diminishes all normal stresses and thus facilitates the block movement.

Thrust planes of Carpathian superficial nappes are often accompanied by the so-called "rauhwackes", which represent basal cataclastic mass formed in a course of nappe movement. As in many similar cases in Alps, Appenines or Pyrenees also these rocks bear evidences for principal importance of hot overpressured fluid incidental to their formation. Fluid inclusions were preserved in synkinematically crystallised authigenic quartz and feldspar from basal rauhwackes of the Muráň nappe, which are believed to contain the authentic fluid facilitating the movement of the nappe. Results of the fluid inclusions investigation support the hypothesis of Hubert and Rubey and on the other hand indicate certain new mechanical difficulties.

Fluid inclusions were investigated by means of optical microthermometry using a Linkam THM600 heating/freezing stage. Chemical composition was determined from eutectic temperature of the solution and melting temperature of the gaseous phase. Concentration of NaCl eq. was calculated from dissolution temperature of halite (= final homogenisation) using equation of Sterner et al. 1988. Pressures at homogenisation were estimated from the isochores of the systems H_2O-NaCl (Brown and Lamb 1989, Bodnar 1994), H_2O-NaCl-CO_2 (Bowers and Helgeson 1983) and CO_2 (Sterner and Pitzer 1994).

Trapped aqueous fluid is highly concentrated solution of NaCl, KCl, $CaCl_2$, $MgCl_2$ and $CaSO_4$ (up to 53 wt% NaCl eq.), containing up to 5 mole % of CO_2 and a small amount of additional gas compound, probably CH_4. Inclusions of this type sometimes coexist with inclusions of pure CO_2 or solid inclusions of halite. Their presence points to a heterogeneous trapping and is also key to the genetic classification of inclusions into 3 groups with different mode of trapping:

Group 1. Aqueous 3–4 phase inclusions containing brine, vapour bubble and 1–2 crystals of salt (halite ± sylvite). These inclusions have been trapped in 1-phase field. Homogenization temperatures (T_h): 250–450 °C, represent minimum possible trapping temperatures. Pressures at T_h are 0,9–5,3 kbar.

Group 2. Aqueous inclusions of the group 1 coexisting with inclusions of pure halite. Fluid was heterogenized prior to trapping, precipitation of halite possibly resulted from cooling of homogenous fluid. T_h: 360–407 °C, represent true trapping temperatures. Pressures at T_h: 0,8–3,1 kbar.

Group 3. Aqueous inclusions of the group 1 coexisting with inclusions of liquid CO_2. Fluid was heterogenized prior to trapping, admixing of CO_2 phase occurred due to the drop of pressure. T_h (of brine inclusions): 430–437 °C, pressure at T_h (derived from density of CO_2 inclusions): 3–4,5 kbar. These are the most reliable pressure data.

Usual practice is to convert inclusion fluid pressure to the depth of burial – this would result in 3–15 km of overburden. In our case, however, the paleo-depth is known: stratigraphically based estimates range between 1–3 km, which is also in good agreement with very weak metamorphic overprint of the Muráň nappe. Consequently, pressure data are not related to the lithostatic load and must be interpreted to reflect a fluid overpressure, varying from lithostatic (p_{lit}) to highly supralithostatic – ca. $5 \times p_{lit}$. Such overpressure below a nappe block is mechanically unstable and cannot be maintained for a long time. Despite this, its duration was long enough to allow for growing quartz crystals (1–2 mm in diameter), containing the fluid inclusions under study. Possible explanation is that the extreme overpressure acted locally in isolated domains. Overheating of pore fluids, resulting from friction in the basal thrusting plane, is regarded as a primary reason for the pressure increase. Relatively wide span of pressures points to a dynamic regime with pressure fluctuations. These were possibly caused by failures of the overlying carbonatic block and fluid leak-off along the ruptures.

References

BODNAR R. J., 1924. Synthetic fluid inclusions XII. The system H_2O-NaCl. Experimental determination of the liquidus and isochores for a 40 % NaCl solution. *Geochim. Cosmochim. Acta*, 58: 1053-1063.

BOWERS T. S. and HELGESON H. C., 1983. Calculation of the thermodynamic and geochemical consequences of nonideal mixing in the system H_2O-CO_2-NaCl on phase relations in geologic systems: Equation of state for H_2O-CO_2--NaCl fluids at highpressures and temperatures. *Geochim. Cosmochim. Acta*, 47: 1247-1275.

BROWN P. E and LAMB W. M., 1989. *P-V-T* properties of fluids in the system $H_2O \pm CO_2 \pm$ NaCl: New graphical presentations and implications for fluid inclusion studies. *Geochim. Cosmochim. Acta*, 53: 1209-1221.

HUBERT M. K. and RUBEY W. W., 1959. Role of fluid pressure in mechanics of overthrust faulting. I. Mechanics of fluid-filled porous solids and its application to overthrust faulting. *Bull. Geol. Soc. Am.*, 70: 115-166.

RUBEY W. W. and HUBERT M. K., 1959. Role of fluid pressure in mechanics of overthrust faulting. II. Overthrust belt in geosynclinal area of Western Wyoming in light of fluid-pressure hypothesis. *Bull. Geol. Soc. Am.*, 70: 167-206.

STERNER S. M., HALL D. L. and BODNAR R. J., 1988: Synthetic fluid inclusions. V. Solubility relations in the system NaCl-KCl-H_2O under vapor-saturated conditions. *Geochim. Cosmochim. Acta*, 52: 989-1005.

STERNER S. M. and PITZER K.S., 1994: An equation of state for carbon dioxide valid from zero to extreme pressures. *Contrib. Mineral. Petrol.*, 117: 362-37.

Interpretation of the Fault Network of the Western Bohemian Region Based on the Digital Model of the Relief DMR2 and Gravimetric Maps

Bedřich MLČOCH and Jana KOTKOVÁ

Czech Geological Survey, Klárov 3, Prague 1, Czech Republic

Western Bohemia and the adjacent area of SE Saxony and NE Bavaria represent a region with enhanced seismicity in the form of reoccurring earthquake swarms. Interdisciplinary studies carried out in this region aim at linking geological and geophysical data to understand distribution of the epicentres and causes of the seismicity. A new insight in the tectonic structure of the area is brought by the digital model of the relief DMR2. This model was created on the basis of topographic map in the 100 × 100 m dense network of the points. Its advantage is to enhance visually tectonic lines separating blocks with different level of the altitude or playing other important role in morphology of the landscape. A sketch showing these lines on scale 1:200,000 for the area of interest has been compiled. Some of these lines of fault character exhibit a close correspondence to the course of the important gravity boundaries and geologically proved faults. In contrast with the tectonic interpretation of the river system made by Č. Nekovařík, faults which do not significantly contribute to the morphology of the relief are not presented here. The NNE-SSW line on which the earthquake epicentres are concentrated cannot be distinctly observed neither in this projection nor in gravimetric maps. This line strikes somewhat diagonally to older structures delimiting the Cheb Basin, and is the most remarkable feature in the Tertiary filling of this basin. The fact that this line is not reflected either in morphology or in gravity and on the other hand that it is followed by a river course, implies that changes in the river system are more sensitive to tectonic movements of a low amplitude. As known from other regions, even an insignificant change in the altitude of different blocks can cause instantaneous change in the drainage pattern during inundations. The movements reflected by this change could have taken place during the Quaternary denudation of the soft sediments of the Cheb Basin.

Gravimetric maps indicate that the Smrčiny granitoid massif reaches a lower depth compared to the Karlovy Vary Massif. Rather pronounced positive anomaly, which is unique in the Czech part of the Krušné hory Mts., extends in-between the two from the north. There is an unusually steep gradient zone between this positive anomaly and the negative anomaly of the Smrčiny Massif. This zone follows the boundary between the Smrčiny Massif and the Oloví unit, the western limit of the Cheb Basin and also the boundary of tectonic blocks with different altitude.

Majority of the earthquake epicentres are located in the region of the positive gravimetric anomaly between the two granitoid massifs. Large part of these is concentrated along the NNE--SSW line of possibly younger origin as discussed above.

Interpretation of the Fault Network of the Western Bohemian Region Based on the Digital Model of the Relief DMR2 and Gravimetric Maps

Bedřich MLČOCH and Jana KOTKOVÁ
Czech Geological Survey, Klárov 3, Prague 1, Czech Republic

Western Bohemia and the adjacent area of SE Saxony and NE Bavaria represent a region with enhanced seismicity in the form of reoccurring earthquake swarms. Interdisciplinary studies carried out in this region aim at linking geological and geophysical data to understand distribution of the epicentres and causes of the seismicity. A new insight in the tectonic structure of the area is brought by the digital model of the relief DMR2. This model was created on the basis of topographic map in the 100 x 100 m dense network of the points. Its advantage is to enhance visually tectonic lines separating blocks with different level of the altitude or playing other important role in morphology of the landscape. A sketch showing these lines on scale 1:200,000 for the area of interest has been compiled. Some of these lines of fault character exhibit a close correspondence to the course of the important gravity boundaries and geologically proved faults. In contrast with the tectonic interpretation of the river system made by Č. Nekovařík, faults which do not significantly contribute to the morphology of the relief are not presented here. The NNE-SSW line on which the earthquake epicentres are concentrated cannot be distinctly observed neither in this projection nor in gravimetric maps. This line strikes somewhat diagonally to older structures delimiting the Cheb Basin, and is the most remarkable feature in the Tertiary filling of this basin. The fact that this line is not reflected either in morphology or in gravity and on the other hand that it is followed by a river course, implies that changes in the river system are more sensitive to tectonic movements of a low amplitude. As known from other regions, even an insignificant change in the altitude of different blocks can cause instantaneous change in the drainage pattern during inundations. The movements reflected by this change could have taken place during the Quaternary denudation of the soft sediments of the Cheb Basin.

Gravimetric maps indicate that the Smrčiny granitoid massif reaches a lower depth compared to the Karlovy Vary Massif. Rather pronounced positive anomaly, which is unique in the Czech part of the Krušné hory Mts., extends in-between the two from the north. There is an unusually steep gradient zone between this positive anomaly and the negative anomaly of the Smrčiny Massif. This zone follows the boundary between the Smrčiny Massif and the Oloví unit, the western limit of the Cheb Basin and also the boundary of tectonic blocks with different altitude.

Majority of the earthquake epicentres are located in the region of the positive gravimetric anomaly between the two granitoid massifs. Large part of these is concentrated along the NNE-SSW line of possibly younger origin as discussed above.