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Extended Abstracts

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Evaluation and management of groundwater — sustainable exploitation

title: Limits for use of thermal waters in the Bohemian Cretaceous Basin

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The groundwater system of the Benesov and Usti nad Labem area in the Bohemian Cretaceous Basin (Czech Republic), taking up around 2000 square kilometers, is more or less a closed hydrogeological unit with a relatively easily definable boundary. The largest thermal water accumulation known so far in the Czech Republic with temperatures often exceeding 30 degrees centigrade and in some spots approaching 40 degrees centigrade can be found in the voluminous and spacious Cretaceous aquifers (Hercik et al., 1999). Exploitation of these thermal waters has thus far been concentrated in the Usti nad Labem and Decin regions (Datel, Krasny, 2005).

Thermal water of Usti nad Labem and Decin areas had not been known in the past. Therefore, before deep boreholes have helped discover the thermal water resources, the whole area of thermal waters known now represented a hydrogeological structure with very slowly flowing, almost stagnating groundwater. Exploiting the resources has made the groundwater flow significantly faster. Even though the area of interest belongs to zones of increased heat flux in the deeper parts of the earth's crust, the question arises whether sufficient heating of these waters will occur with the current accelerated groundwater flow and whether in the future the temperature of the thermal water resources will not fall. It is important to bear in mind that the thermal waters have been exploited for a relatively short period of time - for approximately one century. This period is too short considering the pace of the hydrogeological processes, so no substantial negative consequences of the exploitation can be expected. With continuing or even increasing exploitation of the resources, however, falling temperature and possible quality changes cannot be excluded in the future.

The conceptual model, as the first step necessary for a numerical model (groundwater and heat flow), was based on all the available information that could be collected (Datel et al., 2009; Hercik et al., 1999). Limiting factors for the use of thermal waters consist both in the balance of the amount of water in the structure and also the balance of the amount of heat flowing into the structure.

MAIN CONCLUSIONS

- The framework balance was calculated for the basal and main Cretaceous aquifers (where thermal waters are located) of the defined area and yielded the maximum sustainable yields of natural thermal waters in the drainage areas — 40–45 $l \cdot s^{-1}$ in the Usti area and 250–300 $l \cdot s^{-1}$ in the Decin area (Datel, 2008). Because of the lack of precision in the calculation, these are approximate values that, however, do not differ from estimates to date and practical experience in the utilization of thermal waters and are in accordance with first outputs from numerical models (Baier et al., 2010).
- The main drainage sites for the whole structure were defined — in addition to the Usti and Decin areas, the Kamenice area and the Litomerice area are important drainage areas.
- Data on the occurrence of tectonics and their hydrogeological function were collected and newly evaluated, 8 detailed hydrogeological cross-sections were constructed.
- On the basis of data from new boreholes, data on the thickness of the aquifers, depths of important geological boundaries, basic hydraulic parameters (K,T) and the piezometric contours of aquifers were updated and regionalized.
- Analysis of the piezometric contours of aquifers indicated areas with the greatest potential for vertical groundwater flow.

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