GEOLOGY 334 FIELD TRIP

OREGON COAST: EARLY CENOZOIC TO PRESENT

(compiled by Becky Dorsey)

The purpose of this field trip is to view the bedrock stratigraphy and sedimentology and raised coastal terraces that are well displayed along the coast of Oregon. On this trip you will learn, with our help, to describe and intepret sedimentary rocks and coastal landforms.

The Coast Range of Oregon is made up primarily of Cenozoic-aged (65 - 0 m.y. old) volcanic and sedimentary rocks that accumulated in various types of marine environments. The oldest Cenozoic rocks, which we won't see on this trip, are basalts of the Roseburg and Siletz River volcanic formations. They range in age from late Paleocene to the end of early Eocene (~58 to 50 m.y. old), and were produced by submarine basaltic volcanism above an oceanic hot spot (mantle plume). Those rocks are overlain by a thick succession of marine sedimentary rocks that record deposition in a tectonically active forearc basin. A forearc basin is a type of sedimentary basin that forms between a trench (subduction zone) and the volcanic chain that commonly forms above a subduction zone at a convergent plate boundary. In fact the Coast Range today sits in a similar setting, between the Cascadia subduction zone to the west and the Cascade volcanic range to the east. Thus, the tectonic setting of the Coast Range has stayed approximately the same since it became a forearc basin approximately 50 million years ago.

The thick succession of Cenozoic sedimentary rocks ranges in age from oldest middle Eocene (~ 50 m.y. old) to the end of upper Miocene (~ 5 m.y. old). These strata, seen at **stops 2 and 3**, consist of interbedded sandstone and shale with lesser amounts of conglomerate. They were deposited in deep- to shallow-marine environments of the forearc basin by processes such as turbidity currents, debris flows, shelf storms, and delta-channel sedimentation. Some of these deposits contain fossil shells and burrows that provide a record of ancient marine life.

Since early Pliocene time (~ 5 to 3 m.y. ago), rocks in the Coast Range have been uplifted and eroded as a result of tectonic processes related to ongoing subduction at the active plate margin. This has produced a series of coastal terraces **(stops 1-3)** that were produced by marine wave erosion followed by slow uplift of the rocks, making terrace surfaces preserved at different elevations above sea level. The coastal terraces are Pleistocene in age (1.65 m.y. to 10,000 yrs), and most of them are in the range of 80 thousand to several 100 thousand years old.

Stop 0 (optional). Highway 38 just west of I-5. Marine sedimentary rocks of the Tyee Formation (early Eocene?) are exposed on the north side of the highway. We *may* make a short stop there.

Eugene to Dean Creek: 85 miles (~ 1 hr. 45 min., not including Stop 0)

1. Dean Creek Elk Viewing Station (4 mi. east of Reedsport). View raised marine terraces and drowned valley of Umpqua River, discuss how they have formed in the recent geologic past.

Dean Creek to Sunset Bay, through North Bend: 45 miles (~ 1 hr.)

2. Sunset Bay (west of Coos Bay). Steeply dipping marine deposits and faults in the Eocene Coaledo Formation; Quaternary marine terrace; 1200-yr old tree stumps buried in beach sand.

Sunset Bay to Cape Arago: about 3 miles (~10 min.)

3. Cape Arago (south of Sunset Bay). Deep marine rocks of the Eocene Elkton Formation; different levels of uplifted Quaternary marine terraces; wave-cut cliffs and recent coastal slumps.

Return Eugene ~6:30-7:00 p.m.

Stop 1. Dean Creek Elk Viewing Station (see location maps and Figs. 1 - 2)

Here we are at the lower end of the Umpqua River, one of many sizable rivers that drain across the Coast Range. We can see here evidence for both: (1) submergence of the coastline produced by rapid sea-level rise during the past 10,000 years, and (2) uplift of the Coast Range over a longer time scale of 10's to 100's of thousands of years. Juxtaposition of these two contrasting processes is at first puzzling, and it is worthwhile to think about how both submergence and emergence of the coast can be happening at the same time. <u>Evidence for submergence</u> of the coastline is seen in the wide flat bottom of the river valley, which actually is an estuary that is directly influenced by daily tides. The river valley was carved by erosion when global sea level was about 150 meters lower than it is today (100's of thousands of years ago), and later the valley was filled in with a thick accumulation of tidal sediments as sea level rose during the past 10,000 years (Holocene). <u>Evidence for emergence</u> of the coastline is seen in the high terraces (= flat surfaces) that we can see in the hills on either side of the river valley. The terraces were produced by wave erosion in coastal marine waters, and later they were uplifted, removed from the marine setting, and preserved as the flat terrace surfaces that we can see all along the coast of Oregon.

Now consider this: If young sediments and valley morphology show us that the valley is being submerged by recent sea-level rise, how is it possible that we also see terraces at higher elevations which record uplift of the coast? Shouldn't the coast either be going up or down? How can it be doing both? This bothered your literal-minded professor (Dorsey), so I checked with one of the local experts on these topics: Ray Weldon, another professor in the Department of Geological Sciences. He explained that both processes (submergence and emergence of the coastline) are taking place, but they are occurring at different rates over different geologic time scales. Over long periods of time (100's of thousands of yrs), rocks in the Coast Range are being slowly uplifted at an average rate of about 0.1 mm/yr (= 0.1 meter/1,000 yrs). This means that, for example, a terrace that is 120,000- yrs old is now perched at about 12 meters above sea level. The higher terraces are even older, and the ones seen at ~100 meters above sea level must be many 100's of thousands or even up to 1 million yrs old, but their ages are not well known. Superimposed on this slow steady uplift of the rocks are rapid fluctuations in global sea level that can periodically overwhelm the slow ongoing coastal uplift. Thus in the present day, we see the result of the last 10,000 years of rapid sea-level rise which has submerged and drowned the lower Umpqua River. In this case, "rapid" is a rate of about 1-10 mm/yr (meters/1,000 yrs). The view at Stop 1 shows us that the rapid rise in sea level since 10,000 yrs ago has successfully drowned the lower Umpqua River, even though the rocks in the Coast Range are being uplifted slowly at the same time.

Stop 2. Sunset Bay (see location map and Figures 3 - 8)

At Sunset Bay we see several interesting features: (1) steeply dipping marine deposits and faults in the Eocene Coaledo Formation; (2) raised marine terraces produced by uplift, just like the ones we saw from a distance at Stop 1; and (3) 1200-yr old tree stumps buried in beach sand.

The Eocene epoch ranges from about 58 to 36 million years ago. The Coaledo Formation at Sunset Bay is middle Eocene in age, which means it is about 52 - 44 million years old. Its name derives from the fact that in some places, but not here, it contains significant amounts of coal that accumulated in swamp environments associated with ancient deltas at the margin of the forearc-basin seaway. The deposits at this locality are steeply dipping, which means they were tilted by regional deformation and folding sometime after they were deposited. The Coaledo Formation at Sunset Bay is made up of interbedded sandstone and shale deposits that occur in "packages" 30 to 70 meters thick, that that show a gradual up-section increase in abundance of sandstone (Fig. 6). The up-section increase of sand in each package has been interpreted by previous workers to result from progradation of sand into an ancient marine shelf setting. "Progradation" means advancing of a coastline into the sea that can occur due to an increase in delivery of sand to an area through time. Each coarsening-up package contains a gradual transition from thin offshore marine turbidites in the lower part to well stratified shallow marine and near-shore sandstone in the upper part. The "hummocky" stratification in these upper sandstone units was produced by strong storm waves. The sandstone upper part of each package is abruptly overlain by distal marine mudstone and turbidites, representing a relatively rapid drowning of the near-coastal area that could occur by switching of a delta channel away from that position at that time. If you look carefully, you might be able to find some fossils or burrows in these rocks. Note also the various faults that cut these rocks, and look for offsets of sandstone beds.

Capping these dipping Eocene deposits is a well displayed Pleistocene-age wave-cut terrace that is overlain by coastal sand deposits. This terrace is locally called the "Whisky Run" terrace platform, and it is now perched above sea level because of ongoing slow uplift of the rocks, as described for stop 1. This terrace surface is found at different elevations in different locations around the Coos Bay area, which indicates a very young history of coastal deformation and warping of relatively young marine terraces. You can also see that modern waves are presently carving into the bedrock and are creating the modern wave-cut bench at the level of the beach here. In the future, this wave-cut bench will be gradually uplifted and will become an elevated surface like the one that we now see is cut on the dipping Eocene sedimentary rocks.

We also can see tree stumps here that are now buried in beach sand. The tree stumps have been dated with C-14 dating techniques at about 1,200 years old. The trees grew above sea level and later were drowned, probably by a sudden subsidence event during one of the very large earthquakes that occur in the Cascadia subduction zone about once every 300 to 500 years.

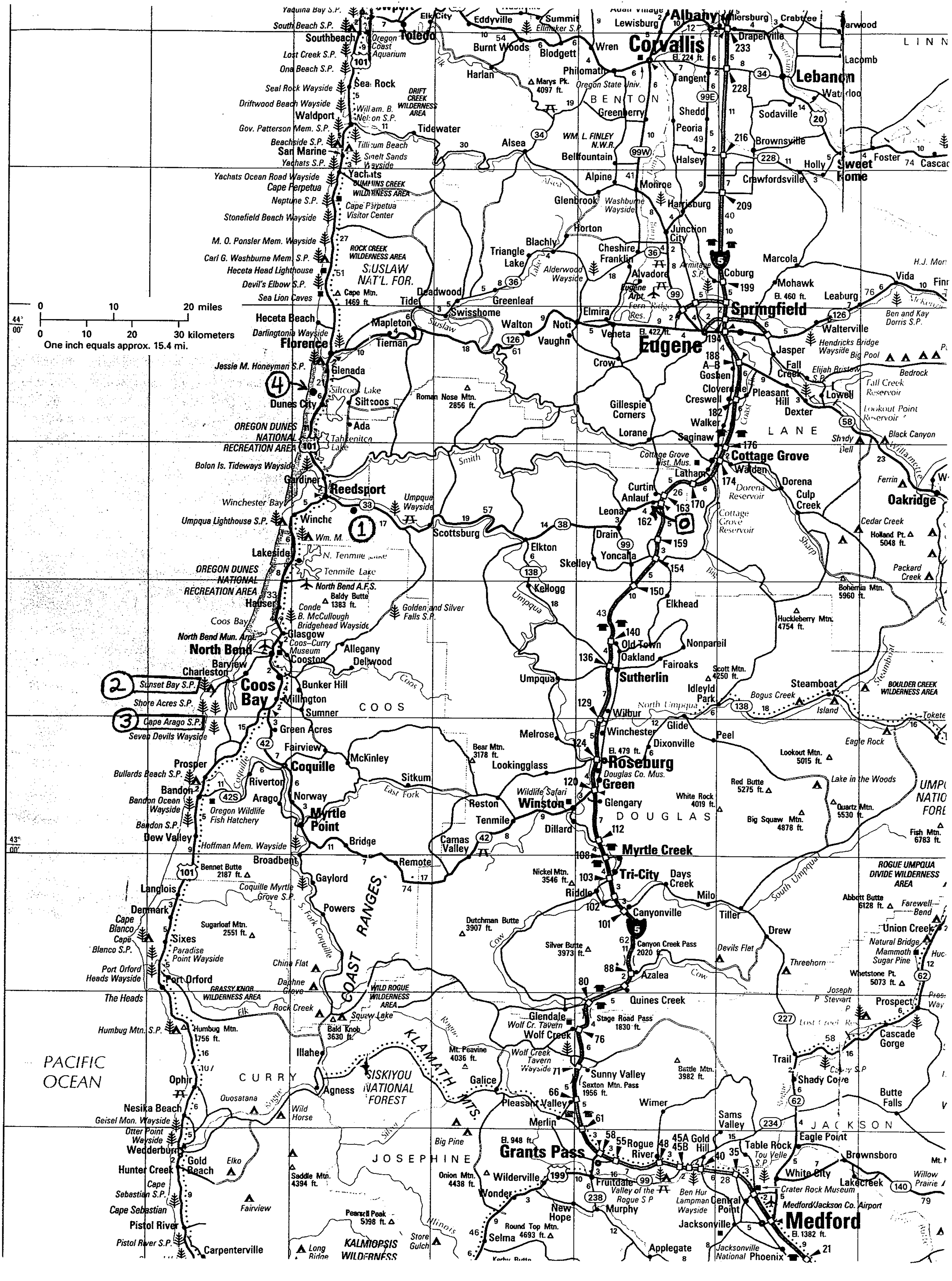
Stop 3. Cape Arago

This is a spectacular setting that displays the rugged coastal cliffs that are typical of the Oregon Coast. We will first view some of the raised marine terraces that are supposed to be preserved in this area (see stop 1 and Figs. 1 & 2 for an explanation). Then we will walk down a short trail to "South Cove" and look at sedimentary rocks exposed in outcrops of the Eocene Elkton Formation. The Elkton Formation underlies (and is older than) the Coaledo Formation. Here we will see interesting deposits of debris flows that formed by slumping and sliding on a submarine slope during Eocene time. The debris flows contain pebble sized pieces (clasts) of old rocks derived from ancient highlands, and also contain fragments of the adjacent sediments that were broken off the sea floor and included into the ancient debris flows. Higher in the section we can see some pretty thin-bedded turbidites that record background deposition on this ancient submarine slope.

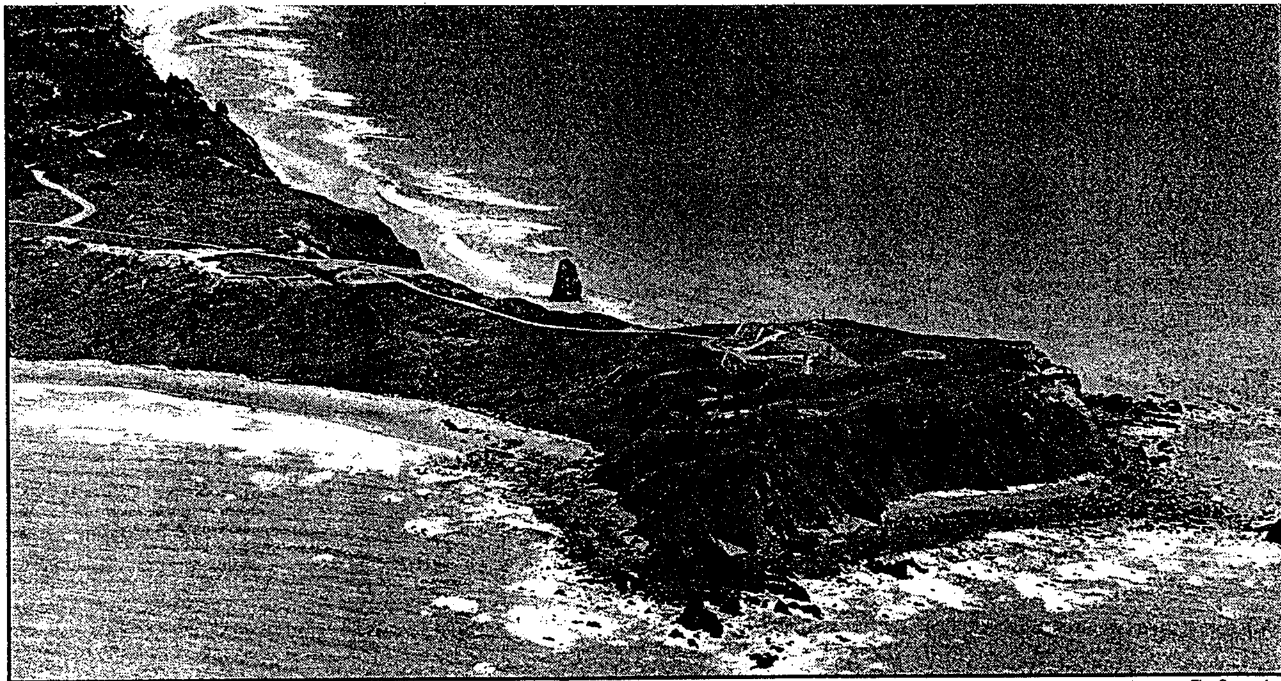
Other things to note here include the vertical coastal cliffs, well rounded beach cobbles produced by wave reworking on this high-energy coastline, and a modern slump that has partially taken out the trail and will make it a little tricky to get down to the beach!

Stop 4. Siltcoos Beach (optional)

Finally, one can stop at Siltcoos Beach on your way back to Eugene, to view and walk on the awesome wind-formed sand dunes of coastal Oregon. Most of the sand transport in these dunes occurs during winter storms when winds sweep in from the south and southwest. Lesser amounts of transport occurs during the summer, when winds blow from the north and northwest. Note the steep slip faces on these large sand dunes: these slip faces are on the down-wind side of the dune and show us the direction of sand transport and dune migration. They are also fun to slide down.



0 10 20 miles
0 10 20 30 kilometers
One inch equals approx. 15.4 mi.
PACIFIC OCEAN
Yaquina Bay S.P.
South Beach S.P.
Southbeach
Oregon Coast Aquarium
Toledo
Elk City
Eddyville
Summit
Ellmaker S.P.
Lewisburg
Albany
Millersburg
Crabtree
Harwood
LINN
Corvallis
Lost Creek S.P.
Ona Beach S.P.
Burnt Woods
Blodgett
Wren
Philomath
El. 224 ft.
Draperville
Lacomb
Lebanon
Seal Rock
Seal Rock Wayside
Harlan
Marys Pk. 4097 ft.
Oregon State Univ.
Tangent
BENTON
Waterloo
Driftwood Beach Wayside
DRIFT CREEK WILDERNESS AREA
Waldport
William B. Nelson S.P.
Greenberry
Shedd
Sodaville
Gov. Patterson Mem. S.P.
Tidewater
Peoria
Brownsville
Beachside S.P.
San Marine
Tillicum Beach
Alsea
WM. L. FINLEY N.W.R.
Bellfountain
Halsey
Holly
Sweet Home
Foster
Cascadia
Yachats S.P.
Smelt Sands Wayside
Yachats
Yachats Ocean Road Wayside
Cape Perpetua
CUMMINS CREEK WILDERNESS AREA
Alpine
Monroe
Crawfordsville
Neptune S.P.
Cape Perpetua Visitor Center
Glenbrook
Washburne Wayside
Harrisburg
Stonefield Beach Wayside
Horton
Junction City
M. O. Ponsler Mem. Wayside
ROCK CREEK WILDERNESS AREA
Blachly
Triangle Lake
Cheshire
Franklin
Carl G. Washburne Mem. S.P.
Heceta Head Lighthouse
SIUSLAW NAT'L. FOR.
Alderwood Wayside
Alvadore
Armitage S.P.
Coburg
Marcola
H.J. Mor
Devil's Elbow S.P.
Cape Mtn. 1469 ft.
Deadwood
Eugene Arpt.
Mohawk
El. 460 ft.
Leaburg
Vida
Finn
Sea Lion Caves
Tide
Greenleaf
Fern Ridge Res.
Springfield
Heceta Beach
Swisshome
Elmira
Ben and Kay Dorris S.P.
Darlingtonia Wayside
Mapleton
Walton
Noti
Walterville
Florence
Tiernan
Siuslaw
Vaughn
Veneta
El. 422 ft.
Eugene
Hendricks Bridge Wayside
Jasper
Big Pool
Jessie M. Honeyman S.P.
Glenada
Crow
Fall Creek
Elijah Bristow S.P.
Bedrock
Siltcoos Lake
Roman Nose Mtn. 2856 ft.
Goshen
Fall Creek Reservoir
Dunes City
Siltcoos
Gillespie Corners
Cloverdale
Creswell
Pleasant Hill
Lowell
Lookout Point Reservoir
Dexter
OREGON DUNES NATIONAL RECREATION AREA
Ada
Tahkenitch Lake
Lorane
Walker
LANE
Saginaw
Shady Dell
Black Canyon
Bolon Is. Tideways Wayside
Smith
Cottage Grove Hist. Mus.
Cottage Grove
Latham
Walden
Gardiner
Reedsport
Umpqua Wayside
Curtin
Dorena
Dorena Reservoir
Ferrin
Winchester Bay
Anlauf
Culp Creek
Oakridge
Umpqua Lighthouse S.P.
Winchester
Scottsburg
Leona
Cottage Grove Reservoir
Cedar Creek
Wm. M.
Elkton
Drain
Holland Pt. 5048 ft.
Lakeside
N. Tenmile Lake
Tenmile Lake
Skelley
Yoncalla
North Bend A.F.S.
Kellogg
Packard Creek
Baldy Butte 1383 ft.
Bohemia Mtn. 5960 ft.
Hauser
Conde B. McCullough Bridgehead Wayside
Golden and Silver Falls S.P.
Elkhead
Coos Bay
Glasgow
Umpqua
Huckleberry Mtn. 4754 ft.
North Bend Mun. Arpt.
North Bend
Coos-Curry Museum
Allegany
Old Town
Oakland
Nonpareil
Barview
Charleston
Cooston
Dellwood
Fairoaks
Sunset Bay S.P.
Coos Bay
Bunker Hill
Coos
Sutherlin
Scott Mtn. 4250 ft.
Idleyld Park
Steamboat
BOULDER CREEK WILDERNESS AREA
Shore Acres S.P.
Millington
COOS
North Umpqua
Bogus Creek
Island
Cape Arago S.P.
Sumner
Wilbur
Glide
Toketee
Seven Devils Wayside
Green Acres
Melrose
Winchester
Peel
Fairview
Dixonville
Eagle Rock
Prosper
Coquille
McKinley
Bear Mtn. 3178 ft.
El. 479 ft.
Roseburg
Lookout Mtn. 5015 ft.
Bullards Beach S.P.
Lookingglass
Bandon
Riverton
Sitkum
Douglas Co. Mus.
Green
Red Butte 5275 ft.
Lake in the Woods
UMPQUA NATIONAL FOREST
Bandon Ocean Wayside
Arago
Norway
East Fork
Reston
Wildlife Safari
Winston
Glengary
White Rock 4019 ft.
Oregon Wildlife Fish Hatchery
Myrtle Point
Tenmile
Quartz Mtn. 5530 ft.
Bandon S.P.
DOUGLAS
Big Squaw Mtn. 4878 ft.
Dew Valley
Bridge
Camas Valley
Dillard
Fish Mtn. 6783 ft.
Hoffman Mem. Wayside
Myrtle Creek
Broadbent
Remote
ROGUE UMPQUA DIVIDE WILDERNESS AREA
Bennet Butte 2187 ft.
Gaylord
Nickel Mtn. 3546 ft.
Tri-City
Days Creek
Langlois
Coquille Myrtle Grove S.P.
COAST RANGES
Riddle
Milo
South Umpqua
Abbott Butte 6128 ft.
Denmark
Powers
Canyonville
Tiller
Farewell Bend
Cape Blanco
Sugarloaf Mtn. 2551 ft.
Dutchman Butte 3907 ft.
Drew
Union Creek
Cape Blanco S.P.
Sixes
Paradise Point Wayside
Silver Butte 3973 ft.
Canyon Creek Pass 2020 ft.
Devils Flat
Natural Bridge
Mammoth Sugar Pine
Port Orford Heads Wayside
Port Orford
China Flat
Threehorn
Whetstone Pt. 5073 ft.
GRASSY KNOB WILDERNESS AREA
Daphne Grove
Azalea
Cow
Joseph P. Stewart
The Heads
WILD ROGUE WILDERNESS AREA
Quines Creek
Prospect
Elk
Rock Creek
Squaw Lake
Glendale
Stage Road Pass 1830 ft.
Humbug Mtn. S.P.
Humbug Mtn. 1756 ft.
Bald Knob 3630 ft.
Wolf Cr. Tavern
Wolf Creek
Cascade Gorge
Mt. Peavine 4036 ft.
Wolf Creek Tavern Wayside
Rogue
Illahe
KLAMATH MTS.
Trail
Sunny Valley
Battle Mtn. 3982 ft.
Ophir
CURRY
SISKIYOU NATIONAL FOREST
Galice
Sexton Mtn. Pass 1956 ft.
Shady Cove
Quosatana
Agness
Wimer
Butte Falls
Nesika Beach
Wild Horse
Pleasant Valley
Geisel Mon. Wayside
Merlin
Sams Valley
Otter Point Wayside
Big Pine
El. 948 ft.
Grants Pass
Rogue River
Gold Hill
Table Rock
Eagle Point
JACKSON
Wedderburn
Gold Beach
JOSEPHINE
Tou Velle S.P.
Brownsboro
Hunter Creek
Elko
Saddle Mtn. 4394 ft.
Onion Mtn. 4438 ft.
Wilderville
Fruitdale
Valley of the Rogue S P
Ben Hur Lampman Wayside
White City
Lakecreek
Willow Prairie
Cape Sebastian S.P.
Wonder
Crater Rock Museum
Cape Sebastian
Fairview
Pearsoll Peak 5098 ft.
New Hope
Murphy
Central Point
Medford/Jackson Co. Airport
Pistol River
Round Top Mtn. 4693 ft.
Jacksonville
Medford
Pistol River S.P.
Carpenterville
Long Ridge
KALMIOPSIS WILDERNESS
Store Gulch
Selma
Applegate
Jacksonville National
Phoenix
El. 1382 ft.



The Oregonian

In the last 2,000 years, Cape Blanco has risen from an average of 4½ feet per thousand years to an estimated 32 feet per thousand years.

Coast proves upwardly mobile

Elevated marine terraces near Cape Blanco rising in tectonic spurts

By ELLEN MORRIS BISHOP

(old-ish article, source unknown)

Just when we thought it was safe to come out from under the doorframe, the October issue of Tectonics arrived. It bears tidings of more earthquakes.

Not the oft-discussed great earthquakes that strike the northern Oregon coast every 600 years. Not the dam-shaking temblors of Eastern Oregon or the rending rattles of the Basin and Range. No, this is the tale of earthquakes in the seemingly placid, unruffled southern Oregon coast — the shore of Cape Blanco, northwestern-most reach of the stable Klamath Mountains, just north of Port Orford.

The white layer-caked seacliffs of Cape Blanco mark Oregon's tenuous, delicate, most westerly advance into the hazardous sea. Cape Blanco is as close as land comes to the spreading Juan De Fuca Ridge that births seafloor a hundred miles or so to the west.

But a glance at the striped and angled rocks of the cape suggests that all is not quiet on this brave western front. No, this is a land of peripatetic geology. Here the earth has moved and moved again for at least the last million years, and maybe the last 10 million, according to Harvey Kelsey of Western Washington University.

Cape Blanco's foundation is dark, solid-but-chaotic rocks of the Klamath Mountains. It is capped by younger, more orderly, light-colored strata of Oregon's Coast Range. Its flat top tilts giddily northward; its fragile connection to the continent is slashed by a fault. It is not a stable place.

In fact, Cape Blanco is rising. As much as 35 inches in the last century, nearly 32 feet in the last 1,000 years. It has risen 175 feet above the constantly pounding surf during the past 80,000 years, according to Harvey Kelsey's resarch.

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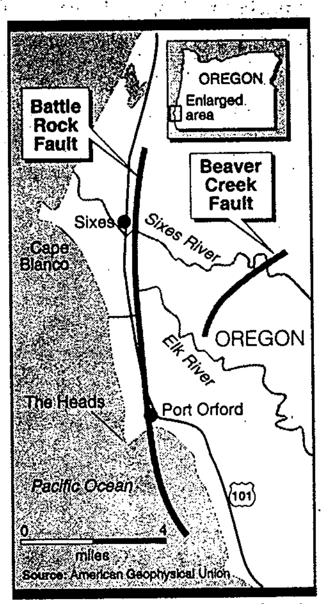


The Oregonian

The tell-tale evidence for this uplift is found in the flat-surfaced pauses in the coast's steep topography known as "marine terraces." These "benches" are ancient beaches that have been uplifted far above sea level, and now roost serenely aloof from the surf's roar.

Harvey Kelsey identified five elevated marine terraces near Cape Blanco. Some are delineated by wave-cut platforms — places where waves carved away solid rock and smoothed a once-level rocky beach for themselves. Other marine terraces can be identified by their flat surfaces and ripple-marked beach sand, by long-abandoned shells and other debris. All these marine terraces were formed by active beach erosion and deposition, followed by tectonic uplift that raised the old beaches far above sea level.

They have poetic names as well as romantic histories, these marine terraces: Poverty Ridge, Indian Creek, Silver Butte, and Pioneer. The tilted, flat top of Cape Blanco itself was once level and just beneath the skin of the sea.

The terraces near Cape Blanco are good gauges of how much the southern Oregon coast has been uplifted or whether it has subsided relative to the rest of coastal Oregon. By determining the age of the sediments on the tops of the terraces, Kelsey could tell how long ago they were at sea level. By comparing these ages with similar terraces along the west coast and known sea-levels at the time, he could estimate the amount of uplift or subsidence of the southern Oregon coast.

Poverty Ridge, the oldest terrace and now at an elevation of about 825 feet above the Pacific, was carved at sea-level during the Pleistocene era, perhaps a million years ago, according to Kelsey's best estimates. The other, younger terraces represent a total uplift of about 150 feet in the last 125,000 years near Cape Blanco.

Kelsey's data also show that the rate of uplift has accelerated in the last 2,000 years from an average of 4½ feet per thousand years to as much as 32 feet per thousand years today.

Why is Cape Blanco rising? Examination of the terrace surfaces shows that they are tilted. To the north of the cape the terraces slope north. To the south they slope south. Cape Blanco is situated at the center, the axis of a growing upwarp called an "anticline."

As the Pacific Ocean floor pushes northeastward, shoving itself beneath Oregon, it catches on and wrinkles some of the crust above it, a bit like fuzzy pajamas catching on the sheets as you slip into bed at night.

In rocks, as in bedsheets, this northward, underhanded push results in folds. Cape Blanco is being uplifted. But just to the north the coast is subsiding as the result of the neighboring "down fold," or "syncline."

As if all this up-and-down folding was not enough, there is faulting, too. Clipping nicely through Port Orford is the Battle Creek fault zone, a fault with a gratifying small offset, and little evident seismicity. Its last significant movement probably occurred about 105,000 years ago. Inland, between the Elk and Sixes rivers, is the Beaver Creek Fault. Although it has shown little activity in the historic past, the Beaver Creek Fault has moved more than 135 feet in the last 200,000 years. That is a rate slower than movement on the San Andreas Fault, but still significant.

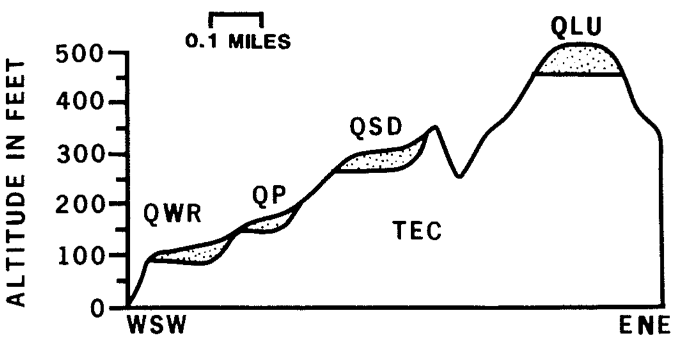
The simple result of all this tectonism, subduction, faulting and folding is that Cape Blanco is upwardly mobile. It is busily rising. It is a good destination if you want an increasingly better view of the Pacific.

But go to Cape Blanco with caution. For it rises not with steady grace, but in jerks and leaps. The last well-documented uplift occurred about 2,000 years ago — about the same time that both turbidites and swamp deposits have indicated a "great, suduction-zone earthquake" along the northern and central Oregon coast.

And Cape Blanco has been rising ever since, faster and faster. Harvey Kelsey thinks this continued uplift is accomplished by what are called officially "coseismic events." That is geologic jargon for "major earthquakes." Major earthquakes of near-magnitude 8 beset the southern Oregon coast and perhaps the northern coast as well, unpredictably, every 500 or 600 years.

Just one thing more: On Nov. 23, 1873, an earthquake with an estimated magnitude of 6.3 was centered beneath Port Orford. Personally, I'd stay under the doorframe.

Figure 1. Rugged coastline and marine terrace at Shore Acres State Park. (Oregon State Highway Division photo)



QWR WHISKY RUN TERRACE

QP PIONEER TERRACE

QSD SEVEN DEVILS TERRACE

QLU LOWER UNNAMED TERRACE

TEC EOCENE COALEDO FORMATION

Raised Marine Terraces, Cape Arago area

Figure 2. Coastal Terrace Sequence: Griggs (1945) has mapped five coastal terraces in the vicinity of Cape Arago. This diagram shows the relative relationship of the four lower and more visible terraces which can be seen from STOP 2. The cross section is drawn trending east-northeast.

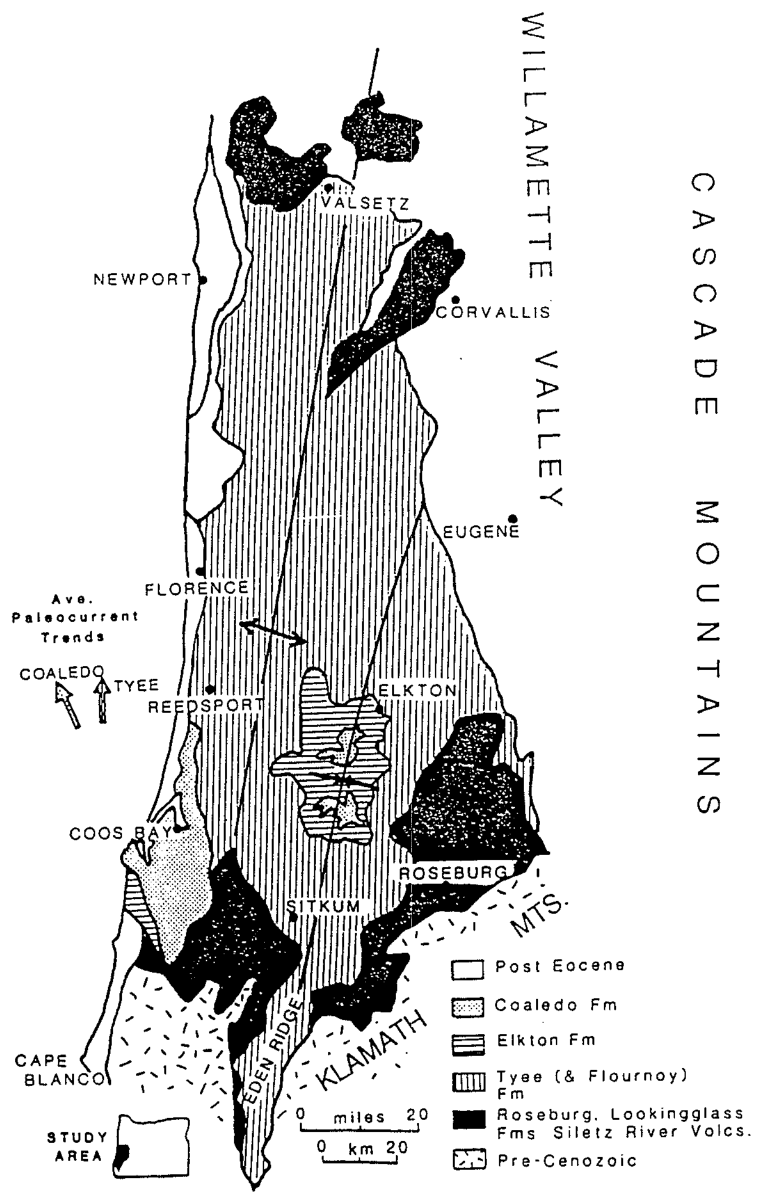


Fig. 3. Generalized geologic map of the Oregon Coast Range modified from Chan and Dott (1986, p. 416). A more detailed geologic map of the region has been published recently by Niem and Niem (1990).

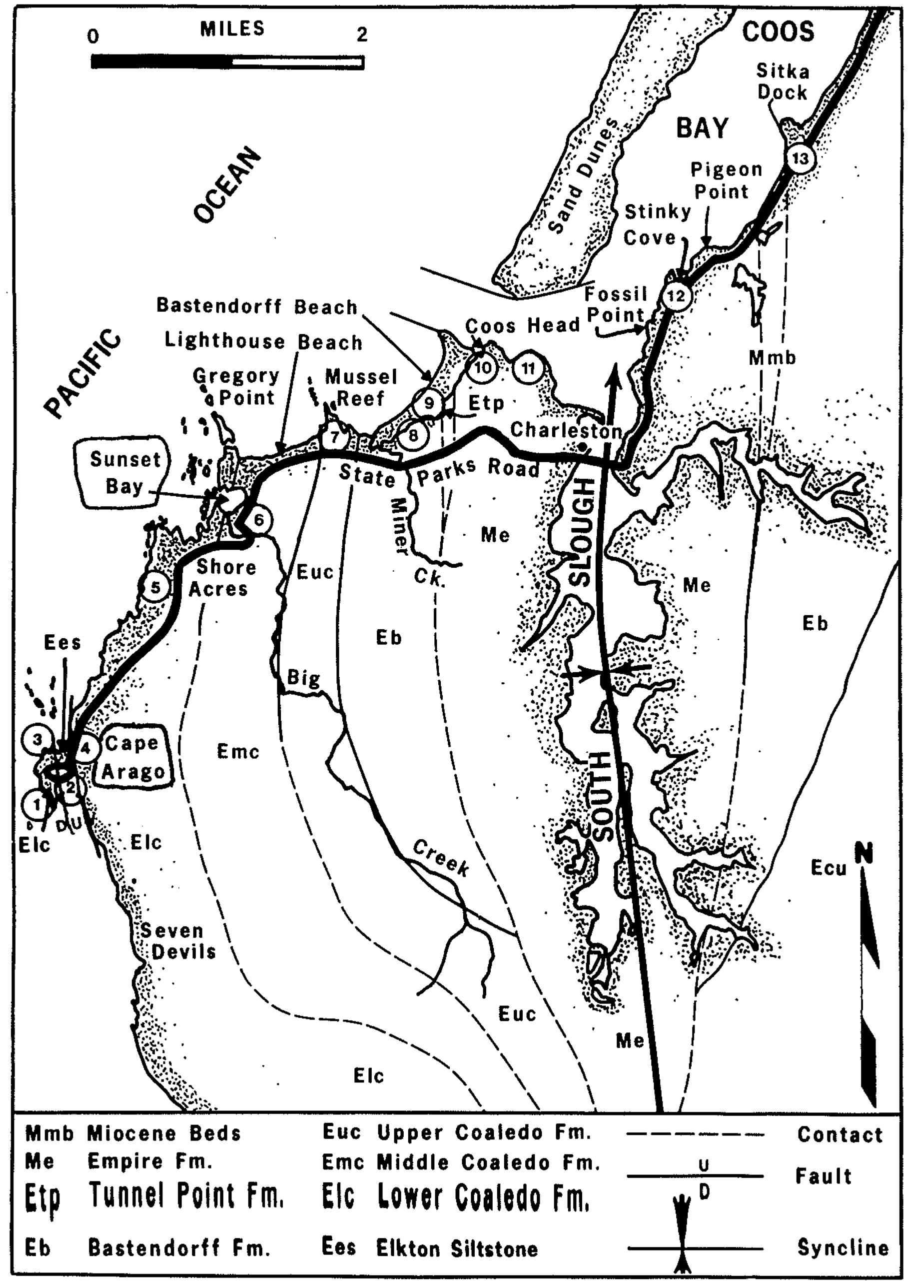


Fig. 4. Geologic map for Coos Bay area (modified from Baldwin and others, 1973). Circled numbers indicate field trip stops.

Western Oregon tectonic reconstruction

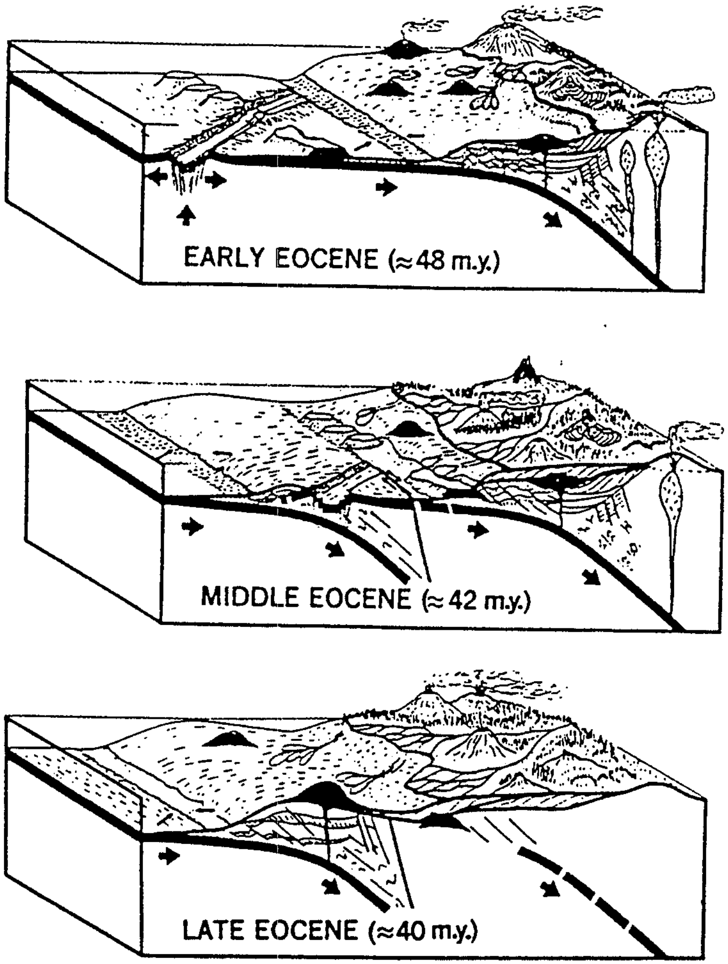
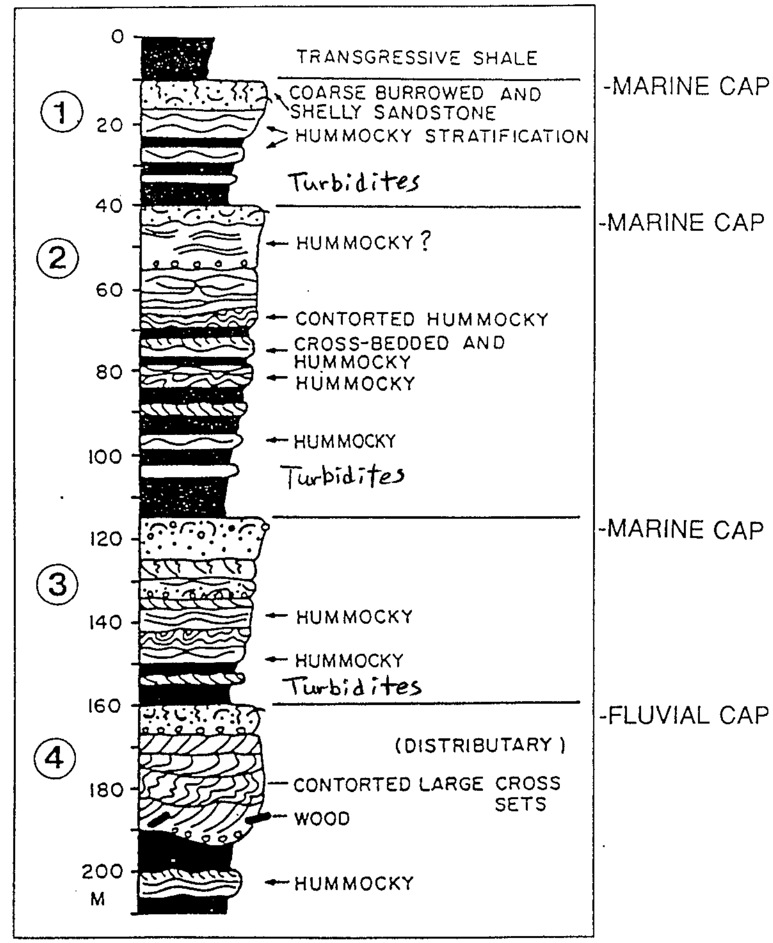


Fig. 5.
Reconstruction of the Eocene forearc basin in western Oregon and Washington. Early: Roseburg-Siletz basaltic seamounts and associated turbidite deposition with arc volcanism to the east. Middle: Subduction zone jumps west and progradation of sediments unconformably over structurally-complex Roseburg accretionary wedge. Late: Further filling of forearc basin by coastal progradation and subsea fan development. (From Armentrout and Suek, 1985).

Sunset Bay: Eocene stratigraphy



"Hummocky" stratification produced by strong storm waves...
Turbidites produced by deposition of sand below storm wave base.

Fig. 6. Columnar section of upper Lower Coaledo strata on the north side of Sunset Bay, showing parts of the upper four shoaling-upward sequences in this member. A and B locate positions of orientation data presented in Fig. 39. (Modified from Chan and Dott, 1986,

Coarsening-up "packages" 1 thru 4 are interpreted as the record of progradation of deltas which delivered sand to the marine shelf setting.

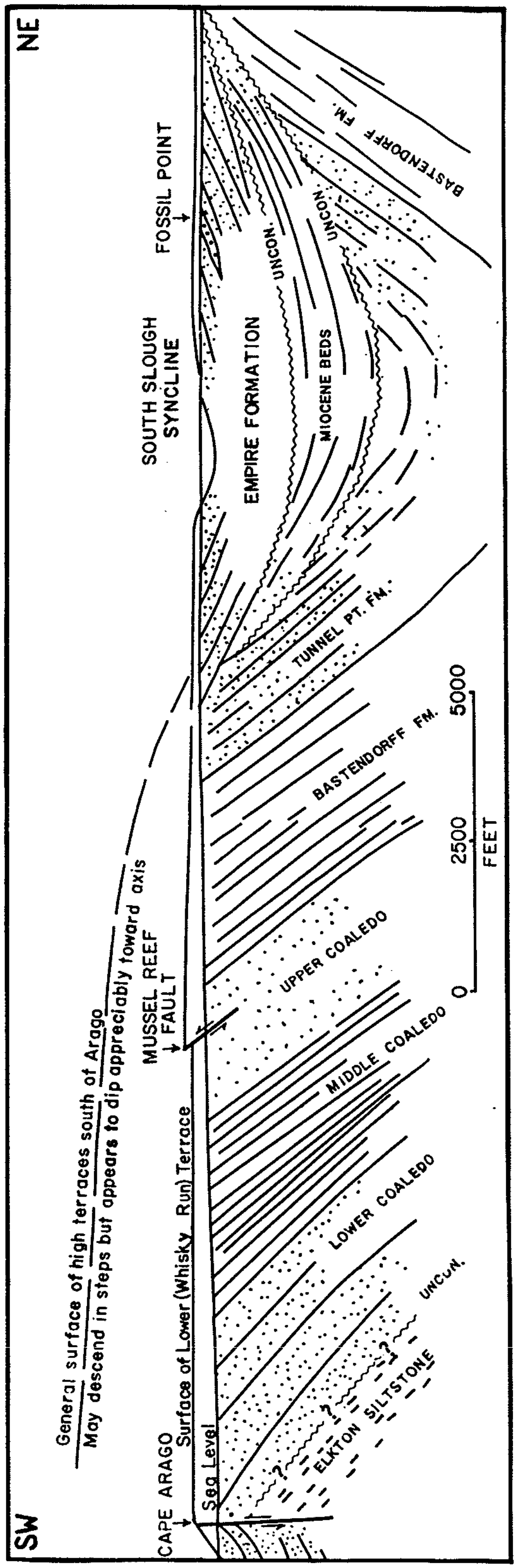


Figure 7. Geologic cross section of South Slough Syncline (modified from Baldwin 1966). Coos Bay area.

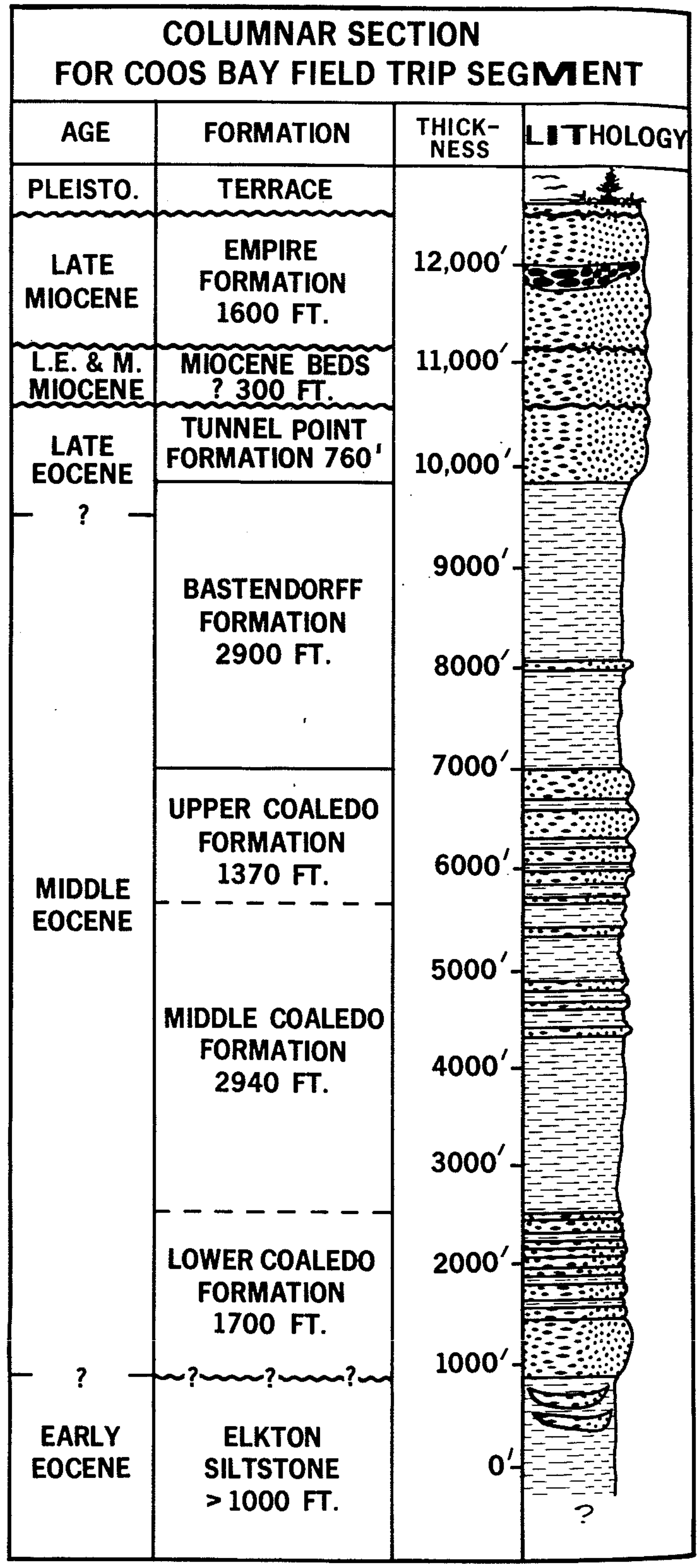


Figure 8. Stratigraphic column for Coos Bay Cenozoic formations.