The main (subhorizontal) veinlet (type 1) in JOBA (NNE–SSW/20–30°E) is usually 0.2 to 2 cm thick. Hydrothermal calcite aggregates show fine-grained gouges on both lower and upper faces of the veinlet. Although it is a tensional joint, these faces were deformed by shearing (also with "tectonic clay" and "micro-breccia" in places). The bedding-parallel translation was of small magnitude, and the kinematic indicators suggest the top-to-the-south movement. Hydrothermal calcite contains 0.45–0.70 wt.% MgO, <0.02 % FeO and <0.05 % MnO; quartz aggregates with chips of carbonates are rare. The **transverse calcite veinlets (type 2)** (N–S to NNE–SSW/70–85°W) are usually 0.3 to 1.5 cm thick. Coarse and undeformed calcite crystal fabrics prevail. This calcite contains 0.30−0.75 % MgO and less than 0.10 % FeO and 0.10 % MnO. Compared to the previous veinlet, Fe and Mn concentrations are somewhat higher. The **superimposed system of veinlets (type 3)** is possibly the youngest (cross-cutting of veinlets). A representative veinlet of this type is 1.5 cm thick, striking W–E, dipping steeply (87°) to the south. Such orientation closely corresponds to planar rock faces (joints to faults) of the cliffs of Bárová, Krkavčí and Býčí skála. This type-3 veinlet differs from the previous generations in the presence of tiny inclusions of galena (~5 μm) and barite (~10 μm), as well as in higher Fe and Mn concentrations in hydrothermal calcite (0.44 % MgO, 0.43 % FeO, 0.19 % MnO).

A weak mineralization with a similar mineral assemblage (galena), associated with increased Mg-Fe-Mn contents in calcite, was found also in other limestone quarries of the Moravian Karst by Slobodník (2002), for instance, in the Mokrá and Skalka quarries. **The type-3 JOBA veinlets** correspond to "F-type" veins reported by Slobodník and Muchez (1998). The latter have also typically increased concentrations of Mg, Fe and Mn (~0.4 % MgO, 0.4 % FeO and 0.2 % MnO) and relatively abundant sulphide inclusions (mainly galena) . This similarity together with low temperatures (<80 °C) indicated by fluid inclusions and oxygen-isotope compositions of these "galena" calcite veins from Mokrá (P. Dobeš, J. Hladíková and J. Hladil,

1994, unpublished) suggest that the type-3 JOBA veinlets are also very young, possibl y Paleogene (surely post-Turonian and pre-Badenian) in age.

Josefov lies in the continuation of the southern Blansko Half-Graben faults, where relics of Cretaceous sediments lie between the Brno massif and the Moravian Karst. Formation of the second generation of these veins was probably coeval with that of metasomatic rims along normal faults in the entrance chamber of the Býčí skála Cave (Hladil, 1983; Blansko Half-Graben); the third generation of veins is even younger. The post-Variscan normal and bedding-parallel faulting occurred with the top-to-the-east and top-to-the-south vergency in the eastern and southern neighbourhood of the Josefov road junction.

References

ČEŠKOVÁ L., 1978. Metallogenic characteristic of selected geological units alongside eastern borders of the Bohemian Massif. *Folia přírodověd. Fak. Univ. J.E. Purkyně v Brně, Geol.*, 19, 3: 5-101. (in Czech)

HLADIL J., 1983. The biofacies section of Devonian limestones in the central part of the Moravian Karst. *Sbor. geol. Věd, Geol.*, 38: 71-94.

SLOBODNÍK M., 2002. Hydrothermal vein-type mineralization of the Moravian Karst area, Moravia, CR: insight from the viewpoint of fluid type and p-T conditions. *Acta Musei Moraviae, Sci. Geol.*, 87: 113-136. (in Czech)

SLOBODNÍK M. and MUCHEZ Ph., 1998. Geochemistry of calcite veins in the Palaeozoic rocks of the Moravian Karst. *Geol. Výzk. Mor. Slez. v R. 1997*, 5: 65-68. (in Czech)

Seismotectonic Model for Probabilistic Seismic Hazard Assessment of Critical Facilities in Western Slovakia

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Probabilistic seismic hazard assessment for critical facilities (e.g, nuclear power plants) requires collecting all relevant seismological, geological and geophysical data in the regional (up to 150 km from the site), near regional (up to 30-40 km from the site) and site vicinity (up to 5 km from the site) scales, respectively. All collected data should be used in the seismotec-

tonic model. Seismotectonic model should define geographical borders of active source zones, magnitude-frequency relationships and estimates of minimum and maximum magnitudes.

We undertook a comprehensive study of the geology, seismicity and seismic zoning for the Bohunice nuclear power plant site (BNPP).

Seismological database contains the data of historic earthquakes and instrumentally localized earthquakes in the regional scale.

Quality of data of historic earthquakes depends mainly on the quality of primary historical sources. Consistently processed primary sources are available in the studies of particular earthquakes that have been completed in the past 10–15 years. However, such studies are only available for some of the strongest earthquakes (such as the June 5, 1443 earthquake in Central Slovakia, or the June 28, 1763 earthquake near Komárno). The data of most of the earthquakes are taken from the descriptive and parametric catalogues. Descriptive catalogues use either both primary and secondary sources, or secondary sources only. The quality of sources has an impact on the uncertainty of earthquake parameters. The epicenter locations are given with an accuracy not better than +/− 10 km (it is usually even as much as +/− 20 km and more). Epicentral intensity is given with an accuracy not better than +/− 0.5° MSK-64 (the usual case is even up +/− 1° MSK-64).

Taking into account the number of earthquakes and the length of the period for which there are data of historic earthquakes, the data of historic earthquakes represent the crucial part of the seismological database for the BNPP far region. However, with the existing uncertainties of the epicenter locations, it is hardly possible to correlate the epicenter locations with the specific tectonic lines.

Systematic seismometric observations have been available since WW II. However, the accuracy of the instrumental localization of earthquakes by the 60s is not better than that of the macroseismic localization. Reliable instrumental localizations are only available for a small number out of the total of earthquakes in the BNPP far region.

Since the seismometric data are only available for a relatively short period and for a small number of earthquakes out of the total of earthquakes in the BNPP far region, the data of instrumentally localized earthquakes are of complementary character regarding the data of historic earthquakes.

Data about the microearthquake activity in the BNPP near region has been available since 1985. From 1985 to 1996 there were 613 micro-earthquakes registered. 65 of them reached the magnitude $M_1 \geq 1$. The localization accuracy for the epicenters of earthquakes with $M_1 \geq 1$ was usually ± 1 up to 2 km. Because of the character of the data of historic earthquakes and instrumentally localized earthquakes, the seismometric data of micro-earthquakes from the local network of the BNPP are of the same relevance as the relevance of the data of historic earthquakes for the determination of boundaries, and the way of simulating the Dobrá Voda seismic source region.

The geological database in the regional scale contains characteristic of basic geomorphologic and morphostructural units in the Bohemian Massif-Eastern Alpine-Western Carpathians--Panonnian junction area; geologic-tectonic classification and description of the structures of the Bohemian Massif, the Eastern Alps, the Western Carpathians and the Panonnian region; description of the basin systems of the Alpine-Carpathian--Panonnian region; description of the quaternary and structural development of the BNPP far region, geophysical characteristic of the BNPP far region (total Bouguer anomalies, magnetic anomalies, thickness of lithosphere, MOHO relief, heat flow density, recent vertical movements, borehole data, data of deep seismic sounding and reflex seismic profiles).

Geological database for the BNPP near region includes geomorphologic classification of the near region; geologic structure of the near region; structural analysis of sites in the BNPP vicinity; geophysical characteristic of the BNPP near region (including data of gravimetric, geomagnetic, geoelectric, radiometric and atmogeochemical surveys; results of seismic reflection profile and logging surveys).

Because location of epicenters of historic earthquakes cannot be correlated with the specific tectonic lines, we have only determined areal source zones in the regional scale. In total, we have determined eight areal source zones.

We have determined the boundaries of the Dobrá Voda source zone in the near region of the BNPP on the basis of the locations of epicenters of the instrumentally localized micro-earthquakes and on the basis of the locations of the faults. Epicenters of micro-earthquakes are found within a distinctively bordered region. Epicenters of the macroseismically observed earthquakes are also located within the Dobrá Voda source zone. Available focal mechanisms are not in contradiction to the identified tectonic lines.

Because of the vicinity of the BNPP site to the Dobrá Voda source zone and because there are available more detailed seismological and geologic-tectonic data for the BNPP near region than those for the BNPP far region, we have not simulated the Dobrá Voda source zone for the purposes of the probabilistic seismic hazard computation as an areal source zone but rather by using faults. Even though we had many more seismological and geologic data about the Dobrá Voda source zone than those about other source zones, we did not have so many of them to be able to simulate the source zone by the help of a single alternative. Therefore, we have simulated the source zone on the basis of real faults demonstrated on the surface, and on the basis of dummy faults. In the first alternative we simulated the source zone by the help of real faults that are found inside the source zone. In the second and third alternatives, the source zone is simulated by the help of dummy faults. The dominant direction of the dummy faults is identical with that of the real faults inside the zone, and the length of the dummy faults is given by the boundaries of the zone. The distance between the dummy faults in the second alternative is 3 km while in the third alternative the distance is 6 km. Both these distances are typical for the real faults inside the zone.

Because of uncertainties in the seismological, geophysical and geological data, i.e. because of existence of modeling uncertainties, we had to define several alternative seismotectonic models. We constructed a logic tree with 1440 branches. We defined 6 branches for source zonation, 4 branches for maximum magnitude, 12 branches for magnitude-frequency relationships and 5 branches for attenuation. All alternative seismotectonic models are presented.