

The Oregon Coastline Over Time

The shape of the coastline is continually changing through erosion and deposition at the surface, and tectonic processes at depth. Sea level has risen globally due to the melting of glaciers at the end of the last ice age, which occurred approximately 10,000 years ago. Here in Oregon, the coastline was hundreds of feet to a mile farther west.

But Oregon also has an emergent coast due to its active tectonic environment. In the *Cascadia Subduction Zone* to the west, the Juan de Fuca oceanic plate is being pushed or subducted underneath the North American continental plate.

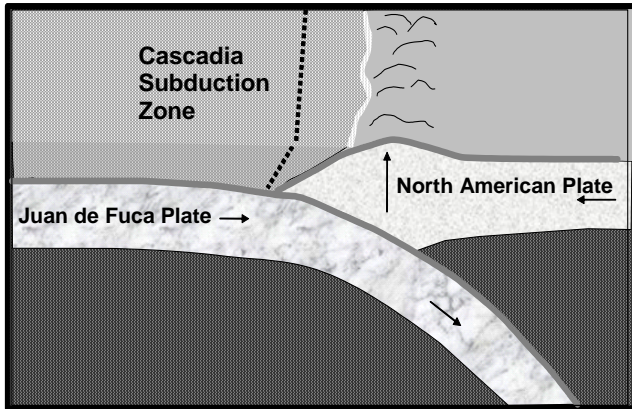


Figure 4. Cross section of subduction of oceanic plate under the continental plate.

As it slides under the North American plate, the Juan de Fuca plate elevates the coast of North America at a rate of 2-5 mm/year. Evidence of the uplifted coast is visible at Indian Sands in Boardman State Park. The layered beds of sand are records of previous sea level. Uplifted marine terraces are also evidence of the changing coastal environment.

The Dynamic Oregon Coast: Geologic Features and Where to See Them

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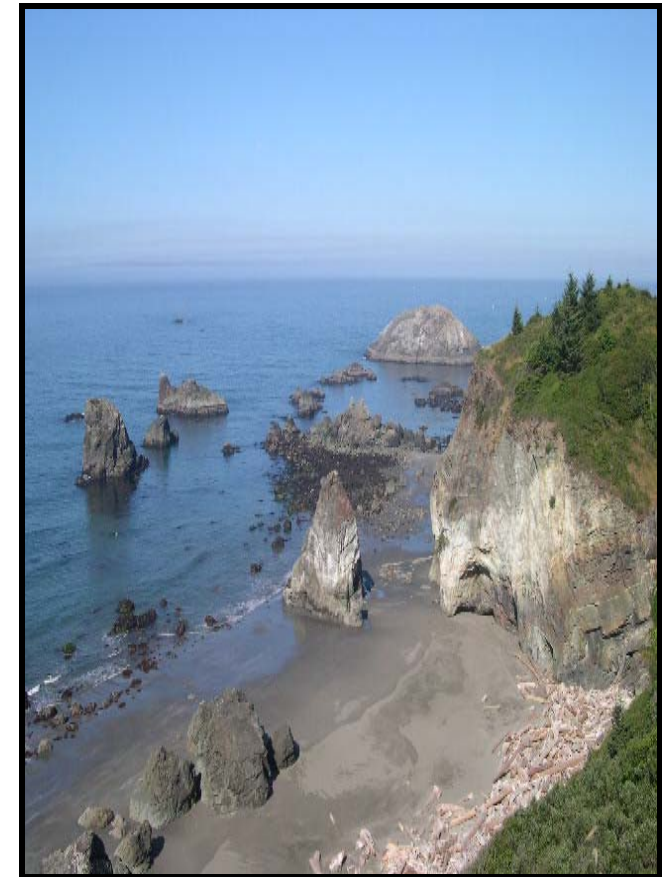
Sea stacks near Myers Creek

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Sea stacks at Rainbow Rock, Oregon

What are sea stacks?

Isolated outcrops of rock standing in the ocean are called sea stacks, and they are remnants of rocky headlands that were eroded by wave action. You can see them along the Oregon coast at Myers Creek, Bandon, and Gold Beach.

How do sea stacks form?

The Oregon coastline naturally has areas of rocky headlands alternating with sandy coves due to variation in the local rock types. As waves approach the shore, they are refracted nearly parallel to shore so that wave energy is concentrated on headlands (Figure 1). Rocky cliffs develop on the headlands and sand is deposited in the bays, forming beaches.

Through this process of erosion and deposition, an irregularly shaped coastline will be gradually straightened.

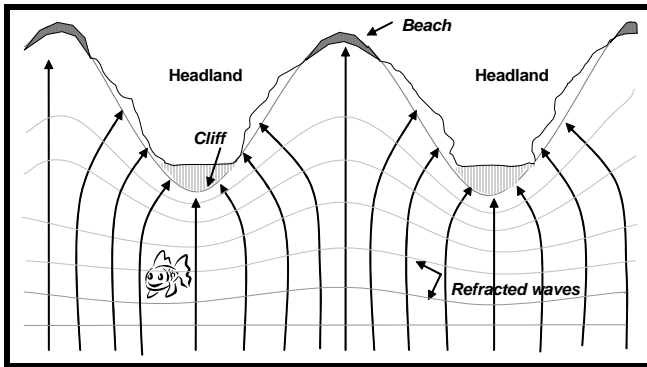


Figure 1. Waves refracting and shaping coastline.

In the cliffs that form the headlands there are areas that are more fractured or have inclusions of softer rocks. Breaking waves exploit the fractures by pounding them with loose pebbles and forcing air into them. Wave action will erode weak areas more quickly, isolating outcrops of more resistant rocks to make sea stacks. The south Oregon coast consists of mixed sedimentary and volcanic rocks that have some shear fractures. The heterogeneity of these rocks makes them prone to developing sea stacks.

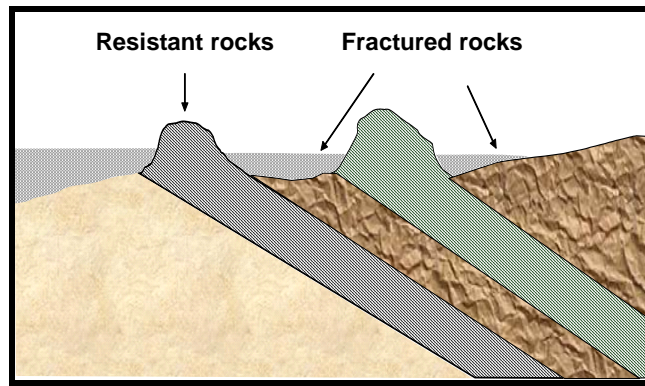


Figure 2. Cross section of sea stacks, showing resistant vs. fractured rocks.

You see sea stacks concentrated at the end of rocky ridges and headlands, marking where a ridge projected as a headland only a few thousand years ago. Cape Sebastian and Humbug Mountain are examples of rocky headlands in this area.

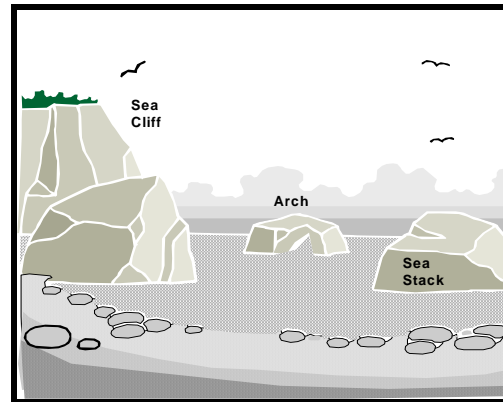


Figure 3. Cliffs, stacks, and arches.

Arches are bridges of rock left above openings eroded in sea cliffs by waves. These are visible at Myers Creek and Arch Rock, south of the Pistol River bridge.



Arch at Myers Creek

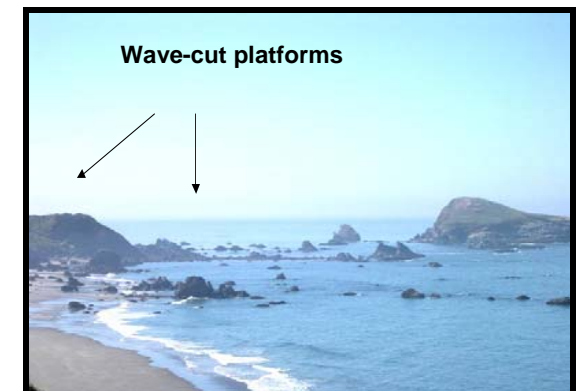


Wave-cut Platforms

Wave erosion also forms **wave-cut platforms** (or benches) along the coast. These are horizontal benches of rock that form in the surf zone, where breaking waves scour the rocks on the bottom. The wave-cut platform meets the shore at a **sea cliff** (Figure 3).

Waves undercut the bases of these cliffs until they collapse, and so the cliffs retreat inland. Uplifted marine terraces are wave cut benches covered in sand that are now above sea level.

You can see wave-cut benches at Rocky Point south of Port Orford, Boardman State Park, and near Bandon (this terrace has been dated to be 80,000 years old.) McVay Wayside south of Brookings even has sea stacks located on an old terrace.



Boardman State Park