Volcanic Ash Clean-up Operations in Kagoshima City

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Synopsis

This paper briefly describes the clean-up operations carried out by Kagoshima city officials against ashfalls from Sakurajima volcano. The volcanic ash from Sakurajima deposited 4,759g/m^2 in 2012 at Kagoshima city hall located 10 km away from the Showa crater, at which almost all of recent eruptions occurred, and 44,624 g/m^2 at Arimura Station in Sakurajima area 2.5 km from the crater. Kagoshima city conducted clean-up operations with 96 vehicles. It spent approximately six hundred million yen (six million USD) only in 2012.

Keywords: Sakurajima Volcano, Kagoshima City, Ashfall, Clean-up

1. Introduction

Kagoshima city is the capital of Kagoshima prefecture and has a population of approximately 600,000. The city has a most active volcano in Japan, Sakurajima, and often experienced volcanic ashfalls since the present series of volcanic activities with frequent vulcanian eruptions began in 1955 (Fig. 1).

The Japanese national government enacted an Act on Special Measures Concerning Active Volcanoes in 1973 to respond the increase of the eruptions at Sakurajima and began to provide grant for clean-up operations in local municipalities around Sakurajima in 1978. With the support of the grant, Kagoshima city kept conducting clean-up operations on roads, housing area, parks, and public schools in this thirty-five years. This paper reviews the outline of the operations.

Fig. 1 The 380th explosive eruption of Sakurajima volcano in 2013. The ash clouds rose up to 3,500 meters above sea level in this eruption. (Photo Courtesy of Japan Meteorological Agency).

2. Geological Background of Sakurajima

Sakurajima volcano is a post-caldera cone of Aira caldeara at the northern half of Kagoshima bay (Fig. 2). The height of Sakurajima's summit is 1,117 m above sea level. It was originally an island with a diameter of approximately 10 km on the southern rim of Aira caldera. The island was joined to Osumi peninsula during the major explosive and effusive eruption in 1914.

Petrology evidence indicates that the volcanic activities of Sakurajima began 13,000 years ago and there are historical records of major eruptions

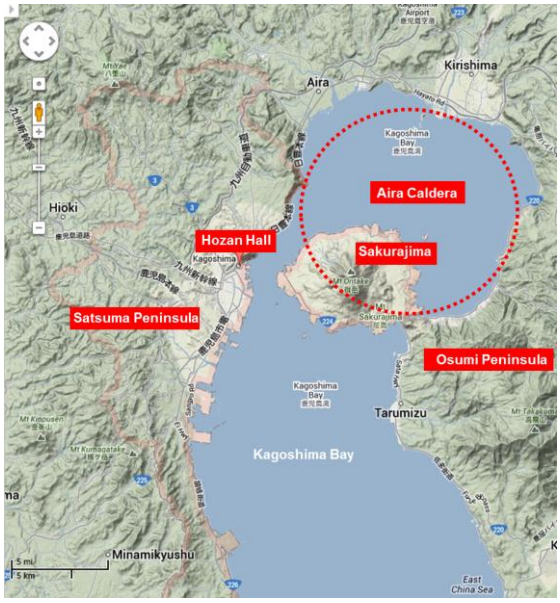

Fig. 2 Topography map of Aira caldera and Sakurajima volcano generated by using GoogleMaps.

in 794 (VEI4), 1471(VEI5), 1779(VEI4), 1914(VEI4).

The series of volcanic activities with frequent vulucanian eruptions began at Minami-dake (South peak in Japanese) crater in 1955. There were some extremely active periods, for example, in 1960, 1974, and 1985, which had 414, 362, and 474 explosive eruptions, respectively.

The eruption at Showa crater, which is on the southern frank of Minami-dake, began in 2006. The scale of each eruption is generally smaller than that at Minami-dake crater. However, the number of eruptions at Showa crater is much larger than those at Minami-dake crater (See Fig. 3). The size of Showa crater as well as the eruption scale at the crater is increasing year after year, and thus, accumulation weights of volcanic ash deposits are also increasing in the recent three years.

3. Ashfalls in Kagoshima City

There are sixty-two observation stations in Kagoshima prefecture to monitor volcanic ashfalls from Sakurajima. Thirteen are in the Sakurajima area and eight in the main land of Kagoshima city.

The accumulation weight of volcanic ash from Sakurajima deposited all through the year is 44,624 g/m^2 in 2012 at Arimura Station in Sakurajima area 2.5 km south from Showa crater and 4,759g/m^2 at Kagoshima city hall located 10 km away from the crater.

The maximum record is 117,532 g/m^2 at Yunohira Viewpoint, which is 3.5 km northwest from Showa crater observed in 1985. They had 12,975 g/m^2 deposits at Kagoshima city hall in this year.

The volume of volcanic ash deposits is significantly affected by wind direction as well as eruption scale. As a result, the central area of Kagoshima city frequently experience severe ashfall in summer, because the prevailing wind blows from east to west in this season (Fig. 4).

The recent severe ashfall occurred on 21th May

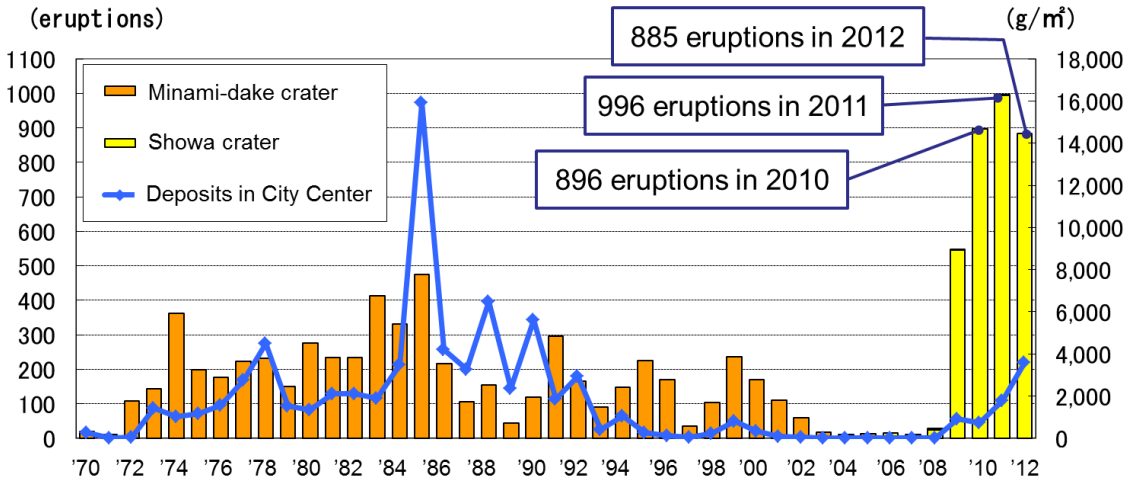

Fig. 3 The numbers of explosive eruptions of Sakurajima volcano and the weight of the ash deposit.

Fig. 4 Central area of Kagoshima city during ashfalls. People use umbrellas to protect themselves from ashfalls. (Photo courtesy of Kagoshima City Office)

2012 when the city center was covered with 733 g/m^2 volcanic ash in twenty-four hours. Thirty-six trains cancelled their services due to the disorder of turnout switch caused by the accumulation of volcanic ash.

4. Clean-up Operations by Local Government

Kagoshima city conducts clean-up operations with the grant from Japanese National Government, which started in 1978 under the Act on Special Measures Concerning Active Volcanoes. Japanese National Government supports a half of the operation costs if the total amount of volcanic ashfall exceeds 1,000 g/m^2 in a year and two-third if it exeeds 2,500 g/m^2/year on the roof of the building of Kagoshma city hall.

Kagoshima city officials divide Kagoshima city of approximately 550 km^2 into 94 areas and use 96 vehicles to conduct clean-up operations. They often form a team of a road sweeper and a sprinkler truck (Fig. 5 and 6). However, they use only a sprinkler truck when they do not have so much ashfalls. They use small manual push sweepers and deck brushes to clean up sidewalks and some other small areas (Fig. 7).

When volcanic eruptions occur, the city officials in Road Maintenance Division patrol and seek severely affected areas by ashfalls mainly depending on wind directions and decide the order of clean-up areas. They conduct clean-up operation if they cannot identify painted lines and symbols on roads (Fig. 8). They make it a rule to complete a single operation in three days. Actual operations are carried out by 13 private cleaning companies in Kagoshima city.

Volcanic ash fallen in housing area should be basically cleaned up by the house owners themselves. City Officials, however, collect volcanic ash filled in plastic bags to take them to designated locations (Fig. 9). Kagoshima City Office provides general public with heavy duty plastic bags for the special use on volcanic ash collection free of charge. They served approximately three million bags in 2011. Also they set 6,400 collection points for volcanic ash in Kagoshima city. The bags on the collection points are basically salvaged once a month by cleaning companies designated by Kagoshima City. They removed approximately 20,000 m^3 volcanic ash from roads and housing area in Kagoshima city.

The total costs for the volcanic ash clean-up operations were approximately six hundred million yen (six million USD) for the only in 2012.

Fig. 5 A road sweeper conducting a clean-up opereation. There are 96 vehicles for volcanic ash clean-up in Kagoshima city. (Photo courtesy of Kagoshima City Office)

Fig. 6 A sprinkler truck (Photo courtesy of Kagoshima City Office)

Fig. 7 A clean-up operation on a sidewalk by using a manual push sweeper and deck brushes (Photo courtesy of Kagoshima City Office)

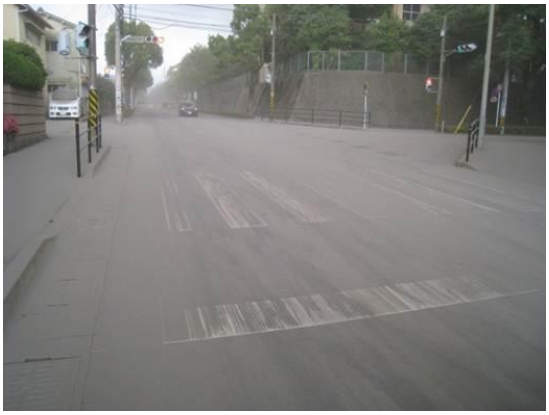

Fig. 8 A road condition that requires clean-up operatons (Photo courtesy of Kagoshima City Office)

Fig. 9 A notice of a volcanic ash collection point and plastic bags filled with volcanic ash (Photo courtesy of Kagoshima City Office)

Fig. 10 Volcanic ash placed in a designated location (Photo courtesy of Kagoshima City Office)