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LANDFORMS ALONG THE COAST OF CURRY COUNTY, OREGON

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The shore of Curry County is the most continuously rugged segment of the Oregon Coast. Highway 101 parallels it, and numerous State parks, waysides, and lookout points along it afford magnificent views of the ocean, the rocks, and the scenery.

The discussion of the geology and related landforms is accompanied by a road log that can be followed either from south to north or north to south. The photographs are keyed into the road log, and four strip maps show locations of geographic features.

Geologic Setting

Curry County lies at the western margin of the Klamath Mountains province, a region composed of some of the oldest rocks in Oregon. Tremendous forces within the earth's crust have made mountains out of rocks that were once sedimentary and volcanic materials on the sea floor. Metamorphic recrystallization and intense folding, faulting, and shearing have altered these rocks to varying degrees. In general, the more ancient the rocks, the more severely they are disrupted and altered.

Since recrystallization hardens rocks, and shearing and fracturing weaken them, the combined effects produce extremes in rock durability. This largely accounts for the differential erosion of bedrock along the coast of Curry County and the resulting ruggedly beautiful scenery.

Most of the bedrock exposed along the County's shoreline is of Mesozoic age, ranging from Late Jurassic (150 to 160 million years old) through Late Cretaceous (65 million years old). Much younger, relatively unaltered bedrock, comprising dikes, sills, and sedimentary beds, of Tertiary age is exposed in a few places. The youngest units are unconsolidated sands and gravels of Quaternary age which lie on marine terraces and along the beaches and rivers.

Geologic formations (rock units) that contribute to coastal scenery are briefly described below in the order of oldest to youngest. For a more thorough discussion, the reader is referred to Dott (1971), from which the following descriptions are summarized.

Mesozoic Rocks

Upper Jurassic bedrock

Dothan Formation: The Dothan Formation crops out along the Curry County coast from Winchuck River, just north of the State line, to Whalehead Cove. It consists mostly of graywacke sandstone but of nearly an equal amount of siltstone and mudstone. About 10 percent of the rock is volcanic, and chert and conglomerate combined make up less than 1 percent. The rock is very much deformed but is somewhat less sheared

than the Otter Point Formation, of which the Dothan Formation is considered in part an age equivalent.

Otter Point Formation: The Otter Point Formation crops out in a belt that extends from Whalehead Cove on the south to Sisters Rocks on the north. It is not continuous along the shore over the entire distance but is interrupted at a number of places by younger formations. To the north, it crops out in The Heads at Port Orford; most of the reefs and sea stacks from Mack Reef northward are of Otter Point rocks.

The Otter Point Formation consists of a very complex mixture of folded and sheared mudstone, sandstone, conglomerate, and volcanic rock. During deformation, serpentinized peridotite, phyllite, and glaucophane schist from other formations mixed with the Otter Point rocks; the whole assemblage has been aptly referred to as chaotic. The name *mélange* has been applied to churned-up assemblages of this type.

The Otter Point Formation has been lightly metamorphosed. Where the rock is not sheared, it is hard and very resistant to erosion, especially the volcanic units, but where it is severely sheared, it has little strength and is easily eroded. Weathering further weakens the sheared rock, making landslides a serious problem. Landslides have damaged the highway at numerous places where it crosses this formation.

Lower Cretaceous bedrock

Humbug Mountain Conglomerate: The Humbug Mountain Conglomerate crops out along the shore over a distance of about 5 miles from Humbug Mountain southward. The rock is mostly conglomerate and is coarsest at its base, but in the higher parts of the formation, beds of sandstone and mudstone are interstratified with conglomerate.

Rocky Point Formation: The Rocky Point Formation crops out along the shore between Humbug Mountain and Hubbard Creek south of Port Orford (Koch, 1966). It overlies the Humbug Mountain Conglomerate stratigraphically, and the two formations have a gradational contact. It is composed mostly of sandstone beds 2 to 5 feet thick alternating with mudstone 3 to 5 inches thick, but also contains some conglomerate, which is finer and less abundant than that of the Humbug Mountain Conglomerate.

Upper Cretaceous bedrock

Cape Sebastian Sandstone: The Cape Sebastian Sandstone is exposed along the shore in the sea cliffs at Cape Sebastian (Howard and Dott, 1961). It is a massive, gray sandstone that weathers to light tan. In the lower parts of the sea cliffs, the formation contains abundant coarse sandstone and lenses of conglomerate that range from 3 inches to 3 feet in thickness.

Hunters Cove Formation: The Hunters Cove Formation overlies the Cape Sebastian Sandstone stratigraphically and is well exposed in the sea cliffs along the southeastern side of Cape Sebastian at Hunters Cove. It makes up the neck of the Cape and is exposed in the first headland north of the Cape. It is exposed along the shore both to the south, between Crook Point and Houstenader Creek, and 38 miles to the north just north of Blacklock Point. The formation consists of alternating thin sandstone and mudstone beds with local conglomerate and thick sandstone lenses.

Tertiary Rocks

Sedimentary bedrock

Beds of Eocene rocks lie in the neck of Cape Blanco. The strata are of thin-bedded mudstone and graywacke sandstone.



Figure 1. Pleistocene marine terrace south of Chetco River. Terrace surface was ocean bottom during the Sangamon interglacial stage, which ended about 60,000 years ago. (Oreg. Hwy. Div. photo by Kinney)



Figure 2. Hastings Rock, rising about 100 feet above the terrace surface, was a sea stack during the Sangamon interglacial stage. Gently sloping terrace is about 50 feet above sea level at Hastings Rock.

Sandstone and conglomerate beds of Miocene to Pliocene age overlie the Otter Point Formation at Cape Blanco (Dott, 1962). They are exposed in the sea cliff along the outer edge of the Cape and in a sea stack and the sea cliff to the southeast. At Blacklock Point, interstratified sandstone and conglomerate overlie the Hunters Cove Formation and extend northward along the shore in a spectacular sea cliff as far as Floras Lake. These beds and those at the Cape correlate in part with the Empire Formation in Coos County.

Intrusive rocks: Numerous light-colored rhyolite dikes and sills intrude the Dothan Formation north of Brookings. Rhyolite is well exposed in the roadcut at the entrance to the Harris Beach visitor information center and in a number of places along the shore at Harris Beach State Park, including the rock knob at the parking lot.

Dark (mafic) dikes of dioritic to gabbroic composition intrude the Otter Point Formation between Horse Prairie Creek and Thomas Creek, where they are exposed in sea cliffs and roadcuts. A black mafic sill 2 to 3 feet thick intrudes the Hunters Cove Formation on the east side of Crook Point.

Quaternary Sediments and Related Landforms

Pleistocene terraces

Pleistocene terraces are numerous along the Curry County coast and are most extensive in the southern and northern parts. A terrace that begins in California extends northward beyond Brookings, where it attains a width of more than a mile. Interesting features of the terraces south of Brookings are the rock knobs that rise abruptly above the terrace surface. These rocks were sea stacks during an interglacial stage of the Pleistocene Ice Age when the terrace surface was part of the sea floor.

The largest terrace extends from Port Orford northward nearly 40 miles to Coos Bay. At Cape Blanco it is about 5 miles wide from the coast to the upland edge.

At many places along the Curry County coast, patches of terrace sediment are perched along the upland front as much as 1,200 feet above sea level. These terrace remnants were formed at different times during the Pleistocene when sea levels were higher, but their present positions high above sea level are the result of uplift, for the ocean surface has probably never been more than 250 feet higher than it is now.

Dunes

Very little of the Curry County coast is favorable to dune formation because most of the shore is bordered by sea cliffs. Dunes have formed near the mouths of some of the streams where there is a beach to supply sufficient sand and the terrain is suitable.

The largest area of dunes is at the mouth of Pistol River, where dunes begin at the south side of the river and form a northwest-southeast oriented lobe about 2 miles long. Dune sand extends along the beach to Crook Point.

A small dune area lies along and behind a beach ridge south of Euchre Creek, and a small area of dunes, remnant of a larger dune mass, is perched on the bluffs south of Elk River (Cooper, 1958). South of Sixes River is a very small but interesting dune where a blowout ascends the slope of the terrace edge, and a mound of sand has accumulated on the terrace surface. This dune is no longer active because a beach ridge capped by grass-stabilized dune sand has cut off the supply of sand from the beach.

Beaches

Despite the fact that along most of the Curry County coast the mountains meet the sea, much of the shore has a sand beach. Where the shore is rocky and rugged,



Figure 3. Edge of terrace. McVay Rock, a large Pleistocene sea stack, was destroyed by quarrying. Hastings Rock is in the upper left of the photograph. (Oreg. Hwy. Div. photo by Kinney)

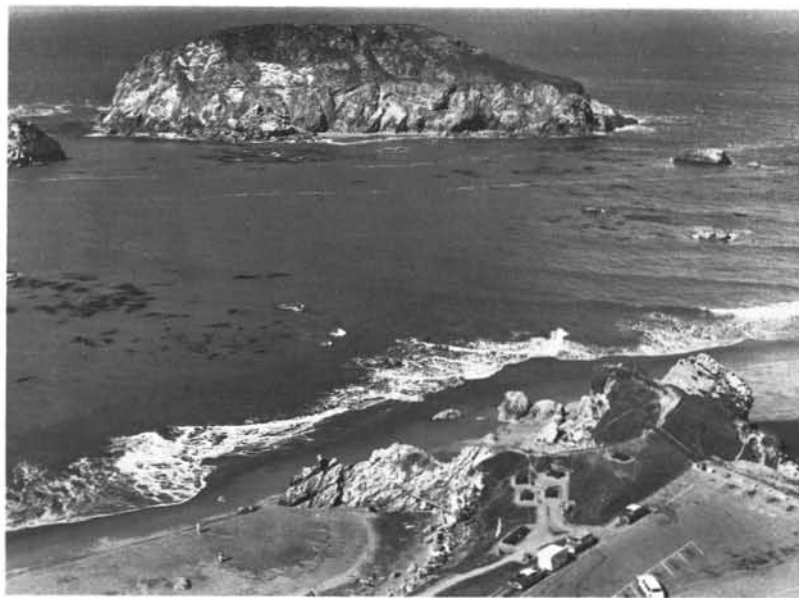


Figure 4. Goat Island at Harris Beach State Park has an area of 21 acres and is Oregon's largest coastal island. The rock between the parking lot and the beach is part of a rhyolite dike. (Oreg. Hwy. Div. photo)

small secluded beaches lie along the edges of coves; where the shore is bordered by terraces or other low terrain, beaches are generally long and wide.

An interesting characteristic of most of the Curry County beaches is their steep slope and narrow swash zone in contrast to the very gentle slopes and wide swash zones of most of the beaches to the north. The water is sufficiently deep immediately off-shore that during times of calm sea the waves break very near or at the beach edge. The surf zone is then very narrow and may consist of the single breaking wave that crashes against the beach and moves quickly up and back over the narrow swash zone. The sand of these beaches consists largely of rock particles and is darker and coarser textured than the predominantly quartz sand of beaches north of Curry County.

Beach ridges at the mouths of many of the coastal streams interfere with the streams' entry into the ocean. These beach barriers may form temporary dams at the mouths of small rivers during low water. When the discharge in streams such as Winchuck, Pistol, Elk, Sixes, and New Rivers and Hunter and Euchre Creeks drops so low that the flow of water is not able to remove the sand and coarser material brought to the rivers' mouths by waves and ocean currents, the outlets are blocked. The water then moves from the impounded stream to the ocean by percolation through the sand and gravel. During the time a stream is dammed, it forms a lagoon behind the barrier; when the stream's flow is large enough, it will again break through to the ocean at a low place somewhere in the ridge. In this way, a stream may change its outlet from time to time. Winter storms may also alter the stream mouths.

During the summer of 1974 Pistol River was flowing directly into the ocean at the southern end of the barrier, and a narrow, mile-long lagoon lay behind the barrier to the north. The outlet of Elk River is deflected northward about a mile, and New River flows behind a beach barrier from Floras Creek northward about 7 miles to Four Mile Creek, where it enters the ocean.

Garrison Lake, just north of Port Orford, and Floras Lake, a few miles south of the Coos-Curry County line, were formed by beach barriers built across the mouths of what were formerly two small bays or indentations in the coast. The volume of water coming into the bays from streams was not enough to maintain sea level outlets, and the barriers converted them into freshwater lakes.

Erosional Landforms

The irregularity in the extremely rugged shoreline, the reefs, the large number of sea stacks and arches, and the innumerable smaller rock masses along the shore give the Curry County coast a distinctive character. The factors that have a bearing on this are many, but two principles will help in understanding the origin of the many landforms that contribute to the superb scenery of this coast. One is that the ocean is steadily wearing away the land, and the other is that soft or badly broken rock erodes faster than hard, intact rock. As the sea encroaches on the land, wave erosion is directed along places of weakness, and the more durable parts form the positive features along the shoreline and offshore.

Except where lowlands along rivers and large creeks break the continuity of a terrace or the hilly terrain along the coast, the shore is bounded either by vertical or nearly vertical sea cliffs or by steep, rubbly slopes, depending upon the ability of the rock to support a vertical surface. Most of the high sea cliffs and rock promontories are basalt units in the sedimentary formations or sedimentary rock that has not been badly sheared. Where the more durable rock is cut by fractures or a narrow shear zone, the waves tend to erode caves in the cliff or tunnels through rock projections.



Figure 5. Rainbow Rock is complexly folded beds of chert in the Dothan Formation.



Figure 6. Terrace surface about 250 feet above sea level on Cape Ferrello.



Figure 7. Whalehead Cove. The outermost of the three sea stacks is Whalehead Rock. (Oreg. Hwy. Div. photo by Kinney)



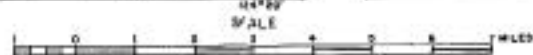
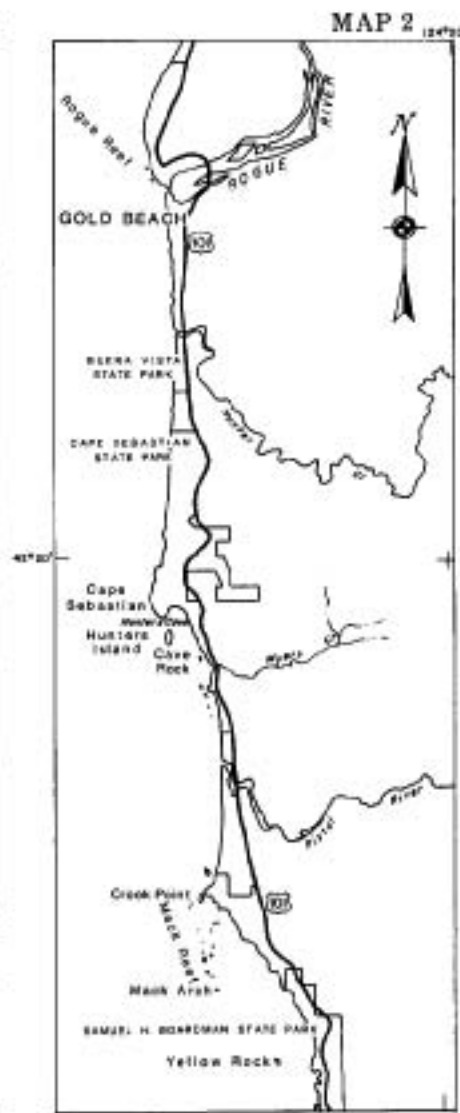
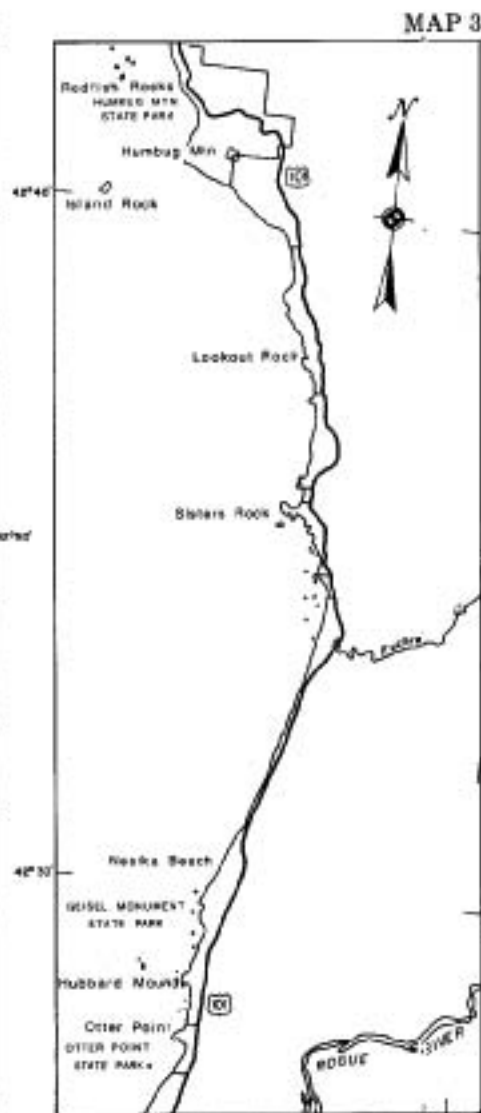
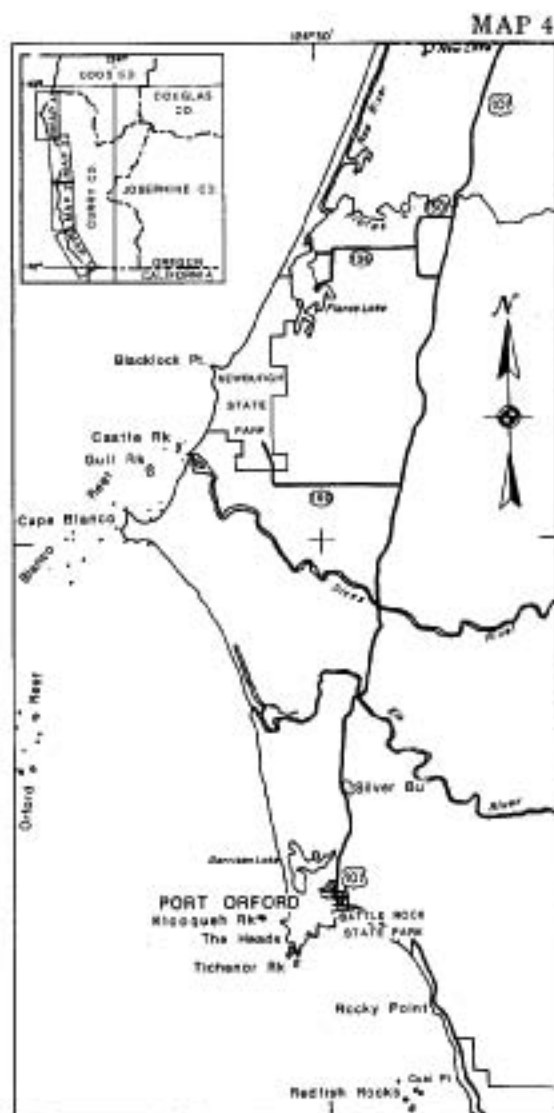
Figure 8. Rugged promontories and coves north of Whalehead Cove. (Oreg. Hwy. Div. photo)



Figure 9. The natural bridges about 1 mile north of Thomas Creek are remnants of the roofs of sea caves that collapsed where the caves intersected. (Oreg. Hwy. Div. photo)



Figure 10. The tunnel through Arch Rock off Deer Point (Arch Rock Point) is probably the remnant of a sea cave formed when the rock was part of the mainland. (Oreg. Hwy. Div. photo)



COASTAL STRIP MAPS OF CURRY COUNTY, OREGON

Along wider fracture zones or other zones of weakness, coves may form between projections of resistant rock.

As erosion shifts the shore landward, rock masses are separated from the mainland; the most resistant survive for a time as stacks, arches, and smaller rock knobs. Clusters or aligned groups of rocks, some standing above sea level, others awash at low tide, but most submerged, make up the reefs along the coast.

Most of the sea stacks and arches are of Otter Point Formation rock. According to Hunter and co-workers (1970), Otter Point sandstone is widely distributed, conglomerates are fairly common, and volcanic rocks are abundant in the offshore stacks. Pleistocene terrace sediments on some of the stacks, including Needle Rock, which is in the Rogue River reef and about $2\frac{1}{2}$ miles offshore, indicate that the stacks were once part of the mainland and give a clue to the rate of shore erosion in this area.

Road Log

Miles S-N	Increase ment	Miles N-S	
0.0		78.2	California-Oregon State line. The coastal plain that extends from California northward to a few miles beyond Brookings is a Pleistocene marine terrace (Figure 1) formed during the Sangamon interglacial stage, which ended about 60,000 years ago. The terrace surface, which slopes gently seaward, was the sea bottom, and the shoreline was along the edge of the hills that border the plain on the east.
0.5	0.5	77.7	Winchuck River. [Map 1 - south end]
1.2	0.7	77.0	Rock knob west of the highway. The rock is hard, graywacke sandstone of the Dothan Formation.
2.0	0.8	76.2	Rock knob on the terrace west of the highway (Figure 2), referred to here as Hastings Rock, rises nearly 100 feet above the terrace surface. It consists of hard, lightly metamorphosed sandstone of the Dothan Formation and was a sea stack when the terrace was the sea bottom. The largest such sea stack, McVay Rock, was an impressive landmark near the edge of the terrace until quarried for stone; only a few small nearby knobs remain (Figure 3).
4.7	2.7	73.5	Harbor (business district).
5.3	0.6	72.9	Chetco River.
6.0	0.7	72.2	Brookings Post Office.
7.6	1.6	70.6	Entrance to Harris Beach State Park. Goat Island (Figure 4), with an area of 21 acres and a height of 184 feet, is Oregon's largest coastal island. It is composed of Dothan Formation. It was established as the Oregon Islands Refuge in 1935 and as the Oregon Islands Wilderness in 1970. The rock knob at edge of beach parking lot is part of a rhyolite dike.
9.5	1.9	68.7	Rainbow Rock viewpoint. Rainbow Rock (Figure 5) is composed of thin, complexly folded beds of chert of the Dothan Formation.



Figure 11. Mack Arch, at the southern end of Mack Reef, is one of Oregon's most picturesque arches.



Figure 12. Crook Point. Sand dunes lie between Crook Point and Pistol River to the north. Cape Sebastian is in the distance. (Oreg. Hwy. Div. photo by Kinney)



Figure 13. (left) Pistol River. At the time this photograph was taken, the river was dammed by a beach barrier, and a mile-long lagoon lay behind the barrier. (Oreg. Hwy. Div. photo by Kinney)

Figure 14. (below) Cape Sebastian and Hunters Island to the south. Viewpoints on this high promontory provide spectacular views. (Oreg. Hwy. Div. photo by Kinney)



- 9.9 0.4 68.3 Samuel H. Boardman State Park southern boundary.
- 10.6 0.7 67.6 Lone Ranch Beach road. Some of Curry County's most rugged shore is just south of Lone Ranch Beach.
- 11.3 0.7 66.9 Cape Ferrelo; road to viewpoint. The top of Cape Ferrelo is an elevated flat terrace surface (Figure 6) 250 feet above sea level.
- 12.1 0.8 66.1 House Rock viewpoint road; terrace sediments in highway roadcuts.
- 13.6 1.5 64.6 Whalehead trail; viewpoint.
- 14.1 0.5 64.1 Whalehead Beach road. Whalehead Island, the outermost of the three (Figure 7), is a sea stack composed of basalt-pebble conglomerate of Otter Point Formation. Shore is very rugged to north (Figure 8).
- 14.9 0.8 63.3 Indian Sands trail; viewpoint.
- 15.6 0.7 62.6 Thomas Creek Bridge, 345 feet above the bottom of the canyon, is claimed to be Oregon's highest bridge.
- 17.4 1.8 60.8 Natural Bridge viewpoint (Figure 9). The "bowl" behind the natural bridges probably was formed by collapse of roof rock of intersecting sea caves. The bridges are what is left of the roofs of the caves.
- 17.6 0.2 60.6 Thunder Rock Cove. [Map 2 - south end]
- 18.6 1.0 59.6 Deer Point (Arch Rock Point). Deer Point and the stacks and arches are Otter Point Formation. When Arch Rock (Figure 10) was still part of the mainland, its arch was probably a sea cave.
- 19.3 0.7 58.9 Samuel H. Boardman State Park northern boundary.
- 21.3 2.0 56.9 Turnout. Mack Arch (Figure 11), directly offshore, is part of Mack Reef, which consists of Otter Point conglomerates and basalts. Terrace sediments are exposed in roadcuts along the highway.
- 21.6 0.3 56.6 Road to Crook Point. The tip of Crook Point (Figure 12) and the rocks around it are mostly of Otter Point Formation basalt.
- 24.3 2.7 53.9 Pistol River (Figure 13). A mile-long lagoon lies behind a beach barrier north of the present (1974) outlet of the river.
- 26.1 1.8 52.1 Viewpoint; cluster of large sea stacks and arches are of Otter Point Formation; those nearest shore can be reached at low tide by a sand connection (tombolo) to the mainland.
- 27.0 0.9 51.2 Viewpoint; Cape Sebastian, Hunters Island, Cave Rock. Hunters Island and the outermost part of Cape Sebastian are composed of Cape Sebastian Sandstone. The neck of the Cape is of Hunters Cove sandstone; Cave Rock is of Port Orford Formation.



Figure 15. Otter Point, penetrated by trenches and caves, is a remnant of a Pleistocene terrace. (Oreg. Hwy. Div. photo by Kinney)



Figure 16. Humbug Mountain, rising high above the sea and the adjacent land, is one of Oregon's most prominent headlands. (Oreg. Hwy. Div. photo)

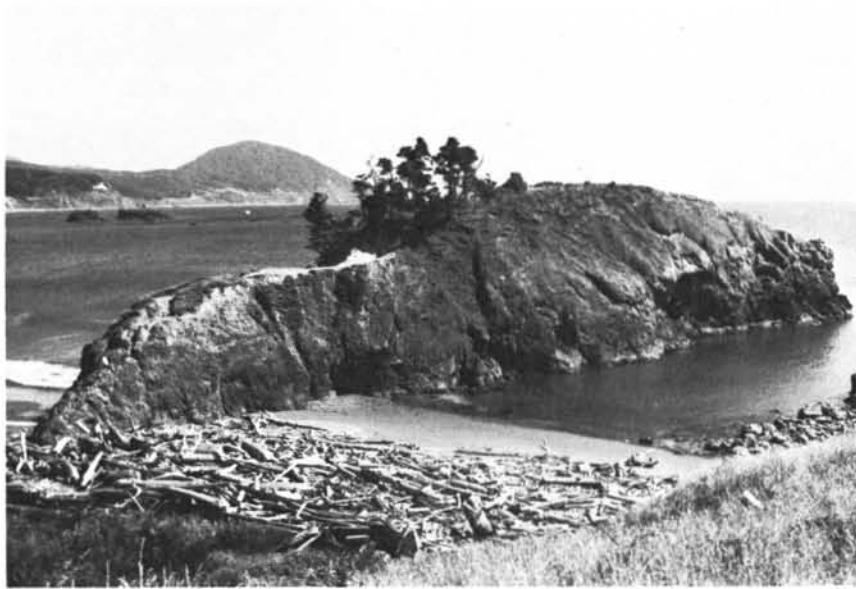


Figure 17. Battle Rock. A tunnel, seen at the water's edge, penetrates the rock along a fracture zone.



Figure 18. The Heads at Port Orford marks the southern edge of a coastal lowland on a Pleistocene terrace that extends northward beyond Bandon in Coos County. Cape Blanco is in the distance. (Oreg. Hwy. Div. photo by Kinney)

28.6	1.6	49.6	Cape Sebastian (Figure 14); road to viewpoints.
33.1	4.5	45.1	Hunter Creek.
35.1	2.0	43.1	Gold Beach; Curry County Courthouse.
35.9	0.8	42.3	Rogue River (middle of bridge).
36.8	0.9	41.4	Serpentinite in roadcut. [Map 3 - south end]
39.6	2.8	38.6	Old Coast Road (north); to Otter Point (Figure 15).
41.3	1.7	36.9	Geisel Monument Wayside.
41.5	0.2	36.7	Nesika Beach junction (south).
42.7	1.2	35.5	Nesika Beach junction (north).
46.6	3.9	31.6	Euchre Creek; sand dunes south of creek.
49.2	2.6	29.0	Sisters Rocks. These rocks are of lightly metamorphosed sediments of the Otter Point Formation.
51.9	2.7	26.3	Lookout Rock. Humbug Mountain (Figure 16) to the north.
56.1	4.2	22.1	Humbug Mountain State Park picnic area entrance.
56.8	0.7	21.4	Humbug Mountain State Park camping area entrance. Type locality for Humbug Mountain Conglomerate. [Map 4 - south end]



Figure 19. Cape Blanco, a projection of the Pleistocene terrace, is Oregon's westernmost point. (Oreg. Hwy. Div. photo by Kinney)



Figure 20. Blacklock Point marks the northernmost extent of Mesozoic rocks along the Curry County shore. (Oreg. Hwy. Div. photo by Kinney)



Figure 21. Floras Lake occupies the flooded lower end of a stream system dammed by a beach barrier. (Oreg. Hwy. Div. photo by Kinney)

- 60.4 3.6 17.8 Rocky Point (north turnout) for which Koch (1966) named the Rocky Point Formation. Redfish Rocks and Island Rock to the south are of Otter Point Formation basalt.
- 62.6 2.2 15.6 Battle Rock State Park entrance at Port Orford. Battle Rock (Figure 17) is Otter Point basalt. The many-lobed headland, The Heads (Figure 18), is Otter Point sedimentary rock.
- 65.0 2.4 13.2 Rock knob (Silver Butte) east of highway is a Pleistocene sea stack of green metamorphic rock.
- 66.6 1.6 11.6 Elk River.
- 67.5 0.9 10.7 Cape Blanco road (Figure 19). At Cape Blanco Otter Point Formation is overlain by Tertiary sandstones. Pleistocene terrace deposits overlie the Tertiary sandstones and form the flat surface of the Cape.
- 68.4 0.9 9.8 Sixes.
- 70.4 2.0 7.9 Road to airport and Blacklock Point (Figure 20).
- 73.6 3.2 4.6 Denmark.
- 74.0 0.4 4.2 Floras Lake road (south). Floras Lake (Figure 21) is impounded by a beach barrier. Water enters ocean 8 miles to the north.
- 75.1 1.1 3.1 Floras Lake road (north).
- 76.3 1.2 1.9 Langlois.
- 78.2 1.9 0.0 Coos-Curry County line. [Map 4 - north end]

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