



Investigation into nitrogen attenuation in groundwater pathways in Irish RBDs through the use of stable isotopic signature analysis

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Nitrogen has been identified by the Water Framework Directive as a major pollutant of concern in terms of water quality. Nitrogen contamination can pose a threat to human health and excessive loading into surface waters can lead to eutrophication. This research aims to investigate groundwater pathways from diffuse sources of nitrogen contamination and attenuation processes in various geological settings in Ireland. As part of the EPA Strive Pathways Project, the overall purpose of this research is to improve the understanding of nitrogen attenuation processes in groundwater for the development of a catchment management tool to assess the risk posed by diffuse contamination to surface and groundwater receptors. This will be undertaken through examining nitrogen attenuation pathways in various geological settings in distinctly different catchments in Ireland. These catchments include Gortinlieve in Co. Donegal and Mattock in Co. Louth which are both poorly drained catchments and Nuenna in Co. Kilkenny which is a well drained limestone catchment. This research will be useful to develop further ongoing research carried out into the natural chemistry of the Gortinlieve catchment.

The research will focus mainly on characterising the fractionation of stable nitrogen isotopes in groundwater. The use of the stable isotopes ^{15}N and ^{18}O in the study of denitrification has been well documented in literature. In addition, the isotopes ^{13}C and ^{34}S have also been shown to be useful in evaluating the influence of sulphur and carbon as electron donors in denitrification. For example FeS_2 produced as a result of denitrification has a different isotopic signature than FeS_2 produced from other processes. This research aims to apply these established stable isotope signatures to a new context in terms of the catchment geology and the broader integrated approach of the Pathways project. Furthermore factors influencing the rate of attenuation will be explored, such as: strata changes with depth which may involve changes in chemistry and hydrogeological properties; total organic carbon; dissolved oxygen; acidity; pore size as a limiter for microbial growth, and precipitation. When evaluating the groundwater flow pathways, particular emphasis will be placed on the riparian and hyporheic zones as there is a significant knowledge gap in relation to their delineation and their role in nitrogen attenuation in an Irish context.