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Isotope hydrology reveals a fissured aquifer enclosed in the karst of Gorski Kotar. The Zeleni Vir case study (Outer Dinarides, Western Croatia)

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The hydrogeology of the upper Curak Valley in Western Croatia gives a local insight to a geological setting, which represents and affects the characteristic karst hydrology of the Gorski Kotar. The sedimentary rocks comprise Permian sandstone, Triassic- and Jurassic dolomite and limestone. During the Dinaric Orogeny these formations were folded and locally overthrusted (HERAK 1980). In terms of structural geology the area around Zeleni Vir appears as a tectonic window, where Jurassic limestones were overthrusted by Permian formations. In the Skrad Mountains (1043 m) the Permian clastic rocks are overlain by Triassic carbonates. From the hydrogeological point of view, the karstified Jurassic limestones act as a basal karst aquifer (karst-floor 1) overlain by an aquiclude consisting of Permian rocks, which in turn bear an upper karst aquifer in its hanging wall (karst-floor 2). Springs located near the village Skrad, discharge at the contact between Permian sedimentary rocks and their Triassic cover (karst-floor 2), and contribute the discharge of the Zeleni Vir Stream. In the Zeleni Vir Cave a big spring discharges karst-floor 1 with a maximum of 75 m3/s (BIONDIC 2006), the hydrogeological catchment of which can be located 10 kilometers to the south, where highly karstified Triassic limestones crop out at Ravna Gora, at an altitude of 620 m.

The focus of this presentation lies in the comparison of the hydraulic reaction of two streams after heavy rain events in summer 2010, namely the Zeleni Vir Stream and the Klamm Stream. Due to the fact that all water discharging the Zeleni Vir Cave was diverted to a nearby hydro power scheme, no karst water from karst-floor 1 contributed the Zeleni Vir Stream but instead water from wells at Skrad discharging at the contact between karst-floor 2 and Permian rocks. The Klamm Stream flows through the Klamm Creek discharging a catchment consisting of Permian clastic rocks.

Hydrogeological information was gathered by detailed geological mapping of the two catchments, and an event-monitoring by means of environmental isotopes (HÄUSLER & STADLER 2010). Data of hydrographs and stable isotopes of both streams during the 48 hours of event-monitoring revealed their particular storage- and discharge dynamics (STADLER et al. 2010, STADLER et al. 2011). From the water-level fluctuations of the Klamm Stream and the variation of stable isotopes throughout the event we conclude a reaction similar to a piston-flow effect when discharging the porous aquifer of weathered Permian sandstones. The Zeleni Vir Stream showed an inertial reaction in discharge and isotope signal during the event, which is untypical for a karstified catchment. From the 48 hours of monitoring the hydrograph, hydrochemistry and stable isotopes of the Zeleni Vir Stream we conclude that no event-water was sampled that has flown through karst-floor 2.

Therefore we conclude that the springs around Skrad do not predominantly discharge karst-floor 2, but rather a local fissured carbonatic aquifer in contact with the underlying and confining sedimentary rocks of Permian age.

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