

## **Intrusion of the An'ei lava flow from Sakurajima volcano into the submerged floor of Aira caldera and consequent submarine eruptions**

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Sakurajima volcano is a composite volcano located on the southern rim of the submerged Aira caldera. The 1779 An'ei eruption of Sakurajima volcano started with plinian eruption at the twin vents opened on the southern and northeastern flanks, followed by effusion of andesite lava (An'ei lava). The lava flow from the southern vent stopped on the coast. Another lava flow from the northeastern vent, however, passed the coast and subsided at the sea just off the Suzue-bana Point into the submarine pumiceous deposits of Aira caldera to form a large lobe fanning out within a radius of 4-5 km. The lobe comprises semicyrindrical ridges of pumiceous deposits upheaved up to a height 50-140 m from the Aira caldera floor. Shinjima Island 800 m long, 3 islets 50-150 m long, and one large shallow bank 800 m long occur on the crests of the ridges, and 5 or 6 funnel-shaped craters 20-50 m deep and 40-400 m across occur on the crest or head of the elevated features.

It was witnessed that Shinjima Islands and islets emerged intermittently during the period from November 21, 1779 to November 9, 1980. Pumiceous deposits exposed on the Shinjima Island is underlain by An'ei lava at depths below 320 m from the surface, and water-chilled An'ei lava is exposed on the islets. The Shinjima Island represents upheaval of the caldera floor by intrusion of An'ei lava, and water-chilled lava exposed on the islets represents a ramp of the lava intrusion.

Submarine eruptions were also witnessed 5 or 6 times at the neighborhood of the islets during the period from September 9, 1780 to November 20, 1785. Craters on the ridges are thought to correspond to the witnessed eruptions. At 16 o'clock, April 11, 1781, a large eruption occurred to form a glowing column with ejection of incandescent blocks and comminuted fragments above the sea adjacent to the island visible in front of Komen village. The island was not specified in ancient documents, but is most likely to be the Shinjima Island. Large andesitic blocks up to 1-2 m across are found sparse on the island, and a large crater 520 m by 320 m in diameter is present under the sea 750 m north-northeast of the island. The scale of the eruption was not so large to bring large blocks onto Kurokami and Komen villages 3 or 4 km distant from the crater, so that the people were able to observe the

eruption. The blocks on the Shinjima Island have curvilinear surfaces with prismatic open-cracks, similar to a cauliflower bomb. Carpets of pumice lapilli and ash with minor andesite lapilli and fragments of sponge, which are most likely derived from the submarine caldera floor, spread over and under the blocks. The morphological features of the juvenile blocks, and the volume of the blocks and associated volcaniclasts, and the scale of the eruption column suggest that a vulcanian eruption occurred from the lava intrusion through overlying pumiceous deposits. On assumption that blocks reached within 2 km from the vent with negligible resistance of the ambient fluids and negligible influence of wind, it is calculated that the velocity of eruption flux was 150 m/s at the conduit and reached a height of 1,200 m above the surface of lava and 900 m above sea level.

Emergence of islands likely indicates passage of lava, and suggests a long-term intrusion into cohesionless pumiceous deposits for one year. Intermittent small-scale vulcanian eruptions for 5 years from dispersed craters occurred from the surface of lava overpressurized by accumulation of exsolved volatiles from the solidifying lava. Restricted convection of interstitial water in the framework of pumiceous deposits likely delayed cooling of the lava, and was, thus, responsible to the long-term intrusion and intermittent eruptions.