

## Twentieth-Century Marine Science

### The Oceanography Explosion

*What change led to the growth and expansion of modern oceanography in the 20th century?*

Oceanography in the modern sense really came into existence at the beginning of the 20th century. Ocean research accelerated from the early 1900s, so that by the 1950s, you could find marine science expeditions and projects in progress somewhere in the world at any given time. Especially in the latter half of the century, these became so numerous and frequent that it's impossible to list them all here. You'll touch on many of them as you go through *Life on an Ocean Planet*.

Although many factors contributed to the growth and expansion of marine sciences in the 20th century, most of these stem from a single, significant social change: the Industrial Revolution. The Industrial Revolution started around 1760 in England and it took time to spread to other countries. Although it was in progress, its most noticeable effects didn't appear until the last half of the 19th century, continuing into the 20th. During this period, science and technology began accelerating the pace of advancements that continues today.

One major change was the rise of steam engines and iron ships. As late as the 1870s, most vessels were wooden ships powered by sail. By 1900, these had largely given way to iron and steel steam ships. This improved trade and oceanography because sea travel was no longer at the mercy of wind and current.

As the Industrial Revolution progressed, so did technologies that applied to ocean research. During the early 1900s, scientists and engineers began designing and building elaborate research equipment. Building on the work of the *Challenger* in the previous century, oceanographers became truly interdisciplinary in collecting data. Research increasingly considered physical, geographic, chemical, and biological oceanography.

Although the dream of an underwater ship had been in the human mind for centuries, it was the invention of the diesel engine, electric motor, and the lead-acid battery that made the first useful submarines possible in the 20th century. This technology advanced rapidly. At the turn of the century there were few submarines and they were largely experimental. However, less

### STUDY QUESTIONS

Find the answers as you read.

1. What change led to the growth and expansion of modern oceanography in the 20th century?
2. For what accomplishment do we recognize the German Meteor expedition?
3. What was the significance of the *Atlantis*?
4. What noted discovery did the second H.M.S. *Challenger* make?
5. How have submarines and self-contained diving changed the study of the oceans?
6. What are the three types of submarine that have been used for underwater research?
7. What are the advantages and disadvantages of submarines and scuba?
8. What other technology has opened underwater research?
9. How have Loran-C and GPS benefited seafaring and oceanography?
10. What are three types of sea surface observations that satellites can make to benefit oceanographers?





**Figure 2-33a**  
Rise of steam engines and iron ships.



**Figure 2-33b**  
Submersible.



**Figure 2-33c**

**Nuclear submarine.** Although many factors contributed to the growth and expansion of marine sciences in the 20th century, most of these stem from a single, significant social change—the Industrial Revolution. The use of steam engines, iron ships, submarines, nuclear submarines, and modern sampling equipment helped further marine science in the 20th century.

than 15 years later, submarine warfare played an important strategic role in World War I. The sinking of the *Lusitania* in May 1915 by a German submarine was a key motivator that propelled the US into the conflict.

As the pace of the Industrial Revolution picked up, the role and view of science took on new weight. More funding became available for research as Western societies became wealthier through industry. Applied research (science to create a specific product or solve a specific problem) grew. This research creates and meets demand for everything from new medicines to consumer goods. Pure research (no goal except science) also increased as government and industry recognized that pure research generates tangible economic benefits. It's worth the investment even when you don't know what the return will be.

Global conflict and the Cold War also drove science and technology in the 20th century. Countries invested in research to develop their military capabilities, but also to further their international stature. The 1960s and 1970s sea and space explorations by the United States and the Soviet Union were good examples. Both countries made great advances while competing for political prestige.

These trends continue today. The need for ocean resources has never been higher. The need for solutions to environmental problems concerning the sea has never been greater. Yet, as you learned in the last chapter, most of the ocean remains unexplored. This suggests need and opportunity. It may well be that the oceanography explosion of the 20th century will pale in comparison to that of the 21st century.

### Three Expeditions

*For what accomplishment do we recognize the German Meteor expedition?*

*What was the significance of the Atlantis?*

*What noted discovery did the second H.M.S. Challenger make?*

Although there were hundreds of marine science expeditions and research vessels in the 20th century, three in particular stand out. These were the German *Meteor* expedition, the *Atlantis*, and the second H.M.S. *Challenger*.

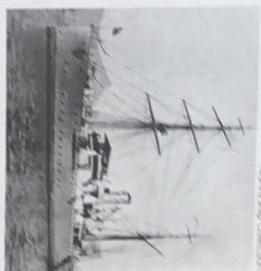
The German *Meteor* expedition began in 1925 and is often cited as one of the first modern oceanographic research cruises.

The *Meteor* crossed the Atlantic 14 times in just over two years, gathering physical, chemical, geological, and biological data. This included about 9,400 temperature, salinity, and chemical samples at varying depths. Analysis of these data established patterns for ocean water circulation, nutrient dispersal, and plankton growth.

The primary accomplishment for which we recognized this expedition, however, is mapping the Atlantic seafloor with echosounding technology. *Meteor* scientists used approximately 67,400 echo soundings to create the first detailed ocean floor map. They discovered a rugged, varied terrain instead of the long, flat bottom they expected. As you'll read in Chapter 11, this was an important step in developing theories that explain the creation and destruction of the seafloor over time.

In 1931, the United States launched the *Atlantis*. The significance of the *Atlantis* is that she was the first ship specifically designed and built for ocean studies. Among many accomplishments, *Atlantis* built on the work of the *Meteor*. During its voyage, it confirmed the existence of the Mid-Atlantic Ridge and mapped it. As with *Challenger*, NASA named one of the space shuttles in honor of *Atlantis*.

In October 1951, a new H.M.S. *Challenger* II began a two-year voyage to measure the depths of the Atlantic, Pacific, and Indian oceans. This effort used echo-sounding technology to further the mapping efforts started by *Meteor* and continued by *Atlantis* and other vessels. The most noted discovery made by the second *Challenger* was finding the deepest known part of the ocean. Located in the Marianas Trench (discovered by the first *Challenger*), they named it the Challenger Deep in honor of the first *Challenger* expedition. At 10,838 meters (35,558 feet), this is still the deepest known place in the world.



**Figure 2-34**  
The *Meteor* research vessel. The German *Meteor* expedition began in 1925 and is often cited as one of the first modern oceanographic research cruises. The *Meteor* crossed the Atlantic 14 times in just over two years, gathering physical, chemical, geological, and biological data. This included about 9,400 temperature, salinity, and chemical samples at varying depths. Analysis of these data established patterns for ocean water circulation, nutrient dispersal, and plankton growth.



**Figure 2-37**  
*Meteor* research. Crew member handling plankton net for biological sampling.

**Figure 2-38**  
**Second Challenger expedition—1950s.** H.M.S. *Challenger* II seen here entering Suez, Fiji, in 1951, during her world voyage. The most noted discovery made by the second *Challenger* was finding the deepest known part of the ocean. Located in the Marianas Trench (discovered by the first *Challenger*), they named it the Challenger Deep in honor of the first *Challenger* expedition. At 10,838 meters (35,558 feet), this is still the deepest known place in the world.

