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Flow pattern and residence time of conduit flow and diffuse flow in calcareous sandstones (Bohemian Cretaceous Basin, Czech Republic)

Iva Kůrková^{1,2} and Jiří Bruthans^{1,2}

¹Charles University, Faculty of Science, Institute of Hydrogeology, Engineering Geology and Applied Geophysics, Prague, Czechia (iva.kurkova@geology.cz)

²Czech Geological Survey, Czech Republic

Localities containing karst features were studied in the northwestern part of Bohemian Cretaceous Basin. Namely Turnov area in facies transition between coarse-delta sandstones and marlstones (Jizera Formation, Turonian) and Miskovice area in limestones and sandy limestones - sandstones (Peruc-Korycany Formation, Cenomanian). Evolution of karst conduits is discussed elsewhere (Kůrková et al. 2019).

In both localities, disappearing streams, caves and karst springs with maximum discharge up to 100 L/s were documented. Geology and hydrogeology of this area was studied from many points of view to describe formation of karst conduits and characterize groundwater flow. Tracer tests were performed using NaCl and Na-fluoresceine between sinkholes and springs under various flow rates to evaluate residence times of water in conduits and to describe geometry of conduits. Breakthrough curves of tracer tests were evaluated by means of Qtracer2 program (Field 2002). Groundwater flow velocity in channels starts at 0.6 km/day during low water levels up to 15 km/day during maximum water levels, the velocity increases logarithmically as a function of discharge. Similar karst conduits probably occur in other parts of Bohemian Cretaceous Basin where lot of large springs can be found.

Mean residence time of difussed flow based on tritium, CFC and SF₆ sampled at karst springs is 20 years for 75% of water and 100 years for remaining 25%, based on binary mixing dispersion model. This shows that most of the water drained by karst conduits is infiltrated through the soil and fractured environment with relatively high residence time. Residence times in different types of wells and springs were also measured in whole north-western part of Bohemian Cretaceous Basin. Results indicate long residence times in semi-stagnant zones represented by monitoring wells and short residence times in preferential zones represented by springs and water-supply wells.

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