Sources and formation environment of biomass burning products in Pliocene and Pleistocene marine sediments in the Japan Sea

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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. Robustness of BC to degradation in the natural environment enables us to use BC as a proxy to study the driving force of frequency and burning temperatures of past wildfire events. But the previous fire researches (paleoclimate rather than modern ecology) did not discuss the control factors for burning temperature or try to rebuild the fire temperature. Objective of this study is to understand factors controlling the thermal/optical/chemical characters of BC with burning temperature, provenance and aging in relation to the variabilities of vegetation in the hinterland. For these purposes, BC was quantified as elemental carbon (EC) in coarse (>2 μm) and fine (<2 μm) fractions of sediment samples using a thermal optical transmittance (TOT) method, and their burning temperatures were estimated for bulk samples through measurement of composition of benzene polycarboxylic acids (BPCAs), molecular markers of fire residues, determined with High Performance Liquid Chromatography (HPLC). In order to examine the relationship between burning temperature and BPCA composition, selected plants were experimentally charred to obtain standard charcoal samples. We also applied TOT and BPCA methods to marine sediments such as the surface sediments collected during KR15-10 cruise off the Wakasa Bay and 63 samples between 0 and 203 m CCSF-D were selected from IODP Site U1423 in the northeastern Japan Sea which covered the last 4.3 Myr. Size dependencies of EC contents and thermal properties will be compared with the contents and composition of BPCAs to examine the influence of sources, transport pathways, and burning temperatures of BCs contained in marine sediments.

Keywords: biomass burning, elemental carbon, benzene polycarboxylic acid

