Stable isotope ratios of sedimentary organic matter as indicators of mountain lake trophic state changes

P. VRECA[1] AND G. MURI[2]

[1] J. Stefan Institute, Jamova 39, 1000 Ljubljana, Slovenia (polona.vreca@ijs.si)

[2] National Institute of Biology, Vecna pot 111, 1000 Ljubljana, Slovenia (gregor.muri@uni-lj.si)

Stable carbon and nitrogen isotope investigations have proven to be a powerful tool in studies related to C and N cycles in aquatic environments. Organic matter produced and sedimented at the lakes bottom represents a time-averaged integration of processes affecting stable isotopic composition. The use of stable isotopes of bulk sediment organic matter (SOM) to study past environmental conditions is based on the assumptions that SOM originates from primary production in the water column and that the isotopic ratios reflect those of organic matter produced in the water column (Schelske and Hodell, 1991). If these assumptions are valid, then the stable isotopic composition of sediments should be a function of nutrient-driven productivity or trophic state in lake (Gu et al., 1996).

In the present study we explore the applicability of C and N stable isotope signatures in SOM to trace changes in lake trophic state in four mountain lakes in NW Slovenia. Obtained results are summarized in the table below.

Lake	**trophic state**	**_^{13}C [‰]**	**_^{15}N [‰]**
Zgornje Krisko jezero	oligotrophic	-19.8 to -15.2	-1.0 to +0.9
Jezero v Ledvicah	oligotrophic to mesotrophic	-26.3 to -22.4	-3.0 to +1.6
Krnsko jezero	eutrophic	-31.5 to -24.9	-1.2 to +2.4
Jezero na Planini pri Jezeru	eutrophic to hypertrophic	-36.0 to -29.6	+1.3 to +2.9

Higher _^{13}C values are associated with lower _^{15}N values and are characteristic of oligotrophic lakes, while lower _^{13}C values are associated with higher _^{15}N values that are characteristic for eutrophic lakes. The latter can be explained by processes such as bacterial methanogenesis and N_2 fixation by cyanobacteria.

References

Schelske C.L. and Hodell D.A., (1991), Limnol. Oceanogr. 36, 961-975.

Gu B., Schelske, C.L. and Brenner M., (1996), Can. J. Fish. Aquat. Sci. 53, 875-883.

Silicon isotopic composition of sponge spicules determined by MC-ICPMS

P.Z.VROON[1], C.J. BEETS[1], R.W.M. VAN SOEST[2], SCHWIETERS[3], S.R. TROELSTRA[1], J.C. VAN BELLE[1], G.R. DAVIES[1] AND P.A.M. ANDRIESSEN[1]

[1] Faculteit Aard- en Levenswetenschappen, De Boelelaan 1085, 1081 HV Amsterdam, The Netherlands (vrop@geo.vu.nl; beec@geo.vu.nl; tros@geo.vu.nl; belj@geo.vu.nl; davg@geo.vu.nl and andp@geo.vu.nl)

[2] The Zoological Museum of Amsterdam, Mauritskade 61, 1092 AD Amsterdam, The Netherlands (Soest@bio.uva.nl)

[3] ThermoFinnigan MAT, Barkhausenstrasse 2, 28197 Bremen, Germany (JSchwieters@ThermoFinniganMAT.de)

Introduction

Silicon isotopes are of interest for a large range of topics in the earth sciences, ranging from continental weathering to biological productivity in the oceans. We present new data on silicon isotopes measured by a high-resolution double focussing ThermoFinnigan Neptune MC-ICPMS. In high-resolution mode, this instrument is capable of separating the ^{12}C^{16}O, ^{15}N^{14}N, ^{14}N$_2$H and ^{14}N^{16}O interferences from ^{28}Si, ^{29}Si and ^{30}Si. The reproducibility of ^{30}Si/^{28}Si ratio on a 10 ppm silica standard during 3 hours is better than 0.17‰, whereas the mass bias is in the order of 12±1%. The sensitivity for ^{28}Si is about 1V/ppm in HR mode.

In this study, we report _^{30}Si on sponge spicules as a possible indicator for the fractionation of silicon isotopes between dissolved silicon and biogenic opal. We selected sponges because they have a large geographical distribution, grow slowly and incorporate only a small fraction of the marine dissolved silicon (Douthitt, 1982).

Results and Discussion

We measured the ^{30}Si of five modern shallow-water sponges of the species *Halichondria panicea* from different settings and regions, varying from arctic waters around Spitsbergen to tropical Indonesia. The ^{30}Si range is at least 3.2‰, and does not correlate with the temperature of the sampling region. We also determined the ^{30}Si of a mixed assemblage of deep-water sponge spicules from Holocene deposits off East Greenland. The absolute ^{30}Si values are different from the modern shallow-water sponge values, however the ^{30}Si range is similar, 3.6‰.

The results from *Halichondria panicea* and the deep-water sponges suggest that there are considerable differences in the isotopic composition of dissolved silicon in surface and deep waters. This confirms earlier results on diatoms and dissolved silicon by De La Rocha et al. (2000).

References

Douthitt C.B., (1982) *Geochim. Cosmochim Acta* **46**, 1449-1458.

De La Rocha et al., (2000) *Geochim. Cosmochim Acta* **64**, 2467-2477.