**History of Oceanography, Woods Hole Oceanographic Institution**

Oceanography may be one of the newest fields of science, but its roots extend back several tens of thousands of years when people began to venture from their coastlines in rafts. These first seafaring explorers, navigators and oceanographers began to pay attention to the ocean in many ways. They observed waves, storms, tides, and currents that carried their rafts in certain directions at different times. They sought fish for food. They realized that although ocean water didn't look different from river water, it was salty and undrinkable. Their experiences and understanding of the oceans were passed down over thousands of years from generation to generation in myths and legends.

But it wasn't until about 2,850 years ago (850 BC) that early naturalists and philosophers started trying to make sense of the enormous bodies of water they saw from land. Because people could see only endless ocean from the shoreline, they believed the world was flat. That didn't keep Columbus and others exploring the oceans in the late 1400s and early 1500s and finally discovering that the world is not flat, but round- a sphere whose surface is nearly 3/4-covered by oceans.

Modern oceanography began as a field of science only a little less than 130 years ago, in the late 19th century, after Americans, British and Europeans launched a few expeditions to explore ocean currents, ocean life, and the seafloor off their coastlines. The first scientific expedition to explore the world's oceans and seafloor was the Challenger Expedition, from 1872 to 1876, on board the British three-masted warship HMS Challenger.

But modern oceanography really took off less than 60 years ago, during World War II, when the U.S. Navy wanted to learn more about the oceans to gain fighting advantages, especially in submarine warfare. This section of Deeper Discovery will give you some background and history on the science of oceanography. It will show you how important early studies were and how far we have come since then in understanding the oceans and seafloor -- Earth's inner space.

**Polynesian Seafarers**
***Masters of Ocean Currents***

About 30,000 years ago, human cultures along the western coastline of the Pacific Ocean -- in the area between what is now Australia and China -- started to migrate eastward across the great expanse of the Pacific Ocean. We are not sure exactly why the migrations started, but tribal wars, disease epidemics, the search for food, or natural disasters such as large volcanic eruptions and earthquakes, may have been factors.

Over about 25,000 years, these people, called the Polynesians, eventually colonized the islands of the south and western Pacific, from New Guinea in the west to Fiji and Samoa in the middle. Then they moved onward to Tahiti and finally Easter Island in the eastern south Pacific. The Polynesians colonized the Hawaiian Islands about 500 years ago. The Hawaiian Islands are among the world's most remote island groups and were one of the last major island groups to be colonized by native cultures. How did the Polynesians manage to travel across thousands of miles of ocean without compasses, sextants, clocks, or other tools of modern navigation? Their migration was truly one of the great achievements of early seafaring cultures, and it marks the start of oceanographic observations by people who lived in harmony with the ocean.

The Polynesians were very observant. They noted the directions that waves came from and how they affected or rocked their canoes. They had a keen sense of ocean currents and variations in bird and sea life in different places in the Pacific. They also were among the first people to use astronomical observations of the stars to help them navigate across the ocean.

They made the earliest form of navigational or oceanographic map, called stick charts. These were made of pieces of bamboo or other wood that were tied together. The locations of islands were often marked with shells or knots, and curved pieces of wood represented the bending of ocean waves around the islands and the way waves rocked their canoes. Polynesians handed down their lore of the sea in both the oral and stick map traditions.

**The Mediterranean Sea**
***Ancient Myths About the Oceans***

The people who lived around the Mediterranean Sea began exploring this nearly landlocked sea several thousand years ago. Sailors from Egypt, Phoenicia and Crete mapped the regional coastlines to establish some of the earliest trading routes. Early Mediterranean civilizations, including the Greeks, have passed down many myths that include gods and goddesses who ruled over nature, such as Poseiden with his triton. Many Mediterranean legends, such as Jason and the Argonauts, also involved adventures on large and dangerous seas.

Many of our earliest maps of the oceans and coastlines come from this region. These early mapmakers, or cartographers, were probably Mediterranean traders who made the maps to help them get back and forth to different cities on the Mediterranean coast.

About 2,900 years ago, the Greeks began to venture outside the Mediterranean, past the Straits of Gibraltar at the western end of the Mediterranean Sea. This narrow channel separates Europe from Africa, and the Mediterranean from the Atlantic Ocean. Just outside of the Straits of Gibraltar, early Greek sailors noticed a strong current running from north to south. Because the sailors had only seen currents in rivers, they thought this great body of water on the other side of the Straits was a very big river. The Greek word for river was okeano, which is the root of our word for ocean.

**Voyages of Exploration and Science**
***The Age of Discovery***

About 650 years ago, European explorers turned to the sea to find faster trade routes to cities in Asia and Europe. Prince Henry the Navigator of Portugal recognized the oceans' importance to trade and commerce and he established a center of learning for the marine sciences. You could think of it as the first oceanographic institution. Mariners came to the center in Sagres, Portugal, to learn about the oceans and currents and how to make maps. These early maps provided the basis for important expeditions. In the late 1400s, Cristopher Columbus became the first European to sail westward across the Atlantic Ocean and return home. In the early 1500s Ferdinand Magellan sailed all the way around, or circumnavigated, the globe.

In the early 1700s, several European countries (mainly Spain, France and Britain) sought to expand their empires and discover new lands for raw materials, colonies or trade, and for spices from the East Indies, which they believed would help cure the Plague. They launched expeditions to survey faraway lands across the Atlantic, Pacific and Indian Oceans, and in doing so also explored the Arctic and Antarctic Oceans.

One of the most famous voyages of discovery of this time began in 1768 when the HMS Endeavour left Portsmouth, England, under the command of Captain James Cook. Over 10 years Cook led three world-encircling expeditions and mapped many countries, including Australia, New Zealand and the Hawaiian Islands. He was an expert seaman, navigator and scientist who made keen observations wherever he went. He was also one of the first ship captains to recognize that a lack of Vitamin C in sailors' diets (due mostly to a lack of fresh fruit) caused scurvy, a serious disease that killed many sailors in those times. Cook always sailed with lots of pickled cabbage, which he insisted that the sailors eat. Scurvy was never a problem on his ships because the cabbage contained lots of Vitamin C.

In 1728, John Harrison, a British cabinetmaker and inventor, started working on an important instrument to aid seafarers navigating across large areas of ocean, far away from land or coastlines. At the time, pendulum clocks kept time. Obviously, these clocks did not work well on a ship on the rolling ocean! In 1736, after years of work, Harrison invented a clock that used a spring instead of a pendulum. It was the first marine chronometer, an instrument that could give accurate time on a rolling ship. With it, sailors could figure out how far east or west they had gone from 0° Longitude, or the prime meridian, and what longitude they were sailing past. By 1761, Harrison had built four clocks, each better than the one before. The last clock was tested on a voyage between England and Jamaica, and it kept excellent time. It ran only about 5 seconds slow per day, and the ship steered a clear course to Jamaica, a true feat in those days.

**The Oceans as Battlefield**
***The Development of Sonar***

The oceans have always played a big role in wars. Ships transported armies and supplies, blockaded harbors, besieged cities, and attacked enemy ships doing the same things. But the Civil War helped launch a stealthy new seagoing weapon that became common in 20th century warfare-submarines.

To combat this new threat, Navy leaders soon realized that they could detect submarines using sound transmitted through water. Huge efforts began to develop sonar, a word that is a combination of abbreviations (an "acronym") for "sound," "navigation" and "ranging". (Interestingly, sonar was first developed to help avoid icebergs after the Titanic sank.)

For oceanographers, sonar provided a much easier way to measure the ocean depths accurately. On the 1872-76 Challenger Expedition, for example, crew members threw overboard a 200-pound weight attached to miles of hemp rope. They waited until it hit bottom, measured the rope length, and then had to haul it back on board-a process that took hours for one measurement!

Sonar allows scientists to use sound waves to measure the distance from the ocean surface to the seafloor. Ships' hulls are equipped with devices called transducers that transmit and receive sound waves. Echo sounders were first used for oceanographic studies during the epic German expedition exploring the South Atlantic in the mid-1920s aboard the Meteor. Today echo sounding remains the key method scientists use to make bathymetric maps of the seafloor. For the last 30 years, marine scientists have used multibeam sonar, which can automatically make very detailed contour maps of large areas of seafloor as a research ship travels fast (about 12 knots) over the ocean surface. Today, many different types of sophisticated sonars exist. They can tell us not only about seafloor depths, but also about the structure of the ocean floor and even about currents and life in the ocean.

The military also developed other tools that also proved useful to oceanographers, such as the

magnetometer, which measures magnetic fields. The Navy uses it to detect the large metal hulls of submarines. Oceanographers use it to learn about magnetic properties of seafloor rocks. As it turned out, these properties provided key clues that completely changed our thinking about how our planet works.

## Oceanography in the 21st Century

### *Inner Space Exploration*

Most of the major discoveries in oceanography have occurred only within the last 50 years. We have found that while rocks and sediments on land are usually wiped away by weather and erosion, rocks and sediments on the seafloor are a well-preserved archive of information that allows us to unravel Earth's geological processes and history. We have learned that oceans play a crucial role in driving and shaping Earth's atmosphere and climate. We have discovered hydrothermal vents on mid-ocean ridge crests, which support previously unimagined ecosystems and exotic communities of life. Heat from the Earth's interior, rather than the sun, supports these life forms, which may hold clues to the origin of life on Earth and possibly to life on other planetary bodies.

The oceans cover 71% of Earth's surface, and so far we have only studied a very small percentage of the ocean floor and the global ocean. Many new discoveries await us as we use new instruments and deep submergence vehicles to explore "inner space" in the 21st century.

In the future, oceanographers want to go beyond learning what's down there in the ocean and learn what's going on down there. They want to observe oceans processes that change over days, weeks, seasons, years or decades. But it is difficult and expensive to send research ships back to the same sites for repeat measurement. Sometimes rough seas and stormy weather make it impossible to send ships to certain parts of the oceans at certain times.

Today oceanographers are launching a new era of ocean exploration. They want to establish long-term ocean floor observatories with arrays of sensors and instruments that make continuous measurements of various ocean properties and events. Data from the observatories will be sent to shored-based laboratories via submerged fiber-optic cables or via cables linked to moored buoys that can transmit data via satellite. The data can then be made available via the Internet.

Oceanographers will use different types of remotely operated vehicles (ROVs) and autonomous underwater vehicles (AUVs) that can "fly" in the oceans or along the seafloor, collecting measurements. The data can be downloaded when the AUVs surface, or when they dock at an underwater docking site and download data there. Oceanographers are also developing instrumented buoys moored thousands of miles from shore, and free-floating drifting instruments that can transmit data to scientists in their laboratories using satellites and the Internet.

Ocean observatories will greatly extend oceanographers' reach, allowing scientists to make more measurements over larger areas of the oceans over longer periods of time.