



**EXPLANATION**

**Quaternary**

**Qal** Alluvium  
In and near the Blue Mountains, composed mostly of coarse poorly sorted basaltic gravel; at lower altitudes, consists largely of silt derived from loessal soils. Porous narrow flood plains bordering the major streams. Gravel beds transmit water readily.

**Qef** Glaciofluvial deposits  
Poorly sorted silt, sand, and gravel deposited by the swollen ice-age Columbia River in areas generally below the 200-foot altitude. Contains numerous ice-rafted erratic boulders and much gravel. Generally less than 100 feet thick. Transmits water readily; at places, contains large quantities of unconfined and perched ground water.

**Qol** Fluvial formation  
Loess derived, at least in part, from the glacial lake sediments lying at lower altitudes. The loess forms a thin veneer over parts of all the Tertiary rocks and is not separately mapped. Patterns is used only where the loess is known to exceed 10 feet in thickness; the relationship to the underlying rocks is shown by a symbol, as Qol/Tcb. Maximum thickness is about 100 feet. The loess does not transmit water readily but contains small amounts of water perched upon the underlying basalt.

**Qls** Glacial lake sediments  
Composed mostly of crudely stratified silt and sand with some ice-rafted gravel and boulders. Form rolling terraces and benches at altitudes less than 1100 feet. The relationship to the underlying rocks is shown by a symbol, as Qls/Tc. Do not transmit water readily but contain small amounts of water perched upon the underlying basalt.

**Tertiary**

**Tc** Pangelemente  
Partly indurated poorly sorted silt and basaltic gravel overlying the basalt; generally less than 20 feet thick. At many places the interstices in the gravel are filled with silt, and the conglomerate does not transmit water readily. Contains small amounts of ground water perched on the underlying basalt.

**Tcb** Columbia River basalt  
Tcb, undifferentiated Columbia River basalt; principally dark heavy aphanitic lava in accordantly layered flows; includes small amounts of volcanic breccia and intrusive siltstone. Columnar, platy, and cubic jointing is common. Upper parts of individual flows commonly agglomerate. Thicknesses range from several thousand feet. Scoriae and jointed zones transmit water readily. Ground water is present in large quantities where structural conditions are favorable and recharge is available. Under silt.

**Tc** Clarno formation  
Continental sandstone, siltstone, and shale, scattered thin beds of impure coal and interstratified lens flows of siliceous intermediate composition; contains carbonized fossil leaves at places. Small amounts of water may be present in the sandstone and in the shallow weathered zone. No wells in the area are known to obtain water from this formation.

**qf** Intrusive rocks  
Primarily quartz diorite occurring in a large intrusive mass, and a smaller body of norite. The quartz diorite is highly weathered and disintegrated near the surface; the norite is relatively fresh and solid. Small amounts of water may be present in the weathered zones near the ground surface. No wells are known to obtain water from these rocks.

**Metamorphic rocks**  
Primarily amphibolite schist and gneiss and scattered bodies of hornblende and granite pegmatite, separated from the intrusive quartz diorite by a zone of mylonite. Foliation generally dips at steep angles from the horizontal. Small amounts of ground water are present near the ground surface in the weathered part of the metamorphic rocks.

Base from U. S. Geological Survey topographic maps of Bliskot Issed (1908) and Pendleton Quadrangle, 1927. U. S. Forest Service maps of Pendleton Ranger district of the Umatilla National Forest, 1942. Modifications from official aerial photographs of the Umatilla National Forest, and field reconnaissance. Drawn by G. M. Hogenson, 1954.

Geology of NW, SW, Eastern parts by G. M. Hogenson. Structural geology northeast of the Horse Heaven anticline after R. C. Newcomb, 1951.

**Contact**  
Dashed where approximately located; dotted where concealed.

**Fault**  
Dashed where approximately located; dotted where concealed. U, upthrown side; D, downthrown side.

**Anticline**  
Dashed where approximately located.

**Syncline**  
Dashed where approximately located.

**Strike and dip of beds**

**Horizontal lava flows**

**Well**

**Flowing well**

**Spring**

Numbered springs are of moderate yield; unnumbered springs are of low yield.

GEOLOGIC MAP AND SECTION OF UMATILLA RIVER BASIN, OREGON, SHOWING LOCATIONS OF REPRESENTATIVE WELLS AND SPRINGS

CONTOUR INTERVAL 50 FEET  
ELEVATION IN FEET NEAR SEA LEVEL

VERTICAL SCALE EXAGGERATED X 5

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