

Outlines of volcanic activity of Anatahan, Northern Marianas, and the observation researches during 2008-2009

Setsuya Nakada[1]; Yuichi Morita[1]; Takeshi Matsushima[2]; Fukashi Maeno[1]; Atsushi Watanabe[1]; Takao Tabei[3]; John Takai Camacho[4]

[1] ERI, Univ. Tokyo; [2] SEVO, Kyushu Univ.; [3] Applied Sci., Kochi Univ.; [4] EMO, CNMI

Anatahan is the southernmost volcanic island in the Northern Mariana volcanic arc. A Plinian explosion started in this volcano on May 11, 2003; it was the first time this volcano was active in the human history. The mode of eruption changed from phreatomagmatic to phreatic a month after the first eruption. The latter eruption continued intermittently to the present time intercalated by a short period of Strombolian eruption in the early 2004. It seems that the phreatic eruption was triggered by interaction of magma with sea water which invaded the vent from the surrounding sea. Geophysical monitoring has been carried out by the Emergency Management Office of Saipan and the US Geological Survey. Geological inspection and additional seismological-geodetic observation have been repeatedly carried out by our group since 2003.

The eruptive activity at Anatahan can be divided up to March 2008 into 4 phases. The intensity of the eruptions decreased roughly with time, as did the magmatic explosions in the first two phases and early stage of Phase 3.

[Phase 1] Plinian explosions at the Eastern Crater emitted brown tephra covering the whole island in May 2003. Following the explosions an andesite dome had been formed in the crater, which was destroyed by the following phreatomagmatic (?) explosions in June 2003. The phreatomagmatic eruption emitted gray tephra (very-fine ash) covering the whole island in middle June 2003. The crater bottom was 15-20 m above sea level in January 2004.

[Phase 2] Continuous strombolian explosions, which started in March 2004 and ended in July, filled the lower part of the Eastern Crater with lavas in June 2004. The deposition of pyroclasts was limited inside the crater.

[Phase 3] It began with strombolian explosions in March 2005. Vulcanian explosions broke and removed completely the lava lakes formed in Phase 2. This event was soon followed by phreatic explosions until early September 2005. Abundant very-fine ash covered the whole island, so that most animals and plants were killed.

[Phase 4] Phreatic explosions and deposition of tephra within the caldera from 2007 to early 2008.

It is noted that a large amount of SO₂ had been emitted during the volcanic activity following the first plinian eruption (Hilton et al., 2007). In many aspects the activity in Anatahan is close to that in Miyakejima which started in 2000 (Nakada et al., 2005a): very-fine ash deposits of phreatic to phreatomagmatic explosions, slow moving low-temperature pyroclastic surge, abundant SO₂ emission after the main eruption and origin of the summit caldera.

Wet and very-fine particles comprise most of the eruption products. The active crater is only 1 km away from the seashore and its bottom deepened during eruption much below sea level. It is likely that these circumstances permitted the invasion of seawater and interaction with hot magma ascending the upper part of the conduit.

Seismological and geodetic observations are being carried out, as the MEXT Grant-in-Aid research projects (2007-9), for understanding the conduit system of Anatahan where magma interacted with external water and the relationship of its magma activity with regional tectonic setting. The preliminary results will be presented also by Morita et al. (this meeting), Watanabe et al. (this meeting), Matsushima et al. (this meeting) and Tabei et al. (this meeting).