UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Video of the August 18, 1992, eruption of Crater Peak vent on Spurr volcano, Alaska

By

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Open-File Report 94-614

1994

After nearly forty years of quiescence, Spurr volcano erupted three times in 1992, spewing ash across large swaths of eastern Alaska (Alaska Volcano Observatory, 1993). The second eruption, on August 18, occurred during daylight hours with favorable weather conditions that allowed a crew from the Alaska Volcano Observatory (AVO) to fly in a fixed-wing aircraft to observe and photographically document part of the eruption.

Spurr volcano is a glacier-clad stratovolcano located approximately 130 kilometers west of Anchorage on the west side of Cook Inlet (fig. 1). Spurr is the easternmost historically active volcano in the 2500-km-long Aleutian volcanic arc (fig. 2). Although the immediate area around the volcano is uninhabited, more than half of Alaska's population lives within 200 km of the volcano.

The summit of Mount Spurr is 3375 m high and is centrally located within a 5 x 6 km caldera (Nye and Turner, 1990). Crater Peak is a satellite vent located in a breach in the caldera rim about 3.5 km south of Mount Spurr at an elevation of 2309 m (fig. 3). Spurr volcano has erupted more than thirty-five times in the mid- to late-Holocene making it the most active Cook Inlet volcano (Riehle, 1985). The Crater Peak vent is the site of all historical eruptive activity: July 9, 1953 (Juhle and Coulter, 1955), and June 27, August 18, and September 17, 1992 (Alaska Volcano Observatory, 1993).

The principal hazards associated with Spurr volcano result from airborne ash and flooding. Trans-north Pacific and trans-arctic air routes converge at Anchorage and ash eruptions from any of the volcanoes along Cook Inlet pose a potential threat to aircraft (Brantley, 1990). Crater Peak is flanked on the north, east, and west by glaciers that cover more than 32 km^2 and contain about 4 km^3 of ice. Streams from these glaciers flow into the Chakachatna River, which flows along the southern edge of Spurr volcano and drains Chakachamna Lake into Cook Inlet (fig. 1). The 1953 eruption generated lahars that dammed the Chakachatna River to form an 8-kilometer-long lake, a remnant of which still exists (Juhle and Coulter, 1955). The September 17, 1992 eruption also produced a lahar that temporarily dammed the Chakachatna River immediately downstream from the 1953 dam site (Meyer and Trabant, in press).

AVO seismologists first detected an increase in seismic activity at Spurr volcano beginning in August 1991. During the next ten months, seismicity slowly but steadily increased, culminating on June 27, 1992 with the first of three explosive eruptions from Crater Peak. Six weeks later, at 4:42 pm on August 18, with almost no warning, Crater Peak erupted explosively again, ejecting more than 50 million m^3 of ash in a column that rose to an estimated height of 18 km (Neal and others, 1993). Westerly winds carried the ash cloud over Anchorage, the Chugach mountains, and across Prince William Sound into southeast Alaska (fig. 4). Air traffic was disrupted as far away as Juneau,

Alaska, 1000 km downwind. Anchorage was covered with as much as 3 mm of coarse ash that disrupted transportation and commerce, and prompted closing of Anchorage International Airport for 20 hours (Alaska Volcano Observatory, 1993).

Shortly after the 4-hour eruption began, scientists from AVO were airborne and enroute to the volcano. Local weather clouds, with tops at about 2400 m, obscured the view of the eruption from Anchorage and the Kenai Peninsula. As the plane broke through the weather clouds, a large rising ash cloud came into view directly to the west with its leading edge 5 km behind the plane, or 25 km west of Anchorage. The initial view of the eruption in the accompanying video begins at this point. The exact source of the ash cloud is not apparent since both Crater Peak and Mount Spurr are hidden from view. However, as the plane heads northwest to maneuver around the ash cloud, the summit of Mt. Spurr comes into view, and the source of the eruption is confirmed to be Crater Peak. A sharply defined, vertical eruption column from Crater Peak can be seen rising through the weather clouds. At this point, the plane is about 15 km east of the volcano and will approach to within 4 km to the north of it and fly half circle traverses west of the eruption column. The area immediately east, or downwind of the eruption, is completely obscured by falling ash.

The plane is almost due north of the eruption column for the first good view of the dark, roiling, rapidly expanding ash cloud rising to form a mushroom- or anvil-shaped top as strong westerly winds disperse the ash. The close-up images of the base of the column are from about 4 km away and show continuous bursts of ash from the vent, which is about 150 m below the weather clouds. Look closely at the clouds adjacent to the column base where shockwaves, appearing as light-colored bands, emanate from the vent. These shockwaves are induced by choked flow conditions in the vent (B. Chouet, USGS, oral communication, 1994).

As the plane circles to the west, several light-brown clouds are visible adjacent to the eruption column on the south (right) side. These clouds are composed of fine ash elutriated from pyroclastic flows that swept down the south and southeast flanks of Crater Peak. In an attempt to determine if the eruption has caused melting of snow and ice on the south flank and subsequent flooding, the pilot maneuvers the plane below the weather clouds above the south flank, and a brief view of the pyroclastic flows comes into view. No evidence of flooding was observed on either the south flank or the Chakachatna River below.

The plane then climbs westward over Chakachamna Lake, providing a full view back to the east of the eruption column. Light-brown clouds rising from the pyroclastic flows are to the right side of the column. White steam clouds produced by the melting of snow and ice around the crater are also visible adjacent to the column. The summit of Mount Spurr appears to the left in some of the images.

As the plane moves from the west towards the northeast, the view is again a close-up of ash clouds bursting forth at the base of the column, and pulsing shockwaves transmitted through the adjacent steam clouds. In some images, large boulders (several meters across) are visible falling out at the edge of the clouds near the base of the column. The plane passes close to the summit of Mount Spurr. Ashfall downwind of the volcano and the leading edge of the cloud are visible as the plane moves farther north and turns to make another westerly traverse.

The final images of the eruption are from almost due north of the column as we leave the area to return to Anchorage. Heavy ashfall is occurring immediately downwind of the volcano and the advancing cloud is low over Cook Inlet producing an artificial sunset. The plane landed in Anchorage one hour before the sky darkened, ash began falling, and the international airport closed.

Our intent in publishing this video is to release most of the raw footage taken during the observation flight. Two SuperVHS camcorders were used, and editing for this video combined footage from both tapes. We have attempted to maintain the correct chronology of the combined images.

Acknowledgements

Dave Henley piloted the twin-engine Beechcraft Baron E55. Susan Walker assisted with photography and observations. Robert Tilling and Wendell Duffield reviewed this report. Editing and graphics by A Alaskan Video Studio, Anchorage, and KAKM, Channel 7, Anchorage.

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SCRIPT FOR THE AUDIO PORTION OF THE VIDEO OF THE AUGUST 18, 1992 ERUPTION OF CRATER PEAK VENT, SPURR VOLCANO, ALASKA

Counter *Rewind tape to beginning; begin playing tape*

00:00 *reset counter to 00:00 immediately when disclaimer appears on screen*

Disclaimer is followed by organization banners and the video title pages (no soundtrack)

00:58 Spurr volcano is a glacier-clad stratovolcano located approximately 130 kilometers west of Anchorage, Alaska on the west side of Cook Inlet. The volcano is located near the northeastern end of the Aleutian volcanic arc and is the closest historically active volcano to Alaska's south-central population centers of Anchorage and the Kenai Peninsula. During the past ten thousand years, Spurr has been the most active volcano in Cook Inlet. All historic eruptions have occurred from Crater Peak, a satellite vent located 3.5 kilometers to the south on the flank of Spurr, visible here on the middle left. This video shows part of the August 18, 1992 eruption of Crater Peak vent.

01:38 Our first views of the ongoing eruption were recorded from about 100 kilometers east of the volcano when we first ascended above the weather clouds, the tops of which are at about 2400 meters altitude. The source of the ash cloud is obscured from this vantage point since Mount Spurr and Crater Peak are behind the eruption column. The plume is shown rising well above the clouds and is narrower at the bottom than at the top, with an anvil-shaped upper section expanding in all directions.

02:40 The eastern leading edge of this cloud is approximately 5 kilometers behind the plane, or 25 kilometers from Anchorage. The southern extent of the ash plume is difficult to identify and the source of the plume is not clear until we move far enough to the north to bring the summit of Mount Spurr into view.

03:10 Once Mount Spurr is visible, the source of the eruption can be confirmed as Crater Peak. As we maneuver closer to the volcano a sharply defined, vertical eruption column can be seen rising through the clouds above the Crater Peak vent. The summit of Mount Spurr is approximately 3,375 meters high above sea level, and Crater Peak, at about 2,300 meters altitude, is below the weather clouds.

04:00 At this point, we are about 15 kilometers away from the volcano heading to the west. We will pass the eruption column on the north side. The area immediately east, (or downwind) of the eruption is completely obscured by falling ash.

04:20 As we come closer to the eruption column, the dark, roiling, rapidly expanding ash clouds come into view. The cauliflower-shaped ash clouds vigorously rise to form a mushroom or anvil-shaped top, reported by airline pilots to be at about 18 kilometers altitude.

05:40 The summit of Mount Spurr passes to the left of the plane as we maneuver for a close-up view of the crater area.

06:10 This close up of the base of the eruption column is taken from about 4 to 5 kilometers away and shows numerous violent ash-laden bursts from the vent.

07:05 Visible on the right side of the eruption column are several light brownish colored clouds rising above the south and southeast flanks of Crater Peak. These clouds are evidence of pyroclastic flows, which have advanced onto the glaciers on the south flank of Crater Peak.

08:35 Views of the near-vent area show several shockwaves transmitted through the weather clouds. These shockwaves were induced by choked flow conditions in the vent and appear as bands of light emanating from the base of the column. The bands of light are actually condensation fronts generated as the shockwaves pass through the steam clouds.

09:20 Mount Spurr is now visible in the distance to the north.

09:40 The Crater Peak vent is about 150 meters below the weather clouds. The roiling, dark ash clouds rise out of the vent, rapidly expand, and climb skyward in the vertical eruption column.

10:10 We are now under the weather clouds and a glimpse of the pyroclastic flows briefly comes into view out the plane's front window between the pilot and the passenger seated in the co-pilots chair.

10:35 For the next few minutes, we are above the clouds on the west side of Spurr volcano over Chakachamna Lake, providing a view of the full vertical extent of the eruption column. The lighter brown clouds to the south (or right) of the eruption column are fine ash winnowed from the pyroclastic flows. White steam clouds produced by melting of snow and ice around the crater rim are also visible near the base of the eruption column. The summit of Mount Spurr can be seen to the north (or left) of the eruption column.

12:45 Our view is now from the north as we closely pass Mount Spurr.

13:00 The southern edge of the anvil-shaped top of the eruption column is visible in the upper right.

13:30 Our view is now from the south and Mount Spurr is again visible in the distance to the left. To the far right a light-brown ash cloud is visible rising from the pyroclastic flow on the east flank.

14:30 We are once again west of Crater Peak providing another full view of the eruption column, and the ash cloud rising from the pyroclastic flows. We have been filming the eruption for about an hour and have completed several semi-circular traverses of the area. Many of our observations have been relayed to colleagues at the Alaska Volcano Observatory in Anchorage by radio. This eruption has been assigned a Volcano Explosivity Index of 3, which compares to an Index of 4 for the 1953

eruption of Crater Peak and a 5 for the May 18, 1980 eruption of Mount St. Helens.

15:50 Note the shockwaves emanating from the left base of the column as bands of light.

16:38 Mount Spurr is now visible in the foreground as we move eastward.

17:10 Heavy ashfall is occurring immediately downwind to the east of the eruption column. The eastern leading edge of the expanding ash cloud is briefly visible.

17:35 As we turn to the west, we can see the summit of Mount Spurr passing between the plane and the eruption column off the left wing. The August 18th eruption lasted 3 and a half hours. Ash began falling in Anchorage at 8 pm. A thin layer of sand-size ash as much as 3 millimeters thick covered the city, disrupting air traffic and closing Anchorage's International Airport for 20 hours. The ash plume was carried southeasterly across the Chugach Mountains, Prince William Sound, and along the outer coastline of southeast Alaska. Light dustings of ash were reported as far away as 1000 kilometers downwind. The eruption vented an estimated 52 million cubic meters of ash.

18:40 Note the shockwaves emanating from the base of the eruption column.

19:15 Coming into view is the southern edge of the anvil-shaped top of the expanding ash cloud.

20:10 Our view is now from the south as the plane begins another turn back towards the north. The prominent white clouds at the base of the eruption column result from melting of snow and ice near the crater. The light-brown clouds from the pyroclastic-flows are visible again on the right and Mount Spurr is on the left.

21:30 Even though we are only 2 kilometers from the eruption column, we can hear nothing but the sound of the plane's engines.

23:05 We are now travelling eastward, leaving the eruption behind, to return to Anchorage.

23:20 Our final view of the ongoing eruption is off the tail of the plane. The eruption continues for another two hours.

23:46 Heavy ash fallout is occurring immediately to the east (or downwind) of the volcano, and the advancing cloud is low over Cook Inlet, producing an artificial sunset.

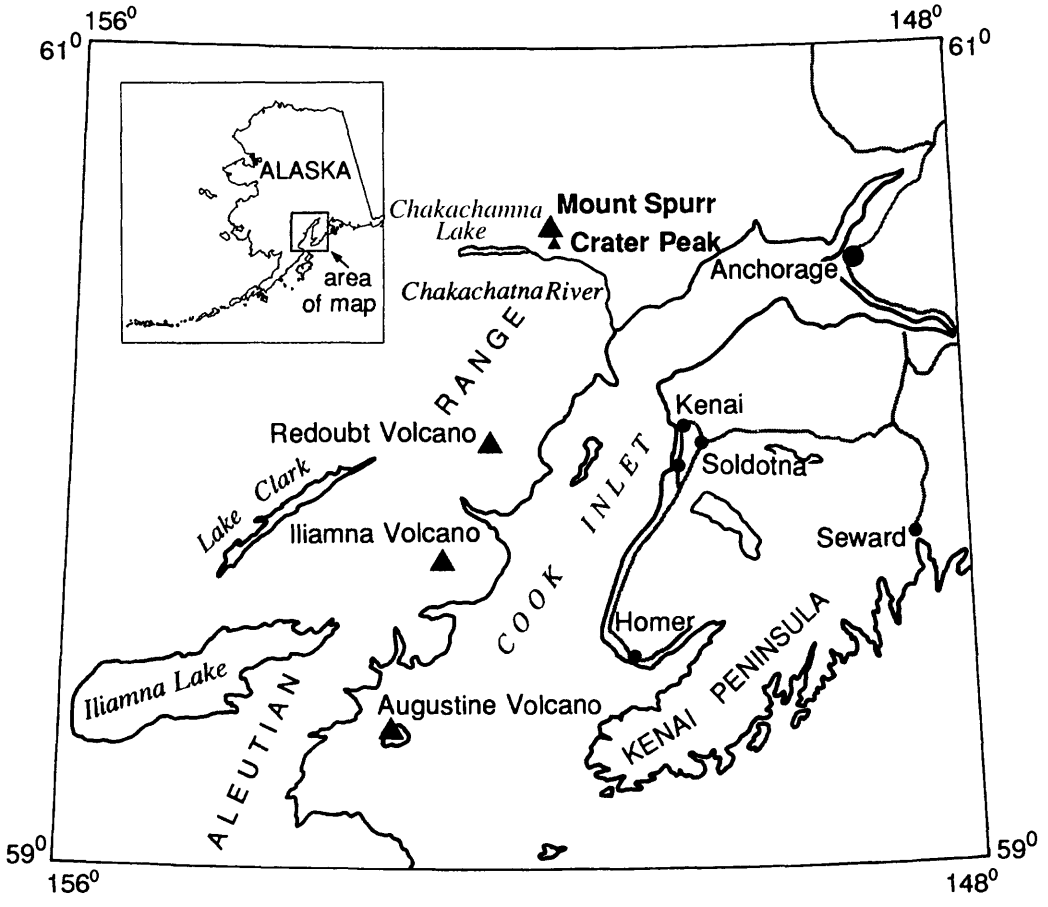

Figure 1. Map of Cook Inlet region showing Spurr and other active volcanoes.

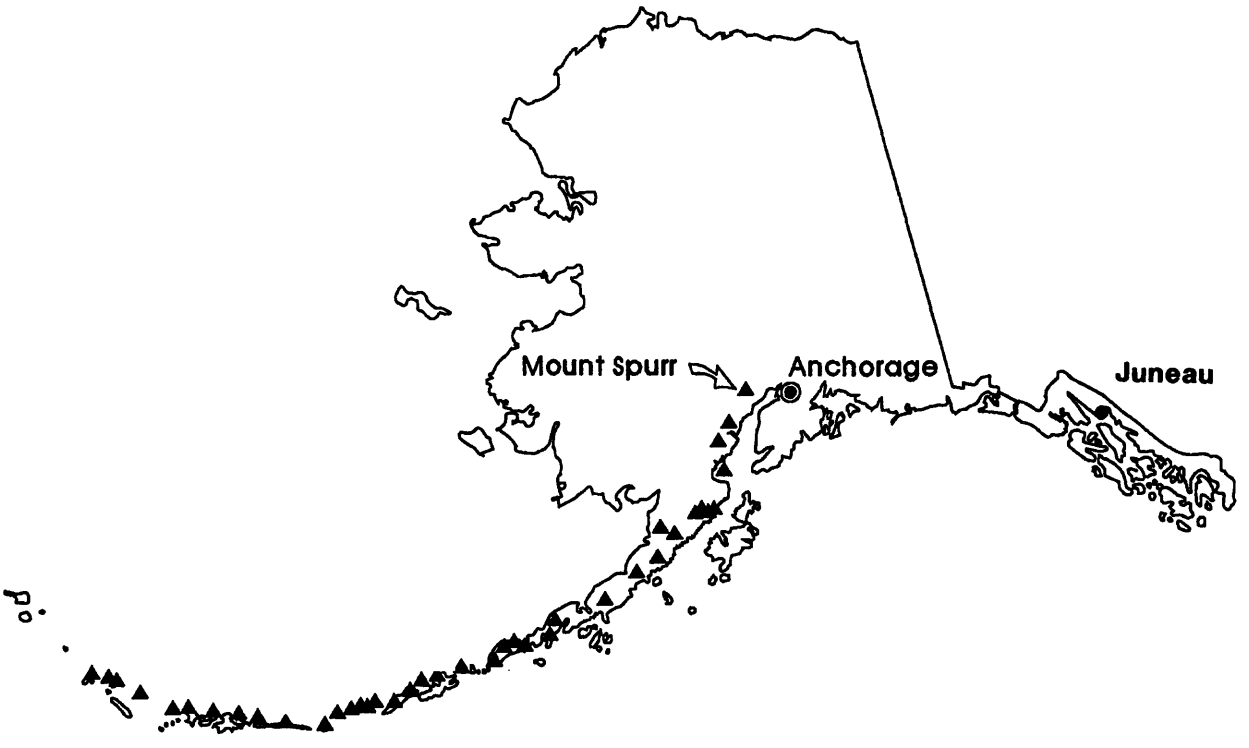

Figure 2. Index map showing active volcanoes (triangles) of the Aleutian volcanic arc.

Figure 3. View of Crater Peak (right foreground) and Mount Spurr (high peak on the skyline, center) from the southwest. Crater Peak straddles the southern rim of the caldera delineated by the peaks at the far left and right in this view. Photograph by Cynthia Gardner, Cascades Volcano Observatory (Vancouver, Washington), September 26, 1992.

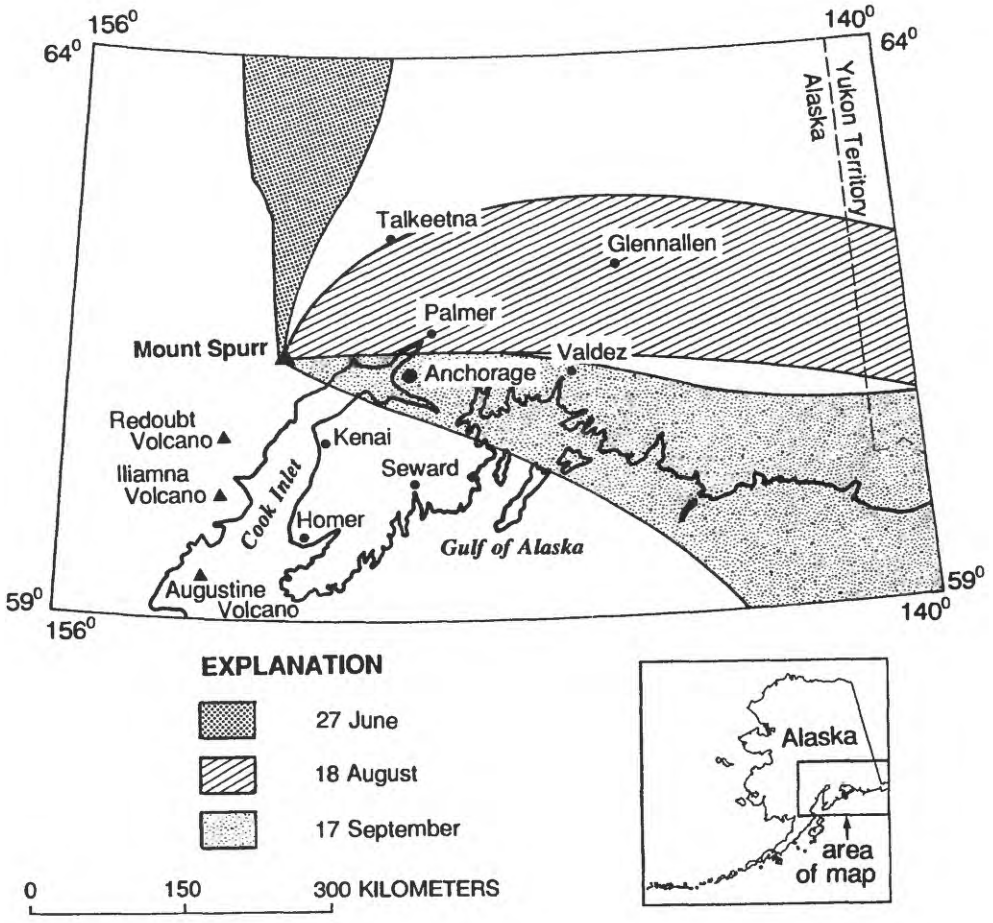

Figure 4. Map of south-central Alaska showing ash-plume tracks from the three 1992 eruptions of Spurr volcano.