



## **Arsenic contamination of fractured bedrock aquifers in the Palaeozoic units of South-East Ireland**

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Arsenic (As) contamination of groundwater is now well documented across the globe in a range of geological environments e.g. sulphide & iron oxyhydroxide bearing volcanic and sedimentary units. In Ireland, approximately 26% of public drinking water supplies are groundwater-derived, with an additional 170,000 unregulated private supplies in use. Recent investigations have highlighted As levels that exceed the 10 ppb World Health Organisation (WHO) limit in some Irish groundwaters. This work focuses on case studies of As-contamination in private wells within bedrock aquifers that are dominated by fracture permeability in South-East Ireland. In contrast with the more widely reported cases of As-contamination in unconsolidated aquifers (e.g. South-East Asia and Argentina), fractured bedrock aquifers are highly anisotropic and compartmentalised fluid flow systems, giving rise to heterogeneous geochemical conditions. A better understanding of the hydrogeochemistry of these systems, from mineral source to water-dissolved As, is needed if populations accessing groundwater are to be better protected by improved risk assessments.

Data collected by the Tellus program in South-East Ireland, a systematic regional geochemical sampling program of stream sediments, were used to identify areas with potential for anomalously high As anomalies in private wells. Several clusters of elevated groundwater As (up to 70 ppb As) were identified across the study area in wells drilled within the Ordovician metasedimentary successions in the region. Detailed hydrochemical results indicate an association between elevated As and low pH (pH 5.5 – 7.5) relatively oxidising (ORP c. 50 – 275 mV) groundwaters. Surface waters in the region exhibit elevated arsenic concentrations (c. 84 – 135 ppb) suggesting that arsenic is readily mobilised at shallow depths. On the other hand, pore-waters from soils do not exhibit elevated As concentrations, indicating that groundwater As is mobilised directly from mineralogical sources in the shallow oxidising recharge zone bedrocks. SEM-EDX analysis of the Ordovician metasedimentary outcrops has confirmed the presence of several As-bearing sulphides (e.g. arsenopyrite and cobaltite). Results from leaching experiments and geochemical modelling to further constrain the electrochemical parameters for arsenic mobilisation in the region will be presented, providing a better understanding of these hydrogeochemical systems for risk assessments.