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Eruptive activity during AD 2006-2011 at Sakurajima volcano, inferred from Petrological features of eruptive materials

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On June 2006, Sakurajima volcano, located in southern Kyushu, Japan, resumed its eruptive activity at Showa crater, and the explosions have been continued until now (February 2012). Recently, on the basis of the petrological features of the eruptive materials, we divided the eruptive activity at Showa crater into the four periods: from June 2006 to August 2009; from September 2009 to March 2010; from April to May 2010; and from June to September 2010 (Matsumoto et al., 2011 in JpGU). In this study, we discuss the relationship between the petrological features of eruptive materials and the change of eruptive activity using new data during AD 2006-2011. On the basis of their relationship, we also mention the present condition of Sakurajima volcano.

The eruptive materials are represented by ash-size samples (scoria, lithic and pumice), and sometimes lapilli-size ones appear in November 2009, April 2010, June 2010, and December 2010. Regardless of the grain size, the main components of eruptive materials are Juvenile-A type (magmatic materials ejected in this eruption), Juvenile-B type (magmatic materials related to the eruptive activity since AD 2006, but not ejected in this eruption), strongly-altered rock. The ash-size samples are also included isolated crystals. There are many strongly-altered rocks in the eruptive materials during June 2006 to August 2009, in which Juvenile-A type materials are absent. In contrast, Juvenile-A type materials are found in the eruptive materials since September 2009. The whole-rock compositions of Juvenile-A and -B type lapilli are consistent with the compositional trends of the 20th juvenile materials, showing the most mafic compositions (SiO2 = 58.5-59.7 wt.%). The matrix glass compositions of Juvenile-A type materials are dacitic (SiO2 = 65.8-72.7 wt.%). Focusing on the temporal variations of their matrix glass compositions, we can recognize the periodic change that the compositions become mafic at some period, and again become silicic at the following period.

On whole-rock chemistry, the juvenile lapilli agree with the compositional trends of the 20th juvenile materials. Thus, the magma system of Sakurajima volcano since AD 2006 would be the similar to that of the 20th century: magma mixing is the main magmatic process. Focusing on the matrix glass compositions of Juvenile-A type materials, they show more mafic compositions in the following three periods: from January to early April 2010, from November 2010 to February 2011, and from late August to September 2011. This suggests that the effect of mafic component became larger in these periods. Comparing the variations of the matrix glass compositions with the other monitored data, the number of explosions and its eruptive volume increased clearly in these three periods. Therefore, it is interpreted that the eruptive activity since AD 2006 becomes more explosive when the mafic component affects largely in the magma system.

Based on the continuous change of ground deformation, the increase of eruptive volume, and the decrease of silica content of the matrix glass compositions, the eruptive activity from January to early April 2010 is considered as a series of the activity since September 2009. That is, from September 2009 to early April 2010, the mafic component largely affected the magma system, resulting in the construction of the conduit system. In contrast, in the other two periods, the number of explosions and eruptive volume were not so large. Especially in the period from late August to September 2011, the glass compositions are slightly more silicic than those of the other periods, suggesting the weakly-effect of mafic component. In summary, Sakurajima volcano reached the climax of the eruptive activity from September 2009 to early April 2010. After then, the volcano has continued the eruptive activity at relatively-lower level, without obvious change of condition.

Keywords: Sakurajima volcano, Showa crater, volcanic ash, glass chemistry, temporal variation