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Low-Enthalpy Geothermal Potential of the Czech Republic with Particular Focus on Waters of Metalliferous Mining Districts in Crystalline Structures of the Bohemian Massif

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Nowadays, numerous underground mines in the Czech Republic are mostly left to spontaneous natural flooding with water. These huges volumes and favourable water temperature represent promissing source of thermal energy. The primary temperature of the mine waters is given by the rock massif temeprature, i.e. by the heat flux which is in the moldanubikum region around 50 – 60 mWm-2 (Michálek et al., 2007). Higher heat flux has been observed in several mountainous regions throughout the country. The real water temperature results form the depth of mines, geothermal gradient and the water circulation in the mine. Temperature measurements suggest a distinct temperature depth stratification.
Several metalliferous mining districts in Crystalline Structures with the water outflow exceeding 1 Ls-1 have been subject of investigation. The temperature was not the only determining factoras it is relatively stable in mines all year round. The data on yield, temperatures, etc. prepared for further mathematical modeling were primarily measured in uranium and oremines in Příbram mining district, Jáchymov, Zlaté Hory and Rožná.
Water of about 18°C and radioactivity make favourable condition for the Jáchymov spa purposes. The average yield reaches 20 Ls-1. The entire outflow for the Jáchymov mines before its decommissioning reached 136 Ls-1.The entire heat capacity of mine waters is supposed to be around 1.150 kW.
Severa l galleries in Zlaté Hory region could be used for thermal purposes. The yield around 60 Ls-1 and temeperature around 7°C was observed in the main drainage gallery. Measurements were accompanied by chemical analysis of water having both a huge pH range from 3 to 9 and huge mineralization range from 135 to 6 500 mgL-1.
The Rožná and Příbram conditions are quite similar with the outflow from 20 - 45 Ls-1 and temperatures from 11 - 18°C. Possible temperature decrease originates from the fact that colder shallow groundwater will inflow into mine spaces mixing with the warmer mine water.
Various technical solutionsfor the exploitation of energetic potential of mine water are relatively well known – geothermal heat from operating mines, geothermal heat capacity of the flooded mines, groundwater bodies in flooded mines used for heat storage.
Regarding the fact that the temperature conditions of the mine water are very stable and the time scale of the mine water temperature decrease is over several centuries, mine waters represent a promising source of geothermal energy. Regional and local demand for heat is being quantified; technical solutions of mine water heat utilization are being investigated along with development of legal framework in the Czech Republic.