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Variation of very fine grained elemental carbon deposition to the Rebun Island, Hokkaido, during the last 5 ky

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Elemental carbon (EC) is a combustion product which is composed of rich C and depleted O, H, S, N. Biomass burning is major source of Pre-industrial EC, while fossil fuel burning has been the most important source since the 18th century. Black carbon (BC) transfered in the atmosphere as aelosols, including EC have a great impact on the climate. EC is also the second strongest contributor to global warming, and has effect to darken snow and ice surface. On the other hand, aerosols including EC have also negative effect on radiative forcing, which lead cooling. Although it is difficult to evaluate the net EC effect on climate, it is necessary to discriminate EC produced by fossil fuel burning from those from biomass burning. EC is not a single chemical compound, but it can be classified into two types , char and soot. Char is produced by pyrolysis, while soot is formed via gas-to-particle conversion. The char particles which are countable under microscope are called charcoal. There are many researches to reconstruct paleo-fire by counting charcoal, and in the late Holocene, the fire sometimes synchronized with human activity. Therefore, it is very important to understand the past EC variation to examine the relationship between climate change and history of human.

There are some methods for analysis of EC, and in this study, we use the method called thermal optical reflectance (TOR) -method. This method is principally used to analyze EC/OC in aelosols, where we can evaluate an interference of pyrolyzed OC produced during the temperature rise under He atmosphere by measuring the transmittance of near-infrared laser. In order to apply TOR-method to analysis of sediment, we examined thermograms for sucrose, fulvic acid, humic acid, and fullerene in advance. As a result, we confirmed that carbon fraction decomposed at 700-850 ℃ under O2 atmosphere can be regarded as an EC.

The sediment sample we used was collected from the Kusyu Lake in the Rebun Island. We established the stratigraphy of the sediment core of 20 m long as well as the sedimentation rate of the surface sediment. From variation of the ratio of coarse/fine particles down to12 m depth , the sedimentary environment would be changed from marine to fresh water at 600 cm. We analyzed EC/OC both for coarse and fine particles for 0-600 cm interval. The result shows that the variation of EC in coarse particle reflects local variation, while the EC in the fine fraction reflects local and/or distal variation. The local biomass burning increased at 521 cm. The influence of distal EC variability was larger in the interval of >217 cm, with the maximum at 217 cm and the minimum at 263 cm. The long-distance transportation of EC could be influenced not only by increase and decrease of supply from biomass burning but also by the variation of wind pathway which transports distant EC.

Keywords: elemental carbon, biomass burning, Holocene, Rebun Island