Geology and eruptive process of new Nishinoshima, Ogasawara, Japan, revealed from first landing and survey of eruptive products

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The island-forming eruption at Nishinoshima volcano, Ogasawara Islands, Japan, began its activity in November 2013 and ended in late 2015. During the KS-16-16 cruise in October 2016, we landed on Nishinoshima for the first time since the beginning of the eruption, and studied geological features of the new island. We approached and landed the western coast of the island where the pre-existed island remains partially. Along the gravelly coast, we observed many lava lobes that were emplaced during the different eruption periods between early 2014 and mid 2015. The periods of lava emplacement were determined based on aerial photos and satellite images. The front of lava lobe (a few to >10 m thick) is generally eroded by wave action and exposed its interior. The lava lobes consist of a black or dark gray, glassy clinker part and a massive inner part, some of which are highly fractured, vesiculated, and/or oxidized. Rubbly lava surface was commonly observed. The top of pre-existed island is covered by ash and scoria fallouts with thickness of ~10 cm or more that were caused by Strombolian activities in early periods and ballistic ejecta (a few tens cm) from the latest Vulcanian activity in November 2015. One of lava lobes in the northern area has a chilled margin that is characterized by a few-cm-thick glassy rim with many fine cracks developed perpendicular to the lava surface. From boats, we also observed clefts along the axial crest of lobes, exposing the interior of massive part of lava flows. They are thought to be products from lava inflation driven by an increase of internal pressure by successive injection of new lava into the lobes during lava emplacement as proposed by Maeno et al. (2016). We collected samples from lava lobes and fallout deposits for petrologial analyses. The analyses were carried out together with other rock samples collected by different surveys at Nishinoshima (by ERI using an unmanned helicopter in June 2016 and by Japan Coast Guard in October 2016). The 2013–2015 lava flows were andesite with <10 vol.% of phenocrysts of plagioclase, clinopyroxene, orthopyroxene, and titanomagnetie. The whole-rock composition is 59.5–59.9 wt.% in SiO_2, analyzed by an XRF at ERI. The petrological features of the 2013–2015 lava flows are similar to those of products from the past eruptions at Nishinoshima (e.g., Umino and Nakano, 2007); however, the whole-rock compositions are clearly distinguished from the 1973–1974 products and the pre-1702 products (older lava), and lies on the narrow range between these two products. Moreover, it seems that the SiO_2 (MgO) contents of lava flows slightly decreased (increased) with time, indicating more differentiated magma was erupted in early stage, although those of fallout deposits doesn’t show such specific chemical trend through the eruption. Although more geological and petrological analyses are needed to explain the origin of chemical variations in products, our findings during surveys at new Nishinoshima offer important insights into understanding the eruption process of this volcano.

Keywords: Nishinoshima, lava, lava lobe, fallout deposit

