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Stable carbon isotope analysis of dissolved inorganic carbon (DIC) and dissolved organic carbon (DOC) in natural waters - Results from a worldwide proficiency test

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Stable carbon isotope ratios of dissolved inorganic (DIC) and organic carbon (DOC) are of particular interest in aquatic geochemistry. The precision for this kind of analysis is typically reported in the range of 0.1 to 0.5‰To date, no published data attempted a comparison of δ13C measurements of DIC and DOC from for natural water samples among different laboratories.

Five natural water sample types (lake water, seawater, two geothermal waters, and petroleum well water) were analyzed for their δ13C-DIC and δ13C-DOC values by 5 laboratories with isotope ratio mass spectrometry (IRMS) in an international proficiency test.

Reported δ13C-DIC values for lake water and seawater showed fairly good agreement within a range of about 1‰ whereas geothermal and petroleum waters were characterized by much larger differences of up to 6.6‰ between laboratories. In contrast, δ13C-DOC values were only comparable for seawater and showed differences of 10 to 21‰ for all other samples.

This study [1] indicates that scatter in δ13C-DIC isotope data can be in the range of several per mil for samples from extreme environments (geothermal waters) and may not yield reliable information with respect to dissolved carbon (petroleum wells). The analyses of lake water and seawater also revealed a larger than expected difference. Evaluation of analytical procedures of the participating laboratories indicated that the differences cannot be explained by analytical errors or different data normalization procedures and must be related to specific sample characteristics or secondary effects during sample storage and handling. Our results reveal the need for further research on sources of error and on method standardization.

References

[1] van Geldern, R., Verma, M.P., Carvalho, M.C., Grassa, F., Huertas, A.D., Monvoisin, G. and Barth, J.A.C. (2013): Stable carbon isotope analysis of dissolved inorganic carbon (DIC) and dissolved organic carbon (DOC) in natural waters – Results from a worldwide proficiency test. - Rapid Communications in Mass Spectrometry, 27, 2099-2107, [doi:10.1002/rcm.6665].