EXPLANATION

af, afm, afd

Artificial fill
af, artificial fill undifferentiated.
afm, modified land.
afd, mine dumps

Qa

Alluvium
Chiefly sand and pebble to cobble gravel beneath modern flood plains, except in Puyallup Valley, where it is mostly sand. Thickness is highly variable

Qms, Qmt

Deposits of mass-wasting processes
Subdivided according to nature of movement and resulting deposit as follows:
Qms, slumps, in which blocks of material move downslope as units and which consist chiefly of drift and rockfall deposits.
Qmt, earthflow deposits which result from flowage of deeply weathered bedrock or Lily Creek formation

Qlo, Qom, Qlc

Lacustrine deposits
Organic and mineral sediments deposited chiefly in closed depressions. Differentiated as follows:
Qlo, primarily peat.
Qlom, peat and muck.
Qlc, chiefly silt and clay. Thickness ranges from about 3 feet to at least 15 feet. In part older than Osceola mudflow

Qem

Electron mudflow
Unsorted mixture of andesitic rock fragments in clayey sand matrix, derived principally from Mount Rainier. Thickness ranges from featheredge to at least 20 feet

Qatw

Terrace alluvium
Sand and pebble to boulder gravel mostly of Mount Rainier provenance; 15 to 30 feet thick; forms terraces adjacent to White River

Qom

Osceola mudflow
Unsorted mixture of andesitic rock fragments in clayey sand matrix, derived chiefly from Mount Rainier. Thickness ranges from 0 to known maximum of 75 feet. Line pattern shows areas where deposit is inferred to be less than 10 feet thick on Vashon drift

Qatc

Terrace gravel
Cobble and boulder gravel of central Cascade and Mount Rainier provenance; occurs as veneers 5 to 10 feet thick on bedrock benches adjacent to Carbon River

Qik, Qit, Qil

Ice-contact stratified drift
Sand and gravel deposited against or closely adjacent to glacier. Subdivided according to mode of origin as follows:
Qik, kame and kame-field gravel.
Qit, kame-terrace gravel, stipple pattern indicates areas of extensive collapse.
Qil, lacustrine sand. Gravel is characterized by abundant large boulders, wide lateral and vertical changes in grain size, and local till inclusions. Areal distribution of lacustrine sand shows no consistent relation to present topography, indicating deposition in contact with ice. Thickness highly variable

Qpv, Qpo, Qpd, Qpl, Qpa

Proglacial stratified drift
Chiefly sand and pebble to cobble gravel deposited beyond ice front. Subdivided as follows:
Qpv, valley-train deposit.
Qpo, outwash-plain deposit; pattern shows where deposit was formed near ice front.
Qpd, delta gravel.
Qpl, lacustrine sand.
Qpa, undifferentiated stream deposits.
Valley-train and delta deposits characterized by good sorting; boulders and till inclusions rare. Outwash-plain deposits similar except where formed near ice front. Vertical distribution of lacustrine sand is limited by altitude of spillway of glacial lake in which sand was deposited, thus bears consistent relation to topography. Thickness highly variable

Qgt

Glacial drift, chiefly till
Mainly compact, unoxidized till deposited by the Puget glacial lobe, but includes sand and gravel both within and on top of till. Till commonly 15 to 30 feet thick in lowland; maximum observed ranges from 2 to 20 feet. Stipple pattern indicates areas of ground moraine; superimposed line pattern shows areas of drumlinized ground moraine

Qsa

Advance stratified drift
Outwash sand and gravel and lacustrine sand deposited during advance of Vashon glacier. Differentiated only where recognized beneath Vashon till. Thickness highly variable; maximum recognized, 100 feet

Qg

Glacial drift, undifferentiated

Qed, Qeo

Evans Creek drift
Till and outwash gravel deposited by alpine glacier in Carbon River valley. Subdivided as follows:
Qed, coarse bouldery unsorted till.
Qeo, pebble to boulder gravel 20 to 100 feet thick

Qw

Wingate Hill drift
Chiefly oxidized till deposited by icecap glacier in Cascade foothills; commonly 4 to 15 feet thick. Includes widespread mantle of silt- and sand-size volcanic ash as much as 16 feet thick and glaciolacustrine sediments of Vashon age

Qss, Qsm, Qsd

Salmon Springs drift
Two deposits of oxidized sand and gravel of central Cascade and northern provenance, and till deposited by the Puget glacial lobe; locally deposits are separated by a few feet of nonglacial volcanic ash, silt, and peat. Thickness highly variable; locally at least 86 feet

Puyallup formation
Chiefly unoxidized sand and gravel and very compact mudflows of Mount Rainier provenance, and a few highly compressed peat beds, deposited in lowland during nonglacial climatic conditions. Maximum known, 135 feet

Stuck drift
Very compact till deposited by the Puget glacial lobe, and oxidized sand and gravel of central Cascade and northern provenance; locally includes compact laminated sand and silt. Thickness highly variable, maximum known, 75 feet

Alderton formation
Principally unoxidized sand and gravel and very compact mudflows of Mount Rainier provenance, and a few highly compressed peat beds; deposited in lowland during nonglacial climatic conditions. Maximum inferred thickness, at least 100 feet

Qu

Pre-Vashon formations undifferentiated
Salmon Springs and Stuck drifts, and Puyallup and Alderton formations adjacent to Puyallup Valley; Salmon Springs and Stuck drifts adjacent to White River valley

Qlt

Lily Creek formation
Sand and gravel and compact mudflows of Mount Rainier provenance in Cascade foothills. Wholly or partly altered to clay to depths of 10 to 50 feet or more below ground surface in most places. Maximum known thickness, 373 feet, but may be as much as 800 or 900 feet. Inferred to be equivalent to Puyallup and Alderton formations

Qor

Orting drift
Deeply oxidized sand and gravel predominantly of central Cascade provenance, and minor amounts of sand and compact till deposited by Puget glacial lobe. Maximum known thickness, about 200 feet

b

Bedrock
Areas where bedrock crops out or is known to occur at shallow depth. Includes outcrops of unconsolidated sediments of Miocene age

Vashon drift: Qik, Qit, Qil; Qpv, Qpo, Qpd, Qpl, Qpa; Qgt; Qsa; Qg
Upper Pleistocene
Bound
Middle(?) Pleistocene: Qu; Qss, Qsm, Qsd; Qlt
Lower(?) Pleistocene: Qor

Contact
Dashed where approximately located

Contact
Indefinite or inferred

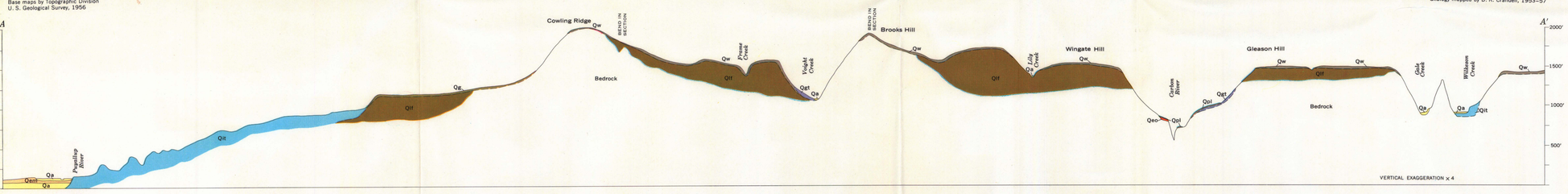
Spring

Glacial striation on bedrock
Point of arrow at striation locality; shaft of arrow indicates bearing of striation

22° TRUE NORTH
MAGNETIC NORTH
APPROXIMATE MEAN DECLINATION, 1962

Base maps by Topographic Division
U. S. Geological Survey, 1956

Geology mapped by D. R. Crandell, 1953–57



SURFICIAL GEOLOGIC MAP AND SECTION OF THE LAKE TAPPS QUADRANGLE, WASHINGTON

SCALE 1:24 000

1 ½ 0 1 MILE

CONTOUR INTERVALS 10, 20, AND 40 FEET
DATUM IS MEAN SEA LEVEL

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.—61051