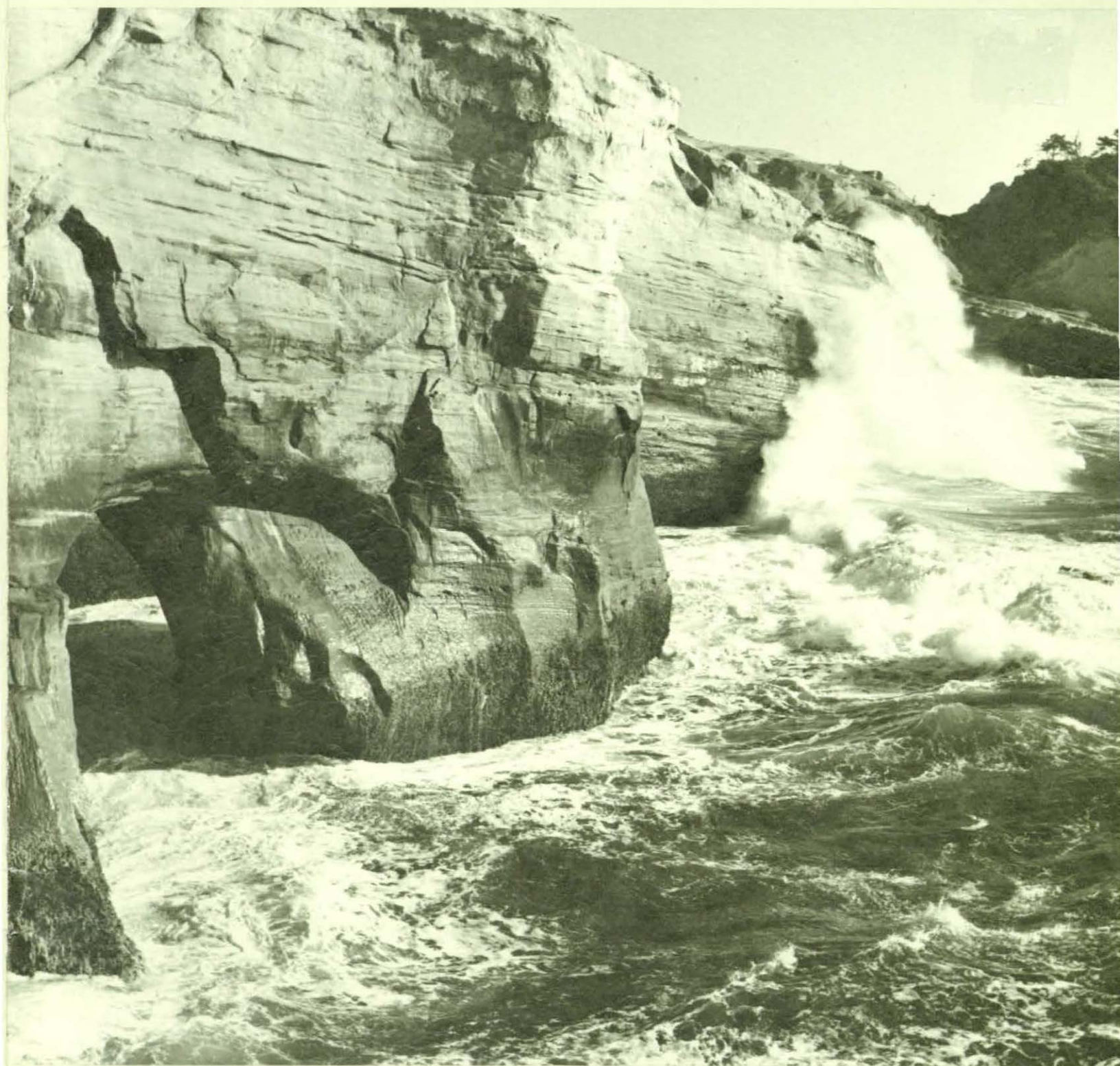


CORRELATION OF CENOZOIC STRATIGRAPHIC UNITS OF WESTERN OREGON AND WASHINGTON



STATE OF OREGON
DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES
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1983

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1005 State Office Building
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in cooperation with

WASHINGTON DEPARTMENT OF NATURAL RESOURCES,
GEOLOGY AND EARTH RESOURCES DIVISION

OIL AND GAS INVESTIGATION 7

CORRELATION OF CENOZOIC STRATIGRAPHIC UNITS OF WESTERN OREGON AND WASHINGTON

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Conducted in conformance with ORS 516.030

1983

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The Oregon Department of Geology and Mineral Industries is publishing this paper because the subject matter is consistent with the mission of the Department.

To facilitate timely distribution of information, camera-ready copy submitted by the project coordinators has not been edited by the staff of the Oregon Department of Geology and Mineral Industries.

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Correlation chart	(folded, in back)
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CORRELATION OF CENOZOIC STRATIGRAPHIC UNITS
OF
WESTERN OREGON AND WASHINGTON

Correlation of rock units is a fundamental data base for interpreting earth history. The chart accompanying this report is a graphical display of current knowledge by thirty stratigraphers on the correlation of the Cenozoic stratigraphic units of twenty local successions in western Oregon and Washington (see Exhibits 1, 2, and 3). The local successions are correlated to both provincial and global chronostratigraphic units.

The new correlation chart, "Correlation of Cenozoic Stratigraphic Units of Western Oregon and Washington," revises part of the 1944 chart "Correlation of the Marine Cenozoic Formations of Western North America," constructed under the chairmanship of C. E. Weaver and published by the Geological Society of America.

Correlations shown on the new chart differ from many previously published reports. The changes reflect two origins:

- 1) New data that change or refine previous correlations; and
- 2) Changes in the local usage of the European series-epoch and stage-age units.

Access to new data is facilitated by the data sheets for individual stratigraphic units. The data sheets have been provided by the geologists contributing to the construction of the local stratigraphic columns. Each data sheet consists of basic nomenclatural, stratigraphical, and biostratigraphical information including references for the first use of the stratigraphic unit and a "most useful" publication. Use of the data sheets and the references cited thereon is essential to the correct usage of the correlation chart.

Changes in European series-epoch and stage-age usage result from the recalibration of Oregon and Washington biostratigraphic and

chronostratigraphic units to the global chronostratigraphic units. This recalibration has been accomplished by redefinition of local zonal and stage units and their correlation, through the use of new data on planktonic microfossils collected from local stratigraphic units, to the planktonic zonal schemes of the worldwide geologic time scale. The biostratigraphic correlations are augmented by integration of radiometric ages (see Armentrout, 1981).

The refinement of correlation between provincial and global chronostratigraphic units requires reevaluation of previously published Oregon-Washington usage of European series-epoch and stage-age units. A case in point are those formations containing foraminiferal faunas assigned to the Narizian and Refugian Foraminiferal Stages. Based on the best data available, Weaver and others (1944) correlated the Narizian Stage to the late Eocene and the Refugian Stage to the Eocene-Oligocene. Recent work incorporating planktonic microfossil faunas recovered from the same strata as the benthic foraminifers has shown that the Narizian best correlates with the middle to early late Eocene, and the Refugian best correlates with the late Eocene (Armentrout, 1981; Rau, 1981; Warren and Newell, 1981).

Geologists must identify the basis of published age assignments, including the time scale used by the original author, and reevaluate that data in light of current correlation frameworks. Reevaluation of provincial usage of European terms is facilitated by inclusion of both global and provincial chronostratigraphic frameworks on the "Correlation of Cenozoic Stratigraphic Units of Western Oregon and Washington" chart and by use of the information on the stratigraphic unit data sheets.

The construction of this chart, "Correlation of Cenozoic Stratigraphic Units of Western Oregon and Washington," has been a cooperative effort of the Oregon Department of Geology and Mineral Industries and the Washington Department of Natural Resources - Geology and Earth Resources Division. Development of the Oregon-Washington chart is part of a national project entitled "Correlation of Stratigraphic Units of North America" (COSUNA).

COSUNA is a research project of the American Association of Petroleum Geologists in cooperation with the United States Geological Survey and the Geological Society of America. The COSUNA project began in 1976 and is concluding during 1983 with the publication of a series of regional correlation charts. These charts are intended to serve as replacements for the sixteen correlation charts published as Bulletins of the Geological Society of America during 1942-1960.

Publication of the COSUNA charts is coordinated by O. E. Childs, A. Salvador and G. Steel. Childs, in his 1981 Annual Report on the COSUNA project, noted that G. Arthur Cooper, senior author of the 1942 Correlation Chart #4, admonished chart users to remember that "Many of the correlations are only tentative; the reader is warned not to accept the chart as a final or fixed expression of correlations; it is a statement of existing knowledge only." The publication of a new correlation chart series in the 1980's provides a new "tentative" statement of existing knowledge reflecting the ever-increasing understanding of the stratigraphic record.

To facilitate understanding of the present chart for the "Correlation of Cenozoic Stratigraphic Units of Western Oregon and Washington," the following aspects of chart construction are noted:

1. The "Correlation of Stratigraphic Units of North America" (COSUNA) project provides a series of correlation charts using a uniform time scale to facilitate correlation of stratigraphic units between different geographic regions of North America. While the correlation of global chronostratigraphic units continues to undergo modification and recalibration (see Berggren, Kent, and Flynn, 1983), the COSUNA charts use the time scale proposed by the COSUNA Geochronology Committee (Salvador, 1981). Use of a single time scale for all charts facilitates both correlations between regions and with updated time scales.

2. The absolute time scale of this chart changes at 1, 5, and 25 million years to conform with the California COSUNA Chart allowing for format uniformity between the two West Coast charts.
3. The Oregon and Washington Chronostratigraphic Units are correlated to the Global and Oceanic Chronostratigraphic Units by specialists in each discipline and are in general agreement with the California COSUNA Chart.

NOTE: To this point, all correlations are by committee and are thus a 'compromise' to attain uniformity between all charts or at least charts of adjacent areas.

4. Correlation of the western Oregon and Washington Cenozoic stratigraphic units is based on the recommendations of local authorities using biostratigraphic data and superpositional relationships.
5. Radiometric data are noted only on the formation data sheets. Some of the radiometric ages are not compatible with biostratigraphically derived million-year ages. Because the Global Chronostratigraphic Units are based on biostratigraphically defined units, correlations to that time scale must be biostratigraphic (see Berggren, 1981). Resolution of discrepancies between biostratigraphically and radiometrically derived million-year ages requires further research.
6. The western Oregon and Washington Cenozoic COSUNA Chart represents a statement of knowledge by the contributing authors as of March 18, 1983.

REFERENCES CITED

This listing is of references cited in the text or on the correlation chart. References for individual stratigraphic units are given on the data sheets.

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Wolfe, J. A., 1981, A chronologic framework for Cenozoic megafossil floras of northwestern North America and its relation to marine geochronology: Geological Society of America Special Paper 184, p. 39-47.

Wood, H. E., II (Chairman), and others, 1941, Nomenclature and correlation of the North American continental Tertiary: Geological Society of America Bulletin, v. 52, p. 1-48.

EXHIBIT 1

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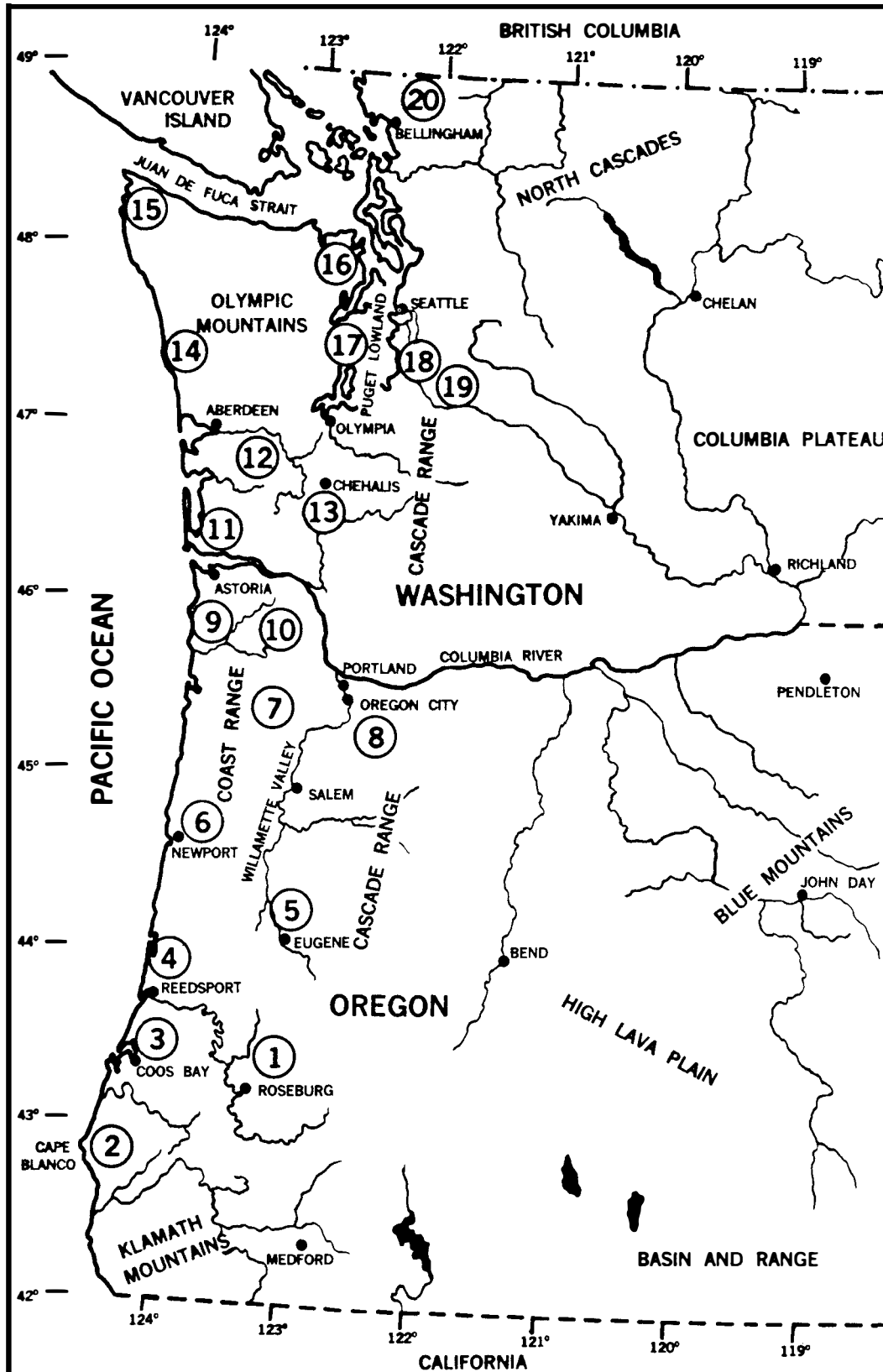
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EXHIBIT 2

STRATIGRAPHIC COLUMNS

- (1) ROSEBURG AREA: composited from units cropping out in the vicinity of Roseburg, Douglas and eastern Coos Counties, Oregon
- (2) CAPE BLANCO AREA: composited from units cropping out along the sea cliffs between Sixes River and Floras Lake near Cape Blanco, Curry County, Oregon
- (3) COOS BAY AREA: composited from units cropping out between Fivemile Point northward to Coos Head and eastward to the Coast Range foothills, Coos County, Oregon
- (4) REEDSPORT AREA: composited from surface and subsurface units in the vicinity of Reedsport, Douglas County, Oregon
- (5) EUGENE AREA: composited from surface and subsurface units in the Eugene area, Lane County, Oregon
- (6) CENTRAL COAST RANGE: composited from units cropping out in the vicinity of Newport, Lincoln County, Oregon
- (7) McMINNVILLE-SHERIDAN AREA: composited from surface and subsurface units in Polk County, Oregon
- (8) OREGON CITY-MOLALLA AREA: composited from surface and subsurface units in the vicinity of Oregon City and Molalla, Clackamas County, Oregon
- (9) ASTORIA AREA: composited from units cropping out along the coastal cliffs and inland in Clatsop County, Oregon
- (10) COLUMBIA COUNTY AREA: composited from surface and subsurface units in Columbia County, Oregon
- (11) SOUTH FLANK-WILLAPA HILLS: composited from surface units in Wahkiakum and Pacific Counties, Washington
- (12) GRAYS HARBOR BASIN: composited from units cropping out along the Willapa, Chehalis, Satsop and Wishkah Rivers, Pacific and Grays Harbor Counties, Washington
- (13) CENTRALIA-CHEHALIS AREA: composited from surface and subsurface units in the Centralia-Chehalis coal district, Thurston and Lewis Counties, Washington
- (14) WESTERN OLYMPIC PENINSULA: composited from units cropping out along the sea cliffs and stream valleys between Point Grenville and the Hoh River, western Grays Harbor and Jefferson Counties, Washington
- (15) NORTHWEST OLYMPIC PENINSULA: composited from units cropping out in the vicinity of Cape Flattery and Crescent Lake, Clallam County, Washington
- (16) NORTHEAST OLYMPIC PENINSULA: composited from units cropping out along the coastline of Discovery Bay and between Port Townsend and Port Ludlow, Jefferson County, Washington
- (17) BREMER TON AREA: composited from units cropping out along the shoreline between Bremerton and Blakeley Harbor, Kitsap County, Washington
- (18) SEATTLE AREA: composited from surface and subsurface units in the vicinity of Seattle and Hobart, King County, Washington
- (19) CARBON RIVER AREA: composited from units cropping out in the Lake Tapps quadrangle, Pierce County, Washington
- (20) BELLINGHAM AREA: composited from surface and subsurface units in western Whatcom and Skagit Counties, Washington

EXHIBIT 3
LOCATION OF STRATIGRAPHIC COLUMNS



DATA SHEETS

The first entry in each section gives the location, column name, general location description, principal reference, and column authors for that particular stratigraphic column.

The following entries in each section are data sheets for each stratigraphic unit included in that particular stratigraphic column.

1. ROSEBURG AREA

A. COMPOSITE SECTION LOCATION

Reference # _____ Location # _____
Latitude 43° 15' N Longitude 123° 20' W
County or Counties 019 Douglas County
State. 36 Oregon State

Column Name: Roseburg Area

Chart Name: Cenozoic Stratigraphic Units, Western Oregon and Washington

General Location Description: Cenozoic section composited from units in and around Roseburg, Oregon, within Douglas County and eastern Coos County.

Principal Reference:

Baldwin, E. M., 1974, Eocene stratigraphy of southwestern Oregon: Oregon Department of Geology and Mineral Industries Bulletin 83, 40 p., 1 map.

Biostratigraphy:

Miles, G. A., 1981, Planktonic foraminifers of the lower Tertiary Roseburg, Lookingglass, and Flournoy Formations (Umpqua Group), Southwest Oregon: Geological Society of America Special Paper 184, p. 85-103.

Column Authors: E. M. Baldwin, University of Oregon
D. R. McKeel, Consultant, Otis, Oregon
G. A. Miles, Exxon U.S.A.

B. DATA SHEETS FOR EACH STRATIGRAPHIC UNIT ON CORRELATION CHART

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
4. Column Name Roseburg Area
5. Chart # _____ 6. Column # 1
7. Name of Stratigraphic Unit fluvial terrace deposits
8. Stratigraphic Rank and Status: Formation Member, Bed, _____
(Circle Appropriate Rank) Group (Circle Appropriate Status) (Formal) (Informal)
9. Age Quaternary Pleistocene
System Series Stage
10. Surface Subsurface or Both Surface
11. Bounding Units: Above alluvium Below Various Eocene Units
12. Lithology: Dominant sands 70 %
Subordinate gravels 30 %
13. Thickness (Metric) 10-30 m
14. Major Unconformities: - Check Appropriate Line -
None Disconformable Angular
Above: _____ x _____
Within: _____
Below: _____ x _____

15. Fossil Data: None

16. Radiometric Data: None Years Method _____
Source: _____

17. Economic Data: sand and gravel

18. Other Data: (?) Plio-Pleistocene river terraces occur intermittently along the valleys.

19. Original Reference:

20. Most Significant Reference: Baldwin, E. M., and Beaulieu, J. D., 1973, Geology and Mineral Resources of Coos County, Oregon: Oregon Department of Geology and Mineral Industries Bulletin 80, 40 p.

21. Author(s) of Sheet Preparation: J. M. Ammentrout
22. Date Prepared: 12/31/82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
4. Column Name Roseburg Area
5. Chart # _____ 6. Column # 1
7. Name of Stratigraphic Unit Bateman Formation
8. Stratigraphic Rank and Status: Formation Member, Bed, _____
(Circle Appropriate Rank) Group (Circle Appropriate Status) (Formal) (Informal)
9. Age Paleogene Eocene Lutetian
System Series Stage
10. Surface Subsurface or Both Surface
11. Bounding Units: Above alluvium Below Elkton/Iye Formation
12. Lithology: Dominant sandstone 70 %
Subordinate gravel 30 %
13. Thickness (Metric) 500m
14. Major Unconformities: - Check Appropriate Line -
None Disconformable Angular
Above: _____ x _____
Within: _____
Below: _____ x _____

15. Fossil Data: Upper Ulatisian Stage Forams; megafossils upper Middle Eocene (?). Fossil plants listed by Brown in Baldwin, 1961: See Baldwin, 1974.

16. Radiometric Data: None Years Method _____
Source: _____

17. Economic Data: Coal beds of marginal quality present in upper part of formation.

18. Other Data:

19. Original Reference: Baldwin, E. M., 1961, Geologic map of the lower Umpqua River Area, Oregon; U. S. Geological Survey Map OM-204

20. Most Significant Reference: E. M. Baldwin, 1974, Eocene Stratigraphy of Southwestern Oregon: Oregon Department of Geology and Mineral Industries Bulletin 83, 40 p.

21. Author(s) of Sheet Preparation: E. M. Baldwin
22. Date Prepared: 12-9-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Roseburg Area
 5. Chart # _____ 6. Column # 1
 7. Name of Stratigraphic Unit Tyee Formation
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) (Formal) Informal
 9. Age Paleogene Eocene Lutetian
 System Series Stage
 10. Surface Subsurface or Both _____ Surface _____
 11. Bounding Units: Above Elkton Fm Below Flournoy Fm
 12. Lithology: Dominant sandstone 70 %
 Subordinate siltstone 30 %
 13. Thickness (Metric) 1,750 m
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____ x _____
 Within: x _____
 Below: _____ x _____
 15. Fossil Data: Utitizian Stage Forams: Miles, G. A., 1981, in Geological Society of America Special Paper 184, p. 85-103.
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: Coal beds at Eden Ridge are possibly commercial.
 18. Other Data: Tyee Formation rests on Flournoy Formation. Both contain massive sandstone beds but the Flournoy beds are better graded and may be of deeper water deposition than Tyee beds. Tyee Formation contains coal and conglomerate at southern end of basin.
 19. Original Reference: Diller, J. S., 1898, Description of the Roseburg quadrangle, Oregon: U. S. Geological Survey Geological Atlas, Folio 49
 20. Most Significant Reference: Baldwin, E. M., 1974, Eocene stratigraphy of southwestern Oregon: Oregon Department of Geology and Mineral Industries Bulletin 80, 82 p.
 21. Author(s) of Sheet Preparation: E. M. Baldwin
 22. Date Prepared: July 1, 1982

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Roseburg Area
 5. Chart # _____ 6. Column # _____
 7. Name of Stratigraphic Unit Elkton Siltstone Member
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation Member, Bed, _____ of Tyee Formation
 (Circle Appropriate Status) (Formal) Informal
 9. Age Paleogene Eocene Lutetian
 System Series Stage
 10. Surface Subsurface or Both _____ Surface _____
 11. Bounding Units: Above Bateman Fm Below Tyee Fm
 12. Lithology: Dominant siltstone 75 %
 Subordinate sandstone 25 %
 13. Thickness (Metric) 100m
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____ x _____
 Within: _____ x _____
 Below: _____ x _____
 15. Fossil Data: Utitizian Stage Forams (Rau and Stewart): perhaps upper part - See Baldwin, 1973. Also Miles, G. A., 1981 in Geological Society of America Special Paper 184, p. 85-103.
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: None
 18. Other Data: Elkton sandstone beds are similar to those in Tyee and the Tyee may interfinger or grade upward into the Elkton: Baldwin (1973) uses "Elkton Formation".
 19. Original Reference: Baldwin, E. M., 1961, Geologic map of the Lower Umpqua River area, Oregon: U.S. Geological Survey Map OM-204
 20. Most Significant Reference: Baldwin, E. M., 1973, Eocene Stratigraphy of southwestern Oregon: Oregon Department Geology and Minerals Industries Bulletin 80, 82 p.
 21. Author(s) of Sheet Preparation: E. M. Baldwin
 22. Date Prepared: July 1, 1982

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Roseburg Area
 5. Chart # _____ 6. Column # 1
 7. Name of Stratigraphic Unit Flournoy Formation
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) (Formal) Informal
 9. Age Paleogene Eocene Ypresian-Lutetian
 System Series Stage
 10. Surface Subsurface or Both _____ Surface _____
 11. Bounding Units: Above Tyee Fm Below Lookingglass Fm
 12. Lithology: Dominant siltstone 55 %
 Subordinate sandstone 45 %
 13. Thickness (Metric) 1,500 m
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____ x _____
 Within: _____ x _____
 Below: _____ x _____
 15. Fossil Data: Utitizian Stage Forams: Miles, G. A., 1981, in Geological Society of America Special Paper 184, p. 85-103.
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data:
 18. Other Data: Basal Flournoy is largely graded sandstone, upper Flournoy is largely siltstone.
 19. Original Reference: Baldwin, E. M., 1974, Eocene stratigraphy of southwestern Oregon: Oregon Department of Geology and Mineral Industries Bulletin 83, 40 p.
 20. Most Significant Reference: Baldwin, E. M., Beaulieu, J. D., Ramp, L., Gray, J., Newton, V. C., Jr., and Mason, R. S., 1973, Geology and mineral resources of Coos County, Oregon: Oregon Department of Geology and Mineral Industries Bulletin 80, 82 p.
 21. Author(s) of Sheet Preparation: E. M. Baldwin
 22. Date Prepared: July 1, 1982

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Roseburg Area
 5. Chart # _____ 6. Column # 1
 7. Name of Stratigraphic Unit Lookingglass Formation
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) (Formal) Informal
 9. Age Paleogene Eocene Ypresian
 System Series Stage
 10. Surface Subsurface or Both _____ Surface _____
 11. Bounding Units: Above Flournoy Fm Below Roseburg and Pre-Tertiary
 12. Lithology: Dominant siltstone 60 %
 Subordinate conglomerate and sandstone 40 %
 13. Thickness (Metric) 2000 m
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____ x _____
 Within: _____ x _____
 Below: _____ x _____
 15. Fossil Data: Penutian Stage (R. Thoms) and Penutian-Ypresian Stage Forams: Miles, G. A., 1981, in Geological Society of America Special Paper 184, p. 85-103.
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data:
 18. Other Data: The basal member is largely conglomerate; middle member mostly siltstone and sandstone; upper member of locally derived conglomerate and sandstone.
 19. Original Reference: Baldwin, E. M., 1974, Eocene stratigraphy of southwestern Oregon: Oregon Department of Geology and Mineral Industries Bulletin 83, 40 p.
 20. Most Significant Reference: Baldwin, E. M., Beaulieu, J. D., Ramp, L., Gray, J., Newton, V. C., Jr., and Mason, R. S., 1973, Geology and mineral resources of Coos County, Oregon: Oregon Department of Geology and Mineral Industries Bulletin 80, 82 p.
 21. Author(s) of Sheet Preparation: E. M. Baldwin
 22. Date Prepared: July 1, 1982

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
4. Column Name Roseburg Area
5. Chart # _____ 6. Column # 1
7. Name of Stratigraphic Unit Roseburg Formation
8. Stratigraphic Rank and Status:
(Circle Appropriate Rank) Group Formation Member, Bed, _____
(Circle Appropriate Status) Formal Informal
9. Age Paleogene Eocene Danian-Ypresian
System Series Stage
10. Surface Subsurface or Both Surface and subsurface
11. Bounding Units: Above Lookingglass Fm Below Unknown
12. Lithology: Dominant siltstone and sandstone 65 %
Subordinant basalt flows and breccia 35 %
13. Thickness (Metric 5000+ m)
14. Major Unconformities: - Check Appropriate Line -
None Disconformable Angular
Above: _____
Within: _____ X
Below: Unknown _____
15. Fossil Data: Forams indicate early Eocene Ypresian of Planktonic stages or Penutian-Bulitian: Miles, G. A., 1981, Geological Society of American Special Paper 184, p. 85-103.
Average 62
16. Radiometric Data: million Years Method K/Ar (Range 58-66 my)
Source: Duncan, R. A., in press (1983), A captured island chain in the Coast Range of Oregon and Washington: Journal of Geophysical Research
17. Economic Data: Basalt used for road construction - also petroleum exploration targets within sedimentary interbeds.
18. Other Data: The fossil data is for the upper part of the Roseburg Formation where sedimentary rocks are abundant. The lower Roseburg Formation age is determined on Potassium/Argon dates.
19. Original Reference: Baldwin, E. M., 1974, Eocene stratigraphy of southwestern Oregon: Oregon Department of Geology and Mineral Industries Bulletin 83, 40 p.
20. Most Significant Reference: Baldwin, E. M., Beaulieu, J. D., Ramp, L., Gray, J., Newton, V. C., Jr., and Mason, R. S., 1973, Geology and Mineral Resources of Coos County Oregon: Oregon Department of Geology and Mineral Industries Bulletin 80, 82 p.
21. Author(s) of Sheet Preparation: E. M. Baldwin
22. Date Prepared: 7-1-82

2. CAPE BLANCO AREA

A. COMPOSITE SECTION LOCATION

Reference # _____ Location # _____
Latitude 72° 50' N Longitude 124° 33' W
County or Counties 015 Curry County
State 36 Oregon State
Column Name: Cape Blanco Area
Chart Name: Cenozoic Stratigraphic Units, Western Oregon and Washington
General Location Description: Cenozoic section composited from units cropping out along the sea cliff between Sixes River and Floras Lake at Cape Blanco, Curry County, Oregon
Principal Reference (with Biostratigraphic review):
Armentrout, J. M., 1980, Cenozoic stratigraphy of Coos Bay and Cape Blanco, southwestern Oregon: Oregon Department of Geology and Mineral Industries Bulletin 101, p. 175-216.
Column Authors: E. M. Baldwin, University of Oregon
J. M. Armentrout, Mobil Oil Corporation
W. O. Addicott, U. S. Geological Survey

B. DATA SHEETS FOR EACH STRATIGRAPHIC UNIT ON CORRELATION CHART

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
4. Column Name Cape Blanco Area
5. Chart # _____ 6. Column # 2
7. Name of Stratigraphic Unit marine and fluvial terrace deposits
8. Stratigraphic Rank and Status: Formation Member, Bed, _____
(Circle Appropriate Rank) Group Formation Member, Bed, _____
(Circle Appropriate Status) Formal Informal
9. Age Quaternary Pleistocene
System _____ Series _____ Stage _____
10. Surface Subsurface or Both Surface
11. Bounding Units: Above alluvium Below Elk River Beds
12. Lithology: Dominant sand 70 %
Subordinate gravel 30 %
13. Thickness (Metric about 13 m)
14. Major Unconformities: - Check Appropriate Line -
None Disconformable Angular
Above: _____ X _____
Within: _____ _____
Below: _____ X _____
15. Fossil Data: Molluscan fauna reported by Addicott (1964)
16. Radiometric Data: None Years Method
Source: _____
17. Economic Data: sand and gravel
18. Other Data: Part of Oregon coastal terrace sequence under study by U. S. Geological Survey, Menlo Park
19. Original Reference: Addicott, W. O., 1964, A late Pleistocene invertebrate fauna from southwestern Oregon: Journal of Paleontology, v. 38, no. 4, p. 650-661.
20. Most Significant Reference: J. M. Armentrout, 1980, Field trip road log for the Cenozoic stratigraphy of Coos Bay and Cape Blanco southwestern Oregon: Oregon Department of Geology and Mineral Industries Bulletin 101, p. 175-216.
21. Author(s) of Sheet Preparation: J. M. Armentrout
22. Date Prepared: 9-10-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
4. Column Name Cape Blanco Area
5. Chart # _____ 6. Column # 2
7. Name of Stratigraphic Unit Elk River Beds
8. Stratigraphic Rank and Status: Formation Member, Bed, _____
(Circle Appropriate Rank) Group Formation Member, Bed, _____
(Circle Appropriate Status) Formal Informal
9. Age Quaternary Pleistocene
System _____ Series _____ Stage _____
10. Surface Subsurface or Both Surface
11. Bounding Units: Above terrace deposits Below Port Orford Formation
12. Lithology: Dominant sandstone 90 %
Subordinate conglomerate 10 %
13. Thickness (Metric 37 m)
14. Major Unconformities: - Check Appropriate Line -
None Disconformable Angular
Above: _____ X _____
Within: _____ _____
Below: _____ X _____
15. Fossil Data: Forams and Mollusks discussed in Armentrout (1980), Mammals mentioned in Armentrout, J. M., 1981, Geological Society of America Special Paper 184, p. 137-148.
16. Radiometric Data: None Years Method
Source: _____
17. Economic Data:
18. Other Data:
19. Original Reference: Diller, J. S., 1902, Topographic development of the Klamath Mountains: U. S. Geological Survey Bulletin 196, 69 p.
Redefinition: Baldwin, E. M., 1945, Some revisions of the late Cenozoic stratigraphy of the southern Oregon coast: Journal of Geology, v. 53, no. 1, p. 35-46.
20. Most Significant Reference: Armentrout, J. M., 1980, Field trip road log for the Cenozoic stratigraphy of Coos Bay and Cape Blanco southwestern Oregon: Oregon Department of Geology and Mineral Industries Bulletin 101, p. 175-216.
21. Author(s) of Sheet Preparation: J. M. Armentrout
22. Date Prepared: 9-10-82

2. CAPE BLANCO AREA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Cape Blanco Area
 5. Chart # _____ 6. Column # 2
 7. Name of Stratigraphic Unit Port Orford Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) (Formal) Informal
 9. Age Quaternary Pleistocene
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Elk River Beds Below Empire Fm.
 12. Lithology: Dominant sandstone 55 %
 Subordinate siltstone + conglomerate 45 %
 13. Thickness (Metric 56 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: x
 Within: _____
 Below: _____
 15. Fossil Data: Molluscan fauna discussed by Roth, B., 1979, Late Cenozoic invertebrates from northwest California and southwest Oregon: University of California Berkeley, Doctoral thesis, 803 p., unpublished.
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data:
 18. Other Data:
 19. Original Reference: Baldwin, E. M., 1945, Some revisions of the late Cenozoic stratigraphy of the southern Oregon coast: Journal of Geology, v. 53, p. 35-46.
 20. Most Significant Reference: Ammentrout, J. M., 1980, Field trip road log for the Cenozoic stratigraphy of Coos Bay and Cape Blanco, Oregon: Oregon Department of Geology and Mineral Industries Bulletin 101, p. 175-216.
 21. Author(s) of Sheet Preparation: E. M. Baldwin
 22. Date Prepared: 7-2-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Cape Blanco Area
 5. Chart # _____ 6. Column # 2
 7. Name of Stratigraphic Unit Empire Formation (restricted)
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) (Formal) Informal
 9. Age Cenozoic Miocene Tortonian-Messinian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Port Orford Formation Below sandstone of Floras Lake
 12. Lithology: Dominant sandstone 80 %
 Subordinate sandy siltstone 20 %
 13. Thickness (Metric 100 m (approx))
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: _____
 Below: _____
 15. Fossil Data: Mollusks (lower part) and diatoms (upper part). The mollusks are referable to the Wishkaham Stage; the diatoms can be correlated with the upper part of the Montesano Formation of Fowler (1965) in western Washington, by J. A. Barron in Addicott (1980).
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data:
 18. Other Data: Restricted formation excluding sandstone of Floras Lake which was formerly included in the Empire Formation.
 The Empire Formation unconformably overlies the Jurassic Otter Point Formation at the main western prominence; south of the main cape the Empire Formation unconformably overlies the sandstone of Floras Lake.
 19. Original Reference: Addicott, W. O., 1980, Miocene stratigraphy and fossils, Cape Blanco, Oregon: Oregon Geology, v. 42, no. 5, p. 87-97.
 20. Most Significant Reference: Addicott, W. O., 1980, Miocene stratigraphy and fossils, Cape Blanco, Oregon: Oregon Geology, v. 42, no. 5, p. 87-97.
 21. Author(s) of Sheet Preparation: W. O. Addicott
 22. Date Prepared: 7-8-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Cape Blanco Area
 5. Chart # _____ 6. Column # 2
 7. Name of Stratigraphic Unit sandstone of Floras Lake
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) (Formal) Informal
 9. Age Paleogene Miocene Burdigalian-Serravalian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Empire Formation Below Roseburg Fm
 12. Lithology: Dominant sandstone 95 %
 Subordinate conglomeratic sandstone 5 %
 13. Thickness (Metric 150-180 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: _____
 Below: _____
 15. Fossil Data: Extensive marine larger invertebrate fauna throughout formation, principally mollusks. A 7-8 m thick tuff bed near top contains fossil leaves. Fossil invertebrates indicate assignment to the Newportian Stage. See Addicott (1980).
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data:
 18. Other Data:
 19. Original Reference: Addicott, W. O., 1980, Miocene stratigraphy and fossils, Cape Blanco, Oregon: Oregon Geology, v. 42, no. 5, p. 87-97.
 20. Most Significant Reference: Addicott, W. O., 1980, Miocene stratigraphy and fossils, Cape Blanco, Oregon: Oregon Geology, v. 42, no. 5, p. 87-97.
 21. Author(s) of Sheet Preparation: W. O. Addicott
 22. Date Prepared: 7-8-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Cape Blanco Area
 5. Chart # _____ 6. Column # 2
 7. Name of Stratigraphic Unit Roseburg Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) (Formal) Informal
 9. Age Paleogene Eocene Thanetian-Ypresian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Floras Lake and Empire Fms. Below Unknown
 12. Lithology: Dominant shale 100 %
 Subordinate _____
 13. Thickness (Metric 40+ m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: _____
 Below: Unknown
 15. Fossil Data: Middle Eocene forams: Bandy, O. L., 1944, Eocene Foraminifera from Cape Blanco, Oregon: Journal of Paleontology, v. 18, no. 4, p. 366-377.
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data:
 18. Other Data: E. M. Baldwin and others (1973, Oregon Department of Geology and Mineral Industries Bulletin 80) assigned these shales to the Roseburg Formation. The Roseburg Formation shales are in fault contact with Jurassic Otter Point Formation metasediments.
 19. Original Reference: Diller, J. S., 1902, Topographic development of the Klamath Mountains (California and Oregon): U. S. Geological Survey Bulletin 196, p. 1-69.
 20. Most Significant Reference: Ammentrout, J. M., 1980, Field trip road log for the Cenozoic stratigraphy of Coos Bay and Cape Blanco, Oregon: Oregon Department of Geology and Mineral Industries Bulletin 101, p. 175-216.
 21. Author(s) of Sheet Preparation: J. M. Ammentrout
 22. Date Prepared: 9-10-82

3. COOS BAY AREA

A. COMPOSITE SECTION LOCATION

Reference # _____ Location # _____
 Latitude 43° 25' N Longitude 124° 15' W
 County or Counties 011 Coos County
 State. 36 Oregon State
 Column Name: Coos Bay Area
 Chart Name: Cenozoic Stratigraphic Units, Western Oregon and Washington
 General Location Description: Cenozoic section composed from units cropping out between Fivemile Point northward to Cape Arago and Coos Head, and eastward to the Coast Range foothills east of Coos Bay, Coos County, Oregon.
 Principal Reference (with Biostratigraphic review):
 Armentrout, J. M., 1980, Cenozoic stratigraphy of Coos Bay and Cape Blanco, southwestern Oregon: Oregon Department of Geology and Mineral Industries Bulletin 101, p. 175-216.
 Column Authors: E. M. Baldwin, University of Oregon
 J. M. Armentrout, Mobil Oil Corporation

B. DATA SHEETS FOR EACH STRATIGRAPHIC UNIT ON CORRELATION CHART

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Coos Bay Area
 5. Chart # _____ 6. Column # 3
 7. Name of Stratigraphic Unit marine and fluvial terrace deposits
 8. Stratigraphic Rank and Status: Formation Member, Bed, Numerous units
 (Circle Appropriate Rank) Group Formation Member, Bed, Numerous units
 (Circle Appropriate Status) Formal Informal
 9. Age Quaternary Pleistocene
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above alluvium Below All formations in area
 12. Lithology: Dominant sand 90 %
 Subordinate silt 10 %
 13. Thickness (Metric 1-10 m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: None Disconformable Angular
 Within: X
 Below: X
 15. Fossil Data: None in Coos Bay area
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: sand and gravel
 18. Other Data: Littoral and aeolian sands - several terraces are present - see Griggs (1945).
 19. Original Reference: Griggs, A. B., 1945, Chromite bearing sands of the southern part of the coast of Oregon: U. S. Geological Survey Bulletin 945-E, 150 p.
 20. Most Significant Reference: Armentrout, J. M., 1980, Field trip road log for the Cenozoic stratigraphy of Coos Bay and Cape Blanco, southwest Oregon: Oregon Department of Geology and Mineral Industries Bulletin 101, p. 175-216.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 9-10-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Coos Bay Area
 5. Chart # _____ 6. Column # 3
 7. Name of Stratigraphic Unit Empire Formation
 8. Stratigraphic Rank and Status: Formation Member, Bed, _____
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Neogene Miocene Tortonian-Zanclean
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Pleistocene deposits Below Tunnel Point Fm. and "Miocene beds"
 12. Lithology: Dominant sandstone 85 %
 Subordinate siltstone 15 %
 13. Thickness (Metric 500 m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: None Disconformable Angular
 Within: X
 Below: X
 15. Fossil Data: Abundant mollusks assigned to Graysian Stage - by recorrelation using Diatoms: See Barron and Armentrout, 1980, Late Miocene diatom florules of the Empire Formation, Coos Bay, Oregon: Geological Society of America Abstracts with Programs v. 12, p. 95-96.
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: _____
 18. Other Data: W. D. Addicott (1976) assigned Empire to Wishkahen Molluscan Stage. Subsequent data on diatoms (Barron and Armentrout, 1980) resulted in Addicott redefining Wishkahen and correlating Empire Fm. with Graysian Stage (correspondence for COSUNA).
 19. Original Reference: Diller, J. S., 1896, A geological reconnaissance in northwestern Oregon: U. S. Geological Survey 17th Annual Report, pt. 1, p. 441-520.
 20. Most Significant Reference: Armentrout, J. M., 1980, Field trip road log for the Cenozoic stratigraphy of Coos Bay and Cape Blanco, southwest Oregon: Oregon Department of Geology and Mineral Industries Bulletin 101, p. 175-216.
 21. Author(s) of Sheet Preparation: E. M. Baldwin
 22. Date Prepared: 7-2-82

3. COOS BAY AREA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Coos Bay Area
 5. Chart # _____ 6. Column # _____
 7. Name of Stratigraphic Unit Coos Conglomerate Member
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, member of Empire Formation
 (Circle Appropriate Status) Formal Informal
 9. Age Neogene Miocene Tortonian-Messinian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Empire Fm sandstones Below Empire Formation sandstones
 12. Lithology: Dominant conglomerate 80 %
 Subordinate sandstone 20 %
 13. Thickness (Metric) 12 m
 14. Major Unconformities: - Check Appropriate Line -
 Above: None Disconformable Angular
 Within: X
 Below: X
 15. Fossil Data: Diatoms of Thalassiosira antiqua - Nitzschia reinholdi Zones
 occur in strata below and above Coos Conglomerate - see Barron and
 Armentrout, 1980, Geological Society of America Programs with Abstracts
 v. 12, p. 95-96.
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: _____
 18. Other Data: Coos Conglomerate fills a channel eroded into Empire Formation
 sandstones; it is an intraformational conglomerate. A second conglomerate
 occurs up section from the type Coos Conglomerate at Fossil Rock.
 19. Original Reference: Diller, J. S., 1896, A geological reconnaissance in
 northwestern Oregon: U. S. Geological Survey 17th Annual Report, pt. 1,
 p. 441-520.
 20. Most Significant Reference: Armentrout, J. M., 1980, Field trip road log for the
 Cenozoic stratigraphy of Coos Bay and Cape Blanco, southwest Oregon: Oregon
 Department of Geology and Mineral Industries Bulletin 101, p. 175-216.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 12-31-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Coos Bay Area
 5. Chart # _____ 6. Column # 3
 7. Name of Stratigraphic Unit Miocene beds (Tarheel formation)
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed,
 (Circle Appropriate Status) Formal Informal
 9. Age Neogene Miocene Burdigalian-Serravallian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Empire Formation Below Bastendorff Shale
 12. Lithology: Dominant sandstone 100 %
 Subordinate _____
 13. Thickness (Metric) 8-2 100 m
 14. Major Unconformities: - Check Appropriate Line -
 Above: None Disconformable Angular
 Within: X
 Below: X
 15. Fossil Data: Megafossils are Newportian and microfossils Luisian/Relizian. See
 Addicott, W. O., 1976, Neogene molluscan stages of Oregon and Washington, in Fritsch,
 A. E., and others, eds., Neogene Symposium: Society of Economic Paleontologists and
 Mineralogists, Pacific Section, San Francisco, California, April 1976, p. 95-115.
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: _____
 18. Other Data: Only known outcrop east of Pigeon Point, Coos Bay area; also known from
 dredging spoil-piles in Coos Bay; see Moore (1963). Name of "Tarheel Formation" has
 been reserved awaiting publication.
 19. Original Reference: Armentrout, J. M., 1967, The Tarheel and Empire Formations -
 Geology and Paleontology of the Type Sections, Coos Bay, Oregon: University of
 Oregon Masters thesis (unpub) 155 p.
 20. Most Significant Reference: Moore, E. J., 1963, Miocene mollusks from the Astoria
 Formation in Oregon: U. S. Geological Survey Professional Paper 419, 109 p. (see
 under Miocene dredgings)
 21. Author(s) of Sheet Preparation: E. M. Baldwin
 22. Date Prepared: 7-2-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Coos Bay Area
 5. Chart # _____ 6. Column # 3
 7. Name of Stratigraphic Unit Tunnel Point Sandstone
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed,
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene Priabonian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Empire Formation Below Bastendorff Shale
 12. Lithology: Dominant sandstone 80 %
 Subordinate siltstone 20 %
 13. Thickness (Metric) 230 m
 14. Major Unconformities: - Check Appropriate Line -
 Above: None Disconformable Angular
 Within: X
 Below: X
 15. Fossil Data: Upper Galvinian Stage Mollusks: See Armentrout, 1980, Oregon
 Department of Geology and Mineral Industries Bulletin 101, p. 175-216.
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: _____
 18. Other Data: Only exposure is in sea cliffs west of mouth of Coos Bay. Also
 referred to as Tunnel Point Formation but Tunnel Point Sandstone is preferred
 in U. S. Geological Survey Bulletin 1535.
 19. Original Reference: Dall, W. H., 1898, A table of the North American Tertiary
 formations, correlated with one another and with those of western Europe with
 annotations: U. S. Geological Survey 18th Annual Report, pt. 2, p. 323-348.
 20. Most Significant Reference: Baldwin, E. M., Beaulieu, J. D., Ramp, L., Gray, J.,
 Newton, V. C., Jr., and Mason, R. S., 1973, Geology and Mineral Resources of Coos
 County, Oregon: Oregon Department of Geology and Mineral Industries Bulletin
 80, 82 p.
 21. Author(s) of Sheet Preparation: E. M. Baldwin
 22. Date Prepared: 7-2-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Coos Bay Area
 5. Chart # _____ 6. Column # 3
 7. Name of Stratigraphic Unit Bastendorff Shale
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed,
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene Bartonian-Priabonian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Tunnel Point Sandstone Below Coaledo Formation
 12. Lithology: Dominant siltstone-shale 80 %
 Subordinate sandstone 20 %
 13. Thickness (Metric) 900 m
 14. Major Unconformities: - Check Appropriate Line -
 Above: None Disconformable Angular
 Within: X
 Below: X
 15. Fossil Data: Narizian and Refugian Forams: See Armentrout, 1980, Oregon
 Department of Geology and Mineral Industries Bulletin 101, p. 175-216.
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: Potential source of petroleum
 18. Other Data: Mostly siltstone and shale, thus poorly exposed. Also referred to as
 Bastendorff Formation but Bastendorff Shale is preferred in U. S. Geological
 Survey Bulletin 1535.
 19. Original Reference: Schenck, H. G., 1927, Marine Oligocene of Oregon:
 California University Publication in Geological Sciences, v. 16, p. 449-460.
 20. Most Significant Reference: Tipton, Ann, 1975, Foraminiferal biostratigraphy of
 the Late Eocene to Early Oligocene type Bastendorff Formation, Near Coos Bay,
 Oregon in Paleogene Symposium: Pacific Section American Association of Petroleum
 Geologists-Society of Economic Paleontologists and Mineralogists-Society of
 Exploration Geophysicists, Los Angeles, p. 563-585.
 21. Author(s) of Sheet Preparation: E. M. Baldwin
 22. Date Prepared: 7-1-82

3. COOS BAY AREA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
4. Column Name Coos Bay Area
5. Chart # _____ 6. Column # 3
7. Name of Stratigraphic Unit Coaledo Formation
8. Stratigraphic Rank and Status: _____
(Circle Appropriate Rank) Group Formation Member Bed, _____
(Circle Appropriate Status) Formal Informal
9. Age Paleogene Eocene Lutetian-Bartonian
- System _____ Series _____ Stage _____
10. Surface Subsurface or Both Surface and subsurface
11. Bounding Units: Above Bastendorff Fm Below Eikton Siltst. Mbr. of Iyee Fm
12. Lithology: Dominant sandstone 55 %
Subordinate siltstone 45 %
13. Thickness (Metric _____)
14. Major Unconformities: - Check Appropriate Line -
None Disconformable Angular
Above: x _____
Within: x _____
Below: _____ x
15. Fossil Data: Narizian Benthic Foraminiferal Stage; Tejon and Transitional Macrofossil Stages: See Armentrout, 1980, Oregon Department of Geology and Mineral Industries Bulletin 101 p. 175-216
16. Radiometric Data: None Years Method
Source: _____
17. Economic Data: Contains coal beds and maybe a source for petroleum
18. Other Data: Divided into a lower deltaic sandstone member; a middle deep water marine member and an upper deltaic coal bearing sandstone member.
19. Original Reference: Diller, J. S., 1899, The Coos Bay coalfield, Oregon: U. S. Geological Survey 19th Annual Report pt. 3, p. 309-370.
20. Most Significant Reference: Baldwin, E. M., Beaulieu, J. D., Ramp, C., Gray, J., Newton, V. C., Jr., and Mason, R. S., Geology and Mineral Resources of Coos County, Oregon: Oregon Department of Geology and Mineral Industries Bulletin 80, 82 p.
21. Author(s) of Sheet Preparation: E. M. Baldwin
22. Date Prepared: 7-1-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
4. Column Name Coos Bay Area
5. Chart # _____ 6. Column # 3
7. Name of Stratigraphic Unit Upper Member of Coaledo Formation
8. Stratigraphic Rank and Status: _____
(Circle Appropriate Rank) Group Formation Member Bed, _____
(Circle Appropriate Status) Formal Informal
9. Age Paleogene Eocene Bartonian
- System _____ Series _____ Stage _____
10. Surface Subsurface or Both Surface and subsurface
11. Bounding Units: Above Bastendorff Shale Below Middle member of Coaledo Fm.
12. Lithology: Dominant sandstone 70 %
Subordinate coal and siltstone 30 %
13. Thickness (Metric 425 m)
14. Major Unconformities: - Check Appropriate Line -
None Disconformable Angular
Above: x _____
Within: _____
Below: x _____
15. Fossil Data: Narizian Foraminifera: see Armentrout, 1980, Oregon Department of Geology and Mineral Industries Bulletin 101, p. 175-216.
16. Radiometric Data: None Years Method
Source: _____
17. Economic Data: Commercial coal measures - subsurface mining now abandoned.
18. Other Data: Deltaic sandstone unit
19. Original Reference: Turner, F. E., 1938, Stratigraphy and Mollusca of the Eocene of western Oregon: Geological Society of America Special Paper 10, 130 p.
20. Most Significant Reference: Allen, J. E., and Baldwin, E. M., 1914, Geology and Coal Resources of Coos Bay Quadrangle, Oregon: Oregon Department of Geology and Mineral Industries Bulletin 27, 160 p.
21. Author(s) of Sheet Preparation: J. M. Armentrout
22. Date Prepared: 12-31-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
4. Column Name Coos Bay Area
5. Chart # _____ 6. Column # 3
7. Name of Stratigraphic Unit Middle Member of Coaledo Formation
8. Stratigraphic Rank and Status: _____
(Circle Appropriate Rank) Group Formation Member Bed, _____
(Circle Appropriate Status) Formal Informal
9. Age Paleogene Eocene Lutetian-Bartonian
- System _____ Series _____ Stage _____
10. Surface Subsurface or Both Surface and subsurface
11. Bounding Units: Above Upper Member of Coaledo Fm Below Lower Coaledo
12. Lithology: Dominant siltstone 90 %
Subordinate sandstone 10 %
13. Thickness (Metric 900 m)
14. Major Unconformities: - Check Appropriate Line -
None Disconformable Angular
Above: x _____
Within: x _____
Below: _____ x
15. Fossil Data: Narizian Foraminifera: See Armentrout, 1980, Oregon Department of Geology and Mineral Industries Bulletin 101, p. 175-216.
16. Radiometric Data: None Years Method
Source: _____
17. Economic Data:
18. Other Data: Deep water siltstone unit
19. Original Reference: Turner, F. E., 1938, Stratigraphy and Mollusca of the Eocene of western Oregon: Geological Society of America Special Paper 10, 130 p.
20. Most Significant Reference: Allen, J. E., and Baldwin, E. M., 1944, Geology and Coal Resources of Coos Bay quadrangle, Oregon: Oregon Department of Geology and Mineral Industries Bulletin 27, 160 p.
21. Author(s) of Sheet Preparation: J. M. Armentrout
22. Date Prepared: 12-31-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
4. Column Name Coos Bay Area
5. Chart # _____ 6. Column #
7. Name of Stratigraphic Unit Lower Member of Coaledo Formation
8. Stratigraphic Rank and Status: _____
(Circle Appropriate Rank) Group Formation Member Bed, _____
(Circle Appropriate Status) Formal Informal
9. Age Paleogene Eocene Lutetian
- System _____ Series _____ Stage _____
10. Surface Subsurface or Both Surface and subsurface
11. Bounding Units: Above Middle Member of Coaledo Fm Below Eikton Siltst. Mbr. of Iyee Fm.
12. Lithology: Dominant sandstone 90 %
Subordinate siltstone 10 %
13. Thickness (Metric 525 m)
14. Major Unconformities: - Check Appropriate Line -
None Disconformable Angular
Above: x _____
Within: _____
Below: _____ x
15. Fossil Data: Narizian Foraminifera: See Armentrout, 1980, Oregon Department of Geology and Mineral Industries Bulletin 101, p. 175-216.
16. Radiometric Data: None Years Method
Source: _____
17. Economic Data:
18. Other Data: Deltaic sandstone unit
19. Original Reference: Turner, F. E., 1938, Stratigraphy and Mollusca of the Eocene of western Oregon: Geological Society of America Special Paper 10, 130 p.
20. Most Significant Reference: Allen, J. E., and Baldwin, E. M., 1944, Geology and Coal Resources of Coos Bay quadrangle, Oregon: Oregon Department of Geology and Mineral Industries Bulletin 27, 160 p.
21. Author(s) of Sheet Preparation: J. M. Armentrout
22. Date Prepared: 12-31-82

3. COOS BAY AREA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Coos Bay Area
 5. Chart # _____ 6. Column # 3
 7. Name of Stratigraphic Unit Bateman Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) (Formal) Informal
 9. Age Paleogene Eocene Lutetian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above alluvium Below Elkton Mbr. of Tyee Fm.
 12. Lithology: Dominant sandstone 75 %
 Subordinate siltstone 25 %
 13. Thickness (Metric 500 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: _____
 Below: _____
 15. Fossil Data: Ulatizian (possibly upper) Foraminiferal Stage: Bird, K. J., 1967, Biostratigraphy of the Tyee Formation (Eocene), southwestern Oregon: University of Wisconsin doctoral dissertation, 209 p., unpublished
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: Contains coal beds of marginal economic value
 18. Other Data: Shallow water offlap phase of Tyee seaway
 19. Original Reference: Baldwin, E. M., 1974, Eocene stratigraphy of southwestern Oregon: Oregon Department of Geology and Mineral Industries Bulletin 83, 40 p., map
 20. Most Significant Reference: Baldwin, E. M., Beaulieu, J. D., Ramp, L., Gray, J., Newton, V. C., Jr., and Mason, R. S., 1973, Geology and Mineral Resources of Coos County, Oregon: Oregon Department of Geology and Mineral Industries Bulletin 80, 82 p.
 21. Author(s) of Sheet Preparation: E. M. Baldwin
 22. Date Prepared: 7-1-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Coos Bay Area
 5. Chart # _____ 6. Column # 3
 7. Name of Stratigraphic Unit Tyee Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) (Formal) Informal
 9. Age Paleogene Eocene Lutetian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Elkton Member Below Flournoy Fm.
 12. Lithology: Dominant sandstone 70 %
 Subordinate siltstone 30 %
 13. Thickness (Metric 1000 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: _____
 Below: _____
 15. Fossil Data: Ulatizian Forams (Miles, G. A., 1981, Geological Society of America Special Paper 184, p. 85-103)
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: Coal beds at Eden Ridge are possibly commercial.
 18. Other Data: Tyee Fm. rests on Flournoy Fm. Both contain massive sandstone beds but the Flournoy beds are better graded and may be of deeper water deposition than Tyee beds. Tyee Fm. contains coal and conglomerate at southern end.
 19. Original Reference: Diller, J. S., 1898, Description of the Roseburg quadrangle, U. S. Geological Survey Geologic Atlas Folio 49.
 20. Most Significant Reference: Baldwin, E. M., 1974, Eocene stratigraphy of southwestern Oregon: Oregon Department of Geology and Mineral Industries Bulletin 80, 82 p.
 21. Author(s) of Sheet Preparation: E. M. Baldwin
 22. Date Prepared: 7-1-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Coos Bay Area
 5. Chart # _____ 6. Column # 3
 7. Name of Stratigraphic Unit Elkton Siltstone Member
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group (Formation) Member, Bed, of Tyee Formation.
 (Circle Appropriate Status) (Formal) Informal
 9. Age Paleogene Eocene Lutetian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Bateman Fm. Below Tyee Fm.
 12. Lithology: Dominant siltstone 75 %
 Subordinate sandstone 25 %
 13. Thickness (Metric 300 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: _____
 Below: _____
 15. Fossil Data: Ulatizian Forams (Raw and Stewart): perhaps upper part of Ulatizian: see Baldwin (1974)
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data:
 18. Other Data: Elkton sandstone beds are similar to those in Tyee - and the Tyee may interfinger or grade upward into the Elkton. Baldwin (1974) used Elkton Formation: locally known at Cape Arago as Sacchi Beach beds.
 19. Original Reference: Baldwin, E. M., 1961, Geologic map of the Lower Umpqua River area, Oregon: U. S. Geological Survey Map 04-204.
 20. Most Significant Reference: Baldwin, E. M., 1974, Eocene stratigraphy of southwestern Oregon: Oregon Department of Geology and Mineral Industries Bulletin 80, 82 p.
 21. Author(s) of Sheet Preparation: E. M. Baldwin
 22. Date Prepared: 7-1-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Coos Bay Area
 5. Chart # _____ 6. Column # 3
 7. Name of Stratigraphic Unit Flournoy Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) (Formal) Informal
 9. Age Paleogene Eocene Ypresian-Lutetian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Tyee Fm. Below Lookingglass Fm.
 12. Lithology: Dominant siltstone 55 %
 Subordinate sandstone 45 %
 13. Thickness (Metric 2000+ m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: _____
 Below: _____
 15. Fossil Data: Forams Ulatizian = Lutetian (Miles, G. A., 1981, Geological Society of America Special Paper 184, p. 85-103)
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data:
 18. Other Data: Basal Flournoy is largely graded sandstone; upper Flournoy is largely siltstone.
 19. Original Reference: Baldwin, E. M., 1974, Eocene stratigraphy of southwestern Oregon: Oregon Department of Geology and Mineral Industries Bulletin 83, 40 p.
 20. Most Significant Reference: Baldwin, E. M., Beaulieu, J. D., Ramp, L., Gray, J., Newton, V. C., Jr., and Mason, R. S., Geology and mineral resources of Coos County, Oregon: Oregon Department of Geology and Mineral Industries Bulletin 80, 82 p.
 21. Author(s) of Sheet Preparation: E. M. Baldwin
 22. Date Prepared: 7-1-82

3. COOS BAY AREA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Coos Bay Area
 5. Chart # _____ 6. Column # 3
 7. Name of Stratigraphic Unit Lookingglass Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene _____ Ypresian _____
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Flournoy fm. Below Roseburg and pretertiary
 12. Lithology: Dominant siltstone _____ 60 %
 Subdominant conglomerate and sandstone _____ 40 %
 13. Thickness (Metric 500 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____ _____ x
 Within: _____ _____ _____
 Below: _____ _____ x
 15. Fossil Data: Forams: Penutian (R. Thoms) and Penutian-Ypresian by Miles, G. A., 1981, Geological Society of America Special Paper 184, p. 85-103.
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: _____
 18. Other Data: The basal member is largely conglomerate; middle member mostly siltstone and sandstone; upper member of locally derived conglomerate and sandstone.
 19. Original Reference: Baldwin, E. M., 1974, Eocene stratigraphy of southwestern Oregon: Oregon Department of Geology and Mineral Industries Bulletin 83, 40 p.
 20. Most Significant Reference: Baldwin, E. M., Beaulieu, J. D., Ramp, L., Gray, J., Newton, V. C., Jr., and Mason, R. S., 1973, Geology and mineral resources of Coos County, Oregon: Oregon Department of Geology and Mineral Industries Bulletin 80, 82 p.
 21. Author(s) of Sheet Preparation: E. M. Baldwin
 22. Date Prepared: 7-1-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Coos Bay Area
 5. Chart # _____ 6. Column # 3
 7. Name of Stratigraphic Unit Roseburg Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene _____ Danian-Ypresian _____
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Lookingglass Formation Below Unknown
 12. Lithology: Dominant siltstone and sandstone _____ 65 %
 Subdominant basalt flows and breccias _____ 35 %
 13. Thickness (Metric 5000+ m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____ _____ x
 Within: _____ _____ _____
 Below: Unknown _____ _____
 15. Fossil Data: Forams indicate early Eocene-Ypresian of planktonic stages or Penutian, Bulittian: G. A. Miles, 1981, Geological Society of America Special Paper 184, p. 85-103.
 16. Radiometric Data: 58-66 million years Method K/Ar
 Source: Duncan, R. A., in press (1983), A captured island chain in the Coast Range of Oregon and Washington: Journal of Geophysical Research.
 17. Economic Data: Might be a source of petroleum. Basalt used for crushed rock for roads and construction.
 18. Other Data: The basalt is confined to the lower part of the Formation along the N. Fork of the Umpqua River. Elsewhere the formation is thicker with leases of basalt interbedded with sedimentary rocks.
 19. Original Reference: Baldwin, E. M., 1974, Eocene stratigraphy of southwestern Oregon: Oregon Department of Geology and Mineral Industries Bulletin 83, 40 p., 1 map.
 20. Most Significant Reference: Baldwin, E. M., Beaulieu, J. D., Ramp, L., Gray, J., Newton, V. C., Jr., and Mason, R. S., 1973, Geology and Mineral Resources of Coos County, Oregon: Oregon Department of Geology and Mineral Industries Bulletin 80, 82 p.
 21. Author(s) of Sheet Preparation: E. M. Baldwin
 22. Date Prepared: 7-1-82

4. REEDSPORT (SUBSURFACE)

A. COMPOSITE SECTION LOCATION

Reference # _____ Location # _____
Latitude 43° 40' N Longitude 124° 10' W
County or Counties 019 Douglas County
State. 36 Oregon State
Column Name: Reedsport Area
Chart Name: Cenozoic Stratigraphic Units, Western Oregon and Washington
General Location Description: Cenozoic section for coastal area and subsurface of the Reedsport Area, Reedsport, Oregon. Subsurface data from the General Petroleum Corporation Long Bell No. 1 Well, sec. 27, T. 20 S., R. 10 W., Reedsport Quadrangle, Douglas County, Oregon
Principal Reference: (with Biostratigraphic Review):
Rau, W. W., 1973, Preliminary identifications of Foraminifera from General Petroleum Corporation Long Bell No. 1 Well, Oregon: Oregon Department of Geology and Mineral Industries Oil and Gas Investigation No. 3, 2 sheets.
Column Authors: W. W. Rau, State of Washington
D. R. McKeel, Consultant, Otis, Oregon

B. DATA SHEETS FOR EACH STRATIGRAPHIC UNIT ON CORRELATION CHART

1. Reference # _____ 2. Location # _____ 3. CSD Province # _____
4. Column Name Reedsport (Surface)
5. Chart # _____ 6. Column # 4
7. Name of Stratigraphic Unit marine and fluvial terrace deposits
8. Stratigraphic Rank and Status:
(Circle Appropriate Rank) Group (Formation) Member, Bed,
(Circle Appropriate Status) Formal (Informal)
9. Age Quaternary Pleistocene
System Series Stage
10. Surface Subsurface or Both Surface
11. Bounding Units: Above alluvium Below all local older units
12. Lithology: Dominant sand 70 %
Subordinate gravel and mud 30 %
13. Thickness (Metric) 1-10+ m
14. Major Unconformities: - Check Appropriate Line -
Above: None Disconformable Angular
Within: X
Below: X
15. Fossil Data: None
16. Radiometric Data: None Years Method
Source: _____
17. Economic Data: Locally chromium-rich terrace sands
18. Other Data: Raised beach terraces and river valley alluvial terraces composed of muds, sands and gravels.
19. Original Reference: Griggs, A. B., 1945, Chromite bearing sands of the southern part of the coast of Oregon: U. S. Geological Survey Bulletin 945-E, 150 p.
20. Most Significant Reference: Same
21. Author(s) of Sheet Preparation: J. M. Armentrout
22. Date Prepared: 10-15-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
4. Column Name Reedsport (subsurface)
5. Chart # _____ 6. Column # 4
7. Name of Stratigraphic Unit siltstone
8. Stratigraphic Rank and Status:
(Circle Appropriate Rank) Group (Formation) Member, Bed,
(Circle Appropriate Status) Formal (Informal)
9. Age Paleogene Eocene Lutetian
System Series Stage
10. Surface Subsurface or Both Subsurface
11. Bounding Units: Above Pleistocene Below sandstone
12. Lithology: Dominant siltstone 95 %
Subordinate sandstone 5 %
13. Thickness (Metric) 220 m
14. Major Unconformities: - Check Appropriate Line -
Above: None Disconformable Angular
Within: Unknown X
Below: Unknown
15. Fossil Data: Ulatisian Foraminiferal Stage: Rau (1973)
16. Radiometric Data: None Years Method
Source: _____
17. Economic Data:
18. Other Data:
19. Original Reference: Rau, W. W., 1973, Preliminary identifications of Foraminifera from General Petroleum Corp., Long Bell No. 1 Well, Oregon: Oregon Department of Geology and Mineral Industries Oil and Gas Investigation No. 3, 2 sheets
20. Most Significant Reference: Same
21. Author(s) of Sheet Preparation: J. M. Armentrout
22. Date Prepared: 10-15-82

4. REEDSPORT (SUBSURFACE)

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name ReedSPORT (subsurface)
 5. Chart # _____ 6. Column # 4
 7. Name of Stratigraphic Unit sandstone
 8. Stratigraphic Rank and Status: (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) Formal (Informal)
 9. Age Paleogene Eocene Ypresian-Lutetian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Subsurface
 11. Bounding Units: Above siltstone Below shale
 12. Lithology: Dominant sandstone 70 %
 Subordinate siltstone 30 %
 13. Thickness (Metric) 1325 m
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: Unknown
 Within: Unknown
 Below: Unknown
 15. Fossil Data: Ulatisian Foraminifera Stage; Rau (1973).
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data:
 18. Other Data: Well log used to estimate sand percent.
 19. Original Reference: Rau, W. W., 1973, Preliminary identifications of Foraminifera from General Petroleum Corp. Long Bell No. 1 Well, Oregon: Oregon Department of Geology and Mineral Industries Oil and Gas Industries No. 3, 2 sheets
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 10-15-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name ReedSPORT (subsurface)
 5. Chart # _____ 6. Column # 4
 7. Name of Stratigraphic Unit shale
 8. Stratigraphic Rank and Status: (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) Formal (Informal)
 9. Age Paleogene Eocene Ypresian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Subsurface
 11. Bounding Units: Above sandstone Below siltstone and shale
 12. Lithology: Dominant shale 100 %
 Subordinate _____ 0 %
 13. Thickness (Metric) 480 m
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: Unknown
 Within: Unknown
 Below: Unknown
 15. Fossil Data: Ulatisian Foraminiferal Stage (Rau, 1973)
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data:
 18. Other Data:
 19. Original Reference: Rau, W. W., 1973, Preliminary identifications of Foraminifera from General Petroleum Corp. Long Bell No. 1 Well, Oregon: Oregon Department of Geology and Mineral Industries Oil and Gas Investigation No. 3, 2 sheets
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 10-15-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name ReedSPORT (subsurface)
 5. Chart # _____ 6. Column # 4
 7. Name of Stratigraphic Unit siltstone and shale
 8. Stratigraphic Rank and Status: (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) Formal (Informal)
 9. Age Paleogene Eocene Ypresian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both subsurface
 11. Bounding Units: Above shale Below volcanics
 12. Lithology: Dominant siltstone and shale 95 %
 Subordinate sandstone 5 %
 13. Thickness (Metric) 526 M
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: Unknown
 Within: Unknown
 Below: Unknown
 15. Fossil Data: Ulatisian to Penutian Foraminiferal Stages: Rau (1973).
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data:
 18. Other Data:
 19. Original Reference: Rau, W. W., 1973, Preliminary identifications of Foraminifera from General Petroleum Corp. Long Bell No. 1 Well, Oregon: Oregon Department of Geology and Mineral Industries Oil and Gas Inv. No. 3, 2 sheets
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 10-25-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name ReedSPORT (subsurface)
 5. Chart # _____ 6. Column # 4
 7. Name of Stratigraphic Unit volcanics
 8. Stratigraphic Rank and Status: (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) Formal (Informal)
 9. Age Paleogene Paleocene-Eocene Thanetian-Ypresian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Subsurface
 11. Bounding Units: Above siltstone and shale Below Unknown
 12. Lithology: Dominant tuff: shale 60 %
 Subordinate basalt 40 %
 13. Thickness (Metric) 430+ m
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: Unknown
 Within: Unknown
 Below: Unknown
 15. Fossil Data: Ulatisian to Penutian Foraminiferal Stages: Rau (1973)
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data:
 18. Other Data:
 19. Original Reference: Rau, W. W., 1973, Preliminary identifications of Foraminifera from General Petroleum Corp. Long Bell No. 1 Well, Oregon: Oregon Department of Geology and Mineral Industries Oil and Gas Inv. No. 3, 2 sheets
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 10-15-82

5. EUGENE AREA

A. COMPOSITE SECTION LOCATION

Reference # _____ Location # _____
 Latitude 44° 14' N Longitude 123° 3' W
 County or Counties 043 Linn County
 State 36 Oregon
 Column Name: Eugene Area
 Chart Name: Cenozoic Stratigraphic Units, Western Oregon and Washington
 General Location Description: Cenozoic section composited from units in and around Eugene, Oregon, including the Mobil #1 Ira Baker wildcat well. Well location 1987' south and 2537' west of NE corner sec. 18, T. 15 S., R. 3 W., Eugene quadrangle, approximately 12.5 miles north of Eugene.
 Principal Reference:
 Vokes, H. E., Snavely, P. D., Jr., and Myers, D. A., 1951, Geology of the southern and southwestern border areas of the Willamette Valley, Oregon: U. S. Geological Survey Oil and Gas Investigation Map OM 110.

Column Authors: E. M. Baldwin, University of Oregon
 W. N. Orr, University of Oregon
 M. Brownfield, State of Oregon

B. DATA SHEETS FOR EACH STRATIGRAPHIC UNIT ON CORRELATION CHART

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Eugene Area 5. Chart # _____ 6. Column # 5
 7. Name of Stratigraphic Unit fluvial deposits
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Quaternary Pleistocene

System	Series	Stage
10. Surface Subsurface or Both	<u>Surface</u>	
11. Bounding Units: Above	<u>alluvium</u>	Below <u>various older units</u>
12. Lithology: Dominant	<u>sands</u>	70 %
Subordinate	<u>gravels</u>	30 %
13. Thickness (Metric)	<u>10-30 m</u>	
14. Major Unconformities: - Check Appropriate Line -		
	None	Disconformable Angular
Above:		<u>X</u>
Within:		
Below:		<u>X</u>

 15. Fossil Data: None
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: Sand and gravel
 18. Other Data: Terraces occur intermittently along rivers
 19. Original Reference:
 20. Most Significant Reference: Vokes, H. E., Snavely, P. D., Jr., and Myers, D. A., 1951: Geology of the southern and southwestern border areas of the Willamette Valley, Oregon: U. S. Geological Survey, Oil and Gas Investigation Map OM-110.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 12-31-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Eugene Area 5. Chart # _____ 6. Column # 5
 7. Name of Stratigraphic Unit little Butte Volcanics
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene-Oligocene Priabonian-Chattian

System	Series	Stage
10. Surface Subsurface or Both	<u>Surface</u>	<u>Fisher and Eugene</u>
11. Bounding Units: Above	<u>locally-alluvium</u>	Below <u>Formations</u>
12. Lithology: Dominant	<u>volcanic sandstone and siltstone</u>	90 %
Subordinate	<u>basaltic flows</u>	10 %
13. Thickness (Metric)	<u>1000+ m</u>	
14. Major Unconformities: - Check Appropriate Line -		
	None	Disconformable Angular
Above:		<u>X</u>
Within:		
Below:		<u>X</u>

 15. Fossil Data: Megafloral studies by J. Wolfe (U.S.G.S.): Lower Angonian Megafloral Stage based on Willamette flora in Little Butte strata overlying Eugene and Fisher Formation: See Wolfe (1981).
 16. Radiometric Data: 31.0 million Years Method K/Ar
 Source: Evernden, J. F., and James, G. T., 1964: Potassium-argon dates and the Tertiary floras of North America: American Journal of Science, v. 262, p. 945-974.
 17. Economic Data:
 18. Other Data:
 19. Original Reference: Wells, F. G., 1956, Geology of the Medford quadrangle, Oregon-California: U. S. Geological Survey Map G.Q.-89.
 20. Most Significant Reference: Wolfe, J. A., 1981, A chronologic framework for Cenozoic megafossil floras of Northwestern North America and its relation to marine geochronology: Geological Society of America Special Paper 184, p. 37-47.
 21. Author(s) of Sheet Preparation: W. N. Orr
 22. Date Prepared: 7-9-82 Additions J. M. Armentrout 10-11-82

5. EUGENE AREA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Eugene Area 5. Chart # _____ 6. Column # _____
 7. Name of Stratigraphic Unit Eugene Formation
 8. Stratigraphic Rank and Status: Group (Formation) Member, Bed, _____
 (Circle Appropriate Rank) (Formal) Informal
 9. Age Paleogene Eocene _____ Priabonian
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface Fisher or Spencer
 11. Bounding Units: Above alluvium Below Formations
 12. Lithology: Dominant sandstone _____ 50%
 Subordinate mudstone, volcanic tuff, lignite _____ 50%
 13. Thickness (Metric 600 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: x _____
 Below: x _____
 15. Fossil Data: Refugian Foraminiferal Stage: early Refugian-K. McDougall, 1979, Paleogeological evaluation of late Eocene biostratigraphy of the west coast; U. S. Geological Survey Open File Report 79-934, 206 p.; Mollusks discussed by C.J.S. Hickman, The Oligocene marine molluscan fauna of the Eugene Formation in Oregon: University of Oregon Natural History Museum Bulletin 16, 112 p., 1969.
 16. Radiometric Data: None Years Method
 17. Economic Data:
 18. Other Data: Paralic to shallow marine depositional environment
 19. Original Reference: Smith, W. D., 1924, Petroleum possibilities of western Oregon: Economic Geology, v. 19, no. 5, p. 455-465.
 20. Most Significant Reference:
 21. Author(s) of Sheet Preparation:
 22. Date Prepared:

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Eugene Area 5. Chart # _____ 6. Column # 5
 7. Name of Stratigraphic Unit Fisher Formation
 8. Stratigraphic Rank and Status: Group (Formation) Member, Bed, _____
 (Circle Appropriate Rank) (Formal) Informal
 9. Age Paleogene Eocene _____ Priabonian
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Eugene Fm or Little Butte Below Spencer Formation
 12. Lithology: Dominant volcanic tuff _____ 45%
 Subordinate volcanic mudstone, basalt, siltstone _____ 55%
 13. Thickness (Metric 2200 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: x _____
 Below: x _____
 15. Fossil Data: upper Eocene: see Vokes and others (1954)
 16. Radiometric Data: 39 million Years Method Fission Track
 Source: E. M. Baldwin, 1981, Geology of Oregon, 3rd Edition, p. 56 (from W. N. Orr)
 17. Economic Data:
 18. Other Data: nonmarine to sublittoral depositional environment
 19. Original Reference: Schenck, H. G., 1927, Marine Oligocene of Oregon: University of California Publication in Geological Sciences Bulletin, v. 16, no. 12, p. 449-460.
 20. Most Significant Reference: Vokes, H. E., Shavely, P. D., Jr., and Myers, D. A., 1951, Geology of the southern and southwestern border areas of the Willamette Valley, Oregon: U. S. Geological Survey Oil and Gas Investigation Map OM 110
 21. Author(s) of Sheet Preparation: Michael Brownfield
 22. Date Prepared: 4-5-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Eugene Area 5. Chart # _____ 6. Column # 5
 7. Name of Stratigraphic Unit Spencer Formation
 8. Stratigraphic Rank and Status: Group (Formation) Member, Bed, _____
 (Circle Appropriate Rank) (Formal) Informal
 9. Age Paleogene Eocene _____ Bartonian-Priabonian
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface Lorane Siltstone
 11. Bounding Units: Above Fisher and Eugene Fms. Below Member of Flournoy Fm.
 12. Lithology: Dominant siltstone _____ 60%
 Subordinate sandstone, mudstone _____ 90%
 13. Thickness (Metric 100 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: x _____
 Within: _____
 Below: _____
 15. Fossil Data: Upper Narizian: see Vokes and others (1954).
 16. Radiometric Data: None Years Method
 Source:
 17. Economic Data: Reservoir rock potential
 18. Other Data: Paralic to inter sublittoral depositional environment
 19. Original Reference: Turner, F. E., 1938, Stratigraphy and mollusca of the Eocene of western Oregon: Geological Society of America Special Paper 10, 130 p.
 20. Most Significant Reference: Vokes, H. E., Myers, D. A., and Hoover, L., Jr., 1954, Geology of the west central border area of the Willamette Valley, Oregon: U. S. Geological Survey Oil and Gas Investigation Map OM 150
 21. Author(s) of Sheet Preparation: Michael Brownfield
 22. Date Prepared: 4-5-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Eugene Area 5. Chart # _____ 6. Column # 5
 7. Name of Stratigraphic Unit Flournoy (or Tyee) Formation
 8. Stratigraphic Rank and Status: Group (Formation) Member, Bed, _____
 (Circle Appropriate Rank) (Formal) Informal
 9. Age Paleogene Eocene _____ Ypresian-Lutetian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Lorane Siltstone Below unknown
 12. Lithology: Dominant sandstone _____ 70%
 Subordinate siltstone _____ 30%
 13. Thickness (Metric 2000+ m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: x _____
 Below: Unknown _____
 15. Fossil Data: Age determined by paleontology of Flournoy Formation in Roseburg Area: see Miles, G. A., 1981, Geological Society of America Special Paper 184, p. 85-103.
 16. Radiometric Data: None Years Method
 Source:
 17. Economic Data:
 18. Other Data: Flournoy Formation grades upward into Lorane Siltstone. Previous maps show Tyee Formation rocks in this area.
 19. Original Reference: Baldwin, E. M., 1974, Eocene stratigraphy of southwestern Oregon: Oregon Department of Geology and Mineral Industries Bulletin 83, 40 p.
 20. Most Significant Reference: Baldwin, E. M., Beaulieu, J. D., Ramp, L., Gray, J., Newton, V. C., Jr., and Mason, R. S., Geology and Mineral Resources of Coos County, Oregon: Oregon Department of Geology and Mineral Industries Bulletin 80, 82 p.
 21. Author(s) of Sheet Preparation: E. M. Baldwin
 22. Date Prepared: 7-1-82

5. EUGENE AREA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710

4. Column Name Eugene Area

5. Chart # _____ 6. Column # 5

7. Name of Stratigraphic Unit Lorane Siltstone Member

8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation Member Bed, of Flournoy Formation
 (Circle Appropriate Status) Formal Informal

9. Age Paleogene Eocene Lutetian

System	Series	Stage

10. Surface Subsurface or Both Surface

11. Bounding Units: Above Spencer Formation Below Flournoy Formation

12. Lithology: Dominant siltstone 60 %
 Subordinate mudstone/sandstone 40 %

13. Thickness (Metric) 200 m

14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: _____
 Below: x _____

15. Fossil Data: Narizian (McKeel, written comm., 1982) also see Vokes and others (1951)

16. Radiometric Data: None Years Method _____
 Source: _____

17. Economic Data:

18. Other Data: Flournoy Formation grades upward into Lorane Siltstone; Lorane Siltstone Member previously assigned to either Tyee Formation or Spencer Formation. See Gandra (1977) cited below. Used by Baldwin (1973) as member of Flournoy.

19. Original Reference: Vokes, H. E., Snively, P. D., Jr., and Myers, D. A., 1951, Geology of the southern and southwestern border areas of the Willamette Valley, Oregon: U. S. Geological Survey Oil and Gas Investigation Map OM 110.

20. Most Significant Reference: Gandra, W. E., 1977, Stratigraphy of the middle to late Eocene Formations of southwest Willamette Valley, Oregon: University of Oregon Masters thesis (unpub)

21. Author(s) of Shee Preparation: Michael Brownfield; additions by E.M. Baldwin &
 22. Date Prepared: 4-5-82 W.N. Orr
 12-10-82

6. CENTRAL COAST RANGE

A. COMPOSITE SECTION LOCATION

Reference # _____ Location # _____
Latitude 44° 50' N Longitude 123° 50' W
County or Counties 041 Lincoln County
State. 36 Oregon
Column Name: Central Coast Range
Chart Name: Cenozoic Stratigraphic Units, Western Oregon and Washington
General Location Description: Cenozoic section composited in Lincoln County, Oregon, in the proximity of Newport, central Oregon Coast Range.
Principal Reference:
Snively, P. D., Jr., MacLeod, N. S., and Wagner, H. C., 1976,
Geologic map of the Yaquina and Toledo quadrangles, Lincoln
County, Oregon: U. S. Geological Survey Miscellaneous
Investigation Series Map I 867: also I 866 and I 868.
Biostratigraphic Synthesis:
Rau, W. W., 1981, Pacific Northwest Tertiary benthic foraminiferal
biostratigraphic framework - An overview: Geological Society of
America Special Paper 184, p. 67-84.
Column Author: P. D. Snively, Jr., U. S. Geological Survey
D. L. Lander, U. S. Geological Survey

B. DATA SHEETS FOR EACH STRATIGRAPHIC UNIT ON CORRELATION CHART

1. Reference # _____ 2. Location # _____ 3. CSD Province #7-10
4. Column Name Central Coast Range
5. Chart # _____ 6. Column # 6
7. Name of Stratigraphic Unit marine and fluvial terrace deposits
8. Stratigraphic Rank and Status:
(Circle Appropriate Rank) Group (Formation) Member, Bed, _____
(Circle Appropriate Status) (Formal) Informal
9. Age Quaternary Pleistocene
System _____ Series _____ Stage _____
10. Surface Subsurface or Both Surface
11. Bounding Units: Above alluvium Below Cape Foulweather Basalt
12. Lithology: Dominant sand _____ 95 %
Subordinate silt and gravel _____ 5 %
13. Thickness (Metric 20 m)
14. Major Unconformities: - Check Appropriate Line -
None Disconformable Angular
Above: _____
Within: x _____
Below: _____
15. Fossil Data: None
16. Radiometric Data: > 35,000 Years Method C¹⁴ (wood)
Source: _____
17. Economic Data: Sand and gravel
18. Other Data: Some Pleistocene marine deposits were uplifted as much as
500 feet.
19. Original Reference:
20. Most Significant Reference:
21. Author(s) of Sheet Preparation: P. D. Snively, Jr., and D. L. Lander
22. Date Prepared: 8-17-81

1. Reference # _____ 2. Location # _____ 3. CSD Province # 7-10
4. Column Name Central Coast Range
5. Chart # _____ 6. Column # 6
7. Name of Stratigraphic Unit Cape Foulweather Basalt
8. Stratigraphic Rank and Status:
(Circle Appropriate Rank) Group (Formation) Member, Bed, _____
(Circle Appropriate Status) (Formal) Informal
9. Age Neogene Miocene Serravalian
System _____ Series _____ Stage _____
10. Surface Subsurface or Both Surface
11. Bounding Units: Above marine terrace deposits Below sandstone of Whale Cove
12. Lithology: Dominant basalt flows and breccia _____ 60 %
Subordinate water-laid lapilli tuff _____ 40 %
13. Thickness (Metric 150 m)
14. Major Unconformities: - Check Appropriate Line -
None Disconformable Angular
Above: _____
Within: x _____
Below: _____
15. Fossil Data: Poorly preserved mollusks and forams in the lapilli tuff suggest
a middle Miocene, Relizian age. Foram age tenuous - basalt geochemistry
correlation is used - Cape Foulweather Basalt correlates with Wanapum Basalt.
16. Radiometric Data: None Years Method _____
Source: _____
17. Economic Data:
18. Other Data: The Cape Foulweather Basalt includes numerous dikes, sills,
intrusive bodies, rings, and radial dikes.
19. Original Reference: Snively, P. D., Jr., MacLeod, N. S., and Wagner, H. C., 1973,
Miocene tholeiitic basalts of coastal Oregon and Washington and their relations to
coeval basalts of the Columbia Plateau: Geological Society of America Bulletin,
v. 84, p. 387-424.
20. Most Significant Reference: Same
21. Author(s) of Sheet Preparation: P. D. Snively, Jr., and D. L. Lander
22. Date Prepared: 8-17-81

6. CENTRAL COAST RANGE

1. Reference # _____ 2. Location # _____ 3. CSD Province # 7-10
 4. Column Name Central Coast Range
 5. Chart # _____ 6. Column # 6
 7. Name of Stratigraphic Unit sandstone of Whale Cove
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group (Formation) Member, Bed,
 (Circle Appropriate Status) Formal (Informal)
 9. Age Neogene Miocene Langhian-Serravallian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Cape Foulweather Basalt Below Depoe Bay Basalt
 12. Lithology: Dominant sandstone _____ 65 %
 Subordinate siltstone _____ 35 %
 13. Thickness (Metric) 60-90 m
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____ x _____
 Within: x _____
 Below: x _____
 15. Fossil Data: A few mollusks indicate a middle Miocene age; a few forams indicate a Relizian age. Foram age tenuous - correlation of subadjacent and superjacent basalts suggests an age of middle Miocene 15-16 m.y.B.P.
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: _____
 18. Other Data: The sandstone of Whale Cove has well defined sandstone channels.
 19. Original Reference: Snively, P. D., Jr., MacLeod, N. S., and Wagner, H. C., 1973, Miocene tholeiitic basalts of coastal Oregon and Washington and their relations to coeval basalts of the Columbia Plateau: Geological Society of America Bulletin, v. 84, p. 387-424.
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: P. D. Snively, Jr., and D. L. Lander
 22. Date Prepared: 8-17-81

1. Reference # _____ 2. Location # _____ 3. CSD Province # 7-10
 4. Column Name Central Coast Range
 5. Chart # _____ 6. Column # 6
 7. Name of Stratigraphic Unit Depoe Bay Basalt
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group (Formation) Member, Bed,
 (Circle Appropriate Status) (Formal) (Informal)
 9. Age Neogene Miocene Langhian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above sandstone of Whale Cove Below Astoria Formation
 12. Lithology: Dominant pillow basalt and breccia _____ 100 %
 Subordinate _____
 13. Thickness (Metric) 15-30 m
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: x _____
 Within: x _____
 Below: _____ x _____
 15. Fossil Data: None
 16. Radiometric Data: 14-16 m.y. Years Method K/Ar
 Source: 16± 0.65 m.y. at Mt. Hebo sill; 14.5± 1.0 and 15.2± 0.6 m.y. at Cape Meares; 14± 2.7 m.y. near Ecola State Park: See Snively and others (1973)
 17. Economic Data: Road rock and building stone
 18. Other Data: Basalts equivalent to the Depoe Bay Basalt form numerous dikes, sills, and plugs. Correlates with Grande Ronde Basalt of Columbia River Basalt Group by geochemistry.
 19. Original Reference: Snively, P. D., Jr., MacLeod, N. J., and Wagner, H. C., 1973, Miocene tholeiitic basalts of coastal Oregon and Washington and their relations to coeval basalts of the Columbia Plateau: Geological Society of America Bulletin, v. 84, p. 387-424.
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: P. D. Snively, Jr., and D. L. Lander
 22. Date Prepared: 8-17-81

1. Reference # _____ 2. Location # _____ 3. CSD Province # 7-10
 4. Column Name Central Coast Range
 5. Chart # _____ 6. Column # 6
 7. Name of Stratigraphic Unit Astoria Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group (Formation) Member, Bed,
 (Circle Appropriate Status) (Formal) (Informal)
 9. Age Neogene Miocene Burdigalian-Langhian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Depoe Bay Basalt Below Nye Mudstone
 12. Lithology: Dominant sandstone _____ 60 %
 Subordinate siltstone _____ 40 %
 13. Thickness (Metric) 150-600 m
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____ x _____
 Within: x _____
 Below: _____ x _____
 15. Fossil Data: An abundant molluscan fauna indicates a middle Miocene age, equivalent to the "Temblor" of California (Moore). Numerous forams indicate a Relizian to Saucian age (Rau). Also contains some land and marine mammals: See Moore (1963).
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: _____
 18. Other Data: _____
 19. Original Reference: Cope, E. D., 1880, Corrections of the geologic maps of Oregon; American Naturalist, v. 24, p. 457-458.
 20. Most Significant Reference: Moore, E. J., 1963, Miocene marine mollusks from the Astoria Formation in Oregon: U.S. Geological Survey Professional Paper 419, 109 p.
 21. Author(s) of Sheet Preparation: P. D. Snively, Jr., and D. L. Lander
 22. Date Prepared: 8-17-81

1. Reference # _____ 2. Location # _____ 3. CSD Province # 7-10
 4. Column Name Central Coast Range
 5. Chart # _____ 6. Column # 6
 7. Name of Stratigraphic Unit Nye Mudstone
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group (Formation) Member, Bed,
 (Circle Appropriate Status) (Formal) (Informal)
 9. Age Neogene Miocene Aquitian-Burdigalian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Astoria Formation Below Yaquina Formation
 12. Lithology: Dominant mudstone with dolomite concretions _____ 95 %
 Subordinate sandstone _____ 5 %
 13. Thickness (Metric) 150-1250 m
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____ x _____
 Within: x _____
 Below: x _____
 15. Fossil Data: Abundant forams indicate a Saucian Stage age (Rau). Brown fish scales and vertebrae are also found in the Nye Mudstone: see Snively and others (1964).
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: _____
 18. Other Data: Grades downward into the Yaquina Formation. It is highly susceptible to landslides.
 19. Original Reference: Schenck, H. G., 1927, Marine Oligocene of Oregon: California University Department, Geological Science Bulletin, v. 16, no. 12, p. 449-460.
 20. Most Significant Reference: Snively, P. D., Jr., Rau, W. W., and Wagner, H. C., 1964, Miocene stratigraphy of the Yaquina Bay area, Newport, Oregon: The Ore-Bin, v. 26, no. 8, p. 133-151.
 21. Author(s) of Sheet Preparation: P. D. Snively, Jr., and D. L. Lander
 22. Date Prepared: 8-17-81

6. CENTRAL COAST RANGE

1. Reference # _____ 2. Location # _____ 3. CSD Province # 7-10
 4. Column Name Central Coast Range
 5. Chart # _____ 6. Column # 6
 7. Name of Stratigraphic Unit Yaquina Formation
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene-Neogene Oligocene-Miocene Chattian to Aquitanian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Nye Mudstone Below Alsea Formation
 12. Lithology: Dominant sandstone 90 %
 Subordinate siltstone/minor conglomerate 10 %
 13. Thickness (Metric 300-600 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: X
 Within: X
 Below: X
 15. Fossil Data: Abundant megafossils suggest a late Oligocene "Blakeley" Stage (Vokes). Forams indicate an age range of early Saucian to Zemorrian (Rau); see Goodwin (1973).
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: Contains several 1-m thick coal beds.
 18. Other Data: The Yaquina Formation is a high energy deltaic deposit.
 19. Original Reference: Harrison and Eaton (Firm), 1920, Report on investigations of oil and gas possibilities in western Oregon: Oregon Bureau of Mines and Geology, Mineral Resources of Oregon, v. 3, no. 1, p. 3-37.
 20. Most Significant Reference: C. J. Goodwin, 1973, Stratigraphy and sedimentation of the Yaquina Formation, Lincoln Co., Oregon: Oregon State University, Master's thesis, unpublished
 21. Author(s) of Sheet Preparation: P. D. Snively, Jr., and D. L. Lander
 22. Date Prepared: 8-17-81

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Oregon Coast Range
 5. Chart # _____ 6. Column # 6
 7. Name of Stratigraphic Unit granophytic gabbro
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group (Formation) Member, Bed, intrusives
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Oligocene Informal
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Alsea Formation Below Alsea Formation
 12. Lithology: Dominant iron-rich granophytic gabbro 100 %
 Subordinate _____
 13. Thickness (Metric 0-330 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: _____
 Below: _____
 15. Fossil Data: None
 16. Radiometric Data: 30 million Years Method K/Ar on mineral separates
 Source: MacLeod, N. S., and Snively, P. D., Jr., 1973, see below
 17. Economic Data:
 18. Other Data: Dikes, sills, and inclined sheets of iron-rich granophytic gabbro crop out along the axial part of the Coast Range. The thickest sill, about 330 meters thick, underlies Mary's Peak 12 miles SW of Corvallis.
 19. Original Reference: Snively, P. D., Jr., and Wagner, H. C., 1961, Differentiated gabbroic sills and associated alkalic rocks in the central part of the Oregon Coast Range, Oregon, in Geological Survey Research, 1961, U. S. Geological Survey Professional Paper 242-D, p. D156-D161.
 20. Most Significant Reference: MacLeod, N. S., and Snively, P. D., Jr., 1973, Volcanic and intrusive rocks of the central part of the Oregon Coast Range: Oregon Department of Geology and Mineral Industries Bulletin 77, p. 47-74.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 1-28-83

1. Reference # _____ 2. Location # _____ 3. CSD Province # 7-10
 4. Column Name Central Coast Range
 5. Chart # _____ 6. Column # 6
 7. Name of Stratigraphic Unit Alsea Formation
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene-Oligocene Priabonian-Chattian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Yaquina Formation Below Nestucca Formation/Yachats
 12. Lithology: Dominant ruffaceous siltstone 80 % Basalt
 Subordinate basaltic and arkosic sandstone 20 %
 13. Thickness (Metric 50-1100 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: X
 Below: X
 15. Fossil Data: Abundant mollusks and forams suggest Zemorrian to late Refugian Stage (Rau); equivalent to the molluscan "Lincoln" to "Blakeley" Stages of Weaver (Addicott); see Snively and others (1975)
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data:
 18. Other Data:
 19. Original Reference: Snively, P. D., Jr., MacLeod, N. S., Rau, W. W., Addicott, W. O., and Pearl, J. E., 1975, Alsea Formation - an Oligocene marine sedimentary sequence in the Oregon Coast Range: U. S. Geological Survey Bulletin 1395-F, 21 p.
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: P. D. Snively, Jr., and D. L. Lander
 22. Date Prepared: 8-17-81

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Oregon Coast Range
 5. Chart # _____ 6. Column # 6
 7. Name of Stratigraphic Unit camptonitic igneous rocks
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group (Formation) Member, Bed, intrusives and extrusives
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene Informal
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Alsea Formation Below Alsea Formation
 12. Lithology: Dominant lapilli tuff and pillow lavas 70 %
 Subordinate dikes and sills 30 %
 13. Thickness (Metric 0-100 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: _____
 Below: _____
 15. Fossil Data: Thin siltstone interbeds in tuff units contain late Eocene foraminiferal faunas: MacLeod and Snively (1973).
 16. Radiometric Data: 33 my Years Method K/Ar (biotite)
 Source: Fiebelkorn, R. B., Walker, G. W., MacLeod, N. S., McKee, E. H., and Smith, J. G., 1982, Index to K/Ar age determinations for the state of Oregon: U. S. Geological Survey Open-File Report 82-596, 40 p., map.
 17. Economic Data:
 18. Other Data: Camptonitic marine lapilli tuff and pillow lavas, dikes and sills crop out in the Central Coast Range area.
 19. Original Reference: Snively, P. D., Jr., MacLeod, N. S., and Wagner, H. C., 1972, Preliminary bedrock geologic map of the Cape Foulweather and Euchre Mountain quadrangles, Oregon: U. S. Geological Survey open-file map, scale 1:48,000.
 20. Most Significant Reference: MacLeod, N. S., and Snively, P. D., Jr., 1973, Volcanic and intrusive rocks of the central part of the Oregon Coast Range: Oregon Department of Geology and Mineral Industries Bulletin 77, p. 47-74.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 1-28-83

6. CENTRAL COAST RANGE

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Oregon Coast Range
 5. Chart # _____ 6. Column # 6
 7. Name of Stratigraphic Unit nepheline syenite intrusive
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Oligocene _____
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Alsea Formation Below Alsea Formation
 12. Lithology: Dominant dikes, sills, stocks _____
 Subordinate _____
 13. Thickness (Metric 0-80 m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ None _____ Disconformable _____ Angular _____
 Within: _____
 Below: _____
 15. Fossil Data: None
 16. Radiometric Data: 32-34 million Years Method K/Ar
 Source: MacLeod, N. S., and Snively, P. D., Jr., 1973, see below
 17. Economic Data:
 18. Other Data: Nepheline syenite and phonolite sills, dikes, and a small stock occur in the Tidewater and Waldport quadrangles. The largest intrusive body is the 80-meter-thick sill that caps Table Mountain.
 19. Original Reference: Vokes, H. E., Norbistrath, H., and Snively, P. D., Jr., 1949, Geology of the Newport-Waldport area, Lincoln County, Oregon: U. S. Geological Survey Oil and Gas Investigation Preliminary Map 88.
 20. Most Significant Reference: MacLeod, N. S., and Snively, P. D., Jr., 1973, Volcanic and intrusive rocks of the central part of the Oregon Coast Range: Oregon Department of Geology and Mineral Industries Bulletin 77, p. 47-74.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 1-28-83

1. Reference # _____ 2. Location # _____ 3. CSD Province # 7-10
 4. Column Name Central Coast Range
 5. Chart # _____ 6. Column # 6
 7. Name of Stratigraphic Unit Yachats Basalt
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene _____ Bartonian-Priabonian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Alsea Formation Below Nestucca Formation
 12. Lithology: Dominant alkalic basalt _____
 Subordinate breccia/conglomerate/pillow lava _____
 13. Thickness (Metric 0-750 m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ None _____ Disconformable _____ Angular _____
 Within: x _____
 Below: x _____
 15. Fossil Data: The Yachats Basalt is overlain by an unnamed fossiliferous basaltic sandstone unit that contains forams of the early Refugian Stage (Rau) of latest Eocene age: 1981.
 16. Radiometric Data: 37.1 ± 3.6 million years Method K-Ar
 Source: Snively and others (1974).
 Biostratigraphic data suggests ages of 38-43 m.y.B.P. for the interbedded sedimentary rocks.
 17. Economic Data: Road rock, building stone
 18. Other Data: The Yachats Basalt interfingers laterally with coeval Nestucca Formation sedimentary rocks.
 19. Original Reference: Snively, P. D., Jr., and MacLeod, N. S., 1974, Yachats Basalt - an upper Eocene differentiated volcanic sequence in the Oregon Coast Range: Journal of Research, U.S. Geological Survey, v. 2, no. 4, p. 395-403.
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: P. D. Snively, Jr., and D. L. Lander
 22. Date Prepared: 8-17-81

1. Reference # _____ 2. Location # _____ 3. CSD Province # 7-10
 4. Column Name Central Coast Range
 5. Chart # _____ 6. Column # 6
 7. Name of Stratigraphic Unit Nestucca Formation
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene _____ Bartonian-Priabonian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Yachats Basalt Below Yamhill Formation
 12. Lithology: Dominant tuffaceous siltstone _____
 Subordinate tuff and arkosic sandstone _____
 13. Thickness (Metric 250-1500 m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ None _____ Disconformable _____ Angular _____
 Within: x _____
 Below: x _____
 15. Fossil Data: Abundant forams indicate a late Narizian late Eocene age: Snively, P. D., Jr., MacLeod, N. S., and Rau, W. W., 1969, Geology of the Newport area, Oregon: The Ore-Bin, v. 31, nos. 2 and 3, p. 25-71.
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data:
 18. Other Data: Interbedded laterally with the Yachats Basalt.
 19. Original Reference: Snively, P. D., Jr., and Vokes, H. E., 1949, Geology of the coastal area between Cape Kiwanda and Cape Foulweather, Oregon: U. S. Geological Survey Oil and Gas Investigation Preliminary Map 97
 20. Most Significant Reference: D. R. McKeel, 1972, Systematics, biostratigraphy and paleoceanography of Tertiary planktonic foraminiferal assemblages, Oregon Coast Range: University of California Davis, Master's Thesis, unpublished.
 21. Author(s) of Sheet Preparation: P. D. Snively, Jr., and D. L. Lander
 22. Date Prepared: 8-17-81

1. Reference # _____ 2. Location # _____ 3. CSD Province # 7-10
 4. Column Name Central Coast Range
 5. Chart # _____ 6. Column # 6
 7. Name of Stratigraphic Unit Yamhill Formation
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene _____ Lutetian-Bartonian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Nestucca Formation Below Tyee Formation
 12. Lithology: Dominant siltstone _____
 Subordinate clauconitic sandstone _____
 13. Thickness (Metric 700+ m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ None _____ Disconformable _____ Angular _____
 Within: x _____
 Below: x _____
 15. Fossil Data: Abundant forams indicate an uppermost Ulatian and lower Narizian Stage. Megaforams suggest late Eocene, probably early late Eocene age: see Snively, P. D., Jr., MacLeod, N. S., and Rau, W. W., 1969, Geology of the Newport area, Oregon: The Ore-Bin, v. 31, nos. 2 and 3, p. 25-71.
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: Clay from the Yamhill Formation is used for brick, tile and other clay products.
 18. Other Data: Interbeds downward with the underlying Tyee Formation.
 19. Original Reference: Baldwin, E. M., Brown, R. D., Jr., Gair, J. E., and Pease, M. H., Jr., 1955, Geology of the Sheridan and McMinnville quadrangles, Oregon: U.S. Geological Survey Oil and Gas Investigation Map OM-155.
 20. Most Significant Reference: Snively, P. D., Jr., MacLeod, N. S., Wagner, H. C., and Rau, W. W., 1976, Geologic map of the Yaquina and Toledo quadrangles, Lincoln County, Oregon: U.S. Geological Survey Miscellaneous Investigation Series, Map 1867
 21. Author(s) of Sheet Preparation: P. D. Snively, Jr., and D. L. Lander
 22. Date Prepared: 8-17-81

6. CENTRAL COAST RANGE

1. Reference # _____ 2. Location # _____ 3. CSD Province # 7-10
 4. Column Name Central Coast Range
 5. Chart # _____ 6. Column # 6
 7. Name of Stratigraphic Unit Tyee Formation
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) (Formal) Informal
 9. Age Paleocene Eocene Lutetian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Yamhill Formation Below Siletz River Volcanics
 12. Lithology: Dominant sandstone 70 %
 Subordinate siltstone 30 %
 13. Thickness (Metric 2000-3000 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: X _____
 Within: X _____
 Below: _____ X _____
 15. Fossil Data: Forams in the siltstone unit at the base, and near the top of the formation indicate a Ulatian Stage. Coccolith samples indicate a Discoaster subloboensis zone (Bukry).
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: Building stone
 18. Other Data: Groove and flute casts indicate a southern source of detritus from an ancestral Klamath Mountain. In the central part of the Oregon Coast Range the strata now assigned to the Tyee Formation were referred to the Burpee Formation of Schenck (1927).
 19. Original Reference: Diller, J. S., 1898, Description of the Roseburg quadrangle (Oregon): U.S. Geological Survey Atlas, Roseburg Folio (no. 49), 4 p.
 20. Most Significant Reference: Snavely, P. D., Jr., Wagner, H. C., and MacLeod, N. S., 1964, Rhythmic-bedded eugeosynclinal deposits of the Tyee Formation, Oregon Coast Range: Kansas Geological Survey Bulletin 169, v. 2, p. 461-480.
 21. Author(s) of Sheet Preparation: P. D. Snavely, Jr., and D. L. Lander
 22. Date Prepared: 8-17-81

1. Reference # _____ 2. Location # _____ 3. CSD Province # 7-10
 4. Column Name Central Coast Range
 5. Chart # _____ 6. Column # 6
 7. Name of Stratigraphic Unit Siletz River Volcanics
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) (Formal) Informal
 9. Age Paleogene Eocene Thanetian-Ypresian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Tyee Formation Below Unknown
 12. Lithology: Dominant tholeiitic basalt 95 %
 Subordinate marine siltstone 5 %
 13. Thickness (Metric 1000-7200 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____ X _____
 Within: _____ X _____
 Below: Unknown _____
 15. Fossil Data: In the sedimentary interbeds are foram assemblages assigned to the Ulatian and Penutian Stages (middle and early Eocene). The megafossils are equivalent to the Copay Stage of California.
 16. Radiometric Data: 48-58 million Years Method K-Ar
 Source: Duncan, R. A., in press (1983), A captured island chain in the Coast Range of Oregon and Washington: Journal of Geophysical Research.
 17. Economic Data: Road rock
 18. Other Data: The Siletz River Volcanics is oceanic crust; the oldest rocks in the central part of the Oregon Coast Range.
 19. Original Reference: Snavely, P. D., Jr., and Baldwin, E. M., 1948, Siletz River Volcanic Series, northwestern Oregon: American Association of Petroleum Geologists Bulletin, v. 32, no. 5, p. 805-812.
 20. Most Significant Reference: Snavely, P. D., Jr., MacLeod, N. S., and Wagner, H. C., 1968, Tholeiitic and alkalic basalts of the Eocene Siletz River Volcanics, Oregon Coast Range: American Journal of Science, v. 266, no. 6, p. 454-481.
 21. Author(s) of Sheet Preparation: P. D. Snavely, Jr., and D. L. Lander
 22. Date Prepared: 8-17-81

7. McMinnville-Sheridan Area

A. COMPOSITE SECTION LOCATION

Reference # _____ Location # _____
Latitude 45° 0' 0" Longitude 123° 0' 12"
County or Counties 053 Polk County
State. 36 Oregon

Column Name: McMinnville-Sheridan Area

Chart Name: Cenozoic Stratigraphic Units, Western Oregon and Washington

General Location Description: Cenozoic section composited from units in Reserve Oil and Gas Bruer-Roy-No. 1 drill hole and surface units nearby in Polk County, Oregon.

Principal Reference:

Brownfield, M., and Schlicker, H., 1980, Geology of the Amity and Mission Bottom quadrangles, Oregon: Oregon Department of Geology and Mineral Industries Open-File Report D-80-5.

Column Author: M. E. Brownfield, State of Oregon
M. H. Beeson, Portland State University

B. DATA SHEETS FOR EACH STRATIGRAPHIC UNIT ON CORRELATION CHART

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
4. Column Name McMinnville-Sheridan Area
5. Chart # _____ 6. Column # 7
7. Name of Stratigraphic Unit fluvial deposits
8. Stratigraphic Rank and Status: Formation Member, Bed, _____
(Circle Appropriate Rank) Group (Circle Appropriate Status) Informal
9. Age Quaternary Pleistocene
System Series Stage
10. Surface Subsurface or Both Surface
11. Bounding Units: Above alluvium Below Various older units
12. Lithology: Dominant sand 70 %
Subordinate gravel 30 %
13. Thickness (Metric 10 m)
14. Major Unconformities: - Check Appropriate Line -
None Disconformable Angular
Above: _____
Within: _____
Below: _____

15. Fossil Data: None

16. Radiometric Data: None Years Method _____
Source: _____

17. Economic Data: Sand and gravel

18. Other Data: Plio-Pleistocene river terraces occur intermittently along the valleys.

19. Original Reference:

20. Most Significant Reference: Brownfield, M., and Schlicker, H., 1980, Geology of the Amity and Mission Bottom quadrangles, Oregon: Oregon Department of Geology and Mineral Industries Open File Report D-80-5.

21. Author(s) of Sheet Preparation: J. M. Ammentrout
22. Date Prepared: 9-16-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
4. Column Name McMinnville-Sheridan Area
5. Chart # _____ 6. Column # 7
7. Name of Stratigraphic Unit Columbia River Basalt Group
8. Stratigraphic Rank and Status: Group Formation Member, Bed, _____
(Circle Appropriate Rank) Group (Circle Appropriate Status) Informal
9. Age Neogene Miocene Langhian-Serravalian
System Series Stage
10. Surface Subsurface or Both Surface and Subsurface
11. Bounding Units: Above Pleistocene fluvial deposits Below marine sedimentary rocks
12. Lithology: Dominant basalts 100 %
Subordinate _____ %
13. Thickness (Metric 0-172 m)
14. Major Unconformities: - Check Appropriate Line -
None Disconformable Angular
Above: _____
Within: _____
Below: _____

15. Fossil Data: None

16. Radiometric Data: None Years Method _____
Source: _____

17. Economic Data: Road rock

18. Other Data: See Grande Ronde and Wanapum Basalts

19. Original Reference: Hodge, E. T., 1938, Geology of the lower Columbia River Valley: Geological Society of America Bulletin v. 49, no. 6, p. 831-930: ALSO: Swanson, D. A., Wright, T. L., Hopper, P. R., and Bentley, R. D., 1979, Revisions in stratigraphic nomenclature of the Columbia River Basalt Group: U. S. Geological Survey Bulletin 1457-G, 59 p.

20. Most Significant Reference: Beeson, M. H., and Moran, M. R., 1979, Columbia River Basalt Group stratigraphy in western Oregon: Oregon Geology, v. 41, no. 1, p. 11-14.

21. Author(s) of Sheet Preparation: J. M. Ammentrout
22. Date Prepared: 12-31-82

7. McMINNVILLE-SHERIDAN AREA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710

4. Column Name McMinnville-Sheridan Area 5. Chart # _____ 6. Column # 7

7. Name of Stratigraphic Unit Frenchman Springs Member, Wanapum Basalt

8. Stratigraphic Rank and Status:
(Circle Appropriate Rank) Group Formation Member Bed of Columbia River Basalt Group
(Circle Appropriate Status) Formal Informal

9. Age Neogene Miocene Serravallian

System	Series	Stage	
10. Surface Subsurface or Both	<u>Surface</u> and <u>Subsurface</u>		
11. Bounding Units: Above <u>Pleistocene fluvial deposits</u> Below <u>Grande Ronde Basalt</u>			
12. Lithology: Dominant <u>basalts</u> Subordinate <u> </u>		<u>100 %</u> <u> </u> %	
13. Thickness (Metric) <u>0-17 m</u>			
14. Major Unconformities: - Check Appropriate Line -			
	<u>None</u>	<u>Disconformable</u>	<u>Angular</u>
Above: <u> </u>	<u> </u>	<u>X</u>	<u> </u>
Within: <u> </u>	<u> </u>	<u> </u>	<u> </u>
Below: <u> </u>	<u> </u>	<u>X</u>	<u> </u>

15. Fossil Data: None

16. Radiometric Data: None Years Method

17. Economic Data: Road rock

18. Other Data: Geochemical and paleomagnetic polarity noncorrelation of local basalts with type Wanapum Basalt of Columbia Plateau.

19. Original Reference: Swanson, D. A., Wright, T. L., Hooper, P. R., and Bentley, R. D., 1979, Revision of stratigraphic nomenclature of the Columbia River Basalt Group: U. S. Geological Survey Bulletin 1457-G, 59 p.

20. Most Significant Reference: Beeson, M. H., and Moran, M. R., 1979, Columbia River Basalt Group stratigraphy in western Oregon: Oregon Geology, v. 41, no. 1, p. 11-14.

21. Author(s) of Sheet Preparation: M. Beeson

22. Date Prepared: 9-16-82

Reference # _____ 2. Location # _____ 3. CSD Province # 710

4. Column Name McMinnville/Sheridan Area _____ 5. Column # 7

7. Name of Stratigraphic Unit Grande Ronde Basalt

8. Stratigraphic Rank and Status:
(Circle Appropriate Rank) Group (Formation) Member, Bed, of Columbia River Basalt Group
(Circle Appropriate Status) (Formal) Informal

9. Age Neogene Miocene Langhian

System	Series	Stage
10. Surface Subsurface or Both	<u>Surface and Subsurface</u>	
11. Lithology Units: Above <u>Quaternary or Wanapum Basalt</u>	Below <u>marine sedimentary rocks</u>	
11. Lithology: Dominant <u>basalt</u>		<u>100%</u>
Subordinate		<u>0</u>
13. Thickness (Metric)	<u>0-155 m</u>	
14. Major Unconformities: - Check Appropriate Line -		
	None	Disconformable
	<u>X</u>	<u>X</u>
	<u>X</u>	<u>X</u>
	<u>X</u>	<u>X</u>

15. Fossil Data: None

16. Radiometric Data: None Years Method

Source: _____

17. Economic Data: Road rock

18. Other Data: Grande Ronde Basalt of Columbia River Plateau is correlated with local unit using geochemistry and magnetic polarity: See Beeson, M. H. and Moran, M. R., 1979, Columbia River Basalt Group Stratigraphy in Western Oregon: Oregon Geology, v. 41, no. 1, p. 11-14.

19. Original Reference: Russell, I. C., 1893, U.S. Geological Survey Bulletin 108, p. 20-22. Also: Swanson, D. A. and others, 1979, Revisions in stratigraphic nomenclature of the Columbia River Basalt Group: U.S. Geological Survey Bulletin 1457-G, 59 p.

20. Most Significant Reference: Baldwin, E. M., Brown, R. D., Jr., Gair, J. E., and Pease, M. H., Jr., 1955, Geology of the Sheridan and McMinnville quadrangles, Oregon: U.S. Geological Survey Oil and Gas Investigation Map OM-155

21. Author(s) of Sheet Preparation: Michael Brownfield Additions by M. H. Beeson

22. Date Prepared: 4-9-82 12-16-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710

4. Column Name McMinville/Sheridan Area

5. Chart # _____ 6. Column # 7

7. Name of Stratigraphic Unit marine sedimentary rocks

8. Stratigraphic Rank and Status:
(Circle Appropriate Rank) Group Formation Member, Bed, _____
(Circle Appropriate Status) Formal Informal

9. Age Paleogene Eocene-Oligocene Prärieanian-Rupelian

System _____ Series _____ Stage _____

10. Surface Subsurface or Both Surface and subsurface

11. Bounding Units: Above Grande Ronde Basalt Below Spencer Formation

12. Lithology: Dominant mudstone/siltstone 70 %
Subordinate sandstone 30 %

13. Thickness (Metric) 716 m

14. Major Unconformities: - Check Appropriate Line -
None Disconformable Angular
Above: _____ x _____
Within: x _____
Below: x _____

15. Fossil Data: Narizian - Refugian Foraminiferal faunas: See Brownfield and Schlicker (1981).

16. Radiometric Data: None Years Method
Source: _____

17. Economic Data:

18. Other Data: May be equivalent to the Keasey, Pittsburg Bluff and Eugene Formations

19. Original Reference: Brownfield, M., and Schlicker, H., 1981, Geology of the Amity and Mission Bottom quadrangles, Oregon: Oregon Department of Geology and Mineral Industries Open-File Report 0-80-5.

20. Most Significant Reference: Baldwin, E. M., Brown, R. D., Jr., Gair, J. E., and Pease, M. H., Jr., 1955, Geology of the Sheridan and McMinville quadrangles, Oregon: U.S. Geological Survey Oil and Gas Investigation Map OM-155.

21. Author(s) of Sheet Preparation: Michael Brownfield

22. Date Prepared: _____ 4-9-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710

4. Column Name McMinnville/Sheridan Area

5. Chart # _____ 6. Column # 7

7. Name of Stratigraphic Unit Spencer Formation

8. Stratigraphic Rank and Status:
(Circle Appropriate Rank) Group Formation Member, Bed, _____
(Circle Appropriate Status) Forma Informal _____

9. Age Paleogene Eocene Bartonian-Priabonian

System	Series	Stage	
10. Surface Subsurface or Both	<u>Surface and subsurface</u>		
11. Bounding Units: Above <u>marine sedimentary rocks</u>		Below <u>Yamhill Formation</u>	
12. Lithology: Dominant <u>sandstone</u>		<u>70 %</u>	
Subordinate <u>siltstone/mudstone</u>		<u>30 %</u>	
13. Thickness (Metric <u>244 m</u>)			
14. Major Unconformities: - Check Appropriate Line -			
	None	Disconformable	Angular
Above: <u>X</u>			
Within: <u>X</u>			
Below: _____			<u>X</u>

15. Fossil Data: upper Narizian Foraminiferal faunas

16. Radiometric Data: None Years Method

Source: _____

17. Economic Data: Possible reservoir rock for hydrocarbons

18. Other Data: Paralic to inter-sublittoral depositional environment

19. Original Reference: Turner, F. E., 1938, Stratigraphy and mollusca of the Eocene of western Oregon: Geological Society of America Special Paper 10, 130 p.

20. Most Significant Reference: Baldwin, E. M., 1964, Geology of the Dallas and Valsetz quadrangles, Oregon: Oregon Department of Geology and Mineral Industries Bulletin 35, 56 p.

21. Author(s) of Sheet Preparation: Michael Brownfield

22. Date Prepared: 4-9-82

7. McMinnville-Sheridan AREA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name McMinnville-Sheridan
 5. Chart # _____ 6. Column # 7
 7. Name of Stratigraphic Unit Nestucca Formation
 8. Stratigraphic Rank and Status: Formation Member, Bed, _____
 (Circle Appropriate Rank) Group Formation Informal
 (Circle Appropriate Status) Formation
 9. Age Paleogene Eocene Bartonian-Priabonian
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above marine sedimentary rocks Below Yamhill Formation
 12. Lithology: Dominant siltstone 50 %
 Subordinate sandstone/volcanics 50 %
 13. Thickness (Metric 610 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: x
 Within: x
 Below: x
 15. Fossil Data: Upper Narizian Foraminiferal Faunas
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data:
 18. Other Data:
 19. Original Reference: Snavely, P. D., Jr., and Vokes, H. E., 1949, Geology of the coastal area between Cape Kiwanda and Cape Foulweather, Oregon U. S. Geological Survey Oil and Gas Investigation Map 97.
 20. Most Significant Reference: Baldwin, E. M., Brown, R. D., Jr., Gair, J. E., and Pease, M. H., Jr., 1955, Geology of the Sheridan and McMinnville quadrangles, Oregon: U. S. Geological Survey Oil and Gas Investigation Map OM-155.
 21. Author(s) of Sheet Preparation: Michael Brownfield
 22. Date Prepared: 4-9-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name McMinnville - Sheridan
 5. Chart # _____ 6. Column # 7
 7. Name of Stratigraphic Unit Yamhill Formation
 8. Stratigraphic Rank and Status: Formation Member, Bed, _____
 (Circle Appropriate Rank) Group Formation Informal
 (Circle Appropriate Status) Formation
 9. Age Paleogene Eocene Lutetian-Bartonian
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Nestucca/Spencer Formations Below Siletz River Volcanics
 12. Lithology: Dominant siltstone 80 %
 Subordinate sandstone/mudstone 20 %
 13. Thickness (Metric 817-900 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: x
 Within: x
 Below: x
 15. Fossil Data: Narizian Foraminiferal Faunas
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: Possible source rock for oil and gas
 18. Other Data:
 19. Original Reference: Baldwin, E. M., Brown, R. D., Geir, J. E., and Pease, M. H., Jr., 1955, Geology of the Sheridan and McMinnville quadrangles, Oregon: U. S. Geological Survey Oil and Gas Investigation Map OM-155
 20. Most Significant Reference: Brownfield, M. E., 1982, Oregon Department of Geology and Mineral Industries - GMS-23 and GMS-24
 21. Author(s) of Sheet Preparation: Michael Brownfield
 22. Date Prepared: 4-6-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name McMinnville-Sheridan
 5. Chart # _____ 6. Column # 7
 7. Name of Stratigraphic Unit Siletz River Volcanics
 8. Stratigraphic Rank and Status: Formation Member, Bed, _____
 (Circle Appropriate Rank) Group Formation Informal
 (Circle Appropriate Status) Formation
 9. Age Paleogene Paleocene-Eocene ? Thanetian-Ypresian
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Yamhill Formation Below Unknown
 12. Lithology: Dominant volcanics 90 %
 Subordinate sandstone/siltstone 10 %
 13. Thickness (Metric 3658 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: x
 Within: x
 Below: Unknown
 15. Fossil Data: Ulatisian Foraminifera faunas: See Snavely and others (1968).
 16. Radiometric Data: 48-58 million Years Method K/Ar
 Source: Duncan, R. A., in press (1983), captured island chain in the Coast Range of Oregon and Washington: Journal of Geophysical Research
 17. Economic Data: Road rock
 18. Other Data: Oldest known geologic unit in the central Oregon Coast Range
 19. Original Reference: Snavely, P. D., Jr., and Baldwin, E. M., 1948, Siletz River volcanic series, northwestern, Oregon: American Association of Petroleum Geologists Bulletin, v. 32, no. 5, p. 806-812.
 20. Most Significant Reference: Snavely, P. D., Jr., MacLeod, M. S., and Wagner, H. C., 1968, Tholeiitic and alkalic basalts of the Eocene Siletz River Volcanics, Oregon Coast Range: American Journal of Science, v. 266, no. 6, p. 454-481.
 21. Author(s) of Sheet Preparation: Michael Brownfield
 22. Date Prepared: 4-6-82

8. OREGON CITY-MOLALLA AREA

A. COMPOSITE SECTION LOCATION

Reference # _____ Location # _____
Latitude 45° 15' N Longitude 122° 32' W

County or Counties 005 Clackamas County

State 36 Oregon

Column Name: Oregon City-Molalla Area

Chart Name: Cenozoic Stratigraphic Units, Western Oregon and Washington

General Location Description: Cenozoic section composited from units cropping out in the vicinity of Oregon City and Molalla, along the Clackamas, Willamette and Molalla Rivers, Clackamas County, Oregon.

Principal Reference:

Peck, D. L., Griggs, A. B., Schlicker, H. G., Wells, F. G., and Dale, H. M., 1964, Geology of the central and northern parts of the Western Cascade Range in Oregon: U. S. Geological Survey Professional Paper 449, 56 p., scale 1:250,000

Column Authors: M. H. Beeson, Portland State University
W. N. Orr, University of Oregon

B. DATA SHEETS FOR EACH STRATIGRAPHIC UNIT ON CORRELATION CHART

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
4. Column Name Oregon City - Molalla Area
5. Chart # _____ 6. Column # 8
7. Name of Stratigraphic Unit fluvial deposits
8. Stratigraphic Rank and Status: (Circle Appropriate Rank) Group Formation Member, Bed, _____
(Circle Appropriate Status) Formal Informal
9. Age Quaternary Pleistocene
System Series Stage
10. Surface Subsurface or Both Surface
11. Bounding Units: Above alluvium Below various older units
12. Lithology: Dominant sands 70% ±
Subordinate gravels 30% ±
13. Thickness (Metric 1-100+ m)
14. Major Unconformities: - Check Appropriate Line -
None Disconformable Angular
Above: _____ X _____
Within: _____ X _____
Below: _____ X _____
15. Fossil Data: None
16. Radiometric Data: None Years Method
Source: _____
17. Economic Data: Sand and gravel
18. Other Data: Includes such units as: Springwater Fm (conglom); Gresham Fm (gravels and mudflows); Estacada Fm (coarse gravels); Willamette Silt (silt); Portland Sand (estuarine deposits)
19. Original Reference: Trimble, D. E., 1963, Geology of Portland, Oregon and adjacent areas: U. S. Geological Survey Bulletin 1119, map, scale 1:62,500
20. Most Significant Reference: Peck, D. L., Griggs, A. B., Schlicker, H. G., Wells, F. G., and Dale, H. M., 1964, Geology of the Central and northern parts of the Western Cascade Range in Oregon; U. S. Geological Survey Professional Paper 449, 56 p., map
21. Author(s) of Sheet Preparation: J. M. Armentrout
22. Date Prepared: 10-22-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
4. Column Name Oregon City - Molalla Area
5. Chart # _____ 6. Column # 8
7. Name of Stratigraphic Unit Boring Lavas
8. Stratigraphic Rank and Status: (Circle Appropriate Rank) Group Formation Member, Bed, _____
(Circle Appropriate Status) Formal Informal
9. Age Neogene Pliocene-Pleistocene
System Series Stage
10. Surface Subsurface or Both Surface
11. Bounding Units: Above Pleistocene units Below Troutdale Formation
12. Lithology: Dominant basalt flows 70% ±
Subordinate volcanic breccias, ash, etc. 30% ±
13. Thickness (Metric 0-50+ m)
14. Major Unconformities: - Check Appropriate Line -
None Disconformable Angular
Above: _____ X _____
Within: _____ X _____
Below: _____ X _____
15. Fossil Data: None
16. Radiometric Data: None Years Method
Source: _____
17. Economic Data: Road rock
18. Other Data: Exposed as a series of vents and related flows - interbedded with Troutdale Formation.
19. Original Reference: Treasher, R. G., 1942, Geologic map of the Portland area, Oregon: Oregon Department of Geology and Mineral Industries, map.
20. Most Significant Reference: Trimble, D. E., 1963, Geology of Portland, Oregon and adjacent areas: U. S. Geological Survey Bulletin 1119, map, scale 1:62,500
21. Author(s) of Sheet Preparation: J. M. Armentrout
22. Date Prepared: 10-22-82

8. OREGON CITY-MOLALLA AREA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Oregon City - Molalla Area
 5. Chart # _____ 6. Column # 8
 7. Name of Stratigraphic Unit Troutdale Formation
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) (Formal) Informal
 9. Age Neogene Pliocene-Pleistocene Zanclean-Pleistocene
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Boring Lavas or younger Below Sandy River Mudstone or older
 12. Lithology: Dominant sandy conglomerate 70%
 Subordinate silty sands 30%
 13. Thickness (Metric 10-300 m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: None Disconformable Angular
 Within: X
 Below: X
 15. Fossil Data: Megafloora from Clackamas area suggests Pliocene-see Trimble, D. E., 1963, Geology of Portland, Oregon, and adjacent areas: U. S. Geological Survey Bulletin 1119, map scale 1:62,500.
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: Locally sand and gravel
 18. Other Data: Contains distinctive quartzite pebbles in east Portland area. Top gradational with Boring Lavas in Portland Area. Probably has units of the same age as Sandy River Mudstone and the Rhododendron Formation to the east in the Columbia River Gorge.
 19. Original Reference: Hodge, E. T., 1933, Age of the Columbia River and lower canyon (abst.): Geological Society of America Bulletin, v. 44, p. 156-157; Formal introduction Hodge, 1936, Geological Society of America, Bulletin 49, p. 831-930.
 20. Most Significant Reference: Peck, D. L., Griggs, A. B., Schlicker, H. G., Wells, F. G., and Dole, H. M., 1964, Geology of the central and northern parts of the Western Cascade Range in Oregon: U. S. Geological Survey Professional Paper 449, 56 p., map (see also Trimble, 1963, cited above).
 21. Author(s) of Sheet Preparation: J. M. Armentrout M. H. Beeson
 22. Date Prepared: 10-22-82 12-16-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Oregon City - Molalla Area
 5. Chart # _____ 6. Column # 8
 7. Name of Stratigraphic Unit Molalla Formation
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) (Formal) Informal
 9. Age Neogene Miocene Serravalian-Tortonian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Sandy River Formation Below Frenchman Springs Member
 12. Lithology: Dominant marginal marine rocks 100%
 Subordinate _____
 13. Thickness (Metric 100-300 m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: None Disconformable Angular
 Within: X
 Below: X
 15. Fossil Data: Leaves suggest early Miocene for lower part of formation, see Peck and others, 1964.
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data:
 18. Other Data: Upper Molalla Formation sandstone and siltstone of Baldwin (1964) equals the Troutdale of Peck and others (1964); Lower Molalla Formation water laid tuffs of Baldwin (1964) equals the Molalla Formation of Peck and others (1964). The Molalla Formation is inadequately treated in the literature.
 19. Original Reference: Lowry, W. D., and Baldwin, E. M., 1952, Late Cenozoic geology of the lower Columbia River Valley, Oregon and Washington: Geological Society of America Bulletin, v. 63, no. 1, p. 1-24, 3 figs., 1 pl.
 20. Most Significant Reference: Peck, D. L., Griggs, A. B., Schlicker, H. G., Wells, F. G., and Dale, H. M., 1964, Geology of the central and northern parts of the Western Cascade Range in Oregon: U. S. Geological Survey Professional Paper 449, 56 p., map.
 21. Author(s) of Sheet Preparation: M. H. Beeson and J. M. Armentrout
 22. Date Prepared: 3-18-83

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Oregon City - Molalla Area
 5. Chart # _____ 6. Column # 8
 7. Name of Stratigraphic Unit Sandy River Mudstone
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) (Formal) Informal
 9. Age Neogene Miocene Tortonian-Messinian
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface (Columbia River Basalt Gp. or
 11. Bounding Units: Above Troutdale Formation Below Rhododendron Fm.
 12. Lithology: Dominant mudstone 70%
 Subordinate sand and conglomerate 30%
 13. Thickness (Metric 100-300 m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: None Disconformable Angular
 Within: X
 Below: X
 15. Fossil Data: Pliocene megafloora (Trimble, 1963)
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data:
 18. Other Data: Originally part of Hodges' (1938) Troutdale Formation: In Columbia River Gorge, channel conglomerates of lower Troutdale are probably equivalent to Sandy River Mudstone, the Sandy River Mudstone being confined largely to the Portland Basin.
 19. Original Reference: Trimble, E. D., 1963, Geology of Portland, Oregon, and adjacent areas: U. S. Geological Survey Bulletin 1119, map.
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: J. M. Armentrout M. H. Beeson
 22. Date Prepared: 10-22-82 12-16-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Oregon City - Molalla Area
 5. Chart # _____ 6. Column # 8
 7. Name of Stratigraphic Unit Rhododendron Formation
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) (Formal) Informal
 9. Age Neogene Miocene Serravalian-Tortonian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Troutdale, Sandy River & other Below Columbia River basalts
 12. Lithology: Dominant volcanic mudflows 100%
 Subordinate _____
 13. Thickness (Metric 200 m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: None Disconformable Angular
 Within: X
 Below: X
 15. Fossil Data: None
 16. Radiometric Data: 9.5 to 12.1 Years Method K/Ar
 Source: Priest, G. R., Beeson, M. H., Gannett, M. W., and Beeson, D. A., 1982, Geology, geochemistry and geothermal resources of the Old Maid flat area, Oregon, in Geology and geothermal resources of the Mount Hood area, Oregon: Oregon Department of Geology and Mineral Resources Special Paper 14, p. 16-30.
 17. Economic Data:
 18. Other Data: Interbedded with lava flows of Cascade Range toward east. Peck and others (1964) included the Rhododendron Formation within their Sardine Formation.
 19. Original Reference: Hodge, E. T., 1933, Age of the Columbia River and lower Canyon (abst.): Geological Society of America Bulletin, v. 44, p. 156-157.
 20. Most Significant Reference: Peck, D. L., Griggs, A. B., Schlicker, H. G., Wells, F. G., and Dale, H. M., 1964, Geology of the central and northern parts of the Western Cascade Range in Oregon: U. S. Geological Survey Professional Paper 449, 56 p., map.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 10-22-82

8. OREGON CITY-MOLALLA AREA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Oregon City - Molalla Area
 5. Chart # _____ 6. Column # 8
 7. Name of Stratigraphic Unit Columbia River Basalt Group
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation Member, Bed,
 (Circle Appropriate Status) Formal Informal
 9. Age Neogene Miocene Langhian-Serravallian
 System Series Stage
 10. Surface Subsurface or Both _____
 11. Bounding Units: Above Rhododendron Fm Below Butte Creek beds
 12. Lithology: Dominant basalts Subordinate _____ 100%
 13. Thickness (Metric) 90-200 m
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ None _____ Disconformable _____ Angular _____
 Within: _____ x _____
 Below: _____ x _____
 15. Fossil Data: None
 16. Radiometric Data: 14.6-16.5 K/Ar (20 samples)
million Years Method $^{40}\text{Ar}/^{39}\text{Ar}$ (3 samples)
 Source: Lux, D. R., 1981, Geochronology, geochemistry, and petrogenesis
 of basaltic rocks from the Western Cascades, Oregon: unpub. Ph.D.
 dissertation, Ohio State University, 171 p.
 17. Economic Data: Road rock
 18. Other Data: See Wanapum and Grande Ronde Basalts: this area.
 19. Original Reference: Swanson, D. A., Wright, T. L., Hooper, P. R., and Bentley, R. D.,
 1979, Revisions in stratigraphic nomenclature of the Columbia River Basalt Group:
 U. S. Geological Survey Bulletin 1457-G, 59 p.
 20. Most Significant Reference: Beeson, M. H., and Moran, M. R., 1979, Columbia River
 Basalt Group stratigraphy in western Oregon: Oregon Geology, v. 41, no. 1,
 p. 11-14.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 12-31-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Oregon City - Molalla Area
 5. Chart # _____ 6. Column # 8
 7. Name of Stratigraphic Unit Grande Ronde Basalt of Columbia River Basalt Group
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation Member, Bed,
 (Circle Appropriate Status) Formal Informal
 9. Age Neogene Miocene Langhian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Wanapum Basalt Below Butte Creek beds and older
 12. Lithology: Dominant basalt Subordinate _____ 100% units
 13. Thickness (Metric) 30-100 m
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ None _____ Disconformable _____ Angular _____
 Within: _____ x _____
 Below: _____ x _____
 15. Fossil Data: None
 16. Radiometric Data: 15.2 ± 0.4 Years Method K/Ar
 Source: Lux, D. R., 1981, Geochronology, geochemistry, and petrogenesis
 of basaltic rocks from the Western Cascades, Oregon: unpub. Ph.D.
 dissertation, Ohio State University, 171 p.
 17. Economic Data: Road rock
 Correlated to Grande Ronde Basalt by geochemistry
 18. Other Data: geochronology, and magnetic polarity.
 Part of flow sequences sourced from fissures in central/eastern Oregon and
 Washington that flowed west through ancestral Columbia River valley.
 19. Original Reference: Beeson, M. H., and Moran, M. R., 1979, Columbia River Basalt
 Group stratigraphy in western Oregon: Oregon Geology, v. 41, No. 1, p. 11-14.
 20. Most Significant Reference: Beeson, M. H., Johnson, A. G., and Moran, M. R., 1976,
 Portland Environmental Geology - Fault Identification, Final Technical Report,
 (September 1, 1974 - December 31, 1975), to the U. S. Geological Survey, Menlo Park,
 California, 107 pp.
 21. Author(s) of Sheet Preparation: J. M. Armentrout M. H. Beeson
 22. Date Prepared: 10-22-82 12-16-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Oregon City - Molalla Area
 5. Chart # _____ 6. Column # 8
 7. Name of Stratigraphic Unit Frenchman Springs Member, Wanapum Basalt
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation Member, Bed, Columbia River Basalt Group
 (Circle Appropriate Status) Formal Informal
 9. Age Neogene Miocene Serravallian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Rhododendron Fm & others Below Grande Ronde Basalt and older
 12. Lithology: Dominant basalt Subordinate _____ 100% units
 13. Thickness (Metric) 60-100 m
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ None _____ Disconformable _____ Angular _____
 Within: _____ x _____
 Below: _____ x _____
 15. Fossil Data: None
 16. Radiometric Data: 15.4 ± 0.5 Years Method K/Ar
million
 Source: Lux, D. R., 1981, Geochronology, geochemistry, and petrogenesis
 of basaltic rocks from the Western Cascades: unpub. Ph.D.
 dissertation, Ohio State University, 171 p.
 17. Economic Data: Road rock
 18. Other Data: Composite thickness approximately 60 m in Oregon City Area;
 up to 100 m thick as intracanyon flow in Molalla River valley. Correlation
 to Columbia River Basalt Group type section by geochemistry and paleomagnetism.
 19. Original Reference: Beeson, M. H., and Moran, M. R., 1979, Columbia River Basalt
 Group stratigraphy in western Oregon: Oregon Geology, v. 41, no. 1, p. 11-14.
 20. Most Significant Reference: Beeson, M. H., Johnson, A. G., and Moran, M. R., 1976,
 Portland Environmental Geology-Fault Identification, Final Technical Report
 (September 1, 1974-December 31, 1975), to U. S. Geological Survey, Menlo Park,
 California, 107 p.
 21. Author(s) of Sheet Preparation: M. H. Beeson
 22. Date Prepared: 12-16-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Oregon City - Molalla Area
 5. Chart # _____ 6. Column # 8
 7. Name of Stratigraphic Unit Butte Creek beds
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation Member, Bed,
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Oligocene Chattian
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Columbia River Basalt Below Little Butte Volcanics
 12. Lithology: Dominant marine volcanic siltstone and sandstone 95 %
 Subordinate limestones 5 %
 13. Thickness (Metric) 300 m
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ None _____ Disconformable _____ Angular _____
 Within: _____ x _____
 Below: _____ x _____
 15. Fossil Data: Mollusks of Juanian Molluscan stage - personal communication from
 W. O. Addicott, U. S. Geological Survey, to W. N. Orr, University of Oregon;
 see Orr and Faulhaber, 1975, Northwest Science.
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: Coal and limestone
 18. Other Data: Currently being remapped by W. N. Orr and P. R. Miller at the
 University of Oregon - to be renamed Abiqua Formation
 19. Original Reference: Harper, H. E., 1946, Preliminary report on the geology of
 the Molalla quadrangle, Oregon: Unpublished MS thesis, Oregon State University.
 20. Most Significant Reference: Hampton, E. R., 1972, Geology and ground water of the
 Molalla Salem Slope area, northern Willamette Valley, Oregon: U. S. Geological
 Survey Water Supply Paper 1997, 83 p.
 21. Author(s) of Sheet Preparation: W. N. Orr Additions J. M. Armentrout
 22. Date Prepared: 7-9-82 10-22-82

8. OREGON CITY-MOLALLA AREA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Oregon City - Molalla Area
 5. Chart # _____ 6. Column # 8
 7. Name of Stratigraphic Unit basalt
 8. Stratigraphic Rank and Status: (Circle Appropriate Rank) Group Formation Member, Bed, Intrusives and flows
 (Circle Appropriate Status) Formal Informal
 9. Age Neogene Oligocene ? Chattian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Butte Creek beds Below Little Butte volcanics
 12. Lithology: Dominant basalt %
 Subordinate %
 13. Thickness (Metric 150 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: _____
 Below: _____
 15. Fossil Data: None
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data:
 18. Other Data: Occurs between younger Butte Creek beds and older Little Butte volcanics.
 19. Original Reference: Mapped in ongoing project by W. N. Orr, University of Oregon, 1982-1983
 20. Most Significant Reference:
 21. Author(s) of Sheet Preparation: W. N. Orr
 22. Date Prepared: 7-9-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Oregon City - Molalla Area
 5. Chart # _____ 6. Column # 8
 7. Name of Stratigraphic Unit Little Butte Volcanics
 8. Stratigraphic Rank and Status: (Circle Appropriate Rank) Group Formation Member, Bed, Intrusives and flows
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Locene-Oligocene Priabonian-Rupelian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Butte Creek beds Below Unknown - not exposed
 12. Lithology: Dominant volcanic sediments 75 %
 Subordinate volcanic flows 25 %
 13. Thickness (Metric 1000+ m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: X _____
 Below: Unknown _____
 15. Fossil Data: By superposition of marine fossiliferous units; the Little Butte volcanics interfinger to the southwest with the Priabonian Eugene Formation and locally with the Chattian (Juranian Molluscan stage) beds of Butte Creek; Also by leaves - see Wolfe in Peck and others (1964).
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data:
 18. Other Data:
 19. Original Reference: Wells, F. G., 1956, Geology of the Medford quadrangle, Oregon and California: U. S. Geological Survey Map G.Q.-89.
 20. Most Significant Reference: Peck, D. L., Griggs, A. B., Schlicker, H. G., Wells, F. G., and Dole, H. M., 1964, Geology of the central and northern parts of the Western Cascade Range in Oregon: U. S. Geological Professional Paper 449, 56 p., Map.
 21. Author(s) of Sheet Preparation: W. N. Orr Additions J. M. Armentrout
 22. Date Prepared: 7-9-82 10-22-82

9. ASTORIA AREA

A. COMPOSITE SECTION LOCATION

Reference # _____ Location # _____
Latitude 45° 45' N Longitude 123° 30' W
County or Counties 007 Clatsop County
State 36 Oregon

Column Name: Astoria Area

Chart Name: Cenozoic Stratigraphic Units, Western Oregon and Washington

General Location Description: Cenozoic section composed of units cropping out along coastal cliffs and inland areas of Clatsop County, Oregon.

Principal Reference:*

Niem, A. R., and Van Atta, R. O., 1973 Cenozoic stratigraphy of northwestern Oregon and adjacent southwestern Washington, in Beaulieu, J. D., ed., Geologic field trips in northern Oregon and southern Washington: Oregon Department of Geology and Mineral Industries, Bulletin 77, p. 75-132.

*Updated by numerous unpublished theses of Oregon State University students supervised by A. R. Niem, Department of Geology.

Column Author: A. R. Niem, Oregon State University

B. DATA SHEETS FOR EACH STRATIGRAPHIC UNIT ON CORRELATION CHART

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
4. Column Name Astoria Area 6. Column # 9
5. Chart # _____
7. Name of Stratigraphic Unit marine and fluvial terrace deposits
8. Stratigraphic Rank and Status:
(Circle Appropriate Rank) Group (Formation) Member, Bed, _____
(Circle Appropriate Status) (Formal) Informal
9. Age Quaternary Pleistocene
System Series Stage
10. Surface Subsurface or Both Surface
11. Bounding Units: Above alluvium Below Troutdale Fm. or older
12. Lithology: Dominant sands, gravels 70 %
Subordinate muds, peat 30 %
13. Thickness (Metric 1 to 40 m)
14. Major Unconformities: - Check Appropriate Line -
None Disconformable Angular
Above: _____
Within: _____
Below: _____

15. Fossil Data: None

16. Radiometric Data: None Years Method _____
Source: _____

17. Economic Data: Sand and gravel

18. Other Data: Unit includes coastal marine and inland fluvial terraces and floodplain alluvium of volcanic gravels and sands, silts, and clays. On coast, it also includes Holocene dune and beach ridge sands and along the lower Columbia River and other river mouths-estuaries includes tidal flat muds, fine sand, and peat.

19. Original Reference: Schlicker, H. G., Deacon, R. J., Beaulieu, J. D., and Olcott, G. W., 1972, Environmental geology of the coastal region, Tillamook and Clatsop counties, Oregon: Oregon Department of Geology and Mineral Industries Bulletin 74, 164 p.

20. Most Significant Reference: Same

21. Author(s) of Sheet Preparation: Alan R. Niem
22. Date Prepared: 7-8-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
4. Column Name Astoria Area 6. Column # 9
5. Chart # _____
7. Name of Stratigraphic Unit Troutdale Formation
8. Stratigraphic Rank and Status:
(Circle Appropriate Rank) Group (Formation) Member, Bed, _____
(Circle Appropriate Status) (Formal) Informal
9. Age Neogene-Quaternary Pliocene-Pleistocene Zanclean-Pleistocene
System Series Stage
10. Surface Subsurface or Both Surface
11. Bounding Units: Above Pleistocene deposits Below Astoria Formation
12. Lithology: Dominant quartzitic-volcanic gravels 100 %
Subordinate _____ %
13. Thickness (Metric 15 m)
14. Major Unconformities: - Check Appropriate Line -
None Disconformable Angular
Above: _____
Within: _____
Below: _____

15. Fossil Data: None

16. Radiometric Data: None Years Method _____
Source: _____

17. Economic Data:

18. Other Data: Flat-lying unit is poorly exposed and is very limited in extent in Clatsop County (i.e. City of Astoria)

19. Original Reference: Hodge, E. T., 1933, Age of the Columbia River and lower canyon (abst.): Geological Society of America Bulletin, v. 44, p. 156-157; Formal Introduction by Hodge, E. T., 1938, Geological Society of America Bulletin 49, p. 831-930.

20. Most Significant Reference: Schlicker, H. G., Deacon, R. J., Beaulieu, J. D., and Olcott, G. W., 1972, Environmental geology of the coastal region, Tillamook and Clatsop counties, Oregon: Oregon Department of Geology and Mineral Industries Bulletin 74, 164 p.

21. Author(s) of Sheet Preparation: Alan R. Niem
22. Date Prepared: 7-8-82

9. ASTORIA AREA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
4. Column Name Astoria Area
5. Chart # _____ 6. Column # 9
7. Name of Stratigraphic Unit Columbia River Basalt Group
8. Stratigraphic Rank and Status: (Circle Appropriate Rank) Group Formation Member, Bed, (Circle Appropriate Status) Formal Informal
9. Age Neogene Miocene Langhian-Serravallian
- System _____ Series _____ Stage _____
10. Surface Subsurface or Both Surface
11. Bounding Units: Above alluvium or Troutdale Fm Below Astoria Formation
12. Lithology: Dominant basalt 100 % Subordinate _____
13. Thickness (Metric) 335-665 m
14. Major Unconformities: - Check Appropriate Line -

Above:	None	Disconformable	Angular
Within:		X	
Below:		X	X
15. Fossil Data: None
16. Radiometric Data: None Years Method _____
Source: _____
17. Economic Data: Road rock
18. Other Data: Includes basalts only: Saddle Mountains Basalt, Wanapum Basalt, and Grande Ronde Basalt. Interbedded sedimentary units are not part of Columbia River Basalt Group.
19. Original Reference: See: Swanson, D. A., Wright, T. L., Hooper, P. R., and Bentley, R. D., 1979, Revisions in stratigraphic nomenclature of the Columbia River Basalt Group: U. S. Geological Survey Bulletin 1457-G, 59 p.
20. Most Significant Reference: Murphy, T. M., 1981, Geology of the Nicolai Mountain-Gnat Creek area, Clatsop County, northwestern Oregon: unpublished M.S. thesis, Oregon State University, Corvallis, 355 p.
21. Author(s) of Sheet Preparation: J. M. Armentrout
22. Date Prepared: 12-28-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
4. Column Name Astoria Area
5. Chart # _____ 6. Column # 9
7. Name of Stratigraphic Unit Pomona Member, Saddle Mountains Basalt, Columbia River
8. Stratigraphic Rank and Status: (Circle Appropriate Rank) Group Formation Member, Bed, (Circle Appropriate Status) Formal Informal
9. Age Neogene Miocene Serravallian
- System _____ Series _____ Stage _____
10. Surface Subsurface or Both Surface
11. Bounding Units: Above none Below sedimentary rocks of Clifton
12. Lithology: Dominant subaerial basalt flow 100 % Subordinate _____
13. Thickness (Metric) 10 to 15 m
14. Major Unconformities: - Check Appropriate Line -

Above:	None	Disconformable	Angular
Within:		X	
Below:	X	X	
15. Fossil Data:
16. Radiometric Data: 12⁺ 0.5 million years Method K-Ar
Source: Dated on Columbia Plateau to the east by McKee and others (1977)
17. Economic Data:
18. Other Data: Pomona basalt is reversely polarized, glomeroporphyritic and is the age and petrologic equivalent to the coastal middle Miocene Basalt of Pack Sack Lookout of Snavely and others (1973). It has very limited distribution in Clatsop County.
19. Original Reference: Schmincke, H. U., 1967, Stratigraphy and petrology of four upper Yakima Basalt flows in south-central Washington: Geological Society of America Bulletin, v. 78, p. 1385-1422.
20. Most Significant Reference: Murphy, T. M., 1981, Geology of the Nicolai Mountain-Gnat Creek area, Clatsop County, northwestern Oregon: unpublished M.S. thesis, Oregon State University, Corvallis, 355 p.
21. Author(s) of Sheet Preparation: Alan R. Niem and David E. Nelson
22. Date Prepared: 7-9-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
4. Column Name Astoria Area
5. Chart # _____ 6. Column # 9
7. Name of Stratigraphic Unit sedimentary rocks of Clifton
8. Stratigraphic Rank and Status: (Circle Appropriate Rank) Group Formation Member, Bed, (Circle Appropriate Status) Formal Informal
9. Age Neogene Miocene Serravallian
- System _____ Series _____ Stage _____
10. Surface Subsurface or Both Surface
11. Bounding Units: Above Pomona Mbr. Saddle Mts. Basalt Below Frenchman Spgs. Mbr. Wanapum
12. Lithology: Dominant arkosic sandstone 50 % Basalt Subordinate laminated mudstone 50 %
13. Thickness (Metric) 200 m
14. Major Unconformities: - Check Appropriate Line -

Above:	None	Disconformable	Angular
Within:	X	X	
Below:		X	
15. Fossil Data: Marine diatom assemblages from the sedimentary rocks of Clifton are middle Miocene (late Relizian to early Luisian) in age (= North Pacific diatom zone D. lauta subzone b and subzone a of D. hustedii-D. lauta of Barron, 1981)
16. Radiometric Data: None Years Method _____
Source: _____
17. Economic Data:
18. Other Data: Unit contains fluvial, coal-bearing (lignite) shallow-marine facies with intervening thin-bedded slope turbidite sandstone, mudstone, and chaotic submarine channel sandstone (Murphy and Niem, 1980). In part equivalent to the upper member of the Astoria (?) Formation of southwest Washington.
19. Original Reference: Niem, A. R. and Van Atta, R. O., 1973, Cenozoic stratigraphy of northwestern Oregon and adjacent southwestern Washington, in Beaulieu, J. D., ed., Geologic field trips in northern Oregon and southern Washington: Oregon Department of Geology and Mineral Industries Bulletin 77, p. 75-132.
20. Most Significant Reference: Murphy, T. M., 1981, Geology of the Nicolai Mountain-Gnat Creek area, Clatsop County, northwestern Oregon: unpublished M.S. thesis, Oregon State University, Corvallis, 355 p.
21. Author(s) of Sheet Preparation: Alan R. Niem and David E. Nelson
22. Date Prepared: 7-9-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
4. Column Name Astoria Area
5. Chart # _____ 6. Column # 9
7. Name of Stratigraphic Unit Frenchman Springs Member, Wanapum Basalt, Columbia River
8. Stratigraphic Rank and Status: (Circle Appropriate Rank) Group Formation Member, Bed, (Circle Appropriate Status) Formal Informal
9. Age Neogene Miocene Serravallian
- System _____ Series _____ Stage _____
10. Surface Subsurface or Both Surface
11. Bounding Units: Above sedimentary rocks of Clifton Below equivalent of Vantage SS
12. Lithology: Dominant subaerial basalt flows 50 % Subordinate submarine basalt breccia and pillow lava 50 %
13. Thickness (Metric) 75 to 150 m
14. Major Unconformities: - Check Appropriate Line -

Above:	None	Disconformable	Angular
Within:	X	X	
Below:		X	
15. Fossil Data: None
16. Radiometric Data: None Years Method _____
Source: _____
17. Economic Data: Road rock
18. Other Data: Frenchman Springs basalts are the age and petrologic equivalents to the locally erupted (?) coastal middle Miocene Cape Foulweather Basalts of Snavely and others (1973). The lavas flowed down an ancestral Columbia River valley to the sea in northwestern Oregon to form pillow lavas and breccias. The flows are normally polarized (N₂).
19. Original Reference: Swanson, D. A., Wright, T. L., Hooper, P. R., and Bentley, R. P., 1979, Revisions in stratigraphic nomenclature of the Columbia River Basalt Group: U. S. Geological Survey Bulletin 1457-G, 59 p.
20. Most Significant Reference: Murphy, T. M., 1981, Geology of the Nicolai Mountain-Gnat Creek area, Clatsop County, northwestern Oregon: unpublished M.S. thesis, Oregon State University, Corvallis, 355 p.
21. Author(s) of Sheet Preparation: Alan R. Niem and David E. Nelson
22. Date Prepared: 7-9-82

9. ASTORIA AREA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Astoria Area
 5. Chart # _____ 6. Column # 9
 7. Name of Stratigraphic Unit sandstone equivalent to Vantage Sandstone
 8. Stratigraphic Rank and Status: _____ of Ellensburg Formation -
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Neogene Miocene Langhian-Serravallian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Frenchman Springs Member Below Grande Ronde Basalt
 12. Lithology: Dominant arkosic to basaltic sandstone _____ 100 %
 Subordinate _____
 13. Thickness (Metric 2 to 70 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: x _____
 Below: _____
 15. Fossil Data: None
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data:
 18. Other Data: Unit is tentatively correlated to a member of the Ellensburg Formation of central Washington and is sandwiched between the Grande Ronde and Frenchman Springs Basalts of the Columbia River Basalt Group. It is fluvial and shallow marine in origin.
 19. Original Reference: Murphy, T. M., 1981, Geology of the Nicolai Mountain-Gnat Creek area, Clatsop County, northwestern Oregon: unpublished M.S. thesis, Oregon State University, Corvallis, 355 p.
 20. Most Significant Reference: same
 21. Author(s) of Sheet Preparation: Alan R. Niem
 22. Date Prepared: 7-8-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Astoria Area
 5. Chart # _____ 6. Column # 9
 7. Name of Stratigraphic Unit Grande Ronde Basalt of Columbia River Basalt Group
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Neogene Miocene Langhian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above equiv. to Vantage Sandstone Below Astoria Formation
 12. Lithology: Dominant subaerial basalt flows _____ 50 %
 Subordinate submarine basalt breccia & pillow lava _____ 50 %
 13. Thickness (Metric 250 to 500 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: x _____
 Below: _____
 15. Fossil Data: None
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: Road rock
 18. Other Data: Grande Ronde Basalts are age and petrologic equivalents to the locally erupted (?) coastal middle Miocene Depoe Bay Basalts of Snavely and others (1973). The lavas flowed down an ancestral Columbia River valley to the sea in NW Oregon to form pillow lavas and breccias. High and low Mg and normal and reversely polarized flows occur within the formation.
 19. Original Reference: Swanson, D. A., Wright, T. L., Hooper, P. R., and Bentley, R. P., 1979, Revisions in stratigraphic nomenclature of the Columbia River Basalt Group: U. S. Geological Survey Bulletin 1457-G, 59 p.
 20. Most Significant Reference: Murphy, T. M., 1981, Geology of the Nicolai Mountain-Gnat Creek area, Clatsop County, northwestern Oregon: unpub. M.S. thesis, Oregon State University, Corvallis, 355 p.
 21. Author(s) of Sheet Preparation: Alan R. Niem and David E. Nelson
 22. Date Prepared: 7-9-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Astoria Area
 5. Chart # _____ 6. Column # 9
 7. Name of Stratigraphic Unit Astoria Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Neogene Miocene Aquitanian-Langhian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Grande Ronde Basalt Below Oswald West mudstone
 12. Lithology: Dominant sandstone _____ 60 %
 Subordinate mudstone, minor conglomerate and coal _____ 40 %
 13. Thickness (Metric 1200 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: x _____
 Below: _____
 15. Fossil Data: Abundant foraminiferal and mollusk faunas indicate a Pillarian-Newportian Mollusian Stage - Saucian Foraminiferal Stage age for the formation. See Moore, E. J., 1963, U. S. Geological Survey Professional Paper 419, 109 p.
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: Some sandstone facies may be potential petroleum reservoirs.
 18. Other Data: Originally "Astoria shales" by Condon in Cope, 1880. A deltaic shallow-marine to deep-marine mudstone and turbidite deposit of the ancestral Columbia River
 19. Original Reference: Condon, T., in Cope, E. D., 1880, Second contribution to a knowledge of the Miocene fauna of Oregon: American Philosophical Society Proceedings, v. 18, p. 370-376.
 20. Most Significant Reference: Cooper, M. D., 1981, Sedimentation, stratigraphy and facies variation of the lower to middle Miocene Astoria Formation in Oregon: Unpub. Ph.D. thesis, Oregon State University, 524 p.
 21. Author(s) of Sheet Preparation: J. M. Armentrout and A. R. Niem
 22. Date Prepared: 9-18-82 12-10-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Astoria Area
 5. Chart # _____ 6. Column # 9
 7. Name of Stratigraphic Unit Silver Point member of Astoria Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Neogene Miocene Aquitanian-Langhian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Grande Ronde, Frenchman Below Angora Peak, Big Creek members
 12. Lithology: Dominant laminated micaceous mudstone _____ 80 %
 Subordinate thin-bedded turbidite sandstone _____ 20 %
 13. Thickness (Metric 210 to 850 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: x _____
 Below: _____
 15. Fossil Data: Abundant foram. assemblages indicate Saucian age (Pacific Northwest provincial stage; early to middle Miocene of Armentrout, 1981, Geological Society of America Special Publication 184, p. 137-148).
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data:
 18. Other Data: Unit is interpreted as a deep-marine continental slope or delta slope deposit formed during a transgression over other deltaic-shallow marine members of the Astoria Formation.
 19. Original Reference: Smith, T. M., 1975, Stratigraphy and sedimentation of the Onion Peak area, Clatsop County, Oregon: unpub. M.S. thesis, Oregon State University, Corvallis, 190 p.
 20. Most Significant Reference: Cooper, M. D., 1981, Sedimentation, stratigraphy and facies variation of the lower to middle Miocene Astoria Formation in Oregon: unpub. Ph.D. thesis, Oregon State University, Corvallis, 524 p.
 21. Author(s) of Sheet Preparation: Alan R. Niem
 22. Date Prepared: 7-8-82

9. ASTORIA AREA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Astoria Area
 5. Chart # _____ 6. Column # 9
 7. Name of Stratigraphic Unit Pipeline member of Astoria Formation
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation Member Bed,
 (Circle Appropriate Status) Formal Informal
 9. Age Neogene Miocene Burdigalian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Silver Point member Below Big Creek member
 12. Lithology: Dominant arkosic sandstone 60 %
 Subordinate mudstone, minor conglomerate and coal 40 %
 13. Thickness (Metric 790 m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: X None Disconformable Angular
 Within: X _____
 Below: X _____
 15. Fossil Data: Saucian age foraminifera and Neoportian age molluscan assemblages occur in the unit: early to middle Miocene of Armentrout, 1981, Geological Society of America Special Publication 184, p. 137-148.
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: _____
 18. Other Data: The unit has been interpreted as a channelized upper submarine canyon deposit.
 19. Original Reference: Coryell, G. F., 1978, Stratigraphy, sedimentation, and petrology of the Tertiary rocks in the Bear Creek-Wickiup Mountain-Big Creek area, Clatsop County, Oregon: unpub. M.S. thesis, Oregon State University, Corvallis, 178 p.
 20. Most Significant Reference: Nelson, M. P., 1978, Tertiary stratigraphy and sedimentation in the Lewis and Clark River - Young's River area, Clatsop County, northwestern Oregon: unpub. M.S. thesis, Oregon State University, Corvallis, 242 p.
 21. Author(s) of Sheet Preparation: Alan R. Niem
 22. Date Prepared: 7-8-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Astoria Area
 5. Chart # _____ 6. Column # 9
 7. Name of Stratigraphic Unit Big Creek member of Astoria Formation
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation Member Bed,
 (Circle Appropriate Status) Formal Informal
 9. Age Neogene Miocene Aquitian-Burdigalian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Silver Point member Below Oswald West mudstone
 12. Lithology: Dominant feldspathic sandstone 70 %
 Subordinate mudstone 30 %
 13. Thickness (Metric 150-420 m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: X None Disconformable Angular
 Within: X _____
 Below: X _____
 15. Fossil Data: Abundant molluscan fossil assemblages indicate a Pillarian-Newportian age for the member: early to middle Miocene of Armentrout, 1981, Geological Society of America Special Publication 184, p. 137-148.
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: _____
 18. Other Data: A high-energy shallow-marine inner shelf to beach depositional environment has been interpreted for this unit.
 19. Original Reference: Coryell, G. F., 1978, Stratigraphy, sedimentation, and petrology of the Tertiary rocks in the Bear Creek-Wickiup Mountain-Big Creek area, Clatsop County, Oregon: unpub. M.S. thesis, Oregon State University, Corvallis, 178 p.
 20. Most Significant Reference: Cooper, M. D., 1981, Sedimentation, stratigraphy, and facies variation of the lower to middle Miocene Astoria Formation in Oregon: unpub. Ph.D. thesis, Oregon State University, Corvallis, 524 p.
 21. Author(s) of Sheet Preparation: Alan R. Niem
 22. Date Prepared: 7-8-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Astoria Area
 5. Chart # _____ 6. Column # 9
 7. Name of Stratigraphic Unit Angora Peak member of the Astoria Formation
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation Member Bed,
 (Circle Appropriate Status) Formal Informal
 9. Age Neogene Miocene Aquitian-Burdigalian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Silver Point member Below Oswald West mudstone
 12. Lithology: Dominant feldspathic-lithic sandstone 70 %
 Subordinate mudstone, coal, conglomerate 30 %
 13. Thickness (Metric 330 m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: X None Disconformable Angular
 Within: X _____
 Below: X _____
 15. Fossil Data: Molluscan fossil assemblages indicate Pillarian and Neoportian age: early to middle Miocene of Armentrout, 1981, Geological Society of America Special Paper 184, p. 137-148.
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: _____
 18. Other Data: Unit is interpreted as forming in a shallow-marine high-energy wave-dominated delta of the ancestral Columbia River
 19. Original Reference: Cressy, F. B., Jr., 1974, Stratigraphy and sedimentation of the Neahkahnie Mountain-Angora Peak area, Tillamook and Clatsop counties, Oregon: unpub. M.S. thesis, Oregon State University Corvallis, 148 p.
 20. Most Significant Reference: Cooper, M. D., 1981, Sedimentation, stratigraphy, and facies variation of the lower to middle Miocene Astoria Formation in Oregon: unpub. Ph.D. thesis, Oregon State University, Corvallis, 524 p.
 21. Author(s) of Sheet Preparation: Alan R. Niem
 22. Date Prepared: 7-8-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Astoria Area
 5. Chart # _____ 6. Column # 9
 7. Name of Stratigraphic Unit Oswald West mudstone
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation Member Bed,
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene-Neogene Eocene-Miocene Priabonian-Aquitian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Astoria Fm., Columbia River B. Below Unknown
 12. Lithology: Dominant bioturbated turbaceous mudstone 90 %
 Subordinate feldspathic and glauconitic ss 10 %
 13. Thickness (Metric 500-1500 m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: X None Disconformable Angular
 Within: X _____
 Below: Unknown _____
 15. Fossil Data: Abundant forams assemblages indicate Refugian to early Saucian age
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: _____
 18. Other Data: Unit is interpreted as outer shelf and upper slope deposit. At the type section, the unit consists of Oligocene (Zemurian) to early Miocene (Saucian) age strata (Cressy, 1974) but has been extended to the north by Neel (1976), Penoyer (1977), and Nelson (1978) to include late Eocene strata (Refugian and Narizian)
 19. Original Reference: Niem, A. R. and Van Atta, R. O., 1973, Cenozoic stratigraphy of northwestern Oregon and adjacent southwestern Washington, in Beaulieu, J. D., ed., Geologic field trips in northern Oregon and southern Washington: Oregon Department of Geology and Mineral Industries Bulletin 77, p. 75-132.
 20. Most Significant Reference: Cressy, F. B., Jr., 1974, Stratigraphy and sedimentation of the Neahkahnie Mountain-Angora Peak area, Tillamook and Clatsop counties, Oregon: unpub. M.S. thesis, Oregon State University, Corvallis, 148 p.
 21. Author(s) of Sheet Preparation: Alan R. Niem and David E. Nelson
 22. Date Prepared: 5-14-82

9. ASTORIA AREA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Astoria Area 6. Column # 9
 5. Chart # _____
 7. Name of Stratigraphic Unit Pittsburg Bluff Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) (Formal) Informal _____
 9. Age Paleogene Eocene? Oligocene Priabonian? Rupelian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface and Subsurface
 11. Bounding Units: Above Oswald West mudstone Below rocks of Vesper Creek
 12. Lithology: Dominant sandstone _____ 90 %
 Subordinate mudstone _____ 80 %
 13. Thickness (Metric) 0-250 m _____
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: X _____
 Below: X _____
 15. Fossil Data: Molluscan faunas of Galvinian Stage age; Foraminiferal faunas of Refugian Stage age. Some foraminiferal faunas from upper units of the Pittsburg Bluff Formation in Clatsop County contain Zemorrian foraminiferal faunas.
 16. Radiometric Data: _____
 Source: _____
 17. Economic Data: _____
 18. Other Data: Deltaic facies of Pittsburg Bluff Formation pinch-out westward into basinal mudstones of Oswald West mudstone: see Nelson, D. E., in preparation, Geology of the Fishhawk Falls-Jewell area, Clatsop County, northwest Oregon: unpublished M.S. thesis, Oregon State University.
 19. Original Reference: Schenck, H. G., 1927, Marine Oligocene of Oregon: University of California Publications, Department of Geological Sciences Bulletin, v. 16, no. 12, p. 449-460.
 20. Most Significant Reference: Moore, E. J., 1976, Oligocene marine mollusks from the Pittsburg Bluff Formation in Oregon: U. S. Geological Survey Professional Paper 922, 66 p., 17 pls.
 21. Author(s) of Sheet Preparation: A. R. Niem and David E. Nelson
 22. Date Prepared: 3-18-83

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Astoria Area 6. Column # 9
 5. Chart # _____
 7. Name of Stratigraphic Unit rocks of Vesper Church
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) (Formal) Informal _____
 9. Age Paleogene Eocene Priabonian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Pittsburg Bluff fm. Below Keasey Formation
 12. Lithology: Dominant thin bedded sandstones and mudstones _____ 90 %
 Subordinate laminated mudstones _____ 10 %
 13. Thickness (Metric) 0-1150 m _____
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: X _____
 Below: X _____
 15. Fossil Data: Coccoliths in type section are assigned to the NP19-NP21 zonal interval (Bukry, 1982, unpublished.)
 16. Radiometric Data: _____
 Source: _____
 17. Economic Data: _____
 18. Other Data: Interfingers with and is overlain by tuffaceous Oswald West mudstone to the west: see Nelson, D. E., in preparation, Geology of the Fishhawk Falls-Jewell area, Clatsop County, northwest Oregon: unpublished M.S. thesis, Oregon State University. Sandstones are micaceous, arkosic turbidites deposited at water depth between 1200 to 2000 meters. Unit correlates with the lower Pittsburg Bluff Formation of western Columbia County: see Kadri, M. M., 1982, Structure and Influence of the Tillamook uplift on the stratigraphy of the Mist area, Oregon, unpublished M.S. thesis, Portland State University, 105 p.
 19. Original Reference: Olbinski, J. G., 1983, Geology of the Buster Creek-Nehalem Valley area, Clatsop County, northwest Oregon: unpublished M.S. thesis, Oregon State University, 150 p.
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: A. R. Niem and David E. Nelson
 22. Date Prepared: 3-18-84

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Astoria area 6. Column # 9
 5. Chart # _____
 7. Name of Stratigraphic Unit Keasey Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) (Formal) Informal _____
 9. Age Paleogene Eocene Informal Priabonian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both _____
 11. Bounding Units: Above rocks of Vesper Church Below Cowlitz Formation
 12. Lithology: Dominant laminated tuffaceous mudstones _____ 98 %
 Subordinate glauconitic sandstones _____ 2 %
 13. Thickness (Metric) 0-320m _____
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: X _____
 Below: X _____
 15. Fossil Data: Foraminiferal faunas of early Refugian Stage age.
 16. Radiometric Data: _____
 Source: _____
 17. Economic Data: _____
 18. Other Data: Paleobathymetry of benthic foraminifera suggest 200 to 500 meters water depth. This tongue of Keasey has been informally named the Jewell member. Nelson (in preparation) correlates the Keasey Formation in Clatsop County to the middle and lower members of the Keasey Formation in Columbia County (see Warren and Norbistrath, 1946).
 19. Original Reference: Schenck, H. G., 1927, Marine Oligocene of Oregon: University of California Publications, Department of Geological Sciences Bulletin, v. 16, no. 12, p. 449-460.
 20. Most Significant Reference: Nelson, D. E., in preparation, Geology of the Fishhawk Falls-Jewell area, Clatsop County, northwest Oregon: unpublished M.S. thesis, Oregon State University.
 21. Author(s) of Sheet Preparation: A. R. Niem and David E. Nelson
 22. Date Prepared: 3-18-83

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Astoria Area 6. Column # 9
 5. Chart # _____
 7. Name of Stratigraphic Unit Cowlitz Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) (Formal) Informal _____
 9. Age Paleogene Eocene Informal Bartonian-Priabonian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Keasey Formation Below Tillamook Volcanics
 12. Lithology: Dominant arkosic and basaltic sandstones _____ 75 %
 Subordinate mudstones and basaltic conglomerates _____ 25 %
 13. Thickness (Metric) 50-670 m _____
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: X _____
 Below: X _____
 15. Fossil Data: Foraminiferal faunas are assigned to the Narizian Stage.
 16. Radiometric Data: _____
 Source: _____
 17. Economic Data: Arkosic sandstones are the reservoir rock of the Mist Gas Field, Columbia County, Oregon.
 18. Other Data: Arkosic sandstones of the Cowlitz Formation in Clatsop County overlie the upper unit of the Tillamook Volcanics (Warren, Norbistrath and Grivetti, 1945, U. S. Geological Survey OM-42 map). Both shallow marine arkosic and basaltic sandstones, basal basaltic conglomerate and deep marine turbidite-mudstone facies are represented. The shallow marine sandstone appear to pinch out to the south and west in Clatsop County. Basinal facies of Cowlitz and Keasey appear to be conformable while basin margin sequences suggest disconformable to angular unconformable relationships.
 19. Original Reference: Warren, W. C., Norbistrath, H., and Grivetti, R. M., 1945, Geology of northwestern Oregon, west of Willamette River and north of latitude 45°15': U. S. Geological Survey Oil and Gas Investigation Map 42.
 20. Most Significant Reference: Olbinski, J. G., 1983, Geology of the Buster Creek-Nehalem Valley area, Clatsop County, northwest Oregon: unpublished M.S. thesis, Oregon State University, 150 p.
 21. Author(s) of Sheet Preparation: A. R. Niem and David E. Nelson
 22. Date Prepared: 3-18-83

9. ASTORIA AREA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
4. Column Name Astoria Area
5. Chart # _____ 6. Column # 9
7. Name of Stratigraphic Unit Tillamook Volcanics - upper unit
8. Stratigraphic Rank and Status:
(Circle Appropriate Rank) Group Formation Member, Bed, _____
(Circle Appropriate Status) Formal Informal
9. Age Paleogene Eocene Lutetian-Bartonian
System Series Stage
10. Surface Subsurface or Both Surface
11. Bounding Units: Above Cowlitz Formation Below Unknown
12. Lithology: Dominant subaerial lava flows 80 %
Subordinate submarine breccias and volcanoclastic sediments 20 %
13. Thickness (Metric 900+ m)
14. Major Unconformities: - Check Appropriate Line -
Above: None Disconformable Angular
Within: X
Below: Unknown X
15. Fossil Data: Narizian Stage foraminiferal faunas from upper unit of Tillamook Volcanics (Snively and others, 1970).
16. Radiometric Data: None Years Method
Source: _____
17. Economic Data: Road rock
18. Other Data: Correlative to Nestucca Formation of Snively and others, 1970.
19. Original Reference: Warren, W. C., Norbistrath, H., and Grivetti, R. M., 1945, Geology of northwestern Oregon, west of Willamette River and north of latitude 45°15': U. S. Geological Survey Oil and Gas Investigation Map 42.
20. Most Significant Reference: Snively, P. D., Jr., MacLeod, N. S., and Rau, W. W., 1970, Summary of the Tillamook area, northern Oregon Coast Range: U. S. Geological Survey Professional Paper 650-A, p. A-47.
21. Author(s) of Sheet Preparation: A. R. Niem and D. E. Nelson
22. Date Prepared: 3-18-83

10. COLUMBIA COUNTY AREA

A. COMPOSITE SECTION LOCATION

Reference # _____ Location # _____
Latitude 45° 45' N Longitude 123° 10' W
County or Counties 009 Columbia
State. 36 Oregon

Column Name: Columbia County Area

Chart Name: Cenozoic Stratigraphic Units, Western Oregon and Washington

General Location Description: Cenozoic section composited from units cropping out along the Nehalem and Columbia Rivers, and from units encountered in wells, Columbia County, Oregon.

Principal Reference:

Niem, A. R., and Van Atta, R. O., 1973, Cenozoic stratigraphy of northwestern Oregon and adjacent southwestern Washington, in Beaulieu, J. D., ed., Geologic field trips in northern Oregon and southern Washington: Oregon Department of Geology and Mineral Industries Bulletin 77, p. 75-132.

Column Authors:

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R. J. Deacon, Arco Exploration Company
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R. E. Wells, U. S. Geological Survey
R. O. Van Atta, Portland State University
K. A. McDougall, U. S. Geological Survey
K. B. Kelty, Portland State University

B. DATA SHEETS FOR EACH STRATIGRAPHIC UNIT ON CORRELATION CHART

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
4. Column Name Columbia County Area
5. Chart # _____ 6. Column # 10
7. Name of Stratigraphic Unit fluvial deposits
8. Stratigraphic Rank and Status: _____
(Circle Appropriate Rank) Group (Formation) Member, Bed, _____
(Circle Appropriate Status) (Formal) (Informal)
9. Age Quaternary Pleistocene
System Series Stage
10. Surface Subsurface or Both Surface
11. Bounding Units: Above alluvium Below older units
12. Lithology: Dominant sands and gravels 70 %
Subordinate muds 30 %
13. Thickness (Metric 1-35 m)
14. Major Unconformities: - Check Appropriate Line -
None Disconformable Angular
Above: _____ X _____
Within: _____ X _____
Below: _____ X _____

15. Fossil Data: None

16. Radiometric Data: None Years Method _____
Source: _____

17. Economic Data: sand and gravel

18. Other Data: _____

19. Original Reference: _____

20. Most Significant Reference: See Trimble, D. E., 1963, Geology of Portland, Oregon, and adjacent areas, U. S. Geological Survey Bulletin 119, map.

21. Author(s) of Sheet Preparation: J. M. Armentrout
22. Date Prepared: 9-23-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
4. Column Name Columbia County Area
5. Chart # _____ 6. Column # 10
7. Name of Stratigraphic Unit Troutdale Formation
8. Stratigraphic Rank and Status: _____
(Circle Appropriate Rank) Group (Formation) Member, Bed, _____
(Circle Appropriate Status) (Formal) (Informal)
9. Age Neogene Miocene-Pleistocene Zanclean-Pleistocene
System Series Stage
10. Surface Subsurface or Both Surface
11. Bounding Units: Above Pleistocene fluvial deposits Below Saddle Mountains Basalt
12. Lithology: Dominant gravels 70 %
Subordinate sandstones 30 %
13. Thickness (Metric 15-275 m)
14. Major Unconformities: - Check Appropriate Line -
None Disconformable Angular
Above: _____ X _____
Within: _____ _____
Below: _____ X _____

15. Fossil Data: Dated as ?Pliocene from fossil leaves to the east of Portland in the Clackamas River area - see Trimble, D. E., 1963, Geology of Portland, Oregon, and adjacent areas: U. S. Geological Survey Bulletin 119, map.

16. Radiometric Data: None Years Method _____
Source: _____

17. Economic Data: Sand and gravel

18. Other Data: Occurs along Columbia River valley.

19. Original Reference: Hodge, E. T., 1933, Age of Columbia River and lower canyon: Geological Society of America Bulletin, v. 44, p. 156-157.

20. Most Significant Reference: See Schlicker, H. G., Deacon, R. J., Beaulieu, J. D., and Olcott, G. W., 1972, Environmental geology of the coastal region, Tillamook and Clatsop Counties, Oregon: Oregon Department of Geology and Mineral Industries Bulletin 74, 164 p., maps.

21. Author(s) of Sheet Preparation: J. M. Armentrout
22. Date Prepared: 9-23-83

10. COLUMBIA COUNTY AREA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Columbia County Area
 5. Chart # _____ 6. Column # 10
 7. Name of Stratigraphic Unit Columbia River Basalt Group
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation Member, Bed,
 (Circle Appropriate Status) Formal Informal
 9. Age Neogene Miocene Langhian-Serravallian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Troutdale Fm. Below Scappoose Fm.
 12. Lithology: Dominant basalt Subordinate _____ 100%
 13. Thickness (Metric 150-300 m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ None _____ Disconformable _____ Angular _____
 Within: _____ X _____
 Below: _____ X _____
 15. Fossil Data: None
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: Road rock
 18. Other Data: Includes basalts only - sediments assigned to other units. Correlated to type sequence in central Washington by geochemistry and magnetic polarity of individual units or sequences.
 19. Original Reference: See Swanson, D. A., Wright, T. L., Hooper, P. R., and Bentley, R. D., 1979, Revisions in stratigraphic nomenclature of the Columbia River Basalt Group: U. S. Geological Survey Bulletin 1457-G, 59 p.
 20. Most Significant Reference: Beeson, M. H., and Moran, M. R., 1979, Columbia River Basalt Group stratigraphy in western Oregon: Oregon Geology v. 41, no. 1, p. 11-14.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 12-28-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Columbia County Area
 5. Chart # _____ 6. Column # 10
 7. Name of Stratigraphic Unit Pomona Member of Saddle Mountain Basalt
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation Member, Bed, of Columbia River Basalt Group
 (Circle Appropriate Status) Formal Informal
 9. Age Neogene Miocene Serravallian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above alluvium Below Astoria (?) Formation
 12. Lithology: Dominant basalt Subordinate _____ 100%
 13. Thickness (Metric 10-15 m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ None _____ Disconformable _____ Angular _____
 Within: _____ X _____
 Below: _____ X _____
 15. Fossil Data: None
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: Road rock
 18. Other Data: Pomona Basalt crops out near Clifton, Oregon: It is reversely polarized and glomeroporphyritic. It is the age and petrologic equivalent of the Pack Sack Lookout basalt of Snavely and others (1973) which crops out in southwest Washington.
 19. Original Reference: Schmincke, H. U., 1967, Stratigraphy and petrology of four upper Yakima Basalt flows in south-central Washington: Geological Society of America Bulletin, v. 78, p. 1385-1422.
 20. Most Significant Reference: Beeson, M. H., and Moran, M. R., 1979, Columbia River Basalt Group stratigraphy in western Oregon: Oregon Geology, v. 41, no. 1, p. 11-14.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 9-23-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Columbia County Area
 5. Chart # _____ 6. Column # 10
 7. Name of Stratigraphic Unit Astoria (?) Formation
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation Member, Bed,
 (Circle Appropriate Status) Formal Informal
 9. Age Neogene Miocene Langhian-Serravallian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Saddle Mtn. Basalt Below Grande Ronde Basalt
 12. Lithology: Dominant sandstone Subordinate _____ 60%
 13. Thickness (Metric 250 m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ None _____ Disconformable _____ Angular _____
 Within: _____ X _____
 Below: _____ X _____
 15. Fossil Data: None
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data:
 18. Other Data: Stratigraphic position based on correlation of overlying and underlying basalt units.
 19. Original Reference: Snavely, P. D., Jr., Brown, R. D., Roberts, A. E., and Rau, W. W., 1958, Geology and coal resources of the Centralia-Chehalis district, Washington: U. S. Geological Survey Bulletin 1053, 159 p., 13 pls., maps.
 20. Most Significant Reference: Nien, A. R., and Van Atta, R. O., 1973, Cenozoic stratigraphy of northwestern Oregon and adjacent southwestern Washington, in Beaulieu, J. D., ed., Geologic field trips in northern Oregon and southern Washington: Oregon Department of Geology and Mineral Industries Bulletin 77, p. 75-132.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 12-21-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Columbia County Area
 5. Chart # _____ 6. Column # 10
 7. Name of Stratigraphic Unit Astoria (?) Formation, upper member
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation Member, Bed,
 (Circle Appropriate Status) Formal Informal
 9. Age Neogene Miocene Langhian-Serravallian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Saddle Mt. Basalt Below Grande Ronde Basalt
 12. Lithology: Dominant sandstone Subordinate _____ 60%
 13. Thickness (Metric 250 m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ None _____ Disconformable _____ Angular _____
 Within: _____ X _____
 Below: _____ X _____
 15. Fossil Data: None
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data:
 18. Other Data: Interbedded with basalt flows of the Columbia River Basalt Group. Includes the type section of the Scappoose Formation of Warren, W. C., and Norbistrath, Hans, 1946, Stratigraphy of the Upper Nehalem River basin, northwestern Oregon: American Association of Petroleum Geologists Bulletin, v. 30, p. 213-237 (see data sheet for Scappoose Formation).
 19. Original Reference: Niem, A. R. and Van Atta, R. O., 1973, Cenozoic stratigraphy of northwestern Oregon and adjacent southwestern Washington in Beaulieu, J. D., ed., Geologic field trips in northern Oregon and southern Washington: Oregon Department of Geology and Mineral Industries Bulletin 77, p. 75-132.
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 12-21-82

10. COLUMBIA COUNTY AREA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710

4. Column Name Columbia County

5. Chart # _____ 6. Column # 10

7. Name of Stratigraphic Unit Frenchman Springs Member, Wanapum Basalt

8. Stratigraphic Rank and Status: _____
(Circle Appropriate Rank) Group (Formation) Member, Bed, of Columbia River Basalt Group
(Circle Appropriate Status) (Formal) Informal

9. Age Neogene Miocene Serravallian

System _____ Series _____ Stage _____

10. Surface Subsurface or Both Surface

11. Bounding Units: Above Astoria (?) Formation Below Astoria (?) Formation

12. Lithology: Dominant basalts _____ 100 %
Subordinate _____

13. Thickness (Metric 75-100 m) _____

14. Major Unconformities: - Check Appropriate Line -
None _____ Disconformable _____ Angular _____
Above: _____
Within: x _____
Below: _____ x _____

15. Fossil Data: None

16. Radiometric Data: None Years Method
Source: _____

17. Economic Data: Road rock

18. Other Data: Frenchman Springs Basalts are normally polarized.

19. Original Reference: Swanson, D. A., Wright, T. L., Hooper, P. R., and Bentley, R. P., 1979, Revisions in stratigraphic nomenclature of the Columbia River Basalt Group: U. S. Geological Survey Bulletin 1457-G, 59 p.

20. Most Significant Reference: Beeson, M. H., and Moran, M. R., 1979, Columbia River Basalt Group stratigraphy in western Oregon: Oregon Geology, v. 41, no. 1, p. 11-14.

21. Author(s) of Sheet Preparation: J. M. Armentrout

22. Date Prepared: 9-23-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710

4. Column Name Columbia County Area

5. Chart # _____ 6. Column # 10

7. Name of Stratigraphic Unit Grande Ronde Basalt

8. Stratigraphic Rank and Status: _____
(Circle Appropriate Rank) Group (Formation) Member, Bed, of Columbia River Basalt Group
(Circle Appropriate Status) (Formal) Informal

9. Age Neogene Miocene Langhian

System _____ Series _____ Stage _____

10. Surface Subsurface or Both Surface

11. Bounding Units: Above Astoria (?) Formation Below Scappoose Formation

12. Lithology: Dominant basalt flows _____ 100 %
Subordinate _____

13. Thickness (Metric 75-100 m) _____

14. Major Unconformities: - Check Appropriate Line -
None _____ Disconformable _____ Angular _____
Above: _____
Within: x _____
Below: _____ x _____

15. Fossil Data: None

16. Radiometric Data: None Years Method
Source: _____

17. Economic Data: Road rock

18. Other Data: Correlated by geochemistry and magnetic polarity with sequence of Columbia Plateau. Part of flow sequences that were sourced from fissures in central-eastern Oregon and Washington and flowed through ancestral Columbia River valley.

19. Original Reference: Swanson, D. A., Wright, T. L., Hooper, P. R., and Bentley, R. D., 1979, Revisions in stratigraphic nomenclature of the Columbia River Basalt Group, U. S. Geological Survey Bulletin 1457-G, 59 p.

20. Most Significant Reference: Beeson, M. H., and Moran, M. R., 1979, Columbia River Basalt Group stratigraphy in western Oregon: Oregon Geology, v. 41, no. 1, p. 11-14.

21. Author(s) of Sheet Preparation: John M. Armentrout with M. H. Beeson

22. Date Prepared: 10-22-82 12-16-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710

4. Column Name Columbia County Area

5. Chart # _____ 6. Column # 10

7. Name of Stratigraphic Unit Scappoose Formation (restricted)

8. Stratigraphic Rank and Status: _____
(Circle Appropriate Rank) Group (Formation) Member, Bed,
(Circle Appropriate Status) (Formal) Informal

9. Age Paleogene Oligocene Rupelian-Chattian

System _____ Series _____ Stage _____

10. Surface Subsurface or Both Surface

11. Bounding Units: Above Grande Ronde Basalt Below Pittsburg Bluff Formation

12. Lithology: Dominant tuffaceous siltstone _____ 70 %
Subordinate tuffaceous sandstone _____ 30 %

13. Thickness (Metric 460 m) _____

14. Major Unconformities: - Check Appropriate Line -
None _____ Disconformable _____ Angular _____
Above: _____
Within: _____ x _____
Below: x _____

15. Fossil Data: Molluscan fauna correlates with "Blakeley Stage" of Weaver and others (1944): correlative with Matlockian and Juanian Molluscan Stages: see Armentrout, J. M., 1981, Geological Society of America Special Paper 184, p. 137-148.

16. Radiometric Data: None Years Method
Source: _____

17. Economic Data: _____

18. Other Data: Warren and Norbistrath (1946) included two principle facies in their Scappoose Formation: 1) basaltic conglomerates and sandstones (Type section along United Railway); 2) tuffaceous siltstones, sandstones and conglomerates containing fossils of "Blakeley age" (= Matlockian and Juanian Molluscan Stages). Recent mapping by VanAtta and Kely (unpublished) shows that the "Blakeley age" strata are overlain unconformably by younger sandstones and basaltic conglomerates, including the Type Scappoose United Railway section. The basalt clasts in the basal conglomerate of the United Railway section correlated geochemically with the Grande Ronde Basalt of the Columbia River Basalt Group. Thus, the younger clastics are middle Miocene in age and probably interfinger with or overlap Grande Ronde Basalt flows. Because Scappoose Formation is generally understood to be of Oligocene age we restrict the use of Scappoose Formation to only those rock units mapped by Warren, Norbistrath and Grivetti (1942, U. S. Geological Survey Preliminary Oil and Gas Investigation Map OM-42) as tuffaceous siltstone, sandstone and conglomerate of "Blakeley age". The type section along the United Railway tracks and associated facies of sandstone and basaltic conglomerate are removed from the Scappoose Formation as used here. Additional mapping by VanAtta and students will result in further clarification of these stratigraphic relationships.

19. Original Reference: Warren, W. C. and Norbistrath, Hans, 1946, Stratigraphy of the Upper Nehalem River basin, northwestern Oregon: American Association of Petroleum Geologists Bulletin, v. 30, p. 213-237.

20. Most Significant Reference: Moore, E. J., (for separation of Pittsburg and Scappoose) 1976, Oligocene marine mollusks from the Pittsburg Bluff Formation in Oregon: U. S. Geological Survey Professional Paper 922, 66 p. 17 pls.

21. Author(s) of Sheet Preparation: J. M. Armentrout

22. Date Prepared: 9-23-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710

4. Column Name Columbia County Area

5. Chart # _____ 6. Column # 10

7. Name of Stratigraphic Unit Pittsburg Bluff Formation

8. Stratigraphic Rank and Status: _____
(Circle Appropriate Rank) Group (Formation) Member, Bed,
(Circle Appropriate Status) (Formal) Informal

9. Age Paleogene Eocene Priabonian

System _____ Series _____ Stage _____

10. Surface Subsurface or Both Surface and subsurface

11. Bounding Units: Above Scappoose Fm Below Keasey Fm

12. Lithology: Dominant siltstone and mudstone _____ 70 %
Subordinate sandstone _____ 30 %

13. Thickness (Metric 260 m) _____

14. Major Unconformities: - Check Appropriate Line -
None _____ Disconformable _____ Angular _____
Above: _____
Within: x _____
Below: _____ x _____

15. Fossil Data: Mollusks of upper Galvinian Stage = upper Refugian: Foraminiferal Stage.

16. Radiometric Data: None Years Method
Source: _____

17. Economic Data: _____

18. Other Data: Basin margin highs have unconformity with underlying Keasey but in depocenter sedimentation was continuous throughout Keasey-Pittsburg Bluff-Scappoose time. Shallow water facies have good faunal and lithologic differences - less so in deep water facies.

19. Original Reference: Schenck, H. G., 1927, Marine Oligocene of Oregon: University of California Publications, Department of Geological Sciences Bulletin, v. 16, no. 12, p. 449-460.

20. Most Significant Reference: Moore, E. J., 1976, Oligocene marine mollusks of the Pittsburg Bluff Formation in Oregon: U. S. Geological Survey Professional Paper 922, 66 p., 17 pls. See also, Kadri, M. M., 1982, Structure and Influence of the Tillamook uplift on the stratigraphy of the Mist area, Oregon: unpublished M.S. thesis, Portland State University, 105 p.

21. Author(s) of Sheet Preparation: J. M. Armentrout

22. Date Prepared: 9-23-82 - modified 12-21-82

10. COLUMBIA COUNTY AREA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Columbia County Area
 5. Chart # _____ 6. Column # 10
 7. Name of Stratigraphic Unit Keasey Formation
 8. Stratigraphic Rank and Status: (Circle Appropriate Rank) Group (Formation) Member, Bed, (Circle Appropriate Status) (Forma) Informal
 9. Age Paleogene Eocene Priabonian
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Pittsburg Bluff Fm Below Cowlitz Formation
 12. Lithology: Dominant tuffaceous siltstone 100%
 Subordinate _____ %
 13. Thickness (Metric) 675 m
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: x _____
 Within: _____
 Below: _____ x
 15. Fossil Data: Refugian Foraminiferal stage. Some workers assign Narizian faunas to Keasey based on picking Keasey/Cowlitz boundary at top of uppermost Cowlitz sandstone which occurs in upper Cowlitz - not at top of Cowlitz.
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: Tuffaceous shales used for "lite-rock" aggregate.
 18. Other Data: Formation base: unconformity on structural highs - vs - gradational in depocenters with underlying Cowlitz. Base defined best by abundance of volcanic ash in Keasey versus feldspathic sand in Cowlitz. See Bruer, W. G., 1980, Mist Gas Field, Columbia County, Oregon: Technical Program Preprints, Pacific Sections AAPG and SEG, Bakersfield, California, April 1980, 10 p., 15 figs.
 19. Original Reference: Schenck, H. G., 1927, Marine Oligocene of Oregon, University of California Publications, Department of Geological Sciences Bulletin, v. 16, no. 12, p. 449-460.
 20. Most Significant Reference: Warren, W. C., Norbistrath, H., and Grivetti, R. M., 1945, Geology of northwestern Oregon, west of Willamette River and north of latitude 45°15' - U. S. Geological Survey Oil and Gas Investigations Preliminary Map 42.
 21. Author(s) of Sheet Preparation: W. G. Bruer modified by J. M. Armentrout
 22. Date Prepared: 6-21-82 12-21-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Columbia County Area
 5. Chart # _____ 6. Column # 10
 7. Name of Stratigraphic Unit Goble Volcanics
 8. Stratigraphic Rank and Status: (Circle Appropriate Rank) Group (Formation) Member, Bed, (Circle Appropriate Status) (Forma) Informal
 9. Age Paleogene Eocene Bartonian
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Keasey Formation Below Cowlitz Formation
 12. Lithology: Dominant flow basalt 65%
 Subordinate _____ 35%
 13. Thickness (Metric) 60-900 m
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: _____ x
 Below: x _____
 15. Fossil Data: Appears to be entirely within interval of Cowlitz Formation which contains upper Narizian Foraminiferal Stage faunas.
 16. Radiometric Data: 30 million Years Method K/Ar
 Source: P. D. Snively, Jr., 1976 - from type quarry of Goble Volcanics (W. G. Bruer). This date is not compatible with million year assignments based on biostratigraphic correlations.
 17. Economic Data: Crushed rock
 18. Other Data: Radiometric data not compatible with biostratigraphic data. Additional geochemistry and detailed field work is required to resolve problem. See Bruer, W. G., 1980, Mist Gas Field, Columbia County, Oregon: Technical Program Preprints, Pacific Sections AAPG and SEG, Bakersfield, California, April 1980, 10 p., 15 figs.
 19. Original Reference: Warren, W. C., Norbistrath, H., and Grivetti, R. M., 1945, Geology of northwestern Oregon west of the Willamette River and north of latitude 45°15' - U. S. Geological Survey Preliminary Oil and Gas Investigation Map 42.
 20. Most Significant Reference: Wilkinson, W. D., Lowry, W. D., and Baldwin, E. M., 1946, Geology of the St. Helens quadrangle, Oregon: Oregon Department of Geology and Mineral Industries Bulletin 31, 39 p.
 21. Author(s) of Sheet Preparation: W. G. Bruer
 22. Date Prepared: 6-22-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Columbia County Area
 5. Chart # _____ 6. Column # 10
 7. Name of Stratigraphic Unit Cowlitz Formation
 8. Stratigraphic Rank and Status: (Circle Appropriate Rank) Group (Formation) Member, Bed, (Circle Appropriate Status) (Forma) Informal
 9. Age Paleogene Eocene Bartonian-Priabonian
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Keasey Fm Below Yamhill Fm or Tillamook Vol.
 12. Lithology: Dominant siltstone and claystone 65%
 Subordinate sandstone and tuff 35%
 13. Thickness (Metric) 1090 m
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: _____ x
 Below: _____ x
 15. Fossil Data: Upper part of Narizian Foraminiferal Stage
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: Both hydrocarbon source rock and reservoir rock - Mist Gas Field produces from this unit.
 18. Other Data: This unit correlates with the type Cowlitz of Weaver (1912) and as restricted by Beck (1943) in southwestern Washington.
 19. Original Reference: Weaver, C. E., 1912, A preliminary report on the Tertiary paleontology of western Washington, Washington Geological Survey Bulletin 15 (see also: Beck, R. S., 1943, Journal of Paleontology, v. 17, no. 6).
 20. Most Significant Reference: Warren, W. C., Norbistrath, H., and Grivetti, R. M., 1945, Geology of NW Oregon west of Willamette River and N. of latitude 45°15', U. S. Geological Survey, Preliminary Oil and Gas Investigation Map 42
 21. Author(s) of Sheet Preparation: W. G. Bruer with modifications by J. M. Armentrout
 22. Date Prepared: 6-21-82 12-21-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Columbia County Area
 5. Chart # _____ 6. Column # 10
 7. Name of Stratigraphic Unit Yamhill Formation
 8. Stratigraphic Rank and Status: (Circle Appropriate Rank) Group (Formation) Member, Bed, (Circle Appropriate Status) (Forma) Informal
 9. Age Paleogene Eocene Lutetian-Bartonian
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Cowlitz Formation Below Siletz River Volcanics
 12. Lithology: Dominant siltstone and shale 90%
 Subordinate volcanics 10%
 13. Thickness (Metric) 1435 m
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: _____ x
 Below: _____ x
 15. Fossil Data: Narizian Foraminiferal Stage faunas: base probably older in Willamette Valley than in Columbia County
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: Potential hydrocarbon source rock - sandstone units potential reservoirs for hydrocarbons.
 18. Other Data: Has been referred to as "lower Cowlitz Fm" in both U. S. Geological Survey Oil and Gas Investigation Map 42 and Oregon Department of Geology and Mineral Industries Oil and Gas Investigation 5 but appears to be equivalent to type section of Yamhill (Mill Ck.) except lowermost part of section.
 19. Original Reference: Baldwin, E. M., Brown, R. D., Jr., Gair, J. E., and Pease, M. H., Jr., 1955, Geology of the Sheridan and McMinnville quadrangles, Oregon: U. S. Geological Survey Oil and Gas Investigation Map OM-155.
 20. Most Significant Reference: Warren, W. E., Norbistrath, H., and Grivetti, R. M., 1945, U. S. Geological Survey Oil and Gas Investigation Map 42 (mapped as "TES")
 21. Author(s) of Sheet Preparation: W. G. Bruer modified by J. M. Armentrout
 22. Date Prepared: 6-22-82 12-21-82

10. COLUMBIA COUNTY AREA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Columbia County Area
 5. Chart # _____ 6. Column # 10
 7. Name of Stratigraphic Unit Tillamook Volcanics
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) (Formal) Informal
 9. Age Paleogene Eocene Lutetian-Bartonian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Cowlitz Formation Below Siletz River Volcanics
 12. Lithology: Dominant volcanics _____ 90 %
 Subordinate sediments _____ 10 %
 13. Thickness (Metric 0-1400 m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ None _____ Disconformable _____ Angular _____
 Within: _____
 Below: _____ X _____
 15. Fossil Data: _____
 16. Radiometric Data: 44.2 million Years Method K/Ar average of several dates
 Source: Magill, Cox and Duncan, Journal of Geophysical Research,
 v. 86, p. 2495, 1981; also, Duncan, R. A., in press (1983),
 a captured island chain in the Coast Range of Oregon and
 Washington: Journal of Geophysical Research.
 17. Economic Data: _____
 18. Other Data: Local name for unit interbedded with Yamhill Formation: includes
 sequences similar to Yachats and Goble volcanics: lies above or lateral to
 Yamhill Fm., which in turn overlies Siletz River volcanics in western Tillamook
 highlands area: Unpub. U. S. Geological Survey mapping 1982 (Ray Wells)
 19. Original Reference: See Niem, A. R., and Van Atta, R. O., 1973, Cenozoic
 stratigraphy of northwestern Oregon and southwestern Washington, in Beaulieu,
 J. D., ed., Geologic field trips in northern Oregon and Southern Washington:
 Oregon Department of Geology and Mineral Industries Bulletin 77, p. 75-132.
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: J. M. Ammentrout with Ray Wells
 22. Date Prepared: 9-23-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Columbia County Area
 5. Chart # _____ 6. Column # 10
 7. Name of Stratigraphic Unit Siletz River Volcanics
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) (Formal) Informal
 9. Age Paleogene Eocene Ypresian-Lutetian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Yamhill or Tillamook Fms. Below Unknown
 12. Lithology: Dominant Tholeiitic basalt _____ 95 %
 Subordinate marine siltstone _____ 5 %
 13. Thickness (Metric Unknown)
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ None _____ Disconformable _____ Angular _____
 Within: _____ X _____
 Below: Unknown _____
 15. Fossil Data: None
 16. Radiometric Data: 53 Million Years Method K/Ar 51.7±1.0 - 56.0±1.5
 Source: Duncan, R. A., in press (1983), A captured island chain in the
 Coast Range of Oregon and Washington: Journal of Geophysical Research.
 17. Economic Data: Road rock
 18. Other Data: Geochemical data suggests oceanic magma type
 19. Original Reference: Snively, P. D., Jr., and Baldwin, E. M., 1948, Siletz River
 Volcanic Series, northwestern Oregon: American Association of Petroleum
 Geologists Bulletin, v. 32, no. 5, p. 805-812.
 20. Most Significant Reference: Snively, P. D., Jr., MacLeod, M. S., and Wagner, H. C.,
 1968, Tholeiitic and alkalic basalts of the Eocene Siletz River volcanics, Oregon
 Coast Ranges: American Journal of Science, v. 266, no. 6, p. 454-481.
 21. Author(s) of Sheet Preparation: J. M. Ammentrout with R. Wells
 22. Date Prepared: 9-23-82

11. SOUTH FLANK WILLAPA HILLS

A. COMPOSITE SECTION LOCATION

Reference # _____ Location # _____
 Latitude 46° 06' 20" N Longitude 123° 30' W
 County or Counties 049 Wahkiakum County and Pacific County
 State. 46 Washington

Column Name: South Flank - Willapa Hills

Chart Name: Cenozoic Stratigraphic Units - Western Oregon and Washington

General Location Description: Cenozoic section composed from units cropping out along the Columbia River between Megler and Cathlamet, and within the Grays River drainage, Wahkiakum County, Washington; and along the Columbia River from Cape Disappointment to Megler and within the Naselle River drainage, Pacific County, Washington.

Principal References:

Wells, R. E., 1979, Geologic map of the Cape Disappointment - Naselle River Area, Pacific County, Washington: U. S. Geological Survey Open-File Report 79-389.

Wells, R. E., 1981, Geologic map of the eastern Willapa Hills, Cowlitz, Lewis, Pacific, and Wahkiakum Counties, Washington: U. S. Geological Survey, Open-File Report 81-674.

Wolfe, E. W., and McKee, E. H., 1972, Sedimentary and igneous rocks of the Grays River quadrangle, Washington: U. S. Geological Survey Bulletin 1335, 70 p.

Column Authors: R. E. Wells, U. S. Geological Survey
 W. W. Rau, State of Washington

B. DATA SHEETS FOR EACH STRATIGRAPHIC UNIT ON CORRELATION CHART

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name South Flank - Willapa Hills
 5. Chart # _____ 6. Column # 11
 7. Name of Stratigraphic Unit fluvial terrace deposits
 8. Stratigraphic Rank and Status: Formation Member, Bed, _____
 (Circle Appropriate Rank) Group (Circle Appropriate Status) normal (Informal)
 9. Age Quaternary Pleistocene
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above alluvium Below older units
 12. Lithology: Dominant sand 80 %
 Subordinate gravel 20 %
 13. Thickness (Metric) 1-75 m
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____ X _____
 Within: _____ X _____
 Below: _____ X _____
 15. Fossil Data: None
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: Sand and gravel
 18. Other Data: Mapped as terrace deposits by Huntington and others, 1961, Geologic map of Washington
 19. Original Reference: Wolfe, E. W., and McKee, E. H., 1968, Geology of the Grays River quadrangle, Wahkiakum and Pacific Counties, Washington: Washington Division of Mines and Geology Geologic Map GM-4, 1:62,500
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: J. M. Ammentrout
 22. Date Prepared: 9-15-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name South Flank - Willapa Hills
 5. Chart # _____ 6. Column # 11
 7. Name of Stratigraphic Unit Troutdale Formation
 8. Stratigraphic Rank and Status: Formation Member, Bed, _____
 (Circle Appropriate Rank) Group (Circle Appropriate Status) normal (Informal)
 9. Age Neogene Miocene-Pleistocene Messinian-Pleistocene
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Pleistocene or younger Below Saddle Mountain basalt or
 12. Lithology: Dominant gravels 70 % older
 Subordinate sandstones 30 %
 13. Thickness (Metric) 20-300 m
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____ X _____
 Within: _____ X _____
 Below: _____ X _____
 15. Fossil Data: Dated as ? Pliocene from fossil leaves to the east of column 11 area - along the Clackamas River area of Cascade Range - See Trimble, D. E., 1963, Geology of Portland, Oregon, and adjacent areas: U. S. Geological Survey Bulletin 119, map.
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: Gravels
 18. Other Data: Occurs along Columbia River valley
 19. Original Reference: Hodge, E. T., 1933, Age of Columbia River and lower canyon: Geological Society of America Bulletin, v. 44, p. 156-157.
 20. Most Significant Reference: Livingston, V. E., 1966, Geology of the Kelso-Cathlamet area, Cowlitz and Wahkiakum Counties, Washington: Washington State Division of Mines and Geology Bulletin 54, 110 p.
 21. Author(s) of Sheet Preparation: J. M. Ammentrout
 22. Date Prepared: 9-19-82

11. SOUTH FLANK WILLAPA HILLS

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name South Flank Willapa Hills
 5. Chart # _____ 6. Column # 11
 7. Name of Stratigraphic Unit Columbia River Basalt Group
 8. Stratigraphic Rank and Status: Group Formation Member, Bed, (Circle Appropriate Rank) (Formal) Informal
 9. Age Neogene Miocene Langhian-Serravallian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Troutdale Fm or alluvium Below Astoria (?) Formation
 12. Lithology: Dominant basalts 100 %
 Subordinate _____ %
 13. Thickness (Metric 145-500 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: _____
 Below: _____
 15. Fossil Data: None
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: Road rock
 18. Other Data: Includes basalts only: Saddle Mountains Basalt, Wanapum Basalt, and Grande Ronde Basalt. Interbedded sedimentary units are not part of Columbia River Basalt Group.
 19. Original Reference: Swanson, D. A., Wright, T. L., Hooper, P. R., and Bentley, R. D., 1979, Revisions in stratigraphic nomenclature of the Columbia River Basalt Group: U. S. Geological Survey Bulletin, 1457-G, 59 p.
 20. Most Significant Reference: Beeson, M. H., and Moran, M. R., 1979, Columbia River Basalt Group Stratigraphy in western Oregon: Oregon Geology, v. 41, no. 1, p. 11-14.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 12-28-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name South Flank Willapa Hills
 5. Chart # _____ 6. Column # 11
 7. Name of Stratigraphic Unit Pomona Member, Saddle Mt. Basalt
 8. Stratigraphic Rank and Status: Group Formation Member, Bed, of Columbia River Basalt Group (Circle Appropriate Rank) (Formal) Informal
 9. Age Neogene Miocene Serravallian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Troutdale Fm or Younger Below Astoria (?) Formation
 12. Lithology: Dominant volcanics 100 %
 Subordinate _____ %
 13. Thickness (Metric 0-300 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: _____
 Below: _____
 15. Fossil Data: None
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: Road rock
 18. Other Data: Geochemistry and magnetic polarity provide correlation to the Pomona Member, Saddle Mountain Basalt of the Columbia River Basalt Group
 19. Original Reference: Wolfe, E. W., and McKee, E. H., 1972, Sedimentary and igneous rocks of the Grays River quadrangle, Washington: U. S. Geological Survey Bulletin 1357
 20. Most Significant Reference: Snively, P. D., Jr., MacLeod, N. S., and Wagner, H. C., 1973: Miocene tholeiitic basalts of coastal Oregon and Washington and their relationship to coeval basalts of the Columbia Plateau: Geological Society of America Bulletin, v. 84, p. 387-424. Also, Magill, J. R., Wells, R. E., Simpson, R. W., and Cox, A. V., 1982 Post 12 m.y. rotation of SW Washington: Journal of Geophysical Research v. 87, p. 3761-3776.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 9-18-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name South Flank Willapa Hills
 5. Chart # _____ 6. Column # 11
 7. Name of Stratigraphic Unit Astoria (?) Formation
 8. Stratigraphic Rank and Status: Group Formation Member, Bed, (Circle Appropriate Rank) (Formal) Informal
 9. Age Neogene Miocene Aquitian-Serravallian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Saddle Mtn. Basalt or younger Below Lincoln Creek Formation
 12. Lithology: Dominant sandstone 60 %
 Subordinate siltstone 40 %
 13. Thickness (Metric 175-1800 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: _____
 Below: _____
 15. Fossil Data: See data sheets for members
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: Potential hydrocarbon reservoir interval
 18. Other Data: _____
 19. Original Reference: Snively, P. D., Jr., Brown, R. D., Roberts, A. E., and Rau, W. W., 1958, Geology and coal resources of the Centralia-Chehalis district, Washington: U. S. Geological Survey Bulletin 1053, 159 p., 13 pls., maps.
 20. Most Significant Reference: Wells, R. E., 1981, Geologic map of the eastern Willapa Hills, Cowlitz, Lewis, Pacific, and Wahkiakum counties, Washington: U. S. Geological Survey Open-File Report 81-674.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 9-18-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name South Flank Willapa Hills
 5. Chart # _____ 6. Column # 11
 7. Name of Stratigraphic Unit Astoria (?) Formation
 8. Stratigraphic Rank and Status: Group Formation Member, Bed, (Circle Appropriate Rank) (Formal) Informal
 9. Age Neogene Miocene Langhian-Serravallian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Saddle Mtn. Basalt or younger Below Grande Ronde Basalt or older
 12. Lithology: Dominant sandstone 78 %
 Subordinate siltstone 30 %
 13. Thickness (Metric 0-300 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: _____
 Below: _____
 15. Fossil Data: None
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: _____
 18. Other Data: Stratigraphic position defined by relationship of basalt units of Columbia River Basalt Group.
 19. Original Reference: Snively, P. D., Jr., Brown, R. D., Roberts, A. E., and Rau, W. W., 1958, Geology and coal resources of the Centralia-Chehalis district, Washington: U. S. Geological Survey Bulletin 1053, 159 p., 13 pls., maps.
 20. Most Significant Reference: Wells, R. E., 1981, Geologic map of the eastern Willapa Hills, Cowlitz, Lewis, Pacific and Wahkiakum Counties, Washington: U. S. Geological Survey Open-File Report 81-674.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 9-18-82

11. SOUTH FLANK WILLAPA HILLS

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name South Flank Willapa Hills
 5. Chart # _____ 6. Column # 11
 7. Name of Stratigraphic Unit Frenchman Springs Member, Wanapum Basalt
 8. Stratigraphic Rank and Status: (Circle Appropriate Rank) Group Formation Member Bed, of Columbia River Basalt Group (Circle Appropriate Status) Formal Informal
 9. Age Neogene Miocene Serravallian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Astoria (?) Formation Below Astoria (?) Formation
 12. Lithology: Dominant basalt 100 %
 Subordinate _____
 13. Thickness (Metric 70-100 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: _____
 Below: _____
 15. Fossil Data: None
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: Road rock
 18. Other Data: Normally polarized basalts equivalent to Frenchman Springs Member of Wanapum Basalt of Columbia River Basalt Group in Central Washington.
 19. Original Reference: Swanson, D. A., Wright, T. L., Hooper, P. R., and Bentley, R. P., 1979, Revisions of stratigraphic nomenclature of the Columbia River Basalt Group: U. S. Geological Survey Bulletin, 1457-G, 59 p.
 20. Most Significant Reference: Wells, R. E., 1981, Geologic map of the eastern Willapa Hills, Cowlitz, Lewis, Pacific, and Wahkiakum Counties, Washington; U. S. Geological Survey Open-File Report 81-674.
 21. Author(s) of Sheet Preparation: J. M. Armentrout and R. E. Wells
 22. Date Prepared: 12-28-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name South Flank Willapa Hills
 5. Chart # _____ 6. Column # 11
 7. Name of Stratigraphic Unit Grande Ronde Basalt of Columbia River Basalt Group
 8. Stratigraphic Rank and Status: (Circle Appropriate Rank) Group Formation Member Bed, (Circle Appropriate Status) Formal Informal
 9. Age Neogene Miocene Langhian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above upper member Astoria (?) Fm. Below lower member Astoria (?) Fm.
 12. Lithology: Dominant basalt flows 95 %
 Subordinate sedimentary interbeds 5 %
 13. Thickness (Metric 75-150 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: _____
 Below: _____
 15. Fossil Data: None
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: Road rock
 18. Other Data: Geochemical and magnetic polarity correlation to Grande Ronde Basalt of Columbia River Plateau type sections
 19. Original Reference: Wolfe, E. W., and McKee, E. H., 1972, Sedimentary and igneous rocks of the Grays River quadrangle, Washington: U. S. Geological Survey Bulletin 1335, 70 p.
 20. Most Significant Reference: Snively, P. D., Jr., MacLeod, W. S., and Wagner, H. C., 1973, Miocene tholeiitic basalts of coastal Oregon and Washington and their relationship to coeval basalts of the Columbia Plateau: Geological Society of America Bulletin, v. 84, p. 387-424.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 9-18-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name South Flank - Willapa Hills
 5. Chart # _____ 6. Column # 11
 7. Name of Stratigraphic Unit Astoria (?) Formation - lower member
 8. Stratigraphic Rank and Status: (Circle Appropriate Rank) Group Formation Member Bed, (Circle Appropriate Status) Formal Informal
 9. Age Neogene Miocene Aquitania
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Grande Ronde Basalt Below Lincoln Creek Fm.
 12. Lithology: Dominant siltstone 60 %
 Subordinate sandstone 40 %
 13. Thickness (Metric 175-1500 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: _____
 Below: _____
 15. Fossil Data: Molluscan fauna assigned to Pillarian or Newportian Molluscan Stages by E. J. Moore, 1981: Foraminifera assigned to Saucian Stage by W. W. Rau, 1979: in Wells, 1981.
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: _____
 18. Other Data: _____
 19. Original Reference: Snively, P. D., Jr., Brown, R. D., Roberts, A. E., and Rau, W. W., 1958, Geology and coal resources of the Centralia-Chehalis district, Washington: U. S. Geological Survey Bulletin 1053, 159 p., 13 pls, maps.
 20. Most Significant Reference: Wells, R. F., 1981, Geologic map of the eastern Willapa Hills, Cowlitz, Lewis, Pacific, and Wahkiakum Counties, Washington: U. S. Geological Survey Open-File Report 81-674.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 9-18-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name South Flank Willapa Hills
 5. Chart # _____ 6. Column # 11
 7. Name of Stratigraphic Unit Lincoln Creek Formation
 8. Stratigraphic Rank and Status: (Circle Appropriate Rank) Group Formation Member Bed, (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene-Oligocene Priabonian-Chattian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Astoria (?) Formation Below Goble Vol. or siltst. Skamokawa Ck.
 12. Lithology: Dominant siltstone 80 %
 Subordinate sandstone 20 %
 13. Thickness (Metric 0-1200 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: _____
 Below: _____
 15. Fossil Data: Refugian and Zemorrian Benthic Foraminiferal Stage faunas (W. W. Rau): Basal sandstone contains Galvinian Stage Molluscan Faunas (Armentrout, 1981) See Wolfe, E. W., and McKee, E. H., 1972, U. S. Geological Survey Bulletin 1335
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: _____
 18. Other Data: Most extensively preserved Paleogene unit in SW Washington
 19. Original Reference: Beikman, H. M., Rau, W. W., and Wagner, H. C., 1967, The Lincoln Creek Formation, Grays Harbor Basin, southwestern Washington: U. S. Geological Survey Bulletin 1244-I, 14 p.
 20. Most Significant Reference: Wells, R. E., 1981, Geologic map of the eastern Willapa Hills, Cowlitz, Lewis, Pacific, and Wahkiakum Counties, Washington: U. S. Geological Survey Open-File Report 81-674.
 21. Author(s) of Sheet Preparation: W. W. Rau with additions: J. M. Armentrout
 22. Date Prepared: 8-17-82 9-18-82

11. SOUTH FLANK WILLAPA HILLS

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name South Flank of Willapa Hills
 5. Chart # _____ 6. Column # 11
 7. Name of Stratigraphic Unit sandstone member of Lincoln Creek Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) Formal (Informal) _____
 9. Age Paleogene Eocene _____
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above tuffaceous member of Lincoln Creek Below Goble vol. or siltstone of Skamokawa Creek
 12. Lithology: Dominant sandstones _____ 100 %
 Subordinate _____
 13. Thickness (Metric 0-1000 m) _____
 14. Major Unconformities: - Check Appropriate Line -
 None _____ Disconformable _____ Angular _____
 Above: _____
 Within: _____
 Below: _____
 15. Fossil Data: Molluscan fossils assigned to Galvinian Stage (Keasey Stage of Weaver and others (1944), see Armentrout, J. M., 1981, Geological Society of America Special Paper 184, p. 137-148.
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: _____
 18. Other Data: Arkosic to basaltic sandstone at base of Lincoln Creek Formation
 19. Original Reference: Snively, P. D., Jr., Brown, R. D., Jr., Roberts, A. E., and Rau, W. W., 1958, Geology and coal resources of the Centralia-Chehalis District, Washington: U. S. Geological Survey Bulletin 1053, 159 p., maps
 20. Most Significant Reference: Wells, R. E., 1981, Geologic map of the eastern Willapa Hills, Cowlitz, Lewis, Pacific, and Wahkiakum counties, Washington: U. S. Geological Survey Open-File Report 81-674
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 1-18-83

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name South Flank - Willapa Hills
 5. Chart # _____ 6. Column # 11
 7. Name of Stratigraphic Unit siltstone of Skamokawa Creek
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) Formal (Informal) _____
 9. Age Paleogene Eocene _____
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Lincoln Creek Formation Below McIntosh Formation
 12. Lithology: Dominant siltstone _____ 100 %
 Subordinate _____
 13. Thickness (Metric 300-450 m) _____
 14. Major Unconformities: - Check Appropriate Line -
 None _____ Disconformable _____ Angular _____
 Above: _____
 Within: _____
 Below: _____
 15. Fossil Data: Benthic forams of upper Narizian Stage (W. W. Rau).
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: _____
 18. Other Data: _____
 19. Original Reference: Wells, R. E., 1981, Geologic map of the eastern Willapa Hills, Cowlitz, Lewis, Pacific and Wahkiakum Counties, Washington: U. S. Geological Survey Open-File Report 81-674.
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: R. E. Wells additions by J. M. Armentrout
 22. Date Prepared: 6-23-82 9-18-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name South Flank - Willapa Hills
 5. Chart # _____ 6. Column # 11
 7. Name of Stratigraphic Unit Goble Volcanics
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) Formal (Informal) _____
 9. Age Paleogene Eocene _____
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Lincoln Creek Formation Below Cowlitz Formation
 12. Lithology: Dominant basalt _____ 90 %
 Subordinate siltstone-sandstone _____ 10 %
 13. Thickness (Metric 0-1500m) _____
 14. Major Unconformities: - Check Appropriate Line -
 None _____ Disconformable _____ Angular _____
 Above: _____
 Within: _____
 Below: _____
 15. Fossil Data: Basalts are interbedded in upper Narizian siltstones (Rau, W. W.)
 16. Radiometric Data: 39 m.y. Years Method K/Ar
 Source: Wells, Heatherington and Tabor, U. S. Geological Survey, unpublished data
 17. Economic Data: _____
 18. Other Data: _____
 19. Original Reference: Wilkinson, W. D., Lowry, W. O., and Baldwin, E. M., 1946: Geology of the St. Helens quadrangle, Oregon: Oregon Department of Geology and Mineral Industries Bulletin 31, 39 p.
 20. Most Significant Reference: Wells, R. E., 1981, Geologic map of the eastern Willapa Hills, Cowlitz, Lewis, Pacific and Wahkiakum Counties, Washington: U. S. Geological Survey Open-File Report 81-674.
 21. Author(s) of Sheet Preparation: R. E. Wells with additions by J. M. Armentrout
 22. Date Prepared: 6-23-82 9-18-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name South Flank - Willapa Hills
 5. Chart # _____ 6. Column # 11
 7. Name of Stratigraphic Unit Cowlitz Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) Formal (Informal) _____
 9. Age Paleogene Eocene _____
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Goble Volcanics Below McIntosh Formation
 12. Lithology: Dominant sandstone _____ 70 %
 Subordinate siltstone _____ 30 %
 13. Thickness (Metric 0-1300 m) _____
 14. Major Unconformities: - Check Appropriate Line -
 None _____ Disconformable _____ Angular _____
 Above: _____
 Within: _____
 Below: _____
 15. Fossil Data: Upper Narizian Benthic Foraminiferal Stage (W. W. Rau)
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: Coal bearing: also potential hydrocarbon reservoir sand
 18. Other Data: _____
 19. Original Reference: Weaver, C. E., 1912, A preliminary report on the Tertiary paleontology of western Washington: Washington Geological Survey Bulletin 15, 80 p.
 20. Most Significant Reference: Wells, R. E., 1981, Geologic map of the eastern Willapa Hills, Cowlitz, Lewis, Pacific and Wahkiakum Counties, Washington: U. S. Geological Survey Open-File Report 81-674
 21. Author(s) of Sheet Preparation: R. E. Wells additions by J. M. Armentrout
 22. Date Prepared: 6-23-82 9-18-82

11. SOUTH FLANK WILLAPA HILLS

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name South Flank - Willapa Hills
 5. Chart # _____ 6. Column # 11
 7. Name of Stratigraphic Unit McIntosh Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene Lutetian-Bartonian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Cowlitz or siltstone of Skamokawa Ck. Below Crescent Formation
 12. Lithology: Dominant sandstone 60 %
 Subordinate siltstone 40 %
 13. Thickness (Metric 600-1500 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: x _____
 Within: _____ x _____
 Below: x _____
 15. Fossil Data: Lower member has Upper Ulatisian to Lower Narizian forams (W. W. Rau)
 Upper member has Narizian Stage Forams (W. W. Rau)
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: _____
 18. Other Data: Lower units interbedded with basalts of Crescent volcanics. Lower and
 upper units separated by local unconformity and a basal sandstone of upper member
 (Wells, 1981).
 19. Original Reference: Snavely, P. D., Jr., Rau, W. W., Hoover, L., and Roberts, A. E.,
 1951, McIntosh Formation, Centralia-Chehalis coal district, Washington: American
 Association of Petroleum Geologists Bulletin, v. 35, p. 1052-1061.
 20. Most Significant Reference: Wells, R. E., 1981, Geologic map of the eastern Willapa
 Hills, Cowlitz, Lewis, Pacific and Wahkiakum Counties, Washington: U. S. Geological
 Survey Open-File Report 81-674.
 21. Author(s) of Sheet Preparation: R. E. Wells additions by J. M. Armentrout
 22. Date Prepared: 6-23-82 9-18-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name South Flank - Willapa Hills
 5. Chart # _____ 6. Column # 11
 7. Name of Stratigraphic Unit upper member - McIntosh Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene Lutetian-Bartonian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Cowlitz Fm. or siltst. Skamokawa Ck. Below lower Member-McIntosh
 12. Lithology: Dominant siltstone 60 % Fm
 Subordinate sandstone 40 %
 13. Thickness (Metric 200-500 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: x _____
 Within: _____ x _____
 Below: _____ x _____
 15. Fossil Data: Narizian Foraminiferal Stage faunas (W. W. Rau)
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: _____
 18. Other Data: _____
 19. Original Reference: Snavely, P. D., Jr., Rau, W. W., Hoover, L., and Roberts, A. E.,
 1951, McIntosh Formation, Centralia-Chehalis coal district, Washington:
 American Association of Petroleum Geologists Bulletin, v. 35, p. 1052-1061.
 20. Most Significant Reference: Wells, R. E., 1981, Geologic map of the eastern Willapa
 Hills, Cowlitz, Lewis, Pacific and Wahkiakum Counties, Washington: U. S. Geological
 Survey Open-File Report 81-674
 21. Author(s) of Sheet Preparation: R. E. Wells and J. M. Armentrout
 22. Date Prepared: 6-23-82 9-18-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name South Flank - Willapa Hills
 5. Chart # _____ 6. Column # 11
 7. Name of Stratigraphic Unit lower member - McIntosh Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene Lutetian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above upper member-McIntosh Fm Below Crescent Formation
 12. Lithology: Dominant sandstone 70 %
 Subordinate siltstone 30 %
 13. Thickness (Metric 400-1000 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____ x _____
 Within: _____ x _____
 Below: x _____
 15. Fossil Data: Upper Ulatisian to Lower Narizian forams (W. W. Rau)
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: _____
 18. Other Data: _____
 19. Original Reference: Snavely, P. D., Jr., Rau, W. W., Hoover, L., and Roberts, A. E.,
 1951, McIntosh Formation, Centralia-Chehalis coal district, Washington: American
 Association of Petroleum Geologists Bulletin, v. 35, p. 1052-1061.
 20. Most Significant Reference: Wells, R. E., 1981, Geologic map of the eastern Willapa
 Hills, Cowlitz, Lewis, Pacific and Wahkiakum Counties, Washington:
 U. S. Geological Survey Open-File Report 81-674
 21. Author(s) of Sheet Preparation: R. E. Wells and J. M. Armentrout
 22. Date Prepared: 6-23-82 9-18-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name South Flank - Willapa Hills
 5. Chart # _____ 6. Column # 11
 7. Name of Stratigraphic Unit Crescent Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene Ypresian-Lutetian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above McIntosh Formation Below Unknown
 12. Lithology: Dominant basaltic volcanics 80 %
 Subordinate tuffaceous siltstone 20 %
 13. Thickness (Metric 3500+ m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: x _____
 Within: _____ x _____
 Below: Unknown _____
 15. Fossil Data: Benthic forams: Upper Penutian Stage to Upper Ulatisian or
 Lower Narizian Stage (W. W. Rau)
 average
 16. Radiometric Data: 49 million Years Method K/Ar
 Source: Duncan, R. A., in press (1983), A captured island chain in the
Coast Range of Oregon and Washington: Journal of Geophysical Research
 17. Economic Data: Road rock
 18. Other Data: _____
 19. Original Reference: Arnold, Ralph, 1906, Geologic reconnaissance of the coast of
 the Olympic Peninsula, Washington: Geologic Society of America Bulletin, v. 17,
 p. 451-468.
 20. Most Significant Reference: Wolfe, E. W., and McKee, E. H., 1972, Sedimentary and
 igneous rocks of the Grays River quadrangle, Washington: U. S. Geological Survey
 Bulletin 1335, 70 p.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 9-18-82

12. GRAYS HARBOR BASIN

A. COMPOSITE SECTION LOCATION

Reference # _____ Location # _____
 Latitude 47° 0' 0" N Longitude 123° 45' W
 County or Counties 049 Grays Harbor County and Pacific County
 State. 46 Washington
 Column Name: Grays Harbor Basin
 Chart Name: Cenozoic Stratigraphic Units - Western Oregon and Washington
 General Location Description: Cenozoic section composited from units cropping out along the Willapa, Satsop, Chehalis and Wishkah Rivers, northern Pacific and eastern Grays Harbor counties, Washington.

Principal References:

Rau, W. W., 1966, Stratigraphy and foraminifera of the Satsop River area, Southern Olympic Peninsula, Washington: Washington Division of Mines and Geology Bulletin 53, 66 p., map
 Rau, W. W., 1967, Geology of the Wynoochee Valley quadrangle, Grays Harbor county, Washington: Washington Division of Mines and Geology Bulletin 56, 51 p., map

Column Authors: W. W. Rau, State of Washington
 J. M. Armentrout, Mobil Oil Corporation

B. DATA SHEETS FOR EACH STRATIGRAPHIC UNIT ON CORRELATION CHART

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Grays Harbor Basin 5. Chart # _____ 6. Column # 12
 7. Name of Stratigraphic Unit Satsop Formation
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group (Formation) Member, Bed,
 (Circle Appropriate Status) Formal Informal
 9. Age Quaternary Pleistocene
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above alluvium Below Montesano Fm. or older
 12. Lithology: Dominant sands 60 %
 Subordinate gravel and silts 40 %
 13. Thickness (Metric) 0-30 m
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____ X _____
 Within: _____ X _____
 Below: _____ _____ X _____
 15. Fossil Data: None
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: Sand and gravel
 18. Other Data: Includes numerous terrace units of unconsolidated sediments, equivalent to the Satsop Formation of Bretz (1913)
 19. Original Reference: Bretz, J. H., 1913, Glaciation of the Puget Sound Region: Washington Geological Survey Bulletin 8, 244 p.
 20. Most Significant Reference: Rau, W. W., 1967, Geology of the Wynoochee Valley quadrangle, Grays Harbor County, Washington: Washington Division of Mines and Geology Bulletin 56, 51 p., map
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 9-18-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Grays Harbor Basin 5. Chart # _____ 6. Column # 12
 7. Name of Stratigraphic Unit lacustrine sediments
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group (Formation) Member, Bed,
 (Circle Appropriate Status) Formal Informal
 9. Age Quaternary Pleistocene
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Satsop Fm. or Younger Below Montesano Formation or Older
 12. Lithology: Dominant silt 100 %
 Subordinate _____ %
 13. Thickness (Metric) 0-10 m
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____ X _____
 Within: _____ X _____
 Below: _____ _____ X _____
 15. Fossil Data: None
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: _____
 18. Other Data: May be gradational laterally with conglomerates of Satsop Formation. Appears to be varved lake deposits.
 19. Original Reference: W. W. Rau, 1967, Geology of the Wynoochee Valley quadrangle, Grays Harbor County, Washington: Washington Division of Mines and Geology Bulletin 56, 51 p., map.
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 12-28-82

12. GRAYS HARBOR BASIN

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Grays Harbor Basin 6. Column # 12
 5. Chart # _____
 7. Name of Stratigraphic Unit Montesano Formation
 8. Stratigraphic Rank and Status: (Circle Appropriate Rank) Group (Formal) Member, Bed, (Circle Appropriate Status) Formal Informal
 9. Age Neogene Miocene Serravallian-Messinian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Pleistocene Below Astoria(?) Formation
 12. Lithology: Dominant siltstone and sandstone 60 %
 Subordinate conglomerate 40 %
 13. Thickness (Metric) 300-1000 m
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: _____
 Below: _____
 15. Fossil Data: Foraminifera (Rau, 1967) and mollusks (Weaver, 1912) indicate a late Miocene age (see Rau, 1981, Geological Society of America Special Paper 184, p. 67-84)
 16. Radiometric Data: _____ Years Method _____
 Source: None
 17. Economic Data: Potential hydrocarbon reservoir sands
 18. Other Data: always unconformable on older rocks
 19. Original Reference: C. E. Weaver, 1912, Preliminary report on the Tertiary paleontology of western Washington: Washington Geological Survey Bulletin 15, 80 p.
 20. Most Significant Reference: W. W. Rau, 1967, Geology of the Wynoochee Valley quadrangle, Grays Harbor County, Washington: Washington Division of Mines and Geology Bulletin 56, 51 p., map
 21. Author(s) of Sheet Preparation: W. W. Rau with additions: J. M. Armentrout
 22. Date Prepared: 8-17-82 9-18-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Grays Harbor Basin 6. Column # 12
 5. Chart # _____
 7. Name of Stratigraphic Unit basalt of Pack Sack Lookout
 8. Stratigraphic Rank and Status: (Circle Appropriate Rank) Group (Formal) Member, Bed, (Circle Appropriate Status) Formal Informal
 9. Age Neogene Miocene Serravallian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above _____ Below Montesano Formation
 12. Lithology: Dominant volcanics 100 %
 Subordinate _____
 13. Thickness (Metric) 0-65 m
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: _____
 Below: _____
 15. Fossil Data: None
 16. Radiometric Data: _____ Years Method _____
 Source: Published dates (Snively et al., 1973) are too young based on Columbia Plateau calibrations and biostratigraphic constraints.
 17. Economic Data: Road rock
 18. Other Data: Equivalent of Saddle Mountain Basalt - Pomona Member, Columbia River Basalt Group
 19. Original Reference: Wolfe, E. W., and McKee, E. H., 1972, Sedimentary and igneous rocks of the Grays River quadrangle, Washington: U. S. Geological Survey Bulletin 1335, 70 p.
 20. Most Significant Reference: Snively, P. D., Jr., MacLeod, N. S., and Wagner, H. C., 1973: Miocene tholeiitic basalts of coastal Oregon and Washington and their relationship to coeval basalts of the Columbia Plateau: Geological Society of America Bulletin, v. 84, p. 387-424.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 9-18-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Grays Harbor Basin 6. Column # 12
 5. Chart # _____
 7. Name of Stratigraphic Unit Columbia River (?) Basalt
 8. Stratigraphic Rank and Status: (Circle Appropriate Rank) Group (Formal) Member, Bed, (Circle Appropriate Status) Formal Informal
 9. Age Neogene Miocene Langhian
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Montesano and younger Below Astoria(?) and older
 12. Lithology: Dominant basalt flows 100 %
 Subordinate _____
 13. Thickness (Metric) 70 m
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: _____
 Below: _____
 15. Fossil Data:
 16. Radiometric Data: 15.3 ± 0.8 million Years Method K/Ar
 Source: Turner, 1970, Potassium-argon dating of Pacific Coast Miocene foraminiferal stages: Geological Society of America Special Paper 124, p. 91-129.
 17. Economic Data: Road rock
 18. Other Data: Columbia River (?) Basalt of Snively and others, 1958, Geology and coal resources of the Centralia-Chehalis district, Washington: U. S. Geological Survey Bulletin 1053, 159 p., 13 pls., maps: Age equivalent of Grande Ronde Basalt of Columbia River Basalt Group
 19. Original Reference: Swanson, D. A., Wright, T. L., Hooper, P. R., and Bentley, R. D., 1979, Revisions in stratigraphic nomenclature of the Columbia River Basalt Group: U. S. Geological Survey Bulletin 1457-G, 59 p.
 20. Most Significant Reference: Snively, P. D., Jr., MacLeod, N. S., and Wagner, H. C., 1973: Miocene tholeiitic basalts of coastal Oregon and Washington and their relationship to coeval basalts of the Columbia Plateau: Geological Society of America Bulletin, v. 84, p. 387-424.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 9-19-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Grays Harbor Basin 6. Column # 12
 5. Chart # _____
 7. Name of Stratigraphic Unit Astoria(?) Formation
 8. Stratigraphic Rank and Status: (Circle Appropriate Rank) Group (Formal) Member, Bed, (Circle Appropriate Status) Formal Informal
 9. Age Neogene Miocene Aquitanian-Serravallian (?)
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Columbia River (?) Basalt Below Lincoln Creek Formation
 12. Lithology: Dominant shales and sandstone 60 %
 Subordinate conglomerate 40 %
 13. Thickness (Metric) 1700+ m
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: _____
 Below: _____
 15. Fossil Data: Forams (W. W. Rau) and mollusks (Addicott, Weaver, Etherington, Armentrout) indicate early to middle Miocene age: see Rau, W. W., 1967.
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: Possible hydrocarbon reservoir sands
 18. Other Data:
 19. Original Reference: Etherington, T. J., 1931, Stratigraphy and fauna of the Astoria Miocene of southwest Washington: University Washington Publications, Department of Geological Sciences Bulletin, v. 20, no. 5, p. 31-142.
 20. Most Significant Reference: Rau, W. W., 1967, Geology of the Wynoochee Valley quadrangle, Grays Harbor County, Washington: Washington Division of Mines and Geology Bulletin 56, 51 p.
 21. Author(s) of Sheet Preparation: W. W. Rau Additions by J. M. Armentrout
 22. Date Prepared: 8-17-82 9-18-82

12. GRAYS HARBOR BASIN

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Grays Harbor Basin
 5. Chart # _____ 6. Column # 12
 7. Name of Stratigraphic Unit Lincoln Creek Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene-Oligocene Priabonian-Chattian
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Astoria(?) Formation Below Skookumchuck Formation
 12. Lithology: Dominant tuffaceous siltstone 80 %
 Subordinate basaltic sandstone 20 %
 13. Thickness (Metric 1500-2750 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: x _____
 Within: x _____
 Below: x _____
 15. Fossil Data: Refugian and Zenorrian Foraminiferal Stages: Rau, W. W., 1966, Stratigraphy and Foraminifera of the Satsop River area, southern Olympic Peninsula, Washington: Washington Division of Mines and Geology Bulletin 53, 66 p.
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: _____
 18. Other Data: Lower sandstone member occurs around paleobasaltic highs.

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Grays Harbor Basin
 5. Chart # _____ 6. Column # 12
 7. Name of Stratigraphic Unit Skookumchuck Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene Bartonian-Priabonian
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Lincoln Creek Formation Below Northcraft Fm. or McIntosh Fm.
 12. Lithology: Dominant arkosic sandstone 80 %
 Subordinate carbonaceous shale and coal 20 %
 13. Thickness (Metric 1000-1200 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: x _____
 Within: x _____
 Below: x _____
 15. Fossil Data: Narizian Foraminiferal Stage: Bulimina schencki-Plectofrondicularia cf. P. jenkins Zone is contained in this formation: Rau, W. W., 1981, Geological Society of America Special Paper 184, p. 67-84.
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: Sand for ceramics: Potential petroleum reservoir: Coal presently used for steam generated electricity
 18. Other Data: Originally mapped as Cowlitz Formation by Weaver, C. E., 1912, A preliminary report on the Tertiary paleontology of western Washington: Washington Geological Survey Bulletin 15, 80 p.
 19. Original Reference: Snavely, P. D., Jr., Roberts, A. E., Hoover, L., Jr., Pease, M. H., Jr., 1951, Geology of the eastern part of the Centralia-Chehalis Coal District: U. S. Geological Survey Coal Investigation Map C-8, 2 sheets
 20. Most Significant Reference: Snavely, P. D., Jr., Brown, R. D., Jr., Roberts, A. E., and Rau, W. W., 1958, Geology and coal resources of the Centralia-Chehalis District, Washington: U. S. Geological Survey Bulletin 1053, 159 p.
 21. Author(s) of Sheet Preparation: W. W. Rau Additions by J. M. Armentrout
 22. Date Prepared: 8-17-82 9-19-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Grays Harbor Basin
 5. Chart # _____ 6. Column # 12
 7. Name of Stratigraphic Unit basaltic sandstone member
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, of Lincoln Creek Formation
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene Priabonian
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Lincoln Creek Fm tuffaceous member Below Skookumchuck Fm or unnamed siltstone
 12. Lithology: Dominant sandstone 100 %
 Subordinate _____
 13. Thickness (Metric 0-300 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: x _____
 Within: x _____
 Below: x _____
 15. Fossil Data: Lower Galvinian Molluscan Stage Faunas, see Armentrout (1973), and Armentrout, J. M., 1981, Geological Society of America Special Paper 184, p. 137-148.
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: _____
 18. Other Data: Occurs around late Eocene topographic highs

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Grays Harbor Basin
 5. Chart # _____ 6. Column # 12
 7. Name of Stratigraphic Unit unnamed sedimentary rocks of late Eocene age
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene Lutetian-Priabonian
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Lincoln Creek Formation Below Crescent Formation
 12. Lithology: Dominant siltstone 95 %
 Subordinate sandstone 5 %
 13. Thickness (Metric 0-900 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: x _____
 Within: x _____
 Below: x _____
 15. Fossil Data: Narizian Foraminiferal Stage: Bulimina schencki-Plectofrondicularia cf. P. jenkins, Urigerina cf. U. yazoensis and possibly the Bulimina cf. B. jacksonensis Zones are represented in these rocks. Rau, W. W., 1981, Geological Society of America Special Paper 184, p. 67-84.
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: Potential hydrocarbon source rock
 18. Other Data: Deep water equivalents of basin margin Skookumchuck and McIntosh Formations. Named by Rau (1966) for units cropping out along the north flank of the Grays Harbor Basin: Occurs in subsurface along basin axis.
 19. Original Reference: Rau, W. W., 1966, Stratigraphy and foraminifera of the Satsop River area, southern Olympic Peninsula, Washington: Division of Mines and Geology of Washington, Bulletin 53, 66 p.
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: W. W. Rau Additions by J. M. Armentrout
 22. Date Prepared: 8-17-82 9-19-82

12. GRAYS HARBOR BASIN

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Grays Harbor Basin
 5. Chart # _____ 6. Column # 12
 7. Name of Stratigraphic Unit McIntosh Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene Lutetian-Bartonian
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Northcraft Formation Below Crescent Formation
 12. Lithology: Dominant siltstone and claystone 90 %
 Subordinate sandstone 10 %
 13. Thickness (Metric 1300+ m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: X _____
 Within: _____
 Below: X _____
 15. Fossil Data: Narizian Foram Stage: Uvigerina cf. U. yazoensis Zone and Bulimina cf. B. jacksonensis Zone faunas are contained in this formation: Rau, W. W., 1981, Geological Society of America Special Paper 184, p. 67-84.
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: Quarry rock from arkosic sandstone facies
 18. Other Data: _____
 19. Original Reference: Snively, P. D., Jr., Rau, W. W., Hoover, L., Jr., and Roberts, A. E., 1951, McIntosh Formation, Centralia-Chehalis Coal District, Washington: American Association of Petroleum Geologists Bulletin, v. 35, no. 5, p. 1052-1061
 20. Most Significant Reference: Snively, P. D., Jr., Brown, R. D., Jr., Roberts, A. C., and Rau, W. W., 1958, Geology and coal resources of the Centralia-Chehalis District, Washington, U. S. Geological Survey Bulletin 1053, 159 p.
 21. Author(s) of Sheet Preparation: W. W. Rau Additions by J. M. Ammentrout
 22. Date Prepared: 8-17-82 9-19-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Grays Harbor Basin
 5. Chart # _____ 6. Column # 12
 7. Name of Stratigraphic Unit Crescent Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene Ypresian-Lutetian
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above McIntosh Fm. or Younger Units Below Unknown
 12. Lithology: Dominant basaltic volcanics 80 %
 Subordinate tuffaceous volcanic sediments 20 %
 13. Thickness (Metric 3000+ m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: X _____
 Within: _____
 Below: Unknown _____
 15. Fossil Data: Benthic Foraminifera: Upper Penutian Stage to Upper Ulatian Stage or Lower Narizian Stage (W. W. Rau, 1966)
 16. Radiometric Data: 49-54 million years Method K/Ar
 Source: Duncan, R. A., in press (1983), A captured island chain in the Coast Range of Oregon and Washington: Journal of Geophysical Research
 17. Economic Data: Road rock
 18. Other Data: _____
 19. Original Reference: Arnold, Ralph, 1906, Geologic reconnaissance of the coast of the Olympic Peninsula, Washington: Geological Society of America Bulletin, v. 17, p. 451-468.
 20. Most Significant Reference: Rau, W. W., 1966, Stratigraphy and foraminifera of the Satsop River area, Southern Olympic Peninsula, Washington: Washington Division of Mines and Geology Bulletin 53, 66 p.
 21. Author(s) of Sheet Preparation: J. M. Ammentrout
 22. Date Prepared: 9-19-82

13. CENTRALIA-CHEHALIS AREA

A. COMPOSITE SECTION LOCATION

Reference # _____ Location # _____
 Latitude 46° 45' N Longitude 123° 0' W
 County or Counties 067 and 041 Thurston County and Lewis County
 State 46 Washington
 Column Name: Centralia-Chehalis Area
 Chart Name: Cenozoic Stratigraphic Units - Western Oregon and Washington
 General Location Description: Cenozoic section composited from units cropping out along the Chehalis and Skookumchuck Rivers, Centralia-Chehalis coal district, Thurston and Lewis Counties, Washington.

Principal Reference:

Snively, P.D., Jr., Brown, R. D., Jr., Roberts, A. E., and Rau, W. W., 1958, Geology and coal resources of the Centralia-Chehalis district, Washington: U. S. Geological Survey Bulletin 1053, 159 p., 13 pls., map.

Biostratigraphic Review:

Armentrout, J. M., 1973, Molluscan paleontology and biostratigraphy of the Lincoln Creek Formation, Late Eocene-Oligocene, southwestern Washington: Unpublished Ph.D. thesis, University of Washington, Seattle, 478 p.

Rau, W. W., 1981, Pacific Northwest benthic foraminiferal biostratigraphic framework, An Overview: Geological Society of America Special Paper 184, p. 67-84.

Column Authors: W. W. Rau, State of Washington
 J. M. Armentrout, Mobil Oil Corporation
 D. J. Easterbrook, Western Washington University

B. DATA SHEETS FOR EACH STRATIGRAPHIC UNIT ON CORRELATION CHART

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Centralia-Chehalis Area
 5. Chart # _____ 6. Column # 13
 7. Name of Stratigraphic Unit Fraser Drift
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Quaternary Pleistocene _____
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above alluvium Below Hayden Creek Drift
 12. Lithology: Dominant glacial drift _____
 Subordinate lake silt _____
 13. Thickness (Metric 3-7 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: _____
 Below: _____
 15. Fossil Data: Marine shells in Bellingham glaciomarine drift member at Bellingham suggest modern fauna. Wood in silt, clay and till units have been dated.
 16. Radiometric Data: 10,000-18,000 Years Method Radiocarbon
 Source: Easterbrook and others, 1967
 17. Economic Data:
 18. Other Data: Fraser Drift includes 1) Sumas Stage (youngest)
 2) Everson Interstage
 3) Vashon Stage
 4) Evans Creek Stage (oldest)
 19. Original Reference: Armstrong, J. E., Crandell, D. R., Easterbrook, D. J., Noble, J., 1965, Late Pleistocene stratigraphy and chronology in southwestern British Columbia and northwestern Washington: Geological Society of America Bulletin, v. 76, p. 321-330.
 20. Most Significant Reference: Snively, P. D., Jr., Brown, R. D., Jr., Roberts, A. E., and Rau, W. W., 1958, Geology and coal resources of the Centralia-Chehalis district, Washington: U. S. Geological Survey Bulletin 1053, 159 p., 13 pls., maps.
 21. Author(s) of Sheet Preparation: D. J. Easterbrook with additions by J.M.Armentrout
 22. Date Prepared: 2-21-83 2-28-83

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Centralia-Chehalis
 5. Chart # _____ 6. Column # 13
 7. Name of Stratigraphic Unit Wade Creek Drift
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Quaternary Pleistocene _____
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Fraser Drift Below Wingate Hill Drift
 12. Lithology: Dominant _____
 Subordinate _____
 13. Thickness (Metric 3-7 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: _____
 Below: _____
 15. Fossil Data:
 16. Radiometric Data: None Years _____ Method _____
 Source: _____
 17. Economic Data: Sand and gravel
 18. Other Data:
 19. Original Reference: Armstrong, J. E., Crandell, D. R., Easterbrook, D. J., Noble, J., 1965, Late Pleistocene stratigraphy and chronology in southwestern British Columbia and northwestern Washington: Geological Society of America Bulletin, v. 76, p. 321-330.
 20. Most Significant Reference: Snively, P. D., Jr., Brown, R. D., Jr., Roberts, A. E., and Rau, W. W., 1958, Geology and coal resources of the Centralia-Chehalis district, Washington: U. S. Geological Survey Bulletin 1053, 159 p., 13 pls., maps.
 21. Author(s) of Sheet Preparation: D. J. Easterbrook with additions by J. M. Armentrout
 22. Date Prepared: 2-21-83 2-28-83

13. CENTRALIA-CHEHALIS AREA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Centralia-Chehalis Area
 5. Chart # _____ 6. Column # 13
 7. Name of Stratigraphic Unit Wingate Hill Drift
 8. Stratigraphic Rank and Status: (Circle Appropriate Rank) Group (Formation) Member, Bed, (Circle Appropriate Status) Formal Informal
 9. Age Quaternary Pleistocene
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Hayden Creek Drift Below Logan Hill Formation
 12. Lithology: Dominant _____ % Subordinate _____ %
 13. Thickness (Metric) 2-7 m
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____ X _____
 Within: _____ X _____
 Below: _____ X _____
 15. Fossil Data:
 16. Radiometric Data: None Years Method
 Source:
 17. Economic Data: Sand and gravel
 18. Other Data:
 19. Original Reference: Armstrong, J. E., Crandell, D. R., Easterbrook, D. J., Noble, J., 1965, Late Pleistocene stratigraphy and chronology in southwestern British Columbia and northwestern Washington: Geological Society of America Bulletin, v. 76, p. 321-330.
 20. Most Significant Reference: Snively, P. D., Jr., Brown, R. D., Jr., Roberts, A. E., and Rau, W. W., 1958, Geology and coal resources of the Centralia-Chehalis district, Washington: U. S. Geological Survey Bulletin 1053, 159 p., 13 pls., maps.
 21. Author(s) of Sheet Preparation: D. J. Easterbrook with additions by J. M. Armentrout
 22. Date Prepared: 2-21-83 2-28-83

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Centralia-Chehalis Area
 5. Chart # _____ 6. Column # 13
 7. Name of Stratigraphic Unit Logan Hill Formation
 8. Stratigraphic Rank and Status: (Circle Appropriate Rank) Group (Formation) Member, Bed, (Circle Appropriate Status) Formal Informal
 9. Age Quaternary Pleistocene
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Wingate Drift Below nonmarine sed. rocks
 12. Lithology: Dominant gravel 70 % Subordinate sand 30 %
 13. Thickness (Metric) 0-70 m
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____ X _____
 Within: _____ X _____
 Below: _____ X _____
 15. Fossil Data: None
 16. Radiometric Data: None Years Method
 Source:
 17. Economic Data: Gravels
 18. Other Data: Believed to be outwash gravels of alpine glaciers in Cascade Range to the east. These deposits are reworked into younger river terrace sequences
 19. Original Reference: Snively, P. D., Jr., Roberts, A. E., Hoover, L., and Pease, M. H., Jr., 1951, Geology of the eastern part of the Centralia-Chehalis coal district, Lewis and Thurston Counties, Washington: U. S. Geological Survey Coal Investigation Map C-8, 2 sheets
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 9-19-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Centralia-Chehalis Area
 5. Chart # _____ 6. Column # 13
 7. Name of Stratigraphic Unit nonmarine sedimentary rocks
 8. Stratigraphic Rank and Status: (Circle Appropriate Rank) Group (Formation) Member, Bed, (Circle Appropriate Status) Formal Informal
 9. Age Neogene Miocene-Pliocene Serravalian-Piacenzian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Logan Hill Fm. Below Columbia River (?) Basalt
 12. Lithology: Dominant sandstone and siltstone 70 % Subordinate conglomerate and tuff 30 %
 13. Thickness (Metric) 350 m
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____ X _____
 Within: _____ X _____
 Below: _____ X _____
 15. Fossil Data: Megafossil data in Snively and others (1958) suggests middle to late Miocene and possibly Pliocene
 16. Radiometric Data: None Years Method
 Source:
 17. Economic Data:
 18. Other Data: Fluvial, lacustrine and brackish water deposits within synclinal areas.
 19. Original Reference: Snively, P. D., Jr., Brown, R. D., Jr., Roberts, A. E., and Rau, W. W., 1958, Geology and coal resources of the Centralia-Chehalis district, Washington: U. S. Geological Survey Bulletin 1053, 159 p., 13 figs., maps
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 9-19-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Centralia-Chehalis Area
 5. Chart # _____ 6. Column # 13
 7. Name of Stratigraphic Unit Columbia River (?) Basalt
 8. Stratigraphic Rank and Status: (Circle Appropriate Rank) Group (Formation) Member, Bed, (Circle Appropriate Status) Formal Informal
 9. Age Neogene Pliocene Langhian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above non-marine sedimentary rocks Below Astoria (?) Formation
 12. Lithology: Dominant basalt flows 100 % Subordinate _____ %
 13. Thickness (Metric) 25 m
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____ X _____
 Within: _____ X _____
 Below: _____ X _____
 15. Fossil Data: None
 16. Radiometric Data: 15.7 ± 0.8 Millidays Method Quarry between Pe Ell and Doty
 Source: Turner, D. L., 1970, Potassium-Argon dating of Pacific coast Miocene foraminiferal stages, in Bandy, O. L., ed., Radiometric dating and paleontological zonation: Geological Society of America Special Paper 124, p. 91-129.
 17. Economic Data: Road rock
 18. Other Data: Columbia River (?) Basalt of Snively and others (1958) is probable equivalent of Grande Ronde Basalt of Columbia River Basalt Group
 19. Original Reference: Swanson, D. A., Wright, T. L., Hooper, P. R., and Bentley, R. P., 1979, Revisions in stratigraphic nomenclature of the Columbia River Basalt Group: U. S. Geological Survey Bulletin 1457-G, 59 p.
 20. Most Significant Reference: Snively, P. D., Jr., Brown, R. D., Jr., Roberts, A. E., and Rau, W. W., 1958, Geology and coal resources of the Centralia-Chehalis district, Washington: U. S. Geological Survey Bulletin 1053, 159 p., 13 pls., maps
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 9-19-82

13. CENTRALIA-CHEHALIS AREA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Centralia-Chehalis Area
 5. Chart # _____ 6. Column # 13
 7. Name of Stratigraphic Unit Astoria (?) Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Neogene Miocene Aquitania-Langhian
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Columbia River (?) Basalt Below Lincoln Creek Formation
 12. Lithology: Dominant shales and sandstone _____ 60 %
 Subordinate conglomerate _____ 40 %
 13. Thickness (Metric 230+ m) _____
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____ x _____
 Within: _____ x _____
 Below: _____ x _____
 15. Fossil Data: Forams (W. W. Rau) and mollusks (Addicott, Weaver, Etherington, Armentrout) indicate early to middle Miocene age
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: Possible hydrocarbon reservoir sands
 18. Other Data: _____
 19. Original Reference: Etherington, T. J., 1931, Stratigraphy and fauna of the Astoria Miocene of southwest Washington: University of Washington Publications, Department of Geological Sciences Bulletin, v. 20, no. 5, p. 31-142.
 20. Most Significant Reference: Snavely, P. D., Jr., Brown, R. D., Jr., Roberts, A. E., and Rau, W. W., 1958, Geology and coal resources of the Centralia-Chehalis district, Washington; U. S. Geological Survey Bulletin 1053, 159 p., 13 pls, map
 21. Author(s) of Sheet Preparation: W. W. Rau Additions by J. M. Armentrout
 22. Date Prepared: 8-17-82 9-18-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Centralia-Chehalis Area
 5. Chart # _____ 6. Column # 13
 7. Name of Stratigraphic Unit Lincoln Creek Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene-Oligocene Priabonian-Chattian
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Astoria (?) Formation Below Skookumchuck Formation
 12. Lithology: Dominant tuffaceous siltstone _____ 80 %
 Subordinate basaltic sandstone _____ 20 %
 13. Thickness (Metric 330-3000 m) _____
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____ x _____
 Within: _____ x _____
 Below: _____ x _____
 15. Fossil Data: Refugian and Zemorrian Foraminiferal Stages: Rau, 1981, Geological Society of America Special Paper 184, p. 67-84
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: _____
 18. Other Data: Lower sandstone member occurs along paleobasaltic highs.
 19. Original Reference: Beikman, H. M., Rau, W. W., and Wagner, H. C., 1967, the Lincoln Creek Formation, Grays Harbor Basin, Southwestern Washington: U. S. Geological Survey Bulletin 1244-I, 14 p.
 20. Most Significant Reference: Snavely, P. D., Jr., Brown, R. D., Jr., Roberts, A. E., and Rau, W. W., 1958, Geology and coal resources of the Centralia-Chehalis district, Washington: U. S. Geological Survey Bulletin 1053, 158 p., 13 pls, map.
 21. Author(s) of Sheet Preparation: W. W. Rau additions by J. M. Armentrout
 22. Date Prepared: 8-17-82 9-18-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Centralia-Chehalis Area
 5. Chart # _____ 6. Column # 13
 7. Name of Stratigraphic Unit tuffaceous siltstone member
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, of Lincoln Creek Fm.
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene-Oligocene Priabonian-Chattian
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface Skookumchuck Fm or basaltic ss. mbr. of Lincoln Ck. Fm.
 11. Bounding Units: Above Astoria (?) Formation Below _____
 12. Lithology: Dominant tuffaceous siltstone _____ 100 %
 Subordinate _____
 13. Thickness (Metric 330-3000 m) _____
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____ x _____
 Within: _____ x _____
 Below: _____ x _____
 15. Fossil Data: Refugian and Zemorrian Foraminiferal Stage faunas, see Rau, W. W., in Geological Society of America Special Paper 184, p. 67-84
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: _____
 18. Other Data: Within basin axes, away from paleohighs where basaltic sandstones are developed, the tuffaceous siltstones of the Lincoln Creek Formation are gradational with underlying tuffaceous siltstones of older units.
 19. Original Reference: Snavely, P. D., Jr., Brown, R. D., Jr., Roberts, A. E., and Rau, W. W., 1958, Geology and coal resources of the Centralia-Chehalis district, Washington; U. S. Geological Survey Bulletin 1053, 158 p., maps.
 20. Most Significant Reference: Armentrout, J. M., 1973, Molluscan paleontology and biostratigraphy of the Lincoln Creek Formation, Late Eocene-Oligocene, southwestern Washington: unpublished PhD thesis, University of Washington, Seattle, 478 p.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 1-18-83

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Centralia-Chehalis Area
 5. Chart # _____ 6. Column # 13
 7. Name of Stratigraphic Unit basaltic sandstone member
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, of Lincoln Creek Formation
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene Priabonian
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Lincoln Ck. Fm. tuffaceous mbr. Below Skookumchuck Formation
 12. Lithology: Dominant sandstone _____ 100 %
 Subordinate _____
 13. Thickness (Metric 0-500 m) _____
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____ x _____
 Within: _____ x _____
 Below: _____ x _____
 15. Fossil Data: lower Galvinian Molluscan Stage Faunas - see Armentrout, 1973, Molluscan paleontology and biostratigraphy of the Lincoln Creek Formation, Late Eocene-Oligocene, southwestern Washington: Unpublished PhD thesis, University of Washington, 478 p. and Armentrout, J. M., 1981, Geological Society of America Special Paper 184, p. 137-148.
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: _____
 18. Other Data: basaltic sandstones generally restricted to areas of basaltic paleo-highs.
 19. Original Reference: Snavely, P. D., Jr., Brown, R. D., Jr., Roberts, A. E., and Rau, W. W., 1958, Geology and coal resources of the Centralia-Chehalis district, Washington: U. S. Geological Survey Bulletin 1053, 159 p., maps
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 1-18-83

13. CENTRALIA-CHEHALIS AREA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Centralia-Chehalis Area
 5. Chart # _____ 6. Column # 13
 7. Name of Stratigraphic Unit Skookumchuck Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed,
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene Bartonian-Priabonian
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Lincoln Creek Formation Below Northcraft Formation
 12. Lithology: Dominant arkosic sandstone 80 %
 Subordinate carbonaceous shale and coal 20 %
 13. Thickness (Metric 1000-1250 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: x _____
 Within: _____
 Below: x _____
 15. Fossil Data: Narizian Foraminiferal Stage: Bulimina schencki-Plectofrondicularia
cf. P. jenkinsi Zone is contained in this formation (Rau, 1981, Geological
 Society of America Special Paper 184, p. 67-84.
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: Sand for ceramics: Potential petroleum reservoir: Coal
 presently used for steam generated electricity
 18. Other Data: _____

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Centralia-Chehalis Area
 5. Chart # _____ 6. Column # 13
 7. Name of Stratigraphic Unit Northcraft Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed,
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene Lutetian-Bartonian
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Skookumchuck Formation Below McIntosh Formation
 12. Lithology: Dominant ferromagnesian lava 90 %
 Subordinate basaltic pyroclastics 10 %
 13. Thickness (Metric 200-500 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: x _____
 Below: x _____
 15. Fossil Data: None
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: Road rock
 18. Other Data: _____

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Centralia-Chehalis Area
 5. Chart # _____ 6. Column # 13
 7. Name of Stratigraphic Unit McIntosh Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed,
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene Lutetian-Bartonian
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Northcraft Formation Below Crescent Formation
 12. Lithology: Dominant siltstone and claystone 90 %
 Subordinate sandstone 10 %
 13. Thickness (Metric 1500+ m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: x _____
 Within: _____
 Below: x _____
 15. Fossil Data: Narizian Foram Stage: Uvigerina cf. U. yazoensis Zone and
Bulimina cf. B. jacksonensis Zone are contained in this formation:
 Rau, W. W., 1981, Geological Society of America Special Paper 184, p. 67-84.
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: Potential petroleum source rock; quarry rock from local
 arkosic sandstone
 18. Other Data: _____

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Centralia-Chehalis Area
 5. Chart # _____ 6. Column # 13
 7. Name of Stratigraphic Unit Crescent Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed,
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene ? Thanetian-Lutetian
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above McIntosh Fm Below Unknown
 12. Lithology: Dominant basaltic volcanics 80 %
 Subordinate tuffaceous volcanic sediments 20 %
 13. Thickness (Metric 3000+ m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: x _____
 Below: Unknown _____
 15. Fossil Data: Benthic foraminifera: Upper Penutian Stage to upper Ulatian Stage
 or lower Narizian Stage: Rau, W. W., 1981, Geological Society of America
 Special Paper 184, p. 67-84.
 16. Radiometric Data: 49-54 million Years Method K/Ar
 Source: Duncan, R. A., in press, (1983) A captured island chain in the
 Coast Range of Oregon and Washington: Journal of Geophysical Research
 17. Economic Data:
 18. Other Data: _____

14. WESTERN OLYMPIC PENINSULA

A. COMPOSITE SECTION LOCATION

Reference # _____ Location # _____
Latitude 47° 30' N Longitude 124° 20' W
County or Counties 031 Grays Harbor County and Jefferson County
State. 46 Washington
Column Name: Western Olympic Peninsula
Chart Name: Cenozoic Stratigraphic Units - Western Oregon and Washington

General Location Description: Cenozoic section composited from units cropping out along the sea cliffs and stream valleys between Point Grenville and the Hoh River, western Grays Harbor and Jefferson Counties, Washington.

Principal Reference:

Rau, W. W., 1975, Geologic map of the Destruction Island and Taholah quadrangles, Washington: Washington Division of Geology and Earth Resources Geologic Map GM-13.

Rau, W. W., 1973, Geology of the Washington Coast between Point Grenville and the Hoh River: Washington Division of Geology and Earth Resources Bulletin 66, 58 p.

Biostratigraphic Review:

Rau, W. W., 1981, Pacific Northwest Benthic foraminiferal biostratigraphic framework, An Overview: Geological Society of America Special Paper 184, p. 67-84.

Column Author: W. W. Rau, State of Washington

B. DATA SHEETS FOR EACH STRATIGRAPHIC UNIT ON CORRELATION CHART

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710

4. Column Name _____ Western Olympic Peninsula _____

5. Chart # _____ 6. Column # 14

7. Name of Stratigraphic Unit marine and fluvial terrace deposits

8. Stratigraphic Rank and Status: _____
(Circle Appropriate Rank) Group Formation Member, Bed, _____
(Circle Appropriate Status) Formal Informal

9. Age Quaternary Pleistocene _____

System _____ Series _____ Stage _____

10. Surface Subsurface or Both Surface

11. Bounding Units: Above alluvium _____ Below Hoh and Quinalt Fms.

12. Lithology: Dominant _____ sands _____ 70 %
Subordinate _____ gravels _____ 30 %

13. Thickness (Metric 0-30 m) _____

14. Major Unconformities: - Check Appropriate Line -
None Disconformable Angular

Above: _____ x _____
Within: _____ x _____
Below: _____ x _____

15. Fossil Data: None

16. Radiometric Data: None Years Method
Source: _____

17. Economic Data: Sand and gravel

18. Other Data: Locally developed marine and fluvial terraces including some reworked glacial debris sourced by Olympic Mountain alpine glaciation.

19. Original Reference: Rau, W. W., 1973, Geology of the Washington Coast between Point Grenville and the Hoh River, Washington: Washington Division of Geology and Earth Resources Bulletin 66, 58 p.

20. Most Significant Reference: Same

21. Author(s) of Sheet Preparation: W. W. Rau Additions by J. M. Armentrout
22. Date Prepared: 8-17-82 9-11-82

4. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 5. Column Name Western Olympic Peninsula 6. Column # 14
 7. Chart # _____
 8. Name of Stratigraphic Unit: Quinalt Formation
 9. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal _____
 10. Age Neogene Miocene-Pleistocene Messinian-Pleistocene
 System Series Stage
 11. Surface Subsurface or Both Surface and subsurface
 12. Bounding Units: Above Quaternary deposits Below High rock assemblage
 Lithology: Dominant siltstones 60 %
 Subordinate sandstone & conglomerate 40 %
 13. Thickness (Metric 1800+ m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ None _____ Disconformable _____ Angular _____
 Within: _____ _____ _____
 Below: _____ _____ _____

15. Fossil Data: "Pliocene" benthic foraminifera (Rau, 1970); present correlation of Quinault faunas includes late Miocene to Pleistocene: Rau, W. W., 1981, Geological Society of America Special Paper 184, p. 67-84

16. Radiometric Data: None Years Method
Source: _____

17. Economic Data: Potential hydrocarbon reservoir

18. Other Data:

19. Original Reference: Arnold, Ralph, 1906, Geologic reconnaissance of the coast of the Olympic Peninsula, Washington: Geological Society of America Bulletin, v. 17, p. 451-468.

20. Most Significant Reference: Rau, W. W., 1970, Foraminifera, stratigraphy and paleoecology of the Quinault Formation, Washington: Washington Division of Mines and Geology Bulletin 62, 34 p., 3 pls.

21. Author(s) of Sheet Preparation: W. W. Rau with additions by J. M. Armentrout
22. Date Prepared: 8-17-82 9-11-82

14. WESTERN OLYMPIC PENINSULA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Western Olympic Peninsula
 5. Chart # _____ 6. Column # 14
 7. Name of Stratigraphic Unit Hoh rock assemblage
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene-Miocene Ypresian-Langhian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Quaternary and Quinault Below Unknown
 12. Lithology: Dominant interbedded sandstone and shale _____ 75 %
 Subordinate broken formation (shale melange) _____ 25 %
 13. Thickness (Metric 3000+ m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: _____
 Below: Unknown
 15. Fossil Data: Rau (1973) indicates most rocks contain middle Miocene forams but some localities contain Eocene (late Eocene) faunas. Beds in the Pt. Grenville volcanics contain Ulatisian foraminifera.
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: Potential petroleum source and reservoir rock
 18. Other Data: Contains both coherent sedimentary sequences and melange packages. For additional information and an alternative interpretation of Hoh rocks see: Tabor, R. W., and Cady, W. M., 1978, Geologic map of the Olympic Peninsula, Washington: U. S. Geological Survey Miscellaneous Investigations Series Map I-994, 1:125,000, with text.
 19. Original Reference: Weaver, C. E., 1937, Tertiary stratigraphy of western Washington and northwestern Oregon: University of Washington Publications in Geology, v. 4, 266 p., 15 pls.
 20. Most Significant Reference: Rau, W. W., 1973, Geology of the Washington Coast between Point Grenville and the Hoh River, Washington: Washington Division of Geology and Earth Resources Bulletin 66, 58 p.
 21. Author(s) of Sheet Preparation: W. W. Rau additions by J. M. Armentrout
 22. Date Prepared: 8-17-82 9-11-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Western Olympic Peninsula
 5. Chart # _____ 6. Column # 14
 7. Name of Stratigraphic Unit tectonic melange rocks of Hoh rock assemblage
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene-Neogene Eocene-Miocene Ypresian-Langhian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Quinault Formation Below Unknown
 12. Lithology: Dominant melange _____ 100 %
 Subordinate _____
 13. Thickness (Metric Unknown)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: _____
 Below: Unknown
 15. Fossil Data: Interbeds in Point Grenville volcanics contain Ulatisian forams; youngest faunas are Relizian: Rau, 1983 personal communication
 16. Radiometric Data: _____ Years Method _____
 Source: _____
 17. Economic Data: _____
 18. Other Data: Melange includes volcanics and sedimentary rocks: Rau (1973) refers these rocks to Hoh rock assemblage:
 19. Original Reference: Rau, W. W., 1973, Geology of the Washington Coast between Point Grenville and the Hoh River: Washington Division of Mines and Geology Bulletin 66, 58 p.
 20. Most Significant Reference: Rau, W. W., 1980, Washington Coastal geology between the Hoh and Quillayute Rivers: Washington Division of Mines and Geology Bulletin 72, 57 p.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 1-18-83

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Western Olympic Peninsula
 5. Chart # _____ 6. Column # 14
 7. Name of Stratigraphic Unit sedimentary rock sequences of Hoh rock assemblage
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene-Neogene Eocene-Miocene Bartonian-Langhian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Quinault Formation Below Unknown
 12. Lithology: Dominant sandstone and shale _____ 100 %
 Subordinate _____
 13. Thickness (Metric 3000+ m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: _____
 Below: Unknown
 15. Fossil Data: Benthic Foraminifera studied by Rau (1973) indicate age of Narizian through Relizian: Rau 1983, personal communication.
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: local source of oil and gas
 18. Other Data: Rau includes these in his Hoh rock assemblage
 19. Original Reference: Rau, W. W., 1973, Geology of the Washington Coast between Point Grenville and the Hoh River: Washington Division of Mines and Geology Bulletin 66, 58 p.
 20. Most Significant Reference: Rau, W. W., 1980, Washington coastal geology between the Hoh and Quillayute Rivers: Washington Division of Mines and Geology Bulletin 72, 57 p.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 1-18-83

15. NORTHWEST OLYMPIC PENINSULA

A. COMPOSITE SECTION LOCATION

Reference # _____ Location # _____
 Latitude 48° 15' Longitude 124° 30'
 County or Counties 009 Clallam County
 State 46 Washington

Column Name: Northwest Olympic Peninsula

Chart Name: Cenozoic Stratigraphic Units - Western Oregon and Washington

General Location Description: Cenozoic section composited from units cropping out in the proximity of Cape Flattery and Crescent Lake, Clallam County, northwestern Olympic Peninsula, Washington.

Principal References:

Snavely, P. D., Jr., Niem, A. R., and Pearl, J. E., 1977, Twin River Group (upper Eocene to lower Miocene) - defined to include Hoko River, Makah and Physt Formations, Clallam County, Washington in Changes in Stratigraphic Nomenclature: U. S. Geological Survey Bulletin 1457-A, p. A111-A120.

Brown, R. D., Jr., Gower, H. D., and Snavely, P. D., Jr., 1960, Geology of the Port Angeles-Crescent Lake area, Clallam County, Washington: U. S. Geological Survey Oil and Gas Investigations Map OM-203.

Biostratigraphy: Updated from Rau, W. W., 1964

Rau, W. W., 1981, Pacific Northwest Tertiary benthic foraminiferal biostratigraphic framework, An overview: Geological Society of America Special Paper 184, p. 67-84.

Column Authors: P. D. Snavely, Jr., U. S. Geological Survey
 D. L. Lander, U. S. Geological Survey

B. DATA SHEETS FOR EACH STRATIGRAPHIC UNIT ON CORRELATION CHART

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Northwest Olympic Peninsula
 5. Chart # _____ 6. Column # 15
 7. Name of Stratigraphic Unit undifferentiated glacial and fluvial deposits
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group (Formation) Member, Bed,
 (Circle Appropriate Status) Formal (Informal)
 9. Age Quaternary Pleistocene
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above alluvium Below older units
 12. Lithology: Dominant sedimentary (ss, cong, sh, mst) 100 %
 Subordinate _____ %
 13. Thickness (Metric 0-100 m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ None _____ Disconformable _____ Angular _____
 Within: _____ _____ _____ _____
 Below: _____ _____ _____ _____
 15. Fossil Data: None
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: _____
 18. Other Data: Deposits of two, possibly three glaciations of alpine origin and fluvial deposits.
 19. Original Reference: Brown, R. D., Jr., Gower, H. D., and Snavely, P. D., Jr., 1960, Geology of the Port Angeles-Lake Crescent area, Clallam County, Washington: U. S. Geological Survey Oil and Gas Investigations Map OM-203.
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 11-6-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Northwest Olympic Peninsula
 5. Chart # _____ 6. Column # 15
 7. Name of Stratigraphic Unit Clallam Formation
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group (Formation) Member, Bed,
 (Circle Appropriate Status) Formal (Informal)
 9. Age Neogene Miocene Aquitanian-Burdigalian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above glacial till Below Pysht Formation
 12. Lithology: Dominant sandstone 80 %
 Subordinate conglomerate and siltstone 20 %
 13. Thickness (Metric 0-800 m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ None _____ Disconformable _____ Angular _____
 Within: _____ _____ _____ _____
 Below: _____ _____ _____ _____
 15. Fossil Data: Abundant molluscan fauna suggests a late early Miocene age (Pillarian Stage which is upper Vaqueros equivalent). A few forams suggest Saucian Stage. A marine carnivore, cetacean bones and sharks teeth have also been found in the Clallam Formation: see Addicott (1976).
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: _____
 18. Other Data: Contains much penecontemporaneous deformation.
 19. Original Reference: Arnold, Ralph, 1906, Geological reconnaissance of the coast of the Olympic Peninsula, Washington: Geological Society of America Bulletin, v. 17, p. 451-468.
 20. Most Significant Reference: Addicott, W. O., 1976, Molluscan paleontology of the early Miocene Clallam Formation, northwestern Washington: U. S. Geological Survey Professional Paper 976, 44 p., 9 pls.
 21. Author(s) of Sheet Preparation: P. D. Snavely, Jr., and D. L. Lander
 22. Date Prepared: 8-17-81

15. NORTHWEST OLYMPIC PENINSULA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Northwest Olympic Peninsula
 5. Chart # _____ 6. Column # 15
 7. Name of Stratigraphic Unit Twin River Group
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, of Twin River Group
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene-Neogene Eocene-Miocene Bartonian-Aquitania
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Clallam Formation Below Lyre Formation
 12. Lithology: Dominant sandstone and siltstone 80 %
 Subordinate mudstone 20 %
 13. Thickness (Metric 5200-6500 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: x _____
 Within: x _____
 Below: x _____
 15. Fossil Data: See Hoko River, Makah and Pysht Formations
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: See Makah and Pysht Formations
 18. Other Data: See Hoko River, Makah and Pysht Formations
 19. Original Reference: Arnold, Ralph, and Hannibal, Harold, 1913, The marine Tertiary stratigraphy of the north Pacific coast of America: Proceedings of the American Philosophical Society, v. 52, p. 559-605.
 20. Most Significant Reference: Brown, R. D., Jr., and Gower, H. D., 1958, Twin River Formation (Redefinition), northern Olympic Peninsula, Washington: American Association of Petroleum Geologists Bulletin, v. 42, no. 10, p. 2492-2512.
 21. Author(s) of Sheet Preparation: P. D. Snively, Jr., and D. L. Lander
 22. Date Prepared: 8-17-81

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Northwest Olympic Peninsula
 5. Chart # _____ 6. Column # 15
 7. Name of Stratigraphic Unit Pysht Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Formation Member, Bed, of Twin River Group
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene-Neogene Oligocene-Miocene Chattian-Aquitania
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Clallam Formation Below Makah Formation
 12. Lithology: Dominant mudstone 80 %
 Subordinate conglomerate and sandstone 20 %
 13. Thickness (Metric 1100-1400 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: x _____
 Within: x _____
 Below: x _____
 15. Fossil Data: Forams indicate a Zemorrian Stage assignment; the mollusks collected in the Pysht Formation are assigned to the Echinophoria apta Zone of Durham (1944) and the Juanian Stage or late "Blakeley" Stage of Addicott, 1976, U. S. Geological Survey Professional Paper 976, 44 p., 9 pls.
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: Contains one four foot thick coal bed.
 18. Other Data: Comprises the upper member of the Twin River Group. Channel deposits of pebble and boulder conglomerate occur at the base, which contain blocks of megafossils derived from an ancient Vancouver Island shelf.
 19. Original Reference: Snively, P. D., Jr., Niem, A. R., and Pearl, J. E., 1977, Twin River Group (upper Eocene to lower Miocene) - defined to include the Hoko River, Makah, and Pysht Formations, Clallam County, Washington, in Changes in Stratigraphic Nomenclature by the U. S. Geological Survey, 1977: U. S. Geological Survey Bulletin 1457-A, p. A111-A120.
 20. Most Significant Reference: Gower, H. D., 1960, Geology of the Pysht quadrangle, Washington: U. S. Geological Survey Map GQ-129.
 21. Author(s) of Sheet Preparation: P. D. Snively, Jr., and D. L. Lander
 22. Date Prepared: 8-17-81

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Northwest Olympic Peninsula
 5. Chart # _____ 6. Column # 15
 7. Name of Stratigraphic Unit Makah Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, of Twin River Group
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene-Oligocene Bartonian-Chattian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Pysht Formation Below Hoko River Formation
 12. Lithology: Dominant siltstone 60 %
 Subordinate sandstone 40 %
 13. Thickness (Metric 2500-2800 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: x _____
 Within: x _____
 Below: x _____
 15. Fossil Data: Foraminifera indicate late Eocene to Oligocene age (late Narizian to Zemorrian) (Rau). Mollusks indicate a late Eocene Galvinian Stage or "Lincoln Stage" (Addicott).
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: Potential reservoir rocks for petroleum.
 18. Other Data: Comprises the middle member of the Twin River Group. The Makah Formation includes six mappable units, four turbidite sandstone packets; an olistostromal unit of shallow-water submarine landslide marine sandstone and pebble conglomerate; and a thin water-laid tuff bed. There is a local unconformity between the Makah and Hoko Formations.
 19. Original Reference: Snively, P. D., Jr., Niem, A. R., and Pearl, J. E., 1977, Twin River Group (upper Eocene to lower Miocene) - defined to include the Hoko River, Makah, and Pysht Formations, Clallam County, Washington, in Changes in Stratigraphic nomenclature by the U. S. Geological Survey, 1977: U. S. Geological Survey Bulletin 1457-A, p. A111-A120.
 20. Most Significant Reference: Snively, P. D., Jr., Niem, A. R., MacLeod, N. S., Pearl, J. E., and Rau, W. W., 1980, Makah Formation - a deep marginal basin sedimentary sequence of late Eocene and Oligocene age in the northwestern Olympic Peninsula, Washington: U. S. Geological Survey Professional Paper 1162-B, 28 p.
 21. Author(s) of Sheet Preparation: P. D. Snively, Jr., and D. L. Lander
 22. Date Prepared: 8-17-81

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Northwest Olympic Peninsula
 5. Chart # _____ 6. Column # 15
 7. Name of Stratigraphic Unit Jansen Creek Member
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, of Makah Formation
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Oligocene Rupelian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Makah Formation Below Makah Formation
 12. Lithology: Dominant siltstone and sandstone 60 %
 Subordinate conglomerate and sandstone 40 %
 13. Thickness (Metric 200 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: x _____
 Within: x _____
 Below: x _____
 15. Fossil Data: Scattered fossils in the allocthonous fine- to medium-grained sandstone include mollusks, Bryozoans, and Tereido-bored carbonized wood fragments. Zemorrian Foraminiferal Stage faunas occur in siltstone beds (Rau).
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data:
 18. Other Data: The uppermost member of the Makah Formation. It is an olistostromal unit composed of large tabular and penecontemporaneously deformed strata of shallow-water marine conglomerate and fossiliferous sandstone enclosed in deep-water marine siltstone and sandstone.
 19. Original Reference: Snively, P. D., Jr., Niem, A. R., MacLeod, N. S., Pearl, J. E., and Rau, W. W., Makah Formation - a deep marginal basin sequence of late Eocene and Oligocene age in the northwestern Olympic Peninsula, Washington: U. S. Geological Survey Professional Paper 1162-B, 28 p.
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: P. D. Snively, Jr., and D. L. Lander
 22. Date Prepared: 8-17-81

15. NORTHWEST OLYMPIC PENINSULA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Northwest Olympic Peninsula
 5. Chart # _____ 6. Column # 15
 7. Name of Stratigraphic Unit Third Beach Member
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member Bed, of Makah Formation
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene Priabonian
 System Series Stage
 10. Surface Subsurface or Both _____ Surface
 11. Bounding Units: Above Makah Formation Below Makah Formation
 12. Lithology: Dominant turbidite sandstone 80 %
 Subordinate siltstone 20 %
 13. Thickness (Metric 43 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: x
 Within: x
 Below: x
 15. Fossil Data: Refugian Foraminiferal Stage faunas occur in siltstone beds (Rau).
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data:
 18. Other Data: The upper turbidite sandstone member of the Makah Formation
 19. Original Reference: Snively, P. D., Jr., Niem, A. R., MacLeod, N. S., Pearl, J. E., and Rau, W. W., 1980, Makah Formation - a deep marginal basin sequence of late Eocene and Oligocene age in the northwestern Olympic Peninsula, Washington: U. S. Geological Survey Professional Paper 1162-B, 28 p.
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: P. D. Snively, Jr., and D. L. Lander
 22. Date Prepared: 8-17-81

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Northwest Olympic Peninsula
 5. Chart # _____ 6. Column # 15
 7. Name of Stratigraphic Unit Klachopsis Point Member
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member Bed, of Makah Formation
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene Priabonian
 System Series Stage
 10. Surface Subsurface or Both _____ Surface
 11. Bounding Units: Above Makah Formation Below Makah Formation
 12. Lithology: Dominant turbidite sandstone 95 %
 Subordinate siltstone 5 %
 13. Thickness (Metric 49-73 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: x
 Within: x
 Below: x
 15. Fossil Data: Refugian Foraminiferal Stage faunas occurs in siltstone beds (Rau).
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data:
 18. Other Data: The middle turbidite member of the Makah Formation. Consists of 40 or more amalgamated sandstone beds.
 19. Original Reference: Snively, P. D., Jr., Niem, A. R., MacLeod, N. S., Pearl, J. E., and Rau, W. W., 1980, Makah Formation - a deep marginal basin sequence of late Eocene and Oligocene age in the northwestern Olympic Peninsula, Washington: U. S. Geological Survey Professional Paper 1162-B, 28 p.
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: P. D. Snively, Jr., and D. L. Lander
 22. Date Prepared: 8-17-81

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Northwest Olympic Peninsula
 5. Chart # _____ 6. Column # 15
 7. Name of Stratigraphic Unit Carpenters Creek Tuff Member
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member Bed, of Makah Formation
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene Priabonian
 System Series Stage
 10. Surface Subsurface or Both _____ Surface
 11. Bounding Units: Above Makah Formation Below Makah Formation
 12. Lithology: Dominant water-laid tuff 100 %
 Subordinate _____
 13. Thickness (Metric 1 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: x
 Within: x
 Below: x
 15. Fossil Data: Refugian Foraminiferal Stage faunas occur in siltstone beds above and below tuff units (Rau).
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data:
 18. Other Data: The only mappable tuff member in the Makah Formation. A good marker bed throughout most of the Makah Formation.
 19. Original Reference: Snively, P. D., Jr., Niem, A. R., MacLeod, N. S., Pearl, J. E., and Rau, W. W., 1980, Makah Formation - a deep marginal basin sequence of late Eocene and Oligocene age in the northwestern Olympic Peninsula, Washington: U. S. Geological Survey Professional Paper 1162-B, 28 p.
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: P. D. Snively, Jr., and D. L. Lander
 22. Date Prepared: 8-17-81

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Northwest Olympic Peninsula
 5. Chart # _____ 6. Column # 15
 7. Name of Stratigraphic Unit Otokoah Point Member
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member Bed, of Makah Formation
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene Priabonian
 System Series Stage
 10. Surface Subsurface or Both _____ Surface
 11. Bounding Units: Above Makah Formation Below Makah Formation
 12. Lithology: Dominant turbidite sandstone 80 %
 Subordinate siltstone 20 %
 13. Thickness (Metric 65 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: x
 Within: x
 Below: x
 15. Fossil Data: Refugian Foraminiferal Stage faunas occur in siltstone units (Rau).
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data:
 18. Other Data: The second lowest member of turbidite sandstone in the Makah Formation, approximately 165 m above the Baada Point Member
 19. Original Reference: Snively, P. D., Jr., Niem, A. R., MacLeod, N. S., Pearl, J. E., and Rau, W. W., 1980, Makah Formation - a deep marginal basin sequence of late Eocene and Oligocene age in the northwestern Olympic Peninsula, Washington: U. S. Geological Survey Professional Paper 1162-B, 28 p.
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: P. D. Snively, Jr., and D. L. Lander
 22. Date Prepared: 8-17-81

15. NORTHWEST OLYMPIC PENINSULA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Northwest Olympic Peninsula
 5. Chart # _____ 6. Column # 15
 7. Name of Stratigraphic Unit Baada Point Member
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, of Makah Formation
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene Priabonian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both _____ Surface _____
 11. Bounding Units: Above Makah Formation Below Makah Formation
 12. Lithology: Dominant turbidite sandstone _____ 80 %
 Subordinate siltstone _____ 20 %
 13. Thickness (Metric 43-120 m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ None _____ Disconformable _____ Angular _____
 Within: X _____
 Below: X _____
 15. Fossil Data: Refugian Foraminiferal Stage faunas occur in siltstone units (Rau).
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: _____
 18. Other Data: The stratigraphically lowest member of turbidite sandstone in the Makah Formation.
 19. Original Reference: Snively, P. D., Jr., Niem, A. R., Macleod, N. S., Pearl, J. E., and Rau, W. W., 1980, Makah Formation - a deep marginal basin sequence of late Eocene and Oligocene age in the northwestern Olympic Peninsula, Washington: U. S. Geological Survey Professional Paper 1162-B, 28 p.
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: P. D. Snively, Jr., and D. L. Lander
 22. Date Prepared: 8-17-81

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Northwest Olympic Peninsula
 5. Chart # _____ 6. Column # 15
 7. Name of Stratigraphic Unit Hoko River Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, of Twin River Group
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene Bartonian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both _____ Surface _____
 11. Bounding Units: Above Makah Formation Below Lyre Formation
 12. Lithology: Dominant siltstone _____ 60 %
 Subordinate sandstone _____ 40 %
 13. Thickness (Metric 1600-2300 m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ None _____ Disconformable _____ Angular _____
 Within: X _____
 Below: X _____
 15. Fossil Data: Concretions contain fossil crab, gastropods and fossil wood. Forams and mollusks indicate a late Eocene age (late Narizian).
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: _____
 18. Other Data: Comprises the lower member of the Twin River Group
 19. Original Reference: Snively, P. D., Jr., Niem, A. R., and Pearl, J. E., 1977, Twin River Group (upper Eocene to lower Miocene) - defined to include the Hoko River, Makah and Pysht Formations, Clallam County, Washington, in Changes in Stratigraphic nomenclature by the U. S. Geological Survey, 1977: U. S. Geological Survey Bulletin 1457-A, p. A11-A120.
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: P. D. Snively, Jr., and D. L. Lander
 22. Date Prepared: 8-17-81

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Northwest Olympic Peninsula
 5. Chart # _____ 6. Column # 15
 7. Name of Stratigraphic Unit Lyre Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene Bartonian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both _____ Surface _____
 11. Bounding Units: Above Hoko River Formation Below Aldwell Formation
 12. Lithology: Dominant sandstone _____ 70 %
 Subordinate conglomerate _____ 30 %
 13. Thickness (Metric 0-1000 m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ None _____ Disconformable _____ Angular _____
 Within: X _____
 Below: X _____
 15. Fossil Data: Sparse fossils in the Lyre Formation. A few incomplete pelecypods. Microfossils indicate middle to early late Eocene age; Lower Narizian at the base of the formation (Rau).
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: _____
 18. Other Data: Conglomerate clasts are derived from Vancouver Island.
 19. Original Reference: Weaver, C. E., 1937, Tertiary stratigraphy of western Washington and northwestern Oregon: University of Washington Publications in Geology, v. 4, 266 p.
 20. Most Significant Reference: Brown, R. D., Jr., Snively, P. D., Jr., and Gower, H. D., 1956, Lyre Formation (redefinition), Northern Olympic Peninsula, Washington: American Association of Petroleum Geologists, v. 40, no. 1.
 21. Author(s) of Sheet Preparation: P. D. Snively, Jr., and D. L. Lander
 22. Date Prepared: 8-17-81

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Northwest Olympic Peninsula
 5. Chart # _____ 6. Column # 15
 7. Name of Stratigraphic Unit Aldwell Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene Lutetian-Bartonian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both _____ Surface _____
 11. Bounding Units: Above Lyre Formation Below Crescent Formation
 12. Lithology: Dominant siltstone _____ 70 %
 Subordinate sandstone _____ 30 %
 13. Thickness (Metric 0-1000 m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ None _____ Disconformable _____ Angular _____
 Within: X _____
 Below: X _____
 15. Fossil Data: Forams indicate a middle Eocene age (lower Narizian) (Rau).
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: Potential source beds for petroleum
 18. Other Data: Interbedded contact with overlying Lyre sands. Contains a basalt mudflow breccia unit in the medial part which is derived from the north.
 19. Original Reference: Brown, R. D., Jr., Gower, H. D., and Snively, P. D., Jr., 1960, Geology of the Port Angeles-Lake Crescent area, Clallam County, Washington: U. S. Geological Survey Oil and Gas Investigation Map OM-203.
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: P. D. Snively, Jr., and D. L. Lander
 22. Date Prepared: 8-17-81

15. NORTHWEST OLYMPIC PENINSULA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
4. Column Name Northwest Olympic Peninsula
5. Chart # _____ 6. Column # 15
7. Name of Stratigraphic Unit Crescent Formation
8. Stratigraphic Rank and Status: _____
(Circle Appropriate Rank) Group (Formation) Member, Bed, _____
(Circle Appropriate Status) (Formal) Informal
9. Age Paleogene Eocene Thanetian-Ypresian
System Series Stage
10. Surface Subsurface or Both Surface
11. Bounding Units: Above Aldwell Formation Below _____
12. Lithology: Dominant pillow basalt and breccia 90 %
Subordinant marine tuffaceous sands and silt 10 %
13. Thickness (Metric (minimum) to 3000 m) _____
14. Major Unconformities: - Check Appropriate Line -
None Disconformable Angular
Above: _____ x _____
Within: x _____
Below: Unknown
15. Fossil Data: Forams in interbeds indicate Penutian to Utiatisian age (Rau). Middle Eocene age fauna, equivalent to the Copay and Domengine Stages in California. Some may be as young as Tejon and Meganos (Durham). Middle to possibly early Eocene coccolith flora indicate abyssal depositional environment (Bukry) for the lower part of the sequence, suggesting these are oceanic basalts.
16. Radiometric Data: None Years Method
Source: _____
17. Economic Data: Manganese and road rock
18. Other Data: The age and lithology correlates with the Metchosin Volcanics of Vancouver Island and the Siletz River Volcanics of Oregon. Base of formation cut out by thrust faults.
19. Original Reference: Arnold, Ralph, 1906, Geological reconnaissance of the coast of the Olympic Peninsula, Washington: Geological Society of America Bulletin, v. 17, p. 451-468.
20. Most Significant Reference: Brown, R. D., Jr., Gower, H. D., and Snively, P. D., Jr. 1960, Geology of the Port Angeles-Lake Crescent Area, Clallam County, Washington: U. S. Geological Survey Oil and Gas Investigation Map OM-203
21. Author(s) of Sheet Preparation: P. D. Snively, Jr., and D. L. Lander
22. Date Prepared: 8-17-81

16. NORTHEAST OLYMPIC PENINSULA

A. COMPOSITE SECTION LOCATION

Reference # _____ Location # _____
 Latitude 48° 0' N Longitude 122° 50' W
 County or Counties 031 Jefferson
 State 46 Washington

Column Name: Northeast Olympic Peninsula

Chart Name: Cenozoic Stratigraphic Units - Western Oregon and Washington

General Location Description: Cenozoic section composited from units cropping out along the shoreline of Discovery Bay, Marrowstone and Indian Islands, and between Port Ludlow and Port Townsend, northeastern Olympic Peninsula, Jefferson County, Washington.

Principal Reference:

Armentrout, J. M., and Berta, A., 1977, Eocene-Oligocene Foraminiferal sequence, northeastern Olympic Peninsula, Washington: Cushman Foundation Journal for Foraminiferal Research, v. 7, no. 3, p. 216-233.

Column Authors: J. M. Armentrout, Mobil Oil Corporation
 V. S. Mallory, University of Washington
 D. J. Easterbrook, Western Washington University

B. DATA SHEETS FOR EACH STRATIGRAPHIC UNIT ON CORRELATION CHART

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Northeast Olympic Peninsula
 5. Chart # _____ 6. Column # 16
 7. Name of Stratigraphic Unit Fraser
 8. Stratigraphic Rank and Status: Formation Member, Bed, _____
 (Circle Appropriate Rank) Group Formation Informal
 (Circle Appropriate Status) Formal Informal
 9. Age Quaternary Pleistocene Wisconsin
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above alluvium Below Olympia sediments
 12. Lithology: Dominant glacial drift 90 %
 Subordinate lake silts 2 %
 13. Thickness (Metric) 3-70 m
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____ x _____
 Within: _____ x _____
 Below: _____ x _____
 15. Fossil Data: Marine shells in Bellingham glaciomarine drift member. Wood occurs in both silt and clay units and till units.
 16. Radiometric Data: 10,000-18,000 Years Method Radiocarbon
 Source: _____
 17. Economic Data: Sand and gravel
 18. Other Data: Fraser Drift includes: 1) Sumas Stade (youngest)
 2) Everson Interstade
 3) Vashon Stade
 4) Evans Creek Stade (oldest)
 19. Original Reference: Armstrong, J. E., Crandell, D. R., Easterbrook, D. J., Noble, J., 1965, Late Pleistocene stratigraphy and chronology in southwestern British Columbia and northwestern Washington: Geological Society of America Bulletin, v. 76, p. 321-330.
 20. Most Significant Reference: Easterbrook, D. J., 1969, Pleistocene chronology of the Puget Lowland and San Juan Islands, Washington: Geological Society of America Bulletin, v. 80, p. 2273-2286.
 21. Author(s) of Sheet Preparation: D. J. Easterbrook with additions by J. M. Armentrout
 22. Date Prepared: 2-21-83

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Northeast Olympic Peninsula
 5. Chart # _____ 6. Column # 16
 7. Name of Stratigraphic Unit Olympia sediments
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, Wisconsin
 (Circle Appropriate Status) Formal Informal
 9. Age Quaternary Pleistocene _____
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Fraser drift Below Possession drift
 12. Lithology: Dominant silt 75 %
 Subordinate peat and sand 25 %
 13. Thickness (Metric) 3-20 m
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____ x _____
 Within: x _____
 Below: _____ x _____
 15. Fossil Data: Wood and shells
 16. Radiometric Data: 18,000-28,000 Years Method Radiocarbon
 Source: _____
 17. Economic Data:
 18. Other Data: Non-glacial deposits
 19. Original Reference: Armstrong, J. E., Crandell, D. R., Easterbrook, D. J., and Noble, J., 1965, Late Pleistocene stratigraphy and chronology in southwestern British Columbia and northwestern Washington: Geological Society of America Bulletin, v. 76, p. 321-330.
 20. Most Significant Reference: Easterbrook, D. J., 1969, Pleistocene chronology of the Puget Lowland and San Juan Islands, Washington: Geological Society of America Bulletin, v. 80, p. 2273-2286.
 21. Author(s) of Sheet Preparation: D. J. Easterbrook
 22. Date Prepared: 2-21-83

16. NORTHEAST OLYMPIC PENINSULA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Northeast Olympic Peninsula 6. Column # 16
 5. Chart # _____
 7. Name of Stratigraphic Unit Possession Drift
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) (Formal) Informal
 9. Age Quaternary Pleistocene
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Olympia sediments Below Whidbey Formation
 12. Lithology: Dominant drift _____ 99 %
 Subordinate silt _____ 1 %
 13. Thickness (Metric 3-60 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____ X _____
 Within: _____ X _____
 Below: _____ X _____
 15. Fossil Data: Shells and wood in glaciomarine drift
 16. Radiometric Data: 35,000-80,000 Years Method Radiocarbon and Amino Acid
 Source: _____
 17. Economic Data: _____
 18. Other Data: Type locality is at Possession Point, Whidbey Island, Washington
 19. Original Reference: Easterbrook, D. J., Crandell, D. R., and Leopold, E. B., 1967, Pre-Olympia stratigraphy and chronology in the central Puget Lowland, Washington: Geological Society of America Bulletin, v. 78, p. 13-20.
 20. Most Significant Reference: Easterbrook, D. J., 1969, Pleistocene chronology of the Puget Lowland and San Juan Islands, Washington: Geological Society of America Bulletin, v. 80, p. 2273-2286.
 21. Author(s) of Sheet Preparation: D. J. Easterbrook
 22. Date Prepared: 2-21-83

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Northeast Olympic Peninsula 6. Column # 16
 5. Chart # _____
 7. Name of Stratigraphic Unit Whidbey Formation
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) (Formal) Informal
 9. Age Quaternary Pleistocene
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Possession Drift Below Double Bluff Drift
 12. Lithology: Dominant sand _____ 70 %
 Subordinate silt _____ 30 %
 13. Thickness (Metric 3-85 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____ X _____
 Within: _____ X _____
 Below: _____ X _____
 15. Fossil Data: Mammuthus cf. M. (Parelophus) columbi skeletal fragments including cheek teeth, fourth premolar, Hyoid bone, first cervical vertebra, and fragment of ulna. Wood also occurs in silts.
 16. Radiometric Data: 100,000 Years Method Amino Acid
 Source: _____
 17. Economic Data: _____
 18. Other Data: Section of both Whidbey Formation and Double Bluff Drift is well exposed in sea cliffs between SE 1/4 NE 1/4 sec. 28, and the SE 1/4 NW 1/4 sec. 26, T. 26 N., R. 2E., southwestern end of Whidbey Island.
 19. Original Reference: Easterbrook, D. J., Crandell, D. R., and Leopold, E. B., 1967, Pre-Olympia stratigraphy and chronology in the central Puget Lowland, Washington: Geological Society of America Bulletin, v. 78, p. 13-20.
 20. Most Significant Reference: Easterbrook, D. J., 1969, Pleistocene chronology of the Puget Lowland and San Juan Islands, Washington: Geological Society of America Bulletin, v. 80, p. 2273-2286.
 21. Author(s) of Sheet Preparation: D. J. Easterbrook with additions by J. M. Armentrout
 22. Date Prepared: 2-21-83 2-28-83

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Northeast Olympic Peninsula 6. Column # 16
 5. Chart # _____
 7. Name of Stratigraphic Unit Double Bluff Drift
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) (Formal) Informal
 9. Age Quaternary Pleistocene
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Whidbey Formation Below undifferentiated terrace
 12. Lithology: Dominant glacial drift _____ 95 % deposits
 Subordinate silt _____ 5 %
 13. Thickness (Metric 3-35 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____ X _____
 Within: _____ X _____
 Below: _____ X _____
 15. Fossil Data: Wood and shells
 16. Radiometric Data: 150,000-250,000 Years Method Amino Acid
 Source: _____
 17. Economic Data: _____
 18. Other Data: Section of both Double Bluff Drift and Whidbey Formation crops out at sea cliffs between SE 1/4 NE 1/4 sec. 28 and the SE 1/4 NW 1/4 sec. 26, T. 26 N., R. 2 E., southwestern end of Whidbey Island, Washington.
 19. Original Reference: Easterbrook, D. J., Crandell, D. R., and Leopold, E. B., 1967, Pre-Olympia stratigraphy and chronology in the central Puget Lowland, Washington: Geological Society of America Bulletin, v. 78, p. 13-20.
 20. Most Significant Reference: Easterbrook, D. J., 1969, Pleistocene chronology of the Puget Lowland and San Juan Islands, Washington: Geological Society of America Bulletin, v. 30, p. 2273-2286.
 21. Author(s) of Sheet Preparation: D. J. Easterbrook with additions by J. M. Armentrout
 22. Date Prepared: 2-21-83 2-28-83

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Northeast Olympic Peninsula 6. Column # 16
 5. Chart # _____
 7. Name of Stratigraphic Unit undifferentiated terrace deposits
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) (Formal) Informal
 9. Age Quaternary Pleistocene
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Double Bluff Drift Below Marrowstone Shale
 12. Lithology: Dominant sands _____ 80 %
 Subordinate gravels _____ 20 %
 13. Thickness (Metric 0-40 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____ X _____
 Within: _____ X _____
 Below: _____ X _____
 15. Fossil Data: None
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: sand and gravel
 18. Other Data: Various units sourced by alpine glaciation, marine terrace development and river and stream terrace building.
 19. Original Reference: _____
 20. Most Significant Reference: Brown, R. D., Jr., Gower, H. D., and Snively, P. D., Jr. 1960, Geology of the Port Angeles-Lake Crescent Area, Clallam County, Washington: U. S. Geological Survey Oil and Gas Inv. Map. OM-203
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 8-12-82

16. NORTHEAST OLYMPIC PENINSULA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Northeast Olympic Peninsula
 5. Chart # _____ 6. Column # 16
 7. Name of Stratigraphic Unit Marrowstone Shale
 8. Stratigraphic Rank and Status: (Circle Appropriate Rank) Group (Formation) Member, Bed, (Circle Appropriate Status) (Formal) Informal
 9. Age Paleogene Eocene Priabonian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both _____ Surface _____
 11. Bounding Units: Above Double Bluff Drift Below Quimper Sandstone
 12. Lithology: Dominant siltstone _____ 80 %
 Subordinate sandstone _____ 20 %
 13. Thickness (Metric) 60-140 m _____
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ None _____ Disconformable _____ Angular _____
 Within: _____ X _____
 Below: _____ X _____
 15. Fossil Data: Foraminifera = Refugian Stage; Mollusca = Molopophorus stephensoni Zone = Galvinian Stage; Armentrout and Berta (1977)
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: None
 18. Other Data: Probably deposited as uppermost slope-outer shelf sequence: conformable upon and gradational with the Quimper Sandstone.
 19. Original Reference: Durham, J. W., 1944, Megafossil zones of the Oligocene of northwestern Washington: University of California, Publications in Geological Sciences, v. 27, no. 5, p. 181-212
 20. Most Significant Reference: Armentrout, John M., and Berta, Annalisa, 1977, Eocene-Oligocene Foraminiferal Sequence from the Quimper Peninsula, Northeast Olympic Peninsula, Washington: Journal of Foraminiferal Research, v. 7, no. 3, p. 215-233, 1 plate.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 8-12-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Northeast Olympic Peninsula
 5. Chart # _____ 6. Column # 16
 7. Name of Stratigraphic Unit Quimper Sandstone
 8. Stratigraphic Rank and Status: (Circle Appropriate Rank) Group (Formation) Member, Bed, (Circle Appropriate Status) (Formal) Informal
 9. Age Paleogene Eocene Priabonian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both _____ Surface _____
 11. Bounding Units: Above Marrowstone Shale Below Lyre Fm. or ss. Scow Bay
 12. Lithology: Dominant sandstone _____ 90 %
 Subordinate siltstone _____ 10 %
 13. Thickness (Metric) 80-300 m _____
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ None _____ Disconformable _____ Angular _____
 Within: _____ X _____
 Below: _____ X _____
 15. Fossil Data: Foraminifera = Refugian Stage; Mollusca = Molopophorus stephensoni Zone = _____ Stage; lower Galvinian: Armentrout and Berta (1977)
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: None
 18. Other Data: Deposited in upper fan system - stacked channel sands.
 19. Original Reference: Durham, J. W., 1944, Megafossil zones of the Oligocene of northwestern Washington: University of California Publications in Geological Sciences, v. 27, no. 5, p. 181-212
 20. Most Significant Reference: Armentrout, John M., and Berta, Annalisa, 1977, Eocene-Oligocene Foraminiferal Sequence from the Quimper Peninsula, Northeast Olympic Peninsula, Washington: Journal of Foraminiferal Research, v. 7, no. 3, p. 215-233, 1 plate.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 8-12-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Northeast Olympic Peninsula
 5. Chart # _____ 6. Column # 16
 7. Name of Stratigraphic Unit Lyre Formation
 8. Stratigraphic Rank and Status: (Circle Appropriate Rank) Group (Formation) Member, Bed, (Circle Appropriate Status) (Formal) Informal
 9. Age Paleogene Eocene Lutetian-Bartonian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both _____ Surface _____
 11. Bounding Units: Above Quimper Sandstone Below Crescent Formation
 12. Lithology: Dominant conglomerate _____ 90 %
 Subordinate sandstone _____ 10 %
 13. Thickness (Metric) 25-175 m _____
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ None _____ Disconformable _____ Angular _____
 Within: _____ X _____
 Below: _____ X _____
 15. Fossil Data: Mollusca = Acila decisa assigned to "Tejon" Stage; Foraminifera of Townsend Shale Member assigned to Narizian Stage: Armentrout and Berta (1977)
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: None
 18. Other Data: Probable source of clasts is Vancouver Island to the north: probably deposited as part of subsea fan: see Ansfield, V. J., 1972, The stratigraphy and sedimentology of the Lyre Formation, Northwest Olympic Peninsula; unpublished PhD thesis, University of Washington, 131 p.
 19. Original Reference: Weaver, C. E., 1937, Tertiary stratigraphy of western Washington and northwestern Oregon: University of Washington Publications in Geological Sciences, v. 4, no. 1, 266 p.
 20. Most Significant Reference: Armentrout, John M., and Berta, Annalisa, 1977, Eocene-Oligocene Foraminiferal Sequence from the Quimper Peninsula, Northeast Olympic Peninsula, Washington: Journal of Foraminiferal Research, v. 7, no. 3, p. 215-233, 1 plate.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 8-12-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Northeast Olympic Peninsula
 5. Chart # _____ 6. Column # 16
 7. Name of Stratigraphic Unit Townsend Shale Member of Lyre Formation
 8. Stratigraphic Rank and Status: (Circle Appropriate Rank) Group (Formation) Member, Bed, (Circle Appropriate Status) (Formal) Informal
 9. Age Paleogene Eocene Lutetian-Bartonian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both _____ Surface _____
 11. Bounding Units: Above Quimper Sandstone Below Within Lyre Formation
 12. Lithology: Dominant siltstone-fine sandstone _____ 90 %
 Subordinate claystone _____ 10 %
 13. Thickness (Metric) 30 m _____
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ None _____ Disconformable _____ Angular _____
 Within: _____ X _____
 Below: _____ X _____
 15. Fossil Data: Foraminifera of Narizian Stage; Mollusca of "Tejon" Stage: Armentrout and Berta (1977).
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: None
 18. Other Data: Originally defined as formation - included as member of Lyre Formation by Allison, R. C., 1959, Geology and Eocene megafaunal paleontology of the Quimper Peninsula Area, Washington: unpub. M.S. thesis, University of Washington, 121 p.
 19. Original Reference: Durham, J. W., 1944, Megafossil zones of the Oligocene of northwestern Washington: University of California Publications in Geological Sciences, v. 27, no. 5, p. 181-212.
 20. Most Significant Reference: Armentrout, John M., and Berta, Annalisa, 1977, Eocene-Oligocene Foraminiferal Sequence from the Quimper Peninsula, Northeast Olympic Peninsula, Washington: Journal of Foraminiferal Research, v. 7, no. 3, p. 215-233, 1 plate.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 8-12-82

16. NORTHEAST OLYMPIC PENINSULA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Northeast Olympic Peninsula
 5. Chart # _____ 6. Column # 16
 7. Name of Stratigraphic Unit sandstone of Scow Bay
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene Ypresian-Bartonian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Quimper Sandstone Below Unknown-probably Crescent
 12. Lithology: Dominant sandstone _____ 90 %
 Subordinate shale _____ 10 %
 13. Thickness (Metric 130-660 m) _____
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ None _____ Disconformable _____ Angular _____
 Within: _____ _____ _____ _____
 Below: Unknown _____
 15. Fossil Data: Foraminifera assigned to late Ulatisian-early Narizian Stage by Armentrout and Berta (1977): Nannofossils assigned to NP Zones 14, 15 and 16 of Martini's Zonation (1970) by Worsley and Creelins (1972)
 16. Radiometric Data: None Years Method _____
 Source: Basaltic dikes cut formation - could be dated
 17. Economic Data: None
 18. Other Data: Deposited as part of subsea fan system - lower to middle fan sequence. "Unnamed Eocene Unit" of Armentrout and Berta, 1977.
 19. Original Reference: Allison, R. C., 1959, Geology and Eocene megafaunal paleontology of the Quimper Peninsula area, Washington: unpub. M.S. thesis, University of Washington, 121 p.
 20. Most Significant Reference: Armentrout, John M., and Berta, Annalisa, 1977, Eocene-Oligocene Foraminiferal Sequence from the Quimper Peninsula, Northeast Olympic Peninsula, Washington: Journal of Foraminiferal Research, v. 7, no. 3, p. 215-233, 1 plate.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 8-12-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Northeast Olympic Peninsula
 5. Chart # _____ 6. Column # 16
 7. Name of Stratigraphic Unit sandstone of Maynard
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene Ypresian-Lutetian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Probably Lyre Formation or Scow Bay Below Crescent Formation
 12. Lithology: Dominant sandstone _____ 90 %
 Subordinate conglomerate _____ 5 %
 13. Thickness (Metric 250 m) _____
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ None _____ Disconformable _____ Angular _____
 Within: _____ _____ _____ _____
 Below: x _____
 15. Fossil Data: Tellina soledadensis, Pyramidella etheringtoni, Nitidavenus conradi, Eohemithyris alexi suggest correlation with Penutian-Ulatisian Stage strata: V.S. Mallory, written communication, August 1982
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: None
 18. Other Data: Basaltic sandstones probably derived from Crescent Formation volcanics. Isolated outcrops of lithic sandstone mapped as Maynard may actually be sandstone of Scow Bay or Quimper Sandstone.
 19. Original Reference: Thoms, R. E., 1959, The geology and Eocene biostratigraphy of the southern Quimper Peninsula area, Washington: unpub. M.S. thesis, University of Washington, 102 p.
 20. Most Significant Reference: Allison, R. C., 1959, Geology and Eocene megafaunal paleontology of the Quimper Peninsula Area, Washington: unpub. M.S. thesis University of Washington, 121 p.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 8-12-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 710
 4. Column Name Northeast Olympic Peninsula
 5. Chart # _____ 6. Column # 16
 7. Name of Stratigraphic Unit Crescent Formation
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene Thanetian-Lutetian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Lyre or Quimper Formations Below Unknown
 12. Lithology: Dominant basalt _____ 80 %
 Subordinate sandstone _____ 20 %
 13. Thickness (Metric 230-1000+ m) _____
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ None _____ Disconformable _____ Angular _____
 Within: _____ _____ _____ _____
 Below: Unknown _____
 15. Fossil Data: None locally - correlated to more western outcrops of Crescent Formation where foraminifera are assigned to Penutian-Ulatisian Age: Rau, W. W., 1964, Foraminifera from the northern Olympic Peninsula, Washington: U.S. Geological Survey Professional Paper 374-G, 33 p., 7 pls.
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: Used as road-rock from Mats-Mats quarry
 18. Other Data:
 19. Original Reference: Arnold, R., 1906, Geologic reconnaissance of the coast of the Olympic Peninsula, Washington: Geological Society of America Bulletin, v. 17, p. 451-468.
 20. Most Significant Reference: Cady, W. M., 1975, Tectonic setting of the Tertiary volcanic rocks of the Olympic Peninsula, Washington: U. S. Geological Survey Journal of Research, v. 3, p. 575-582.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 8-12-82

17. BREMERTON AREA

A. COMPOSITE SECTION LOCATION

Reference # _____ Location # _____
 Latitude 47° 30' N Longitude 122° 45' W
 County or Counties 035 Kitsap County
 State 46 Washington

Column Name: Bremerton Area

Chart Name: Cenozoic Stratigraphic Units - Western Oregon and Washington

General Location Description: Cenozoic section composited from units cropping out along the shoreline of Waterman Point, Orchard Point, Restoration Point and Blakeley Harbor, Kitsap County, Washington.

Principal Reference (with Biostratigraphy):

Fulmer, C. V., 1975, Stratigraphy and paleontology of the type Blakeley and Blakeley Harbor Formations, in Weaver, D. W., Hornaday, G. R., and Tipton, A., eds., Paleogene Symposium: Pacific Sections AAPG-SEPM-SEG, Long Beach, California, April 1975, p. 210-271, 10 pls.

Column Authors: W. W. Rau, State of Washington
J. M. Armentrout, Mobil Oil Corporation
D. J. Easterbrook, Western Washington University

B. DATA SHEETS FOR EACH STRATIGRAPHIC UNIT ON CORRELATION CHART

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Bremerton Area
 5. Chart # _____ 6. Column # 17
 7. Name of Stratigraphic Unit Fraser Drift
 8. Stratigraphic Rank and Status: Formation Member, Bed, _____
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Quaternary Pleistocene Wisconsin
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above alluvium Below Olympia sediments
 12. Lithology: Dominant glacial drift 88 %
 Subordinate lake silts 2 %
 13. Thickness (Metric 3-70 m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: None Disconformable Angular
 Within: X
 Below: X
 15. Fossil Data: Marine shells in Bellingham glaciomarine drift member. Wood occurs in both silt and clay units and till units.
 16. Radiometric Data: 10,000-18,000 Years Method Radiocarbon
 Source: _____
 17. Economic Data: Sand and gravel
 18. Other Data: Fraser Drift includes: 1) Samas Stade (youngest)
 2) Everson Interstade
 3) Vashon Stade
 4) Evans Creek Stade (oldest)
 19. Original Reference: Armstrong, J. E., Crandell, D. R., Easterbrook, D. J., Noble, J., 1965, Late Pleistocene stratigraphy and chronology in southwestern British Columbia and northwestern Washington: Geological Society of America Bulletin, v. 76, p. 321-330.
 20. Most Significant Reference: Easterbrook, D. J., 1969, Pleistocene chronology of the Puget Lowland and San Juan Islands, Washington: Geological Society of America Bulletin, v. 80, p. 2273-2286.
 21. Author(s) of Sheet Preparation: D. J. Easterbrook with additions by J. M. Armentrout
 22. Date Prepared: 2-21-83 2-28-83

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Bremerton Area
 5. Chart # _____ 6. Column # 17
 7. Name of Stratigraphic Unit Olympia sediments
 8. Stratigraphic Rank and Status: Formation Member, Bed, _____
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Quaternary Pleistocene Wisconsin
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Fraser Drift Below Possession Drift
 12. Lithology: Dominant silt 75 %
 Subordinate peat and sand 25 %
 13. Thickness (Metric 3-20 m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: None Disconformable Angular
 Within: X
 Below: X
 15. Fossil Data: Wood and shells
 16. Radiometric Data: 18,000-28,000 Years Method Radiocarbon
 Source: _____
 17. Economic Data: _____
 18. Other Data: Non-glacial deposits
 19. Original Reference: Armstrong, J. E., Crandell, D. R., Easterbrook, D. J., and Noble, J., 1965, Late Pleistocene stratigraphy and chronology in southwestern British Columbia and northwestern Washington: Geological Society of America Bulletin, v. 76, p. 321-330.
 20. Most Significant Reference: Easterbrook, D. J., 1969, Pleistocene chronology of the Puget Lowland and San Juan Islands, Washington: Geological Society of America Bulletin, v. 80, p. 2273-2286.
 21. Author(s) of Sheet Preparation: D. J. Easterbrook
 22. Date Prepared: 2-21-83

17. BREMERTON AREA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Bremerton Area
 5. Chart # _____ 6. Column # 17
 7. Name of Stratigraphic Unit Possession Drift
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Quaternary Pleistocene
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Olympia sediments Below Whidbey Formation
 12. Lithology: Dominant drift 99 %
 Subordinate silt 1 %
 13. Thickness (Metric 3-60 m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: None Disconformable Angular
 Within: _____ X _____
 Below: _____ X _____
 15. Fossil Data: Shells and wood in glaciomarine drift
 16. Radiometric Data: 35,000- Years Method Radiocarbon and Amino Acid
 Source: 80,000
 17. Economic Data:
 18. Other Data: Type locality is at Possession Point, Whidbey Island, Washington
 19. Original Reference: Easterbrook, D. J., Crandell, D. R., and Leopold, E. B., 1967, Pre-Olympia stratigraphy and chronology in the central Puget Lowland, Washington: Geological Society of America Bulletin, v. 78, p. 13-20.
 20. Most Significant Reference: Easterbrook, D. J., 1969, Pleistocene chronology of the Puget Lowland and San Juan Islands, Washington: Geological Society of America Bulletin, v. 80, p. 2273-2286.
 21. Author(s) of Sheet Preparation: D. J. Easterbrook
 22. Date Prepared: 2-21-83

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Bremerton Area
 5. Chart # _____ 6. Column # 17
 7. Name of Stratigraphic Unit Whidbey Formation
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Quaternary Pleistocene
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Possession Drift Below Double Bluff Drift
 12. Lithology: Dominant sand 70 %
 Subordinate silt 30 %
 13. Thickness (Metric 3-85 m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: None Disconformable Angular
 Within: _____ X _____
 Below: _____ X _____
 15. Fossil Data: Mammuthus cf. M. (Parelephas) columbi skeletal fragments including cheek teeth, fourth premolar, hyoid bone, first cervical vertebra, and fragment of ulna. Wood also occurs in silts.
 16. Radiometric Data: 100,000 Years Method Amino Acid
 Source: _____
 17. Economic Data:
 18. Other Data: Section of both Whidbey Formation and Double Bluff Drift is well exposed in sea cliffs between SE 1/4 NE 1/4 sec. 28, and the SE 1/4 NW 1/4 sec. 26, T. 26 N., R. 2 E., southwestern end of Whidbey Island.
 19. Original Reference: Easterbrook, D. J., Crandell, D. R., and Leopold, E. B., 1967, Pre-Olympia stratigraphy and chronology in the central Puget Lowland, Washington: Geological Society of America Bulletin, v. 78, p. 13-20.
 20. Most Significant Reference: Easterbrook, D. J., 1969, Pleistocene chronology of the Puget Lowland and San Juan Islands, Washington: Geological Society of America Bulletin, v. 80, p. 2273-2286.
 21. Author(s) of Sheet Preparation: D. J. Easterbrook with additions by J. M. Ammentrout
 22. Date Prepared: 2-21-83 2-28-83

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Bremerton Area
 5. Chart # _____ 6. Column # 17
 7. Name of Stratigraphic Unit Double Bluff Drift
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Quaternary Pleistocene
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Whidbey Formation Below undifferentiated terrace
 12. Lithology: Dominant glacial drift 95 %
 Subordinate silt 5 %
 13. Thickness (Metric 3-35 m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: None Disconformable Angular
 Within: _____ X _____
 Below: _____ X _____
 15. Fossil Data: Wood and shells
 16. Radiometric Data: 150,000- Years Method Amino Acid
 Source: 250,000
 17. Economic Data:
 18. Other Data: Section of both Double Bluff Drift and Whidbey Formation crops out at sea cliffs between SE 1/4 NE 1/4 sec. 28 and the SE 1/4 NW 1/4 sec. 26, T. 26 N., R. 2 E., southwestern end of Whidbey Island, Washington.
 19. Original Reference: Easterbrook, D. J., Crandell, D. R., and Leopold, E. B., 1967, Pre-Olympia stratigraphy and chronology in the central Puget Lowland, Washington: Geological Society of America Bulletin, v. 78, p. 13-20.
 20. Most Significant Reference: Easterbrook, D. J., 1969, Pleistocene chronology of the Puget Lowland and San Juan Islands, Washington: Geological Society of America Bulletin, v. 80, p. 2273-2286.
 21. Author(s) of Sheet Preparation: D. J. Easterbrook with additions by J. M. Ammentrout
 22. Date Prepared: 2-21-83 2-28-83

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Bremerton Area
 5. Chart # _____ 6. Column # 17
 7. Name of Stratigraphic Unit undifferentiated terrace deposits
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Quaternary Pleistocene
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Whidbey Formation Below older units
 12. Lithology: Dominant sands 70 %
 Subordinate gravels 30 %
 13. Thickness (Metric 0-40 m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: None Disconformable Angular
 Within: _____ X _____
 Below: _____ X _____
 15. Fossil Data: None
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: Sand and gravel
 18. Other Data: Shown as Quaternary on most maps: includes "Older Glacial Drift" of Geologic Map of Washington: Huntting, M. P., and others, 1961.
 19. Original Reference: Bennett, W.A.G., Livingston, V. E., Jr., and Moen, W. S., compilers, 1961, Geologic map of Washington: Washington Division of Mines and Geology, scale 1:500,000.
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: J. M. Ammentrout
 22. Date Prepared: 9-30-82

17. BREMERTON AREA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Bremerton Area
 5. Chart # _____ 6. Column # 17
 7. Name of Stratigraphic Unit Blakeley Formation of Weaver, 1937
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene/Neogene Eocene-Miocene Priabonian-Burdigalian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above alluvium and glacial deposits Below Eocene volcanic rocks
 12. Lithology: Dominant conglomerate _____ 80 %
 Subordinate sandstone and siltstone _____ 40 %
 13. Thickness (Metric 2550 m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ None _____ Disconformable _____ Angular _____
 Within: _____
 Below: _____
 15. Fossil Data: Refugian-Zemorian Foraminifera in lower half (see Fulmer, 1975):
Type section for "Blakeley Stage" of Weaver and others, 1944, Correlation of Marine
Cenozoic Formations of western North America: Geological Society of America
Bulletin, v. 55, p. 569-598.
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: _____
 18. Other Data: Included rocks now assigned to the Blakeley Formation of Fulmer (1975)
and Blakeley Harbor Formation of Fulmer (1975).
 19. Original Reference: Weaver, C. E., 1912, A preliminary report on the Tertiary
paleontology of Western Washington: Bulletin of Washington Geologic Survey,
No. 15, p. 1-18, 15 pls.
 20. Most Significant Reference: Fulmer, C. V., 1975, Stratigraphy and paleontology of the
type Blakeley and Blakeley Harbor Formations, in Weaver, D. W., Hornaday, G. R., and
Tipton, A., eds., Paleogene Symposium: Pacific Sections AAPG-SEPM-SEG, Long
Beach, California, April 1975, p. 210-271, 10 pls.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 9-30-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Bremerton Area
 5. Chart # _____ 6. Column # 17
 7. Name of Stratigraphic Unit Blakeley Harbor Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Neogene Miocene Aquitanian-Burdigalian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Pleistocene units Below Blakeley Formation
 12. Lithology: Dominant conglomerate with ss matrix _____ 95 %
 Subordinate carbonaceous siltstone, mudst. and coal _____ 5 %
 13. Thickness (Metric 1000 m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ None _____ Disconformable _____ Angular _____
 Within: _____
 Below: _____
 15. Fossil Data: Non-marine: age by regional correlation and superposition:
see Fulmer, 1975.
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: _____
 18. Other Data: _____
 19. Original Reference: Fulmer, C. V., 1975, Stratigraphy and paleontology of the type
Blakeley and Blakeley Harbor Formations, in Weaver, D. W., Hornaday, G. R., and
Tipton, A., eds., Paleogene Symposium: Pacific Sections AAPG-SEPM-SEG,
Long Beach, California, April 1975, p. 210-271, 10 pls.
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 9-30-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Bremerton Area
 5. Chart # _____ 6. Column # 17
 7. Name of Stratigraphic Unit Blakeley Formation of Fulmer, 1975
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene-Oligocene Priabonian-Chattian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Blakeley Harbor Formation Below Eocene volcanic rocks
 12. Lithology: Dominant sandstone and siltstone _____ 70 %
 Subordinate conglomerate _____ 30 %
 13. Thickness (Metric 1550 m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ None _____ Disconformable _____ Angular _____
 Within: _____
 Below: _____
 15. Fossil Data: Refugian-Zemorian Foraminiferal Stages - See Fulmer (1975)
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: _____
 18. Other Data: _____
 19. Original Reference: Fulmer, C. V., 1975, Stratigraphy and paleontology of the
type Blakeley and Blakeley Harbor Formations, in Weaver, D. W., Hornaday, G. R.,
and Tipton, A., eds., Paleogene Symposium: Pacific Sections AAPG-SEPM-SEG,
Long Beach, California, April 1975, p. 210-271, 10 pls.
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 9-30-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Bremerton Area
 5. Chart # _____ 6. Column # 17
 7. Name of Stratigraphic Unit Restoration Point Member of Blakeley Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Oligocene Chattian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Blakeley Harbor Formation Below Orchard Point Member
 12. Lithology: Dominant basaltic sandstone _____ 50 %
 Subordinate tuffaceous shale _____ 50 %
 13. Thickness (Metric 500 m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ None _____ Disconformable _____ Angular _____
 Within: _____
 Below: _____
 15. Fossil Data: Zemorian Foraminiferal Stage (see Fulmer, 1975)
 16. Radiometric Data: None Years Method
 Source: _____
 17. Economic Data: _____
 18. Other Data: _____
 19. Original Reference: Fulmer, C. V., 1975, Stratigraphy and paleontology of the
type Blakeley and Blakeley Harbor Formations, in Weaver, D. W., Hornaday, G. R.,
and Tipton, A., eds., Paleogene Symposium: Pacific Sections AAPG-SEPM-SEG,
Long Beach, California, April 1975, p. 210-271, 10 pls.
 20. Most Significant Reference: same
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 9-30-82

17. BREMERTON AREA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Bremerton Area
 5. Chart # _____ 6. Column # 17
 7. Name of Stratigraphic Unit Orchard Point Conglomerate Member of Blakeley Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Oligocene _____ Rupelian _____
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Restoration Point Member Below Refugian beds
 12. Lithology: Dominant conglomerate, basaltic _____ 50 %
 Subordinate sandstone and shale, tuffaceous _____ 50 %
 13. Thickness (Metric 850 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: X _____
 Within: _____
 Below: X _____
 15. Fossil Data: Zemurian Foraminiferal Stage (See Fulmer, 1975)
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: _____
 18. Other Data: Fulmer uses Orchard Pt Mbr. - U. S. Geological Survey Geologic names used Orchard Point Conglomerate Member
 19. Original Reference: Fulmer, C. V., 1975, Stratigraphy and paleontology of the type Blakeley and Blakeley Harbor Formations, in Weaver, D. W., Hornaday, G. R., and Tipton, A., eds., Paleogene Symposium: Pacific Sections AAPG-SEPM-SEG, Long Beach, California, April 1975, p. 210-271, 10 pls.
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 9-30-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Bremerton Area
 5. Chart # _____ 6. Column # 17
 7. Name of Stratigraphic Unit Refugian beds of Blakeley Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene _____ Priabonian _____
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Orchard Point Mbr./Blakeley Fm. Below ? Eocene volcanic rocks
 12. Lithology: Dominant siltstone-tuffaceous _____ 50 %
 Subordinate sandstone and conglomerate _____ 50 %
 13. Thickness (Metric 200 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: X _____
 Within: X _____
 Below: _____ X _____
 15. Fossil Data: Refugian Foraminiferal Stage (see Fulmer, 1975)
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: _____
 18. Other Data: _____
 19. Original Reference: Fulmer, C. V., 1975, Stratigraphy and paleontology of the type Blakeley and Blakeley Harbor Formations, in Weaver, D. W., Hornaday, G. R., and Tipton, A., eds., Paleogene Symposium: Pacific Sections AAPG-SEPM-SEG, Long Beach, California, April 1975, p. 210-271, 10 pls.
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 9-30-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Bremerton Area
 5. Chart # _____ 6. Column # 17
 7. Name of Stratigraphic Unit Undifferentiated Eocene volcanic rocks
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene _____ ? Ypresian ? Priabonian _____
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Both
 11. Bounding Units: Above Blakeley Formation Below Unknown
 12. Lithology: Dominant basalt _____ 70 %
 Subordinate basaltic sandstone _____ 30 %
 13. Thickness (Metric 100+ m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____ X _____
 Within: _____
 Below: Unknown _____
 15. Fossil Data: None
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: road rock
 18. Other Data: Mapped as "middle and lower Eocene volcanic rocks" on Geologic Map of Washington, Huntting and others, 1961. These rocks could be either Crescent or Tukwila equivalents, or both.
 19. Original Reference: Huntting, M. T., Bennett, W.A.G., Livingston, V. E., Jr., and Moen, W. S., compilers, 1961, Geologic map of Washington: Washington Division of Mines and Geology, scale 1:500,000.
 20. Most Significant Reference: _____
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 9-30-82

18. SEATTLE AREA

A. COMPOSITE SECTION LOCATION

Reference # _____ Location # _____
 Latitude 47° 30' N Longitude 122° 10' W
 County or Counties 033 King County
 State 46 Washington

Column Name: Seattle Area

Chart Name: Cenozoic Stratigraphic Units - Western Oregon and Washington

General Location Description: Cenozoic section composited from local outcrops along Puget Sound shoreline, river and stream valleys, and road and railroad cuts between Seattle and Hobart, King County, Washington

Principal Reference:

Vine, J. D., 1969, Geology and coal resources of the Cumberland, Hobart, and Maple Valley quadrangles, King County, Washington: U. S. Geological Survey Professional Paper 624, 67 p.

Biostratigraphy:

Wolfe, J. A., 1968, Paleogene biostratigraphy of nonmarine rocks in King County, Washington: U. S. Geological Survey Professional Paper 571, 33 p., 7 pls.

Column Authors: J. M. Armentrout, Mobil Oil Corporation
 V. A. Frizzell, Jr., U. S. Geological Survey
 D. J. Easterbrook, Western Washington University

B. DATA SHEETS FOR EACH STRATIGRAPHIC UNIT ON CORRELATION CHART

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Seattle Area 5. Chart # _____ 6. Column # 18
 7. Name of Stratigraphic Unit Fraser Drift
 8. Stratigraphic Rank and Status: Formation Member, Bed, _____
 (Circle Appropriate Rank) Group (Formal) Informal
 9. Age Quaternary Pleistocene Wisconsin
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above alluvium Below Olympia sediments
 12. Lithology: Dominant glacial drift 98 %
 Subordinate lake silt 2 %
 13. Thickness (Metric 0-40m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: None Disconformable Angular
 Within: x
 Below: x
 15. Fossil Data: Martac shells in Bellingham glaciomarine drift member. Wood occurs in both silt and clay units and till units.
 16. Radiometric Data: 10,000-18,000 Years Method Radiocarbon
 Source: Easterbrook, D. J., 1969, Pleistocene chronology of the Puget Lowland and San Juan Islands, Washington: Geological Society of America Bulletin, v. 80, p. 2273-2286.
 17. Economic Data: Sand and gravel
 18. Other Data: Fraser Drift includes: 1) Sumas Stade (youngest)
 2) Vashon Stade
 3) Everson Interstade
 4) Evans Creek Stade (oldest)
 19. Original Reference: Willis, Bailey, 1898, Drift phenomena of Puget Sound, Washington: Geological Society of America Bulletin, v. 9, p. 111-162
 20. Most Significant Reference: Armstrong, J. E., Crandell, D. R., Easterbrook, D. J., and Noble, J. B., 1965, Late Pleistocene stratigraphy and chronology in southwestern British Columbia and northwestern Washington: Geological Society of America Bulletin, v. 76, p. 321-330.
 21. Author(s) of Sheet Preparation: D. J. Easterbrook with additions by J. M. Armentrout
 22. Date Prepared: 2-21-83 2-28-83

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Seattle Area 5. Chart # _____ 6. Column # 18
 7. Name of Stratigraphic Unit Olympia sediments
 8. Stratigraphic Rank and Status: Formation Member, Bed, _____
 (Circle Appropriate Rank) Group (Formal) Informal
 9. Age Quaternary Pleistocene Wisconsin
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Fraser Drift Below older Cenozoic units
 12. Lithology: Dominant silt 75 %
 Subordinate peat and sand 25 %
 13. Thickness (Metric 1-100 m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: None Disconformable Angular
 Within: x
 Below: x
 15. Fossil Data: Wood and shells
 16. Radiometric Data: 18,000-28,000 Years Method Radiocarbon
 Source: Easterbrook, D. J., 1969, Pleistocene chronology of the Puget Lowland and San Juan Islands, Washington: Geological Society of America Bulletin, v. 80, p. 2273-2286.
 17. Economic Data:
 18. Other Data: Mapped as glacial drift by Huntting and others, 1961, Geologic map of Washington, State of Washington, 2 sheets.
 19. Original Reference: Armstrong, J. E., Crandell, D. R., Easterbrook, D. J., Noble, J., 1965, Late Pleistocene stratigraphy and chronology in southwestern British Columbia and northwestern Washington: Geological Society of America Bulletin, v. 76, p. 321-330.
 20. Most Significant Reference: Huntting, M. T., Bennett, W.A.G., Livingston, V. E., Jr. and Moen, M. S., compilers, 1961, Geologic map of Washington: Washington Division of Mines and Geology, scale 1:500,000.
 21. Author(s) of Sheet Preparation: D. J. Easterbrook with additions by J. M. Armentrout
 22. Date Prepared: 2-21-83 2-28-83

18. SEATTLE AREA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Seattle Area
 5. Chart # _____ 6. Column # 18
 7. Name of Stratigraphic Unit undifferentiated fluvial and glacial deposits
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Quaternary Pleistocene
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above alluvium Below various older units
 12. Lithology: Dominant sand and gravels 100 %
 Subordinate _____ _____ %
 13. Thickness (Metric) 1-100 m
 14. Major Unconformities: - Check Appropriate Line -
 Above: None Disconformable Angular
 Within: _____ X _____
 Below: _____ _____ X
 15. Fossil Data: None
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: Sand and gravel
 18. Other Data: Mapped as older glacial deposits, landslide debris and mudflow deposits
 19. Original Reference:
 20. Most Significant Reference: Hunting, M. T., Bennett, W.A.G., Livingston, V. E., Jr. and Moen, W. S., compilers, 1961, Geologic map of Washington: Washington Division of Mines and Geology, scale 1:500,000.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 1-18-83

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Seattle Area
 5. Chart # _____ 6. Column # 18
 7. Name of Stratigraphic Unit continental sedimentary rocks of Miocene age
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Neogene Miocene ? Serravallian - ? Messinian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Wells
 11. Bounding Units: Above Pleistocene Below older units
 12. Lithology: Dominant sandstones 750 %
 Subordinate siltstones 750 %
 13. Thickness (Metric) ? 10+ m
 14. Major Unconformities: - Check Appropriate Line -
 Above: None Disconformable Angular
 Within: _____ _____ ? X
 Below: _____ _____ ? X
 15. Fossil Data: Reported as Miocene from wells - palynology imprecise. Local nonmarine outcrops sometimes called Oligocene/Miocene - not documented.
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data:
 18. Other Data: Probable lateral equivalents of part of Miocene Cascade Range volcanics
 19. Original Reference:
 20. Most Significant Reference:
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 10-16-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Seattle Area
 5. Chart # _____ 6. Column # 18
 7. Name of Stratigraphic Unit marine sedimentary rocks
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene-Oligocene Priabonian-Chattian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Both
 11. Bounding Units: Above glacial deposits and alluvium Below Renton Formation
 12. Lithology: Dominant siltstone 70 %
 Subordinate sandstone 30 %
 13. Thickness (Metric) 0-400+ m
 14. Major Unconformities: - Check Appropriate Line -
 Above: None Disconformable Angular
 Within: _____ _____ X
 Below: _____ X _____
 15. Fossil Data: Molluscan fauna similar to Blakeley Formation fauna
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data:
 18. Other Data: Eastern near-shore facies of Blakeley Formation which occurs at Blakeley Harbor, near Bremerton, Washington.
 19. Original Reference:
 20. Most Significant Reference:
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 10-16-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Seattle Area
 5. Chart # _____ 6. Column # 18
 7. Name of Stratigraphic Unit andesitic volcanic rocks
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene-Oligocene Priabonian-Chattian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above continental sed. rks. of Miocene Below Renton Fm
 12. Lithology: Dominant volcanics 100 %
 Subordinate _____ _____ %
 13. Thickness (Metric) 0-100+ m
 14. Major Unconformities: - Check Appropriate Line -
 Above: None Disconformable Angular
 Within: _____ _____ X
 Below: _____ X _____
 15. Fossil Data: by lateral correlation with Ohanapecosh Fm. - See Wolfe, J. A., 1968, Paleogene biostratigraphy of nonmarine rocks in King County, Washington: U. S. Geological Survey Professional Paper 571, 33 p., 7 p.s.
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data:
 18. Other Data: Occur as local intrusions in Seattle area and as western facies of Cascade Range units: lateral equivalents of Ohanapecosh Formation
 19. Original Reference: Vine, J. D., 1961, Preliminary geology map of the Hobart and Maple Valley quadrangles, King County, Washington: Washington Division of Mines and Geology, Geologic Map GM-1
 20. Most Significant Reference: Vine, J. D., 1969, Geology and coal resources of the Cumberland, Hobart, and Maple Valley quadrangles, King County, Washington: U. S. Geological Survey Professional Paper 624, 67 p.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 10-16-82

18. SEATTLE AREA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Seattle Area
 5. Chart # _____ 6. Column # 18
 7. Name of Stratigraphic Unit Puget Group
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene Lutetian-Priabonian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above marine or volcanic rocks Below Raging River Formation
 12. Lithology: Dominant sedimentary rocks _____ 50 %
 Subordinate volcanics _____ 50 %
 13. Thickness (Metric) 2100-4800 m
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ None _____ Disconformable _____ Angular _____
 Within: _____ x _____
 Below: _____ x _____
 15. Fossil Data: Megafossils - See Wolfe, J. A., 1981, A chronologic framework for Cenozoic megafossil floras of northwestern North America and its relation to marine geochronology: Geological Society of America Special Paper 184, p. 39-47.
 16. Radiometric Data: 41-42 million Years Method K/Ar & Fission track
 Source: See Tukwila Formation

17. Economic Data: Coal
 18. Other Data: See Tiger Mountains, Tukwila and Renton Formations
 19. Original Reference: White, C. A., 1888, On the Puget Group of Washington Territory: American Journal of Science, 3rd Series, v. 36, p. 443-450.
 20. Most Significant Reference: Vine, J. D., 1969, Geology and coal resources of the Cumberland, Hobart, and Maple Valley quadrangles, King County, Washington: U. S. Geological Survey Professional Paper 624, 67 p.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 10-16-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Seattle Area
 5. Chart # _____ 6. Column # 18
 7. Name of Stratigraphic Unit Renton Formation
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation Member, Bed, _____ of Puget Group
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene Bartonian-Priabonian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above marine or volcanic rocks Below Tukwila Formation
 12. Lithology: Dominant sandstone _____ 70 %
 Subordinate coal, carbonaceous siltstone, claystone _____ 30 %
 13. Thickness (Metric) 640-1200 m
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ None _____ Disconformable _____ Angular _____
 Within: _____ x _____
 Below: _____ x _____
 15. Fossil Data: Megafossil studied by Wolfe, J. A., 1968, Paleogene biostratigraphy of nonmarine rocks in King County, Washington: U. S. Geological Survey Prof. Paper 571, 33 p, 7 pls. - See also Wolfe, J. A., 1981, in Geological Society of America Special Paper 184, p. 39-47.
 16. Radiometric Data: None Years _____ Method _____
 Source: _____

17. Economic Data: Coal; potential hydrocarbon reservoir rock
 18. Other Data:
 19. Original Reference: Waldron, H. H., 1962, Geology of the Des Moines quadrangle, Washington: U. S. Geological Survey quadrangle map G.Q.-159.
 20. Most Significant Reference: Vine, J. D., 1969, Geology and coal resources of the Cumberland, Hobart, and Maple Valley quadrangles, King County, Washington: U. S. Geological Survey Professional Paper 624, 67 p.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 10-16-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Seattle Area
 5. Chart # _____ 6. Column # 18
 7. Name of Stratigraphic Unit Tukwila Formation
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation Member, Bed, _____ of Puget Group
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene Lutetian-Bartonian-Priabonian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Renton Formation Below Tiger Mountain Formation
 12. Lithology: Dominant volcanics _____ 80 %
 Subordinate sandstones _____ 20 %
 13. Thickness (Metric) 750-2000 m
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ x _____ None _____ Disconformable _____ Angular _____
 Within: _____ x _____
 Below: _____ x _____
 15. Fossil Data: None
 16. Radiometric Data: 41 and 42.0 million Years _____ fission track and K/Ar:
 Source: See Frizzell, V. A., Jr., 1979; Petrology and stratigraphy of Paleogene nonmarine sandstones, Cascade Range, Washington: U. S. Geological Survey Open-File Report 79-1149, 151 p.
 17. Economic Data: Road rock

18. Other Data: Gradational and interbedded with Tiger Mountain Formation and Renton Formation.
 19. Original Reference: Waldron, H. H., 1962, Geology of the Des Moines quadrangle, Washington: U. S. Geological Survey Quad Map G.Q. 159
 20. Most Significant Reference: Vine, J. D., 1969, Geology and coal resources of the Cumberland, Hobart, and Maple Valley quadrangles, King County, Washington: U. S. Geological Survey Professional Paper 624, 67 p.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 10-16-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Seattle Area
 5. Chart # _____ 6. Column # 18
 7. Name of Stratigraphic Unit Tiger Mountain Formation
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation Member, Bed, _____ of Puget Group
 (Circle Appropriate Status) Formal Informal
 9. Age Paleogene Eocene Lutetian-Bartonian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Tukwila Formation Below Raging River Formation
 12. Lithology: Dominant sandstone _____ 95 %
 Subordinate siltstone _____ 5 %
 13. Thickness (Metric) 600 m
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ x _____ None _____ Disconformable _____ Angular _____
 Within: _____ x _____
 Below: _____ x _____
 15. Fossil Data: Megafossil described by J. A. Wolfe, 1968, Paleogene biostratigraphy of nonmarine rocks in King County Washington: U. S. Geological Society Professional Paper 571, 33 p., 7 pls.
 16. Radiometric Data: None Years _____ Method _____
 Source: _____

17. Economic Data: Possible hydrocarbon reservoir rock
 18. Other Data: Contacts gradational; lower from Raging River marine siltstones below to nonmarine sandstone of Tiger Mountain: upper from nonmarine sediments of Tiger Mountain to dominance of volcanics of Tukwila Formation.
 19. Original Reference: Vine, J. D., 1962, Stratigraphy of Eocene rocks in a part of King County, Washington: State of Washington Division of Mines and Geology Report of Investigations No. 21, 20 p.
 20. Most Significant Reference: Vine, J. D., 1969, Geology and coal resources of the Cumberland, Hobart, and Maple Valley quadrangles, King County, Washington: U. S. Geological Survey Professional Paper 624, 67 p.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 10-16-82

18. SEATTLE AREA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
4. Column Name Seattle Area
5. Chart # _____ 6. Column # 18
7. Name of Stratigraphic Unit Raging River Formation
8. Stratigraphic Rank and Status:
(Circle Appropriate Rank) Group (Formation) Member, Bed, _____
(Circle Appropriate Status) (Formal) Informal
9. Age Paleogene Eocene Lutetian
System Series Stage
10. Surface Subsurface or Both Surface and subsurface
11. Bounding Units: Above Tiger Mountain Fm. Below Unknown
12. Lithology: Dominant siltstone and claystone 70 %
Subordinate sandstone 30 %
13. Thickness (Metric 1000 m)
14. Major Unconformities: - Check Appropriate Line -
None Disconformable Angular
Above: x _____
Within: _____
Below: Unknown
15. Fossil Data: Forams = Bulimina cf. B. jacksonensis Zone (see Vine, 1962),
of upper Ulatian to lower Narizian Stages, Rau, 1981, Geological Society
of America Special Paper 184, p. 67-84.
16. Radiometric Data: None Years Method
Source: _____
17. Economic Data: Possible hydrocarbon source rock
18. Other Data: Marine rocks lithologically similar to the Raging River Formation crop
out near Seattle where they are interstratified with the Tukwila Formation;
see McWilliams, R.G., 1971, Biostratigraphy of the marine Eocene near Seattle,
Washington: Northwest Science, v. 45, no. 4, p. 276-287. Physical stratigraphy
suggests that the Tiger Mountain Formation wedges out in that area.
19. Original Reference: Vine, J. D., 1962, Stratigraphy of Eocene rocks in a part of
King County, Washington: State of Washington Division of Mines and Geology
Report of Investigations No. 21, 20 p.
20. Most Significant Reference: Vine, J. D., 1969, Geology and coal resources of the
Cumberland, Hobart, and Maple Valley quadrangles, King County, Washington:
U. S. Geological Survey Professional Paper 624, 67 p.
21. Author(s) of Sheet Preparation: J. M. Armentrout
22. Date Prepared: 10-16-82

19. CARBON RIVER AREA

A. COMPOSITE SECTION LOCATION

Reference # _____ Location # _____
 Latitude 47° 15' N Longitude 122° 5' W
 County or Counties 053 Pierce
 State 46 Washington
 Column Name: Carbon River Area
 Chart Name: Cenozoic Stratigraphic Units - Western Oregon and Washington
 General Location Description: Cenozoic section composited from units in and around the Lake Tapps quadrangle, Pierce County, Washington.

Principal Reference:

Gard, M. L., Jr., 1968, Bedrock geology of the Lake Tapps quadrangle, Pierce County, Washington: U. S. Geological Survey Professional Paper 388-B, 33 p.

Column Authors: V. A. Frizzell, Jr., U. S. Geological Survey
 D. J. Easterbrook, Western Washington University

B. DATA SHEETS FOR EACH STRATIGRAPHIC UNIT ON CORRELATION CHART

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Carbon River Area
 5. Chart # _____ 6. Column # 19
 7. Name of Stratigraphic Unit Fraser Drift
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Quaternary Pleistocene Wisconsin
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above alluvium Below Salmon Springs Drift
 12. Lithology: Dominant drift 98 %
 Subordinate lake silt 2 %
 13. Thickness (Metric 3-50 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____ x _____
 Within: _____ x _____
 Below: _____ x _____
 15. Fossil Data: Martac shells in Bellingham glaciomarine drift member. Wood occurs in both silt and clay units and till units.
 16. Radiometric Data: 10,000-18,000 Years Method Radiocarbon
 Source: Easterbrook, D. J., 1969, Pleistocene chronology of the Puget Lowland and San Juan Islands, Washington: Geological Society of America Bulletin, v. 80, p. 2273-2286. And new data.
 17. Economic Data:
 18. Other Data: Fraser Drift includes: 1) Sumas Stade (youngest)
 2) Vashon Drift
 3) Everson Interstade
 4) Evans Creek Stade (oldest)
 19. Original Reference: Armstrong, J. E., Crandell, D. R., Easterbrook, D. J., and Noble, J. B., 1965, Late Pleistocene stratigraphy and chronology in southwestern British Columbia and northwestern Washington: Geological Society of America Bulletin, v. 76, p. 321-330.
 20. Most Significant Reference: Strong, J. E., Crandell, D. R., Easterbrook, D. J., Noble, J. B., 1965, Late Pleistocene stratigraphy and chronology in southwestern British Columbia and northwestern Washington: Geological Society of America Bulletin, v. 76, p. 321-330.
 21. Author(s) of Sheet Preparation: D. J. Easterbrook additions by J. M. Ammentrout
 22. Date Prepared: 2-21-83 2-28-83

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Carbon River Area
 5. Chart # _____ 6. Column # 19
 7. Name of Stratigraphic Unit Salmon Springs Drift
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Quaternary Pleistocene
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Fraser Drift Below Puyallup Formation
 12. Lithology: Dominant gravel 80 %
 Subordinate till 20 %
 13. Thickness (Metric 7-30 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____ x _____
 Within: _____ x _____
 Below: _____ x _____
 15. Fossil Data: Pollen dominantly pine and fir (Abies), small amount of spruce (Picea), Western hemlock and mountain hemlock.
 16. Radiometric Data: 800,000 Years Method Fission-track on ash
 Source: _____
 17. Economic Data:
 18. Other Data: Good section location - east wall of White River Valley in gully 150 feet east and another gully 400 feet north of southeast corner of the SW 1/4 Sec. 18, T. 20 N., R. 5 E., in vicinity of Salmon Springs, about 1 mile NE of Sumner, Washington.
 19. Original Reference: Crandell, D. R., Mullineaux, D. R., and Waldron, H. H., 1958, Pleistocene sequence in the southeastern part of the Puget Sound, Lowland, Washington: American Journal of Science, v. 256, p. 384-397.
 20. Most Significant Reference: Easterbrook, D. J., Briggs, N. A., Westgate, J. A., and Gorton, M. P., 1981, Age of the Salmon Springs Glaciation in Washington: Geology, v. 9, p. 87-93.
 21. Author(s) of Sheet Preparation: D. J. Easterbrook
 22. Date Prepared: 2-21-83

19. CARBON RIVER AREA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Carbon River Area
 5. Chart # _____ 6. Column # 19
 7. Name of Stratigraphic Unit Puyallup Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) (Formal) Informal
 9. Age Quaternary Pleistocene
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Salmon Springs Drift Below Stuck Drift
 12. Lithology: Dominant sand _____ 80 %
 Subordinate silt _____ 20 %
 13. Thickness (Metric) 12-40 m _____
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ None _____ Disconformable _____ Angular _____
 Within: _____ X _____
 Below: _____ X _____
 15. Fossil Data: Pollen studies indicate warming trend followed by cooling trend during deposition of Puyallup Formation.
 16. Radiometric Data: > 800,000 Years Method Fission-track
 Source: _____
 17. Economic Data: _____
 18. Other Data: Typical section-gullies under transmission line of Bonneville Power Administration in center section 1, T19N, R4E, about 0.5 miles southwest of Alderton, Washington.
 19. Original Reference: Crandell, D. R., Mullineaux, D. R., and Waldron, H. H., 1958, Pleistocene sequence in the southeastern part of the Puget Sound Lowland, Washington: American Journal of Science, v. 256, p. 384-397.
 20. Most Significant Reference: _____
 21. Author(s) of Sheet Preparation: D. J. Easterbrook
 22. Date Prepared: 2-21-83

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Carbon River Area
 5. Chart # _____ 6. Column # 19
 7. Name of Stratigraphic Unit Stuck Drift
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) (Formal) Informal
 9. Age Quaternary Pleistocene
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Puyallup Formation Below Alderton Formation
 12. Lithology: Dominant drift _____ 95 %
 Subordinate sand _____ 5 %
 13. Thickness (Metric) 3-9 m _____
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ None _____ Disconformable _____ Angular _____
 Within: _____ X _____
 Below: _____ X _____
 15. Fossil Data: None
 16. Radiometric Data: > 800,000 Years Method Fission-track
 Source: _____
 17. Economic Data: _____
 18. Other Data: _____
 19. Original Reference: Crandell, D. R., Mullineaux, D. R., and Waldron, H. H., 1958, Pleistocene sequence in the southeastern part of the Puget Sound Lowland, Washington: American Journal of Science, v. 256, p. 384-397.
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: D. J. Easterbrook
 22. Date Prepared: 2-21-83

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Carbon River Area
 5. Chart # _____ 6. Column # 19
 7. Name of Stratigraphic Unit Alderton Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) (Formal) Informal
 9. Age Quaternary Pleistocene
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Stuck Drift Below Orting Drift
 12. Lithology: Dominant sand _____ 65 %
 Subordinate mudflows _____ 35 %
 13. Thickness (Metric) 16 m _____
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ None _____ Disconformable _____ Angular _____
 Within: _____ X _____
 Below: _____ X _____
 15. Fossil Data: None
 16. Radiometric Data: > 800,000 Years Method Fission-track
 Source: _____
 17. Economic Data: _____
 18. Other Data: Consists of mudflow deposits, sand, pebble to boulder gravel; includes bed of pumice tuff.
 19. Original Reference: Crandell, D. R., Mullineaux, D. R., and Waldron, H. H., 1958, Pleistocene sequence in the southeastern part of the Puget Sound Lowland, Washington: American Journal of Science, v. 256, p. 384-397.
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: D. J. Easterbrook
 22. Date Prepared: 2-21-83

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Carbon River Area
 5. Chart # _____ 6. Column # 19
 7. Name of Stratigraphic Unit Orting Drift
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) (Formal) Informal
 9. Age Quaternary Pleistocene
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Alderton Formation Below nonmarine sedimentary rocks
 12. Lithology: Dominant drift _____ 90 %
 Subordinate sand _____ 10 %
 13. Thickness (Metric) 43-80 m _____
 14. Major Unconformities: - Check Appropriate Line -
 Above: _____ None _____ Disconformable _____ Angular _____
 Within: _____ X _____
 Below: _____ X _____
 15. Fossil Data: None
 16. Radiometric Data: > 800,000 Years Method Fission-track
 Source: _____
 17. Economic Data: _____
 18. Other Data: Older than Lily Creek Formation, younger than late Miocene
 19. Original Reference: Crandell, D. R., Mullineaux, D. R., and Waldron, H. H., 1958, Pleistocene sequence in the southeastern part of the Puget Sound Lowland, Washington: American Journal of Science, v. 256, p. 384-397.
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: D. J. Easterbrook
 22. Date Prepared: 2-21-83

19. CARBON RIVER AREA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Carbon River Area 6. Column # 19
 5. Chart # _____
 7. Name of Stratigraphic Unit undifferentiated fluvial and glacial deposits
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) Formal (Informal)
 9. Age Quaternary Pleistocene
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above alluvium Below various older units
 12. Lithology: Dominant sands and gravels 100%
 Subordinate _____
 13. Thickness (Metric) 1-100 m
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: _____
 Below: _____
 15. Fossil Data: None
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: Sand and gravel
 18. Other Data: Mapped as older glacial deposits, landslide debris and mudflow deposits
 19. Original Reference:
 20. Most Significant Reference: Hunting, M. T., Bennett, W.A.G., Livingston, V. E., Jr. and Moen, W. S., compilers, 1961, Geologic map of Washington: Washington Division of Mines and Geology, scale 1:500,000.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 1-18-83

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Carbon River Area 6. Column # 19
 5. Chart # _____
 7. Name of Stratigraphic Unit nonmarine sedimentary rocks of volcanic origin
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) Formal (Informal)
 9. Age Neogene Miocene ? Serravallian - ? Messinian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above alluvium Below Unknown?
 12. Lithology: Dominant sediments of volcanic origin 100%
 Subordinate _____
 13. Thickness (Metric) 0-40 m
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: _____
 Below: _____
 15. Fossil Data: Fossil leaves, see Gard, 1968, p. 823
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data:
 18. Other Data:
 19. Original Reference: Gard, M. L., Jr., 1968, Bedrock geology of the Lake Tapps quadrangle, Pierce County, Washington: U. S. Geological Survey Professional Paper 388-B, 33 p.
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: V. A. Frizzell, Jr.
 22. Date Prepared: 12-11-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Carbon River Area 6. Column # 19
 5. Chart # _____
 7. Name of Stratigraphic Unit Ohanapechosh Formation
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) Formal (Informal)
 9. Age Paleogene Oligocene Priabonian-Chattian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above various younger units Below Spiketon Formation
 12. Lithology: Dominant volcanics; flows and sediments 100%
 Subordinate _____
 13. Thickness (Metric) 3000+ m
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: _____
 Below: _____
 15. Fossil Data: Various plant remains, see Gard, 1968, p. 8-17
 16. Radiometric Data: 30-36 million Years Method Fission Track on ash outside Lake Tapps quadrangle
 Source: Vance, J. A., 1982, Cenozoic stratigraphy and tectonics in the Washington Cascades: Geological Society of America Abstracts, v. 14, no. 4, p. 241
 17. Economic Data:
 18. Other Data:
 19. Original Reference: Fiske, R.S., Hopson, C. A., and Waters, A. C., 1963, Geology of Mount Rainier National Park, Washington: U. S. Geological Survey Professional Paper 444, 93 p. maps
 20. Most Significant Reference: Gard, M. L., Jr., 1968, Bedrock geology of the Lake Tapps quadrangle, Pierce County, Washington: U. S. Geological Survey Professional Paper 388-B, 33 p.
 21. Author(s) of Sheet Preparation: V. A. Frizzell, Jr.
 22. Date Prepared: 12-10-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # _____
 4. Column Name Carbon River Area 6. Column # 19
 5. Chart # _____
 7. Name of Stratigraphic Unit Puget Group
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) Formal (Informal)
 9. Age Paleogene Eocene Lutetian-Priabonian
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Ohanapechosh Formation Below Unknown
 12. Lithology: Dominant sedimentary rocks 80%
 Subordinate volcanics 20%
 13. Thickness (Metric) 3200 m
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____
 Within: _____
 Below: Unknown
 15. Fossil Data: Megaflores - see Wolfe, J. A., 1968, Paleogene biostratigraphy of nonmarine rocks in King County, Washington: U. S. Geological Survey Professional Paper 571, 33 p., 7 pls.
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data:
 18. Other Data: See Carbonado, Northcraft and Spiketon Formations
 19. Original Reference: White, C. A., 1888, On the Puget Group of Washington Territory: American Journal of Science, 3rd Series, v. 36, p. 443-450.
 20. Most Significant Reference: Gard, L. M., Jr., 1968, Bedrock geology of the Lake Tapps quadrangle, Pierce County, Washington: U. S. Geological Survey Professional Paper 388-B, 33 p.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 10-16-82

19. CARBON RIVER AREA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Carbon River Area
 5. Chart # _____ 6. Column # 19
 7. Name of Stratigraphic Unit Spiketon Formation of Puget Group
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group (Formal) Member, Bed, _____
 (Circle Appropriate Status) (Formal) Informal
 9. Age Paleogene Eocene Bartonian-Priabonian
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Ohanapecosh Formation Below Northcraft Formation
 12. Lithology: Dominant sedimentary 100%
 Subordinate _____ %
 13. Thickness (Metric) 1100 m _____)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____ X _____
 Within: _____ X _____
 Below: _____ X _____
 15. Fossil Data: Nondiagnostic fossils - see Gard, 1968, p. B-12
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: Coal
 18. Other Data:
 19. Original Reference: Gard, L. M., Jr., 1968, Bedrock geology of the Lake Tapps quadrangle, Pierce County, Washington: U. S. Geological Survey Professional Paper 388-B, 33 p.
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: Virgil A. Frizzell, Jr.
 22. Date Prepared: 12-11-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Carbon River Area
 5. Chart # _____ 6. Column # 19
 7. Name of Stratigraphic Unit Northcraft Formation of Puget Group
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group (Formal) Member, Bed, _____
 (Circle Appropriate Status) (Formal) Informal
 9. Age Paleogene Eocene Lutetian-Priabonian
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Spiketon Formation Below Carbonado Formation
 12. Lithology: Dominant andesitic volcanics and mudflows 90 %
 Subordinate sedimentary rocks 10 %
 13. Thickness (Metric) 60-610 m _____)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____ X _____
 Within: _____ X _____
 Below: _____ X _____
 15. Fossil Data: None
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: Road rock
 18. Other Data:
 19. Original Reference: Snavely, P. D., Jr., Roberts, A. E., Hoover, Linn, Jr., and Pease, M. H., Jr., 1951, Geology of the eastern part of the Centralia-Chehalis coal district, Lewis and Thurston Counties, Washington: U. S. Geological Survey Coal Investigations Map C-8, 2 sheets, 1:31,680
 20. Most Significant Reference: Gard, L. M., Jr., 1968, Bedrock of the Lake Tapps quadrangle, Pierce County, Washington: U. S. Geological Survey Professional Paper 388-B, 33 p.
 21. Author(s) of Sheet Preparation: V. A. Frizzell, Jr.
 22. Date Prepared: 12-11-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Carbon River Area
 5. Chart # _____ 6. Column # 19
 7. Name of Stratigraphic Unit Carbonado Formation of Puget Group
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group (Formal) Member, Bed, _____
 (Circle Appropriate Status) (Formal) Informal
 9. Age Paleogene Eocene Lutetian-Bartonian
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Northcraft Below Unknown
 12. Lithology: Dominant sedimentary rocks 100%
 Subordinate _____ %
 13. Thickness (Metric) 1500 m _____)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____ X _____
 Within: _____ X _____
 Below: Unknown _____
 15. Fossil Data: Megafloora - discussed by Wolfe, J. A., 1968, Paleogene biostratigraphy of nonmarine rocks in King County, Washington: U. S. Geological Survey Professional Paper 571, 33 p. 7 pls. Also mollusks - see Gard, 1968.
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: Coal
 18. Other Data:
 19. Original Reference: Willis, B., 1898, Some coal fields of Puget Sound: U. S. Geological Survey 18th Annual Report, pt. 3-C, p. 393-436.
 20. Most Significant Reference: Gard, L. M., Jr., 1968, Bedrock geology of the Lake Tapps quadrangle, Pierce County, Washington: U. S. Geological Survey Professional Paper 388-B, 33 p.
 21. Author(s) of Sheet Preparation: V. A. Frizzell, Jr.
 22. Date Prepared: 12-11-82

20. BELLINGHAM AREA

A. COMPOSITE SECTION LOCATION

Reference # _____ Location # _____
 Latitude 48° 45' N Longitude 122° 30' W
 County or Counties 057 and 073 Whatcom County and Skagit County
 State. 46 Washington

Column Name: Bellingham Area

Chart Name: Cenozoic Stratigraphic Units-Western Oregon and Washington

General Location Description: Cenozoic section composited from both surface and subsurface units in western Whatcom and Skagit Counties, Washington

Principal Reference:

Johnson, S. Y., 1982, Stratigraphy, sedimentology and tectonic setting of the Eocene Chuckanut Formation, northwest Washington: unpub. Ph.D. thesis, University of Washington, Seattle, 221 p.

Column Authors: S. Y. Johnson, Washington State University
 D. J. Easterbrook, Western Washington University

B. DATA SHEETS FOR EACH STRATIGRAPHIC UNIT ON CORRELATION CHART

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Bellingham Area 5. Chart # _____ 6. Column # 20
 7. Name of Stratigraphic Unit Fraser Drift
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Quaternary Pleistocene Wisconsin
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above alluvium Below Olympia sediments
 12. Lithology: Dominant drift Subordinate lake silt
 13. Thickness (Metric) 2-70 m
 14. Major Unconformities: - Check Appropriate Line -
 Above: None Disconformable Angular
 Within: X
 Below: X
 15. Fossil Data: Marine shells in Bellingham glaciomarine drift member. Wood occurs in both silt and clay units and till units.
 16. Radiometric Data: 10,000-18,000 Years Method Radiocarbon
 Source: Easterbrook, D. J., 1969, Pleistocene chronology of the Puget Lowland and San Juan Islands, Washington: Geological Society of America Bulletin, v. 80, p. 2273-2286.
 17. Economic Data:
 18. Other Data: Fraser Drift includes: 1) Sumas Stage (youngest)
 2) Vashon Stage
 3) Everson Interstage
 4) Evans Creek Stage (oldest)
 19. Original Reference: Armstrong, J. E., Crandell, D. R., Easterbrook, D. J., and Noble, J., 1965, Late Pleistocene stratigraphy and chronology in southwestern British Columbia and northwestern Washington: Geological Society of America Bulletin, v. 76, p. 321-330.
 20. Most Significant Reference: Easterbrook, D. J., 1976, Geologic map of western Whatcom County, Washington: U. S. Geological Survey, Miscellaneous investigations series Map I-854-B.
 21. Author(s) of Sheet Preparation: D. J. Easterbrook with additions by J. M. Armentrout
 22. Date Prepared: 2-21-83

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Bellingham Area 5. Chart # _____ 6. Column # 20
 7. Name of Stratigraphic Unit Olympia sediments
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group Formation Member, Bed, _____
 (Circle Appropriate Status) Formal Informal
 9. Age Quaternary Pleistocene Wisconsin
 System Series Stage
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above Fraser Drift Below undiff. terrace deposits
 12. Lithology: Dominant silt Subordinate peat and sand
 13. Thickness (Metric) 0-20 m
 14. Major Unconformities: - Check Appropriate Line -
 Above: None Disconformable Angular
 Within: X
 Below: X
 15. Fossil Data: Wood and shells
 16. Radiometric Data: 18,000-28,000 Years Method Radiocarbon
 Source: Easterbrook, D. J., 1969, Pleistocene chronology of the Puget Lowland and San Juan Islands, Washington: Geological Society of America Bulletin, v. 80, p. 2273-2286.
 17. Economic Data:
 18. Other Data:
 19. Original Reference: Armstrong, J. E., Crandell, D. R., Easterbrook, D. J., Noble, J. B., 1965, Late Pleistocene stratigraphy and chronology in southwestern British Columbia and northwestern Washington: Geological Society of America Bulletin, v. 76, p. 321-330.
 20. Most Significant Reference: Easterbrook, D. J., 1976, Geologic map of western Whatcom County, Washington: U. S. Geological Survey, Miscellaneous investigations series Map I-854-B.
 21. Author(s) of Sheet Preparation: D. J. Easterbrook with additions by J. M. Armentrout
 22. Date Prepared: 2-21-83

20. BELLINGHAM AREA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Bellingham Area
 5. Chart # _____ 6. Column # 20
 7. Name of Stratigraphic Unit undifferentiated terrace deposits
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) Formal (Informal)
 9. Age Quaternary Pleistocene
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface and subsurface
 11. Bounding Units: Above alluvium Below Eocene or older units
 12. Lithology: Dominant sediments _____ 100%
 Subordinate _____ %
 13. Thickness (Metric _____)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____ x _____
 Within: _____ x _____
 Below: _____ x _____
 15. Fossil Data: None
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: Sand and gravel
 18. Other Data: Various units sourced by alpine glaciation, marine terrace development and river and stream terrace building
 19. Original Reference: Armstrong, J. E., Crandell, D. R., Easterbrook, D. J., Noble, J. B., 1965, Late Pleistocene stratigraphy and chronology in southwestern British Columbia and northwestern Washington: Geological Society of America Bulletin, v. 76, p. 321-330.
 20. Most Significant Reference: Easterbrook, D. J., 1976, Geologic map of western Whatcom County, Washington: U. S. Geologic Survey, Miscellaneous Investigations series Map I-854-B.
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 1-18-83

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Bellingham Area
 5. Chart # _____ 6. Column # 20
 7. Name of Stratigraphic Unit nonmarine sedimentary rocks
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) Formal (Informal)
 9. Age Neogene Miocene ? Serravallian to ? Messinian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Subsurface
 11. Bounding Units: Above Pleistocene sediments Below Eocene rocks
 12. Lithology: Dominant sandstone _____ 30% Available
 Subordinate siltstone _____ 70% data imprecise
 13. Thickness (Metric 1000 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____ x _____
 Within: _____ x _____
 Below: _____ x _____
 15. Fossil Data: Palynomorph assemblages suggest correlation both with Miocene floras of Pacific Northwest and Miocene floras of Europe (Hopkins, 1968)
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: _____
 18. Other Data: _____
 19. Original Reference: Hopkins, W. S., Jr., 1968, Subsurface Miocene rocks, British Columbia-Washington, A Palynological Investigation: Geological Society of America Bulletin, v. 79, p. 763-768
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: J. M. Armentrout
 22. Date Prepared: 8-4-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Bellingham Area
 5. Chart # _____ 6. Column # 20
 7. Name of Stratigraphic Unit rocks of Bulson Creek
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) Formal (Informal)
 9. Age Paleocene Eocene-Oligocene Priabonian - ? Rupelian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Quaternary Below pre-Tertiary
 12. Lithology: Dominant conglomerate _____ 60%
 Subordinate sandstone _____ 40%
 13. Thickness (Metric 1000 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____ x _____
 Within: _____ x _____
 Below: _____ x _____
 15. Fossil Data: Upper Bulson Creek unit contains megafossils of early to middle Eocene age: Marcus, 1981, unpub. M.S. thesis, Western Washington University, 84 p. (Bathymbix columbianum Zone and Echiophoria fax Zone of Armentrout (1975): see Armentrout, J. M., 1981, Geological Society of America Special Paper 184, p. 137-148.
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: _____
 18. Other Data: Consists of a lower unit, 1300 m thick, disconformably overlain by an upper 600 m thick unit. Bounded to the north by the Devils Mountain fault.
 19. Original Reference: Lovseth, T. P., 1975, The Devils Mountain fault zone, northwestern Washington, unpub. M.S. thesis, University of Washington, 29 p.
 20. Most Significant Reference: Marcus, K. L., 1980, Eocene-Oligocene sedimentation and deformation in the northern Puget Sound Area, Washington: Northwest Geology, v. 9, p. 52-58
 21. Author(s) of Sheet Preparation: S. Y. Johnson Additions by J. M. Armentrout
 22. Date Prepared: 7-7-82 10-23-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Bellingham Area
 5. Chart # _____ 6. Column # 20
 7. Name of Stratigraphic Unit Huntingdon Formation
 8. Stratigraphic Rank and Status: _____
 (Circle Appropriate Rank) Group (Formation) Member, Bed, _____
 (Circle Appropriate Status) Formal (Informal)
 9. Age Paleogene Eocene-Oligocene Priabonian-Rupelian
 System _____ Series _____ Stage _____
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Quaternary Below pre-Tertiary
 12. Lithology: Dominant sandstone _____ 65%
 Subordinate siltstone _____ 35%
 13. Thickness (Metric 550 m)
 14. Major Unconformities: - Check Appropriate Line -
 None Disconformable Angular
 Above: _____ x _____
 Within: _____ x _____
 Below: _____ x _____
 15. Fossil Data: Palynomorphs indicate Eocene age (Hopkins, 1966), probably Late Eocene: Reiswig, 1982, unpub. M.S. thesis, Western Washington University, Bellingham
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: Mined for fire clay across the international boundary in Canada on Canadian Sumas Mountain
 18. Other Data: _____
 19. Original Reference: Daly, R. A., 1912, Geology of the North American Cordillera at the 49th parallel: Geological Survey of Canada Memoir 38, 546 p.
 20. Most Significant Reference: Hopkins, W. S., Jr., 1966, Palynology of Tertiary rocks of the Whatcom Basin, southwestern British Columbia and northwestern Washington: unpub. Ph.D. thesis, University of British Columbia, Vancouver, 184 p.
 21. Author(s) of Sheet Preparation: S. Y. Johnson
 22. Date Prepared: 7-7-82

20. BELLINGHAM AREA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705

4. Column Name Bellingham Area

5. Chart # _____ 6. Column # 20

7. Name of Stratigraphic Unit Chuckanut Formation

8. Stratigraphic Rank and Status:
(Circle Appropriate Rank) Group Formation (Member) Bed, _____
(Circle Appropriate Status) Formal (Informal)

9. Age Paleogene Eocene Ypresian-Priabonian

System _____ Series _____ Stage _____

10. Surface Subsurface or Both Surface and subsurface

11. Bounding Units: Above Quaternary deposits Below pre-Tertiary

12. Lithology: Dominant siltstone _____ 55 %
Subordinate sandstone _____ 45 %

13. Thickness (Metric 5000-6000)

14. Major Unconformities: - Check Appropriate Line -
Above: _____ None _____ Disconformable _____ Angular _____
Within: X _____ _____
Below: _____ X _____

15. Fossil Data: Palynomorphs indicate middle to late Paleocene age (based on correlation with assemblages with the Canadian Arctic) for the base of the unit and late Eocene ages for the upper part of the unit: Reisswig, 1982, unpub. M.S. thesis, Western Washington University, Bellingham. (Fission track zircon date)

16. Radiometric Data: 49-55 million Years Method Of 49.9± 1.2 Ma
Source: From tuff at top of Bellingham Bay Member; fission track ages on detrital zircons from the base of the unit indicate it can be no older than 55 Ma (Johnson, 1982).

17. Economic Data: Contains abandoned coal mines

18. Other Data: Recently subdivided by Johnson, 1982.

19. Original Reference: McLellan, R. D., 1927, The geology of the San Juan Islands: Washington University Publications in Geology, no. 2, 185 p.

20. Most Significant Reference: Johnson, S. Y., 1982, Stratigraphy, sedimentology and tectonic setting of the Eocene Chuckanut Formation, northwest Washington: unpub. Ph.D. thesis, University of Washington, 221 p.

21. Author(s) of Sheet Preparation: S. Y. Johnson

22. Date Prepared: 7-6-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705

4. Column Name Bellingham Area

5. Chart # _____ 6. Column # 20

7. Name of Stratigraphic Unit Padden member of the Chuckanut Formation

8. Stratigraphic Rank and Status:
(Circle Appropriate Rank) Group Formation (Member) Bed, _____
(Circle Appropriate Status) Formal (Informal)

9. Age Paleogene Eocene Lutetian-Priabonian

System _____ Series _____ Stage _____

10. Surface Subsurface or Both Surface and subsurface

11. Bounding Units: Above Quaternary Below Governors Point and Bellingham Bay members

12. Lithology: Dominant sandstone _____ 60 %
Subordinate siltstone _____ 40 %

13. Thickness (Metric 2000-3000)

14. Major Unconformities: - Check Appropriate Line -
Above: _____ None _____ Disconformable _____ Angular _____
Within: X _____ _____
Below: _____ X _____

15. Fossil Data: Pollen have been assigned late-middle to late Eocene ages (Reisswig, 1982)

16. Radiometric Data: None Years Method _____
Source: _____

17. Economic Data: Contains abandoned coal mines

18. Other Data: Type section of lower 1200 m is exposed on Chuckanut Bay (sections 25 and 14 T. 37 N., R. 2 E.). Petrologically distinct from underlying and interfingering Chuckanut Formation strata. Unconformably overlies pre-Tertiary basement along basin margin.

19. Original Reference: Johnson, S. Y., 1982, Stratigraphy, sedimentology, and tectonic setting of the Eocene Chuckanut Formation, northwest Washington: unpub. Ph.D. thesis, University of Washington, 221 p.

20. Most Significant Reference: Same

21. Author(s) of Sheet Preparation: S. Y. Johnson

22. Date Prepared: 7-6-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705

4. Column Name Bellingham Area

5. Chart # _____ 6. Column # 20

7. Name of Stratigraphic Unit Maple Falls member of the Chuckanut Formation

8. Stratigraphic Rank and Status:
(Circle Appropriate Rank) Group Formation (Member) Bed, _____
(Circle Appropriate Status) Formal (Informal)

9. Age Paleogene Eocene Bartonian-Priabonian

System _____ Series _____ Stage _____

10. Surface Subsurface or Both Surface and subsurface

11. Bounding Units: Above Quaternary Below Slide and Padden members

12. Lithology: Dominant conglomerate _____ 70 %
Subordinate siltstone and sandstone _____ 30 %

13. Thickness (Metric 800)

14. Major Unconformities: - Check Appropriate Line -
Above: _____ None _____ Disconformable _____ Angular _____
Within: X _____ _____
Below: X _____ _____

15. Fossil Data: None, but is older than last movement on Boulder Creek fault, which is draped by the late Eocene Huntingdon Formation. Therefore, it is no younger than late Eocene age.

16. Radiometric Data: None Years Method _____
Source: _____

17. Economic Data:

18. Other Data: Type section in the bed of Coal Creek (sec. 4, T. 39 N., R. 5 E.). Contains greenstone-rich boulder conglomerates and lithic sandstones derived from proximal northern sources.

19. Original Reference: Johnson, S. Y., 1982, Stratigraphy, sedimentology, and tectonic setting of the Eocene Chuckanut Formation, northwest Washington: unpub. Ph.D. thesis, University of Washington, 221 p.

20. Most Significant Reference: Same

21. Author(s) of Sheet Preparation: S. Y. Johnson

22. Date Prepared: 7-6-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705

4. Column Name Bellingham Area

5. Chart # _____ 6. Column # 20

7. Name of Stratigraphic Unit Bald Mountain member of the Chuckanut Formation

8. Stratigraphic Rank and Status:
(Circle Appropriate Rank) Group Formation (Member) Bed, _____
(Circle Appropriate Status) Formal (Informal)

9. Age Paleogene Eocene Priabonian

System _____ Series _____ Stage _____

10. Surface Subsurface or Both Surface and subsurface

11. Bounding Units: Above Quaternary Below Wernick member

12. Lithology: Dominant conglomerate _____ 80 %
Subordinate sandstone _____ 20 %

13. Thickness (Metric 550)

14. Major Unconformities: - Check Appropriate Line -
Above: _____ None _____ Disconformable _____ Angular _____
Within: X _____ _____
Below: X _____ _____

15. Fossil Data: Contains angiosperm pollen (E. Leopold, written communication 1980). Unit is cut by last movement on Boulder Creek fault, which is draped by the late Eocene Huntingdon Formation. Therefore, it is no younger than late Eocene age.

16. Radiometric Data: None Years Method _____
Source: _____

17. Economic Data:

18. Other Data: Misch (1966) named this unit the Bald Mountain Formation and correlated it with early Mesozoic strata. Chert-rich conglomerates are dominant lithology. Very indurated. Unconformably overlies pre-Tertiary basement on basin margin.

19. Original Reference: Misch, P., 1966, Tectonic Evolution of the Northern Cascades of Washington State - A West-Cordilleran Case History: Canadian Institute of Mining and Metallurgy, Special Volume 8, p. 101-148.

20. Most Significant Reference: Johnson, S. Y., 1982, Stratigraphy, sedimentology, and tectonic setting of the Eocene Chuckanut Formation, northwest Washington, unpub. Ph.D. thesis, University of Washington, 221 p.

21. Author(s) of Sheet Preparation: S. Y. Johnson

22. Date Prepared: 7-6-82

20. BELLINGHAM AREA

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Bellingham Area
 5. Chart # _____ 6. Column # 20
 7. Name of Stratigraphic Unit Warnick member of the Chuckanut Formation
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation (Member) Bed, _____
 (Circle Appropriate Status) Formal (Informal)
 9. Age Paleogene Eocene Bartonian-Priabonian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Bald Mountain member Below Slide member
 12. Lithology: Dominant siltstone and sandstone 70 %
 Subordinate conglomerate 30 %
 13. Thickness (Metric 600-1000 m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: X None Disconformable Angular
 Within: X
 Below: X
 15. Fossil Data: None but is cut by last movement on Boulder Creek fault, which is draped by the late Eocene Huntingdon Formation. Therefore, it is no younger than late Eocene age.
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: _____
 18. Other Data: Type section above Canyon Creek (sec. 24, T. 39 N., R. 6 E.)
 Contains beds of chert-rich conglomerate derived from north.
 19. Original Reference: Johnson, S. Y., 1982, Stratigraphy, sedimentology, and tectonic setting of the Eocene Chuckanut Formation, northwest Washington: unpub. Ph.D. thesis, University of Washington, 221 p.
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: S. Y. Johnson
 22. Date Prepared: 7-6-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Bellingham Area
 5. Chart # _____ 6. Column # 20
 7. Name of Stratigraphic Unit Slide member of the Chuckanut Formation
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation (Member) Bed, _____
 (Circle Appropriate Status) Formal (Informal)
 9. Age Paleogene Eocene Lutetian-Bartonian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Maple Falls and Warnick mbrs. Below Bellingham Bay member
 12. Lithology: Dominant siltstone 70 %
 Subordinate sandstone 30 %
 13. Thickness (Metric 1960 m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: X None Disconformable Angular
 Within: X
 Below: X
 15. Fossil Data: pollen from sample of uncertain location has been assigned early to early-middle Eocene age (G. E. Rouse, written communication 1982); overlies radiometrically (fission track-zircon) dated early Eocene Bellingham Bay member.
 16. Radiometric Data: None Years Method _____
 Source: _____
 17. Economic Data: _____
 18. Other Data: Type section on log roads on Slide Mountain (secs. 9 & 4, T. 39 N., R. 6 E.) Interfingers with the Padden member to the west but has different petrology.
 19. Original Reference: Johnson, S. Y., 1982, Stratigraphy, sedimentology and tectonic setting of the Eocene Chuckanut Formation, northwest Washington: unpub. Ph.D. thesis, University of Washington, 221 p.
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: S. Y. Johnson
 22. Date Prepared: 7-6-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Bellingham Area
 5. Chart # _____ 6. Column # 20
 7. Name of Stratigraphic Unit Governors Point member of the Chuckanut Formation
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation (Member) Bed, _____
 (Circle Appropriate Status) Formal (Informal)
 9. Age Paleogene Eocene Ypresian-Lutetian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Padden member Below Bellingham Bay member
 12. Lithology: Dominant sandstone 80 %
 Subordinate conglomerate 20 %
 13. Thickness (Metric 375 m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: X None Disconformable Angular
 Within: X
 Below: X
 15. Fossil Data: None
 16. Radiometric Data: None Years Method _____
 Source: Overlies upper part of Bellingham Bay member which has 49.9±1.2 Ma tuff bed (fission track-zircon).
 17. Economic Data: _____
 18. Other Data: Type section at Governors Point (sec. 26, T. 38 N., R. 4 E.) Unit is 375 m thick at type section and thins to the east. Contains meta-graywacke-rich conglomerates with proximal northern sources.
 19. Original Reference: Johnson, S. Y., 1982, Stratigraphy, sedimentology, and tectonic setting of the Eocene Chuckanut Formation, northwest Washington: unpub. Ph.D. thesis, University of Washington, 221 p.
 20. Most Significant Reference: Same
 21. Author(s) of Sheet Preparation: S. Y. Johnson
 22. Date Prepared: 7-6-82

1. Reference # _____ 2. Location # _____ 3. CSD Province # 705
 4. Column Name Bellingham Area
 5. Chart # _____ 6. Column # 20
 7. Name of Stratigraphic Unit Bellingham Bay member of the Chuckanut Formation
 8. Stratigraphic Rank and Status:
 (Circle Appropriate Rank) Group Formation (Member) Bed, _____
 (Circle Appropriate Status) Formal (Informal)
 9. Age Paleogene Eocene Ypresian-Lutetian
 System Series Stage
 10. Surface Subsurface or Both Surface
 11. Bounding Units: Above Governors Slide, Padden Mbrs. Below pre-Tertiary basement
 12. Lithology: Dominant siltstone 60 %
 Subordinate sandstone 40 %
 13. Thickness (Metric 2700-3300 m)
 14. Major Unconformities: - Check Appropriate Line -
 Above: X None Disconformable Angular
 Within: X
 Below: X
 15. Fossil Data: Pollen have been assigned middle or late Paleocene ages based on correlation with pollen assemblages in the Canadian Arctic (Reiswig, 1982).
 16. Radiometric Data: 49.9-55 million Years Method Fission track-zircon dates
 Source: 49.9± 1.2 Ma fission track on zircon from tuff at top of member; 55 Ma fission track on detrital zircon from bottom of member.
 17. Economic Data: Contains abandoned coal mines
 18. Other Data: Type section along Chuckanut Drive and on coastline along Bellingham Bay (secs. 9, 8, 7, 6, T. 36 N., R. 3 E.; sec. 1, T. 36 N., R. 2 E.; secs. 36, 25, T. 37 N., R. 2 E.).
 19. Original Reference: McLellan, R. D., 1927, The geology of the San Juan Islands; Washington University Publications in Geology, no. 2, 185 p. (Original reference to the Chuckanut Formation)
 20. Most Significant Reference: Johnson, S. Y., 1982, Stratigraphy, sedimentation, and tectonic setting of the Chuckanut Formation, northwest Washington: unpub. Ph.D. thesis, University of Washington, 221 p.
 21. Author(s) of Sheet Preparation: S. Y. Johnson
 22. Date Prepared: 7-6-82

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