

THE CONTINENTAL SLOPE AND RISE

THE CONTINENTAL SLOPE AND RISE are areas of sloping sea floor that lead from the continental shelf to the abyssal plain. Beyond a point on the shelf called the shelf break, the sea bed begins to drop more steeply. This is the continental slope, which leads into the open ocean. It sweeps down to 9,800–14,800 ft (3,000–4,500 m), where the seabed flattens out. In places, the slope is broken by submarine canyons. Sediments wash down these canyons, and accumulate at the base of the slope in a gentler gradient, forming the continental rise.

CONTINENTAL MARGIN

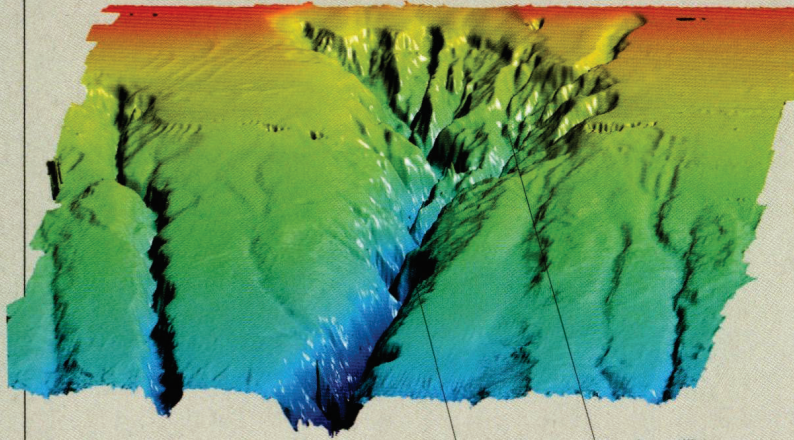
A typical continental margin is shown here, including the transition from a shoreline to the abyssal plain via the continental shelf, slope, and rise. The continental slope is about 87 miles (140 km) wide, and the continental rise is about 60 miles (100 km) wide. The vertical scale has been exaggerated: the continental slope actually has a gentle gradient, of about 1 in 50 (2 percent); and the rise is even gentler, at about 1 in 100 (1 percent).

submarine canyon
shelf break—around 660 ft (200 m) below surface

slumped sediments form continental rise

CONTINENTAL SLOPE

The rock of the continental slope is blanketed by sediments washed from the land that have accumulated over millions of years. Crustaceans, echinoderms, and many other animals live in, or on, these sediments. The slope is dissected by deep canyons. These have been cut by an abrasive mix of sediment and water, called turbidity currents, which flow down the gorges at 50–60 mph (80–100 km/h). Some submarine canyons are massive: the Grand Bahama Canyon in the Caribbean has cliffs rising 14,060 ft (4,285 m) from the canyon floor. Many canyons are seaward extensions of great rivers. At the canyon end, the sediment is deposited as a spreading outwash fan, extending far out onto the abyssal plain.



CANYON AND GULLIES

This sonar image shows a deep submarine canyon in the continental slope off Sodwana Bay, in KwaZulu Natal, South Africa.

submarine canyon

outwash fan at foot of canyon

large outwash fan extending onto abyssal plain

ABYSSAL PLAIN

This flat plain is formed by a deep accumulation of sediments. It typically lies at a depth of 15,000 ft (4,500 m).

LIFE ON THE CONTINENTAL SLOPE

Like the shelf, the continental slope is enriched by nutrients washed off the land. This helps support both midwater (pelagic) and bottom-dwelling (demersal) fish. Fish stocks over most continental-shelf regions have declined dramatically in recent decades, as a result of overexploitation and poor management, driving more fishermen to seek deeper-water species over the continental slope. Unfortunately for fisheries, although deep-water species are long-lived, they breed slowly, and stocks take a long time to recover. So many fisheries are now in serious decline.

SABLEFISH

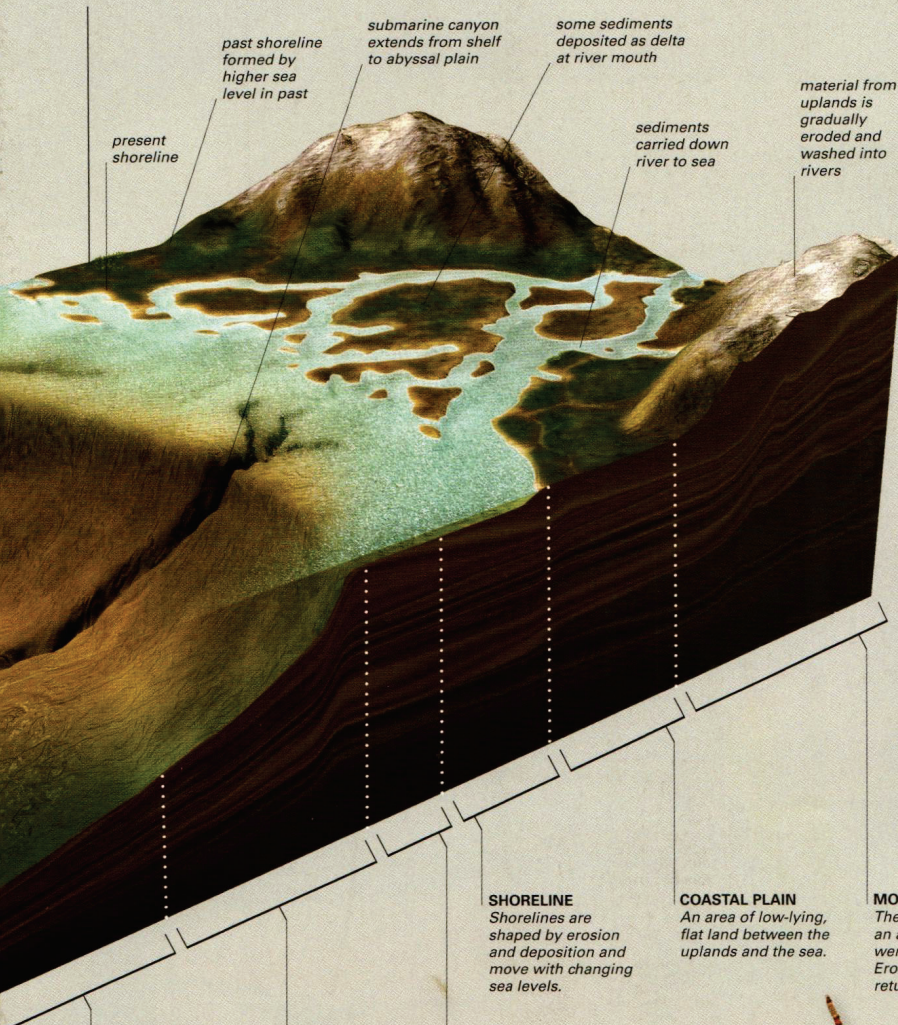
Sablefish breed slowly, and it takes 14 years to replace each fish caught. Fish farms (right) may be a better option.



CATCHING SABLEFISH

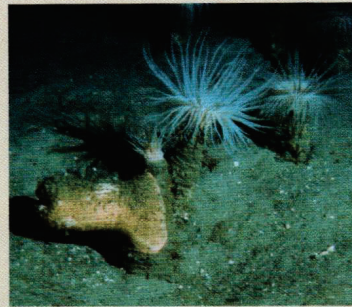
Sablefish are caught with longlines, 3/4 mile (1.2 km) long, that reach down toward the continental slope.





GANGES DELTA

The Ganges River carries 2 billion tons of sediment a year. Some is deposited in this massive delta. More is carried out to sea where it forms a deep-sea fan over the Bay of Bengal.



TUBE ANEMONES

These sea anemones bury their bodies in sediment, at depths of 13,100 ft (4,000 m), feeding with their tentacles.

CONTINENTAL RISE
Deeper sediments build up, creating a gentle gradient of less than 1 in 100.

CONTINENTAL SLOPE
The slope drops to 9,800 ft (3,000 m) at a gradient of 1 in 50.

CONTINENTAL SHELF
The continental shelf is typically 460–660 ft (140–200 m) below the surface. Its width varies greatly.

SHORELINE
Shorelines are shaped by erosion and deposition and move with changing sea levels.

COASTAL PLAIN
An area of low-lying, flat land between the uplands and the sea.

MOUNTAINS
These rocks formed on an ancient sea bed and were later uplifted. Erosion will eventually return them to the sea.

SEDIMENT FEEDER
Brittlestars are among the most common animals found feeding on the sediment of the continental rise.

DISCOVERY

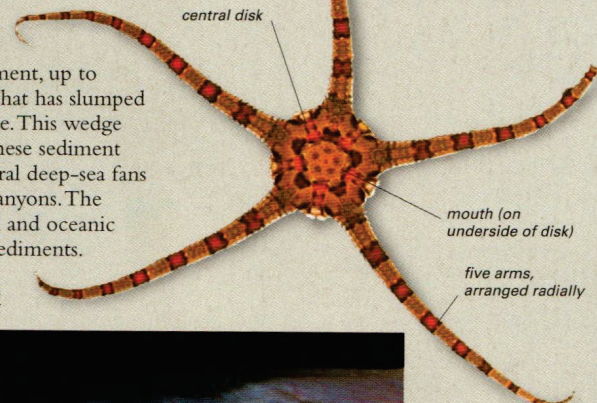
STAKING A CLAIM

Lured by vast oil reserves, oil companies have begun drilling in waters as deep as 7,550 ft (2,300 m) on the continental slope. These waters are also increasingly important for fisheries, so coastal countries want to establish national waters where they have sole rights to these resources. The continental rise is critical here. The United Nation's Convention on the Law of the Sea rules that a nation's Exclusive Economic Zone is "the submerged prolongation of the landmass of the coastal state, and consists of the seabed and subsoil of the shelf, the slope, and the rise."



CONTINENTAL RISE

The continental rise is a thick wedge of sediment, up to 9 miles (15 km) deep, formed from material that has slumped downward to the base of the continental slope. This wedge drops gently away toward the abyssal plain. These sediment mounds are particularly extensive where several deep-sea fans meet and coalesce at the foot of submarine canyons. The geological boundary between the continental and oceanic crusts is completely obscured beneath these sediments. The sediments of the continental rise merge into the abyssal plains beyond. Brittlestars and polychaete worms, a type of segmented worm, live on the sediments, surviving on detritus falling from above. Atlantic Red Crabs scavenge on the seabed, migrating up the continental slope to breed. Deep-sea cod, Dover sole, rockfish, goosefish, and thornyheads are among the demersal species living on the slope and rise. Trawling has damaged many of these habitats, but the deeper canyons remain havens of biodiversity.



LIZARDFISH HABITAT

The highfin lizardfish is found on the abyssal plain and continental rise, typically below about 6,600 ft (2,000 m), in water colder than 39°F (4°C).