Development process of Lake Naganuma in a large-scale landslide on Hachimantai Volcano

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In the Hachimantai volcanic group, landslide is one of the most important origins of wetland, and various types of wetlands, including lakes and peatlands, tend to coexist in a large-scale landslide (Sasaki and Sugai, 2015). Landslide wetlands commonly develop from lakes to peatlands, so the wetland types are considered to reflect their developmental stage. This study analyzed sediment cores to reconstruct the development history of Lake Naganuma formed in a large landslide of the Hachimantai volcanic group, and discussed the difference in the developmental history with Oyachi, a large peatland in the same landslide.

Lake Naganuma, which is formed in the upper part of the Komonomori landslide in the northwest of Hachimantai volcano, has an elliptical shape with a long axis in the north-south direction parallel to the scarp of the landslide, and its southern part is peatland. Drilling surveys were conducted at two sites on the long axis, and each sediment core was designated as NN1 and NN 2 from near to the water area. In NN1 core, we identified two lithostratigraphic units: NN1-Unit 1 (3.40–2.64 m depth) was organic silt; NN1-Unit 2 (2.64–0.00 m depth) was peat. In NN2 core, we recognized three lithostratigraphic units: NN2-Unit 1 (4.50–4.20 m depth) was silt with low organic content showing parallel lamination; NN2-Unit 2 (4.20–1.57 m depth) was organic silt; NN2-Unit 3 (1.57–0.00 m depth) was peat. The boundary between each unit was unclear, and their organic content gradually changed. We visually identified 5 tephra layers in NN1 core and 4 layers in NN2 core. From the result of chemical composition analysis of volcanic glasses, pumice layers at 1.05 m depth in NN1 core and at 1.10 m depth in NN2 core 2 were correlated with the To-a tephra, which is widely distributed over the northern Tohoku region as a result of the 915 AD eruption of Towada volcano. And the chemical composition of volcanic glasses at 2.22 m depth in NN1 core and at 2.87 m depth in NN2 were similar to that of the To-Cu tephra, erupted by Towada volcano at 6.2 ka.

The southern part of Lake Naganuma had developed from lake to peatland, because the organic silt layer changed to the peat layer upward in both sediment cores, and because the lower part of the organic silt layer in NN1 and the silt layer in NN2 showed parallel lamination. The lake changed to peatland before 6.2 ka, since the peat layer of NN1 contained To-Cu tephra. However, in NN2 far from the water area, To-Cu was contained in the organic silt layer below the peat layer. Moreover, the organic silt layer of NN2 was thicker, and the deposition rate between To-a and To-Cu layer was estimated about 0.35 mm/yr for NN2, while that of NN1 was about 0.27 mm/year. These suggest that fine grained soil continuously and slightly flowed into peatland around NN2 from the surrounding slopes even after terrestrialization. From the above, we concluded that Lake Naganuma had gradually filled from the upstream part and then been stable in the present state at least for over a thousand years, while peat layer formed.

Many wetlands are formed in the Komonomori landslide, and the development process of Oyachi peatland in the landslide, located about 800 m southwest of Lake Naganuma, is different from that of Lake Naganuma. Oyachi wetland was in the depression formed by a landslide activity before 8600 cal BP, and its transition from peatland to forest was interrupted at about 5500 cal BP by slope movement leading to the development of a lake that was drained by streams at about 3300 cal BP, after which a peatland environment has persisted until the present (Sasaki and Sugai, 2018). On the other hand, Lake Naganuma is more stable for a long period. These suggested that development processes and rates of wetlands are various even in a same landslide, probably depending on local slope stability rather than regional climatic changes.

References
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