Change of depositional environment in Lake Tazawa estimated by X-ray fluorescence core scanner

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Lake Tazawa, located in eastern part of Akita Prefecture, is caldera lake formed at 1.7 Ma (Kano et al., 2008 & 2020). The lake is the deepest lake in Japan (432 m in depth). Researches on sediments of Lake Tazawa are few because of difficulty of sampling caused by the depth. Four sediment cores were collected from Lake Tazawa in 2015. The age of sediments at the bottom of the cores is estimated to be 7,000 years ago (Matsuoka, 2016). In this study, TZW15-4 core sample, which is located at the point near caldera wall in southwest part in Lake Tazawa, was investigated. The distance between edge of Lake Tazawa and sampling point of TZW15-4 is 1.0 km. This study presents results of variation of facies of sediments, grain size distribution, density, mineral assemblage and chemical composition determined by X-ray fluorescence (XRF) core scanner, Itrax regarding TZW15-4 core sample and estimates events in Lake Tazawa from 7000 years ago to present.

Total length of TZW15-4 core is 340 cm. The sediment core is composed of silt, sandy silt, diatom earth and tephra. The dominant sediment is silt in the core. Thirty-eight (38) sandy silt layers, 9 diatom earth layers and 2 tephra layers are intercalated in the silt. The tephra layers are Towada Chuseri and Towada-a tephra (Matsuoka, 2016). The sediment is classified into three parts from lower to upper parts from 340 to 185 cm, 185 to 13 cm and 13 to 0 cm by observation by naked eyes. The lower part is characterized by presence of lamina of sandy silt. The part from 185 to 13 cm is characterized by dominance of silt. The part from 13 to 0 cm is also characterized by discolored silt. The relative density of sediments of the core samples was measured by Computed Tomography (CT) scan. The part of silt and sandy silt correspond to low density and high density, respectively.

Fe, As, Ca, Sr, Cu, Pb and Zn concentrations of the core samples were measured by XRF core scanner. The positions having high intensity of Ca and Sr (peaks of Ca and Sr) in the Ca and Sr spectra correspond to sandy silt. Based on the number of peaks of Ca in the core sample, number of emplacements of sandy silt in silt can be clarified clearly.

Age of sediments of TZW15-4 was estimated by ^{14}C radiometric method (Matsuoka, 2016). Based on the age data and number of peaks of Ca (number of sandy silt layers), frequency of emplacement of sandy silt layers was estimated. The frequency is different in the part from 340 to 185 cm and the part from 185 to 13 cm. The frequency of sandy silt layers in the part from 340 to 185 cm is 6.1 times/1000 years, on the other hand, the frequency of sandy silt layers in the part from 185 to 13 cm is 1.7 times/1000 years. Particle size distribution also shows that sandy silt layers in the parts from 340 to 185 cm and 185 to 13 cm is rich and poor in sand component, respectively. Lake Tazawa does not have large river flowing into Lake Tazawa. Source of sediment materials is thought to be derived from the somma of lake Tazawa. Under the warmer condition, amount of precipitation at catchment area of Lake Tazawa is thought to be increased. Amount and frequency of inflow of sediment materials was increased due to the increase of amount of precipitation. This mechanism corresponds to bottom part (340 to 185 cm). On the other hand, the upper part was estimated to be sediments that was formed under small precipitation in colder period because the low frequency of inflow of sandy silt layer and low abundance of sand in sandy silt layers. Based on the ^{14}C radiometric age data (Matsuoka, 2016, Fukumoto et al., 2019), the boundary between the part from 340 to 185 cm and part from 185 to 13 cm corresponds to the age of climate

change around 4,700 BP. The age accord with the age of the starting of climate cooling in Japan around 5,000 BP (Komoto, 2008; Fukumoto et al., 2019).

Keywords: Lake Tazawa, Lake sediment, Depositional environment, X-ray fluorescence core scanner, Holocene

