DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF-1379-D

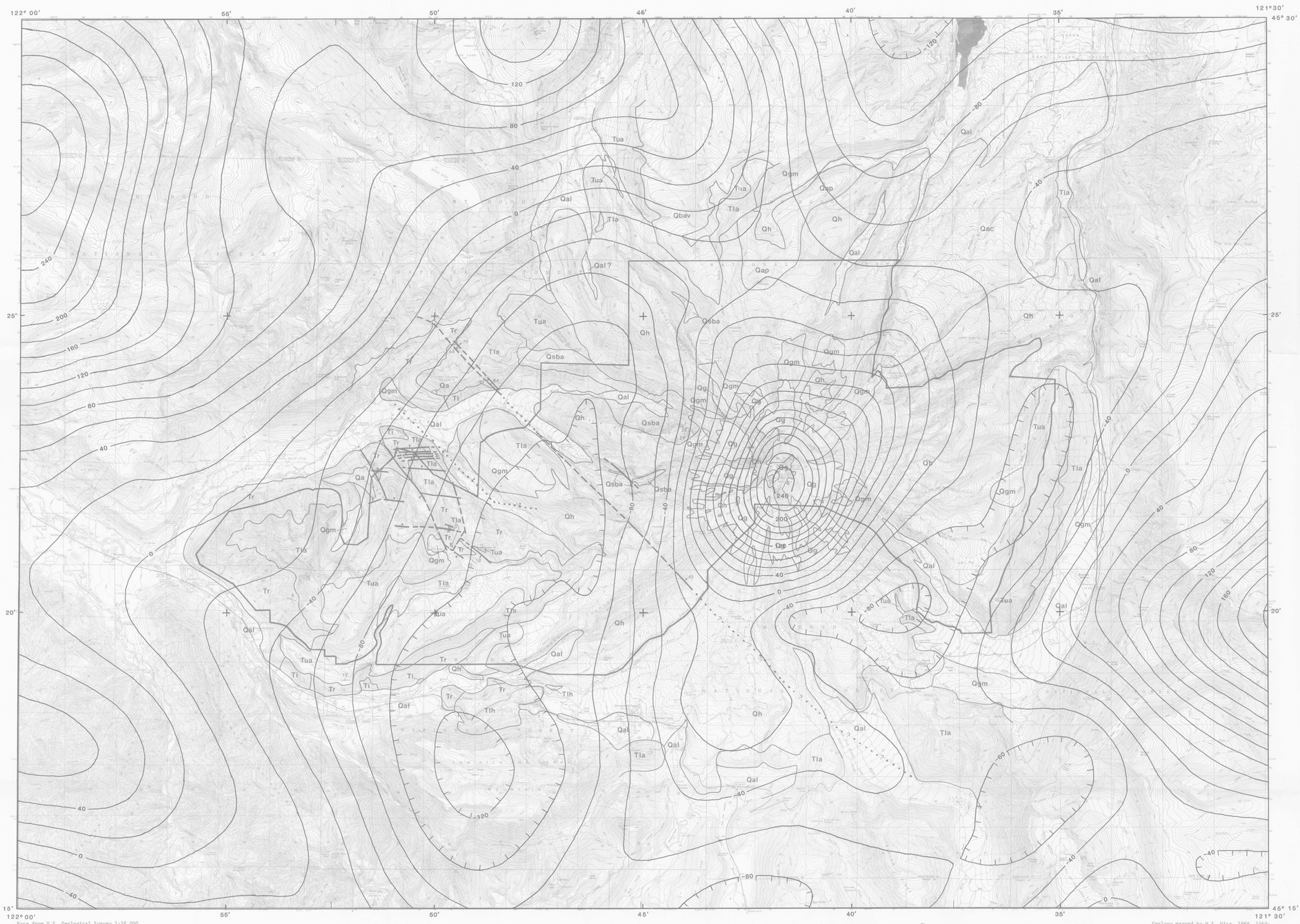
AEROMAGNETIC AND BOUGUER GRAVITY MAPS OF MOUNT HOOD WILDERNESS, CLACKAMAS AND HOOD RIVER COUNTIES, OREGON

By

D.L. Williams and T.E.C. Keith

1982

AEROMAGNETIC MAP



Base from U.S. Geological Survey 1:24,000
Badger Lake, Bull Run Lake, Cathedral Ridge, Dog River, Government Camp, Hickman Butte, Mount Hood South, Rhododendron, 1962

Geology mapped by W.S. Wise, 1968, 1969; T.E.C. Keith, M.H. Beeson, K.E. Bargar, 1979, 1980; H.J. Meyer, J. Hook, M.W. Gannet, 1980.

SCALE 1:62 500

1 ½ 0 1 2 3 4 5 MILES

1 .5 0 1 2 3 4 5 KILOMETERS

CONTOUR INTERVAL 40 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

AREA OF MAP

APPROXIMATE MEAN DECLINATION, 1981

The aeromagnetic survey was flown in two parts. The first part (low-level), flown at 7,000 ft (2,134 m) barometric elevation, covers the flanks of the mountains and surrounding areas. The second part (high level), flown at about 14,000 ft (4,268 m) barometric elevation, covers an area of approximately 88 mi² (228 km²) centered over the peak of Mount Hood volcano. The two surveys overlap and were flown east-west at approximately 2 mi (3.2 km) line spacings. The June 1977 International Geomagnetic Reference Field (IGRF) was removed from the data. The low-level survey was upward continued to 14,000 ft (4,268 m) and integrated with the high-level survey to produce this map. The integrated data set was reduced to the pole to correct for the inclination of the Earth's magnetic field and machine contoured. The resulting map is useful in describing the distribution of various magnetic bodies.

A detailed interpretation of the aeromagnetic data is contained in Flanagan and Williams (1982). They report that the aeromagnetic data are dominated by the topographic expression of highly magnetized Cenozoic volcanic rocks. Three-dimensional magnetic modeling of the Mount Hood volcanic cone indicates that the bulk of the cone, above an elevation of approximately 5,412 ft (1,650 m), is composed of magnetically similar andesites. The andesites are magnetized in a normally polarized direction (I=80.0°, D=28.3°) and with a magnetization of 2.9 A/m. The chief exceptions to this are the possible remnants of several old volcanic cones which underlie the Mount Hood cone. The largest old cone is beneath the northward slope of the mountain (Flanagan and Williams, 1982). Calculations show that this old volcanic cone is magnetized with a direction approximately opposite to the Earth's present field and with a magnitude of magnetization of 3.9 A/m.

EXPLANATION

MAGNETIC CONTOURS--Showing residual magnetic intensity of Earth's magnetic field in gammas. Universal Transverse Mercator Projection. Data is reduced to the pole. Flight lines are east-west at 2 mile line spacing. Hachured to indicate closed areas of lower magnetic intensity. Contour interval is 20 gammas

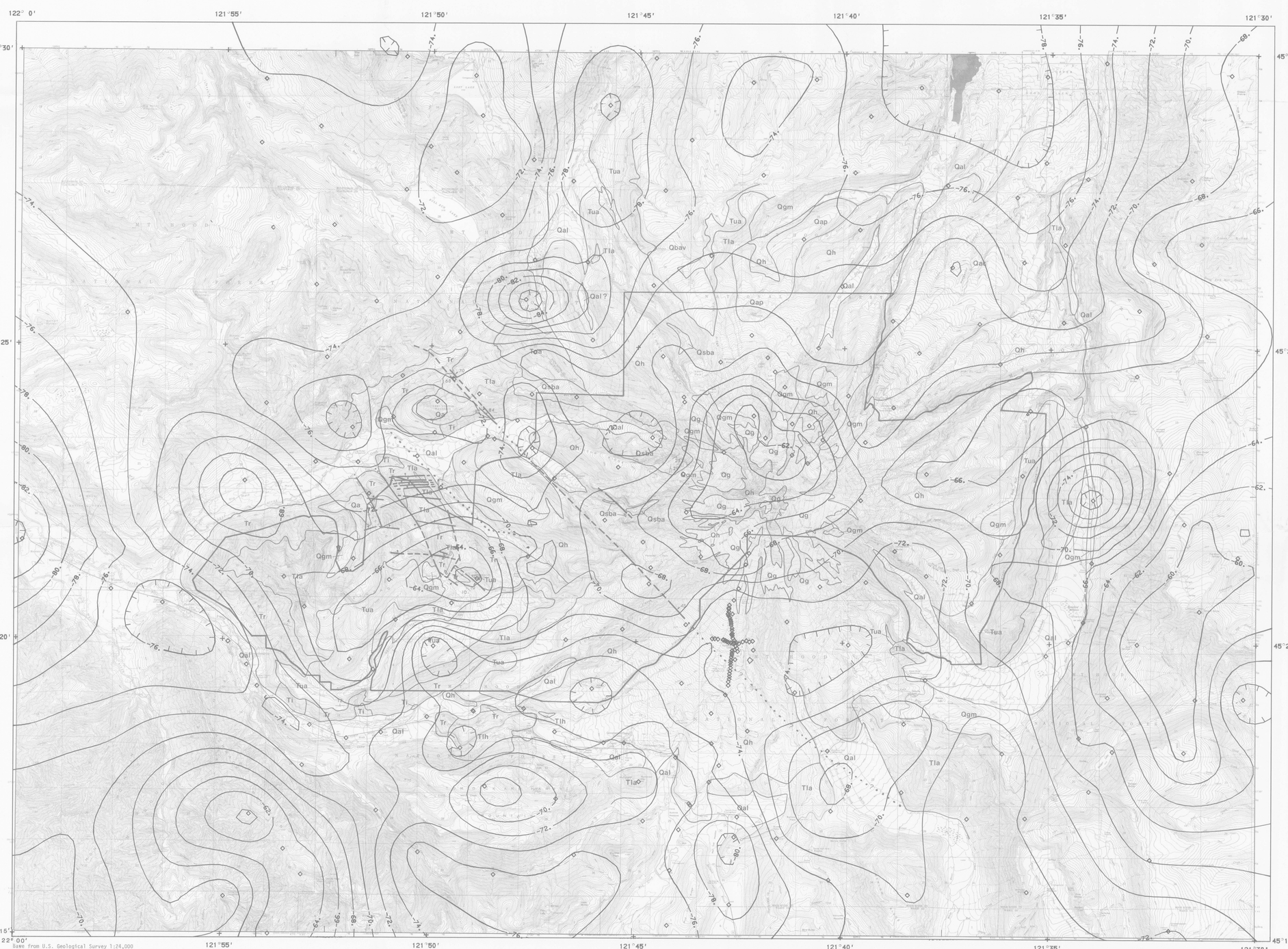
78 — CONTACT--Approximately located

FAULT, SHOWING DIP--Dashed where approximately located; dotted where uncertain. Bar and ball on downthrown side

STRIKE AND DIP OF LAVA FLOWS AND BEDDING IN VOLCANICLASTIC LAYERS

BOUNDARY OF MOUNT HOOD WILDERNESS

BOUGUER GRAVITY MAP



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AREA OF MAP

APPROXIMATE MEAN DECLINATION, 1981

The Bouguer gravity map contains 285 gravity stations taken from Couch and others (1981). The gravity data were reduced using the 1967 Geodetic Reference System Formula (International Association of Geodesy, 1971). A density of 2.2 g/cm³ was used for terrain and Bouguer corrections. The justification for such a low reduction density is given by D. L. Williams and Carol Finn (written commun., 1982).

Almost the entire Mount Hood Wilderness area is a gravity high (Couch and others, 1981) centered about 0.6 mi (1 km) north of the summit of Mount Hood. To the west, a lobe of the gravity high is found on Zigzag Mountain.

Mount Hood volcano rests on a succession of older volcanic rocks which reach a total thickness of about 2.4 mi (4 km). The gravity high near the summit of Mount Hood probably delineates the boundaries of a dense intrusive body intruding into this layer of older volcanic rocks and into the edifice of Mount Hood. The intrusion of this body presumably produced the volcanic products that built Mount Hood volcano and the cones buried beneath Mount Hood that were identified in the aeromagnetic study. Within the underlying volcanic layer the intrusive body has a diameter of about 3 mi (5 km). It necks upward to about 0.6 mi (1 km) as the body enters the volcanic edifice of Mount Hood volcano.

A similar but older intrusion is probably beneath Zigzag Mountain. The plutons of Laurel Hill and Still Creek outcrop just south of Zigzag Mountain and may be part of a large pluton that extends north under Zigzag Mountain. Some of the gravity high at Zigzag Mountain could be a result of reducing the gravity data at a density somewhat too low. The density of 2.2 g/cm³ was chosen for the study of Mount Hood volcano; Zigzag Mountain is probably more dense.

EXPLANATION

GRAVITY CONTOURS--Bouguer anomaly values drawn by computer from a gridded representation of the data. Universal Transverse Mercator Projection. Hachured to indicate gravity lows. Contour interval is 2 milligals. Reduction density is 2.2 g/cm³

GRAVITY STATION LOCATION--Collected by Couch and others (1981)

78 — CONTACT--Approximately located

FAULT, SHOWING DIP--Dashed where approximately located; dotted where uncertain. Bar and ball on downthrown side

4 — STRIKE AND DIP OF LAVA FLOWS AND BEDDING IN VOLCANICLASTIC LAYERS

BOUNDARY OF MOUNT HOOD WILDERNESS

STUDIES RELATED TO WILDERNESS

Under the provisions of the Wilderness Act (Public Law 88-577, September 3, 1964) and the Joint Conference Report on Senate Bill 4, 88th Congress, the U.S. Geological Survey and the U.S. Bureau of Mines have been conducting mineral surveys of wilderness and primitive areas. Areas officially designated as "wilderness," "wild," or "canoe" when the act was passed were incorporated into the National Wilderness Preservation System, and some of them are presently being studied. The act provided that areas under consideration for wilderness designation should be studied for suitability for incorporation into the Wilderness System. The mineral surveys constitute one aspect of the suitability studies. The act directs that the results of such surveys are to be made available to the public and be submitted to the President and the Congress. This report discusses the results of a mineral survey of the Mount Hood Wilderness, Mount Hood National Forest, Clackamas and Hood River Counties, Oregon. The area was established as a Primitive Area in 1931, and converted to a wilderness on June 27, 1940.

GEOLOGICAL SUMMARY

The Mount Hood Wilderness lies along the crest of the Cascade Range in Clackamas and Hood River Counties, Oregon. Mount Hood is a Quaternary stratovolcano, still potentially active (Crandell, 1980), which rises conspicuously to an altitude of 11,234 ft (3,425 m). The wilderness covers approximately 47,100 acres (19,061 ha) and includes the east, north, and west flanks, and the summit area of the volcano. Zigzag Mountain makes up the western part of the wilderness.

All exposed rocks in the wilderness area are of Tertiary or Quaternary age. The oldest rocks are late Miocene volcaniclastic rocks and andesitic lava flows of the Rhododendron Formation. Late Miocene andesite plugs intrude, and flows overlie, the Rhododendron Formation. The quartz diorite intrusive body of Laurel Hill was emplaced during late Miocene time, and drill hole data indicate that it is a larger body than surface outcrops might indicate. Andesite flows of Pliocene age were extruded from several centers and flowed over petrographically similar andesite lava flows of Late Miocene age.

The Sandy Glacier volcano of Pleistocene age (Keith and others, 1982) is exposed on the west side of Mount Hood where it has been partly eroded by glaciation. The well-developed cone is composed of basalt and andesite flows that dip east and southeast under Mount Hood. Other Pleistocene volcanoes may have been buried by the Mount Hood volcano (Flanagan and Williams, 1982).

Construction of the present cone of Mount Hood volcano began approximately 730,000 years B.P. with andesitic lava flows pouring out over the older Pleistocene volcanic rocks. Crater Rock, just south of the summit of Mount Hood, is a hornblende dacite dome which was emplaced approximately 200-300 years B.P. (Crandell, 1980). Fumarolic activity has been continuous around the dome since emplacement.

The general east-northeast and north-northwest structural pattern in the Mount Hood area is typical of the Cascade Range (Venkatakrishnan and others, 1980). The rocks on Zigzag Mountain particularly appear to reflect the regional structural pattern.

SELECTED REFERENCES

Couch, R. W., and Gemperle, M., 1979, Gravity measurements in the area of Mount Hood, Oregon; in Hull, D. A., and Riccio, J. F., eds., Geothermal resource assessment of Mount Hood, Oregon: Department of Geology and Mineral Industries Open-file report O-79-8, p. 137-189.

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CORRELATION OF MAP UNITS

SEDIMENTARY DEPOSITS			VOLCANIC ROCKS			
Qal	Qg	Qgm	Qh	Qac	Qap	Qbav	Qa	Holocene	QUATERNARY
			Qsba					Pleistocene	
			Tua					Pliocene	TERTIARY
			Tla					Miocene	
			Ti						
			Tlh						
			Tr						

ABBREVIATED GEOLOGIC UNIT DESCRIPTION

SEDIMENTARY DEPOSITS

Qal — ALLUVIUM (HOLOCENE)--Unconsolidated stream deposits

Qg — GLACIERS (HOLOCENE)--Presently active ice bodies

Qgm — GLACIAL MORAINES (HOLOCENE AND PLEISTOCENE)--Unsorted and poorly indurated glacial deposits

VOLCANIC ROCKS

Qh — LAVAS OF MOUNT HOOD (HOLOCENE AND PLEISTOCENE)--Undifferentiated andesite flows and dacitic pyroclastic rocks of Mount Hood volcano

Qac — ANDESITE OF CLOUD CAP (PLEISTOCENE)--Medium- to dark-gray andesite flows from vent at Cloud Cap

Qap — ANDESITE OF THE PINNACLE (PLEISTOCENE)--Medium- to dark-gray andesite flows from vent at The Pinnacle

Qbav — ANDESITE AND BASALT OF VISTA RIDGE (PLEISTOCENE)--Medium- to dark-gray olivine andesite flows from several vents along Vista Ridge. Dark-gray to black aphanitic basalt from Vista Ridge including red scoriaceous basalt from the cinder cone at Red Hill

Qa — UNDIFFERENTIATED ANDESITES FROM SATELLITIC VENTS (PLEISTOCENE)--Medium- to dark-gray microporphyritic olivine andesite flows

Qsba — SANDY GLACIER VOLCANO (PLEISTOCENE)--Black to dark-gray olivine basalt flows, pyroxene and hornblende andesite flows, and interlayered tuffs and breccias forming a partly exposed and dissected cone on the west side of Mount Hood

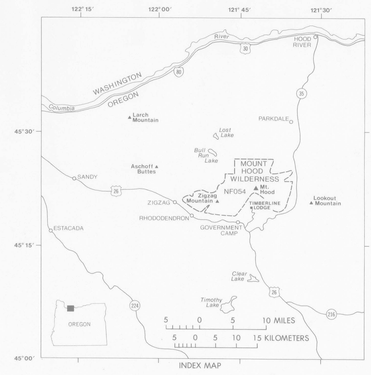
Tua — UPPER ANDESITE FLOWS (PLIOCENE)--Medium-gray microporphyritic olivine andesite flows

Tla — LOWER ANDESITE FLOWS (MIOCENE)--Light- to medium-gray olivine and pyroxene andesite flows with interlayered tuffs and breccias; characterized in places by coarse porphyritic hypersthene andesite

Ti — INTRUSIVE ROCKS (MIOCENE)--Medium-gray andesite plugs

Tlh — QUARTZ DIORITE OF LAUREL HILL (MIOCENE)--Medium-grained quartz diorite and quartz monzonite intrusion

Tr — RHODODENDRON FORMATION (MIOCENE)--Varicolored volcaniclastic rocks and andesite lava flows



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Interior—Geological Survey, Reston, Va.—1982

For sale by Branch of Distribution, U.S. Geological Survey, Box 25286, Federal Center, Denver, CO 80225