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Paleoflood reconstruction using peat ash in the Ishikari Lowland, northern Japan

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Previous studies of paleoflood reconstruction often focus on slackwater deposits, and they have discussed the relationship between the frequencies of rare, large floods and regional climate changes. On the other hand, paleoflood reconstruction using overbank deposits are scarce because it has many problems.

The relative amounts of the clastic sediments in peat mainly reflect the overbank sedimentation rate. The sedimentation rate of fine sediments is usually controlled by the flooding duration. Therefore, reconstruction of flood frequency can be made using Loss on Ignition (LOI) of peat.

Ishikari Lowland is one of the largest meandering river systems in Japan, and large peatlands are distributed between rivers. I collected sediment samples using hand-operated auger and measured LOI. Furthermore, I conducted seed analysis to clarify the conditions of nutrients. Radiocarbon dating was conducted on plant fragments, wood pieces and twigs.

The peat has approximately 3-5 m thick, and is underlain by bluish grey clay. Plant fragments are usually scarce in the clay. The patterns of LOI can be classified into 3 categories and they are also characterized by its location. The LOI decreases from 5400 to -3600 cal BP, relatively stabilizes between 3600 and 1500 cal BP, and increases after 1500 cal BP in pattern 1. This pattern is found near the Ishikari River. The LOI just fluctuates between 20 and 80 % and long-term trend is not clear in pattern 2. This pattern occurs near tributaries. The LOI of pattern 3 is relatively high and stable (>70%). This pattern is found in eastern margin of the lowland. The LOI of peat is consistent with the changes in nutrients conditions. Where peat LOI is low, plant species that prefer high-nutrients conditions are found, and vice versa.

Peat LOI is determined by the balance between the overbank sedimentation rate and organic sedimentation rate. They may be influenced by the flood frequency, magnitude of flood, temperature, and plant species composition. However, it is apparent that the changes in LOI are consistent with that of nutrients conditions. Nutrients conditions of peatland are usually defined by the flood frequency. Therefore, peat LOI can be used as the indicator of paleoflood frequency.

The overbank floods of the Ishikari river are usually triggered by the combination of Baiu/Akisame front and typhoon. Therefore, the LOI of pattern 1 can be interpreted as an indicator of the frequency of typhoon. The changes in typhoon frequency estimated from this study are almost consistent with the result of major flood frequency inferred from the Lake Suigetsu deposits (Schlolaut et al., 2014).

Keywords: paleoflood, peat, floodplain, Holocene