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Applied dual-gas tracing of a fissured sandstone aquifer

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Dissolved noble gas tracing is being used by the Environmental Tracers Laboratory (ETL) at Queen's University Belfast (QUB) as a novel, 'environmentally-friendly', applied tracer approach to characterise subsurface structure and transport properties for aquifer systems. A single-borehole slug injection (so-called 'push-pull') tracer test has been conducted at QUB in the fissured, permeable Triassic Sherwood Sandstone aquifer using both dissolved Krypton (Kr) and Xenon (Xe) noble gases as well as a standard organo-dye tracer Rhodamine WT (RWT), all applied simultaneously in a 'push' phase lasting 12 hours. Input concentrations (C_0) for both noble gas tracers initially were chosen to be equimolar, specifically to test for the possible role of diffusive exchange between fissures and matrix systems over advective exchange. Their simultaneous breakthrough curves during the 'pull' phase show two characteristic peaks and long-tailing, which clearly demonstrate the dual-permeability nature of this important aquifer over the spatial and temporal scales investigated.