Determination of iron and sulfur cycling rates in bioturbated saltmarsh sediments with multicomponent inverse modeling

Y. FURUKAWA[1], A. C. SMITH[2] AND J. E. KOSTKA[2]

[1]Naval Research Laboratory, Seafloor Sciences Branch, Stennis Space Center, Mississippi, USA (yoko.furukawa@nrlssc.navy.mil)
[2]Department of Oceanography, Florida State University, Tallahassee, Florida, USA (agold@ocean.ocean.fsu.edu; jkostka@ocean.fsu.edu)

Multicomponent inverse modeling was used to determine the depth profiles of elemental cycling rates in the saltmarsh of Skidaway Island, Georgia, USA. The model-calculated rates were compared to the depth profiles of sulfate reduction rates (SRR) that were directly determined for the sediment core samples using radiolabeled sulfur method (Jørgensen, 1978).

The multicomponent inverse model developed in this study calculates the rates of terminal electron acceptor (TEA) cycling using variables directly measured at the field site as forcings. The forcings include the distribution of burrows created by bioturbating organisms directly observed in situ with visual inspections and x-radiography, sediment accumulation rates determined by the radionuclide analysis, as well as the depth profiles of multiple major geochemical speices such as iron oxy-hydroxides, sulfate, ammonium, and total dissolved carbonate carbon. The calculation scheme is based on the minimization routine previously applied in diagenetic studies (Berg et al., 1998; Meile et al., 2001). The rates calculated were subsequently used in a forward method-of-line calculations (Boudreau, 1996) in order to ensure their aptness.

The comparison between modeled sulfate reduction rates and directly determined SRR yielded good agreement. The comparison between model-calculated net TEA reduction rates, Fe(III) reduction rates, and SRR revealed that sulfate reduction is predominantly responsible for the organic matter remineralization in sediments with little bioturbation, whereas the Fe(III) reduction becomes predominant in heavily bioturbated sediments.

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Observation of microbes causing ground biodeterioration by low-vacuum SEM freeze drying method

T. FUTAGAMI[1], K. YOSHIMOTO[2] AND S. SHIMA[3]

[1]Hiroshima Institute of Technology, Hiroshima, Japan (futagami@cc.it-hiroshima.ac.jp)
[2]Graduate Student, Hiroshima Institute of Technology, Hiroshima, Japan (kazukiyo@cc.it-hiroshima.ac.jp)
[3]Hiroshima Institute of Technology, Hiroshima, Japan (shima@cc.it-hiroshima.ac.jp)

Biodeterioration of Ground

The eutrophication (nutrient enrichment) of ground by the accumulation of organic detritus promotes biodeterioration of mechanical structures of ground (Futagami, et al., 2001). Microbes promote the weathering of rocks to soils and cause aggregation of soils by their enzymes. Aggregated structures of soils wet and swell the ground, resulting in the decrease of resistance to failure of ground. Microbes deteriorate ground as in decayed teeth. It seems that microbial activities promoted by eutrophication of ground accelerate ground failure.

Low-Vacuum SEM Freeze Drying Method

A new preparation method, low-vacuum SEM freeze drying method (Matsumoto N. and T. Suzuki, 2002), is used for the preparing of SEM pore samples.

Results

Examples of microbes in soils are shown in Fig. 1.

Fig.1 Microbes in Soils

Conclusion

It was found out that low-vacuum SEM freeze drying method was a useful method for the preparation of SEM pore sample for observing microbes in terrestrial ecosystems.

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