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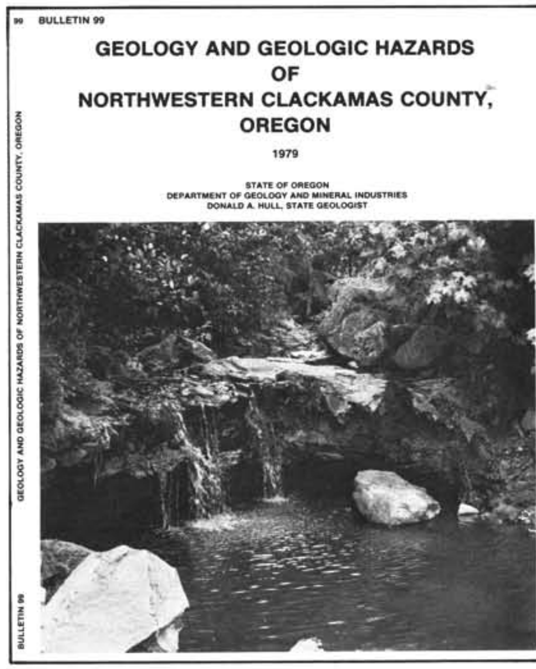
COVER PHOTO: Golden Falls, Glen Creek valley, Golden and Silver Falls State Park, Coos County. Here stream flows over rocks of the Flournoy Formation, one of the geologic units discussed in article beginning on next page. Photo courtesy Oregon Highway Division.

Geology and geologic hazards study of northwestern Clackamas County now available

The Oregon Department of Geology and Mineral Industries (DOGAMI) announces the completion of its 18-month study of the *Geology and Geologic Hazards of Northwestern Clackamas County, Oregon*, published as Bulletin 99. The study was a joint effort involving DOGAMI, the Oregon Land Conservation and Development Commission, and Clackamas County. Authors of the report are Herbert G. Schlicker and Christopher T. Finlayson.

The bulletin is intended to provide practical information about specific geological hazards and engineering geology conditions in northwestern Clackamas County.



The text describes the surficial and bedrock geologic units found in the study area and describes such geologic hazards as landslides, soil erosion, high ground water and ponding, stream erosion and deposition, earthquakes, and volcanism. Included are a table presenting engineering characteristics of soils developed on each rock unit; matrices relating geologic hazards to geologic units, land uses, and steepness of slope; and flood tables giving stages, elevations, and peak discharges of the ten greatest observed floods on the Willamette, Molalla, Pudding, Tualatin, and Clackamas Rivers and Johnson Creek. In addition, Bulletin 99 contains five geology and five geologic hazard maps covering a total of nine 7½-minute quadrangle maps.

Price of the complete Bulletin 99 is $10.00. Address orders to the Oregon Department of Geology and Mineral Industries, 1069 State Office Building, Portland, Oregon 97201. Payment must accompany orders of less than $20.00. □

Eocene correlations in western Oregon-Washington

by Robert G. McWilliams, Department of Geology, Miami University-Hamilton, Hamilton, Ohio 45011

ABSTRACT

Eocene volcanic rocks and immediately overlying sediments of the Columbia Arc appear to be Tertiary sea floor wedged between the Juan de Fuca and North American Plates. Sea-floor spreading between the Farallon-Kula Plate boundaries can explain the geographic separation of the Roseburg Formation and the true Siletz River Volcanic Series in southwestern Oregon from the coeval true Crescent Formation in northwestern Washington. It can also explain why the younger "Siletz River Volcanic Series" and "Crescent Formation" are found between them in central-western Oregon-Washington.

According to this interpretation, the clockwise rotation of the Oregon Coast Range was produced by flexural-slip folding analogous to that which formed the clockwise-twisted Gorda Basin. The Farallon-Kula Plates were trapped between the North American Plate on the east and the northwesterly-moving Juan de Fuca Plate on the west.

INTRODUCTION

My purpose in this paper is to review the time-stratigraphy of the Oregon-Washington Eocene volcanic rocks and contiguous strata. The time-stratigraphic units used are those based on benthic organisms in California; namely the "stages" of Weaver and others (1944), the zones of Laiming (1939, 1940), and the stages of Mallory (1959) (Figure 1). There have been differences between correlations based on planktonic organisms—particularly calcareous nannoplankton—and benthic organisms. However, Poore (1979) has concluded that the Ulatisian-Narizian stage boundary closely coincides with the *Discoaster sublodoensis* zone and the *Nannotetrina quadrata* zone boundary. Thus correlations based on the Ulatisian-Narizian stage boundary—and that is the most important correlation discussed in this paper—probably approximate time correlation.

Figure 1. Correlation of Eocene time-stratigraphic units based on benthic organisms. After Mallory (1959, p. 74-98) and Rau (1966, Figure 4).

AGE	WEAVER AND OTHERS 1944	LAIMING 1939, 1941		MALLORY 1959
EOCENE	TEJON	?	A-1	NARIZIAN
		A-3	A-2	
	TRANSITION	?		ULATISIAN
	DOMENGINE	B-1A		
		B-1 — B-4		
	CAPAY	C		PENUTIAN

THE PENUTIAN-ULATISIAN BOUNDARY

Portions of the stratigraphic column which straddle the Penutian-Ulatisian stage boundary are shown in Figure 3. The following discussion of time-stratigraphy is keyed to Figure 3 by means of numbers, set off by parentheses, referring to the respective numbered stratigraphic section.

The Penutian-Ulatisian boundary appears to be located within the Roslyn Formation of north-central Washington (Figure 3, section 2). Part of the Roslyn Formation is of Bridgerian age (Wheeler, 1955), which is equivalent to the Ulatisian stage (Evernden and others, 1964, p. 167). The stratigraphic position of the underlying Teanaway Formation between the Paleocene Swauk Formation and the Ulatisian Roslyn Formation indicates it is equivalent to the Roseburg Formation, which is Paleocene to Penutian (early Eocene) in age.

The Raging River Formation of central-western Washington (section 3) is Ulatisian, based on the occurrence of *Gaudryina jacksonensis* var. *coalingensis* Cushman and G. D. Hanna (Vine, 1962b, p. 9). The overlying Tiger Mountain Formation is Domengine (lower Ulatisian), based on fossil leaves (Wolfe, 1968, p. 11). Although the underlying strata are not exposed, it is clear that the Ulatisian-Penutian boundary must be within or below the Raging River Formation.

In central-western Oregon, the uppermost portion of the Siletz River Volcanic Series (section 10) contains *Pseudophragmina psila* (Woodring). This species is unknown above the Penutian stage and occurs together with mollusk fossils which indicate a Capay age (Snavely and Vokes, 1949). Baldwin (1964b, p. 13-14) reviewed all published lists of fossils from the Siletz River Volcanic Series in the Dallas-Valsetz and adjacent areas (section 13) and also assigned a Capay age (Penutian) to the formation.

The King's Valley Siltstone is the uppermost member of the Siletz River Volcanic Series and is Capay (Penutian) near Marys Peak (section 14). The overlying Flournoy Formation (Baldwin, 1975, p. 53), formerly called Tyee and Burpee, is Domengine (lower Ulatisian), based on stratigraphic position (Baldwin, 1955; 1964b, p. 16-17).

The Lorane Siltstone Member (shown in Figure 3 as Lorane Shale) is the uppermost part of the Flournoy Formation (formerly Tyee) in the southwestern Willamette Valley (section 17). Bird (1967, Figure 14) determined a Ulatisian age for these rocks, based on fora-

	PRE-PENUTIAN	PENUTIAN	ULATISIAN	NARIZIAN	POST-NARIZIAN
AMPHIMORPHINA CALIFORNICA C.& M.			X	X	
BULIMINA CORRUGATA C.& S.			X	X	X
B. SCULPTILIS VAR. LACINIATA C.& P.				X	X
CIBICIDES HODGEI C.& S.				X	X
GAUDRYINA COALINGENSIS CUSHMAN	X	X	X		
G. JACKSONENSIS VAR. COALINGENSIS C.& H.	X	X	X		
NODOGENERINA BRADYI CUSHMAN				X	
NODOSARIA LATEJUGATA GÜMBEL			X	X	
PSEUDOPHRAGMINA PSILA (WOODRING)	X	X			
PLECTOFRONDICULARIA MINUTA SULLIVAN				X	
P. SACATENSIS HORNADAY				X	
ROBULUS CHIRANUS CUSHMAN & STONE				X	X
UVIGERINA CHURCHI CUSHMAN & SIEGFUS				X	
U. GARZAENSIS CUSHMAN & SIEGFUS				X	X
VALVULINERIA MENLOENSIS RAU				X	X
VIRGULINA BRAMLETTI G.& M.				X	X
VAGINULINOPSIS MEXICANA VAR. NUDICOSTATA C.&H.	X	X	X		

Figure 2. Table showing known biostratigraphic range of foraminifer species mentioned in text.

minifers. In addition, Stewart (1957, p. 13) reported species indicative of Ulatisian from the rocks now called Flournoy Formation at Comstock Overpass.

In southwestern Oregon, the Bateman Formation of the Umpua River area (section 20) contains Ulatisian foraminifers (Baldwin, 1974, p. 28). Baldwin (1961) summarized the foraminifers indicative of B-1 to B-1A age (lower Ulatisian) and mollusks indicative of the Domengine (lower Ulatisian) from the Elkton Formation in the lower Umpqua River area (section 20). The Flournoy Formation is also Ulatisian and overlies the Lookingglass (middle Umpqua) and the Roseburg (lower Umpqua) Formations, which are Penutian (Baldwin, 1974, p. 8-10, 16, 19).

Bird (1967, p. 77) reported foraminifers indicative of the Ulatisian from the Flournoy Formation at Sacchi Beach (section 21). The Flournoy Formation is in fault contact with the Penutian Roseburg Formation (Baldwin, 1975, p. 54).

THE ULATISIAN-NARIZIAN BOUNDARY

Discussion of the Ulatisian-Narizian boundary is keyed to Figure 4. Numbers set off by parentheses refer to the respective stratigraphic section.

The Aldwell Formation of northwestern Washington (Figure 4, section 1) was assigned a Narizian age by Rau (1964, p. 4-6). Rau noted *Amphimorphina californica* Cushman and McMasters in these strata and indicated that the foraminifer is not diagnostic of the Ulatisian stage because it occurs in Narizian strata in Oregon and Washington. The Crescent Formation between Crescent and Freshwater Bays (section 1) is between Penutian and Ulatisian in age (Berthiaume, 1938; Mallory, 1953; Rau, 1964). I have interpreted it as thrust above the Twin River Formation of Refugian age (McWilliams, 1970, 1971, 1974b). Although the fault relationship has been debated (Brown, 1971; Brown and Hanna, 1971), it is clear that the structural and

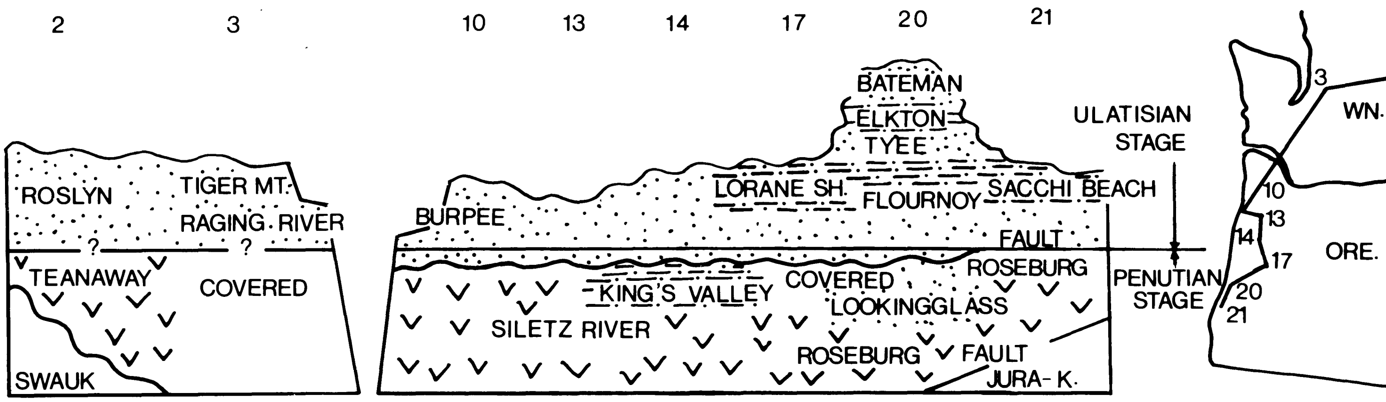


Figure 3. Correlations of Eocene stratigraphic units in western Oregon-Washington based on positions of Penutian-Ulatisian stage boundary. All stratigraphic names are the same as those used in cited reference. Locations of sections and references are as follows: 1) Lake Crescent, Brown and others (1960); 2) Mount Stuart, Smith (1904); 3) Hobart and Maple Valley, Vine (1962a); 4) Satsop River, Rau (1966); 5) Doty-Minot Peak, Pease and Hoover (1957); 6) Chehalis-Centralia, Snavely and others (1958); 7) Toledo-Castle Rock, Roberts (1958); 8) Kelso-Cathlamet, Livingston (1966); 9) Northwestern Oregon, Warren and others (1945); 10) Cape Kiwanda, Snavely and Vokes (1949); 11) Tualatin Valley, Schlicker and Deacon (1967); 12) Sheridan-McMinnville, Baldwin and others (1955); 13) Dallas-Valsetz, Baldwin (1964b); 14) Marys Peak-Alsea, Baldwin (1955); 15) Newport-Waldport, Vokes and others (1949); 16) West-central Willamette Valley, Vokes and others (1954); 17) South-southwest Willamette Valley, Vokes and others (1951); 18) Siuslaw River, Baldwin (1956); 19) Anlauf-Drain, Hoover (1963); 20) Umpqua River, Baldwin (1974); 21) Coos Bay, Baldwin (1975).

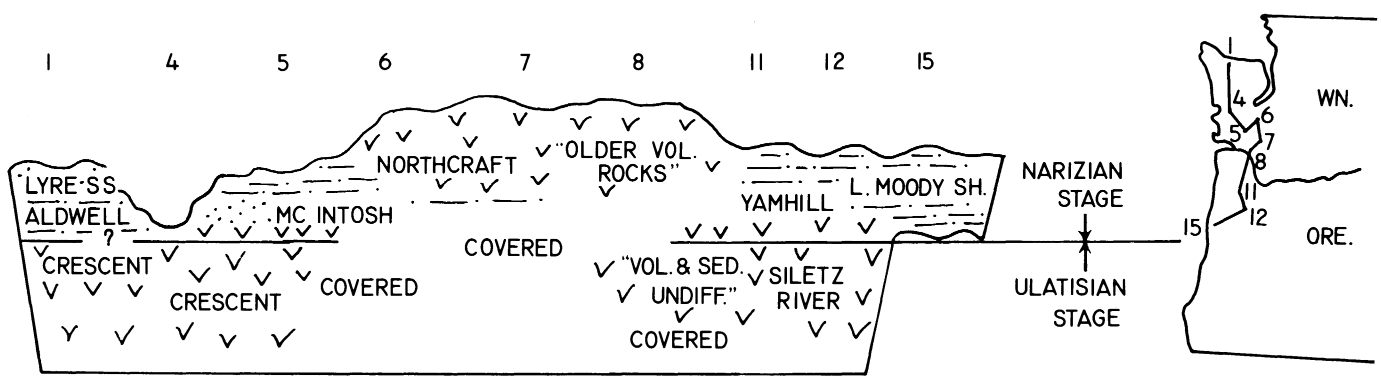


Figure 4. Correlation of Eocene stratigraphic units in western Oregon-Washington based on location of Ulatisian-Narizian stage boundary. Locations of sections and references are same as for Figure 3.

stratigraphic complexities of this locality preclude using it to indicate the age of the uppermost "Crescent Formation" (see Figure 6).

The "Crescent Formation" in the Satsop River area of northwestern Washington (section 4) was interpreted by Rau (1966, p. 24) to be Ulatisian. The writer agrees that localities F-36 through F-39 in the Little River section are Ulatisian (see Rau, 1966, Figure 2). However, the "Crescent Formation" at locality F-62 in the Canyon River section contains *Uvigerina churchi* Cushman and Siegfus, which is unknown below the Narizian. I have studied this locality in the field and have found, in addition, *Bulimina sculptilis* var. *laciniata* Cushman and Parker and *Valvulineria menloensis* Rau, which indicate Narizian.

The McIntosh Formation of the Centralia-Chehalis area (section 6) has been correlated with the B-1A zone (middle Ulatisian) of Laiming (Rau, 1956; Snavely and others, 1951). The evidence presented, however, does not support this correlation, since *Nodosaria latejugata* Gümbel and *Amphimorphina californica* Cushman and McMasters range into the Narizian (see Baldwin and others, 1955; Snavely and others, 1958, p. 18; Rau, 1964, p. 4, 7; Rau, 1966, Figure 5; and McWilliams, 1973b, p. 176, 1974a). Snavely and others (1958) found one locality (f11148) which contains B-1A fossils, but this is "Crescent Formation," not McIntosh Formation (see Pease and Hoover, 1957; Rau, 1958; and Strong, 1966).

Rau (1958) interpreted a pre-Narizian age for the lower McIntosh Formation, based on *Gaudryina coalingensis* Cushman, *Nodosaria latejugata* Gümbel, *Amphimorphina californica* Cushman and McMasters, *Bulimina corrugata* Cushman and Siegfus, *Bulimina* cf. *B. jacksonensis* Cushman, *Baggina tenninoensis* Rau and *Robulus* sp. C. The last-named three have not been reported from dated rocks outside southwestern Washington. Only one of the other four, *Gaudryina coalingensis*, is restricted to the Ulatisian stage and older. However, the many samples independently collected and picked by University of Washington students from the locality where *G. coalingensis* was reported (Rau, 1958, locality 9) show that it is not present. Instead, I have found in these samples abundant *Gaudryina* cf. *G. navarroana* Cushman, which is of unknown time-stratigraphic value on the West Coast. Moreover, I have found additional species not reported by Rau, such as *Robulus chiranus* Cushman and Stone and *Bulimina sculptilis* var. *laciniata* Cushman and Parker, which indicate Narizian rather than B-1A age (middle Ulatisian).

A Narizian age for the McIntosh Formation is supported by Pease and Hoover (1957), who concluded that in the Doty-Minot Peak area the unit is entirely late Eocene in age (section 5). They also reported two late Eocene localities in the underlying "Crescent Formation." This conclusion was corroborated by Strong (1966, p. 12-13), who reported the Narizian foraminifers *Robulus chiranus* Cushman and Stone and *Nodogenerina bradyi* Cushman from the "Crescent Formation" and numerous other species indicative of Narizian from the McIntosh Formation of the Doty-Minot Peak area (section 5). Therefore, given the evidence for Narizian age of the McIntosh Formation and the upper "Crescent Formation," it is my conclusion that the previously assigned B-1A age (middle Ulatisian) and correlation with the Tyee Formation and Sacchi Beach strata cannot be accepted for these formations. Both the Sacchi Beach strata and strata formerly called Tyee north of the Siuslaw River are now recognized to be the older Flournoy Formation (Baldwin, 1975).

The Yamhill Formation in the Tualatin Valley area of northwestern Oregon (section 11) is late Eocene in age (Schlicker and Deacon, 1967). Fossils collected by Robertson and Orr (1973) along Gales Creek at the base of the Yamhill (section 11) include benthic foraminifers indicative of lower Narizian. The underlying unit, "Eocene volcanics and sediments undifferentiated," is also Narizian (Schlicker and Deacon, 1967).

The Yamhill Formation in central-western Oregon (section 12) was named by Baldwin and others (1955), who reported fossil mollusks indicative of a "late Eocene, probably early late Eocene" age (see also McWilliams, 1974a, p. 122-123). Stewart (1957, p. 11, and *in* Baldwin and others, 1955), in apparent contradiction of this, assigned the Yamhill to Laiming's B-1A zone (middle Ulatisian). Current information does not support his correlation. Although *Amphimorphina californica* and *Nodosaria latejugata* are present in the Yamhill Formation, the other B-1A zone (middle Ulatisian) species reported on Stewart's check list are not present in my collections from the Yamhill Formation along Mill Creek and elsewhere (McWilliams, 1973b, tables 1-5 and 7). As noted previously, *Amphimorphina californica* and *Nodosaria latejugata* have been reported in joint occurrence with Narizian foraminifers at many different localities in the Pacific Northwest.

Baldwin (1964b) defined the Rickreall Limestone Member as a part of the Yamhill Formation in the Dallas and Valsetz quadrangles. I interpret the Rickreall Limestone, however, to be a part of the "Siletz River Volcanic Series" because it is Ulatisian age and because its paleoecology closely resembles that of the "Siletz River" (Boggs and others, 1973, p. 653-54; McWilliams, 1973b, p. 170).

I have mapped the basal contact of the Yamhill Formation and shown that it does not interfinger with the underlying Flournoy (formerly Tyee) Formation in the Grand Ronde, Dallas, and Valsetz areas (McWilliams, 1973b). In addition, I have an extensive collection of fossils from the Yamhill Formation in this area (section 12) indicating an age no older than Narizian. Samples from 40 ft above the base of the Yamhill Formation in Rock Creek are Narizian (McWilliams, 1973b, localities 42-43). An exposure 100 ft above the "Siletz River Volcanic Series" in the type Yamhill Formation along Mill Creek is also of Narizian age (McWilliams, 1973b, locality 20). Although this conclusion has been debated (Rau, 1974; McWilliams, 1974a), the same section along Mill Creek has been studied by Gaston (1974), who reported *Plectofrondicularia minuta* Sullivan, *Plectofrondicularia sacatensis* Hornaday, *Uvigerina garzaensis* Cushman and Siegfus, and

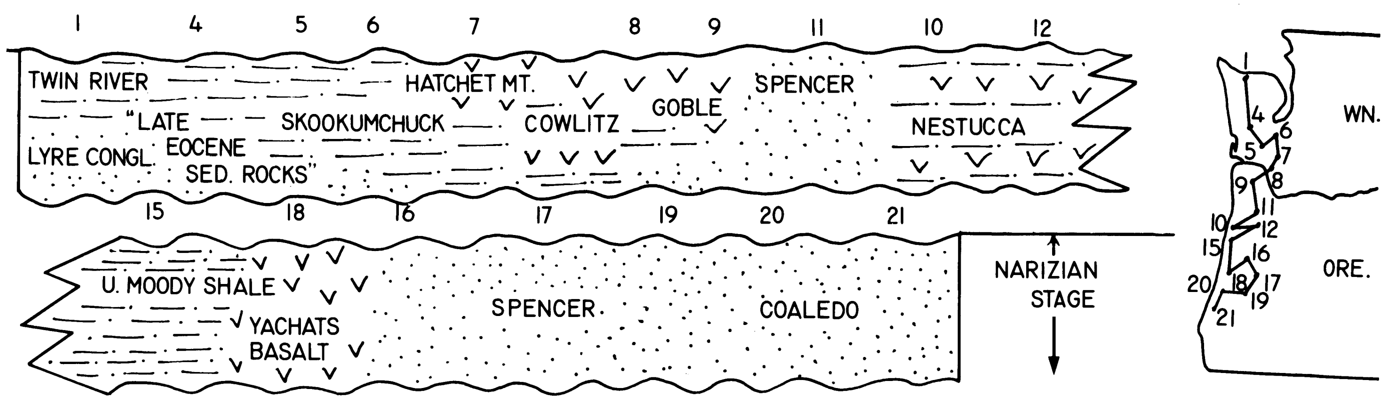


Figure 5. Correlation of upper Narizian stratigraphic units in western Oregon-Washington below Narizian-Refugian stage boundary. Locations of sections and references are same as for Figure 3.

Virgulina bramletti Galloway and Morrey from the lowermost exposed Yamhill Formation. All of these species are unknown from below the Narizian and confirm my interpretation of a Narizian age for the lower Yamhill Formation.

The uppermost "Siletz River Volcanic Series" below this locality contains *Vaginulinopsis mexicana* var. *nudicostata* Cushman and Hanna, which is not known from above the Ulatisian, and *Cibicides hodgei* Cushman and Schenck, of Narizian and post-Narizian time. The joint occurrence of these and other species (McWilliams, 1973b, localities 18-19) indicates that the Ulatisian-Narizian boundary is within the uppermost "Siletz River Volcanic Series" at this locality. Therefore, even the lowermost type Yamhill can be no older than Narizian.

This conclusion is consistent with the Narizian age of the uppermost "Crescent Formation" and overlying rocks in the Satsop River area and in the Doty-Minot Peak area of Washington—and also with the Narizian age of the "Eocene volcanics and sediments undifferentiated" and overlying rocks of the Tualatin Valley, Oregon, area. These Narizian volcanic rocks cannot be volcanic rocks of the Nestucca or Goble Formations because their stratigraphic position is below the Yamhill and McIntosh Formations.

The lower Moody Shale Member of the Toledo Formation is Narizian in the Newport-Waldport area (section 15), based on mollusks (Vokes and others, 1949) and foraminifers (Cushman and others, 1949; McWilliams, 1968, Table 2). The Moody Shale Member overlies the Flournoy Formation (Tyee of Vokes and others, 1949) with angular unconformity (Schenck, 1928, p. 35; McWilliams, 1968, p. 4).

THE UPPER NARIZIAN SEQUENCE

A regional unconformity (Snavely and Wagner, 1964, p. 11) separates the upper Narizian strata with their distinctive molluscan fauna of Tejon age (Turner, 1938; Weaver, 1942) from older rocks. The upper boundary of this sequence is an unconformity which coincides with the base of the Refugian stage (Armentrout, 1973). As the correlations shown in Figure 5 have been proposed by many workers and are generally accepted, they will not be discussed further in this paper.

STRATIGRAPHIC SUMMARY

Eocene rocks of western Oregon-Washington are generally interpreted to be an interfingering sequence of volcanic units and coarse and fine detrital sedimentary rocks (Snavely and Wagner, 1964; Braislin and others, 1971). The stratigraphic relations I interpret are radically different, as shown in Figure 6. The submarine basalts in the northern and southern extremities of western Oregon-Washington appear to straddle the boundary of the Penutian-Ulatisian stages, although only the Penutian portion is preserved below the unconformity in the sections depicted in Figure 3. In central-western Oregon-Washington, the submarine basalts bestride the boundary of the Ulatisian-Narizian stages and are therefore younger. The Narizian Yamhill Formation cannot be a facies of the Tyee, Flournoy, and Bateman Formations because they are Ulatisian. Similarly, the Narizian McIntosh Formation is not a facies of the Tiger Mountain, Raging River, and Roslyn Formations because they are also Ulatisian. The strata which I call "Crescent Formation" and "Siletz River Volcanic Series" and which underlie the Yamhill-McIntosh are Narizian in at least the upper part and therefore younger than any of the known Roslyn, Raging River, Tiger Mountain, Tyee, Flournoy, or Bateman Formations. The geographic distribution of older true Crescent and Teanaway basalts to the north and the Roseburg and true Siletz River Volcanic Series basalts to the south with younger "Siletz River" and "Crescent" basalts in the middle suggests spreading of deep sea floor away from an axis of rifting (McWilliams, 1972, 1978).

PLATE ROTATION

The plate scenario proposed to explain rifting may also explain the clockwise rotation of western Oregon and southwestern Washington indicated by paleomag-

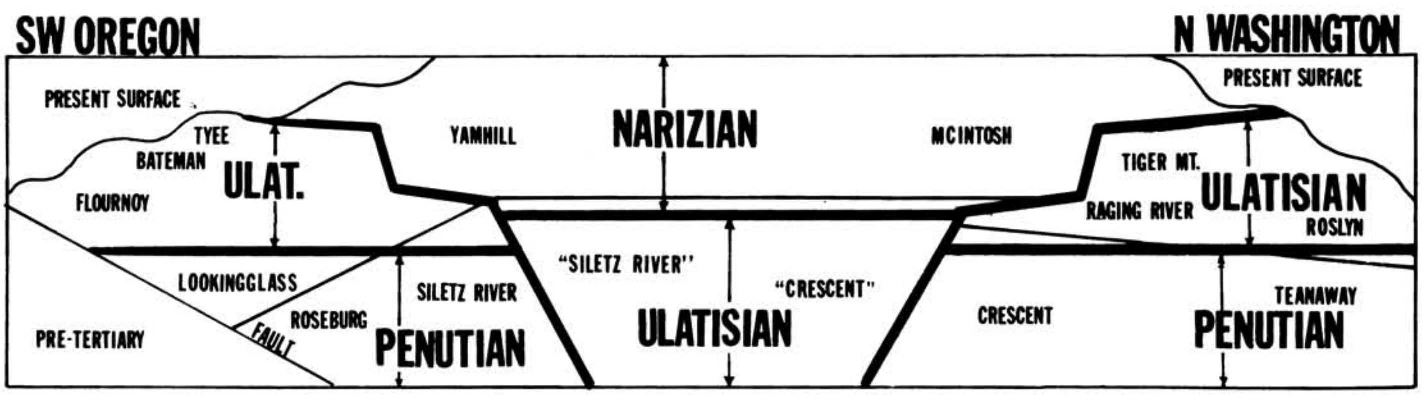


Figure 6. Generalized cross section from southwestern Oregon to northern Washington summarizing the correlations proposed. Heavy lines mark time-stratigraphic boundaries. Light lines mark boundaries between volcanic units (Crescent, Siletz River, Roseburg, Teanaway), fine clastic units (Yamhill, McIntosh), and coarse clastic units (Bateman, Flournoy, Lookingglass, Tyee, Raging River, Tiger Mountain, and Roslyn).

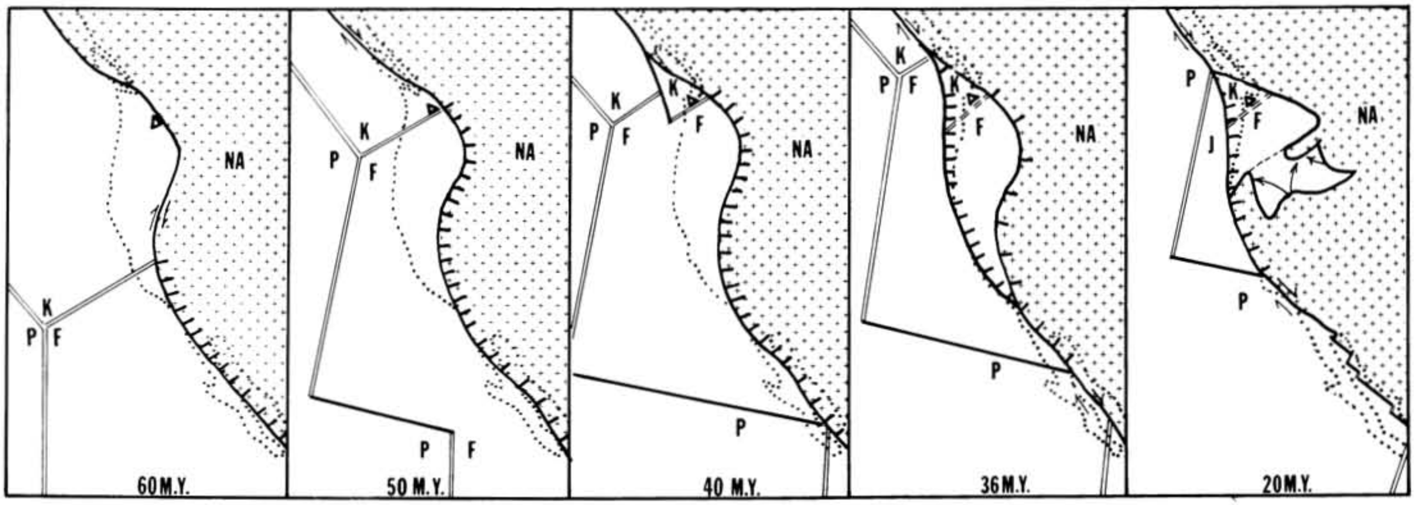


Figure 7. Location of plate boundaries at different times during the Tertiary. Dotted lines show present outline of western North America between Vancouver Island and Baja California. Triangular fragment is schematic representation of part of North American Plate. F = Farallon Plate, K = Kula Plate, P = Pacific Plate, NA = North American Plate. 60 m.y. modified after Hamilton (1969). 36 m.y. modified after Atwater (1970). 20 m.y. modified after Hamilton and Myers (1966).

netism (Simpson and Cox, 1977; Beck and Burr, 1979). Clockwise rotation could be due to flexural-slip folding of the Farallon Plate between 50 and 40 m.y.b.p. (Figure 7). The eastern portion of the Farallon Plate was trapped between a northwesterly moving block on the west (Kula-Farallon Plate) and a westerly moving block on the east (North American Plate). This situation is analogous to the clockwise-twisted Gorda Basin, which is trapped between the Mendocino Fracture Zone and the North American Plate (Silver, 1971).

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Mount St. Helens photos available for purchase from USGS

Over 1,500 frames of photography of the eruption of Mt. St. Helens, taken from April 10 to June 4 and covering most of the significant aspects of the eruption, are now available for purchase from the U.S. Geological Survey (USGS), Department of the Interior.

The initial USGS photography is available in the form of two rolls of microfilm for $15 each. By purchasing the microfilm, or viewing it in one of the USGS offices where it will be available for inspection, the user can view all the photography so far available and then choose which frames to have made into photographs.

"Because of the intense scientific as well as general interest in the eruption, the USGS is trying to make the photography available as quickly as possible," said Allen H. Watkins, chief of the USGS Earth Resources Observation Systems Data Center, the office distributing the volcano photographs and other remotely sensed data such as satellite images. The microfilm is designed particularly for scientists with a serious interest in volcano dynamics and other detailed studies of the eruptive process.

To assist the general public, who may wish to order more limited quantities, the USGS has also selected 12 of the most dramatic prints for direct sale as 9-in. by 9-in. black-and-white photographs at a cost of $3 each. The photos can also be obtained in larger sizes of 18 in. by 18 in., 27 in. by 27 in., and 36 in. by 36 in. for $10, $15, and $20 each, respectively.

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Oil and gas activity continues to increase

The Oregon Department of Geology and Mineral Industries issued 36 oil and gas drilling permits in the first seven months of 1980. Most of the permits have been in the vicinity of the Mist Gas Field in Columbia County, northwest Oregon. Seven producing wells have been found in the field to date. The Mist gas is the first commercial production in Oregon. Two holes were drilled in the area 34 years ago by Texaco, and the present development resulted from data obtained from them. Since 1975, 21 holes have been put down in the Mist area.

Leasing of oil and gas minerals has continued at a steady pace since the Mist discovery last May. Newest entries to exploration in northwest Oregon include Nehama and Weagant, Bakersfield, California, and AMOCO Production Company, Denver, Colorado.

At present, an estimated 5 million acres are under lease or applied for in the state. The increase in exploration comes at a time when the timber economy is sagging. Although the economic impact of drilling and production is still small in Oregon, it has the prospect of becoming more important in the next few years.

Northwest Exploration Company has drilled three of five locations in southwestern Oregon, where it has an estimated 200,000 acres of leases. A discovery in southwestern Oregon would set off an exploration effort for the next five to ten years.

Table 1. *Oil and gas drilling permits issued since April 1980*

Permit number	Date issued	Company	Lease name	Location
73 RD	3/14/80	Reichhold Energy Corp.	DSC-Longview Fibre 1 Redrill	SW¼ sec. 11, T. 6 N., R. 5 W. Columbia County
123	3/31/80	Reichhold Energy Corp.	Columbia County 11-10	NW¼ sec. 10, T. 6 N., R. 5 W. Columbia County
124	3/31/80	Reichhold Energy Corp.	Columbia County 33-3	SW¼ sec. 3, T. 6 N., R. 5 W. Columbia County
125	3/31/80	Reichhold Energy Corp.	Columbia County 43-11	SE¼ sec. 11, T. 6 N., R. 5 W. Columbia County
126	3/31/80	Reichhold Energy Corp.	Crown Zellerbach 42-1	NE¼ sec. 1, T. 6 N., R. 5 W. Columbia County
127	3/31/80	Reichhold Energy Corp.	Longview Fibre 34-12	SE¼ sec. 12, T. 6 N., R. 5 W. Columbia County
128	3/31/80	Reichhold Energy Corp.	Libel 44-15	SE¼ sec. 15, T. 6 N., R. 5 W. Columbia County
129	3/31/80	Reichhold Energy Corp.	Columbia County 44-4	SE¼ sec. 4, T. 6 N., R. 5 W. Columbia County
130	3/31/80	Reichhold Energy Corp.	Columbia County 21-10	NW¼ sec. 10, T. 6 N., R. 5 W. Columbia County
131	3/31/80	Reichhold Energy Corp.	Columbia County 32-3	NE¼ sec. 3, T. 6 N., R. 5 W. Columbia County
132	3/31/80	Reichhold Energy Corp.	Laubach 34-13	SE¼ sec. 13, T. 6 N., R. 5 W. Columbia County
133	3/31/80	Reichhold Energy Corp.	Libel 22-15	NW¼ sec. 15, T. 6 N., R. 5 W. Columbia County

Table 1. *Oil and gas drilling permits issued since April 1980* (continued)

Permit number	Date issued	Company	Lease name	Location
134	3/31/80	Reichhold Energy Corp.	Longview Fibre 33-12	SE¼ sec. 12, T. 6 N., R. 5 W. Columbia County
135	3/31/80	Reichhold Energy Corp.	White 33-13	SE¼ sec. 13, T. 6 N., R. 5 W. Columbia County
136	4/4/80	Northwest Exploration Co.	Coos County 1	SW¼ sec. 14, T. 27 S., R. 13 W. Coos County
137	4/4/80	Northwest Exploration Co.	Westport 1	SE¼ sec. 16, T. 26 S., R. 13 W. Coos County
138	4/4/80	Northwest Exploration Co.	Fat Elk 1	SW¼ sec. 15, T. 28 S., R. 13 W. Coos County
139	4/4/80	Northwest Exploration Co.	Sawyer Rapids 1	NE¼ sec. 3, T. 23 S., R. 9 W. Douglas County
140	5/13/80	Reichhold Energy Corp.	Longview Fibre 24-12	SW¼ sec. 12, T. 6 N., R. 5 W. Columbia County
141	5/27/80	Northwest Exploration Co.	Fish Trap 1	SE¼NE¼ sec. 32, T. 28 S., R. 13 W. Coos County
142	6/4/80	Reichhold Energy Corp.	Adams 32-34	NE¼ sec. 34, T. 7 N., R. 5 W. Columbia County
143	6/4/80	Reichhold Energy Corp.	Adams 24-34	SW¼ sec. 34, T. 7 N., R. 5 W. Columbia County
144	6/4/80	Reichhold Energy Corp.	Adams 23-34	SW¼ sec. 34, T. 7 N., R. 5 W. Columbia County
145	6/4/80	Reichhold Energy Corp.	Columbia County 21-34	NW¼ sec. 34, T. 7 N., R. 5 W. Columbia County
146	6/4/80	Reichhold Energy Corp.	Columbia County 11-33	NW¼ sec. 33, T. 7 N., R. 5 W. Columbia County
147	6/4/80	Reichhold Energy Corp.	Columbia County 12-9	NW¼ sec. 9, T. 6 N., R. 5 W. Columbia County
148	6/4/80	Reichhold Energy Corp.	Columbia County 32-5	NE¼ sec. 5, T. 6 N., R. 5 W. Columbia County
149	6/4/80	Reichhold Energy Corp.	Columbia County 31-3	NE¼ sec. 3, T. 6 N., R. 5 W. Columbia County
150	6/4/80	Reichhold Energy Corp.	Columbia County 42-4	NE¼ sec. 4, T. 6 N., R. 5 W. Columbia County

Table 1. *Oil and gas drilling permits issued since April 1980* (continued)

Permit number	Date issued	Company	Lease name	Location
151	6/4/80	Reichhold Energy Corp.	Columbia County 22-3	NW¼ sec. 3, T. 6 N., R. 5 W. Columbia County
152	6/21/80	Reichhold Energy Corp.	Longview Fibre 23-12	SW¼ sec. 12, T. 6 N., R. 5 W. Columbia County
153	6/25/80	Reichhold Energy Corp.	Columbia County 13-2	SW¼ sec. 2, T. 6 N., R. 5 W. Columbia County
154	7/8/80	American Quasar Petroleum Co.	Investment Management 34-22	SE¼NW¼ sec. 34, T. 6 N., R. 4 W. Columbia County
155	7/8/80	American Quasar Petroleum Co.	Larkins 23-33	NW¼SE¼ sec. 23, T. 6 N., R. 5 W. Columbia County
156	7/18/80	American Quasar Petroleum Co.	Rau 18-14	SW¼SW¼ sec. 18, T. 6 N., R. 4 W. Columbia County
157	8/20/80	American Quasar Petroleum Co.	Crown Zellerbach 30-33	NW¼SE¼ sec. 30, T. 6 N., R. 4 W. Columbia County
158	Application	Reichhold Energy Corp.	Columbia County 14-2	SW¼ sec. 2, T. 6 N., R. 5 W. Columbia County
159	Application	Reichhold Energy Corp.	Sweet 14-1	SW¼ sec. 1, T. 6 N., R. 5 W. Columbia County
160	Application	Reichhold Energy Corp.	Independence 12-25	NW¼ sec. 25, T. 8 S., R. 4 W. Marion County
161	Application	Reichhold Energy Corp.	Bagdanoff 23-28	SW¼ sec. 28, T. 5 S., R. 2 W. Marion County
162	Application	Reichhold Energy Corp.	Crown Zellerbach 22-6	NW¼ sec. 6, T. 6 N., R. 4 W. Columbia County
163	Application	Northwest Exploration Co.	Fat Elk 2	SE¼ sec. 11, T. 28 S., R. 13 W. Coos County

Table 2. *Oil and gas tests drilled since January 1980*

Permit number	Operator	Well name	Location	Depth (ft)		Status
73 RD	Reichhold Energy Corp.	Longview Fibre 1 Redrill	SW¼ sec. 11, T. 6 N., R. 5 W. Columbia County	2,803	RD	Abandoned 5/10/80.
115	Reichhold Energy Corp.	Columbia County 12	NW¼ sec. 14, T. 6 N., R. 5 W. Columbia County	3,160 3,365	TD RD	Abandoned 3/15/80.

Table 2. *Oil and gas tests drilled since January 1980* (continued)

Permit number	Operator	Well name	Location	Depth (ft)		Status
116	Oregon Natural Gas Development Corp.	Crown Zellerbach 1	NW¼ sec. 13, T. 2 S., R. 10 W. Tillamook County	6,158	TD	Abandoned 1/8/80.
117	John T. Miller	John Stump 1	NW¼ sec. 26, T. 8 S., R. 5 W. Polk County	1,502	TD	Preparing to abandon 7/24/80.
119	American Quasar Petroleum Co.	Wall 24-13	SW¼ sec. 24, T. 6 N., R. 5 W. Columbia County	2,810	TD	Abandoned 1/25/80.
121	American Quasar Petroleum Co.	Longview Fibre 25-32	NE¼ sec. 25, T. 6 N., R. 5 W. Columbia County	2,902 3,261	TD RD	Abandoned 2/14/80.
122	American Quasar Petroleum Co.	Crown Zellerbach 14-21	NW¼ sec. 14, T. 5 N., R. 5 W. Columbia County	1,832	TD	Abandoned 2/22/80.
124	Reichhold Energy Corp.	Columbia County 33-3	SE¼ sec. 3, T. 6 N., R. 5 W. Columbia County	2,750	TD	Completed on 6/4/80 for an estimated flow of 6,000 MCF/D.
125	Reichhold Energy Corp.	Columbia County 43-11	SE¼ sec. 11, T. 6 N., R. 5 W. Columbia County	3,226 3,100 ±	TD RD	Suspended 6/23/80.
126	Reichhold Energy Corp.	Columbia County 42-1	NE¼ sec. 1, T. 6 N., R. 5 W. Columbia County	1,854	TD	Completed 7/22/80 new field extension, 900 MCF/D rate.
129	Reichhold Energy Corp.	Columbia County 44-4	SE¼ sec. 4, T. 6 N., R. 5 W. Columbia County	3,060	TD	Abandoned 5/26/80.
131	Reichhold Energy Corp.	Columbia County 32-3	NE¼ sec. 3, T. 6 N., R. 5 W. Columbia County	3,395	TD	Suspended 5/2/80.
135	Reichhold Energy Corp.	White 33-13	SE¼ sec. 13, T. 6 N., R. 5 W. Columbia County	2,708	TD	Abandoned 5/17/80.
137	Northwest Exploration Co.	Westport 1	SE¼ sec. 16, T. 26 S., R. 13 W. Coos County	3,692	TD	Abandoned 6/27/80.
138	Northwest Exploration Co.	Fat Elk 1	SW¼ sec. 15, T. 28 S., R. 13 W. Coos County	3,110	TD	Abandoned 7/28/80.
139	Northwest Exploration Co.	Sawyer Rapids 1	NE¼ sec. 3, T. 23 S., R. 9 W. Douglas County	5,563	TD	Abandoned 5/31/80.
143	Reichhold Energy Corp.	Adams 24-34	SW¼ sec. 34, T. 7 N., R. 5 W. Columbia County	3,377	TD	Abandoned 7/3/80.
153	Reichhold Energy Corp.	Columbia County 13-2	SW¼ sec. 2, T. 6 N., R. 5 W. Columbia County	–		Redrilling. □

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