Holocene biomass burning history reconstructed from the Lake Suigetsu sediments

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Behavior of black carbon (BC) is crucial for the earth surface environment because it could cause global warming by absorbing sunlight in the atmosphere. BC is originated from incomplete combustion of biomass or fossil fuels. Combustion in natural processes is incomplete due to local limitation of oxygen during the fire, which leads to the formation of organic fire residues. As burning (or pyrolysis) is a continuous process, it results in different types of compounds with no clear boundaries, and also no single defined structure. Depending on the degree of combustion, these organic fire residues can be called: elemental carbon (EC), soot, black carbon (BC), and charcoal. Although biomass burning is related to the volume of vegetation, frequency of ignition events, connectivity of the fuel bed, and human activities would be a main determining factor. Therefore, biomass burning history in the Holocene time-scale is important for researches of climate change as well as the related past human activities revealed from archaeology.

Observed degradation rates of BC in the natural environment are much lower than those of the organic carbon. Increasing the fire temperature of the biomass burning leads to a decrease of BC degradability due to higher degree of condensation of hydrocarbons. Even under the strong weathering condition in the tropical climate, EC can be stable for more than a century. Although the previous fire researches (paleoclimate rather than modern ecology) reconstructed the amount of BC or charcoals from sediments, the temperature of BC formation has not been discussed well.

Objective of this study is understanding the controlling factors of the thermal character of BC such as aging and provenance in relation to the variabilities of vegetation and human activity in the hinterland as well as burning temperature. For this purpose, BC in the bulk samples are determined with thermal optical transmittance and benzene polycarboxylic acid methods for SG-12 core sediments collected from the Lake Suigetsu. Preliminary results show that fire temperature of soot was higher during stronger East Asian summer monsoon periods for the last 15 kyr.

Keywords: Biomass burning, Thermal optical transmittance, Benzene polycarboxylic acid, Lake Suigetsu

