

HYDRO-GEOLOGICAL EFFECTS OF SEISMICITY IN THE HRONOV-POŘÍČÍ FAULT ZONE AREA

Project of the Grant Agency of the Academy of Sciences of the Czech Republic, No. 2005/05/H020

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ABSTRACT

The recent mobility of the marginal parts of Bohemian Massif is manifested by an increased seismic activity and presence of mineral waters. Prominent tectonic faults are accompanied by the mineral water sources. In the North-East Bohemia these phenomena are concentrated at the Hronov-Poříčí fault zone area.

During this project monitoring of the effects of local seismicity to the groundwater regime was carried out. These effects were described for the first time after the strong 1901 earthquake, though never have they been systematically monitored.

The goal of this project was to widen the amount of knowledge about the seismic regime in the Hronov-Poříčí area and evaluation of effects of the local seismicity on the groundwater regime.

In a framework of this project the seismic station OSTA and adjacent small aperture array has been built. Moreover, several hydrogeological parameters in deep boreholes and mineral springs were monitored. Evaluation of hydrogeological data was based on separation of possible effects of seismicity from effects of other factors like tide effects or common meteorological effects. The project contributed to the knowledge of groundwater role in the geodynamical phenomena research

KEYWORDS: Hronov-poříčí fault, local seismicity, small-aperture seismic array

PROJECT OBJECTIVES AND METHODS

The main result of this project (with a special aim on finishing of PhD study of five students) is widening of the amount of the current knowledge about the seismic regime in the area of the Hronov-Poříčí fault zone area and evaluation of the effects of local seismicity on the groundwater regime. This marginal part of the Bohemian Massif is the second seismically most active part of the Massif.

This area has not been seismically monitored until the year 2005 when, as a part of this project, new seismic station OSTA has been built. Within this project selected hydrogeological parameters were monitored and their connection within the local seismicity has been sought. Revealed links were essential for further studies of geodynamical phenomena in the lithosphere.

Results of this project will contribute into the future development of another seismic stations in the area. Moreover, also the old macroseismic data from the beginning of the 19th century can be compared with the newly available macroseismic and hydrogeological data.

The seismic station Ostaš (OSTA) was built in the old army bunker and is now in the property of the

AS CR. Later during the project the station has been converted into the small aperture array. Three more sensors has been added at the distance of 60 meters from the main sensor. The state of the art methods of small scale event detection have been tested on data from this array. This methodology is very important for a seismic hazard evaluation. Moreover, also new method of phase velocities of the surface waves measurements using the relative method has been developed.

Researchers involved in this project continue their work in the new GACR project (Mgr. Petr Kolínský, 2009 – 2013 – Nature of seismicity in the Hronov-Poříčí fault zone area) since the January 2009. The refinement of knowledge about the tectonic structure of the area is essential during the monitoring and interpretation of a spatial distribution of seismic events.

Within the project the fault on the NE margin of the Hronov-Poříčí trough was mapped using the geoelectrical methods. This fault is parallel with the main Hronov-Poříčí thrust. Also the SW margin of the trough has been investigated, however, the results do not reveal the presence of a fault. Therefore the SW margin has been interpreted as a flexural one.

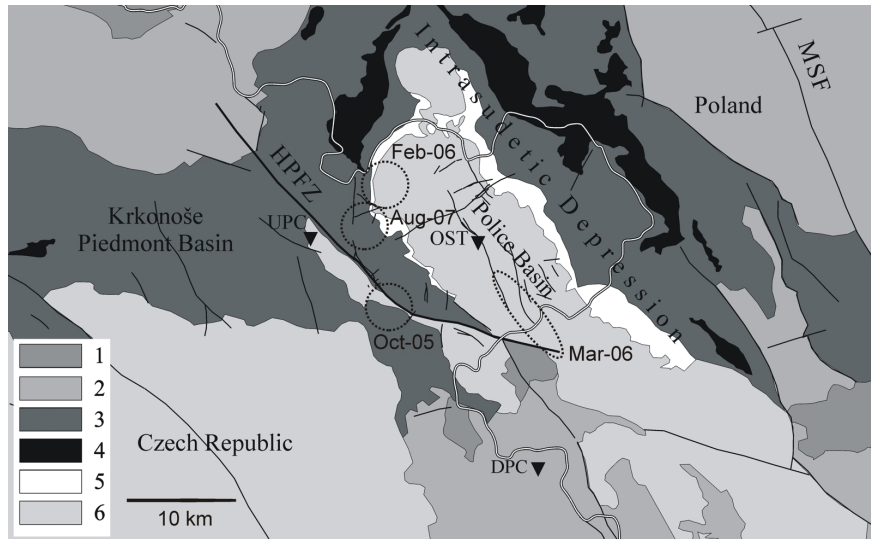


Fig. 1 Geological map of the study area with zones of foci locations. (1 –plutonic bodies, 2 – metamorphic rocks, 3 – Permo-Carboniferous sediments, 4 – Permian volcanites, 5 – Triassic sediments, 6 – Cretaceous sediments, HPFZ – Hronov-Poříčí Fault Zone, MSF – Marginal Sudetic Fault, OST – seismic station Ostaš, DPC, UPC – seismic stations of the Czech Reginal Seismic Network.

Since the measurements has been carried out only for a limited amount of time (in the geological point of view) its is necessary to continue the observations and link them with observations from the Czech and European seismic network. This is why it is intended to incorporate the OSTA station to the EPOS (European Plate Observing System) project. This also implies necessity of on-line data processing and completion of a standard seismic bulletin.

Very important part of seismic monitorings is completion of a macroseismic catalogue. It comprises of cooperation with local macroseismic observers and of methodology of macroseismic questionnaires processing. Significant contribution of this project is in evaluation of macroseismic data in connection with the seismic data from the OSTA station.

The OSTA station has been used also for the surface wave measurements. The phase velocities of surface waves have been derived (using the relative method), which necessitated also other seismic stations within the Bohemian Massif. This relative method was developed also using the seismic data from this station. The OSTA station has also been involved in the international passive seismic experiment – PASSEQ.

Blasts from the local quarries were also monitored using the OSTA station and were used for the surface wave measurements.

The small aperture array was used as a tool for localisation of very small seismic events in the vicinity of the station. A statistics of aftershocks has been evaluated (relationship between the number of

events and time) and correlated with general Omori's law for different areas.

ACKNOWLEDGEMENT

Processed data of the seismic and hydrogeological monitoring for the first time in the history describe phenomenas of this important tectonically active area of the Bohemian Massif. It will enable determination of seismicity in the area and re-evaluation of past seismic data.

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ÚČINKY SEISMICITY NA REŽIM PODZEMNÍCH VOD V OBLASTI HRONOVSKO-POŘÍČSKÉHO ZLOMOVÉHO PÁSMA

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ABSTRAKT:

Současná mobilita okrajových částí českého masívu se projevuje zvýšenou seismickou aktivitou a výskytem minerálních vod, jejichž zřídelní struktury jsou vázány na významné tektonické dislokace. V oblasti severovýchodních Čech jsou tyto jevy soustředěny do oblasti hronovsko-poříčského zlomového pásma.

V tomto projektu byly sledovány účinky lokální seismicity na vydatnost zdrojů podzemních vod. Tyto byly poprvé popsány v souvislosti se silným zemětřesením z roku 1901, ale nikdy nebyly systematicky sledovány.

Cílem projektu bylo rozšíření současných znalostí o seismickém režimu v oblasti hronovsko-poříčského zlomu a posouzení účinků lokální seismicity na režim podzemních vod.

V rámci projektu byla vybudována lokální seismická stanice OSTAŠ a skupinová seismická stanice v její blízkosti. Bylo realizováno sledování vybraných hydrogeologických parametrů v hlubokých vrtech a minerálních pramenech. Hodnocení výsledků hydrogeologického monitoringu spočívalo v separaci možných projevů seismicity od účinků ostatních faktorů, jakými jsou slapové vlny nebo chod základních meteorologických prvků. V obecné rovině projekt přispěl k poznání role podzemních vod při studiu dynamických jevů v litosféře.