



Beaches

A beach is a strip of land that borders a body of water, most frequently the ocean. Most of us love the beach. We swim in the water, surf on the waves and play or stroll on the sand.

But what we probably don't realize is that we never set foot on the same beach twice. All beaches are in a constant process of change -- altered by the wind and waves in a continual cycle of formation and erosion. A wide, gently sloping beach in the summer may become steep and narrow in the winter. Or it may vanish overnight -- its sand washed away by a violent storm and not returned till summer.

How Beaches Are Made

Beaches begin on land. And they begin with two natural processes that we learned about in our last Instruction. Those processes are *weathering* and *erosion*.

First, weathering breaks rocks down into particles of the materials they're made up of. One of those materials is sand. Rivers then wash the particles down to sea (that's erosion). River sediment accounts for 80 to 90 percent of all beach sand. But it takes two steps to actually turn it into a beach.

First, the sediment is washed down to the sea and deposited close to the shore. This sediment is called *visible load* because you can see it suspended in the water.

Then the *visible load* is picked up and carried along the coast by the *longshore current*, which then deposits it along the shore to form a beach. These longshore current flows parallel to the shore and can deliver more than a million cubic yards of sediment a year.

But the sand doesn't always stay put. It is stirred up by waves and sometimes carried back out to sea.

Waves & Wind

As we said, beaches are constantly changing because of waves and wind. Most waves get their energy from the wind, although waves can also be caused by underwater earthquakes and by the pull of the Sun and the Moon.



Try this experiment. Fill a bowl with warm water and blow on it gently. Your breath causes the water to go up and down -- but it appears to be moving forward. That's exactly what happens when the wind blows on the ocean.

There are many different kinds of waves. The big ones you see at the beach are called *Breakers*. A Breaker forms when the lower part of a wave hits the sand near the shore and the top part crashes ("breaks") over it. There are three kinds of Breakers.

Surging Breakers -- which happen on beaches with extremely sharp slopes. This kind of wave doesn't actually break; it rolls onto the steep beach. Surging Breakers can be very destructive.

Plunging Breakers -- which happen on beaches with moderately steep slopes. This kind of wave curls over and forms a tunnel until the wave collapses. Surfers love Plunging Breakers.

Spilling Breakers -- which occur on beaches with gentle slopes. These waves break far from shore and the surf rolls gently over the front of the wave.

Tsunamis

A Tsunami (pronounced tsoo-nah-mee) is sometimes called a tidal wave. But it is not the result of natural tidal action. What it *is* is a series (or "train") of waves caused by the movement of the Earth under the water (an underwater earthquake or volcanic eruption, for example).

Waves caused by the wind involve mainly the *surface* of the water, but a tsunami involves the *entire depth* of the water. This makes them huge (as high as 90 feet) and very destructive.

Tsunami means "harbor wave" in Japanese -- and these waves have been known to destroy many harbors and take many lives. On May 26, 1983, an underwater earthquake in the Pacific Ocean caused a 42-foot-high tsunami that killed 104 people on the western coast of Japan.

To see an animation of how a tsunami happens, click:

<http://www.pbs.org/wnet/savageearth/animations/tsunami/main.html>

Tides and Currents

Tides are the regular daily movement of the sea. They are caused by the turning of the Earth and the tug of gravity from the Sun and Moon.



Tides happen twice a day. In the morning the beach may be dry, but six hours later the whole beach will be under water. The sea is said to have "risen," and the tide is said to be "high" or "in."

About six hours later, the water will be gone but the beach will be wet. It will also be littered with driftwood and other things left as the water went back down. Now the tide is said to be "low" or "out." You have probably been warned about *rip* tides, which can occur when wave after wave breaks on the shore in quick succession. Rip tides are very dangerous and can carry a swimmer out to sea. A rip tide is usually quite narrow -- so if you are caught in one, swim out of it in a direction *parallel* to the beach.

Currents are moving streams of water in the sea. They can be very helpful to sailors and navigators and have a strong effect on the weather. Currents move mainly because of wind. But they are also helped along by the heat of the Sun and the motion of the Earth.

Different Kinds of Beaches

There are many different kinds of beaches. Beaches have different shapes because of the forces that created them: waves, tides and wind. They also differ according to the materials they are made of -- mud, sand, iron sand, shells, cobbles, pebbles or boulders.

On sheltered coasts, beaches are usually made of sand. On exposed coasts, they are usually made of boulders and pebbles.

Most of the beaches we go to for fun are sand beaches. Some beaches consist chiefly of materials derived from one kind of rock, which may give them a distinctive color. Coral and limestone produce white sand and quartz usually produces yellow sand. Sands formed from volcanic rock are black.

Beaches are defined by their high and low water marks.

Ocean beaches are divided into a *foreshore* and a *backshore*. The foreshore extends from where the ocean reaches at low tide to where it reaches at high tide.

The backshore is that part of a beach that is submerged only during *unusually* high tides and storms. The backshore may contain one or more berms, which are ridges of sand and debris parallel to the beach. This sand and debris are deposited by storms at the highwater mark.



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The backshore may also contain sand dunes. Sand dunes are piles of sand built by the wind blowing across the beach.

To see interesting photographs of various types of beaches, go to <http://www.seafriends.org.nz/oceano/beach.htm> (pages 10, 11 & 12). The photographs also contain close-ups of the material the beaches are made of. These beaches are in New Zealand, where the *Lord of the Rings* movies were filmed.

Beaches in California

There are major differences between the beaches in Northern California and the beaches in Southern California. These differences are caused by the wind and by local coastal geography. Along the north coast, *cove* or *pocket* beaches are common, with sea cliffs that have been sculpted by high winds and battered by high-energy waves over millions of years.

In Southern California, beaches often consist of long ribbons of sand interrupted by rocky points.