Total grain size distribution and granulometric component of Ito pyroclastic flow

Tatsuyuki Ueno[1]

[1] Geosystem Sciences, Nihon Univ.

1. Introduction

It is thought that vesiculation and fragmentation of magma are causes in a pyroclastic eruption (e.g. Sparks, 1978). Therefore, it leads to the understanding of fragmentation mechanism of magma that is the cause of pyroclastic eruption to know total grain size distribution (TGSD) of eruption ejecta. Accordingly, the attempt to obtain TGSD of eruption ejecta has been done many times (e.g. Bonadonna and Houghton, 2005). A non-welded pyroclastic flow deposit is advantageous to obtain TGSD by two following reasons compared with a pyroclastic fall deposit. 1) Because a pyroclastic flow directly emplaced in mixture of pyroclastic grains and gas, the sample collected in an arbitrary locality keeps grain size distribution that resembles TGSD. 2) As for a pyroclastic fall eruption, many of pyroclastic fragments flies far away than point where sample can be collected (For instance, 80 % or more in Taupo plinian eruption). On the other hand, because a lot of the parts emplaced as pyroclastic flow deposit in pyroclastic flow eruption, the sample can be easily obtained. Moreover, pyroclastic ejecta are composed of vesiculated essential fragments, free crystals, and lithic fragments, respectively. Since destruction strength is different depending on the kind of grains, it is necessary to obtain grain size distribution of each component. Therefore, this study estimates TGSD and total granulometric component of pyroclastic fragments (TGC) of Ito pyroclastic flow eruption ejecta (Ito pyroclastic flow deposit and AT co-ignimbrite ash fall deposit) from Aira caldera.

2. Methods

The TGSD and the TGC of Ito pyroclastic flow deposit estimated by following process. Distribution area of Ito pyroclastic flow deposit was divided into concentric circles that are 5-10 km intervals from source. The deposit weight of the each concentric circular area was estimated from the distribution area, the average thickness of the deposit, and the bulk density. Next, grain size distribution and granulometric component were measured from collected samples. The TGSD and the TGC of Ito pyroclastic flow deposit were estimated by composing these data.

The TGSD and TGC of AT co-ignimbrite ash fall deposit were estimated as well as Ito pyroclastic flow deposit. However, grain size distribution and granulometric component were measured for the deposit that is thicker than 5 cm. There is AT co-ignimbrite ash fall deposit of 3 mm in thickness in Tsugaru peninsula. The deposit represented whole deposit that is thinner than 5 cm.

3. Total grain size distribution and granulometric component

Median diameter (Md) and standard deviation (stdev) of TGSD of Ito pyroclastic flow eruption ejecta are 3.2 phi and 2.8 phi, respectively. Component of vesiculated essential fragment (pumice and volcanic glass fragment) indicates Md: 3.7 phi and stdev: 2.7 phi, respectively. 75 wt.% of this component is a size of 1-6 phi in the diameter. Moreover, there are not so many variation on the coarse grain from 0 phi. Component of free crystal indicates Md: 0.9 phi and stdev: 1.2 phi, respectively. The shape of the component plot shows positive skewness. Component of lithic fragment indicates Md: 0.2 phi and stdev: 2.2 phi, respectively. Large bubble size glass, so-called 'bubble wall type glass' are included in ejecta of Ito pyroclastic flow eruption. Essential fragments of 1-6 phi in diameter are in large quantities, and are almost composed by bubble wall type glass. On the other hand, the fragments coarser than 1 mm in the size are small amount, and are composed almost of small bubble size glass (micro pumice). Therefore, eruption of Ito pyroclastic flow principally produced bubble wall type glass. That is, it is thought that bubble size was comparatively large.