Department of Natural Resources
Division of Geology and Earth Resources
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A pre-1980 Eruption Description of Mount St. Helens

North face of Mount St. Helens as an eruption begins on the afternoon of April 2, 1980. Dogs Head is the large rock formation at left, and Goat Rocks are just right of center, approximately the same elevation as Dogs Head (photo courtsey of U.S. Forest Service, Jim Hughes).

[illegible]

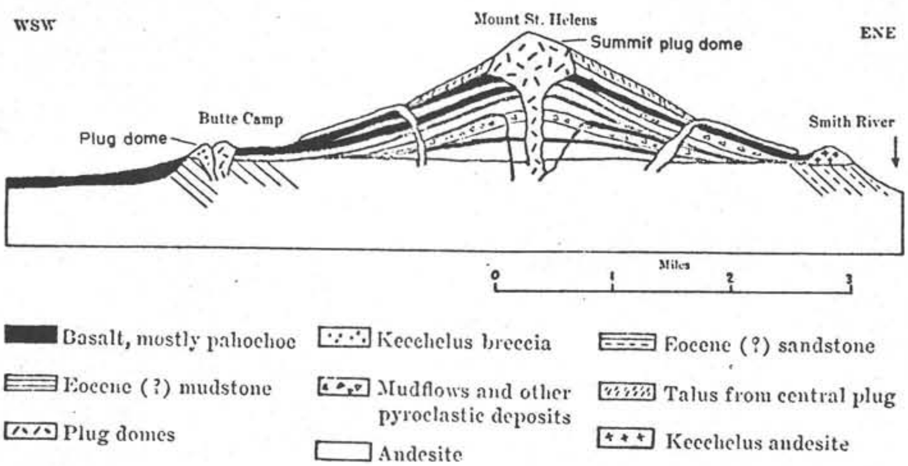
Mount St. Helens before 1980 eruption.

A PRE-1980 ERUPTION DESCRIPTION OF MOUNT ST. HELENS

This description is totally from the works of Jean Verhoogen (Mount St. Helens — A Recent Cascade Volcano: University of California Publications, Bulletin 24, no. 9, 1937) and Dwight R. Crandell and Donal R. Mullineaux (Potential Hazards from Future Eruptions of Mount St. Helens Volcano, Washington: U.S. Geological Survey Bulletin 1383-C, 1978).

Mount St. Helens is a very symmetrical stratovolcano located in southwest Washington, about 40 miles northeast of Portland, Oregon. It is the youngest of the five big stratovolcanoes in Washington, having apparently been built up during late Pleistocene time. In fact, geologists believe that the part of the cone that is visible was formed during the last 1,000 years.

The cone is made up of a combination of cinders, talus, lava flows, mudflows, and domes as illustrated by the schematic sketch below.



Schematic cross section through Mount St. Helens.

From Verhoogen, 1937.

THE CONE

The shape of the mountain as seen from a distance is surprisingly symmetrical; there are no big glacial scars, no deep gullies. The profile is that of a truncated cone, with a base 4 miles in diameter and an elevation of 5,000 feet above the basement platform. Five glaciers and extensive snowfields cover the summit, concealing the upper structure. Outcrops of solid rock are rare above 6,000 feet; the slopes of the cone are made entirely of loose fragments, mostly talus, with a few accessory blocks belonging to earlier stages of activity and apparently blown out by explosive eruptions. The talus is clearly made of fragments of the summit rock, a much-fractured, platy pyroxene andesite.

The crater is completely filled with snow. Its east wall appears to have been blown away, opening a large breach through which flows the Shoestring glacier. This gap, as seen from below, can be best described as a deep notch in the crater wall, widening out toward the base of the cone and spreading into a fan of pyroclastic debris.

THE PLUGS

Evidence of the pluglike nature of the summit rock is gained from the platy but otherwise structureless appearance of the pyroxene andesites which crop out at the summit. The rising of the plug may be correlated with the apparent tilting suffered by thin sheets of pahoehoe olivine basalts, on the western and northern sides.

Another noticeable feature of the volcano is the occurrence of several andesitic domes on its flanks. They do not seem to bear any relation to one another, being scattered in apparently haphazard fashion. The picturesque "Goat Rock" on the northern side is a typical plug although it does not exhibit any particular structure. A plug with fan-shaped flow planes rises on the southern slope, at an elevation of 6,000 feet. A structureless dome stands out conspicuously at the eastern base of the cone.

The exact mode of emplacement of the "Sugar Bowl" on the northeast flank is a matter for conjecture. The Sugar Bowl is a flat-topped mass, with prominent horizontal flow structures made visible by the alteration of grayish and reddish bands. From the field relations it appears to be a plug, as it seems to have been thrust through older basalts, but this origin hardly accounts for the horizontal banding which extends throughout the mass. It is possible that the inward-dipping flow planes are restricted to the very margin and concealed by talus.

At Butte Camp, at the southwest base of the cone, a fresh, apparently recent hornblende andesite has been intruded into older lavas of probably Eocene age. A peculiar rock has developed at the contact. It is a red porphyritic andesite or dacite in which has developed large hexagonal flakes of biotite, up to half a centimeter in largest dimension.

THE FLOWS

The only flows which can be discriminated in the field and mapped are, of course, the latest ones. They consist essentially of dark, glassy, blocky pyroxene andesite or olivine-rich pahoehoe basalts. Most of the flows seem to have issued from the flanks and not from the crater of the volcano.

Pahoehoe Flows

The recent pahoehoe flows are best exposed on the southern and southwestern slopes. The entire area, from the foot of the cone down to the Lewis River, is covered by extensive and probably fairly recent flows of ropy lava. They issued probably from the base of the volcano and streamed quietly down, on a 14 percent slope. From the plateau 600 feet above the river they cascaded down, temporarily damming its course. Verhoogen was unsure of the age but estimated the youngest to be no older than 100 years. Later work by Crandell and Mullineaux has pretty well demonstrated that they are more on the order of 2,000 years old. To this pahoehoe series belongs the flow which overlies the gravels of the lower terrace of the Lewis River.

Perhaps no better examples of pahoehoe lavas could be found anywhere. These southern flows display the typical features of the pahoehoe type of lava: ropy surfaces, lava tubes, tree molds, and so forth.

BLOCKY ANDESITES

Conspicuous tongues of pyroxene andesites stretch down the flanks of Mount St. Helens on all sides. A particularly large flow issued from the northwest side, at an elevation of approximately 6,000 feet, and continued down toward Toutle River. This flow appears to be quite recent, and may represent the latest volcanic activity at Mount St. Helens. It is probably the flow that Crandell and Mullineaux dated at about 500 years old. Apparently the fissure from which it issued was active more than once, for there is evidence of a succession of flows in the same area, as shown by the vegetation-covered kipukas preserved between branches of the very recent flow.

These late blocky pyroxene andesites grade in reality into true aa basalts. It is not often an easy matter to decide in the field or in the laboratory whether a lava is a basalt or a pyroxene andesite. As a rule it may be said that at Mount St. Helens the true andesites are more likely to show sharp, conchoidal fractures whereas the more basaltic types often exhibit jagged, irregular edges and have a more reddish color as well as a more vesicular appearance.

PYROCLASTIC DEPOSITS

Including mudflows locally

The pyroclastic material may be described as a volcanic breccia of angular blocks, up to two or three cubic meters in size, imbedded in a fine sandy matrix. The large size of the fragments and the subordinate amount of the fine-grained matrix help to distinguish these deposits from ordinary mudflows, in which the matrix is usually coarser. The fragments show no sign of reheating. Evidently the explosion which blew off the wall of the crater was of the low-temperature, ultravulcanian type, but there are no indicators that reveal the circumstances of the explosion.

The pyroclastic deposits are usually 15 to 18 feet thick. They could readily be mistaken for glacial deposits and are distinguishable only by their confused bedding. They occur extensively in the area between the northeast corner and the outlet of the small glacier which hangs between Goat Rock and "The Lizzard," on the north side. To the west, they are gradually replaced by the Goat Rock pyroclastic deposits.

On the northern side of the main cone immediately to the east of the recent blocky flow, and on the southwest side, are two narrow areas characterized by the frequent occurrence of "bread-crusted" bombs of a peculiar type. In the southwestern deposits, these bombs are mixed with the ordinary talus material which covers the slope.

The distinctive aspect of the bread-crusted bombs is that the fissuring is not restricted to the surface. These bombs may be described as an aggregation of cones, in contact at their apices only, their bases having irregular patterns resembling mud cracks. The bombs generally have sharp edges and so have each of the individual cones. Obviously the bombs were fractured at or after their fall, for many of them may be torn to pieces without the help of a hammer; they could not be expected to travel any distance in such a condition. There is no glassy surface, neither is there any vesiculation or pumiceous structure of any kind; the rock is perfectly fresh and massive.

Bombs are also found on the western slopes scattered on the surface of the talus. They are not found below 5,000 feet, a fact that points to the mildness of the eruption which blew them out.

Andesitic Pumice

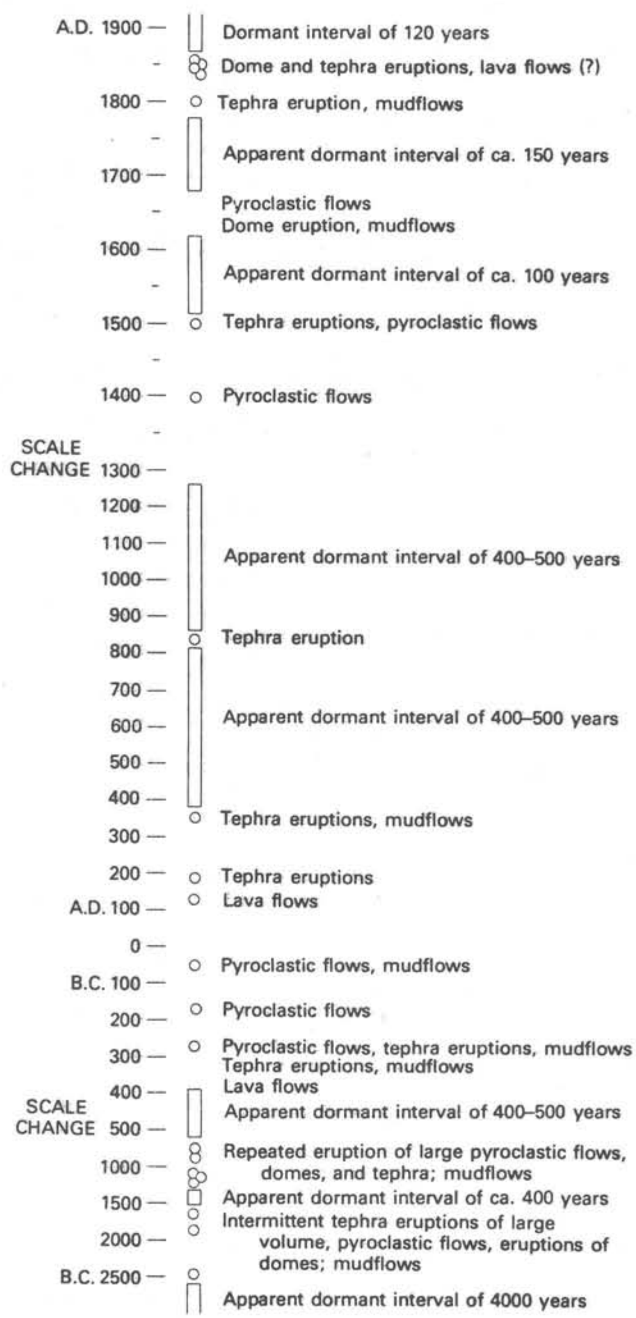
The entire region north and east of Mount St. Helens is covered by a yellowish pumice that, in places, is 2 to 3 feet thick. Pumice is reported to have been erupted from Mount St. Helens in 1842, and blown over The Dalles, on the Columbia River. There is little doubt that the pumice showered over the Mount St. Helens region is of very recent age, and that it probably belongs to the 1842 ejecta. Since pumice is found on both sides of the blocky lava flow on the northeastern side, and does not cover the flow itself, the flow must be younger than the pumice and may well have been erupted in 1854.

TYPES OF VOLCANIC ACTIVITY

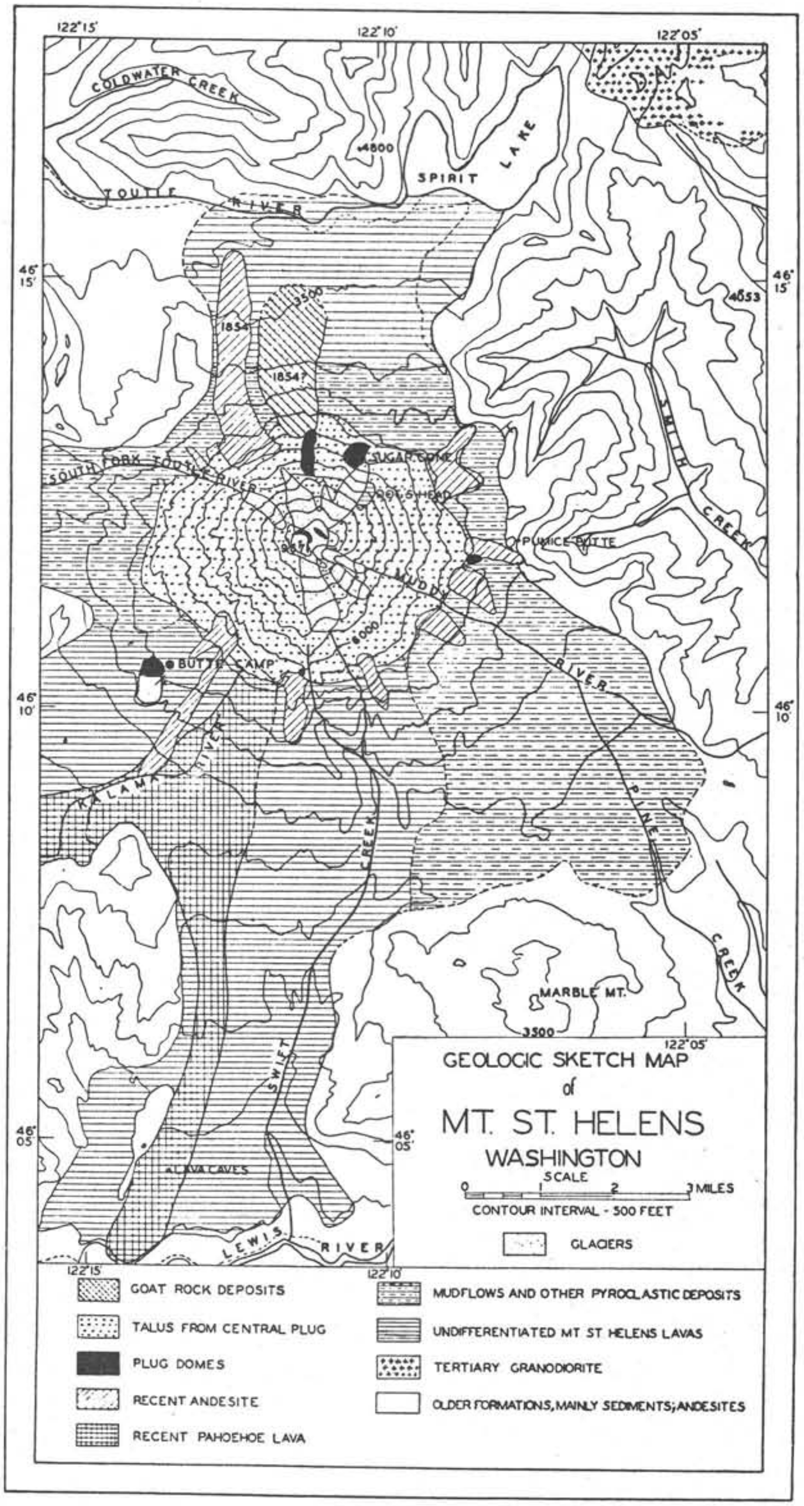
In spite of the uniform composition of its lavas, Mount St. Helens has displayed types of activity which range from low-temperature ultravulcanian explosions to the eruption of high-temperature pahoehoe basalts. Emphasis has been laid, in the preceding pages, on the abundance of olivine basalt erupted mostly on the southern side. Judging from the thinness and extension of these flows, they must have been poured out at a high temperature. However, there is no indication that high temperatures prevailed during the rise of the plug domes. Basaltic lavas which, 6 or 7 miles from their source, still display the features of gas-rich lavas, were erupted side by side with blocky, massive, viscous, gas-poor andesites. Differences in chemical composition between massive andesites and the frothy andesitic pumice are not sufficient to explain the high concentration of gases in the later ejecta. Attention is directed also to the fact that the acidic type of magma with which the rise of domes, or the eruption of "block and ash" flows, is usually connected, is not represented in the later stages of activity at Mount St. Helens. The mountain is thus a volcano in which the type of activity seems to be independent of the chemical composition of the magma.

Eruptions and dormant intervals at Mount St. Helens since 2500 B.C.

[The circles represent specific eruptions that were observed or that have been dated or closely bracketed by radiocarbon age determinations; the vertical boxes represent dormant intervals]

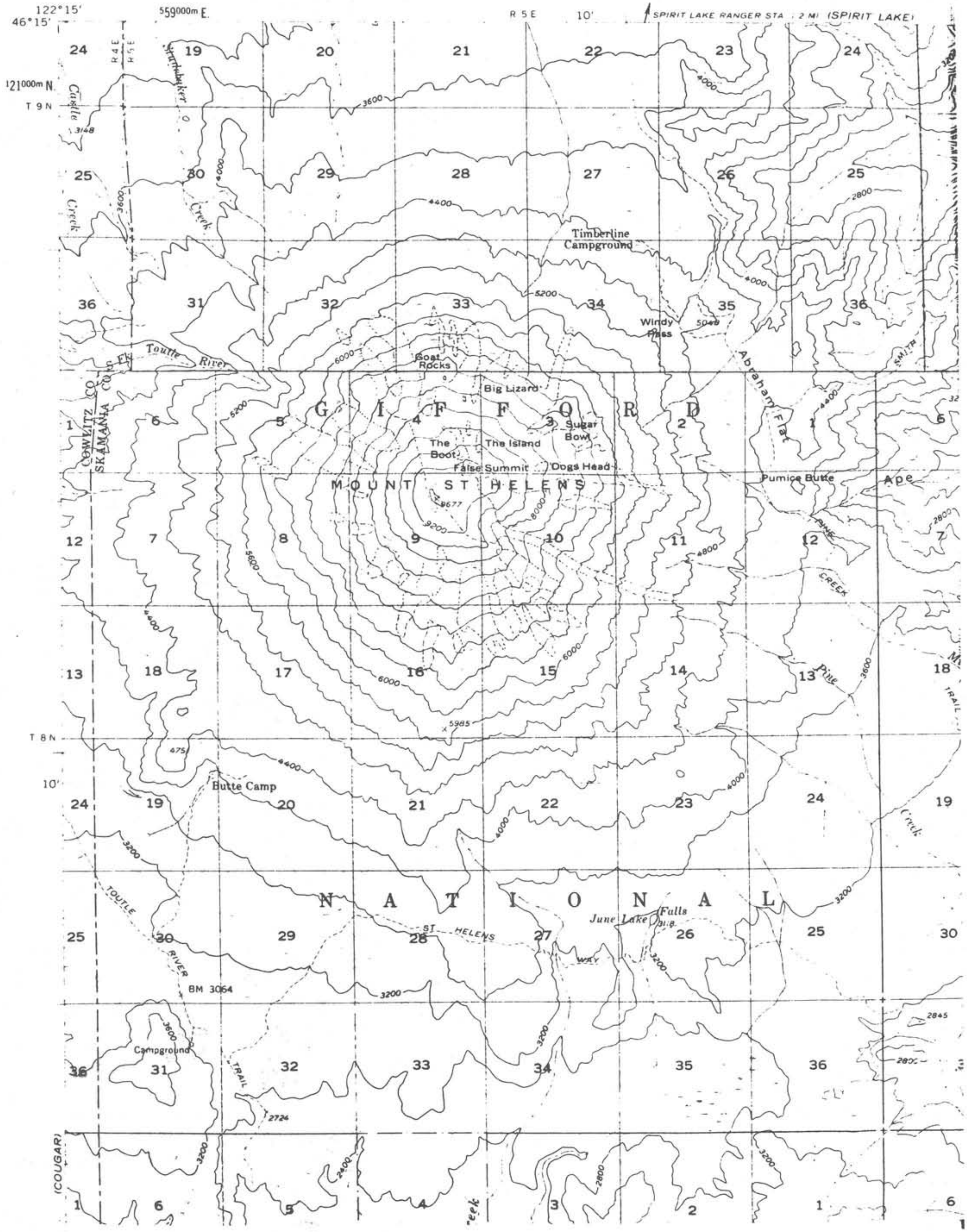


From Crandell and Mullineaux, 1978.



Geologic sketch map of Mount St. Helens.

From Verhoogen, 1937.



U.S. Geological Survey Mount St. Helens topographic quadrangle map