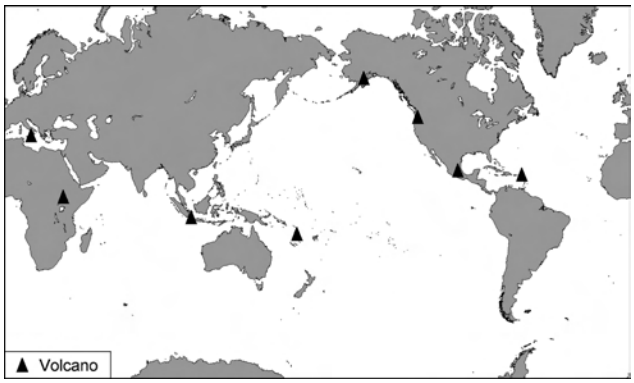
Bulletin of the Global Volcanism Network



Volume 30, Number 12, December 2005

Smithsonian
National Museum of Natural History

Global Volcanism Program · National Museum of Natural History, Room E-421, PO Box 37012 · Washington, DC 20013-7012 · USA
Telephone: (202) 633-1800 · Fax: (202) 357-2476 · Email: gvn@volcano.si.edu · URL: http://www.volcano.si.edu/

The text of the *Bulletin* is also distributed through the Volcano Listserv (volcano@asu.edu).

Data are preliminary and subject to change; contact the original source or the Global Volcanism Program before using.

Augustine

southwestern Alaska
59.363°N, 153.43°W; summit elev. 1,252 m
All times are local (= UTC - 9 hours)

This report covers events from May 2005 through 26 January 2006. The first substantial ash-bearing eruption took place on 11 January; another one, on 17 January, rose to ~ 13.7 km. By late January there had been eight eruptions.

A National Oceanic and Atmospheric Administration (NOAA) message pointed out that life-threatening costly damages can occur to aircraft that fly through an eruption cloud. It added that the Federal Aviation Administration put NOAA's information to work, giving air traffic managers and controllers a heads-up to ensure airspace safety around the volcano as well as along the forecast trajectory of the ash plumes. Augustine eruptions had also automatically alerted the West Coast and Alaska Tsunami Warning Center. The geography of the Cook Inlet, where Augustine is located, is shown on figure 1.

1985-89 crisis and eruption. The last major eruption of Augustine was in March 1986. Between mid-July and early August 1985, seismicity at Augustine began to increase. From then until late February 1986, recorded earthquakes averaged 12/day, with occasional short bursts of seismicity. On 17 February 1986 an explosion plume was observed over the volcano. Seismicity intensified after the end of February. On 27 March 1986 explosions sent eruption clouds into the stratosphere and generated pyroclastic flows that reached the sea. Ash was deposited over a wide area and international air traffic was disrupted. Explosive activity, ash plumes, and pyroclastic flows continued through August and September 1986, and Augustine steamed continuously through at least July 1989 (*BGVN* 11:02-11:08, 13:07, 14:09).

Current eruption. This report is chiefly based on the continuing coverage of the Augustine eruption by the Alaska Volcano Observatory (AVO). The AVO website presents observations and remarkable photos documenting eruptive stages seen thus far.

Beginning in May 2005, there was a slow increase in the number of earthquakes under Augustine. The earthquakes were generally small (less than M 1) and concentrated roughly 1 km below the volcano's summit. These earthquakes slowly increased from 4-8 per day to 20-35 per day.

Data from a Global Positioning System (GPS) network on Augustine indicated that a slow, steady inflation of the volcano started in mid-summer 2005, continuing until the present. The GPS benchmark located nearest the summit moved a total of 2.5 cm. This motion is consistent with a source of inflation or pressure change centered under the volcano. This was the first such deformation detected at Augustine since measurements began just prior to the 1986 eruption.

On 29 November 2005 AVO raised the Concern Color Code from Green to Yellow after recording important long-term changes in seismicity and ground deformation consistent with renewed volcanic unrest. There were no indications that an eruption was imminent or certain. Seismicity remained at elevated levels during 30 November to 12 December 2005.

During 9-12 December, changes in the style of earthquake activity at the volcano were recorded, and there were reports of gas emissions and steaming. Seismic events on 9 and 11 December may have perturbed the hydrothermal system, initiating steam explosions. These seismic events were consistent with reports of steaming at the summit observed on 10 December, and reports of a distinct sulfur smell ("like from a sewer") in the air on the evening of 11 December at Nanwalek and Port Graham, ~ 80 km E of the volcano. Augustine remained at Concern Color Code Yellow. On 12 December a steam plume visible on video and satellite images extended 75 km SE (figure 2).

During a 12 December flyover, AVO scientists saw profuse steaming from numerous summit fumaroles, emanat-

Figure 1. Map showing Augustine in its relation to nearby volcanoes, Cook Inlet, and surrounding communities. Courtesy of Janet Schaefer and AVO / Alaska Division of Geological & Geophysical Surveys.

Figure 2. On 12 December 2005, a plume of volcanic gas and steam billowed from Augustine and spread ~ 80 km SE. This image was captured the same day by the Moderate Resolution Imaging Spectroradiometer (MODIS) onboard the Aqua satellite. In this image, the volcanic plume streams from the tiny, snow-capped volcanic island where Augustine is located and dissipates over the ocean. NASA image created by Jesse Allen, Earth Observatory, using data obtained courtesy of the MODIS Rapid Response team.

Figure 3. On 20 December 2005, Augustine emitted a steam jet from a SE-flank fissure and gave off steam from its summit area. Courtesy of C.F.Waythomas and AVO / USGS.

ing mainly from behind the 1986 lava dome. Several energetic fumaroles were also located 200 m down the SE flank. A gas-and-steam plume extended 75 km SE. Augustine remained at Concern Color Code Yellow. Reports during 14-23 December mentioned that residents E of the volcano smelled sulfur; and the reports noted intervals of elevated seismicity, and several small steam explosions.

A gas-measurement flight on 20 December detected SO_2 for the first time at Augustine since routine airborne measurements began in the early 1990s. Aerial observations and analysis of photography and video of the summit area indicated some deformation within the summit crater area. A crack or fissure was noted cutting the 1986 lava dome and extending to the SE (figure 3). Heavy steam from this feature, along with patches of bare ground, indicated an increase in the summit's heat output.

Thermal imaging of the summit area took place on 22 December, using a helicopter-mounted FLIR (Forward Looking Infrared Radiometer). The imaging confirmed the presence of a new, high-temperature fumarole or gas vent located high on Augustine's S flank.

Seismicity decreased during the last week of December compared to the previous week; but steam and gas emissions continued. AVO scientists visited the volcano to install additional GPS receivers and deploy additional ash-collection devices. Observations continued to suggest that new magma was present. The level of seismicity was still well below that observed just prior to the 1986 eruption. Augustine remained at Concern Color Code Yellow.

During the first week of January 2006, seismicity increased slightly compared to the previous week. The volcano continued to steam vigorously from several summit fumaroles. AVO scientists visited the volcano to install additional seismic monitoring equipment, to deploy additional ash-collection devices, and to undertake helicopter-aided thermal surveys of the summit area. The high-temperature fumarole or gas vent on Augustine's upper S flank, previously reported on for 22 December, had cooled significantly, but elevated temperatures were detected at one summit fumarole imaged through the steam and gas. Although fumarole temperatures varied, there were no significant changes in the distribution of thermal features compared to the previous survey . A gas-measurement flight detected a significant increase in SO_2 compared to 20 December.

On 10 January 2006, AVO raised the Concern Color Code from Yellow to Orange. Earthquake activity beneath Augustine had increased markedly, indicating the heightened possibility of an explosive eruption within hours to days.

On 11 January 2006, AVO raised the Concern Color Code from Orange to Red after recording two discrete explosions at the summit at 0440 and 0513. Satellite data confirmed that an ash cloud was produced and, in collaboration with the National Weather Service (NWS), the top of the cloud was estimated at 9 km altitude. NWS and AVO tracked the ash plume, which detached from the vent and drifted to the N and E. By 0740, the ash cloud had traveled 40 km E and 50 km N. An ash-fall advisory was issued by the NWS at 0644. Seismicity decreased significantly after the explosions. During an 11 January afternoon overflight, AVO scientists observed a pure white steam cloud rising to about 3.5 km altitude and drifting NE. Little volcanic ash was observed on the island itself, but volcanic mudflows were evident on the E, S, and W sides of the volcano (figure 4). A brown haze in the air was observed over the central part of Cook Inlet.

After the eruption on 11 January, seismic activity declined. On 12 January 2006 the Level of Concern Color Code was lowered from Red to Orange.

Explosive eruptions on 13 and 14 January 2006 produced clouds of volcanic ash and flows of mud and rock fragments. A marked increase in seismicity early on 13 Jan-

Figure 4. A W-looking view of Augustine from an observation flight made after the early morning steam emission on 11 January 2006. The image shows a snow-and-rock avalanche on the SW flank (to the left) and lahars visible as gray lobes on E and N flanks (to the right). Courtesy of Stephanie Prejean and AVO / USGS.

uary preceded an eruption interval that began at around 0355 and ended around 0439. NWS subsequently reported ash heights of 10 km altitude. Other explosive events followed on 13 January, occurring at 0847, 1122, 1640 (figure 5) and 1858; and on 14 January at 0014 (figure 6). Each of these events produced ash plumes, mudflows, and pyroclastic flows on the island.

Ash clouds surpassed 9 km altitude, as reported by pilots and determined by radar data provided by the National Weather Service (NWS). Ash was carried to the E-SE and light ash falls were reported in communities of the southwestern Kenai Peninsula. According to preliminary assessment by Pavel Izbekov (Geophysical Institute, University of Alaska Fairbanks and AVO), the majority of ash particles in the 13 January seemed to be juvenile, though there are large variations in the morphology of ash particles as well as the composition of matrix glass. Enlargements of two ash grains appear in figures 7 and 8.

Figure 5. This photo of a large Augustine's eruption cloud was taken between about 1645 and 1700 on 13 January 2006 from Kokhanok on the SE side of Lake Iliamna, a spot ~ 80 km W of the volcano. Image courtesy of Gerald Andrew.

On 14 January, AVO received reports from pilots of sulfurous odors and diffuse brown haze at flight altitudes when flying 400-500 km E of Augustine in SE Alaska (near Yakatat and Sitka). These diffuse ash-and-gas clouds were presumably from Augustine's explosive events on 13 January.

Seismicity declined in the 30 hours after the event early on 14 January, and AVO downgraded the color code from Red to Orange. The level of seismic activity at the volcano remained above background.

On 17 January 2006 an explosive eruption began at 0758 and ended at 0803. Seismic and pressure-sensor data indicated numerous small explosions, which could produce small amounts of low-level ash and could initiate small rock avalanches on the flanks. AVO raised the concern color from Orange to Red. A flight later on 17 January disclosed a brown ashy haze lingering over the island. Occasional views through the haze showed that most of the lava dome that formed following the 14 January eruption was destroyed in the explosion of 17 January. Observations made during a flight on the afternoon of 18 January 2006 indicated that the summit was steaming vigorously, consistent with the formation of a new lava dome. Evidence of explosive ejection of volcanic bombs included circular craters the size of large trucks seen on the NW flank. Block-and-ash-flow deposits with car-sized blocks produced by dome collapse covered parts of the SE flank. Surge deposits were observed on the NW flank. A white steam plume was observed rising to about 2,600 m altitude before it trailed off as a bluish haze to the E. Little to no ash appeared to be present in the plume.

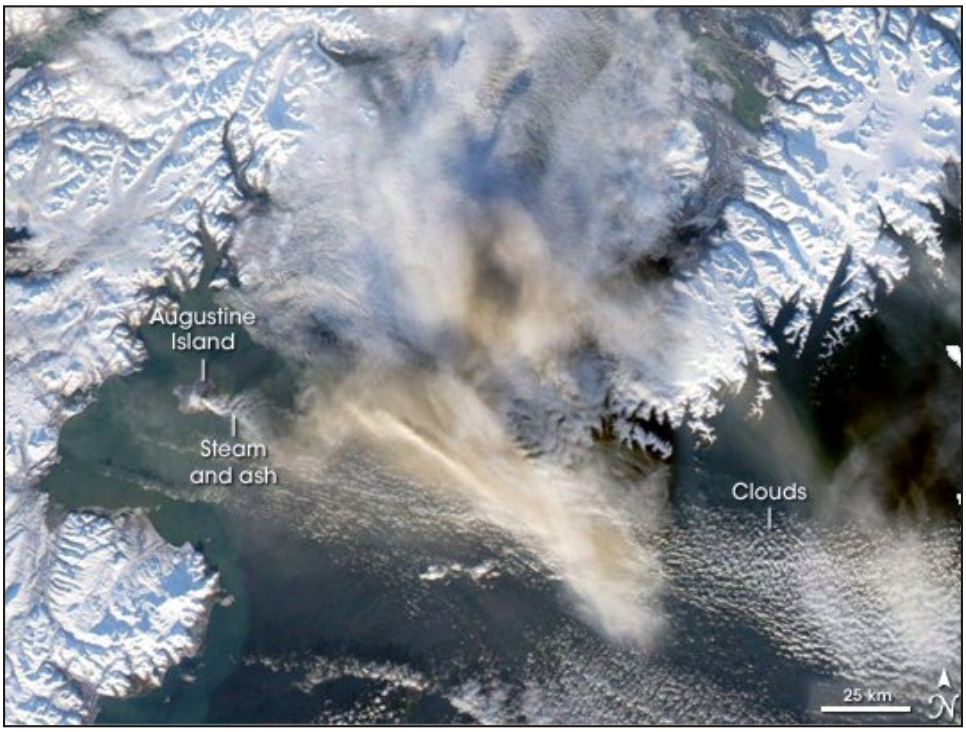


Figure 6. The Moderate Resolution Imaging Spectroradiometer (MODIS) flying onboard the Aqua satellite captured this image of an Augustine plume on 13 January 2006. Within a few ten's of kilometers of Augustine, a narrow steam and ash plume streams out and heads E over the ocean. Much broader zones of ash cloud dominate the middle of the image for over 100 km, both as an elongate zone to the ESE and more widely in a dispersed zone covering areas to the E and NE. In the colored image the ash clouds in the middle part of the image appear brown and white, and may well represent Augustine products in the atmosphere. NASA image created by Jesse Allen, Earth Observatory, using data obtained from the Goddard Earth Sciences DAAC (Distributed Active Archive Center).

After the eruption at 0758 on 17 January, seismicity diminished significantly and AVO lowered the color code from Red to Orange late on 18 January. By the morning of 19 January seismicity remained fixed at lower levels; it decreased further on 20 January but still stood above background. Periods of quiescence and low seismicity in the intervals between eruptive events are not unusual at Augustine, having occurred during the 1976 and 1986 eruptive episodes. By 25 January seismic activity at Augustine remained low but above background levels. During 23-26 January, satellite observations

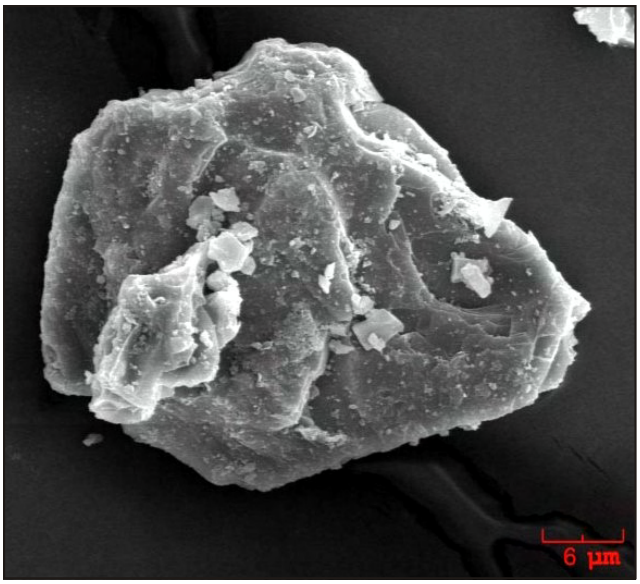


Figure 7. SEM image of an ash particle erupted by Augustine on 13 January 2006. This is an individual plagioclase crystal. The ash sample was collected in Homer by John Paskievitch of AVO. Image courtesy of Pavel Izbekov, the University of Alaska Fairbanks, Geophysical Institute and the AVO.

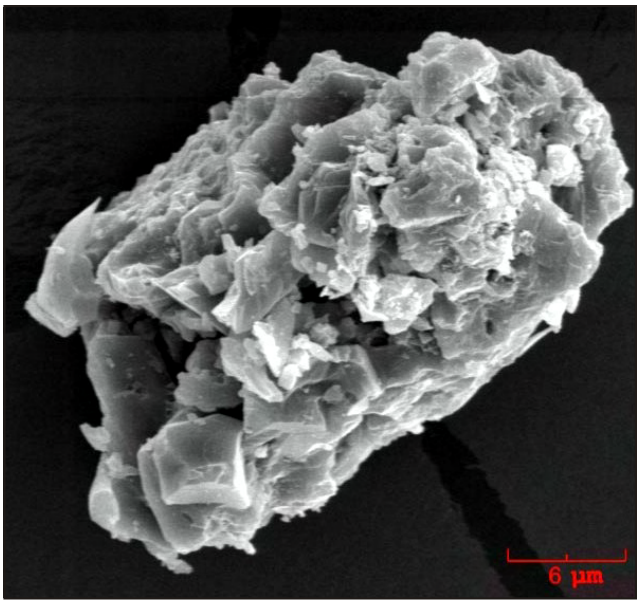


Figure 8. SEM image of an irregularly shaped ash particle erupted by Augustine on 13 January 2006. The ash sample was collected during the ashfall in Homer, Alaska by John Paskievitch, AVO. Image courtesy of Pavel Izbekov, the University of Alaska Fairbanks, Geophysical Institute and the AVO.

indicated the persistence of faint thermal anomalies. On 26 January steaming continued at the summit (figure 9).

Background. Augustine volcano, rising above Kamishak Bay in the southern Cook Inlet about 290 km SW of Anchorage, is the most active volcano of the eastern Aleutian arc. It consists of a complex of overlapping summit lava domes surrounded by an apron of volcaniclastic debris that descends to the sea on all sides. Few lava flows are exposed; the flanks consist mainly of debris-avalanche and pyroclastic-flow deposits formed by repeated collapse and regrowth of the volcano's summit. The latest episode of edifice collapse occurred during Augustine's largest historical eruption in 1883; subsequent dome growth has restored the volcano to a height comparable to that prior to 1883. The oldest dated volcanic rocks on Augustine are more than 40,000 years old. At least 11 large debris avalanches have reached the sea during the past 1,800-2,000 years, and five major pumiceous tephras have been erupted during this interval. Historical eruptions have typically consisted of explosive activity with emplacement of pumiceous pyroclastic-flow deposits followed by lava dome extrusion with associated block-and-ash flows.

Information Contacts: *Alaska Volcano Observatory (AVO)*, a cooperative program of the *U.S. Geological Survey*, 4200 University Drive, Anchorage, AK 99508-4667, USA (URL: http://www.avo.alaska.edu/), *Geophysical Institute*, University of Alaska, P.O. Box 757320, Fairbanks, AK 99775-7320, USA, and *Alaska Division of Geological & Geophysical Survey*s, 794 University Ave., Suite 200, Fairbanks, AK 99709, USA; Jesse Allen, NASA Earth Observatory, *Pavel E. Izbekov*, Geophysical Institute, University of Alaska Fairbanks, 903 Koyukuk Drive, P.O. Box 757320 Fairbanks, AK 99775-7320 USA (Email: pavel@gi.alaska.edu); *Anchorage VAAC*, Alaska Aviation Weather Unit, 6930 Sand Lake Road, Anchorage, AK 99502-1845,USA, (URL: http://pafc.arh.noaa.gov/).

Figure 9. Augustine as seen from the NE on 24 January 2006 when a steam-and-gas plume drifted SSE. Image courtesy of M.L. Coombs and AVO/ USGS.

St. Helens

Washington, USA
46.20°N, 122.18°W; summit elev. 2,549 m
All times are local (= UTC - 8 hours)

Throughout the period covered by this report, August 2005 to December 2005, growth of the lava dome inside the crater of Mount St. Helens continued, accompanied by low rates of seismicity, low emissions of steam and volcanic gases, and minor production of ash. This report came from those posted on the website of the Cascade Volcano Observatory (CVO, part of the U.S. Geological Survey). The hazard status remained at Volcano Advisory (Alert Level 2); aviation color code Orange. During the month of August 2005, growth of the lava dome produced rockfalls, resulting in ash plumes that occasionally rose above the rim (figure 10). A rockfall on 21 August at 2056 generated a bright glow of hot rock and a thick ash plume. The induced atmospheric conditions temporarily affected radio transmissions from instruments in the crater.

Figure 10. Before and after views of a rockfall that removed the upper portions of a spiny ridge on the growing St. Helens dome. View as seen from remote camera on the SW crater rim. Both photos were taken on 21 August 2005. Courtesy of USGS Cascades Volcano Observatory.

A digital elevation model of the active lava dome, which was created from aerial photographs taken on 10 August, showed that the volume had grown to 62 million cubic meters with the average growth during late July and early August at about 2 million cubic meters per second.

During 31 August-6 September 2005, the new lava dome inside the crater of St. Helens continued to grow, accompanied by low rates of seismicity, low emissions of steam and volcanic gases, and minor production of ash. Images of the crater showed continued westward motion of the new lava dome.

On 6 September 2005, dry conditions and rockfalls from the lava dome generated occasional ash plumes that rose above the volcano and rapidly dissipated. During the week of 7-13 September 2005, growth of the lava dome continued and photos showed continued slumping of the central part of the dome and W motion of the presently active area. This movement continued throughout September 2005 and is illustrated in a time-series of images showing the active NW portion of the new lava dome as it continued to move W, butting into the W arm of a glacier, spawning rockfalls. This time-series of images is available on the CVO website.

During 28 September-4 October 2005, growth of the new lava dome inside the crater continued to grow, accompanied by low rates of seismicity, low emissions of steam and volcanic gases, and minor production of ash. Reanalysis of late September time-series photographs of the active part of the new lava dome indicated that points on the dome then moved NW and upward at about 5.5 m per day as extrusion continued.

Images taken on 10 of October showed that the pattern of dome growth established during the previous few months continued. The actively growing portion of the dome moved NW; pushing the W arm of the glacier against the W crater wall, causing the glacier to narrow, thicken, and become increasingly fractured. From the end of October to 21 November there were no significant changes in seismicity or edifice deformation.

Figure 11. Linear feature developed at St. Helens on the Spring/Summer 2005 spine. Photo taken on 18 October 2005. Courtesy of USGS CVO.

During the previous few weeks, a prominent linear feature developed on the disintegrating "whaleback" that grew during the previous spring and summer and was currently located E of the actively growing part of the new lava dome (figure 11).

On 22 of November two notable rockfalls occurred at 1200 and shortly after 1500. Both produced dilute ash clouds that rose a few hundred meters above the crater rim, which are common during lava-dome growth (figure 12).

The well-established pattern of tiny "drumbeat" earthquakes continued at a rate of one every 1-2 minutes; other monitoring data remained in typical ranges. Despite the continuing procession of earthquakes, the overall seismic energy release was very low compared to that during early phases of the eruption. Small rockfalls continued from the growing lava dome, with larger ones producing ash plumes that were visible above the crater rim.

The volume of the lava dome measured on 24 October was 70 million cubic meters–about 90% of the volume of the 1980-1986 dome. Repeat images taken on 15 December from fixed cameras within the crater and at the crater rim showed the seventh lava spine to emerge during the current activity. It continued to push upward and SW from a source just S of the 1980-186 dome (figure 13).

During 21-27 December 2005, seismicity was marked by the repetitive small earthquakes, occurring every 2-3 minutes, that have come to characterize the past 15 months. Tiltmeters within 500 m of the new lava dome showed minute ground deformation; whereas the volcano's flanks were quiet. At the end of December 2005, St. Helens remained at Volcano Advisory (Alert Level 2); aviation color code Orange.

Table 1 gives a summary of the growth of the dome since October 2004. It was reported on 26 January 2006 that initial analysis of recent photographs from fixed cameras in the crater showed that the top of the currently active part of the new lava dome is at ~ 2,240 m elevation, which is about 90 m higher than it was in early November 2005. On several occasions during the eruption, parts of the dome have been considerably higher, for instance 2,365 m in July 2005. Those high points have since been lowered by disintegration, but still are higher than the top of the currently active part.

Figure 12. Two photos of dense local plumes created as a result rockfalls from St. Helens' dome on 22 November 2005. The photo on the top was taken from the NE; the photo on the bottom was taken from the NW. Courtesy of USGS CVO.

Figure 13. St. Helens' recent dome complex as seen from the NW. Four different stages of growth are visible in this image. They were given these sequence numbers: 4, 5, 6, and 7 (the latter for the one currently extruding). All occurred as whalebacks or spines in 2005. Photo was taken 8 December 2005 by Willie Scott. Courtesy of USGS CVO.

Background. Prior to 1980, Mount St. Helens formed a conical, youthful volcano sometimes known as the Fuji-san of America. During the 1980 eruption the upper 400 m of the summit was removed by slope failure, leaving a 2 x 3.5 km horseshoe-shaped crater now partially filled by a lava dome. Mount St. Helens was formed during nine eruptive periods beginning about 40-50,000 years ago and has been the most active volcano in the Cascade Range during the Holocene. Prior to 2200 years ago, tephra, lava domes, and pyroclastic flows were erupted, forming the older

Date	Volume (10^6 m^3)	Elevation of dome top (m)
04 Oct 2004	5	—
13 Oct 2004	12	—
04 Nov 2004	20	—
01 Feb 2005	—	2,332
21 Feb 2005	—	2,341
10 Mar 2005	58	2,339
12 Apr 2005	47.5*	—
15 Jun 2005	54	—
Jul 2005	58	2,365
10 Aug 2005	62	—
24 Oct 2005	70	—
Early Nov 2005	—	2,150
26 Jan 2006	—	2,240

Table 1. St. Helens dome summit elevations and volumes compiled at a series of times during October 2004-January 2006. The dome summit elevations have decreased due to repeated failure of the unstable blocks, spires, and protrusions along the dome summits. Also, the method of assessing dome volumes changed in April 2005 (indicated by the asterisk). Courtesy USGS Cascades Volcano Observatory.

St. Helens edifice, but few lava flows extended beyond the base of the volcano. The modern edifice was constructed during the last 2200 years, when the volcano produced basaltic as well as andesitic and dacitic products from summit and flank vents. Historical eruptions in the 19th century originated from the Goat Rocks area on the north flank, and were witnessed by early settlers.

Information Contacts: *Cascades Volcano Observatory* (CVO), U.S. Geological Survey, 1300 SE Cardinal Court, Building 10, Suite 100, Vancouver, WA 98683-9589, USA (URL: http://vulcan.wr.usgs.gov/, Email: GSCVOWEB@usgs.gov).

South Sister

Oregon, USA
44.10°N, 121.77°W; summit elev. 3,157 m
All times are local (= UTC - 8 hours)

According to the U.S. Geological Survey, field surveys indicated that the uplift of the broad area in the Three Sisters region of central Oregon, gradually swelling since late 1997 (*BGVN* 26:05), continued as of 14 December 2005. However, the swelling may have slowed somewhat during the past year.

The area of uplift is 20 km in diameter and is centered 5 km W of South Sister volcano. The middle of the uplift rose at an average rate of 2.5 cm per year as a result of intrusion of a modest volume of magma 7 km below the ground surface. Seismic activity related to the uplift has been scant, except for a swarm of more than 300 small earthquakes in late March 2004 (*BGVN* 29:06). Volcanic gases released from the intruding magma dissolve in ground water so water in local springs and streams is slightly enriched in chemical components derived from volcanic gases. Scientists believe that periods of intrusion similar to the present one have occurred in the area before. The duration and outcome of the current episode are considered to be impossible to forecast, and only continued monitoring will show whether or not this episode of intrusion is slowly ending.

Investigations during 2005 showed the following. (1) Earthquakes continued at a low rate—only five were located in the uplift area in 2005; these were small, up to M1.5. (2) The chemical composition of local spring and stream water remained unchanged from that of the past 5 years. (3) Uplift of the ground surface continued, but seems to have slowed from the rate observed in past years. The three techniques used to measure ground deformation, all having a degree of uncertainty, together suggest that the rate decreased in 2004-2005, perhaps by as much as one half. If so, the rate of intrusion of magma has declined as well.

Background. South Sister is the highest and youngest of the Three Sisters volcanoes that dominate the landscape of the central Oregon Cascades. The main edifice of South Sister is constructed of andesitic and dacitic lava flows capped by a symmetrical summit cinder cone of probable latest-Pleistocene age. The late Pleistocene or early Holocene Cayuse Crater on the SW flank of Broken Top volcano and other flank vents such as Le Conte Crater on the SW flank of South Sister mark mafic vents that have erupted at considerable distances from South Sister itself. Late-Holocene eruptions formed a chain of dike-fed rhyodacitic lava domes and flows on the volcano's SE-to-SW flanks about 2000 years ago. Satellite radar interferometry (InSAR) data obtained by U S Geological Survey scientists detected continuing long-term slight uplift of the ground surface over a broad region centered 5 km west of South Sister volcano that began in 1997.

Information Contacts: *Cascades Volcano Observatory* (CVO), U.S. Geological Survey, 1300 SE Cardinal Court, Building 10, Suite 100, Vancouver, WA 98683-9589, USA (URL: http://vulcan.wr.usgs.gov/, Email: GSCVOWEB@usgs.gov).

Soufrière Hills

West Indies
16.72°N, 62.18°W; summit elev. 915 m
All times are local (= UTC - 4 hours)

Activity at Soufriere Hills continues to remain elevated during the latter half of 2005 (table 2). Since 5 September slow lava dome growth continued. During the week of 30 September through 7 October dome growth increased on the western side. On 26 October a pyroclastic flow with a runout of 2 km was reported around 2400. The pyroclasitic flow was confined to the Tar River Valley.

On 4 November dome growth on the southern flank was observed. The following week, reports yielded growth on the E, S, and SE flanks. Radar imaging of the dome indicated a dome volume of about 6.5 million cubic meters, suggesting a growth rate over the past two weeks of between 1.3 and 1.8 cubic meters per second with incandescence visible at night. Observations on the morning of 18 November indicated the dome continued to grow and spilled rockfalls to the E, S, W, and N. A pyroclastic flow was observed in the Tar River valley on 15 November and reached to within 1km of the sea. The ash cloud associated with this event rose to ~ 2.1 km.

Report Date (2005)	Number of earthquakes		
	Hybrid	Volcano-tectonic	Long-period
26 Aug-02 Sep	10	3	9
02 Sep-09 Sep	5	6	—
09 Sep-16 Sep	13	70	5
16 Sep-23 Sep	3	6	5
23 Sep-30 Sep	—	42	3
30 Sep-07 Oct	—	50	2
07 Oct-14 Oct	—	183	—
14 Oct-21 Oct	1	359	15
21 Oct-28 Oct	—	53	2
28 Oct-04 Nov	—	19	2
04 Nov-11 Nov	2	14	6
11 Nov-18 Nov	—	3	8
18 Nov-25 Nov	7	21	176
25 Nov-02 Dec	2	1	93
09 Dec-16 Dec	—	—	31
16 Dec-23 Dec	2	1	40
23 Dec-30 Dec	19	9	63

Table 2. Soufriere Hills seismicity during 26 August to 30 December 2005. Courtesy of MVO.

Figure 14. A photo showing a Soufriere Hills pyroclastic flow as seen from the NE on 22 November 2005. Photo courtesy of MVO.

Figure 15. A photo showing a Soufriere Hills ash cloud as seen from the SE on 24 November 2005. Photo courtesy of MVO.

A pyroclastic flow was observed in the upper reaches of the Tar River valley on 22 November (figure 14). Minor venting of ash occurred, with one event taking place on the afternoon of 24 November, which produced an ash cloud that rose ~ 1 km above the summit (figure 15).

During the month of December, dome growth continued on all flanks although more intense on the S and E flanks. More rockfalls and smaller pyroclastic flows have been reported with incandescence observed at night along the SE and E flanks.

Background. The complex dominantly andesitic Soufrière Hills volcano occupies the southern half of the island of Montserrat. The summit area consists primarily of a series of lava domes emplaced along an ESE-trending zone. English's Crater, a 1-km-wide crater breached widely to the east, was formed during an eruption about 4,000 years ago in which the summit collapsed, producing a large submarine debris avalanche. Block-and-ash flow and surge deposits associated with dome growth predominate in flank deposits at Soufrière Hills. Non-eruptive seismic swarms occurred at 30-year intervals in the 20th century, but with the exception of a 17th-century eruption that produced the Castle Peak lava dome, no historical eruptions were recorded on Montserrat until 1995. Long-term small-to-moderate ash eruptions beginning in that year were later accompanied by lava-dome growth and pyroclastic flows that forced evacuation of the southern half of the island and ultimately destroyed the capital city of Plymouth, causing major social and economic disruption.

Information Contacts: *Monserrat Volcano Observatory* (MVO), Fleming, Montserrat, West Indies (URL: http://www.mvo.ms/).

Popocatépetl

México
19.023°N, 98.622°W; summit elev. 5,426 m
All times are local (= UTC - 6 hours)

The last report on Popocatépetl covered the period December 2004-January 2005 (*BGVN* 30:01). This report covers the rest of 2005 (February-December) and comes from the Mexican group Centro Nacional de Prevención de Desastres (CENAPRED).

The volcano has been relatively quiet with daily, low-intensity exhalations of steam and gas sometimes containing minor ash. Some highlights of the reporting interval follow (both in text and in tables), essentially a list of ash-bearing eruptions that usually rose 1-3 km above the crater rim. On 1 December an ash plume rose 5 km.

At 0723 on 13 July an exhalation of moderate intensity produced an ash emission that reached 2 km above the level

Date (2005)	Local Time	Height of ash column (km)	Ash plume blown	Comments
30 Mar	0521	1.5	NE	—
12 May	1048	1.8	—	—
13 Jul	0723	2	—	Ash falls reported in Yecapixtla and Ocuituco in the State of Morales.
14 Jul	1005	2	—	Followed a high-frequency tremor
29 Jul	0313	2	—	See text
29 Jul	0614	2.5	NW	See text
30 Jul	0819	2	NW	The emission continued in its most intense phase until 0845.
02 Aug	1247	2	—	—
24 Oct	0305	1.2	—	Followed a high-frequency tremor.
01 Dec	0653	5	ENE	See text.
04 Dec	1653	—	—	Ash falls reported in the States of Tlaxcala and Puebla.
13 Dec	2225	2.5	SE	See text.
18 Dec	0457	2.5	NE	The 1-minute explosion was followed by 8 minutes of high-frequency tremor.
25 Dec	0447	3	ENE	See text.

Table 3. Discharges at Popocatépetl during February-December 2005. Courtesy of CENAPRED.

of the crater. Reports were received of ash fall in Yecapixtla and Ocuituco in the state of Morelos, respectively ~ 30 and ~ 23 km SW of the volcano.

At 0906 on 21 July an exhalation of moderate intensity followed a tremor of high frequency and produced an ash emission that reached 2 km.

At 0313 on 29 July, a moderate exhalation with an explosive component occurred, throwing incandescent fragments onto the E side of the cone, out to a distance of about 1 km. The duration of the intense phase was ~ 1 minute; it was preceded by high-frequency tremor, the same signal was observed for 15 minutes after the explosion. The height of the steam, gas, and ash plume was estimated at 2 km. There were no reports mentioning ash fall.

At 0614 on 29 July a new exhalation with explosive component occurred producing an ash column ~ 2.5 km above the crater. The winds directed the plume NW. The duration of the intense phase was 30 seconds followed by high-frequency tremor (4 minutes). Reports of ashfall in the Milpa Alta area (SE of Mexico City) were received.

At 0819 on 30 July high-frequency tremor started, associated with an ash column. The plume reached 2 km and was directed NW. The emission continued in its most intense phase until 0845. On 2 August at 1247 an exhalation of moderate intensity produced an ash emission that reached 2 km.

At 0305 on 24 October an exhalation of moderate intensity occurred. It was followed by a tremor of high-frequency. The resulting ash plume reached 1.2 km and traveled NE.

At 0653 on 1 December a moderate exhalation sent an ash column to a height of 5 km above the summit, the highest reported ash column in 2005. It was dispersed towards the ENE. The intense episode lasted 2 minutes and was followed by high-frequency tremor lasting 30 minutes. A small ash fall was reported in Amecameca and a warning was issued noting that minor ash fall could occur within the next few hours in Tlaxcala and Puebla states. At 0920 another, smaller eruption produced an ash column 2.5 km above the crater, which also blew ENE.

An eruption that occurred at 1653 on 4 December resulted in reports of ash fall in the states of Tlaxcala and Puebla.

At 2225 on 13 December an explosion at Popocatépetl ejected incandescent fragments over its SE flanks. The explosion lasted ~ 1 minute and was followed by 30 minutes of tremor. The explosion produced a 2.5 km ash column carried by winds to the SE. After the explosion, the volcano returned to its previous low level of activity.

At 0457 on 18 December a small explosion was detected at the Popocatépetl. This event produced an ash column that reached 2.5 km over the summit. The plume traveled towards the NE. The explosion lasted ~ 1 minute and was followed by 8 minutes of high-frequency tremor.

At 0447 on 25 December a moderate exhalation with a minor explosive component occurred. Some incandescent fragments fell on the E side of the cone extending 700 m from the crater edge. The accompanying ash column reached a height of about 3 km moving ENE. The total duration of seismicity associated with this event was nearly 3 minutes, of which 50 seconds corresponded to the intense phase. There were no reports of resulting ash fall.

All of the reported ash-producing events for the February-December 2005 reporting interval are listed in table 3. Table 4 contains the reported earthquakes.

Background. Volcán Popocatépetl, whose name is the Aztec word for smoking mountain, towers to 5426 m 70 km SE of Mexico City to form North America's 2nd-highest volcano. The glacier-clad stratovolcano contains a steep-walled, 250-450 m deep crater. The generally symmetrical volcano is modified by the sharp-peaked Ventorrillo on the NW, a remnant of an earlier volcano. At least three previous major cones were destroyed by gravitational failure during the Pleistocene, producing massive debris-avalanche deposits covering broad areas south of the volcano. The modern volcano was constructed to the south of the late-Pleistocene to Holocene El Fraile cone. Three major plinian eruptions, the most recent of which took place about 800 AD, have occurred from Popocatépetl since the mid Holocene, accompanied by pyroclastic flows and voluminous lahars that swept basins below the volcano. Frequent historical eruptions, first recorded in Aztec codices, have occurred since pre-Columbian time.

Information Contacts: *Centro Nacional de Prevención de Desastres (CENAPRED)*, Av. Delfín Madrigal No.665. Coyoacan, México D.F. 04360, México. Email: amb@cenapred.unam.mx gvazquez@cenapred.unam.mx; URL: http://www.cenapred.unam.mx/).

Date	Time (Local)	Magnitude	Depth (km)	Distance (km)	Direction
09 Feb	0715	2.2	3.7	—	SE
18 Feb	0624	2.2	3.0	8	SE
18 Feb	1248	2.7	9.0	8.5	SE
18 Feb	1607	2.5	9.0	8.5	SE
19 Feb	0056	2.4	4.0	2	E
24 Feb	2003	2.1	3.8	7.5	SE
14 Mar	1103	2.7	4.0	8	SE
22 Mar	—	2.5	6.8	8	SE
24 Mar	—	2.7	—	—	—
24 Mar	—	2.7	—	—	—
02 Apr	0112	2.6	6.5	4	SW
03 Apr	0721	2.2	4.4	1	E
05 May	—	2.4	—	—	—
14 May	2146	2.1	—	8	SE
15-16 May	2144-0648	4 events 2.0-2.6	5-10	—	SE
16 May	1433	2.5	5.8	1	N
16 May	2318	2.4	5.0	8	SE
17 May	0511	2.3	4.9	8	SE
20 May	0231	2.6	4.8	8	SE
29 May	1039	2.2	2.5	8	SE
01 Jun	1446	2.0	5.4	—	—
13 Jun	—	2.1	4.7	—	—
13 Jun	—	2.2	3.7	—	—
16 Jun	—	2.1	5.5	8	SE
20 Jun	1023	2.0	4.6	0.5	NW
20 Jun	1251	2.0	5.0	Below	—
25 Jun	0640	2.7	5.0	Below	—
29 Jun	0133	2.9	8.7	2.5	SW
29 Jun	0142	2.2	6.0	8	SE
07 Jul	0009	2.6	5.9	Below	—
12 Jul	1645	2.0	—	8	SE
19 Jul	1921	2.4	4.6	Below	—
02 Aug	2319	2.5	5.4	3	NW
05 Aug	2153	2.2	5.3	7	SE
14 Aug	1516	2.6	6.5	8	SE
17 Aug	1118	2.5	—	8	SE
29 Aug	0055	2.3	—	2	NW
29 Aug	0238	2.7	—	Below	—
15 Sep	0325	2.3	8.0	8	SE
17 Sep	0430	2.1	5.5	Below	—
18 Sep	1757	2.1	5.2	Below	—
19 Sep	0443	1.9	3.5	8	SE
19 Sep	2333	2.1	5.2	2	SE
21 Sep	1738	2.0	4.0	Below	—
11 Oct	1004	2.2	4.4	1	E
12 Oct	1946	2.3	5.3	2	N
14 Oct	1416	2.2	6.0	2	N
24 Oct	2152	2.7	3.0	2	E
26 Oct	1537	2.3	4.2	Below	—
29 Oct	0336	2.0	—	8	SE
09 Nov	0052	2.7	6	1.5	W
09 Nov	0235	2.4	6	1.5	W
09 Nov	0612	2.1	5	Below	—
11 Nov	—	2.5	6	1.5	W
12 Nov	—	2.7	—	—	—
23 Nov	1713	1.6	5.7	2	NE
24 Nov	0242	2.0	5.4	2	NE
25 Nov	—	2.0	3.8	8	SE
01 Dec	—	2.3	4.8	Below	—
01 Dec	—	2.1	4.5	Below	—
05 Dec	1838	2.4	3.8	1	SE
06 Dec	1800	2.0	3.6	Below	—
08 Dec	0824	1.9	4.3	5.5	S
08 Dec	0907	1.9	5.0	5.5	S

Table 4. Earthquakes at Popocatépetl during February-December 2005. “Below” refers to earthquakes below or in the edifice. Courtesy of CENAPRED.

Lopevi

Vanuatu
16.507°S, 168.346°E; summit elev. 1,413 m
All times are local (= UTC + 11 hours)

As noted by the Wellington Volcanic Ash Advisory Center (24 and 25 January 2006), pilots reported a vertical plume rising from Lopevi at 0845 hours on 24 January 2006 to an altitude of 2.1-2.4 km and drifting to the S. At 0845 the next day, 25 January, the plume extended SE and was reportedly at 2.7 km.

MODIS satellite data also detected thermal anomalies around this time (0055 and 1020 hours on 24 January), preceded by an absence of measured anomalies for ~ 9 days (since 2240 hours on 15 January). Satellite thermal anomalies are often detected over this volcano.

Background. The small 7-km-wide conical island of Lopevi is one of Vanuatu's most active volcanoes. A small summit crater containing a cinder cone is breached to the NW and tops an older cone that is rimmed by the remnant of a larger crater. The basaltic-to-andesitic volcano has been active during historical time at both summit and flank vents, primarily along a NW-SE-trending fissure that cuts across the island, producing moderate explosive eruptions and lava flows that reached the coast. Historical eruptions at the 1,413-m-high volcano date back to the mid-19th century. The island was evacuated following eruptions in 1939 and 1960. The latter eruption, from a NW-flank fissure vent, produced a pyroclastic flow that swept to the sea and a lava flow that formed a new peninsula on the western coast.

Information Contacts: *Rob Wright*, *Luke Flynn*, and *Eric Pilger*, Hawai'i Institute of Geophysics and Planetology, University of Hawaii and Manoa, 168 East-West Road, Post 602, Honolulu, HI 96822 (wright@higp.hawaii.edu, flynn@higp.hawaii.edu, pilger@higp.hawaii.edu; URL: http://modis.higp.hawaii.edu/); *Wellington Volcanic Ash Advisory Center (VAAC),* MetService, PO Box 722, Wellington, New Zealand (URL: http://www.metservice.co.nz/).

Aoba

Ambae Island, Vanuatu
167.83°E, 15.40°S; summit elev. 1,496 m
All times are local (= UTC + 11 hours)

As previously reported (*BGVN* 30:11), a new eruption of Aoba began on 27 November 2005 when vapor plumes and ash columns were observed originating from Lake Voui, a crater lake at the summit. Activity continued into early January, building a large cinder cone in the west-central part of Lake Voui (figure 16). The new cone also contained its own crater lake.

An image taken by ASTER's visible, near infra-red (VNIR) telescope on 24 December 2005 (UTC) showed the two larger caldera lakes, and steam escaping from an island in the center of Lake Voui (figure 17). The VNIR telescope has a resolution of ~ 15 m and operates in the spectral range 0.52-0.86 μm.

During September through December 2005, infrared satellite data provided by Moderate Resolution Imaging Spectroradiometer (MODIS) and processed by the MODVOLC Hot-Spot algorithm at the Hawaii Institute of Geophysics and Planetology (HIGP) only observed a single-pixel thermal anomaly. It occurred at 0110 local time on 26 November 2005 (the image was acquired at 1410 UTC on 25 November 2005). That was 1 day prior to reports of the eruption from ground-based observers, although the ground-based reports could easily have been delayed so it is not clear that the MODVOLC thermal anomaly was actually prior to ground based observations.

Matt Patrick noted that the anomaly is nicely centered in the caldera and is almost certainly volcanic – no other anomalies occurred on the island in the previous 5 years.

Background. Aoba is a massive 2,500 km^3 basaltic shield volcano that is the most voluminous volcano of the New Hebrides archipelago. A pronounced NE-SW-trending rift zone dotted with scoria cones gives the 16 x 38 km island an elongated form. A broad pyroclastic cone containing three crater lakes is located at the summit of the Hawaiian-style

Figure 16. A N-looking view of Aoba's Lake Voui taken 9 January 2006. The new island is composed of a cinder cone and the cone's crater appears to host a new, steaming internal lake. This photograph was taken from a fixed-wing aircraft by Job Eassau during his trip to Pentecote Island. Courtesy of Esline Garaebiti, Department of Geology, Mines and Water Resources, Port Vila, Vanuatu.

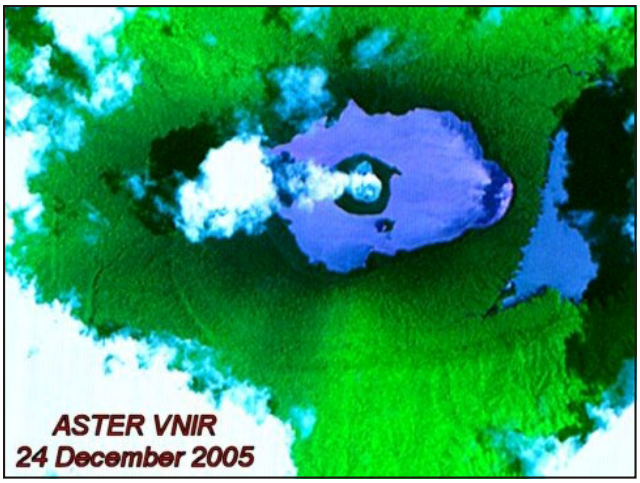


Figure 17. ASTER VNIR image of Aoba taken at the stated UTC time and date (N is upwards), as it continued to emit a vapor plume from Lake Voui. The 27 November 2005 eruption built a substantial new island (dark area venting steam in the center of lake Voui). This island is almost circular in shape with a mean diameter of 525 m. Lake Manaro Lakua sits in the E caldera and is partly obscured by cloud or shadow. Courtesy of NASA and Alain Bernard (IAVCEI Commission on Volcanic Lakes and Université Libre de Bruxelles).

shield volcano within the youngest of at least two nested calderas, the largest of which is 6 km in diameter. Post-caldera explosive eruptions formed the summit craters of Lake Voui (also spelled Vui) and Lake Manaro Ngoru about 360 years ago. A tuff cone was constructed within Lake Voui about 60 years later. The latest known flank eruption, about 300 years ago, destroyed the population of the Nduindui area near the western coast.

Information Contact: *Alain Bernard*, IAVCEI Commission on Volcanic Lakes, Université Libre de Bruxelles, Brussels, Belgium (URL: http://www.ulb.ac.be/sciences/cvl/aoba/Ambae1.html); *NASA Earth Observatory* (URL: http://earthobservatory.nasa.gov/); *Esline Garaebiti*, Department of Geology, Mines and Water Resources, Port Vila, Vanuatu; *Matt Patrick*, University of Hawaii, Hawaii Institute of Geophysics and Planetology (HIGP) Thermal Alerts Team, 2525 Correa Road, Honolulu, HI 96822 (URL: http://www.modis.higp.hawaii.edu, Email: patrick@higp.hawaii.edu).

Tangkubanparahu

Western Java, Indonesia
6.77°S, 107.60°E; summit elev. 2,084 m

Typically quiet, Tangkubanparahu went into a period of unrest from 12 to 19 April 2005. After that, it became relatively quiet again. The reports during this period did not in general cover an entire day, but rather only 6 or 12 hours. The reports chiefly discussed a seismic crisis and elevated SO_2 fluxes. A brief review for this period follows.

Seismic activity increased dramatically beginning on 12 April 2005. Normally about two volcanic eruptions occurred daily. Volcanic earthquakes recorded on 12 April consisted of five deep (type-A events with peak-to-peak amplitudes of 7-24 mm) and 56 shallow (type-B events with peak-to-peak amplitudes of 3-10 mm), with numbers increasing throughout the day. About 8 hours of tremor on 13 April, a swarm of earthquakes took place, of which 111 were deep type-A events and 181 were shallow type-B events. The peak of the activity occurred on 14 April, when the deep events numbered 108 and the shallow events numbered 327. A located hypocenter was 1.6-1.9 km beneath the Domas crater.

Based on the above seismic data, the hazard status for the volcano was raised on 13 April 2005 at 0825 to Level 2, and then at 1300 to Level 3.

The SO_2 measurement around Domas crater yielded about 10 metric tons/day (t/d) on 14 April. It was less than 2 t/d on 18 April.

The hazard status of the volcano was downgraded to Level 2 on 19 April 2005 at 1200, and the area was re-opened to the public. The other craters (Upas, Domas, Baru, Jarian) remained closed to the public.

Background. Tangkubanparahu (also known as Tangkuban Perahu) is a broad shield-like stratovolcano overlooking Indonesia's former capital city of Bandung that was constructed within the 6 x 8 km Pleistocene Sunda caldera. The volcano's low profile is the subject of legends referring to the mountain of the "upturned boat." The age the caldera-forming eruption exceeds the >40,000 year range of radiocarbon dating (Newhall and Dzurisin, 1988). The rim of Sunda caldera forms a prominent ridge on the western side; elsewhere the caldera rim is largely buried by deposits of Tangkubanparahu volcano. The dominantly small phreatic historical eruptions recorded since the 19th century have originated from several nested craters within an elliptical 1 x 1.5 km summit depression.

Information Contact: *Directorate of Volcanology and Geological Hazard Mitigation (DVGHM)*, Jalan Diponegoro 57, Bandung 40122, Indonesia (Email: dali@vsi.esdm.go.id; URL: http://www.vsi.esdm.go.id/).

Elgon

Kenya and Uganda (East African rift)
1.133°N, 34.550°E; summit elev. 4,321 m.

An eruption at Mount Elgon was mistakenly inferred when fumes escaped from this otherwise quiet volcano. The fumes were eventually traced to dung burning in a lava-tube cave. The cave is home to, or visited by, wildlife ranging from bats to elephants. Mt. Elgon (Ol Doinyo Ilgoon) is a stratovolcano on the SW margin of a 13 x 16 km caldera that straddles the Uganda-Kenya border 140 km NE of the N shore of Lake Victoria. No eruptions are known in the historical record or in the Holocene.

On 7 September 2004 the web site of the Kenyan newspaper *The Daily Nation* reported that villagers sighted and smelled noxious fumes from a cave on the flank of Mt. Elgon during August 2005. The villagers' concerns were taken quite seriously by both nations, to the extent that evacuation of nearby villages was considered.

The Daily Nation article added that shortly after the villagers' reports, Moses Masibo, Kenya's Western Province geology officer visited the cave, confirmed the villagers observations, and added that the temperature in the cave was 170°C. He recommended that nearby villagers move to safer locations. Masibo and Silas Simiyu of KenGens geo-

thermal department collected ashes from the cave for testing.

Gerald Ernst reported on 19 September 2004 that he spoke with two local geologists involved with the Elgon crisis from the Geology Department of the University of Nairobi (Jiromo campus): Professor Nyambok and Zacharia Kuria (the former is a senior scientist who was unable to go in the field; the latter is a junior scientist who visited the site). According to Ernst their interpretation is that somebody set fire to bat guano in one of the caves. The fire was intense and probably explains the vigorous fuming, high temperatures, and suffocated animals. The event was also accompanied by emissions of gases with an ammonia odor. Ernst noted that this was not surprising considering the high nitrogen content of guano—ammonia is highly toxic and can also explain the animal deaths. The intense fumes initially caused substantial panic in the area.

It was Ernst's understanding that the authorities ordered evacuations while awaiting a report from local scientists, but that people returned before the report reached the authorities. The fire presumably prompted the response of local authorities who then urged the University geologists to analyze the situation. By the time geologists arrived, the fuming had ceased, or nearly so. The residue left by the fire and other observations led them to conclude that nothing remotely related to a volcanic eruption had occurred.

However, the incident emphasized the problem due to lack of a seismic station to monitor tectonic activity related to a local triple junction associated with the rift valley or volcanic seismicity. In response, one seismic station was moved from S Kenya to the area of Mt. Elgon so that local seismicity can be monitored in the future.

Information Contacts: *Gerald Ernst*, Univ. of Ghent, Krijgslaan 281/S8, B-9000, Belgium (Email: plumeman2000@yahoo.co.uk); *Chris Newhall*, USGS, Univ. of Washington, Dept. of Earth & Space Sciences, Box 351310, Seattle, WA 98195-1310, USA (Email: cnewhall@ess.washington.edu; URL: http://www.ess.washington.edu/); *The Daily Nation* (http://www.nationmedia.com/dailynation/); *Uganda Tourist Board* (URL: http://www.visituganda.com/).

Etna

Italy
37.734°N, 15.004°E; summit elev. 3,350 m

The previous report on Mount Etna (*BGVN* 30:01) described what turned out to be the final activity of the 2004-05 eruption, which ended by March (Burton and others, 2005). From March 2005 until November there was only a low and quiet degassing at the summit craters. Between the end of November and early December 2005 a significant increase in the SO_2 output was accompanied by an increase of volcanic tremor and a minor deformation of the summit part of the volcanic cone.

On 16 December 2005 an explosive sequence was recorded by the INGV-CT seismic network, localized at the summit. This was accompanied by an increase in SO_2 emission, which reached peaks 10 times the background flux levels. On 22 December the increase in gas pressure was accompanied by a dilute emission of juvenile ash from the Bocca Nuova crater. This vent had been blocked since the end of the previous summit eruption. However, the very fine-grained nature of the ash suggested a deep level of the magma column within the conduit.

Reference: Burton, M., Neri, M., Andronico, D., Branca, S., Caltabiano, T., Calvari, S., Corsaro, R.A., Del Carlo, P., Lanzafame, G., Lodato, L., Miraglia, L., Muré, F., Salerno, G., and Spampinato, L., 2005, Etna 2004-05: an archetype for geodynamically-controlled effusive eruptions: Geophysical Research Letters, v. 32, L09303, doi:10.1029/2005GL022527.

Background. Mount Etna, towering above Catania, Sicily's second largest city, has one of the world's longest documented records of historical volcanism, dating back to 1500 BC. Historical lava flows of basaltic composition cover much of the surface of this massive volcano, whose edifice is the highest and most voluminous in Italy. The Mongibello stratovolcano, truncated by several small calderas, was constructed during the late Pleistocene and Holocene over an older shield volcano. The most prominent morphological feature of Etna is the Valle del Bove, a 5 x 10 km horseshoe-shaped caldera open to the east. Two styles of eruptive activity typically occur at Etna. Persistent explosive eruptions, sometimes with minor lava emissions, take place from one or more of the three prominent summit craters, the Central Crater, NE Crater, and SE Crater (the latter formed in 1978). Flank vents, typically with higher effusion rates, are less frequently active and originate from fissures that open progressively downward from near the summit (usually accompanied by strombolian eruptions at the upper end). Cinder cones are commonly constructed over the vents of lower-flank lava flows. Lava flows extend to the foot of the volcano on all sides and have reached the sea over a broad area on the SE flank.

Information Contact: *Sonia Calvari*, Istituto Nazionale di Geofisica e Vulcanologia Sezione di Catania, Piazza Roma 2, 95123 Catania, Italy (Email: calvari@ct.ingv.it, URL: http://www.ct.ingv.it/).