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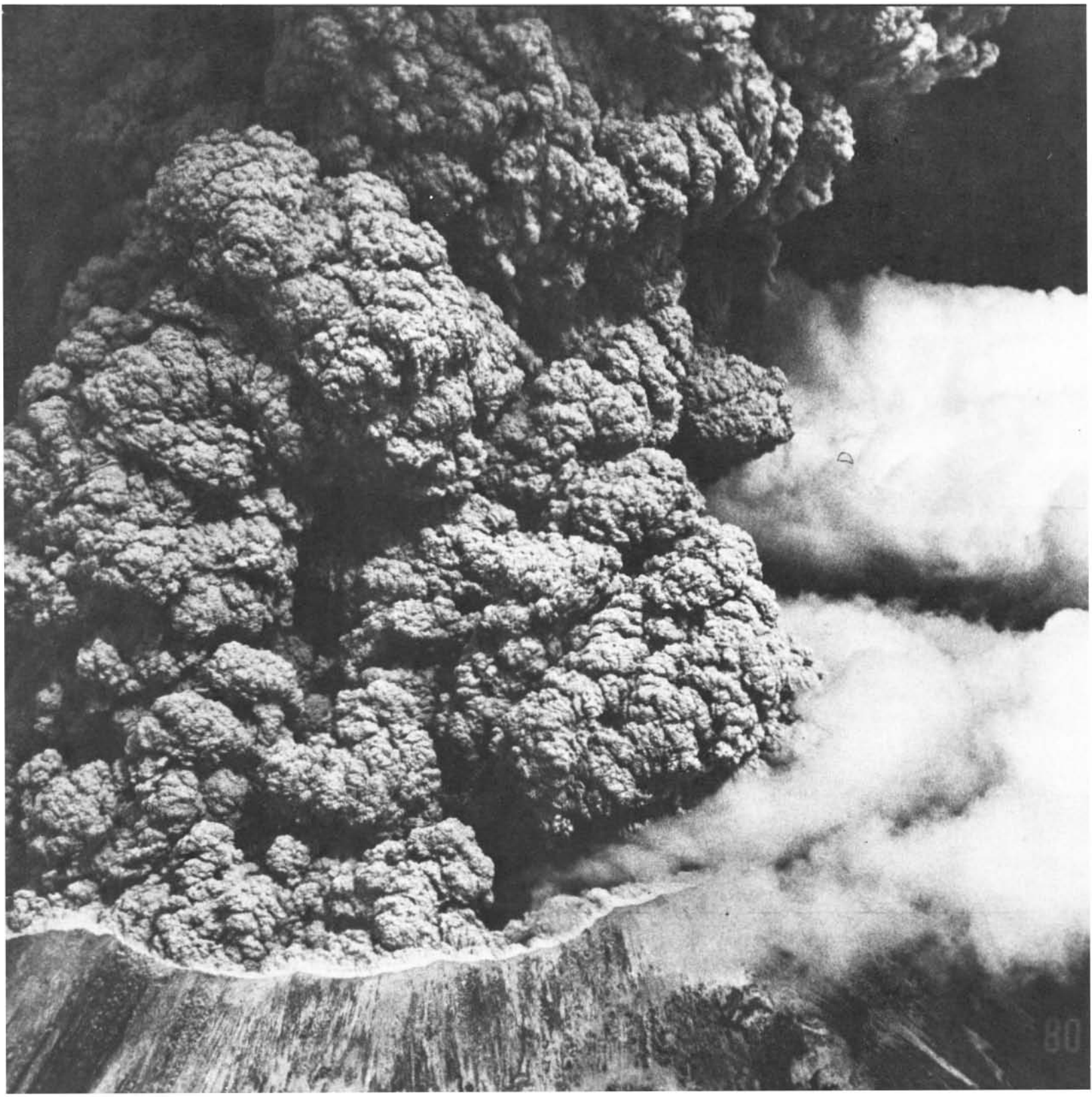
VOLUME 42, NUMBER 6 JUNE 1980



OREGON GEOLOGY

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COVER PHOTO

Disastrous eruption of Mount St. Helens Volcano, Washington, May 18, 1980. This photo shows west rim of crater, part of the ash-laden plume, and white condensation form clouds caused by the shock wave of the explosive eruption. Photographs and SLAR (side-looking airborne radar) and thermal infrared imagery appearing in this issue were taken by the Oregon Army National Guard.

Mount St. Helens erupts

On May 18, Mount St. Helens shattered the peaceful Sunday morning silence with an explosive eruption that devastated most of the immediate areas to the north and northwest, killed an as yet unknown number of people, caused numerous destructive floods and mudflows, and blanketed much of eastern Washington, northern Idaho, and western Montana with volcanic ash. Succeeding smaller eruptions have deposited ash over parts of Oregon and the rest of Washington. By now, this very active volcano in our midst has affected in one way or another almost all of us living in the Pacific Northwest.

The Oregon Department of Geology and Mineral Industries maintains an interest in the volcano from the standpoint of public safety via coordination with the Oregon Division of Emergency Services and the U.S. Geological Survey. The Oregon National Guard, flying at the request of the Oregon Department of Geology and Mineral Industries, kindly provided the imagery and photographs in this issue.

The article beginning on the next page is preliminary in nature. It was written under a tight time constraint to meet our deadline, and material in it is, of course, subject to further interpretation. Because of the magnitude of this eruption, the article originally scheduled for this issue will appear in next months' *Oregon Geology.* □

Students win 1980 DOGAMI awards

As in previous years, the Oregon Department of Geology and Mineral Industries has again awarded some financial aid for field work to graduate geology students who are active in mapping in Oregon. The following students are the winners of this year's awards:

Name and school	Location and topic of studies
Avramenko, Walter University of Oregon	Echo Mountain, Western Cascades; geology and structure
Coward, Robert Rice University, Houston	Sumpter 30′ sheet; Elkhorn Ridge Argillite
Flaherty, Gerald University of Oregon	McKenzie Bridge, Western Cascades; geology and structure
Hoffman, Charles Portland State University	Salem and Portland Hills; ferruginous bauxite
Mullen, Ellen Oregon State University	Canyon Mountain complex; petrogenesis
Walker, Nicholas UC at Santa Barbara	Eastern Oregon; chronology of pre-Tertiary terrain
Wozniak, Karl Oregon State University	Three Sisters; geology

□

Remote sensing of the Mount St. Helens eruption, May 18, 1980

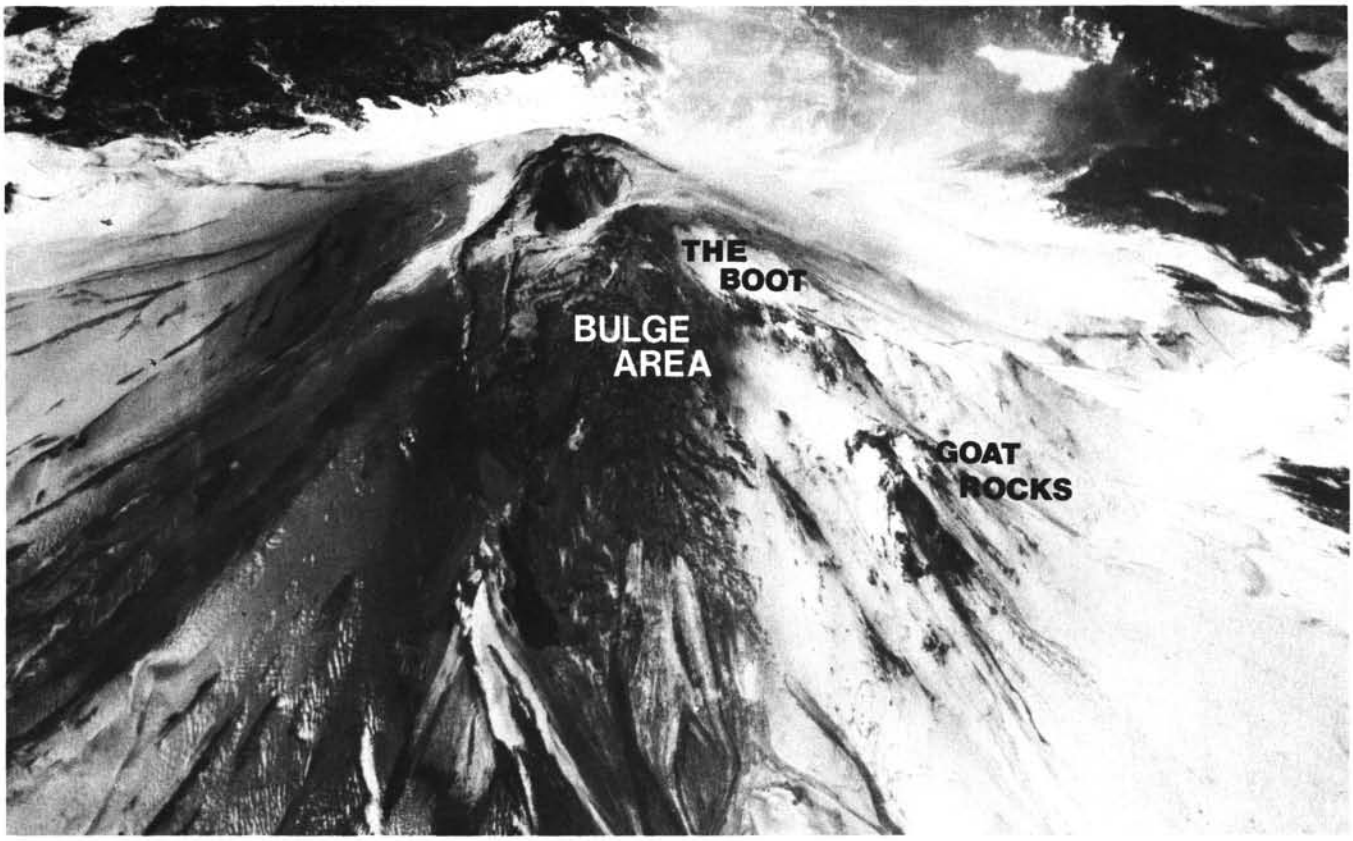
by Charles L. Rosenfeld, Assistant Professor of Geography, Department of Geography, Oregon State University, Corvallis, Oregon

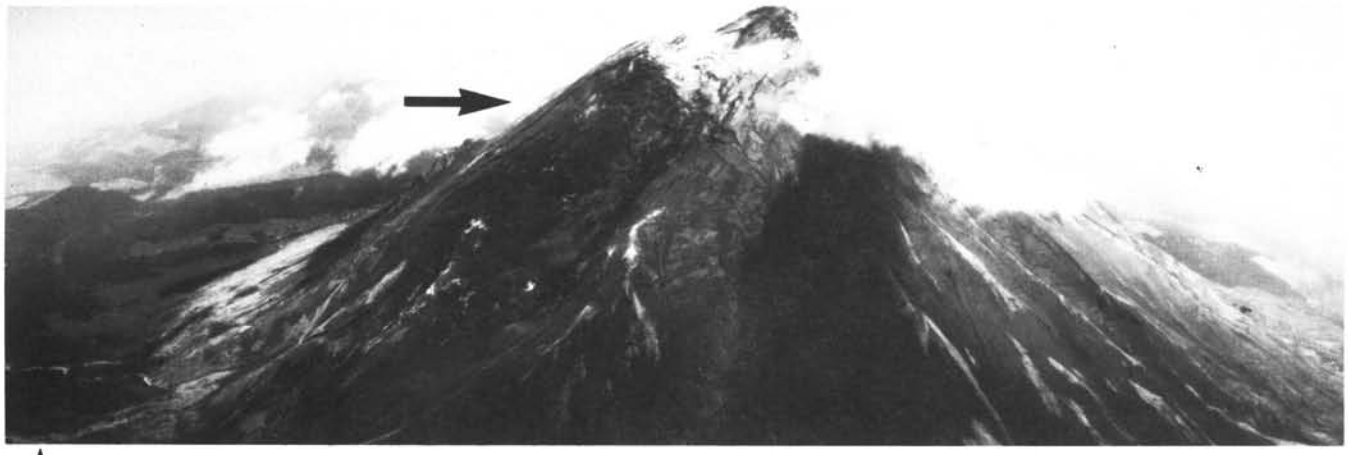
As a result of continued aerial surveillance activity by the Oregon Army National Guard at the request of the Oregon Department of Geology and Mineral Industries, a sharp increase in the thermal activity in the crater area of Mount St. Helens was observed at 5:30 a.m. on Sunday, May 18. An increased number of hot spots were noted on the "Boot" and in the bulge area, which had been swelling at a rate of about 5 ft per day since mid-April. However, just as the thermograph recording film was being developed, information was received that a passing aircraft had witnessed an explosive eruption at 8:30 a.m.

The first of four day-time photo missions was launched from Salem. Initial reports indicated that the top of the mountain had been lowered from the old elevation of 9,677 ft to about the 8,300-ft level. A dense, mushroom-shaped plume of ash rose ominously into the stratosphere, obscuring everything to the north and east of the mountain. Large debris flows were moving down the North and South Forks of the Toutle River, destroying roads and bridges and carrying off log decks in the flooding caused by the rapid melting of the mountain's glaciers.

In an effort to locate the U.S. Geological Survey observation post north of Mount St. Helens, our National Guard Mohawk aircraft skirted the rising ash plume toward the north side of the mountain. We observed that the elevation of the rim of the new crater formed by the eruption dropped dramatically from about 8,300 ft on the south side to about the 4,500-ft level on the north flank and that huge amounts of rock and ash debris had been ejected toward the north. The effects of the shock wave from the blast were terribly evident: entire forests had been leveled and then covered

Northeast side of Mount St. Helens, April 11, 1980, 15 days after first volcanic activity was spotted and 37 days before the violent May 18 eruption that destroyed the north side of the mountain. The area around the bulge began expanding in mid-April and was swelling at a rate of 5 ft per day by May 18.

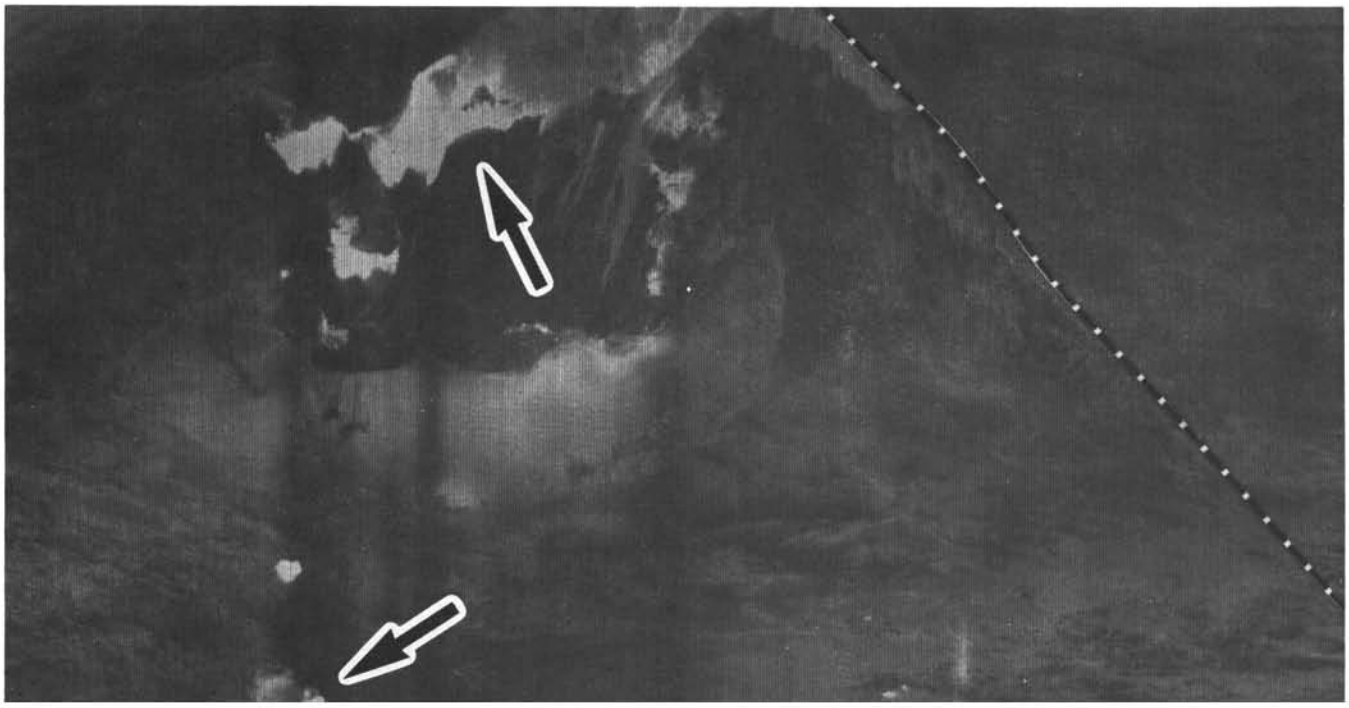




Two photographs taken roughly six weeks apart of the northwest side of Mount St. Helens show development of bulge (arrow). Upper picture was taken during a small eruption on April 2; lower picture was taken May 17, one day before the May 18 eruption.

Flying under mushroom-shaped cloud, shortly after May 18 eruption occurred. Ash-laden plume is rising vertically on the left; condensation form clouds are at bottom right. Picture was taken from the north while aircraft was over Coldwater Peak on search and rescue mission.

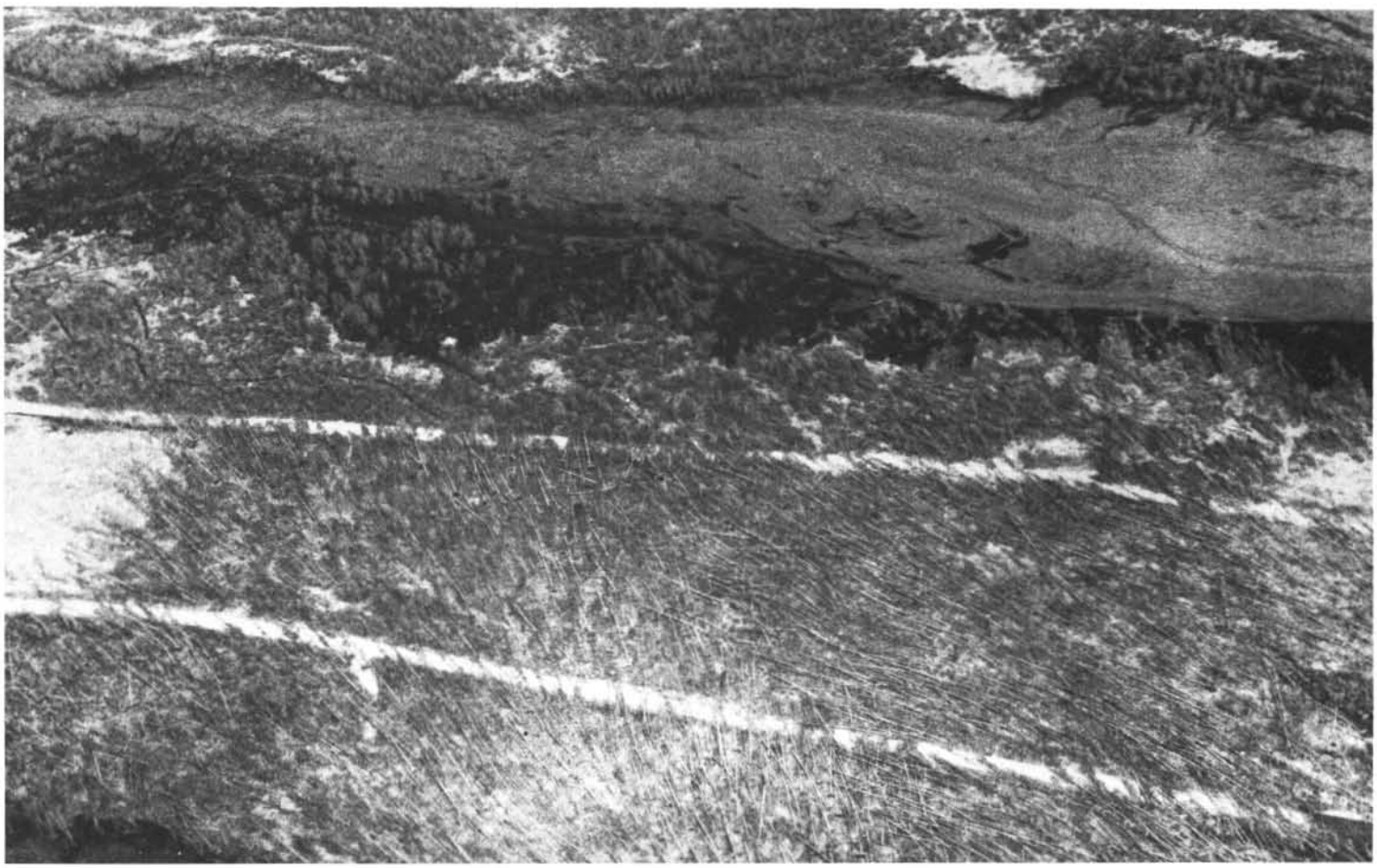
Thermal infrared imagery of an oblique aerial view of the north side of Mount St. Helens, May 18, 5:30 a.m., approximately 3 hours before the eruption began. Hot areas appear white. Dashed line shows part of the outline of the mountain. Top arrow points to hot area around crater; lower arrow indicates heating on the bulge.

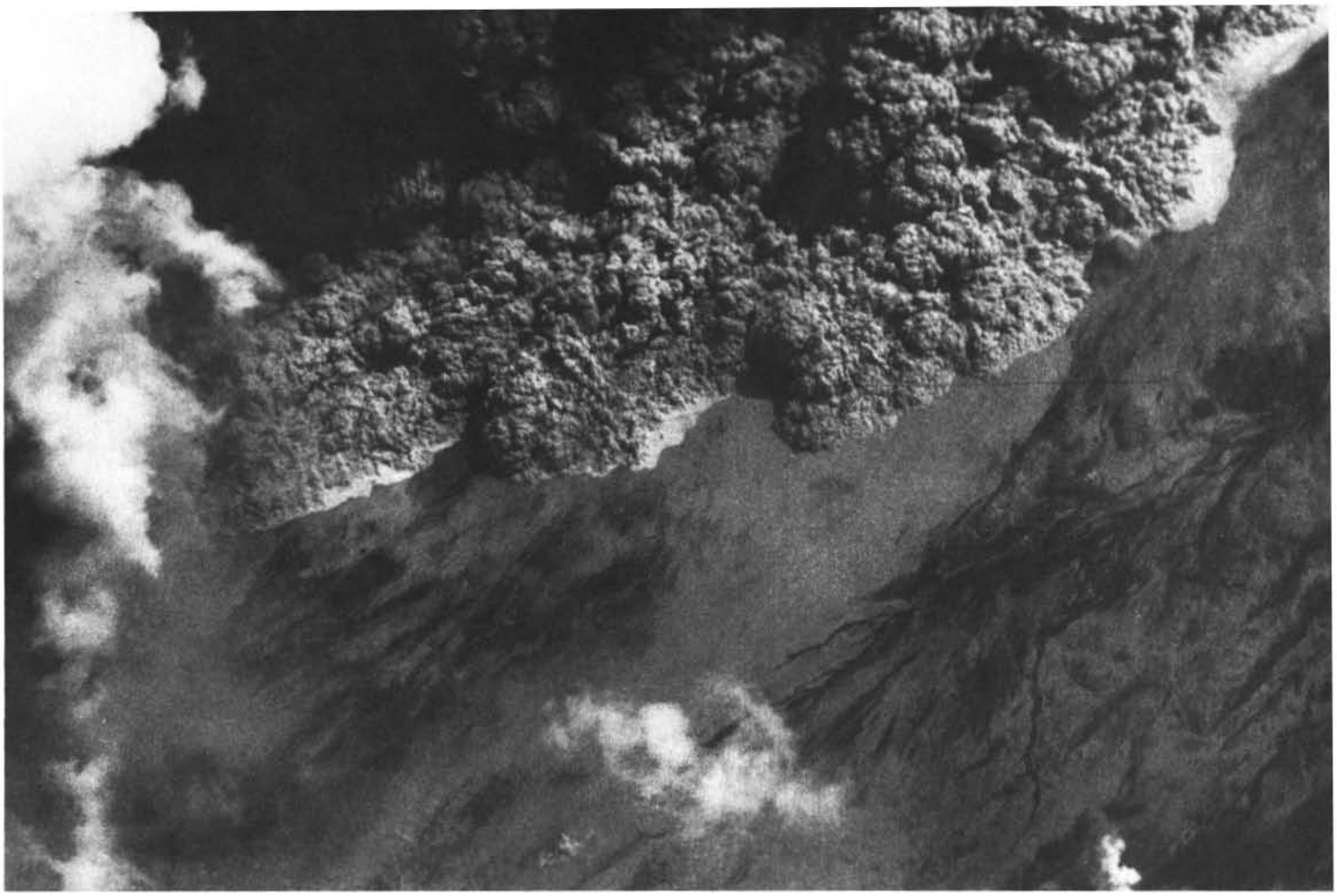



80 5 18

West side of Mount St. Helens, 10:00 a.m., 1½ hours after initial explosion. Elevation of crater rim drops from 8,300 ft on the south side to 4,400 ft on the north.

Trees blown down along the South Fork of the Toutle River, May 18. Mudflow is at top of picture.





Hot ash flow, northwest flank, May 18. Steam on left and in foreground is rising from the Toutle River.

by light-colored ash. The blast effect was quite directional, carrying almost 22 mi to the west and 13 mi to the north of the mountain. We observed numerous hot ash flows on the northwest flank and about 30 small fires in the heaps of shattered timber.

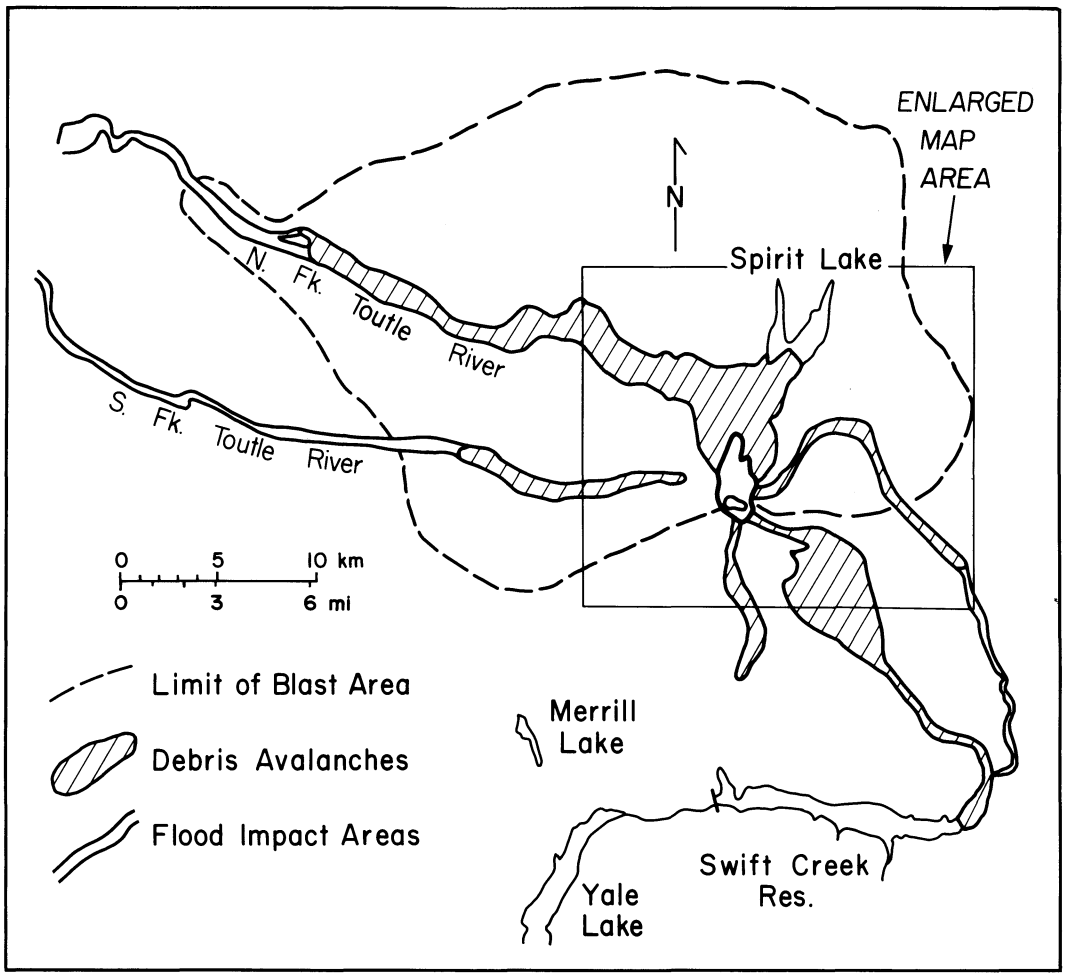
Since our aircraft was unable to penetrate the dense plume that was being carried off to the northeast, we turned and attempted to locate survivors along the North and South Forks of the Toutle River. The North Toutle valley was choked with a rock and mud flow for a distance of over 20 mi west of Spirit Lake. This flow, occasionally over a mile wide, ended abruptly a few miles east of Camp Baker. Beyond this point, floodwaters and mudflows choked with debris were carrying roads, bridges, and log decks down to the Cowlitz River and then out to the Columbia River at Longview, Washington, where, by May 21, siltation had reduced the 40-ft-deep channel to a draft of 12 ft.

At 4:30 p.m., May 18, we obtained a side-looking airborne radar (SLAR) image of Mount St. Helens from the Mohawk aircraft. By transmitting microwaves through the eruptive plume, we were able to produce an image of the concealed crater. This yielded the first measurement of the full dimensions of the explosion crater: 2.2 mi in length from north to south and 1.1 mi in width. Nearly a cubic mile of mountain was gone. The eruptive center was located along the former south "rift" fault, with the floor of the crater sloping down toward the north.

By 3:10 a.m. on Monday, May 19, the eruptive plume had diminished enough to allow a flight across the north flank. On this flight, we directed the SLAR south into the gaping crater. A smaller eruption crater, centered around the former "rift" zone, was located at about the 7,500-ft elevation within the larger explosion crater. Subsequent SLAR images have indicated the presence of small constructional features in this area (see map).

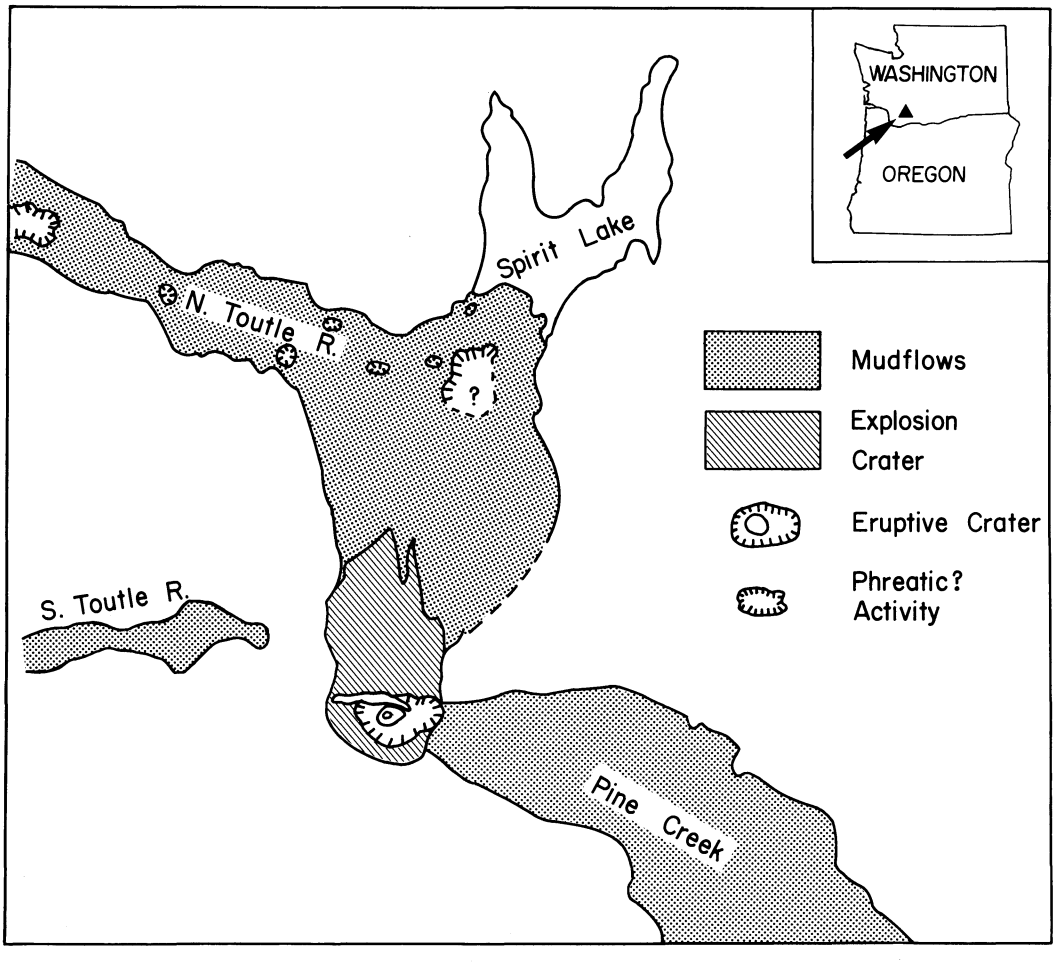
Hot ash flows have continued down the north flank of Mount St. Helens into the former valley of the North Fork of the Toutle River, producing explosions described as "phreatic" upon contact with water in the valley. An infrared thermograph, flown before dawn on Tuesday, May 20, shows a hot ash flow at the base of the north flank and numerous pits caused by phreatic explosions in the North Fork of the Toutle Valley.

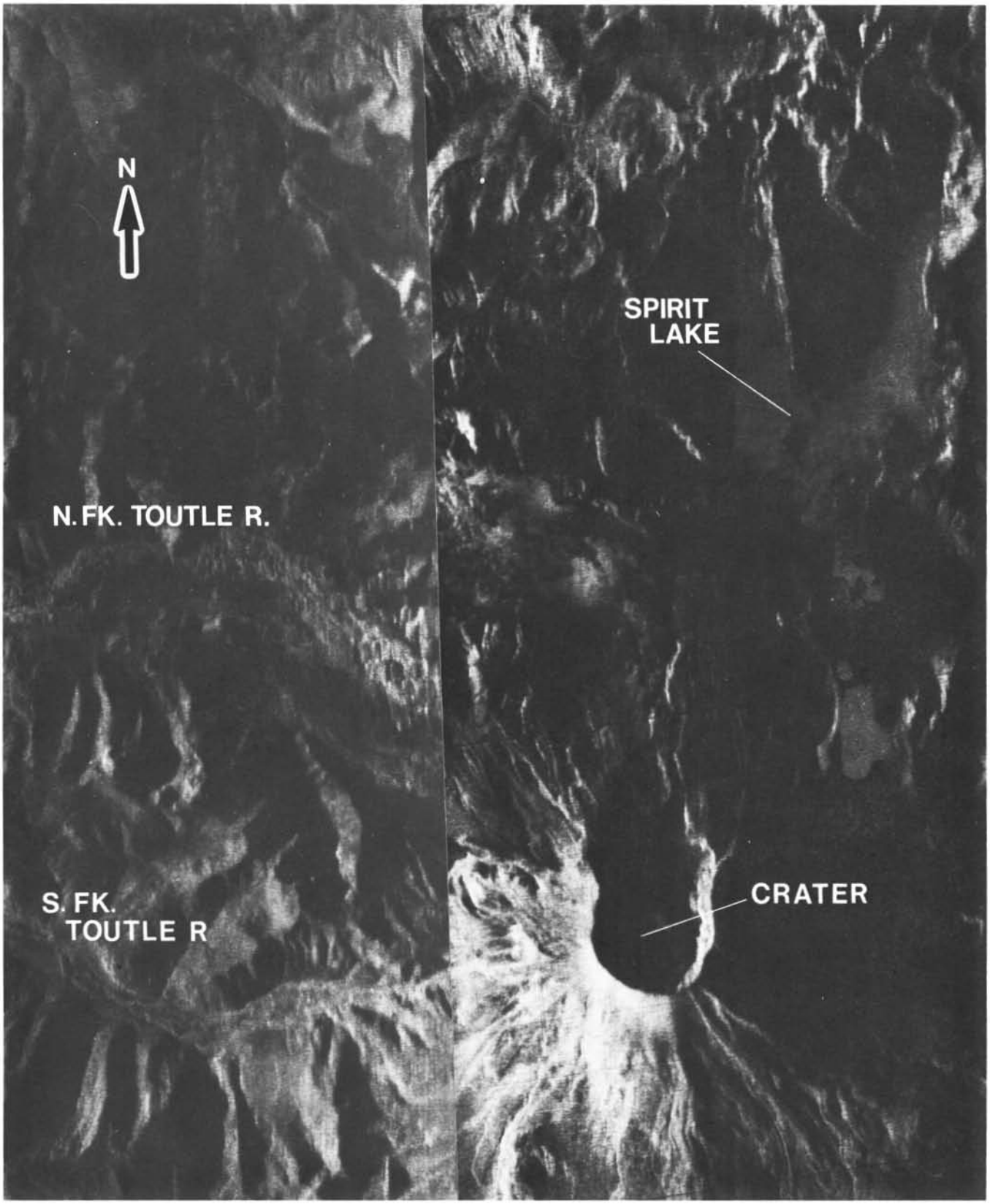
At this writing (May 23), the crater of Mount St. Helens remains obscured by the continuing ash plume. Remote sensing, both thermal and SLAR imagery of the type shown here, is being provided to the U.S. Geological Survey by the Oregon Army National Guard through the Oregon Department of Geology and Mineral Industries.



Map of Mount St. Helens and surroundings. Area inside square is enlarged in map below.

Enlarged map of area immediately around Mount St. Helens Volcano.

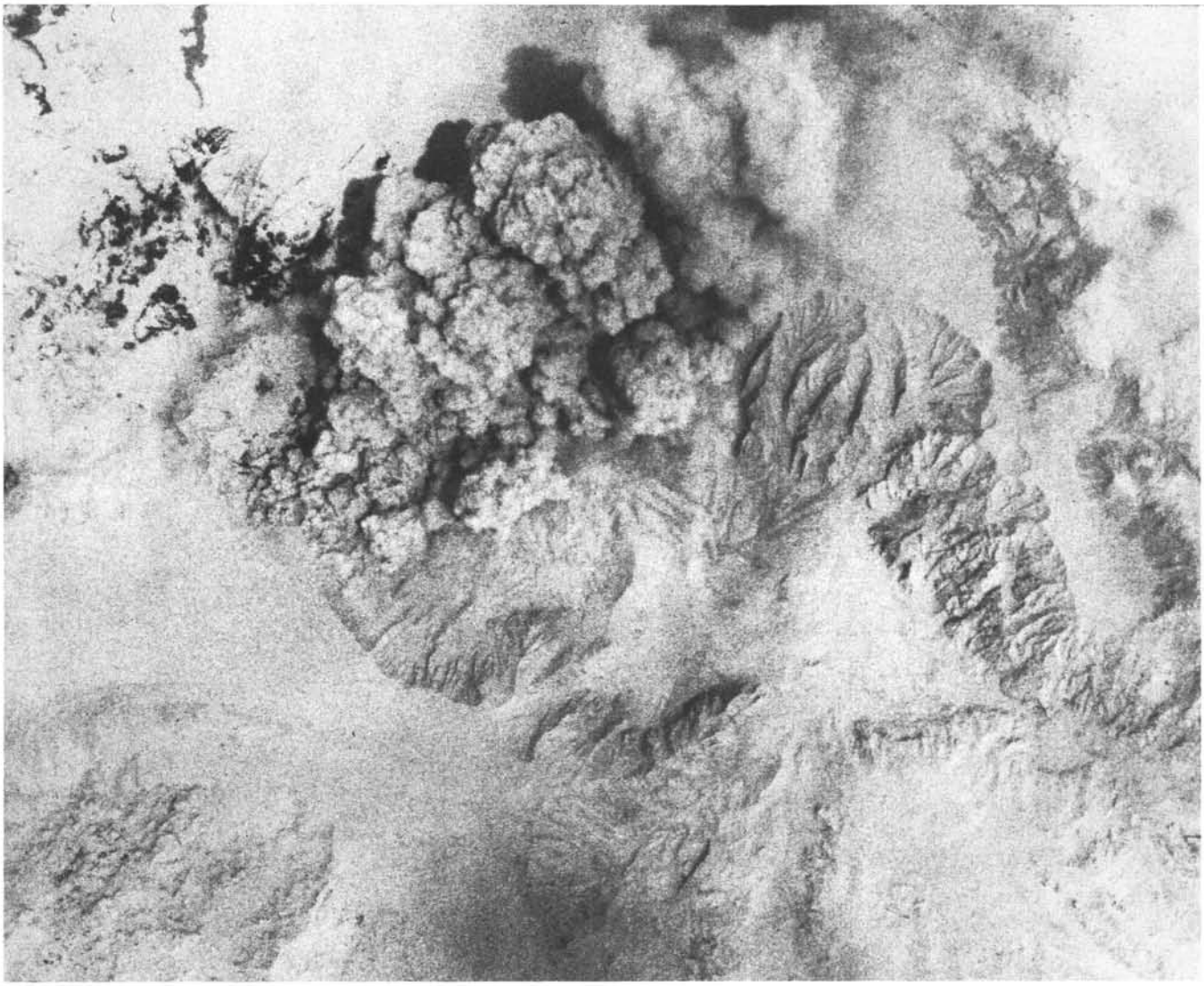




May 18, 4:30 p.m. SLAR imagery obtained through eruptive plume shows crater blown out to the north. North is at top of photograph. At this time, Spirit Lake to the north-northeast is approximately 100 ft deeper than before eruption. Note mudflows on the North and South Forks of the Toutle River, northwest and west of the volcano, and on Pine Creek, to the southeast.

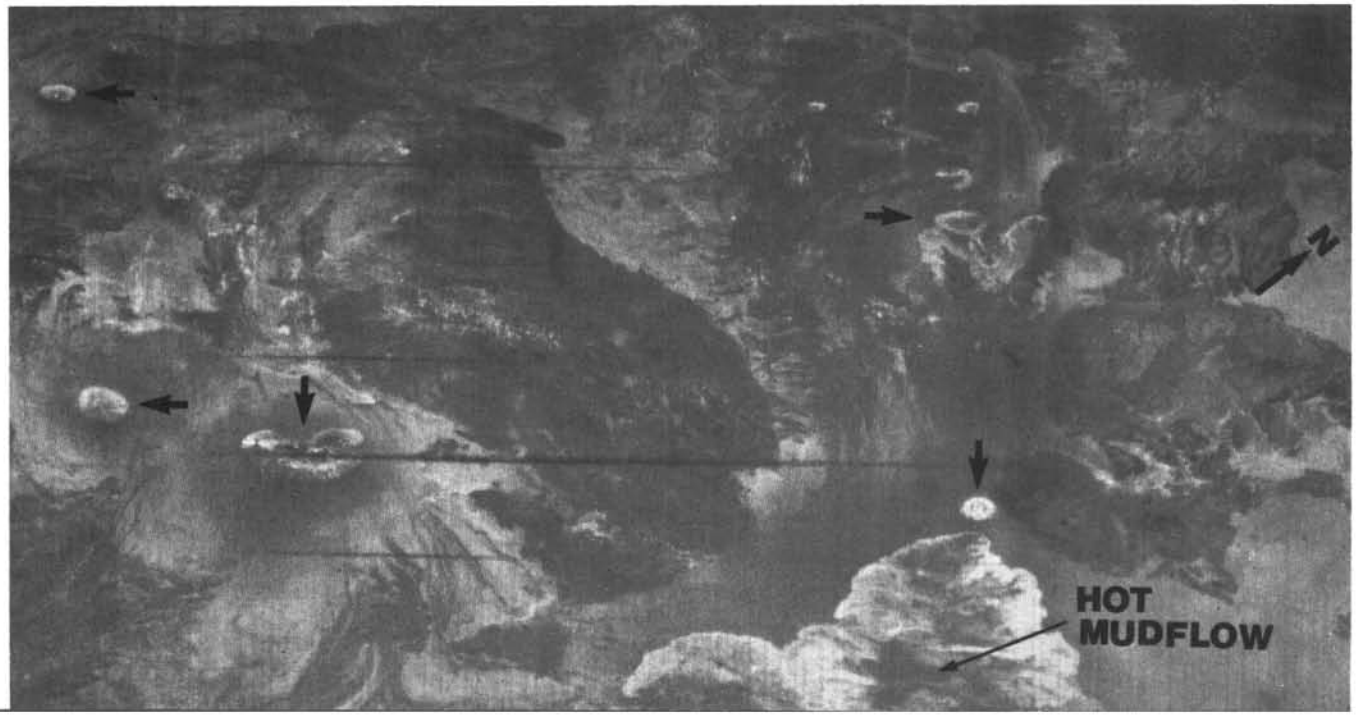
Mudflow on the South Fork of the Toutle River, May 18. Note roads that have been washed out, trees blown down, and forest fire.

Flood and mudflow damage at Camp Baker, 24 river miles west of Mount St. Helens, May 18.

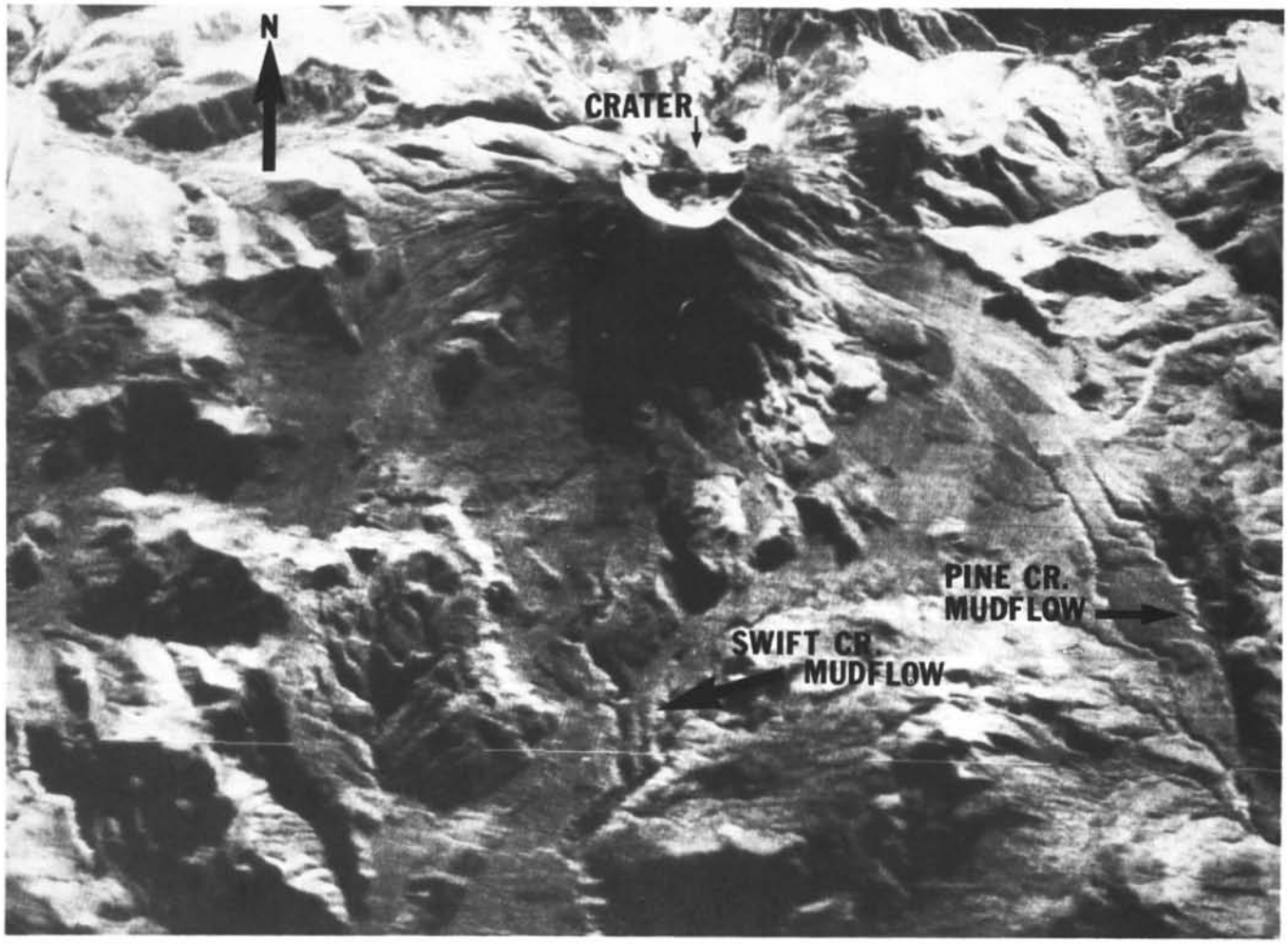


Phreatic explosion craters along North Fork of the Toutle River, north-northwest of Mount St. Helens, May 18. Thick layer of volcanic ash blankets entire area.

Thermal infrared imagery of oblique view of area immediately north of Mount St. Helens, May 20. Hot areas appear white in this imagery. Arrows point to phreatic explosion craters. Hot lahar (mudflow) is coming directly from the mountain. Spirit Lake is to the right, just past the edge of the imagery.

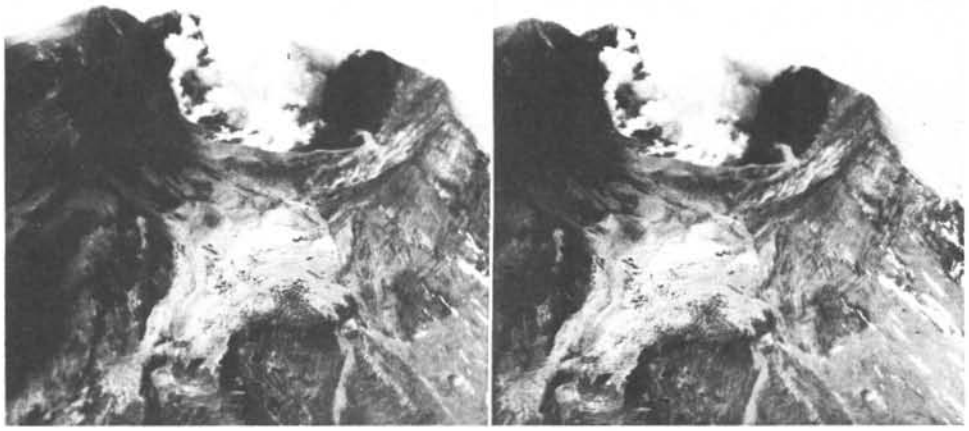


Mount St. Helens from the south, May 19. Pine Creek mudflow shown here entered Swift Reservoir, located about 8 air miles south of the volcano.



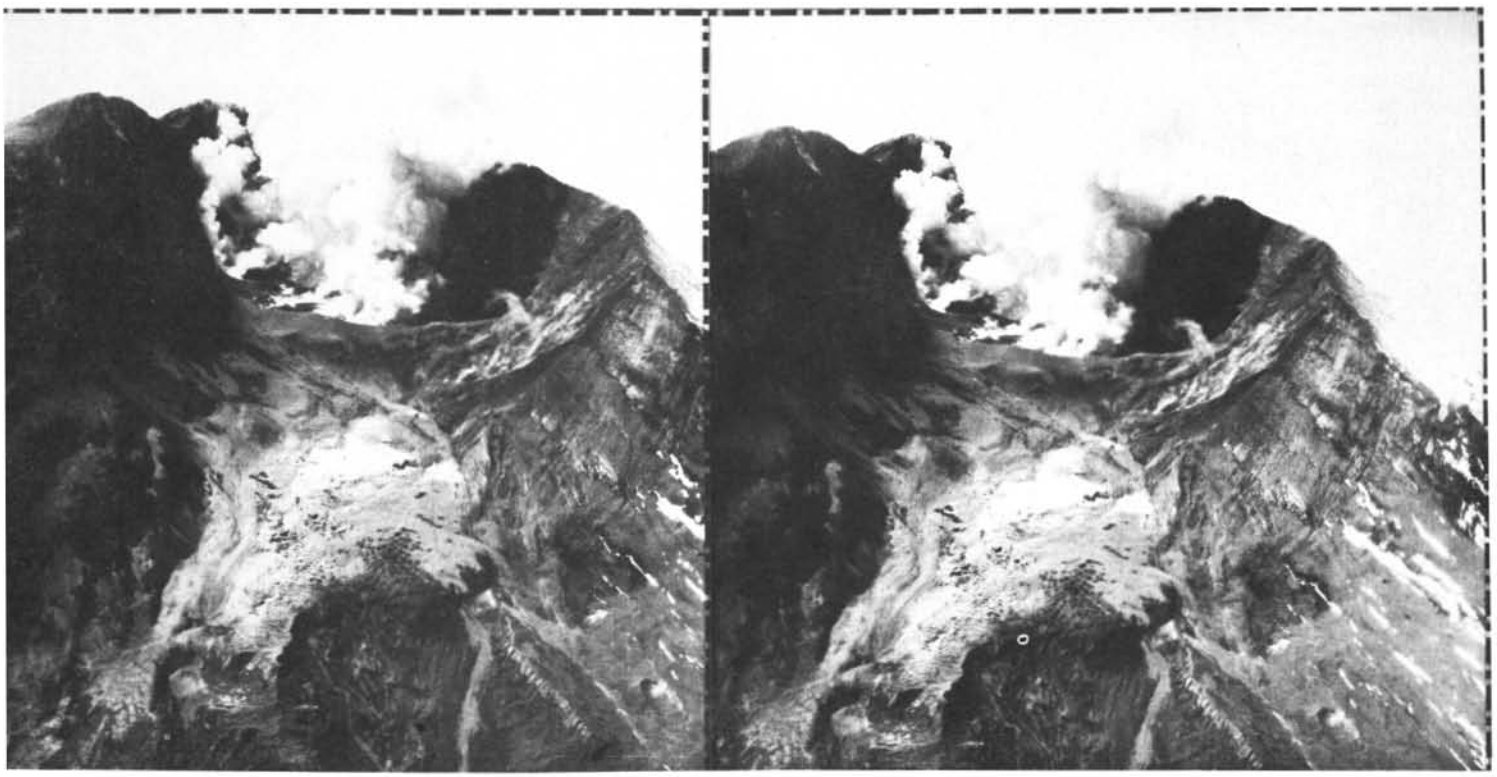
SLAR imagery, May 23, 3:10 a.m. Compare with sketch map of mountain.

SLAR imagery, May 27.



Stereopair of crater, north side, May 30, 1980.

Photographs are reproduced below at a larger size for those readers who want to cut them out and look at them through a stereoscope.



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