Revealing the importance of endospores in sediments

J. FICHTEL[1], J. KÖSTER[1], H. SASS[2] AND J. RULLKÖTTER[1]

[1]Institute of Chemistry and Biology of the Marine Environment (ICBM), Carl von Ossietzky University of Oldenburg, P.O. Box 2503, D-26111 Oldenburg Germany (joerg.fichtel@icbm.de)

[2]School of Earth, Ocean and Planetary Sciences, Cardiff University, Cardiff, CF10 3YE Wales, U.K.

Introduction

Endospores are bacterial resting stages being able to remain viable for long periods of time. Consequently, they can be expected to accumulate in sediments during burial and may contribute significantly to total cell counts. This emphasises the need for a new cultivation-independent approach for the quantification of bacterial endospores in sediments.

Application of dipicolinic acid for estimation of endospore numbers

In the present study, dipicolinic acid (DPA), a biomarker for endospores, was used to quantify endospores in sediment samples. Sediment cores of about 6 m length were collected from different sites in the backbarrier tidal flat of the island of Spiekeroog in the southern North Sea and analysed for their DPA content to determine endospore depth profiles. For conversion of sediment DPA contents into spore numbers, purified endospores of tidal flat strains were investigated for their DPA content.

Contribution of endospores to total cell counts

Sediment samples taken from different lithological subunits of the cores showed high variations in DPA contents. Estimated spore numbers were in a range of 10^5 to 10^7 endospores g^{-1} sediment and accounted for up to 10% of total cell counts. Huge differences in endospore numbers estimated from DPA contents and determined by viable counts obtained after pasteurization (Köpke *et al.*, 2005) were found. The conversion of sediment DPA contents resulted in at least three orders of magnitude higher endospore numbers than the most probable number (MPN) counts.

Conclusions

Since quantification of endospores on the basis of DPA content does neither discriminate between viable and non-viable spores nor between different physiological groups, it apparently provides a more realistic estimate of endospores as part of the microbial community than cultivation-dependent approaches. For this reason, we suggest to use DPA for the determination of endospore numbers in addition to total cell counts in order to reveal the importance of endospores in sedimentary microbial communities.

References

Köpke B., Wilms R., Engelen B., Cypionka H. and Sass H. (2005), *Appl. Environ. Microbiol.* **71,** 7819-7830.

New approaches for the analysis of stable and radiogenic strontium isotopes using LA-MC-ICP-MS

JAN FIETZKE[1], VOLKER LIEBETRAU[1], KARSTEN ZUMHOLZ[2], THOR HANSTEEN[3] AND ANTON EISENHAUER[1]

[1]RD2 Marine Geochemistry, IFM-GEOMAR, Kiel, Germany (jfietzke@ifm-geomar.de, vliebetrau@ifm-geomar.de, aeisenhauer@ifm-geomar.de)

[2]RD3 Marine Ecology, IFM-GEOMAR, Kiel, Germany (kzumholz@ifm-geomar.de)

[3]RD4 Dynamics of the Ocean Floor, IFM-GEOMAR, Kiel, Germany (thansteen@ifm-geomar.de)

Strontium isotopes in various marine carbonates have been determined using an "AXIOM" MC-ICP-MS in combination with a NewWave UP193 laser ablation unit. Using new developed measurement protocols we did achieve an external reproducibility of Sr^{87}/Sr^{86} ratios in carbonates of about 18 ppm (RSD). For recent and sub-recent marine carbonates a radiogenic strontium isotope ratio Sr^{87}/Sr^{86} of 0.70917(1) was determined, which agrees well with the accepted value for modern sea water. It was achieved without the use of any additional correction of the data. Only the rubidium correction was performed in its accepted form and the strontium isotope ratios were normalized to a Sr^{86}/Sr^{88} ratio of 0.1194 using the exponential law for fractionation correction.

A major benefit of the applied method is the direct determination of the stable strontium isotope fractionation. Assuming stable plasma conditions and a reproducible sample ablation this method is advantageous when compared to "conventional" MC-ICP-MS. It avoids additional fractionation of the sample strontium due to the chemical pretreatment (ion chromatography and solution preparation).

In aragonitic sclerosponge samples the stable strontium isotope fractionation was determined via LA-MC-ICP-MS. In these samples, spanning a temperature range of about 11°C, stable strontium isotope fractionation was found to be temperature dependent. The Sr^{88}/Sr^{86} was positively correlated to temperature. The latter correlation was estimated to 0.0396(103) per mill/°C. This value agrees within the analytical uncertainty with previous findings for coralline aragonite of 0.033(5) per mill/°C (Fietzke & Eisenhauer, 2006).

References

Fietzke J. and Eisenhauer A., 2006, *G-cubed*, **7**, Q08009, doi: 10.1029/2006GC001243.