WASHINGTON DIVISION OF GEOLOGY AND EARTH RESOURCES
Raymond Lasmanis, State Geologist

GEOLOGIC MAP OF THE CHEHALIS RIVER AND WESTPORT QUADRANGLES, WASHINGTON

Compiled by

ROBERT L. LOGAN

WASHINGTON DIVISION OF GEOLOGY AND EARTH RESOURCES

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Brian Boyle · Commissioner of Public Lands
Art Stearns · Supervisor

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INTRODUCTION

This map is one of a series of 1:100,000-scale geologic maps compiled by staff geologists of the Division of Geology and Earth Resources and used as source maps of the southwest quadrant of the geologic map of Washington (Walsh and others, in press). Other maps in the series are available for all 1:100,000-scale quadrangles within the southwest quadrant, that is south of 47°15' north latitude and west of 120°30' west longitude.

The 1:100,000-scale maps in this series that have been released to date are:

Korosec, M. A., compiler, 1987, Geologic map of the Hood River quadrangle, Washington and Oregon: Washington Division of Geology and Earth Resources Open File Report 87-6, 42 p., 1 pl., scale 1:100,000

Korosec, M. A., compiler, 1987, Geologic map of the Mount Adams quadrangle, Washington: Washington Division of Geology and Earth Resources Open File Report 87-5, 41 p., 1 pl., scale 1:100,000

Logan, R. L., compiler, 1987, Geologic map of the south half of the Shelton and the south half of the Copalis Beach quadrangles, Washington: Washington Division of Geology and Earth Resources Open File Report 87-9, 17 p., 1 pl., scale 1:100,000

Logan, R. L., compiler, 1987, Geologic map of the Chehalis River and Westport quadrangles, Washington: Washington Division of Geology and Earth Resources Open File Report 87-8, 18 p., 1 pl., scale 1:100,000

Phillips, W. M., compiler, 1987, Geologic map of the Mount St. Helens quadrangle, Washington and Oregon: Washington Division of Geology and Earth Resources Open File Report 87-4, 63 p., 1 pl., scale 1:100,000

Phillips, W. M., compiler, 1987, Geologic map of the Vancouver quadrangle, Washington and Oregon: Washington Division of Geology and Earth Resources Open File Report 87-10, 32 p., 1 pl., scale 1:100,000

Phillips, W. M.; Walsh, T. J., compilers, 1987, Geologic map of the northwest part of the Goldendale quadrangle, Washington: Washington Division of Geology and Earth Resources Open File Report 87-13, 9 p., 1 pl., scale 1:100,000

Schasse, H. W., compiler, 1987, Geologic map of the Centralia quadrangle, Washington: Washington Division of Geology and Earth Resources Open File Report 87-11, 27 p., 1 pl., scale 1:100,000

Schasse, H. W., compiler, 1987, Geologic map of the Mount Rainier quadrangle, Washington: Washington Division of Geology and Earth Resources Open File Report 87-16, 43 p., 1 pl., scale 1:100,000

Walsh, T. J., compiler, 1986, Geologic map of the west half of the Toppenish quadrangle, Washington: Washington Division of Geology and Earth Resources Open File Report 86-3, 8 p., 1 pl., scale 1:100,000

Walsh, T. J., compiler 1986, Geologic map of the west half of the Yakima quadrangle, Washington: Washington Division of Geology and Earth Resources Open File Report 86-4, 12 p., 1 pl., scale 1:100,000

Walsh, T. J., compiler, 1987, Geologic map of the Astoria and Ilwaco quadrangles, Washington and Oregon: Washington Division of Geology and Earth Resources Open File Report 87-2, 30 p., 1 pl., scale 1:100,000

Walsh, T. J., compiler, 1987, Geologic map of the south half of the Tacoma quadrangle, Washington: Washington Division of Geology and Earth Resources Open File Report 87-3, 12 p., 1 pl., scale 1:100,000

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DESCRIPTION OF MAP UNITS
CHEHALIS RIVER AND WESTPORT
QUADRANGLES, WASHINGTON

Quaternary Sediments

Deposits of Non-Glacial Origin

Qsb

Beach deposits--Fine to coarse sand, forming beaches and associated active and stabilized back-beach dune fields, and minor estuarine deposits

Qal

Alluvium--Silt, sand, and gravel deposited in streambeds and fans; surface relatively undissected; includes low-level terraces

Qls

Landslide debris--Can contain rock fragments, colluvium, soil material and organic matter deposited as a result of mass wasting; unstratified and poorly sorted; surface commonly hummocky

Qg

Older unconsolidated Pleistocene alluvium--Predominantly pebble and cobble gravels stained various shades of red by weak iron iron-oxide cement; deposited in streambeds and piedmont fans; generally undeformed; may form low terraces whose surfaces are commonly dissected; weathered to depths greater than 35 ft and contains smaller pebbles that readily disaggregate and larger cobbles that have thin rinds; may be in part equivalent to the Wedekind Creek formation of Carson (1970)

QTg

Older deformed unconsolidated Pliocene(?)/Pleistocene sediments--Mostly sand and pebble gravel with local beds of coarse gravel and silt; moderately to intensely deformed; deposited as piedmont gravels scattered along the southern and western flanks of the Olympic Mountains; usually so deeply weathered that pebbles within the gravels can be cut by a knife; iron oxide imparts reddish-brown color and a moderate degree of cementation to gravels (Moore, 1965)

Qtr

Terraced sediments, undifferentiated--Includes a variety of sediments at various elevations, ranging from iron-stained pebble gravel, to laminated fine sand and clay with cross-bedded gravel and local peat layers; represents older alluvium along the Willapa River and uplifted coastal marine and estuarine deposits between Aberdeen and Raymond; the best preserved coastal terraces are between 80 and 120 ft elevation, and more deeply dissected terraces are at 220 to 240 ft; another terrace surface is at 520 to 560 ft (Palmer, 1967)

Late Wisconsin Cordilleran Glacial Deposits

Qdvm

Vashon moraine--Unweathered clay, silt, sand and gravel; contains moraines and mixtures of till and outwash not separately mappable

Qdvt

Vashon Till--Unweathered, gray, unsorted, unstratified, highly compacted mixture of clay, silt, sand, gravel, and boulders deposited directly by glacial ice; locally contains outwash sand and gravel both within and overlying till; age of maximum ice advance in map area has been estimated to be 14,000 yr. (Porter, 1970) to 12,600 yr. (Carson, 1970)

Qov

Vashon outwash--Recessional and proglacial stratified, unweathered sand and gravel; locally contains silt and clay

Qovg

Vashon outwash gravel--Recessional and proglacial, stratified pebble, cobble, and boulder gravel deposited in meltwater streams and their deltas; locally contains ice-contact deposits

Qovs

Vashon outwash sand--Recessional and proglacial stratified sand; locally contains silt, clay, and gravel

Pre-Late Wisconsin Cordilleran Glacial Deposits

Qdp

Pre-Vashon drift, undifferentiated--Pleistocene till, outwash sand and gravel, and loess; includes "Helm Creek" and "Salmon Springs" deposits, both of Carson (1970). The Helm Creek deposits form high terraces along the Chehalis, Wynoochee, and Satsop Rivers and are composed of moderately oxidized but otherwise unweathered, horizontally stratified, crossbedded and well-sorted gravels with a maximum clast diameter of 6 in.; manganese and iron-oxide staining imparts dark purple and reddish brown color to the deposits; a thick loess cover occurs on much of the unit; till is mottled orange a yellowish gray, containing a smaller ratio of clast to matrix than the "Salmon Springs" till. The "Salmon Springs" drift consists of reddish brown oxidized till and sandy gravels with local loess, and represents the penultimate advance of the Puget ice lobe in this area; topography is more subdued than surrounding unglaciated areas but more highly dissected than adjacent areas overridden by Vashon ice (Carson, 1970). According to Easterbrook (1985), "Helm Creek" and "Salmon Springs" drifts of Carson (1970) can be respectively correlated with the Stuck Drift of Crandell and others (1958) and the Double Bluff Drift of Easterbrook (1966, 1969), indicating that Carson's "Helm Creek" is older than the type Salmon Springs and Carson's "Salmon Springs" is younger than the type Salmon Springs Drift that has been dated by Easterbrook and others (1981), at 0.66 to 0.87 m.y.b.p. However, Helm Creek Drift is normally magnetized (Woodward-Clyde Consultants, 1978), while type Salmon Springs and Stuck Drifts are reversely magnetized (Easterbrook and others, 1985) indicating that the Helm Creek Drift is also younger than the type Salmon Springs. The age of the Helm Creek Drift is estimated at 0.25 to 0.32 m.y. (Washington Public Power Supply System (WPPSS), 1982) to as much as 0.50 m.y. (Colman and Pierce, 1981; McCrumb and West, 1981).

Pre-Late Wisconsin Alpine Glacial Deposits

Qwe

Wedekind Creek Formation--Pleistocene outwash or possibly non-glacial alluvial gravels, sands, and silts occurring in patchy distribution capping interfluvial areas at elevations between 300 and 600 feet near the Satsop and Wynoochee River drainages. Clast lithologies are "graywackes" or basalt of

Olympic Mountain origin. Unit is generally undeformed but locally weakly deformed; intensely weathered clasts are stained red, orange, and brown by iron oxide and are easily cut with a knife (Carson, 1970); may be in part equivalent to unit Qg; till has not been found in these deposits

Qlh

Logan Hill Formation--Pleistocene alpine outwash sand and gravel with minor interbedded silt and clay; stained reddish to yellowish brown; completely weathered to clay near land surface, only moderately weathered at depth (Noble and Wallace, 1966); contains volcanic rocks of the Northcraft Formation and reworked material from Miocene conglomerates and other adjacent Tertiary rocks (Snavely and others, 1958)

Tertiary Sedimentary Rocks

Miocene Sedimentary Rocks

Tmn

Montesano Formation--Middle to upper Miocene marine sedimentary rocks, consisting of coarse- to fine-grained, silty, friable lithofeldspathic and feldspatholithic sandstone, local to widespread conglomerate, siltstone, and mudstone; blue gray where fresh, orange brown where weathered; locally tuffaceous; most commonly massive, but bedding locally enhanced by conglomerate lenses and beds, carbonized wood, mica flakes, and concretion-rich layers; contains foraminiferal faunas referable to the Mohnian and Delmontian Stages

Twk

Wilkes Formation--Upper Miocene continental sedimentary rocks, semi-consolidated sandstone, siltstone, and conglomerate, commonly tuffaceous, blue gray and olive green when fresh; weathers to mottled yellowish to reddish orange; includes some tuff breccias, lahars, and volcanic arenites, primarily the products of fluvial systems draining Tertiary volcanic terrains; carbonized fossil plants are abundant

Tas
  Tas_3
  Tas_2
  Tas_1

Astoria (?) Formation--Lower to middle Miocene marine sedimentary rocks, consisting of fine-grained, friable, micaceous, silty feldspathic sandstone; gray where fresh,

weathers to olive brown or creamy orange; massive to thin bedded; locally tuffaceous; abundant siltstone and silty sandstone contains macerated carbonaceous material; locally contains basaltic sandstone, pebble conglomerate, and poorly sorted basal conglomerate; numerical subscripts indicate the presence of foraminiferal faunas referable to the following provincial zones: 1. Siphogeneria kleinpelli, (Saucesian); 2. Baggina washingtonensis (Relizian); 3. Rotalia becki (Luisian ?)

Eocene-Oligocene Sedimentary Rocks

Tlc

Lincoln Creek Formation--Upper Eocene to Oligocene marine sedimentary rocks, consisting of light-gray tuffaceous siltstone and fine-grained tuffaceous sandstone, indistinctly bedded to massive, commonly concretionary; lower strata contain discontinuous beds of basaltic and glauconitic sandstone; dominantly offshore marine but grades into nonmarine volcaniclastic rocks east of Chehalis; contains foraminiferal faunas referable to the Refugian and Zemorrian Stages

Tlcs

Lincoln Creek basaltic sandstone member--Massive fine-grained, upper Eocene or lower Oligocene basaltic lithic sandstone; light greenish gray to medium olive brown; clasts are mostly basalt and andesite with minor amounts of feldspar, quartz and mica; local waterlaid pumiceous lapilli tuffs; wood fragments and marine fossils and local calcareous concretions (Snavely and others, 1958); contains foraminifers of the Refugian Stage

Tcz

Cowlitz Formation (as restricted by Wells, 1981)--Middle and upper Eocene, massive to thin-bedded, planar laminated and crossbedded, very fine to coarse-grained feldspathic sandstone, laminated micaceous carbonaceous siltstone, tuffaceous siltstone, very coarse grained volcanic lithic sandstone, and lignite as much as 11.5 m thick (Utah International, Inc.written commun., 1987); contains forminifers referable to the upper Narizian Stage; this unit is equivalent to the Olequa Creek Member of the Cowlitz Formation (Henriksen, 1956)

Tmc

McIntosh Formation--Middle to upper Eocene marine sedimentary rocks, consisting of laminated to massive, tuffaceous siltstone, claystone, shale, and massive to crossbedded micaceous feldspathic sandstone, and, in lower part, interbeds of basaltic sandstone; locally interbedded with basalt flows, tuffs, tuff breccias, and conglomerates; contains foraminiferal faunas referable to the Narizian Stage

Tsk

Skookumchuck Formation--Middle to upper Eocene nearshore marine to nonmarine sedimentary rocks, micaceous feldspathic sandstone, siltstone, shale, carbonaceous siltstone, claystone, and coal; locally interbedded with basalt flows and volcaniclastic rocks; contains foraminiferal faunas referrable to the Narizian Stage; includes rocks mapped as the upper member of the McIntosh Formation by Pease and Hoover (1957) near the Lincoln Creek drainage basin

Tme

Unnamed unit--Middle Eocene marine sedimentary rocks, siltstone and massive to planar-laminated micaceous feldspathic sandstone, locally with graded bedding; contains foraminiferal faunas referable to the Ulatisian Stage; equivalent to Unit A of Wolfe and McKee (1972), lower McIntosh Formation of Wagner (1967a), sandstones of Megler (Wells, 1979), sedimentary rocks of the Crescent Formation (Rau, 1966)

Tcrs

Crescent Formation sedimentary rocks--Lower to middle Eocene basaltic siltstone and sandstone interbeds found within the Crescent Formation that contain foraminiferal assemblages referable to the Ulatizian and possibly Penutian Stages (Rau, 1986)

Volcanic and Intrusive Rocks

Miocene Columbia River Basalt Group Flows

Tsp

Pomona Member, Saddle Mountains Basalt--Middle to upper Miocene, fine-grained, medium-gray, inequigranular basalt, containing phenocrysts and glomerocrysts of labradorite,

augite, and olivine; larger labradorite phenocrysts contain distinctive glass and pyroxene inclusions. K-Ar ages for Pomona flow range from approximately 13.5 to 10.5 m.y. with a generally "accepted age" of 12 m.y.; equivalent to the basalt of Pack Sack Lookout, (Snavely and others, 1973)

Tisp

Pomona member invasive--Sills and dikes of olivine basalt and peperites thought to be formed by the invasion of the Pomona Member of the Saddle Mountains Basalt (Tsp) into poorly consolidated sediments as young as middle Miocene/ Astoria Formation (Wolfe and McKee, 1972); consists of basalt mapped as intrusive basalt of Pack Sack Lookout (Snavely and others, 1973)

Tgr

Grande Ronde Basalt--Middle Miocene flood basalt with basaltic andesite chemistry, forms single sheet flow with K-Ar date of 15.3 $\pm$ 0.8 m.y.b.p. in map area (Turner, 1970); faunas referable to the Saucesian Stage occur both above and below the basalt; west of Doty the flow becomes subaqueous and locally invasive; includes both Yakima-type and Depoe Bay Basalt of Snavely and others (1973); represents N_2 magnetostratigraphic unit of Swanson and others (1979)

Eocene Volcanic and Intrusive Rocks

Tbt

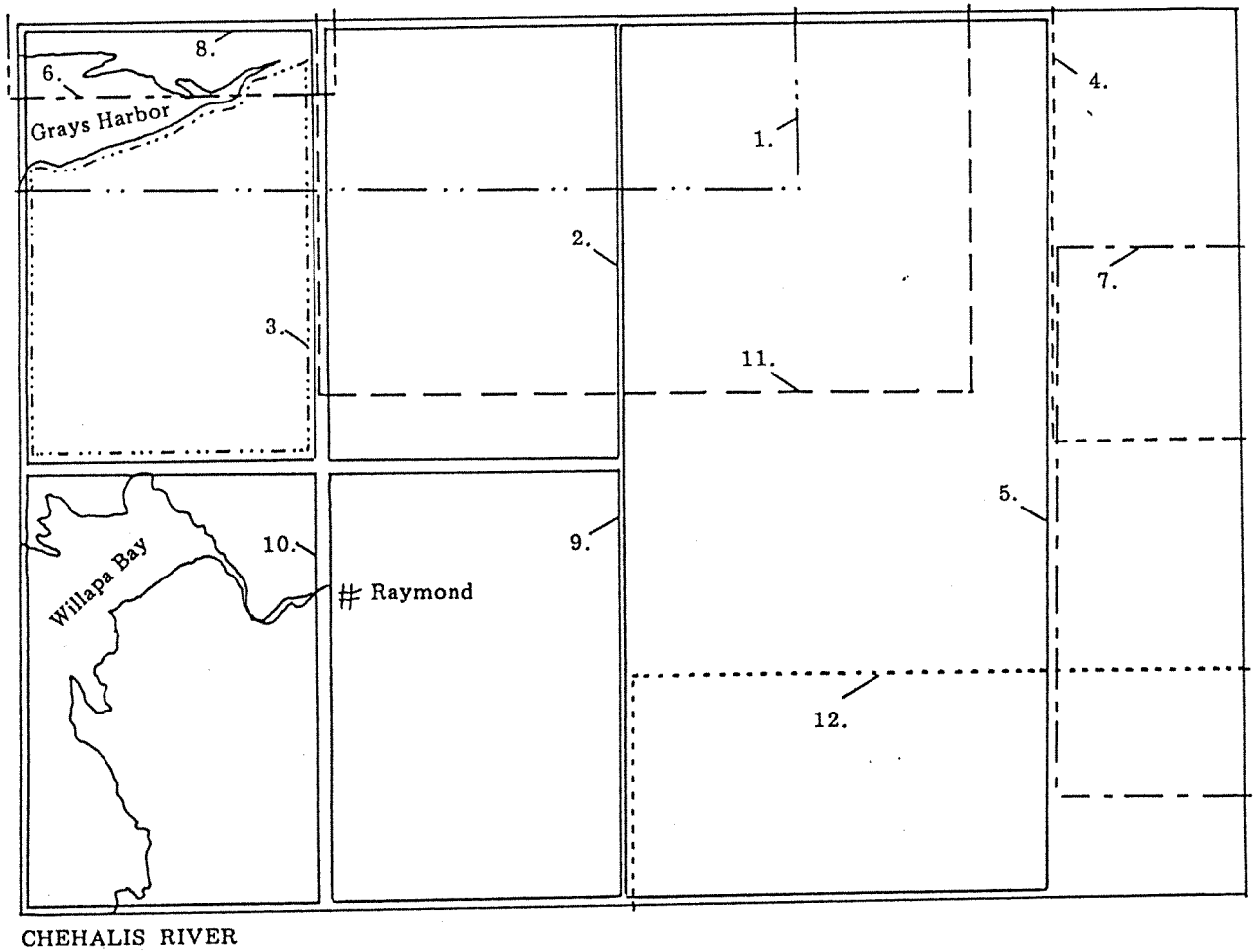
Basaltic tuff--Mafic subaqueous tuff, massive to well-bedded palagonitic basaltic lapilli tuff and tuff breccia, basaltic sandstone, siltstone, and conglomerate; includes Pe Ell volcanics member of the Cowlitz Formation (Henriksen, 1956) and volcanic unit of the McIntosh Formation (Wagner, 1967a)

Tcr

Crescent Formation--Lower to middle Eocene, fine-grained, dominantly submarine tholeiitic basalt flows and flow breccia, typically with zeolitic or chloritic alteration; pillows and altered palagonite common; locally contains thin interbeds of basaltic tuff and siltstone with foraminiferal faunas referable to the Ulatisian Stage; probably originated as mid-ocean ridge basalt and as seamounts; accreted to continent by middle Eocene time (about 48 m.y.b.p.)(Duncan, 1982); forms basement in the Coast Range

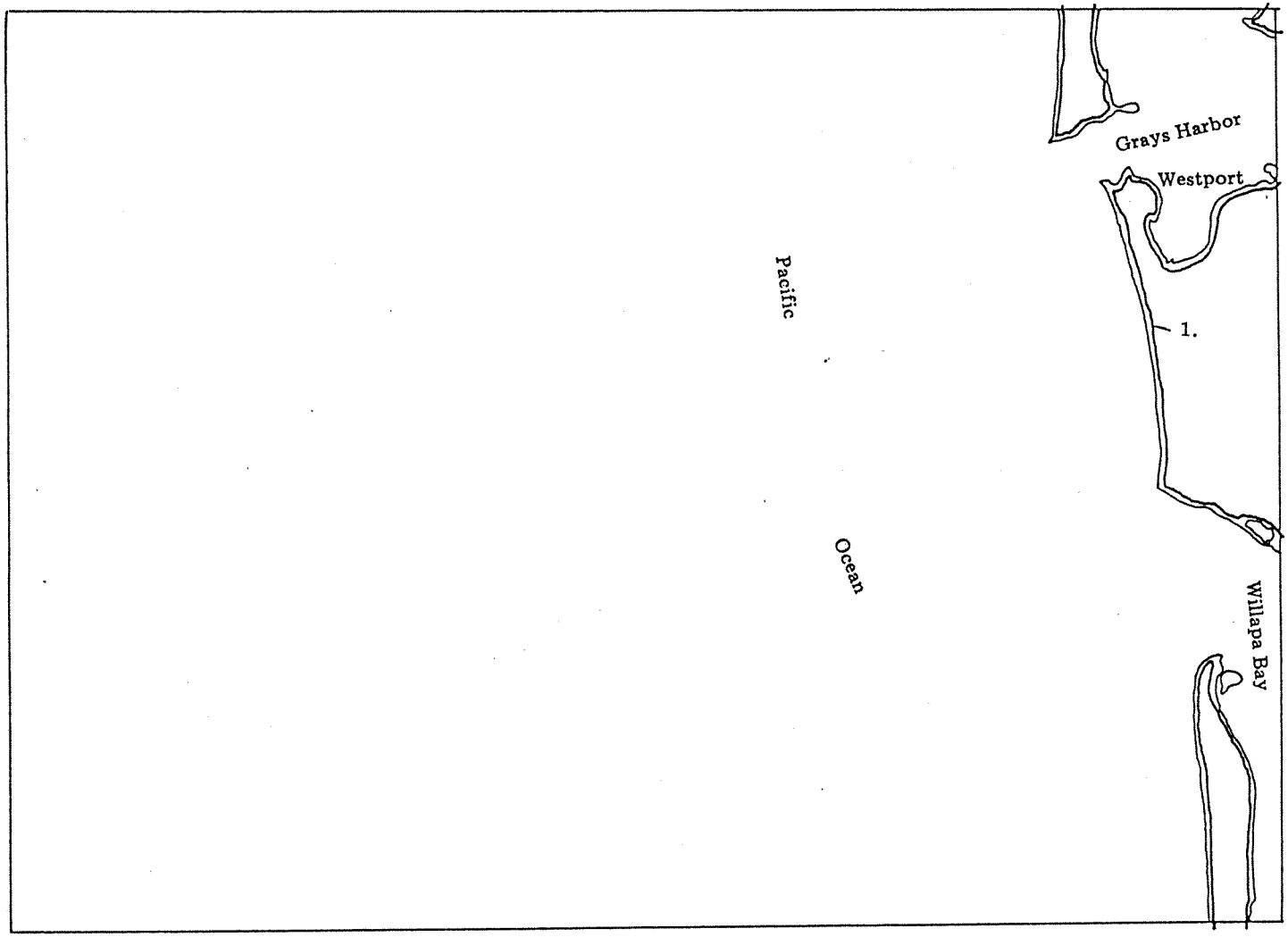
Tig
Tib

Basic intrusive rocks--Gabbro, diabase, and basalt dikes and sills; Tib in the Willapa Hills, flow-banded and vesicular sill complex with sill interiors of coarse-grained to pegmatitic gabbro and margins of columnar-jointed basalt. Tig indicates predominantly coarser grained rocks and Tib indicates dominantly finer grained rocks



1. Eddy, P. A., 1966.
2. Gower, H. D. and Pease, M. H., Jr., 1965.
3. Logan, R. L., 1986.
4. Noble, J. B. and Wallace, E. F., 1966.
5. Pease, M. H., Jr. and Hoover, L., 1957.
6. Rau, W. W., 1986.
7. Snavely, P. D., Jr. and others, 1958.
8. Snavely, P. D., Jr. and Wagner, H. C., 1985.
9. Wagner, H. C., 1967a.
10. Wagner, H. C., 1967b.
11. Washington Public Power Supply System, 1982.
12. Wells, R. E., 1981.

Source of Data Map

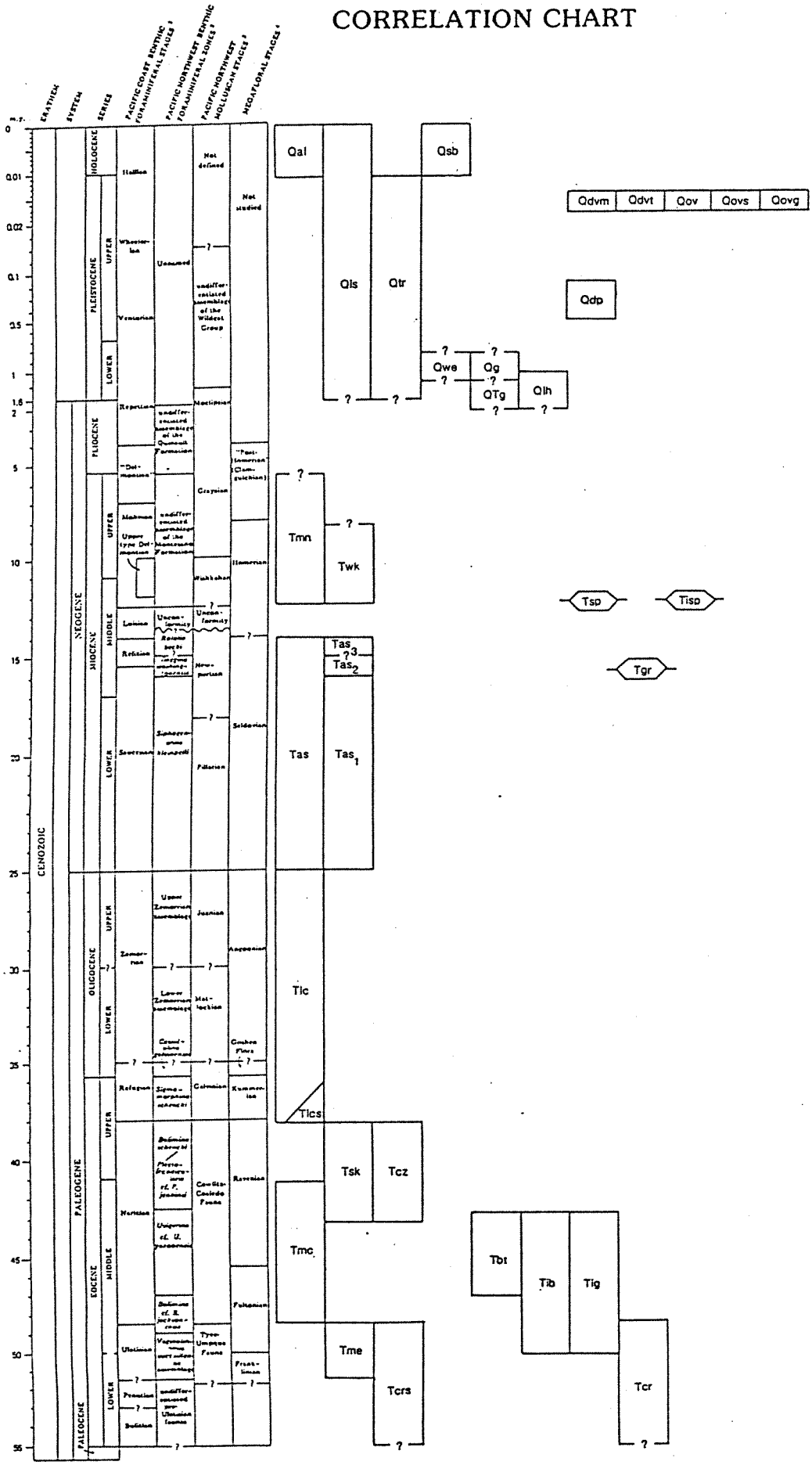


WESTPORT

Source of Data Map

1. Logan, R. L., 1986.

WESTPORT-CHEHALIS RIVER CORRELATION CHART



[1] From Kleinpell & others, 1980; Mallory, 1959.
[2] From Rau, 1961.
[3] From Addicott, 1976; Armentrout, 1981.
[4] From Wolfe, 1961.

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