Sourcing groundwater arsenic contamination in North-East Ireland

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Arsenic (As) contamination of drinking waters is thought to affect up to 200 million people globally. Geological environments similar to those in which high levels of dissolved geogenic As occur elsewhere are common in Ireland, yet reliable ppb-level As data for groundwater are sparse. Recent investigations have identified geogenic arsenic to be an emerging concern in some Irish groundwaters, exceeding the limit of 10 μg L^{-1} of both the World Health Organisation (WHO) and the Irish Drinking Water Regulations (2014).

The work presented here focuses on an area of known elevated groundwater As concentrations within a fractured-bedrock aquifer in the Longford-Down Terrane of NE Ireland. Arsenic occurs in groundwater at elevated levels (up to 60 μg L^{-1}) at basalt dyke contacts within both the Palaeogene Slieve Gullion Complex and the Silurian-Ordovician greywacke-shale units. A geogenic origin is hypothesised, as the contamination is relatively widespread with no obvious anthropogenic source(s).

Three drill cores were retrieved in the area by Geological Survey Ireland during late 2015 and were subsequently logged. Bulk geochemical data (ICP-MS and ICP-AES), alongside Scanning Electron Microscopy work, coupled with energy dispersive *X*-ray spectroscopy are discussed. Data for sulphide minerals and secondary iron oxy-hydroxides that occur along shallow angle fractures are presented to identify potential mineralogical source(s) for the arsenic.

A total average As content of c. 3 ppm for all bulk-rock samples is similar to estimated upper crustal abundances of 2–5 ppm, but several samples of greywacke and basalt exhibit more elevated values, ranging between 10–17 ppm. Within these lithologies a range of disseminated sulphide minerals have been identified, including arsenic-bearing sulphides, some of which contain cobalt (Co) and nickel (Ni) enrichments. Initial mass balance calculations indicate that relatively large volumes (c. 4000 grains/g) of small (1500 μm^3) disseminated sulphides would be required to account for the observed whole-rock concentrations in the 10-17 ppm range.