

Correlations between current eruptions and the long-term eruptive history of the Shinmoedake volcano and Kirishima volcano group

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The Shinmoedake volcano produced fine ash that fell from October 11 to 16, 2017 after the 2011 magmatic eruptions. Recently, Shinmoedake produced phreatic eruptions in 1959, 1991-92, 2008, and 2010 and magmatic eruptions in 2011 (Minakami, 1968; Imura 1992; Geshi et al., 2010, Nakada et al., 2013). It is impressive that the Shinmoedake volcano has become active from 1950s. But, discussions to evaluate the long-term activity of the Shinmoedake volcano are lacking. Inoue (1988) discovered three pumice fall layers named Setao, Maeyama, and Kyoho pumice falls from Shinmoedake. Imura and Kobayashi (1991) demonstrated three eruptions after Kyoho pumice fall: the Meiwa eruption in 1771-1772, the Bunsei eruption in 1822, and the Showa eruption in 1959. But, recent studies showed that the Meiwa eruption generated from the Ohachi and Bunsei eruptions produced a small eruption from Shinmoedake (Yasui and Nagatomo, 1961; Tsutsui and Kobayashi, 2005; 2011). Tajima et al. (2013) noted the correlation between the tephra and lava from the Shinmoedake volcano. They discussed three concentrated magma-producing periods. The ages of the volcanic materials were determined by Okuno (2002) and Tajima et al. (2013).

Setao sub-plinian tephra (Sm-St) was the first produced tephra from Shinmoedake at 10.4 ka BP. Ryobuiké D (RyD) lavas composed the Shinmoedake cone under the Ushinosune ash (UsA), and the youngest age was a little older 7.6 ka BP at southwest part of the cone. Outcrops belonging to this period are lacking around the volcano because they are covered by the younger Nakadake and Ohachi volcanoes. The next magma-producing age from the Shinmoedake volcano—that is, the Maeyama sub-plinian tephra (Sm-My) at 5.6 ka BP—indicates the time interval from the last RyD lava. Also, many Ryobuiké C (RyC) lavas are not covered by Sm-My tephra; rather, they are covered by Shinyu sub-plinian tephra (Sm-Sy) aged 4.5 ka BP. It is assumed that the RyC lavas were produced between 5.6 ka BP and 4.5 ka BP. RyC lavas topographically divided some lava flows; therefore, this period is defined as the Shinmoedake-Shinyu period. Shinyurindo B and A vulcanian tephra (Sm-SrB, A) contain olivine from Shinmoedake that is aged 2.7 and 2.3 ka BP. Tajima et al. (2013) reported Sm-Sy tephra covered by RyA and B lava flows bearing olivine and two pyroxenes in the Shinmoedake crater. During this period, two vulcanian tephra layers and lava flows were produced over a period of roughly five hundred years, which is defined as the Shinmoedake-Shinyurindo period. A tephra layer generated from Shinmoedake volcano between the Sm-SrA tephra and the Shinmoedake Kyoho sub-plinian tephra (Sm-Kp) was not found in 1716-1717 AD at the western outcrop of Shinmoedake, indicating the interval between the two tephra layers. The Shinmoedake volcano erupted in 1822, 1959, 2008, 2010, 2011, and 2017 after the Kyoho eruptions. This indicates a time period characterized by frequent eruptions that have continued from the Kyoho eruptions to the present day and is defined as the Shinmoedake Kyoho-Heisei period.

The Shinmoedake volcano is characterized by active periods of 500 to 1000 years that are separated by roughly a 2000-year interval. Additionally, the Shinyu period is distinguished by its large lava-producing activities with sub-plinian eruptions, and the Shinyurindo period is distinguished by vulcanian eruptions and small lava flows. The Kyoho-Heisei period produced two sub-plinian eruptions, according to geological records, with small amounts of lava. We need to carefully monitor the magmatic activity of the Shinmoedake volcano.

Keywords: Shinmoedake volcano, eruptive history, Kirishima volcano group