

Re-examination of the sequence of the Early Pleistocene Shirakawa ignimbrites and their identifications in distal areas in Northeast Japan

*Takehiko Suzuki¹, Masanori Murata², Kiyohide Mizuno³, Takeshi Ishihara³

1. Faculty of Urban Environmental Sciences, Tokyo Metropolitan University, 2. University Education Center, Tokyo Metropolitan University, 3. National Institute of Advanced Industrial Science and Technology

The Aizu volcanic region located in NE Japan is one of the Quaternary volcanic clusters resulting from the subduction of the oceanic Pacific Plate beneath the North American Plate. This volcanic region is characterised by Early Pleistocene large Shirakawa ignimbrites resulting from repeated caldera-forming eruptions and has been examined by several previous studies that established the eruptive sequence, the correlations of proximal ignimbrites with distal fall-out tephra and the eruptive history. However, the proximal sequence of ignimbrites proposed by previous studies is inconsistent with that of distal fall-out tephra, suggesting the necessity to re-examine the sequence. We present a revised stratigraphical framework of the ignimbrites included in the Nanaorezaka Formation exposed in the West Hills of the Aizu Basin, together with their petrographic description and correlations with distal fall-out tephra. From the glass chemistries and refractive indices of glass shards and phenocrysts, we identified six Early Pleistocene ignimbrites: in ascending order, the Kumado, Akai, Ashino, Nishigo, Kachikata and Ten-ei ignimbrites. In addition, the vitric widespread Kurokawa Tephra originated from a distant volcano. Four distal fall-out tephra associated with four ignimbrites (Kumado, Akai, Ashino and Kachikata) are distributed broadly in the Kanto and Niigata regions. Each combination of both the proximal and distal tephra was labelled Sr-Kmd, Sr-Aki-Kd18, Sr-Asn-Kd8 and Sr-Kc-U8, respectively. We re-examined their ages considering the stratigraphic positions of distal tephra identified in the Kanto region where calcareous nanofossil biostratigraphic and magneto-stratigraphic frameworks were available and many radiometric ages have been determined: Sr-Kmd (1.542–1.504 Ma), KK (1.533–1.485 Ma), Sr-Aki-Kd18 (1.522–1.460 Ma), Sr-Asn-Kd8 (1.219 Ma) and Sr-Kc-U8 (0.922–0.910 Ma). In addition, we estimated the volume of each fall-out tephra for Sr-Kmd, Sr-Aki-Kd18, Sr-Asn-Kd8 and Sr-Kc-U8 to be approximately 23 km³. It is concluded that the total volume of each eruptive event, except the Ten-ei eruption, ranges between 38 km³ and 173 km³. This indicates that these eruptions can be classified as VEI 6–7. The total volume of the Shirakawa ignimbrite and its associated fall-out tephra is 498 km³ (DRE: 199 km³). In addition, we estimated the eruption rate of the tephra associated with caldera-forming eruptions during the period from the Sr-Kmd to Sr-Kc-U8 eruptions to be 0.3 km³/kyr in DRE, an average value for the Quaternary volcanoes in the area of the Japanese Islands. The four repose periods between the successive eruptions were variable, ranging from approximately 0.3 My to less than 0.08 My.

Keywords: Shirakawa ignimbrites, Early Pleistocene, Northeast Japan, caldera forming-eruption, widespread tephra