Assessment for BPCA method as biomass burning proxies and their application to meteorite impact event

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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 did not discuss the BC archives of fire remnants caused by meteorite impact.

Objective of this study is to reconstruct the thermal field during Australasian Tektite Event (AATE) and its impact on climate change. For these purposes, the burning temperatures were estimated for ejecta deposits and charcoal samples through measurement of composition of benzene polycarboxylic acids (BPCAs), molecular markers of fire residues, determined with High Performance Liquid Chromatography (HPLC).

It has been suggested that the location of the impact crater is in eastern part of Indochina peninsula. Surge and air-fall deposits were sampled from the outcrop at Huai Om section site (HO), in NE Thailand. HO section consists of Units1, 2, and 3 in ascending order. Unit1 consists of alternating beds of granular fine-medium sand and silt with red shale fragment. Unit2 is characterized by inversely graded granular to pebbly sand. Unit3 is homogenous fine-medium sand with granules. Plant debris were also collected in Ban Tha Chang, which may have undergone pyrolysis during the AATE event.

The concentration of BPCA in Units2 and 3 sediments are 5 times higher than sediments from Unit1 in HO site. The fire temperature estimated from B6CA (%) indicate that the charcoal in Units2 and 3 sediments experienced a fire above 500 ˚C, while those in Unit1 were burnt by a fire of only 400 ˚C. We speculate that the charcoal in sediments formed by surge and air-fall contains charcoals from different environments of burning temperature.

The concentration of BPCA in plant debris samples are about 10 mg/g, all of them from low temperature fires (< 400℃). The estimated burning temperature for two plant debris samples from Ban Tha Chang show higher BPCA concentrations and higher fire temperatures than one sample from Ban tha Chang and the other from NR1 site. Although all the sampling sites are closely located, the BPCA compositions showed that the bark and core of these plant debris experienced different pyrolysis temperatures.

Keywords: Biomass burning, Benzene polycarboxylic acid, Australasian Tektite Event

