Eruptive activity of Sinabung volcano in 2013 and 2014

Sinabung in the Northern Sumatra of Indonesia began its eruptive activity with phreatic events in August and September 2010. It resumed its activity in September 2013 with phreatic events. In November 2013, eruption columns stood about 5 km above the volcano. Volcanic ash issued since the middle November contained juvenile particles, and pumice fragments were ejected on to the NE flank of the volcano by the vulcanian event on 23 November 2013. Small-scale pyroclastic flows descended during the events. Though, then, the appearance of the activity looked declined, the summit of the volcano inflated and partial collapse of the summit crater outer-slope repeated. Lava appearance was confirmed in late December.

Fig. 1. Easterly view of erupting Sinabung volcano on 25 January 2014 (S. Nakada).

Fig. 2. Andesite lava flow extending on the SE slope of Sinabung volcano. Taken on the early morning of 25 January (S. Nakada).

Lava appeared in the summit crater grew as a dome and started its partial collapse on 30 December, generating pyroclastic flows which descended on the SE slope of the volcano. The lava dome grew into a lava flow moving to the SE, repeating its partial collapse. The horizontal length of the lava flow exceeded 1 km in late January 2014.

Fig. 3. Relatively small pyroclastic flows on the SE slope of Sinabung volcano. Taken on 25 January 2014 (S. Nakada)

Several tens collapses occurred everyday in January 2014. Relatively large collapse (pyroclastic flows) generated on 7, 11 and 21 January and 1 February. Pyroclastic flows on 1 February traveled about 4.5 km, according to newspapers, and 16 local people who invaded into the danger zone, 5 km from the summit, were involved in the flows.

The present eruption at Sinabung is close to the eruption of 9 to 10th Century of this volcano in terms of both eruption site and scale (Fig. 4). It is also similar to lava-dome eruptions at Unzen, Japan, in 1991-95 and at Soufriere Hills, Montserrat, West Indies, in 1995-present, where lava dome/flow growth associated with pyroclastic-flow events continued for several years.

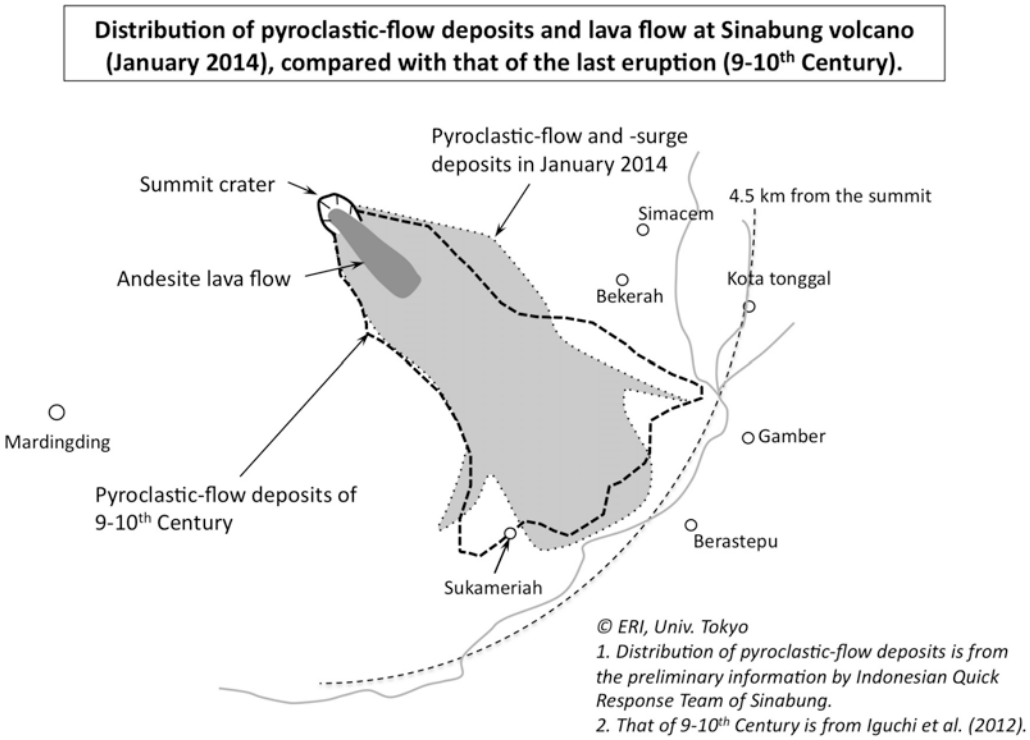

Fig. 4. Comparison of distribution of pyroclastic-flow deposits in January 2011 with that of the 9 to 10th Century eruption. Approximate location of lava flow in late January 2014 is also shown.

Composition of magma

Based on the chemical analyses of pumice of the Vulcanian event on 23 November 2013 and pebbles included in pyroclastic flow event on 11 January 2014, magma of this eruption (hornblende andesite) is similar to but a little poorer in SiO2 than the magm of the 9 to 10th Century. Even in this eruption, there is a small chemical range in erupted materials.

Table 1. Chemical composition of juvenile pebbles of the 11 January 2014 pyroclastic-flow event, pumice of the 23 November 2013 vulcanian event, and the 10th Century lava.

	SiO2	TiO2	Al2O3	FeO*	MnO	MgO	CaO	Na2O	K2O	P2O5
11 Jan. 2014	58.1	0.71	18.3	7.09	0.16	2.92	8.05	2.95	1.70	0.12
23 Nov. 2013	58.9	0.71	17.9	6.78	0.15	2.84	7.73	2.97	1.86	0.13
AD 800-1000	59.7	0.71	17.6	6.58	0.15	2.86	7.37	2.99	1.93	0.13

* Total iron as FeO.

Earthquake Research Institute, the University of Tokyo continues the geological inspection of the volcanic activity at Sinabung since 2010, in corporation with Kyoto and Hokkaido Universities and the Indonesian Center for Volcanology and Geological Hazard Mitigation (CVGHM). The research contains forecasting the future eruption based on geological survey and petrological monitoring of juvenile material included in volcanic ash. Kyoto University keeps monitoring of the activity with seismometer and GPS jointly with the Indonesian team.

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(S. Nakada and M. Yoshimoto)