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Karst in calcareous sandstone aquifer, Turnov area, Czech Republic

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Many karst features such as sinkholes with disappearing streams, caves and karst springs with maximum discharge up to 100 L/s were documented in northern part of Bohemian Cretaceous Basin near Turnov. Highly permeable pathways originate in calcareous sandstones, in so-called transitional facies between shallow-water coarse-delta sandstones and deep-water marlstones (Jizera Formation, Turonian, Cretaceous). Geology and hydrogeology of this area was studied from many points of view to describe formation of karst conduits and characterize groundwater flow.

Rock samples from outcrops were drilled out in vertical profiles and were subjected to a fast dissolution simulation with HCl to observe degree of disintegration of sandstone after leaching the $CaCO_3$. Carbonate content was measured for each sample by calcimetry. Carbonate content varies considerably in vertical direction. Samples containing more than 35-50% of $CaCO_3$ completely disintegrate after leaching in HCl and are thus prone to karstification. Yet, correlation between carbonate content and degree of disintegration is weak. Scanning electron microscopy showed that sandstone is composed dominantly of quartz grains cemented by calcium carbonate.

Tracer tests were performed between sinkholes and springs under different flow rates to evaluate residence times of water in conduits and infer conduit geometry. Flow velocity in conduits varies between 200 m/day and 10000 m/day. Mean residence time in aquifer adjacent to conduits based on tritium, CFC and SF6 is 20 years for 75% of water and 100 years for remaining 25%, based on binary mixing dispersion model. Oxygen isotopes have minimum variability in time, showing low admixture of water with residence time <1 year. This shows that most of the water drained by karst conduits is infiltrated through the soil and fractured environment with relatively high residence time. Similar karst conduits probably occurs in other parts of Bohemian Cretaceous Basin.

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