



AKUTAN, AK

HAZARD PROFILE

In the center of the Aleutian Islands, Akutan dominates Akutan Island about 750 miles south west of Anchorage and 35 miles east of Dutch Harbor/Unalaska. Akutan Island is located at the transition between the continental and oceanic crust where the NE-directed Pacific Plate is moving under the North American Plate. The volcano is one of the most seismically active in the eastern Aleutian Arc.

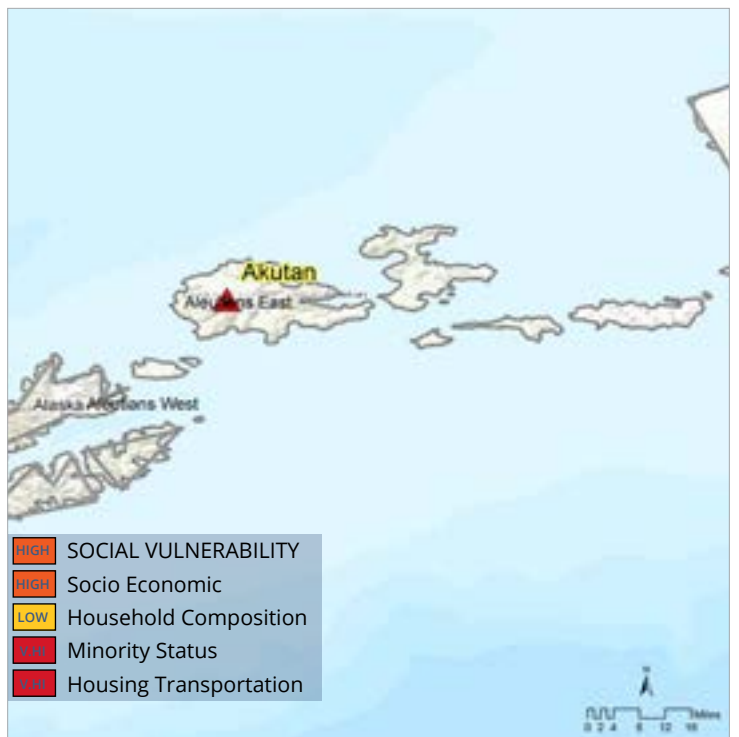
A stratovolcano with cinder cone, Akutan features a summit caldera and an active inner caldera cinder cone. The caldera is breached to the north. Small glaciers filled an older crater, which lies within the rim boundary of the younger caldera.

The active intracaldera cinder cone is located in the northeast quarter of the caldera. The summit houses three small sulfur-lined craters and several fumaroles are present along three small sulfur-lined craters occupy its summit and fumarole zones are present along its south and southwest flank.

In 1948, Byers and Barth described a crescent-shaped lake along the inner southwest rim of the caldera and a hot, slightly acidic lake along the northern caldera wall. In 1981, Motyka, et al, speculated that these lakes might have been obliterated by more recent

activity. Both lakes drained to the north through a gap in the caldera wall.

Akutan Island is home to indigenous people located in several coastal villages, and the base of a large fish processing facility.



AKUTAN HAZARD PROFILE



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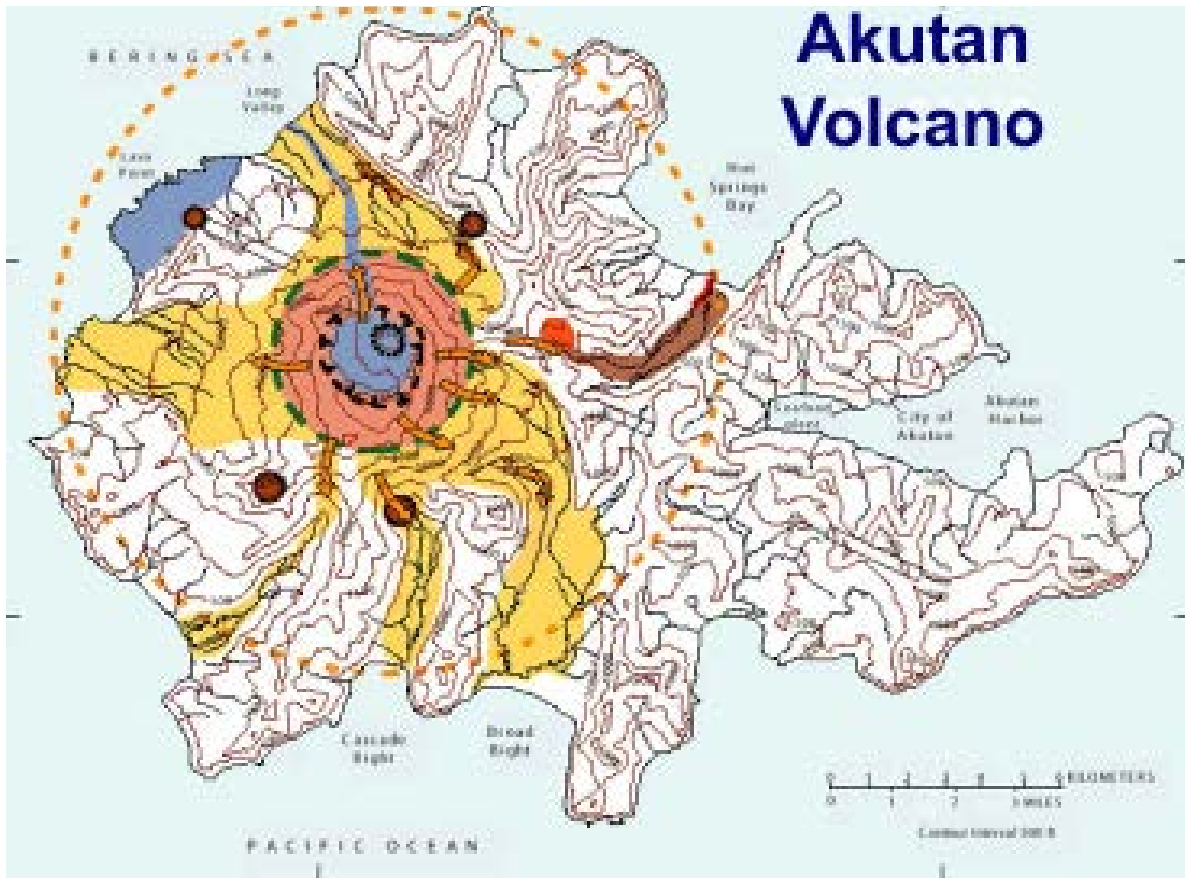
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URBAN DESIGN & PLANNING



AREAS OF IMPACT



MONITORING

- AVO has a program of real-time seismic monitoring at four Cook Inlet volcanoes, Mt. Spurr (Crater Peak), Redoubt, Iliamna, and Augustine. In addition, AVO employs a system to detect volcanically-induced lightning, conducts periodic observational overflights and/or landings as weather and volcanic conditions permit, and obtains intermittent airborne sulfur dioxide and carbon dioxide measurements.
- For some volcanoes, AVO has remote, real-time video capability (Redoubt, Spurr, Iliamna) and, although still experimental, near real-time deformation monitoring (Augustine). The continuous recording of earthquake activity at Cook Inlet volcanoes, in combination with other monitoring techniques, usually allows AVO to warn of the possibility of a volcanic eruption hours to weeks in advance and, during business hours and periods of 24-hour duty, to issue notification of an ash-producing eruption, usually within 10 minutes of onset of eruption.
- At the present time, AVO has no monitoring instrumentation on approximately 17 active Alaskan volcanoes. AVO relies principally on pilot reports (via FAA), satellite imagery (with NWS), and observations from local observers including village residents, military, US Coast Guard, US Fish and Wildlife Service, National Park Service, and fishing vessels to detect and monitor eruptions on unmonitored volcanoes.
- Seismic array of seismometer stations: <https://avo.alaska.edu/volcanoes/data.php?volname=Akutan>
- Alaska Volcano Observatory webicorders: <https://avo.alaska.edu/webicorders/Akutan/>

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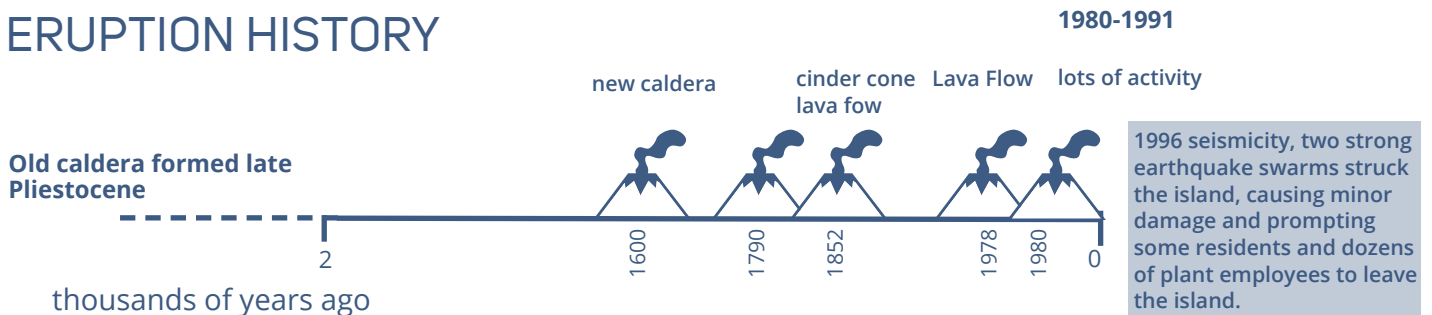
MOUNTAIN FACTS

coordinates	54.133° N, 165.985° W
summit / elevation	1303 m / 4275 ft
last known eruption	1992 CE
population	within 5 km / 0 10 km / 24 30 km / 233 100 km / 4,361
location	Aleutians East Borough
nearby towns	Akutan, Unalaska, False Pass, Pauloff Harbor, Anchorage

GEOLOGICAL SUMMARY

One of the most active volcanoes of the Aleutian arc, Akutan contains 2-km-wide caldera with an active intracaldera cone. An older, largely buried caldera was formed during the late Pleistocene or early Holocene. Two volcanic centers are located on the NW flank. Lava Peak is of Pleistocene age, and a cinder cone lower on the flank produced a lava flow in 1852 that extended the shoreline of the island and forms Lava Point. The 60-365 m deep younger caldera was formed during a major explosive eruption about 1600 years ago and contains at least three lakes. The currently active large cinder cone in the NE part of the caldera has been the source of frequent explosive eruptions with occasional lava effusion that blankets the caldera floor. A lava flow in 1978 traveled through a narrow breach in the north caldera rim almost to the coast. Fumaroles occur at the base of the caldera cinder cone, and hot springs are located NE of the caldera at the head of Hot Springs Bay valley and along the shores of Hot Springs Bay.

ERUPTION HISTORY



AKUTAN HAZARD PROFILE



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VOLCANO THREAT ASSESSMENT

OVERALL THREAT
VERY HIGH

HAZARD THREAT
HIGH (16)

EXPOSURE THREAT
HIGH (8.8)

MONITORING

REQUIRED

4

CURRENT

3

Overall Threat

This is an overall ranking based on multiple factors including tectonic setting, population density, eruption frequency, and potential to erupt again. The variations in these factors make this volcano uniquely dangerous.

Hazard Threat

This includes volcano type, max volcano explosivity index, explosive activity, eruption recurrence, holocene - pyroclastic flows, lava flows, lahar, tsunami, hydrothermal explosion potential, sector collapse potential, primary lahar source, and historical unrest.

Exposure Threat

This is based on volcano population index, population downstream, historical fatalities and evacuations, local and regional aviation exposure, infrastructure, major development of sensitive areas, and populated island location.

Current Monitoring

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MORE RESOURCES

Suscribe to Volcano Notification Service

<http://volcanoes.usgs.gov/vns/>

Find Designated Public Shelter

Text SHELTER + ZIP code to 43362 (4FEMA)

Alaska Volcano Observatory

Information, alerts, and realtime monitoring

<https://www.avo.alaska.edu/volcanoes/volcinfo.php?volcname=Akutan>

Alaska Interagency Operating Plan for Volcanic Ash Episodes (2014)

http://www.ofcm.gov/publications/volcanicash/regional_plans/2014%20Alaska%20Plan.pdf

Alaska Volcano Mitigation Plan

Division of Homeland Security & Emergency Management

For information on Volcano Preparedness <https://ready.alaska.gov/Plans/mitigation/volcano>

USGS report on Volcanic Activity in Alaska

Summary of Events and Response of the Alaska Volcano Observatory (2013)

<https://pubs.usgs.gov/sir/2015/5110/sir20155110.pdf>

Alaska Department of Natural Resources

Geological & Geophysical Surveys, Volcanoes: <https://pubs.usgs.gov/sir/2015/5110/sir20155110.pdf>

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AUGUSTINE, AK

HAZARD PROFILE

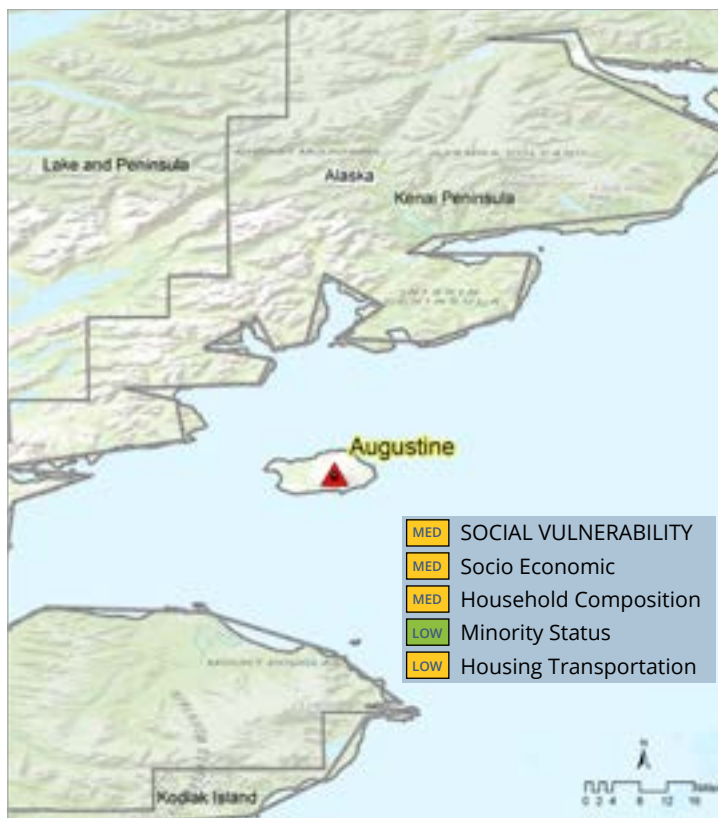
Augustine Volcano, in lower Cook Inlet, is a central dome volcano, composed of an overlapping summit lava domes which is surrounded by steep sided, viscous lava that has been thrust out from a vent. The volcano is about 185 miles from Anchorage, which houses more than half of the population of Alaska.

According to T.P. Miller, et al, Augustine Island, which is nearly uninhabited, was formed entirely by Augustine debris. It is typlified by repeated summit dome collapse which sends debris avalanching down the steep flanks and into Cook Inlet. Debris avalanches falling into the inlet have the potential to generate a tsunami.

Eruptions typically begin with a fast and furious explosion which spews plumes of ash and steam into the air. Ash fall is extensive and followed by the lava dome collapse and hot debris and lahars flowing down the steep flanks.

In January 2000, Augustine experienced an explosive eruption sending up an ash plume that reached 30,000 ft. Micro earthquake (< 2) activity was the first alert that an eruption was possibly building. Mud flows gushed down the steep sides of the volcano along with rock an snow avalanche deposits. A subsequent eruption on Jan 27th, sent ash 40,000 ft with continuing pyroclastic flows seeping down the flanks. Small eruptions continued until April 2006

Augustine was selected as one of Alaska's potentially most hazardous volcanoes, capable of initiating damaging tsunami to lower Cook Inlet, but geologic evidence for them on the mainland is sporadic and sparse.



AUGUSTINE HAZARD PROFILE



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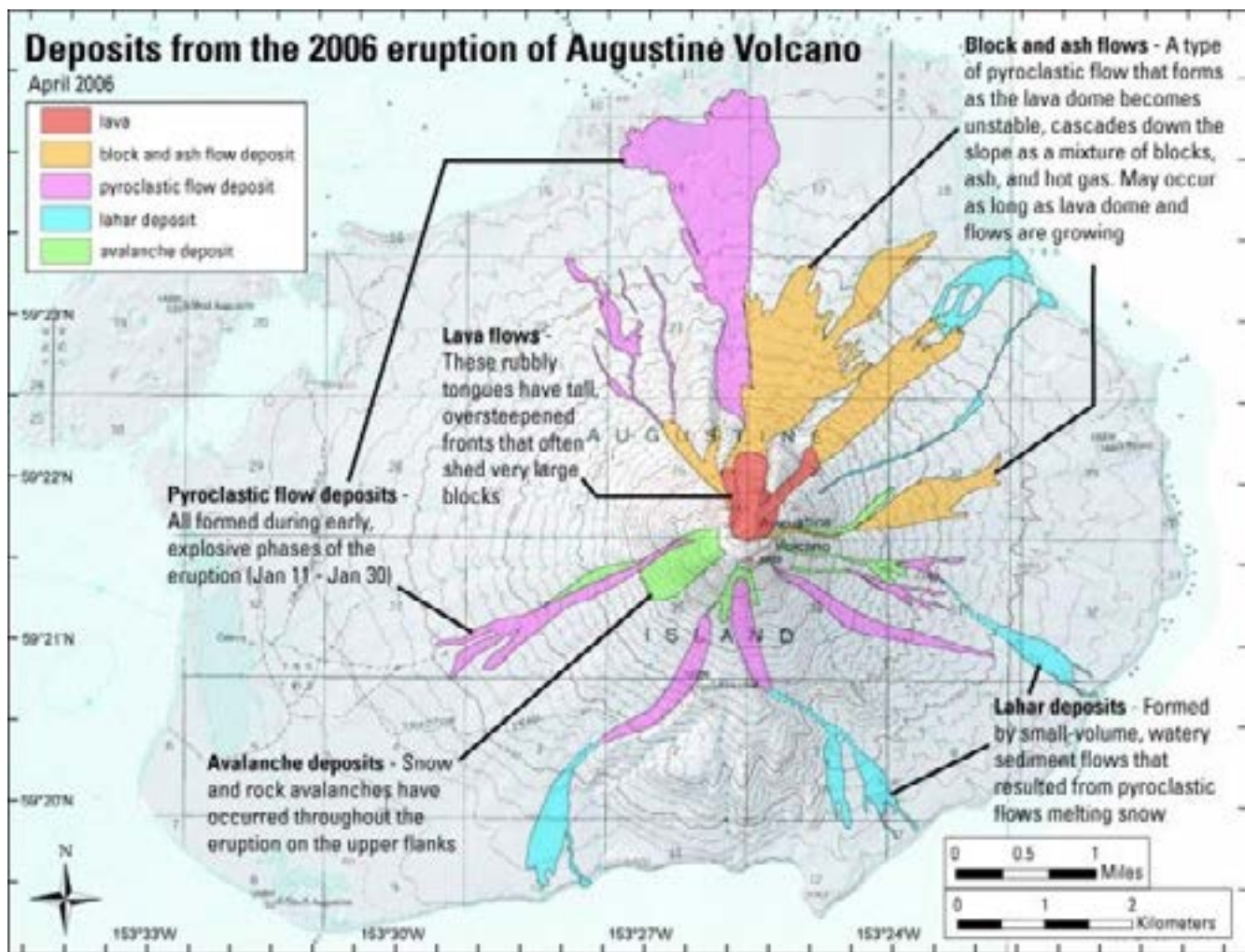
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AREAS OF IMPACT



(Source: AVO/ USGS)

MONITORING

Augustine is currently monitored closely because of its close proximity to several highly populated areas. There is concern that a major eruption could initiate a tsunami which would endanger coastal towns located in Cook Inlet. Advances in monitoring technology and techniques have enabled an accurate and timely warning system in the event of an eruption, tsunami, or debris avalanche

- The Plate Boundary Observatory, operated by UNAVCO has a network of 10 high-precision GPS instruments on the flanks of Augustine. 2 of these sites were lost during eruption activities.
- The Alaska Volcano Observatory also operates a number of seismometers and tiltmeters all around the volcano, including four webcams.
- In 2006, WoodsHole deployed 5 ocean-bottom seismometers to assist Alaska Volcano Observatory in monitoring the volcano eruptions.
- Sensors to gauge gas emissions, and global positioning systems (GPS) to detect land deformations.
- NOAA has established a West Coast and Alaska Tsunami Warning Center to monitor seismic and volcanic activity for early detection of a tsunami evidence.

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(R. G. McGimsey, USGS)

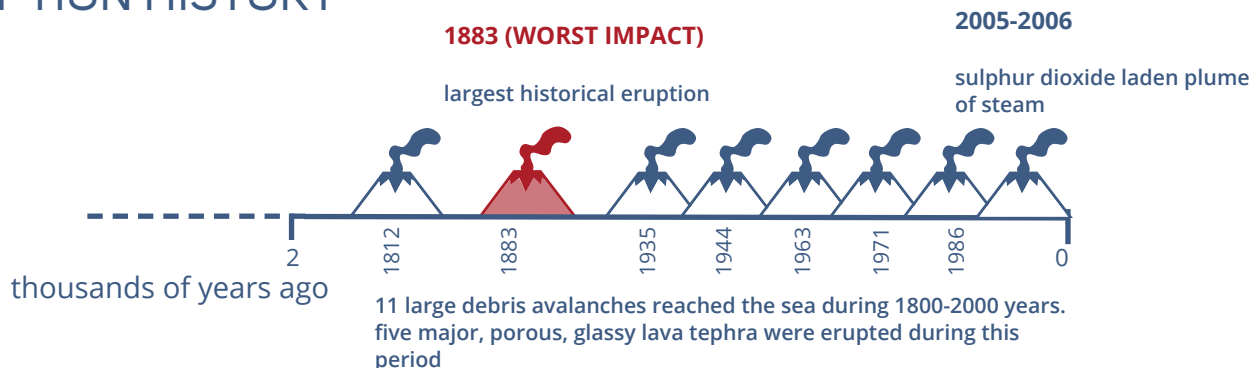
MOUNTAIN FACTS

coordinates	59.363° N, 153.43° W
summit / elevation	1252 m / 4107 ft
last known eruption	2006 CE
population	within 5 km / 0 10 km / 0 30 km / 23 100 km / 1,340,896
county	Kenai Peninsula Borough
nearby towns	Pedro Bay, Pope-Vannoy Landing, Kokhanok, Nanwalek

GEOLOGICAL SUMMARY

Augustine volcano, rising above Kamishak Bay in the southern Cook Inlet about 290 km SW of Anchorage, is the most active volcano of the eastern Aleutian arc. It consists of a complex of overlapping summit lava domes surrounded by an apron of volcanoclastic debris that descends to the sea on all sides. Few lava flows are exposed; the flanks consist mainly of debris-avalanche and pyroclastic-flow deposits formed by repeated collapse and regrowth of the volcano's summit. The latest episode of edifice collapse occurred during Augustine's largest historical eruption in 1883. That eruption generated a tsunami that reached 30 feet at Port Graham. Subsequent dome growth has restored the volcano to a height comparable to that prior to 1883. The oldest dated volcanic rocks on Augustine are more than 40,000 years old. At least 11 large debris avalanches have reached the sea during the past 1800-2000 years, and five major pumiceous tephras have been erupted during this interval. Historical eruptions have typically consisted of explosive activity with emplacement of pumiceous pyroclastic-flow deposits followed by lava dome extrusion with associated block-and-ash flows.

ERUPTION HISTORY



AUGUSTINE HAZARD PROFILE

VOLCANO THREAT ASSESSMENT

OVERALL THREAT
VERY HIGH

HAZARD THREAT
HIGH (14)

EXPOSURE THREAT
HIGH (8.8)

MONITORING
REQUIRED **4** | CURRENT **3**

Overall Threat

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MORE RESOURCES

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Division of Homeland Security & Emergency Mangement

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Alaska Volcano Observatory

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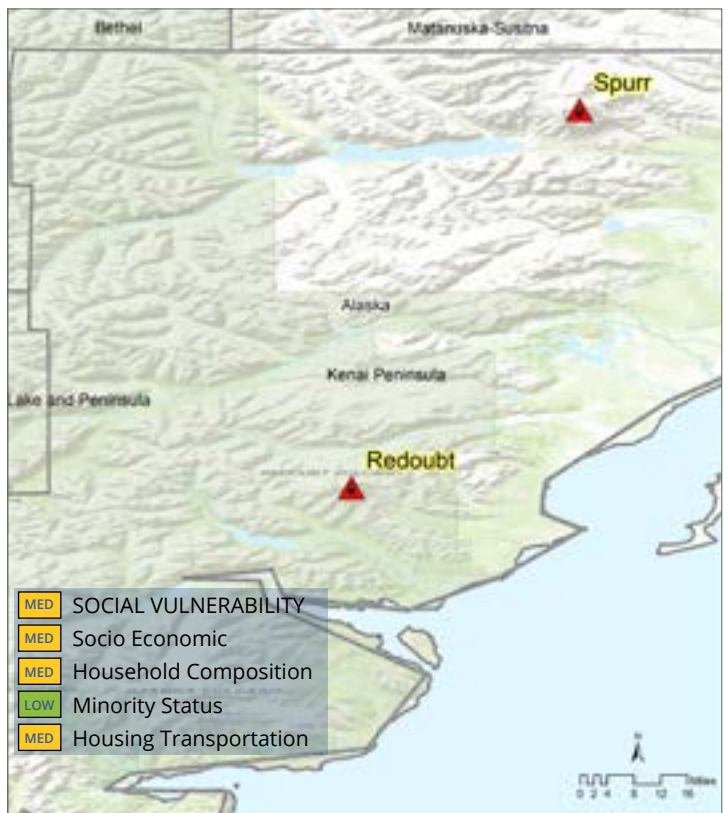
REDOUBT, AK

HAZARD PROFILE

Redoubt is a very active stratovolcanic that started forming about 890,000 years ago and is currently the highest summit in the Aleutian Range, Alaska. Just west of Cook Inlet and about 110 miles southwest of Anchorage, Redoubt is a steep sided cone composed of lava flows and a high density mix of lava blocks, pumice, ash, and rock fragments (pyroclastic deposit). The volcano is highly glaciated and has a summit crater filled with ice and snow.

Currently, the main vent on Redoubt is on the north side of the crater near Drift glacier. Glacier movement on Redoubt has caused some erosion of the volcano. Old layers of rocky debris, and water mudflow deposits (Lahars) are evident and extend as far as Cook Inlet.

Redoubt is known for explosive eruptions, sending ash-rich columns up to 7-1/2 miles into the air and collapsing 80% of the dome.



REDOUBT HAZARD PROFILE



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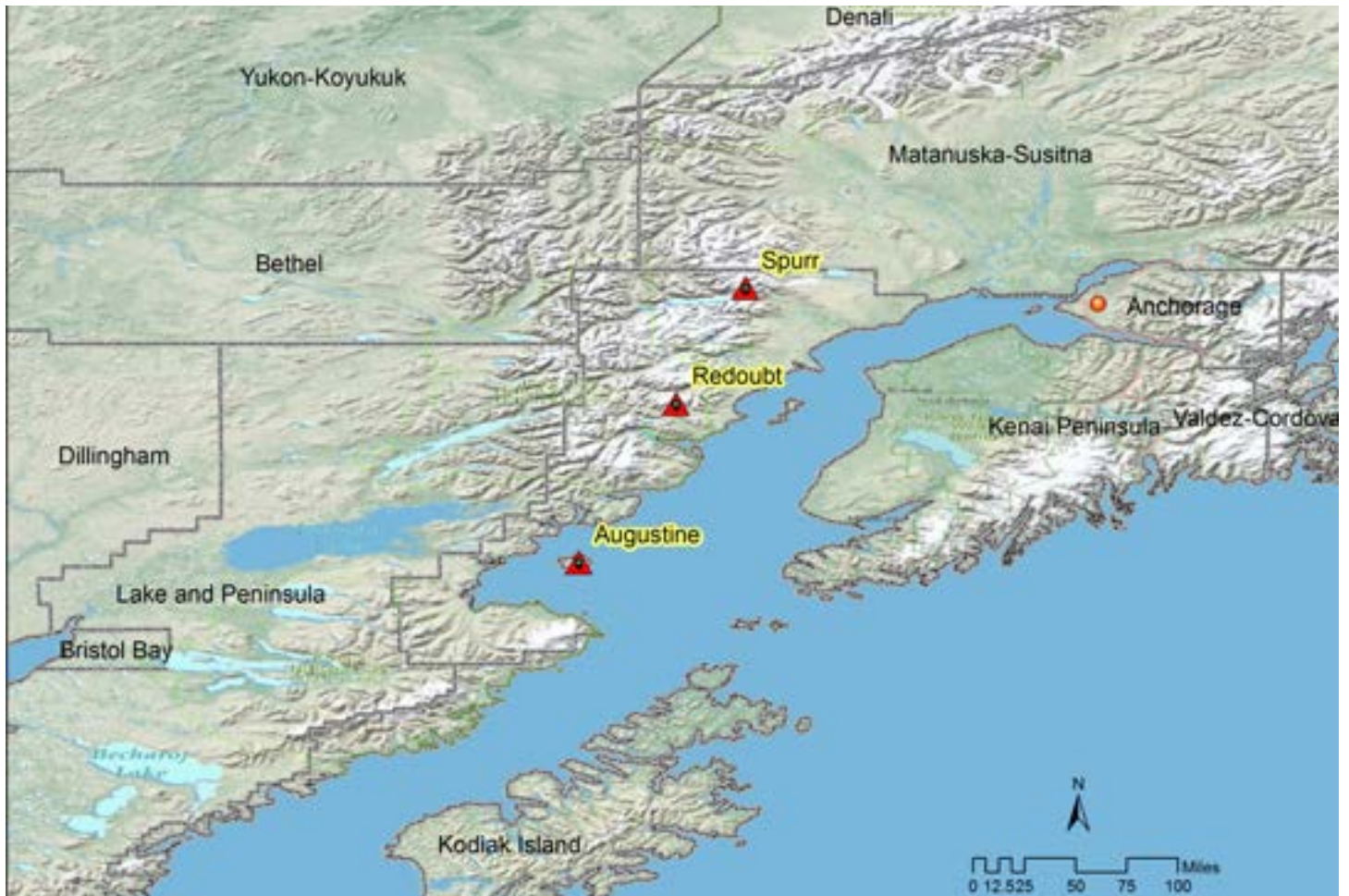
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AREAS OF IMPACT



MONITORING

- AFM Acoustic Flow Monitor
- A device that alerts of a possible lahar by measuring the movement of rocks against each other
- National Weather Service Ash fall alerts
- Seismic station array
- AVO helicopter flyovers.
- Gauging stations
- which measure water levels in rivers every 15 minutes and automated pumping samplers that collect water samples for laboratory analysis
- DEM Digital Elevation Models
- creates highly accurate maps of the ground surface
- Monitoring thermal features:
 - Steam, or vapor-dominated features such as gas vents, fumaroles, mud pots
 - Water-dominated features including geysers, hot springs/pools, crater lakes
 - Lava-dominated features include lava lakes, lava flows, lava domes, and pyroclastic flows

REDOUBT HAZARD PROFILE



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MOUNTAIN FACTS

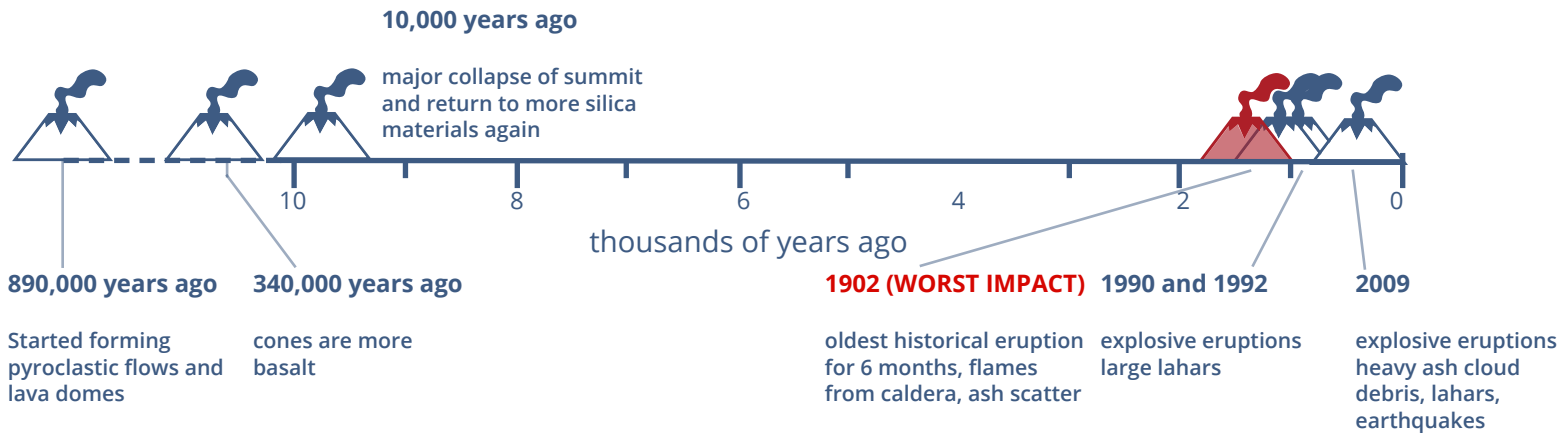
coordinates	60.485° N, 152.743° W
summit / elevation	3108 m / 10194 ft
last known eruption	2009 CE
population	within 5 km / 0 10 km / 0 30 km / 1 100 km / 32,410
Location	Lake Clark National Park and Preserve, Kenai Peninsula Borough, AK
nearby communities	Ninilchik 47 mi (76 km) Sesalamatof 48 mi (78 km) NE Clam Gulch 49 mi (79 km) SE Kenai Peninsula Borough 50 mi (81 km) NE Anchorage 108 mi (174 km) NE

(AVO / USGS)

GEOLOGICAL SUMMARY

In January 1902, Redoubt explosively erupted throwing ash into the atmosphere for 6 months. Newspaper reports of the eruption vary in their reports of a terrific earthquake that split the mountain apart, shooting flames from the caldera, and ash scatter for over 150 miles. During the 1902 eruption scientists began using the newly developed Acoustic Flow Monitor to measure rocks moving against each other. This information could be used to alert nearby stations that lahar formation was initiated. Redoubt is known for explosive eruptions, sending ash-rich columns up to 7-1/2 miles into the air and collapsing 80% of the dome. Hot avalanches of dome particles and fragmented rock flowed and ice mixed into this slurry of debris, increasing its volume and speed creating an enormous debris flow that ran downstream and completely filled the Drift River Valley. Subsequent eruptions ejected hot ash, lava fragments, and gases (pyroclastic flows) the hot material melted summit ice and snow causing mud and debris flows (lahars). The lahars flowed rapidly down the north flank of the volcano to Cook Inlet and where it threatened to destroy an oil storage facility.

ERUPTION HISTORY



REDOUBT HAZARD PROFILE



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VOLCANO THREAT ASSESSMENT

OVERALL THREAT
VERY HIGH

HAZARD THREAT
HIGH (14)

EXPOSURE THREAT
HIGH (11.7)

MONITORING

REQUIRED
4

CURRENT
3

Overall Threat

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Alaska Interagency Operating Plan for Volcanic Ash Episodes (2014)

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Alaska Volcano Mitigation Plan

Division of Homeland Security & Emergency Management

For information on Volcano Preparedness <https://ready.alaska.gov/Plans/mitigation/volcano>

Service Review--Mount Redoubt Volcanic Eruptions March - April 2009

<https://www.weather.gov/media/publications/assessments/redoubt.pdf>

Preliminary Volcano-Hazard Assessment for Redoubt Volcano, AK (1998)

<https://avo.alaska.edu/pdfs/redoubt.hazards.ofr.pdf>

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REDOUBT HAZARD PROFILE



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MT. SPURR, AK

HAZARD PROFILE

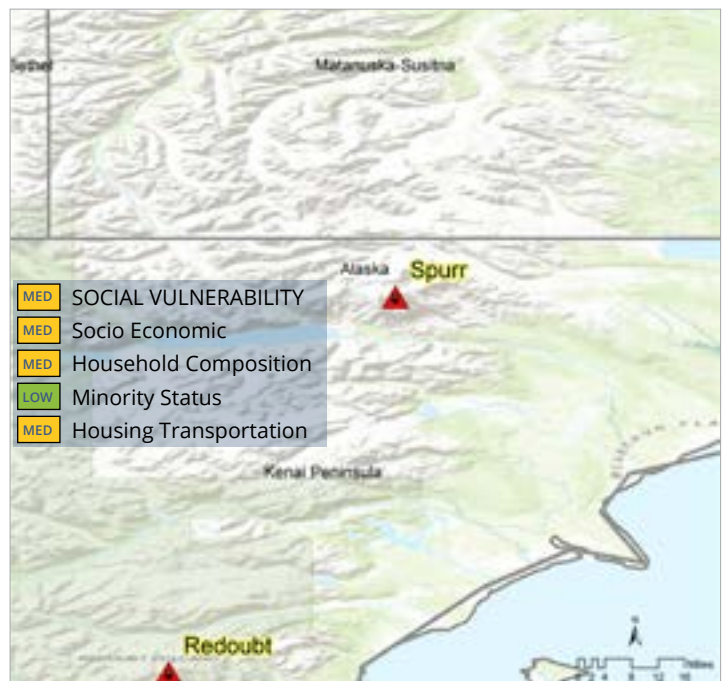
(Mc Gimsey, 1992. AVO/ USGS)

Mt. Spurr is a large, ice-covered, lava dome volcano and the highest volcano of the Aleutian Arc. Located in the north-central Cook Inlet region, about 62 miles from Anchorage, Alaska, it contains a summit caldera in the shape of a horseshoe and an open southern rim where at least 40 older tephra layers have been identified.

It has been suggested that Spurr is part of a larger, dissected stratovolcano. Crater Peak is a satellite cone of Spurr. Located in the caldera breach, Crater Peak also has a summit along the south rim and and the site of most recent activity. The North rim exposes the remains of an older dome or lava lake. (AVO). Before the 1992 eruption, there was a small crater lake in the bottom of Crater Peak's crater.

In 2004, the summit peak experienced a heating event which created a small crater lake. The summit crater had cooled enough by 2008 to have accumulated significant amounts of snow again.

The second of 3 large explosive eruptions from Crater Peak took place on August 18, 1992. This aerial view above from the west shows the base of the vertical eruption column, which reached a height of about 13.5 km. This eruption lasted about 4 1/2 hours and produced ashfall in Anchorage, 125 km to the east, that forced its international airport to close for 20 hours.



MT SPURR HAZARD PROFILE



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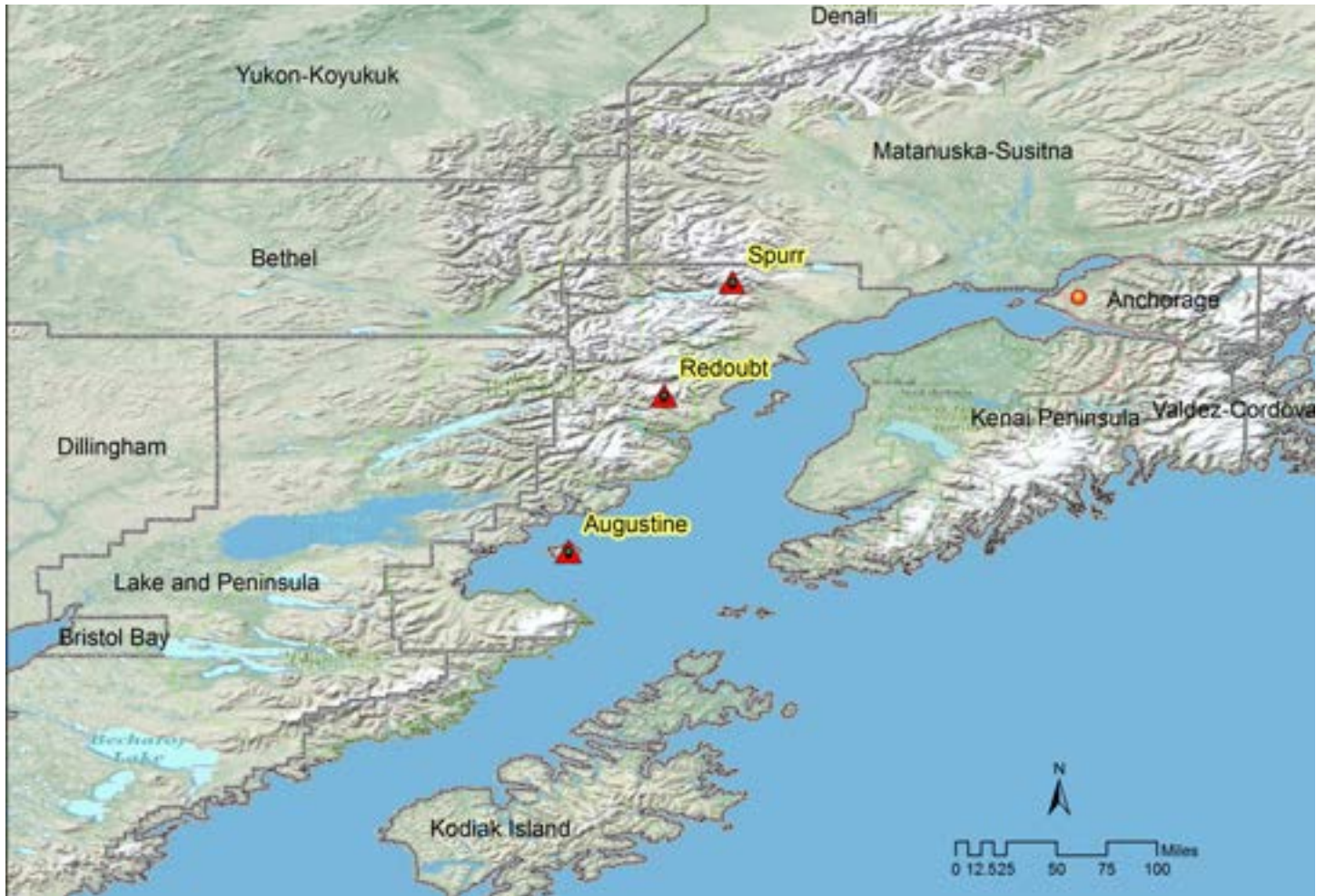
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AREAS OF IMPACT



MONITORING

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- Satellite observations & meteorological radar using very high resolution radiometer (AVHRR) weather satellite data
- Webcam looking north, located on an oil and natural gas platform in Cook Inlet
- Proposed geothermal plant: using magma chamber as alternative fuel



(Mc Gimsey, AV01 USGS)

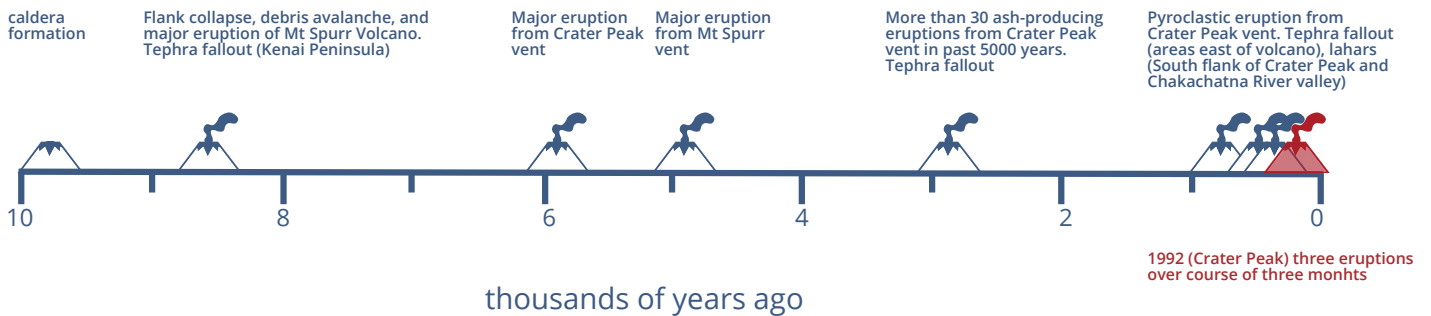
MOUNTAIN FACTS

coordinates	61.299° N, 152.251° W
summit / elevation	3374 m / 11067 ft
last known eruption	1992 CE
population	within 5 km / 0 10 km / 0 30 km / 0 100 km / 11,097
location	Kenai Peninsula Borough, AK
nearby communities	Anchorage, Cook Inlet communities, Cordova, Kenai Peninsula

GEOLOGICAL SUMMARY

The 3374-m-high summit of Mount Spurr, the highest volcano of the Aleutain arc, is a large lava dome constructed at the center of a roughly 5-km-wide horseshoe-shaped caldera that is open to the south. The volcano lies 130 km west of Anchorage and NE of Chakachamna Lake. The caldera was formed by a late-Pleistocene or early Holocene debris avalanche and associated pyroclastic flows that destroyed an ancestral Spurr volcano. The debris avalanche traveled more than 25 km to the SE, and the resulting deposit contains blocks as large as 100 m in diameter. Several ice-carved post-caldera cones or lava domes lie in the center of the caldera. The youngest vent, 2309-m-high Crater Peak, formed at the breached southern end of the caldera and has been the source of about 40 identified Holocene tephra layers. Spurr's two historical eruptions, from Crater Peak in 1953 and 1992, deposited ash on the city of Anchorage.

ERUPTION HISTORY



MT SPURR HAZARD PROFILE

VOLCANO THREAT ASSESSMENT

OVERALL THREAT
VERY HIGH

HAZARD THREAT
HIGH (14)

EXPOSURE THREAT
HIGH(9.3)

MONITORING

REQUIRED

4

CURRENT

3

Overall Threat

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http://www.ofcm.gov/publications/volcanicash/regional_plans/2014%20Alaska%20Plan.pdf

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USGS report on Volcanic Activity in Alaska

Summary of Events and Response of the Alaska Volcano Observatory (2013)

<https://pubs.usgs.gov/sir/2015/5110/sir20155110.pdf>

Preliminary Volcano Hazard Assessment for Mt Spurr (2002)

<https://pubs.usgs.gov/of/2001/0482/pdf/of01-482.pdf>

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MT SPURR HAZARD PROFILE



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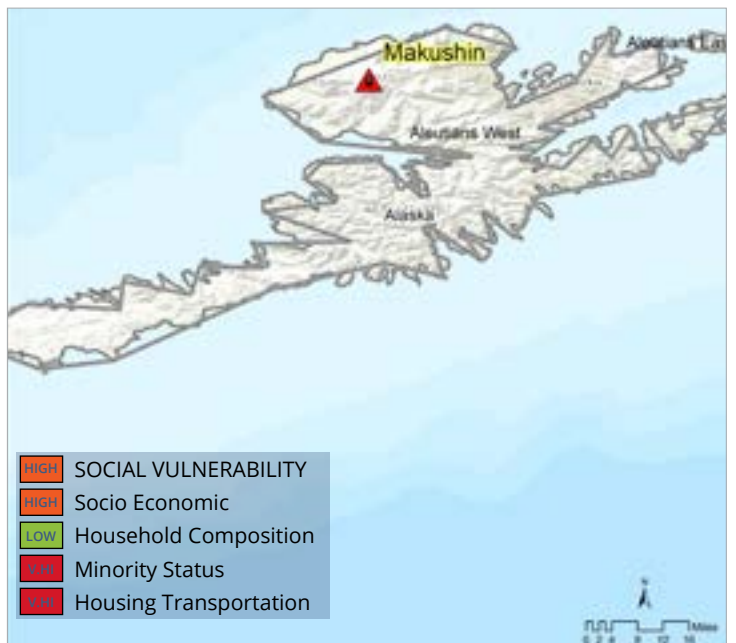
MAKUSHIN, AK

HAZARD PROFILE

Makushin is a broad, dome shaped stratovolcano with a caldera, cone, and ice field. Located on Unalaska Island across the bay from Dutch Harbor, extensive, dense, deposits of ash, lava fragments and gas that ejected explosively in the past, have extended the island by several miles along the northwest coast. These layers consist mostly of basalt and andesite (fine grained material with crystallized structure).

Makushin is about 800 miles from Anchorage. The nearest town to the volcano is Unalaska town, about 28 miles to the west. It is the old site of shipping and trade during the Russian occupation of 1741-1867. Dutch Harbor was a major naval base during WWII. Today fishing and crabbing are the main industries of Unalaska Island. It is one of the few places in the Aleutians where a large population live and work near an active volcano. The population of the two towns is over 4,000 residents but can exceed 10,000 during the commercial fishing season.

Geothermal areas are found in the summit caldera of Makushin and on the SE and eastern flanks of the volcano. They represent the largest and most investigated high-temperature geothermal resources in Alaska.



MAKUSHIN HAZARD PROFILE



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AREAS OF IMPACT



MONITORING

- Alaska Volcano Observatory (AVO) maintains a real-time seismic network to detect small earthquakes that often precede volcanic eruptions. AVO distributes by fax and e-mail a weekly report updating the status of more than 20 monitored volcanoes in Alaska, including Makushin Volcano.
- In addition, AVO employs a system to detect volcanically-induced lightning, conducts periodic observational overflights and/or landings as weather and volcanic conditions permit, and obtains intermittent airborne sulfur dioxide and carbon dioxide measurements.
- AVO relies principally on pilot reports (via FAA), satellite imagery (with NWS), and observations from local observers including village residents, military, US Coast Guard, US Fish and Wildlife Service, National Park Service, and fishing vessels to detect and monitor eruptions on unmonitored volcanoes.

Source: World Organization of Volcano Observatories & AVO



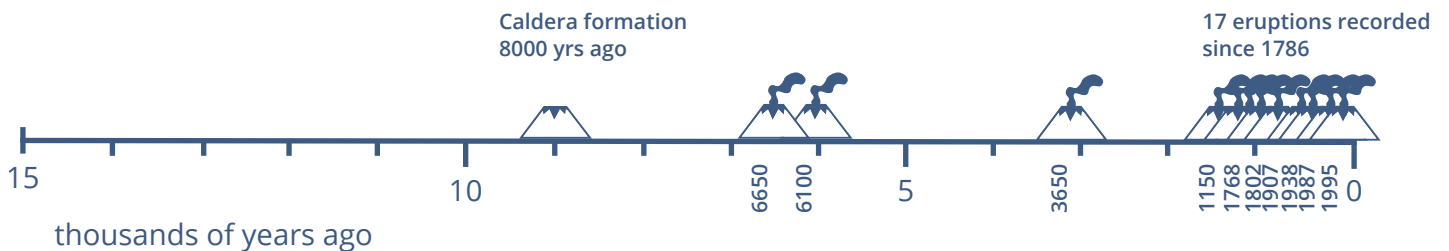
MOUNTAIN FACTS

coordinates	53.887° N, 166.932° W
summit / elevation	1800 m / 5906 ft
last known eruption	1995CE
population	within 5 km / 0 10 km / 0 30 km / 3,437 100 km / 3,850
location	Unalaska Island
nearby communities	Unalaska Town Dutch Bay

GEOLOGICAL SUMMARY

Makushin is one of the active volcanoes in the Aleutian Islands. The volcano has erupted several times in the past several thousands of years. At least seventeen modest eruptions have been recorded since 1786. The caldera was formed around 8000 years ago. The summit collapsed, forming the caldera and sending a high-density mix of hot lava blocks, pumice, ash and volcanic gas (pyclastic) debris racing down the volcano flanks and engulfing the surrounding valleys up to 100 feet deep. Volcanic lava fills the northeast border of the volcano and is called "Lava Ramp." Hot springs and fumaroles (vents of hot sulphuric gas) formed in the summit and valleys. Exploration efforts are underway to develop geothermal steam resources to use to power the nearby communities rather than continue the current use of diesel fuel. A relatively small eruption in 1980 initiated from a vent on the south side of the volcano below the peak. The summit erupted in March of 1987 sending an ash plume 3,000 feet above the volcano. The last eruption, January 1995, generated an ash cloud of about 1.5 miles.

ERUPTION HISTORY



MAKUSHIN HAZARD PROFILE



FEMA



Institute for
Hazard Mitigation
Planning and Research



URBAN DESIGN & PLANNING



VOLCANO THREAT ASSESSMENT

OVERALL THREAT

VERY HIGH

HAZARD THREAT

HIGH (16)

EXPOSURE THREAT

HIGH (9.5)

MONITORING

REQUIRED

4

CURRENT

3

Overall Threat

This is an overall ranking based on multiple factors including tectonic setting, population density, eruption frequency, and potential to erupt again. The variations in these factors make this volcano uniquely dangerous.

Hazard Threat

This includes volcano type, max volcano explosivity index, explosive activity, eruption recurrence, holocene - pyroclastic flows, lava flows, lahar, tsunamis, hydrothermal explosion potential, sector collapse potential, primary lahar source, and historical unrest.

Exposure Threat

This is based on volcano population index, population downstream, historical fatalities and evacuations, local and regional aviation exposure, infrastructure, major development of sensitive areas, and populated island location.

Current Monitoring

This assesses the current ability to detect and track pre-eruptive and eruptive changes in real-time, including what is occurring. This assessment considers seismic, deformation, gas, hydrologic, and remote sensing monitoring capabilities.

MORE RESOURCES

Suscribe to Volcano Notification Service

<http://volcanoes.usgs.gov/vns/>

Find Designated Public Shelter

Text SHELTER + ZIP code to 43362 (4FEMA)

Alaska Volcano Observatory

Information, alerts, and realtime monitoring

<https://www.avo.alaska.edu/volcanoes/volcinfo.php?volcname=Akutan>

Alaska Interagency Operating Plan for Volcanic Ash Episodes (2014)

http://www.ofcm.gov/publications/volcanicash/regional_plans/2014%20Alaska%20Plan.pdf

Alaska Volcano Mitigation Plan

For information on Volcano Preparedness <https://ready.alaska.gov/Plans/mitigation/volcano>

USGS report on Volcanic Activity in Alaska

Summary of Events and Response of the Alaska Volcano Observatory (2013)

<https://pubs.usgs.gov/sir/2015/5110/sir20155110.pdf>

Preliminary Volcano Hazard Assessment for Makushin (2000)

http://pubs.dggsalaskagov.us/webpubs/dggs/ri/text/ri2000_004.pdf

**BE INFORMED.
MAKE A PLAN.
BUILD A KIT.**

MAKUSHIN HAZARD PROFILE



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