly the marked divergence between them was detected, indicating the deformational overprint of magnetic structure.

Present AMS investigations reveal different magnetic fabrics in individual granite types what support an idea of multistage – pulse character of the Ľubochňa massif of the Veľká Fatra Mts. inferred from field, petrological and geochemical studies. The magnetic fabric of Mesozoic rocks from the Veľká Fatra Mts. showed difference not only within different units (e.g. cover unit, Krížna nappe and Choč nappe) but also within various domains of the same unit. However, there were observed only slight Alpine overprint of the magnetic fabric of the Hercynian granite rocks near the principal faults. We can suggest dextral character of young Alpine movement at N-S Ľubochňa fault in spite of limited data. Indeed, the results of AMS study display rather inhomogeneous character with independent domains within granitic basement and Mesozoic units. It is evident that this magnetic fabric is not consequence of Neogene deformation only, but also records the multistage evolution including the Hercynian, Paleo-Alpine and Neo-Alpine periods.

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Easternmost Thrust Tectonics of Czech Part of Upper Silesian Coal Basin (Variscan Accretion Wedge, Bohemian Massif, Czech Republic)

Radomír GRYGAR[1], Petr WACLAWIK[2], Jan JELÍNEK[1], Jiří PTAČEK[3] and Petr KONÍČEK[3]

[1] *Institute of Geological Engineering, VŠB-TU Ostrava, 17. listopadu, 708 33 Ostrava, Czech Republic*
[2] *ČSM Mine, Českomoravské doly a. s., 735 Stonava, Czech Republic*
[3] *OKD, DPB Paskov a. s., Rudé armády 637, 739 Paskov, Czech Republic*

The Upper Silesian Coal Basin (USCB) represent typical foreland basin located in the toe domain of the Variscan accretion wedge (Grygar and Vavro, 1995, Dopita et al., 1997, Grygar et al., 2000) of the Moravosilesian area. The Karviná sub-basin represents most eastward transverse structural depression (Grygar et al., 1989) of the USCB. The coal-bearing Karviná formation (continental molasse – Namurian A–B) is cropping out on buried Pre-Alpine basement surface. The structure style in the Karvina sub-basin is distinctly different in relation to this part of the USCB, which is located westward of the main tectonic Or-