Origin and depositional age of Toyamaoki-tephra from the Toyama Deep-Sea Channel on the basis of glass major element composition

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1. Background of the study

Toyamaoki-tephra (To-tephra) is one of the famous and important upper Quaternary marker tephras at the Sea of Japan area. To-tephra is intercalated by the upper Aira-Tanzawa tephra (ca. 24 ka) and the lower Aso-4 tephra (ca. 88 ka) and its depositional age is estimated as 30 to 35 ka (Ikehara et al., 1994). However, its source volcano has not been estimated yet.

Toyama Deep-Sea Channel, which starts from Toyama Bay and extends for ca. 750 km, is one of the most prominent deep-sea channels around the Japanese Islands. Narrow shelf width allows direct linkage between sediment supply fluctuation and land climatic fluctuation (Nakajima, 2001). The supplied sediments are deposited on levees and on terminal submarine fan. Sediments around the Toyama Deep-Sea Channel are adequate to tephro-stratigraphic studies because a lot of volcanic ash layers are frequently intercalated (Nakajima et al., 1996).

It is necessary to sample long cores and to establish chrono-stratigraphic indices such as a minute tephro-stratigraphy for understand of the long termed sediment supply fluctuation at the area.

2. Method and result

Five long piston cores (TYP-2 to TYP-6) were sampled penetrating levee deposits beside the Toyama Deep-Sea Channel by KH01-02 cruise at 2001. We choose two piston cores (TYP-3 and TYP-6) among the long cores and analyzed volcanic glasses.

Refractive indices measurement on volcanic glasses was carried out toward every tephra layers with RIMS System 2000 (Kyoto Fission-Track Co.) in Ocean Research Inst., University of Tokyo. Then, according to the result of RIMS measurement, we choose tephra samples for major element composition measurement with WDS/EPMA (JEOL Co.) in Ocean Research Inst., University of Tokyo.

As the result of the measurements, we discover many famous middle to upper Quaternary widespread tephras (TYP-3; AT, To, San-1?, Aso-4, Toya, and Ata-Th and TYP-6; AT, To, U-Ym, Aso-4, and Toya).

3. Discussion; Source and depositional age of To-tephra

Tephra layers TYP-3, Sec.6, 29-30 and TYP-6, Sec.8, 33-34 have been identified as the To-tephra with lithologic characteristics. Volcanic glasses major element composition of these tephras are characterized by low CaO content and high Na2O and K2O contents. These characteristics are peculiar to continental volcanic glasses, which mainly divided into two origins (Baegdusan Volcano and Ulreung-do Volcano). Major element composition of To-tephra glasses is similar to that of Baegdusan volcano glasses with relatively high SiO2 content and relatively low Na2O and K2O contents.

To-tephras sampled from TYP-3 and TYP-6 are correlated with a tephra layer sampled from ODP Site 794 (794-1H-2-73; Shirai et al., 1997; Tab. 2a) on the basis of major element composition of glasses. Depositional age of 794-1H-2-73 was estimated as 23 to 33 ka. So, depositional age of 794-1H-2-73 is also estimated as 23 to 33 ka.

Major element composition analysis reveals source area and depositional age of To-tephra which is one of the important marker tephras of the upper Quaternary at the Sea of Japan area. Estimation of source area of the To-tephra allows us to guess distribution of To-tephra. Estimated depositional age and distribution will make To-tephra as a more significant and more available marker tephra of the upper Quaternary Sea of Japan.