Depositional structure and emplacement temperature of the coarse-grain facies of Ata pyroclastic flow deposit

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The coarse-grain facies of Ata pyroclastic-flow deposit, including coarse accidental clasts (<1 m), is distributed around shoreline of southern Satsuma peninsula, Kagoshima Pref., southern Kyushu, Japan (Suzuki, 2014). Its depositional mechanism or comparison with Ata pyroclastic-flow deposit of other regions have not been clarified yet. In this work, the origin of this lithofacies were discussed from the depositional structure. And the emplacement temperature, is one of restriction conditions of the origin, was estimated by paleomagnetic measurement.

A large-scale pyroclastic eruption, formed Ata-north caldera (105-110 ka; Machida and Arai, 2003), erupted Ata pyroclastic-flow deposit, distributed around southern Kyushu. The deposit is composed of non-welded facies and welded facies in ascending order. However, the former is found only in the coastal areas southeast of the caldera (Suzuki-Kamata, 1988) and the latter of vent-facing slopes show depositional rumps (Suzuki-Kamata and Ui, 1988) that imply Ata ignimbrite was dense and minimum-heat loss.

At present, the coarse-grain facies is interspersed with shoreline of southern Satsuma peninsula, over 20 km from the source caldera (Fig. 1), however, their lithofacies changes in a horizontal direction. At the site A of Fig. 1, it is composed of 3 units, unit1, unit2, and unit3 in ascending order. Unit1 is welded tuff, its fiamme are a few-20 cm in long. Unit2 is a poor-sorting and welded layer, composed of rounded accidental clasts (RAC) and plastically deformed volcanic blocks (PDVB), and is highly welded where RAC are not relatively distinguished but is not highly welded where RAC are distinguished. Unit3 is a poor-sorting and non-welded layer of RAC and flat volcanic blocks. At the site B, welded tuff is gradually overlain by a poor-sorting gravel layer. At the site C, it is composed of poor-sorting layer of rounded gravels includes gray-pumice clasts, and a poor-sorting layer of RAC and PDVB (where RAC are distinguished, PDVB are layered and where RAC are not distinguished, it looks like welded tuff includes RAC) in ascending order. At the site D, deposit is composed of only a welded tuff includes RAC. At the site E, deposit is composed of a poor-sorting gravel layer and welded tuff includes RAC in ascending order. At the site F, 2 units, unit1’ and unit2’ in ascending order. Unit1’ is a poor-sorting and welded layer of RAC (layered) and PDVB. Unit2’ is gradually overlain by poor-sorting layer of gray pumice clasts.

80 clasts (PDVB and gray pumice clasts as juvenile clasts, RAC as accidental clasts, and welded tuff) were collected from site A and F. Eventually 73 clasts could be separate stable magnetization components over 200℃ and almost all of them were single-components, and magnetization directions assembled similar directions. Most of magnetization intensity of juvenile clasts and welded tuff were weakened drastically from 450 or 500℃ and were lost in 560, 590 or 620℃. These results revealed that the emplacement temperature was higher than 560℃, a few cm deep from surface of accidental clasts were maintained temperature higher than 560℃ when emplaced, and major magnetic mineral of juvanile clasts was magnetite and hematite. In addition, average inclinations of PDVB were shallower than accidental clasts’ by 5°.

Lithofacies of coarse-grain facies can change in a horizontal direction (welded-tuff unit, juvenile and accidental clast-rich unit, and/or gray-pumice flow unit) even in same site. However, almost of all units were poor-sorted and not mantle-bedding, so they were estimated to derive from a pyroclastic density current. And paleomagnetization measurement revealed that emplacement temperature was hotter than 560℃. In conclusion, all results suggest that the source flow was high density and hot.

Keywords: pyroclastic flow deposit, paleomagnetism

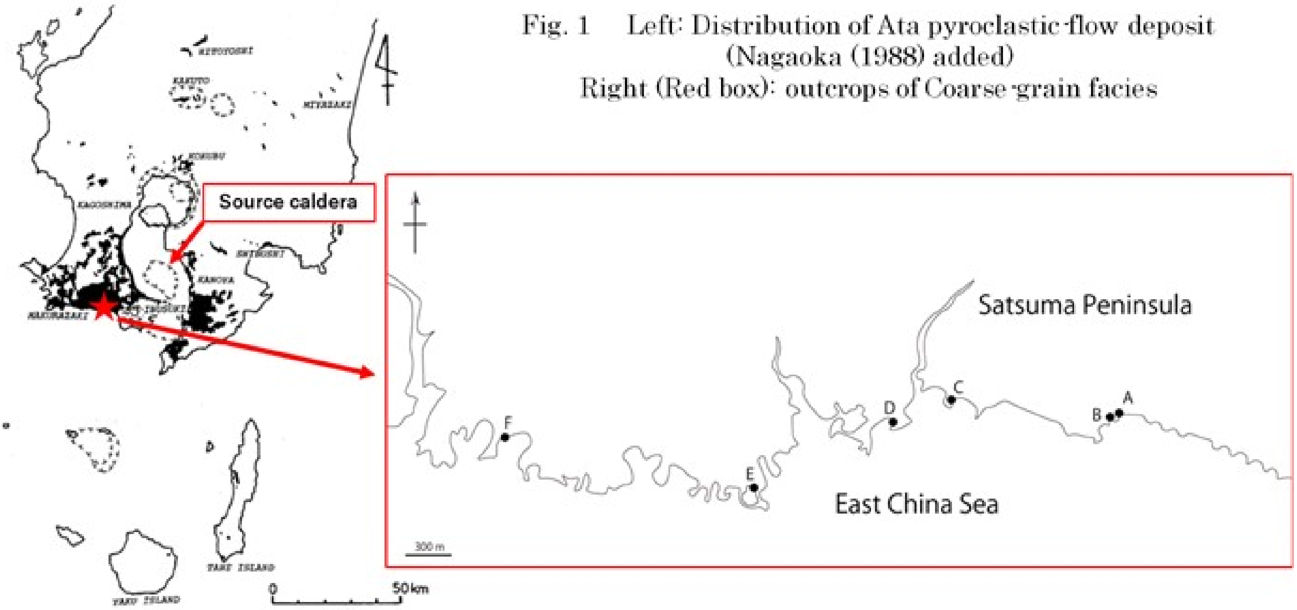

Fig. 1 Left: Distribution of Ata pyroclastic-flow deposit (Nagaoka (1988) added)
Right (Red box): outcrops of Coarse-grain facies

