

History of Exploration & Marine Science



There are three main reasons to study oceanography history.

- 1. The history of oceanography isn't isolated from the world's overall history.
- 2. Oceanography's past helps you understand why and how people apply marine sciences today.
- 3. Its interesting!

4 stages of oceanography

- 1. ancient uses and explorations
- 2. the middle ages
- 3. European voyages of discovery
- 4. modern marine sciences

3 primary reasons for early civilizations to interact with the ocean

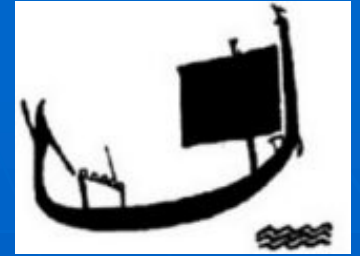
- 1. food
- 2. discover new lands
- 3. trade

5000 B.C to 800 A.D

- Egyptians- Earliest recorded sea voyage around 3200 BC.
 - made the first sailboats with a sail and oars
- Phoenicians- made the first trade routes (Mediterranean).
 - Stayed within sight of land, using the North Star for navigation
- Polynesians- made primitive maps and were the first to have long distance open ocean voyages with land out of sight.



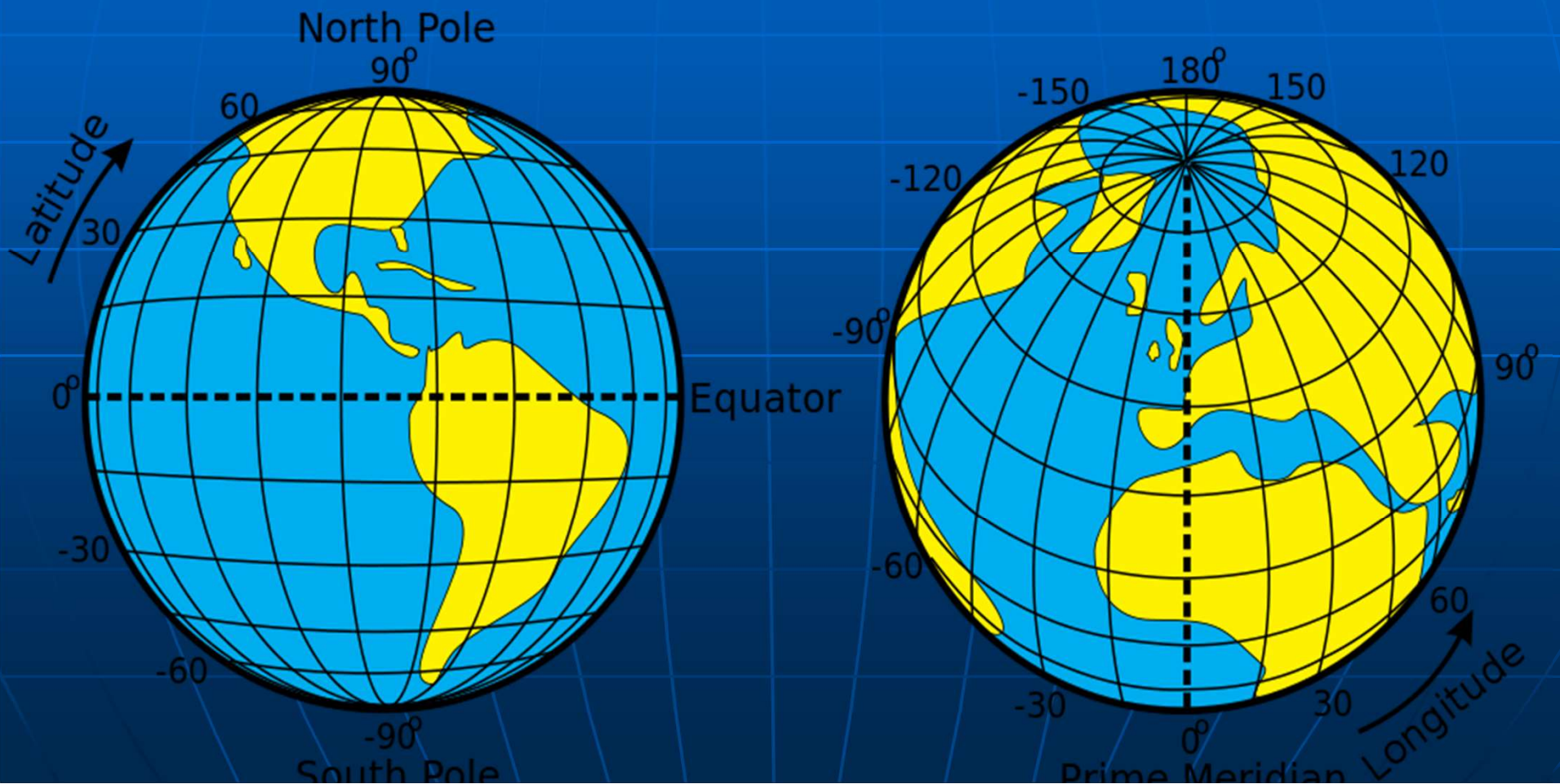
5000 B.C to 800 A.D



- Greeks- Major advancements in navigation
 - **Pytheas**- mapped out latitude using the North Star
 - **Eratosthenes**-
 1. **calculated Earth's circumference**
 - *Greeks knew the Earth was a sphere, not flat. Western civilization would "lose" this knowledge in the Middle Ages.*
 2. **Invented the first latitude/longitude system**, but it was irregular.
 - **Hipparchus** – **invented the lat/long grid system we use today** (450BCE)

Latitude and Longitude

Purpose: to identify specific locations on Earth's surface.



What is a parallel?

What is a meridian?

- Latitude lines never intersect, so they are called "parallels".
- The *equator* is at zero degrees parallel.
- Longitude lines are called meridians. Zero degrees meridian is called the *Prime Meridian* and it runs through Greenwich, England.

Stage 2

Middle Ages = Dark Ages In Europe

- Any thoughts on why they were called the dark ages?
- Knowledge of geography and science entered an intellectual “darkness” there was also, poor communication and lack of education.
 - Myths replaced knowledge (Earth is round vs Earth is flat).

800 A.D to 1400 A.D

- Vikings- Improved sailboats

- Bigger sails
- Oarsmen if no wind
- Flat-bottom boats (get closer to land)

- Sea exploration was only done by Vikings

- This lasted from about 800-1100 A.D. (the middle of the dark ages)



Major Viking discoveries

- 9th century: warming climate led to melting N. Atlantic ice, this allowed more Viking voyages through previously frozen area.
- Discoveries:
 1. Iceland (mild climate)
 2. Greenland (frozen land)
 3. North America (Newfoundland Canada) led by Leif Eriksson
 - Leif Eriksson day is Oct. 9th



Meanwhile... In China...

- During the European “Dark Ages” other parts of the world, were making intellectual progress.
- In 1125 the magnetic compass was invented and being used by the Chinese sailors.
- Chinese ships had central rudders and watertight compartments

Stage 3

European Discovery (1400-1700)

- Primary motivations that led to the ocean explorations of the 15th century?
 - Economics, politics, and religion

Prince Henry the Navigator of Portugal 1400s

- Used the compass (new to Europeans) to find a passage route around Africa. He failed, but brought back new information about the west African coast.

The End of the Dark Ages

■ Bartholomeu Dias

- A Portuguese navigator
- 1487-Sailed around the tip of Africa, which he called: "Cape of Storms" (*Cabo das Tormentas*). Later named the Cape of Good Hope

■ Christopher Columbus



- 1492 went to sea to find a new route to India for trade, he headed west and crossed the Atlantic and landed in the Bahamas. He thought he had reached Asia because he was using Ptolomy's estimation of Earth's circumference.

- Later he reached South and Central America

Later Expeditions

- **John Cabot**- 1497 left England and sailed to what is now Delaware.
- **Vasco Nunez de Balboa** – 1500s
crossed the Isthmus of Panama, first to see the East coast of the Pacific
- **Amerigo Vespucci** explored 9600 km of coastline from North to South America
 - Mapmakers in Europe named the Americas after him
 - First to recognize S. America as its own continent

Later Expeditions Cont.

- **Ferdinand Magellan**, a Portuguese navigator , was the first to attempt to circumnavigate the earth
- **Francis Drake**- 1577 second successful circumnavigation of the world, his purpose was to raid Spanish ships for treasure.

Stage 4: Scientific Explorations Modern Marine Science

Science – Using observation
and experimentation to find
answers (empirical evidence).

Scientific Exploration

- James Cook: Mid 1700's
 - Figured out how to prevent scurvy (A crippling disease caused by vitamin C deficiency)
 - <http://dl.nfsa.gov.au/module/1318/>
 - 1st to use **chronometer (accurate clock or watch)** to determine longitude.
 - Mapped many islands in the Pacific including Australia and New Zealand.



- James Harrison: Invented the chronometer.
- The chronometer is a clock invented to be used specifically at sea. This allowed sailors to accurately comparing Greenwich Mean time to the local time.



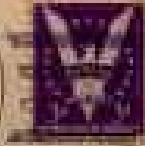
- Cornelis Drebbel- 1620 1st submarine

- http://www.dutchsubmarines.com/specials/special_drebbel.htm

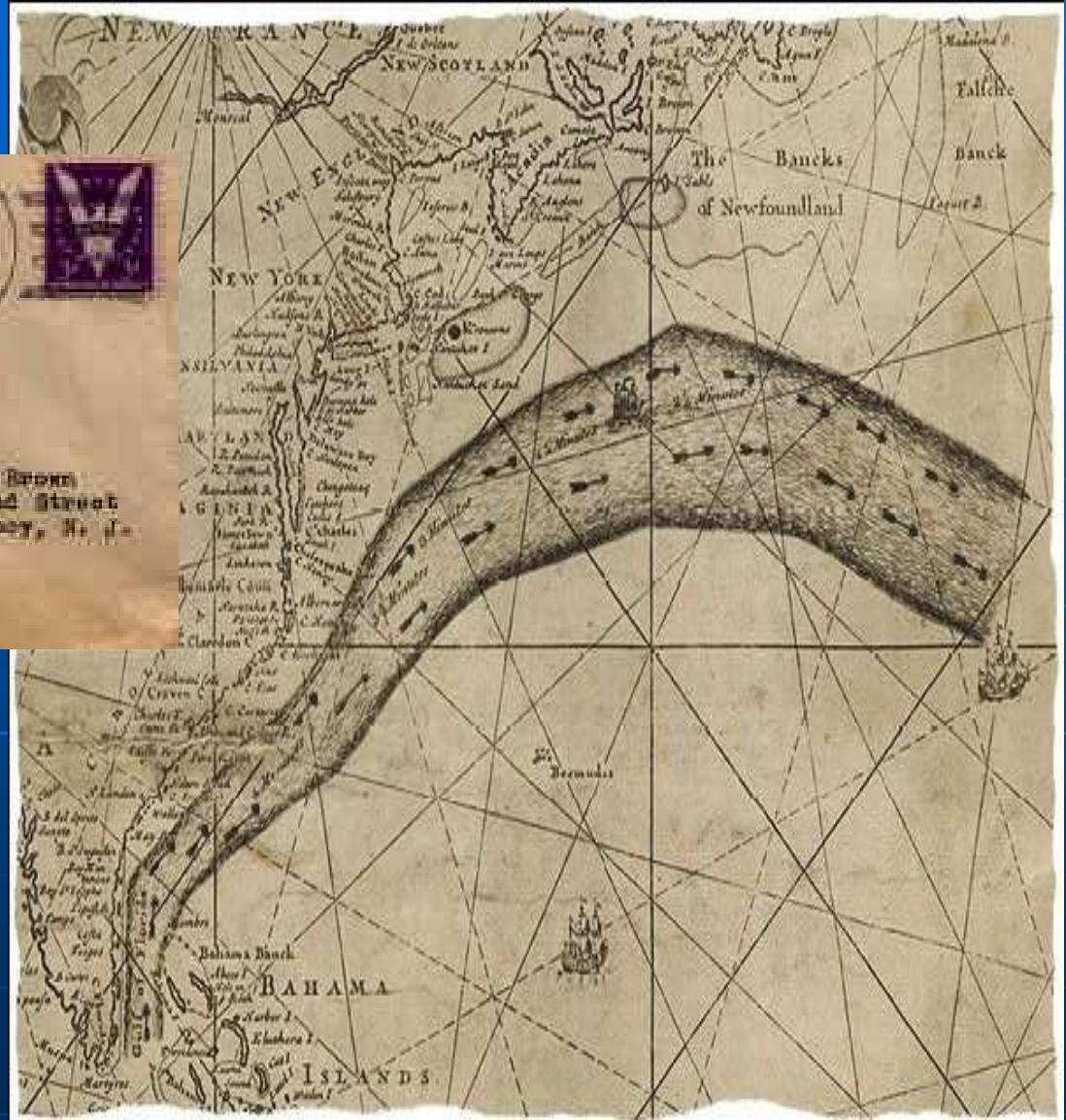
- Benjamin Franklin, US postmaster, wanted to know why it took longer for mail to come from Europe to America than vice versa
 - Later he drew an accurate map of the Gulf Stream



The first submarine was constructed by Cornelius and Oliver of Holland, in the summer of 1790. It was used by 17 men and submerged to a depth of twelve feet. This occurred in 1791.



John T. Brown
463 Second Street
South Amboy, N. J.



Drebbel's 1st Submarine

Ben Franklin's Gulf Stream- Image 1

- Matthew Fontaine Maury:
American Naval Officer
 - “The Father of Oceanography”
 - Studied currents and other physical aspects of the sea
 - 1855 analyzed the logbooks of navy ships and published the first books on oceanography called
 - *The Physical Geography of the Sea*

More Exploration

- Thomas Jefferson: 1807 authorized *Survey of the Coast* (the predecessor to NOAA)
 - NOAA- National Oceanic and Atmospheric Administration
- Charles Wilkes: 1836 the Wilkes Expedition (U.S. Exploring Expedition) proved the existence of Antarctica.

Tuesday, Sept 14, 2021

Pick Up: ■ none

Today
you
will: ■ Finish notes on Modern marine
science explorations

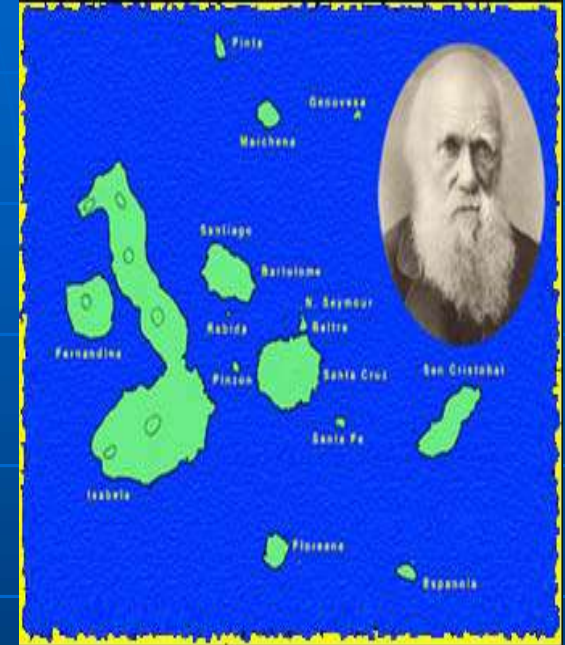
Focus on the learning, not the grade!

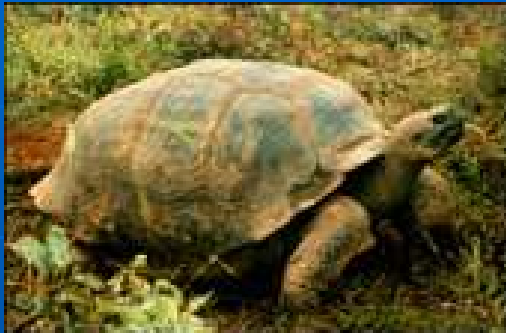
Charles Darwin

Marine Contributions

■ naturalist

- 1831, sailed on the HMS *Beagle*
- Studied coral reef construction and theorized that corals build upward as the seafloor receded (this is still accepted today)
- Found new species of plants and animals.
- Proposed Theory of Natural Selection in his publication the "Origin of Species"





vandenburghi



porteri



chatamensis



abingdoni



hoodensis



unknown

Galapagos Tortoise

http://www.youtube.com/watch?v=Qd-1_CjgGCQ&safe=active



Marine Iguana

<http://www.youtube.com/watch?v=VfZQfCkKuKM&safe=active>

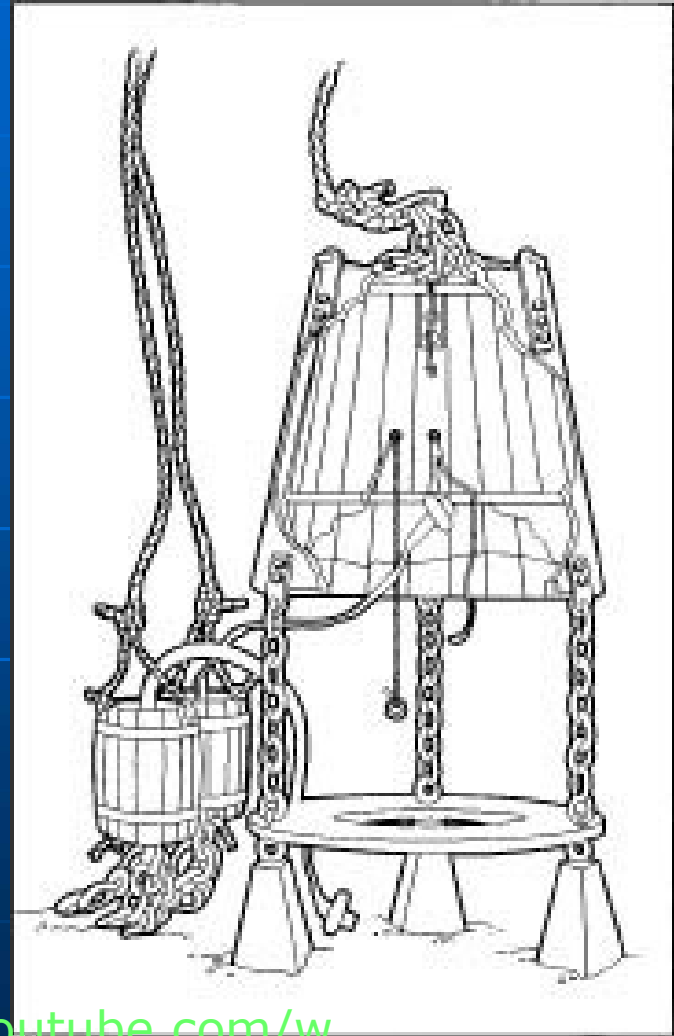
- **HMS *Challenger***- 1873-1876

- First exploration mission devoted entirely to marine science
- Led by Sir Charles Thompson
- Collected water, sediment, and temp data
- Identified more than 4700 new species of marine organisms
- **Challenger II expedition discovered the "Challenger Deep" in the Mariana's trench.** (over 35,000 ft. deep, deepest known point in the ocean)

Technology Advancements in Marine Science

Exploring the Ocean

- Under world called Inner Space
- 2500 B.C., glass was discovered and the first mask was made
- In the 17th century a diving chamber/bell was invented
- Later came a diving suit



<http://www.youtube.com/watch?v=oxWFqwFHXoo&safe=active>

Diving Bell





1797



1837



1855

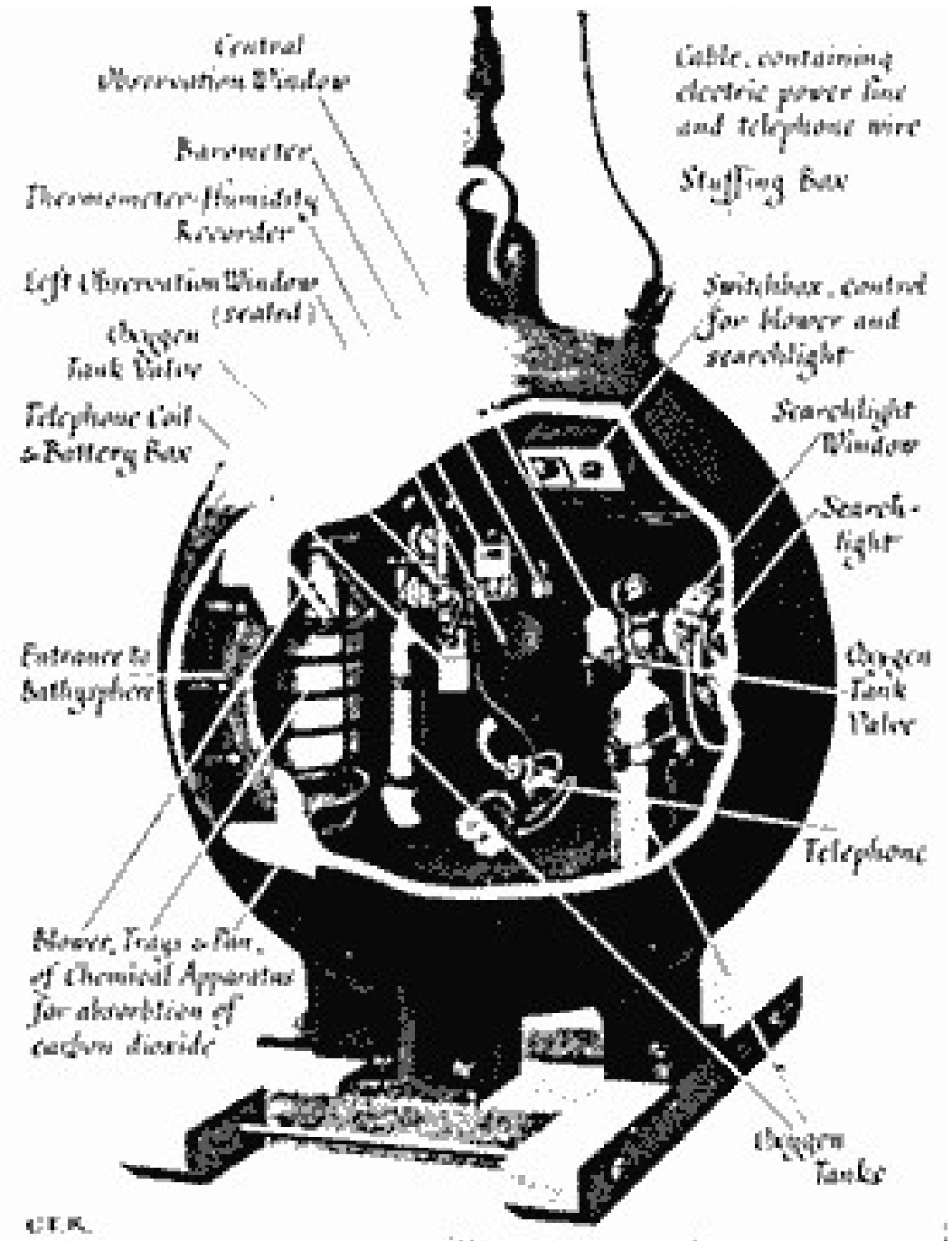
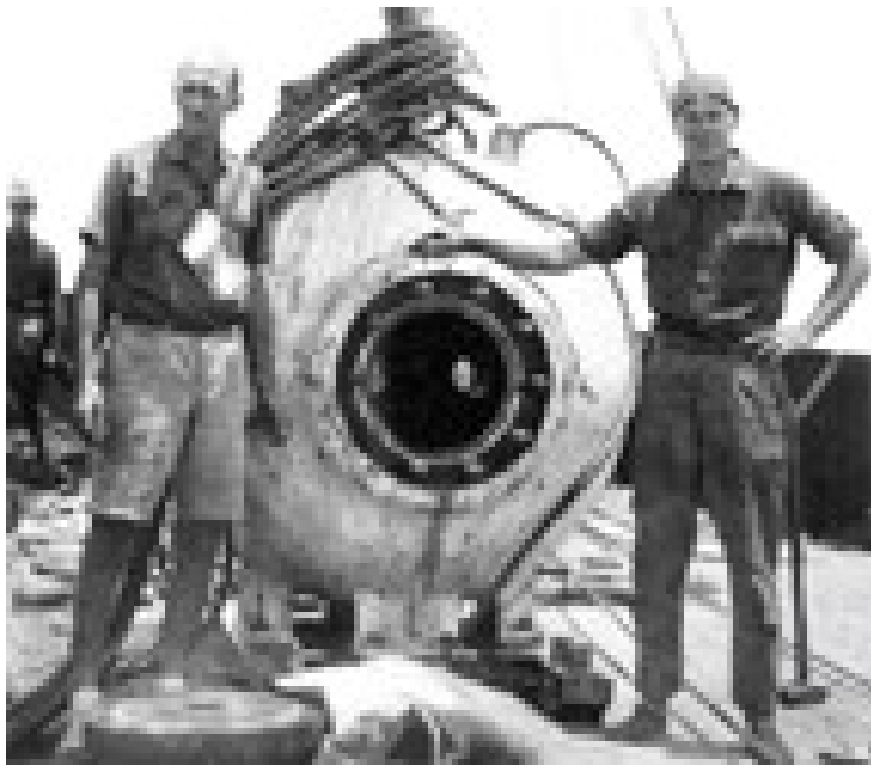
The Modern Scuba Tank

- 1943- **Jacques Cousteau and Emile Gagnan** made final improvements
- A tank with compressed air was developed that was strapped on the diver's back
- air breathed through a regulator
- marketed as the aqua-lung
- S.C.U.B.A- Self Contained Underwater Breathing Apparatus.



1880 to 1950

- V. Walfrid Ekman – Figured out the Ekman Spirals and Ekman Layer
- Fridtjof Nansen – Made the Nansen Bottle. Now people could take samples of water from different depths of water.
- Beebe and Barton – First bathysphere to 4,000 feet
 - Steel sphere at the end of a long cable (tethered)



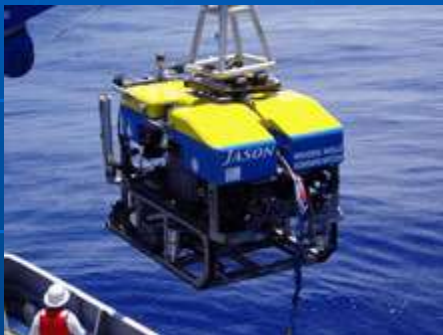
The Bathysphere

Diving Vessels

Also called submersibles

1. Bathysphere, allowed aquanauts to go to deeper depths
2. Bathyscaphe is a steel untethered submersible that could be controlled. Deepest dive in history (1960).
3. Alvin is a self-propelled machine with mechanical arms that can pick up specimens and can carry three humans
4. JASON, a robot, does not carry people

■ Jason



Alvin

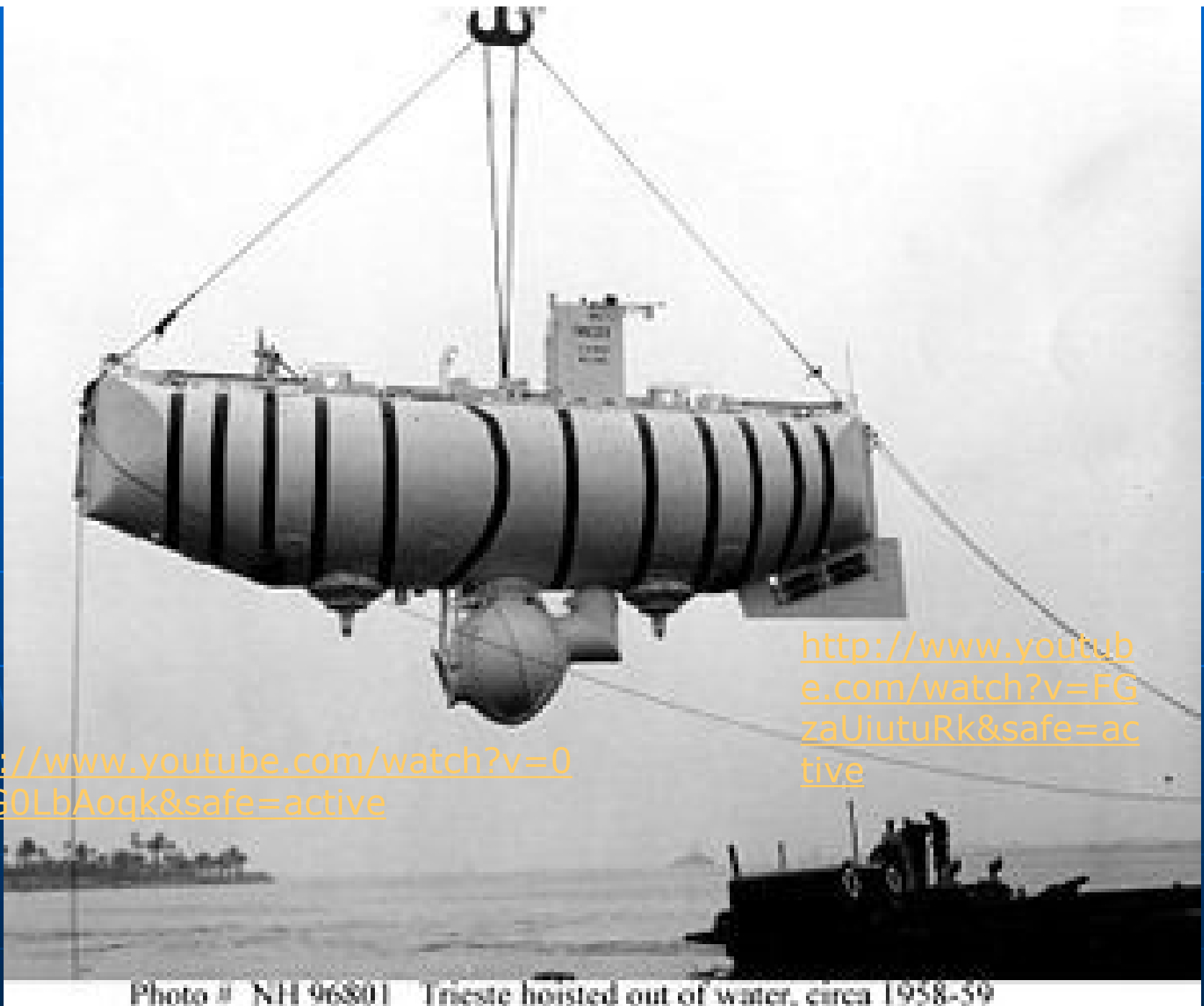


Buoyancy

- Discovered around 200 B.C. by Archimedes
- **Definition:** The force on any object is equal to the weight of the liquid that the object displaces
 - Buoyancy was the reason the Titanic sank

- Marie Thorp and Bruce Heezen – made the first map of the ocean bottom and provided evidence for the theory of Continental Drift.
- Auguste Piccard – First bathyscaphe to reach the bottom of the Mariana's Trench at 35,800 feet.





<http://www.youtube.com/watch?v=0mBG0LbAogk&safe=active>

<http://www.youtube.com/watch?v=FGzaUiutuRk&safe=active>

Photo # NH 96801 Trieste hoisted out of water, circa 1958-59



This trip was made in 1960 and **never** Repeated!! The decent took 4 hours and 48 minutes.



- Don Walsh and Jacques Piccard inside *Trieste*

The ***Meteor***, a German ship,
25 months on **Atlantic**
ocean using sonar

- **Sonar- sound navigation ranging**
- **mapped the ocean floor revealing many different depths and features**



<http://www.youtube.com/watch?v=4dftaWQLtPQ&safe=active>



FAU Human powered sub

- http://www.youtube.com/watch?v=BowxagcXpho&safety_mode=true&persist_safety_mode=1&safe=active

<https://www.youtube.com/watch?v=UwVNkfCov1k>

Watch the following clip and
note down the major
contributions in each section.

- http://www.youtube.com/watch?v=aMWJIOyiY8o&safety_mode=true&persist_safety_mode=1&safe=active

The 5 Oceans

- Arctic- smallest, covered in ice
- Pacific- largest, ring of fire
- Indian- warm latitudes, whale sanctuary
- Antarctic- lots of krill and marine life (aka- Southern Ocean)
- Atlantic- growing @ mid-ocean ridge
- Mediterranean Sea- not an ocean but connected to Atlantic. Pollution is a huge problem.

Oceans

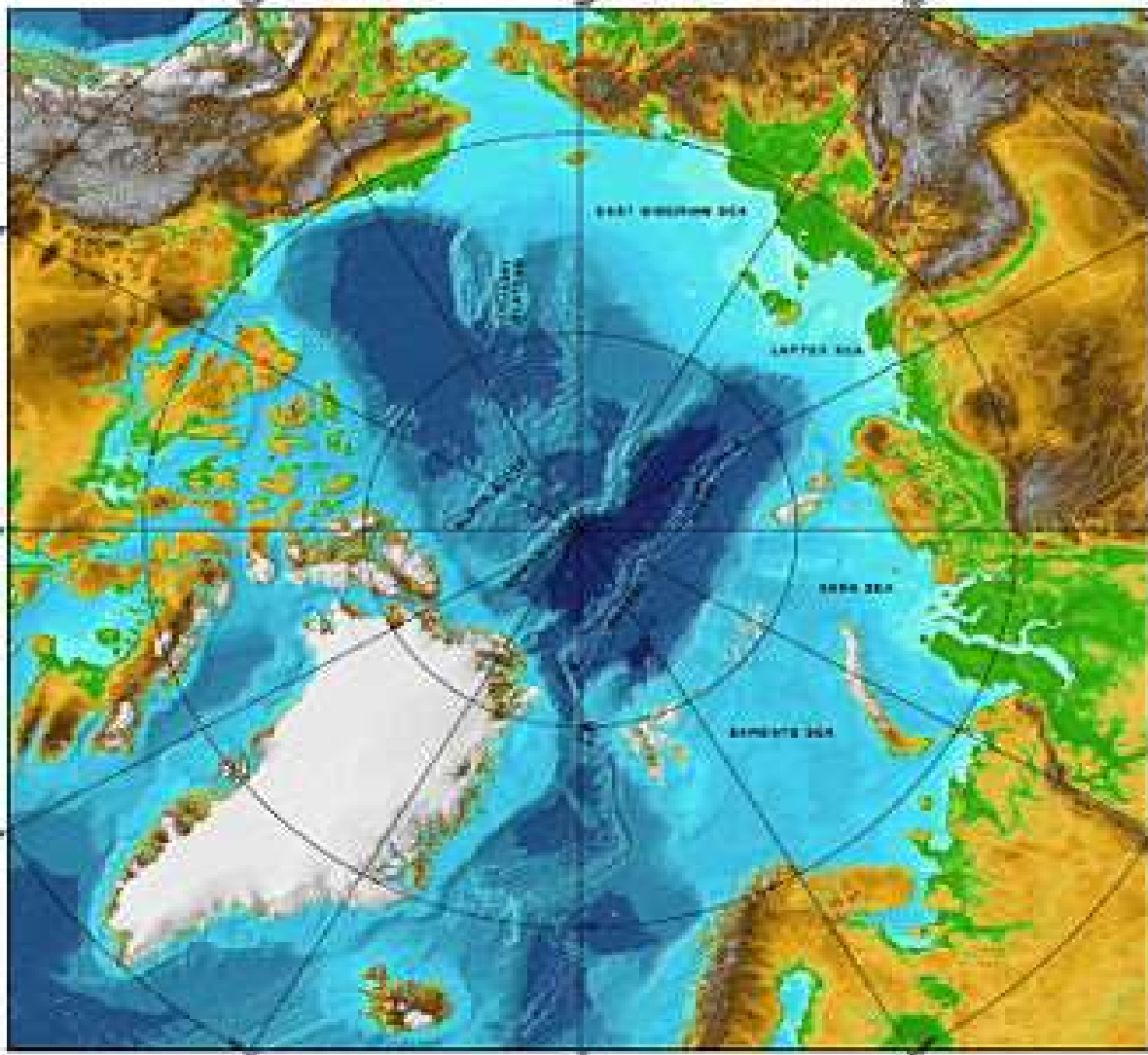
- There is really only ONE ocean!!
- This makes navigating difficult so we subdivide it into several smaller ones.

The 5 Oceans

- Arctic
- Pacific
- Indian
- Antarctic
- Atlantic

Arctic Ocean

- Smallest ocean
- Covered in pack ice
- Attracts migrating animals, like whales



Bathymetry and topographic data



Scale: 1:100,000. Water with 200 m depth is shaded in white. Islands larger than 100 km² are shaded in white. Contours of 1000 m depth are shown in black. Contours of 2000 m depth are shown in grey.



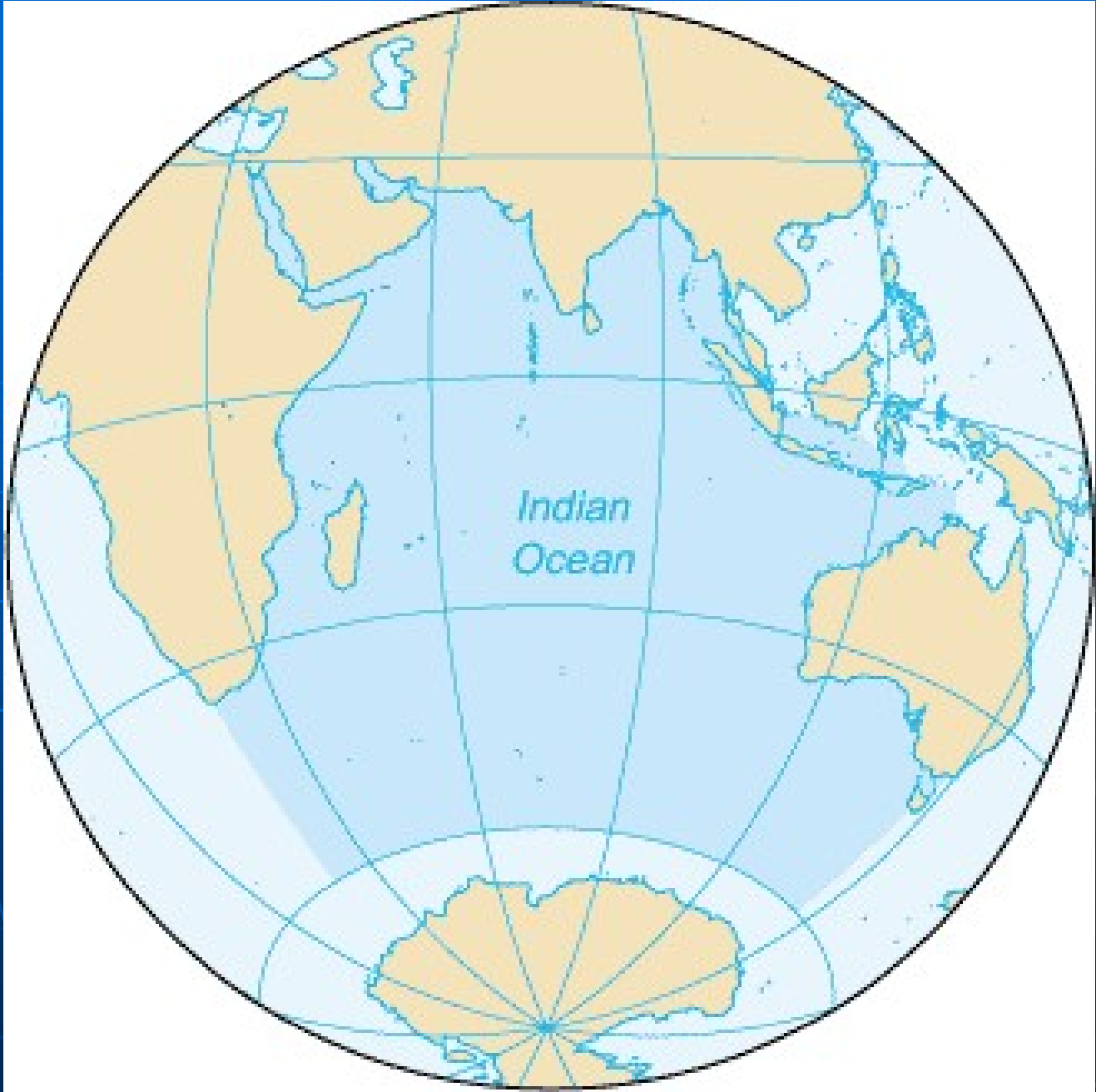
Pacific Ocean

- 1/3 of the globe is covered by this ocean
 - Half of the planet's seawater
- Has the highest mountain – Mauna Kea Volcano (10,200m)
- Has the deepest trench – Mariana's Trench (11,034m)
- Shrinking because of subduction zone causing the "Ring of Fire".
- Nuclear Testing during the 40's and 50's



Indian Ocean

- Warm latitudes
- Tropics and coral reefs
- Subtropics have monsoons (reverse currents)
- Whale sanctuary
- Red Sea



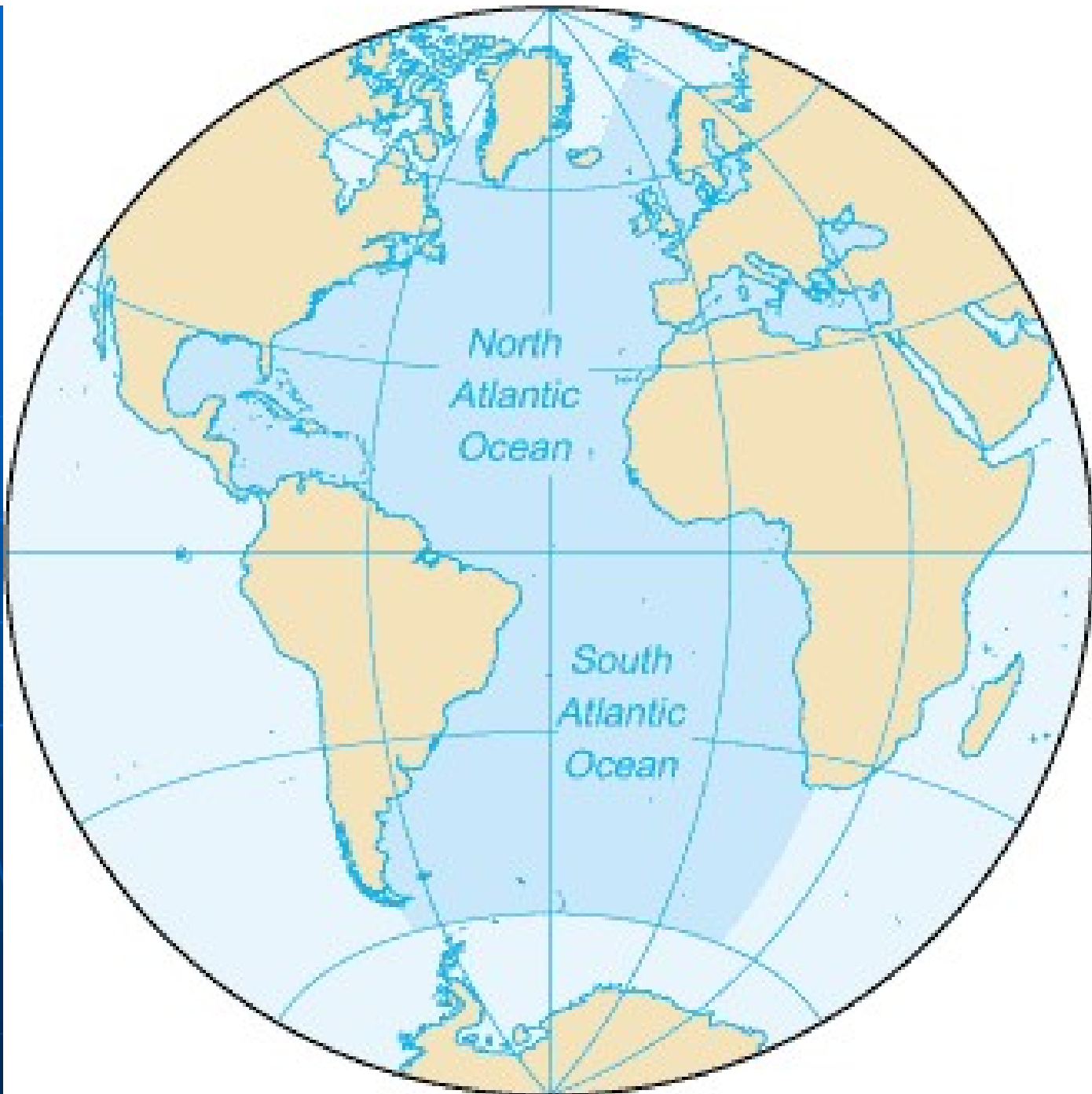
Antarctic Ocean

- Marine life flourishes here
- Krill, plankton
- Cold goes north to balance the tropics



Atlantic Ocean

- Icy northern region, but includes the Caribbean
- North Atlantic Drift Current
 - The Gulf Stream
- Spreading and growing b/c of the Mid-Atlantic Ridge
- Abundant sea life, suitable habitats



Record the following on your map (use colors):

Oceans:

Atlantic

Pacific

Indian

Arctic

Southern

Continents:

North America

South America

Europe

Asia

Africa

Australia

Antarctica

Other Bodies of Water:

Amazon River

Arabian Sea

*Baltic Sea

Bering Sea

Black Sea

Caribbean Sea

Caspian Sea

Gulf of Mexico

Mediterranean Sea

Mississippi River

Nile River

Persian Gulf

Red Sea

Ocean Features:

Mid-Atlantic Ridge

Marianas Trench/Challenger Deep