Geophysical Research Abstracts, Vol. 9, 01304, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-01304

Dissolved organic carbon in European groundwaters

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Organic carbon is present in all natural waters and plays an important role in many geochemical processes. Aqueous phase total organic carbon (TOC), measured on unfiltered samples, has been analysed on more than 400 groundwater samples from 8 European Union countries. The operationally defined dissolved organic carbon (DOC), measured on 0.45μm-filtered samples, was analysed on approximately 250 groundwater samples from 4 of these countries. TOC was found at a median concentration of 2.7 mg C/L with a range from 0.1 – 59.4 mg C/L and DOC had a median concentration of 2.2 mg C/L with a range from 0.2 – 58.9 mg C/L, demonstrating that very high natural organic carbon values can occasionally be found locally in some pristine aquifers. A relationship between the assimilable organic carbon (AOC) utilised by bacteria and TOC is observed although the correlation is not clear. Generally, there is a linear correlation between the TOC, DOC and the chemical oxygen demand (COD) values.

Organic contaminants derived from anthropogenic activities are generally not identified in the TOC/DOC analysis as these contaminant concentrations are typically several orders of magnitude lower than the bulk aqueous carbon measurement. TOC/DOC analysis can, however be an important indicator of pollution at landfills, effluent ponds and similar pollution settings with high loads of organic carbon, but in many other situations the total or dissolved organic carbon concentration is not a good tracer or indicator of contamination. However, the total or dissolved organic carbon is a very important component in the biogeochemical cycling of elements and consequently it is recommended as a component to be measured on all groundwater samples. The measurement of a filtered organic carbon fraction is recommended where groundwa-

ters contain significant amounts of particulate material. Measurements of TOC and DOC on the same samples in this study show comparable concentrations, however, the TOC/DOC ratio varied and TOC was not always found to be significantly greater than DOC, as may have been expected. Further research is needed to evaluate what part of the TOC is readily available for biogeochemical processes.