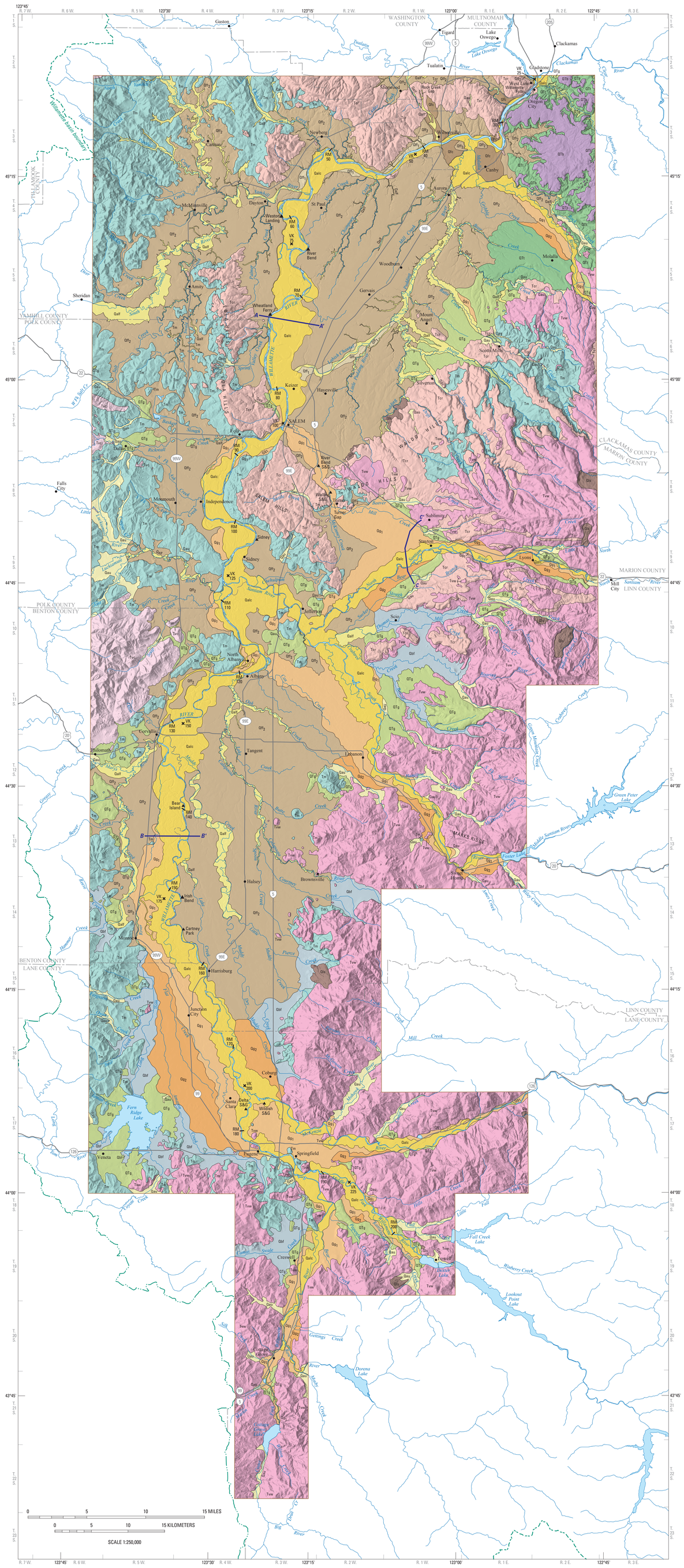
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

Prepared in cooperation with
OREGON WATER RESOURCES DEPARTMENT

PROFESSIONAL PAPER 1620
Quaternary geologic units in Willamette Valley, Oregon—PLATE 1
O'Connor and others, 2001, Origin, Extent, and Thickness of Quaternary Geologic Units in the Willamette Valley, Oregon.



DESCRIPTION OF MAPPING UNIT

Qalf **Alluvium of smaller streams (Holocene and upper Pleistocene)**—Unconsolidated clay, silt, sand, and minor gravel deposited in floodplains and active channels of smaller streams and rivers. Variable surface morphology. Thickness not defined, but probably less than 10 meters. Differentiated from units Qbf and Qau where clearly younger than Missoula Flood deposits. Mostly younger than 12 ka.

Qalc **Floodplain deposits of the Willamette River and major tributaries (Holocene and upper Pleistocene)**—Unconsolidated silt, sand, and gravel of the Willamette River and major Cascade Range tributaries. Includes active channel and modern floodplain surfaces. Meander-scroll topography with surfaces as high as 15 meters above summer water stage. Drillers' logs and exposures indicate that unit thickness ranges up to 15 meters. Isotopic dating, tephrochronology, and stratigraphic relations within the Willamette Valley indicate that these deposits are mostly younger than 12 ka.

Qg_1 **Sand and Gravel that postdates Missoula Floods (upper Pleistocene)**—Alluvial sand and gravel deposited in broad braidplains within Willamette Valley and traced upstream as alluvial fills in major Cascade Range tributary valleys. Forms surfaces of large fans where major Cascade Range tributaries enter the Willamette Valley. Deposits now preserved as planar to slightly undulating terraces 0 to 15 meters above the modern floodplain. Drillers' logs and stratigraphic exposures indicate that unit is up to 30 meters thick. Stratigraphic relations and isotopic dating indicate that deposits primarily date from about 12 ka, although some areas mapped as Qg_1 in the Eugene-Springfield area and within the Cascade Range foothills may be substantially older.

Missoula Flood deposits (upper Pleistocene)—Unconsolidated clay, silt, sand, and gravel deposited by floods originating in glacial Lake Missoula that flowed down the Columbia River and backflooded into the Willamette Valley (Glenn, 1965; Allison, 1978). Largest flows reached stages of about 120 meters above sea level in the map area. Maximum thickness of deposits about 35 meters in northern Willamette Valley, thins to less than 1 meter at elevations above about 100 meters. Radiocarbon dating, tephrochronology, and stratigraphic relations from within and outside the map area indicate that most units date from about 15 to 12.7 ka. Divided into:

Qff_1 **Younger and lower fine-grained Missoula Flood deposits**—Clay, silt, sand, and minor gravel forming benches along Labish channel and Pudding River, and locally flanking Willamette River in northern Willamette valley. Planar to undulating surface almost everywhere 40-50 meters above sea level. Set into main-body fine facies (Qff_2). Probably mostly deposited by latest Pleistocene Missoula Floods between 13.5 and 12.7 ka, but possibly includes late Pleistocene and early Holocene deposits of units Qalf and Qalc.

Qff_2 **Main body of fine-grained Missoula Flood deposits**—Stratified silt and clay with minor sand. Underlies much of Willamette Valley lowland floor. Many sections show rhythmic bedding, with up to 40 individual beds between 0.1 and 1.0 meter thick. Encloses sparse pebbles to boulders of types exotic to Willamette Basin. Forms undulating to planar topography in lowlands; mantles foothills below altitudes of 120 meters. Mapped where thickness is sufficient to obscure previous topography. Commonly capped by up to two meters of late Pleistocene and Holocene alluvium, colluvium, and loess.

Qfc **Coarse Missoula Flood deposits**—Bouldery, cobbly, sandy gravel fans deposited by Missoula Floods as they spilled into northern Willamette Valley through the Oregon City and Rock Creek gaps. Crudely stratified, commonly with south-dipping foresets. Commonly capped by several meters of sandy silt, especially south of Willamette River. Drillers' logs indicate that thickness locally exceeds 30 meters.

Qg_2 **Sand and gravel that predates Missoula Floods (Pleistocene)**—Unconsolidated to semiconsolidated sand and gravel deposited in broad braidplains and meandering floodplain environments within Willamette Valley and upstream as alluvial fills along major Cascade Range tributaries. Locally contains lahar deposits. Forms planar to slightly undulating terrace surfaces 0 to 20 meters above the modern floodplain and generally at slightly higher elevations than adjacent surfaces of unit Qg_1. Thickness not systematically determined but locally exceeds 100 meters in broad fans formed where major Cascade Range tributaries enter the Willamette lowlands. Isotopic dating and tephrochronology indicate these deposits range from greater than 0.41 Ma to about 22 ka.

Qau **Alluvium, undifferentiated (Holocene and Pleistocene)**—Sand, silt, clay, and minor gravel deposited by smaller streams and rivers that enter the Willamette Valley, and by larger streams and rivers outside the area of detailed mapping. Age and thickness not determined.

Qbf **Fine-grained alluvium (Holocene and Pleistocene)**—Clay, silt, sand, and minor gravel deposited in small basins flanking the Willamette Valley. Planar surfaces. Age and thickness not determined. Distinction with unit Qau locally arbitrary.

Qls **Landslide deposits and colluvium (Holocene and Pleistocene)**—Unconsolidated and heterogeneous mixtures of rock fragments and soil. Some landslide deposits have hummocky surfaces. Colluvium mapped on steep debris-mantled slopes where underlying bedrock is not known. Only larger deposits mapped, mostly after Walker and McLeod (1991). Age and thickness not defined.

QTg **Weathered terrace gravel (Pleistocene and Pliocene?)**—Alluvial sand and gravel preserved as terraces flanking Willamette Valley and tributary valleys. Terrace surfaces planar to undulating, with thick, strongly-developed soils, and severely weathered clasts. Terrace surfaces up to 100 meters above modern floodplains. Drillers' logs and stratigraphic exposures indicate sand and gravel 0 to 60 meters thick. May be in part equivalent to Troutdale Formation (QTt) as mapped near Molalla. Probably mostly deposited between 2.5 and 0.5 Ma.

UPLAND UNITS (Primarily compiled from previous workers)

QTb **Boring Lava (Pleistocene and Pliocene)**—Gray to light-gray, open-textured olivine basalt lava flows. Only mapped in the northern part of map area after Hampton (1973). Up to 60 meters thick. Ten radiometric ages on separate flows near Oregon City span 0.427 ± 0.026 Ma to 3.15 ± 0.062 Ma (Madin, 1994).

QTt **Troutdale Formation (Pleistocene? and Pliocene)**—Sand, gravel, sandstone, conglomerate, siltstone, and mudstone. Only mapped in northern part of map area after Trimble (1963) and Hampton (1972) where it is up to 150 meters thick. May be locally equivalent to the weathered terrace gravel (QTg) near Molalla. Overlain by Boring Lava near Oregon City.

Tvw **Volcanic and volcaniclastic rocks of the western Cascade Range, undivided (upper Eocene to Pliocene)**—Lava flows, tuff, breccia, and volcaniclastic sediment of variable composition. Locally interfingers with marine sedimentary rocks (Tm) in the southern portion of map area. Includes the Fisher Formation, "volcanic rocks of the western Cascade Range", and Sardine Formation as compiled by Gannett and Caldwell (1998). Youngest rocks are ridge-capping basalt flows in Santiam River drainage with reported ages as young as 2.80 ± 0.3 Ma (Verplanck, 1985, cited in Walker and Duncan, 1989).

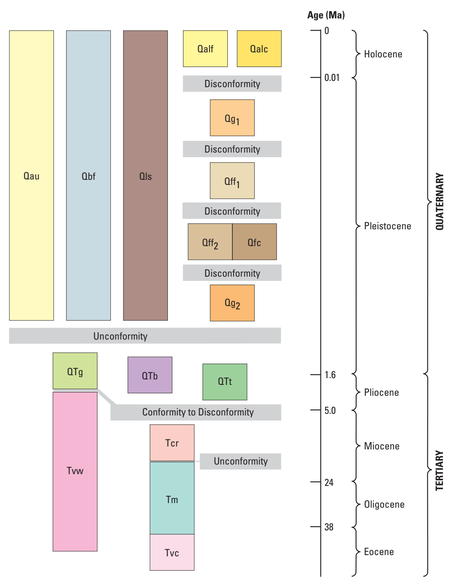
Tcr **Columbia River Basalt Group (Miocene)**—Lava flows of dark gray to black, locally porphyritic basalt. Locally deeply weathered. Mostly between 16 and 15 Ma in northern Willamette Valley (M.H. Beeson, Portland State University, written communication, 1998). Also includes small areas of alluvium, colluvium, loess, and landslide debris. Distribution after Gannett and Caldwell (1998).

Tm **Marine sedimentary rocks (lower Miocene to Eocene)**—Marine sandstone, siltstone, shale, and claystone, with lesser conglomerate; locally tuffaceous. Also includes numerous small mafic intrusions, and small areas of alluvium, colluvium, loess, and landslide debris. Distribution after Gannett and Caldwell (1998).

Tvc **Volcanic rocks of the Coast Range (Eocene)**—Basaltic pillow lava, tuff breccia, subaerial basalt lava flows, and sills, with interbeds of basaltic sandstone, siltstone, and conglomerate. Includes small areas of alluvium, colluvium, loess, and landslide debris. Distribution after Gannett and Caldwell (1998).

Note: "Ma" refers to millions of years before present, and in this report is used to indicate radiometric and fission track ages on volcanic rocks. "ka" refers to kiloannum, indicating thousands of radiocarbon years before present.

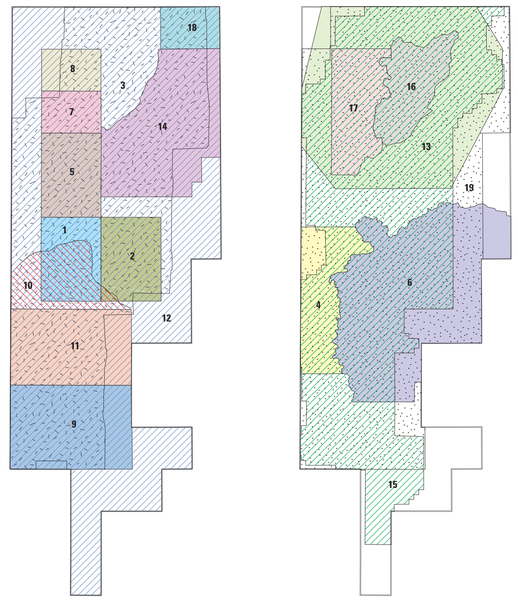
CORRELATION OF MAP UNITS



EXPLANATION

- Water
- Contact
- A——A' Trace of generalized geologic sections shown on figure 2 of the report
- Study area boundary
- RM 110 **River mile location**—From US Geological Survey 1:24,000-scale topographic quadrangles
- VK 125 **Valley kilometer**—Measured from Columbia River confluence along axis of Holocene floodplain of the Willamette River
- Sidney **Site location**—Stratigraphic section or sample site described in accompanying text. Note: "S&G" = Sand and Gravel.

SOURCES OF GEOLOGIC MAPPING



Source map number and authors—Full reference citation at back of text

1 Allison (1953)
2 Allison and Felts (1956)
3 Balster and Parsons (1968)
4 Bela (1979)
5 Bela (1981)
6 Beaulieu and others (1974)
7 Brownfield and Schlicker (1981a)
8 Brownfield and Schlicker (1981b)
9 Frank (1973)
10 Frank (1974)
11 Frank (1976)
12 Gannett and Caldwell (1998)
13 Glenn (1965)
14 Hampton (1972)
15 Piper (1942)
16 Price (1967a)
17 Price (1967b)
18 Trimble (1963)
19 Yeats and others (1996)

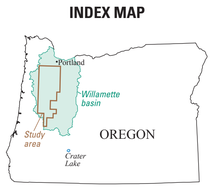
Not shown are the Geologic Map of Oregon (Walker and MacLeod, 1991), and the Soil Conservation Service (now Natural Resources Conservation Service) soil surveys for each of the counties within the map area (Williams, 1972; Otte and others, 1974; Knezevich, 1975, 1982; Gerig, 1985; Langridge, 1987; Patching, 1987).

LOCATION MAP

Base composited from USGS digital line graphs and other digital information. Universal Transverse Mercator projection, Zone 10, North American Datum 1927

0 10 20 MILES
0 10 20 KILOMETERS

INDEX MAP



Base compiled from U.S. Geological Survey digital base, includes:
U.S. Geological Survey Digital Line Graphs published at 1:100,000, 1987;
U.S. Bureau of the Census TIGER/Line® files, published at 1:100,000, 1990;
U.S. Geological Survey Digital Line Graphs published at 1:100,000, 1988 and modified by the State of Oregon, 1994;
U.S. Geological Survey quadrangle topographic maps published at 1:24,000 as digitized by Oregon Department of Transportation
Projection: Universal Transverse Mercator projection, Zone 10, 1927 North American Datum

Geologic unit linework was compiled and digitized at a scale of 1:24,000, but the accuracy of the contacts varies depending on location and geologic unit.

GEOLOGIC MAP OF QUATERNARY UNITS IN THE WILLAMETTE VALLEY, OREGON

By
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2001