



Reference List for Index Map

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DESCRIPTION OF MAP UNITS

- Qu** **Undivided nonmarine sediments (Quaternary)**-Unconsolidated gravel, sand, and silt of fluvial and lacustrine origin; includes Linn Gravels and Willamette Silt of Allison (1953), and "Younger deposits" and "Older deposits" of Piper (1942); radiocarbon dates of 36,000 B.P. to present.
- Qt** **High terrace gravels (Pleistocene)**-Stratified gravel, sand, silt, and clay; deeply weathered; includes Lascumb and Lether Gravels of Allison (1953), "Terrace gravels" of Baldwin (1964), "Quaternary upper Terrace" and "Quaternary middle terrace" of Beaulieu (1974), "Terrace deposits" of Piper (1942) and "Higher terrace deposits of Bela (1979, 1981); "High terrace deposits" of Brownfield (1982a, c); early to middle Pleistocene in age (Allison, 1953).
- Qls** **Landslide deposits (Quaternary)**
- QPv** **Basalts and basaltic andesites (Pleistocene-Pliocene)**-Olivine basalt and basaltic andesite, and some pyroclastic material of local extent, vents located at Highland Butte; Corresponds to the Bozong Lava; radiometric dates range from 5 Ma (Laelle and Smith, 1982) to 612±23 Ka (R. Duncan, personal communication to I. Madin, 1990), radiometric date from the Oregon City plateau 2.6 Ma (R. Duncan and N. MadLeod, 1985, written communication to R. Swanson); includes basalt, basaltic andesite flows, and basaltic breccia of Snow Peak volcano; radiometric dates at 2.8±0.3 Ma and 3.3±0.6 Ma (Verplanck, 1985).
- PMf** **Fluvial and lacustrine sediments (Pliocene-Miocene)**-Clay, silt, sand, and gravel. Largely fluvial (A. R. Niem and C. D. Peterson personal communication to I. Madin, 1989), but may contain some lacustrine sediment. Correlates to the Sandy River Mudstone and Troutdale Formation in the Portland area; includes unnamed fluvial sediments on cross sections in the southern Willamette Valley.
- PMb** **Basalt (Pliocene-Miocene)**-Basalt of Marks Ridge; radiometric date of 4.5±0.28 Ma (Verplanck, 1985). Included in Sardine Fm.
- Mu** **Undivided volcanic rocks (Miocene)-Sardine Fm.**
- Mn** **Tuffaceous nonmarine sediments (Miocene)**-Fine- to coarse-grained tuffaceous siltstone and sandstone, pebble conglomerate, agglomerate, volcanic cobble conglomerate, basaltic andesite flows, and minor interbeds of air-fall tuff (Hampton, 1972; Walker and Duncan, 1989); includes Fern Ridge Tuffs of Thayer (1939), part of Sardine Fm. of Peck and others (1964).
- Mv** **Volcanic rock (Miocene)**-Mudflow breccia, water-laid tuff, and tuff (Hampton, 1972). Corresponds to Rhododendron Formation of Hodge (1933).
- Ma** **Andesite (Miocene)**-Capping andesite flows of the Sardine Fm.; also includes basaltic andesite of Washburn and Lone Pine Buttes; K-Ar age of 11.9±0.3 Ma (Verplanck, 1985).
- Mbc** **Columbia River Basalt Group undivided (Miocene)**-Subaerial tholeiitic basalt flows; in places, separated by baked tuffaceous sedimentary rocks; locally deeply weathered to lateritic soil; locally divided into:
 - Mbcw** **Frenchman Springs Member, Wanapum Basalt**-Thin flows of grey to dark grey, medium-grained, commonly plagioclase-phyric basalt, 15.3 Ma.
 - Mbcg** **Grande Ronde Basalt**-Flows of dark-gray to black, glassy to mostly aphyric, locally vesicular tholeiitic basalt, 16 - 15.6 Ma in Willamette Valley.
- Ms** **Sedimentary rock (Miocene)**-Poorly indurated, friable, fluvial basaltic conglomerate, sandstone, carbonaceous mudstone and coal, interfingering with shallow marine to estuarine mud rock, tuffaceous siltstone and sandstone. Corresponds to the Scappoose Formation. Fluvial deposits in the upper portion of the formation are derived from, intercalated with, and invaded by Grande Ronde Basalt flows of the Yakima Basalt. Scappoose unconformably overlies Keasey and Pittsburg Bluff Formations (Van Atta and Kelly, 1985).
- MOm** **Molalla Formation (Miocene)**-Pumiceous volcanic conglomerate and aqueous tuff with tuffaceous paleosols (Miller and Orr, 1988). Contains early Miocene fossil leaves (Wolfe, personal communication to Peck and others, 1964); radiometric dates of 15.9±1.0 Ma and 15.0±0.7 Ma determined by Fiebelkorn and others (1983).
- MOs** **Strandline sedimentary rocks (Miocene-Oligocene)**-Marine and nonmarine strata consisting of volcanic conglomerate, arkose, and mudstone, tuffaceous sandstone, burrowed claystone, barnacle limestone, and interbedded coal of nonmarine origin; equivalent to Scotts Mills Formation of Miller and Orr (1988); interfingers with nonmarine sedimentary rocks of Molalla Fm. Dated as upper Oligocene to lower Miocene based on molluscs, barnacles, vertebrate fossils, and echinoderms (Orr and Miller, 1986).
- MOu** **Undifferentiated nonmarine sedimentary rocks, basalt flows, and tuff (Miocene-Oligocene)**-Assemblage of basalts and basaltic andesites complexly interstratified with volcanoclastic deposits of basaltic to rhyodacitic composition; includes rhyodacitic to andesitic ash-flow and air-fall tuffs, lapilli tuff and tuff breccia, andesite to dacitic mudflow deposits, massive to bedded fine- to coarse-grained nonmarine tuffaceous sedimentary rocks, and volcanic conglomerates; included in Little Butte Volcanic Series of Peck and others (1964); K-Ar ages range from 35 to 22 Ma in the map area with suspect ages older than 35 Ma (Lux, 1982).
- MOb** **Basalts and basaltic andesites (Miocene-Oligocene)**-Basalt and basaltic andesite flows and flow breccias; included in Little Butte Volcanic Series of Peck and others (1964).
- MOa** **Porphyritic andesites (Miocene-Oligocene)**-Massive porphyritic andesite; included in Little Butte Volcanic Series of Peck and others (1964).
- MOd** **Dacite and rhyodacite (Miocene-Oligocene)**-Dacite to rhyodacite vent complexes; included in Little Butte Volcanic Series of Peck and others (1964).
- MOt** **Welded to nonwelded ash-flow tuff (Miocene-Oligocene)**-Mostly vitric-crystal and vitric ash-flow tuff (Walker and Duncan, 1989).
- OEm** **Marine sedimentary rocks (Oligocene-Eocene)**-Tuffaceous siltstone and sandstone in the south becoming tuffaceous claystone and mudstone to the north; equivalent, in part, to the Eugene, Keasey, and Pittsburg Bluff Formations; also equivalent to Eocene-Oligocene sedimentary rock of Bela (1981); tuffaceous sedimentary rocks of Baldwin and others (1955), and Ilabe Formation of Thayer (1939); foraminiferal assemblages assigned to the Refugian Stage in the south (McKeel, 1985) and the Refugian and upper Narizian Stage in the north (Brownfield and Schlicker, 1981a).
- OEb** **Basaltic flows (Oligocene-Eocene)**-Basaltic flows which may be invasive into the undivided Fisher Formation (OEn), and questionable sills which may intrude the undivided Fisher Formation (Walker and Duncan, 1989).
- OEn** **Nonmarine sedimentary rock (Oligocene-Eocene)**-Andesitic lapilli tuff and breccia, tuffaceous sandstone and siltstone, and pebble to boulder conglomerate interbedded with flows of andesite, dacite and basalt; equivalent to Fisher Formation of Vokes and others (1951); interfingers to the northwest with marine strata of the Eugene Formation; fossil leaves indicate late Eocene to Oligocene age (R. Brown in Hoover, 1963); radiometric ages range from 35-40 Ma (Lux, 1982).
- Emg** **Spencer Formation (Eocene)**-Massive to thin-bedded tuffaceous mudstone and siltstone grading eastward to tuffaceous and volcanic rocks, and well sorted, shallow marine, micaceous arkosic sandstone, and siltstone with minor coal; correlative in part to the Nestucca and Cowitz Formations; foraminiferal fauna assigned to the Narizian Stage (McKeel, 1984, 1985); broken into three members on cross-sections:
 - Emg2 (Upper member)**-Tuffaceous mudstone, siltstone, and minor sandstone;
 - Emg1 (Lower member)**-Micaceous arkosic sandstone, siltstone, and minor coal;
 - Ev8 (Spencer equivalent volcanics)**-Basalt, andesite and tuff; grades into upper member of the Spencer Formation to the west.
- Emn** **Nestucca Formation (Eocene)**-Tuffaceous shale and siltstone and thin-bedded sandstone intercalated with pillow basalt, breccia, and tuff (Baldwin and others, 1955); foraminiferal fauna assigned to upper Narizian Stage (W. Rau, written communication to Wells and others, 1983).
- Eb** **Submarine basalt (Eocene)**-Pillow basalt and submarine basalt breccia and lapilli breccia and intrusive rock (Wells and others, 1983); possibly Tillamook Volcanics or Siletz River Volcanics.
- Evwh** **Basalt of Waverly Heights and associated undifferentiated sediments (Eocene)**-Subaerial basalt and associated sedimentary rock (Beeson and others, 1989b). Two flows have K-Ar ages of approximately 40 Ma (R. Duncan in Beeson and others, 1989b).
- Emy** **Yamhill Formation (Eocene)**-Massive to thin-bedded marine siltstone with thin interbeds of arkosic, glauconitic and basaltic sandstone; interfingers with Tillamook Volcanics to the northwest and unrelated(?) volcanics to the southeast; broken into four members on cross sections in the southern Willamette Valley:
 - Emy1 (Upper mudstone member)**-Siltstone, mudstone, and minor sandstone; foraminifera indicate deposition at upper to middle bathyal depths (McKeel, 1984, 1985).
 - Emy2 ("Miller sand" member)**-Tuffaceous to arkosic sandstones and interbedded siltstones becoming more volcanic rich and conglomeratic to the southeast; foraminifera indicate deposition at upper bathyal to inner neritic and nonmarine depths (McKeel, 1984, 1985). Largely restricted to the southern Willamette Valley.
 - Emy3 (Lower mudstone member)**-Tuffaceous mudstone and siltstone with minor interbedded sandstone; foraminifera indicate deposition at middle bathyal to outer neritic depths (McKeel, 1985).
 - Ev7 (Yamhill equivalent volcanics)**-Tuff, basalt, dacite and andesite; grades into "Miller Sand" member to the west.
- Emt** **Tyce Formation (Eocene)**-Rhythmically interbedded, medium to fine-grained micaceous, feldspathic, lithic or arkosic marine sandstone and micaceous, carbonaceous siltstone of turbidite origin; finer grained distal facies to the north; foraminiferal fauna referred to Uluatian Stage (Snavey and others, 1969; Moleznag, 1985).
- Emgr** **Kings Valley Siltstone Member of the Siletz River Volcanics (Eocene)**-Thin-bedded, tuffaceous, deep marine siltstone and shale; contains thin lenses of basaltic sandstone.
- Evgr** **Siletz River Volcanics (Eocene)**-Submarine pillow lavas, massive flows, tuff breccias and flow breccias of tholeiitic and alkalic basalt and associated sills and dikes, and calcareous sandy tuff; abundant zeolites and calcite veining; upper part of unit contains intercalated tuffaceous shale, siltstone, basaltic sandstone and locally derived basaltic conglomerate; foraminiferal fauna are referred to the Uluatian and Penatian Stages of Malky (1959; Snavey and others, 1968; McWilliams, 1980); radiometric ages range from 50.7±5.1 to 58.1±1.5 Ma (Duncan, 1982).

Ti **Intrusive rocks (Tertiary)**-Sills and dikes of granophyric gabbro and granophyric diorite in the Coast Range south of Sheridan, and andesite to coarse grained basalt and diabase in the Coast Range north of Sheridan; basalts, basaltic andesites, and andesites with minor dacite to rhyodacite in the Western Cascades; ages range from Eocene to Miocene in the Coast Range (Wells and others, 1983) and from Oligocene to Pliocene in the Western Cascades (Walker and Duncan, 1989).

GEOLOGIC SYMBOLS

- Inferred geologic contact
- Unconformity (on cross sections)
- Strike and dip of bedding
- Fault; dashed where inferred; ball and bar on the downthrown side.
- Thrust fault; sawteeth on upper plate.
- Concealed fault; dashed dots where location is unconstrained; ball and bar on downthrown side.
- Anticline - showing plunge
- Syncline - showing plunge
- Monocline - showing plunge. Abrupt increase of dip in direction of arrows. Dashed where inferred.
- Aeromagnetic high. Contours enclose areas of high total intensity corresponding in most cases to intrusive bodies mapped or inferred at the surface, or in the shallow subsurface.
- Structure contour line representing base of Eugene Formation in the southern Willamette Valley south of Franklin Butte and Rogers Mountain and south and west of Salem Hills. (contour interval = 200 m), and top of Columbia River Basalt in the northern Willamette Valley (contour interval = 100 m).
- Location of seismic reflection line
- Subcrop of Eugene-Spencer contact.
- Exploratory petroleum well - labels show the elevation from which depths were measured (usually kelly bushing) over the elevation of the bottom of the well. Formation tops are listed below relative to sea level. All elevations are in meters.
- Water well - Reaches contoured horizon, located to the quarter-quarter section.
- Water well - Constrains altitude of contoured horizon, located to the quarter-quarter section.
- Water well - Reaches contoured horizon, accurately located.
- Water well - Constrains altitude of contoured horizon, accurately located.
- Radiometric age

PLATE 1 D GEOLOGIC MAP EXPLANATION

This report (map) is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards (or with the North American Stratigraphic Code). Any use of trade, product or firm name is for descriptive purposes only and does not imply endorsement by the U.S. Government.