eter in 2% HNO_3 with a within-run precision better than 1 ‰ and long-term reproducibility better than 2.1 ‰.

The Li isotopic composition of Recent foraminiferal tests corresponds to the composition of modern ocean water (−32 ‰ δ^6Li). The composition of fossil tests and their host sediments from ODP 926A varies from ca −30 to −15 ‰ and from 0 to +5 ‰, respectively. Our data suggest no significant isotopic equilibration of Li between the foraminiferal carbonate and the sediments over the period of the past 14 m.y. The variations in Li isotopic composition in planktonic foraminifers during the past 14 m.y., and especially the shift from −20 ‰ to −32 ‰ δ^6Li in the last 4 m.y., are interpreted as resulting from a progressive change in the mechanism of continental weathering.

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New Progress in Deciphering Structural and Metamorphic Evolution of the Vepor Basement in West Carpathians

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The Vepor basement represents the inner Variscan zone of Central West Carpathians. It is mainly composed of micaschists, orthogneisses and heterogeneous para- and ortho-derived migmatites intruded by porphyritic to medium-grained peraluminous granites. The emplacement ages of granites and cooling ages of basement rocks are mostly Variscan (370–300 Ma, U/Pb and 346–377 Ma, Ar/Ar Amp–amphibolites, respectively). The basement rocks exhibit high-grade fabrics represented by compositional layering and stromatitic banding in migmatites.

The Variscan fabrics are affected by two main Alpine tectonic events. The older extensional phase results in the development of subhorizontal mylonitic foliation generally dipping to the ESE, bearing eastward-dipping stretching lineation. The extensional mylonitic foliation exhibits metamorphic and deformational gradient marked by temperature increase from east to west and from top to bottom, whilst the intensity of deformation increases in opposite direction. These phenomena are marked by the development of anastomose network of small-scale shear zones in deeper parts of the massif passing to homogeneous mylonitic reworking in a large-scale normal shear zone in the uppermost part. The temperature gradient was determined mainly by microstructural criteria, i.e., recrystallization mechanisms of individual phases and products of plagioclase destabilization.

The subsequent compressional event is documented by the development of new cleavage planes steeply dipping to the south and north with lineations and fold hinges slightly plunging to the northeast. This deformation heterogeneously affected the Vepor basement and is developed predominantly in two major zones: the Pohorelá shear zone in the north and the Korimovo shear zone in the south. Both zones are developed in zones of weakness marked by the presence of micaschists and paragneisses.

The structural, microstructural, compositional and EBSD textural data are presented to distinguish the Variscan amphibolite-facies fabrics from the Alpine upper-greenschist ones. In addition, optically measured biotite textures from microstructural–metamorphic zones are used to determine the orientation tensor to examine biotite CPO contribution to the AMS fabric pattern.

Variscan Foreland Fold-Thrust Belt of Wielkopolska (W Poland): New Structural and Sedimentological Data

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Variscan externides of Wielkopolska comprise an entirely concealed succession, at least c. 2500 m thick, of Carboniferous clastic sediments folded and thrust before the Permian. Their subcrop zone extends over a considerable area of central western Poland and is the eastern continuation of the Rhenohercynian Zone of Germany. The Carboniferous succession of Wielkopolska consists of fairly monotonous series of turbidites consistently interpreted as flysch. It was deposited during

the Tournaisian(?) through Westphalian times and was locally buried below rather thin Upper Westphalian–Stephanian molasse (Wierzchowska-Kicułowa, 1984). Basement rocks underlying the Carboniferous succession remain generally unknown, except for two minor WNW-trending crystalline highs in southern Wielkopolska. The larger one, the Wolsztyn–Leszno High, consists of phyllites, possibly of Devonian protolith age (Haydukiewicz et al., 1999), which underwent low-grade metamorphism at c. 340 Ma (Żelaźniewicz et al., 2003). The northeastern border of the Wolsztyn–Leszno High is defined by the Dolsk Fault, which is the most prominent structure of the pre-Permian basement of Wielkopolska. On seismic refraction profiles, it corresponds to a major boundary between the low-velocity Variscan-type crust to the SW and the three-layer 'transitional' crust of suspected East Avalonian affinities to the NE (Grad et al., 2002). The Carboniferous series are unconformably overlain by a Permo-Mesozoic sequence of the German–Polish Basin that represents platform cover 1 to 4 km thick. The occurrence of the Variscan external orogenic zone in western Poland is known from over 100 boreholes which have penetrated the Carboniferous strata since the early 1960s. Despite the considerable data-base, the sedimentary and tectonic developments of the Variscan externides are still far from being well understood. New structural and sedimentological data were collected from drill cores in more than 20 selected scientific and gas wells located in the northern and southern parts of the area underlain by the Carboniferous series.

The Carboniferous sediments from the Variscan external zone represent a fairly uniform clastic succession. It comprises three major facies associations produced by (1) density currents, (2) gravitational flows and (3) pelagic sedimentation. They collectively indicate depositional environment of submarine alluvial fans. No clear diversity of sedimentological characteristics has so far been detected among the studied drill-cores from different parts of the Carboniferous basin.

Preliminary results of structural study reveal a relatively intense deformation of the Carboniferous succession to the south of the Dolsk Fault. They point to an important role of thrust tectonics in that area, as confirmed by extensive duplications of stratigraphic intervals in some of the studied wells. The deformation of the Carboniferous succession is mostly concentrated in limited depth intervals of the studied boreholes, usually a few hundreds of metres thick and constrained both from the bottom and top by thrusts. The tectonically affected parts of the Carboniferous sequence are characterized by steep dips of strata and common occurrence of inverted fold limbs. According to the preliminary palynological data, thrusting and the resulting stratigraphic inversion involved an interval of the Carboniferous succession ranging from the Viséan up to the Westphalian C. Our still incomplete results confirm the presence of a stratigraphic gap between Namurian A and Westphalian B, earlier identified to the south of the Dolsk Fault (Żelichowski, 1995).

This gap is absent to the north of the Dolsk Fault, where Carboniferous rocks experienced apparently weaker tectonic deformation and bear no clear evidence of thrusts and folds. The only exception seems to be the boreholes on the northeastern limb of the Wolsztyn–Leszno High. In that area, Carboniferous strata consistently dip to the N and NE at moderate or high dip angles. They carry a number of meso- to macro-scale asymmetric, N- or NE-verging folds with locally well-developed axial-plane cleavage. In the light of our data, their origin can be tentatively attributed to a large-scale rotation of the Carboniferous sequence due to the uplift of the adjacent Wolsztyn–Leszno High in post-Westphalian B times. This event involved the essentially continuous Carboniferous succession, including rocks ranging in age from the Late Viséan to Westphalian B.

In general, the tectonic style observed to the southwest of the Dolsk Fault resembles that known from the Rhenohercynian Zone. Carboniferous succession from that area probably corresponds to fragments of a Variscan accretionary prism that was overthrust and subsequently uplifted together with its basement. On the other hand, the less intense tectonic overprint to the northeast of the Wolsztyn–Leszno High may indicate a transition to the foreland basin which was only weakly deformed, possibly in a transpressional regime. The final deformation on both sides of the Dolsk Fault seems to have taken place not earlier than in the Late Westphalian. It may have overprinted the effects of the early Viséan deformational and metamorphic events known at least from the phyllites of the Wolsztyn–Leszno High.

Acknowledgements

This research has been a part of the project "Palaeozoic Accretion of Poland" (PCZ 07-21) financed by the Polish Research Committee (KBN) and by the Ministry of Environmental Protection in cooperation with the National Fund for Environmental Protection and Water Management.

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The Carbonatization of Blastomylonites – an Example from the Oskava Block, Jeseníky Mts.

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The Oskava block is a 15 km long and up to 4 km wide, NNE-SSW oriented tectonic slice of the Cadomian basement of the Desná paraautochton. The block is formed by metagranites and blastomylonites cutted by sporadic metadoleritic dykes. The rocks are inhomogenously mylonitised due to late Carboniferous event of the Variscan orogeny and retrogressively metamorphosed under the greenschist facies conditions. The blastomylonites originated from middle- to coarse-grained granites to trondhjemites, their chemical composition is calc-alcaline, peraluminous and shows a volcanic-arc affinity (Hanžl et al. 2000).

The occurrences of gold mineralization were discovered in metagranites of the Oskava block, hosted by steeply plunging quartz-calcite-arsenopyrite veins parallel to the later regional subvertical axial cleavage S_3 (Mixa et al. 1990).

Intense pervasive and fissural post-magmatic hydrothermal alterations occur in metagranites and blastomylonites. Albitization, sericitization and carbonatization are most common features of the alteration related to mylonitization. Microscopy, microprobe analysis and cathodoluminiscence illustrates that these alterations are due to replacing plagioclase porphyroclasts by albite, white mica and to a lesser extent by prehnite. Most of An component forms epidote and perhaps Fe-Mg carbonate. Albitization of K-feldspars is common, K substituted by Na forms muscovite (´sericite´) through hydrating reaction. Secondary chlorite is formed by breakdown of biotite.

Using microscopy, microprobe analysis and isotope geochemistry two main groups of carbonates in altered rocks and veins were distinguished.

1) Young quartz-calcite veins, veinlets and aggregates with the thickness up to several centimetres are formed by pure calcite containing common limonitic pigment and rarely hematite and Mg-chamosite. Quartz crystalises as idiomorphic columnar crystals with rhombs on its tips. According to Dobeš (1990) fluid inclusions restricted to young qtz-cc veins are hydrous, marked by low salinities (5–13 wt% NaCl equiv.), homogenized to the liquid phase between 117–194 °C.
2) The carbonates of dolomite-ankerite group occur as a widespread impregnation between rock-forming minerals, abundant inclusions in albites and fillings of hairlike fissures in feldspars and crossing the phyllosilicates concentrated on S-foliations as well.

The chemism of these carbonates varies in a wide range from ankerite to ferroan dolomite, with relatively homogenous sum of Fe+Mg cca 22 % but with a wide range of Fe–Mg substitution (Fe 7–23 wt % and Mg 4–13 wt %). The content of MnO is 1,42 % avg. The presence of heavy carbonates is also detected by increasing density, ranges from 2,725 to 2,811 g/cm^3 compared to density 2,665 g/cm^3 in an ordinary granite (Chlupáčová 1990).

The carbonates of dolomite-ankerite group represent evidently the older alteration stage with higher temperatures perhaps connected with breakdown of plagioclases and their albitization. According to Dobeš (1990) at least three generations of fluid inclusions from the older generations of quartz-carbonate veins are related to a more concentrated aqueous fluids (H2O > CO2 >> CH4). As for the salts, besides NaCl, they contain $CaCl_2$ and perhaps $MgCl_2$ as well. Fluid inclusion microthermometry indicates that inclusions homogenize to vapor within the range of 210 to 349 °C. The pressures estimated through the intersection of the isochores vary between 0,7–1,6 kb.

The isotopic composition of C in the carbonates of dolomite-ankerite group vary from delta^{13}C –8,3 to –10,2 ‰ PDB, the value of delta^{18}O range between +10,8 and +13,8 ‰ SMOW. The calcites from young veins have delta^{13}C values of –4,9 to –8,4 ‰ PDB and delta^{18}O values of +18,8 to +22,4 ‰ SMOW. Assuming the temperature of ank-dol carbonate fluid ranging between 350–400 °C and the temperature of calcite veins up to 200 °C we are able to calculate (according to Robinson, 1975) the composition of delta^{13}C in hydrothermal fluids to be −6 to −8 ‰ PDB – the same for both types of fluids. This interval is typical for crustal rocks and also restricts the Devonian sedimentary carbonates in the vicinity of the Oskava block from beiing the prevailing source of carbon in the hydrothermal fluids.

The calculated delta^{18}O values (according to O´Neil et al. 1969) range between +8 to +10 ‰ SMOW for dolomites and ankerites and +10 to +12 ‰ SMOW for calcites. Most probably these values reflect the formation of water of metamorphic origin.

The similar hydrothermal fluid values of delta^{13}C a delta^{18}O from which both calcite and ankerite/dolomite originated, show the same source of carbon and water for these fluids. This indicates that carbonates of both types might have originated from the same fluid the temperature of which was decreasing.