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# Characterisation of the origin of nitrate in groundwater using coupled nitrogen and boron isotopes: a synthesis

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Nitrate (NO3) is one of the world's major pollutants of drinking water resources. Although recent European Directives have reduced input from intensive agriculture, NO3 levels in groundwater are approaching the drinking water limit of 50 mg L-1 almost everywhere.

Determining the sources of groundwater contamination is an important first step toward improving its quality by emission control. It is with this aim that we summarise here the benefit of using a coupled isotopic approach (delta-15N and delta-11B) to trace the origin of NO3 in water. These tools are used in addition to conventional hydrogeological analyses and with the use of Sr isotopes which allow to better understand the structure and functioning of aquifers.

The studied watersheds include fractured bedrock, subsurface and deep alluvial hydrogeological contexts. The joint use of nitrogen and boron isotope systematics in each context deciphers the origin of NO3 in the groundwater and allows a semiquantification of the contributions of the respective pollution sources (mineral fertilisers, wastewater, and animal manure), whereas Sr isotopes provide constraints on water circulation.

Such a coupled approach with different and complementary isotopic tools together with the conventional hydrogeological characterisations represent a powerful combination to deciphers the origin of nitrate pollutions in a well characterised hydrogeological context. Within the $6^{th}$ FP project Aquaterra, in order to better understand the relevant processes in the Brevilles catchment (France; small agricultural watershed composed of limestone overlaying a sandy aquifer), such an approach will be developed.