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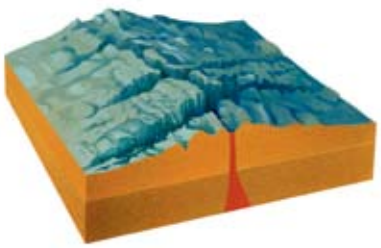
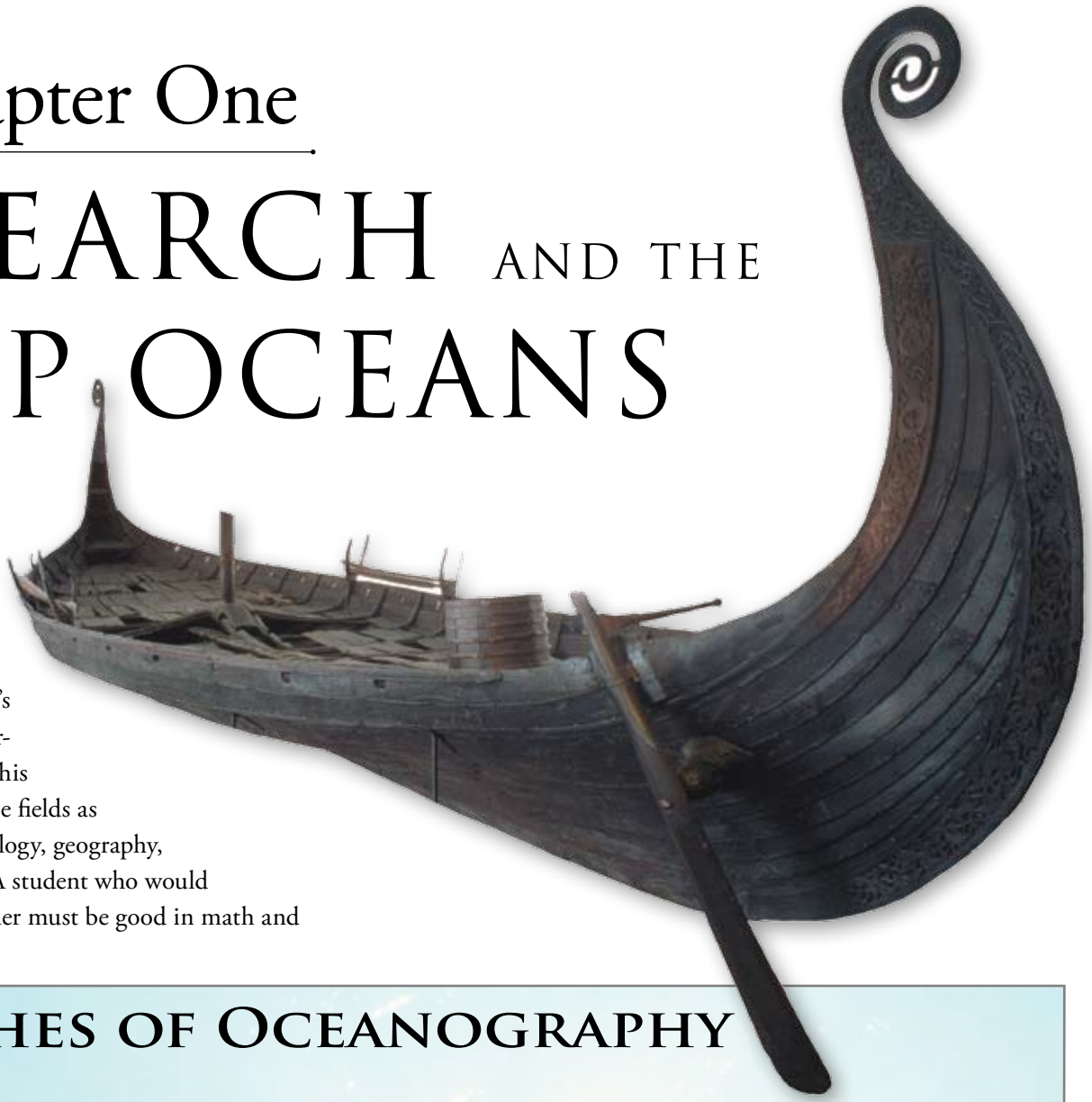


Chapter One

RESEARCH AND THE DEEP OCEANS



Oceanography is the exploration and scientific study of phenomena associated with the world's seas, oceans, and their surrounding environment. This study involves such diverse fields as zoology, physics, meteorology, geography, geology and chemistry. (A student who would like to be an oceanographer must be good in math and

Branches of Oceanography

- CHEMICAL OCEANOGRAPHY involves the study of the chemical composition of seawater and material in suspension, the nature of dissolved gases and solids, chemical cycles like the carbon cycle, and the acidity of seawater in relationship to the ocean bottom and the atmosphere.
- PHYSICAL OCEANOGRAPHY includes the study of the physical features of the ocean's water, such as temperature, density, waves, currents, tides, sea ice, air-sea interaction, and the ability to transmit sound and light.
- BIOLOGICAL OCEANOGRAPHY, or marine biology, is the application of the scientific method to the ocean's animal and plant life, including chemical and physical changes, food webs, the interaction of life with its surroundings, and other related factors.
- MARINE GEOLOGY AND GEOPHYSICS are the study of the nature and physics of the ocean's solid structure, including all aspects of the continental slopes and shelves and the ocean basins. A majority of what is known in regard to the geology of the oceans has only been discovered in the last half-century.
    - — The marine geologist mainly studies oceanic sediments and rocks. Some common examples of marine geology are: petrology – study of the origin, composition, structure, and properties of rocks associated with the oceans; sedimentology – the study of marine sediments; and geomorphology – the study of the origin of the seafloor and its modification by dynamic processes, such as volcanism, tidal actions, earthquakes or tsunamis.
    - — The marine geophysicist, using physics and math, applies the properties of magnetism, gravity, electricity, heat flow, and seismic methods to the study of the oceanic crust and mantle.

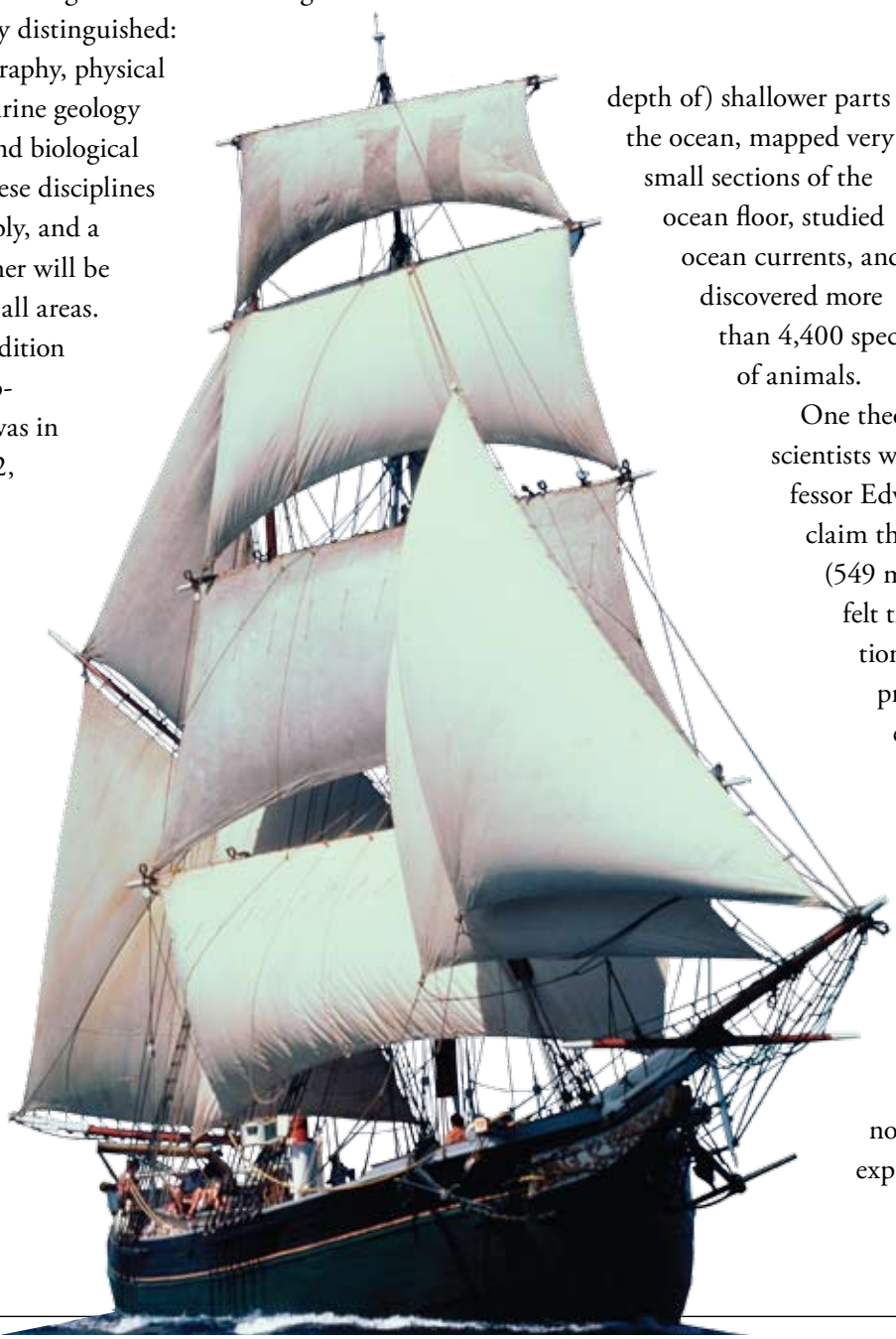
chemistry.) Oceanography, a relatively young discipline, is important to many different fields, such as commerce (shipping products between nations), defense (navies of various nations), engineering (construction and operation of seagoing structures and devices), communications (laying cables along the ocean bottom), safety (tracking icebergs), mineral and petroleum exploration (finding and recovering mineral deposits and oil), and meteorology (determining weather patterns). Scores of oceanographic research ships are presently monitoring events and collecting information on and below the surface of the sea. This information will contribute to a greater understanding of the oceans God created.

Today, the following divisions of oceanography are generally distinguished: chemical oceanography, physical oceanography, marine geology and geophysics, and biological oceanography. These disciplines overlap considerably, and a good oceanographer will be knowledgeable in all areas.

The first expedition devoted to oceanographic research was in December of 1872, when the HMS *Challenger* set out from England to conduct a three-and-a-half year oceanographic expedition of the ocean floor, sea life, and seawater temperature and salinity. The *Challenger* staff of six scientists traveled 68,900 miles (110,860 km). Naturalists on board used weighted lines to sound (measure the depth of) shallower parts of the ocean, mapped very small sections of the ocean floor, studied ocean currents, and discovered more than 4,400 species of animals.

HMS Challenger

Stone weight used for sounding



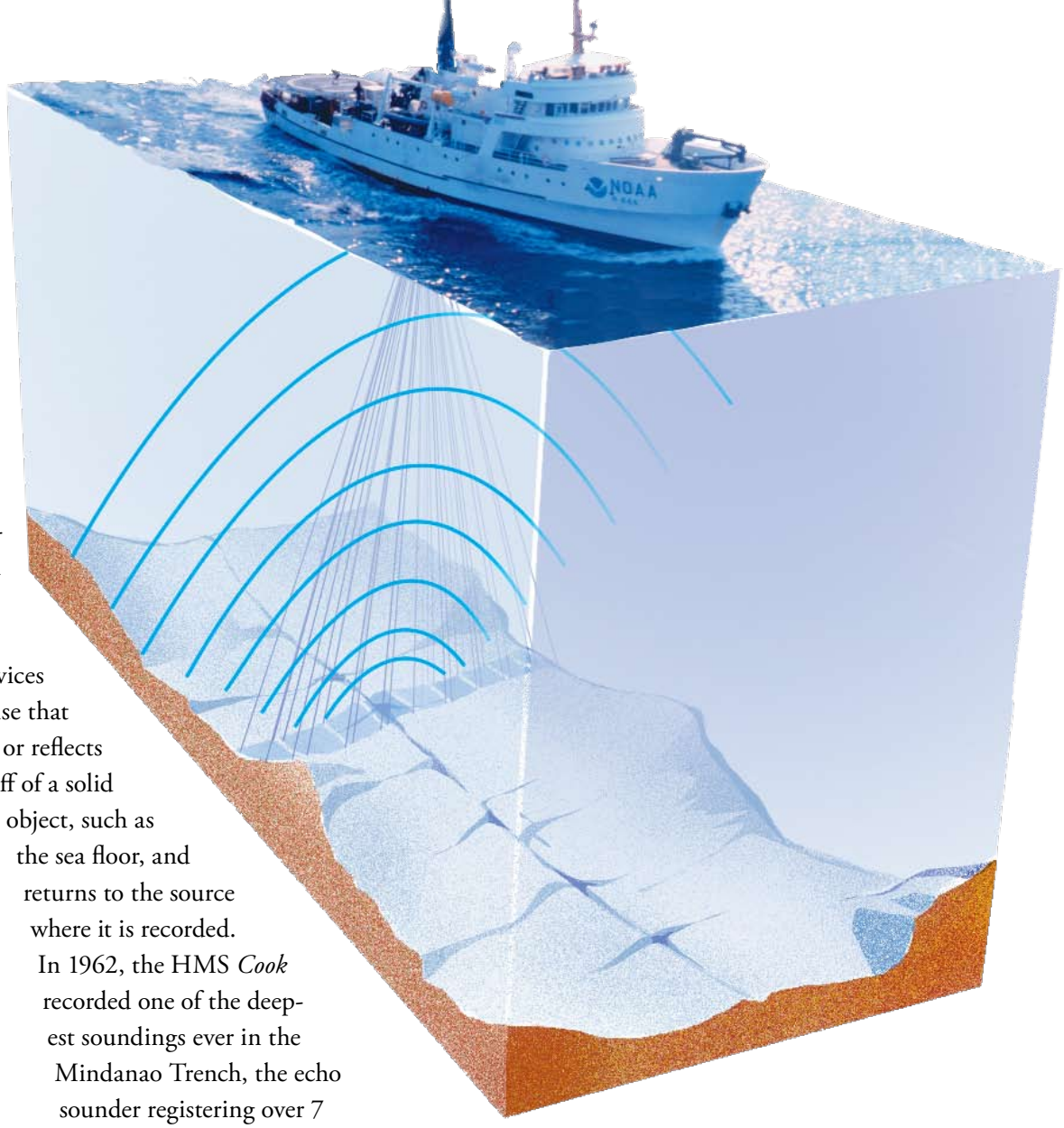
One theory the scientists wanted to examine was Professor Edward Forbes's (1815-1854) claim that life below 1,800 feet (549 m) was impossible. Forbes felt that with such poor conditions as lack of light and high pressure, life surely could not exist. His claim was clearly proven wrong. Hundreds of samples were taken during the *Challenger* voyage from depths of over five miles (8,185 m) down. The scientists found a vast array of bizarre, previously undiscovered creatures. Mysterious manganese nodules, first discovered on this expedition, were described as

potato-shaped nodules ranging from walnut-size to grapefruit-size." Another significant discovery made on this voyage, a rise in the middle of the Atlantic Ocean, turned out to be the first clue to the extensive mid-oceanic ridge.

Researchers have come a long way since those early days of oceanographic studies. By the 1920s, the depth and shape of the ocean bottom were being determined by echo sounders. These devices send out a strong sound pulse that bounces or reflects off of a solid object, such as the sea floor, and returns to the source where it is recorded. In 1962, the HMS *Cook* recorded one of the deepest soundings ever in the Mindanao Trench, the echo sounder registering over 7 miles (11,515 m)!

In the 1950s and 60s, technology provided tools so sophisticated that the newly developed apparatuses could even study the earth's crust below the ocean floor. There has been more exploration of the ocean bottom since 1950 than in all the rest of recorded history.

Weights used to measure ocean depths



Today, ships use a seismic profile (a picture made by sound waves) to view the composition of the ocean bottom.

Today, ships are capable of generating a seismic profile (pictures made by sound waves) to view the composition of the ocean bottom. The devices which accomplish this task work in much the same manner as the echo sounders but are more powerful and use advanced technology.

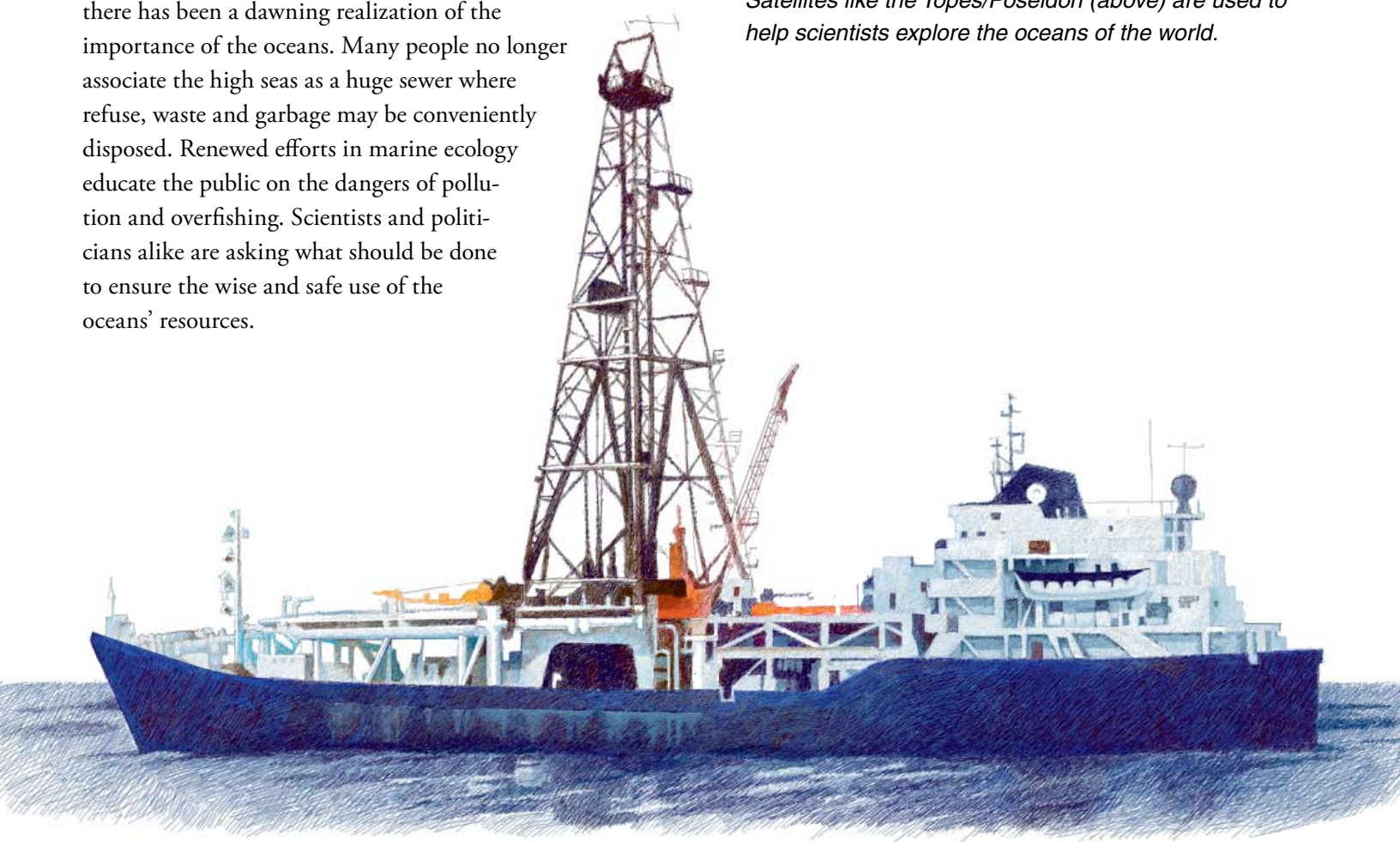
The formidable Deep Sea Drilling Project (DSDP) was conducted from 1968 to 1983 by an international group of oceanographic institutions. Cores — thirty-foot (9.5 m) vertical, cylindrical columns of sediment and rock — were taken from the seafloor by a 400-foot long drilling ship. After core samples were extracted from the ocean bottom, scientists sometimes placed sensors into the hole to gather more

information such as temperature readings. Scientists examined, and continue to examine, the composition of the thin multicolored bands of core sediments. Many thousands of core samples from various oceanic expeditions are stored in cold, hermetically sealed (airtight) rooms throughout the world. They remain, much like books in a library, available for further investigation when necessary.

In the mid-90s, the main emphasis of oceanography was exploration. Certainly, a large amount was accomplished by traditional methods using ships, but Earth-orbiting satellites were increasingly used in a method that came to be known as satellite oceanography. Now, in the 21st century, oceanographers use everything from deep sea robots to these more sophisticated satellite images to further the fascinating field of oceanic research. Using satellites, scientists have determined where to penetrate the seafloor with drill holes tens-of-thousands of feet deep.

After decades of research and exploration, there has been a dawning realization of the importance of the oceans. Many people no longer associate the high seas as a huge sewer where refuse, waste and garbage may be conveniently disposed. Renewed efforts in marine ecology educate the public on the dangers of pollution and overfishing. Scientists and politicians alike are asking what should be done to ensure the wise and safe use of the oceans' resources.

Satellites like the Topes/Poseidon (above) are used to help scientists explore the oceans of the world.



The Glomar Challenger *was used for drilling core samples.*

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