

MAP EXPLANATION

This map delineates volcano-hazard zones that could be affected by future eruptions and other hazardous volcanic events in the Three Sisters region. As described in the accompanying report, eruptions at the composite volcanoes, including South and Middle Sister, are characterized by explosive venting of tephra, generation of pyroclastic flows, and extension of lava flows. Pyroclastic flows can melt snow and ice to produce lahars and floods. Tephra fall from a volcano in the Three Sisters region or one of the other volcanic centers in the Cascade Range can blanket areas far downwind from vents (see regional tephra-hazard maps below). Landslides on the high peaks in the Three Sisters region can be triggered by eruptions, but can also occur without eruptive activity. Such landslides, called debris avalanches, can also transform into lahars that surge further downstream. In addition to the composite volcanoes, scores of mafic volcanoes [2], including Mount Washington, Belknap Crater, and Mount Bachelor, are scattered throughout the region and define a broad lava-flow hazard zone within which a new mafic volcano could erupt and generate chiefly tephra falls and lava flows.

Boundaries between hazard zones do not represent sharp changes in hazards. Rather, the degree of hazard decreases gradually in a down-valley direction and, for various types of flows, more rapidly as elevation above valley floors increases.

Rare eruptions of much greater magnitude than those used to define the hazard zones on this map have originated during the past one-half million years in the area occupied by the Three Sisters and Broken Top. Such an eruption today would seriously affect much of the region, including Bend and Sisters, but the annual probability of such great eruptions is very low, less than 1 in 100,000.

¹Numerals in brackets refer to end notes in report.

Proximal Hazard Zone

Areas subject to rapidly moving, devastating pyroclastic flows, debris avalanches, and lahars [1], some of which could reach the hazard-zone boundary in less than a few minutes. Areas are also subject to ballistic projectiles and lava flows. Several valleys that drain high peaks are also subject to small lahars generated by failure of glacial moraine dams that impound small lakes [4]

Distal Hazard Zones

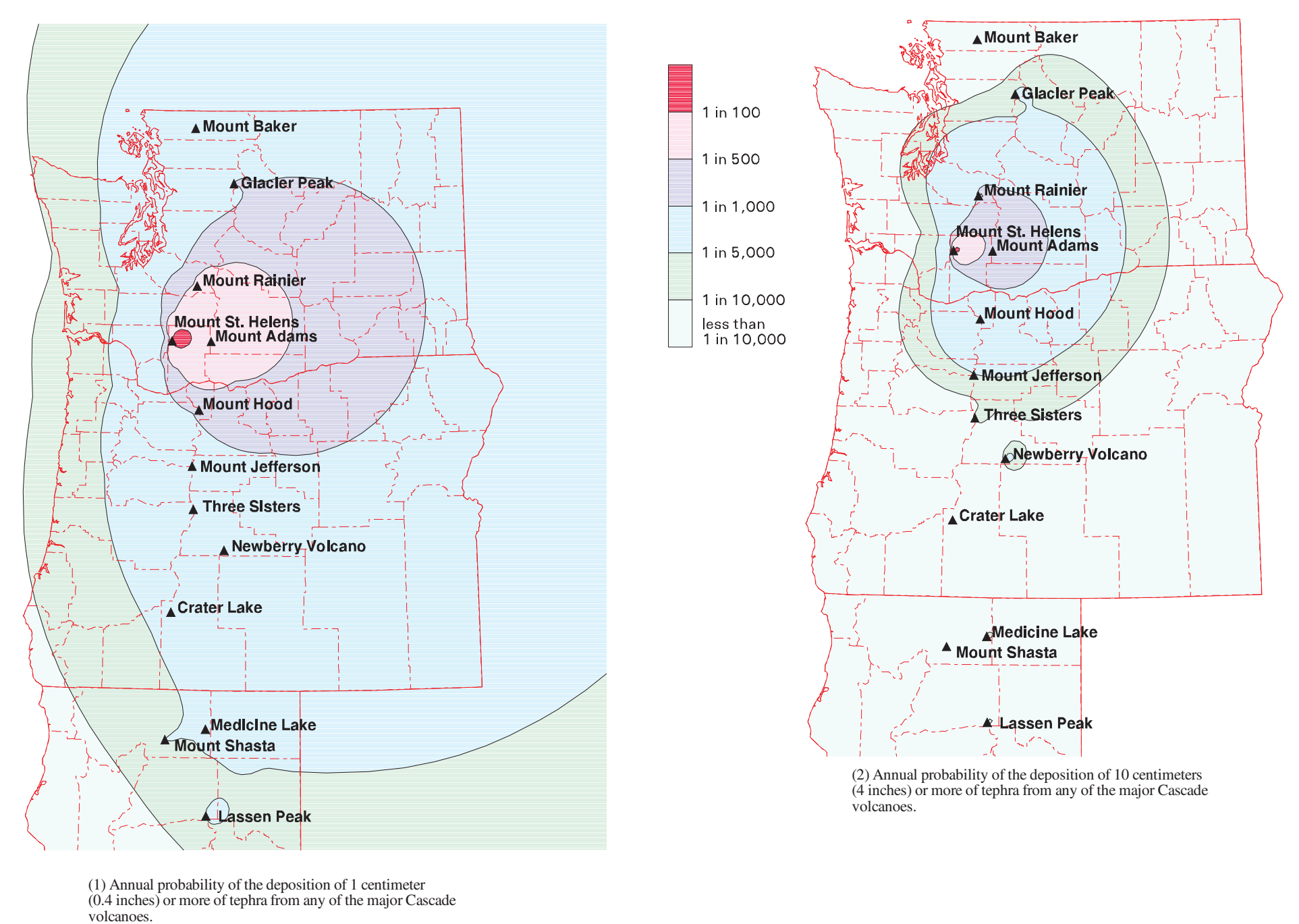
Valleys heading on high peaks of the Three Sisters region that are subject to lahars generated by pyroclastic flows and to debris avalanches and lahars originating on steep upper volcano flanks. Distal hazard zones are subdivided into three nested zones on the basis of hypothetical lahar volumes and associated ranges of lahar probability [5]. Because large lahars are less likely to occur than are small lahars, the nested distal hazard zones show that the likelihood of lahar inundation decreases as distances from volcanoes and elevations above valley floors increase.

- 20 million cubic meter hypothetical lahar
- 100 million cubic meter hypothetical lahar
- 500 million cubic meter hypothetical lahar

Regional Lava Flow Hazard Zone

Area that could be affected by eruptions of mafic volcanoes [2]. Hazards include localized thick tephra fall, ballistics, and pyroclastic flows near vents, and lava flows that typically travel less than 10 to 15 kilometers (6 to 9 miles), but rarely 15 to 20 kilometers (9 to 12 miles)

Regional Tephra-Hazard Maps



(1) Annual probability of the deposition of 1 centimeter (0.4 inches) or more of tephra from any of the major Cascade volcanoes.

(2) Annual probability of the deposition of 10 centimeters (4 inches) or more of tephra from any of the major Cascade volcanoes.

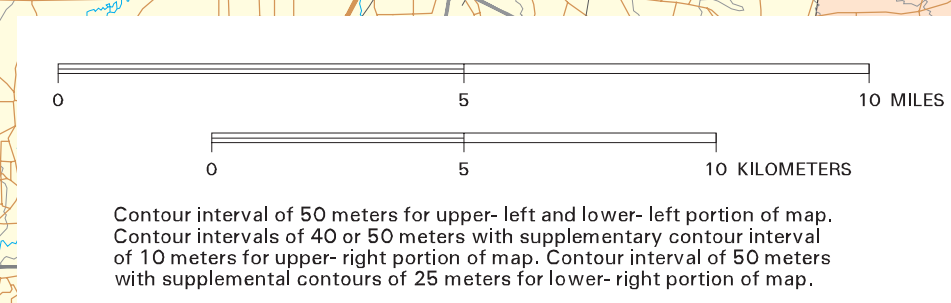
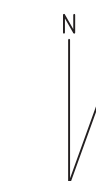
Base map compiled in digital form by Steven P. Schilling from U.S. Geological Survey, Bend (1982), La Pine (1988), Crater Lake (1983) and McKenzie River (1983) 1:100,000 scale maps. Data for hydrography, culture, transportation, and boundaries from U.S. Geological Survey (EROS Data Center) Digital Line Graph files. Digital Line Graph hydrography (topographic contours) created from U.S. Geological Survey blackline clearfilms by Pacer Infotect, Inc., Portland, Oregon.

Universal Transverse Mercator projection, Zone 10
1927 North American Datum

VOLCANO HAZARDS IN THE THREE SISTERS REGION, OREGON

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Contour interval of 50 meters for upper-left and lower-left portion of map. Contour intervals of 40 or 50 meters with supplementary contour interval of 10 meters for upper-right portion of map. Contour interval of 50 meters with supplemental contours of 25 meters for lower-right portion of map.

This map is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards or with the North American Stratigraphic Code. Any use of trade, product, or firm names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

Newberry Volcano Hazard Zones
See USGS Open-File Report 97-513