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Cover photos: Cone A of Okmok Caldera in eruption, February, 1997, by John Sease, NOAA.

In This Issue

Highlights and Summary

- Korovin Volcano in the Aleutians and Sheveluch Volcano in Kamchatka had short but energetic ash bursts.
- Residents of the Alaska Peninsula were shaken by a swarm of earthquakes centered near the 1977 Ukinrek Maar vents.
- Field investigations were conducted at the sites of the 1997 eruption of Okmok Caldera in the Aleutians and of the continuing eruption of Shrub Mud Volcano in the Wrangells.
- A seismic net was installed on Westdahl Volcano in the Aleutians.
- Seven stations were added to the seismic net in Katmai National Park, Alaska Peninsula.
- Completed mapping of Shishaldin Volcano shows that most of the cone was built in Holocene time.
- Expansion of access to Alaska volcano seismic data over the Internet continues.

This was a period of widespread, though not major, volcanic activity and of solid technical accomplishments. A seismic net was installed on Westdahl Volcano on Unimak Island. This volcano is known for its spectacular fire fountains during a Thanksgiving '91 eruption and is probably overall our most remote installation to date. In addition, the net in Katmai National Park was expanded by 7 stations, making this our largest volcano network. Eighteen stations are now operating at Katmai, providing a seismic station within 20km of every volcano in the Park. The concentration of resources in the Katmai area is appropriate given its status as the site of the largest eruption on Earth this century, as an international tourist destination, as the largest cluster of volcanoes in at least the Peninsula portion of the arc, as a neighbor to a number of sizeable communities and major airport, and as the seismically "busiest" volcanic system we know about.

A number of small eruptions occurred or, in the case of Karymsky, continued in Kamchatka. In the Aleutians, Korovin Volcano near the Aleutian town of Atka produced an ash plume. (Accounts of the resettlement of this town following World War II make interesting reading – but not easy reading for citizens of either Japan or the US.) Meanwhile, far to the east in the Wrangells, the strange eruption of Shrub Mud Volcano continues. While more of a hazard to local inhabitants than high-flying aircraft, this phenomena reminds us that not all the output from subduction "factories" is from towering magmatic chimneys. Perhaps even stranger is the reflection that neither silicate melts nor melt/solid phase changes (though perhaps melt/vapor phase changes to provide "air lift" for the "magma" column) are required to generate "volcanic" geomorphologies including cones, vents, fissures, collapse pits, and flows.

John Eichelberger

Eruptions

Becharof Lake Seismic Swarm -
(57º56'N, 156º23'W)

A seismic swarm shook the King Salmon, Dillingham, Pilot Point region beginning Friday 5/8/98, 4:30pm ADT (0030 UT) with strongly felt earthquakes as follows:

M5.2 eq at 4:30pm,
M4.8 at 4:59pm,
M5.2 at 7:55 pm,
M4.7 at 8:58pm, and
M4.8 at 10:59pm.

Many dozens of earthquakes in the M2.5 to M3.5 range also occurred and were felt locally in Egegik, Bible Camp, Pilot Point, and some in King Salmon. The earthquakes continued through Saturday, May 9, with a few M4+ and many in the M2.5 to M3 range. By Sunday morning the number of earthquakes was decreasing notably, though a felt earthquake of M4.4 was reported at 2:00am at King Salmon. The earthquakes were all very shallow, located mostly at 0 to about 4 km depth and clustered on land near the SW shore of Lake Becharof. The locations were a few kilometers NW of the Ukinrek Maars which erupted vigorously in 1977 where no older volcanic vents existed. An AVO observation flight with FWS was carried out on 9 May but no cracks were seen in the area. Some sediment disturbance in the lake was recorded on video. A joint AEIC-AVO information release was issued May 12, 1998, because the origin of the earthquake swarm was not clearly either solely tectonic or volcanic in origin. The closest seismic stations are the Katmai net to the NE and the Aniakchak net to the SW. Two portable AEIC seismometers were set out near Gas Rocks and Bible Camp to collect data for better locations. The series of felt earthquakes were followed by a normal decay that continued to 4 June. The earthquake swarm was not normal for a tectonic swarm, but sensitive stations were not close enough to detect uniquely volcanic signals had they been present. The seismic activity is not unlike that at Long Valley during the past several years where intrusions have taken place under Mammoth Mountain. The Lake Becharof area bears watching.

Sheveluch Volcano, Kamchatka
(56°38' N, 161°19' E)

Sheveluch Volcano has had several ash bursts during the summer months, as follows:

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

May 30, 1998-
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 images 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.

June 14, 98
A small eruption of Sheveluch was reported by V. Kirianov of KVERT to AVO about noon. The start time of the Sheveluch eruption, based on tremor, was 2:47am KDT (1347UT, 5:47am ADT). There was an explosion and about 2 minutes of eruption; the seismicity was a little bigger than that 2 weeks ago. Based on the seismicity, an ash cloud might have gone as high as 5 km asl, but it probably dispersed fairly quickly. This is similar to other recent Sheveluch explosive bursts. No volcanic cloud was seen in satellite imagery although conditions were such that one would have been seen had it been there.

S*eptember 2-3, 1998*
A short-lived but apparently energetic ash burst from Sheveluch volcano in Kamchatka was detected by JMA in satellite imagery from 0300UT 9/3/98 (7:30 pm ADT, 9/2/98). AVO, using satellite imagery, followed the small ash cloud, about 80 km long and 20 km wide, drifting easterly and shrinking in size, at an altitude of approximately 25,000 ft asl. The cloud diffused completely before reaching 173°E by 0130UT 9/4/98 (5:30pm ADT 9/3/98). No visual observations of the event or the ash clouds have been received either from KVERT or pilot reports. However, ash explosions on September 3, 16:22 KDT, are reported in the KVERT Information Release 98-38 of September 8. The small ash burst and ash cloud are well documented with satellite imagery.

Korovin Volcano
(52º23'N, 174º10'W)

At about 10 am ADT on Tuesday, June 30, 1998, AVO received a report of an eruption of Korovin volcano (52°23' N 174o09' W) 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.

On July 7, 1998, Dutch Harbor pilot Burke Mees called to give his

recent observations of Korovin. On Friday, July 3, between 2 and 3 pm, he made several passes around the volcano and reported seeing no eruptive activity. He said that a central pit in the summit crater was steaming profusely, as it has for the past few months. The southwest, south, southeast, and east flanks were darkened with new ash, and a thin trail of ash extended about 5 miles to the southwest from the cone (toward the village, which is about 13 miles distant). He smelled no sulfur during this flight, but indicated that he had on previous occasions. No new fumarolic activity was noticed. No further reports of activity were received regarding Korovin activity. However, it has been the source of controversy regarding a supposed, but unconfirmed ash cloud allegedly sighted over Vancouver, BC on 10 July 1998.

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.

Chiginagak Volcano

A report was received of puffs of black "smoke" from Chiginagak. FWS pilot Bill Smoke flew around Chiginagak to observe the fumarole field and look for signs of activity. He said he believed the reported black puffs were just shadows from the steam puffs against the volcano. He said there were possible new deposits on the snow, a lot of greenish yellow material deposited on the fumarole fields, and strong steaming—more than “before”.

We did find a thin steam plume on satellite imagery the day after the overflight. This is unusual, so very likely there was a small event that was mostly steam and sulfur gas on the evening of the initial report. I have no reason to doubt that this is real activity, consistent with other reports that Chiginagak has been chuffing a bit off and on all summer.

Terry EC Keith

Monitoring

Satellite observations of Alaska and Kamchakta volcanoes

AVO monitors volcanoes in Alaska and Kamchatka using the relatively high spatial resolution and nadir view of polar orbiting satellites, and the high temporal resolution of geostationary satellites. All of these systems include visible and thermal infrared wavelength data.

The polar orbiting system consists of Advanced Very High Resolution Radiometers (AVHRR) on the NOAA-12 and -14 satellites. Images are recorded in five spectral bands at a spatial resolution of 1.1 km at nadir. Data for Alaska volcanoes are received by the ground station at the Geophysical Institute, University of Alaska Fairbanks. These images are are analyzed daily to detect volcanic eruption clouds and thermal anomalies at volcanoes in the North Pacific region. Coverage is repeated at 8 images per 24 hours for Alaska volcanoes and approximately 4 images per 24 hours for Kamchatka volcanoes. The timing of satellite passes is not distributed evenly over the 24-hour time frame.

Geostationary data are received from the GMS and GOES Satellites via computer networks at AVO-Anchorage, and provide off-nadir observations of the western North Pacific (GMS), and the eastern North Pacific (GOES). Hourly GMS data (4km resolution in the visible and TIR) are available for analysis within 1.25 hour after reception by a ground station. GOES data are available at 15 minute and 30 minute intervals at resolutions of 1 km (visible band), and 4 km (TIR bands), respectively, within 15-30 minutes after reception by a ground station.

During this period, our attention was primarily focused on eruptions at Bezymianny and Karymsky Volcano and the sporadic activity at Sheveluch Volcano. The Bezymianny and Karymsky eruptions are phases of ongoing activity including dome collapse, lava flows and short-lived explosive bursts at these volcanoes.

Table 1 shows dates in which volcanic-related activity (x) was observed at these volcanoes. Hot spots mentioned in the report are Band 3 pixels with temperatures greater than 5 degrees above background temperature. Note that the AVHRR Band 3 sensor saturates at approximately 50°C. A lava flow or area of hot ground need occupy only a small portion of a pixel to increase the apparent temperature.

The table shows that the most frequently observed activity was in June. An analysis of the data over the entire 4-month period shows that the

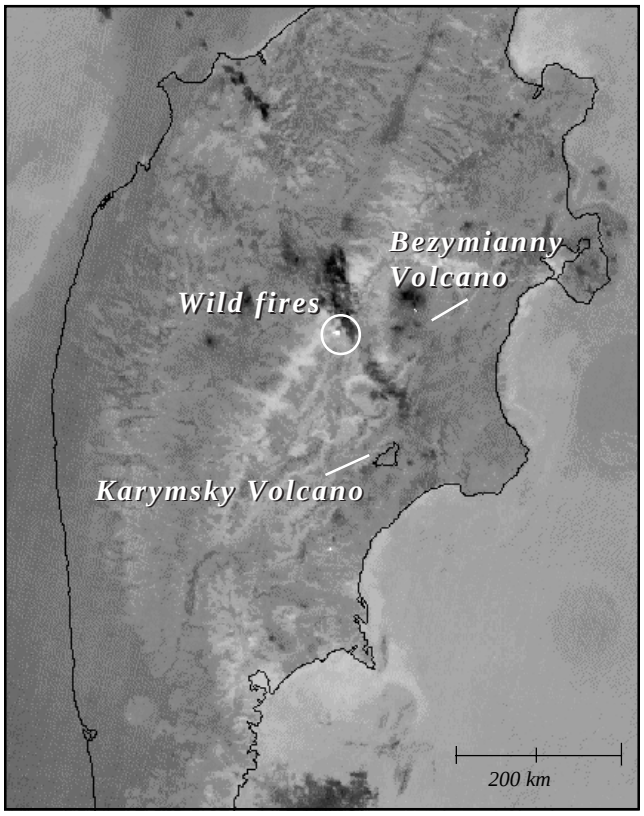

Figure 2: AVHRR satellite image of Kamchatka Peninsula, Russia. The thermal infrared (Band 3) image shows a volcanic hot spot at Bezymianny and Karymsky volcanoes, and a hot spot related to a wild fire.

blank periods were mostly due to cloud cover that obscured the volcanoes, hindering observation. Therefore, the lesser frequency of observed volcanic activity in May, July or August compared to June was likely due to cloud cover. However, there were 1 to 6 days of clear weather in which no hotspots or plumes were observed, suggesting a break in the volcanic activity.

Bezymianny Volcano

At Bezymianny Volcano, surface thermal anomalies and occasional short plumes were detected May through August. Hot spot temperatures ranged from 3 to 49°C and background temperatures 10 to -14°C. The size of the anomaly ranged from 1 to 5 pixels.

Karymsky Volcano

The eruption at Karymsky Volcano continued, with surface thermal anomalies and short plumes observed May through August. Hot spot temperatures ranged from 49 to –5.5°C and background temperatures from 24 to –16, with the size ranging from 1 to 4 pixels. Plumes were observed on 15 June and on August 17,19 and 23, with the longest (50 km) on 15 June.

Sheveluch Volcano

A plume was observed at Sheveluch Volcano on May 30 that was 60 km long and 10 km wide and drifting to the SE. Band 4 minus band 5 values were around –2, indicating that ash was present. Several pilots observed this plume as well.

Data was not recorded during June 20 through July 1 by the AVHRR satellite receiving station due to mechanical problems. Geostationary images were used whenever possible for monitoring.

Shelly Worley, Ken Dean, Dave Schneider, Jon Dehn, Kevin Engle and Jean Sobolik

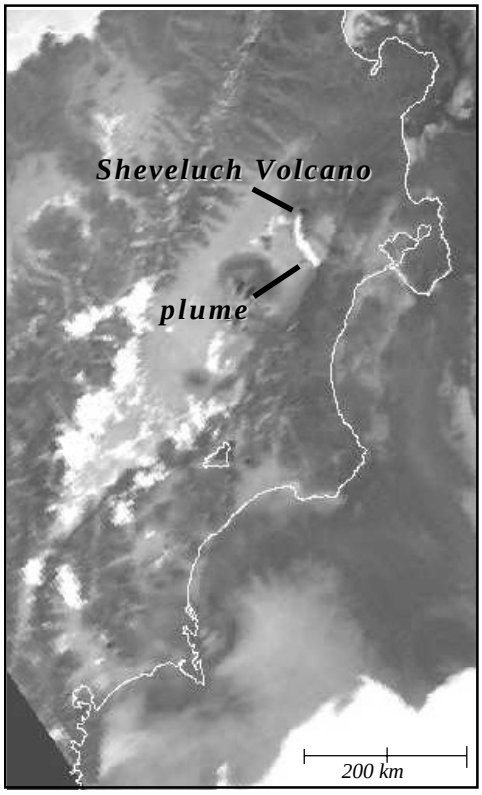

Figure 3: AVHRR satellite image of Kamchatka Peninsula, Russia, recorded on 30 May 1998. The thermal infrared image shows a 60 km long volcanic plume emanating from Sheveluch Volcano and blowing to the south and southeast. Subtraction of thermal infrared data (Band 4 minus 5) indicated that ash was present.

TABLE 1. SATELLITE OBSERVATIONS OF ALASKA AND KAMCHATKA VOLCANOES FOR THE MONTHS OF MAY-AUGUST, 1998

May	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**
Bezymianny				x											x														x	x x	
Sheveluch																														x	
Karymsky					x						x		x	x								x	x	x							
June	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	
Bezymianny			x					x	x	x	x	x		x	x	x	x	x	x			x	N	N	N	N	N	N	N	N	
Karymsky		x	x							x	x	x			x								N	N	N	N	N	N	N	N	
July	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**
Bezymianny	N				x	x																	x	x	x						
Karymsky	N				x	x										x							x	x	x						
August	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**
Bezymianny													x																		
Karymsky												x	x		x	x	x		x			x	x							x	

X = Hot Spot or plume observed in satellite data.
N = AVHRR station off line.