In conclusion, the succession of formations reflects general subsidence in an extensional regime (syn–rift– and post–rift sedimentation) which is superimposed by eustatic sea level changes.

Reference

Dallmeyer, R.D. – Neubauer, F. (in press): 40Ar/40Ar age of detrital muscovites from the Carnic Alps: Evidence for a Cadomian linkage of the Eastern Alps. J. geol. Soc London.

ULTRAMAFIC ROCKS IN THE MOLDANUBICUM – BOHEMICUM BORDER AREA (BOHEMIAN MASSIF).

Z. POUBA[1], Z. PERTOLD[1], H. KLÁPOVÁ[2], J. PERTOLDOVÁ[3]

[1]*Department of Mineral Deposits, Charles University, Albertov 6, Praha 2, Czech Republic 128 43*

[2]*Department of Petrology, Charles University*

[3]*GMS, a.s. Praha 7, Přístavní 24, Czech Republic 170 04*

There are isolated occurences of ultramafic rocks in the area between moldanubicum and bohemicum which might contribute to the knowledge of the upper mantle in this zone. Moldanubicum is a gravimetrically lighter terrain with few magnetometrically positive units. Bohemicum on the other side is heavier with steeper magnetometric gradients. Mantle rocks are known from these units as xenoliths (Jakeš and Vokurka 1987) and from mantle slabs which were emplaced tectonically (Mísař et al. 1971, Machart 1982, Dudek et al. 1990 and others). Some of the ultramafic rocks have been recognized as members of ophiolite complexes (Mísař et al. 1984, Jelínek et al. 1984). Differences in geochemistry implicate mantle heterogenities which have not been fully explained (Jelínek 1991) and suggest gradients.

The zone between moldanubicum and bohemicum consists of the “Jílové zone” and the “Islet zone” of the central Bohemian pluton in the NW and of the Železné hory area in the NE. It is characterized by different stratigraphical and lithological development of the Upper Proterozoic and Lower Palaeozoic sequences compared to the Barrandien block (Kachlík 1992 and Chlupáč 1992). The ultramafic rocks of the “Islet zone” are situated in a Silurian sequence (Urbanův mlýn near Mirovice). These are serpentinites and pyroxenites with low TiO_2 contents (0.2%) suggesting relative primitive geochemical nature with little differentiation. They are very different from the spatially close ultramafics of the Barrandien area which are mostly of Silurian age and have very high TiO_2 levels (picritic intrusions and flows) interpreted as within plate volcanics, eg. Patočka et al. in print. In the Ti:Cr:Ni diagram the rocks from this border zone are closer to the rocks from the border zone between Orlice – Kladsko unit and the moravosilesicum than to the ultramafic rocks of the moldanubicum. The temperature of their equilibration is somewhat higher than the average temperature of moldanubian ultramafics.

Ultramafic rocks in the NE of the border area (Želené hory) are part of the Ransko intrusive massif. This massive is of tholeiitic chemistry, including rocks from ultramafic cumulates to gabbros and quartz diorites. Also in this part of the border zone rocks posses low TiO_2 levels. However, the age of the Ransko massive is uncertain (Cadomian to Variscan).

Geochemistry of the ultramafic rocks from the border zone shows fundamental differencies compared to similar rocks from adjacent units, suggesting different mantle and/or crustal regimes.

CHRONOLOGY OF MOVEMENTS IN CENTRAL EUROPE IN NEOTECTONIC ERA

D. PROCHÁZKOVÁ[1], Z. ROTH[2]

[1] *Czech Ecological Institute, Údernická 1931, 148 00 Praha 4, Czech Republic*

[2] *Czech Geological Survey, Klárov 3, 11821 Praha 1, Czech Republic*

Collision continuing between the plate of Africa, has carried to the north, relative to stable Europe, over 200 Ma at a almost steady rate of about 25 mm/year. The Proterozoic continental core of Europe (Fennosarmatia) has hardly changed its position relative to the Earth’s rotation axis (contrary to Af–

rica) since the beginning of the Tertiary. Central Europe is essentially formed by the Hercynides and Alpides. Central European Hercynides mostly lie within and in the forefield of the Alpine – Carpathian mountain system. The development in the Late Tertiary and Quaternary formed the tectonic framework. The Late Tertiary features exhibit both the reliefs of the Alps, the Carpathians and of the block mountain ranges of the Bohemian Massif and its environs (Krkonoše Mts, Šumava Mts Krušné hory Mts. Železné hory Mts, Harz, etc.) as well as depressions inside the Alpides and the epi–Variscan platform forefield – molasse basin in the Alps foreland, Rhine graben, etc.

At the beginning of the Pyrenean phase (40–38 Ma ago, the whole phase lasted from 40 to 22 Ma), which created the primary tectonic structure of the Central Alps and the inner nappes of the Outer Carpathians, the compressive stress transmitted from Africa was remarkably homogeneous. It markedly slackened with the onset of the nappe motion of the Alpides (in the later period of the Pyrenean phase, 38–22 Ma) and the E – W dilatation and subsidence prevailed in the platform. The subsequent Savian – early Styrian tectogenic phase (22–17 Ma) started with a new strong impact of the Alpine stress on the platform foreland, which E of the Rhone – Saone rift incorporated a subcrust part of the platform foreland into the Alps, in the form of the Helveticum. W of the river Reuss it was chiefly a coupling with the platform cover which, being separated from its basement, started to fold and shift to the NW in front of the Alps as the Jura nappe; whereas the platform basement arched here forming the Vosges – Schwarzwald dome. The arching according to seismic and other record has continued untill the present time. Further to the E between the river Reuss and the Diendorf – Boskovice fault the coupling also involved the platform basement; this was breaking and back–thrusting as block mountains of the Bohemian Massif and Central Europe in general. The movements are most intensive in the S part of the platform (up to the Berlin – Cracow line). East of the Diendorf – Boskovice fault the platform was strained essentially less since about the Ottnangian (19 Ma ago), because the stress was there relieved by the separation in overthrust of the Carpathians on the platform foreland (mainly in the Karpatian stage 17 Ma ago). The far – reaching shift to the N (with respect to the Alps) in the Savian – early Styrian phase gave rise to the West Carpathian arc (19 – 17 Ma ago).

The Savian – early Styrian movements in Central Europe (19 – 17 Ma ago) laid the basis of the surface relief of the Outer and Inner Carpathians, Alps, the block mountains of the Bohemian Massif and Central Europe, as well as the present–day relief of the MOHO in the depth. Simultaneously, with the block movement local uparching occurred in the platform (the Vosges – Schwarzwald dome) and in the Alpides (e.g. the Hohe Tauern window in the Eastern Alps). The Savian – early Styrian stress impact of the Alps on the platform (22 – 17 Ma) was appreciably stronger than the subsequent late Styrian – Moldavian. The latter represents in the Alps foreland only fading out of the former, continuing in general its tendencies, as is proved by earthquake foci. The separation of the Carpathians from the Alps towards the end of the Savian – early Styrian phase (in the Ottnangian – Karpatian period, 19 – 17 Ma ago) led to the division of the Central European Alpides into the more compressed Alps and the more mobile Carpathian – Pannonic – Dinaric part. The dividing fault zone was represented by the newly formed Kvarnerski Bay – Graz – Vienna zone opening slightly to the S as early as the Karpatian. Owing to the strong compression of coupled block of the Alps with their foreland platform and the less compressed, loosened Pannonian – Carpathian block in the E, the Kvarnerski Bay – Vienna fault zone turned up into a marked sinistral strike – slip in its NE termination. The opening of this fault zone with subsidence and volcanism near Graz documents, that also the moderate sinistral rotation of the Pannonian – Carpathian block, evidenced especially during the late Styrian – Moldavian phase (by 7–17°), started already towards the end of the previous Savian – early Styrian phase (in the Karpatian stage). With this eccentric rotation of the Central Carpathians centered upon the subthrust and rising Sudetic – Maleník platform block is connected with the younger subsidence and dilatation of the Vienna and Danube Basins in the Carpathians. Also the Pliocene and early Quaternary extension (NW – SE trending) tectonics of the Upper Morava valley parallel with the platform Sudety – Maleník block and accompanied by young basalt volcanism in the Nízký Jeseník Hills (N Moravia) and in the Železný Brod area (N Bohemia) was associated with the pressure of the Pannonian – Carpathian block concentrated against the underthrust Sudetic – Maleník platform block as documented by a regional palaeomagnetic (sinistral) deviation ascertained in E Sudets by Krs.

The late Styrian – Moldavian renewal of stress of the Alps gave rise to the seismic Mur – Muerz – Leitha – Žilina zone at the boundary between the Alps blocked in motion by the Bohemian Massif and the Carpathians moving readily onto the platform by sinistral strike – slip during the Pontian or

Dacian stages (5 Ma ago).The motion along the young Mur – Little Carpathian – Žilina tectonic zone notably contributed to the present – day orographic distinction of the Little Carpathians.

It was found that the genesis of the focal regions with occurrence of the strongest earthquakes is connected with several movement trends in last 5 Ma. Six more or less tectonically separate regional units were revealed. The earthquake epicenters often concentrate along the boundary lines of these neotectonic units.

U–PB ZIRCON DATA AND PB–SR–ND ISOTOPE GEOCHEMISTRY FROM META–GABBROS FROM THE KTB BORE HOLE

A. VON QUADT

Laboratory for Isotope geochemistry and Mass spectrometry, Federal Institute of Technology, ETH–Zurich, Switzerland

Meta–gabbros of the continental deep drilling (KTB) from depths at 1240,1340, 3610, 3718, 3835, 4690, 6450 and 6550 m are analysed for major–, trace– and rare earth element data as well as for Rb/Sr–, U/Pb–, Sm/Nd– and Pb/Pb isotope data.

U/Pb analyses from different zircon fractions of the meta–gabbros point to protolith ages reflecting an extensional evolution of an oceanic micro–basin. Several discordias with upper intercept ages among 475 and 493 Ma reflect the magmatic evolution of a source material for the meta-gabbros (Fig.1).The zircons from the meta–gabbros at depths 4690 and 6450 m reflect a shift to "younger" ages.

The Pb_{rad} contents of the zircon fractions are varying from 23.9 to 67.54 ppm and the U contents are in a range from 265 to 798 ppm, which is in line with other mafic–ultramafc occurrences; the grain size of the analysed zircon (>250 μm) speaks for an intrusion of this mafic material. As most zircon fractions plot near the upper intercept, the U/Pb system remains closed within the high–pressure event at L'Devonian (~390 Ma) and the granite intrusions with their fluids cannot open the U/Pb system of the zircons. The zircon fractions show no inherited old Pb components excluding one example from a depth at 4688 m (53–75 μm) reflecting an $^{207}Pb/^{206}Pb$ age of 510 Ma. Sm/Nd whole rock–garnet pairs from sample VB 1340 (398±20 Ma) and VB 3718 (385±15 Ma) reflect the high–pressure event in L'Devonian time.

The L'Ordovician protolith age of the meta-gabbros from the Zone of Erbendorf–Vohenstrauss gives an additionally piece of the puzzle of the European Hercynides. Similar protolith ages from the Münchberg gneiss massif, from the Saxonian granulite massif (von Quadt,1993), from the Hohe Bogen as well as the Variscan basement of the Alps (Eastern Alps; von Quadt, 1992) point to an extensional scenario of the geological environment. At that time (500 Ma) no high pressure event is known.

REE pattern of meta–gabbros from KTB–VB and KTB–HB exclude an N–type source for the mafc/ultramafic rocks. The LREE of the mafic rocks are slightly enriched (10–25 chondritic), no Eu anomaly is observed and the trace element distribution shows an enriched alkali content

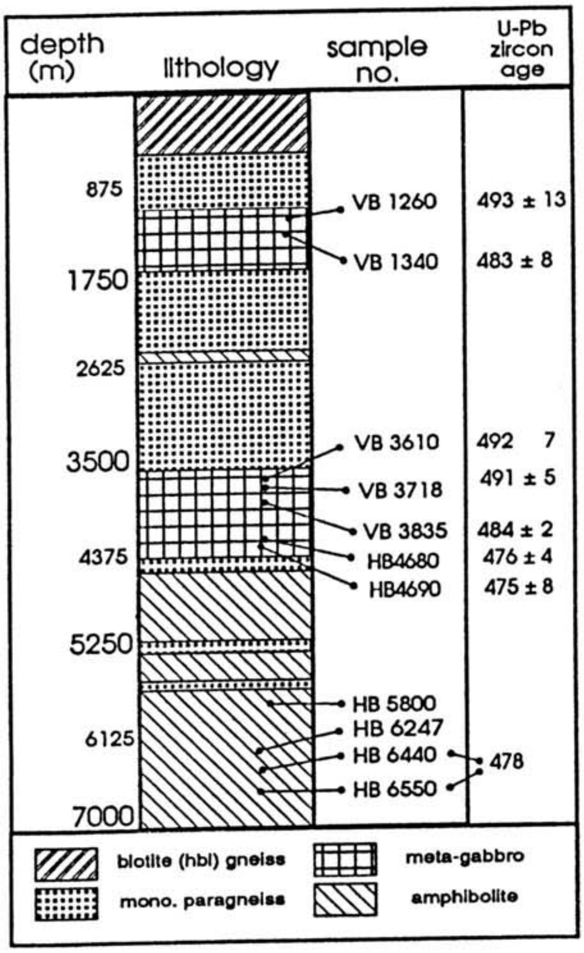

Fig. 1. Schematic profile of the KTB bore hole including the U–Pb zircon ages (upper intercept)