Variations of burial rates of organic carbon in terrestrial and marine environments during the Phanerozoic

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Emergence and evolution of land plants had a large effect on atmospheric O_2 and CO_2 levels through carbon geochemical cycle, especially an increase in an efficiency of chemical weathering of soils, and an increase in a rate of organic carbon burial on land. However, there are few studies which evaluate influence of the rise of land plant and relative contribution of organic carbon burial in terrestrial and marine environments to the carbon geochemical cycle and to the climate through geologic time.

In this research, we modified a model for combined cycles of carbon and sulfur (GEOCARBSULF) to consider this problem. We estimated ratios of global organic carbon and pyrite burial rates (C/S ratio) from the model with marine carbon and sulfur isotopic records. We used compiled data of C/S ratio from sediments deposited in freshwater, oxygenated and euxinic seawater environments to distinguish the burial rates of organic carbon in terrestrial and marine environment.

As a result, it was indicated that, as inferred from the previous studies of carbon cycle by Robert Berner, the burial rate of organic carbon in terrestrial environment had increased greatly in the Late Paleozoic (Carboniferous) owing to advent of vascular plants which produces microbially resistant organic matters such as lignin. In contrast, it was also shown that terrestrial burial rate had been virtually zero before the Silurian when there were no vascular plants on land, and decreased largely at the Devonian/Carboniferous, Permian/Triassic and Triassic/Jurassic mass extinction boundaries. We will discuss influence of Ocean Anoxic Events (OAEs) on the burial rate of organic carbon and pyrite through the Phanerozoic time.

Keywords: carbon cycle, C/S ratio, land plant, Phanerozoic

