REMINDERS

- ❑ Atlas Extra Credit for Exam II: Available on the Course Home Page Blue Scantron sheet is due Apr. 11
- ❑ **EXAM II – New Date is Tuesday, April 17**

❖ Two required essays are due by March 27, 2018.

A third may be used for extra credit in place of a "Think Geographically" essay.

ESSAY TOPICS (choose any two):

- Contributions of a noted geographer, earth scientist or explorer (chapter 1)
- Relationship of climate change to a listed current event topic (ch. 2)
- Discuss a natural process that is deemed a natural hazard (ch. 3)

❖ Extra Credit: "Think Geographically" Essays from any five of the textbook's 12 chapters.

- Last day to submit is May 15 but it is best to do them as you finish reading a chapter.

➢ Any essay may be submitted before the deadline.
➢ Don't wait for the night before to write them!!

PART II: People and their Physical Environment

- ✓ I. Introduction to the Physical Environment
- ✓ II. Earth-Sun Relationship
- III. Earth Systems
- ✓ A. The Hydrosphere: Oceans
- ✓ B. The Atmosphere: Weather and Climate
- ➢ **C. The Lithosphere: Geologic Influences**
- IV. Earth Habitat
  - A. Biosphere
  - B. Natural Controls and Cycles
  - C. Human Impact
  - D. Natural Hazards

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GEOG 101 Part II
People and their Physical Environment

14: The Lithosphere
Geologic Processes and Forces Shaping the Earth

Prof. Anthony Grande
Hunter College Geography

Geologic Influences

❖ **Geologic environment influences people living on the surface of the earth.**

➢ The pattern of human activity is related to what is on and below the surface.

Factors include:

- ✓ type of rock
- ✓ slope
- ✓ soil fertility
- ✓ water supply
- ✓ mineral resources
- ✓ geologic processes

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Definitions

❖ **GEOLOGY**: scientific study of the earth: origin, structure and processes.

❖ **GEOMORPHOLOGY**: study of landforms: origin, characteristics, processes, evolution

❖ **TOPOGRAPHY:** study of surface features

All used by geographers to evaluate location.

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GEOLOGIC CYCLE

There are 3 parts to the geologic cycle:

1. **Continental Drift:** *Plate Tectonic Theory*
2. **Rocks and Minerals:** *Creation of earth materials*
3. **Building and Gradational Processes**: *Creation and shaping of surface landform features*

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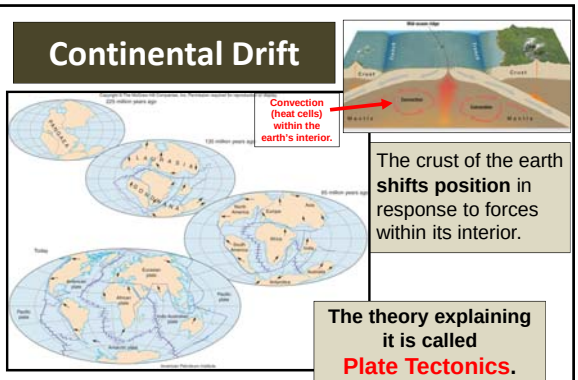
Continental Drift



The crust of the earth **shifts position** in response to forces within its interior.

The theory explaining it is called Plate Tectonics.

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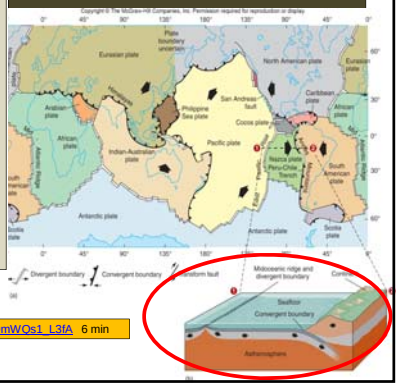
Plate Tectonics

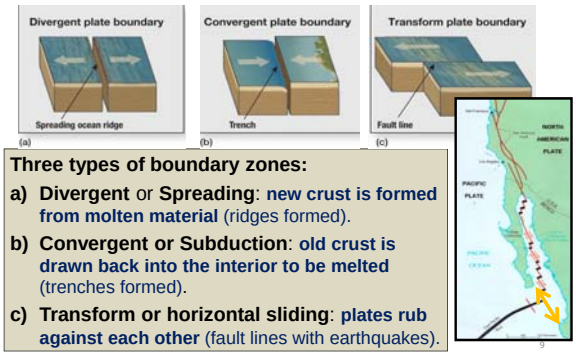
Plate Tectonics Theory says that the continents and ocean floor are on **lithospheric plates** that "float" on the upper mantle.

They **collide and scrape** against each other as they slowly shift position ("drift") in response to convective forces within the earth.



https://www.youtube.com/watch?v=0mWQs1_L3fA 6 min

Plate Boundaries



Three types of boundary zones:

a) **Divergent** or **Spreading**: **new crust is formed from molten material** (ridges formed).

b) **Convergent or Subduction**: **old crust is drawn back into the interior to be melted** (trenches formed).

c) **Transform or horizontal sliding**: **plates rub against each other** (fault lines with earthquakes).

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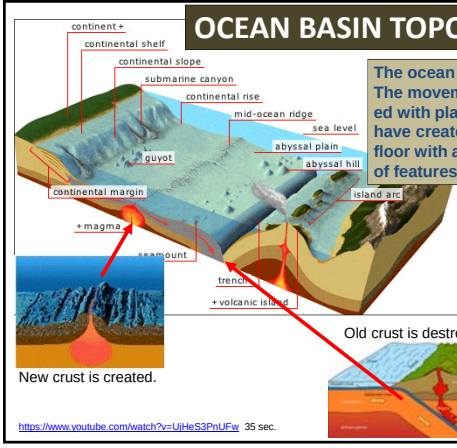
OCEAN BASIN TOPOGRAPHY



The ocean floor is not flat! The movements associated with plate tectonics have created an ocean floor with a great variety of features.

New crust is created.

Old crust is destroyed.

https://www.youtube.com/watch?v=UjHeS3PnUFw 35 sec.

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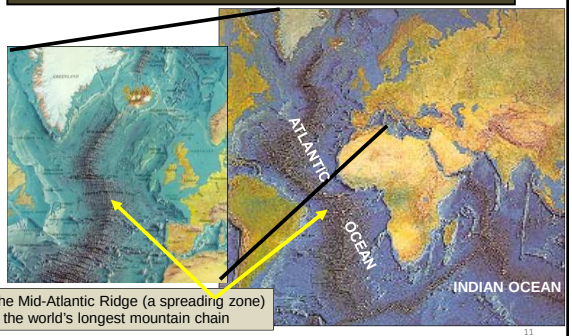
Atlantic and Indian Ocean Basin Topography



The Mid-Atlantic Ridge (a spreading zone) is the world's longest mountain chain

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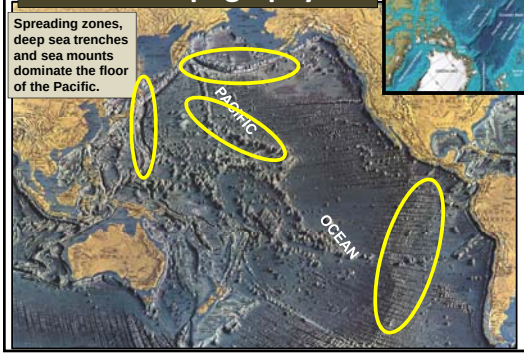
Pacific and Arctic Ocean Basin Topography

Spreading zones, deep sea trenches and sea mounts dominate the floor of the Pacific.



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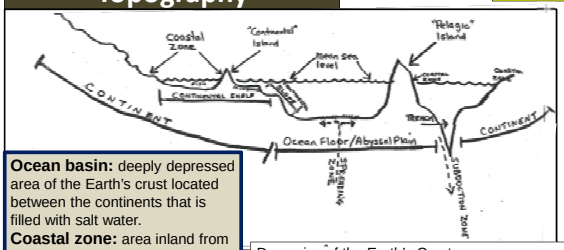
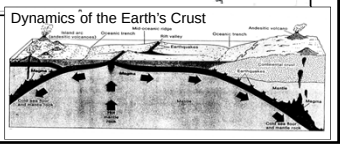
Generalized Ocean Basin Topography

Copy in Handouts section of course home page.

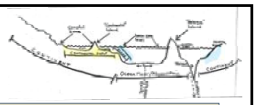


Ocean basin: deeply depressed area of the Earth's crust located between the continents that is filled with salt water.
Coastal zone: area inland from the shore that has ocean-related features.
Mean sea level: the height of the oceans calculated by averaging all high and low tides.

Dynamics of the Earth's Crust



OCEAN BASIN TOPOGRAPHY



- **Continental Shelf** is the **underwater extension** of the continent that flooded when sea level rose.
  - It is fairly **shallow** (0-600 ft. deep); **sunlight penetrates** to it
  - **"Continental" islands** rise from the shelf (mountain tops). *Examples: Long Island, Bahamas, British Isles, Indonesia*
  - It is the site of the **"fishing banks."**
  - It is the site of off shore **mineral deposits.**
- **Continental Slope** is the edge of the continent that steeply descends to the ocean floor (c.600 -12,000 ft deep)

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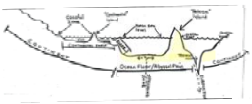
OCEAN BASIN TOPOGRAPHY



- **Ocean Floor** or **Abyssal Plain**.
  - About **12,000-18,000 ft below** the surface.
  - It is **very cold** and **very dark**. Sunlight does not penetrate to these depths.
  - **Few fish** and bottom dwelling creatures live here, except near the thermal vents.
  - It has the **potential** as a supplier of minerals.
- **"Pelagic" islands, seamounts and ridges rise from the floor.** *Ex.: Bermuda, Iceland, Mid-Atlantic Ridge, Hawaii, islands of the South Pacific.*

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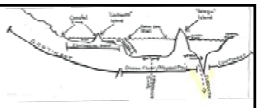
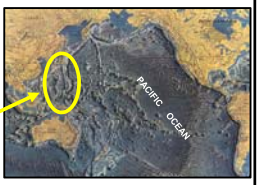
OCEAN BASIN TOPOGRAPHY



- **Trenches, deeps, troughs.**
  - These are the **deepest points** on the ocean floor extending **below 18,000 ft**.
  - Here the **crust is dragged back into the interior** of the planet and is remelted.
- **Mariana Trench**, contains the deepest point on Earth: the bottom of the **Challenger Deep** is 36,070 ft (6.8 mi) below mean sea level.



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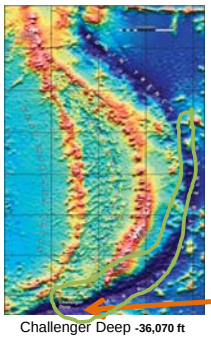
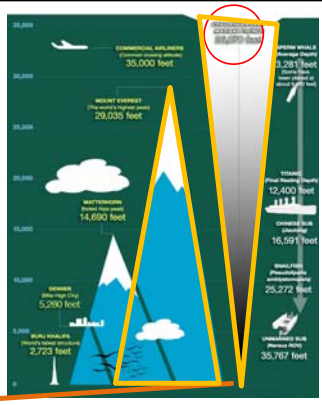
Marianna Trench





National Geographic Expedition 2013

Challenger Deep -36,070 ft

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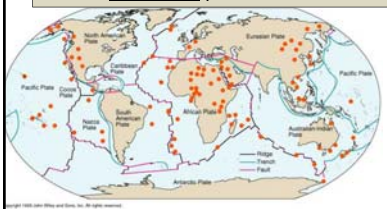
Geologic Hot Spots

- **Hot spot:** Zone of weakness in the earth's crust (ocean and continental) that allow molten material to breach the crust away from plate boundaries.



Volcano chains trail away from mid-ocean hotspots, with the oldest volcanoes (now long extinct) now lying far from the hotspot.
- These hotspot tracks are aligned along the direction of motion of the overlying plate.

The Hawaiian Island Chain is an example of this.

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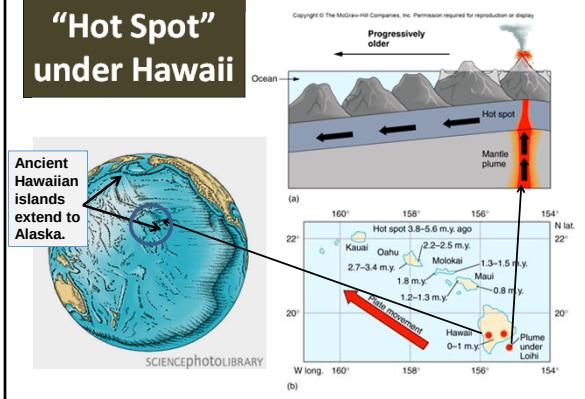
"Hot Spot" under Hawaii



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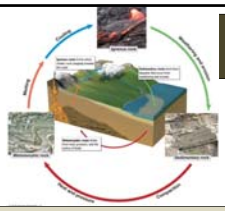
ROCK CYCLE



❖ **ROCK CYCLE:** illustrates how earth materials (rocks and minerals) are created and how they are inter-related to surface landforms and the internal processes of the earth.

✓ It is driven by the earth's internal heat engine and influenced by solar powered atmospheric processes

Copy in Handouts section of course home page.

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ROCK CYCLE

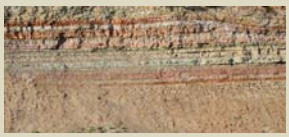
There are three main categories of rock:

- **sedimentary**
- **igneous**
- **metamorphic**

❖ **Sedimentary Rocks**

Formed by the **compaction** and **cementation** of rock fragments by a process called ***lithification***.

- They are deposited in parallel horizontal layers.



✓ They make up about 75% of the earth's surface.

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ROCK CYCLE

❖ **Igneous Rocks**

Formed from the **cooling** of molten (liquid) rock.

- The molten rock is a "soup" of minerals.
- The **rate of cooling** determines the **crystal-lization of minerals** and their appearance.

❖ **Metamorphic Rocks**

Created as **great heat and pressure is applied** to existing rocks (sedimentary, igneous and other metamorphic rocks).

- They are "baked."
- This changes their physical composition and creates a new material.

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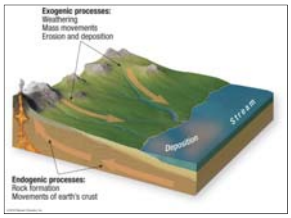
Forces Creating and Shaping Surface Landforms

There are two opposing forces always at work:

❖ **ENDOGENIC: tectonic or building forces**

❖ **EXOGENIC: gradational or reducing forces**

They are part of dynamic earth, including the rock cycle, and interact with both atmospheric and hydrologic processes.



These forces are usually present together. Can't have just one process working, although one may be dominant.

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Forces Creating and Shaping Surface Landforms

The three TECTONIC or building forces are:

a) FOLDING: compression, bending breaking

b) FAULTING: movement, tension, breaking

c) VOLCANISM: melting, movement of molten material, release of pressure (eruption/explosion)

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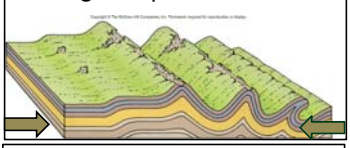
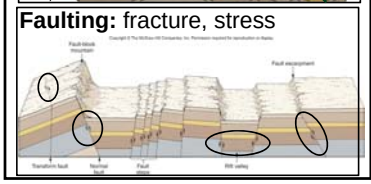
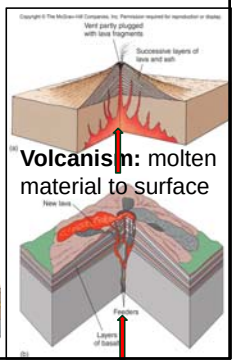
Tectonic Forces:
Folding, Faulting and Volcanism

Folding: compression



Faulting: fracture, stress

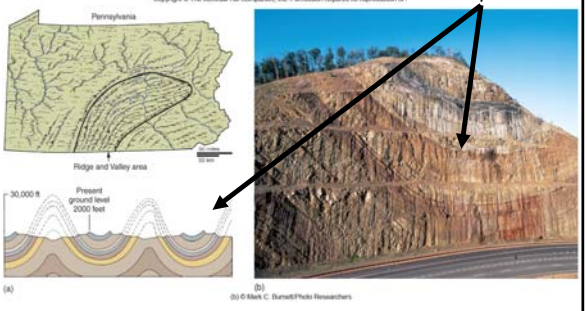




Volcanism: molten material to surface

FOLDING

This were once horizontal layers of rock that have been warped over time.



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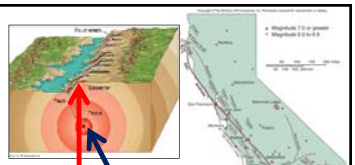
FAULT ZONES

The **San Andreas Fault** is an example of a primary fault zone with hundreds of other faults associated with it.

- **Earthquakes occur when built-up stress is relieved along a section of the fault.**
- The shaking (quaking) of the ground is a result of stress release.



- The **FOCUS** of an earth-quake is where the stress is released along the fault.
- The **EPICENTER** of an earth-quake is the geographic coordinates **at the surface directly above** the "focus".

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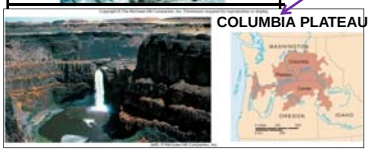
VOLCANISM

Gentle → HAWAII VOLCANO NP



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Gradational Forces

- **Gradational** or reducing **forces wear away the land surface.**

  There are 3 major categories:

  1. **Weathering:** changes in place.
  2. **Mass Wasting:** loosening and movement under the force of gravity.
  3. **Erosion:** friction, movement and deposition (occurring concurrently) create new shapes.

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Gradational Forces

- **WEATHERING:** a change in place in reaction to exposure to air, water and temperature.

  Happens in 2 ways:

  1. **Mechanical weathering or disintegration**
     - crumbling and fragmentation
     - frost action, crystallization, root action
  2. **Chemical weathering or decomposition**
     - decay and separation of parts
     - oxidation, hydrolysis, carbonization

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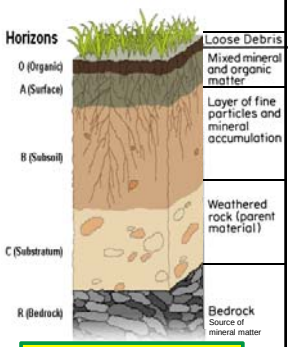
Soils

❖ **Soil Formation: Result of a very long period of mechanical and chemical weathering.**
- Air, water and heat break down bedrock and organic material and release nutrients (climate related).
- Soil development is slope dependent.

❖ **Soil Horizons: the layers of the soil were certain conditions prevail.**



There are tens of thousands of different combinations creating unique soils around the world.

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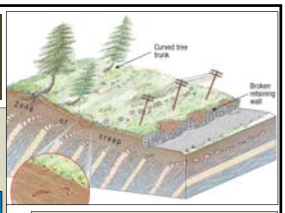
Gradational Forces

❖ **MASS WASTING:** loosening and movement down slope under the force of gravity.
- landslides
- rock slides
- mud flows
- soil creep
- slump



➢ Stability of slopes can be affected by natural events and human actions.

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Gradational Forces

❖ **EROSION:** The combination of friction, movement and deposition occurring at the same time that creates new shapes: *"Take-Move-Place"*

➢ **Agents of erosion are:**
- **running water**
- **moving ice**
- **wind**
- **waves**
- **currents**

"Take-Move-Place"

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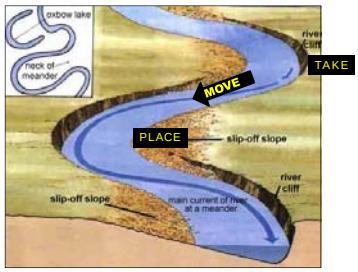
Moving Water and Valley Shapes

V-shape Valley
Downward cutting by fast-flowing water is greater than lateral cutting: the valley **deepens**.

U-shape Valley
When the water flow is weak, it cannot cut downward. Looping rivers **cut laterally** (side to side): the valley **widens**.

River Meander Diagram

https://www.youtube.com/watch?v=8a3r-cG8Wic 3 min



TAKE --- MOVE --- PLACE

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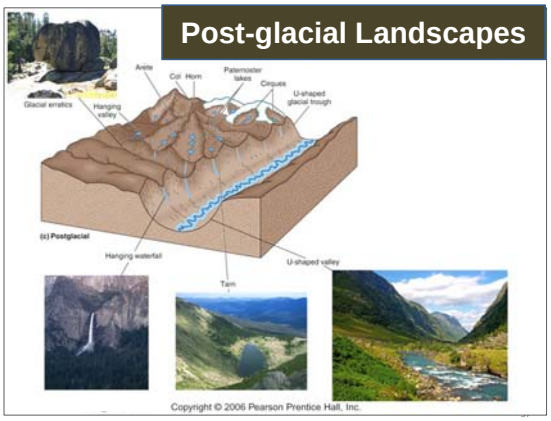
Moving Ice and Glacial Landscapes

<<<<mountain glacier and its features
https://www.youtube.com/watch?v=SROTQaENeHs

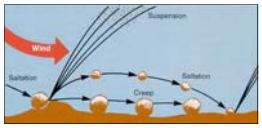
TAKE --- MOVE --- PLACE

continental glacier and its features. >>>>
Long Island was at the edge of the last continental glacier. Most of the named features on the diagram are found on LI.

Post-glacial Landscapes

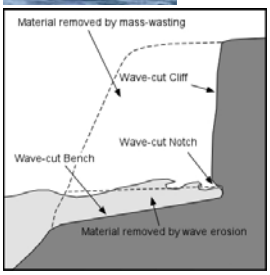


Wind Formed Landscapes



Wind is a sandblaster!

Wave Action Landscapes



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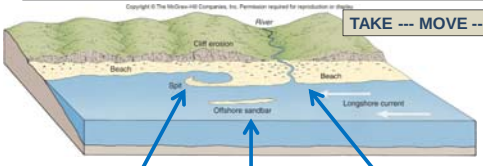
Longshore Currents



TAKE --- MOVE --- PLACE

Coastal landscapes created by long shore currents.

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N E X T

LANDFORMS
and
LAND USE

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