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Arsenic contamination of groundwater in Ireland; occurrences and sources.

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Arsenic (As) contamination of groundwater is now well documented across the globe. Geological environments similar to those in which high levels of dissolved As occur elsewhere are common in Ireland (e.g. sulphide-bearing volcanic & sedimentary units), yet reliable data at the μg/L level for As in groundwater are sparse. An improved understanding of As occurrence and its sources is important in Ireland because up to 20-30% of public drinking water supplies are provided by groundwater, and an additional 170,000 small private supplies are in use which remain largely unregulated. Recent investigations have highlighted As to be a contaminant of emerging concern in some Irish groundwaters that have As values exceeding the 10 μg/L World Health Organisation (WHO) limit. The work presented here will focus on specific cases with an emphasis on the geological and mineralogical sources of arsenic.

Results from a reconnaissance survey of private wells in South-East Ireland will be discussed. Data collected by the Tellus program, which systematically collects regional geochemical samples of soils, stream sediments, and stream waters, across Ireland were used to identify potential geochemical anomalies of As. Over 250 samples have been collected and analysed to date across south-east Ireland, with c. 10% of samples exceeding the WHO limit. Several clusters of elevated groundwater As were found e.g. Brittas, Co. Dublin, where As levels exceeded the recommended limits (up to 70 μg/L) in Ordovician greywacke units. Detailed hydrochemical data from this area will be discussed.

In North-East Ireland, As was found to be elevated (up to 60 μg/L) within private wells accessing a fractured bedrock aquifer close to the contact between Silurian greywacke units and the Palaeogene Slieve Gullion igneous complex. No anthropogenic source of this As was identified. Two drill cores recovered during late 2015, have been studied to identify potential sources and/or sinks of As. Bulk geochemistry (ICP-MS and ICP-AES) of drill core samples indicated an average As concentration of c. 3 mg/Kg for all samples, akin to upper continental crustal averages, but the work also highlighted the presence of intrusive basaltic dykes containing up to 80 mg/Kg of As, elevated compared to the global basalt average of c. 2 - 5 mg/Kg. Disseminated arsenic-bearing sulphide minerals with associated cobalt (Co) and nickel (Ni) have been identified within the basaltic dykes using SEM-EDX as the likely source of arsenic in the groundwater, but the apparent absence of elevated sulphate levels in the groundwater may indicate a multistage mobilisation process.