Geology and Geomorphology of the Mid-Willamette Valley

Peoria-Corvallis Willamette Paddle Trip
June 23, 2007

Prepared By

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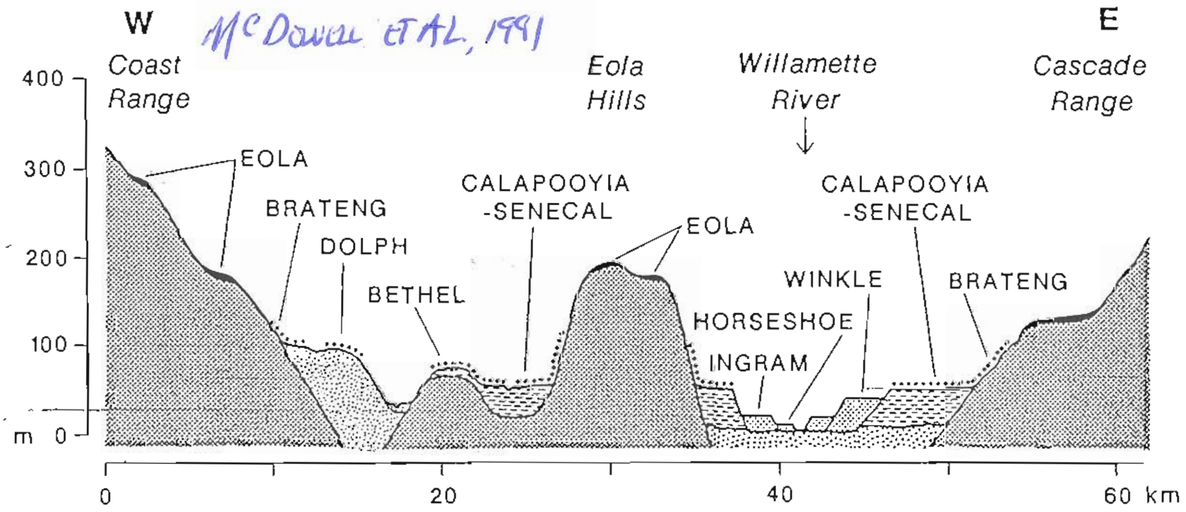
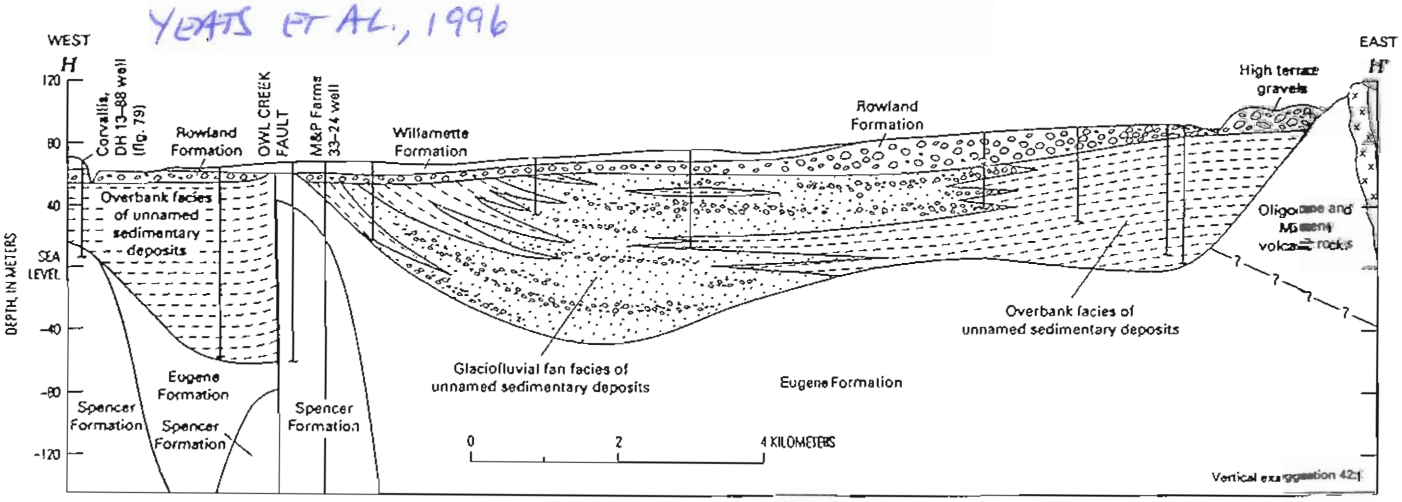

McDowell et al, 1991


Yeats et al., 1996

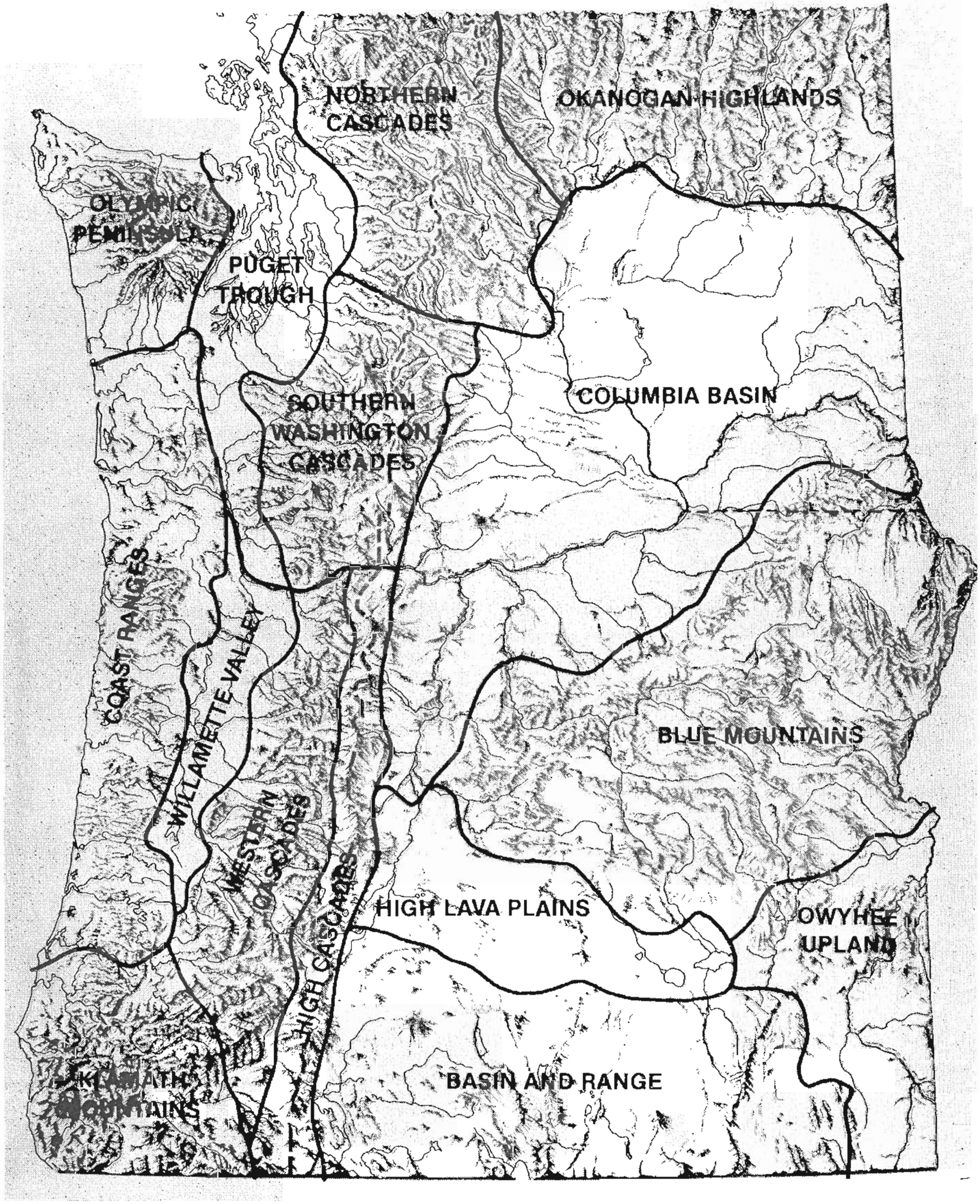
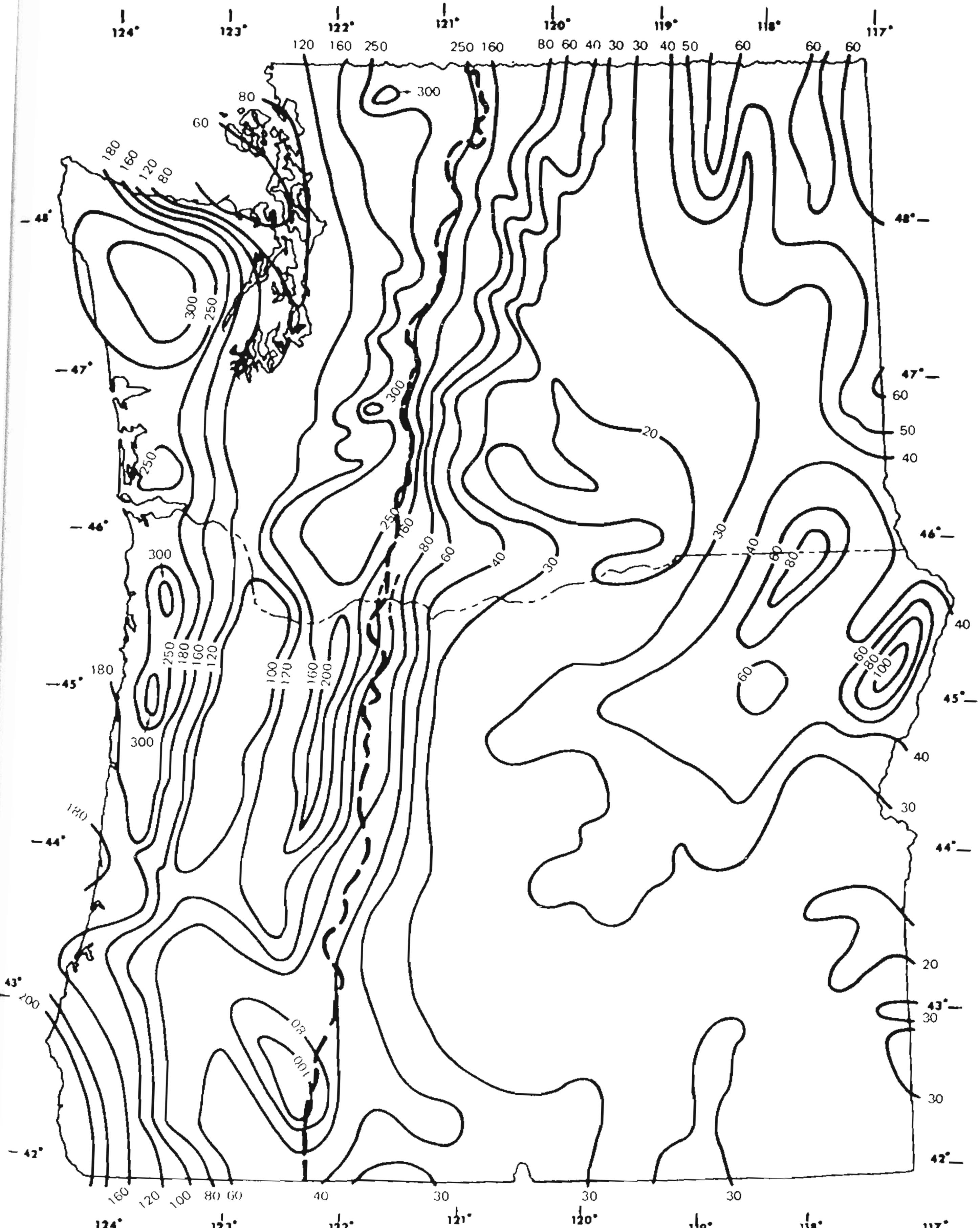


Figure 2. — Physiographic and geological provinces of Oregon and Washington.

2



Mean Annual Precipitation (cm.)

Figure 23. — Mean annual precipitation in Oregon and Washington (U.S. Weather Bureau 1960a, b).

2

Yeats et al., 1996

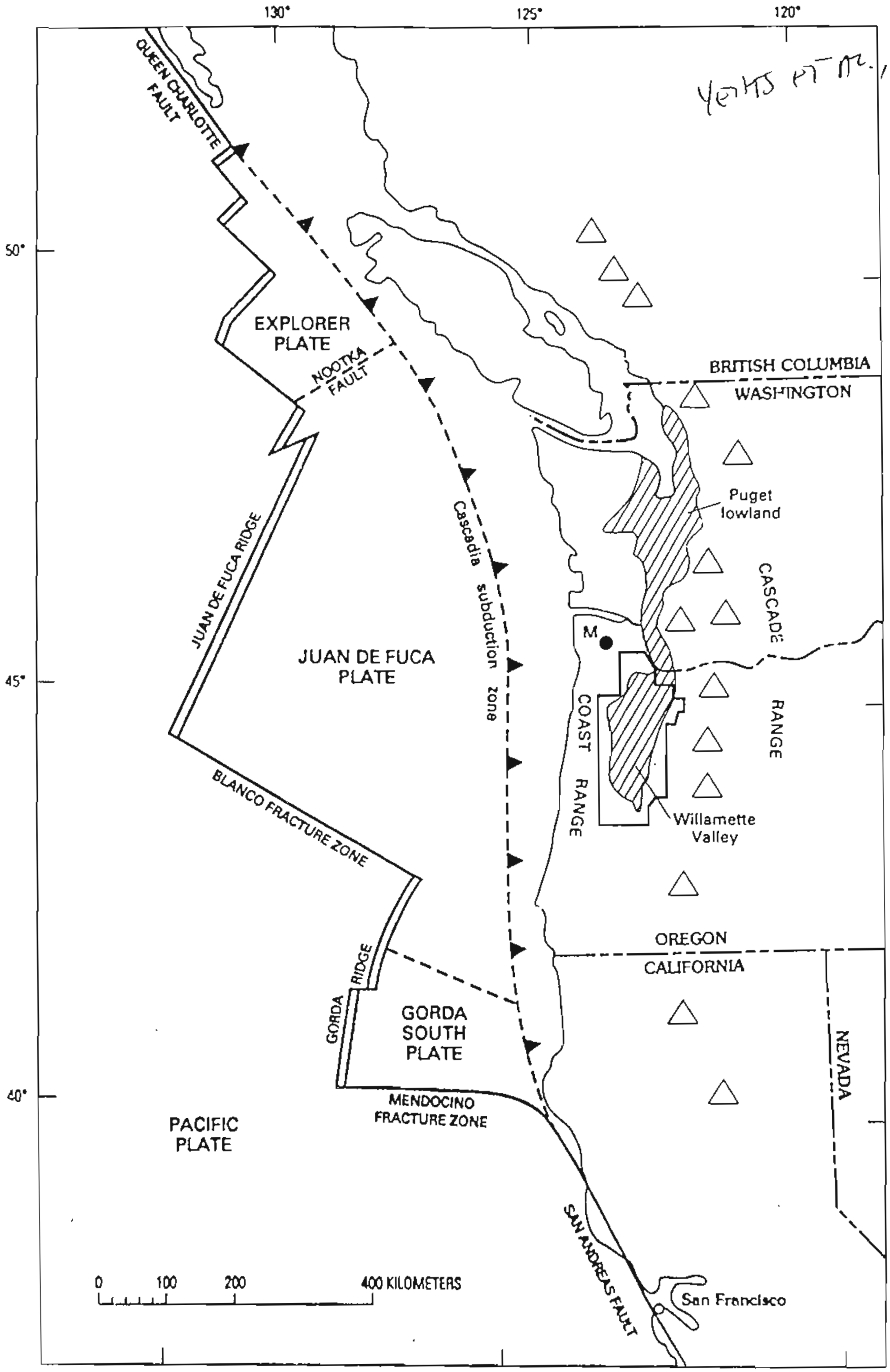
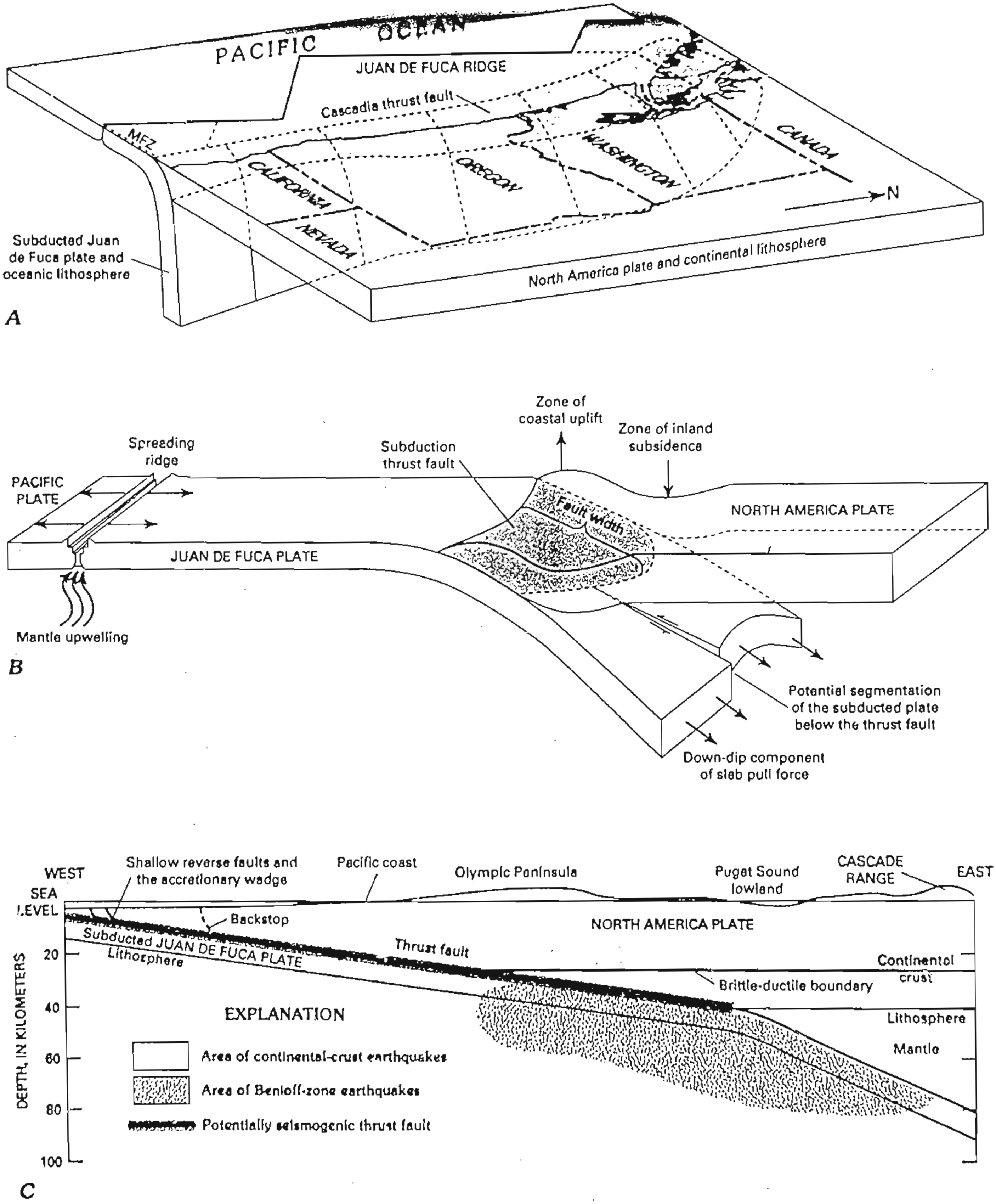
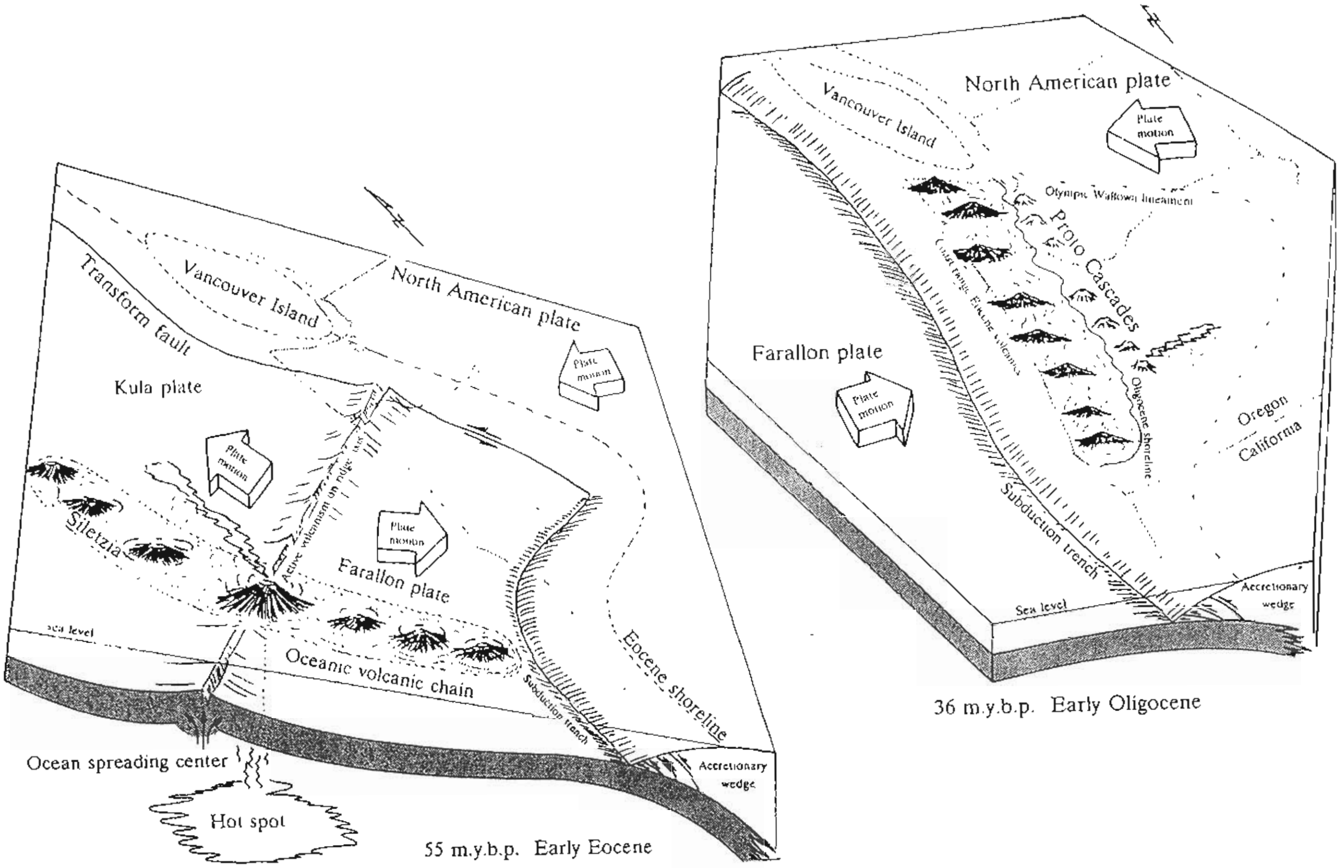
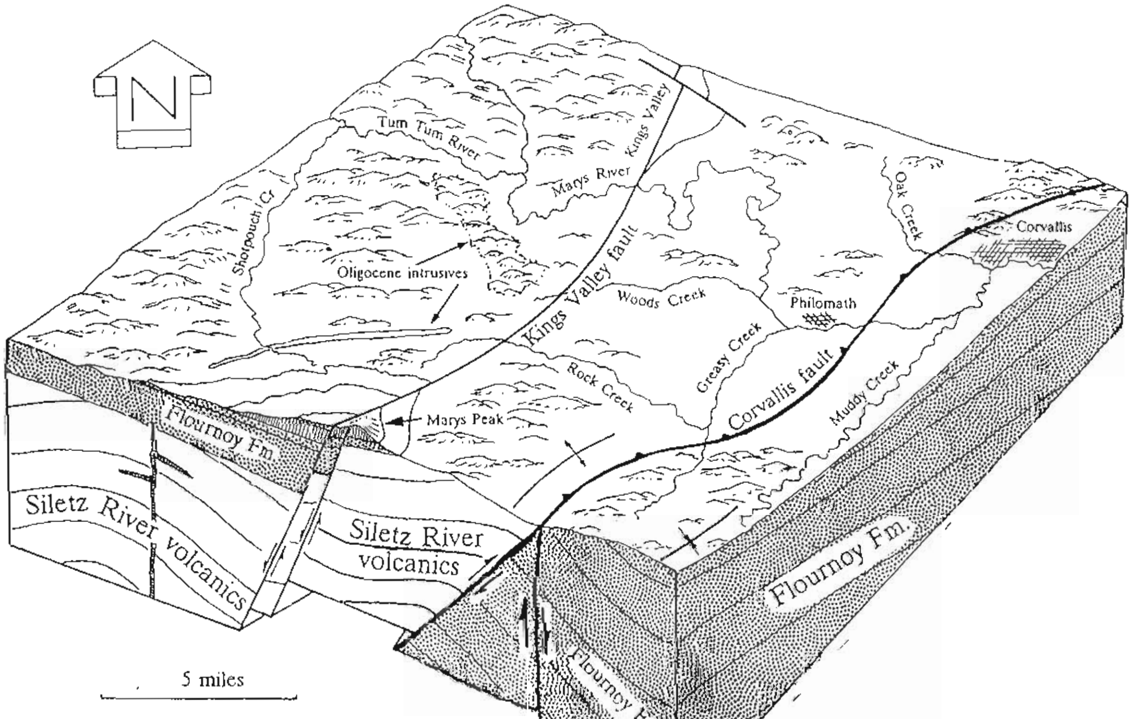


Figure 76. Plate boundaries of the Pacific Northwest showing locations of tectonic features and the Willamette Valley study area. Heavy line, study-area boundary; hatched area, Willamette Valley and Puget lowland; sawteeth denote upper plate of thrust fault. Major stratovolcanoes are shown by open triangles. Dot labeled "M" in northwestern Oregon is the Mist gas field.


PACIFIC OCEAN
JUAN DE FUCA RIDGE
Cascadia thrust fault
MFZ
CALIFORNIA
OREGON
WASHINGTON
CANADA
NEVADA
N
Subducted Juan de Fuca plate and oceanic lithosphere
North America plate and continental lithosphere
A
Spreading ridge
PACIFIC PLATE
JUAN DE FUCA PLATE
Mantle upwelling
Subduction thrust fault
Zone of coastal uplift
Zone of inland subsidence
Fault width
NORTH AMERICA PLATE
Potential segmentation of the subducted plate below the thrust fault
Down-dip component of slab pull force
B
WEST
SEA LEVEL
Shallow reverse faults and the accretionary wedge
Pacific coast
Olympic Peninsula
Puget Sound lowland
CASCADE RANGE
EAST
Backstop
NORTH AMERICA PLATE
Subducted JUAN DE FUCA PLATE
Lithosphere
Thrust fault
Continental crust
Brittle-ductile boundary
Lithosphere
Mantle
DEPTH, IN KILOMETERS
20
40
60
80
100
EXPLANATION
Area of continental-crust earthquakes
Area of Benioff-zone earthquakes
Potentially seismogenic thrust fault
C



Accretionary tectonic model for Siletz River Volcanics (from Orr and Orr, 1999)



Schematic of Corvallis and Kings Valley Faults (from Orr and Orr 1999)

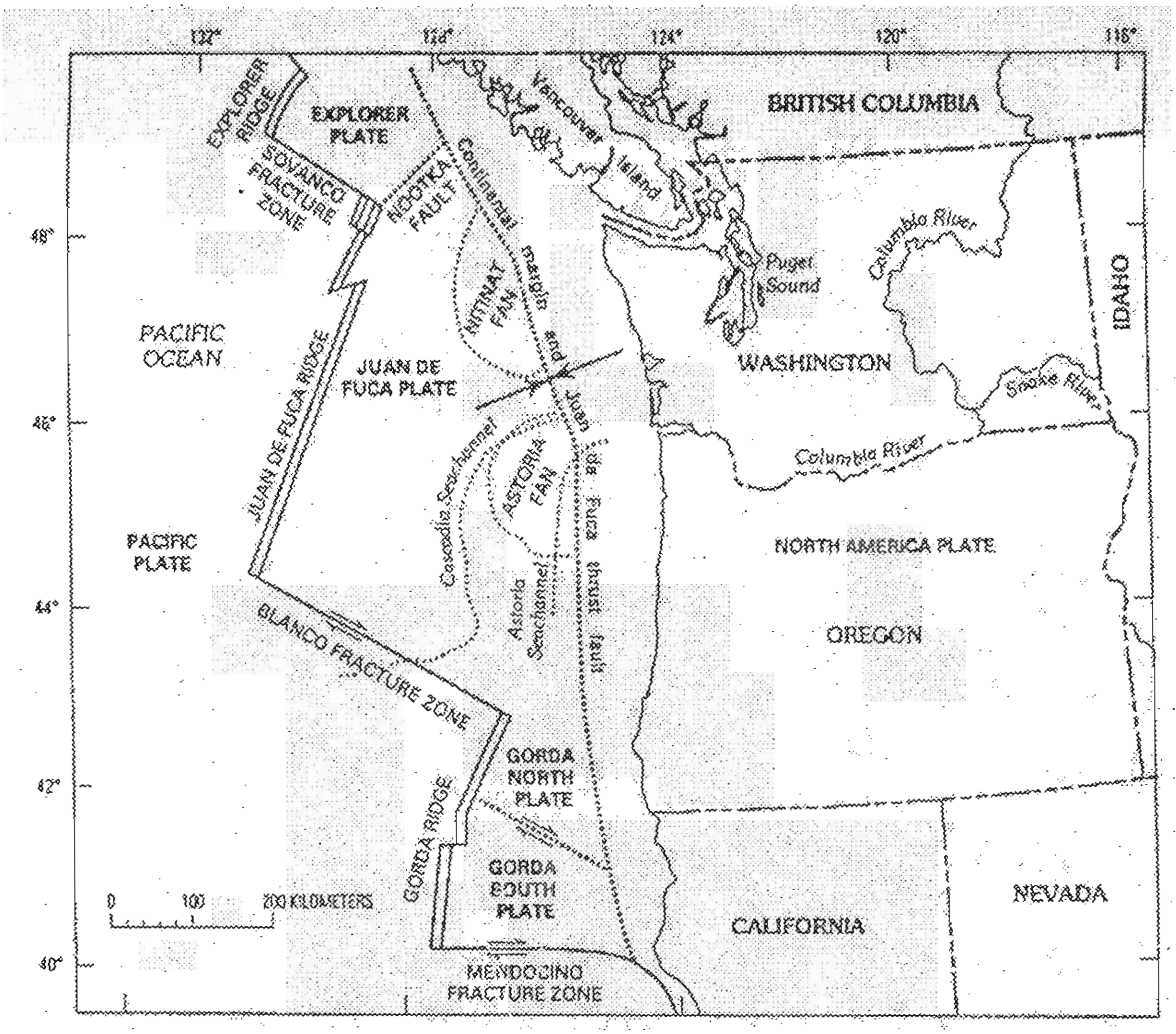
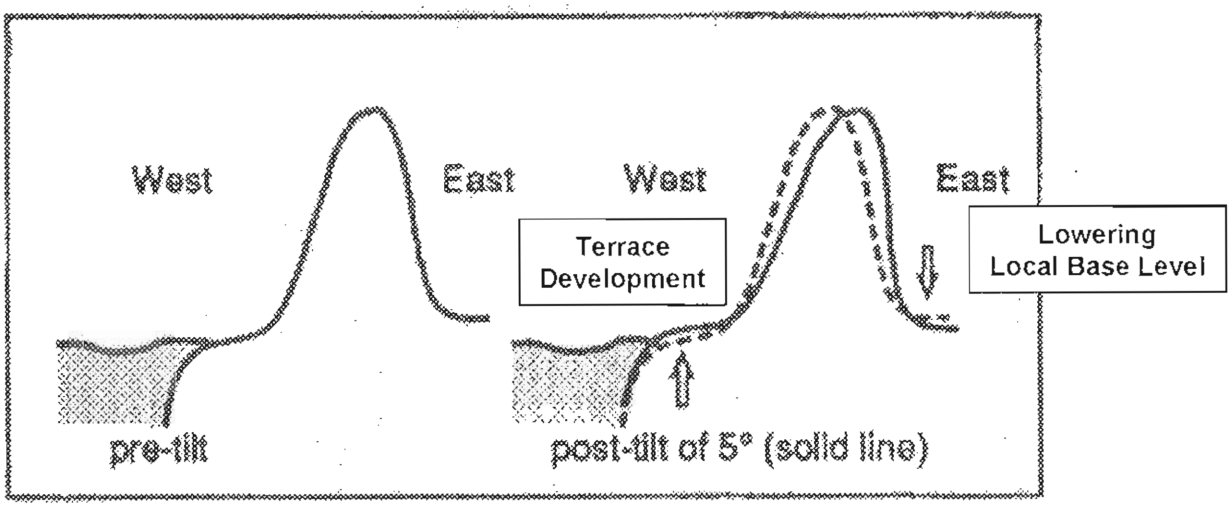


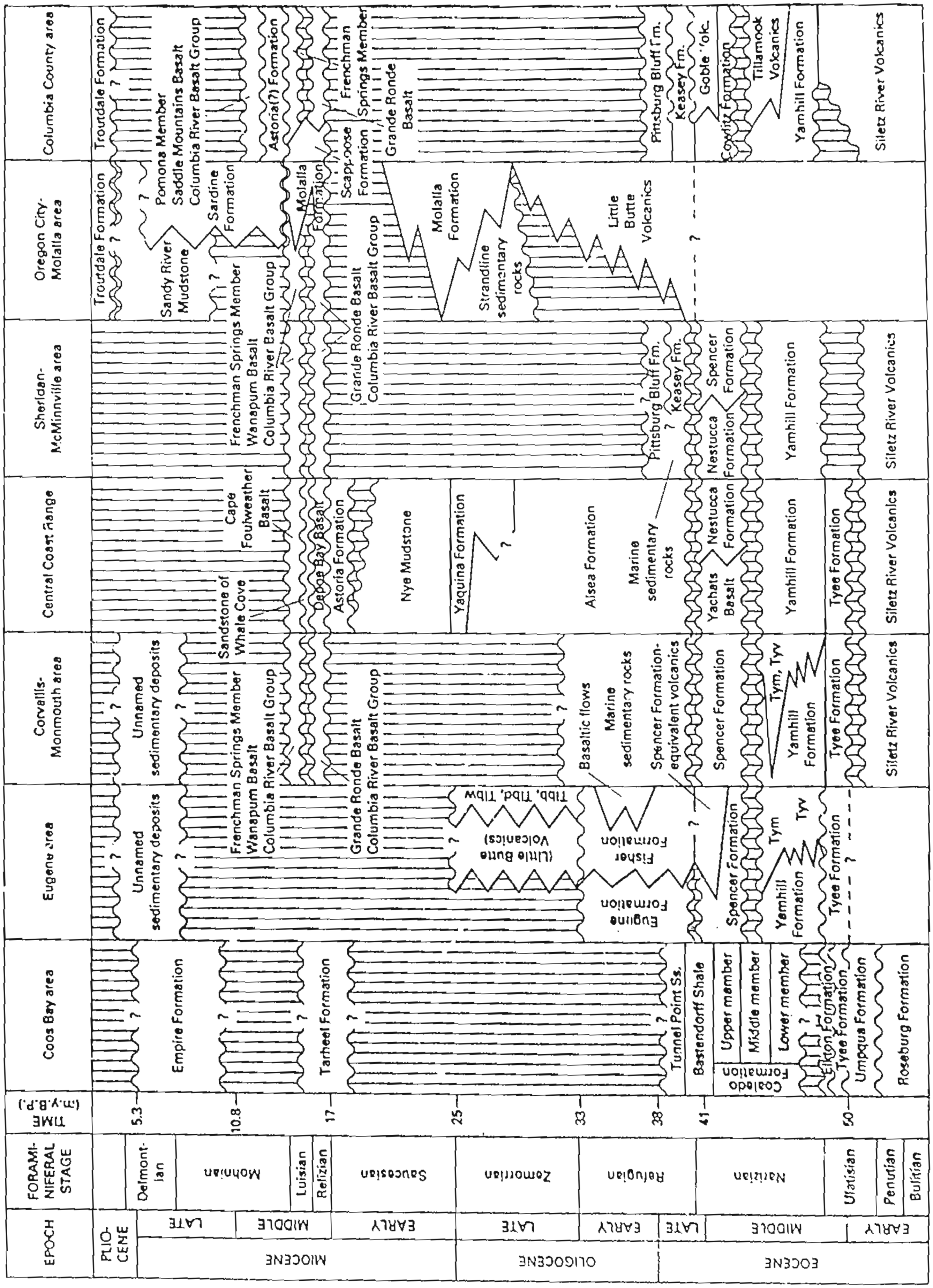
Plate tectonic configuration of the Pacific Northwest.



Cartoon showing effects of Coast Range tilting on watershed gradient (from Rhea, 1993)

Geo mAP

MAP
EXPLANATION


EPOCH
FORAMINIFERAL STAGE
TIME (m.y.B.P.)
PLIOCENE
MIOCENE
OLIGOCENE
EOCENE
LATE
MIDDLE
EARLY
Delmontian
Mohnian
Luisian
Relizian
Saucesian
Zemorrian
Refugian
Narizian
Ulatisian
Penutian
Bulitian
5.3
10.8
17
25
33
38
41
50
Coos Bay area
Empire Formation
Tarheel Formation
Tunnel Point Ss.
Bastendorff Shale
Coaledo Formation
Upper member
Middle member
Lower member
Elkton Formation
Tyee Formation
Umpqua Formation
Roseburg Formation
Eugene area
Unnamed sedimentary deposits
Frenchman Springs Member
Wanapum Basalt
Columbia River Basalt Group
Grande Ronde Basalt
Columbia River Basalt Group
(Little Butte Volcanics)
Tlbb, Tlbd, Tlbw
Fisher Formation
Eugene Formation
Spencer Formation
Tym
Tyv
Yamhill Formation
Tyee Formation
Corvallis-Monmouth area
Unnamed sedimentary deposits
Frenchman Springs Member
Wanapum Basalt
Columbia River Basalt Group
Grande Ronde Basalt
Columbia River Basalt Group
Basaltic flows
Marine sedimentary rocks
Spencer Formation-equivalent volcanics
Spencer Formation
Tym, Tyv
Yamhill Formation
Tyee Formation
Siletz River Volcanics
Central Coast Range
Sandstone of Whale Cove
Cape Foulweather Basalt
Depoe Bay Basalt
Astoria Formation
Nye Mudstone
Yaquina Formation
Alsea Formation
Marine sedimentary rocks
Yachats Basalt
Nestucca Formation
Yamhill Formation
Tyee Formation
Siletz River Volcanics
Sheridan-McMinnville area
Frenchman Springs Member
Wanapum Basalt
Columbia River Basalt Group
Grande Ronde Basalt
Columbia River Basalt Group
Pittsburg Bluff Fm.
Keasey Fm.
Nestucca Formation
Spencer Formation
Yamhill Formation
Siletz River Volcanics
Oregon City-Molalla area
Troutdale Formation
Sandy River Mudstone
Pomona Member
Saddle Mountains Basalt
Columbia River Basalt Group
Sardine Formation
Frenchman Springs Member
Wanapum Basalt
Columbia River Basalt Group
Molalla Formation
Scappoose Formation
Grande Ronde Basalt
Columbia River Basalt Group
Molalla Formation
Strandline sedimentary rocks
Little Butte Volcanics
Columbia County area
Troutdale Formation
Pomona Member
Saddle Mountains Basalt
Columbia River Basalt Group
Astoria(?) Formation
Frenchman Springs Member
Scappoose Formation
Grande Ronde Basalt
Pittsburg Bluff Fm.
Keasey Fm.
Goble Vok.
Cowlitz Formation
Tillamook Volcanics
Yamhill Formation
Siletz River Volcanics
?

10

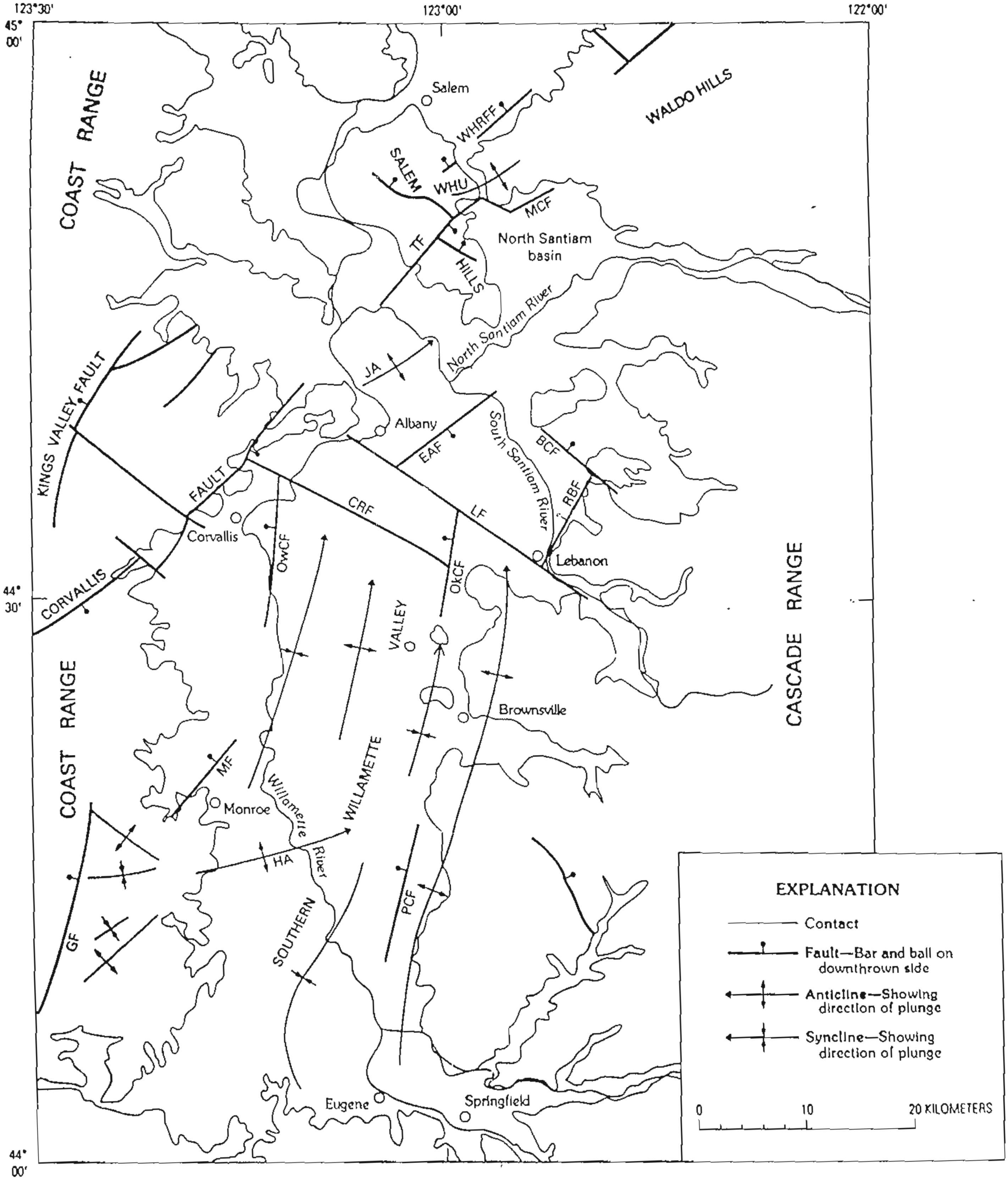


Figure 84. Tectonic map of the southern Willamette Valley, Oregon. Areas underlain by alluvial and fluvial deposits that postdate the Columbia River Basalt Group are unshaded; areas underlain directly by bedrock are shaded. BCF, Beaver Creek fault; CRF, Calapooia River fault; EAF, East Albany fault; GF, Glenbrook fault; HA, Harrisburg anticline; JA, Jefferson anticline; LF, Lebanon fault; MCF, Mill Creek fault; MF, Monroe fault; OwCF, Owl Creek fault; OkCF, Oak Creek fault; PCF, Pierce Creek fault; RBF, Ridgeway Butte fault; TF, Turner fault; WHRFF, Waldo Hills range-front fault; WHU, Waldo Hills uplift.

199

YEATS ET AL 1996

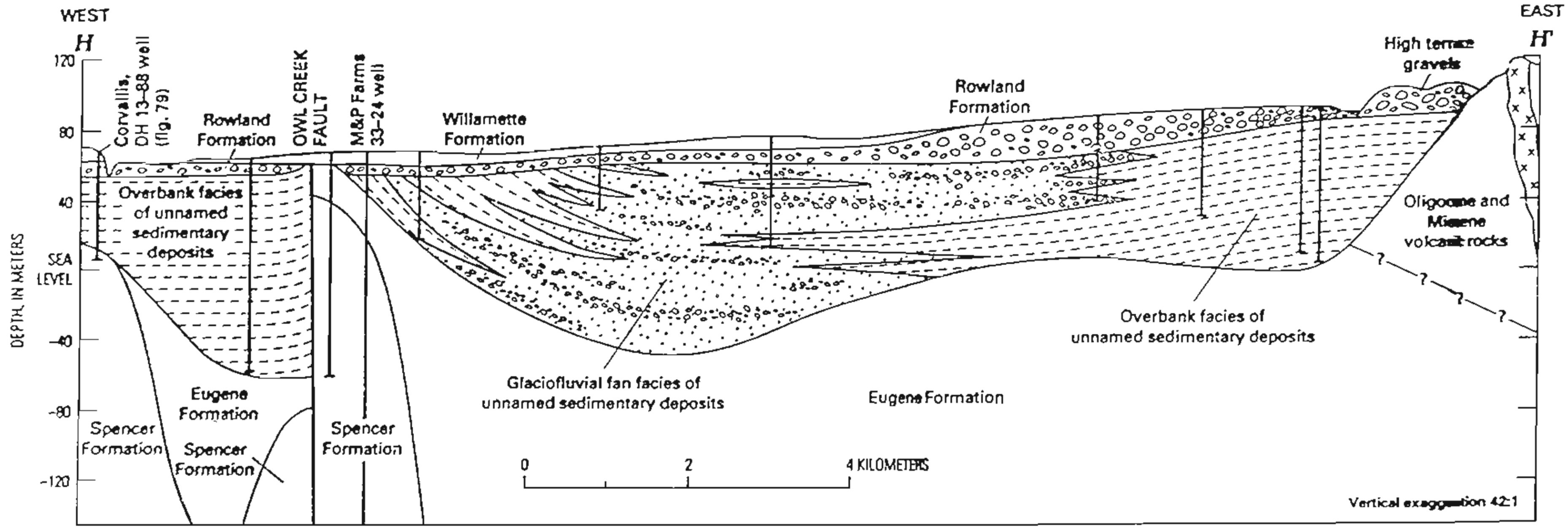
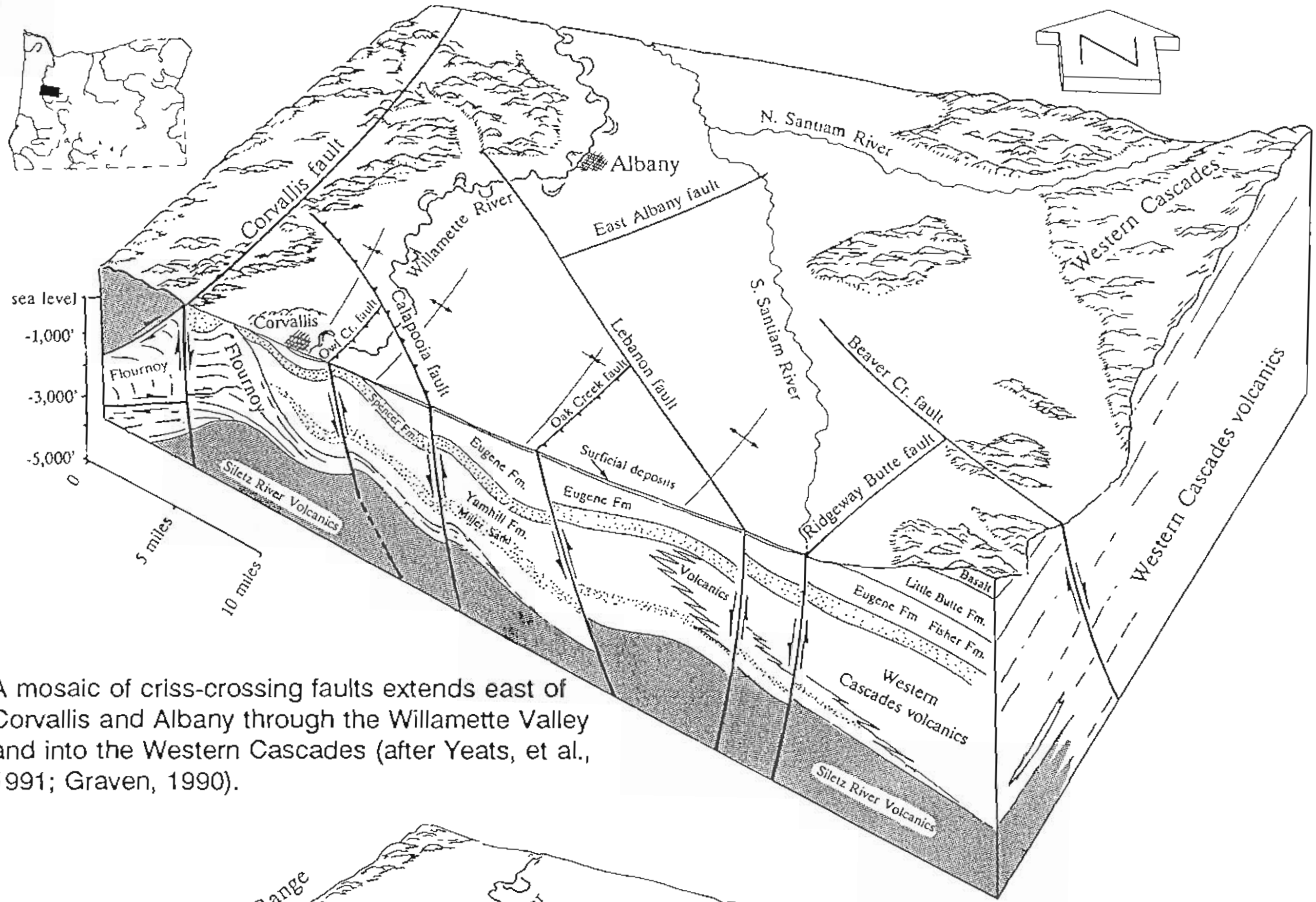
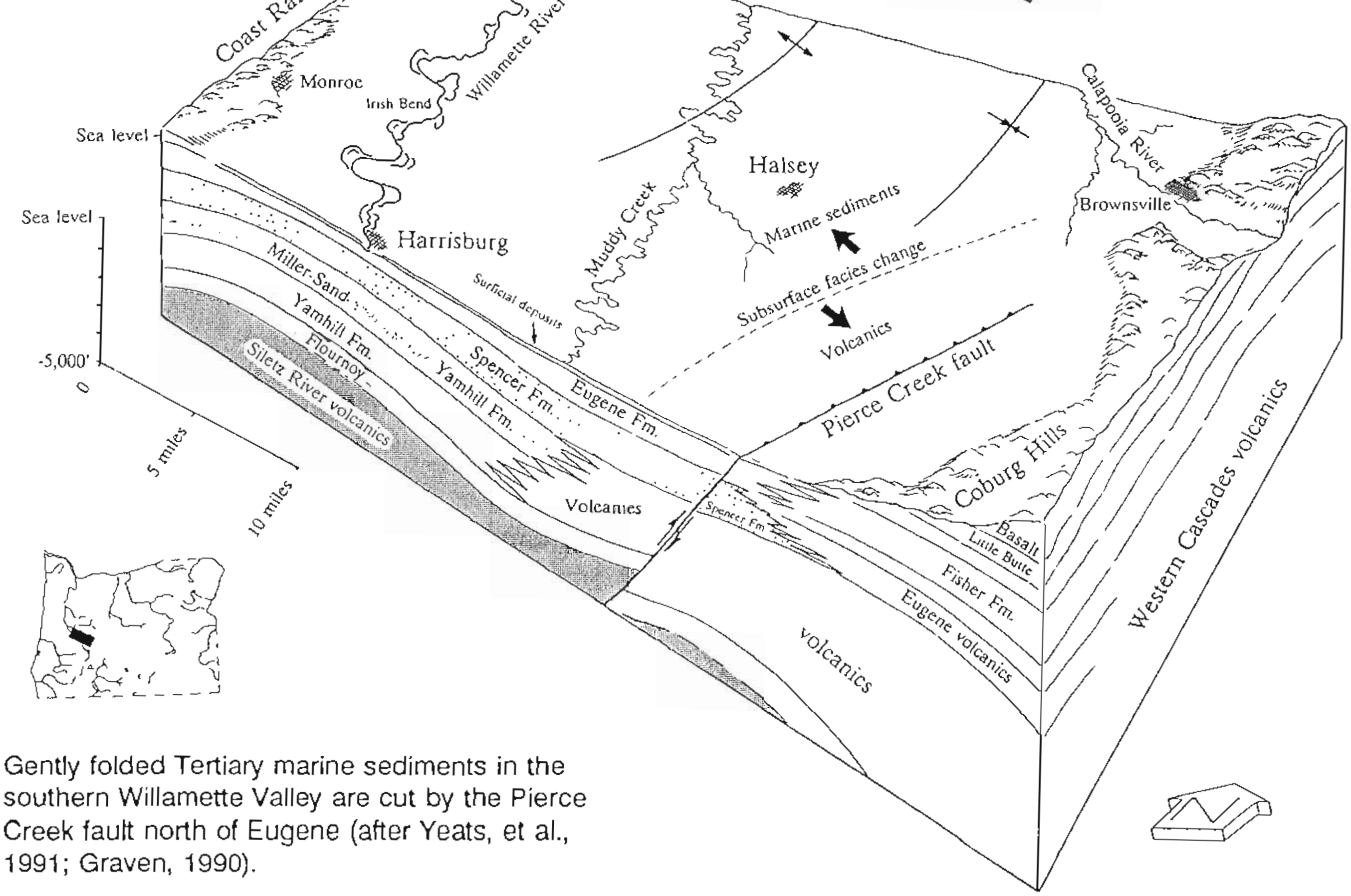


Figure 82. Structural cross section between Corvallis and Lebanon, Oreg., showing channel and overbank facies of unnamed fluvial sedimentary deposits, high-terrace gravels, late Pleistocene outwash deposits of the Rowland Formation, and catastrophic flood deposits of the Willamette Formation. Data are from water wells, engineering bore holes, and petroleum-exploration wells.

12

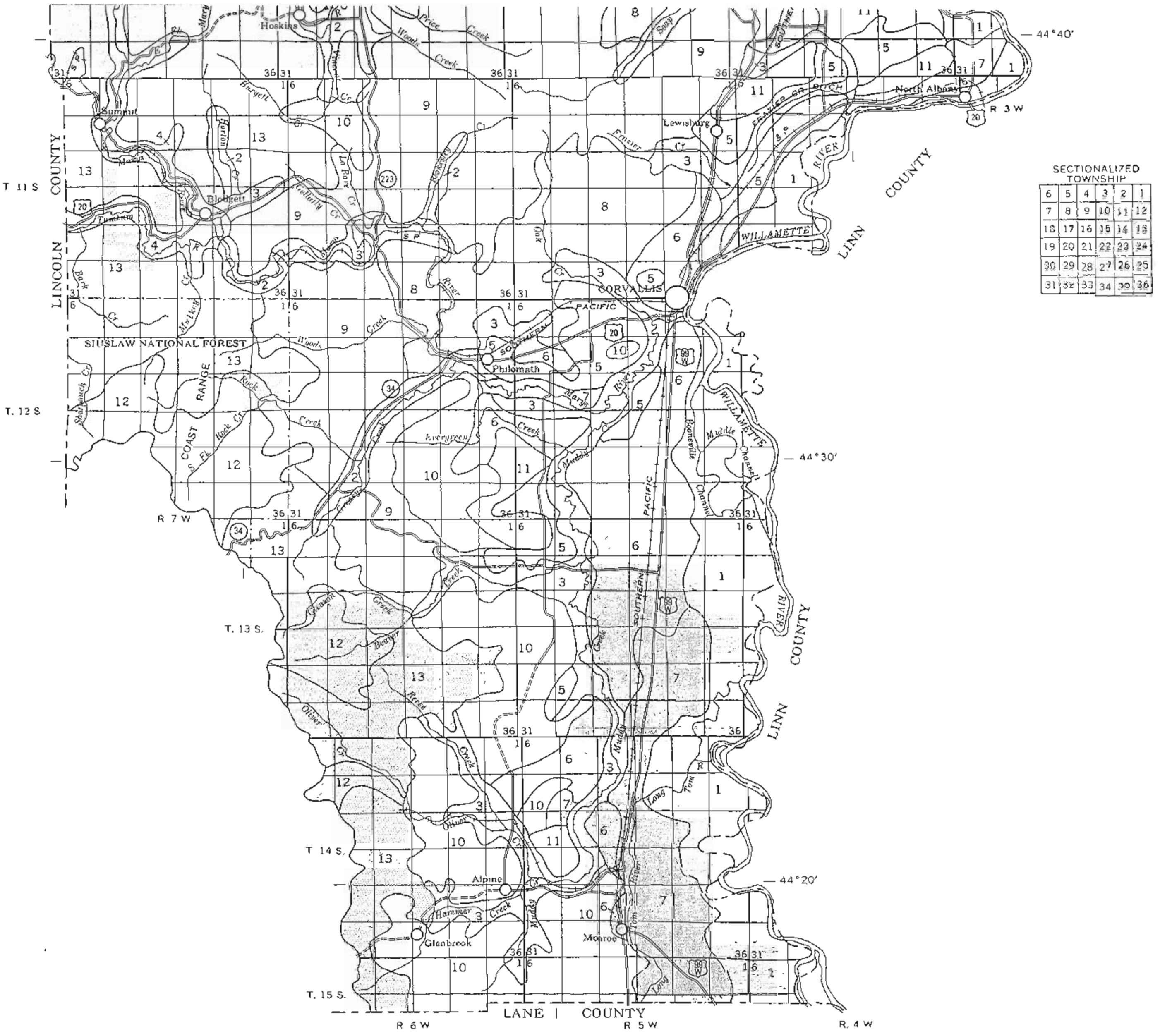


A mosaic of criss-crossing faults extends east of Corvallis and Albany through the Willamette Valley and into the Western Cascades (after Yeats, et al., 1991; Graven, 1990).



Gently folded Tertiary marine sediments in the southern Willamette Valley are cut by the Pierce Creek fault north of Eugene (after Yeats, et al., 1991; Graven, 1990).

ARE WE HAVING FUN YET???



U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
OREGON AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

BENTON COUNTY AREA, OREGON

Scale 1:190,080
1 0 1 2 3 4 Miles

SOIL ASSOCIATIONS *

AREAS DOMINATED BY DEEP, SOMEWHAT EXCESSIVELY DRAINED TO POORLY DRAINED SOILS OF THE BOTTON LANDS

1 Chehalis-Newberg-Cloquato association: Well-drained silty clay loams and silt loams and excessively drained loams and fine sandy loams

2 McAlpin-Abiqua association: Moderately well drained and well drained silty clay loams

3 Waldo-Bashaw association: Poorly drained silty clay loams and clays

4 Winchuck variant-Nehalem association: Well-drained silt loams

AREAS DOMINATED BY DEEP, WELL-DRAINED TO POORLY DRAINED SOILS OF THE WILLAMETTE VALLEY TERRACES

5 Woodburn-Willamette association: Moderately well drained and well drained silt loams

6 Dayton-Amity association: Poorly drained and somewhat poorly drained silt loams

7 Malabon-Coburg association: Well drained and moderately well drained silty clay loams

AREAS DOMINATED BY SHALLOW TO DEEP, WELL-DRAINED TO SOMEWHAT POORLY DRAINED SOILS OF THE FOOTHILLS

8 Dixonville-Philomath association: Moderately deep, well-drained silty clay loams and shallow, well-drained silty clays

9 Price-Ritner association: Deep, well-drained silty clay loams and moderately deep, well-drained gravelly silty clay loams

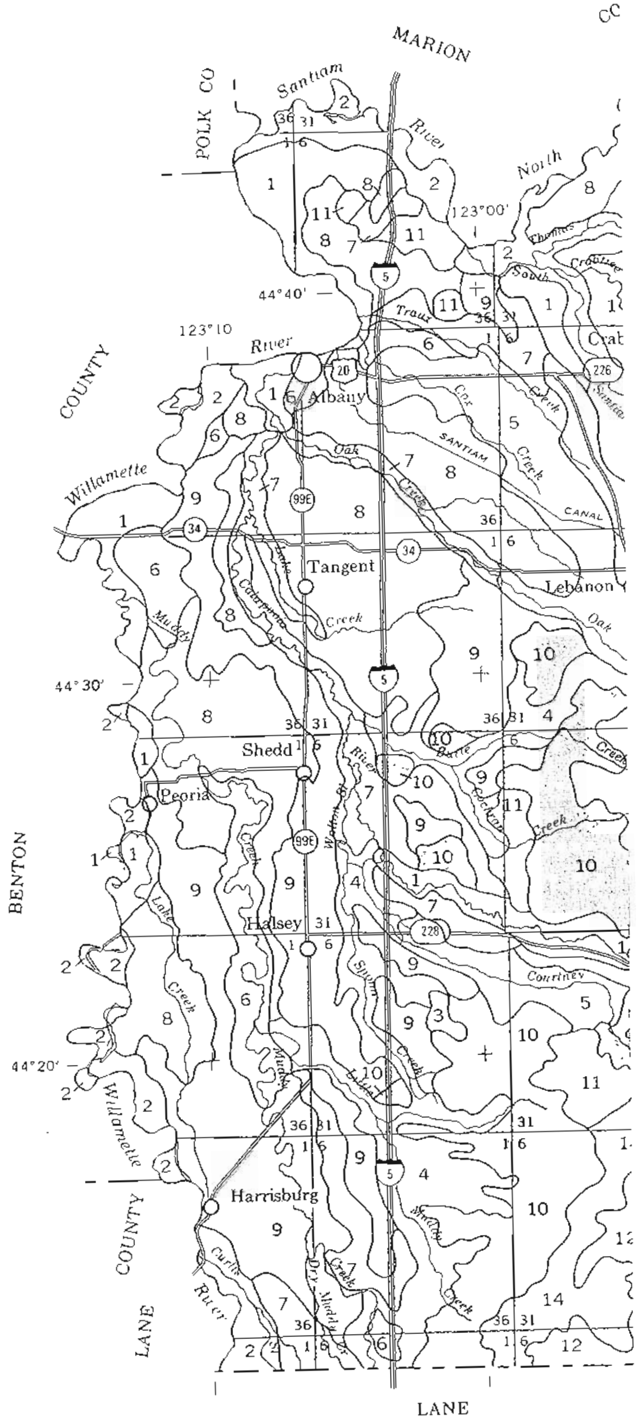
10 Jory-Bellpine association: Deep and moderately deep, well-drained silty clay loams

11 Hazelair-Veneta association: Moderately deep, moderately well drained to somewhat poorly drained silt loams and deep, moderately well drained to well drained silt loams

AREAS DOMINATED BY DEEP AND MODERATELY-DEEP, WELL-DRAINED SOILS OF THE DEEPLY DISSECTED COAST RANGE

12 Klickitat-Marty association: Deep, well-drained gravelly clay loams and gravelly loams

13 Apt-Honeygrove-Bohannon association: Deep, well-drained silty clay loams and moderately deep, well-drained gravelly loams



LEGEND

	DOMINANTLY NEARLY LEVEL, DEEP, SOMEWHAT EXCESSIVELY DRAINED, WELL DRAINED, MODERATELY WELL DRAINED, AND POORLY DRAINED SOILS ON FLOOD PLAINS AND STREAM TERRACES
1	CHEHALIS-McBEE-CHAPMAN Deep, well drained and moderately well drained, nearly level to undulating silty clay loams and loams that formed in recent alluvial deposits
2	NEWBERG-CLOQUATO FLUVENTS Deep, somewhat excessively drained and well drained, nearly level to undulating fine sandy loams, silt loams, gravelly sandy loams, and sandy loams that formed in recent alluvial deposits
3	McALPIN WALDO ABIQUA· Deep, well drained, moderately well drained, and poorly drained, nearly level silty clay loams that formed in recent alluvial deposits
4	BASHAW Deep, poorly drained, nearly level silty clays that formed in alluvial deposits
	DOMINANTLY NEARLY LEVEL, DEEP, WELL DRAINED TO POORLY DRAINED SOILS ON TERRACES OF THE WILLAMETTE VALLEY
5	CLACKAMAS-COURTNEY-SALEM Deep, well drained, somewhat poorly drained, and poorly drained, nearly level gravelly silt loams and gravelly silty clay loams that formed in old alluvial deposits
6	MALABON-COBURG CONSER Deep, well drained to poorly drained, nearly level silty clay loams that formed in old alluvial deposits
7	AWBRIG-COBURG-CONSER Deep, moderately well drained to poorly drained, nearly level silty clay loams that formed in old alluvial deposits
8	WOODBURN-AMITY-WILLAMETTE· Deep, well drained to somewhat poorly drained, nearly level silt loams that formed in old alluvial deposits
9	DAYTON AMITY-HOLCOMB Deep, somewhat poorly drained and poorly drained, nearly level silt loams that formed in old alluvial deposits
	DOMINANTLY GENTLY SLOPING TO STEEP, DEEP TO SHALLOW, WELL DRAINED TO SOMEWHAT POORLY DRAINED SOILS ON THE FOOTHILLS OF THE WESTERN PART OF THE CASCADE RANGE
10	HAZELAIR DIXONVILLE-PHILOMATH Moderately deep and shallow, well drained to somewhat poorly drained, gently sloping to steep silty clay loams, silty clays, and cobbly silty clays that formed in material weathered from basic igneous or sedimentary rock
11	NEKIA-BELLPINE-JORY Deep and moderately deep, well drained, gently sloping to steep silty clay loams that formed in material weathered from basic igneous, sedimentary, or tuffaceous rock
	DOMINANTLY GENTLY SLOPING TO VERY STEEP, DEEP AND MODERATELY DEEP, WELL DRAINED, WARM SOILS OF THE WESTERN PART OF THE CASCADE RANGE
12	HONEYGROVE PEAVINE APT· Deep and moderately deep, well drained, gently sloping to very steep silty clay loams that formed in colluvium derived from sedimentary or tuffaceous rock
13	BLACHLY-KLICKITAT-HARRINGTON Deep and moderately deep, well drained, gently sloping to very steep clay loams, stony loams, and gravelly loams that formed in colluvium derived from sedimentary or basic igneous rock
14	KINNEY-KLICKITAT-HARRINGTON· Deep and moderately deep, well drained, gently sloping to very steep cobbly loams, stony loams, and gravelly loams that formed in glacial till or colluvium derived from basic igneous or tuffaceous rock
	DOMINANTLY GENTLY SLOPING TO EXTREMELY STEEP, DEEP TO SHALLOW, SOMEWHAT EXCESSIVELY DRAINED AND WELL DRAINED, COLD SOILS OF THE WESTERN PART OF THE CASCADE RANGE
15	KEEL-HUMMINGTON-CRUISER Deep and moderately deep, well drained, gently sloping to very steep gravelly silt loams, very gravelly loams, and gravelly loams that formed in colluvium derived from basic igneous rock and volcanic ash
16	HENLINE-YELLOWSTONE-BENSLEY. Deep to shallow, somewhat excessively drained and well drained, gently sloping to extremely steep stony loams and very stony sandy loams that formed in glacial till and colluvium derived from basic igenous rock
17	MOE-FLANE Deep, well drained, gently sloping to very steep gravelly loams that formed in colluvium derived from basic igneous rock, tuffaceous rock, and breccia

COMPILED 1985

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SOIL CONSERVATION SERVICE
OREGON AGRICULTURAL EXPERIMENT STATION
UNITED STATES DEPARTMENT OF INTERIOR
BUREAU OF LAND MANAGEMENT

GENERAL SOIL MAP

LINN COUNTY AREA, OREGON

Scale 1:316,800
1 0 1 2 3 4 5 Miles

McDowell, 1991

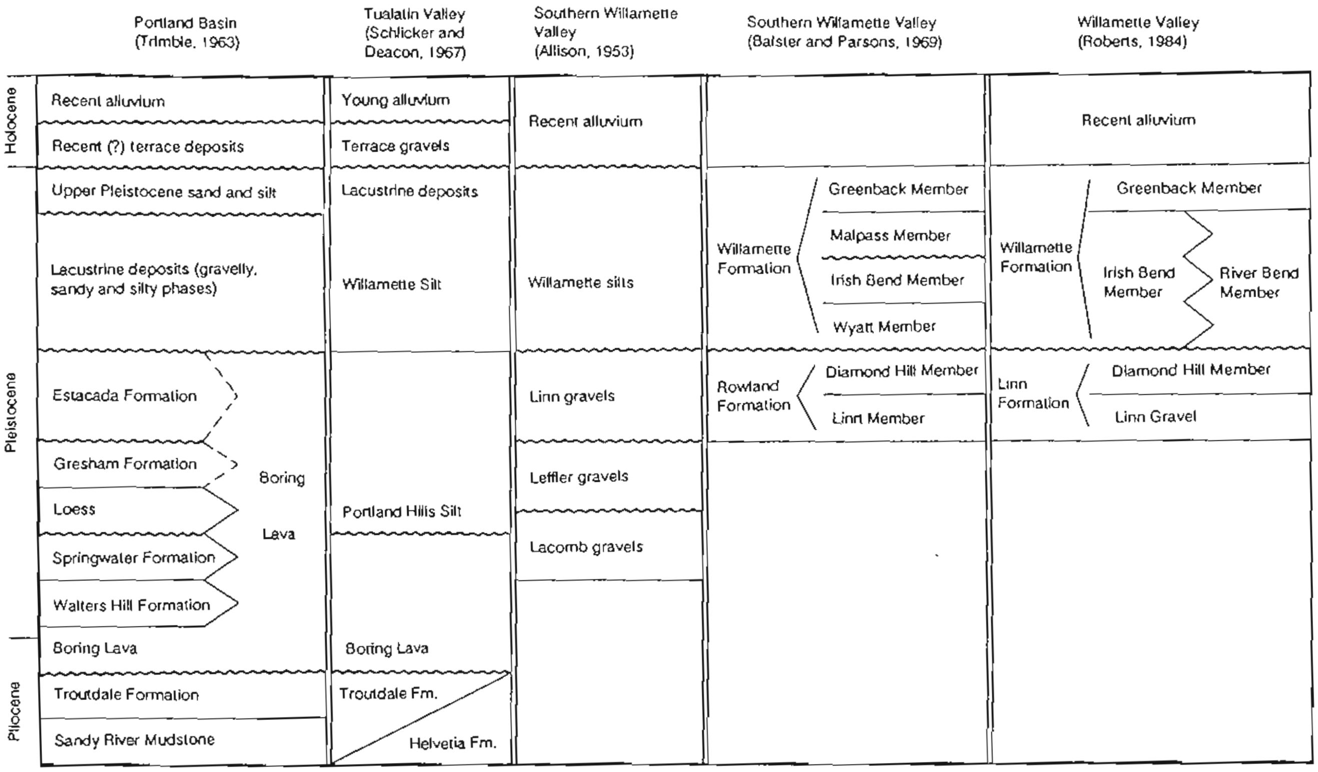


Figure 15. Correlation of Quaternary stratigraphic units of the Willamette Valley and adjacent areas. Alternative stratigraphic schemes for the Willamette Silt/Willamette Formation are shown in the three columns to the right.

Relief / Level / Above / Channel / Grade

[illegible] 100 m

[illegible] 60 m

50 [illegible]

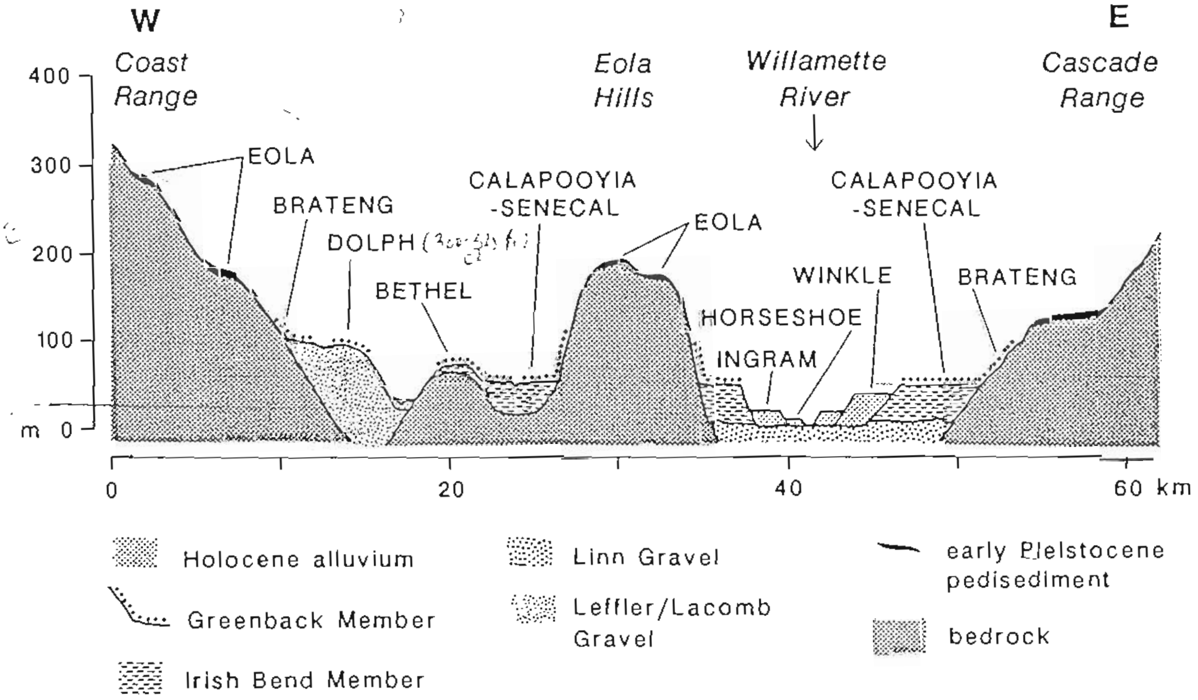
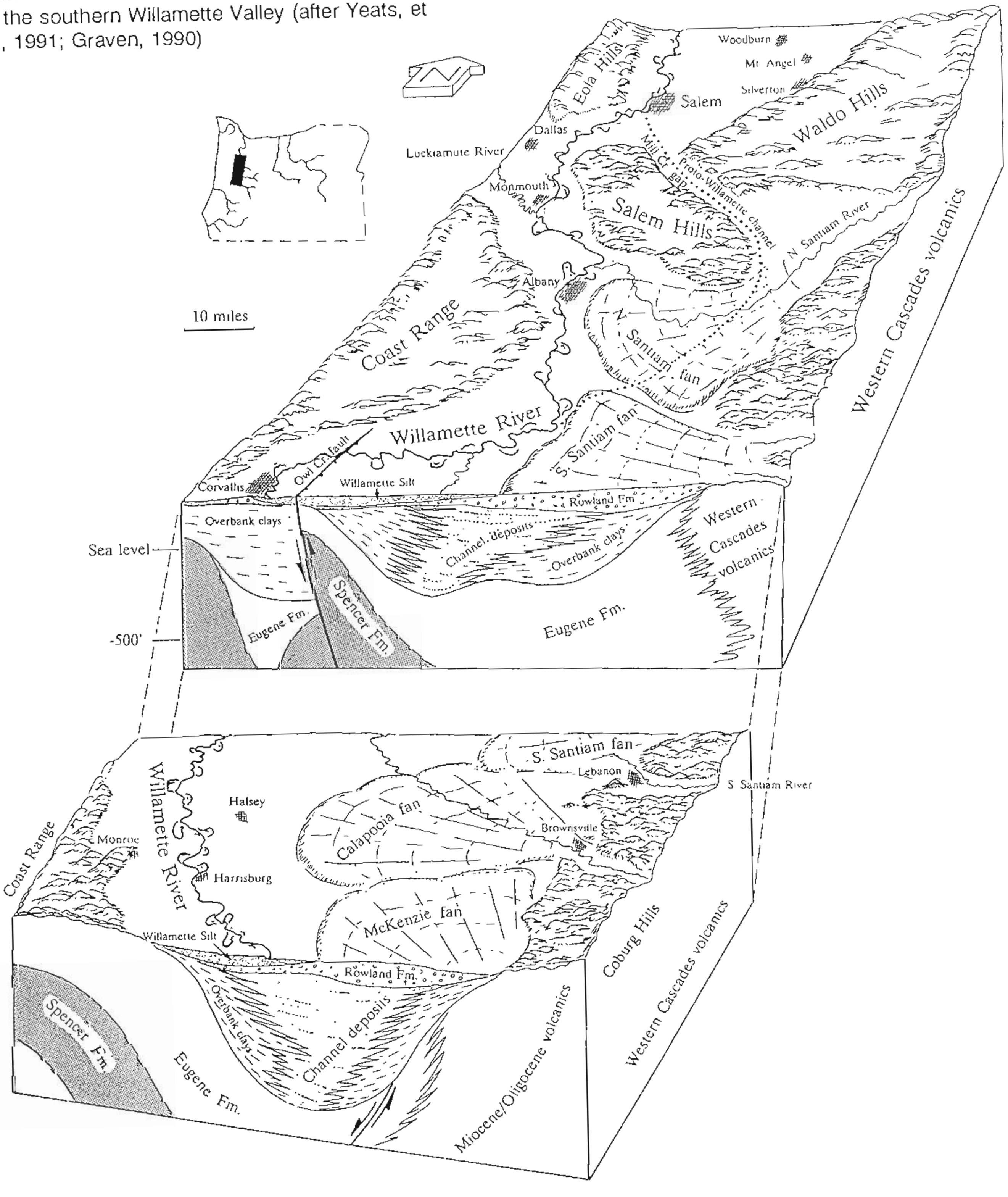


Figure 16. Generalized cross section of geomorphic surfaces at about the latitude of Salem. Subsurface distribution of the Linn Gravels shown here is speculative.

Pleistocene fluvial and flood deposits and structure of the southern Willamette Valley (after Yeats, et al., 1991; Graven, 1990)

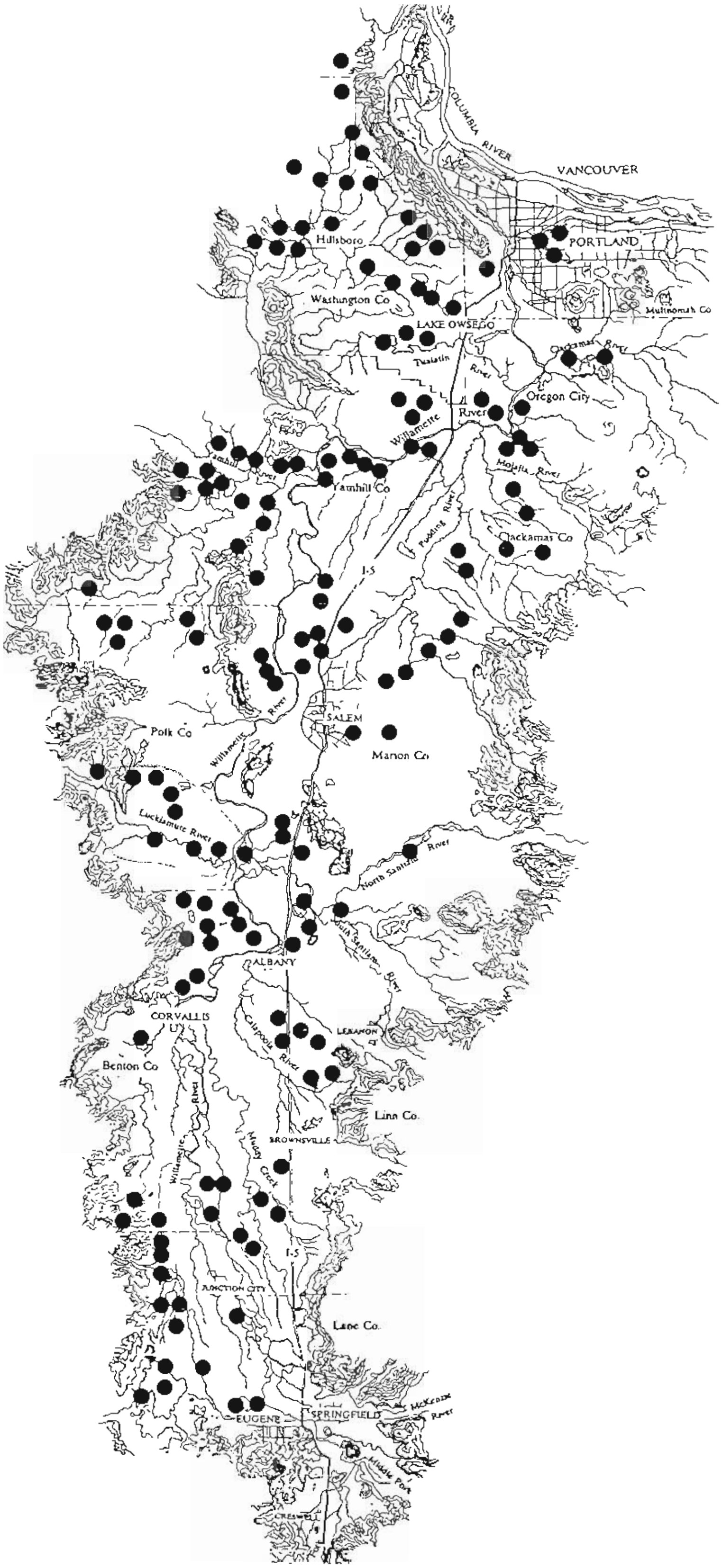


MISSOULA
DIAGRAM

Along with floating icebergs, the rushing waters carried enormous amounts of gravel, sand, silt, and clay in suspension as well as rolling and tumbling along the bottom. In the valley this mass of flood borne sediment was segregated by the narrows at Lake Oswego leaving much of the coarse material in the vicinity of Portland and the Tualatin Valley. A huge sand and gravel bar dammed the Tualatin River for a period to form a small lake 5 miles west of Oswego. Sometime after the flood receeded, the river cut through the bar, and the lake drained, but the basin which had been scoured and deepened by the flooding remains. Sweeping through Lake Oswego, large volumes of the finer sands and silts along with ice rafted boulders that had been collected upstream washed southward into the lower Willamette Valley where they were deposited over the valley floor and lower slopes of the surrounding hills. Sands predominate at Canby and Aurora, and silts, tens of feet thick, were spread as far south as Harrisburg.

The muddy waters filled the central valley temporarily creating Lake Allison. Extending from the Lake Oswego and Oregon City gaps southward almost to Eugene, the surface of this large body of water was over 350 feet above present sea level. The lake formed when the valley was dammed at its north end by ice jams or overwhelmed by the amount of water coming south. Repeated surging as new water came through the gap at Oregon City and ebbing as it drained out kept the lake level in a constant state of fluctuation. The tops of lake silt deposits are commonly 180 to 200 feet in elevation throughout the Tualatin, Yamhill, and Willamette valleys. After a brief interval the water drained back out to the Columbia and the ocean.

The multiple floods had a lasting impact on the channel of the Columbia River and the Willamette Valley. Because the flow of flood water into the Willamette Valley was opposite to the normal northward drainage, the river was disrupted for periods up to two weeks until the waters receeded. Distinct banded layers of Willamette Silt brought into the valley indicate the flood waters must have invaded many times. As flood waters entered the valley they were quickly stripped of coarse sand and gravel when ponding took place. Silt and clay particles, however, remainded suspended in the turbid waters and covered the valley with a layer up to 100 feet deep exposed today along the banks of the Willamette and its tributaries. Surface deposits of these silts are best developed in the southern Willamette Valley where they are subdivided into four members of the Willamette Formation on the basis of subtle mineral and textural differences. Within the Willamette Silts, the Irish Bend Member has been identified as the primary



Glacial erratics carried into the Willamette Valley atop icebergs during large Pleistocene floods are scattered from Eugene to Portland (after Allison, 1935).

21

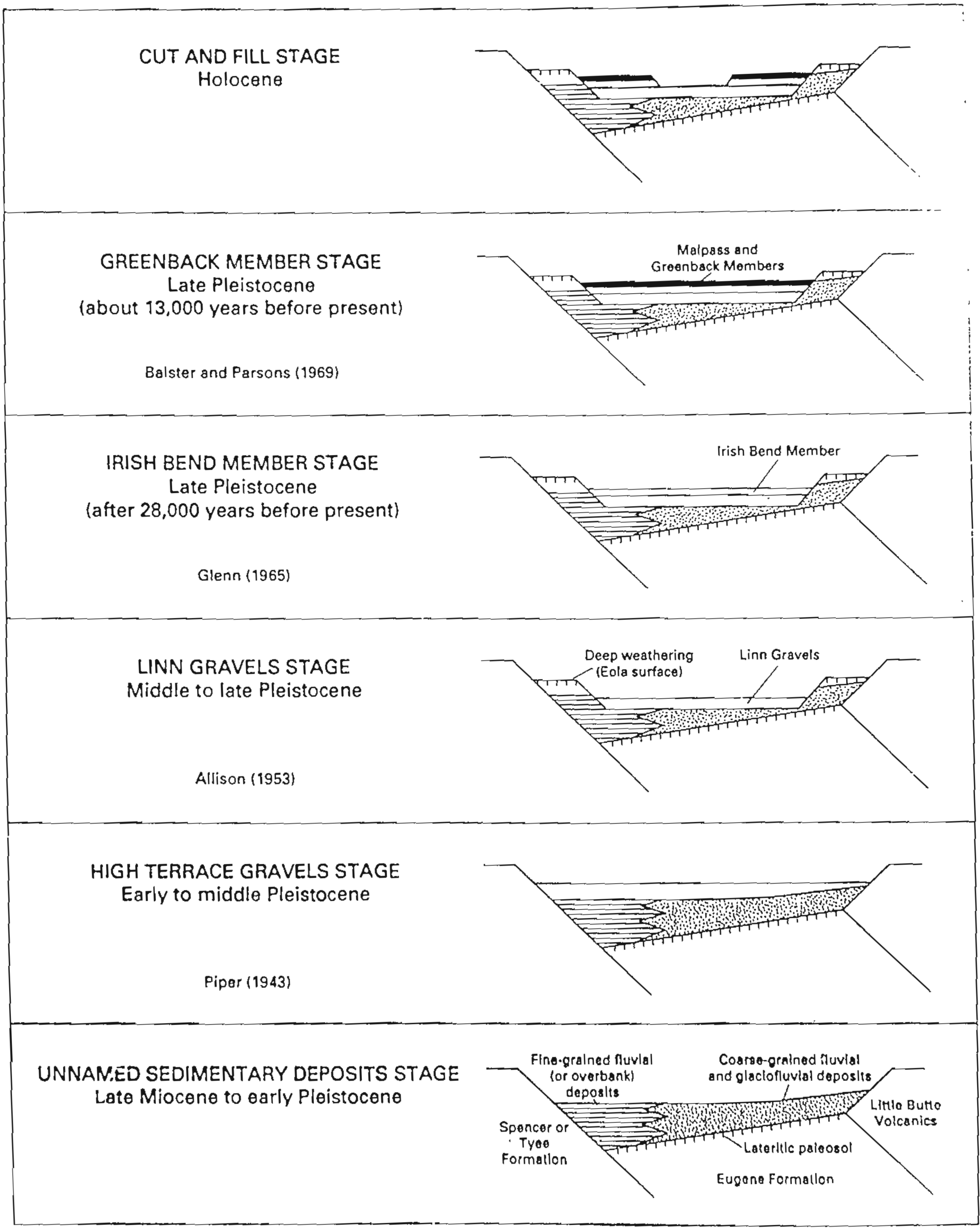


Figure 83. Depositional history of the southern Willamette Valley, Oregon, after Miocene time. Modified from Roberts (1984).

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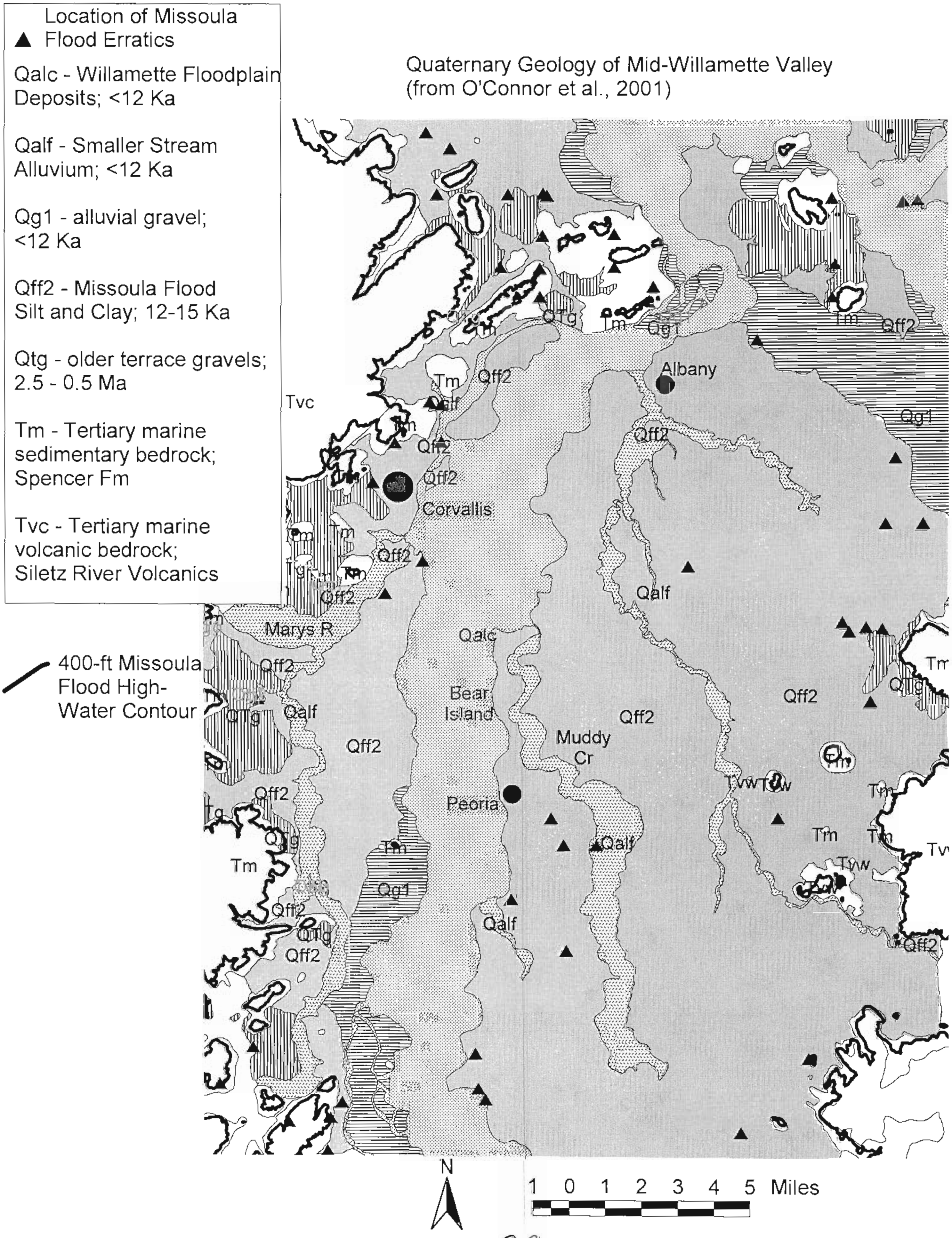

Quaternary Geology of Mid-Willamette Valley (from O'Connor et al., 2001)

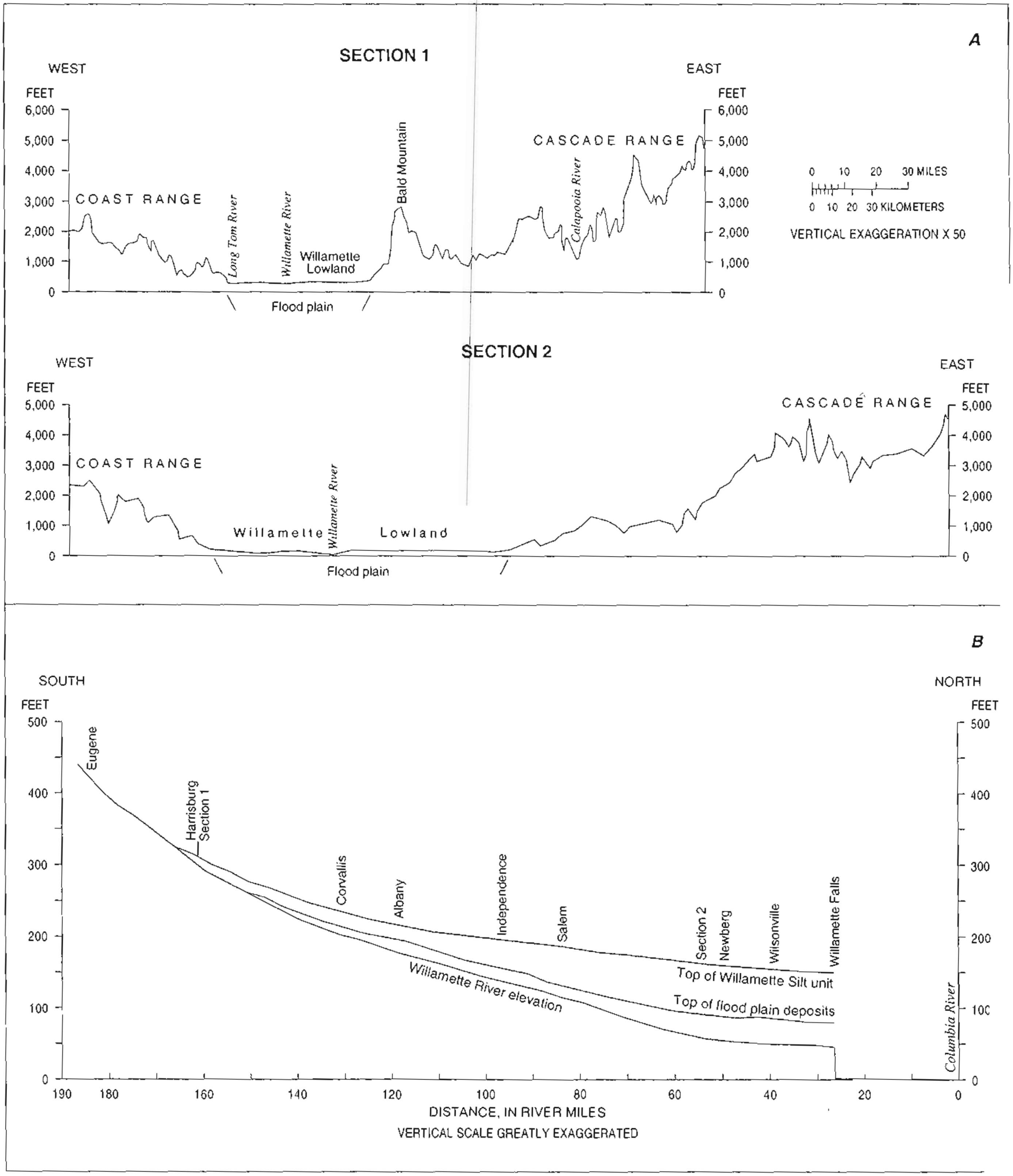

FIGURE 3. (A) Topographic sections west-east across study area and (B) Bank section along Willamette River. (Trace of topographic sections shown on figure 2.)

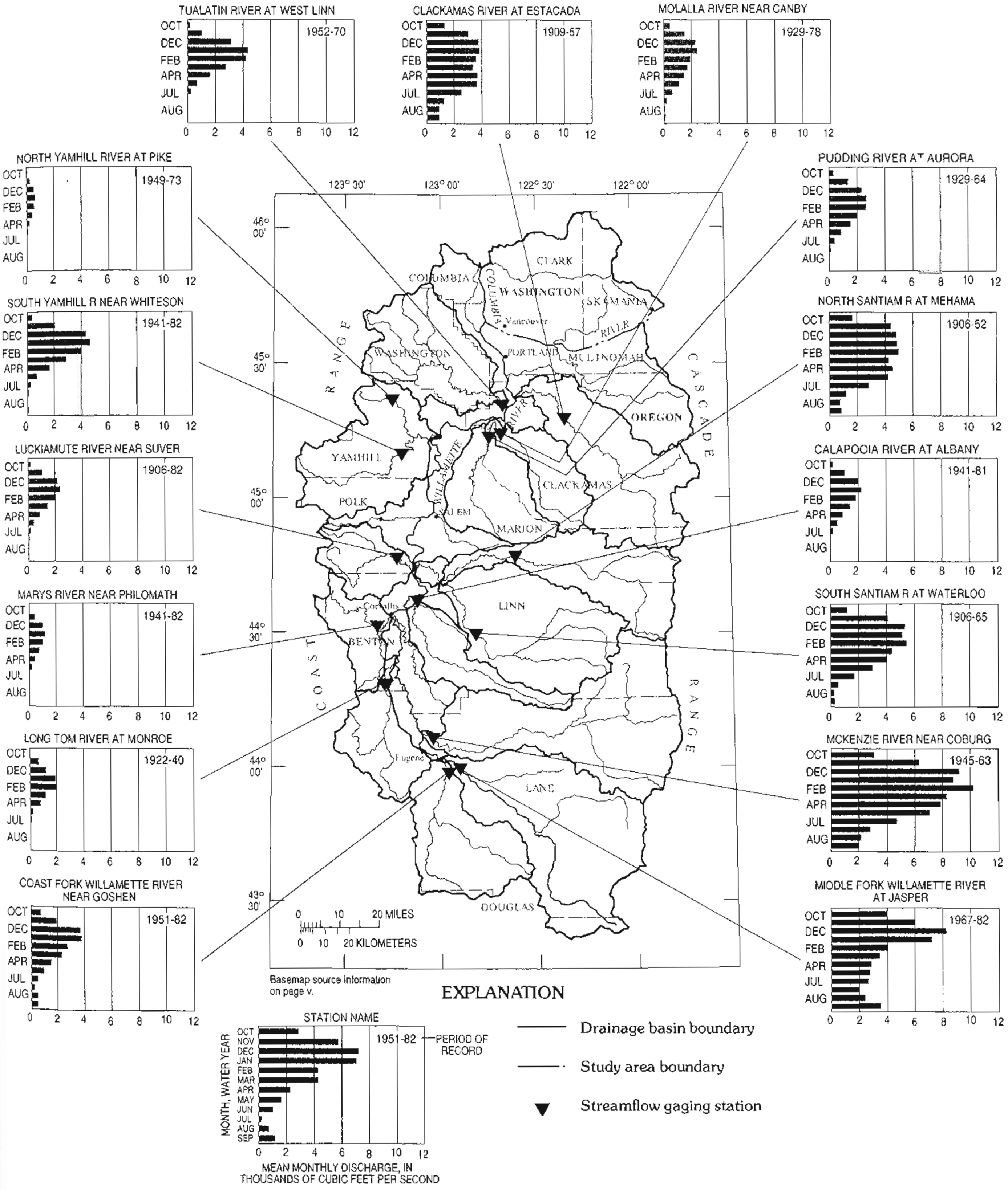

FIGURE 5.—Mean monthly discharge for selected major tributaries of the Willamette River.

TABLE 1.—*Discharge characteristics for selected rivers, Willamette Lowland, Oregon and Washington*

[mi2, square miles; ft3/s, cubic feet per second; --, not regulated]

Name of gaging station[1]	Drainage area (mi2)	Year flow regulation began	Annual discharge (ft3/s) of Minimum	Mean	Maximum	Period record
Middle Fork Willamette River at Jasper	1,340	1953	1,880	4,060	6,220	1967–91
Coast Fork Willamette River near Goshen	642	1942	510	1,600	2,700	1951–91
McKenzie River near Coburg	1,337	1963	4,580	6,020	8,280	1945–63
Long Tom River at Monroe	391	1941	310	700	1,230	1922–40
Marys River near Philomath	159	--	100	460	820	1941–82
Calapooia River at Albany	372	--	240	900	1,510	1941–81
South Santiam River at Waterloo	640	1966	1,700	2,910	4,550	1906–65
North Santiam River at Mehama	655	1953	2,060	3,250	4,330	1906–52
Santiam River at Jefferson	1,790	1953	4,250	7,600	11,630	1908–53
Luckiamute River near Suver	240	--	230	890	1,460	1905–91
South Yamhill River near Whiteson	502	--	460	1,720	3,120	1940–91
North Yamhill River at Pike	67	--	160	240	370	1949–73
Molalla River near Canby	323	--	520	1,160	1,820	1929–78
Pudding River at Aurora	479	--	700	1,220	1,980	1929–64
Tualatin River at West Linn	706	1975	1,050	1,530	2,540	1952–70
Clackamas River at Estacada	671	1958	1,660	2,690	3,920	1909–57
Clackamas River near Clackamas	930	1958	1,720	3,640	5,720	1963–82
Willamette River at Portland	11,100	1941	13,710	32,180	54,490	1973–91
East Fork Lewis River near Heisson	125	--	417	757	1,117	1930–79

[1] All rivers located in Oregon except the East Fork Lewis River.

The stream discharge is derived principally from rainfall runoff. Additionally, snowmelt from some of the eastern tributaries provides increased flows into the late spring, and ground-water discharge contributes to streamflow as well (particularly to most stream reaches in the lowland areas). The discharge pattern coincides with the precipitation pattern. Although the total amount of runoff is very different between wet and dry years (Oster, 1968), the seasonal pattern of runoff in both wet and dry years is similar. Generally, the initial rains of the early fall recharge the soil zone and contribute little runoff. After the soil has reached field capacity, runoff begins to increase. By November, runoff closely corresponds to the pattern of precipitation, and the largest monthly flows occur throughout the study area between November and April (fig. 5)—a direct result of heavy rains and some early snowmelt. The combination of warm winter temperatures and heavy rains falling on snow generally results in the largest rates and volumes of runoff, as exemplified by the disastrous floods of December 1964 and February 1996. Runoff also is large during the spring, when streams draining the Cascade Range carry large volumes of snowmelt. Throughout the study area, streams recede to minimum flows between July and October, when precipitation is lowest and the temperature is relatively high.

There are marked differences in the volume ar seasonal distribution of tributary discharge (Friday ar Miller, 1984). The differences are a function of whi mountain range a stream drains. The major easte tributaries (Clackamas, Molalla, Pudding, Nor Santiam, South Santiam, Calapooia, McKenzie, and Mi dle Fork Willamette Rivers) drain about 60 percent of t Willamette River Basin and account for about 75 perce of the mean annual discharge of the Willamette Riv Basin (table 1, using data from the Santiam Riv at Jefferson gage to represent the combined influence the North Santiam and South Santiam River These eastern tributaries contribute more (and seasona prolonged) discharge compared with the western trib taries because they have drainage basins that (1) a larger, (2) are at higher altitudes, (3) receive more rai fall, (4) receive more snow, (5) are capable of receivi and transmitting more ground water, and (6) conta permanent glaciers.

The major western tributaries (Tualatin, North Yai hill, South Yamhill, Luckiamute, Marys, and Long To Rivers) drain the Coast Range and its foothills a account for about 17 percent of the mean annual d charge of the Willamette River Basin (table 1). The Coa Range was not subject to glaciation and, as a resu does not contain large glacially derived alluvial valle that store and transmit large quantities of ground wate

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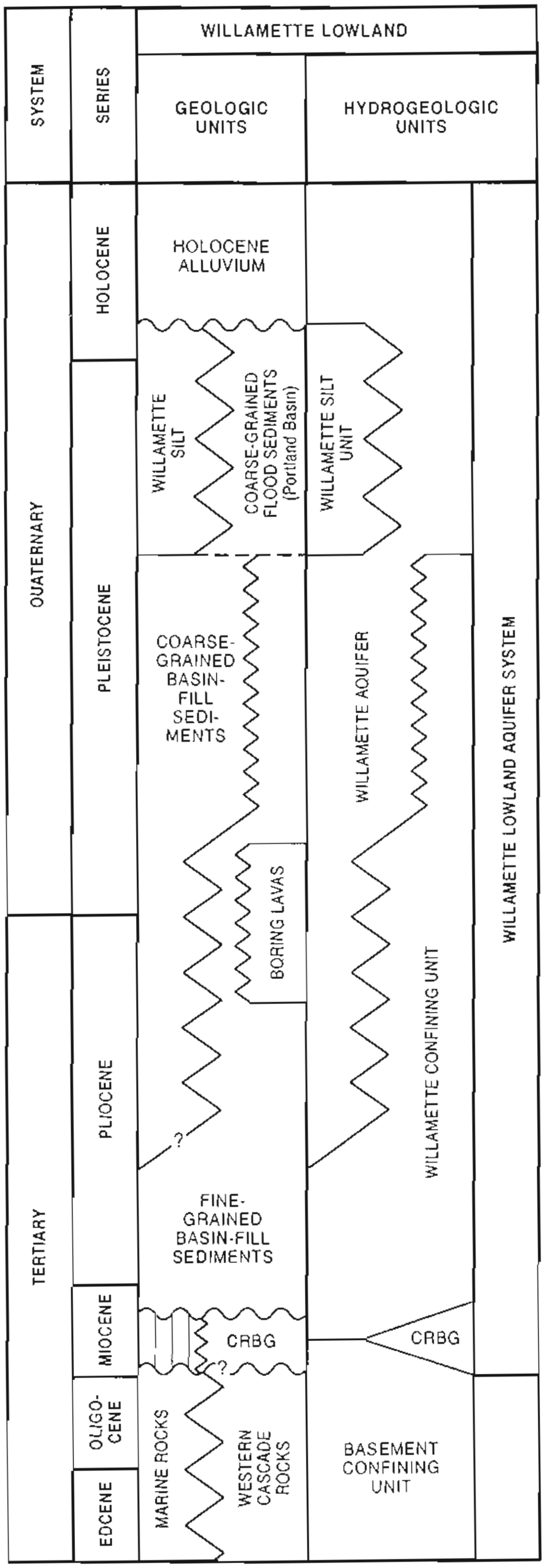
REGIONAL HYDROGEOLOGIC UNITS

Five regional hydrogeologic units, each consisting of one or more recognized geologic units, have been defined for this study (Gannett and Caldwell, 1998). Geologic units that have similar overall hydrogeologic characteristics and are adjacent or occupy similar stratigraphic positions were combined into a single hydrogeologic unit. The five hydrogeologic units, from oldest to youngest, are (1) the basement confining unit, (2) the Columbia River basalt aquifer, (3) the Willamette confining unit, (4) the Willamette aquifer, and (5) the Willamette Silt unit. These units each have relatively uniform and distinct hydrologic properties. A correlation chart showing the relation between hydrogeologic and geologic units is presented in figure 7. A map of the surficial extent of the regional hydrogeologic units (fig. 8) and the two hydrogeologic sections (fig. 9) show the three-dimensional framework of the aquifer system.

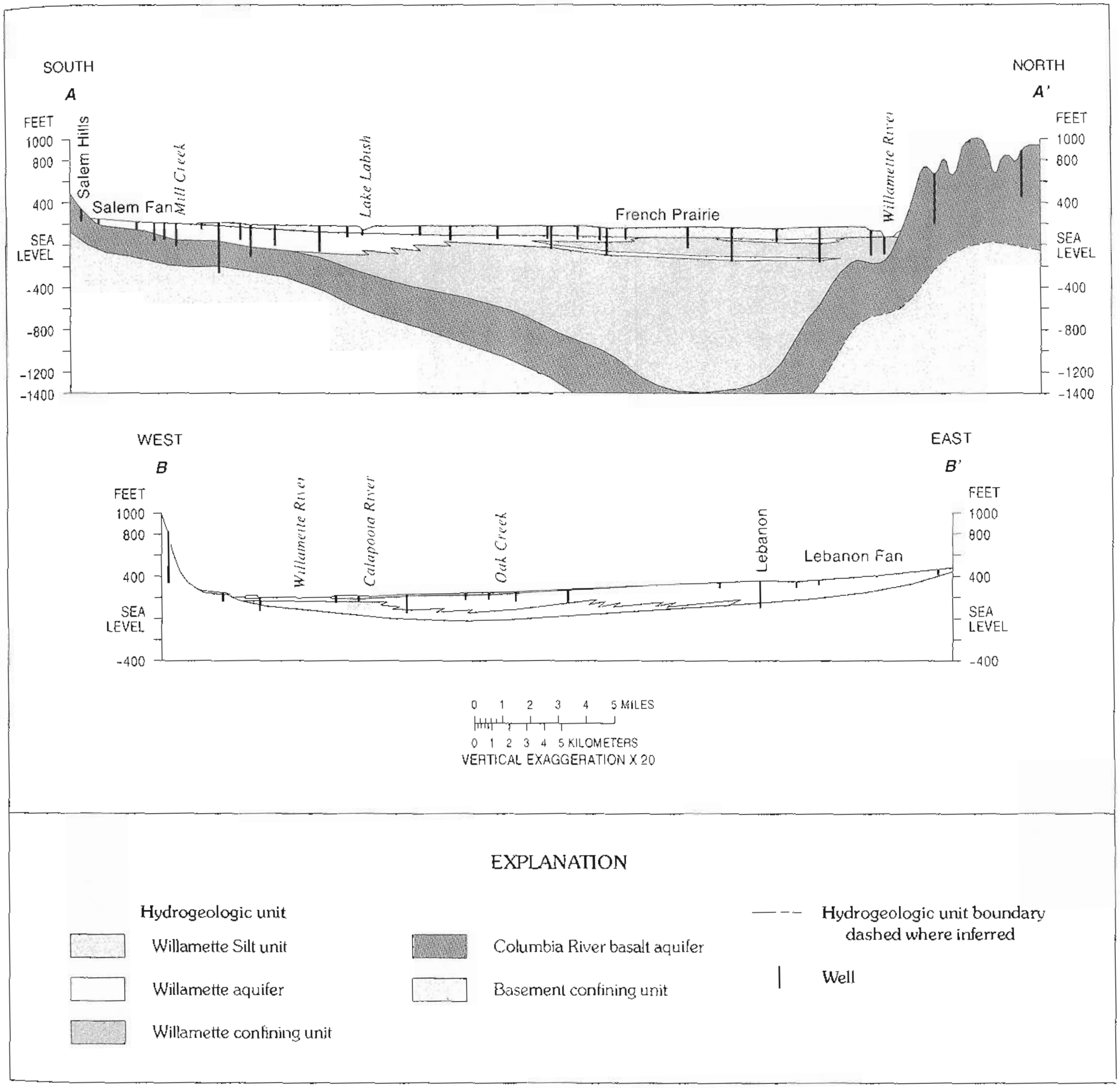
In their work in the Portland Basin, Swanson and others (1993) included the Boring Lava in the Troutdale gravel aquifer (considered to be part of the Willamette aquifer in this regional study). Where the Boring Lava is most extensive in the study area—on the plateau between the Portland Basin and the central Willamette Valley—it overlies fine-grained sediment of the Willamette confining unit and is hydraulically distinct from the Willamette aquifer. Because a number of wells yield water from the Boring Lava, the formation is shown on figure 8; however, the formation is limited in extent and is not considered a regional hydrogeologic unit for this study.

The basement confining unit forms the lateral and basal boundary to the Willamette Lowland aquifer system. The basement confining unit includes all the stratigraphic units that underlie either the Columbia River Basalt Group in the northern part of the lowland or the basin-fill deposits in the southern part (fig. 9). The unit is composed of Tertiary marine sedimentary rocks and Eocene volcanic rocks of the Coast Range and volcanic rocks of the western Cascade Range. Tertiary marine sandstone, siltstone, claystone, and shale are exposed in the Coast Range and underlie most of the southern and central Willamette Valley, the entire Tualatin Basin, and the western part of the Portland Basin. Marine sedimentary rocks and western Cascade volcanic rocks are exposed in the Cascade Range foothills and underlie the eastern parts of the southern and the central Willamette Valley and the eastern part of the Portland Basin (fig. 8). The contact relation between marine strata and Cascade Range volcanic rocks beneath the Willamette Lowland is poorly known.



NOTE CRBG = COLUMBIA RIVER BASALT GROUP

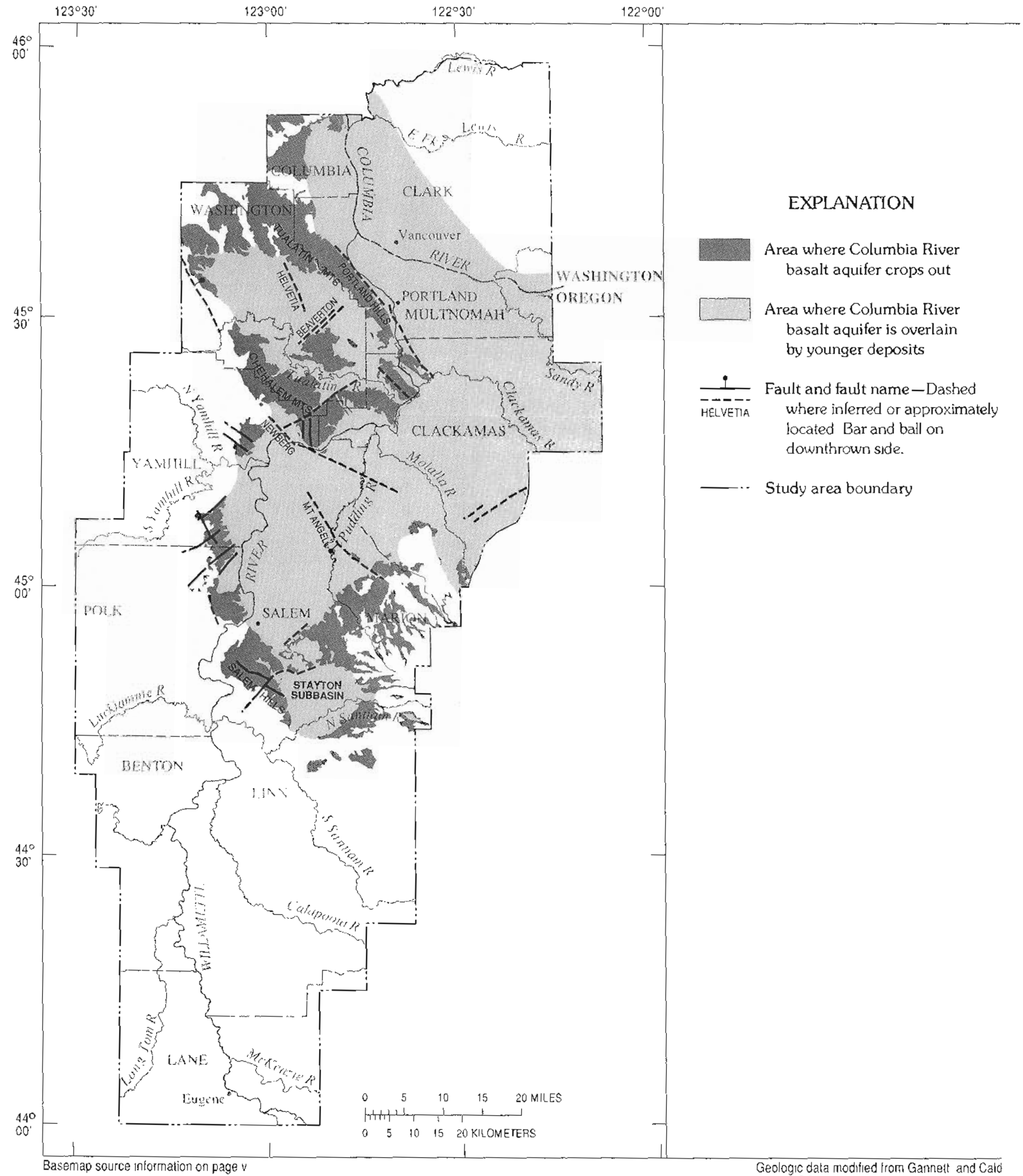
FIGURE 7.—Regional relation between generalized geologic units and hydrogeologic units in the Willamette Lowland.



Geologic data modified from Gannett and Caldwell, 1998, USGS Professional Paper 1424A

FIGURE 9.—Hydrogeologic sections. (*A–A'*–North-south section in central Willamette Valley. *B--B'*–East-west section in southern Willamette Valley. Trace of sections shown on figure 8.)

The Columbia River basalt aquifer overlies the basement confining unit over 2,500 mi^2 of the northern part of the Willamette Lowland (fig. 10) and consists of layers of basalt flows of the Columbia River Basalt Group. The thickness of the aquifer generally is several hundred feet but locally is as much as 1,000 ft. The top of the Columbia River basalt aquifer was mapped (Gannett and Caldwell, 1998) by using information from water well logs, oil and gas exploration well logs, and seismic reflection interpretations from Werner (1990) and Yeats and others (1991). The top of the Columbia River basalt aquifer coincides with the structure contours of the base of the Willamette confining unit in the northern part of the lowland (fig. 11).



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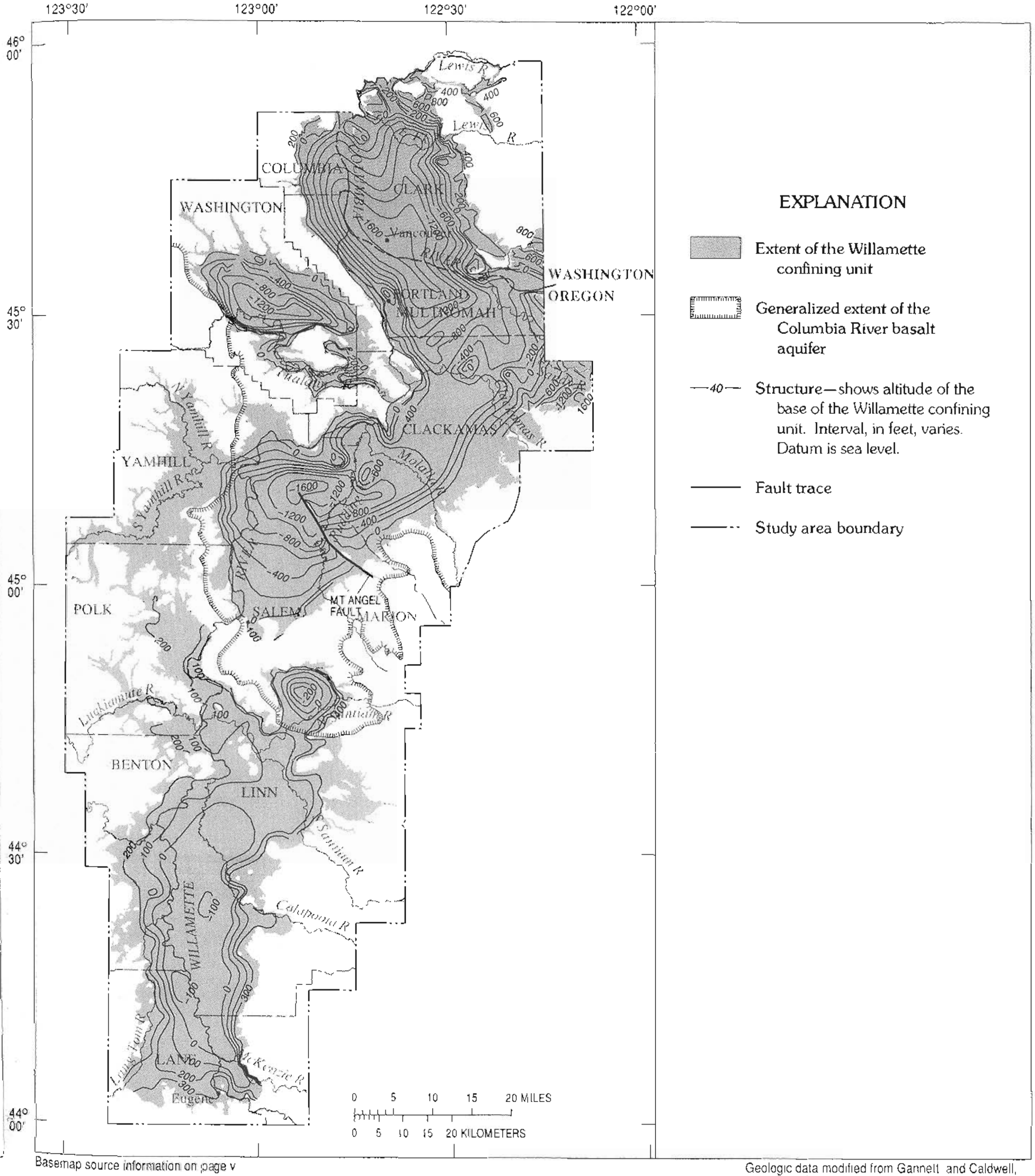
Geologic data modified from Gannett and Caldwell, 1998, USGS Professional Paper 1424-A.

FIGURE 10.—Extent of the Columbia River basalt aquifer.



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Geologic data modified from Gannett and Caldwell, 1998, USGS Professional Paper 1424-A

FIGURE 11.—Altitude of the base of the Willamette confining unit.

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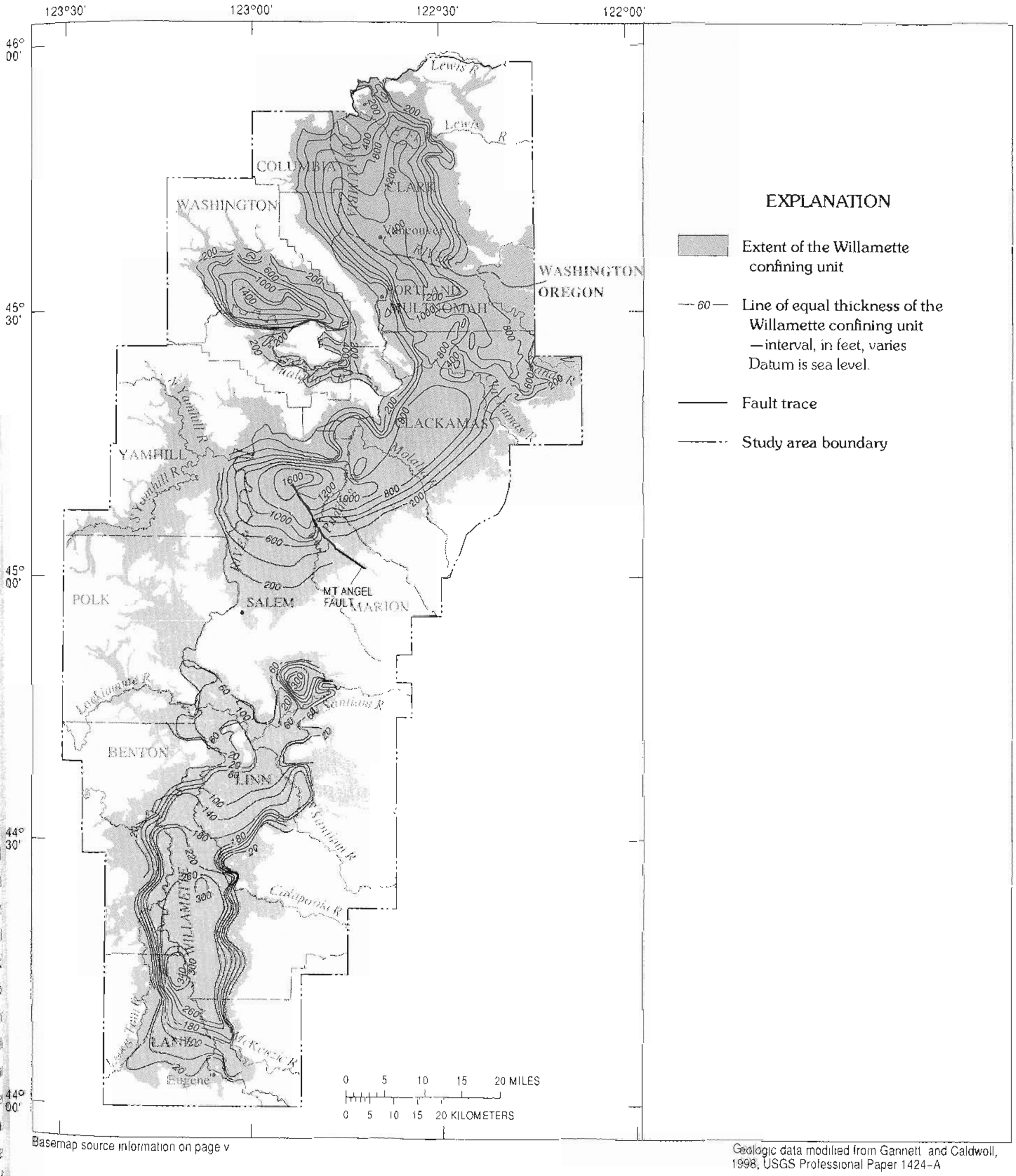

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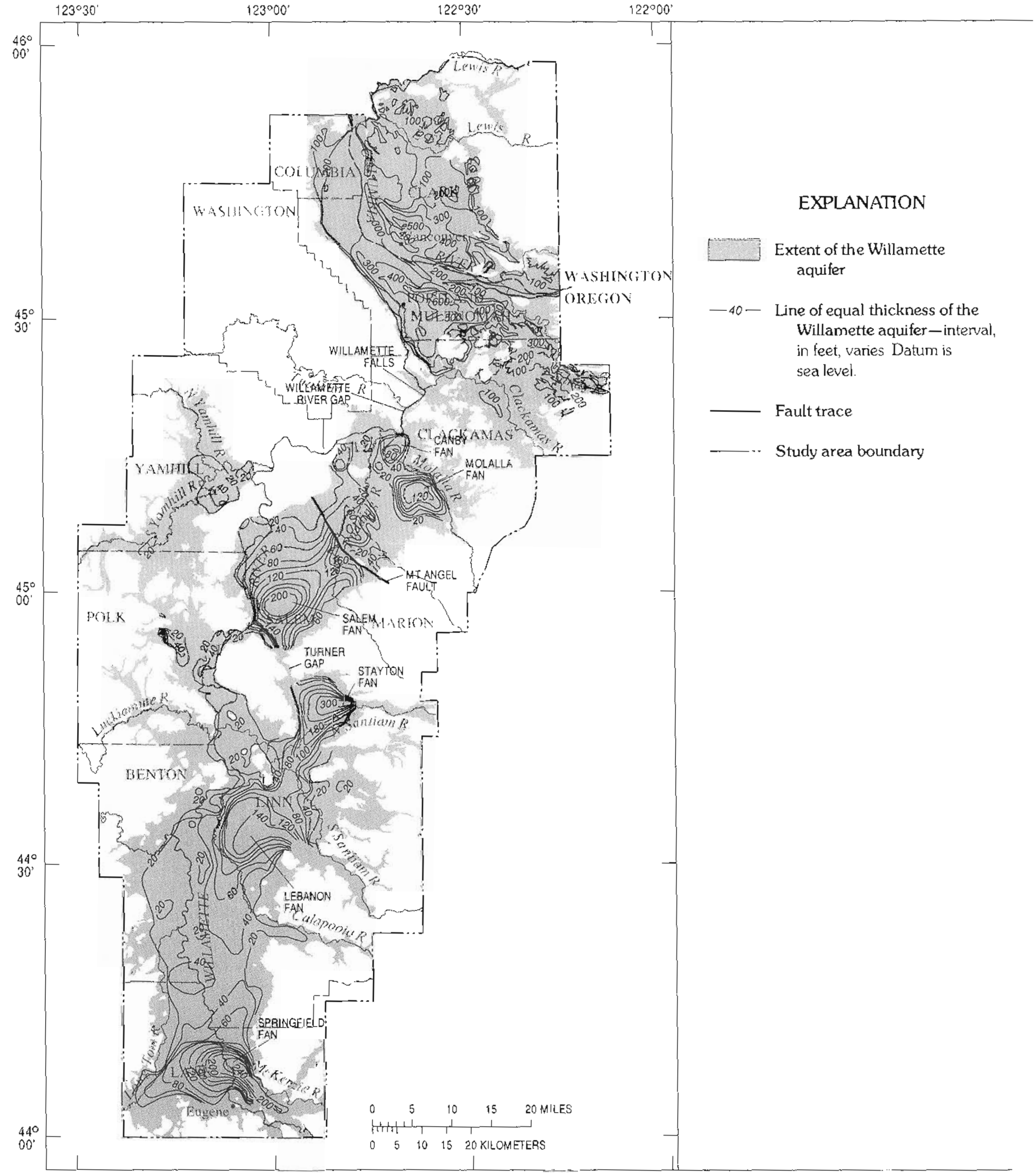
Geologic data modified from Gannett and Caldwell, 1998, USGS Professional Paper 1424-A

FIGURE 12.—Extent and thickness of the Willamette confining unit.



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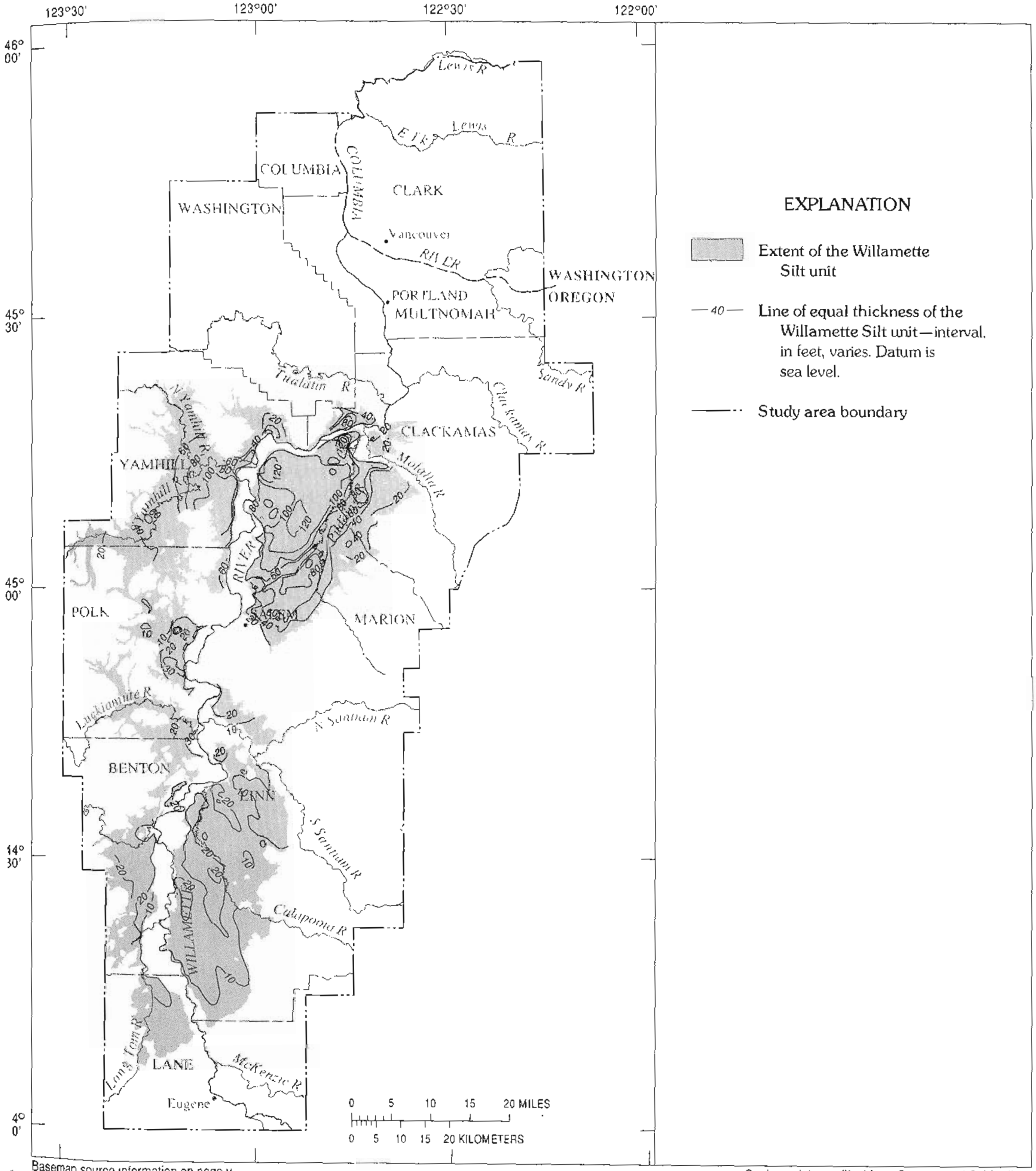
Geologic data modified from Gannett and Cal
1998, USGS Professional Paper 1424–A.

FIGURE 13.—Extent and thickness of the Willamette aquifer.



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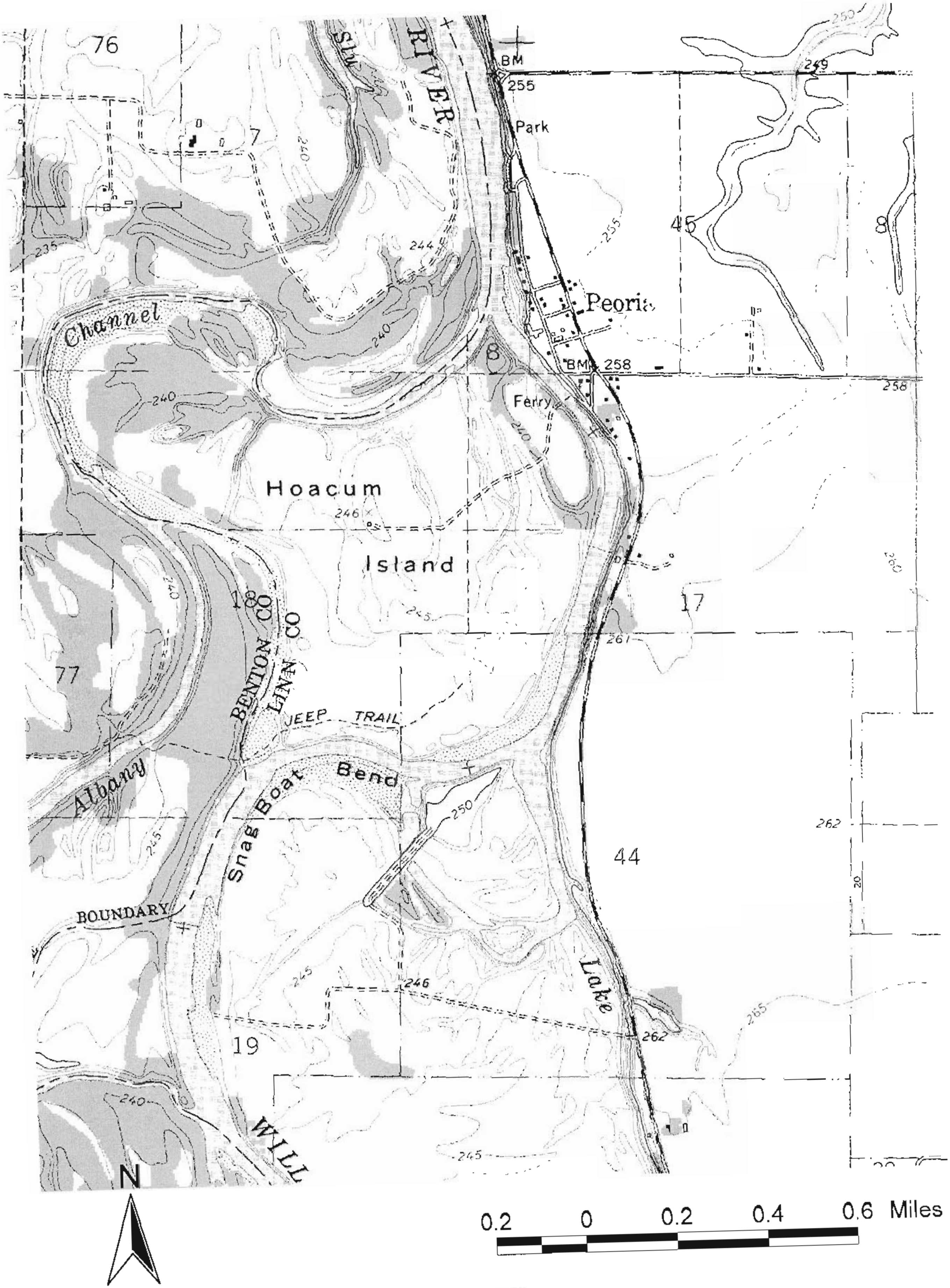
Geologic data modified from Gannett and Caldwell, 1998, USGS Professional Paper 1424-A

FIGURE 14.—Extent and thickness of the Willamette Silt unit.


76
Slw
RIVER
BM
255
Park
7
240
45
8
235
244
255
Peoria
Channel
240
8
BM 258
258
Ferry
240
240
Hoacum
246
Island
260
18
BENTON CO
LINN CO
245
17
261
77
JEEP TRAIL
Albany
Snag Boat Bend
250
262
245
44
20
BOUNDARY
Lake
245
246
265
262
19
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WILL
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249
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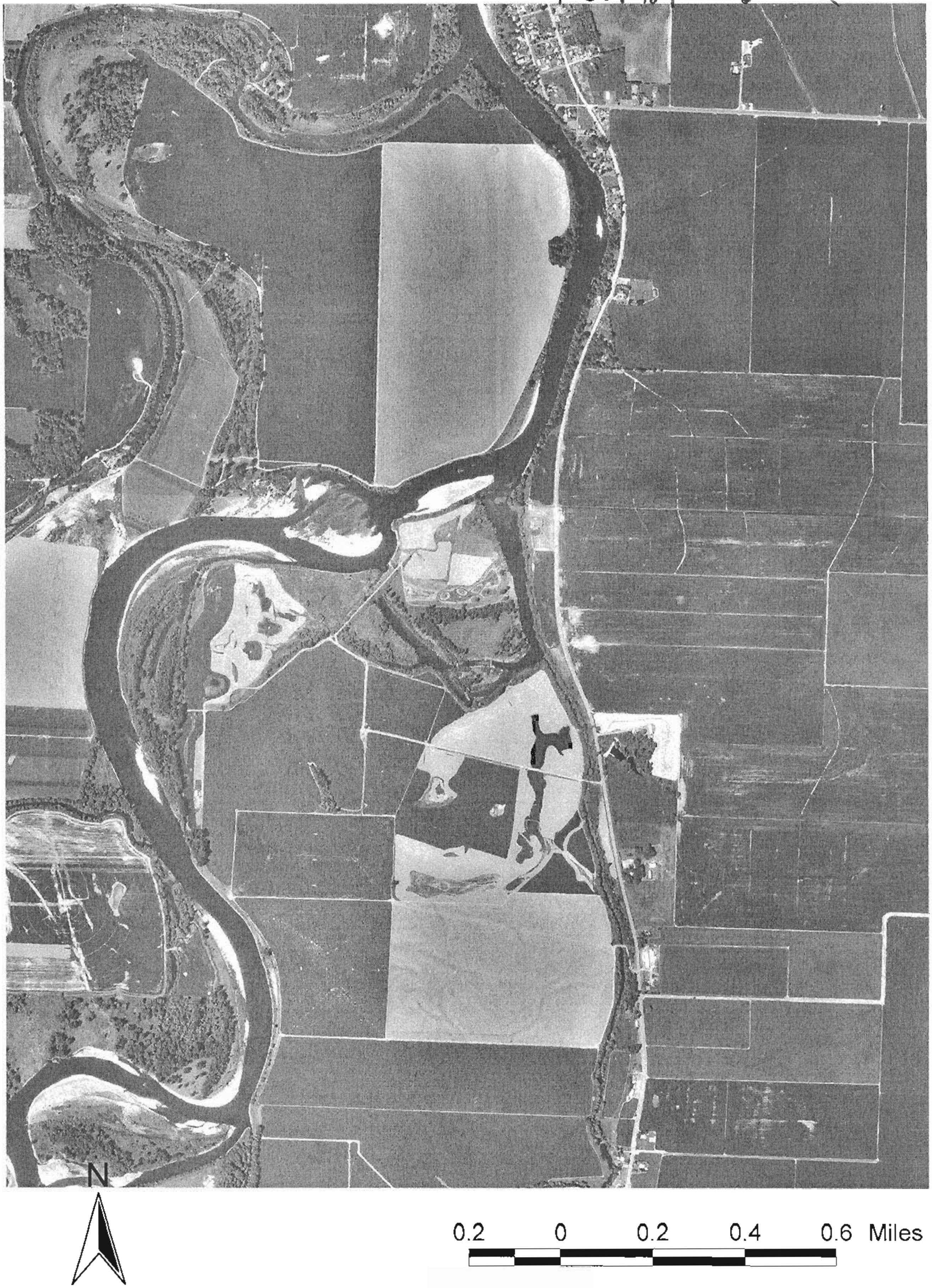

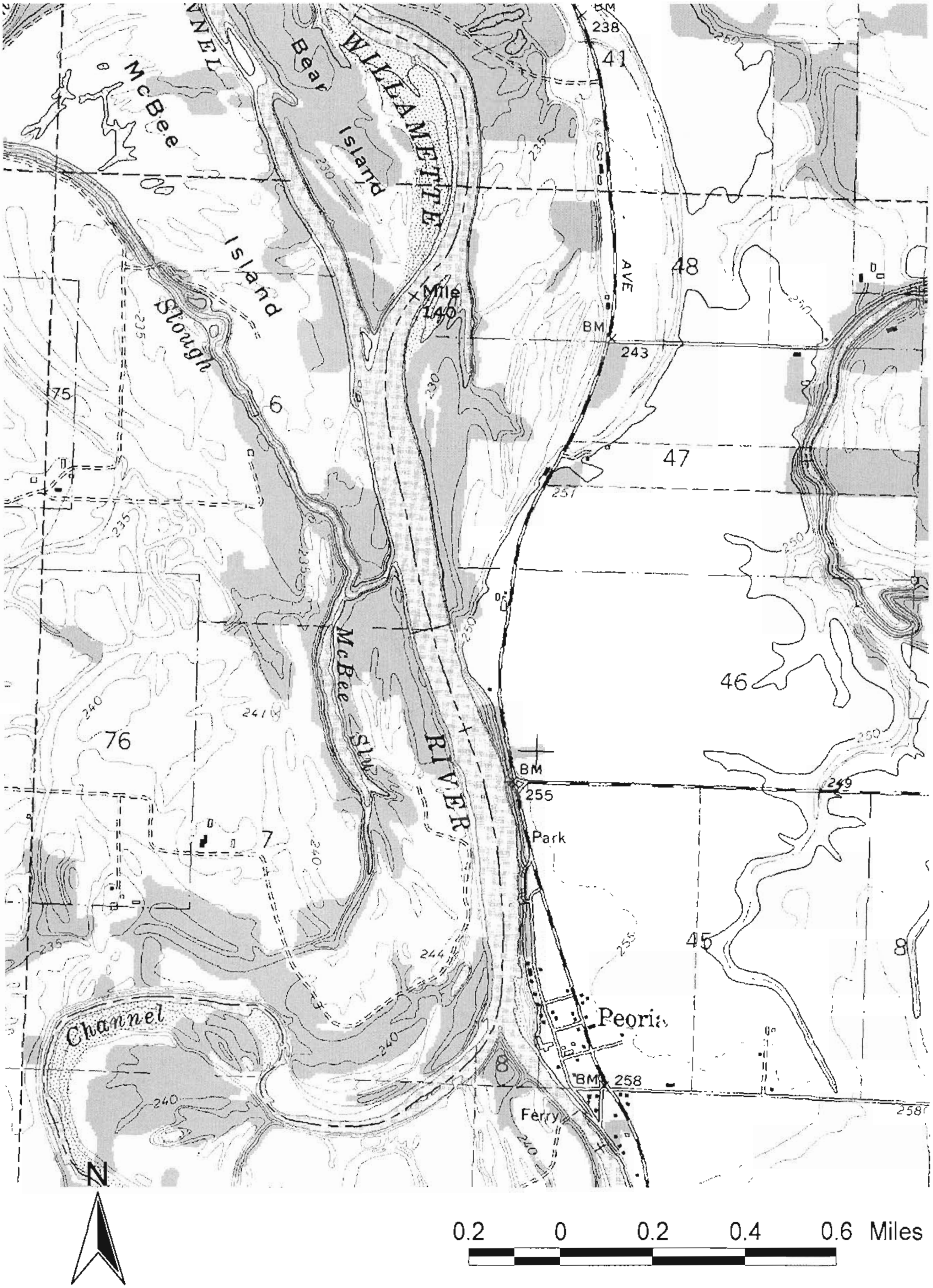
McBee
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RIVER
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257
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McBee Slu
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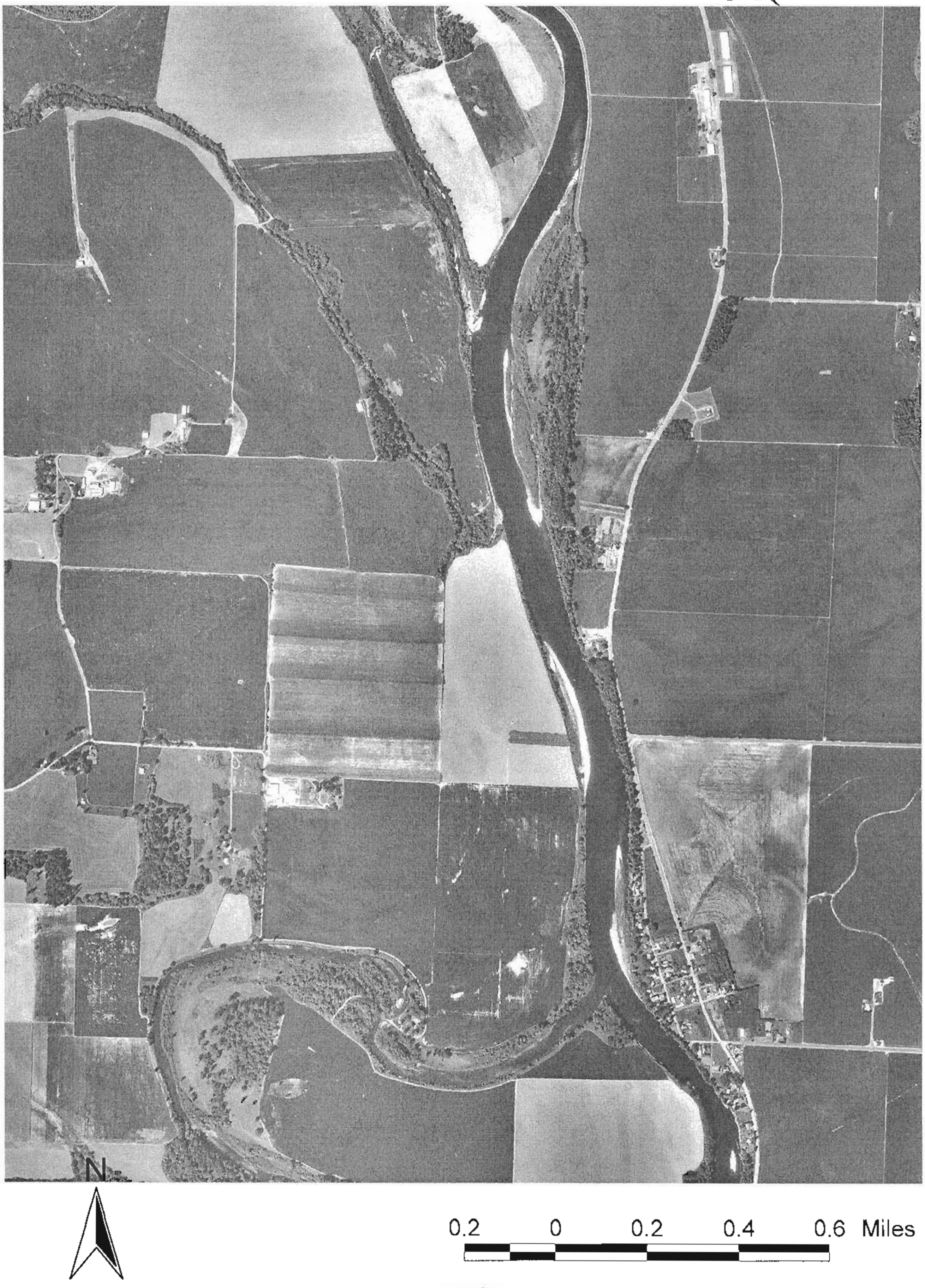
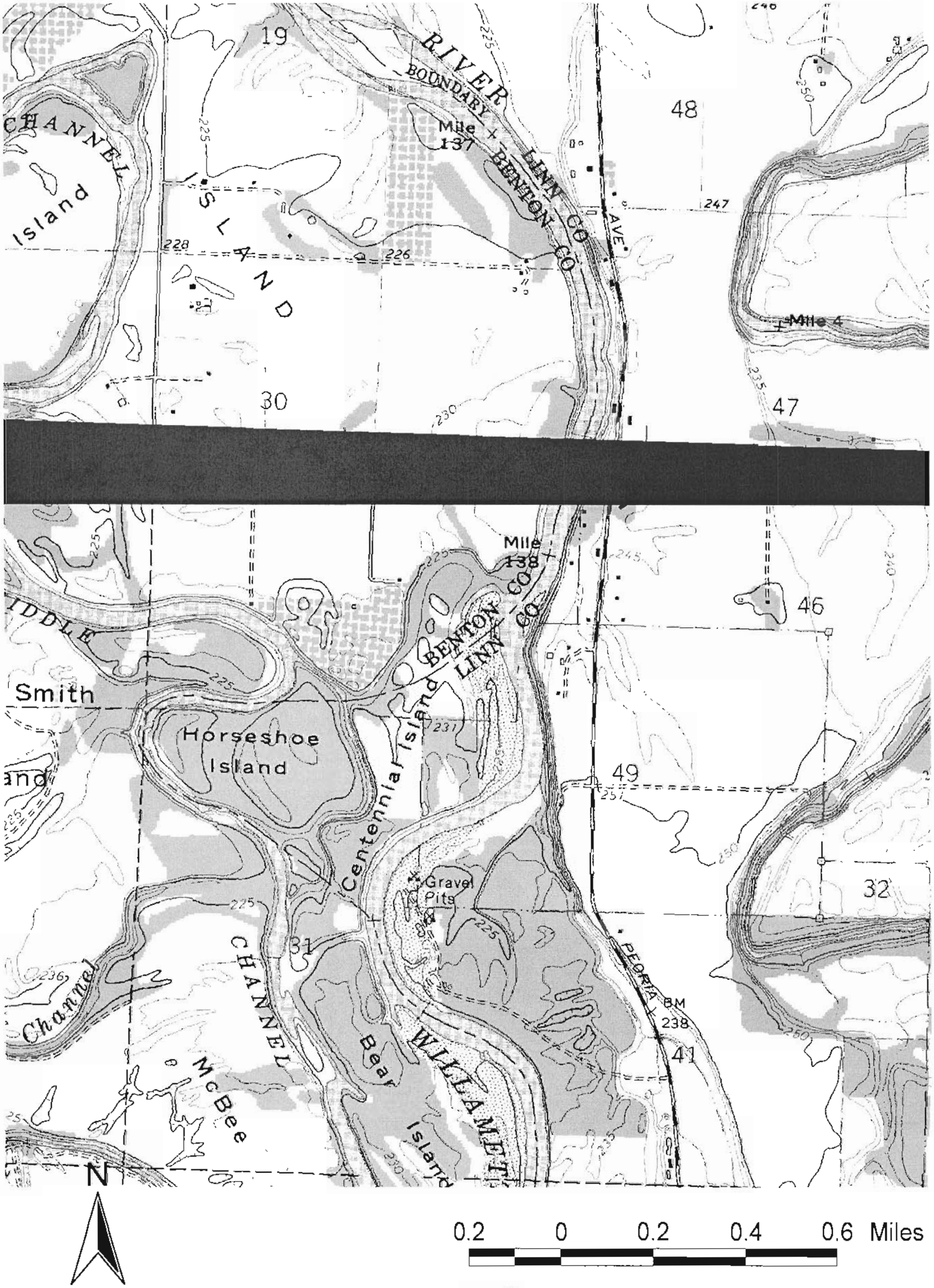
BEAR ISLAND DOQ




19
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IDDLE
Smith
225
Horseshoe Island
Centennial Island
231
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Gravel Pits
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PEORIA
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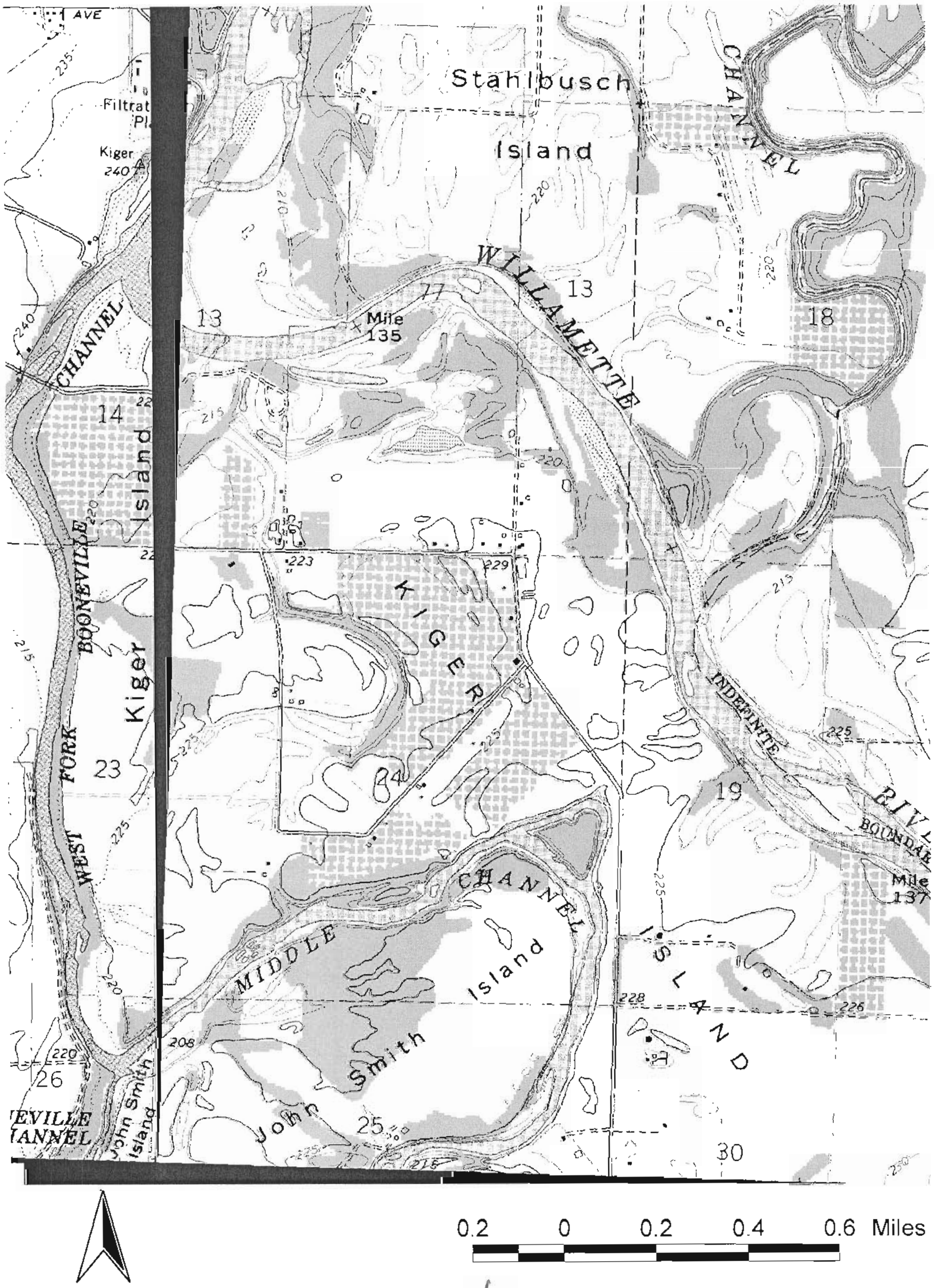
HORSE SHOE ISLAND DOQ


AVE
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Kiger
240
Stahlbusch
Island
CHANNEL
WILLAMETTE
Mile
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18
14
CHANNEL
BOONEVILLE
WEST
FORK
Kiger
Island
23
KIGER
223
229
INDEFINITE
BOUNDARY
RIV
Mile
137
19
24
MIDDLE
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John
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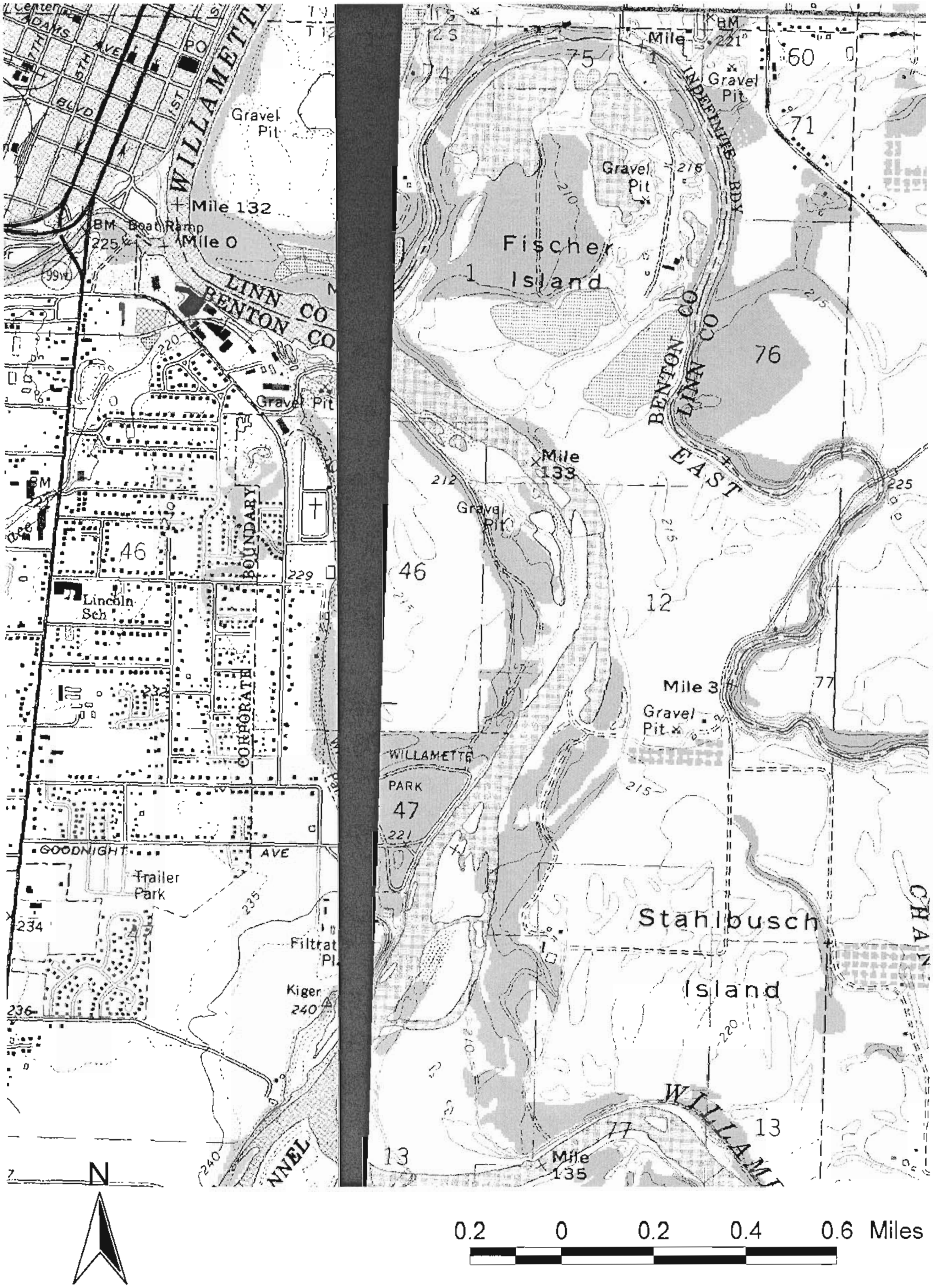
Miles

STAHLBUSCH ISLAND DOQ


WILLAMETTE
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Gravel Pit
Fischer Island
INDEFINITE BDY
BENTON CO
LINN CO
EAST
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60
71
76
Mile 1
BM 221
Mile 133
Mile 3
77
12
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WILLAMETTE PARK
BOUNDARY
CORPORATE
Lincoln Sch
GOODNIGHT AVE
Trailer Park
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Corvallis DOQ