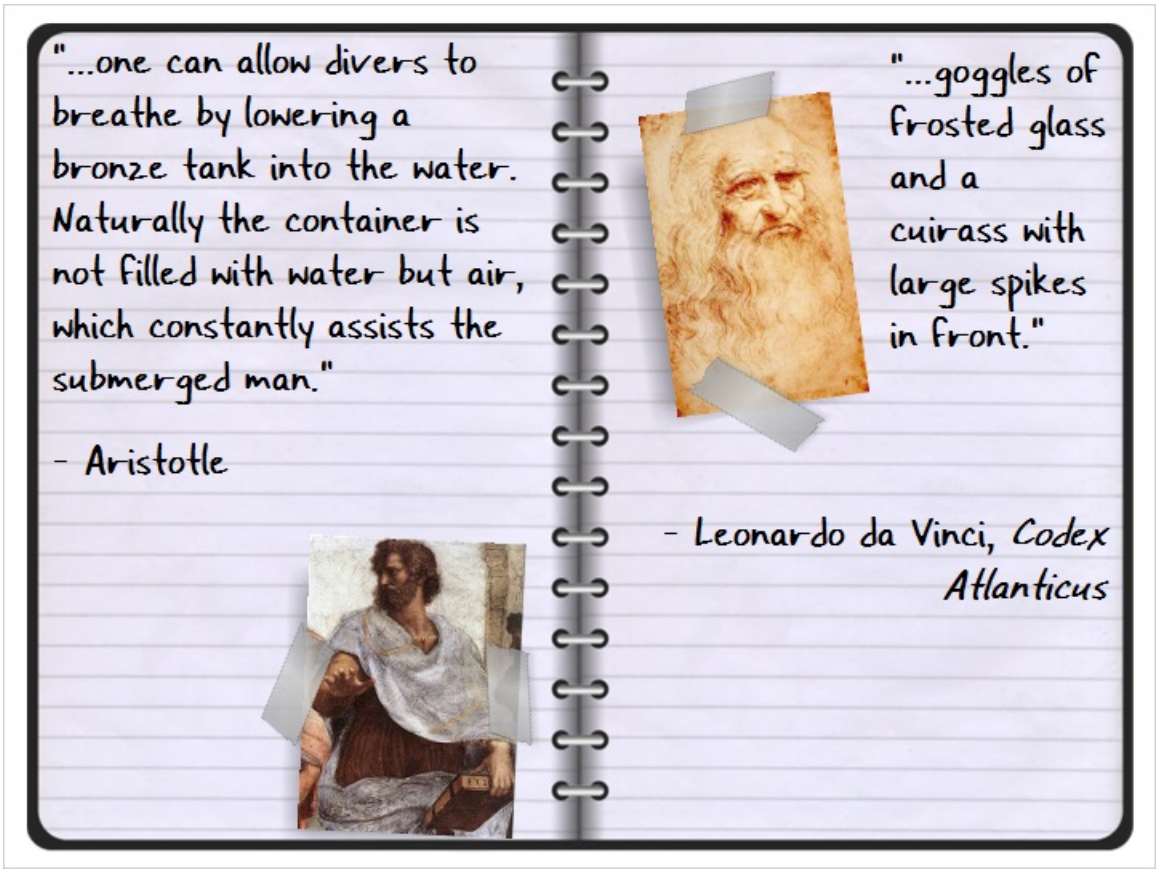
Module 2: The History of Oceanography
Topic 5 Content: SCUBA and Underwater Oceanography Notes



Throughout history, records exist of people's attempts to dive and explore beneath the ocean's surface. In fact, Aristotle wrote of a diving bell apparatus in the 4th century BC. During the Renaissance in the 1500s, Leonardo da Vinci described in his *Codex Atlanticus* specific ideas for fins, a snorkel, and even a breathing apparatus! Unfortunately, diving was neither well practiced nor widespread until the development of SCUBA in 1948.

Aristotle and da Vinci Image Credits: Public Domain

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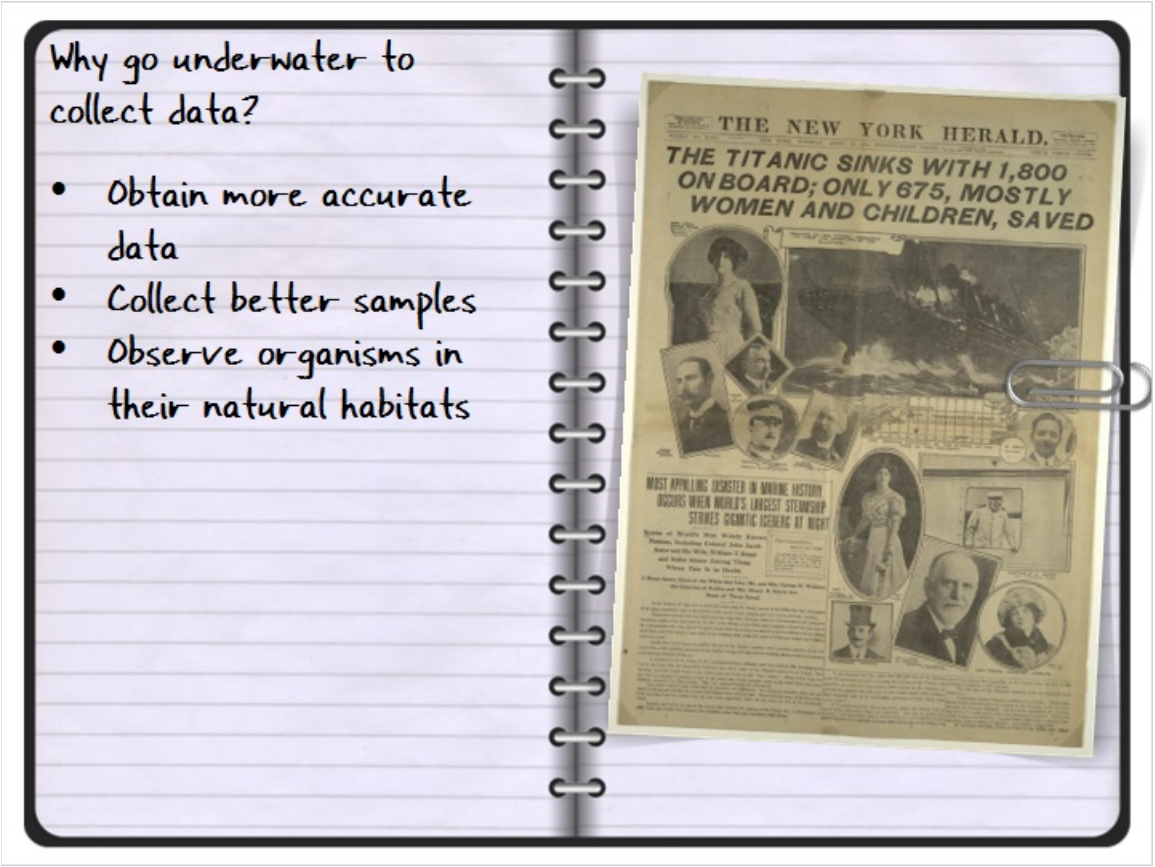
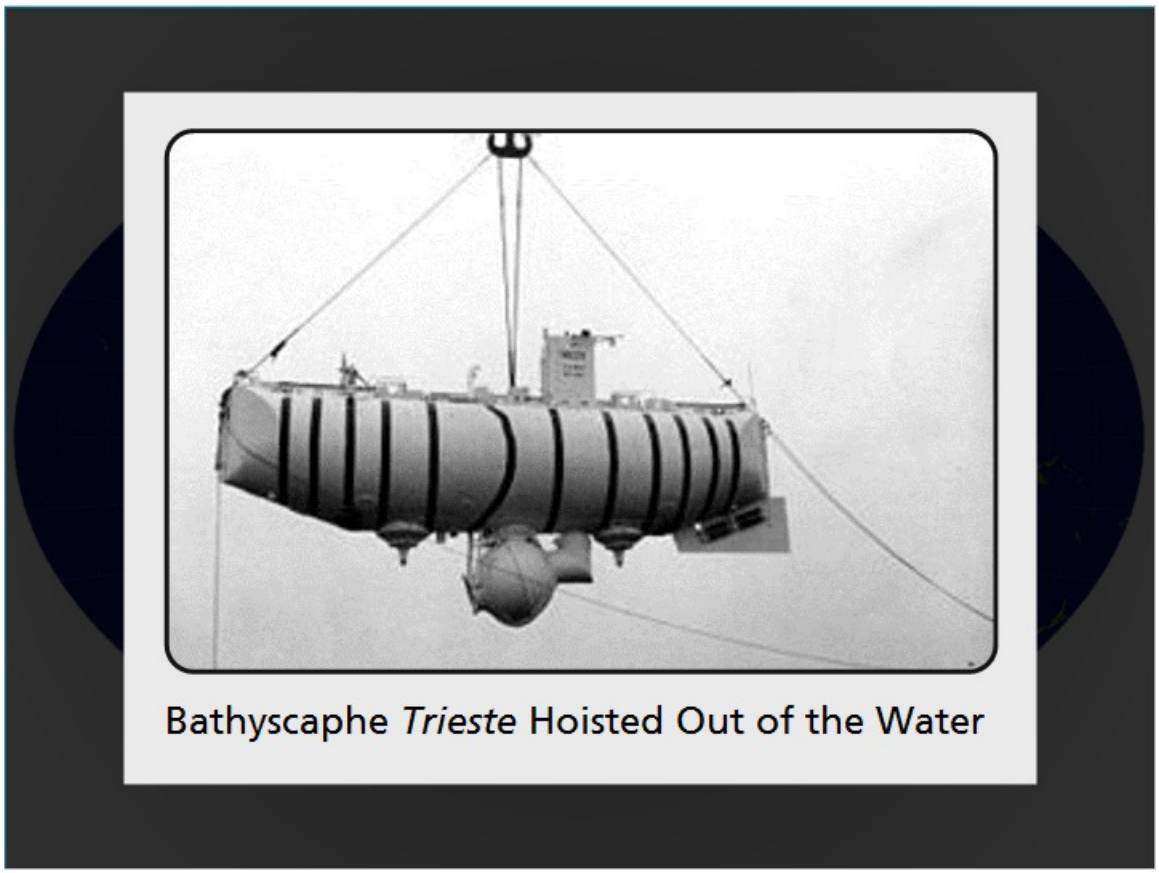


But why go underwater to collect data? Why take the risk of drowning and nitrogen poisoning? Well, the development of underwater oceanography has helped researchers obtain more accurate data, collect better samples, and make direct observations of organisms in their natural habitats. All this helps us to better understand our environment, improve ocean travel, and make surprising advancements in fields from biology and archeology, to medicine and even improve the food we eat! Scientific reasons aside, venturing deep underwater can be exciting and rewarding, such as when researchers finally located the wreck of the RMS *Titanic*.

William Beebe and Otis Barton created the first fully enclosed submersible in the 1930s. Their submersible was a thick-walled, large steel ball with a window, and it was attached to a ship by a cable and an oxygen hose. They called their submersible a bathysphere. Although it could reach a depth of 2,700 feet, rough seas often resulted in very unpleasant conditions for whoever was inside the bathysphere. Nevertheless, Beebe and Barton's bathysphere "got the ball rolling" for later advancements in underwater oceanography.

Image Credit: Public Domain



A new vessel called the bathyscaphe improved on the bathysphere design by suspending a bathysphere-like crew compartment beneath a large float and ballast assembly. This innovation made the bathyscaphe a true deep-sea diving submersible as it could rise and sink on its own without being cabled to another ship. It also had propellers for self-propulsion and maneuvering.

One famous bathyscaphe was the Swiss and Italian vessel named *Trieste*. In 1960, researchers Don Walsh and Jacques Piccard dove the *Trieste* to the Challenger Deep, an abyss over 36,000 feet down in the Mariana Trench. With this record-breaking dive, the *Trieste* became the first and only manned vessel to reach the lowest known point on Earth.

Image Credit: U.S. Navy

Today, engineers and scientists have available far more sophisticated submersibles and submarines. These vessels are made of lightweight, but very strong materials. They're faster, have greater maneuverability, and many vessels feature robotic arms and even high definition cameras with lights!

Perhaps the most famous of these modern day submersibles is DSV *Alvin*. Built in 1956 and heavily modified since, *Alvin* averages over 150 divers per year. One of Alvin's claims to fame is its role in helping to find the RMS *Titanic* shipwreck.

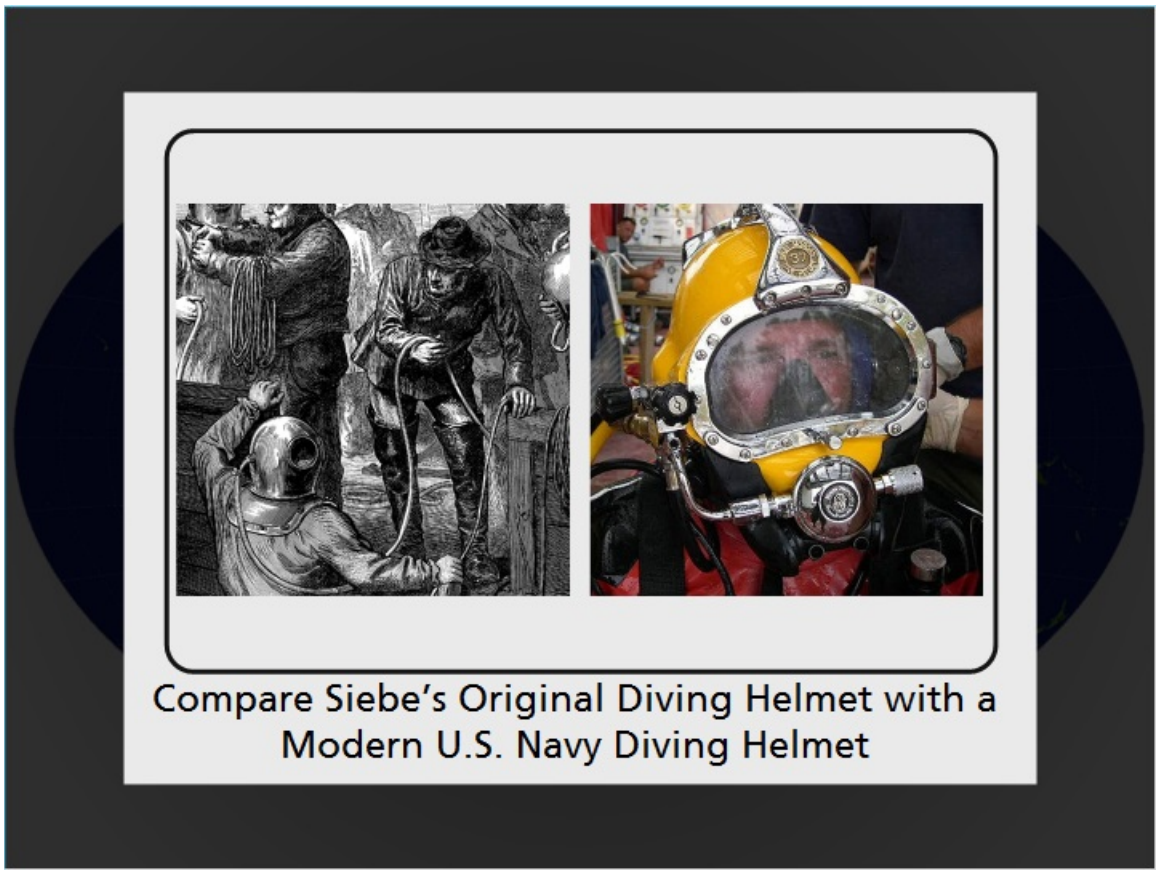
Image Credit: NOAA

Diving attempts exist throughout the historical records, with people trying different technologies and techniques as far back as the 4th century BC. In 1535, an Italian inventor named Guglielmo de Lorena built what historians believe to be the first modern diving bell, a device much like a small barrel that rested on a diver's shoulders. Later advancements were shaped like a large, elongated bell, with most diving bells big enough to fit one or two people.

A diving bell works by balancing the pressure of air inside the bell with the pressure of water outside the bell. You can see the same effect if you turn a drinking glass upside down and submerge it straight down into a tub of water. In the early designs, a diver could stay submerged only until that air ran out. Later designs over the next few centuries used various means to pump fresh air into the chamber. As you can imagine, diving bells were not very practical, nor safe!

Diving Bell Image Credit: Creative Commons

Alexander the Great Image Credit: NOAA



In 1840, August Siebe developed hardhat diving helmets. Essentially, the diving helmet is a thick suit and heavy helmet tethered to a ship by a cable and oxygen hose. Siebe intended for his diving helmet to be used for underwater ship repair or other general underwater labor. However, oceanographers soon discovered the advantages afforded by Siebe's invention, and used the diving helmets on many subsequent research missions.

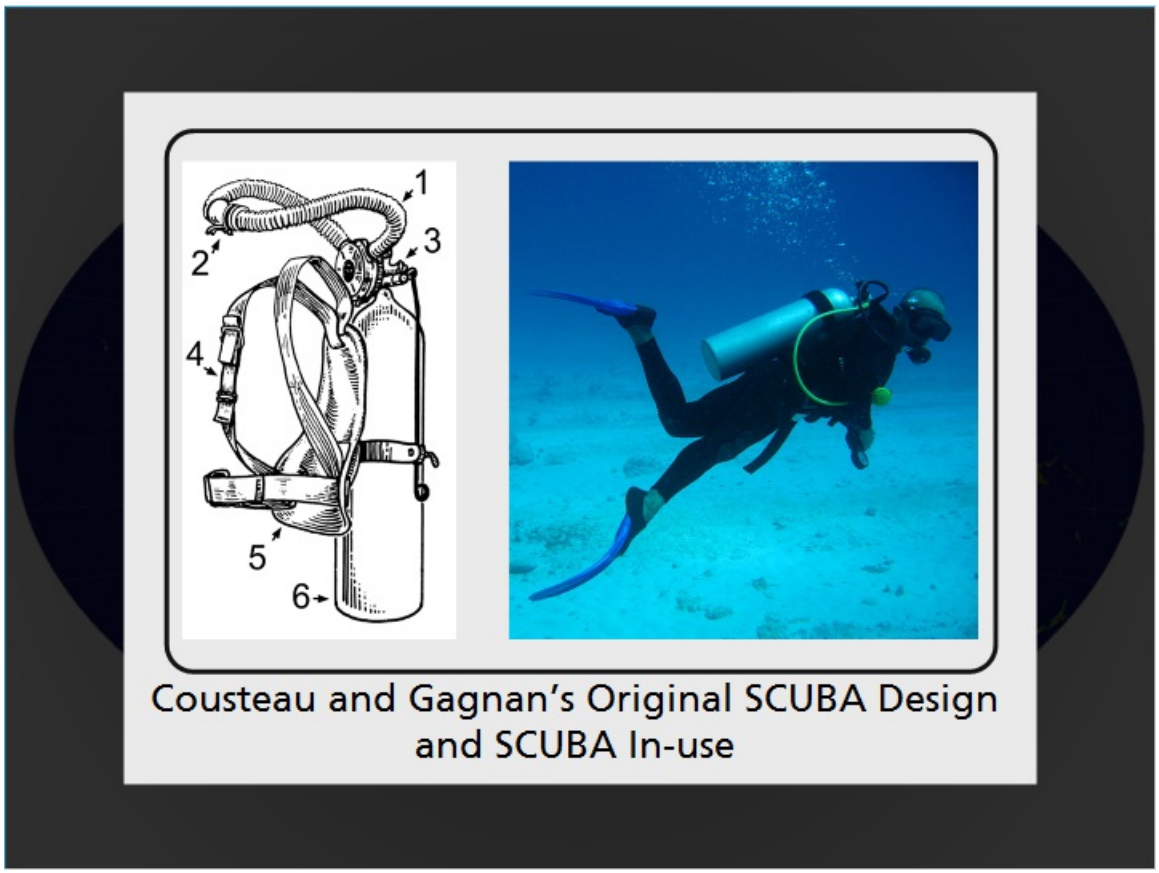
Siebe Diving Helmet Image Credit: Public Domain

U.S. Navy Diving Helmet Image Credit: U.S. Navy

What about SCUBA? The acronym SCUBA stands for Self Contained Underwater Breathing Apparatus. In 1878, Henry Fleuss developed the first SCUBA, which was a re-breather that recirculated pure oxygen while absorbing carbon dioxide through chemical reactions within tanks.

Unfortunately, divers realized that it's not safe to breathe pure oxygen while diving under pressure, so Fleuss's initial SCUBA design soon fell out of favor. However, re-breathers are in use today thanks to significant design innovations.

Image Credit: Creative Commons



A breakthrough in SCUBA technology came in 1943 when the famous ocean explorer Jacques-Yves Cousteau and Emile Gagnan developed a safer version of SCUBA. Their system consisted of one or two metal tanks strapped to the back of a swimmer. Importantly, instead of using pure oxygen, Cousteau took Gagnan's advice and simply used compressed air, which is a mixture of oxygen, nitrogen, and other atmospheric gases. Cousteau and Gagnan designed their system so that it expelled waste carbon dioxide directly into the surrounding water.

At last, divers had a safe and reliable underwater breathing system that allowed them to swim freely about the ocean waters. Cousteau and Gagnan's SCUBA system reached worldwide use within twenty years, and is still the system divers use today!

Original SCUBA Image Credit: Public Domain

SCUBA In-use Image Credit: Creative Commons

So now we have discussed submersibles, and SCUBA, but how else can oceanographers get a good look into the ocean depths? One way is to use an ROV or remotely operated vehicle. An ROV is a small, unmanned submersible with propellers, video cameras, robotic arms, and is connected to a ship via a very long cable. An ROV is more versatile than manned submersibles because of its increased maneuverability, longevity underwater, and its ability to fit into tight or dangerous places. The British Royal Navy developed the first ROV, named *Cutlet*, in the 1950s to recover practice torpedoes.

Image Credit: Woods Hole Oceanographic Institute

AUV *Sentry*

On the cutting edge of oceanographic research is the AUV, or autonomous underwater vehicle. An AUV has all the advantages of an ROV, but without the need for a tether. Instead, an AUV can be programmed with navigational and data collection instructions, launched from a ship, and then picked up at a later time. Although the future is bright for AUV technology, there have been a few setbacks. For example, in 2010, the U.S. Navy lost four Advs. while conducting a study in the Chesapeake Bay!

Image Credit: Woods Hole Oceanographic Institution