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Stratigraphy and grain-size characteristics of the 2011 Shinmoedake eruption deposits, Kirishima Volcano, Japan

MIYABUCHI, Yasuo[1*], Daisuke Hanada[1], Hiroshi Niimi[2], KOBAYASHI, Tetsuo[3]

[1]Faculty of Education, Kumamoto University, [2]National Agricultural Research Center for Kyushu Okinawa Region, [3]Faculty of Science, Kagoshima University

Shinmoedake Volcano, Kirishima Volcanic Complex in southern Kyushu, southwestern Japan, began a series of eruptions on January 19, 2011. Activity started with a small phreatomagmatic eruption, but shifted to magmatic eruptions characterized by subplinian eruptions on January 26. Lava appeared in the summit crater on January 28 and filled the crater completely until February 2. Multiple vulcanian explosions occurred in the crater filled by the lava, and the number of eruptions declined after February 9. The largest vulcanian explosion happened on March 13, thereafter relatively small eruptions occurred intermittently until September 7, 2011. We performed fieldwork around Kirishima Volcano in order to examine the distribution and characteristic features of tephra deposits associated with these eruptions. In this paper, we describe the stratigraphy and grain-size characteristics of the 2011 Shinmoedake eruption deposits.

In the proximal area (2.5-3 km SE of the vent), the 2011 Shinmoedake eruption deposits are divided into six units: unit 1 to 6 in ascending order. Unit 1, which is probably the 19 January 2011 deposit, is less than 0.5 cm thick and composed mainly of lithic fragments. Unit 2 is the subplinian pumice-fall deposits from the evening of January 26 to early morning of January 27, and 10-25 cm thick in the proximal area. The unit 2 tephra is subdivided into three units and is characterized by the upward coarser and poorer sorted nature. Moreover, the lower part is lithic rich and proportion of lithic fragments decreased upward, whereas major component of the upper part is yellowish gray pumice. Differently from other units, the unit 2 deposit is clearly observed at distal areas more than 20 km SE of the Shinmoedake crater. Unit 3 (<2 cm thick) is a lithic-rich well-sorted (coarse sand sized) pumice-fall deposit, and is thought to be emplaced in the morning of January 27. Unit 4 is related to explosive eruptions after 15h41m on January 27, and is composed mainly of coarse yellowish gray pumiceous lapilli. Unit 5 is a fine-grained (>50 % silt sized) ash-fall deposit and consists mostly of fresh lithic fragments and crystal grains. This fine ash is believed to be deposited between 28 and 29 January according to the stratigraphy and observation record of the eruptions. Unit 6 is originated from multiple vulcanian explosions after early February, but most of unit 6 is considered to be the largest vulcanian eruption deposit on March 13. The vulcanian ash is medium to coarse sand sized and composed mainly of fresh lithic fragments. The unit 6 also contains scoriaceous grains.

Based on the isopach maps, bulk volumes of unit 2, unit 3, unit 4 and unit 5 were calculated at 0.004 km^3, 0003 km^3, 0.0005 km^3, 0.0003 km^3, respectively. The volume of unit 2 is one order of magnitude greater than those of other units. However, the estimated volume of unit 2 is one order of magnitude smaller than those of previous reports because we cannot use thickness data in the proximal area within 2.5 km of the source crater.

Keywords: Kirishima Volcano, Shinmoedake, 2011 eruption deposits, eruption sequence