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Editors: Rick Wunderman, Edward Venzke, and Gari Mayberry

Volunteer Staff: Robert Andrews, Jacquelyn Gluck, William Henoch, and Catherine Galley

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: gvp@volcano.si.edu · URL: <http://www.volcano.si.edu/>

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Piton de la Fournaise

Réunion Island, Indian Ocean
21.229°S, 55.713°E; summit elev. 2,631 m
All times are local (= UTC + 4 hours)

Inflation over the last year and a half, monitored by permanent GPS stations, has not been interrupted by six eruptions over this period, the latest during 2-18 May 2004 (*Bulletin* v. 29, no. 5). Increased seismicity and ground deformation reported by the Observatoire Volcanologique du Piton de la Fournaise (OVPDLF) in late June 2004 continued through 9 August when the seismic network recorded 50-70 low-intensity earthquakes. The third eruption of 2004 started on 13 August. Increasing seismicity and fissure opening had occurred since early July 2004. At 0240 in the morning of 13 August, a 25-minute seismic crisis beneath the summit preceded the opening of an ~500-m-long E-W fissure within Dolomieu crater, with the fissure continuing on the E flank to an elevation of 1,900 m. The main activity was located at 2,150 m elevation. A significant lava flow ran down the “Grandes Pentès.”

Ten days after the beginning of the eruption, ~750 m of National Road 2 was overrun, and on 25 August lava from an 8.5-km-long system of lava tubes entered the sea. A 670-m-long, 320-m-wide platform was built up within several days, representing more than 2×10^6 m³ of material. A second smaller platform was built up in the following days by nearby lava flows entering the sea. Two small hornitos, up to 8 m high, formed on the seaside edge of the first platform. The main eruption phase stopped on 2 September. However, significant phreatic activity continued on the new platform and was followed by two minor phases from the main vent on the E flank, the last one stopping at about 0300 on 4 October. Formation of pillow lava was recorded by professional divers for the first time at île de la Réunion, at a water depth of 50 m in front of the new platform.

The Toulouse Volcanic Ash Advisory Center reported noteworthy eruptive activity beginning on 4 September, following the end of the main eruption phase. Ash reportedly fell near the volcano's summit, and a lava flow entering the sea produced a steam and ash plume that rose ~2 km. Emissions ceased on the morning of 7 September.

Background. The massive Piton de la Fournaise basaltic shield volcano on the French island of Réunion in the western Indian Ocean is one of the world's most active volcanoes. Much of its >530,000 year history overlapped with eruptions of the deeply dissected Piton des Neiges shield volcano to the NW. Three calderas formed at about 250,000, 65,000, and less than 5,000 years ago by progressive eastward slumping of the volcano. Numerous pyroclastic cones dot the floor of the calderas and their outer flanks. Most historical eruptions have originated from the summit and flanks of Dolomieu, a 400-m-high lava shield that has grown within the youngest caldera, which is 8 km wide and breached to below sea level on the eastern side. More than 150 eruptions, most of which have produced fluid basaltic lava flows, have occurred since the 17th century. Only six eruptions, in 1708, 1774, 1776, 1800, 1977, and 1986, have originated from fissures on the outer flanks of the caldera. The Piton de la Fournaise Volcano Observatory, one of several operated by the Institut de Physique du Globe de Paris, monitors this volcano.

Information Contacts: Thomas Staudacher, Observatoire Volcanologique du Piton de la Fournaise Institut de Physique du Globe de Paris, 97418 La Plaine des Cafres, La Réunion, France (URL: <http://volcano.ipgp.jussieu.fr:8080/reunion/stationreu2.html>; Email: Thomas.Staudacher@univ-reunion.fr); Toulouse Volcanic Ash Advisory Center (VAAC), Météo-France, 42 Avenue G. Coriolis, 31057 Toulouse Cedex, France (Email: vaac@meteo.fr; URL: <http://www.meteo.fr/aeroweb/info/vaac/homepage/eindex.html>).

Heard

southern Indian Ocean
53.106°S, 73.513°E; summit elev. 2,745 m

Infrared satellite data triggered MODVOLC thermal alerts between 24 May 2000 and 2 February 2001 (*Bulletin* v. 28, no. 1). A new series of alerts began on 9 June 2003, with frequent alerts continuing until 14 June 2004. The cloud-free ASTER imagery from June 2003 to June 2004 was examined, and although it does not offer very complete coverage of this new phase of activity, all the images contained very small anomalies (just a few pixels) in the central crater. This suggests that most of these alerts are due to increased activity at the lava lake, with no indication of lava flows. Also, all the 2003-2004 MODVOLC anomalies were 1-2 pixels (no elongate thermal anomalies), further suggesting that this is local central-vent activity.

Background. Heard Island on the Kerguelen Plateau in the southern Indian Ocean consists primarily of the emergent portion of two volcanic structures. The large glacier-covered composite basaltic-to-trachytic cone of Big Ben comprises most of the island, and the smaller Mt. Dixon volcano lies at the NW tip of the island across a narrow isthmus. Little is known about the structure of Big Ben volcano because of its extensive ice cover. The historically active Mawson Peak forms the island's 2745-m high point and lies within a 5-6 km wide caldera breached to the SW side of Big Ben. Small satellitic scoria cones are mostly located on the northern coast. Several subglacial eruptions have been reported in historical time at this isolated volcano, but observations are infrequent and additional activity may have occurred.

Information Contacts: Matt Patrick, Luke Flynn, Harold Garbeil, Andy Harris, Eric Pilger, Glyn Williams-Jones, and Rob Wright, HIGP Thermal Alerts Team, Hawai'i Institute of Geophysics and Planetology (HIGP) / School of Ocean and Earth Science and Technology (SOEST), University of Hawai'i, 2525 Correa Road, Honolulu, HI 96822, USA (<http://hotspot.higp.hawaii.edu/>; Email: patrick@higp.hawaii.edu).

McDonald Islands

southern Indian Ocean
53.03°S, 72.60°E; summit elev. 186 m

The first ever MODVOLC thermal anomaly at the McDonald Island volcano was detected on 14 November 2004. The anomaly, one pixel in size, was located directly over the island. There have been none since then through 13 Jan-

uary 2005, nor have there been any other obvious false-alert pixels in the vicinity, suggesting that this anomaly was genuine.

Andrew Tupper investigated the above-mentioned anomaly (on a Terra MODIS image, overpass time 1827 UTC, 14 November 2004; seen in bands 20-25 (3.8-4.5 μm)). Basically, the anomaly occurred within 2 km of the location of the summit coordinates given in the title above. Tupper went on to note: "I've looked at other MODIS images from around that time, and some recent AVHRR images, but it is extremely difficult to get a cloud-free shot of that area. There are no other hot spots visible, and no volcanic plumes visible, but unless there was a bonfire lit by a stranded party of toothfish poachers at the time, I can't think of any reason to doubt that the hot-spot is volcanic."

Background. Three small, low islands on the Kerguelen Plateau form the McDonald Islands. The largest island, McDonald, is composed of a layered phonolitic tuff plateau cut by phonolitic dikes and lava domes. A possible nearby active submarine center was inferred from phonolitic pumice that washed up on Heard Island in 1992. Volcanic plumes were observed in December 1996 and January 1997 from McDonald Island. During March of 1997 the crew of a vessel that sailed near the island noted vigorous steaming from a vent at the N side of the island along with possible pyroclastic deposits and lava flows. During a visit to the area in November 2002 the island was reported to have more than doubled in area since previous reported observations in November 2000. The high point of the island group had shifted to the N end of MacDonald island, which had merged with Flat Island to the north.

Information Contacts: Matt Patrick, Luke Flynn, Harold Garbeil, Andy Harris, Eric Pilger, Glyn Williams-Jones, and Rob Wright, HIGP Thermal Alerts Team, Hawai'i Institute of Geophysics and Planetology (HIGP) / School of Ocean and Earth Science and Technology (SOEST), University of Hawai'i, 2525 Correa Road, Honolulu, HI 96822, USA (<http://hotspot.higp.hawaii.edu/>, Email: patrick@higp.hawaii.edu); Andrew Tupper, Darwin Volcanic Ash Advisory Centre (VAAC), Commonwealth Bureau of Meteorology, Northern Territory Regional Office, PO Box 40050, Casuarina, NT 0811, Australia (URL: www.bom.gov.au/info/vaac/; Email: darwin.vaac@bom.gov.au).

Soputan

Sulawesi, Indonesia

1.108°N, 124.725°E; summit elev. 1,784 m

All times are local (= UTC + 8 hours)

Activity at Soputan that began on 18 July 2003 (*Bulletin* v. 28, no. 8) continued with occasional ash explosions in August (*Bulletin* v. 28, nos. 10-11) and through 4 September 2003 (*Bulletin* v. 29, no. 11). The report of the 12 December 2004 eruption (*Bulletin* v. 29, no. 11) also mentioned activity on 18 October. The following information from the Indonesian Directorate of Volcanology and Geological Hazard Mitigation describes that October 2004 activity in greater detail.

Volcanic tremor increased at 0930 on 18 October 2004 with amplitudes in the range of 10-40 mm. From 1026 to 1452 tremor amplitudes reached a maximum of 41 mm

(over scale). At 1041 Soputan exploded, releasing a white to gray ash column as high as 600 m above the crater rim and drifting E. The explosion, along with rumbling sounds, was heard at the Post Observatory ~ 12 km from the summit. Based on increasing seismicity, the official hazard level was raised to Orange or II (on a scale of I-IV) at 1500 that day. At 1815 incandescence was visible, rising 25-30 m above the crater rim. Ash reached the Observatory at 2130, and a "lava avalanche" at 2135 traveled to the S. Tremor was recorded until 0712 on the following day, 19 October, with amplitudes of 0.5-2 mm.

A GOES-9 satellite loop of the 18 October 2004 eruption was compiled by the Darwin Volcanic Ash Advisory Centre (VAAC). Based on the dispersion patterns and infrared temperatures (minimum temperature of zero degrees), the cloud probably reached between 5,000 and 6,000 m altitude, where there was an atmospheric inversion that prevented further rise.

The Darwin VAAC also noted that a satellite image from the Terra MODIS instrument taken at 0210 UTC on 1 September 2003 showed an eruption plume during clear weather. The imaged eruption, described as a low-level cloud streaming to the SW that probably didn't rise much above the summit, occurred during a period of previously reported ash plumes and lava flow activity (*Bulletin* v. 28, no. 10).

Background. The small Soputan stratovolcano on the southern rim of the Quaternary Tondano caldera on the northern arm of Sulawesi Island is one of Sulawesi's most active volcanoes. The youthful, largely unvegetated volcano rises to 1784 m and is located SW of Sempu volcano. It was constructed at the southern end of a SSW-NNE trending line of vents. During historical time the locus of eruptions has included both the summit crater and Aesepu, a prominent NE-flank vent that formed in 1906 and was the source of intermittent major lava flows until 1924.

Information Contacts: Directorate of Volcanology and Geological Hazard Mitigation, Jalan Diponegoro 57, Bandung 40122, Indonesia (Email: dali@vsi.dpe.go.id; URL: <http://www.vsi.esdm.go.id/>); Andrew Tupper, Darwin Volcanic Ash Advisory Centre (VAAC), Australian Bureau of Meteorology (URL: <http://www.bom.gov.au/info/vaac/soputan.shtml>).

Canlaon

central Philippines

10.412°N, 123.132°E; summit elev. 2,435 m

The Philippine Institute of Volcanology and Seismology (PHIVOLCS) noted in a March 2004 report that the most recent eruptive episode of Canlaon had begun on 7 March 2003. Their 2003 Annual Report described a mild ash-and-steam emission on 7 March that rose 1 km above the summit and resulted in traces of ash deposited at Cabagnaan, 5.5 km S. On 17 March 2003 the hazard status had been raised to Alert Level 1 (*Bulletin* v. 28, nos. 3, 6, 7, and 8). A total of 46 minor ash ejections were documented or observed, most from June to July 2003, characterized by steam clouds with minor ash that rose as high as 1,500 m. Prevailing winds dispersed the ash over the mid-upper slopes in the SW and SE sectors of the volcano.

Sporadic recordings of high-frequency volcanic earthquakes (HFVQ) and low-frequency volcanic earthquake swarms (LFVQ) starting in January 2003 prompted PHIVOLCS to issue a warning on the possibility of sudden phreatic explosions. In June 2003 daily occurrences of LFVQs increased dramatically and these heightened levels were sustained until July 2003. Low-frequency short-duration harmonic tremors (SDHLF) also appeared in June 2003 and increased like the LFVQs, indicating a continuous supply and transport of volcanic fluids towards the shallow levels of the crater area.

A general trend towards volcanic quiet was recognized during August 2003, but the status was maintained at Alert Level 1 because HFVQs, LFVQs, and SDHLFs persisted, though in diminishing numbers, until September 2003. After that time, steam emissions from the summit crater were only weak or absent, with normal levels of seismic activity. On 1 March 2004 PHIVOLCS lowered the hazard status to Alert Level 0, meaning the volcano has returned to a quiet state. The public was strongly advised, however, to consider the risk when entering the 4-km Permanent Danger Zone because sudden phreatic explosions may occur without warning. People planning to climb the volcano are advised to check with an observatory first.

Phreatic emission, January 2005. The value of continued warnings was shown on 21 January 2005, when Canlaon generated a sudden brief ash emission. The PHIVOLCS observatory at La Carlota City College reported moderate emission of a grayish volcanic plume at about 0930 that rose to ~ 500 m above the active crater and drifted WNW and SW, depositing light ash on the upper SW slopes. Traces of ash deposits were also observed at Cabagnaan, 5.5 km SW of the active crater. No coincident volcanic earthquakes were recorded, and Canlaon continued to be seismically quiet. These observations suggest the activity is hydrothermal in nature and occurring at very shallow levels near the crater floor.

Background. Canlaon volcano (also spelled Kanlaon), the most active of the central Philippines, forms the highest point on the island of Negros. The massive 2435-m-high stratovolcano is dotted with fissure-controlled pyroclastic cones and craters, many of which are filled by lakes. The summit of Canlaon contains a broad elongated northern caldera with a crater lake and a smaller, but higher, historically active crater to the south. The largest debris avalanche known in the Philippines traveled 33 km to the SW from Canlaon. Historical eruptions, recorded since 1866, have typically consisted of phreatic explosions of small-to-moderate size that produce minor ashfalls near the volcano.

Information Contact: *Philippine Institute of Volcanology and Seismology (PHIVOLCS)*, Department of Science and Technology, PHIVOLCS Building, C.P. Garcia Avenue, Univ. of the Philippines Campus, Diliman, Quezon City, Philippines (URL: <http://www.phivolcs.dost.gov.ph/>).

Mayon

Luzon, Philippines
13.257°N, 123.685°E; summit elev. 2,462 m

An explosion-type volcanic earthquake detected by the Upper Anoling seismic station on the afternoon of 3 June 2004 was not visually observed due to thick clouds cover-

ing the summit. Residents closer to the Upper Anoling Seismic Station and Mayon Resthouse did not notice any unusual activity. No traces of ash or changes in the crater wall were observed. Sulfur dioxide (SO₂) emission rose from 1,169 metric tons/day (t/d) on 12 May to 2,521 t/d on 4 June, then decreased to 1,514 t/d on 18 June. Precise leveling measurements showed a slight but deflation of the edifice. The number of low-frequency volcanic earthquakes and low-frequency short-duration harmonic tremors increased in June to almost twice the number recorded in May. In addition, faint crater glow continued to be observed at the summit, as it had since 7 October 2003.

Another explosion was recorded on 22 July 2004. According to news reports, ash from that event was deposited in two local villages.

Sulfur dioxide (SO₂) emissions remained only slightly above baseline at 829 metric tons per day as of 6 September 2004. On the evening of 12 September 2004 the very faint glow at the summit of Mayon intensified slightly. The brighter incandescence, observable from Lignon Hill Volcano Observatory and in Legaspi City proper, coincided with a slight increase in the overall background tremor detected by seismographs around the volcano. However, there were no significant changes in ground deformation or SO₂ measurements. A news report also noted that volcanic material emitted from the crater that day set fire to grass on the volcano's slopes.

The hazard status remained at Alert Level 2, indicating a low level of volcanism. PHIVOLCS reminded the public to refrain from venturing into the 6-km Permanent Danger Zone because life-threatening volcanic flows may occur with little or no warning.

Background. Beautifully symmetrical Mayon volcano, which rises to 2462 m above the Albay Gulf, is the Philippines' most active volcano. The structurally simple volcano has steep upper slopes averaging 35-40 degrees that are capped by a small summit crater. The historical eruptions of this basaltic-andesitic volcano date back to 1616 and range from strombolian to basaltic plinian, with cyclical activity beginning with basaltic eruptions, followed by longer term andesitic lava flows. Eruptions occur predominately from the central conduit and have also produced lava flows that travel far down the flanks. Pyroclastic flows and mudflows have commonly swept down many of the approximately 40 ravines that radiate from the summit and have often devastated populated lowland areas. Mayon's most violent eruption, in 1814, killed more than 1200 people and devastated several towns.

Information Contact: *Philippine Institute of Volcanology and Seismology (PHIVOLCS)*, Department of Science and Technology, PHIVOLCS Building, C.P. Garcia Avenue, Univ. of the Philippines Campus, Diliman, Quezon City, Philippines (URL: <http://www.phivolcs.dost.gov.ph/>); *Associated Press* (URL: <http://www.ap.org/>); *The Australian* (<http://www.theaustralian.news.com.au/>).

Taal

Luzon, Philippines
14.002°N, 120.993°E; summit elev. 400 m

The Taal seismic monitoring network began to record significant volcanic earthquakes on 23 September 2004. In

general, the numbers of these events occurring through 29 October increased, with a maximum 13 earthquakes on 15 October. Some of these earthquakes were instrumentally recorded with relatively large amplitudes although none were felt by residents on Volcano Island. Initial earthquake locations showed epicenters dispersed in the vicinity of Main Crater, to the NNW near Binintiang Malaki, and to the SSE near Calauit. Surface observations, however, did not indicate any significant change in the thermal and steam emission characteristics of the Main Crater lake area. The increased seismicity is an indication of a low-level episode of unrest, although at this time there is no clear indication of an impending eruption. A series of volcanic earthquakes was recorded on 9 January 2005. Two of these earthquakes, only one minute apart, were felt in Pira-piraso.

PHIVOLCS raised the hazard status on 29 October from Alert Level 0 to Alert Level 1, meaning that there was a slight increase in seismic activity but no eruption is imminent. PHIVOLCS recommend as off-limits the Main Crater area because sudden steam explosions may occur or high concentrations of noxious gases may accumulate. Several fissures traversing the Daang Kastila Trail are also potentially hazardous as possible sites of future steam emission. PHIVOLCS is conducting several enhancements of the monitoring system at Taal with deployment of more seismometers and ground-deformation surveillance equipment. The entire Volcano Island is a Permanent Danger Zone and permanent settlement is strictly prohibited.

Background. Taal volcano is one of the most active volcanoes in the Philippines and has produced some of its most powerful historical eruptions. In contrast to Mayon volcano, Taal is not topographically prominent, but its pre-historical eruptions have greatly changed the topography of SW Luzon. The 15 x 20 km Taal caldera is largely filled by Lake Taal, whose 267 sq km surface lies 700 m below the south caldera rim and only 3 m above sea level. The maximum depth of the lake is 160 m, and several eruptive centers lie submerged beneath the lake. The 5-km-wide Volcano Island in north-central Lake Taal is the location of all historical eruptions. The island is a complex volcano composed of coalescing small stratovolcanoes, tuff rings, and scoria cones that has grown about 25% in area during historical time. Powerful pyroclastic flows and surges from historical eruptions of Taal have caused many fatalities.

Information Contact: *Philippine Institute of Volcanology and Seismology (PHIVOLCS)*, Department of Science and Technology, PHIVOLCS Building, C.P. Garcia Avenue, Univ. of the Philippines Campus, Diliman, Quezon City, Philippines (URL: <http://www.phivolcs.dost.gov.ph/>).

Anatahan

Mariana Islands, central Pacific Ocean
16.35°N, 145.67°E; summit elev. 788 m
All times are local (= UTC + 10 hours)

Although the latest eruptive period ended in late July (*Bulletin* v. 29, no. 8), the volcanic system at Anatahan continued to exhibit unrest in the following months. On 27 September, several hours after the onset of a series of intense tropical depressions and storms, the first long-period seismic events since July 2004 were recorded. However, only a few, small events occurred. Beginning on 12 Octo-

ber, several episodes of small, regularly-spaced long-period events were recorded at intervals of 4-15 seconds. On 18 October, people in Saipan smelled H₂S during very hazy visibility, but no plume was detected on satellite imagery by the Washington Volcanic Ash Advisory Center (VAAC).

Based on a pilot report to the Guam Forecast Office, the Washington VAAC reported that ash from Anatahan was at a height of ~3 km altitude on 2 December. Ash was not visible on satellite imagery, but a hotspot was briefly evident on infrared imagery.

Eruptions in January 2005. Major eruptive activity at Anatahan resumed on 5 January 2005, preceded by two days of small long-period earthquakes and a day of harmonic tremor. The airport tower at Guam confirmed that a plume of diffuse ash and gas up to ~200 m above the vent was visible at first light on 6 January, and at the 1225 hours VAAC reported a plume 60 km long and 20 km wide, blowing W.

Frequent Strombolian explosion signals began on 6 January and continued during 7 and 8 January, accompanied by a change in the seismic signals, from harmonic tremor to a broader band tremor, with explosions recorded by microphones several times per minute. The eruption type and activity level were both very similar to the peak eruptive activity during the eruption of April-June 2004 (*Bulletin* v. 29, nos. 4, 5, and 6). During an overflight on 7 January, personnel from the Emergency Management Office (EMO) reported ash rising well above 1,500 m and a plume that likely extended up to 100 km downwind. A dome was visible in the crater and bombs were observed rising less than 600 m.

On 7 January ash rose to ~3 km and bombs a meter or more in diameter were expelled to ~100 m and formed a new cinder cone ~120 m in diameter. The amplitude of the explosion signals increased slowly after 6 January to about double these values by noon on 10 January, with explosions every 3-10 seconds. Explosion signals amplitudes then plunged suddenly to half the values at the start of 10 January. The amplitudes surged again, nearly doubling by approximately 0400 on 11 January, dropping to half the value again by about noon. The eruption apparently stabilized at that level through 14 January. During 15-19 January, the eruption appears to have stopped twice for a few hours but swiftly resumed at higher levels. National Oceanic and Atmospheric Agency (NOAA) satellite photos show a plume of vog (volcanic smog) trailing ~60 km downwind.

Near mid-day on 20 January seismicity dropped abruptly to near background levels, whereas microphone noise became fairly continuous, indicating that the explosions had ceased but that degassing may have been continuing. The apparent cessation of Strombolian activity lasted until late 22 January, when explosions resumed. The eruption peaked about 0700 on 23 January, at which time a SIGMET (significant meteorological forecast) was issued by the FSS (Flight Service Station) Honolulu, based on pilot reports of ash up to 3-4.6 m. The explosions then decreased somewhat but were still frequent and strong through 24 January, based on the seismicity.

The EMO placed Anatahan Island off limits until further notice and concluded that, although the volcano was not currently dangerous to most aircraft within the CNMI airspace, conditions may change rapidly. Aircraft should pass upwind of, or beyond 30 km downwind from, the island, and exercise due caution within 30 km of Anatahan.

Synopsis of recent eruptions. Anatahan had no historical eruptions prior to 2003. On 10 May of that year, after several hours of increasing seismicity, a phreatomagmatic eruption sent ash to over 10 km and deposited about 10 million cubic meters of material over the island and sea. A very small craggy dome extruded during late May and was destroyed during explosions on 14 June, after which the eruption essentially ceased. A second eruption began about 9 April 2004, after more than a week of increasing seismicity. The eruption consisted of passive extrusion during mid-April, then increased to Strombolian explosions every minute or two on 24 April. The Strombolian explosions continued through mid-July, often sending a thin plume of gas and ash upwards a few hundreds of meters and 100 km downwind. Activity decreased substantially on 26 July, though visitors to the island three months later could still see very small amounts of steam and ash rising 30–40 m above the crater rim and could smell SO₂ near the crater.

Background. The elongated, 9-km-long island of Anatahan in the central Mariana Islands consists of two coalescing volcanoes with a 2.3 x 5 km, E-W-trending summit depression formed by overlapping summit calderas. The larger western caldera is 2.3 x 3 km wide and extends eastward from the summit of the western volcano, the island's 788-m high point. Ponded lava flows overlain by pyroclastic deposits fill the caldera floor, whose SW side is cut by a fresh-looking smaller crater. The summit of the lower eastern cone is cut by a 2-km-wide caldera with a steep-walled inner crater whose floor is only 68 m above sea level. Sparseness of vegetation on the most recent lava flows on Anatahan indicated that they were of Holocene age, but the first historical eruption of Anatahan did not occur until May 2003, when a large explosive eruption took place forming a new crater inside the eastern caldera.

Information Contacts: *Juan Takai Camacho and Ramon Chong*, Emergency Management Office of the Commonwealth of the Northern Mariana Islands (CNMI/EMO), P.O. Box 100007, Saipan, MP 96950, USA (URL: <http://www.cnmiemo.org/>; Email: juantacamacho@hotmail.com and rchongemo@hotmail.com); *Frank Trusdell*, Hawaii Volcano Observatory, U.S. Geological Survey (HVO/USGS), Hawaii National Park, HI 96718, USA (URL: <http://hvo.wr.usgs.gov/cnmi/>; Email: trusdell@usgs.gov); Washington Volcanic Ash Advisory Center (VAAC), Satellite Analysis Branch, NOAA/NESDIS E/SP23, NOAA Science Center Room 401, 5200 Auth Road, Camp Springs, MD 20746 USA (URL: <http://www.ssd.noaa.gov/>); NOAA/ National Weather Service, National Centers for Environmental Prediction, Aviation Weather Center, Volcanic Ash SIGMETS, (URL: <http://adds.aviationweather.gov/airmets/>)

Villarrica

central Chile

39.42°S, 71.93°W; summit elev. 2,847 m

All times are local (= UTC - 4 hours,

-3 hours October–March)

The last report of activity at Villarrica, through May 2002 (*Bulletin* v. 27, no. 6), described a general decrease in incandescence in the summit crater's lava lake, and noted ballistics ejected in January 2002.

Jacques-Marie Bardintzeff reported that climbers to the top of the volcano on 5 November 2004 noted a strong sulfur smell and observed projections of red lava at a depth of 200–300 m in the crater. On 16 November, a small lava lake was visible in the crater from the air; it was photographed on the 19th (figure 1). Many volcanologists attending the IAVCEI General Assembly at Pucón 14–19 November 2004 ascended and observed activity in the summit crater (figure 2). Although the lava lake itself lay at the bottom of a steep-walled inner crater and was not visible, periodic ejection of large quantities of incandescent lava fragments to a maximum height just above the rim of the inner crater could be seen from a bench below the SW rim of the outer summit crater (figure 3). Bardintzeff noted on 24 November 2004 that a white and blue plume of H₂O vapor and SO₂, extending to the E from Villarrica, was observed from Pucón. During the night, the plume was red colored. According to the local inhabitants, this was the first observation of a plume since January 2004.

According to the Publicación Oficial del Grupo Proyecto de Observación Villarrica (P.O.V.I.) website, incandescence was seen above the summit crater on the nights of 5–6 August and 27–28 October 2004 and frequently during November and December. On the night of 12–13 December Strombolian explosions every 2–5 minutes ejected incandescent spatter and bombs to 100 m height that landed on the outer crater rim. On the 13th the lava lake was ~30 m in diameter and at a depth of ~100 m. Vigorous convection of the lava lake was punctuated at intervals not exceeding 15 seconds by Strombolian explosions that ejected fine ash, lapilli up to 4 mm in diameter that fell to within a few meters of the inner edge of the crater, and incandescent spatter to the NE to heights of ~50 m. By 27 December solidification of ejected spatter around the vent had decreased its diameter by 2/3 with respect to 13 December, and Strombolian explosions at intervals of 2–5 minutes ejected material ~100 m above the vent. On 9 and 17 January minor explosions took place at intervals of 1–2 minutes. By 17 January fissures had formed around the N to E sides of the vent, and the opposite side of the vent edge, and the slope above it, had collapsed.

Satellite-based MODIS thermal alerts were first detected at 0345 UTC on 5 November and also occurred on 6, 16, 17, 22, 24, and 29 November, 5, 8, 9, 14, 19, 21, and 31 December, and 1 and 2 January 2005. Prior to 5 November 2004, MODIS thermal alerts not previously reported in this *Bulletin* had been detected at Villarrica on 23 May, 10 and 17 July, 2, 6, 25, and 27 August, 16 and 28 September, 2, 12, 14, 27, and 30 October, 1, 3, 22, and 28 November 2003, 31 January, 1–3, 7, 10, 12, and 14 February, and 0345 UTC on 26 March 2004 (2345 local time 25 March). According to the P.O.V.I. website, strong explosive activity ejected incandescent pyroclastic material on 28 August 2003, and except for three cloud-covered days, incandescence above the summit crater was seen daily from 27 January to 20 February 2004.

Background. Villarrica, one of Chile's most active volcanoes, rises above the lake and town of the same name. It is the westernmost of three large stratovolcanoes that trend perpendicular to the Andean chain. A 6-km wide caldera formed during the late Pleistocene. A 2-km-wide caldera that formed about 3,500 years ago is located at the base of the presently active, dominantly basaltic to basaltic-andesitic cone at the NW margin of the Pleistocene



Figure 1. A near-vertical aerial view into the ~250-m-wide summit crater of Villarrica volcano at about 1430 on 19 November shows the incandescent lava lake in the steep-walled inner crater. The chain of dots left (north) of the crater are climbers ascending to the crater rim. The photograph was taken through the side window of a Cessna aircraft executing an extremely sharp turn. Figure 2 (below) was taken from the upper left crater rim and figure 3 from the lower right. Courtesy of Jean-Claude Tanguy.



Figure 2. Climbers walk along the outer snow-covered rim of Villarrica's summit crater on 17 November 2004 and stand on a small bench just below the SW rim (left), which provided periodic views of incandescent ejecta from the inner crater lava lake (figure 3). Courtesy of Judy Harden.

caldera. More than 30 scoria cones and fissure vents dot Villarrica's flanks. Plinian eruptions and pyroclastic flows that have extended up to 20 km from the volcano have been produced during the Holocene. Lava flows up to 18 km long have issued from summit and flank vent. Historical eruptions, documented since 1558, have consisted largely of mild-to-moderate explosive activity with occasional lava effusion. Glaciers cover 40 km² of the volcano, and lahars have damaged towns on its flanks.

General Reference. Calder, E. S., Harris, A.J.L., Peña, P., Pilger, E., Flynn, L.P., Fuentealba, G., and Moreno, H., 2004, Combined thermal and seismic analysis of the Villarrica volcano lava lake, Chile: *Revista Geológica de Chile*, v. 31, no. 2, p. 259-272.



Figure 3. Incandescent spatter and bombs are ejected from the lava lake in the inner crater of Villarrica as seen from a bench just below the SW rim of the outer crater on 17 November 2004. Courtesy of Judy Harden.

Lara, L.E., and Clavero, J. (eds.), 2004, Villarrica volcano (39.5°S), Southern Andes, Chile: Servicio Nacional de Geología y Minería - Chile, Santiago, Boletín No. 61.

Information Contacts: Jacques-Marie Bardintzeff, Laboratoire de Pétrographie- Volcanologie, Bât. 504 Université Paris-Sud, F-91405 Orsay, France (URL: <http://www.lave-volcans.com/bardintzeff.html>, Email: bardizef@geol.u-psud.fr); Judy Harden, Department of Geology, University of South Florida, 4202 E. Fowler Ave, SCA528, Tampa, FL 33620, USA (Email: jaharden@juno.com); *Publicación Oficial del Grupo Proyecto de Observación Villarrica - Internet (P.O.V.I.)* (URL: <http://www.povi.cl/>); Jean-Claude Tanguy, Univ. Paris 6 & Institut de Physique du Globe de Paris, Observatoire de St. Maur, 94107 St. Maur des Fossès, France (Email: tanguy@ipgp.jussieu.fr).

Deception Island

South Shetland Islands, Antarctica
62.97°S, 60.65°W; summit elev. 576 m

Deception Island is the most active volcano in the Antarctic Peninsula region. A team of Spanish-Argentine scientists collected data from 25 November 2003 to 16 March 2004 in order to provide background activity records. Local and regional seismicity, thermal activity, gas emission, geodetic, and geological studies were carried out. During this survey, one seismic antenna and three continuous-recording stations were installed (figure 4). One dense seismic antenna with twelve vertical-component short-period seismometers was located between the Spanish and Argentine base stations, one vertical-component short-period seismometer was placed at North Fumarole Bay (with telemetry), and three-component short-period seismic stations

were installed near both the “Gabriel de Castilla” Spanish station and the Argentine station.

The recorded seismicity included long-period events (LP), volcanic-tremor episodes (T), and a few volcano-tectonic earthquakes (VT). More than 3,660 LP events were recorded (figure 5), 35 of them with hybrid character, and many with frequencies of 1-8 Hz. Eight volcanic tremors occurred with durations ranging from less than one hour to twenty-one hours; 66 VT earthquakes were also recorded. Four remarkable periods of activity were detected in this survey, during last December, mid-January, early February, and mid-March. All of these periods were characterized by a relatively high level of seismic activity with frequent LP events and tremor. Most earthquakes recorded during the field season were located

inside the island, and these events have been closely related with LP and tremor events. Earthquakes with S-P wave time lags of less than 3 seconds were classified as local or VT, with local magnitudes of up to 2.0, none of which were felt. LP seismicity might be related to thaw water (seasonal

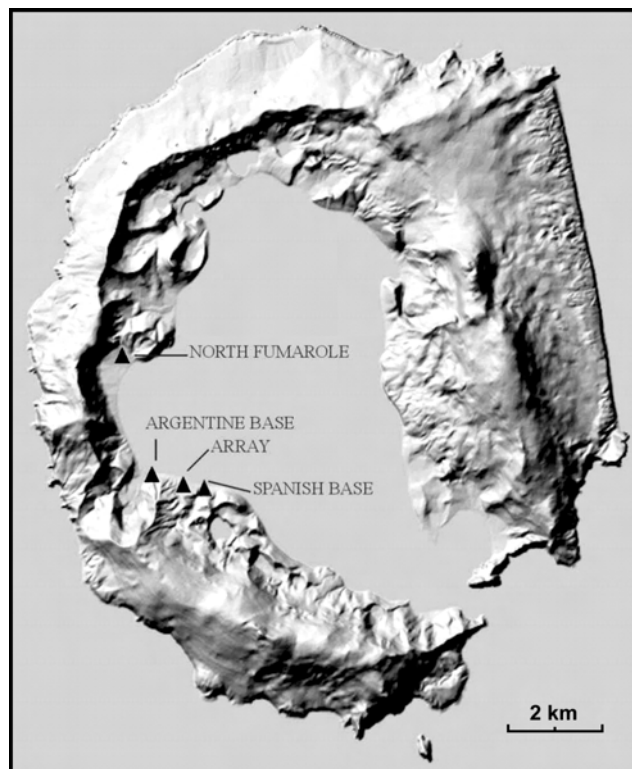


Figure 4. Seismological stations deployed at Deception Island in 2003-2004 summer survey. Courtesy of the Spanish-Argentine research team.

effect) but this year's anomalous activity could also be due to strong pressurization in a sealed system.

Fumarole temperatures and hot soils remained stable between 99 and 101°C in Fumarole Bay, 95°C in Caliente hill, 65°C in Whalers Bay, 41°C in Telefon Bay, and 72°C in Pendulum Cove. Systematic monitoring of fumarolic activity continued as in past years, and during this survey radon was measured. Samples of condensable and uncondensable acid gases were collected. The obtained composition from the fumarole vents at Fumarole Bay was similar to previous years. The average chemical composition of the fumarolic gases was $\text{H}_2\text{O}_{(v)}$ (86.21%), CO_2 (13.59%), H_2S (0.19%), and SO_2 (0.01%). Lapilli with a coating of pyrite were found around vent outlets. Compositional changes in acidic gases observed in early February and March 2004 correlated with increased seismicity, especially with LP events.

Background. Ring-shaped Deception Island, one of Antarctica's most well known volcanoes, contains a 7-km-wide caldera flooded by the sea. Deception Island is located at the SW end of the Shetland Islands, NE of Graham Land Peninsula, and was constructed along the axis of the Bransfield Rift spreading center. A narrow passageway named Neptunes Bellows provides entrance to a natural harbor that was utilized as an Antarctic whaling station. Numerous vents located along ring fractures circling the low, 14-km-wide island have been active during historical time. Maars line the shores of 190-m-deep Port Foster, the caldera bay. Among the largest of these maars is 1-km-wide Whalers Bay, at the entrance to the harbor. Eruptions from

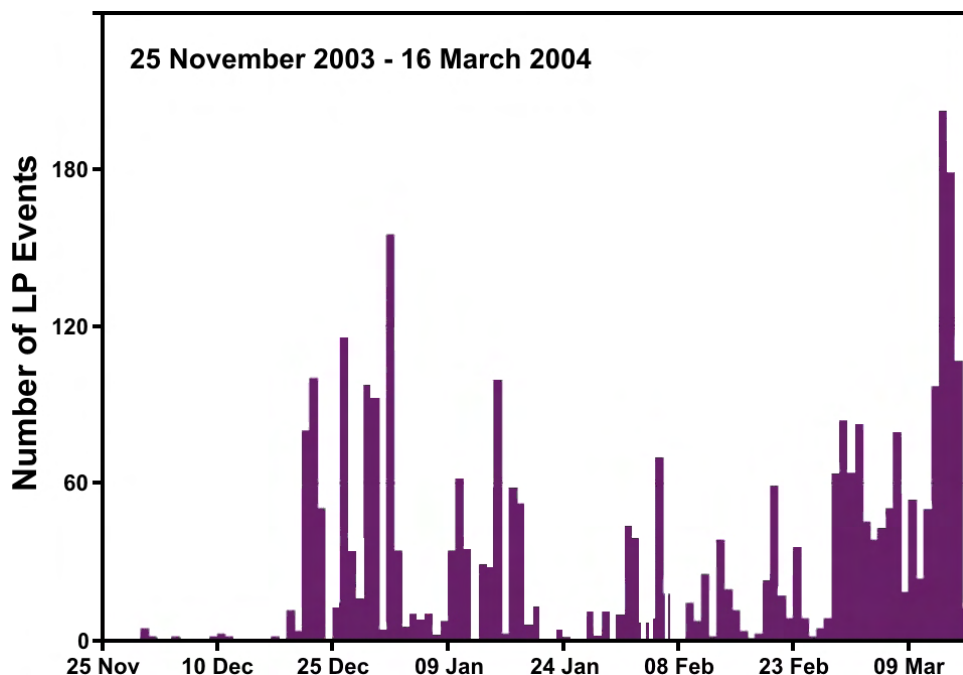


Figure 5. Long-period seismic activity at Deception Island during the 2003-2004 summer survey. Adapted from a histogram showing six types of recorded seismicity. Courtesy of the Spanish-Argentine research team.

Deception Island during the past 8700 years have been dated from ash layers in lake sediments on the Antarctic Peninsula and neighboring islands.

Information Contacts: A.T. Caselli, C. Bengoa, and E. Rojas Vera, Universidad de Buenos Aires-Instituto Antártico Argentino, Ciudad Universitaria, Pab.2, (1428) Buenos Aires, Argentina (Email: acaselli@gl.fcen.uba.ar); A. Bidone and G. Badi, Dpto. de Sismología e I.M., Facultad de Cs. Astronóm. y Geofísicas, UNLP, Av. Centenario s/n Paseo del Bosque, B1900FWA La Plata, Pcia. de Buenos Aires, Argentina; Daria Zandomenighi, Nieves Sánchez, Fermín Fernández-Ibañez, and Jesús Ibáñez, Instituto Andaluz de Geofísica y P.D.S. Universidad de Granada, Campus Universitario de Cartuja, s/n 18071, Granada, Spain.

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