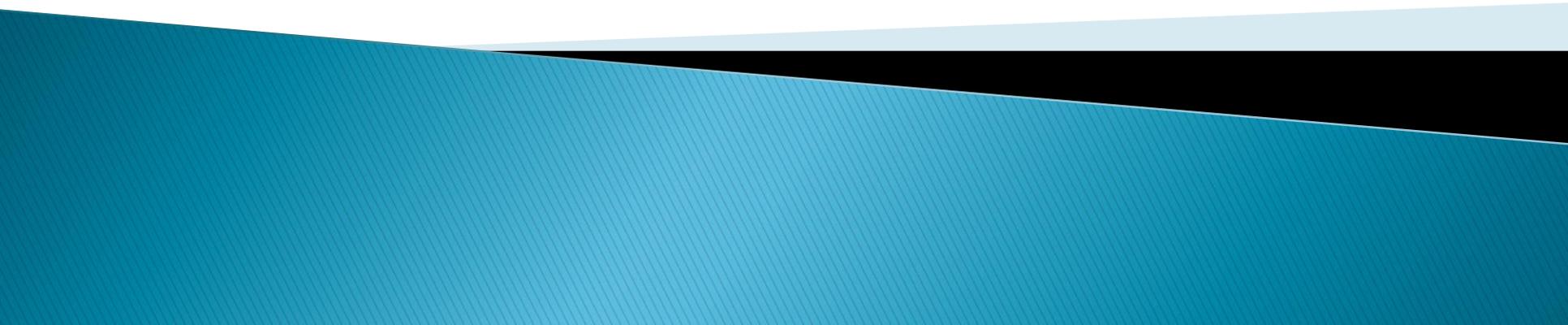


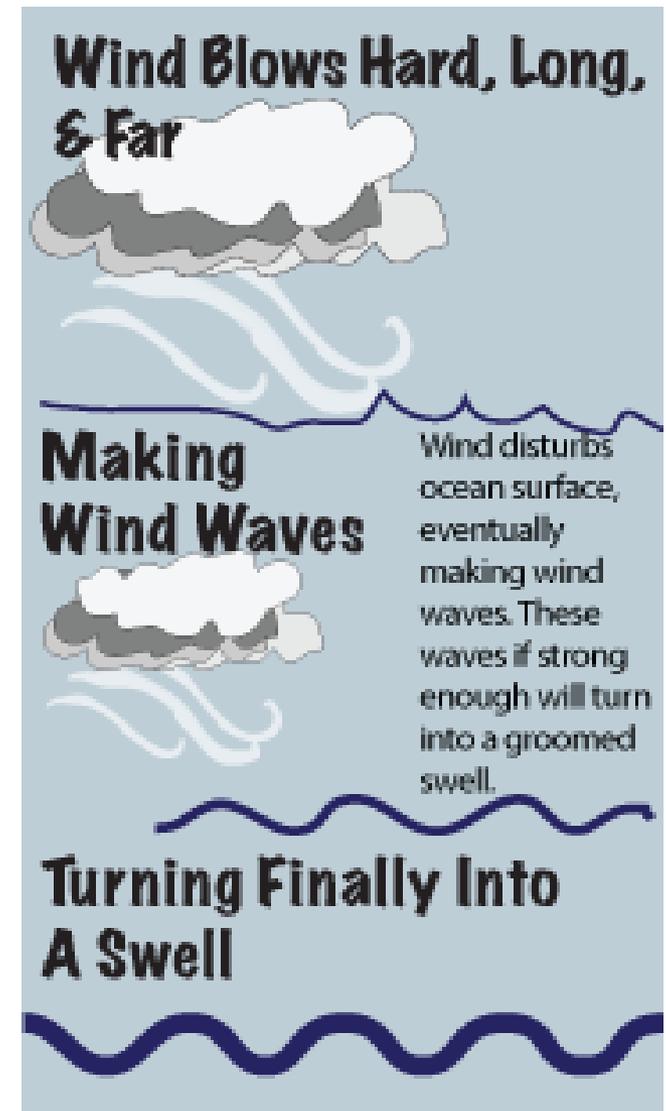
# Waves and Tides

Section 2.3



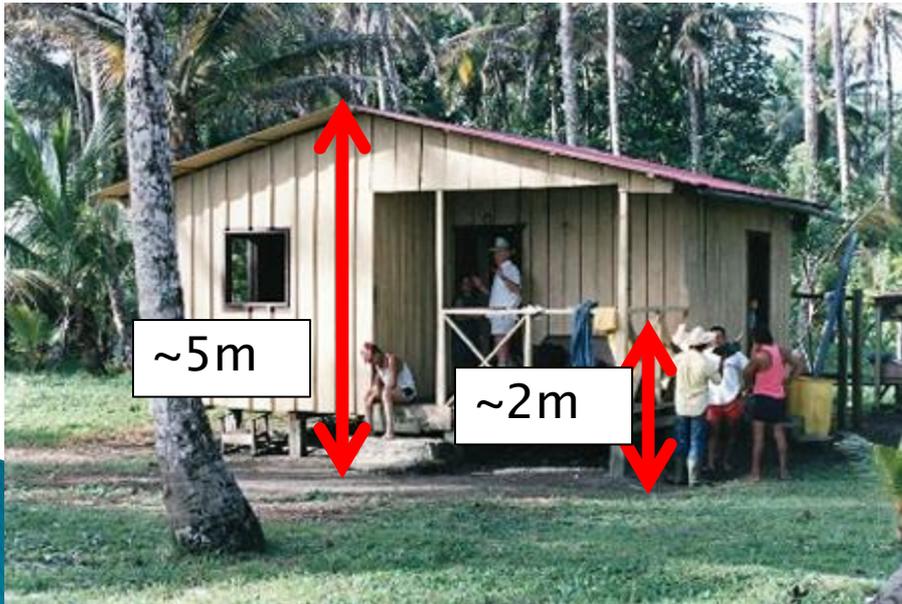
# Ocean Waves

- ▶ Ocean waves are just large ripples, set in motion by steady wind
- ▶ Energy from the wind is transferred to the water
- ▶ Wave height depends on how fast, how long and how far the wind blows



# Ocean Waves

- ▶ Normal wind can produce waves 2 to 5 metres high



# Ocean Waves

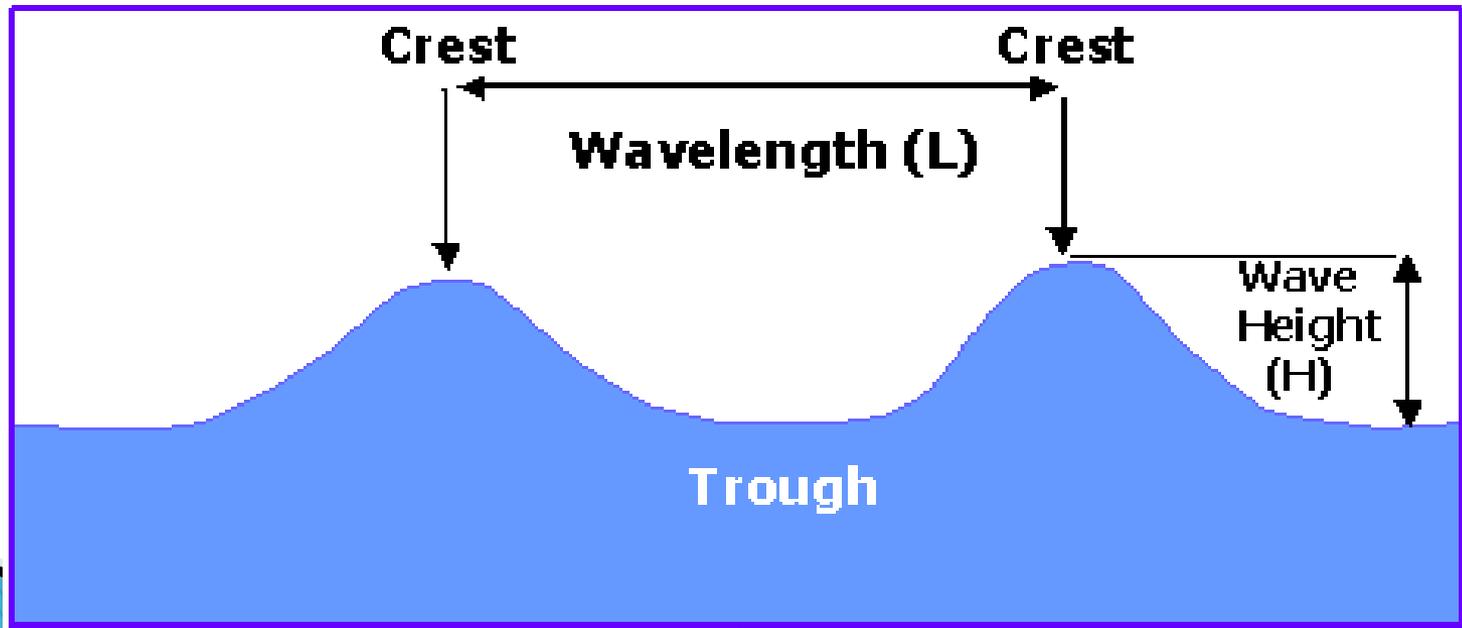
- ▶ Hurricane winds can create waves 30m high



So...  
3 TIMES  
the  
height  
of this  
wave!!

# Wave Characteristics

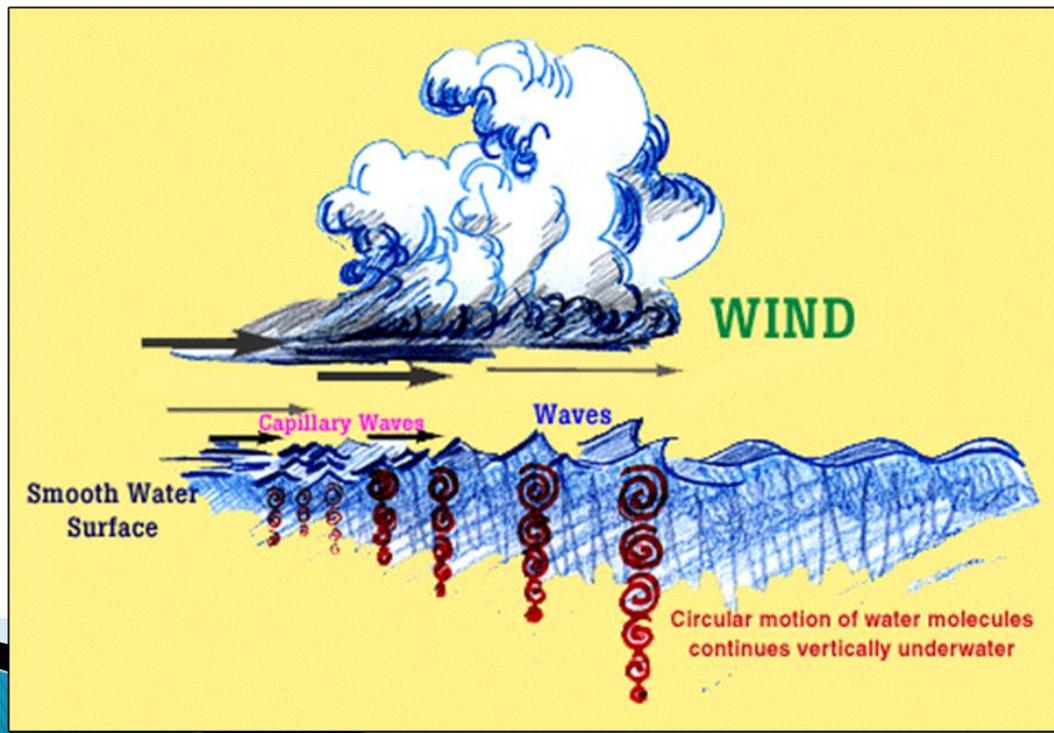
- ▶ Crest – highest point
- ▶ Trough – lowest point
- ▶ Wave height – trough to crest
- ▶ Wavelength – crest to crest



# Types of Waves

## ▶ Ocean Waves:

- Individual water particles move in a circular motion as a wave passes
- Each particle bumps into the next passing on its energy



# Types of Waves

- ▶ **Breaker:** a wave which collapse onshore in a tumble of water



# Types of Waves

## ▶ Swells:

- steady movement of smooth waves present even on calm days
- Caused by winds and storms far out in the ocean



# Tsunamis

- ▶ Giant waves caused by ocean floor events (earthquakes, volcanic eruptions, or landslides)
- ▶ Wavelength could be 150km
- ▶ May travel over open ocean at 800km/h
- ▶ When a tsunami approaches land, it is pushed into a towering, powerfully destructive wave



# How a tsunami occurs

**1** An earthquake rocks the ocean floor

**2** Displaces volume of water, pushing it up

**3** Sets off an oscillation, which develops underwater at great speed

**4** Sea water is sucked back from the shore

Waves get bigger as water gets shallower

Sources: Nature/USGS

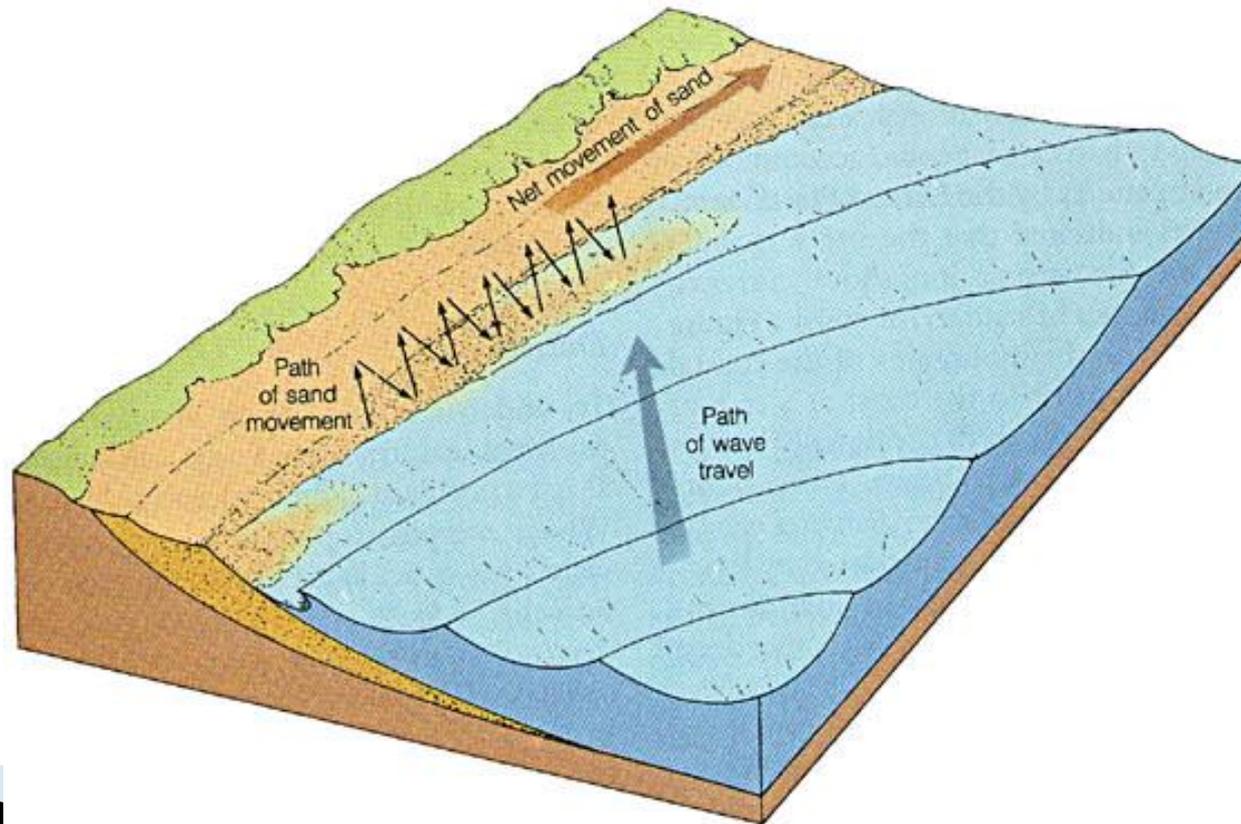
AFP

Japan  
Tsunami

Japan  
Tsunami  
2

# How Waves Change Shorelines

- ▶ Waves erode shorelines
  - Loose sediment is carried away
  - Rocks are slowly worn away
- ▶ Waves redeposit sediments
  - Waves move along the shoreline carrying loose sediment with them



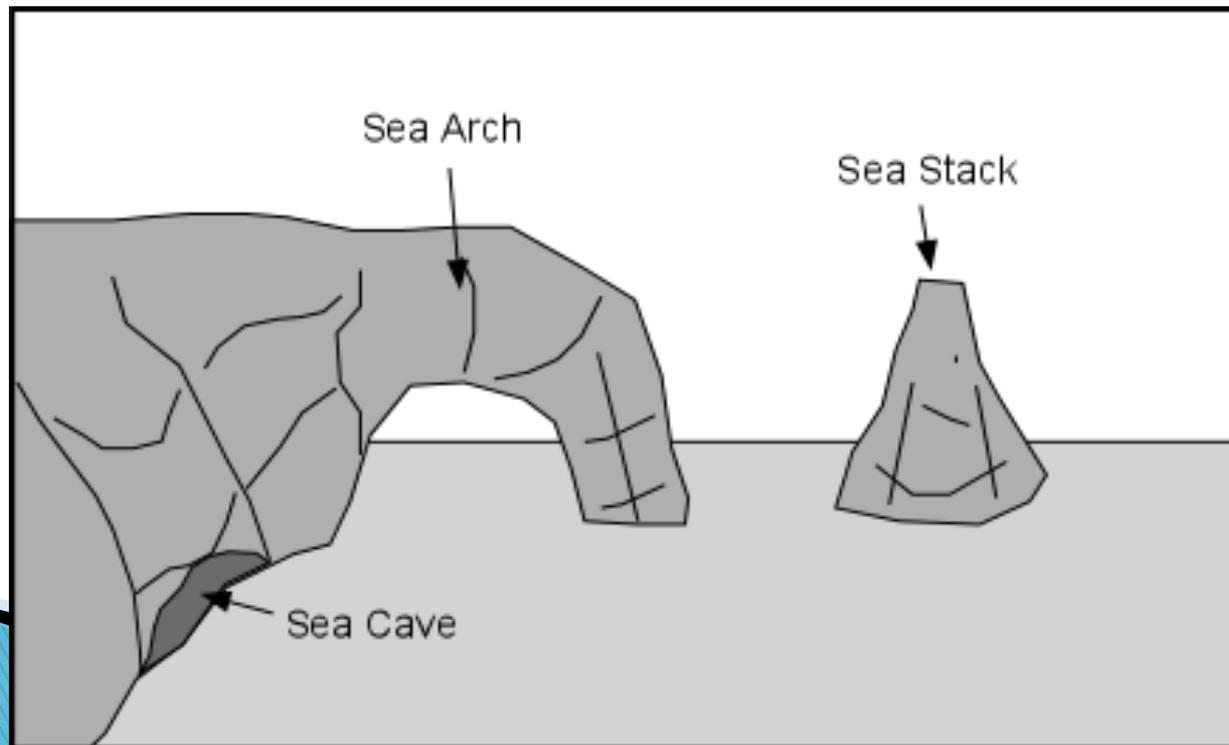
# How Waves Change Shorelines

- ▶ Waves may slowly wear away rocks and form hollows
- ▶ These hollows enlarge and become caves
- ▶ Caves eventually meet and a sea arch is formed



# How Waves Change Shorelines

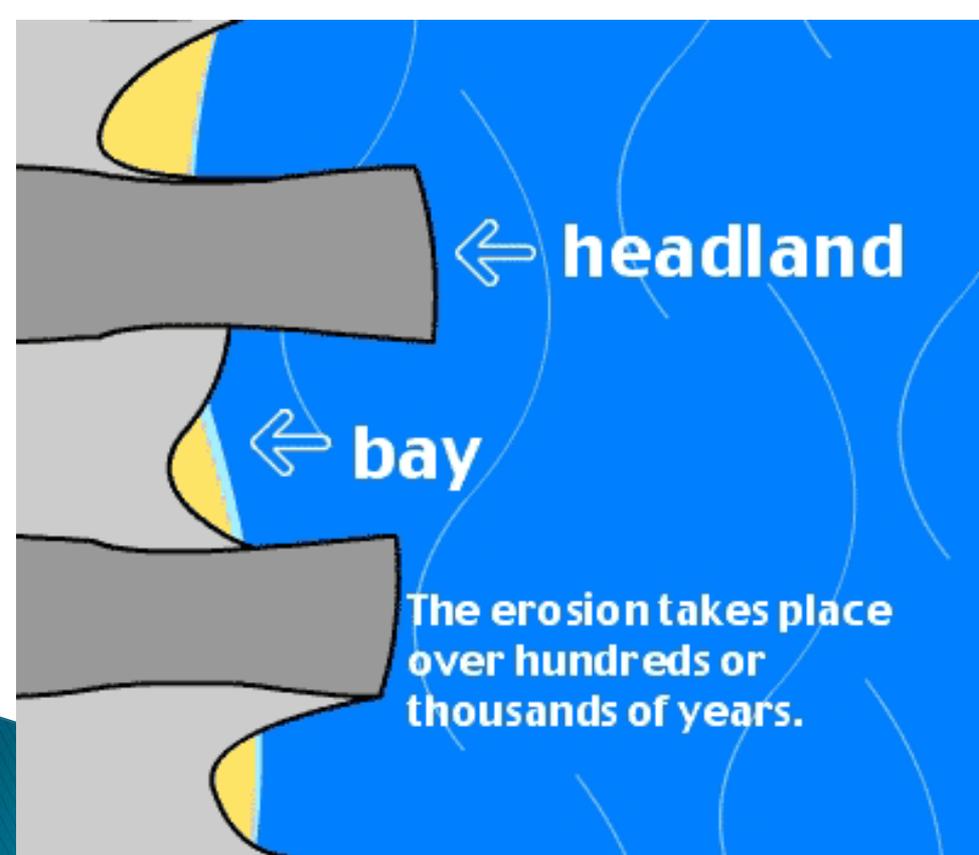
- ▶ Overhanging rock will eventually erode too much and fall into the ocean
- ▶ Rock fragments are ground into sediments



# Headlands and Bays



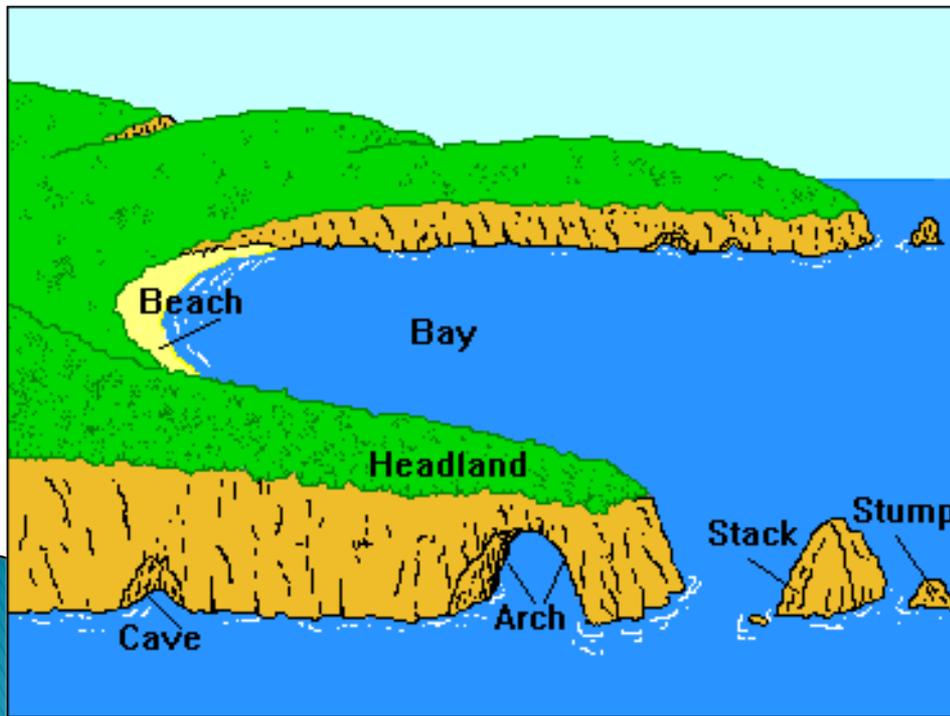
- ▶ Waves erode the shoreline at different rates



- Eroding Faster:
  - Softer rock –sandstone
  - Areas hit by more forceful waves
  - Creates bays
- Eroding Slower:
  - Harder rock –granite
  - Areas hit by less forceful waves
  - Creates headlands

# Headlands and Bays

- ▶ Once headlands are formed the waves hit them first
- ▶ This constant full force of the waves creates interesting features



The slower waves that hit the bays deposit sediment

# Formation of Beaches



- ▶ Rocks on beaches are ground together by crashing waves and made smaller and more smooth over time
- ▶ Steeply-sloping shorelines
  - Rock fragments are washed out to sea leaving a shoreline of mostly bare rock
- ▶ Gentler sloping shorelines
  - Small rock fragments settle and build up forming a beach

Beaches are constantly changing!

# Tides

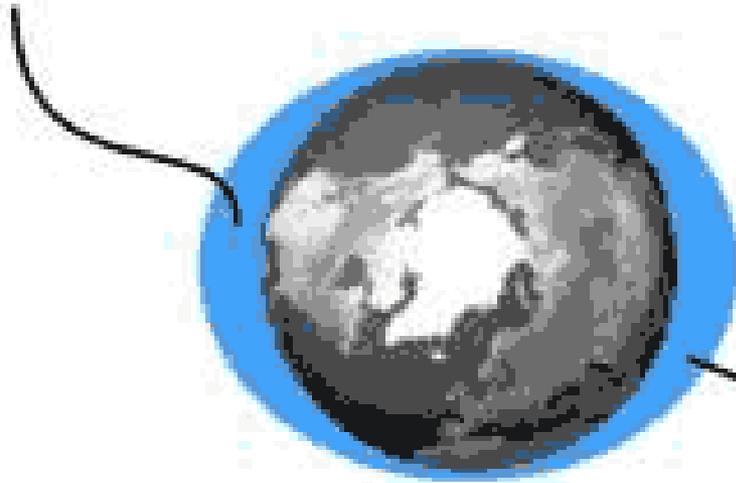
- ▶ The slow and regular rise and fall of the ocean
- ▶ High tide mark at the upper edge of a beach
- ▶ Low tide mark at the lower edge of a beach



# Tides

Cycle of movement is linked to the motion of the moon

Water 'bulges' on the opposite side of the Earth to the Moon



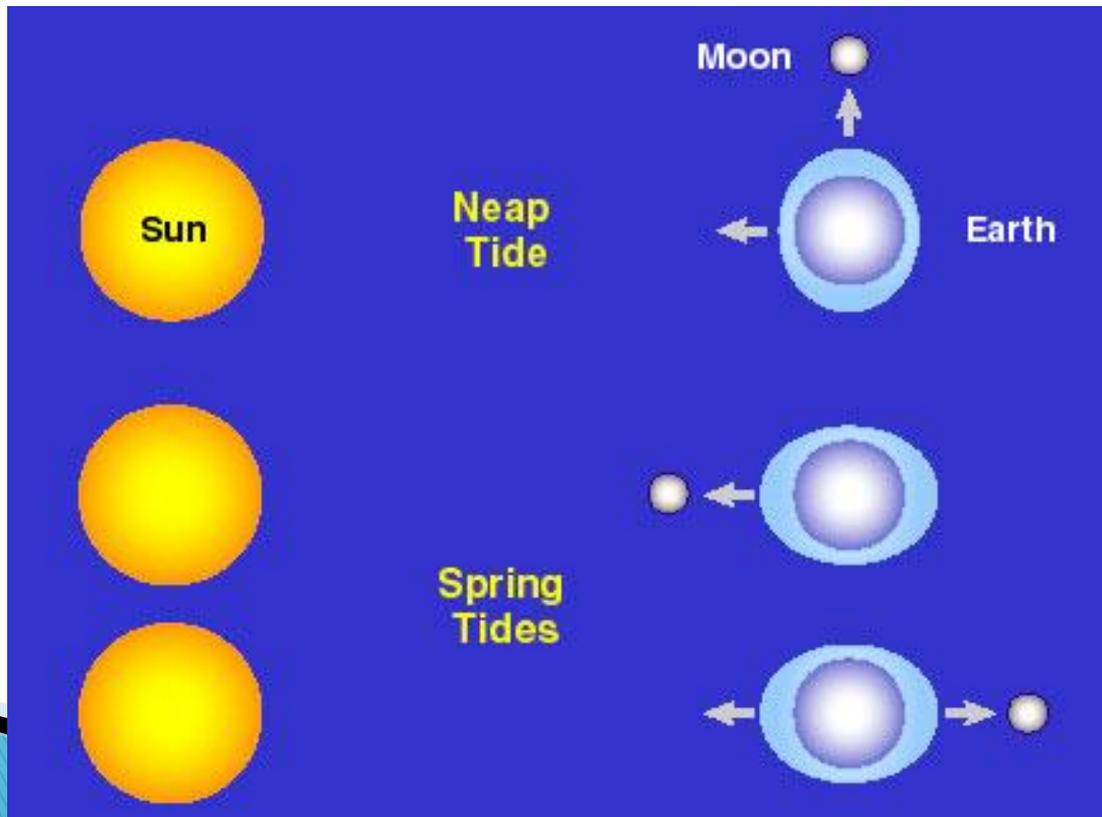
Moon



Water 'bulges' on the side of the Earth facing the Moon

# Tides

- ▶ Spring Tides occur twice per month at full moon and New moon
- ▶ Neap Tides occur twice per month during the first quarter phase and third quarter phase



# Tides

## ▶ Gulf of Mexico

- The tidal range is only 0.5m
- The gulf has a long narrow passage and a long coastline that spreads out the rising tide



## ▶ Bay of Fundy

- The tidal range can be up to 20m
- The bay is long and V-shaped which funnels the rising tide



Bay of Fundy