ASH FALL
Newsletter of the Volcanology and Igneous Petrology Division
Geological Association of Canada

#47 February, 1999

Division Business:

A reminder to all that the division awards medals for the best BSc, MSc and PhD theses with a significant Volcanology and Igneous Petrology content. MSc and PhD theses should be submitted by February 28 to the secretary (or any member of the executive) and BSc theses should be forwarded to the Vice Chair by April 30. All theses should be accompanied by a letter of nomination. Nominations for the Career Achievement Award should be forwarded to the Chair.

The current executive's mandate was extended for one year at last year's annual meeting. A new slate of officers will be elected this year in Sudbury. Any volunteers or nominations will be welcome. This year's annual meeting will be held in conjunction with the Symposium on homogeneous and heterogeneous equilibria in magmas which the Division is co-sponsoring with the MAC. Try to be there, and if you want a particular subject on the agenda of the meeting please advise a member of the executive beforehand.

Editor's Comment:

I am still looking for individual contributions to the newsletter. Places to see, special photographs, coinages or stamps of the world with volcanoes or igneous rocks on them and so on. I finally went to see the Grand Canyon last spring, and I guess I had forgotten analysing the Canyon in Geology 101, but was overjoyed to see those beautiful 500 my old basalts spilling down the side canyons and along the river like chocolate icing drooling down the layer cake. Fantastic columns too!

The eruptions in this issue, excerpted from the Smithsonian Global Volcanism Network <http://www.volcano.si.edu.gvp/>, show recent activity in off-ridge oceanic, island and continental arcs and continental rift contexts. A number of volcanoes currently active sit very close to large cities.

Guagua Pichincha
north-central Ecuador
0.171°S, 78.598°W; summit elev. 4,784 m
All times are local (= GMT - 5 hours)

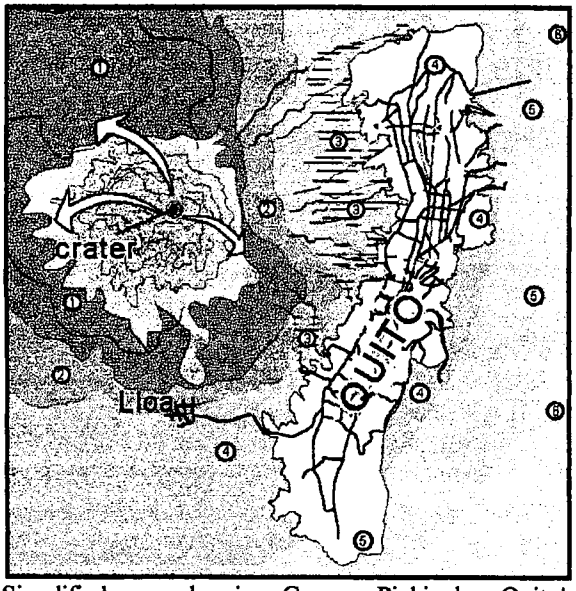
Guagua Pichincha and the older Pleistocene Rucu Pichincha stratovolcanoes rise immediately W of Quito at the W end of the 25-km-long volcanic complex. The horseshoe-shaped summit crater, ~2 km in diameter and 600 m deep, was breached to the W during a late-Pleistocene slope failure ~50,000 years ago. Subsequent late-Pleistocene and Holocene eruptions from the central vent consisted of explosive activity with pyroclastic flows accompanied by periodic lava dome growth and destruction. Many minor eruptions have occurred since the Spanish era. The central lava dome was probably emplaced during the volcano's largest historical eruption, in 1660, that dropped 30 cm of ash on Quito and generated W-flank pyroclastic flows. The volcano has no permanent ice cap.

Seismic data has been collected intermittently since 1977 and continuously since 1981 by the Instituto de Geofisico, Escuela Politécnica, which installed a 6-station telemetering seismic network in August 1988. Phreatic activity from the NE flank of the lava dome in 1981 and 1982 ejected a small amount of ash and blocks. A single phreatic explosion occurred from the same area in 1985.

In late August or early September, one or more small phreatic explosions ejected about 5,000 m3 of ash from five new vents, 2-12 m in diameter, on the NE flank of the central lava dome. Ash thickness decreases from more than 1 m adjacent to the vents to about 1 cm at 500 m to the E, and traces extended about halfway up the E inner wall of the crater. There was no evidence of any fresh magma in the ash. By early October, vapour emission from the explosion vents and a group of new fumaroles at the base of the S inner wall of the crater had declined to only 2-3 times its normal level.

Seismographs installed on the flanks of the volcano detected no local earthquakes until early October, but recorded several events in most 5-day periods between 1 October and 15 November (figure

1). The number of recorded events peaked at about 2/day in early November and had declined slightly to 4-6/week by early December.



Simplified map showing Guagua Pichincha, Quito's urban areas (elongate zone with selected roads), and hazard designations associated with the volcano. Revised from a colour hazard map on the IG-EPN website and keyed as follows: 1) Maximum danger (including major risks of hot volcanic flows, lahars, and ashfall - requiring total evacuation); 2) Minor danger (minor risk of ash clouds, hot volcanic flows, and lahars - areas immediately abandoned should an eruption be either imminent or large); 3) Lahar risk along drainage areas; and 4-6) graded risk of ashfalls. The bold arrows help identify the location of source vents and portray ejecta trajectories representative of those that might occur during an eruption. For more detail, see Hall and von Hillebrandt (1988). Courtesy of the Instituto Geofisico, Escuela Politécnica Nacional.

Cerro Azul

Galápagos Islands, Ecuador

0.90°S, 91.42°W, summit elev. 1,690 m

All times are local (= GMT - 6 hours)

Located at the SW tip of the J-shaped Isabela Island, Cerro Azul contains a steep-walled 4 x 5 km summit caldera that is one of the smallest diameter, but at 650 m one of the deepest in the Galapagos Islands. A conspicuous bench occupies the SW and west sides of the caldera. A prominent cinder cone is located at the NE side of the caldera and youthful lava flows cover its floor. Numerous spatter cones dot the western flanks. Fresh-looking lava flows, many erupted from circumferential fissures, descend the NE and NW flanks. Historical eruptions date back only to 1932, but Cerro Azul has been one of the most active Galapagos volcanoes since that time. Isabela is the largest of the Galápagos Islands, 965 km W of Ecuador's mainland. Cerro Azul lies 55 km from the coastal town of Villamil, home of most of the archipelago's ~1,000 inhabitants. The town and neighbouring settlements are on the S flank of Sierra Negra volcano.

08/98 (GVNB 23:08) Flank and caldera fissure eruption

New eruptive activity at Cerro Azul on Isabela Island was first recognized on 15 September by a satellite-based monitoring system. The first visual observations were from the town of Villamil, 55 km E of the volcano, and were reported to the Charles Darwin Research Station (CDRS) on Santa Cruz Island around 1800 that day. The eruption was from a radial fissure on the SE slope with at least two vents in the summit caldera. The last recorded eruption of Cerro Azul, in 1979, was from a vent very close to the current radial fissure, with lesser activity in the caldera. The region is uninhabited by humans, but is close to nesting zones of endangered Galápagos tortoises.

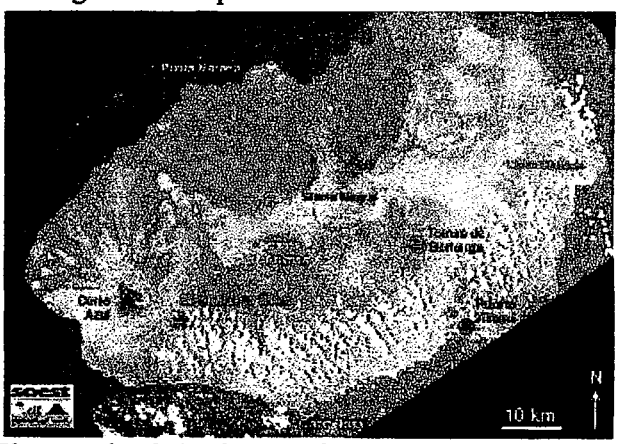
Fissure eruption. The eruption began just after noon on 15 September. A thermal anomaly appeared on a satellite image at 1246 that was not on the previous image at 1215. Eight earthquakes were recorded from 1229 to 1304 by the new multi-island Galápagos network; these and one epicentre the next day plotted on the volcano's E flank. The hypocentres of these earthquakes occurred at depths of less than ~7 km.

During an overflight at midday on 17 September observers estimated the fissure as ~1 km long, oriented roughly E-W, and at an elevation of 620-640 m on the volcano's SE slopes. The erupting fissure discharged three constant lava fountains, along with other intermittent fountains, to heights of 200-300 m. The principal lava flow extended ~8 km E by 1230 on 17 September.

Observers on an overflight at 1146 on 18 September noted that the flow had progressed another 2.3 km. The flow consisted of cooled levees surrounding a central, fast-flowing river of lava that was orange along most of its length. No lava tunnels were seen. The flow front moved at an average rate of 168 m/hour until 17 September, but slowed to ~100 m/hour when it reached flatter terrain. The flow averaged 500 m wide, broadening slightly at the volcano's base. Lava had covered no more than 5 km^2 by 1330 on 17 September. Small fires associated with the flow did not appear to be spreading. By 18 September, new lava had reached older flows that extend N-S between Cerro Azul and Sierra Negra volcano. The flow then turned S and was 7.6 km from the sea by late on 18 September.

Activity within the caldera. Caldera eruptions likely began sometime between noon on 16

September and the morning of 17 September. At 1230 on 17 September two lava flows, each <2 km long, had reached the ephemeral caldera lake. The lava flows in the caldera covered an area of ~4 km^2. The steam cloud generated where the lava flows entered the lake looked like a narrow thunderhead reaching 2,600 m as measured by aeroplane altimeter. Lava from a fissure on a bench along the S caldera wall reached the lake where a pre-existing tuff ring was visible on satellite images. The tuff ring contains another lake, but no lava reached it. Lava from a vent on the caldera floor reached the lake from the opposite direction. No glowing lava was visible in the caldera, but observers flying directly over on 17 September (at ~2,100 m altitude) noticed a strong smell of sulphur.



Photograph of the S part of Isabela Island, taken from the Space Shuttle in 1983, showing the site of the September 1998 flank eruption. Puerto Villamil and the scientific station at Tomas de Berlanga (or Santo Tomas) are the only inhabited locations on the island. White zones over the island are clouds. Courtesy of the GOES Hotspot Monitoring System.

The first scientists reaching the volcano were from Ecuador's Instituto Geofisico-Escuela Politécnica Nacional (IG-EPN) and ORSTOM. They described the flank eruption site as a SE-directed radial fissure, 400-500 m long, and between 680 and 630 m elevation. Lava fountaining (to ~200 m) built an elongate cinder cone 50 m high during the team's 19-25 September observations. The main cone was breached on the E, issuing flows that travelled over 8 km E before turning S toward the sea. During the night of 24-25 September a break in the main cone fed a new flow to the SE. All were 3-5-m-thick aa flows, and the longest ended 2 km from the coast.

University of Idaho graduate student Rachel Ellisor arrived on the night of 22 September, and described additional details of the flank eruption, including a smaller cone (NW of the main cone) with low fountains feeding a flow moving more directly S toward the sea. This flow was sampled daily; its velocity ranged from 0.001 to 10-20 km/hour and its thickness was described as 2-3 m at the front but 10-12 m in the interior. Gas clouds billowed from the fissure's SE end, and fountains issued from the main vent.

Ellisor took a 1 October overflight and described the intracaldera flows. One issued from a small vent (20-30 m high) on the S bench and flowed NW onto the caldera floor, while a larger cone (~60 m high) on the W caldera floor fed flows eastward into the shallow lake. Intracaldera activity had ended by 1 October.

Returning to the flank eruption, Ellisor reported that three large cones (60-80 m high) had been built in a N-S orientation. The mid-September flows (to the E, then S) had stagnated on the coastal flats, and their thickness was estimated at 5-15 m (interior) to 1-3 m (fronts). Increased activity on 6 October fed new flows building a channel system directly S of the main fissure. Ellisor's most recent report was dated 13 October, but GOES-8 images showed a thermal anomaly continuing through 4 November, the eruption's 51st day.

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Colima

western Mexico

19.51°N,103.62°W; summit elev. ~3,850 m

All times are local (= GMT - 6 hours)

Located in the Mexican state of Jalisco, the Colima volcanic complex consists of a chain of southward-younging volcanoes; Colima lies near the S end. Quaternary cinder cones lie on the E and W sides of the complex.

09/98 (GVNB 23:09) Explosion on 6 July follows seven months of seismic unrest

After seven months of seismic unrest (small swarms, with durations lasting some few hours to as much as 90 hours), at 1858 on 6 July an explosion at the summit dome was similar in behaviour and about half of the magnitude of an explosion in 1994.

A microbarograph 8 km SW of the summit at La Yerbabuena failed to register the explosion's shock wave, and the events were not noticed by residents of that settlement or La Becerrera (12 km SW of the summit), nor were these effects noticed by rangers at Rancho El Jabali (12 km SSW of the summit). Residents did report light rain and a bit of thunder and lightning at 1900, which may have helped conceal, or have been confused with, the sound of the explosion.

Plant leaves contained ash residue left after rainfall: seen through a microscope, mineral particles and hydrothermally altered rock fragments under 0.5 mm in diameter, often of light cream colour, and similar to those collected at Yerbabuena after the

1994 explosion.

Melchor Ursua of the Civil Defence reported that at 1900 residents of Tonila (13.5 km SE of the summit) observed a small black mushroom cloud rise above the summit accompanied by the sound of thunder or explosion. At 2300 that day from La Yerbabuena, observers Navarro, Breton, and Santaana saw fumarolic gases blown around the W face of the volcano, but in the faint moonlight he failed to discern any glow or ash from the crater.

The last seismic crisis started around 2200 on 2 July 1998 and ended at 1858 on 6 July: a vigorous swarm of earthquakes, which according to Gabriel Reyes comprised ~1,000 events a day for the last 3 days. One event with coda magnitude (Mc) 3.5-4.0 gained registry at all network stations including those near the coast at Tecoman and Armeria; it was interpreted as related to the above-discussed explosion. The seismic quiet afterwards consisted of zero events in a pattern reminiscent of 1994 when quiet prevailed for about 12 hours.

Noteworthy swarms during 1997 occurred on 20 March, 16, 21, and 30 June, 28 November, and 5 December. Compared to the 1997 swarms, this one (2-6 July 1998) was the largest and most energetic. During the latest swarm the volcano was only visible from 0800 to 1000. After 160 mm of rain had fallen at La Yerbabuena, a lahar swept downslope between 1400 and 1800 on 2 July, blocking passage across the Becerrera River valley 12.5 km SW of the summit.

During 1900-2000 on 7 July, the seismic station closest to the W-flank (SOMA, 1.7 km NW from the summit) registered strong, continuous mass wasting and later, during 2200-2300, a relatively strong volcanic event. Seismic quiet returned later, but vigorous fumarolic emissions were blown W. An update on 28 October noted that for a few weeks after the explosion the volcano displayed unrest, including about 23 seismic swarms, each lasting for 2 to 6-8 hours. All the seismic information was provided by the Colima seismic network (RESCO). The last swarm occurred on 25 October and prevailed for 13 hours.

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Popocatépetl

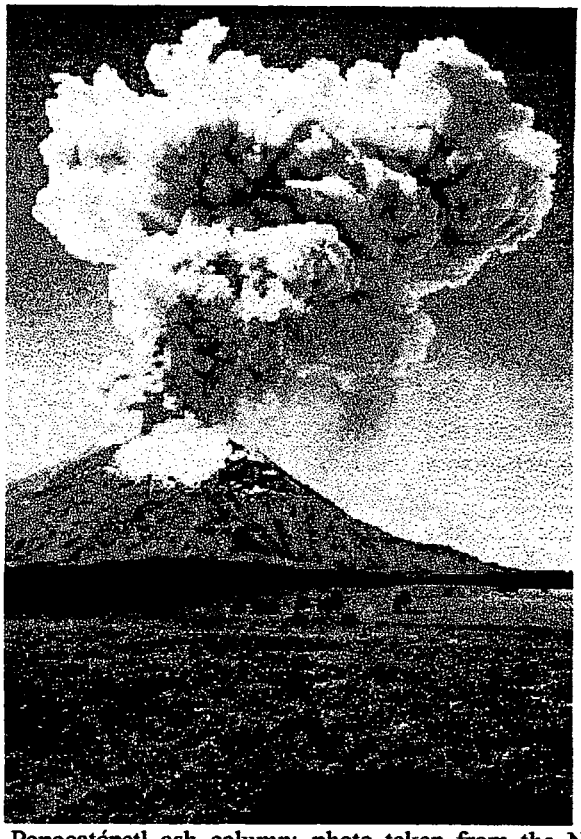
central Mexico

19.023°N, 98.622°W; summit elev. 5,426 m

All times are local (= GMT - 6 hours)

During the Holocene, Popocatépetl produced both effusive and pyroclastic activity. About 30 eruptions are known since 1345, although early documentation is poor. Most historical eruptions were apparently mild-to-moderate Vulcanian steam and ash emissions, with larger explosive eruptions in 1519 and possibly 1663. Activity in 1920-22 produced intermittent explosive eruptions and a small lava plug in the summit crater. Minor ash clouds were also reported in 1923-24, 1933, 1942-43, and 1947.

09/98 (GVNB 23:09) Several episodes of ash emission during September



Popocatépetl ash column; photo taken from the NW (above Paso de Cortes) at 1032 on 11 June 1997. Courtesy of CENAPRED

Following a large ash exhalation on 8 September, eruptive activity at Popocatépetl decreased in intensity and duration. CENEPRED reported a few moderate emissions during September that caused local ashfall. Small-volume, discrete, short-duration emissions containing ash, sometimes accompanied by steam and gas, were recorded occasionally during the period 9-15 September. Brief episodes of harmonic tremor were also recorded. During the night of 14 September glow reflected from clouds over the crater was seen.

Moderate exhalations of steam, gas, and light ash took place during 16 September. Several brief episodes of high-frequency tremor were recorded that afternoon; the largest emissions occurred at 1546-1552, 1604, and 1611. Ashfall was reported at Amecameca, 20 km NW of the volcano. Despite bad weather that reduced visibility most of the day, a dense column of steam and gas was seen rising 700 m above the summit before being blown to the NW.

Activity decreased to stable background levels on 17 September. A dense steam and gas cloud seen on the morning of 18 September dispersed to the NE; as the cloud gained altitude, its direction changed to the south. SO_2 measurements showed significant increases following the 16 September explosion over levels earlier in the month.

Another moderate increase in eruptive activity began a few days later. A steam and gas column rising 1 km above the summit was observed during 20 September. Brief, moderately intense emissions of steam and gas, sometimes with light ash puffs, took place throughout the morning of 21 September. An explosion at 1148 that morning produced light ashfall in towns up to 20 km NW of Popocatépetl. A similar but less intense event occurred at 1543. Emissions decreased to relatively low levels until 1225 on 22 September when a moderate explosion lasting 7 minutes produced a steam, gas, and ash plume that rose 4 km above the summit. Visibility during 22 August was poor due to bad weather, but a large ash cloud near the crater was detected by Doppler radar. Ash was dispersed during the afternoon NW of the volcano, producing light ash falls in the suburban SE of metropolitan México City.

Following the explosion on 22 September, eruptive activity paused until a similar explosion occurred at 1829 on 23 September. This explosion lasted 6 minutes and produced a 3-km high column of steam, gas, and ash. Ash fall was reported in towns SW of the volcano. Eruptive activity soon decreased again, stabilizing at low levels of small, isolated emissions of steam and gas, typical of earlier in September. An exhalation at 1025 on 24 September was followed by 30 minutes of low-frequency harmonic tremor. An A-type earthquake of M 2.1 located 1.8 km E of the crater at a depth of 3.9 km was recorded at 2224 on 24 September, and another moderate exhalation lasting 7 minutes began at 2332.

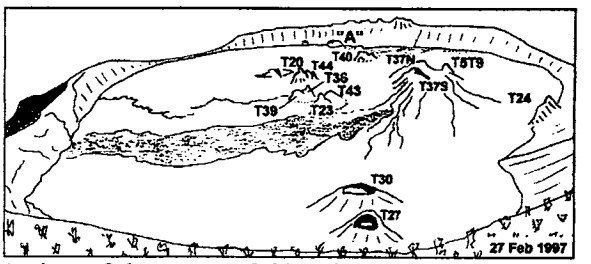
Information Contacts: Centro Nacional de Prevencion de Desastres (CENAPRED) Delfin Madrigal 665, Col. Pedregal de Santo Domingo, Coyoacan, 04360, México D.F. (URL: http://www.cenapred.unam.mx/); and 2Instituto de Geofisico, UNAM, Coyoacán 04510, México D.F., México.

Ol Doinyo Lengai
northern Tanzania
2.751°S, 35.902°E; summit elev. 2,890 m
All times are local (= GMT + 3 hours)

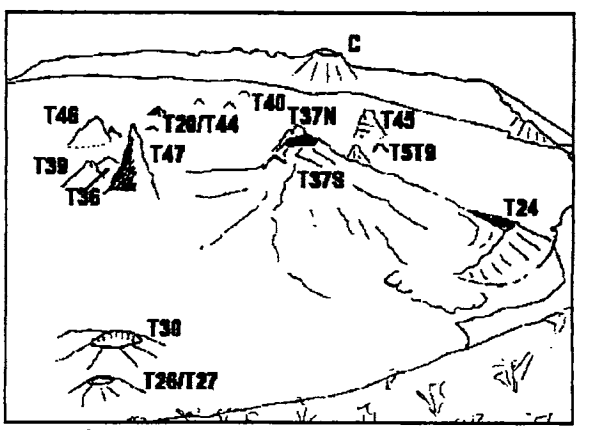
This symmetrical stratovolcano is the only volcano known to have erupted carbonatite tephras and lavas in historical time. Ol Doinyo Lengai, known as "The Mountain of God," rises abruptly above a broad plain S of Lake Natron. The volcano's cone-building stage ended ~15,000 years ago and was followed by periodic ejection of natrocarbonatite and nephelinite tephra during the Holocene. The volcano has historically produced smaller tephra eruptions and numerous small natrocarbonatite lava flows on the floor of the summit crater. Petrologists first observed the eruption of carbonatitic lavas at Ol Doinyo Lengai in the early 1960's. Subsequent visits have documented long-term effusion of this unusual magma type.

09/98 (GVNB 23:09) New cones, vigorous activity since February

From February through August 1998, several visitors to the crater of Ol Doinyo Lengai produced photographs and descriptions of eruptive activity. The following are taken from a summary of those visits provided by Celia Nyamweru, including detailed observations of certain hornitos made by Fred Belton and Chris Weber during their visits in June and August.



A view of the crater of Ol Doinyo Lengai looking N from the crater rim on 27 February 1997. Sketch by C. Nyamweru from a photo by B.A. Gadiye.



View of the crater of Ol Doinyo Lengai looking N from the S crater wall as it appeared 23 February 1998. The oblique view has a variable scale: it is ~ 300 m from T47 to C, and ~ 100 m from T47 to both T37S and T26/T27. Courtesy of C. Nyamweru from a photo by J.S. Antonio.

Among the conspicuous new features appearing in 1998 are three large hornitos. one was described in February 1998 as being "possibly a new cone," but it may have been active as early as

December 1997; by August it had grown to a height of ~7 m and was the dominant landmark in the E of the crater. T47 is a tall, very narrow cone with a pointed top. It is located in the south-central area of the crater near the site of an older one, which has nearly vanished. The cone cluster known as "A" has completely disappeared beneath recent lava.

General appearance. During a visit to the summit on 12 March, observers noted no major changes to the crater since 23 February. Pale-brown, brown, and grey lava of differing ages covered the floor. Pahoehoe flow patterns were clear in some areas. An open vent contained a bubbling lava pool and steam issued from various vents. T47 was described as a very tall cone with a vertical crack and sharp peak, making it easily distinguishable from other nearby cones.

An aerial photograph taken during May showed no important changes. No steam or fresh lava was seen. The crater floor was covered with white or pale grey lava. A summit visit on 12 June revealed few changes. No fresh lavas were seen, but recent flows of grey and brown lava were noticed.

There were no signs of fresh surface activity when observers arrived on 17 June. The entire crater floor was greyish white and mostly soft, and no new spatter was visible on any hornito. The lowest point on the crater rim, to the NW, was 30 cm above the crater floor. T47 was the tallest cone in the crater (~11 m) and was lightly steaming. A 150-m-long steaming fracture, rich in sulphur deposits, was oriented SW-NE; the fracture passed over the site of T41 and T42, both of which had disappeared.

During visits through the first week of August, the steaming fissure was no longer visible, but a new fissure of the same type had developed. This was oriented NW-SE. T37S had two small cones recently added to the S part of its summit and a small lava flow down its W flank. A few clots of lava were ejected from T44C around 1300 on 2 August; although no taller, it showed recently added lava cascades on its N flank. At 0615 on 7 August T44 splashed black liquid lava out of its 6-m-high peak.

T37N1. On 17 June, T37N1 was open to the SE and contained a lava platform consisting of a 2-m-diameter circular pit beneath a 5-m overhanging wall. The pit opened into a cave that was ~4 m deep. A small spatter cone, 4 m W and 2.5 m above the pit, was located on the shoulder of the overhanging wall. At 0630 on 18 June a vigorously sloshing pond of very gas-rich lava rose slowly inside the circular pit. Lava was also visible through the vent of the spatter cone. Within an hour the pond overflowed and the spatter cone began ejecting lava clots up to 2 m above the cone, eventually producing pahoehoe and aa flows that travelled ~100 m ESE. This activity continued until 1200. At 1815 on 19 June a 20-minute eruption resulted in an overflow of the pond. Continuous lava fountains rose up to 1 m above the spatter cone, covering the flows from the previous day. At 1600 on 20 June an eruption lasting more than 15 hours began with a high-volume pond overflow and explosions every 2 seconds from the spatter cone. By 2245 the explosions had stopped and an orange flame was seen at the cone's vent. Lava continued to pour from the pond all night. A tube-fed flow first travelled N, then curved E as a narrow strip ~80 m long containing a single tube, and finally spread out into a wide stacked flow-field that piled up against the E rim.

At 1800 on 5 August a lava lake was seen in the cave under the spatter cone, ~5 m below the rim. At 1930 the lake began to glow dull red in the darkness, revealing that the cave was much larger than it had first appeared. The entire hornito was hollow with a lake slowly rising inside that flowed toward the SW and entered a westward-directed tube or cave. As the lake rose higher lava appeared on the crater floor at the W base of T37N1, flowing slowly along the bottom of an old tube. Within 10 minutes the lake rose up to vent level and began to slosh over the rim, but lava could no longer be seen on the crater floor. From 2000 to 2330 the lake overflowed numerous times and lava advanced to a point near the base of T5T9. Due to frequent fluctuations in lake level, no long tubes developed; instead the flows were short and thickly stacked.

Similar activity occurred in the early morning hours of 6 August; just before 0715 the lake was ~3 m below the rim of the spatter cone, which had been increased in height and reduced in diameter during the eruption. The open interior of T37N1 filled with lava to a depth of 2 m, completely burying the pit that had contained the overflowing lava pond in June. The T37N1 spatter cone, positioned on the W side of the new, higher lava platform, was taller and had a larger vent than in June. Foaming white to pale grey carbonatite lava splashed out and fed short lava flows a few metres long down the W slope. Its vent opened into a large cave, ~8 m deep. A recent tube-fed flow from the vent extended to the W crater wall. The vesiculation of the gas-rich lava was high. Activity stopped around 1100 causing a 4-m drop of the lava level.

At 0800 on 18 June (while T37N1 was erupting) T48 produced lava fountains up to 3 m high for 10 minutes, forming short aa flows on its N side. Throughout the morning of 19 June it occasionally ejected solid lapilli along with loud puffs of steam. At 2335 that night it began exploding loudly every 2 seconds and produced lava fountains up to 7 m high. After less than 2 minutes of these explosions the fountains decreased in height to 3 m but increased in volume. Each explosion covered the NW half of T48 with a thick layer of spatter that glowed dull red.

By August T48 had increased in height by at least 2 m and had produced many fresh flows extending in all directions. Aerial photographs taken by Benoit Wangermez on 1 August showed several fresh lava flows originating from vents in the approximate location of T48 and T49 extending to the NE and W crater rims. At 1300 on 2 August, low lava fountaining began from the summit vent and within an hour a lava stream was cascading down the nearly vertical SW flank of T48. Over the next 7 hours a large tube formed from the summit down the SW flank. Lava from this tube advanced past the N slope of T20 more than halfway to the WNW crater wall. Near the base of T48 the tube was ~60 cm in diameter and had several skylights from which lava often overflowed. The lava was gas-rich with a surface that appeared to be covered with grey foam.

The eruption continued all night but lava never reached the crater wall. At 0800 on 3 August a close inspection of the vertical lava tube revealed a small crack expelling hot air. Near 1000 the tube ruptured at that point, creating a powerful horizontal lava fountain that played on the N flank and base of nearby T44C. As the rupture progressed, other fountains directed at various angles of inclination developed, and eventually a flow began to form a second tube. The original tube was still full of flowing lava. By 1800 no lava was visible in the skylights. At 1930 a thin lava stream was spraying horizontally from the E side of T48's summit. At 0600 on 4 August T48 was inactive but at 0800 fountains developed on its upper east flank, creating pahoehoe and aa flows that reached the base of T40B. Similar activity continued until 2000. There was no further activity until 2330 on 5 August when a wide lava fountain sprayed horizontally for 20 minutes from just above a small ledge on the E flank, 2 m below the summit.

On 6 August at 1400 lava splashed out of two openings close to the peak of T48. Black, degassed, very liquid lava fed little lava flows reaching 8 m down the E slope. The activity stopped shortly after 1600.

Sloshing lava was heard inside T40 during the entire June visit. During the night of June 19 a pahoehoe flow travelled ~10 m from a small vent in its base. Lava flowed into a cave under a low, broad hornito just NE of T40. This new lava flow was ~1 m thick. The cave had contained an impressive group of white lava stalactites. On 20 June a 3-m2 section of the SW flank collapsed into its interior.

On 2 August at 1000 occasional lava clots were being ejected from T40's summit, but this continued for only ~30 minutes. During the August visit T40 was noisily degassing. The collapse pit that formed on 20 June in the SW flank of T40 was no longer visible, having been filled in by lava. Recent flows extended a short distance SW and SE of T40, partially covering a low mound to the SE. A tall, narrow cone had very recently been formed on the summit of T40 and was the source of several very fresh aa flows extending to the base of T40.

A small cone just NE of T49 extended toward the NW and grew in height between visits. Sloshing lava was frequently heard there. After several earthquakes during the night of 6 August, at 0408 on 7 August a loud explosion blew off the top and N side of T49. Rocks up to 1 m3 were thrown or rolled a few meters. A dark-red lava fountain ~15 m high continued until 0413 with a loud, jet-like noise. Pahoehoe lava with little viscosity (1-5 Pa s) splashed N of T49 and travelled NW. The flow was thin (10-20 cm) and stopped shortly after the end of the eruption. The amount of erupted lava was ~70-100 m3. Lava pearls up to 4 mm diameter and fine ash were blown over 200 m NW.

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Ambrym

Ambrym Island, Vanuatu
16.25°S, 168.12°E; summit elev. 1,334 m
All times are local (= GMT + 11 hours)

Ambrym Island is a large basaltic volcano with a 12-km-wide summit caldera slightly inclined to the E (660-700 m high). The caldera was formed during a major Plinian eruption with dacitic pyroclastic flows ~1,900 years ago. Post-caldera eruptions, primarily from Marum (1,270 m) and Benbow (1,159 m) cones, have partially filled the caldera floor and produced lava flows that ponded on the floor or overflowed through gaps in the caldera rim. Lava lakes appear regularly in the craters of the two caldera cones. Eruptions have apparently occurred almost yearly, since discovered by Captain Cook in 1774, from intra-caldera cones or flank vents, although from 1850-1950 primarily only extra-caldera eruptions that would have affected the local population were recorded.

09/98 (GVNB 23:09) Long-active lava lake continues to hold bubbling lava

This long-active caldera was visited by John Seach during 4-7 September 1998. At Niri Mbwelesu Taten, a small collapse pit, strong degassing was observed as well as yellow sulphurous deposits on the NW wall. During the night, degassing was heard from a distance of 4 km and white vapour tinged with blue was constantly emitted from the pit. Niri Mbelesu

crater was constantly full of vapour resulting in poor visibility. But bubbling lava was heard and at night the clouds reflected a red glow from the crater.

At Mbwelesu crater, an active elongated lava lake (~100 x 30 m) was observed. The larger explosions threw lava high into the air and onto the crater wall. To the east of the lava lake a smaller elongated vent contained lava. On the NW wall of the crater was a circular vent 20 m in diameter from which no lava was extruded.

Benbow crater was climbed from the S. The sound of bubbling lava was heard but not observed, and there was a very intense night glow.

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Komaga-take

Hokkaido, Japan

42.07°N, 140.68°E; summit elev. 1,140 m

Komaga-take sits 30 km N of Hakodate City (population 320,000). The andesitic stratovolcano has a 2-km-wide horseshoe-shaped caldera open to the E. The volcano has generated large pyroclastic eruptions, including major historical eruptions in 1640, 1856, and 1929. In the 1640 eruption, debris from a partial summit collapse entered the sea resulting in a tsunami that killed 700 people. Although the 1929 eruption was one of the largest 20th century eruptions in Japan, it may not have had clear geophysical precursors.

09/98 (GVNB 23:09) Phreatic eruption spreads ash 25 October

The Japan Meteorological Agency (JMA) issued an advisory and three observation reports concerning Hokkaido-Komaga-take volcano on 25 October following a small-scale phreatic eruption that began at 0912 the same day. Ash rose in a column to a height of ~1,200 m above the crater. The eruptive activity soon declined. There were no report of injuries or damage caused by the eruption, and no evacuation order was issued.

Volcanologists surveyed the activity from a helicopter the afternoon of 25 October (figure 7). They reported that the eruption originated from the same crater that opened during the 1929 eruption, which was also the site of the March 1996 eruption. Ash covered a significant area around and to the E of the crater. The scale of this eruption apparently was smaller than that of the March 1996 eruption.

Volcanic tremor lasting six minutes was associated with this eruption. In addition, five volcanic earthquakes were recorded in the 12 hours following the first eruption signs.

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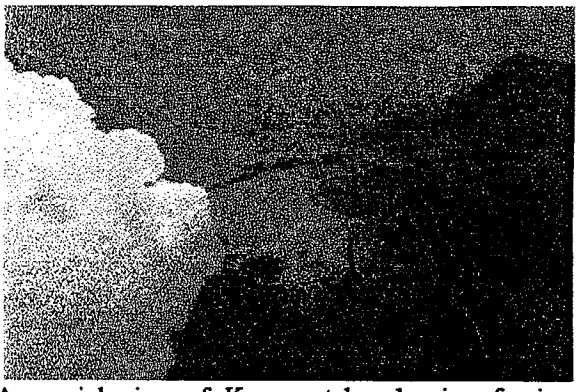

An aerial view of Komaga-take showing fuming activity from the 1929 Crater about 6 hours after the 25 October 1998 eruption. View is from the SE looking towards the Komanose Rim and the Sawaradake Rim. The 1942 Large Fissure and the 1996 Southern Fissure Crater can also be seen. Hyoutan Crater is adjacent to the 1929 Crater. Photograph by Bousai Heli; courtesy of Hiromu Okada, Usu Volcano Observatory.

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