Biomass burning history deduced from elemental carbon variability at IODP Exp. 346 Site U1423 during the last 4 million years

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The burning of trees and grasses produces charred particles such as charcoal and soot that may be transported long distances via winds and rivers to coastal, deltaic, and ocean environments where they may become preserved in the sediments. Charcoal contained in sediments has been widely used as a proxy for biomass burning and human activities as well as climate change. Charcoal and soot in Cenozoic marine sediments at IODP Exp. 346 Site U1423 was measured to examine the regional history of biomass burning in the East Asia and carbon sequestration in the ocean.
IODP Exp.346 Site U1423 is located in the northeastern Japan Sea and the water depth is 1785 m. Relatively low Linear sedimentation rates (LSRs) are anticipated based on results from the site survey. The LSR are likely to be low enough to detect the contribution of minor amount of charcoal or soot from the surrounding land. One hundred nine samples have been collected from interval between 0 and 200 m CCSF-D which cover the last 4.3 m.y. Charcoal and soot were measured as elemental carbon (EC) in coarse (>2 um) and fine (<2 um) fractions, respectively, using thermal optical transmittance (TOT) method followed by grain size separation using repeated settling. Organic carbon (OC) was also quantified during the process.
EC and OC in both coarse and fine fractions are higher from 0 to 1.8 Ma and lower from 1.8 to 4.3 Ma with large variation, which suggests more frequent or intense biomass burning since 1.8 Ma. The fact that dark layer samples contain higher OC and EC also suggests net carbon input or preservation controls the amount of OC and EC in the sediments. Comparison of OC and EC variabilities with vegetation change reconstructed from pollen analysis suggests that OC and EC was high both in coarse and fine fractions in warm and wet environment. Terrestrial biomass and precipitation could be major control on EC supply. Fine EC varies independently from coarse EC, which suggests remote origin of fine EC. High temperature resistive EC is associated with grass dominant vegetation, while coarse EC is lower (fine EC is higher) when wood vegetation is dominant suggesting that vegetation type could affect the type of burning products.

Keywords: biomass burning, elemental carbon, IODP Expedition 346 Site U1423

