

Earth Science

Chapter 19 – THE OCEAN BASINS

Section 2 – Features of the Ocean Floor

E.Q.: *What are the major divisions of the ocean, what are their features, and how do we study them?*

STANDARDS:

SES6. Students will explain how life on Earth responds to and shapes Earth systems.

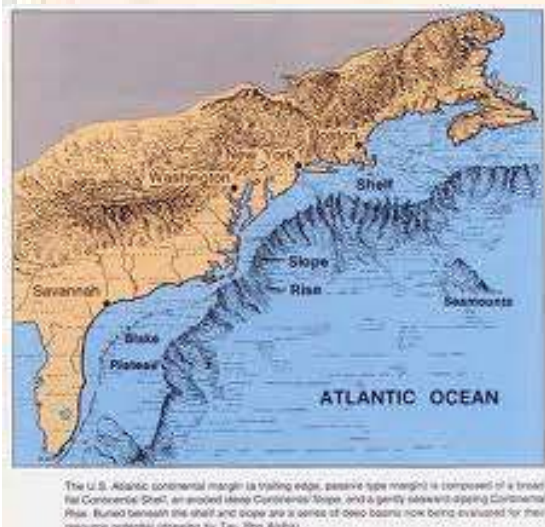
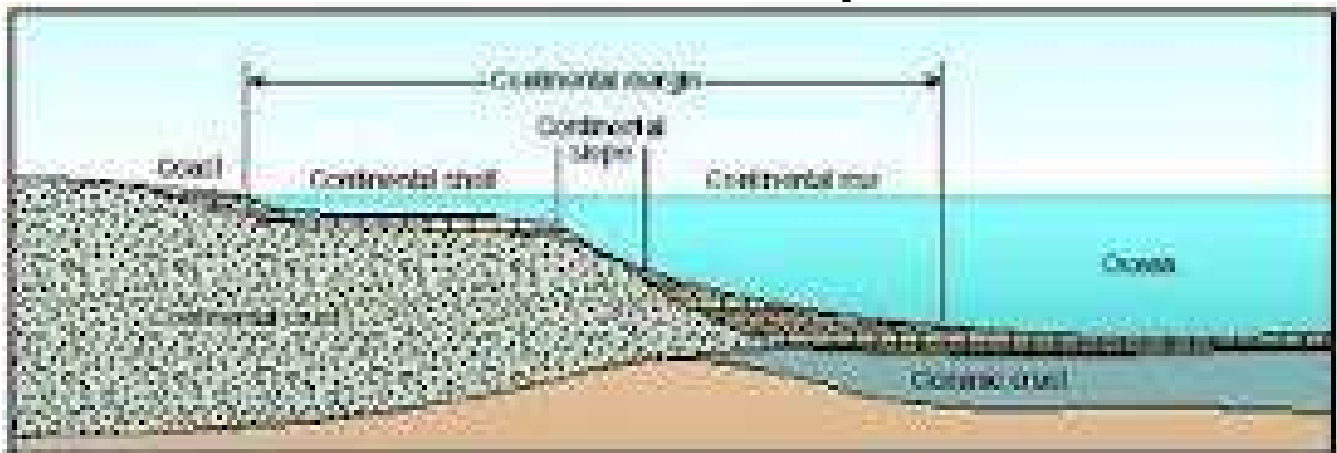
- a. Relate the nature and distribution of life on Earth, including humans, to the chemistry and availability of water.**

Objectives

- Describe the main features of the continental margins.**
- Describe the main features of the deep-ocean basin.**

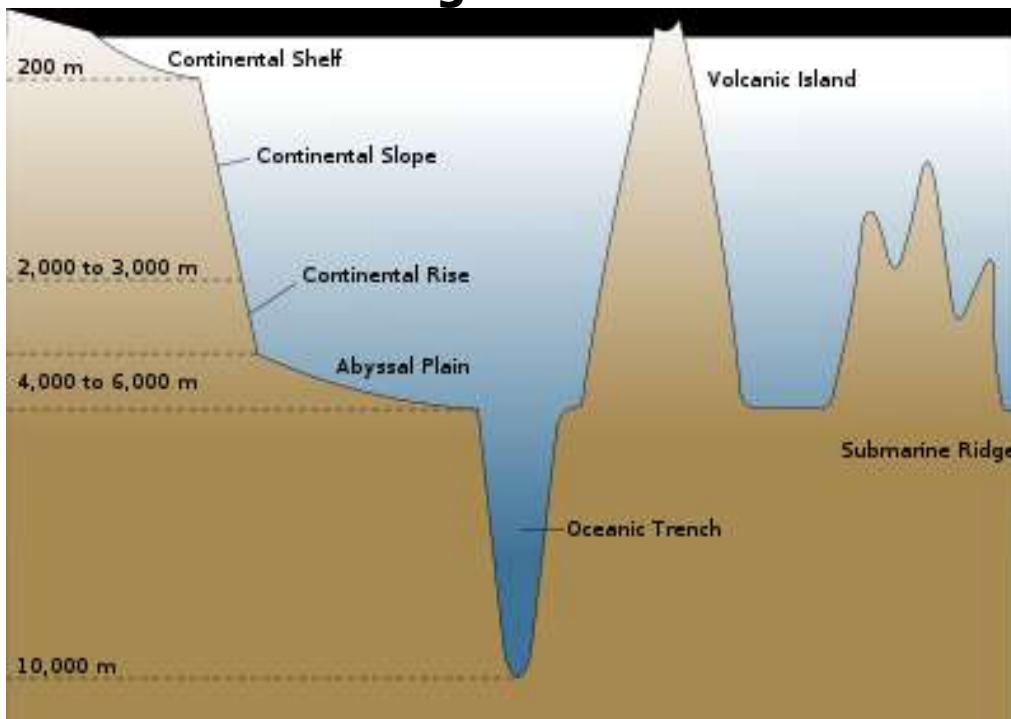
Features of the Ocean Floor

***continental margin* - the shallow sea floor that is located between the shoreline and the deep-ocean bottom**



deep-ocean basin - the part of the ocean floor that is under deep water beyond the continental margin and that is composed of oceanic crust and a thin layer of sediment

- The ocean floor can be divided into two major areas.
- The line that divides the continental crust from the oceanic crust is not abrupt or distinct.
- Shorelines are not the true boundaries between the oceanic crust and the continental crust.
- The boundaries are actually some distance offshore and beneath the ocean and the thick sediments of the continental margin.



Continental Shelf

- **Continents are outlined in most places by a zone of shallow water where the ocean covers the end of the continent.**
- **The part of the continent that is covered by water is called the *continental shelf*.**
- **The shelf usually slopes gently from the shoreline and drops about 0.12 m every 100 m.**
- **The average depth of the water covering a continental shelf is about 60 m.**
- **Although it is underwater, a continental shelf is part of the continental margin, not the deep-ocean basin.**
- **Changes in sea level affect the continental shelves.**

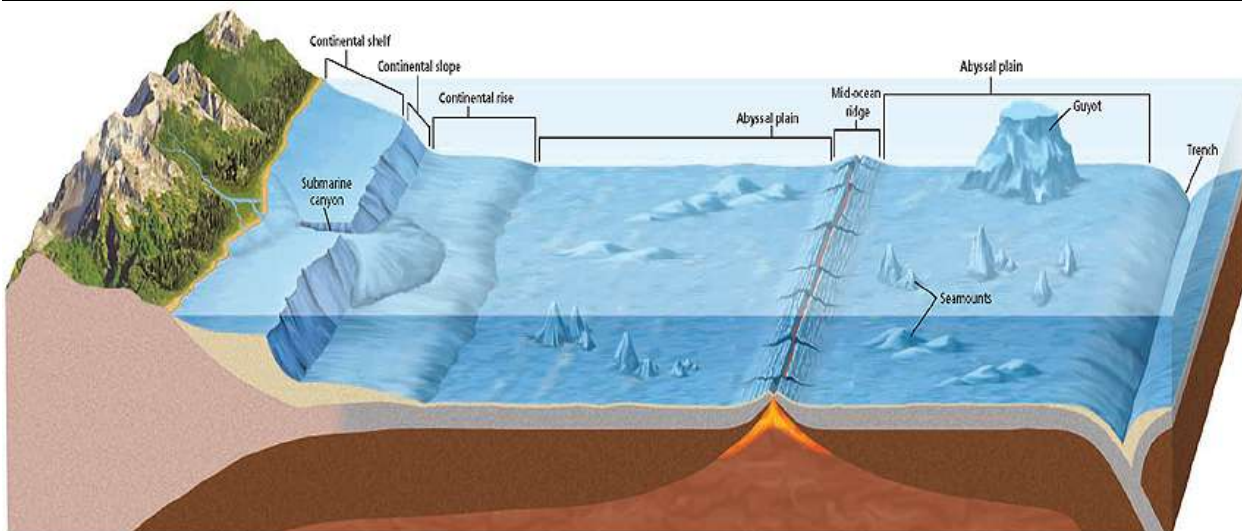


Ga. coast

Continental Slope and Continental Rise

- At the seaward edge of a continental shelf is a steep slope called a *continental slope*.
- The continental shelf and continental slope may be cut by deep V-shaped valleys. These deep valleys are called *submarine canyons*.
- Other canyons may form over time as very dense currents called *turbidity currents* carry large amounts of sediment down the continental slopes.
- Turbidity currents form when earthquakes cause underwater landslides or when large sediment loads run down a slope.
- These sediments form a wedge at the base of the continental slope called a *continental rise*.

The diagram below shows the features of the ocean floor.



Deep-Ocean Basins

- Deep-ocean basins also have distinct features.
- These features include broad, flat plains; submerged volcanoes; gigantic mountain ranges; and deep trenches.
- In the deep-ocean basins, the mountains are higher and the plains are flatter than any features found on the continents are.

READING CHECK

What features are located in the deep-ocean basins?

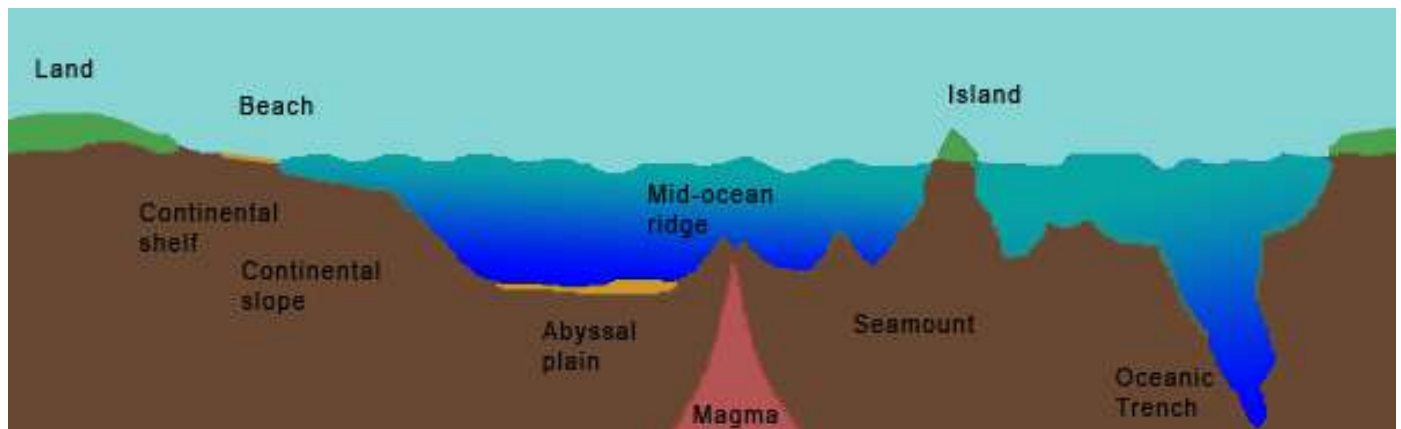
Trenches; broad, flat plains; mountain ranges; and submerged volcanoes are part of the deep-ocean basins.

Deep-Ocean Basins, (continued)

Trenches

trenches a long, narrow, and steep depression that forms on the ocean floor as a result of subduction of a tectonic plate, that runs parallel to the trend of a chain of volcanic islands or the coastline of a continent, and that may be as deep as 11 km below sea level; also called an *ocean trench* or a *deep-ocean trench*

- Earthquakes occur near trenches. Volcanic mountain ranges and volcanic island arcs also form near trenches.



Abyssal Plains

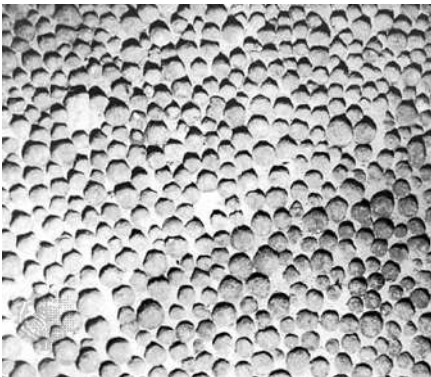
abyssal plain - a large, flat, almost level area of the deep-ocean basin

- Abyssal plains cover about half of the deep-ocean basins and are the flattest regions on Earth.
- Layers of fine sediment cover the abyssal plains.

The thickness of sediments on the abyssal plains is determined by three factors.

Although they are more common and widespread in the Atlantic and Indian Ocean basins than in the Pacific, abyssal plains are found in all major ocean basins. Approximately 40% of Earth's ocean floor is covered by abyssal plains. The remainder of the ocean floor topography consists of hills, cone-shaped or flattopped mountains, deep trenches, and

mountain chains such as the mid-oceanic ridge systems. Abyssal plains are often littered with manganese nodules containing varying amounts of iron, nickel, cobalt, and copper. The pea- to potato-sized nodules form by direct precipitation of minerals from the seawater onto a bone or rock fragment.



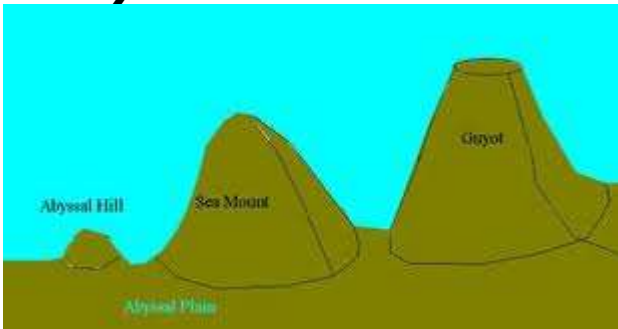
Mid-Ocean Ridges

- The most prominent features of ocean basins are the *mid-ocean ridges*, which form underwater mountain ranges that run along the floors of all oceans.
- Mid-ocean ridges rise above sea level in only a few places, such as in Iceland.

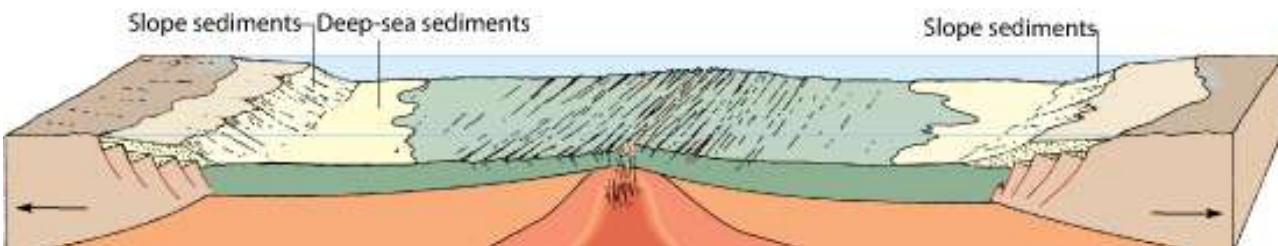
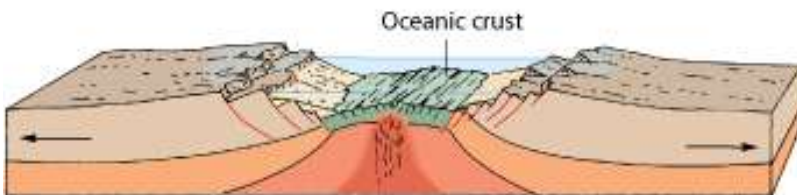
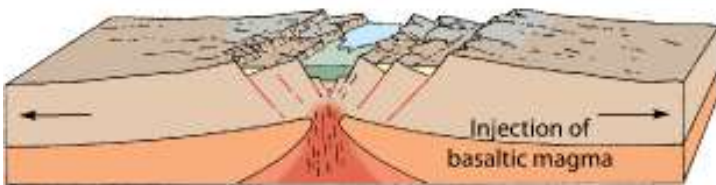
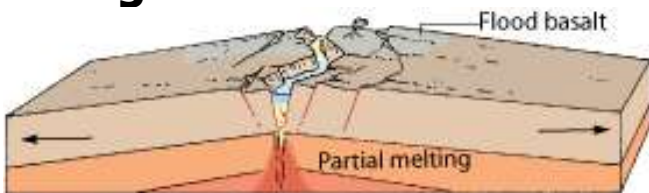


Iceland - mid-ocean ridge

- Fault-bound blocks of crust that form parallel to the ridges as the lithosphere cools and contracts are called ***abyssal hills***.



- As ridges adjust to changes in the direction of plate motions, they break into segments that are bounded by faults.
- These faults create areas of rough topography called ***fracture zones***, which run perpendicular across the ridge.





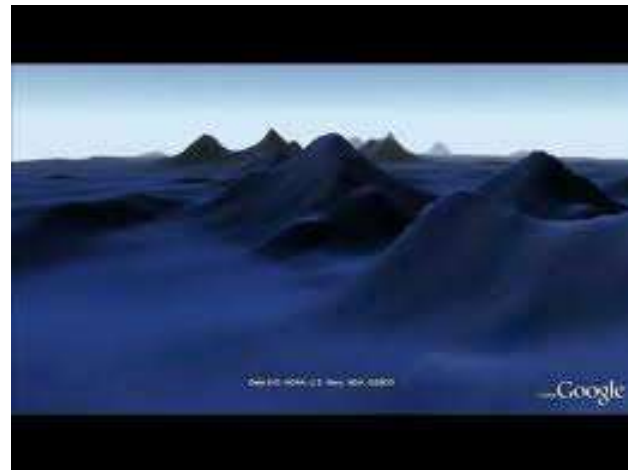
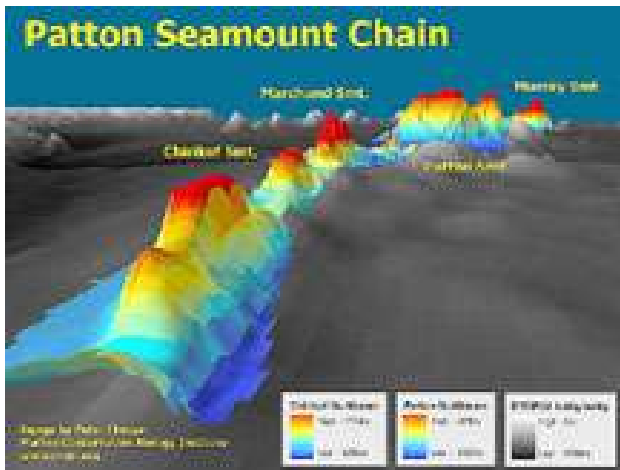
Fracture Zones.

Mid-ocean ridges do not form straight lines but are instead offset in many places by fracture zones, or transform faults. Fracture zones are thought to occur due to zones of weakness in the pre-existing continent before it was rifted apart. Most mid-ocean ridges are divided into hundreds of segments by fracture zones. Along the Mid-Atlantic Ridge, fracture zones occur at an average interval of 55 kilometers (34 miles). As the Mid-Atlantic Ridge is some 16,000 kilometers (10,000 miles) long, it is divided by fracture zones into about 300 distinct segments. The ridge crest and its associated faults are the locus of nearly all shallow earthquakes occurring in mid-ocean areas.

Read more: [Mid-Ocean Ridges - river, sea, oceans, types, system, Pacific http://www.waterencyclopedia.com/Mi-Oc/Mid-Ocean-Ridges.html#ixzz1ptemldeU](http://www.waterencyclopedia.com/Mi-Oc/Mid-Ocean-Ridges.html#ixzz1ptemldeU)

Seamounts

- **Submerged volcanic mountains that are taller than 1 km are called *seamounts*. Seamounts form in areas of increased volcanic activity called *hot spots*.**
- **Seamounts that rise above the ocean surface form oceanic islands.**
- **As tectonic plate movements carry islands away from a hot spot, the islands sink and are eroded by waves to form flat-topped, submerged seamounts called *guyots* or *tablemounts*.**



hairy angler fish

10 Horrible Deep Sea Creatures

Published on 4/2/2007 under [Weird Science](#)

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Viperfish

The Viperfish (Mesopelagic - found at 80-1600 meters - about a mile down) is one of the most wicked looking sea monsters. Some of them are black as night all over with light organs (called photophores) in strategic places on their bodies, including one on a long dorsal fin that serves as a lure for the fish it preys upon. Some viperfish (and many other deep ocean fish species)

don't have any pigment (color) at all - they're transparent. They also have enlarged eyes, presumably for gathering as much light as possible where there is little or no light at all. The light organs of this sea animal create lights by using a chemical process called bioluminescence.





The fangtooth, also known as *Anoplogaster cornuta*, is another menacing looking creature that inhabits the deep waters of the ocean. Although it may look like a monster, it only grows to a size of about six inches in length. It has a short body and a large head. The fangtooth gets its name from the long, sharp, fang-like teeth that line its enormous, over-sized mouth. Its gruesome appearance has earned it the name, "ogrefish". The color of the adults ranges from dark brown to black. Juveniles look completely different. They are light gray in color with long spines on their heads. The fangtooth is an extreme deep-water species that lives at depths of about 16,000 feet. The pressure at these depths is intense and the water temperature is near freezing. Food here is scarce, so the fangtooth will eat just about anything it can find. Most of its meals probably fall from the upper depths of the ocean. The fangtooth is found throughout the world in temperate and tropical ocean regions including the waters off the coast of Australi.

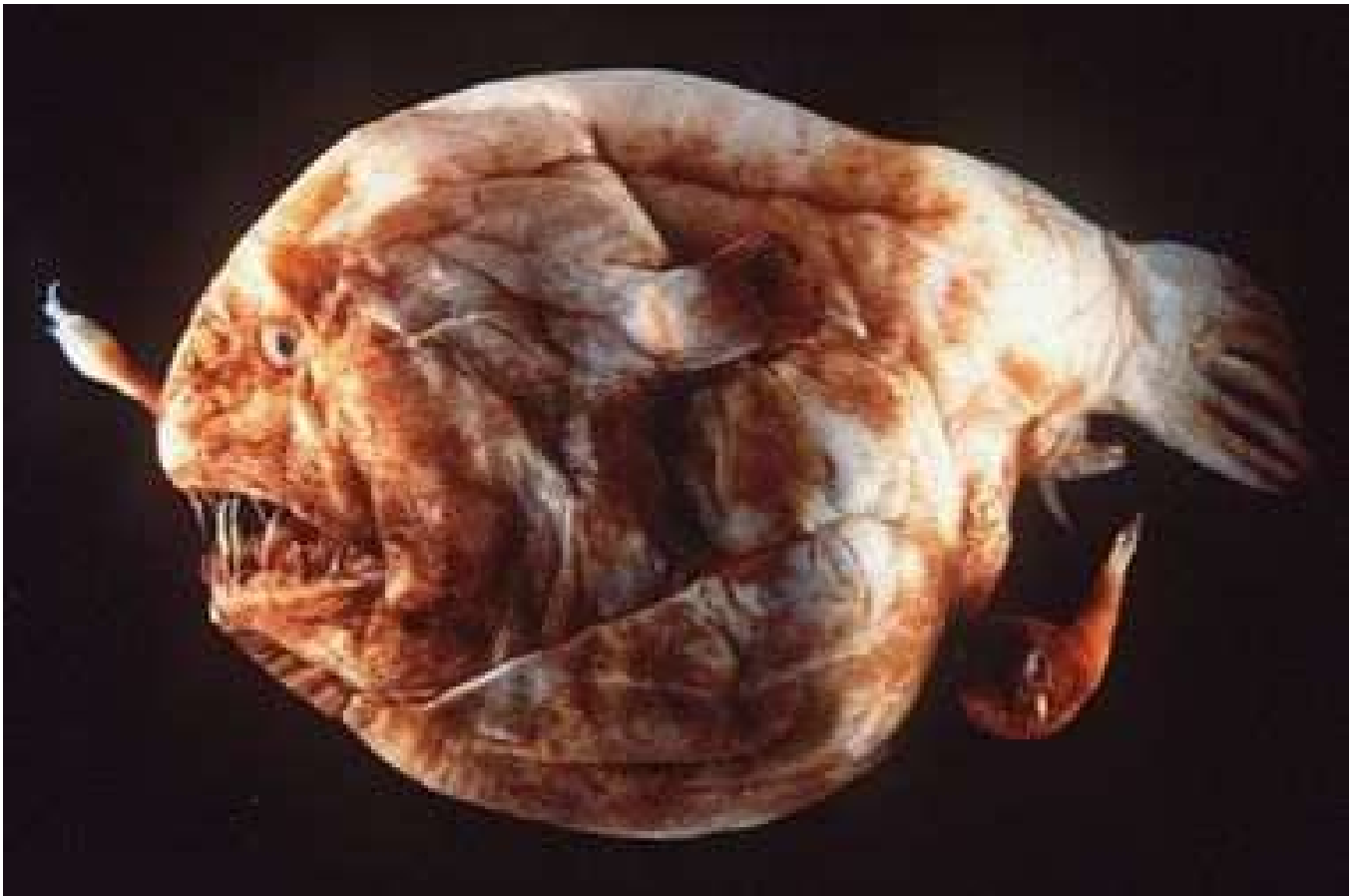


Black Dragonfish, Peter Shearer, *NZWA*

The Deep Sea Dragonfish, or *Grammatostomias flagellibarba*, is a ferocious predator in spite of its small size. It is one of many species known to inhabit the deep oceans of the world. This fish grows to about six inches in length. It has a large head and mouth equipped with many sharp, fang-like teeth. The dragonfish has a long barbel attached to its chin. This barbel is tipped with a light-producing organ known as a photophore. The dragonfish uses this organ like a fishing lure, flashing it on and off and waving it back and forth. Once an unsuspecting fish gets too close, it is snapped up in the dragonfish's powerful jaws. The dragonfish also has photophores along the sides of its body. These light organs may be used to signal other dragonfish during mating. They may also serve to attract and disorient prey fishes from deep below. The Dragonfish lives in deep ocean waters at depths of up to 5000 feet (1,500 meters). They are found in most tropical regions around the world.



Dragonfish



The deep sea angler, known also as *Melanocetus johnsoni*, is a grotesque-looking fish that lives in the extreme depths of the ocean. Its round body resembles a basketball, and indeed, it looks like it could easily swallow one. It has a large mouth like with sharp, fang-like teeth. Its appearance has earned it a second name of "common black devil". Despite its ferocious appearance, the angler only reaches a maximum length of about five inches. The angler gets its name from the long, modified dorsal spine which is tipped with a light producing organ known as a photophore. Like many other deep-water fish, the angler uses this organ like a lure to attract its prey. It will flash its light on and off while waving it back and forth like a fishing pole. When the prey fish gets close enough, the angler snaps it up with its powerful jaws. A strange fact about the deep sea angler is the fact that the male is smaller and different in appearance from the female, which is pictures above. The male of the species is about the size of a finger and has small hook teeth, which it uses to attach itself to the female. Once attached, its blood vessels join with that of the female and it will spend the rest of its life joined to her like a parasite, getting all of its nourishment from her body. If the male is unable to attach to a female, it will eventually dies of starvation. The deep sea angler is found throughout the world at depths of over 3000 feet.



The gulper eel, known scientifically as *Eurypharynx pelecyanoides*, is perhaps one of the most bizarre looking creatures in the deep ocean. Its most notable attribute is the large mouth. The eel's mouth is loosely hinged, and can be opened wide enough to swallow an animal much larger than itself. The hapless fish is then deposited into a pouch-like lower jaw, which resembles that of a pelican. In fact, it is sometimes referred to as the pelican eel. The gulper's stomach can also stretch to accommodate its large meals. This giant mouth gives the eel its other common name of umbrellamouth gulper. The eel also has a very long, whip-like tail. Specimens that have been brought to the surface in fishing nets have been known to have their long tails tied into several knots. The gulper eel grows to a length of about two to six feet and is found in all of the world's oceans at depths ranging from 3000 to 6000 feet.





The elusive giant squid, known to science as *Architeuthis dux*, is one of the world's largest animals, reaching a length of up to 60 feet. It is the largest known Invertebrates in the world. The giant squid is a mollusk and is member of the cephalopod class, which includes the octopus and other squids. Very little is known about these mysterious animals because none have been seen alive in the wild. Most of what we know about them comes from the bodies of dead squid that have washed ashore or been pulled up in fishermen's nets. These animals are carnivores, and will eat just about anything they can catch. During World War II, stories from the survivors of sunken ships tell of shipmates being eaten by these creatures in the dark of night. There have even been reports of giant squid reaching out of the water and pulling men off small boats. None of these reports have been officially verified, but they paint a picture of a powerful predator. The squid's eight long tentacles have strong suction cups, which they use to hold on to their prey. A sharp, powerful beak finishes off their helpless victim with eerie efficiency. The giant squid appears to be a favorite meal for the sperm whale. They have been found in the stomachs of dead whales and many these whales bear scars from the squid's suction-cupped tentacles.



The giant isopod, known scientifically as *Bathynomus giganteus*, is the largest known member of the isopod family. It is very closely related to the small pillbugs that you can find in the garden. It is a carnivorous crustacean that spends its time scavenging the deep ocean floor. Food is extremely scarce at these great depths, so the isopod has adapted to eat what ever happens to fall to the ocean floor from above. It will also feed on some of the small invertebrates that live at these depths.



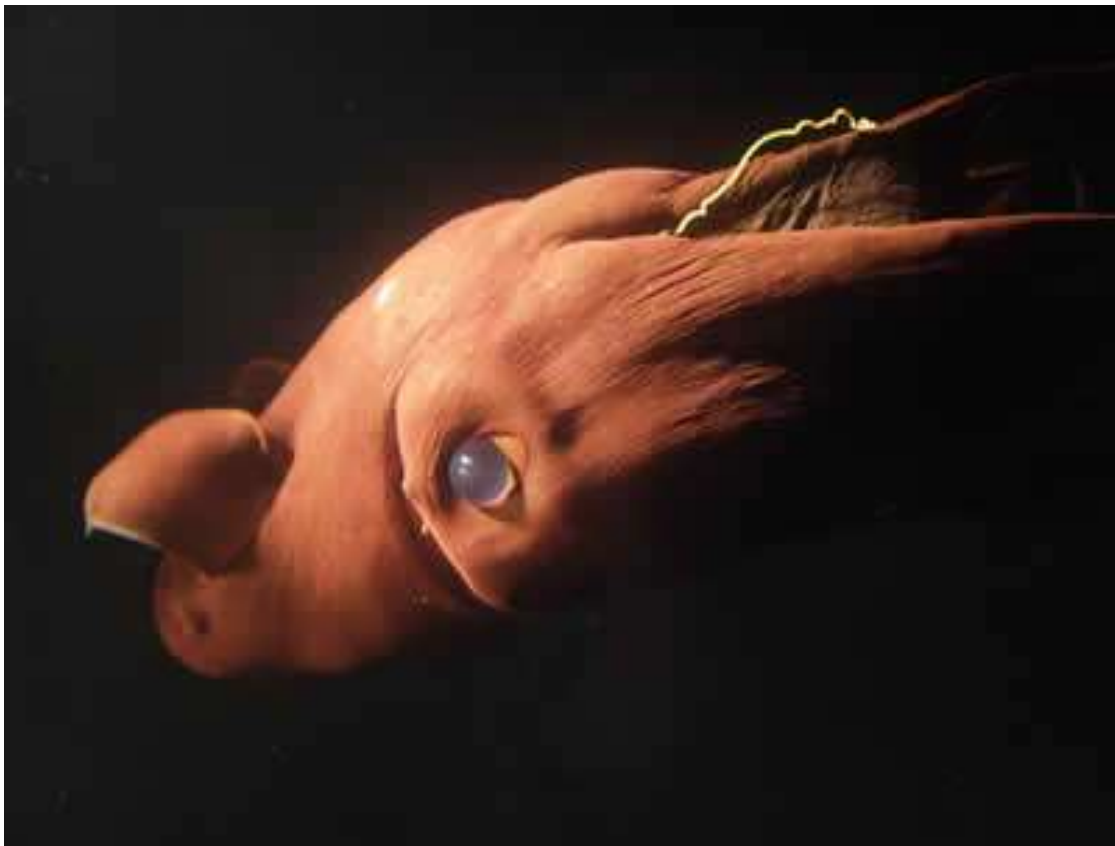


Giant isopods are known to reach a size of over 16 inches in length and are one of the largest members of the crustacean family. These animals are very prehistoric in appearance. When threatened, they can roll themselves into a tight ball where they are protected by their strong, armor-plated shells. They have complex mouths that contain many components that work together to pierce, shred, and disembowel live or dead prey. Giant isopods are all over the world at depths of over 2000 feet.



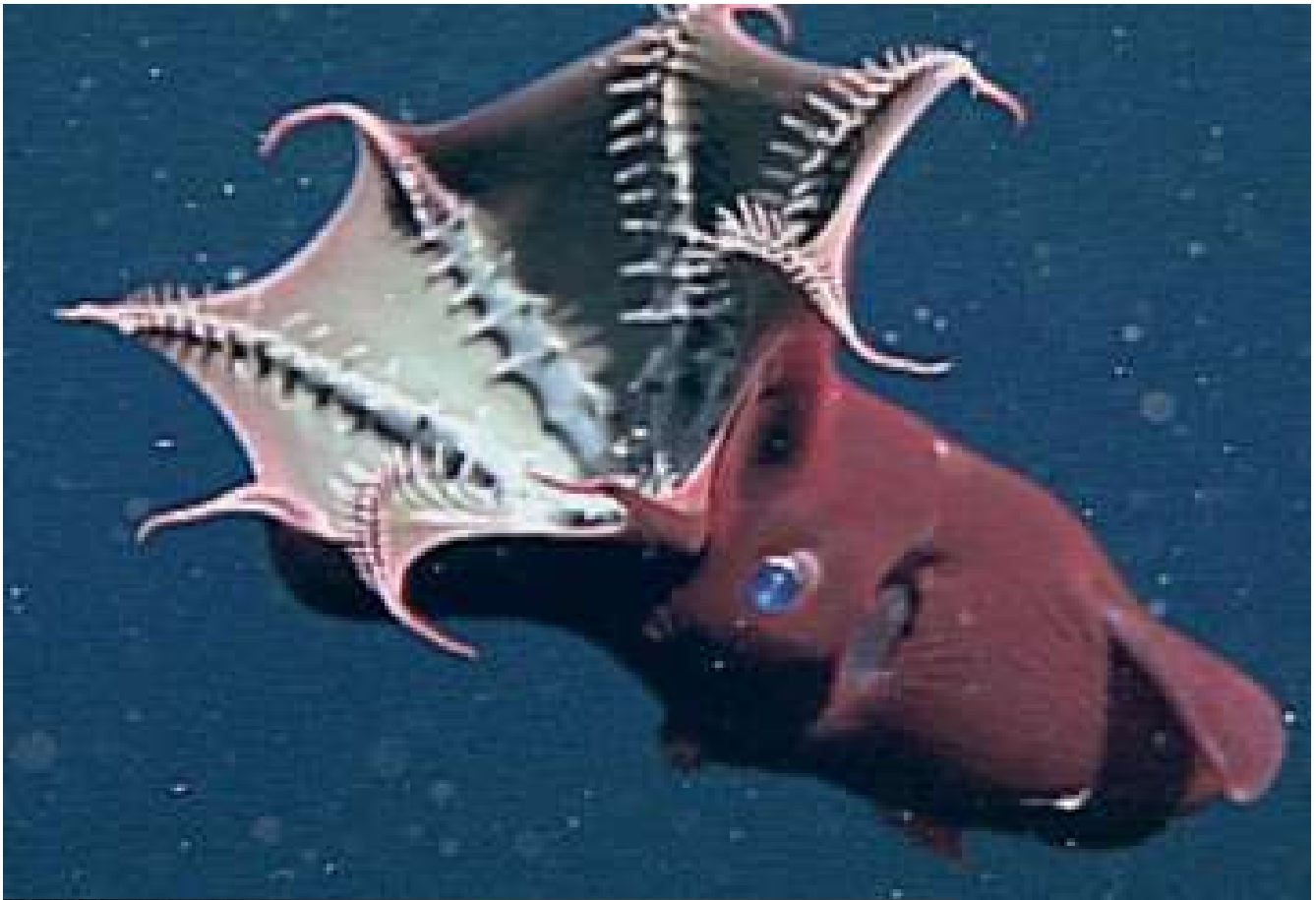
The coffinfish (*B.melanostomus*) has a flabby body and long tail that are both covered with small spines. It has a black mouth lining and an illicium (glossary) on the snout that can be lowered into a groove. This species grows to at least 10cm in length. *B.melanostomus* has been trawled in the Central to Eastern Indian Ocean at depths ranging from 1320m to 1760m. The name *melanostomus* comes from the Greek *melanos* meaning black and *stoma* meaning mouth. There are two genera in the family Chaunacidae; *Bathychaunax* and *Chaunax*. *Bathychaunax* differs from *Chaunax* by having a lower lateral line count, longer illicium, a wider head, more widely spaced body spines and several skeletal characters.





Vampire Squid

The vampire squid, known to scientists as *Vampyroteuthis infernalis*, looks more like something that swam out of a late-night science fiction movie. The squid has large fins at the top of its body that resemble large ears. It is very gelatinous in form, resembling a jellyfish more than the common squid. The vampire squid has the largest eyes of any animal. It is a small animal, growing to a length of about six inches, but it has globular eyeballs as large as the eyes of a large dog. The vampire squid's body is covered with light-producing organs called photophores. This gives the squid the unique ability to "turn itself on or off" at will. When the photophores are off, the squid is completely invisible in the dark waters where it lives. These squid live as deep as 3000 feet. Unlike other squid and octopi, the vampire squid has no ink sack. The vampire squid's arms are covered with sharp tooth-like spikes. This gives the animal its name. One pair of arms has been modified into retractile filaments that can extend to twice the body length of the animal. The squid may use these arms to capture its prey. When threatened, the squid can draw its arms up over itself and form a defensive web that covers its body. The vampire squid can swim extremely fast for a gelatinous animal. It can reach a speed of 2 body lengths per second and can accelerate to this speed in only 5 seconds. If danger is present, it can make several quick turns in an attempt to escape its enemies. The vampire squid is found throughout the world in most tropical and temperate regions.



Vampyroteuthis infernalis, it translates to 'vampire squid from hell'



Long-nosed Chimaera

Biologists have gone to great lengths to describe the long-nosed chimaera, *Harriotta raleighana*, whose kind can reach five feet in length. Its stiletto-like nose reminded one of "the nose contour of a supersonic jet aircraft." Others have dubbed it "rattail," for obvious reasons. In South Africa, it is known as the "ghost shark," though it is only distantly related to sharks. A touch of the venomous spine on the first dorsal fin can kill a person, though such a fate is unlikely given the 8,000-foot depths at which this creature lives.



Claire Nouvian's book [The Deep: The Extraordinary Creatures of the Abyss](#) contains a stunning collection of more than 160 color photos. Species from as far down as four and a half miles are depicted in exquisite detail; most are mere centimeters long, though the giant squid, a timid creature despite its size, grows to almost 60 feet.