

Accepted Manuscript

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PII: S0375-6742(17)30642-8
DOI: [doi:10.1016/j.gexplo.2018.02.019](https://doi.org/10.1016/j.gexplo.2018.02.019)
Reference: GEXPLO 6113

To appear in: *Journal of Geochemical Exploration*

Received date: 15 September 2017
Revised date: 13 December 2017
Accepted date: 28 February 2018

Please cite this article as: Angela Nigro, Giuseppe Sappa, Maurizio Barbieri , Boron isotopes and rare earths elements in the groundwater of a landfill. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. *Gexplo*(2017), doi:[10.1016/j.gexplo.2018.02.019](https://doi.org/10.1016/j.gexplo.2018.02.019)

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Boron isotopes and rare earths elements in the groundwater of a landfill

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Abstract

A geochemical assessment of groundwaters beneath a municipal solid waste landfill in Central Italy was carried out by using a hydrochemical approach. The aim of this study was to determine the quality of groundwater using major ions, trace elements and boron isotopes as tracers of contamination due to the presence of the landfill. Results obtained show that Fe, Mn, Cr, Ni and B present high values in groundwater located downgradient from the landfill. Boron isotopes allow identifying contamination source, anthropogenic and/or geogenic. Furthermore, rare earths elements were analysed to identify possible anthropogenic input in groundwater and reporting first REE patterns from the study area.

Keywords: Boron Isotope; Groundwater; Landfill; Rare earths elements;

1. Introduction

Leachates of municipal solid waste landfill are the source of environmental contaminations. It is a complex of products that originates from the decomposition of organic matter and inorganic contaminants by bacteria and the solvent action of meteoric water.

There have been numerous approaches and methods to evaluate leachate leakage in groundwater using elemental and isotopic tracing techniques. A tracer is a substance in water that is present naturally (natural tracer) or introduced by man (artificial tracer) and is used to identify the route taken by water in the subsoil (Leibundgut et al., 2009; Tazioli 2011). A suitable tracer that has been used successfully in previous wastewater studies is boron and its isotopes. Boron isotopes are sensitive for tracing urban wastewater in surface water (Petelet-Giraud, 2009). Many contaminants have a distinct isotopic composition that reflects their solute source and are often isotopically different from native groundwater (Barth, 2000a; Nigro et al., submitted). $\delta^{11}\text{B}$ values are known for municipal wastewater (Vengosh et al., 1994; Bassett et al., 1995; Eisenhut et al., 1996;

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