



## **Joint kinematic inversion of Pg/Sg phases from quarry blasts, tectonic events, mining induced events and selected data from Celebration 2000/Sudetes 2003 refraction experiments in the Moravo-Silesian region, Czech Republic**

B.Růžek (1), J.Zedník (1), K.Holub (2), O.Novotný (3)

(1) Geophysical Institute AS CR, Boční II/1401, 141 31 Prague 4, Czech Republic, (b.ruzek@ig.cas.cz, Tel.: +420 267 103 111, Fax: +420 272 761 549), (2) Institute of Geonics AS CR, Studentská 1768, 708 00 Ostrava - Poruba, Czech Republic, (holub@ugn.cas.cz, Tel.: +420 596 979 111, Fax: +420 596 919 452), (3) Dept. of Geophysics, Charles University, V Holešovičkách 2, 180 00 Praha 8, Czech Republic, (on@karel.troja.mff.cuni.cz, Tel.: +420 221 912 536, Fax: +420 221 912 555)

We present results following previous research (Růžek et al. 2004) in more details and using better input data sets. We have collected seismic recordings and/or phase readings from all accessible seismic stations operating on the territory of northern Moravia and Silesia ( $\sim 16^{\circ}\text{E}$ - $19^{\circ}\text{E}$  x  $49^{\circ}\text{N}$ - $51^{\circ}\text{N}$ ) in 2003/2004. Our database contains information relating to three types of seismic events: (i) 12 local quarry blasts, (ii) 10 mining induced seismic events, (iii) 18 local tectonic events. We know exact foci positions and origin times for all considered quarry blasts, since special measurements were made close to the explosions. Hypocentral parameters of stronger mining induced events are known from mining catalogues of seismoacoustics networks. Hypocentral characteristics of tectonic events are computed independently. Totally, we have 124 onset times for tectonic events, 91 for explosions, and 64 for mining induced events. Additionally, we have used also a subset of data coming from the older Celebration 2000 and Sudetes 2003 refraction experiments (Grad et al. 2003, Guterch et al. 2003a,b, Růžek et al. 2003), which provided us with 588 more picks. Totally, we made inversions based on a data set containing nearly 900 rays.

The inversions were aimed at deriving a simple smooth optimum velocity model, and

obtaining the best possible locations of the recorded tectonic events. We used the common tomographic technique. The velocity model is considered as a smooth 3D function defined in an irregular rectangular grid. Trilinear or tricubic-spline interpolation is used for getting the velocity in between the nodes. Ray tracing is based on bending method described by Um and Thurber (1987). Computation of the velocity model is made as traditional tomographic iterative process composed of consecutive solutions of linear equations. Each step requires new ray tracing of events with known hypocenter and also new relocation of the foci of all tectonic events.

We got velocity model which is consistent with local geology. Velocity isolines are quasi-parallel with the direction of geologic structures ( $\sim$ NE-SW), and the mean velocity gradient is nearly perpendicular to the dipping layers. All tectonic events are located with a reasonable reliability. The depths are in the range cca 5-25 km, and the energy is comparable with firing in the quarries.

#### References

- Grad M., Špičák A., Keller G.R., Brož M. and Hegedüs E. (2003). SUDETES 2003 seismic experiment. *Studia geoph. et geod.*, 47, 681-689.
- Guterch A., Grad M., Keller G.R., Posgay K., Vozár J., Špičák A., Brückl E., Hajnal Z., Thybo H. and Selvi O. (2003a). CELEBRATION 2000 seismic experiment. *Studia geoph. et geod.*, 47, 659-669.
- Guterch A., Grad M., Špičák A., Brückl E., Hegedüs E., Keller G.R. and Thybo H. (2003b). An overview of recent seismic refraction experiments in Central Europe. *Studia geoph. et geod.*, 47, 651-657.
- Růžek B., Vavryčuk V., Hrubcová P. and Zedník J. (2003). Crustal anisotropy in the Bohemian Massif, Czech Republic: observations based on Central European Lithospheric Experiment Based on Refraction (CELEBRATION) 2000. *J. Geophys. Res.*, 108 [B8] 2392, ESE 9-1-9-15, doi:10.1029/2002JB002242 (2003).
- Růžek B., Zedník J., Jedlička P., Holub K., Rušajová J. and Novotný O. (2004): A simple smooth velocity model of the uppermost crust in the Moravo-Silesian region derived from joint inversion of quarry blasts, tectonic events and mining induced events. *XXIX-th General Assembly of the European Seismological Commission (ESC)*, Potsdam, Germany, 12-17 September 2004. Book of abstracts and papers, p. 119.
- Um J. and Thurber C. (1987). A fast algorithm for two-point seismic ray tracing, *Bull. Seism. Soc. Am.*, 77, 972-986.