

STATE OF WASHINGTON  
DEPARTMENT OF NATURAL RESOURCES  
BRIAN J. BOYLE, Commissioner of Public Lands  
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DIVISION OF GEOLOGY AND EARTH RESOURCES  
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COMPILATION GEOLOGIC MAP OF THE GREEN RIVER  
COAL DISTRICT, KING COUNTY, WASHINGTON

by

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Open File Report 84-4

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This report consists of a compilation geologic map (Plate 1), a table of radiometric age determinations (Table 1), a tabulation of available subsurface data (Table 2), and graphic columns from 14 drill holes (Plates 2 and 3). Table 1 and all the references cited in this report are contained in Plate 1.

The report was produced in order to supply a single-sheet geologic map of one of the most productive of Washington's coal mining districts. Because of its position on the join of four 1:24,000-scale U. S. Geological Survey topographic maps, the Green River area has not been mapped as a unit since 1945 (Warren and others, 1945).

In addition, this report summarizes the available (nonproprietary) subsurface data of the district. Since publication of the last major studies of the area (Mullineaux, 1965, 1970; Vine, 1969), a large amount of subsurface information has been collected, mostly as a result of oil, gas, and coal exploration. The drill holes illustrate very well the complex structure and abrupt facies changes present within the coal-bearing Eocene Puget Group. Understanding of the Puget Group on a regional, as well as a local basis, is a requirement for future extraction of energy resources.

TABLE 2 -- SUBSURFACE DATA

Map No.	Total Depth (ft)	Date	Information Available	Comments	Source
K-3	1,403	1911	Driller's logs, well cuttings, gas analysis	Cable tools. Gas showings 900-1000 ft. Salt water below 1000 ft.	1
K-6	2,362	1928	Driller's log	Cable tools. Bottom of glacial drift at 256 ft. Good gas showing.	1
K-11	3,440	1937	Driller's log, ditch samples, gas analysis, E log.	Base of glacial drift at 294 ft. Good oil and gas showing.	1
K-12	5,047	1938	Driller's log, E log.	Cable tools. Slight gas and oil showing.	1
K-14	5,770	1942	Driller's log, core analysis, E log.	Traces of oil and gas	1
K-15	4,016	1944	Driller's log, core description, core analysis, ditch samples, E log.	Traces of oil and gas	1
K-16	4,319	1947	Core description, well history, sidewall core description, E log, ditch sample descriptions.	Several small gas showings, one small oil show at 3,210 ft.	1
K-17	3,509	1948	Core description, well history, sidewall core description, E log, ditch sample description.	Bottom of glacial drift at 660 ft. Cove from 900 ft. has oil odor.	1
125	6,023	1957	Driller's log, microlog, baroid log, E log, dipmeter survey.	Several gas showings	1
128	4,326	1957	Driller's log, microlog, baroid log, E log, core description, core analysis.	Gas and oil showings	1
151	3,944	1961	Sample description, E log, mud log, ditch samples.	Dry hole	1
158	3,411	1961	Sample descriptions, E log.	Dry hole	1
353	7,270	1983	—	Data available 3-85	2

TABLE 2 -- Continued

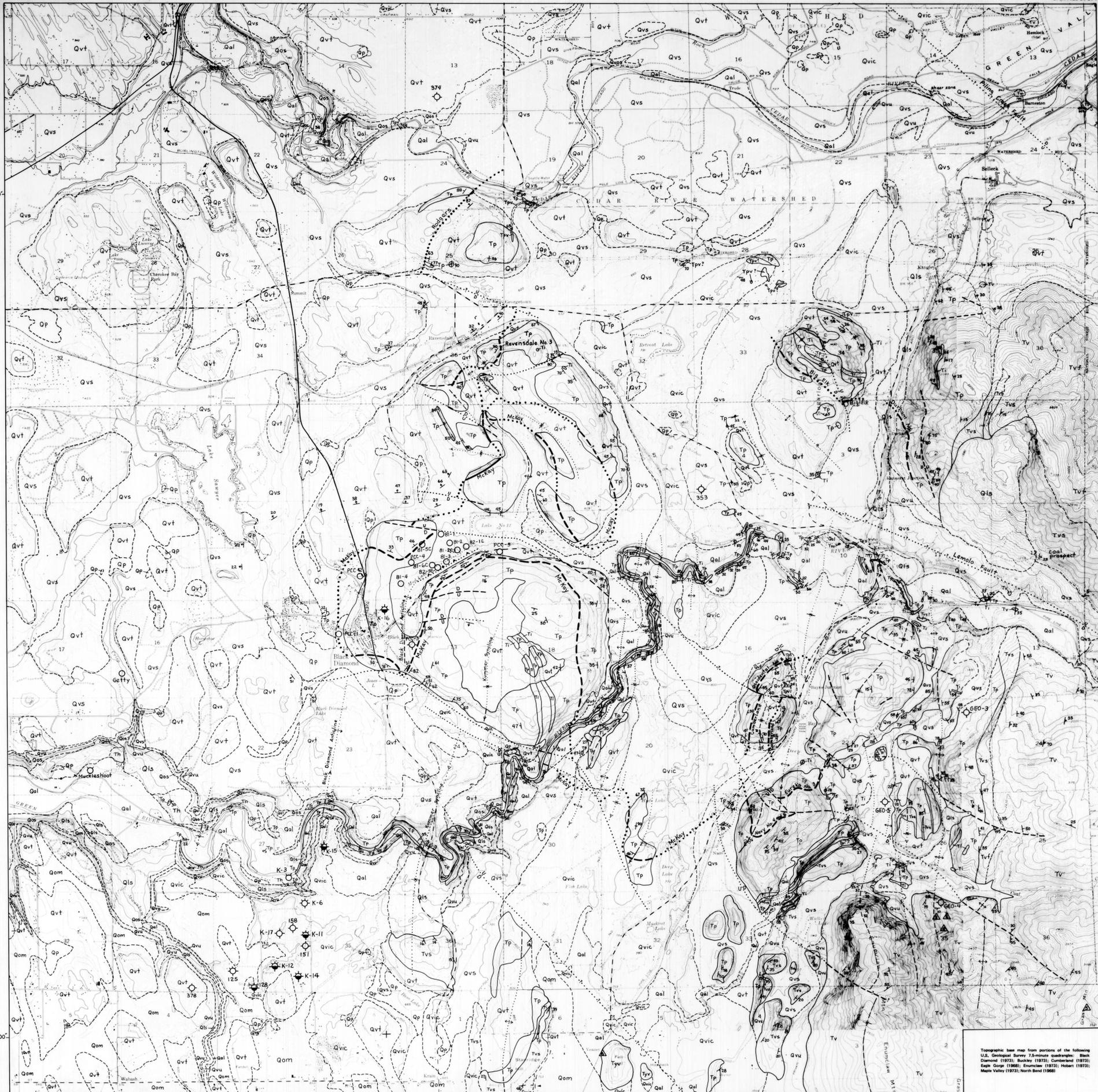
Map No.	Total Depth (ft)	Date	Information Available	Comments	Source
374	1,736	1984	—	Data available 10-85	2
378	1,517	1984	—	Data available 10-85	2
Getty	2,150	1983	Graphic column constructed from downhole geophysical logs.	Base of glacial drift at 560 ft. Numerous coal beds encountered.	3
Muckleshoot	2,465	1983	Sample descriptions, ditch samples	Base of glacial drift at 400 ft. Penetrated volcanic and/or igneous intrusive rocks interbedded with coal-bearing sediments. Gas showing.	4
PCC-1	1,153	1960	Graphic column constructed from drill core logs. Coal analysis.	Core hole. Penetrated Big Dirty through Franklin No. 9 coal beds.	5
PCC-2	1,289	1960	Graphic column constructed from drill core logs. Coal analysis.	Core hole. Penetrated McKay through Franklin No. 9 coal beds.	5
PCC-3	683	1960	Graphic column constructed from drill core logs. Coal analysis.	Core hole. Penetrated Franklin No. 12 and 11 coal beds.	5
PCC-4	1,022	1960	Graphic column constructed from drill core logs. Coal analysis.	Core hole. Penetrated Big Dirty through Franklin No. 9 coal beds.	5
PCC-5	1,150	1960	Graphic column constructed from drill core logs.	Core hole. Penetrated thick andesite sill and fault zones.	5
GEO-3	2,000	1981	Temperature, density, and porosity logs.	Geothermal test hole (abandoned)	6
GEO-4	2,423	1982	Temperature, density, and porosity logs.	Geothermal test hole (adandoned)	6
GEO-5	2,006	1981	Temperature, E-log, with density logs.	Geothermal test hole (abandoned)	6

TABLE 2 - Continued

Map No.	Total Depth (ft)	Date	Information Available	Comments	Source
81-1	420	1981	Graphic column and sample descriptions	Coal reserve drilling for proposed John Henry coal mine.	7
81-2	700	1981	Graphic column and sample descriptions	Coal reserve drilling for proposed John Henry coal mine.	7
81-3	200	1981	Graphic column and sample descriptions	Coal reserve drilling for proposed John Henry coal mine.	7
81-4	553	1981	Graphic column and sample descriptions	Coal reserve drilling for proposed John Henry coal mine.	7
81-5c	320	1981	Graphic column, sample description and coal analysis	Coal reserve drilling for proposed John Henry coal mine.	7
81-6c	400	1981	Graphic column and sample descriptions	Coal reserve drilling for proposed John Henry coal mine.	7
81-7c	400	1981	Graphic column and sample descriptions	Coal reserve drilling for proposed John Henry coal mine.	7
82-1	310	1982	Graphic column and sample descriptions	Coal reserve drilling for proposed John Henry coal mine.	7
82-3c	420	1982	Graphic column and sample descriptions	Coal reserve drilling for proposed John Henry coal mine.	7
MW-5	687	1980	Ditch sample descriptions and graphic column.	Groundwater monitor well for Cedar River Watershed. Bedrock encountered at 660 ft.	8

Sources of data:

- |   |   |
|---|---|
| 1. McFarland, 1983  | 5. Glaeser, 1960, 1961.   |
| 2. Carl McFarland, Division of Geology and Earth Resources, personal communication, 1984. | 6. Division of Geology and Earth Resources geothermal well files. |
| 3. Jon Lindberg; Getty Mining Company, personal communication, 1983                       | 7. Pacific Coast Coal Company, 1983.                              |
| 4. Shawn Muller, Council of Energy Resource Tribes, personal communication, 1983          | 8. Seattle Water Department, 1980.                                |



Topographic base map from portions of the following U.S. Geological Survey 7.5-minute quadrangles: Black Diamond (1973), Buckley (1973), Combedale (1973), Eagle Gorge (1968), Enbridge (1973), Hobart (1973), Made Valley (1973), North Bend (1968)

**EXPLANATION**

**Quaternary**

**Qal** Alluvium. Along Cedar and Green Rivers consists mostly of well-sorted pebbles and cobbles of sand and gravel. Includes some terrace deposits along Green River. Along smaller streams consists of thin deposits of sand and gravel.

**Qp** Fine and sandy (loess-like) deposits. Thickness highly variable. Most deposits formed from late glacial time to present.

**Qs** Landslides and colluvium; also alluvium from small streams in northeast portion of map area. Thickness highly variable. Large landslides north of Green River in S. 121-71 involve failure of competent, ridge-capping Tertiary lava flows (Tv) underlain by volcanic-derived sediments (Tv).

**Qom** Oolitic mudflow. Unsorted, unstratified mixture of granite-cobble rock fragments in clay, silt, and sand matrix. Thickness 0 to 20 feet in map area (Mullineux, 1965). Derived from northwestern side of Mt. Rainier, possibly as a result of volcanic eruption, northward-sloping slope failure, or slope failure after overstepping by glacial erosion. Radiocarbon dates indicate age of about 5000 years. (Mullineux, 1970)

**Qv** Vashon stratified drift deposits. Mostly well-sorted to unconsolidated pebbles and cobbles gravel deposited by streams along and behind retreating front of Puget glacial lobe (Mullineux, 1965). Includes outwash plain and valley train deposits of Mullineux (1965, 1970); recessional outwash and lacustrine deposits of Luster (1969); terrace gravel and stratified drift deposits of Vasey (1969); and recessional outwash and lacustrine deposits of Rosegram (1965). Thickness of these deposits is highly variable, ranging less than 10 feet to over 50 feet. In S. 121-71, include terrace deposits of Green River of probable post-Vashon age.

**Qvic** Ice-contact deposits. Unconsolidated gravel and sand deposited on or against glacial ice of Puget lobe. Includes boulders and lenses (clasts) deposited by direct vertical and horizontal changes in grain size, by boulders, and by icebergs of till (clasts) heavy sand deposited in ice-dammed ponds (Mullineux, 1965). Thickness highly variable but generally less than 100 feet.

**Qvt** Vashon till deposits. Compact, unsorted mixture of sand, silt, clay, and gravel deposited by Puget glacial lobe. In map area, generally forms drumlinized, southeast-trending hills underlain by bedrock. Highly variable in thickness but generally less than 40-50 feet.

**Qvu** Vashon deposits, undivided. Includes outwash deposits along Cedar and Green Rivers (Luster, 1969) and recessional outwash and lacustrine deposits of Rosegram (1965).

**Qvs** Older (pre-Vashon) Pleistocene sediments. Includes Salmon Springs and Oriskany Drift in S. 29-29 (21-6) (Mullineux, 1965). These deposits consist of non-stratified, generally well-sorted sand and gravel derived from British Columbia and northern and central Cascade Range. Along the Cedar River 2 till layers separated by sand and silt. Mullineux (1965) reports that these deposits include Vashon sediments and are about 200 feet thick. Also reported north-west of Landsburg are about 110 feet of strongly oxidized, well-sorted sand, and gravels assigned a pre-Vashon age by Rosegram (1965).

**Qv** Hammer Bluff Formation. Cohesive and compact clayey quartzite and sandstone overlain by volcanic sand and gravel with thin kaolinitic clay beds, woody lignite, and volcanic ash beds. Formation is at least 100 feet thick when exposed along Green River in S. 28-21 (21-6). At base Miocene age is assigned to the Hammer Bluff Formation on the basis of fossil leaves. Probably deposited by streams draining eroded Puget Group rocks and late Oligocene-Miocene volcanic rocks of the western Cascade (Mullineux, 1965, 1970)

**Qv** Younger volcanic rocks. Previously unrecognized in area. Two isolated, but very prominent outcrops in S. 54 (20-7) of unstratified, glassy to holocrystalline, coarse-grained basalt flows. Cooling columns are inclined suggesting that the vent has been either folded and/or fractured or that the exposure are residual remnants of valley flows. Presence of groundmass glass and unaltered mafic minerals contrast sharply with pervasively altered nature of older volcanic rocks of the western Cascade. Radiocarbon dates at Vasey Quarry indicate a middle Miocene (16.5 +/- 4.1) age for the units (Table 1)

**Tertiary**

**Tv** Invasive igneous rocks, chiefly basaltic to andesitic composition dikes and sills invading Puget Group sediments. Typically porphyritic with phenocrysts of augite and plagioclase. Groundmass generally composed of quartz, clinopyroxene, chlorite, clay minerals, and magnetite (Vine, 1969). Attrition of augite to calcite, quartz, and magnetite common. Many dikes and sills have been labeled a reddish-gray color; a few have been completely altered to "chertlike," i.e., a mass of kaolinite, quartz, hematite, calcite and magnetite (Vine, 1969). An example is the altered sill in the SW corner of Qv, S. 34 (22-7). Outcrop patterns of intrusive rocks suggest that they were emplaced before folding and faulting of the Puget Group sediments. K-Ar age dating (Table 1) indicates that the intrusive rocks are upper Oligocene and perhaps coeval with some of the volcanic rocks overlying the Puget Group. Very complex contact relations and poor exposure conditions preclude mapping intrusions in the volcanic highlands of the eastern side of the map area. The map unit Tv probably contains many small intrusive bodies.

**Tv** Unwelded volcanic rocks, stratigraphically above and gradational with welded sediments of the Puget Group. Tv indicates where volcanic sediments and flow rocks were not distinguished during mapping. Tv denotes volcanic-derived sediments, chiefly volcanic ash, tephra, conglomerates, impure coals, and water-worked tuffs. Tv includes sediments mapped by Hammond (1963) as Tulewa Formation and Mt. Catherine tuff. Interstratified with the volcanic sediments are andesite lava flows, identified Td. These flows correspond in large part to the Enumelaw Formation of Hammond (1963). The most commonly played to blocky, ridge-forming porphyritic basaltic andesites. Attrition of andesites to quartz and carbonate in common. About 5000 feet (Vine, 1969) of volcanic rocks overlie the Puget Group in the map area. Radiocarbon dates (Table 1) and fossil leaves (Wolfe, 1968) indicate a lower Oligocene (16.5 +/- 4.1) age for the andesite base of the volcanic rocks.

**Tv** Puget Group undivided (Tp) and volcanic rocks contained in lower portions of Puget Group (Tv). Feldspathic, micaceous sandstone, siltstone, shale, sandstone, shale, claystone, and coal make up the undivided Puget Group (Vasey, 1969). North of the map area, a thick volcanic unit (Tulewa Formation) permits division of the Puget Group into 3 formations (Tiger Mountain, Tulewa, and Renton Formation); the division is not possible in the map area. Coal beds, which have been extensively mined, serve as locally useful stratigraphic markers. The most commonly dated coal bed, the McKay, and it's approximate correlation are indicated on the map.

**Tp** Stratigraphic control based upon structure, coal beds, and fossil leaves is adequate to define a volcanic unit in the best Puget Group. In SW 1/4, S. 19 (22-7), the unit consists of a well-sorted sandstone, siltstone, and claystone of dark-colored volcanic rock and well-sorted sandstone fragments. In NE 1/4, S. 23 (22-6), a sequence of volcanic sandstone and siltstone is exposed. This unit is stratigraphically below the Franklin coal series and therefore cannot be correlated with the Tulewa Formation. This volcanic unit is tentatively correlated with massive volcanic sandstone and siltstone in the lower part of the Raging River Formation exposed north of the map area in T. 22 N., R. 7 E., Vine, 1969).

**Tp** The Puget Group is at least 6200 feet thick in the map area. Fossil leaves (Wolfe, 1968) indicate an early Eocene to early Oligocene age for the Green River area Puget Group section. However, radiometric dating of ash partings (Turner and others, 1963) suggests a middle Eocene age (14.2 +/- 1.8 to 45.0 +/- 2.1 m.y.) for this section.

**TABLE 1**  
Radiometric Age Determinations

Sample	Map Unit	Method	Dated Material	Age (Million years +/- 2 sigma)	Source
1	Ti	K-Ar whole rock	altered basalt including Puget Group	26.1 +/- 1.8	Turner and others, (1963)
2	Tv	K-Ar whole rock	altered andesite including volcanic rocks overlying Puget Group	32.5 +/- 2.0	Turner and others, (1963)
3	Tv	K-Ar whole rock	andesite intrusive in volcanic rocks overlying Puget Group	27.9 +/- 1.6	Turner and others, (1963)
4	Tv	K-Ar whole rock	porphyritic andesite flow breccia in volcanic rocks overlying Puget Group	36.2 +/- 2.2	Turner and others, (1963)
5	Tv	K-Ar whole rock	Enumelaw flow in andesite Formation of Hammond, 1963	33.1 +/- 1.7	Courtesy, Dan Vasey, Medicinal Land and Minerals, Inc.
6	Tv	K-Ar whole rock	fresh, columnar basalt flow at Vasey Quarry	16.5 +/- 4.1	Courtesy, Steve Pappasoph, AMOCO Production Inc.

**EXPLANATION**

**Structural Features**

Anticline, showing trace of axial plane and direction of plunge. Dashed where approximately located; dotted where concealed; quilled where inferred.

Syncline, showing trace of axial plane and direction of plunge. Dashed where approximately located; dotted where concealed; quilled where inferred.

Thrust fault, with movement on upper plate. Dashed where approximately located; dotted where concealed.

Fault, showing upthrown (U) and downthrown (D) sides. Dashed where approximately located; dotted where concealed; quilled where inferred.

Fault, showing relative movement. Dashed where approximately located; dotted where concealed; quilled where inferred.

Coal bed, dashed where approximately located; dotted where concealed. Only the widely-spread McKay coal bed and it's approximate correlation are shown.

Contact, dashed where approximately located; dotted where concealed; quilled where inferred.

**Structural Features**

Strike and dip of overturned beds

Strike and dip of beds

Strike and dip of partings in volcanic rocks

Strike of vertical beds

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Strike and dip of overturned beds

Strike and dip of beds

Strike and dip of partings in volcanic rocks

Strike of vertical beds

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**Structural Features**

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Day hole with show of gas

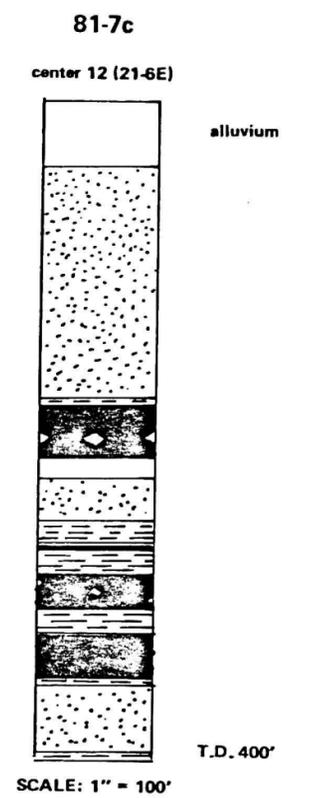
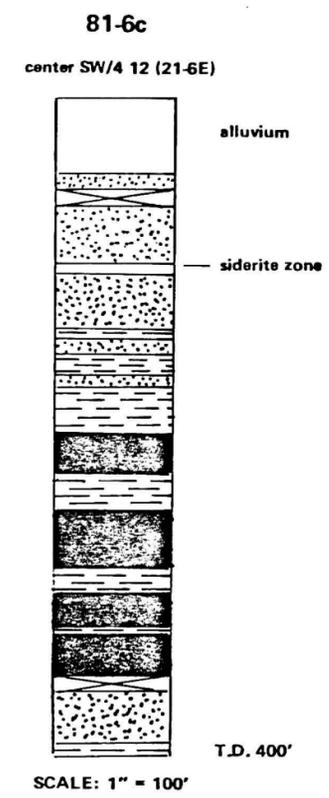
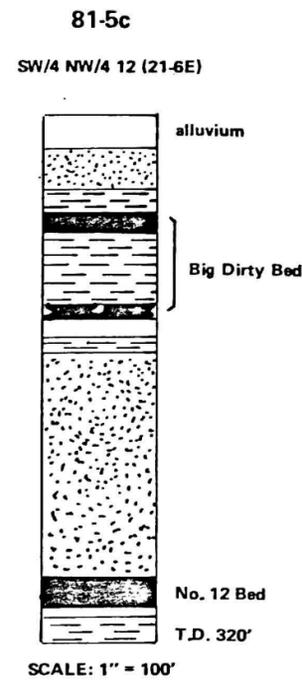
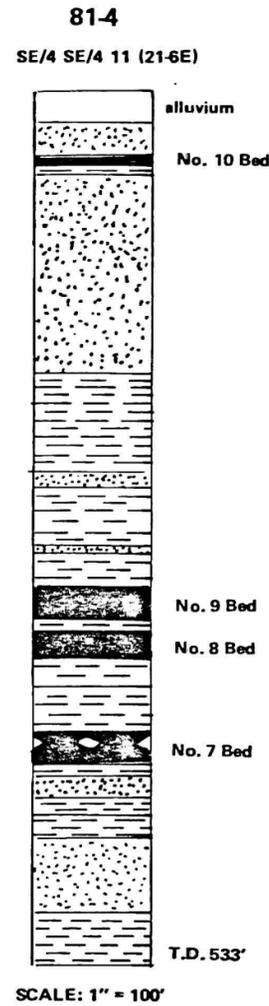
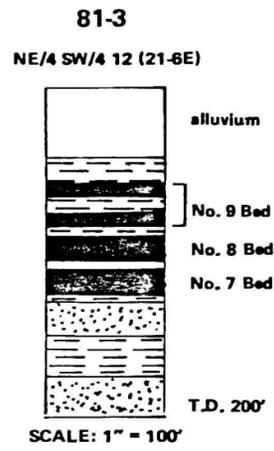
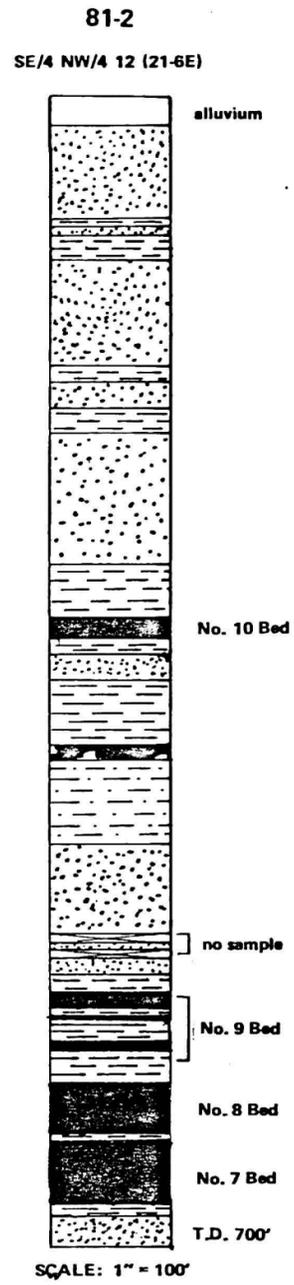
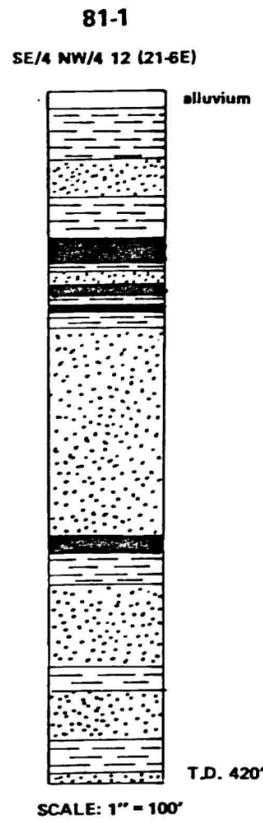
Coal exploration hole

Coal exploration hole with show of gas

Strike and dip of overturned beds

Strike and dip of beds

Strike and dip of partings in volcanic rocks



-  sandstone
-  siltstone
-  shale
-  claystone
-  coal and impure coal
-  igneous rock
-  lost or unsampled

