P403-TH

EFFECT OF CLAY MINERALS ON THE DECOMPOSITION OF ALGAL LIPIDS IN OXIC AND ANOXIC SEDIMENTS

Dong-Wei LV[1], Qian SONG[1] and Xu-Chen WANG[1,2]

1. Department of Marine Ecology and Environmental Studies, Institute of Oceanography, Chinese Academy of Science, Qingdao 266071, China
2. Department of Environmental, Earth and Ocean Science, University of Massachusetts at Boston, Boston MA 02120, USA.

Clay minerals play an important role in the transport and protection of many organic compounds by adsorption thus affecting the decomposition and preservation of organic matter during early diagenesis in marine sediments. In this study, we examined the effects of two clay minerals, montmorillonite and kaolinite, on the decomposition of the green algal *Chlorella. sp* in marine sediments under both oxic and anoxic conditions. The laboratory incubation experiments were conducted for 240 days and changes in total organic content, carbon isotopic composition ($\delta^{13}C$), and both "free" and "bound" algal fatty acid concentrations were analyzed with incubation time.

Our results indicate that when excess clay minerals were added to the sediment, the algal organic matter decomposed much slower than when no clays were added and showed no significant differences in decomposition rate under both oxic and anoxic conditions. During the decomposition process, $\delta^{13}C$ values of total organic matter decreased slightly in comparison to the original value but also showed no differences under both oxic and anoxic conditions. Among the detectable fatty acids, 14:0, 16:0, 16:1, 18:1, and 20:5 were the major compounds present. In most cases, the decomposition of "free" fatty acids exhibited a general pattern of a rapid decrease in the initial 10 weeks, followed by a much slower decline. During the decomposition, concentrations of bacterial fatty acids (15:0, 17:0) increased in association with a decrease in algal fatty acid levels. The decomposition of algal fatty acids occurred more rapidly under the oxic condition than the anoxic condition. Using a simple early diagenetic model, we calculated the decomposition rate constant for the fatty acids. Our values ranged from 0.018 to 0.059 d^{-1} and were much lower than those reported in previous laboratory studies in which no clay minerals were added to the incubated sediments. This suggests that the decomposition of fatty acids was protected by adsorption of clay minerals. The adsorption of fatty acids onto both montmorillonite and

kaolinite appeared to be a very rapid process as detected by dramatic increase in “bound” fatty acid levels. In general, mono- and polyunsaturated fatty acids had a higher degradation rate constant than that of saturated fatty acids in both oxic and anoxic sediments, indicating that double bonds play an important role in molecular liability. Our study suggests that in natural sediments, environmental factors such as mineralogy, redox condition, bacterial activities and molecule structure all play important roles in controlling the decomposition dynamic and pathway of organic matter.

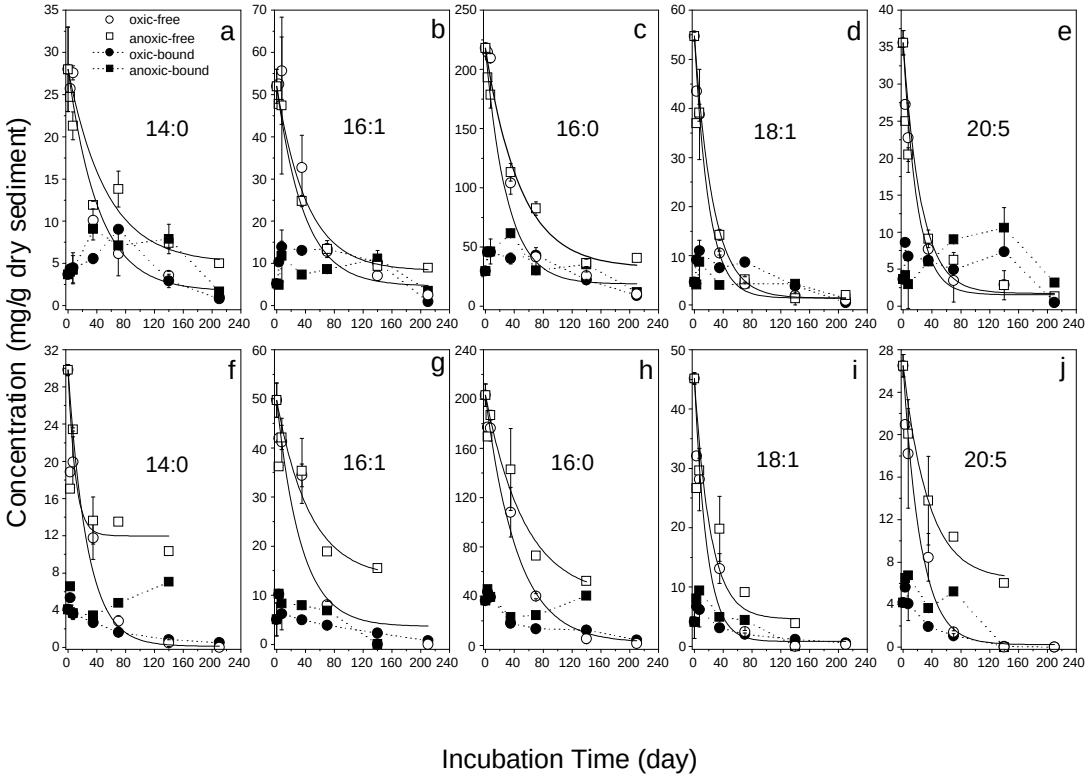

Figure 1. Plot of concentration changes in “free” and “bound” fatty acids during the decomposition in oxic and anoxic sediments with montmorillonite (a-e) and kaolinite (f-j) added. (○) and (□) are “free” fatty acids in oxic and anoxic sediments; (●) and (■) are “bound” fatty acids in oxic and anoxic sediments. The solid lines are model fits to the data.