

EARTHQUAKE COUNTS FROM DETECTED EVENTS

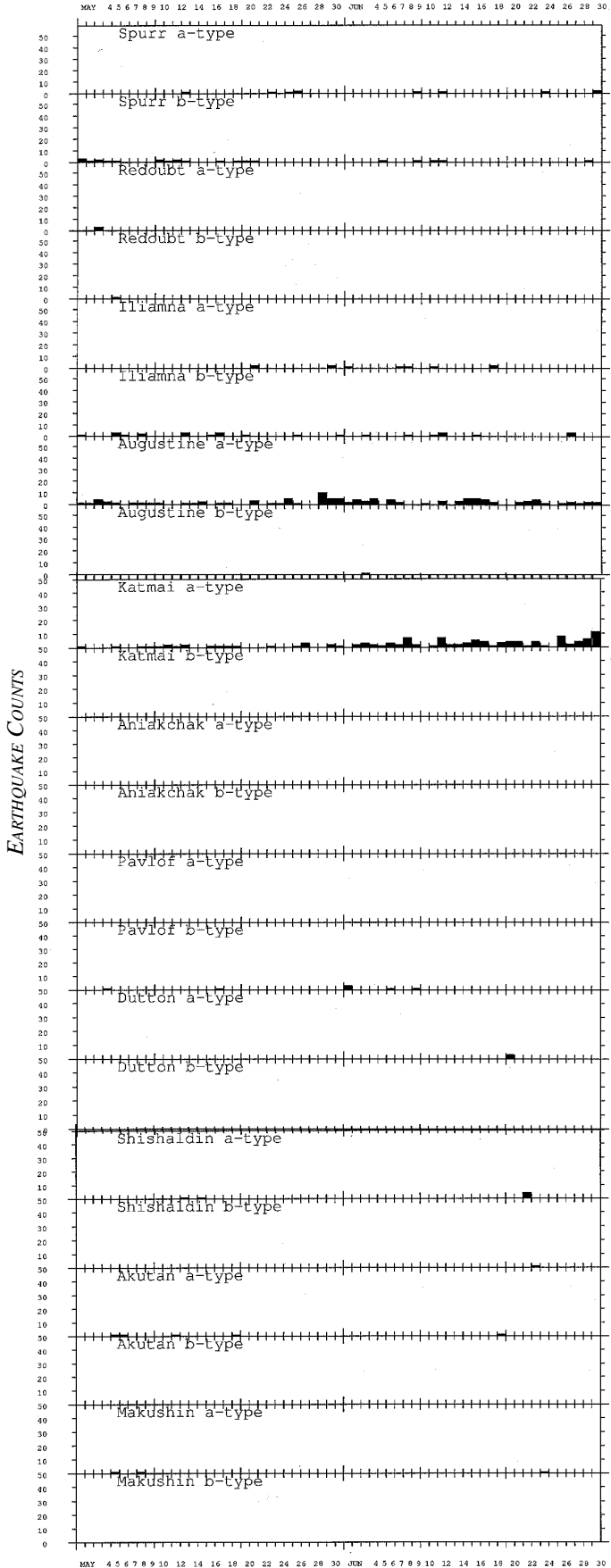


Figure 16a: Histogram of computer detected ("Willie system") seismic events during May through June.

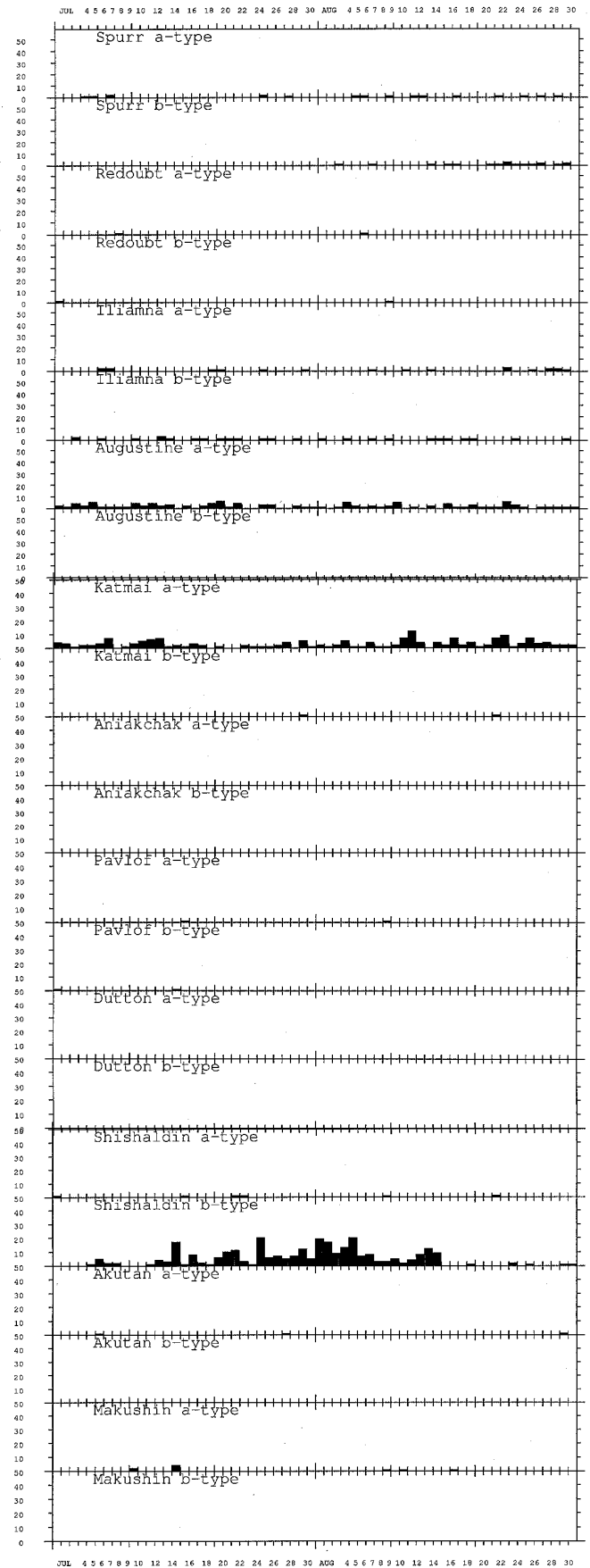


Figure 16b: Histogram of computer detected ("Willie system") seismic events during July through August.

Augustine Deformation

GPS

Both WINDY and DOMO GPS stations were not working at the start of the report period. By the end of the report period, both were. However, we do not know why one was, and the other wasn't. To explain this, we start by a field visit by Tom Murray and John Power to WINDY in July. They found that the GPS antenna was bad and changed it. This is the easy one to explain.

Owing to inclement weather, the helicopter was never able to land on the dome to visit DOMO GPS. But John Power hiked up to DOMO and found a very interesting sight. In 1994, the antenna was moved near the helicopter landing area because of the hot ground. We cemented in a pad with the antenna approximately 25 cm above ground level. We had hoped the hot ground might keep snow off the antenna during the winter. Figure 17 is a plot of MOUND-DOMO. There is a large offset in late October. We thought perhaps a slump had occurred and the antenna moved. John found that the antenna was crushed from the top. Since it was only October, we think the antenna was not crushed by snow loading, but possibly by a helicopter landing on it. We thought the problem solved with John changing the antenna.

We were wrong. Figure 18 shows that MOUND-DOMO did not start coming in until late August. The best explanation for this would be a bad/wet antenna cable that may have been damaged when the antenna was crushed. We will see when Tom hopefully goes back to fix it. Figure 19 is the MOUND-

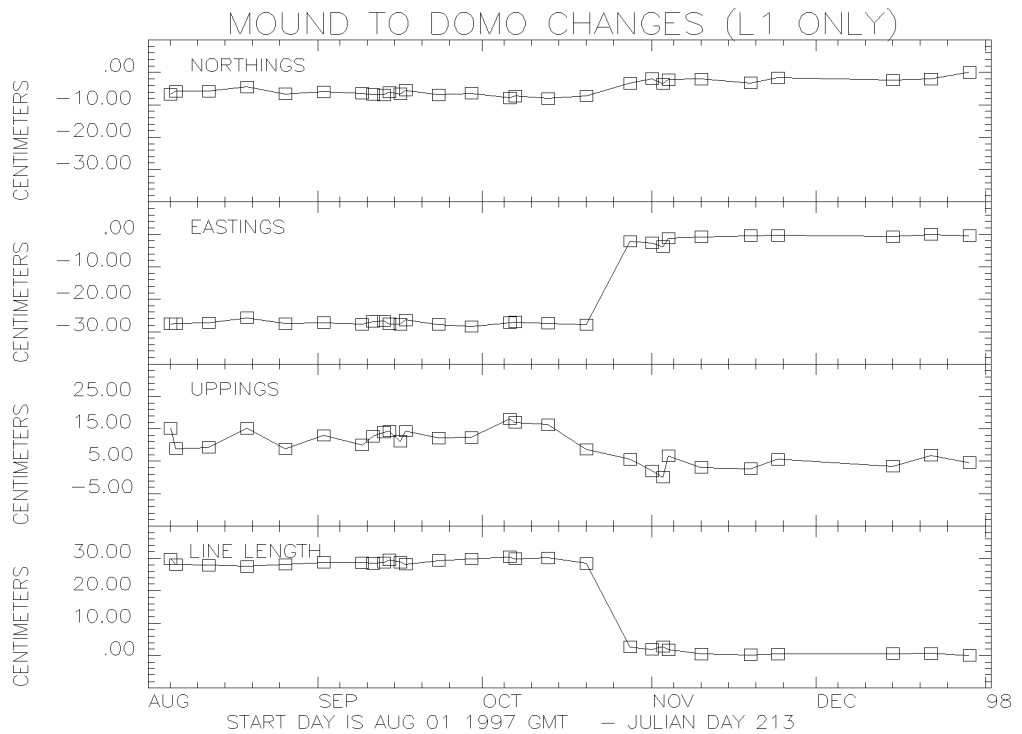


Figure 17 - Plot of MOUND-DOMO during late 1997. Note the offset in late October. We believe the top of the antenna was crushed by a helicopter landing on it. The antenna failed in the early part of 1998. The antenna was changed in July.

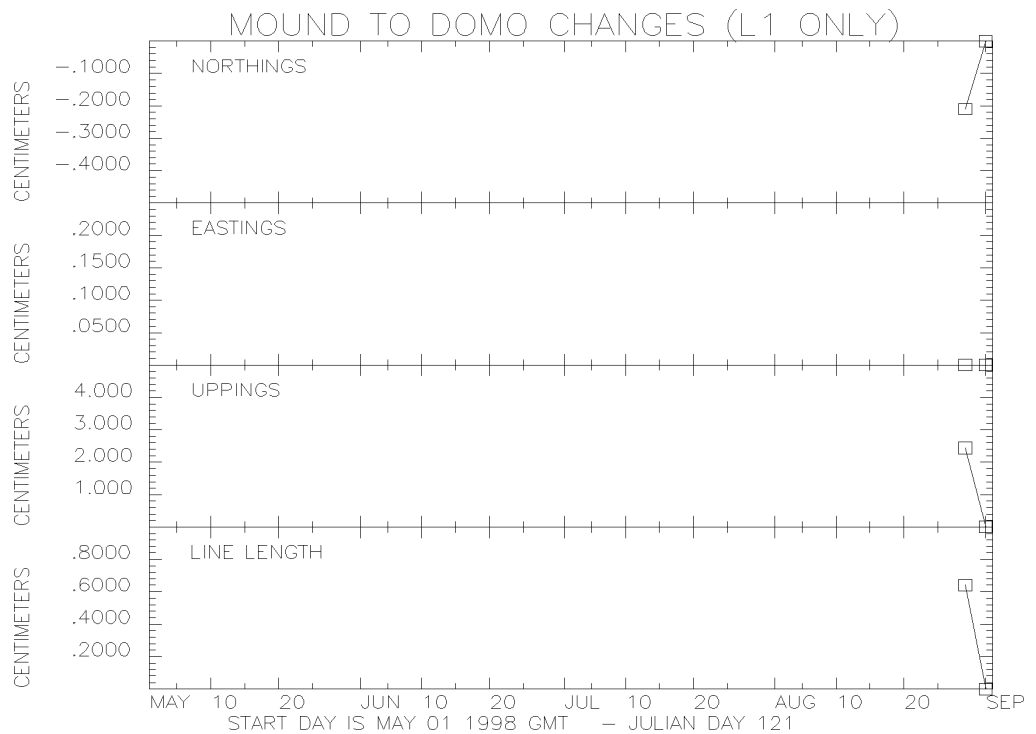


Figure 18 - MOUND-DOMO just started recording at the end of August. It appears the antenna cable may have also been affected by the helicopter and during the warm summer, started working again.

WINDY plot that continues along the trend established prior to the antenna failing.

Tiltmeters

There were no significant changes on any of the tiltmeters (figs. 20-24). Tom was not able to get to the summit tiltmeter to fix it, otherwise everything seemed to be working well.

Gene Iwatsubo

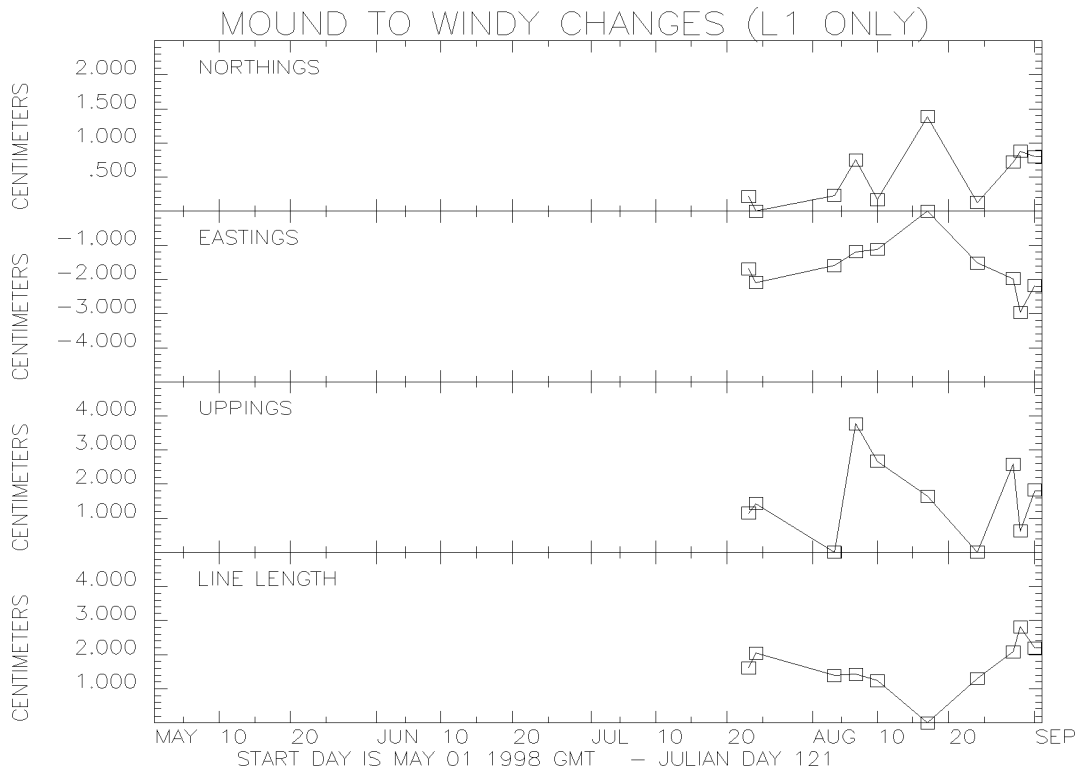


Figure 19 - MOUND-WINDY plots after the antenna was changed in July. The trend continues to be the same as before the antenna failed.

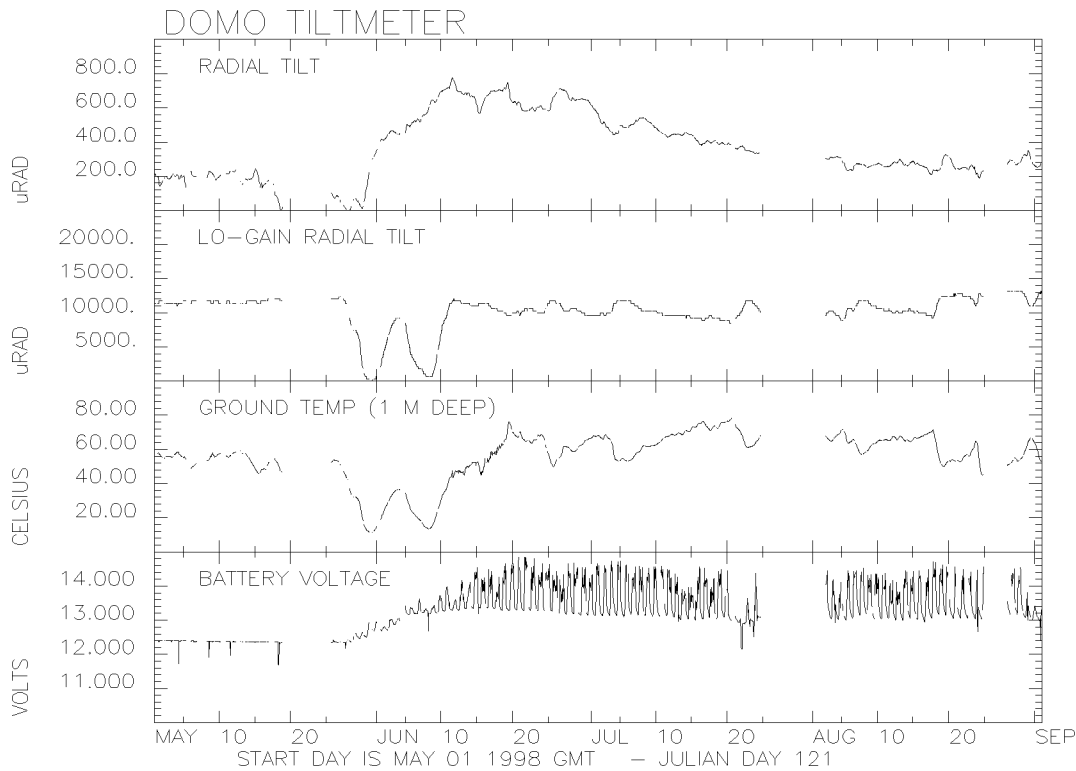


Figure 20 - DOMO tiltmeter plots. After the large change in May (possibly related to temperature?), the tilt slowly comes back and continues the trend it has been following for years.

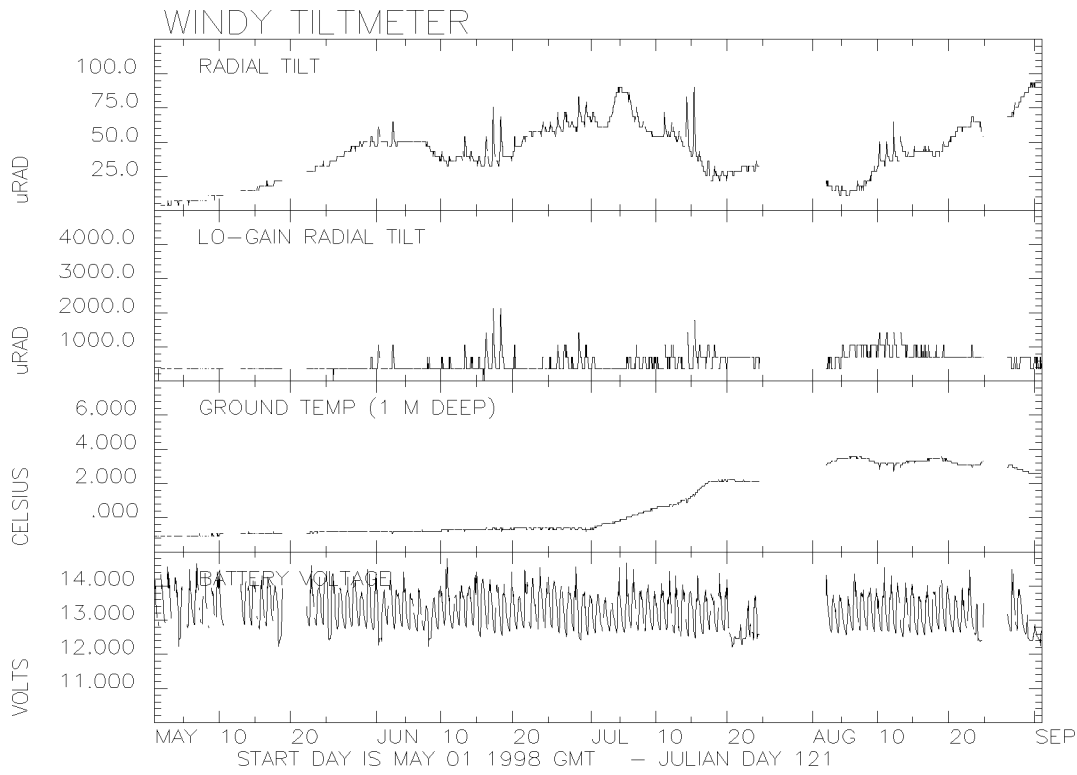


Figure 21 - WINDY titlmeter plots. Nothing unusual can be seen.

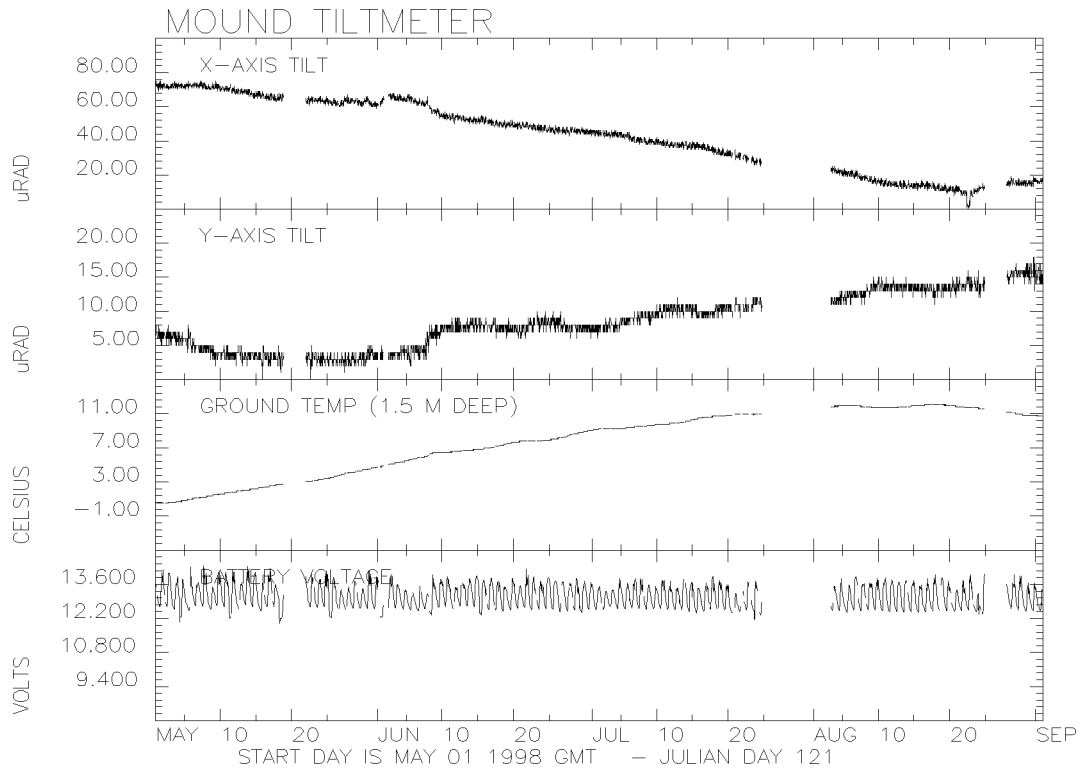


Figure 22 - MOUND titlmeter plots. Working great with no large scale offsets.

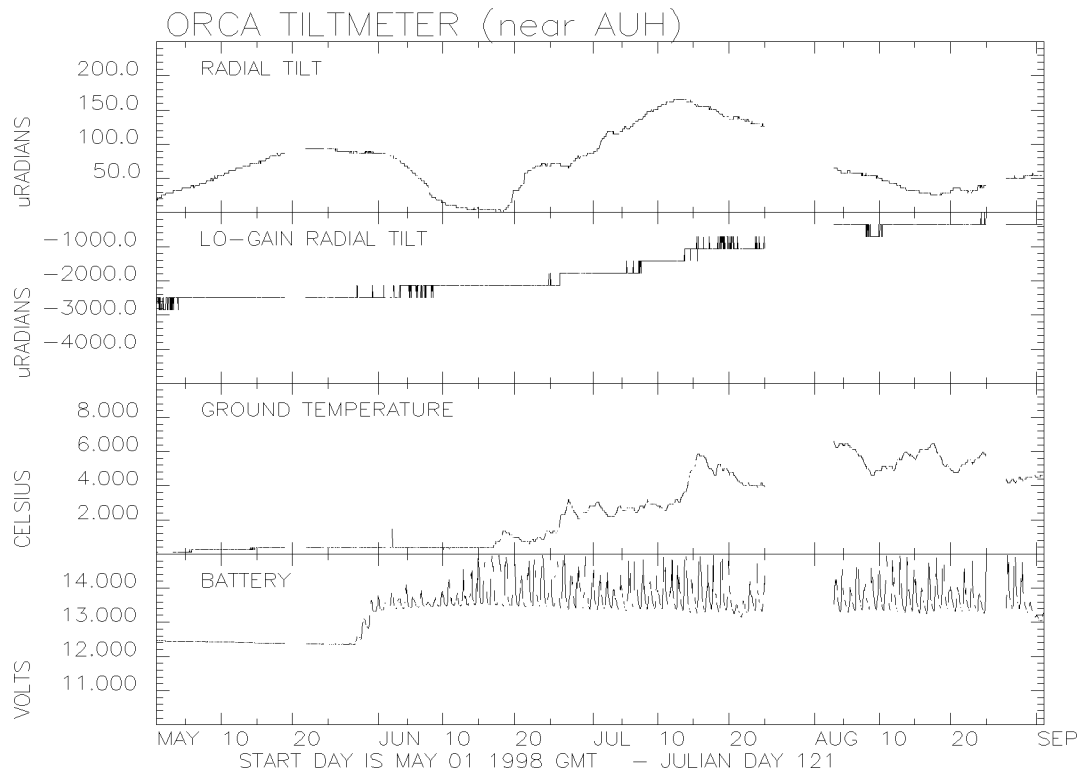


Figure 23 - ORCA tiltmeter plots. Typical summer tilt pattern.

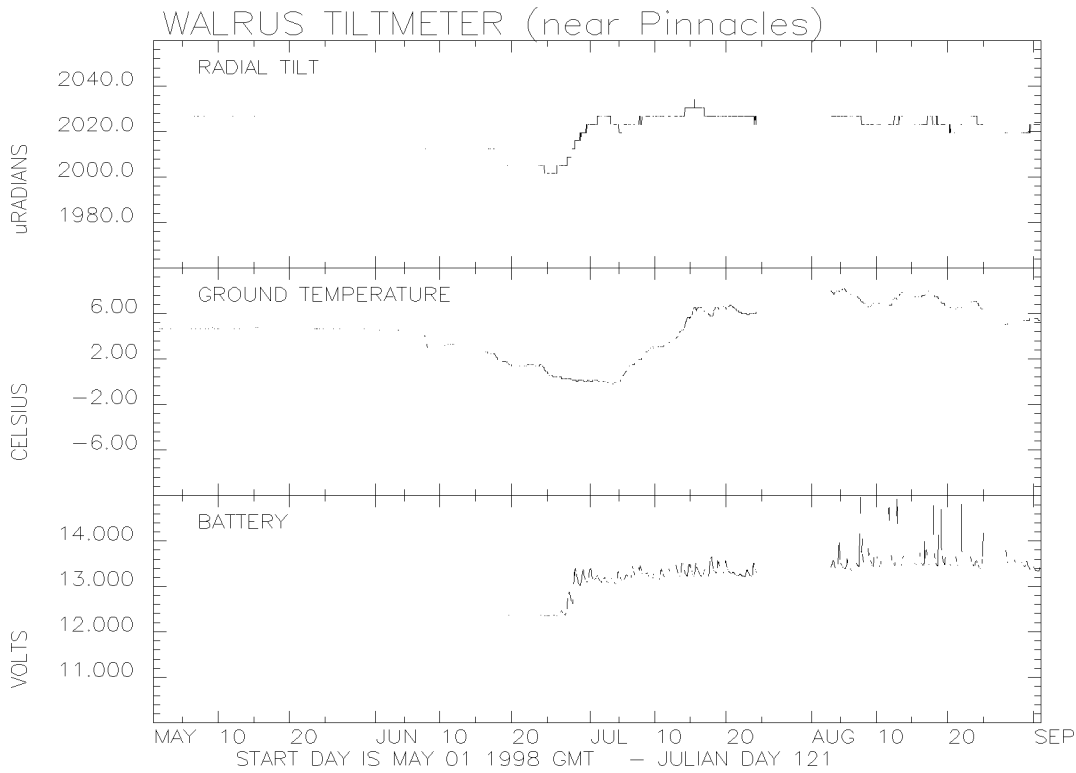


Figure 24: WALRUS tiltmeter plots. Flat line tilt signal.

Operations

1986 Augustine Dome Fumarole Temperatures

Measurements of the fumarole temperatures at the base of the spine on the 1986 dome were made on July 23, 1998. As in 1997, temperatures were measured with an Omega 873C thermocouple in cracks at the base of the spine and 5 meters east of the spine. Two measurements at the base of the spine yielded temperatures of 93.8°C and 96.3°C. Temperatures 5 m east of the spine were 95.8°C, 96.9°C, and 95.8°C. Note that the theoretical boiling point of water at 4000 feet elevation is 96.0°C, and the elevation of the A15 benchmark is 3964 feet. These temperatures are similar to those measured at the same locations with the same thermocouple in 1997.

John Power

Augustine Geology Team

In mid-July, Kathy Cashman (Univ. of Oregon), John Power, and Cynthia Gardner spent 5 days on Augustine Volcano sampling deposits of the 1986 and 1976 eruptions as well as the domes from 1935, 1964, and 1986. The work was part of a new USGS study entitled "Controls on eruptive style at Cook Inlet volcanoes", which attempts to combine textural studies of eruptive products with observational, geochemical, and geophysical data in order to examine the relationships among rates of magma ascent, discharge, degassing (vesiculation), and degassing-induced crystallization on eruptive behavior. With Richard Waitt's Augustine map in hand, we were able to sample the early 1986 pumiceous pyroclastic flows, the denser pyroclastic flows associated with later dome growth and collapse, the 1986 lava flow, and 1986 dome, as well as some of the early pumiceous pyroclastic flow deposits from the 1976 eruption. A first-order observation is that the 1976 pumiceous flows are of much lower density than anything expelled during the

1986 event. We are still missing tephra deposits from the early phase of the 1976 and 1986 eruptions, so if anyone knows of some samples, please contact one of us.

Cynthia Gardner
cgardner@usgs.gov. or
Cascades Volcano Observatory at
(360) 993-8942

Changes to the AVO internal page (Seismology & IceWeb system)

(1) Spectrograms are additionally being produced for Spurr and Redoubt, so there is now a total of seven volcanoes monitored by the IceWeb system.

(2) 3-day-reduced-displacement plots are now produced for 5 volcanoes.

(3) The most important addition is the option to request any reduced displacement plot you want, for any time period for any of the five volcanoes. Plots take a minimum of about 20s to generate, and can take much longer depending on how much data you ask for.

Email me if you experience any problems with the spectrograms or reduced displacement plots. Known problems are:

* The first time you request a plot, the gif image is kept in cache. If you subsequently request a plot for another volcano/time period, the previous gif image is loaded from cache. (If anyone knows how to avoid this I would be interested to hear).

* Sometimes the server crashes and this corrupts some data files with the result that the automatically generated reduced displacement plots (3 days for any volcano) are stopped from being produced.

There is now sufficient bandwidth to support 10 volcanoes on the IceWeb system. More will be added when that becomes possible.

Glenn Thompson

1998 Field Work

Westdahl seismic network installation and Shishaldin seismic network maintenance

The Westdahl/Shishaldin field campaign was conducted between July 1 and July 21, 1998. This year's crew was composed of Bob Hammond, Andy Lockhart (CVO), Doerte Mann and myself (Guy Tytgat). Doerte was supposed to do a GPS survey and help us part-time. Unfortunately, her gear didn't arrive until the very end, so she ended up helping us full-time. Like last year, we were based out of False Pass. Although it is the closest town to Westdahl Volcano not requiring flight over water, the distance we had to cover every day was relatively large. For that reason, it was decided to use an Aerospeciale A-Star helicopter rather than the usual Bell Jet-Ranger. This allowed us to make fewer trips across Unimak Island since the A-Star has a larger payload capacity.

The new Westdahl Volcano Seismic Network is composed of five stations around the edifice plus three telemetry repeaters (fig. 25). One station on the North-East side (WESN), one on the East side (WESE), a three component instrument on the South side (WESS), one on the West side by Farris Peak (WFAR), and one on the North-West flank of Pogromni Volcano (WPOG).

One of three telemetry repeaters located in the Tugamak Range North of Westdahl is also a seismic station (WTUG). The remaining two repeaters, which brings the signals to Akutan Village and Cold Bay, are located on Akutan Island and Mount Baldy, respectively. The circuits, which were promised to us by July 1st by AT&T/Alascom, for Akutan and Cold Bay were not installed yet. We found out later that there would be no more circuits available out of Akutan, while the Cold Bay circuit was not installed until October.

During the first few days, we made the final preparations to the gear in False Pass, while Ken Wheeler, our helicopter pilot (ERA), ferried some fuel and most of the fiberglass

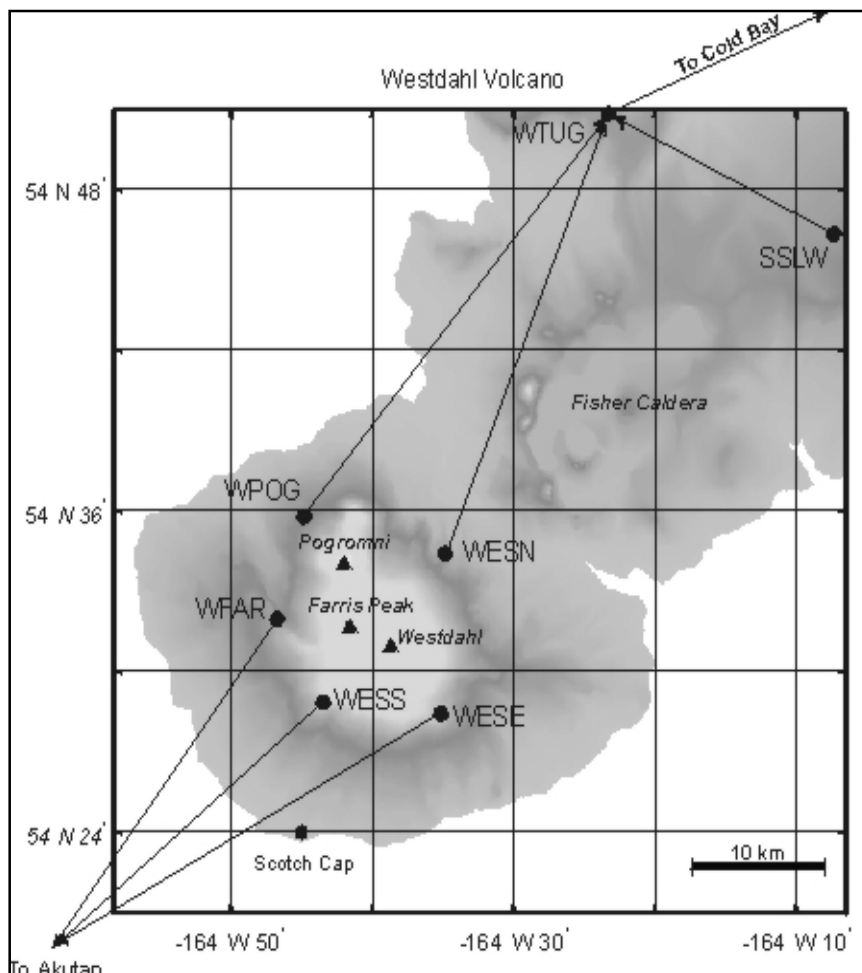


Figure 25: Map of the new Westdahl seismic network.

was surrounded by so much snow during breakup, the water level rose inside it to about midway up the batteries. Luckily, there were no signs that the water got higher and into the aircell batteries. At SSLS, there was also evidence of water entry into the fiberglass enclosure, but in this case the water did reach a higher level and ruined the aircell batteries. There were strong indications that the water damage was caused by snow blowing inside the hut through the door seal and the air vent. We plugged the air vent, and reinforced the door to limit future damage to the batteries. In the future, we will install two latches on the hut's door instead of one to ensure a tighter seal. All other stations only needed minor repairs and adjustments.

Figure 26: Station ISTK (South of Isanotski Volcano). Photo taken on 4th July. Deep snow this last winter is probably the cause of the damage sustained by both solar panels.

enclosures across the island to Cape Sarichef and Scotch Cap. We spent our 4th of July touring the Shishaldin network which was installed last year to assess winter damage, and make Bob, Andy and Doerte (yes, we could fit all 4 of us plus some gear in the A-Star!) familiar with the style of seismic installation. The next week, whenever the weather would allow, we spent installing the new stations on Westdahl. The conditions were marginal at best most of the time. It was unfortunately nearly impossible to guess the weather conditions around Westdahl by assessing the conditions in False Pass. Several times, we encountered terrible weather conditions midway across the Island, where we had to fly along the coast because the ceiling was so low, and yet we would enjoy a calm sunny day on some part of Westdahl. The opposite was often true too. The installation of the new network went relatively fast, considering the weather conditions. By 11 July we had the South Westdahl network installed and sending data to Akutan Village (although no circuit to Fairbanks yet). Two days later we had the North Westdahl network installed

as well, transmitting data to Cold Bay (no circuit to Fairbanks either).

The Shishaldin seismic network maintenance was performed during and after the installation of the Westdahl network. When and where we were going was entirely dictated by the weather. In general, the network seemed to have survived its first winter well. The only major damages were at station ISTK (Isanotski South) and SSLS (Shishaldin South). At ISTK, both solar panels were destroyed, apparently by snow load. When we first visited that station for inspection on 4th July, the snow was reaching almost to the tip of the fiberglass enclosure (5ft). Also, since the hut



Station SSLN (Shishaldin North) had bear claw marks on the side of the fiberglass enclosure and bear tracks around it. But once again (see notes on last year's maintenance trip to Pavlof Volcano), no damage was done to the equipment. Is it luck, or is it that the bears show little interest on the seismic fiberglass huts?

Changes were made to the telemetry path of station SSLW (Shishaldin West). Last year it was being repeated through SSLS and BRPK (Brown Peak), one of the Deer Island repeaters, and was received in King Cove. Since this summer, it is repeated through WTUG (Tugamak Mountain repeater), Mount Baldy, and is received in Cold Bay. This has the advantage of eliminating a repeater link. Also, by being received at a different site (Cold Bay), we reduce the chance of losing most of the Shishaldin network in the case of a receiver or telephone circuit failure.

Additional maintenance was performed on a couple of stations outside the Shishaldin/Westdahl network. Station DT1 (Dutton Volcano) was dead. We found that the solar regulator had filled up with water. Since we didn't have a spare regulator with us, we made a temporary fix that would make it last through the winter. Finally, station NAG (Nagai Island), one of the Shumagin Island station used by AEIC, had died during the previous winter. Since Nagai Island is in the neighborhood, it was decided that we would take the opportunity to fix that station as well.

Guy Tytgat, Bob
Hammond, Andy
Lockhart and Doerte

Mann

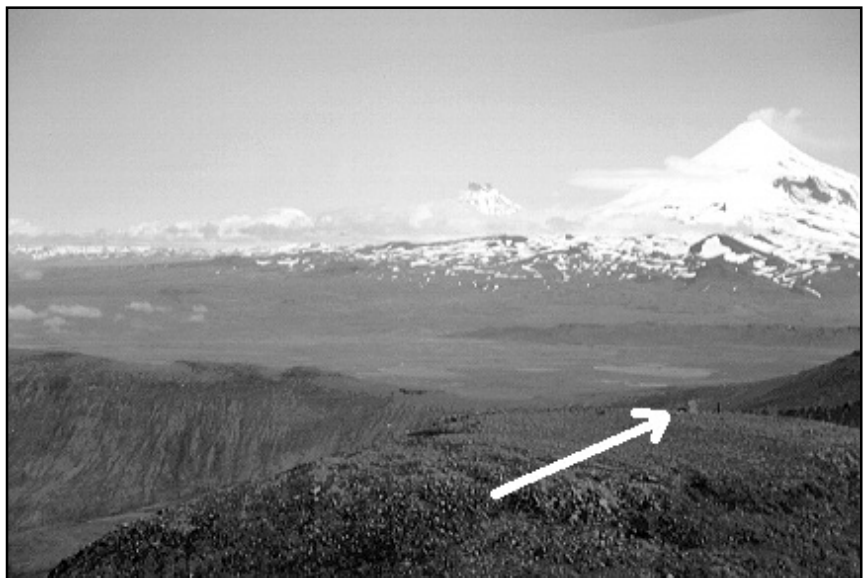
Figure 27:
Station WESN
(North of
Westdahl
Volcano).
View looking
towards
North-East.
Fisher
Caldera is
visible in the
background
beyond the
layer of fog.



Figure 28:
Station
WFAR (West
of Farris
Peak). View
looking
towards
North-East.
The base of
Pogromni
Volcano is
visible in the
background.



Figure 29:
Station
WTUG
(Tugamak
Mountain).
View looking
towards
East. The
station is
located on
the flat area
near the
bottom right
corner of the
photo.
Shishaldin,
Isanotski
and Round
Top
Volcanoes
are visible
from right to
left in the
background.



Okmok Volcano

Geology

Don Richter, Game McGimsey, Dick Moore, Jon Dehn, Jessica Faust Larsen, Scott Dreher, and Doerte Mann hiked into Okmok Caldera on Umnak Island in late July 1998. One of our main goals was to map and sample the products of the 1997 eruption. Despite generally poor weather, we managed to complete this task and also sampled lava flows from two earlier eruptions. A ã and blocky flows erupted in 1997 cover about 11.3 km², and we estimate their volume at between 45 and 70 x 10⁶ m³. These volume figures are based in part on an observed average thickness of 4 m at the margins and an estimated 6 m or more in the interior parts of the flows. A cinder blanket of variable thickness discontinuously covers another 2-4 km². We don't have chemical analyses yet. The 1997 rocks appear to be basalt or basaltic andesite with phenocrysts of plagioclase and minor olivine. The geologic map (fig.30), created mainly by Don Richter, and a collage of photos of Okmok will be presented in poster form at the Fall Coordination Meeting.

Dick Moore

Remote Sensing

Work was also conducted (during mid-July) to aid interpretation of remote sensing data and begin petrologic investigations. Due to difficult logistics and the short period of stay, only very basic GPS operations were possible at Okmok Caldera. Three positions in the caldera at locations that can be located on the satellite radar images were measured (Fig. 31). These locations will be used as registration points for image processing and interferometric studies. Accurate positions, and especially heights, are very important to successfully lunwrap phase in interferometric processing.

Shelly Worley, Ken Dean, Jon Dehn, Dave Scheider and Kevin Engle

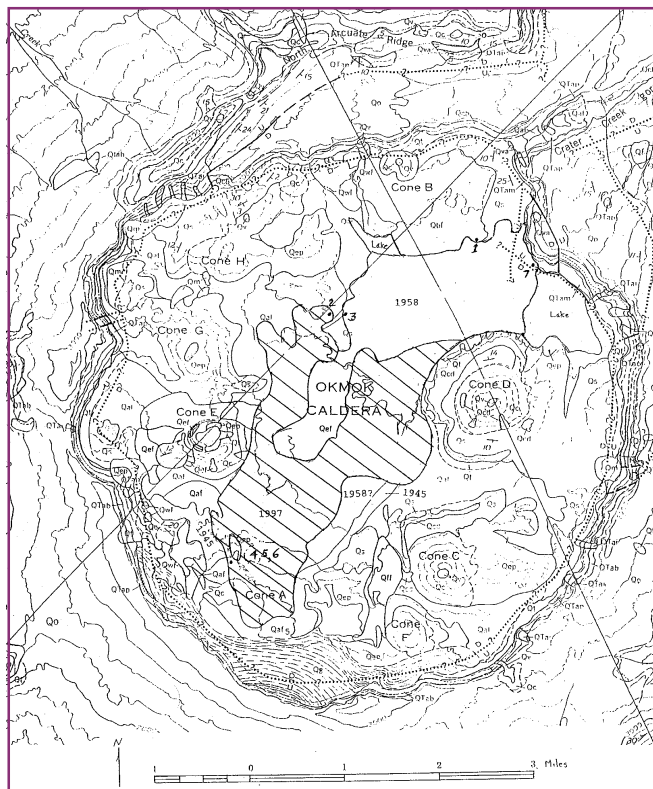


Figure 30: Approximate extent of recent lava flows in Okmok Caldera as determined from ground observation (July 28-30, 1998) and radar imagery. Base map is from F.M. Byers, Jr. (USGS Bull. 1028-L) who conducted field work in 1946-47. DOT and number refer to samples collected in 1998. J. Dehn, R. McGimsey, R. Moore, D. Richter.

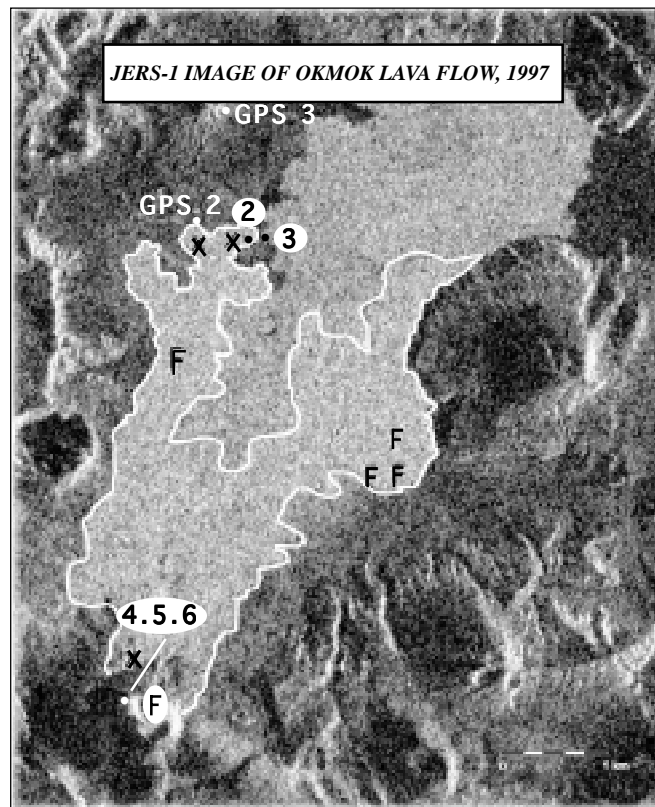


Figure 31: A November 5th 1997 JERS radar image of Okmok Caldera showing the 1997 flow (outlined in white). #'s are sample localities (#1 and GPS#1 are located off this image). "X" notes the locations of temperature measurements. "F" the locations of strong fumaroles.

Westdahl Volcano

Detailed geologic mapping of Westdahl volcano on Unimak Island began in August 1998. This work was carried out mainly by Tracey Felger (Menlo Park), Game McGimsey, Dick Moore, and Pete Stelling. Tom Miller also spent three days with us. Marginal wind and cloud conditions during most of our stay largely restricted our efforts to the volcano's lower slopes, and only rarely were we able to reach higher rocks (over 2,500 ft. elevation). We mapped and sampled along about 40 km of coastline, chiefly on the south and west sides of the volcano. We mapped and sampled many spatter cones and associated flows on the western, eastern, and southern flanks of the volcano. We spent a little time sampling and studying Pogromni Volcano and its smaller "sister" stratovolcano, 3 km to the north. Westdahl itself appears to have been built atop a much older (possibly Tertiary) complex of flows, dikes, and pyroclastic rocks exposed on the southern and northern coasts. For example, Scotch Cap, on the southwestern coast, is a high-standing erosional remnant of these older, locally olivine-rich, basaltic rocks. Promontory hill, near the southeastern coast, is an old, deeply eroded tuff cone cut by dikes. Westdahl has the appearance of a dissected stratovolcano whose summit area was truncated by caldera collapse. Formation of the

postulated caldera, now mostly filled with ice, may be associated with laharic deposits near Scotch Cap. Pumice fragments and breadcrust bombs in coastal pyroclastic-flow deposits, at least 13 km from their presumed source, are as large as 0.5 m across. Faults of significant but as yet unmeasured displacement apparently cut the volcano's edifice on its northwestern, western, and southeastern sides. We will present a sketch map of Westdahl's geology at the Coordination Meeting.

Dick Moore

New Katmai seismic stations installed

Seven new stations were installed in the northeastern half of Katmai National Park during July 7-19. These stations include one located ~15 km south of Mt. Katmai (KABR), one due north of Mt. Griggs (KAIC), one ~8 km northwest of Snowy Mtn. (KAWH), one 12-15 km north of Mts. Denison, Steller, and Kukak (KAHG), one ~18 km west of Kaguyak Caldera (KAPH), and one ~40 km north of the entire range (KAHC). All have short-period seismometers, and all are single-component except KAPH which is a short-period, three-component station.

The signals from KAIC, KAWH, KARR, KAHG, and KAPH are received at KAHC, where they are multiplexed and sent directly to King Salmon. These six stations constitute the new northern arm of the Katmai seismic network. KABR was added to the central arm, taking advantage of an open channel. A repeater was installed on the west flank of Mt. Cerberus to relay the signal from KABR to KBM. A receiver and summing amplifier were

added at KBM. At a later date, station KCE may be moved to the current repeater-only site at Cerberus.

Thanks to two-plus days of amazing weather and a fantastic helicopter pilot (Bill Springer), the deployment of the new stations went more rapidly than expected. Fieldwork began on 7/11, and cranked into high gear on 7/13 with the first of 2 cloudless days. The entire northern arm was deployed by 7/14, with spot visits needed over the next several days to fine-tune radios. Installation of KABR was more problematic, as a persistent marine cloud layer made site access spotty. Bill's willingness to let us work until 7-8 p.m. on these days cost him his supper on two occasions (he got back after closing time at the King Salmon eateries; sorry, Bill!). In addition to the new stations, several stations in the central and southern arms of the network were serviced and some reconfiguring of antennas and

Steller, Denison, Snowy, Katmai, Griggs, Novarupta, Trident, Mageik, and Martin.

This past summer's field work was greatly aided by the generous cooperation of personnel of Katmai National Park. Advance logistical operations commenced in King Salmon on July 5. During the following week, several tons of batteries and Jet-A fuel were transported across Naknek Lake on the NPS landing craft to Brooks Camp. At Brooks, they were reloaded on a NPS truck for a 20 mile ride down the Valley of Ten Thousand Smokes access road, to an approved fuel/battery cache. The NPS Maintenance personnel were extremely helpful to us during this timing by piloting the landing craft, aid in loading and unloading, and in use of their truck. The NPS also provided housing in Brooks Camp during the advance logistics work, and housing and transportation in King Salmon through-

Katmai Seismic Network

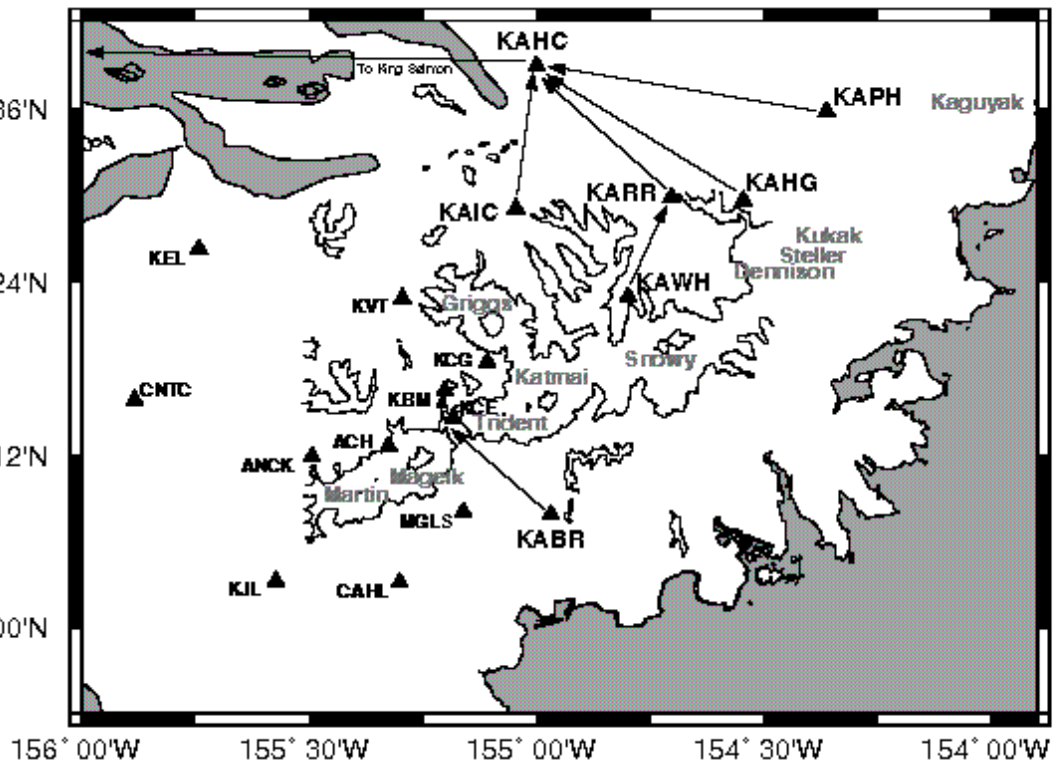


Figure 32: Map of the current Katmai Seismic Net.

radio receivers was done in King Salmon.

As a result of this work, the Katmai network increased to a total of 18 stations and 24 components (15 vertical, 3 3-component). There are now seismometers within 20 km of all major known volcanic centers within the park, including Kaguyak, Kukak,

out the entire field campaign. Through their cooperation, the Katmai National Park saved AVO many thousands of dollars in helicopter time (by allowing us to bring the batteries and fuel much closer to where we were working) and in housing costs.

John Paskievitch, Tim Plucinski, Seth Moran, Art Jolly, and Dave Schneider

Ongoing Investigations

Aerial reconnaissance of Ukinrek Maars and Gas Rocks area

In response to the occurrence of intense seismic swarms near Ukinrek Maars, John Paskievitch and Game McGimsey left King Salmon at 12:45 pm on Saturday, May 9 aboard the USFWS Bell 206 Helicopter piloted by Bill Smoke. The weather was sunny with scattered cumulus clouds and isolated showers. We flew directly to Becharof Lake and crossed to the south side about 15 kilometers west of Gas Rocks and made several traverses along the south shore near the cluster of recent epicenters. There was no sign of any unusual activity (i.e. no ground breakage, steaming, discoloration, bubbling in lake, etc.). We did see several recent lake-shore bank slumps that produced small sediment blooms into the lake.

We observed a few aquamarine colored patches of sediment on the lake bottom, located a few tens of meters off shore in shallow water, east/southeast of the earthquake epicenters (section 8, T27S, R45W of Ugashik D3 quad). A sediment plume extended from the patch parallel to shore for about a kilometer to the northwest. No bubbling, turbulence, or any other sign of gas emission were noted. Pilot Bill Smoke stated he had not seen the patch and plume in previous flights. It is probably a spring or upwelling and the colored patch is likely clay from underlying glacio/lacustrine deposits.

We circled Ukinrek Maars and noted ripples from rockfall into the lake in the large maar. Ripples from a rockfall off the crater wall was the only disturbance we noted. Bill Smoke thought that the color of the lake (grass green) was slightly different from what it had been in recent observa-

tions (more blue). Sloughing from the crater walls may account for increased turbidity and hence a color change. Other than the rockfall, we saw no signs of activity in the maar lake.

The zones of dead vegetation that we noted in 1995 field studies—if still present—were indistinguishable from the surrounding areas since this year's new growth has not "greened-up" the landscape yet.

We then made several circles around Gas Rocks, noting that the prominent CO₂ upwellings just offshore did not appear changed in any way from that of past observations. There were no signs of new activity anywhere around the Gas Rocks.

Proceeding southeastward parallel to the lake shore, Bill Smoke pointed out a small stream that flows off the north flank of Peulik that had been running muddy the previous day (May 8) and was clear today. We surmised that a bank failure had occurred upstream, possibly triggered by the recent seismicity.

All of the north flank except the very summit of Peulik was visible to us. The mountain is heavily snow-covered and we saw no sign of avalanching, snowmelt, or steaming. We did not circle the volcano. Bill Smoke stated that he had had a clear view of the entire mountain earlier in

the day and that he saw no sign of any activity.

We then flew east to check on one of the Katmai seismic stations, made a quick stop at the USFWS "Bible Camp" on the north shore of Becharof Lake to pick up some cargo, and returned to King Salmon at 2:45 pm.

We took some still photos and a short segment of video.

*Game McGimsey and
John Paskievitch*



Figure 33: Sediment plume extending about 1 km northwestward from one of several aquamarine colored patches located on the lake bottom in shallow water off the southern shore of Becharof Lake near the epicenters of the earthquake swarm.

Revisiting Shrub Mud Volcano

Shrub Mud Volcano (62° 9'N, 145° 1'W) in the Copper River Basin was visited on July 31, 1998 as part of an informal joint NPS-USGS project monitoring the current eruptive activity that began in the spring of 1997.

Summary

The level of activity remains high. Total amount of mud production at the volcano is probably about the same as in August 1997. However, production at the Main vent area is considerably less than the rate observed in 1997. A very noticeable change is the nature of the eruptive activity. The violent discharge of mud and gas that was typical of the 1997 activity was not observed during this visit. Rather all presently active vents were quietly discharging mud and gas from bubbling mud pools or ponds. Temperatures as high as 49.9°C—more than 2°C higher than those of June and August, 1997—were measured. Approximately 500,000 m³ of mud have been erupted since activity began in the spring of 1997.

Description of Activity, (For the following features, refer to Fig. 34)

1. Gusher vents (Main vent area). Activity is now restricted to the central two(?) vents in this northwesterly-trending series of vents. Collapse of the walls of the two central vents has formed double, gas-agitated, mud ponds each 5m to 7m in diameter. The southernmost pond is the most active, discharging mud directly into the gully that has been a main mud course since the beginning of activity. Mud production is considerably less than the cubic meter/minute rate estimated in August 1997. Temperature was 41.2°C, about 5°C cooler than in August 1997.

Since the last visit in August 1997, additional small vents were active at the north end of the system and allowed minor amounts of mud to flow down the north side of the cone and join mud flows from the area of numerous small vents.

2. Fissure vent. Activity has increased in this vent system since August 1997. Similar to what has occurred in the main vent area there has been considerable collapse of the fissure walls and the fissure has

been extended to the east. The roily mud pools are 2-4m below the surface at the west-end of the fissure, but at the east end are discharging mud on the surface. Mud production is estimated at about 60-100 liters/minute or about half of the production rate at the Main vent. Temperature was 49.3°C, more than 6°C hotter than in June 1997.

The small vent south of the Fissure vent also exhibits collapsed walls, but was inactive.

3. Mud/Gas pit and New pit. These two collapse pits are presently connected and producing a small but steady stream of mud on the cone's north flank. Temperature is 49.9°C, the hottest recorded to date on the mud volcano.

4. Numerous small mud vents. A new vent, presently inactive, was observed west of the Mud/Gas pit and there are probably other new vents on this brush-covered slope of the cone.

*Don Richter, Game McGimsey,
(USGS) and
Danny Rosenkrans, (NPS)*

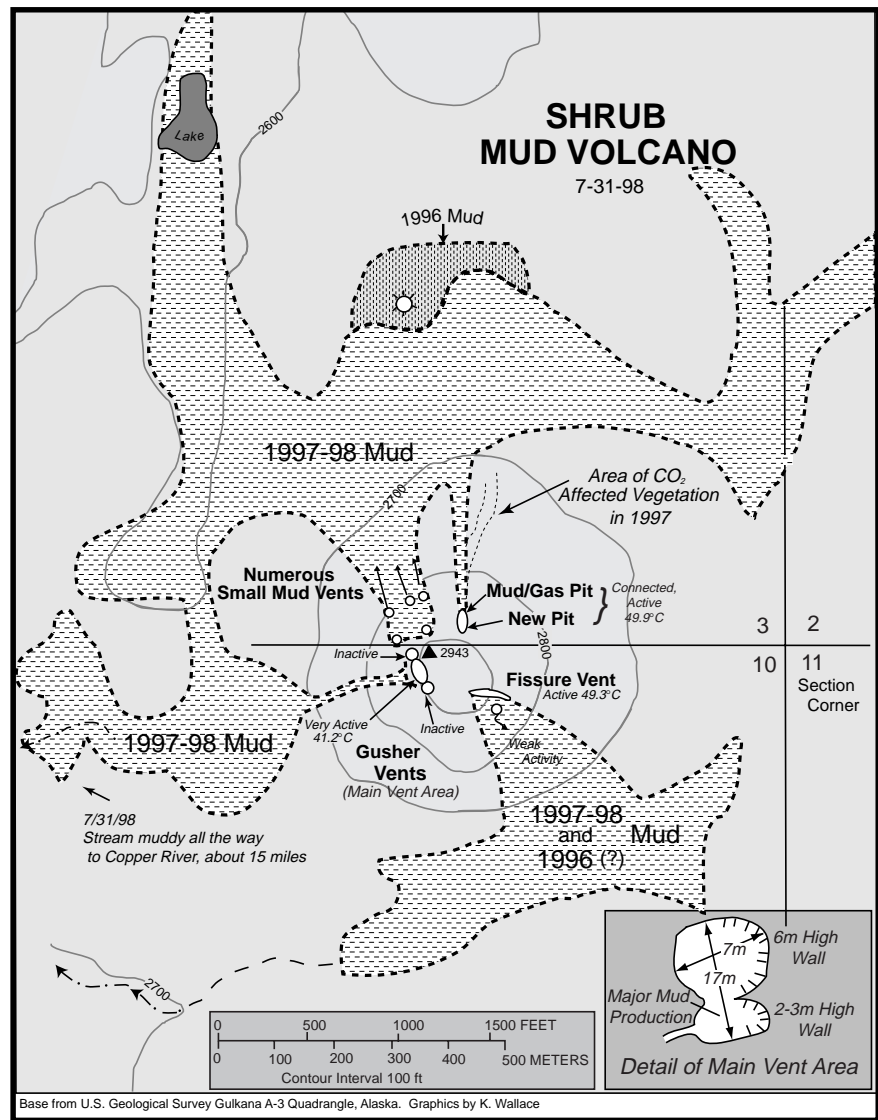


Figure 34: Sketch map of Shrub mud volcano showing vents and approximate extent of mud deposits as of July 31, 1998.

Completion of geologic mapping at Shishaldin Volcano, Unimak Island

Shishaldin Volcano is the highest and most active volcano in the Aleutian Islands, erupting at least 36 times in the last 250 years, most recently in 1995. It lies near the center

is the smooth form of the flanks on all but the western side.

Shishaldin has erupted frequently through the Holocene since the debris avalanche. We identified numerous deposits of lahars and jokulhlaups preserved in fans on all flanks of the volcano. Radiocarbon dates from these deposits are consistent with their deposition during multiple eruptions through the Holocene. Thick sections containing more than 100

tephra layers from Shishaldin were found preserved on several ridges southeast (downwind) from the volcano. Numerous lava flows from the summit edifice and from cinder cones on the flanks of the volcano also postdate the debris avalanche. Taken together, these deposits require sustained eruption rates of at least $1 \text{ km}^3/1000$ years.

Among the youngest volcanic deposits are a large, unglaciated lava

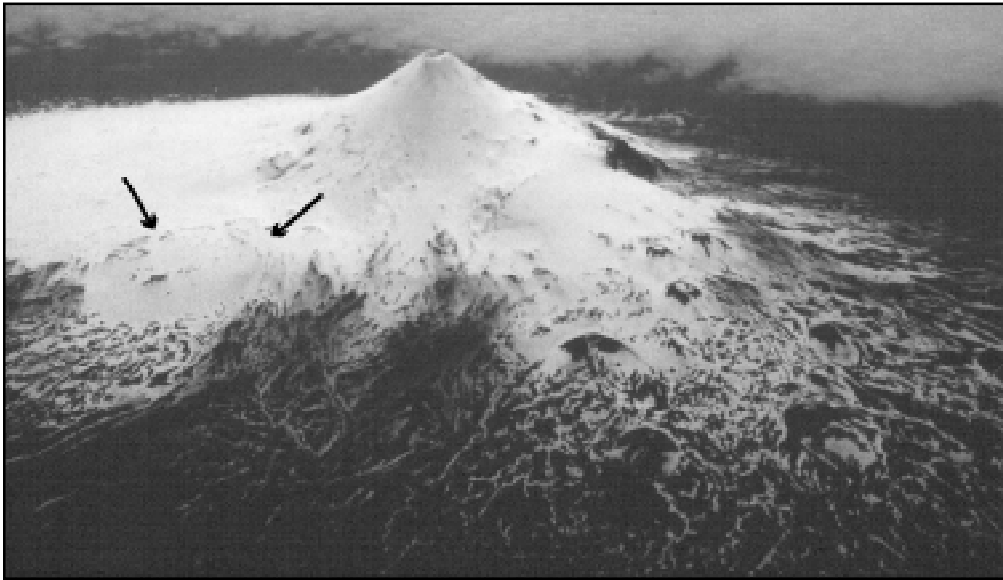
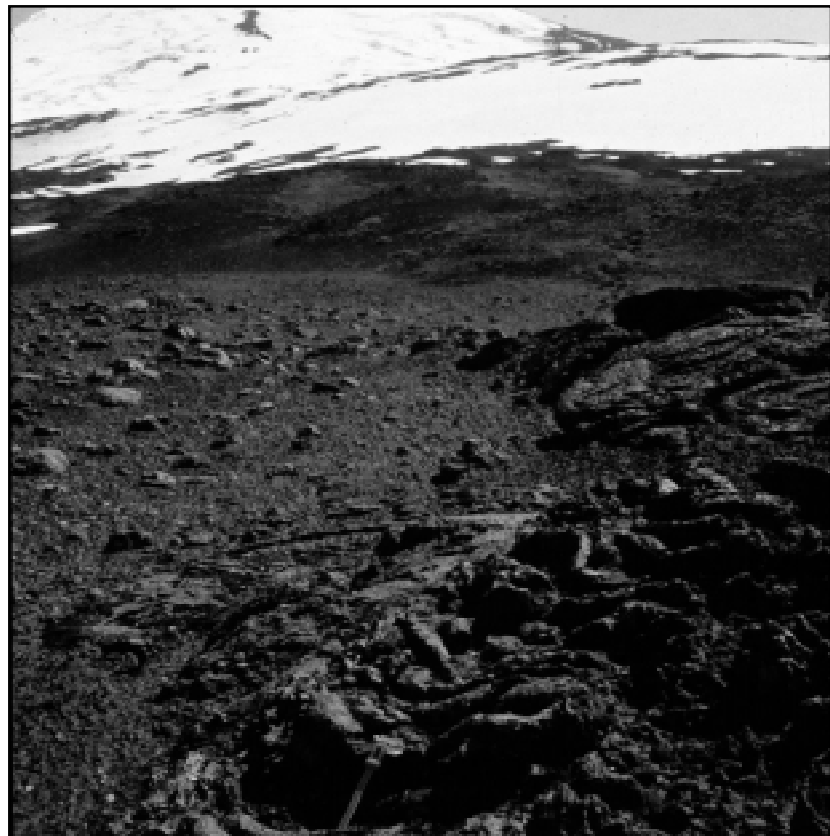


Figure 35: Shishaldin from the north-northwest. The feature shown by arrows is a large "blister" of lavas. This feature is very young. Geomorphic and lichenometric evidence suggests it may have erupted in the 1825 episode described by Veniaminov. The eruption which produced this feature penetrated the ice cover of the cone, which has not yet reestablished itself.

Figure 36: The lava "blister" shown in fig. 35 from below. Note the fresh pahoehoe surface.

of Unimak Island, the largest and easternmost of the Aleutian Islands. In spite of its pattern of very frequent explosive eruptions, there was no preexisting geologic map of Shishaldin Volcano at better than 1:250,000 scale. AVO field parties in 1997 and 1998 mapped the cone of Shishaldin, and an area totalling over 2000 km² of lava flows, cinder cones, and volcaniclastic deposits on the flanks of the volcano. Several important discoveries were made during the mapping. We identified deposits of a large debris avalanche on the northwest side of Shishaldin Volcano. The avalanche deposit can be traced to the shores of the Bering Sea at Lapin Point, 20 km to the north of the volcano, where it is buried by ashflow deposits produced by nearby Fisher Caldera ca. 9300 yr B.P. The remnants of a coeval pre-Shishaldin horseshoe-shaped crater are buried by the current cone of Shishaldin Volcano. Remains of this Pleistocene stratocone also exist as fingers of ridge-forming lavas low on the north and south flanks. The upper third of the volcano is entirely Holocene, as



“blister” and several lava flows on the northeast flank of the volcano (figs. 35, 36). These deposits may have been produced during the large eruptions in the 1825 reported by the Russian naturalist Veniaminov.

“On March 10, 1825, after a loud subterranean thunder.....which lasted almost the whole day and was audible on Unalashaka.....the northeast range of Unimak exploded in five or more places and over a large area with an eruption of flames and a great quantity of black ashes” (Veniaminov, translated by Black and Geohegan)

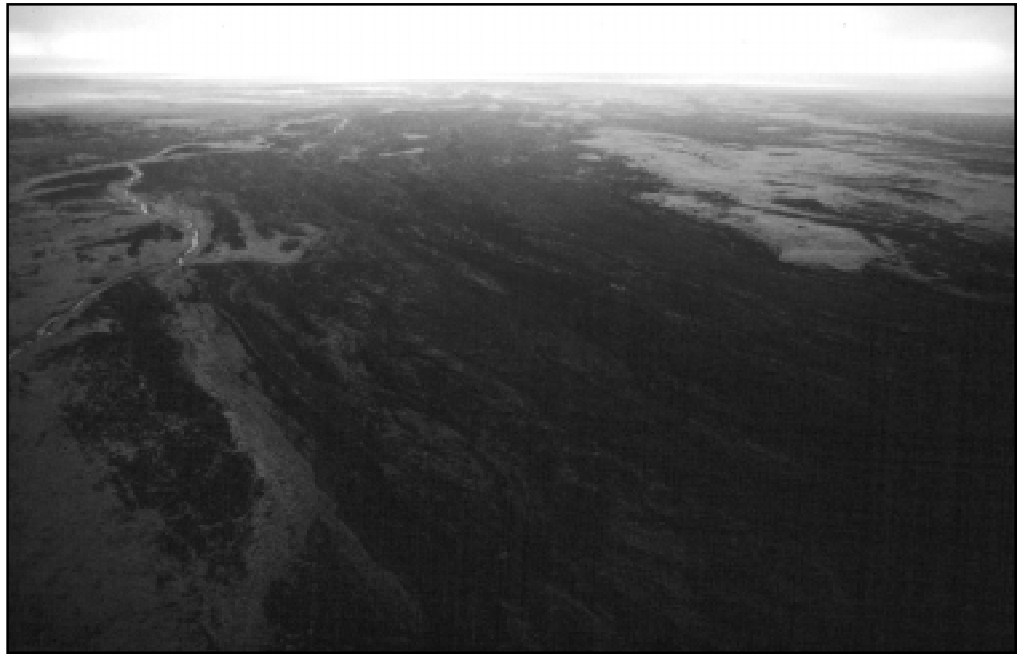


Figure 37: Sandur on the north flank of Shishaldin. This probably originated by eruption-induced snowmelt flooding associated with the 1825 eruption described by Veniaminov.

One of the most conspicuous and unique features of Shishaldin are the broad “sandur” plains which extend nearly to the coast on the north and south flanks (fig. 37). These unvegetated sand plains have unsorted volcanic debris at the surface with maximum block sizes of many tens of centimeters. Stream channels are conspicuously absent. The youngest of these are likely the result of eruption-induced snowmelt floods from the 1825 eruptions:

“On this occasion the ice and snow, lying on the range melted and for several days flowed in a dreadful river, 5 to 10 versts wide. These waters poured over the eastern side of the island in such a quantity that the nearby sea remained muddy until late autumn.” (Veniaminov, translated by Black and Geohegan)

Shishaldin Volcano is among the most active and productive volcanoes on earth; the characteristic high eruptions rates and frequent explosive eruptions will continue into the future. While there are no nearby population centers at risk, the volcano should continue to be closely monitored for future explosive eruptions which might affect North Pacific airplane traffic.

*Jim Beget, Chris Nye, Pete Stelling,
Janet Schafer, Andrew McCarthy*

Figure 38: View eastward from the summit of Shishaldin of Isanotski, Roundtop, and Frosty. A moment of personal satisfaction for Pete Stelling.



Katmai Gas Studies

In July, with ample AVO helicopter support, Bob Symonds and Bea Ritchie (AVO volunteer) investigated volcanic degassing in Katmai NP. This project, started in 1992, is part of a larger effort by Symonds and Ritchie to obtain data on baseline fumarole emissions from potentially restless volcanoes in the Western US and Alaska. This year's Katmai work focused on Mount Mageik, Mount Griggs, and Trident Volcano. From each site, we measured vent temperatures and collected samples for bulk gas composition. Where possible, we also collected samples to determine $d^{13}C$ in CO_2 , $^3He/^4He$, and dD and $d^{18}O$ in H_2O ; $d^{34}S$ in total sulfur will be determined from the bulk gas samples. At the crater lake of Mount Mageik, we collected water samples from the lake for analyses of anion, cations, and dD and $d^{18}O$ in H_2O . We also installed a lake monitoring package in the crater lake.

At Mount Mageik, last visited in 1997, we investigated and sampled the fumaroles and acidic lake in the summit crater (latitude: $58^\circ 12.00'$; longitude: $155^\circ 14.68'$). Degassing in the crater occurs from several jets on south side of the crater (up to $167^\circ C$), a newly exposed jet on the north shore of the lake ($130^\circ C$), a less vigorous fumarole field (up to $102^\circ C$) on the northeast crater wall, and from several vents beneath the lake. The analyses of the 1995 Mageik samples show that these gases contain 96% H_2O , 3.2-3.6% CO_2 , 0.2-0.3% H_2S , and $< 0.1\%$ H_2 , NH_3 , CH_4 , Ar, O_2 , and He. Isotopic data indicate that CO_2 ($d^{13}C = -6.6$) and He ($^3He/^4He [R/Ra] = 7.5$) derive from a magmatic source. The lake is about 100 m in diameter, bluish green in color, and sulfur froth floats on the surface. Several jets discharge into the lake. The largest vent, on the eastern lake shore, causes vigorous upwelling. The composition of the lake in 1997 is as follows: $T = 72^\circ C$, $pH = 1.56$, conductivity = 8.58 mS, 852 ppm SO_4 , 764 ppm Cl, 185 ppm SiO_2 , 124 ppm NH_4 , 70 ppm Al, 67 ppm B, 55 ppm Ca, 49 ppm Fe, 30 ppm Na, 20 ppm Mg, 25 ppm H_2S , 7.1 ppm K, 1.5 ppm F, 1 ppm Mn, and < 1 ppm Br, Sr, V, Ba, Zn, Rb, Ti, Li, As, Cu, and Hg. Since our first visit to the crater in 1995, the lake level has dropped about two meters and the conductivity has increased from 5.68 mS in 1995 to 8.58 mS in 1997 to 10.18 mS in 1998. The pH and temperature of the lake decreased and increased, respectively, between 1995 ($pH = 2.02$, $T = < 65^\circ C$) and 1997 ($pH = 1.56$, $T =$

$72^\circ C$), but reversed this trend in 1998 ($pH = 1.67$, $T = 66-72^\circ C$).

In order to monitor chemical and physical changes in the lake through the upcoming year, we also installed a sensor package to monitor pH, temperature, conductivity, and water level. The package will log data every two hours. Since volcanic crater lakes act as condensers for the water soluble magmatic gases (e.g., SO_2 , HCl, and HF), monitoring of the lake might detect magmatic intrusions beneath the lake. Such packages could be installed in lakes from other potentially active US volcanoes.

At Mount Griggs, we investigated and sampled the flank (latitude: $58^\circ 20.94'$; longitude: $155^\circ 06.68'$) and summit (latitude: $58^\circ 21.18'$; longitude: $155^\circ 06.30'$) fumarole fields. The flank field contains 3 major jets ($97 - 99^\circ C$) with sulfur chimneys plus other smaller vents whereas the summit field contains less vigorous boiling-point fumaroles. Although the summit vents have similar temperatures as in 1995, the temperatures of the flank vents have declined by $0.7 - 3^\circ C$ since 1995; the lower and hottest jet has declined from $105^\circ C$ in 1979 (measured by David Johnston), to $104^\circ C$ in 1993, to $99.8^\circ C$ in 1995, to $99.2^\circ C$ in 1997, to $99.0^\circ C$ in 1998. The analyses of the 1993 and 1995 samples show that these flank gases contain 97-99% H_2O , 0.5-2.7% CO_2 , 0.03-0.3% H_2S , and $< 0.1\%$ N_2 , CH_4 , O_2 , Ar, H_2 , NH_3 , and He. Isotopic data indicate that CO_2 ($d^{13}C = -5$ to -6) and He ($^3He/^4He [R/Ra] = 8.0$) derive from a magmatic source.

At Trident, we investigated and sampled the east flank field (latitude: $58^\circ 13.87'$; longitude: $155^\circ 04.94'$). The east flank field consists of numerous boiling-point fumaroles up to $94^\circ C$ and two, diffusely degassing, 7-meter-wide collapse pits (2 meters deep). There is a persistent H_2S odor at the site and past analyses show that these gases contain (excluding H_2O) 69-77% CO_2 , 16-20% H_2 , 2-7% H_2S , 1-3% CH_4 , 0.3-2.5% H_2S , 0.9-1.3% NH_3 , variable amounts of air (N_2 , O_2 , Ar), and $< 0.01\%$ He. Isotopic data indicate that He ($^3He/^4He [R/Ra] = 7.5-7.6$) and CO_2 ($d^{13}C = -10$) derive from a magmatic source.

Bob Symonds

Outreach

Several AVO folks, Dave Schneider, Ken Dean, Shelly Worley, and Bill Rose, participated in the "Remote Sensing for Volcanic Ash" session at a NOAA Workshop entitled Weather Services for Aviation Operations held in Anchorage 6-10 April 1998. Flight Operations managers from several major air carriers operating in the North Pacific Region toured AVO Anchorage. Volcanic ash was only a small part of the many hazards addressed during the workshop - a very good perspective of what all is involved in aircraft safety issues and communications of hazards such as icing, wind shear, and laser light shows. The latter have caused permanent eye damage to pilots in the Las Vegas area.

Terry Keith

New Personnel

Fairbanks:

James Gardner—(Ph.D., 1993, Grad. School of Oceanography, Univ. of Rhode Island). Jim holds a joint appointment as assistant professor with the Geophysical Institute and the Department of Geology and Geophysics. He will be conducting field, experimental, and analytical studies of the products of explosive and effusive eruptions.

John J. Sanchez—John hails from Manizales, Colombia where he worked at the Manizales Volcano Observatory, keeping an eye on Nevado del Ruiz volcano and some other active volcanoes of the Andean chain. He also did research on Q-coda temporal variations at Ruiz volcano and holds a BS in Geology from Caldas University, Colombia, 1996. He is currently a graduate student working with Steve McNutt on the topic of focal mechanisms at several Alaskan volcanoes.

Ellen Knowlton Wilson—(B.A. 1998 Washington University in St. Louis). A seismology Ph.D student with Steve McNutt, Ellen is working on characteristics of precursory volcanic earthquake swarms.

Addendum

Log of Updates for the Current Period

Publications

- Begét, J., Nye, C., and Stelling, P. 1998, *Postglacial collapse and regrowth of Shishaldin Volcano, Alaska, requires sustained high eruptions rates. Eos V22B-04, p. 261. (Spring AGU abstract)*
- Begét, J. and Keskinen, M. 1998, *Volcanism and iron fertilization of the ocean: a new global climate change mechanism. International Quaternary Association Commission on Tephrochronology and Volcanism Inter-Congress symposium, Tephrochronologie et coexistence Homme-Volcans, Le Puy, France: abstract and program, p. 123.*
- Begét, J. 1998, *Postglacial growth of Shishaldin Volcano, eastern Aleutian Islands, Alaska, due to frequent eruptions and high eruption rates. International Quaternary Association Commission on Tephrochronology and Volcanism Inter-Congress symposium, Tephrochronologie et coexistence Homme-Volcans, Le Puy, France: abstract and program, p. 72.*
- Gardner, C.A., Cashman, K. V., and Neal, C.A., 1998, *Tephra-fall deposits from the 1992 eruption of Crater Peak, Alaska: implications of clast textures for eruptive processes, Bulletin of Volcanology, v. 59, p. 537-555.*
- Searcy, C., K. Dean, and B Stringer; 1998. *PUFF: A Volcanic Ash Tracking and Prediction Model, J. Volc. and Geophys. Res., 80(1-2), 1-16.*

ALASKA VOLCANOES UPDATE

Friday, May 1, 1998 10:30 AM ADT
(1830 UTC)

Alaska Volcanoes:

Seismic activity is monitored in real time at 16 volcanoes in Alaska. Some of these volcanoes may currently display anomalous seismicity, but they are not considered to be at a dangerous level of unrest.

Spurr, Redoubt, Iliamna, Augustine, Griggs, Katmai, Novarupta, Trident, Mageik, Martin, Pavlof, Dutton, Akutan, Shishaldin, Aniakchak, and Makushin volcanoes are all at or near normal levels of background seismicity.

ABBREVIATED COLOR CODE KEY (contact AVO for complete description)

GREEN	volcano is dormant; normal seismicity and fumarolic activity occurring
YELLOW	volcano is restless; eruption may occur
ORANGE	volcano is in eruption or eruption may occur at any time
RED	significant eruption is occurring or explosive eruption expected at any time

Volcano Information on The Internet:
[Http://www.Avo.Alaska.Edu](http://www.Avo.Alaska.Edu)
Recording of The Status of Alaska's
Volcanoes (907) 786-7478

INFORMATION RELEASE 98-18 KAMCHATKAN VOLCANIC ACTIVITY Tuesday May 5, 1998, 11:00 AM KDT (22:00 UTC)

The following Release was received by e-mail from KVERT (Kamchatkan Volcanic Eruptions Response Team). All times are Kamchatkan Daylight Time (21 hours ahead of ADT)

Klyuchevskaya Group of Volcanoes
Klyuchevskoy Volcano:
56°03' N, 160°39' E; Elevation 4,750 m
CURRENT LEVEL OF CONCERN
COLOR CODE IS YELLOW

During the last week (April 27-May 4), seismicity under the volcano continued to be above background levels and deep (25-30 km) earthquakes were recorded. On April 27-29, the fumarolic

plume rose 50-100 m above the volcano.

Sheveluch Volcano:

56°38' N, 161°19' E; Elevation 2,800 m
CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN

Clouds have obscured the volcano for much of the week. On April 27, the fumarolic plume rose 100 m above the volcano. Seismicity was above background level. High-frequency tremor and shallow earthquakes were registered.

Bezymianny Volcano:

55° 58' N, 160°36' E
CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN

On April 27-29, a fumarolic plume rose 50-100 m above the volcano. No seismicity was registered under the volcano.

Karymsky Volcano: 54°03' N, 159°27' E

CURRENT LEVEL OF CONCERN
COLOR CODE IS YELLOW

Seismicity remains above background level. The low level strombolian eruptive activity that has characterized the volcano for more than two years continues. About 100 earthquakes and gas explosions occur every day. Deeper events predominate over explosive events.

Avachinskaya Group of Volcanoes:

153°15' N, 158°51' E
CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN

Seismicity at Avachinsky and Koryaksky volcanoes is at normal levels.

ALASKA VOLCANOES UPDATE

Friday, May 8, 1998 10:30 AM ADT
(1830 UTC)

Alaska Volcanoes:

Seismic activity is monitored in real time at 16 volcanoes in Alaska. Some of these volcanoes may currently display anomalous seismicity, but they are not considered to be at a dangerous level of unrest.

ALASKA EARTHQUAKE INFORMATION CENTER

ALASKA VOLCANO OBSERVATORY

Lake Becharof Seismic Swarm:
General Lat 57°50' N, Long 156°30' W

A seismic swarm of tectonic earthquakes shook the mid-Peninsula region Friday and Saturday, May 8, 9, 1998, including the towns of King Salmon, Dillingham, Egegik, and Pilot Point. The swarm began with five earthquakes of M5.2 to M4.7 between 4:30pm and 10:59pm ADT. Many dozens of earthquakes in the M2.5 to M3.5 range also occurred and were felt locally. The earthquakes continued through Saturday, May 9. By

Sunday morning the number of earthquakes was decreasing notably, though felt earthquakes are still occurring at a rate of 1 or 2 per day as of Tuesday afternoon, 12 May.

The earthquake locations are clustered on the SW shore of Lake Becharof, several miles NW of the 1977 Ukinrek Maars volcanoes and the southern end of the Bruin Bay fault. The earthquakes are all very shallow, locating less than about 7 km depth. The area has few seismic stations so only earthquakes greater than about M4 have been located in this general region in the past.

The recent expansion of AVO volcano seismic monitoring to volcanoes in Katmai National Park, NE of Lake Becharof, and Aniakchak Volcano, to the SW, has allowed better detection and location of Becharof earthquakes.

The current swarm is the most energetic one to date. There was no major seismic activity detected in association with the March 30 to April 10, 1977 Ukinrek Maar eruptions except for a flurry of small events detected by a portable seismic net that was deployed by UAF and USGS for several months following the eruptions.

AVO scientists traveled to King Salmon on Saturday morning for an overflight of the swarm location and vicinity. Their Fish and Wildlife Service pilot had overflown the area Friday evening after the first earthquakes.

Nothing indicating any volcanic activity was seen on either flight. Saturday afternoon some small slumping was noticed along the southwest shoreline of Lake Becharof and some local discoloration by sediments was seen – both likely resulting from so much ground shaking. Similarly, a slight change in the green coloration of the small crater lake in Ukinrek Maar is likely a result of disturbed sediments in the lake. No evidence of any disturbance or unusual activity was seen at Peulik Volcano. Peulik is heavily snow-covered and showed no sign of discoloration, deformation, or slumping.

The scientists scouted the area for possible instrument locations to establish a short-term temporary seismic net. The purpose of the net would be to determine whether or not there is a volcanic component to the earthquake swarm and any potential volcanic hazard.

The current interpretation is that the swarm is of tectonic origin, although the occurrence of five M4.7 to 5.2 earthquakes in such a short time period with no clear mainshock may suggest a volcanic component. Considering the formation of the Ukinrek Maars in 1977, where no volcano existed previously, intrusion of magma associated with tectonic movement is possible.

The National Park Service and Fish and Wildlife Service in King Salmon have been very helpful with our investigation of this seismic swarm. Also, the citizens of Egegik, Meshik, and Pilot Point have provided important information regarding felt earthquakes.

**INFORMATION RELEASE 98-20
KAMCHATKAN VOLCANIC ACTIVITY**
Monday, May 18, 1998, 4:20 PM KDT
(03:20 UTC)

*Klyuchevskaya Group of Volcanoes
Klyuchevskoy Volcano:*

56°03' N, 160°39' E; Elevation 4,750 m

**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

During the last week (May 11-17), seismicity under the volcano was slightly above background levels. Hypocenters of earthquakes were concentrated at two levels: near the summit crater and at depths of 25-30 km. On May 11, 14, and 16, the fumarolic plume rose 50-100 m above the volcano; on May 13 and 17, the plume rose 50 m above the volcano moving 2-3 km to the south and southeast.

Sheveluch Volcano:

56°38' N, 161°19' E; Elevation 2,800 m

**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

Clouds have obscured the volcano for much of the week. On May 17, no fumarolic plume was observed. Seismicity was about at background levels.

Bezmianny Volcano:

55° 58' N, 160°36' E

**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

On May 12-14 and 16-17, the fumarolic plume rose 50-100 m above the volcano. No seismicity was registered under the volcano.

Karymsky Volcano: 54°03' N, 159°27' E

**CURRENT LEVEL OF CONCERN
COLOR CODE IS YELLOW**

Seismicity remains above background level. The low level strombolian eruptive activity that has characterized the volcano for more than two years continues. About 100 earthquakes and gas explosions occur every day. Deeper events predominate over explosive events.

Avachinskaya Group of Volcanoes:
153°15' N, 158°51' E

**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

Seismicity at Avachinsky and Koryaksky volcanoes is at normal levels.

ALASKA VOLCANOES UPDATE

Friday, May 22, 1998 3:00 PM ADT
(2300 UTC)

Lake Becharof Seismic Swarm:
10-20 km (6-12 miles) NW of Ukinrek Maars

During the past week several additional, but less intense, tectonic earthquake swarms occurred near the SW side of Lake Becharof. The swarms of the past week consisted of tens of earthquakes with magnitudes as large as M4.5. An initial swarm of tectonic earthquakes began at 4:30 PM ADT on Friday, May 8, 1998 with five earthquakes of M5.2 to M4.7 that shook the mid-Alaska Peninsula region, including the towns of King Salmon, Dillingham, Naknek, Egegik, and Pilot Point. Epicenters of the earthquakes are located on the SW side of Lake Becharof, approximately 10-20 km (approximately 6-12 miles) NW of Ukinrek Maars, and near the southern end of the Bruin Bay fault.

**THERE IS NO EVIDENCE OF
IMMINENT VOLCANIC HAZARD
RESULTING FROM THIS SEISMIC
SWARM.**

Alaska Volcanoes:

Seismic activity is monitored in real time at 16 volcanoes in Alaska. Some of these volcanoes may currently display anomalous seismicity, but they are not considered to be at a dangerous level of unrest.

**INFORMATION RELEASE 98-21
KAMCHATKAN VOLCANIC ACTIVITY**

Monday, May 25, 1998, 3:10 PM KDT
(02:10 UTC)

*Klyuchevskaya Group of Volcanoes
Klyuchevskoy Volcano:*

56°03' N, 160°39' E; Elevation 4,750 m

**CURRENT LEVEL OF CONCERN
COLOR CODE IS YELLOW**

During the last week (May 18-25), seismicity under the volcano was above background levels. Hypocenters of earthquakes were concentrated at two levels: near the summit crater and at depths of 25-30 km. Since May 24, 23:00 (KST), the series of shallow earthquakes in the M=1.5 to M=2.0 range began to be recorded. From May 18-24, the fumarolic plume rose 50-100 m above the volcano moving 1-5 km to the south and southeast. On

May 25, the plume rose 50 m above the volcano.

Sheveluch Volcano:

56°38' N, 161°19' E; Elevation 2,800 m
**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

On May 21 and 24 the fumarolic plume rose 100-200 m above the volcano; on May 19-20 and 22-23 the plume rose 700-1000 m above the volcano moving 2-5 km to the southeast. Seismicity was about at background levels.

Bezymianny Volcano:

55° 58' N, 160°36' E
**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

On May 18, 19, 21, and 22, the fumarolic plume rose 50-100 m above the volcano, on May 20, 23, and 24, the plume rose 50-300 m above the volcano moving as much as 10 km to the northwest. No seismicity was registered under the volcano.

Karymsky Volcano:

54°03' N, 159°27' E
**CURRENT LEVEL OF CONCERN
COLOR CODE IS YELLOW**

Seismicity remains above background level. The low level strombolian eruptive activity that has characterized the volcano for more than two years continues. About 100 earthquakes and gas explosions occur every day. Deeper events predominate over explosive events.

Avachinskaya Group of Volcanoes:

153°15' N, 158°51' E
**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

Seismicity at Avachinsky and Koryaksky volcanoes is at normal levels.

ALASKA VOLCANOES UPDATE

Friday, May 29, 1998 1:30 PM ADT
(2130 UTC)

Lake Becharof Seismic Swarm

10-20 km (6-12 miles) NW of Ukinrek Maars

During the past week, the anomalous seismic activity under SW Lake Becharof continued but at a decreased rate and intensity; magnitudes of a dozen locatable earthquakes ranged from M1.7 to M3.3. If the decrease in the number and magnitude of earthquakes continues to decline, Lake Becharof will be removed from our next update. However, AVO will continue to closely monitor the situation.

The initial swarm of tectonic earthquakes began at 4:30 PM ADT on Friday, May 8, 1998 with five earthquakes of M5.2 to M4.7 that shook the mid-Alaska Peninsula region, including the towns of King Salmon, Dillingham, Naknek,

Egegik, and Pilot Point. Epicenters of the earthquakes are located on the SW side of Lake Becharof, approximately 10-20 km (approximately 6-12 miles) NW of Ukinrek Maars, and near the southern end of the Bruin Bay fault.

Alaska Volcanoes:

Seismic activity is monitored in real time at 16 volcanoes in Alaska. Some of these volcanoes may currently display anomalous seismicity, but they are not considered to be at a dangerous level of unrest.

**INFORMATION RELEASE
KAMCHATKAN VOLCANIC ACTIVITY**
Saturday, May 30, 1998, 12:10 PM
ADT (20:10 UTC)

Sheveluch Volcano:

56°38' N, 161°19' E; Elevation 2,800 m
**CURRENT LEVEL OF CONCERN
COLOR CODE IS YELLOW**

A report of an ash plume from Sheveluch volcano was received by AVO via Japan Meteorological Agency and Anchorage VAAC early this morning. AVO analysis of various satellite imagery determined that the eruption began about 0500 UT on Friday. A 0630 UT image showed a small, narrow, well defined ash plume, detached from the vent, and extending about 100 km downwind to the SSE. Satellite imagery analysis by AVO this morning shows the Sheveluch area clear with no volcanic activity. There is no sign of ash detected in the downwind area SSE of the volcano where the cloud diffused. Three pilot reports from flights >30,000 ft asl over the Sheveluch area this morning confirm that there is no ash cloud remaining in the region. The ash plume did not act like an energetic, high-level eruption plume but rather a low-level short-lived eruption burst from the volcano. This type of eruption burst is not uncommon from Sheveluch volcano.

**INFORMATION RELEASE 98-22
KAMCHATKAN VOLCANIC ACTIVITY**
Monday, June 1, 1998, 4:20 PM KDT
(03:20 UTC)

NOTE: Current "rolling" electrical power blackouts in Petropavlovsk-Kamchatsky may delay real-time reporting of volcanic events by KVERT

Klyuchevskaya Group of Volcanoes

Klyuchevskoy Volcano:
56°03' N, 160°39' E; Elevation 4,750 m
**CURRENT LEVEL OF CONCERN
COLOR CODE IS YELLOW**

During the last week (May 26-31), seismicity under the volcano was above background levels. Hypocenters of earthquakes were concentrated at two levels: near the summit crater and at depths of 25-30 km. Since May 24, 23:00 (KDT), a series of shallow earthquakes in the M=1.5 to M=2.0 range began to be recorded. On May 27-29, the fumarolic plume rose 50-100 m above the volcano moving 2 km to the south and southeast.

Sheveluch Volcano:

56°38' N, 161°19' E; Elevation 2,800 m
**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

On May 28, a fumarolic plume rose 100 m above the volcano and seismicity was about at background levels. On May 30 at 17:39 local time, an ash explosion occurred forming a plume that rose to 4 km above sea level and extended more than 35 km to the east. At 06:30 UTC, Japan Meteorological Agency informed KVERT that the satellite imagery showed a small, narrow, well-defined ash plume detached from the vent and extending about 100 km downwind to the SSE.

On May 31, a gas and steam plume (without ash) rose 2 km above the volcano extending the east. Currently seismicity under the volcano is at background level. This type of short explosive event is not uncommon from the volcano and is connected with the growing extrusive dome inside the crater.

Bezymianny Volcano:

55° 58' N, 160°36' E
**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

On May 28 and 30, the fumarolic plume rose 50-300 m above the volcano, moving 5 km to the east. No seismicity was registered under the volcano.

Karymsky Volcano: 54°03' N, 159°27' E
**CURRENT LEVEL OF CONCERN
COLOR CODE IS YELLOW**

Seismicity remains above background level. The low level strombolian eruptive activity that has characterized the volcano for more than two years continues. About 100 earthquakes and gas explosions occur every day. Deeper events predominate over explosive events. On June 1 at 10:55 KDT, pilots informed KVERT of an explosive event to a height of about 900 m above the volcano with the ash plume moving to the west.

Avachinskaya Group of Volcanoes:
153°15' N, 158°51' E

**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**
Seismicity at Avachinsky and Koryaksky volcanoes is at normal levels.

ALASKA VOLCANOES UPDATE

Friday, June 5, 1998 12:00 PM ADT
(2000 UTC)

Lake Becharof Seismic Swarm:
10-20 km (6-12 miles) NW of Ukinrek Maars

During the past week, the anomalous seismic activity under SW Lake Becharof continued; magnitudes of 20 locatable earthquakes ranged from M1.8 to M4.3. AVO will continue to closely monitor the situation. Several overflights of the swarm location by AVO scientists revealed no signs of volcanic activity or surface breakage. The area of seismicity is currently not monitored by real-time seismic instrumentation. However, a portable seismic instrument has been installed. AVO is also in communication with local citizens and land managers who frequently overfly the area.

The initial swarm of tectonic earthquakes began at 4:30 PM ADT on Friday, May 8, 1998 with five earthquakes of M5.2 to M4.7 that shook the mid-Alaska Peninsula region, including the towns of King Salmon, Dillingham, Naknek, Egegik, and Pilot Point. Epicenters of the earthquakes are located on the SW side of Lake Becharof, approximately 10-20 km (approximately 6-12 miles) NW of Ukinrek Maars.

**THERE IS NO EVIDENCE OF
IMMINENT VOLCANIC HAZARD
RESULTING FROM THIS SEISMIC
SWARM**

Alaska Volcanoes:

Seismic activity is monitored in real time at 16 volcanoes in Alaska. Some of these volcanoes may currently display anomalous seismicity, but they are not considered to be at a dangerous level of unrest.

**INFORMATION RELEASE 98-23
KAMCHATKAN VOLCANIC ACTIVITY**
Monday, June 8, 1998, 9:20 PM KDT
(08:20 UTC)

*Klyuchevskaya Group of Volcanoes
Klyuchevskoy Volcano:*
56°03' N, 160°39' E; Elevation 4,750 m
**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

During the last week (June 1-7), seismicity under the volcano was above background levels. Hypocenters of earthquakes were concentrated at two levels: near the summit crater and at depths of

25-30 km. On June 5, the fumarolic plume rose 1000 m above the volcano. On other days, the volcano was obscured by clouds except for short periods when the volcano was open and the usual fumarolic plume (50-100 m above the crater) was observed.

Sheveluch Volcano:
56°38' N, 161°19' E; Elevation 2,800 m
**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

On June 5, the fumarolic plume rose 700 m above the volcano. Seismicity was about at background levels. On other days, the volcano was obscured by clouds.

Bezymianny Volcano:
55°58' N, 160°36' E
**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

The volcano was obscured by clouds all week. No seismicity was registered under the volcano.

Karymsky Volcano: 54°03' N, 159°27' E
**CURRENT LEVEL OF CONCERN
COLOR CODE IS YELLOW**

Seismicity remains above background level. The low level strombolian eruptive activity that has characterized the volcano for more than two years continues. About 100 earthquakes and gas explosions occur every day. Deeper events predominate over explosive events.

Avachinskaya Group of Volcanoes:
153°15' N, 158°51' E
**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

Seismicity at Avachinsky and Koryaksky volcanoes is at normal levels.

**INFORMATION RELEASE 98-24
KAMCHATKAN VOLCANIC ACTIVITY**
Wednesday, June 10, 1998, 8:40 AM
KDT (19:40 UTC)

Bezymianny Volcano:
55°58' N, 160°36' E
**CURRENT LEVEL OF CONCERN
COLOR CODE IS YELLOW
PREVIOUS LEVEL OF CONCERN
COLOR CODE WAS GREEN**
For about the past 10 days, satellite images of Bezymianny volcano (when not obscured by clouds) have indicated a persistent and slowly growing hot spot more than 5 pixels in size when last observed. The apparent thermal anomaly is similar to that observed prior to the December 5, 1997 eruption of Bezymianny volcano, which sent a short-lived eruption plume to over 30,000 feet (>9 km) above sea level. The volcano has generally been obscured by clouds the past week and the seismicity is at background levels; however, visual

observations on May 28 indicated color change in the fumarolic plume suggesting an increase in gas emission. The thermal anomaly observed on satellite imagery indicates the summit lava dome may be growing again and therefore subject to a sudden partial collapse similar to the December 5, 1997 event. KVERT has therefore placed the volcano in Level of Concern Color Code YELLOW and, together with AVO, will continue to monitor the situation closely.

ALASKA VOLCANOES UPDATE

Friday, June 12, 1998 10:30 AM ADT
(1830 UTC)

Lake Becharof Seismic Swarm:
10-20 km (6-12 miles) NW of Ukinrek Maars

During the past week, the anomalous seismic activity under SW Lake Becharof continued but at a decreased rate and intensity; four locatable earthquakes with magnitudes less than M3.0 occurred. If the decrease in the number and magnitude of earthquakes continues to decline, Lake Becharof will be removed from our next update. However, AVO will continue to closely monitor the situation.

**THERE IS NO EVIDENCE OF
IMMINENT VOLCANIC HAZARD
RESULTING FROM THIS SEISMIC
SWARM**

Alaska Volcanoes:

Seismic activity is monitored in real time at 16 volcanoes in Alaska. Some of these volcanoes may currently display anomalous seismicity, but they are not considered to be at a dangerous level of unrest.

**INFORMATION RELEASE 98-25
KAMCHATKAN VOLCANIC ACTIVITY**
Monday, June 15, 1998, 9:20 PM KDT
(0820 UTC)

*Klyuchevskaya Group of Volcanoes
Klyuchevskoy Volcano:*
56°03' N, 160°39' E; Elevation 4,750 m
**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

During the last week (June 8-14), seismicity under the volcano was above background levels. Hypocenters of earthquakes were concentrated at two levels: near the summit crater and at depths of 25-30 km. On June 8, 12, and 14, a fumarolic plume rose 50-100 m above the volcano.

Sheveluch Volcano:
56°38' N, 161°19' E; Elevation 2,800 m
**CURRENT LEVEL OF CONCERN
COLOR CODE IS YELLOW**
On June 9-11, a fumarolic plume rose 100-500 m above the volcano.

Seismicity was about at background levels. From June 11 to June 15, seismicity under the volcano increased and volcanic tremor was registered. On June 15, at 2:47 AM local time, according to seismic information, about 2 minutes of explosive activity was registered. The volcano was obscured by clouds and the explosion took place at night so visual information is absent. According to seismic data and compared with previous eruptions, the height of plume was estimated at more than 5 km ASL.

Bezmianny Volcano:

55° 58' N, 160° 36' E

**CURRENT LEVEL OF CONCERN
COLOR CODE IS YELLOW**

On June 9-11, the fumarolic plume rose 100-500 m above the volcano, moving 5-10 km to the southeast. No seismicity was registered under the volcano. The thermal anomaly visible on satellite images the past 2 weeks persists suggesting a slowly growing dome and the possibility of its partial collapse.

Karymsky Volcano: 54°03'N, 159°27'E

**CURRENT LEVEL OF CONCERN
COLOR CODE IS YELLOW**

Seismicity remains above background level. The low level strombolian eruptive activity that has characterized the volcano for more than two years continues. About 100 earthquakes and gas explosions occur every day. Deeper events predominate over explosive events.

Avachinskaya Group of Volcanoes:

153°15'N, 158°51'E

**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

Seismicity at Avachinsky and Koryaksky volcanoes is at normal levels.

ALASKA VOLCANOES UPDATE

Friday, June 19, 1998 12:00 PM ADT
(2000 UTC)

Lake Becharof Seismic Swarm:

10-20 km (6-12 miles) NW of Ukinrek Maars

Due to the decrease in seismicity, Lake Becharof is being removed from our update. However, AVO will continue to closely monitor the situation.

Alaska Volcanoes:

Seismic activity is monitored in real time at 16 volcanoes in Alaska. Some of these volcanoes may currently display anomalous seismicity, but they are not considered to be at a dangerous level of unrest.

**INFORMATION RELEASE 98-26
KAMCHATKAN VOLCANIC ACTIVITY**
Monday, June 22, 1998, 4:20 PM KDT
(0320 UTC)

*Klyuchevskaya Group of Volcanoes
Klyuchevskoy Volcano:*

56°03' N, 160°39' E; Elevation 4,750 m

**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

During the last week (June 15-22), seismicity under the volcano was about at background levels. Hypocenters of earthquakes were concentrated at two levels: near the summit crater and at depths of 25-30 km. On June 15, 16, and 29, a fumarolic plume rose 50-100 m above the volcano, moving 1.2-5 km to the southeast. On June 17-19, the gas and steam plume was less than 50 m above the volcano.

Sheveluch Volcano:

56°38' N, 161°19' E; Elevation 2,800 m

**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

On June 17-19, a fumarolic plume rose 200-800 m above the volcano. On other days, the volcano was obscured by clouds. Seismicity under the volcano was about at background levels.

Bezmianny Volcano:

55° 58' N, 160° 36' E

**CURRENT LEVEL OF CONCERN
COLOR CODE IS YELLOW**

On June 17 and 19-21, a fumarolic plume rose 100-800 m above the volcano, moving to the southeast. No seismicity was registered under the volcano. The thermal anomaly visible on satellite images the past 3 weeks persists suggesting a slowly growing dome and the possibility of its partial collapse.

Karymsky Volcano: 54°03'N, 159°27'E

**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

Seismicity remains above background level. The low level strombolian eruptive activity that has characterized the volcano for more than two years continues. About 100 earthquakes and gas explosions occur every day. Deeper events predominate over explosive events.

Avachinskaya Group of Volcanoes:

153°15'N, 158°51'E

**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

Seismicity at Avachinsky and Koryaksky volcanoes is at normal levels.

ALASKA VOLCANOES UPDATE

Friday, June 26, 1998 10:00 AM ADT
(1800 UTC)

Alaska Volcanoes:

Seismic activity is monitored in real time at 16 volcanoes in Alaska. Some of these volcanoes may currently display anomalous seismicity, but they are not considered to be at a dangerous level of unrest.

**INFORMATION RELEASE 98-27
KAMCHATKAN VOLCANIC ACTIVITY**
Monday, June 29, 1998, 4:20 PM KDT
(0320 UTC)

*Klyuchevskaya Group of Volcanoes
Klyuchevskoy Volcano:*

56°03' N, 160°39' E; Elevation 4,750 m

**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

During the last week (June 22-28), seismicity under the volcano was about at background levels. Hypocenters of earthquakes were concentrated at two levels: near the summit crater and at depths of 25-30 km. On June 22-24, the fumarolic plume was less than 50 m above the volcano. On other days, the volcano was obscured by clouds.

Sheveluch Volcano:

56°38' N, 161°19' E; Elevation 2,800 m

**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

On June 23, no fumarolic plume was observed. On June 24, a fumarolic plume rose 100 m above the volcano. On other days, the volcano was obscured by clouds. Seismicity under the volcano was about at background levels.

Bezmianny Volcano:

55° 58' N, 160° 36' E

**CURRENT LEVEL OF CONCERN
COLOR CODE IS YELLOW**

On June 22, a fumarolic plume rose 300-500 m above the volcano, moving to the southeast. On June 22-23 the gas and steam plume was 100-300 m above the volcano. Avalanches and glowing of the Novy dome were observed on June 20-22. Weak shallow seismic events were registered during the week.

Karymsky Volcano: 54°03'N, 159°27'E

**CURRENT LEVEL OF CONCERN
COLOR CODE IS YELLOW**

Seismicity remains above background level. The low level strombolian eruptive activity that has characterized the volcano for more than two years continues. About 100 earthquakes and gas explosions occur every day. Deeper events predominate over explosive events.

Avachinskaya Group of Volcanoes:

153°15'N, 158°51'E

**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

Seismicity at Avachinsky and Koryaksky volcanoes is at normal levels.

**ALASKA VOLCANOES UPDATE
INFORMATION RELEASE**

Tuesday, June 30, 1998, 1:00 pm ADT
(2100 UTC)

Korovin Volcano:

52° 23, N 174°09, W summit elevation 1533 m (~5029 feet)

At about 10 am ADT this morning, AVO received a report of an eruption of Korovin volcano from a ground observer in the village of Atka. The crew of a Coast Guard C-130 confirmed a plume to 16,000 feet (4877 m) ASL at 10:30 am ADT. Local winds at the time were light and to the south southwest, and a dusting of ash was reported in Atka. The low level ash and steam plume was not visible in satellite imagery. Korovin volcano is located on the north end of Atka Island in the central Aleutians, 538 km (334 miles) west of Dutch Harbor. It is 21 km (13 miles) north of the village of Atka, population about 100. Korovin is a 1533-m-high (5029 ft) stratovolcano with a basal diameter of 7 km (4 miles). The last reported eruption was in March, 1987.

AVO does not maintain seismic monitoring equipment on Atka. AVO will continue to monitor the situation closely using satellite and field observations.

ALASKA VOLCANOES UPDATE

Friday, July 3, 1998 10:30 AM ADT
(1830 UTC)

Korovin Volcano: 52°23' N 174°09' W
Elevation 5029 feet (1533 m)

On the morning of Tuesday, June 30, AVO received a report of an eruption of Korovin Volcano from a ground observer in the village of Atka. Low-level eruption plumes were reported, and light ashfall occurred in the village of Atka. The crew of a Coast Guard C-130 confirmed a plume to 16,000 feet (4877 m) ASL. On Wednesday, July 1, inclement weather prohibited direct observation of the volcano. Poor weather conditions also hindered observation of the volcano with satellite imagery. AVO has received no reports of further eruptive activity.

Korovin Volcano is located on the north end of Atka Island in the central Aleutians, 334 miles (538 km) west of Dutch Harbor. It is 13 miles (21 km) north of the village of Atka, population of approximately 100. Korovin is a 5029-foot-high (1533 m) stratovolcano with a basal diameter of 4 miles (7 km). The last reported eruption was in March, 1987.

AVO does not maintain seismic monitoring equipment on Atka Island. However, AVO will continue to monitor the situation closely using satellite and field observations.

Alaska Volcanoes:

Seismic activity is monitored in real time at 16 volcanoes in Alaska. Some of these volcanoes may currently display anomalous seismicity, but they are not considered to be at a dangerous level of unrest.

**INFORMATION RELEASE 98-28
KAMCHATKAN VOLCANIC ACTIVITY**
Monday, July 6, 1998, 4:20 PM KDT
(0320 UTC)

Klyuchevskaya Group of Volcanoes

Klyuchevskoy Volcano:

56°03' N, 160°39' E; Elevation 4,750 m

**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

During the last week (June 29-July 05), seismicity under the volcano was about at background levels. Hypocenters of earthquakes were concentrated at two levels: near the summit crater and at depths of 25-30 km. On June 29-July 02, the fumarolic plume was 100-300 m above the volcano. On other days, the volcano was obscured by clouds.

Sheveluch Volcano:

56°38' N, 161°19' E; Elevation 2,800 m

**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

On June 29-July 02, a fumarolic plume rose 100-200 m above the volcano. On other days, the volcano was obscured by clouds. Seismicity under the volcano was about at background levels.

Bezymianny Volcano:

55° 58'N, 160° 36'E

**CURRENT LEVEL OF CONCERN
COLOR CODE IS YELLOW**

On June 29-July 02, a fumarolic plume rose 50-100 m above the volcano.

Karymsky Volcano: 54°03'N, 159°27'E

**CURRENT LEVEL OF CONCERN
COLOR CODE IS YELLOW**

Seismicity remains above background level. The low level strombolian eruptive activity that has characterized the volcano for more than two years continues. About 100 earthquakes and gas explosions occur every day. Deeper events predominate over explosive events.

Avachinskaya Group of Volcanoes:

153°15'N, 158°51'E

**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

Seismicity at Avachinsky and Koryaksky volcanoes is at normal levels.

ALASKA VOLCANOES UPDATE

Friday, July 10, 1998 11:30 AM ADT
(1930 UTC)

Korovin Volcano: 52° 23'N 174° 09' W
Elevation 5029 feet (1533 m)

AVO has received no reports of further eruptive activity.

Alaska Volcanoes:

Seismic activity is monitored in real time at 16 volcanoes in Alaska. Some of these volcanoes may currently display anomalous seismicity, but they are not considered to be at a dangerous level of unrest.

**ALASKA VOLCANO OBSERVATORY
VOLCANIC ACTIVITY UPDATE**

Wednesday, July 1, 1998, 3:30 pm
ADT (2330 UTC)

Korovin Volcano: CAVW 1101-16

52° 23, N 174°09, W summit elevation 1533 m (~5029 feet)

AVO has received no reports of further eruptive activity at Korovin volcano. Inclement weather has prevented direct observation of the volcano today. Low-level eruption plumes were reported yesterday morning, and light ashfall occurred in the village of Atka. Coast Guard pilots confirmed a plume at 16,000 feet ASL. Late yesterday afternoon, AVO received a pilot report of a plume at 30,000 feet over the volcano. However, subsequent analysis of satellite imagery indicates that at the time of the report a meteorological cloud was present over the volcano, and observers in Atka reported no unusual activity at the time.

**INFORMATION RELEASE 98-29
KAMCHATKAN VOLCANIC ACTIVITY**
Monday, July 13, 1998, 5:20 PM KDT
(0420 UTC)

Klyuchevskaya Group of Volcanoes

Klyuchevskoy Volcano:

56° 03'N, 160°39' E; Elevation 4,750m

**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

During the last week (July 6-12), seismicity under the volcano was about at background levels. Hypocenters of earthquakes were concentrated at two levels: near the summit crater and at depths of 25-30 km. On July 12, 17:49 (KDT), a 43-minute series of shallow earthquakes was recorded. On July 6 and 11, the fumarolic plume was 100 m above the volcano. On July 7, a gas and steam plume rose 50-100 m above the summit crater, extending 1 km to the south. On other days, the volcano was obscured by clouds.

Sheveluch Volcano:

56° 38'N, 161°19' E; Elevation 2,800m

**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

On July 11, a fumarolic plume rose 100 m above the volcano. On other days, the volcano was obscured by clouds. Seismicity under the volcano was about at background levels.

Bezymianny Volcano:
55° 58'N, 160°36'E

**CURRENT LEVEL OF CONCERN
COLOR CODE IS YELLOW**

On July 6-7, a fumarolic plume rose 50-100 m above the volcano, extending to the southeast. No seismicity was registered under the volcano.

Karymsky Volcano: 54°03'N, 159°27'E
**CURRENT LEVEL OF CONCERN
COLOR CODE IS YELLOW**

Seismicity remains above background level. The low level strombolian eruptive activity that has characterized the volcano for more than two years continues. About 100-200 earthquakes and gas explosions occur every day. Since July 10, a change in the eruptive regime has been noted, based on seismic data. The explosive events are accompanied by 1-4 minute segments of harmonic tremor.

Avachinskaya Group of Volcanoes:
153°15'N, 158°51'E

**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

Seismicity at Avachinsky and Koryaksky volcanoes is at normal levels.

ALASKA VOLCANOES UPDATE

Friday, July 17, 1998 2:00 PM ADT
(2200 UTC)

Alaska Volcanoes:

Seismic activity is monitored in real time at 16 volcanoes in Alaska. Some of these volcanoes may currently display anomalous seismicity, but they are not considered to be at a dangerous level of unrest.

**INFORMATION RELEASE 98-30
KAMCHATKAN VOLCANIC ACTIVITY**
Monday, July 20, 1998, 4:20 PM KDT
(0320 UTC)

*Klyuchevskaya Group of Volcanoes
Klyuchevskoy Volcano:*
56°03' N, 160°39' E; Elevation 4,750 m

**CURRENT LEVEL OF CONCERN
COLOR CODE IS YELLOW**

During the last week (July 13-19), seismicity under the volcano was above background levels. Hypocenters of earthquakes were concentrated at two levels: near the summit crater and at depths of 25-30 km. The shallow events predominate over the deep ones. On July 13, a gas and steam plume rose 200 m above the

summit crater, extending 3 km to the southwest. On July 14, the fumarolic plume was 50-100 m above the volcano. On other days, the volcano was obscured by clouds.

Sheveluch Volcano:
56°38' N, 161°19' E; Elevation 2,800 m

**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

On July 13, a fumarolic plume rose 300 m above the volcano. On other days, the volcano was obscured by clouds. On July 13, a 25-minute series of shallow earthquakes was recorded. It is possible these events were connected with explosions, but the volcano was obscured by clouds at that time. Similar events were recorded on July 17 and 19.

Bezymianny Volcano:
55° 58'N, 160°36'E

**CURRENT LEVEL OF CONCERN
COLOR CODE IS YELLOW**

The volcano was obscured by clouds during the entire week. No seismicity was registered under the volcano.

Karymsky Volcano: 54°03'N, 159°27'E
**CURRENT LEVEL OF CONCERN
COLOR CODE IS YELLOW**

Seismicity remains above background level. The low level strombolian eruptive activity that has characterized the volcano for more than two years continues. KVERT visual observations from the vicinity of the volcano on July 14-15 showed that the gas-ash explosions up to 400-600 m above the crater occurred every 8-10 minutes on average; gas-ash explosions to heights up to 1000 m above the volcano occurred every 2 hours on average. The lava flow continuities to move. During the night of July 14-15 and in the morning of July 15, a weak ashfall was observed at a distance of 3.5 km from the active crater. On July 15, 8:00-11:00 AM (KDT), a series of ash explosions accompanied by blowouts was observed occurring with a periodicity of about 5 minutes.

Avachinskaya Group of Volcanoes:
153°15'N, 158°51'E

**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

Seismicity at Avachinsky and Koryaksky volcanoes is at normal levels.

ALASKA VOLCANOES UPDATE

Friday, July 24, 1998 12:00 PM ADT
(2000 UTC)

Alaska Volcanoes:

Seismic activity is monitored in real time at 16 volcanoes in Alaska. Some of these volcanoes may currently display anomalous

seismicity, but they are not considered to be at a dangerous level of unrest.

**INFORMATION RELEASE 98-31
KAMCHATKAN VOLCANIC ACTIVITY**
Monday, July 27, 1998, 4:20 PM KDT
(0320 UTC)

*Klyuchevskaya Group of Volcanoes
Klyuchevskoy Volcano:*
56°03' N, 160°39' E; Elevation 4,750 m
**CURRENT LEVEL OF CONCERN
COLOR CODE IS YELLOW**

During the last week (July 20-26), seismicity under the volcano was above background levels. Hypocenters of earthquakes were concentrated at two levels: near the summit crater and at depths of 25-30 km. The shallow events predominate over the deep ones. The volcano was obscured by clouds until July 23, 13:00 KDT when gas and ash explosions were observed occurring every 15-20 minutes. The plume rose to a height of 300 m above the summit crater. No unusual change in seismic activity was reported. At 17:00 KDT, the plume rose to a height of 500 m. Beginning on July 25 at 12:00 KDT, the number and energy of earthquakes abruptly decreased. At the same time, the amplitude of volcanic tremor increased. On July 24-26, a gas and steam plume rose 100-300 m above the summit crater.

Sheveluch Volcano:
56°38' N, 161°19' E; Elevation 2,800 m

**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

ALASKA VOLCANOES UPDATE

Friday, July 31, 1998 12:30 PM ADT
(2030 UTC)

Alaska Volcanoes:

Seismic activity is monitored in real time at 16 volcanoes in Alaska. Some of these volcanoes may currently display anomalous seismicity, but they are not considered to be at a dangerous level of unrest.

**INFORMATION RELEASE 98-32
KAMCHATKAN VOLCANIC ACTIVITY**
*Klyuchevskaya Group of Volcanoes
Klyuchevskoy Volcano:*

56°03' N, 160°39' E; Elevation 4,750 m
**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

During the last week (July 27 - August 2), seismicity under the volcano was about at background levels. Hypocenters of earthquakes were concentrated at two levels: near the summit crater and at depths of 25-30 km. The shallow events predominate over the deep ones. On August 2, a fumarolic plume rose 50 m above the volcano. On

other days, the volcano was obscured by clouds.

Sheveluch Volcano:

56°38' N, 161°19' E; Elevation 2,800 m

**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

On August 2, a fumarolic plume rose 200 m above the volcano. On other days, the volcano was obscured by clouds. Seismicity under the volcano was about at background levels.

Bezymianny Volcano:

55° 58'N, 160°36'E

**CURRENT LEVEL OF CONCERN
COLOR CODE IS YELLOW**

No seismicity was registered under the volcano.

Karymsky Volcano: 54°03'N, 159°27'E

**CURRENT LEVEL OF CONCERN
COLOR CODE IS YELLOW**

Seismicity remains above background level. The low level strombolian eruptive activity that has characterized the volcano for more than two years continues. About 100-200 earthquakes and gas explosions occur every day.

Avachinskaya Group of Volcanoes:

153°15'N, 158°51'E

**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

Seismicity at Avachinsky and Koryaksky volcanoes is at normal levels.

ALASKA VOLCANOES UPDATE

Friday, August 7, 1998 10:00 AM ADT (1800 UTC)

Alaska Volcanoes:

Seismic activity is monitored in real time at 16 volcanoes in Alaska. Some of these volcanoes may currently display anomalous seismicity, but they are not considered to be at a dangerous level of unrest.

INFORMATION RELEASE 98-33

KAMCHATKAN VOLCANIC ACTIVITY

Monday, August 10, 1998, 4:00 PM KDT (0300 UTC)

Klyuchevskaya Group of Volcanoes

Klyuchevskoy Volcano:

56°03' N, 160°39' E; Elevation 4,750 m

**CURRENT LEVEL OF CONCERN
COLOR CODE IS YELLOW**

During the last week (August 2-9), seismicity under the volcano was above background levels. Hypocenters of earthquakes were concentrated near the summit crater and accompanied by tremor. On August 9, a fumarolic plume rose 100 m above the volcano. On other days, the volcano was obscured by clouds.

Sheveluch Volcano:

56°38' N, 161°19' E; Elevation 2,800 m

**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

The volcano was obscured by clouds during the entire week. Seismicity under the volcano was slightly above background levels.

Volcanic tremor was registered beneath the volcano on August 9.

Bezymianny Volcano:

55° 58'N, 160°36'E

**CURRENT LEVEL OF CONCERN
COLOR CODE IS YELLOW**

No seismicity was registered under the volcano and no visual observations were available during the last week.

Karymsky Volcano: 54°03'N, 159°27'E

**CURRENT LEVEL OF CONCERN
COLOR CODE IS YELLOW**

Seismicity remains above background level. The low level strombolian eruptive activity that has characterized the volcano for more than two years continues. About 100-200 earthquakes and gas explosions occur every day.

Avachinskaya Group of Volcanoes:

153°15'N, 158°51'E

**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

Seismicity at Avachinsky and Koryaksky volcanoes is at normal levels.

ALASKA VOLCANOES UPDATE

Friday, August 14, 1998 11:45 AM ADT (1945 UTC)

Chiginagak Volcano:

57° 08' N 157° 00' W Elevation 7005 feet (2135 m)

Fish and Wildlife Service personnel in the field and citizens of Pilot Point reported that on Thursday, 8/13, the usual white steaming from Chiginagak volcano fumaroles changed for a time to puffs of black ash accompanied by a greenish-yellow gas and steam plume rising about 500 to 1000 ft above the volcano. A dusting of black ash was observed on fresh snow on the upper part of the volcano this morning. However, the plume had reverted to white steam. The activity was not substantial enough to be detected by satellite imagery. AVO has no seismic instruments on the volcano but will watch the activity via satellite and in cooperation with ground observers.

Chiginagak Volcano is a 7005-ft-tall (2135 m) snow- and ice-covered symmetric stratovolcano. It is located 110 miles (175 km) south of King Salmon and 37 miles (60 km) southeast of Pilot Point on the Alaska Peninsula. On October 22, 1997, AVO received multiple reports of increased steaming, snowmelt, and sulfur smells. Robust steam plumes have issued from an active fumarole at

an elevation of about 5500 feet (1676 m) on the north flank of the volcano since at least 1943 and sulfur deposition in the vicinity of the fumarole discolours the adjacent snow and ice. Reports of historic activity at Chiginagak are poorly documented. Prehistoric domes, young pyroclastic deposits and lava flows occur on the volcano's flanks.

Alaska Volcanoes:

Seismic activity is monitored in real time at 16 volcanoes in Alaska. Some of these volcanoes may currently display anomalous seismicity, but they are not considered to be at a dangerous level of unrest.

INFORMATION RELEASE 98-34

KAMCHATKAN VOLCANIC ACTIVITY

Monday, August 18, 1998, 20:00 KST (0800 UTC)

Klyuchevskaya Group of Volcanoes

Klyuchevskoy Volcano:

56°03' N, 160°39' E; Elevation 4,750 m

**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

During the last week (August 10-16), seismicity under the volcano was about at background levels. Hypocenters of earthquakes were concentrated at two levels: near the summit crater and at depths of 25-30 km, and accompanied by weak tremor. On August 15, a fumarolic plume rose 400 m above the crater, extending more than 10 km to the northeast. On August 11 and 16, no fumarolic plume was visible. On other days, the volcano was obscured by clouds.

Sheveluch Volcano:

56°38' N, 161°19' E; Elevation 2,800m

**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

On August 15, a fumarolic plume rose 250 m above the volcano, extending more than 5 km to the east. On August 16, no fumarolic plume was visible. On other days, the volcano was obscured by clouds. Seismicity under the volcano was slightly above background levels.

Bezymianny Volcano:

55° 58'N, 160°36'E

**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

No seismicity was registered under the volcano, and no visual observations were available during the last week.

Karymsky Volcano: 54°03'N, 159°27'E

**CURRENT LEVEL OF CONCERN
COLOR CODE IS YELLOW**

Seismicity remains above background level. The low level strombolian eruptive activity that has characterized the volcano for more than

two years continues. About 100-200 earthquakes and gas explosions occur every day.

Avachinskaya Group of Volcanoes:
153°15'N, 158°51'E

**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

Seismicity at Avachinsky and Koryaksky volcanoes is at normal levels.

ALASKA VOLCANOES UPDATE

Friday, August 21, 1998 10:00 AM ADT
(1800 UTC)

Chiginagak Volcano:

57°08' N 157°00' W Elevation 7005 feet (2135 m)

During the past week, AVO has received no additional reports of unusual activity at Chiginagak Volcano. AVO has no seismic instruments on the volcano but will watch for signs of activity via satellite and in cooperation with ground observers.

Alaska Volcanoes:

Seismic activity is monitored in real time at 16 volcanoes in Alaska. Some of these volcanoes may currently display anomalous seismicity, but they are not considered to be at a dangerous level of unrest.

INFORMATION RELEASE 98-36

KAMCHATKAN VOLCANIC ACTIVITY

Monday, August 24, 1998, 3:00 PM
KDT (0200 UTC)

Klyuchevskaya Group of Volcanoes

Klyuchevskoy Volcano:

56°03' N, 160°39' E; Elevation 4,750 m

**CURRENT LEVEL OF CONCERN
COLOR CODE IS YELLOW**

During the last week (August 17-23), seismicity under the volcano was above background levels. Hypocenters of earthquakes were concentrated at two levels: near the summit crater and at depths of 25-30 km. Since August 19 at 14:00 (KDT), tremor began to decrease, and the number of shallow earthquakes began to increase. By August 21, no volcanic tremor was registered. On August 23, a 23-minute series of shallow earthquakes was recorded. On August 16, 19, and 23, no fumarolic plume was visible; on other days, the volcano was obscured by clouds.

Sheveluch Volcano:

56°38' N, 161°19' E; Elevation 2,800 m

**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

On August 16, no fumarolic plume was visible. On other days, the volcano was obscured by clouds. Seismicity under the volcano was about at background levels.

Bezymianny Volcano:

55° 58'N, 160°36'E

**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

No seismicity was registered under the volcano and no visual observations were available during the last week.

Karymsky Volcano: 54°03'N, 159°27'E

**CURRENT LEVEL OF CONCERN
COLOR CODE IS YELLOW**

Seismicity remains above background level. The low level strombolian eruptive activity that has characterized the volcano for more than two years continues. About 100-200 earthquakes and gas explosions occur every day.

Avachinskaya Group of Volcanoes:

153°15'N, 158°51'E

**CURRENT LEVEL OF CONCERN
COLOR CODE IS GREEN**

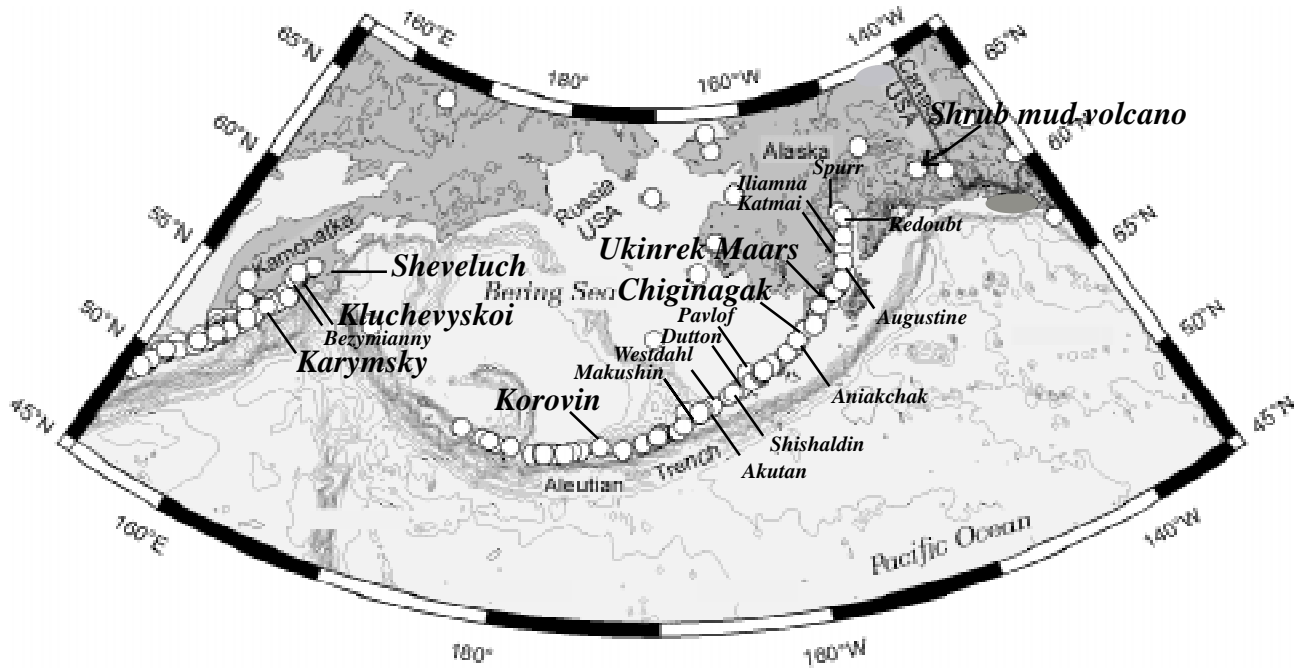
Seismicity at Avachinsky and Koryaksky volcanoes is at normal levels.

ALASKA VOLCANOES UPDATE

Friday, August 28, 1998 11:00 AM ADT
(1900 UTC)

Alaska Volcanoes:

Seismic activity is monitored in real time at 16 volcanoes in Alaska. Some of these volcanoes may currently display anomalous seismicity, but they are not considered to be at a dangerous level of unrest.



Map showing Alaska Peninsula, Aleutian arc and Kamchatka Peninsula and subregions of study. White circles are volcanoes. Names are given for all monitored volcanoes. Names in large font denote volcanoes discussed in this report with visible changes in activity.

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