Emplacement Mechanism of Volcanic Breccias Distributed in the SW Wall of Aso Caldera

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Aso caldera was formed by the four large-scale pyroclastic eruptions, which occurred between 300 and 90ka (Ono et al., 1977; Matsumoto et al., 1991). Distribution of pre-caldera volcanic products is limited in the caldera wall (Ono and Watanabe, 1985). The pre-caldera volcanic products are characterized by thick lavas. However, the SW caldera wall is composed of lithic breccias (0.67+/-0.09Ma, NEDO, 1991). In order to establish the emplacement model of the lithic breccias, we investigated their rock facies and paleomagnetism.

It is difficult to decide the source vent of lithic breccias because the primary topography is completely eroded. However, dipping direction of bedding structure, dune structure, and imbrication of lithics are probably useful to clarify the location of the vent. Our geological data indicate that the source vent was located around the Green-pia Minami Aso. Breccias are characterized by well-sorted lithic volcanic breccia and tuff breccia with minor intercalated-stratified tuff and lapilli tuff. They vary from matrix- to clast-supported, massive to bedded. Dune structure and imbrication of lithics are occasionally observed. The lithic breccias contain blocks up to 100cm in diameter. Most of the blocks are 20cm in diameter. The blocks are mainly composed of hornblende-two-pyroxene andesite, although vary in crystallinity, opacitization conditions of hornblende, oxidation state and vesiculation.

The following diverse lithofacies were observed: well-sorted lithic volcanic breccia, tuff breccia with minor intercalated-stratified tuff, and lapilli tuff. These facies vary from matrix- to clast-supported, and massive to bedded. Dune structure and imbrication of lithics are occasionally observed. Although the most frequent size of the block included in lithic breccia is 20 cm, some layers contain the huge blocks bigger than 100 cm. These blocks are hornblende-two-pyroxene andesite, and show diverse crystallinity, opacitization conditions of hornblende, oxidation state and vesiculation. We suggest the following four candidates of origin of the lithic breccia: (1) laharic breccia, (2) debris avalanche deposit, (3) co-ignimbrite lag breccia (Wright and Walker, 1981), (4) autoclastic breccia of lava flow (Smith et al., 1999). These four types of deposits probably show different temperatures of emplacement. The emplacement temperatures of the former two deposits are near ambient temperature. On the other hand, those temperatures of later two deposits are significantly higher than the former. It is difficult to constrain the origin of lithic breccia by using only geological data; because their textures are quite similar. However, paleomagnetism is useful to investigate the emplacement temperatures. We collected and analyzed 18 samples from 2 sites in order to constrain the emplacement mechanisms of the lithic breccias. Our results showed that the emplacement temperatures of lithic breccias are between 200 and 350 degrees C. This range of temperature probably indicates that lithic breccias were originated from pyroclastic flow or fragmentation of lava flow.