

Mining environments – GTK's isotope analytical facilities on dissolved elements in water

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The Geological Survey of Finland (GTK) has been developing methods for the use of new isotopic tracers to monitor the impact of mine water discharge on natural waters, to pinpoint hydraulic connections and interactions within mine environments, as well as to detect possible natural trends and discriminate them from the impacts of mine water.

In addition to traditional water isotopes (O and H), S, Li, Mg, Pb, Sr and U isotopes can be now analysed. Analytical methods for Fe, Cu, Zn and B isotopes are currently under development. While all other elements may be isolated using ion chromatography or conventional column methods, only S is isolated using solely conventional methods.

The isotope ratios of the purified elemental fractions are then measured using MC-ICPMS (*multicollector inductively coupled plasma mass spectrometer*) and/or TIMS (*thermal ionization mass spectrometer*).

In general U and S isotopes indicate changing redox conditions. Mg and Li are sensitive to weathering and they show slight fractionation between the mineral and the water phase. Here, the effect of runoff on the isotope ratios may be important. The more traditional Sr and Pb systems trace natural and antropogenic sources eg. (minerals, soils, chemicals).

The current pilot studies show evidence for mixing of mine waters in recipient surface waters and thereafter introduction of polluted surface waters into ground water. Sr isotopes have been extremely useful to separate the contamination related to the mining process from the natural signature.