

The hydrogeology of Ogof Draenen: new insights into a complex multi-catchment karst system from tracer testing

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Abstract

A current understanding of the hydrology of Ogof Draenen, Wales, one of the longest and most complex cave systems in Europe, is presented. Previous tracer tests are reviewed and results of two new tracer tests presented. Numerous dolines occur on the Carboniferous Millstone Grit and Limestone that outcrop around the edges of the mountains overlying Ogof Draenen, with hydrologically active sinking streams common along the boundary of these strata. Surface pollution of a doline caused diesel pollution in the cave beneath demonstrating the vulnerability of groundwater. In addition to a few recently formed hydrologically active cave passages, groundwater flow is influenced by many kilometres of fossil passages, formed during multiple phases of speleogenesis, creating vertical and horizontal misfit streams which cross or flow through large fossil passages. In the southeast of the cave, tracer testing revealed an underground watershed demonstrating the complexity of groundwater flowpaths. In the north a cave stream flows to springs which drain north to the Clydach Gorge. Small amounts of drainage in the cave may also reach springs in the Tumble Valley to the northeast, although these springs may be unconnected to the cave and fed entirely by stream sinks on the Bloreng mountain side. Multi-tracer injections within the

cave revealed that its major underground streams flow south to feed large springs at Snatchwood and Pontnewynydd in the Afon Lwyd valley, in a different topographical catchment some 8 km beyond the known cave, with rapid groundwater velocities of up to 4 km/day. Nine other springs in the Afon Lwyd valley appear unconnected to the Ogof Draenen streams, being fed independently by sinking streams on the local mountainside. In addition, we show that specific electrical conductance varies greatly both between and within springs, is negatively related to background fluorescence, and can be used to aid interpretation of dye tracer data.