REPORT OF SIERRA NEGRA ERUPTION
October 2005

Dr. Dennis Geist, University of Idaho, Moscow, Idaho, USA
Email: dgeist@uidaho.edu
Dr. Terry Naumann, University of Alaska, Anchorage, Alaska, USA
Email: aftrn@uaa.alaska.edu
Dr. Karen Harpp, Colgate University, Hamilton, New York, USA
Email: kharpp@mail.colgate.edu

Summary

We concur with the assessment of Dr. Hall, from his visit to the eruption on Day 1. This eruption presented little danger because it was contained in caldera and over the uninhabited north flank of Sierra Negra. Significant quantities of vegetation were burned mostly inside the caldera, when they came in contact with the lava flows. We observed no harmful effects to any birds or animals during our study.

Daily Reports

Thursday October 27, 2005

0830 h: According to eyewitness report of Godfrey Merlin, a second, lower vent (Vent 2)opens up without diminishing the strength of the upper vent's activity (Vent 1). Consequently, the total flux of erupted material nearly doubles at this time.

As of 1400 h: Two active vents (Vents 1 and 2, Vent 1 is older one, upslope from Vent 2) are both fountaining up to about 50 m height (max). The vents are producing a constant roaring sound. Two lava channels emanate from Vent 1, one channel from Vent 2. The channels meet slightly downhill from the vents and merge into two, with two crossover junctions. The channels contain rapidly flowing lava (~10 meters/second) as it moves downhill. Where topography becomes flat, the flows slow down and move south across the caldera floor, banking against the east wall and moving clockwise around to the south caldera, producing a major a'a field with pahoehoe breakouts at the margins along the caldera wall. Brush fires have broken out along the E and S caldera wall vegetation. The gas plume is several km high and drifting approximately SW, just to the south of Cerro Azul. At ~2.5 km from Vent 2, tephra pieces up to 4 cm are observed along the path and caught in vegetation, likely from the fire fountaining of the first day. Tephra abundance and size increases toward the vents; Pele's hair is observed beginning up to ~1 km from the vents.

At dusk: Volcan Chico fissures have multiple steaming fumaroles along them, more activity than was observed in June. Active Vents 1 and 2 are producing typical Hawaiian-style spatter, including occasional collapses of the crater wall back into the vent . Spatter is accumulating both inside and outside the craters. Fire fountaining of Vent 1 is vigorous enough to clear the caldera rim and is agglutinating to form a clastigenic lava flow on the flank of the caldera wall. Incandescence extends 1-2 km down the flanks from the caldera rim. Inside the caldera, in the upper parts of lava channels, where they are cascading down the caldera terraces, lava is moving fast enough to set up standing waves at corners, and is effervescing for most of its visible length. Lava in the steep areas appears to be moving >10 m/s. Lava occasionally overshoots a corner and begins a new, short-lived

flow. On the flatter caldera floor, the lava channels coalesce into an expansive a'a flow moving south until incandescence is no longer visible (within ~1 km of the edge of the caldera floor, ~2 km from the vent). Incandescence along the western margin of the flow indicates that the flow is also extending westward. Pahoehoe breakouts on the eastern margin of the floor are igniting brush fires along the caldera wall. Inspection of permanent GPS station (GV01) reveals that it is intact, as is the seismometer of the Instituto Politecnica de Quito.

Friday October 28, 2005
During the night, at least one loud explosion is heard. Cause is unknown.

AM: At GV01 GPS station, computer interface is established and receiver is reset. Activity of Vents 1 and 2 appears to be approximately similar compared to last night. Lava in fast-moving flows on the terraces below the vents is slightly lower in volume than last night and is not splashing up out of the channels as much.

~1030h: Increase in flow volume in all channels, possible widening of Vent 1.

Until approximately 1200h, tephra is blowing to the ~NE, falling mostly within ~300 m of the vents. Between 1200h and 1300h, low altitude plume and tephra change direction and tephra begins to fall more to the south, including on the GV01 GPS site, up to 400 m from the vents. Gas production increases throughout eruptive area, more in the vent plumes, more from several locations along the lava channels on the steeper parts.

1310h and 1313h: Two strong tremors occur, felt at GV01 GPS station, the first larger than the second.

1800h: Clastigenic lava flow on the north flank exhibits incandescence only several km NE of the vent. No incandescence is observed in the first km. The crossovers in the lava channels inside the caldera from Vents 1 and 2 are gone; one channel is emanating from Vent 2 and two channels are emanating from Vent 1. Channels seem more well defined than yesterday. At the base of the westernmost channel (from Vent 1), where the topography flattens, there is now a large lava pool into which big (10s of meters) pieces of solidified lava are being rafted. Pool appears to be widening gradually. At the base of the channel from Vent 2, there is a smaller, less incandescent pool. Lava flowing into this pool is moving at ~10 m/s off the terraces. Expansion of major a'a field to the west appears to have increased since Thursday night. Incandescence throughout the a'a flow is limited to long, linear regions stretching from N-S (perhaps a rift zone at the surface). Approximately half a dozen pahoehoe breakouts are observed along the eastern caldera wall. The bases of the two vents are both wider than they were yesterday. Spatter onto the northern flank from Vent 1 is intense. Gas production remains high. No fumarole activity is visible along the Volcan Chico fissure system.

Saturday October 29, 2005
0800h: During the night, Vent 1 shut off and is now only producing white vapor (sulfur-rich). The two westernmost channels have become inactive (no molten material visible in them during the day). The channel from Vent 2 remains active, but lava is flowing ~5 m/s on the upper slopes and volume is down by ~50%. Vent 2 continues to fountain to ~40 m,

with bursts that are much higher every few minutes up to 2-3 times its average height. The base of Vent 2 is wider and extends lower down the caldera wall. Gas production in the plume from Vent 2 is significantly lower as well. Vapor continues to be produced at several locations in the active channel from Vent 2. On the caldera floor, long straight areas of smooth lava are visible in the a'a field, where the rifts were located. Park guards report that the flow is not progressing along the southern wall. The incandescent areas are significantly less extensive. Tephra is being distributed mostly to the NE, falling within ~300 m of Vent 2. The roar from the vent is significantly less loud than it was yesterday. Vent 1 is emanating opaque white vapor, as is a center just to the west of Vent 1. The white, opaque vapor is pooling in the valley just NE of the vents. Entire region is shrouded in a gray haze that limits visibility significantly.

0830-0900h: National Park guards report 3 explosions, but they were not heard at our camp. No ballistic clasts are observed at the vent later upon inspection.

1800h: Lava fountain of Vent 2 is consistently less high than it has been to date, maximum height of spatter is at the top of the vents on the flank side, peaking every 1-5 minutes. This vent has an active lava lake, in which the lava levels vary systematically. Lava from the lake overflows through a breach in the S side of the vent wall, supplying the lava channel. Previously, the fountaining was caused by continuous streaming of gas. During this lava lake phase, large bubbles are bursting periodically, causing fountaining, in typical Strombolian-style activity. Only one lava channel is visible, originating at Vent 2. The two channels from Vent 1 are not visible at night, except for small patches of incandescence. Glow along the western edges of the major a'a flow on the caldera floor is apparent, suggesting that the flow continues to move westward slowly.

Sunday, October 30, 2005
0200h: Faint glow from vent observed in night sky from camp.
0400h: No glow visible in night sky from camp, no sound either.
0700h: Only a plume of white smoke from Vent 1 is visible from the eruptive area, no lava fountaining. Minor vapor is emanating from Vent 2. Only small amounts of gas are being produced from areas on the terraces below the vents, a decrease from yesterday. Fumarole to west of the two vents continues to produce gas. Still no fumarole activity along the Volcan Chico system.

Eruption appears to have ceased between 0200h and 0400h Sunday, October 30, 2005.

1200h: Major brush fires along S/SW edge of the caldera spread rapidly and produce abundant smoke, moving toward Volcan Azufre.

Additional Observations

According to satellite reports, preliminary GPS data processing indicates that the caldera floor has contracted approximately 6 meters along a north-south line, and has subsided ~2 meters since the beginning of the eruption.

We estimate that approximately 14 km2 of the caldera floor were covered during the eruption. The likely total eruptive volume is between 50 and 100 million cubic meters.

Recommendations

1. Extreme care must be taken within 1 kilometer of the new cones/vents. Ground that appears to be cool to touch can be underlain by hot rocks that can cause injury. This may be the situation for several months.
2. None of the new lavas should be approached because of possible danger from high temperatures for several months.
3. Care should be taken near the vents, because potentially harmful gases continue to be produced by them. Wind direction should be observed at all times to prevent exposure to vapors.
4. Volcan Chico is probably safe to re-open in several days, provided the eruption does not resume.
5. The new vents should be monitored carefully, because there is a small chance that the eruption could start again (at Cerro Azul in 1998, the eruption paused for several days then resumed).
6. Because the volcano is inhabited, Civil Defense authorities should continue to develop emergency plans for future eruptions like this one anywhere on the volcano.