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Degradation and alteration of phytodetritus by benthic foraminifera: *in situ* ^{13}C -tracer experiments

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The fate of organic matter on the seafloor is crucial both for understanding carbon cycle in the ocean and for the application of sedimentary organic matter as a recorder of paleoenvironment. Since benthic foraminifera often dominate large biomass on the deep-sea floor, they are expected to play a significant role in organic carbon consumption at the sediment-water interface. Here, we evaluated the role of the benthic foraminifera by operating *in situ* ^{13}C tracer experiments in Sagami Bay, Japan.

The *in situ* ^{13}C -tracer experiments were operated in Sagami Bay (water depth 1450 m) by supplying ^{13}C -labeled unicellular algae (*Dunaliella tertiolecta*, as a model of phytodetritus) onto the surface sediments in closed chambers. We examined the incorporation of ^{13}C -labeled carbon into total biomass and each lipid compound extracted from the bulk sediment and benthic foraminiferal cell. The benthic foraminifera ingest large quantity of phytodetritus ($\sim 3.8 \text{ mgC m}^{-2} \text{ d}^{-1}$) as much as by bacteria. Furthermore, degradation rates of C_{18} and $\text{C}_{18:1}$ fatty acids in the foraminiferal cells of two phytodetritus feeding species were nearly 10 times faster than those in the bulk sediments, indicating that foraminiferal feeding enhances the degradation of phytodetritus on the deep-sea floor. On the other hand, benthic foraminifera synthesized some fatty acids and sterols (stigmasterol, methylencholesterol, etc.) within 4 to 6 days after being fed by ^{13}C -labeled algae. A total abundance of sterols in benthic foraminiferal cell accounts for 20 mg m^{-2} in the surface 5 cm of the sediments, corresponding to $\sim 4\%$ of total sterols in the surface sediments. Considering days- to weeks- scale turnover of foraminifera, organic matter on the seafloor should be largely altered by foraminiferal ingestion, digestion, and synthesis in time scale of few days.