farther to the east. The only difference is seen in higher degree of metamorphism of the Velké Vrbno Unit relative to the Keprník and Desná units in the east. In such a context, the Velké Vrbno Unit represents only the westernmost part of the Silesian domain that experienced the deepest continental subduction. Therefore, the major intraplate boundary between the Lugian and the Silesian domains should be located farther to the west between the Velké Vrbno Unit and the Staré Město Belt.

Carbonates of the Devonian Transitional Development in the Surroundings of Valchov (Němčice–Vratíkov Belt, Drahany Upland)

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The Němčice–Vratíkov belt of the Devonian Transitional Development, which was defined by Chlupáč (1959) but described as juxtaposition of two facies by Kettner (Kettner 1967), is situated at the eastern margin of the northern part of the Brno massif, stretching from Šebetov across Vratíkov, Valchov and Němčice to Petrovice. Devonian and Lower Carboniferous carbonates crop out in many isolated and strongly tectonically strained bodies. Tectonic pattern of the Němčice–Vratíkov belt was described by Melichar and Kalvoda (1997). The study of conodont assemblages and microfacies investigations of carbonate rocks from the abandoned quarry SW of Valchov were performed.

1. The western part of the quarry is formed by layers of grey to black biomicritic, thin-bedded limestones (2–10 cm thick) with abundant black shale intercalations (1–4 cm thick) dipping towards ESE. This sequence shows thinning- and fining-upward trend, with frequent parallel lamination in the carbonate beds. The carbonates can be classified as moderately sorted wackestones–packstones. Shallow-water grains are represented by small crinoids and detrital quartz grains. Pelagic styliolinids are locally abundant. The matrix is composed of neomorphic microspar. These rocks can be regarded as distal calciturbidites. The mixed conodont assemblages belong to the Upper Frasnian Pa. rhenana and Pa. linguiformis zones.
2. The eastern part of the Valchov quarry is formed by grey coarse-grained biodetrital limestones. They may be described as poorly sorted floatstones–rudstones with abundant fragments of corals and stromatoporoids (often silicified) and crinoids. Detrital quartz grains form a minor contribution. Matrix is composed of neomorphic microspar. The limestones probably represent sediments of fore-reef talus. The rich conodont assemblages belong to the Upper Frasnian Pa. rhenana Zone and correspond to the Palmatolepid–Polygnathid biofacies of the upper to middle slope environment.

The study of conodont assemblages and sedimentological and microfacies investigations indicate that two tectonically juxtaposed facies of different sedimentary environments appear in the Pa. rhenana Zone.

References

CHLUPÁČ I., 1959. Stratigrafický výzkum moravského devonu v severní části Drahanské vysočiny. *Věst. Ústř. Úst. geol.*, 34: 193-200

KETTNER R., 1967. Problém tektoniky Moravského krasu. *Čs. Kras*, 18 (1966): 69-90.

MELICHAR R., KALVODA J., 1997. Strukturně-geologická charakteristika němčicko-vratíkovského pruhu. II. seminář České tektonické skupiny, Ostrava, pp. 51-52.

Preliminary Data on the AMS Fabric in Crystalline Rocks from the West/East Sudetes Contact Zone in the Fore-Sudetic Block – Structural Implications

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Introduction

Crystalline complexes situated in the Sudetic foreland east of the Góry Sowie massif were investigated by means of anisotropy of magnetic susceptibility (AMS) method. The AMS data combined with the available structural data allow a new approach to be undertaken in the reconstruction of tectonic evolution of the West/East Sudetes contact zone.

Geological background

Crystalline rocks in the eastern Fore-Sudetic Block have experienced three deformation events, D$_1$, D$_2$ and D$_3$ (Mazur and Puziewicz 1995; Mazur et. al. 1997; Mazur and Józefiak 1999; Szczepański and Józefiak 1999). Deformation D$_1$ produced the main foliation S$_1$, which is now mostly steeply dipping. The locally preserved L$_1$ stretching lineation trends generally E–W, although locally reorientated on limbs of younger folds F_2. The axes of the F_2 folds trend NE–SW and the accompanying penetrative axial cleavage S_2 shows gentle dips to the W, SW or NW. The S_2 foliation is represented either by crenulation cleavage or, more frequently, by transposition foliation that has completely replaced the older foliation S_1. Intersecting S_2 and S_1 surfaces define penetrative lineation L_2, the most prominent linear structure in the southern part of the study area. Deformation D_3 was confined to low-angle normal-slip shear zones dipping to the SW and NE in the southern and northern parts of the study area, respectively. The S_3 foliation within the shear zones bears the L_3 stretching lineation plunging NE or WSW, parallel to the dip of the S_3.

Kinematic indicators point to an E-directed tectonic transport during the D_1 event in the East/West Sudetes contact zone (Mazur and Józefiak 1999). The subsequent deformation D_2 involved two coeval components: a top-to-NE simple shear and an irrotational shortening in the NW–SE direction. The latter produced the large-scale NE–SW-trending folds F_2. The progressive shortening was followed by the development of normal-slip shallow-dipping shear zones D_3 showing top-to-WSW or to-NE sense of shear. The normal-slip shearing was related to bi-vergent extensional collapse D_3 at the eastern margin of the Sudetic foreland. The upper time limit for the ductile deformation in this part of the Sudetes is defined by the age of late- to post-tectonic granites dated at 347–330 Ma in the Strzelin massif (Oberc-Dziedzic et al. 1998) and at 340 Ma in the Žulová pluton (Jedlička 1995).

Magnetic fabric

AMS measurements were preformed for 41 hand-specimens from 27 localities situated in the Fore-Sudetic Block, in the West/East Sudetes border zone. Up to 10–12 standard (25 by 22 mm) cylindrical specimens were cut from each handsample. We have sampled 10 localities in the Strzelin crystalline massif, 4 localities in the Doboszowice massif, 3 sites in the Niedźwiedź massif and the neighbouring Lipniki and Maciejowice gneisses plus, finally, 12 sites in the Polish part of the Jeseniky Mts. The AMS tensors were determined with KLY-2 and KLY-3 Kappabridges and calculated according to the algorithm of Jelínek (1977) in the palaeomagnetic laboratory of the Institute of Geophysics of Polish Academy of Sciences in Warsaw.

At the scale of the single specimen and locality the magnetic fabric is mostly well defined with well-defined magnetic foliation or lineation. The orientation of the principal AMS axes were found to be widely scattered in samples with very low susceptibility (quartzites WE 10, 11, 13, 17, 18, with bulk susceptibility $k < 10^{-5}$ SI) or very low magnetic anisotropy (granite, WE 21) and some sample-scale heterogeneous samples (calc-silicate rock, WE 45 and gneiss WE 46). In all other samples, the magnetic foliation and lineation are mostly parallel to their metamorphic equivalents. However, in the case of sample WE 38, mineral (metamorphic) lineation is parallel to K_{int} of the AMS ellipsoid, suggesting a swapping of K_{int} and K_{max} magnetic axes. Moreover, in two other samples (WE 8, 14 and 15) we observed distinctly different orientations of the mineral and magnetic lineation.

The lowest susceptibility values, lower than $20 * 10^{-6}$ SI are typical for quartzites. Granites and some gneisses are characterized by susceptibility values in the range between 20 and $150 * 10^{-6}$ SI. Susceptibility of the remaining gneisses and amphibolites is slightly higher and varies from 150 to $1{,}100 * 10^{-6}$ SI. Only one sample (WE 8 – gneiss) demonstrated extremely high values of susceptibility in the range between 1,400 and $2{,}000 * 10^{-6}$ SI. In rocks with low susceptibility, the carriers of the AMS are mostly micas, while in the samples with susceptibility higher than $600 * 10^{-6}$ SI the AMS is most probably carried by hornblende and partly by iron oxides.

From the viewpoint of magnetic fabric the studied rocks were divided into two groups. The first group consists of rocks with NE–SW-orientated magnetic lineation. This group includes mostly rocks of the Strzelin crystalline massif (both metamorphic and plutonic) and, partly, also gneisses of the Doboszowice massif. Samples from this group are characterized by mostly flattened AMS ellipsoids. The second group includes samples with generally E–W-trending magnetic lineation. These samples were collected from the southern part of the study area (the Lipniki and Maciejowice quarries and the Polish part of the Jeseniky Mts). This group includes both Variscan granitoids and metamorphic rocks.

The AMS ellipsoid for the metamorphic rocks is flattened. In contrast, the AMS ellipsoid of the granitoids in most of the cases is constrictional and in a few cases transitional from flattened to constrictional (samples WE 41, 44). The effects of the rock-magnetic composition on the AMS results are yet to be studied.

Conclusions

Heterogeneous deformation allowed the preservation of magnetic fabrics consistent with the D_2 and D_3 deformations in various parts of the study area. The effects of the D_1 are probably mostly erased by younger deformations and thus not revealed by the AMS data. The dominant magnetic fabric in most metamorphic rocks is generally consistent with their penetrative deformational structures, produced by the D_2 event. Approximately similar orientations of the magnetic and structural fabrics were also revealed by the AMS data for the D_3 shear zones, often related to contact aureoles of intrusions or to rocks affected by regional HT/LP metamorphism. Furthermore, the occurrence of the magnetic fabric consistent with the D_3 episode is well-documented in the Variscan granites from both the Strzelin massif and the northern vicinity of the Žulová pluton. The presence of magnetic fabric consistent with the D_3 episode in mesoscopically almost structureless granites indicates that (1) emplacement of these rocks is related to the late phase of the D_3 extensional event and (2) a top-to-WSW or to-NE-directed bi-vergent extensional collapse represents the last ductile deformation in the study area. Kinematics of this late extensional event is similar to that described from the Niemcza–Kamieniec metamorphic complex (Mazur and Józefiak 1999) and from the Jeseniky massif (Cymerman 1993; Cháb et al. 1994; Schulmann et al. 1995).

References

CHÁB J., ŽÁČEK V., 1994. Evidence of an extensional tectonics in the NW part of the Hrubý Jeseník Mts. (the Bohemian Masif, Central Europe). *Věst. Čes. Geol. Úst.* 69: 7-15.

CYMERMAN Z., 1993. Geological units of the Strzelin crystalline massif in the light of new structural analysis (Lower Silesia). *Geol. Rev.*, 6: 421-427.

JEDLIČKA J., 1995. The Žulová massif in Silesia – its geochemistry and petrogenesis. Unpublished PhD. Thesis, Charles University, Czech Republic.

JELÍNEK, V., 1977. The Statistical Theory of measuring Anisotropy of Magnetic Susceptibility of Rocks and Its Applications. Geofyzika Brno.

MAZUR S., PUZIEWICZ J. and SZCZEPAŃSKI J., 1997. Zdeformowane granity z Lipnik na bloku przedsudeckim: zapis waryscyjskiej ekstensji w strefie granicznej zachodnich i wschodnich Sudetów. *Geol. Rev.*, 45: 290-294.

MAZUR St. and JÓZEFIAK D., 1999. Structural record of Variscan thrusting and subsequent extensional collapse in the mica schists from vicinities of Kamieniec Ząbkowicki, Sudetic Foreland, SW Poland. *Ann. Soc. Geol. Polon.*, 69: 1-26.

MAZUR S. and PUZIEWICZ J., 1995. Deformation and metamorphism of rock series east of the Sowie Góry Block – new data interpretations. *Geol. Rev.*, 43: 786-793 (in Polish).

OBERC-DZIEDZIC T., PIN C., DUTHOU J.L. and COUTURIE J.P., 1996. Age and origin of the Strzelin granitoids (Fore-Sudetic Block, Poland) ^{87}Rb/^{86}Sr data. *N. Jb. Miner. Abh.*, 171: 187-198.

SCHULMANN K., GAYER R. and CHÁB J., 1995. Silesian Domain. Thermal and Mechanical Interactions in Deep Seated Rocks, Excursion Guide – Post Conference Excursion, Czech Republic.

SZCZEPAŃSKI J. and JÓZEFIAK D., 1999. Jegłowa beds – record of polyphase deformation and metamorphism in the Strzelin crystalline massif (Fore-Sudetic Block, SW Poland). *Mineral. Soc. Pol. Spec. Pap.*, 14: 33-37.

Role of Basin-Margin Physiography and Sediment Supply History in Sequence Architecture: Insights from Field Studies and Computer Modelling

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There is a general agreement that stratal geometries in depositional sequences are controlled by tectonic subsidence, eustasy, and sediment inpzut, as the main three variables which act together in creating and filling accommodation. However, also variables commonly assumed to be of marginal importance, e.g. compaction or marine current regime, can have surprisingly pronounced effects in depositional geometry. A potentially important and so far under-researched variable is the basin-margin physiography, which becomes important especially in fault-bounded basins. Topographic breaks, formed by faulting at the margins of extensional and strike-slip basins, are known to be essential in providing the gradient between the depth of the fluvial channel and the water depth seaward of the river mouth, which is the most important pre-requisite for the development of steep „Gilbert-type“ foresets in coarse-grained delta systems (Postma 1995). If such physiographic break is absent, the deltas tend to develop a flat, „shelf-type“ morphology at the basin margin. The delta morphology is an important control on the response of the depositional system to relative sea/lake-level changes, and its expression in stratigraphy. The critical “initial depth” is defined here as the pre-depositional bathymetry at the basin margin, resulting most commonly from the delay between the onset of subsidence and the onset of sediment input.

In this study we explore the influence of the initial bathymetry on the stratigraphic architectures of high-frequency sequences, using a series of computer-model runs based on outcrop and subsurface data from two basins with prominent coarse-grained delta systems: the Bohemian Cretaceous Basin (Czech Republic) and the Gulf of Corinth (Greece). The two cases represent end-members in terms of rates of base-level change: a relatively slowly subsiding (c. 80 m/Ma), strike-slip margin of the intracontinental Bohemian Cretaceous Basin during a time interval characterized by low-magnitude eustatic changes of the Mid-Cretaceous greenhouse period, vs. an order of magnitude faster subsidence along extensional faults in the Gulf of Corinth (c. 1 km/Ma), with a possible influence of high-frequency, large-magnitude, sea- or lake-level changes induced by the Quaternary climate.

The Bohemian Cretaceous coarse-grained deltas show a variety of internal geometries, ranging from stacks of very thin (3–15 m) deltaic packages with low-angle foresets (or they show no foresets distinuishable on outcrop scale) to thick (55–75 m) packages of high-angle foresets in Gilbert-type deltas (Uličný1998). Significant differences exist between architectures of deltas deposited along margins of a pull-apart sub-basin or in neighbouring sub-basins, under very similar subsidence rates, same eustatic sea-level fluctuations, and probably also similar sediment supply rates. All these deltaic packages show a degree of influence of high-frequency sea-level fluctuations. The modelling in this case focused on understanding the role of initial depth in governing the geometry and stacking of high-frequency sequences of the Gilbert-type vs. shelf-type deltas.

Along the margins of the Gulf of Corinth, huge Gilbert deltas of probably Early Pleistocene age, of inferred lacustrine origin with marine incursions, with up to 700 m thick foresets, show distinct variations in internal architecture (e.g., Dart et al. 1994). Whereas some deltas show a complex stacking of sequences in both the topset and foreset areas, other examples from the same depositional setting show a uniform pattern of foreset progradation and topset aggradation, suggesting no major changes in base level.

Hardy et al. (1994), in a numerical modelling study of these deltas, attempted to simulate the effects of high-frequency, glacio-eustatic sea-level changes on their internal architecture. Because the stacking patterns predicted by the modelling showed a number of thin, vertically stacked, shelf-type deltas, very different from the real architectures, Hardy et al. (1994) rejected the possibility of high-frequency sea- or lake-level fluctuations in this depositional setting. In this case, our modelling runs were focused on the testing of the role of initial depth of c.