

Geology of the Oregon Coast Itinerary

Day 1: Weed to Crescent City

Depart Weed heading north on I-5 (0.0 mi.)

- Cascade volcanic rocks – debris avalanche along highway and both young High Cascade and older Western Cascade rocks on ridge to the east (0.0-19.0 mi.)
- Eastern Klamath Terrane – low outcrops of serpentine along I-5 (28.9 mi.)
- Metavolcanic and metasedimentary(?) rocks of the Western Paleozoic and Triassic Terrane exposed along I-5. Greenstones abundant, some deeply weathered to reddish soils. (32.8 to 40.0 mi.)
- Unconformity between Western Pz-Tr rocks and overlying Hornbrook Formation (40.0 mi.)
- Hornbrook Formation – Cretaceous forearc basin sediments, mostly sandstones and shales; contains both shallow marine and terrestrial (coal-bearing) facies (40.0 to 55 mi.)

Siskiyou Summit (54.1 mi.)

- Ashland pluton – large mass of granitic rock intrusive into the Western Pz-Tr Terrane exposed in outcrops on the left side of the highway (57.1 mi.)
- Table Mountain – erosional remnant of a Western Cascade lava flow that now forms inverted topography east of Medford (86 mi.)
- Western Pz-Tr rocks are poorly exposed in road cuts along I-5 (93 to 104.5 mi.)

Turn west onto Hwy. 199 at Grants Pass (105.9 mi.)

- Galice Formation – marine sedimentary rocks (mostly sandstones and siltstones) that lie atop the Josephine Ophiolite and form part of the Western Jurassic Terrane are poorly exposed between Wilderville and Cave Junction

Turn left onto Hwy. 46 in Cave Junction

STOP 1: Oregon Caves National Monument: The cave system is developed in a block of Triassic marble that is part of the Western Pz-Tr Terrane. Stop here will include a tour of the cave and lunch.

Return to Hwy. 199 and turn left. Proceed across California border and through Collier Tunnel. Just after exiting the tunnel, turn right into the:

STOP 2: Collier Rest Stop: Walk around the embankment between the rest stop and the highway to examine outcrops of the Galice Formation that, here, has been metamorphosed to slate. (15.2 mi. beyond Hwy. 46 junction)

Leaving the rest stop, turn right onto Hwy. 199 and proceed southwestward along the Smith River

- Josephine Ophiolite – this body of oceanic crust and upper mantle rocks forms the basement of the Western Jurassic Terrane. Lying beneath the marine sediments of the Galice Formation it includes: seafloor “pillow” basalts, sheeted basalt dikes, gabbro, and ultramafic rocks (peridotite and pyroxenite, now partially

serpentinized). Look for altered basalt pillows and dikes (greenstone) and serpentinite in the road cuts along this stretch of Hwy. 199 (21.2 to 27.4 mi. past Hwy. 46 junction)

STOP 3: Mary Adams River Access – park in lot on left and walk down to Smith River to see basalt dikes with darker quenched margins cutting across the gabbro (lower oceanic crust) of the Josephine Ophiolite. (36.9 mi. beyond Hwy. 46 junction).

Continue southwest on Hwy. 199 to the junction with Hwy. 101 (45.2 mi. beyond Hwy. 46 junction). Follow Hwy. 101 into Crescent City for lodging and meals.

Day 2: Crescent City to Coos Bay

Depart Crescent City heading north on Hwy. 101.

Turn left (onto 101) at the junction with Hwy. 199 (0.0 mi.)

- Beneath the young alluvial sediments of the Smith River valley lie the older Jurassic and Cretaceous of the Franciscan and Dothan Formations. These are mélanges – sheared mixtures of sandstone, shale, greenstone, serpentine, and chert – that preserve oceanic sediments and lithospheric rocks “scraped” off the sinking Gorda Plate and piled up against the western margin of the continent. Farther north, similar rocks that crop out along the coast are called the Otter Point Formation but, like the Franciscan and Dothan Formations appear to be equivalent to rocks that form much of California’s Coast Range.
- Some of the large coherent blocks (“knockers”) in the underlying mélange consist of chert, a fine-grained sedimentary rock composed of quartz. Chert is made of the shells of tiny, single-celled marine organisms that secrete silica coverings. When these organisms die their remains may settle to the bottom of the sea to accumulate as siliceous oozes far from land where other land-derived materials will not “dilute” them. When buried and recrystallized, siliceous oozes form cherts, and imply deep-sea deposition far from land.

Brookings/Harbor (16 mi.)

STOP 1: Boardman State Park – drive down to the beach at the south end of the park and walk out to see the stacks (including Ranibow Rock) that are composed of chert. (20.8 mi.)

Return to Hwy. 101 and proceed north.

- Landslides are common in the weak, sheared mélange of both the Oregon and California coasts. Steepening the hill slopes by cutting the highway or undercutting of the bases of the slide by wave erosion helps promote movement. Heavy rainfall and loss of vegetation do too. Look for drainpipes installed to dewater the moving slides.

STOP 2: Landslides along Hwy. 101 – park in pullout to observe the hummocky topography of these young, active slides. (29.8 to 30.6 mi.)

- Sand dunes along the Oregon Coast are shaped by winds that blow from the northwest during the summer and the southwest during the winter. The stronger winter winds shape the main dunes and the weaker summer winds shape cross ridges. Dark minerals – including chromite and ilmenite from the ophiolitic rocks of the Klamaths – contribute an important component to these sands. Winds create longshore currents that transport sand parallel to the coastlines, northward in the summer and southward in the winter. At the mouth of the Pistol River, longshore transport has created a spit that deflects the river northward.

STOP 3: Dunes near the mouth of the Pistol River offer an opportunity to study local sand transport and deposition, as well as the effect of imported grasses in stabilizing coastal dune fields. (34.4 mi.)

- Serpentinite is peridotite from the Earth’s upper mantle that has been altered by hot water penetrating downward along fractures near ancient mid-ocean ridge crests. This soft rock is usually pervasively sheared and is quite soft so that it tends to be “squeezed” towards the surface (like a watermelon seed between your fingers) in fault zones.

STOP 4: Serpentinite outcrop in a cut on a side road just off the right side of the highway offers an opportunity to examine this relatively uncommon rock. (43.4 mi.)

Continue north on Hwy. 101.

- Marine terraces and subduction zone tectonics – because subduction zones stick and slip episodically, the land along the Oregon coast is pushed suddenly up or down when a subduction zone earthquake occurs. Because rock material is being wedged under the leading edge of the continent, however, the long-term trend is one of uplift. When the land remains at a fixed level for at least several thousands of years, wave erosion will cut a flat bench just below wave base. Uplift then elevates this to become a marine terrace, and the stacked terraces along the Oregon coastline tell of a long history of episodic uplifts.
- Coastal erosion: stacks and Humbug Mountain – normally wave erosion cuts a notch at the base of coastal cliffs and deepens this notch until the overlying rock collapses into the sea. More resistant rocks (such as knockers in mélangé) resist this cliff retreat better than their soft matrices and stand out as stacks. The very steep western face of Humbug Mountain (no shelf for waves to shoal on) and its resistant lithology (strongly cemented conglomerate) cause it to stand out as a point as softer rocks around it retreat.

Highway 101 crosses a marine terrace north of Gold Beach (47.5 mi.)

Highway 101 skirts the base of Humbug Mountain (64.9 mi.)

STOP 5: Battle Mountain Wayfinding Point- view westward shows the topography of a coast cut into mélangé, with prominent terraces and stacks. Farther north the coastal topography is somewhat more subdued as Highway 101 crosses younger Tertiary sedimentary rocks. Lunch stop – picnicking here or lunch in Port Orford. (72.6 mi.)

Cape Blanco State Park entrance, turn left. Drive down the road through the campground and park in the small parking lot that affords beach access just south of the cape.

STOP 6: Coastal cliffs afford exposures of: (1) a pair of uplifted marine terraces; (2) a recent rockfall caused by wave erosion at the base of the cliff; and (3) a climbing dune.

Return to Hwy. 101 and turn left (north).

Bandon (113.2 mi.)

- Formation of Coos Bay – Coos Bay was formed by the flooding of the mouth of the Coos River Valley as sea level rose at the end of the last ice age. Note that a large sand spit has grown from the north end of the bay mouth and now deflects the mouth of the river far to the south before it enters the sea.
- Eocene Coaledo Formation deposited in shallow marine and nearshore terrestrial environments. Named for abundant coal seams formed in coastal swamps. May contain a significant amount of petroleum. Not well exposed along the highway, so will examine it in the coastal cliffs at Cape Arago.

Turn left at the junction with the road to Charleston, and continue through the town to the Cape Arago road. Turn left onto the Cape Arago road and follow it to its end at the parking circle on Cape Arago.

STOP 7: Cape Arago State Park – examine the moderately dipping layers of cross-bedded sandstone exposed in the cliffs and shoreline outcrops. Be careful not to fall!

Return to Charleston along the Cape Arago road and then follow the signs to downtown Coos Bay for lodging and meals at the end of this second day.

Day 3: Coos Bay to Weed – Across the Coast Range and Home!

Depart Coos Bay and head south on Hwy. 101

Junction of Hwy 101 and Hwy. 42, bear left onto Hwy. 42 (0.0 mi.)

- Structural overview of marine sediments in the southwestern Coast Range – westernmost sedimentary rocks in this part of the Coast Range are a set of relatively young, nearly flat-lying Eocene sedimentary rocks that overlie the folded, older Eocene sedimentary rocks we will see to the east.
- Basalt “slivers” and faulting of the Coast Range rocks – crustal shortening associated with subduction has broken the Eocene sediments and their basaltic basement along a series of shallowly east-dipping thrust faults. On the eastern sides of these faults, older basalts are thrust up on top of younger sediments. We will drive through several such basalt “slivers” on our way to Winston.

STOP 1: Undeformed Eocene strata in the western Coast Range – these strata afford an opportunity to look at some of the youngest Eocene rocks in the area. Mollusc fossils suggest deposition in a marine environment.

Entering Coquille (10.2 mi.).

Basalt outcrops, including one with a small quarry, along the highway (15.3 to 23.9 mi.)
Entering Myrtle Point (19.5 mi.).

STOP 2: Quarry exposing well developed pillow basalt (seafloor lavas) with glassy pillow rims overlain by Eocene marine sandstones (28.2 mi.).

Passing road to Bridge (30.2 mi.).

- Crustal shortening of Coast Range has led to folding and thrust faulting and, along at least one fault, to the rise of a mass of serpentine has squeezed to the surface carrying blocks of blueschist. Blueschist is a metabasalt that has undergone high-pressure/low-temperature metamorphism in a subduction zone. This deep-seated metamorphic rock may then be carried up to the surface by the circulation of material in a wedge of mélangé (some knockers along the coast were blueschist) or by the upward flow of a softer rock (like serpentine) along a fault zone.

STOP 3: Kincheloe Quarry – this quarry, visible just south of the road from the parking area, is a source of blueschist mined from a mass of serpentine that has risen along a fault here in the Coast Range. Blueschist is a very tough, dense rock useful for the construction of breakwaters, jetties, and similar engineered structures. (33.1 mi.)

Deformed (dipping) and nearly undeformed (flat-lying) Eocene marine sediments are well exposed in road cuts along Hwy. 42. (36.4 to 50.9 mi.)

STOP 4: Flat-lying Eocene continental shelf sediments – these beds are the relatively undeformed equivalents of the folded Eocene strata we have been driving through since just past Bridge. Because the continental shelf on which they were deposited was deformed from the west, folding is least intense here. These rocks are older than the flat lying Eocene rocks we visited at STOP 1 this morning.

End of Hwy. 42 in Winston (70.6 mi.).

I-5 junction at Winston (74 mi.).

- Meta-andesites of an accreted island arc – just south of Winston I-5 leaves the Coast Range province and re-enters rocks of the Franciscan Formation and its equivalents. Most of the rocks the road crosses from just south of Winston to Stage Road Pass are severely altered and deformed metavolcanic rocks (andesites) that may have once formed an offshore volcanic arc before subduction forced it against the western edge of North America.

Canyonville – lunch stop at truck stop restaurant on west side of highway (93 mi.).

- Re-entering the Western Pz-Tr Terrane – just south of Canyonville (between Canyonville and Stage Road Pass) I-5 crosses back into Klamath basement rocks again and remains in them until we reach Grants Pass.

Stage Road Pass (115.5 mi.).

Junction with Hwy. 199 in Grants Pass (139.2 mi.)

Weed – end of road log (245 mi.).