

Black Point & Bihler Point



Conglomerate

Photo: looking north toward end of Black Point (south of post 1)

All of the rocks in this photo are conglomerate. Both Black Point and Bihler Point are formed from thick layers of this conglomerate. The conglomerate was deposited on the floor of the Gualala Basin when the basin was formed in late Cretaceous time, about 80 million years ago. At that time, the basin was somewhere in southern California or Baja California, no one knows exactly where. Over the last 25 million years the basin has been transported north several hundred miles by the San Andreas Fault, bringing these rocks to their present location on the Sea Ranch coast. The conglomerates consist of rounded pebbles and cobbles that were eroded from the hills that were near the Gualala Basin when the basin was formed. As the basin moved north, these hills were left behind, and many geologists have spent many years trying to find them.

**Black Point Beach
South End**



Basalt

Black Point Beach

Access steps

Conglomerate

Photo: looking north from Black Point toward Black Point Beach (south of post 1)

The bluff along Black Point Beach consists of dark green basalt. Basalt is an igneous rock that forms in the upper part of the earth's mantle by partial melting of the mantle. When the hard rocks of the crust are broken, molten basalt flows out of the broken rocks like blood from a cut. The basalt exposed at Black Point Beach formed when the crust was pulled apart and broken in late Cretaceous time, forming a depression similar to the Dead Sea. Basalt leaked out from the broken crust and covered the floor of the depression, then the sedimentary rocks of the Gualala Formation were deposited on top of the basalt.

Black Point



Photo: looking south toward Black Point from Black Point Beach (near post 2)

The basalt along Black Point Beach is not hard and is easily broken down by weathering and wave erosion. The sand on the beach is made up of small grains of the basalt that are a residue of the weathering process. In contrast, the conglomerates that make up Black Point are very hard and have resisted weathering and erosion, so that Black Point juts out sharply from the shoreline. The contact between the soft basalt and hard conglomerate can be seen in the bluff at the south end of Black Point Beach, and the red line in the photo shows the projected contact offshore.

Black Point Beach



Black Point Beach

Basalt

Basalt

Photo: looking north along Black Point Beach from bluff (near post 2)

All of the rocks in the bluff from Black Point Beach to Pebble Beach are basalt, and all of the sedimentary rocks in the Gualala Basin were deposited on top of this basalt. About 10 million years ago the rocks in this area were uplifted to form the Black Point Anticline. As the rocks were uplifted, they were also eroded. In a few million years, the sedimentary rocks over the crest of the anticline were removed and the basalt that once formed the floor of the basin was exposed at the surface. This basalt can now be seen in the bluff along Black Point Beach.

Sea Stacks near Sea Meadow Drive



Photo: looking north to sea stacks from bluff (near post 7)

These sea stacks, about 1/4 of a mile north of Black Point Beach, are formed from a very hard layer of basalt that was resistant to wave erosion. The sea stacks were left behind as the softer basalt was eroded landward. The tops of the sea stacks are somewhat flat and represent remnants of the meadow surface.

Pillow Basalt near Whaler's Reach



Photo: looking south from the bluff near Whaler's Reach (between posts 7 and 8)

The bluff near Whaler's Reach is formed from steeply dipping beds of basalt. This is the same basalt that occurs at Black Point Beach, except that the basalt here has been cemented with silica and is much more resistant to erosion. Many of the basalt layers consist of elongated "pillows" of basalt a foot or so in diameter. The pillows were formed when the basalt was extruded from a volcanic vent on to the seafloor. As the basalt magma flowed onto the seafloor, the water chilled the outer part of the magma forming a crust in the shape of a pillow. The magma inside the pillow continued to flow, breaking through the crust to form another pillow, and so on. Pillows are often stacked together in beds that are several feet thick. The silica cement was probably added to the basalt from silica-saturated sea water that was present during the eruption. This type of basalt is referred to as "pillow basalt" and is a good indicator that the basalt was extruded under water.

**Pebble Beach
South End**



Photo: looking toward south end of Pebble Beach from beach access (near post 9)

Pebble Beach is formed from sandstone, shale and conglomerate that lie at the base of the Gualala Formation. These sedimentary rocks were deposited on top of the basalt that forms the floor of the basin. At low tide you can see the contact between the Gualala Formation and the underlying basalt at the south end of Pebble Beach, and the basalt exposures continue south to Black Point Beach.

**Pebble Beach
Main Beach**



**Conglomerate
and sandstone**

**Sandstone
and shale**

**Cobbles of
basalt**

Photo: looking toward north end of beach (near post 9)

The outcrop on the center right is composed of thin layers of light sandstone and dark shale. These rocks were deposited on the floor of the Gualala Basin as thin layers of mud and loose sand. Over time, they were buried to a depth of 30,000 feet by younger sediments in the Gualala Basin. Time, heat and pressure turned these sediments into sandstone and shale. At the north end of the beach there is a thick layer of conglomerate, somewhat similar to the conglomerates at Black Point and Bihler Point. There are many pebbles and cobbles along the beach near the conglomerate that have weathered from the conglomerate, and the beach was probably named from these pebbles. The green cobbles of basalt in the foreground were derived from the basalt exposed in the bluff at the south end of Pebble Beach.

Stengel Beach



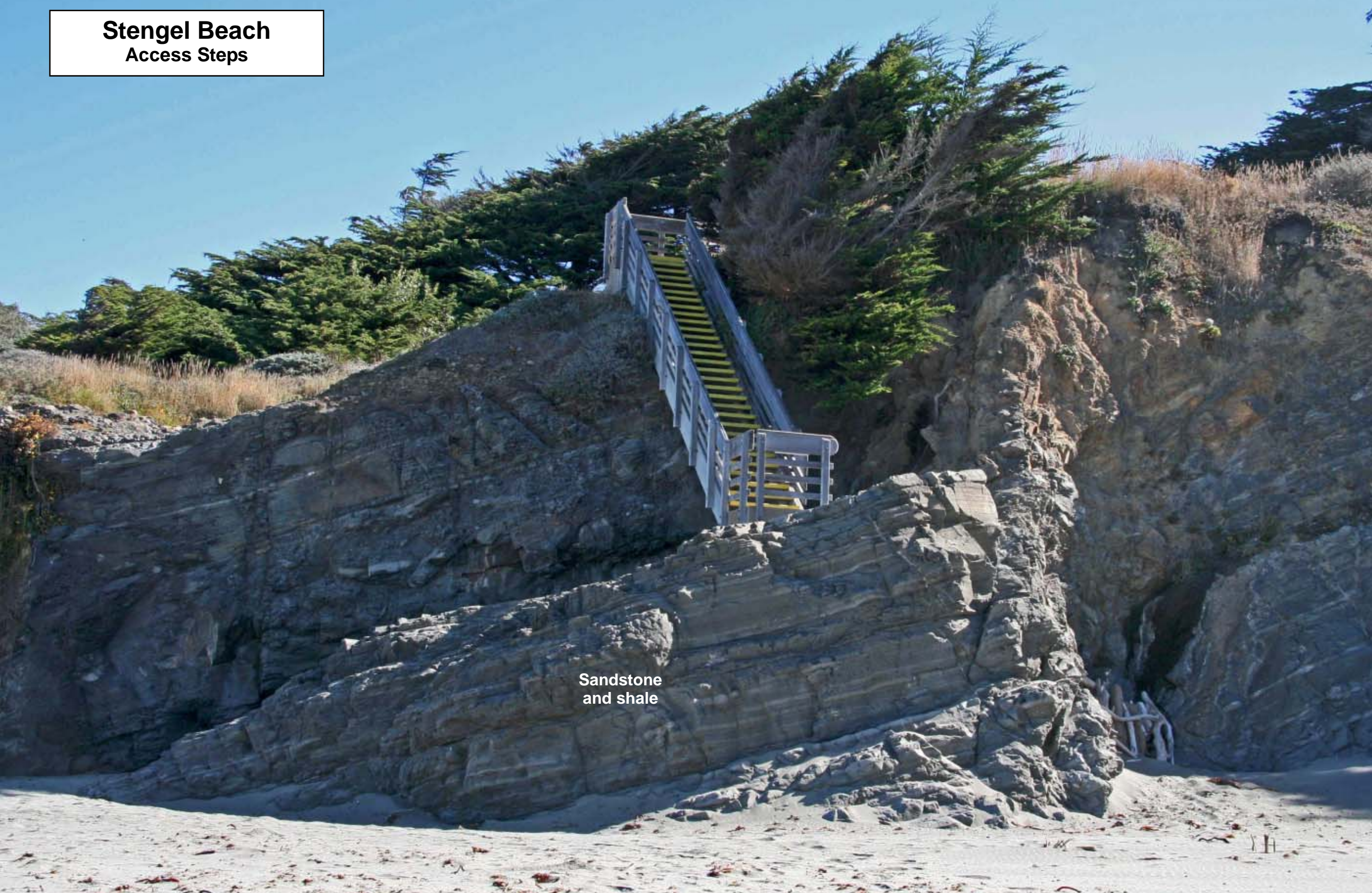
Weathered zone

Sandstone and shale

Access steps

Photo: looking north to Stengel Beach from bluff (near post 23)
The bluff along Stengel Beach is formed from thin-bedded sandstone and shale of the Gualala Formation. In this photograph, the sandstone and shale appear as light and dark gray layers that are tilted gently to the northeast. All of the sedimentary rocks from Pebble Beach to the north end of the Sea Ranch are on the northeast flank of the Black Point Anticline and were tilted to the northeast during uplift of the anticline. The reddish brown color in the upper part of the bluff is caused by weathering of the upper part of the sedimentary rocks that underlie the meadow. This red weathering can be seen most everywhere along the bluff.

Stengel Beach Access Steps



Sandstone
and shale

Photo: access steps to Stengel Beach (near post 24)

The access steps to Stengel Beach terminate on the top of a sandstone bed that is tilted to the north and you walk down that sandstone surface to reach the beach. This sandstone bed was deposited in the Gualala Basin as part of a “turbidity current”, an underwater avalanche of sand, mud and water. When the turbidity current reached the floor of the basin, the current slowed down and the larger grains of sand settled out first, followed by the smaller grains, and then the mud. Most of the sedimentary rocks in the Gualala Basin were deposited in this manner. You can see the graded bedding formed from turbidity currents in the sandstone beds below the steps.

**Shell Beach
South Cove**

**Seal Observation Area
Tide Pool Beach**

**Conglomerate
and sandstone**

**Conglomerate
and sandstone**

Shale

Shell Beach (south cove)

Photo: looking north toward Shell Beach from bluff (north of post 32)
The coastline from Wild Moor Reach to the Seal Observation Area at Tide Pool Beach is broken into a number of coves and points, and there are several small islands and many rocks in the surf zone. This coastline has been eroded from conglomerate, sandstone, and shale of the Gualala Formation. The conglomerate and sandstone are very hard and resistant to erosion, and these rocks form the headlands, islands and offshore rocks. In contrast, the shale is soft and easily eroded and forms the coves.

Shell Beach



Photo: Shell Beach from bluff (near post 34)

Shell Beach is in a large cove that has been eroded from soft shale of the Gualala Formation. Since the shale is soft and easily eroded, it is difficult to see good exposures, but some shale can be seen in the bluff along the cove. The headlands, islands and offshore rocks are conglomerate and sandstone. Note the island with the flat top at the far end of the beach. This flat surface was once part of the meadow and has been left behind as the bluff eroded landward. Also note the reddish brown weathered rocks in the upper part of the bluff at the north end of the beach. Hard sandstones and conglomerates in the lower part of the bluff that extend up into this weathered zone become soft and can be easily crumbled by hand.

TSRA Marine Preserve

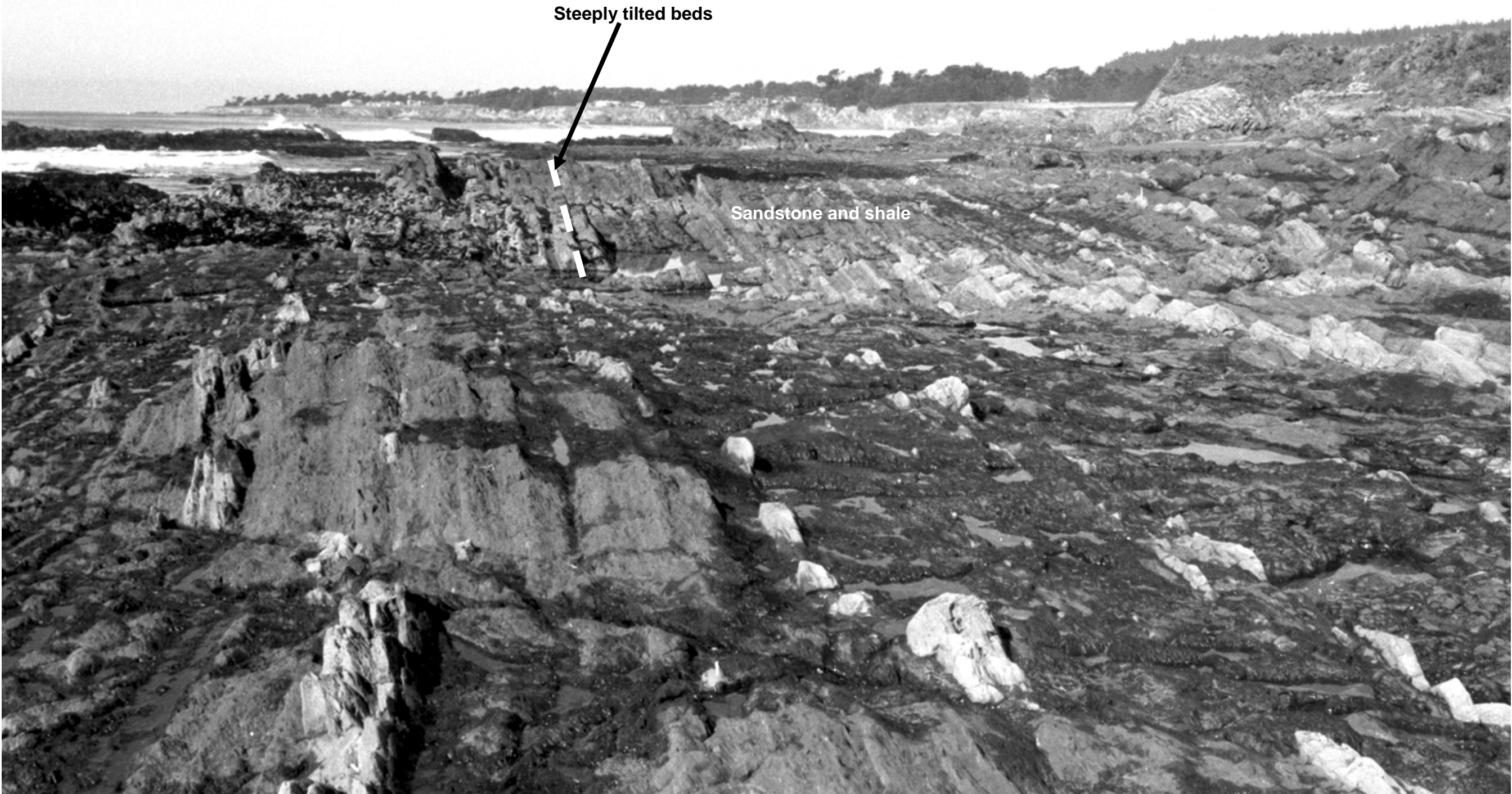


Photo: TSRA Marine Preserve at low tide (near post 39)

This broad “wave-cut platform” is exposed only at very low tide and was formed by wave erosion. During storms, most of the wave energy is concentrated at the base of the bluff, undermining the bluff and causing the bluff to retreat. As the bluff retreats, the rocks below the wave action are left behind, forming a wave-cut platform. The rocks at this locality consist of thin beds of light gray sandstone and dark gray shale of the Gualala Formation. These beds were steeply tilted to the northeast when they were uplifted along the Black Point Anticline. The tilted beds were then truncated by the wave erosion. The sand beds are more resistant to erosion than the shale, resulting in this “grooved” surface. There are many other wave-cut platforms along the Sea Ranch coast. If this platform were lifted above wave level, it would be preserved as a marine terrace, and the storm waves would start cutting a new platform at the new lower wave level. The Sea Ranch Meadow is marine terrace that was formed about 100,000 years ago when sea level was higher during an interglacial period.

Walk-On Beach Sand Dunes



Dune sand

Photo: sand dunes on bluff at south end of Walk-On Beach (near post 41)

From One-eyed Jacks (near post 37) to the south part of Walk-On Beach (post 41) there are a number of sand dunes. Most of the dunes are covered by vegetation, so you may have to look hard to see the dunes, but much of the trail is in sand. The dunes were formed from sand that was picked up from Walk-On Beach by prevailing northerly winds and deposited along the edge of the bluff. The dunes are extensive here because there is a good source of sand along Walk-On Beach.

**Walk-On Beach
North End**

Access steps

Beds tilted northeast

Sandstone



Photo: north end of Walk-On Beach taken from bluff (near post 42)
The rocks at the north end of Walk-On Beach are thick sandstones of the lowermost part of the Paleocene German Rancho Formation. The beds are hard and resistant to erosion, so they jut out into the surf. The thick sandstones are separated by a few thin layers of shale which are darker gray.

Walk-On Beach



Sandstone
(German Rancho formation)

Shale

Walk-On Beach

Dunes

Sandstone and shale
(Gualala Formation)

Cretaceous

Paleocene

Photo: looking south to Walk-On Beach, taken from the rocks at the north end of the beach (north of post 42)
The sandstone and shale at the south end of Walk-On Beach are late Cretaceous in age and were deposited in the upper part of the Gualala Formation. The sandstones at the north end of the beach are of Paleocene age and are in the lower part of the German Rancho Formation. The low bluff along Walk-On Beach is mostly shale, and the contact between the late Cretaceous and Paleocene shale is probably in the shale at the south part of the beach, but its exact location is not known. The shale along the beach is soft and was easily eroded to form the long beach. The beach sand was mostly derived from erosion and weathering of the sandstones at north and south ends of the beach. The beach sand has been built so that it now covers the lower part of the bluff and protects the soft shale from most of the strong wave action. Instead of eroding the bluff, the wave energy is spent removing the sand from the beach in the winter and then moving it back again in the summer.

Bluff North of Walk-On Beach



Del Mar Point

Sandstone

Northeast dip

Photo: looking north from bluff north of Walk-On Beach (near post 44)
This photo shows the Sea Ranch bluff from Walk-On Beach toward Del Mar Point. The bluff is formed mainly from thick sandstone beds that are separated by with thin layers of shale, giving the rocks a strong layered appearance. The sandstone beds dip steeply to the northeast because they were tilted in that direction during uplift of the Black Point Anticline. The sandstones are hard and resist erosion, so that most of the bluff is steep and there are no large accessible beaches north of Walk-On Beach. These rocks all belong to the German Rancho Formation and were deposited in the Gualala Basin during Paleocene time.

Del Mar Point



From 1898 to 1910 there was a lumber mill and a chute for loading the lumber on schooners at Del Mar Point. A small railroad brought the lumber to the mill. On the nearby Coast Road, now Highway 1, there was a store, saloon and school for the children of the millworkers. The Del Mar School is still standing, and can be seen at the southwest corner of Deer Trail and Leeward.

Photo: Del Mar Point (near post 58)

Del Mar Point is one of the best areas to see the sandstones of the German Rancho Formation in more detail. The sandstone beds are tilted toward the bluff and wave action keeps the rocks clean so that they are fresh and well-exposed. Most of the beds are from one to several feet thick and are separated by thin layers of shale. Each sandstone bed was deposited by a turbidity current, the coarse sand separating out first, followed by the finer grains and then the mud. Many of the sandstones at Del Mar Point also provide good examples of honeycomb weathering. This weathering occurs within the splash zone where sea water collects in small depressions on the rock. When the water evaporates, the crystallizing salt pries out the sand grains, forming a larger pocket, and so on.

Gualala Point and Gualala Island



Sand dunes

Sandstone

Gualala Point

Gualala Island

Photo: looking south to Gualala Point and Gualala Island from bluff (near post 75)

Gualala Island and Gualala Point are both formed from hard sandstones of the German Rancho Formation. The sandstones at Gualala Island were especially hard, so the island was left behind as the bluff eroded landward. The flat top of the island is a remnant of the Sea Ranch meadow. The cove on this side of Gualala Point was formed where fractured sandstones of the German Rancho Formation allowed more rapid erosion of the bluff. This is one of the largest coves north of Walk-On Beach, but there is no access to the cove. Sands exposed at low tide in the cove were the source for the sand dunes on the bluff south of the cove.

Whale Watch Point



Photo: Whale Watch Point, Gualala Point Regional Park

Whale Watch Point is formed from hard sandstones of the German Rancho Formation. Most of the sandstone beds are a couple of feet thick, and are separated by thin layers of dark gray shale. These beds dip to the southwest, toward the axis of the Gualala Syncline. The axis of the syncline is near the north boundary of the Sea Ranch.

Gualala Point Regional Park



Outlet of
Gualala River

Beach access

Beds tilted southwest

Sandstone

Sandstone spit

Gualala

Photo: looking north to Gualala Point Regional Park from Whale Watch Point

The Gualala River flows into the ocean at Gualala Point Regional Park. The river cannot be seen in this photo, but lies between the spit and the town of Gualala. The outlet of the river is at the north end of the spit. The spit and beach were formed from sand brought down the river during high water and deposited at the mouth of the river when the current decreased. During periods of low river flow, the river is blocked by the sand and does not flow into the ocean. During periods of heavy surf and high tide, the surf crosses the northern part of the spit. The rocks along the bluff to the right are thick beds of sandstone of the German Rancho Formation. These beds dip southwest toward the axis of the Gualala Syncline.