Detection of bacterial population contributing to organoarsenic decomposition

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Arsenic, 20th most common in the earth's crust, is chemically similar to phosphorus, also in the same group. In aquatic environments, microorganisms take arsenate through their phosphate-concentrating mechanisms, bioalkylate to methylarsenic species and additionally produce more complex organoarsenic compounds. Decomposition of the organoarsenic compounds is thought to depend on bacterial activities. To understand the bacterial influence on the arsenic cycle in the environment, we obserbed the relationship between arsenic speciation and the bacterial population decomposing the organoarsenic compounds in lake water from April to December in 2002.

The cells number of bacteria involving organoarsenics decomposition were determined using the culture dilution method, MPN (Most Probable Number) method. The bacterial abundance was found to show a peak in July and November. After isolation of the dominant bacteria using agar plates, 43 isolates were classified to 13 groups by RFLP (restriction-fragment-length polymorphoism) analysis of 16S rDNA. Especially, 32 isolates belonged to main 3 groups, of which one group continuously dominated and the other groups increased in summer and fall respectively. The concentrations of methyl and inorganic oarsenic species were measured by atomic absorption spectrometry combined with the cold-traping. Consequently, the methylarsenics was not detected, although the inorganic arsenic concentration remained over 5 nM during the experimental period. The organoarsenics was probably remineralized by the bacteria, which was suggested by culture experiment using the isolates.

In conclusion, this bacterial detection system is useful for monitoring the microbial activities that contribute to organoarsenic decomposition in aquatic environments.
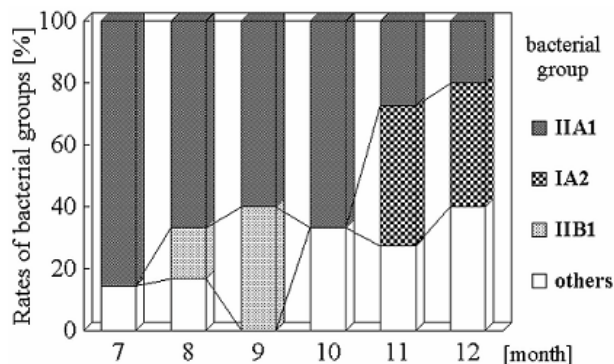

Figure 1. Seasonal changes in dominated bacterial groups

Simultaneous determination of Ru, Pd, Re, Os, Ir and Pt contents and ^{187}Os/^{188}Os ratios in geological samples using a new anion exchange chromatographic procedure

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We present a new group separation method for Ru, Pd, Os, Ir and Pt (PGEs) and Re in silicate samples employing less hazardous reagents and procedures. A silicate sample and isotope spikes were mixed, and digested with HF-HBr in a Teflon bomb at 518 K after *in situ* generated Br_2 treatment (M&N, 2001; Makishima et al., 2002). The sample was then dried and redissolved with 0.1 M HBr. After separation of fluoride residues by centrifugation, Re and PGEs were adsorbed on a 0.1 ml TEVA anion exchange resin, which has distribution coefficients (K_ds) of >1600 for Re and PGEs (Makishima et al., 2001). Re and PGEs were recovered into Re and Os fractions, by the combination of the eluents HCl, HBr and HI. Total recovery yields using this procedure were >90% for Ru, Pd, Os and Ir, and >70% for Re for ~1g of a peridotite sample. The Re fraction was further purified by 0.1 ml of cation exchange resin AG 50W-X8, and Re and PGE concentrations were determined by isotope dilution (ID) ICP-MS with a detection limit of <4 pg g^{-1} except for Os. The Os fraction was purified by the micro-distillation technique, and its ^{187}Os/^{188}Os ratio was measured with negative thermal ionization mass spectrometry (N-TIMS). Total blanks were 2~3 pg for Ir and Os, 8 pg for Re, and 12~14 pg for Pd and Pt. This technique, therefore, enables us to determine simultaneously sub ng g^{-1} levels of Ru, Pd, Re, Os, Ir and Pt and the Os isotope ratio of silicate samples. Furthermore, since only common distillable acids were used, Sr, Ce, Nd and Pb isotope ratios should be easily determined from the same sample. In addition, determination of calcophile elements such as sulfur, Ni and Cu in the same sample can be performed by simply adding S-Ni-Cu spikes together with the PGE spikes (M&N, 2001; Makishima et al. 2002)

References

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