
Time for
the Navy


GALVANO-MAGNETIC CLOCK
LEADENHALL ST
The Shepherd
24-hour Gate Clock
The Time Ball
Ordnance Survey
Bench Mark
Public Standards
of Length
BRITISH YARD
TWO FEET
ONE FOOT

With this in mind we can discuss how one can finds one longitude. How many degrees are there in a circle? 360. How many hours in a

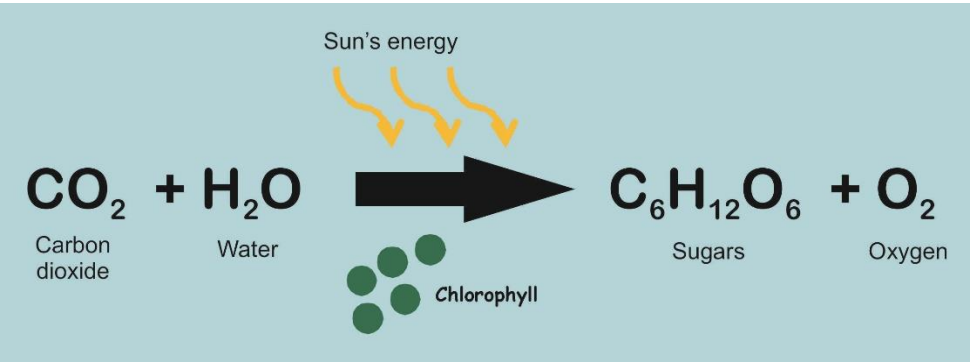
day? 24. So how many degrees are there in an hour? (divide 360 by 24 and the answer is 15). So for every hour away from the p
rime
meridian you are 15 degrees away from it. Ships would take a chronometer or a clock on the ship set at the time at the Prime Meridian. When the sun was directly overhead on the ship, the navigator would know it was “noon” and look at the clock which might say 1300 hours (1 p.m.) So there is an hour difference in time between the ship and London. This would mean that the ship is 15 degrees west of the prime meridian.

Charles Darwin

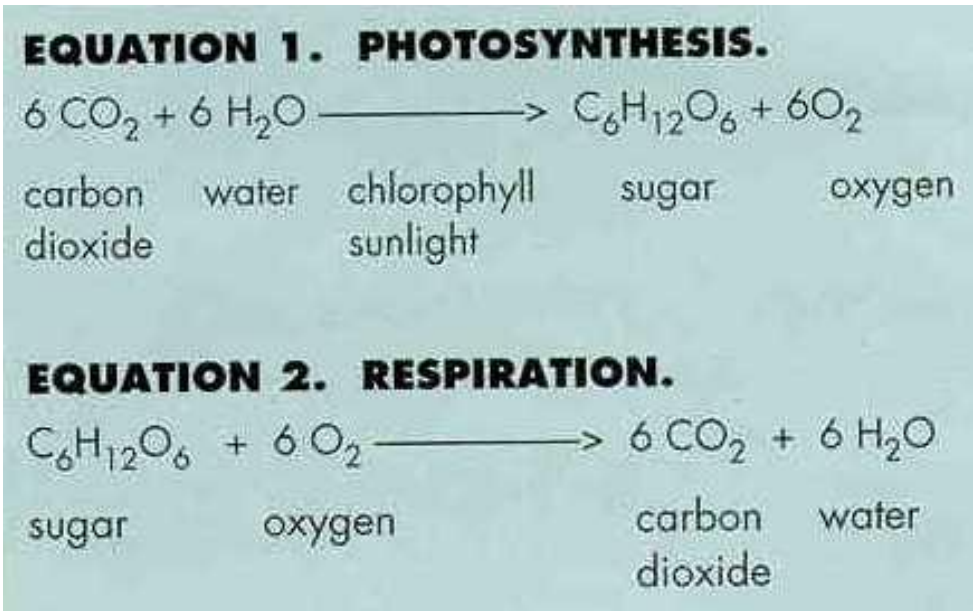
Darwin traveled on a ship called “The Beagle” captained by Robert Fitzroy. The ship was to undertake a journey that would last nearly 5 years. The ship left on 27 Dec, 1831. Charles Darwin as naturalist whose job, basically was to disprove the idea of evolution which was growing in popularity at the time.

Darwin made two significant hypotheses on the trip. One had to do with his theory of reef formation, The other had to do with the idea of biological evolution. We deal here with the first of the two – reef formation

First. What is a reef made of? Largely coral. What is coral? Coral is an animal belonging to a phylum called Cnidaria. This phylum contains animals which are sessile (don't move) like sea anemones and corals and well as some organisms which are motile (can move) like jelly fish. Animals, which are motile, may be able to propel themselves against a current which are called "nekton" while those which are moved about by the current are called "plankton". Now the coral are small animals which secrete a calcium carbonate which forms the hard kind of "exoskeleton". The coral are involved in a symbiotic relationship (mutually beneficial) with a dinoflagellate – that photosynthesize (are able to create their own food by taking water and carbon dioxide and in the presence of sunlight, turn it into sugar and oxygen and share some the material with the coral.

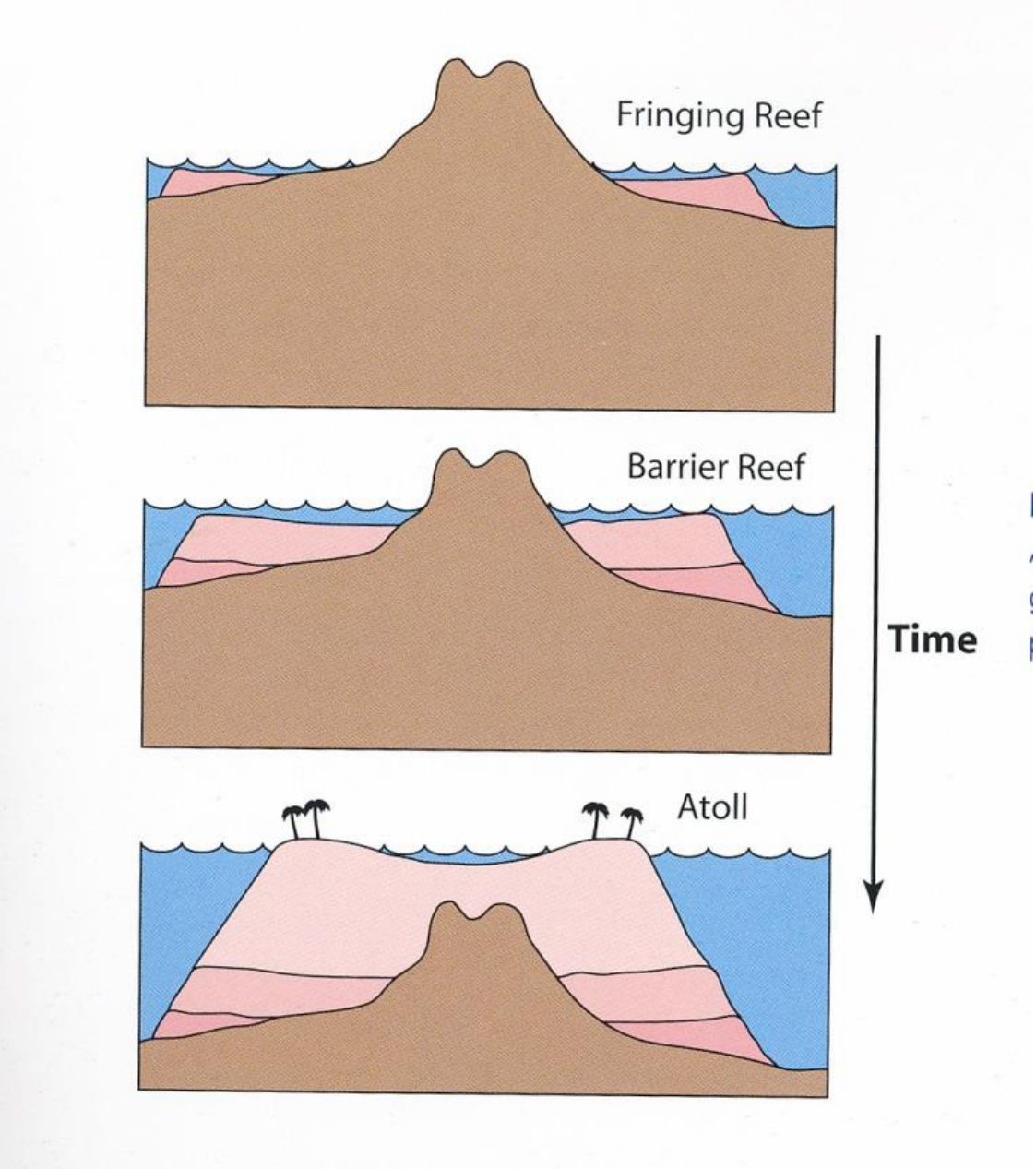


Uses carbon dioxide and gives off oxygen



Uses carbon and gives off carbon dioxide

This makes them “autotrophs” and opposed to “heterotrophs” which have to eat to survive. Autotrophs are considered “primary producers” and are at the very bottom of the food chain. The dinoflagellates benefit from the protection of the coral whose nematocysts or stinging cells (like those in jelly fish) are used to neutralize prey. The coral exhale CO_2 that is needed by the dinoflagellates for photosynthesis. The dinoflagellates are a kind of algae (more about algae later) and give the coral their color. In times of stress, the coral may expel the dinoflagellates and appear pale. This is a process called “bleaching”. This gives the coral a short term survival for whatever causes the stress. The later can regain the algae if the stress isn’t severe enough to kill them Darwin’s theory of coral formation was based on an observation of many reefs. Some reefs surrounded islands, others had lagoons and still others had not island in the middle. He postulated that the islands arose from undersea volcanos which stopped erupting. Then the corals begin to form around the island. They need to be close enough to the surface for there to be the sunlight needed for the algae’s photosynthesis.



Video on atoll https://www.youtube.com/watch?v=pRD8ZwdPYsY

An undersea volcano spews up an island and stops erupting. Coral begins to build up around the island's edge called a fringing reef. After a while erosion tales place and the edge of the island disappears and the top of the volcano also erodes. At this point the reef is a barrier reef.

Finally the entire islands is eroded away and all that is left is the reef, now called an "Atoll"

The Challenger Expedition

This voyage is seen as the beginnings of the scientific study of the ocean – oceanography. It lasted from 1872 to 1876. Organized by Charles Wyville Thomson from the University of Edinburgh and the Merchiston - Castle School organized the expedition. The ship, The Challenger, was gotten from the Royal Navy. Traveling over 70,000 miles it collected an immense amount of information. The expedition catalogued over 4,000 previously unknown species.

The goals were to investigate the physical conditions of the deep sea in the great ocean basins (as far as the neighborhood of the Great Southern Ice Barrier) in regard to depth, temperature, circulation, specific gravity and penetration of light.

a. To determine the chemical composition of seawater at various depths from the surface to the bottom, the organic matter in solution and the particles in suspension. To ascertain the physical and chemical character of deep - sea deposits and the sources of these deposits.

b. To investigate the distribution of organic life at different depths and on the deep seafloor.

There were many misconceptions about water and what was in it.
An example of this had to do with the nature of water itself.
It was originally thought that as one descended in the ocean, the water would become more and more dense reaching a rather thick consistency. It was thought that things would not sink to the bottom because the water would be compressed to such a density that things would no longer sink any further and would be suspended at some level among the ocean floor. Even as late as the sinking of the Titanic, it was thought by many that the ship would have not reached the bottom and would in fact be “floating” at a level somewhere in the depths, but not at the bottom. Although it was known that this was not the case, many people still believed it.

While the ocean does not become more dense at lower depths, it does become heavier as water piles up above it. It simply
is not heavy enough to compress the water any great degree. Every 33 feet (or 10 meters) down, there is an increase in pressure of one atmosphere (which is about 15 pounds per square inch). Inn whether I atmosphere is 1.013.25 millibars.
Interestingly enough water does get somewhat denser as it get colder, but when it freezes, it becomes less dense and the molecules form a different structure. This is why ice floats.

WHAT KIND OF WAYS ARE THERE TO DEFINE THE GEOGRAPHY OF THE OCEAN?
In order to talk about the ocean, we need to know something about the way scientists classify its areas. There are two dimensions involved – one has to do with the distance from the shore, the other has to do with the depth of the water. These are critical distinctions since they have a strong impact on the kinds of adaptation that life forms make to those zones Ocean Zones
Starting at the shore line there is a zone which is called “the splash zone”. This zone is one which is generally not covered by water at any time, but receives a “spray” from the surf. Because it is generally not under water for any period of time, it will not be discussed particularly here.

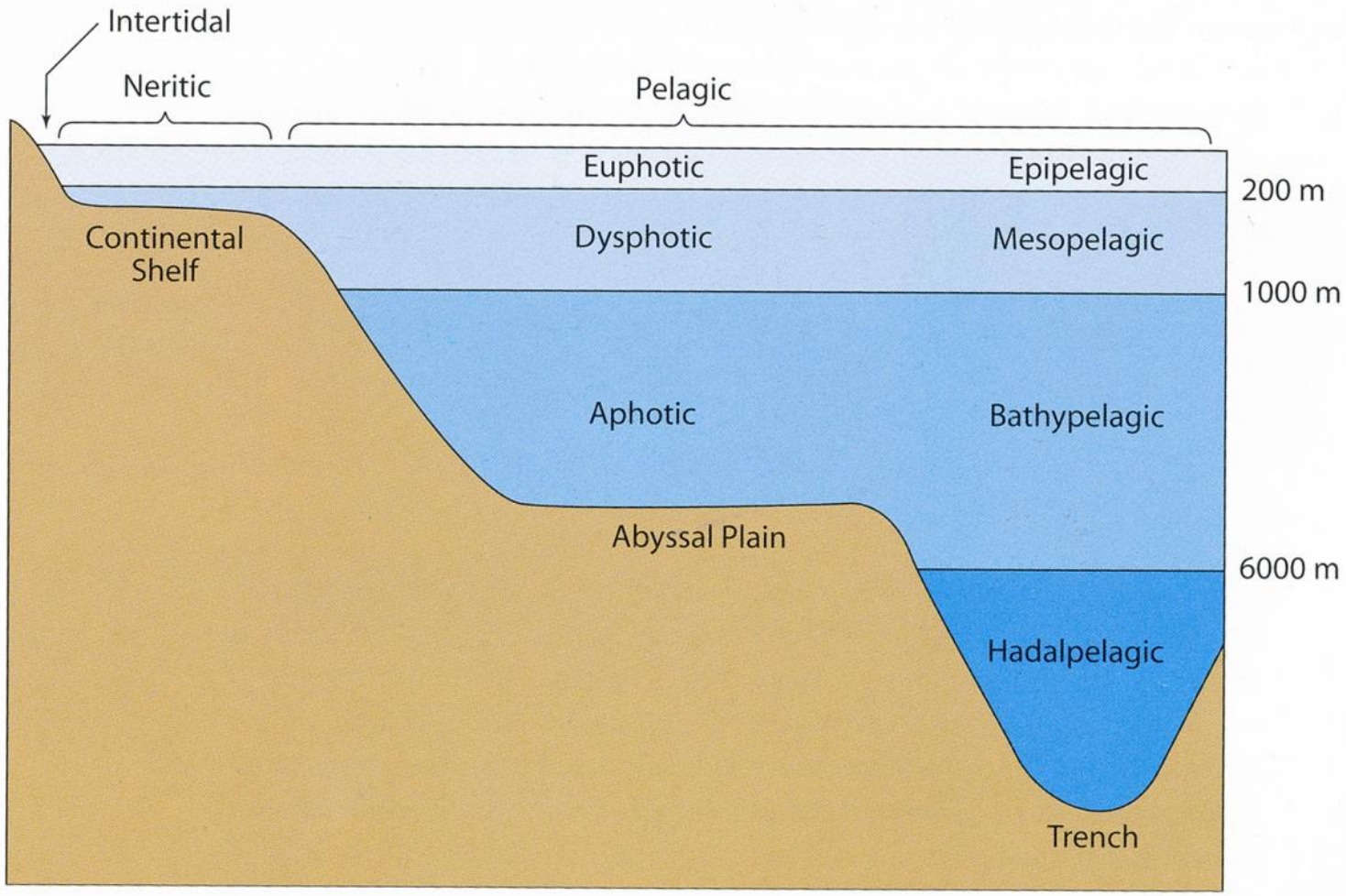


Figure 2.10. The named zones of the ocean.

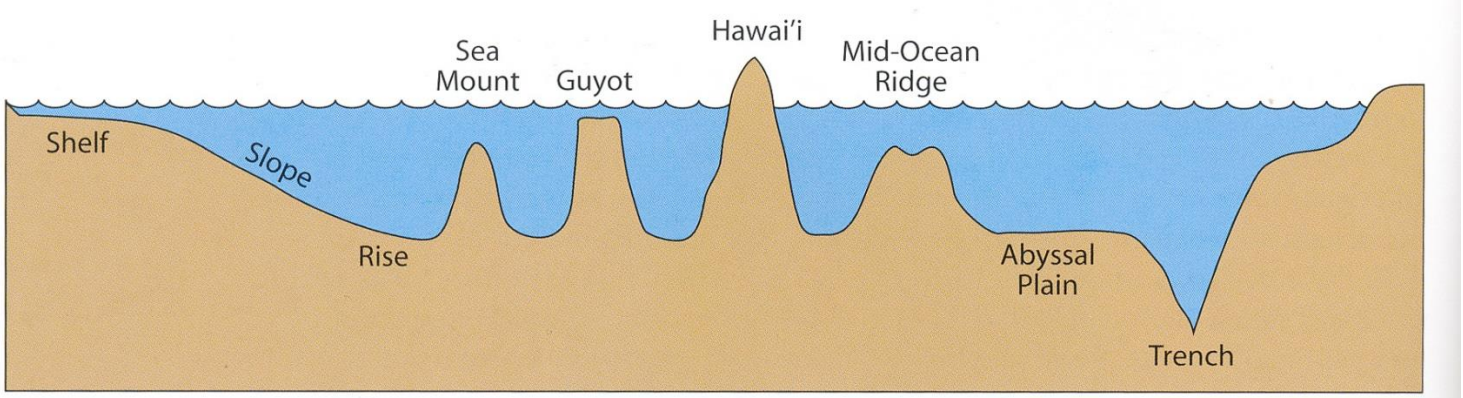
The next zone out is the intertidal zone, sometimes called the “littoral zone”. This is the area that is underwater part of the time and exposed to the air at other times. Organisms found in this area must be able to handle periods when they are exposed toair and other times when they are not. This means, among other things that the organisms which need buoyancy – that is they may lack any kind of support system like a skeletal system or they need the water to keep them up would have to handle periods of time when the water was not there to do that. The animals and plants that live in the zone, such as anemones, barnacles, chitons, crabs, green algae, isopods, limpets,

mussels, sea lettuce, sea palms, sea stars, snails, sponges, and whelks, must often deal with rough waters and well as exposure.

The next section from the shore is called the “neritic zone” and refers to that part of the ocean that is over the continental shelf. This the area where the continent drops off toward the deep ocean called the abyssal plain. The water that lies over the abyssal plain is called pelagic.

In terms of depth, the upper level of the ocean is called Euphotic (or epipelagic). Euphotic means “good light” and refers to those areas where sunlight can penetrate enough for photosynthesis to take place Below that layer lies the dysphotic (bad light) level (or mesopelagic) Here the is some light but not enough for photosynthesis to occur. Bel ow that is the aphotic zone (no light) or bathypelagic.

In the deep trenches in the ocean the term hadalpelagic is sometimes used.



Common features of the ocean floor (not drawn to scale).

The underlying structure of the ocean floor was thought to be just a basin, but in fact the terrain is as varied as on land.

Starting with the shore, the continental shelf drops off slowly and then rather rapidly. The bottom of the ocean is not smooth like the bottom

of a bowl. The ocean has a number of complex features that include mountain ranges , sea mounts, and trenches A seamount is a mountain that rises from the ocean floor; a submerged flat-topped seamount is termed a guyot. By arbitrary definition, seamounts must be at least 3000 ft (about 900 m) high, but in fact there is a continuum of smaller undersea mounts, down to heights of only about 300 ft (100 m). Some seamounts are high enough temporarily to form oceanic islands, which ultimately subside beneath sea level. There are on the order of 10,000 seamounts in the world ocean, arranged in chains (for example, the Hawaiian chain in the North Pacific) or may occur as isolated features. In some chains, seamounts are packed closely to form ridges (for example, the Walvis Ridge in the South Atlantic). Very large oceanic volcanic constructions, hundreds of kilometers across, are called oceanic plateaus (for example, the Manihiki Plateau in the South Pacific).

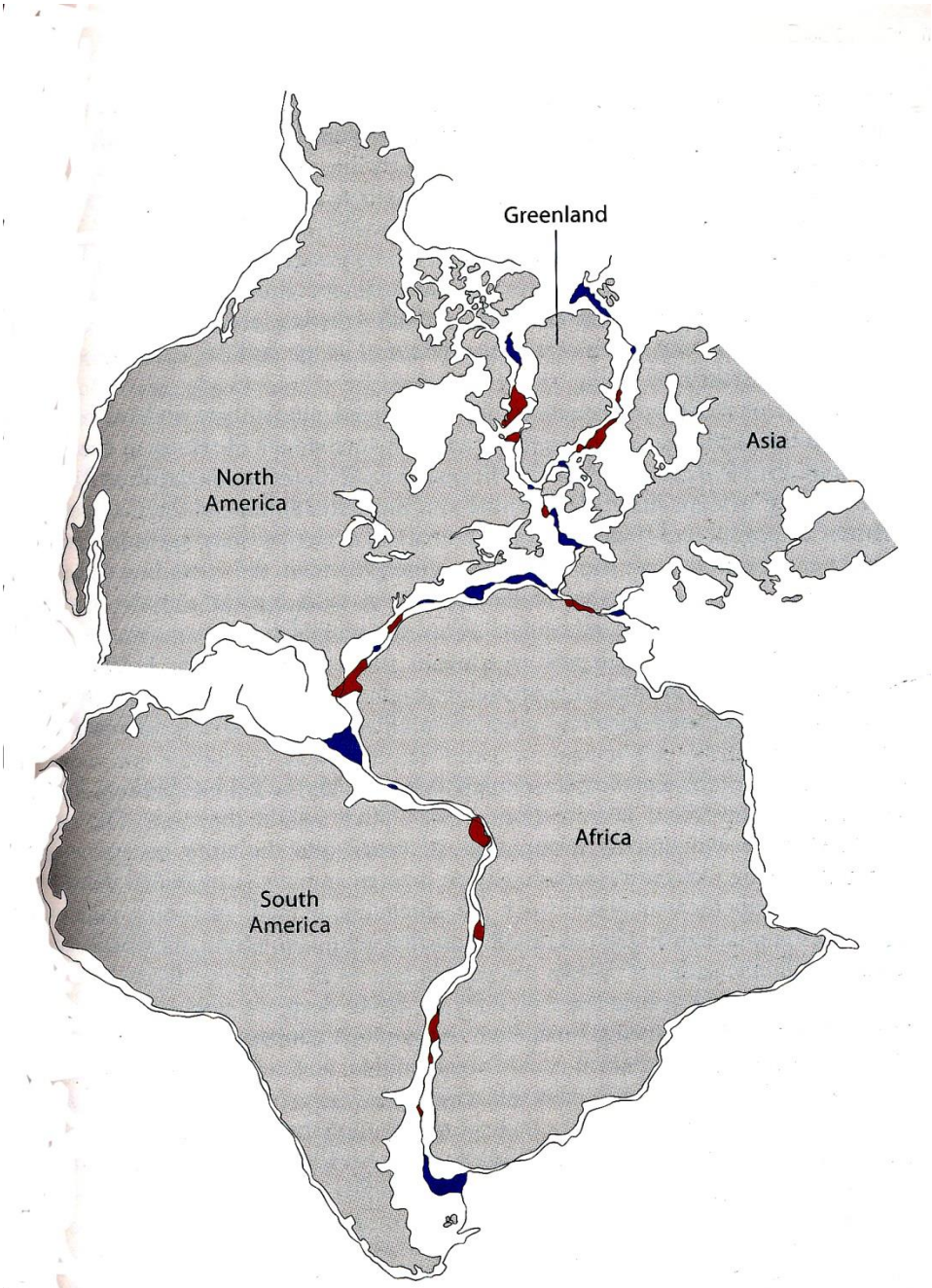
Seamounts are formed by volcanic activity and can be taller than 10,000 feet. They can be isolated or part of large mountain chains. The New England Seamount contains more than 30 peaks that stretch 994 miles from the coast of New England. Seamounts often have a high level of biological productivity because they provide habitats for many species of plants and animals. Over 200 species of sea creatures have been observed at a single guyot in the New England Seamounts are great locations to discover new species because each seamount houses different types of animals, including many that can only be found in guyot habitats.Seamounts are home to many commercial fish and are therefore very beneficial to our economy. Seamounts are also important to the field of medicine, as any number of undiscovered species may lead to new drugs or medical treatments.

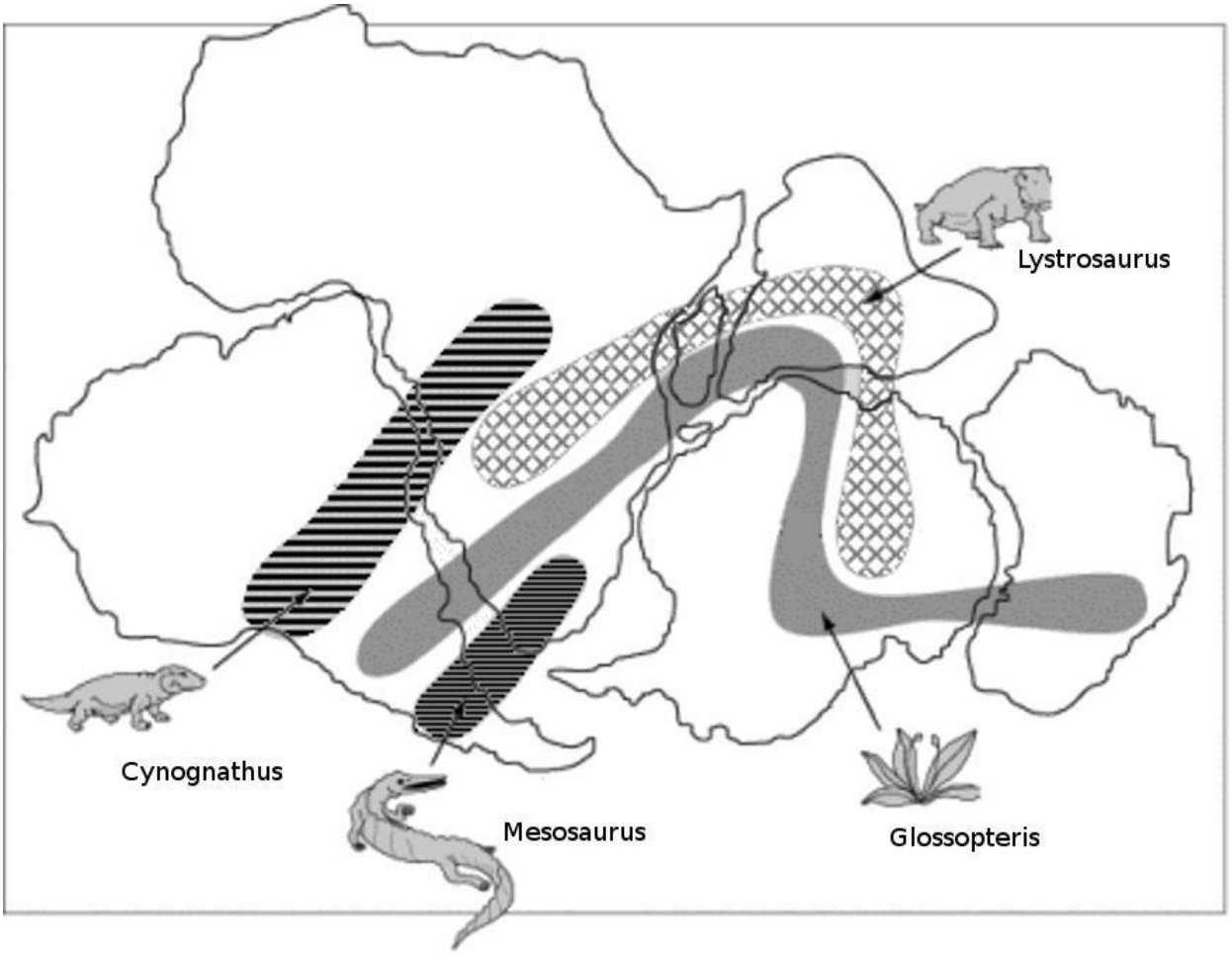
Guyots are seamounts that have built above sea level. Erosion by waves destroyed the top of the seamount resulting in a flattened shape. Due to the movement of the ocean floor away from oceanic ridges, the sea floor gradually sinks and the flattened guyots are submerged to become undersea flat-topped peaks.

CONTINENTAL DRIFT AND MID OCEANIC RIDGE

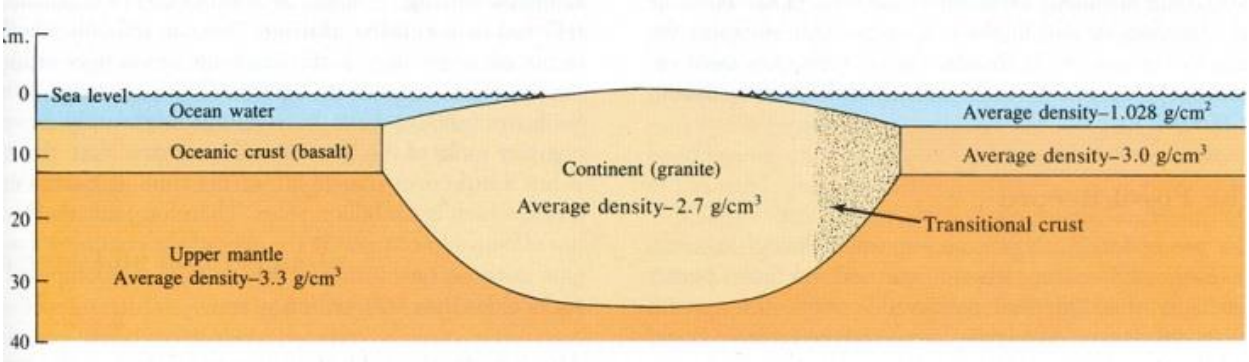
Alfred Wegener, in 1912 proposed the idea that the continents were actually floating and moved.

This appeared to be the solution to distributions of fossils that were found in S. America and Africa



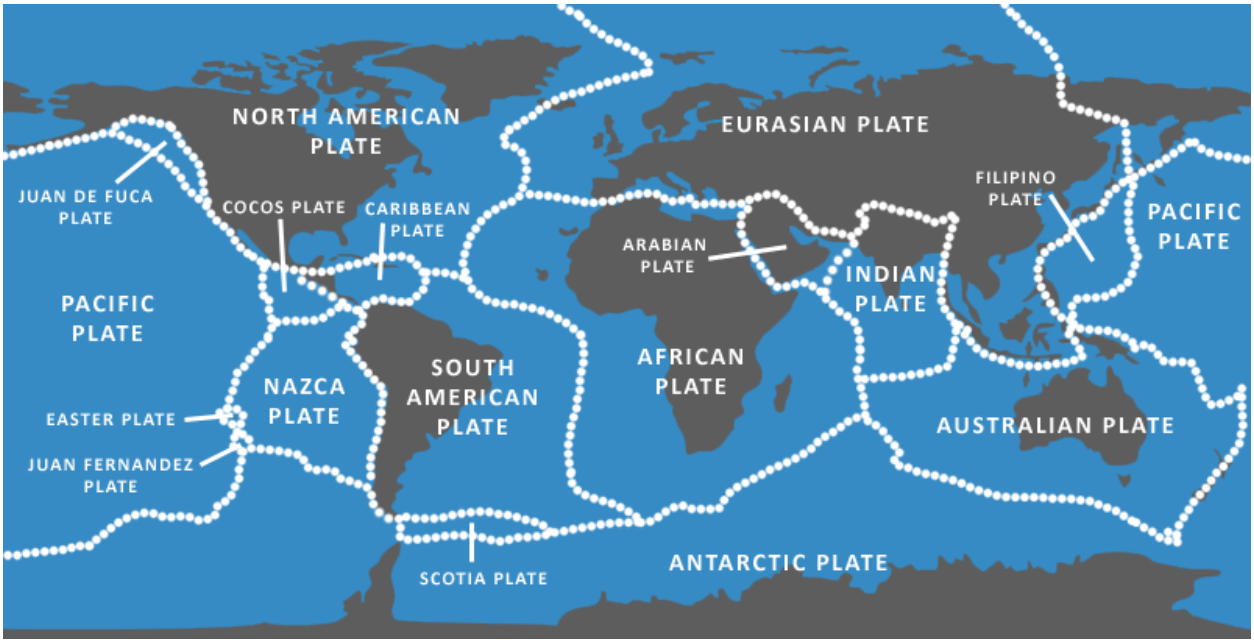


The idea was generally rejected because there was no way to show how the continents could be moved. The continents are less dense than oceanic crust and the upper mantle and so could “float” on them.



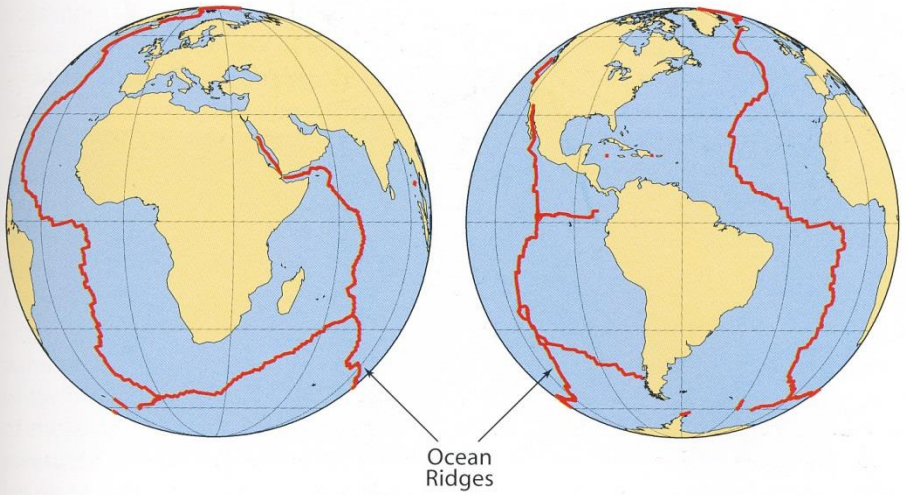
Although the theory was not initially accepted since the idea of continents floating seemed inconceivable. The idea gained more and more acceptance as new evidence appeared. The idea is now accepted.

VIDEO Continental Drift 11 Stock animation



MID OCEANIC RIDGE

Along the boundries of the plates is The Mid-Ocean Ridge system that forms the most extensive chain of mountains on Earth, with more than 90 percent of the mountain range lying in the deep ocean. It runs about 40,390 miles and averages about 8,200 feet. However, some of the ridge appears above the water. Iceland is an example. Along the ridge boundaries, molten rock rises through the sea floor. These volcanic eruptions are very deep and often go unnoticed. In 1783 an eruption in Iceland was sufficiently bad that it destroyed crops, and killed more than 10.000 Icelanders – about a quarter of the population. NOAA says “Like the rest of the deep-ocean floor, we have explored less of the mountains of the Mid-Ocean Ridge system than the surface of Venus, Mars, or the dark side of the Moon. Use of submersible or remotely operated vehicles to explore the mid-ocean ridge has provided information on less than 0.1 percent of the ridge!”



Spreading sites between tectonic plates form an extensive system of ocean