

# 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/>
- 1<sup>st</sup> 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.



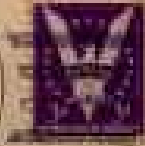
- Cornelis Drebbel- 1620 1<sup>st</sup> submarine

- [http://www.dutchsubmarines.com/specials/special\\_drebbel.htm](http://www.dutchsubmarines.com/specials/special_drebbel.htm)

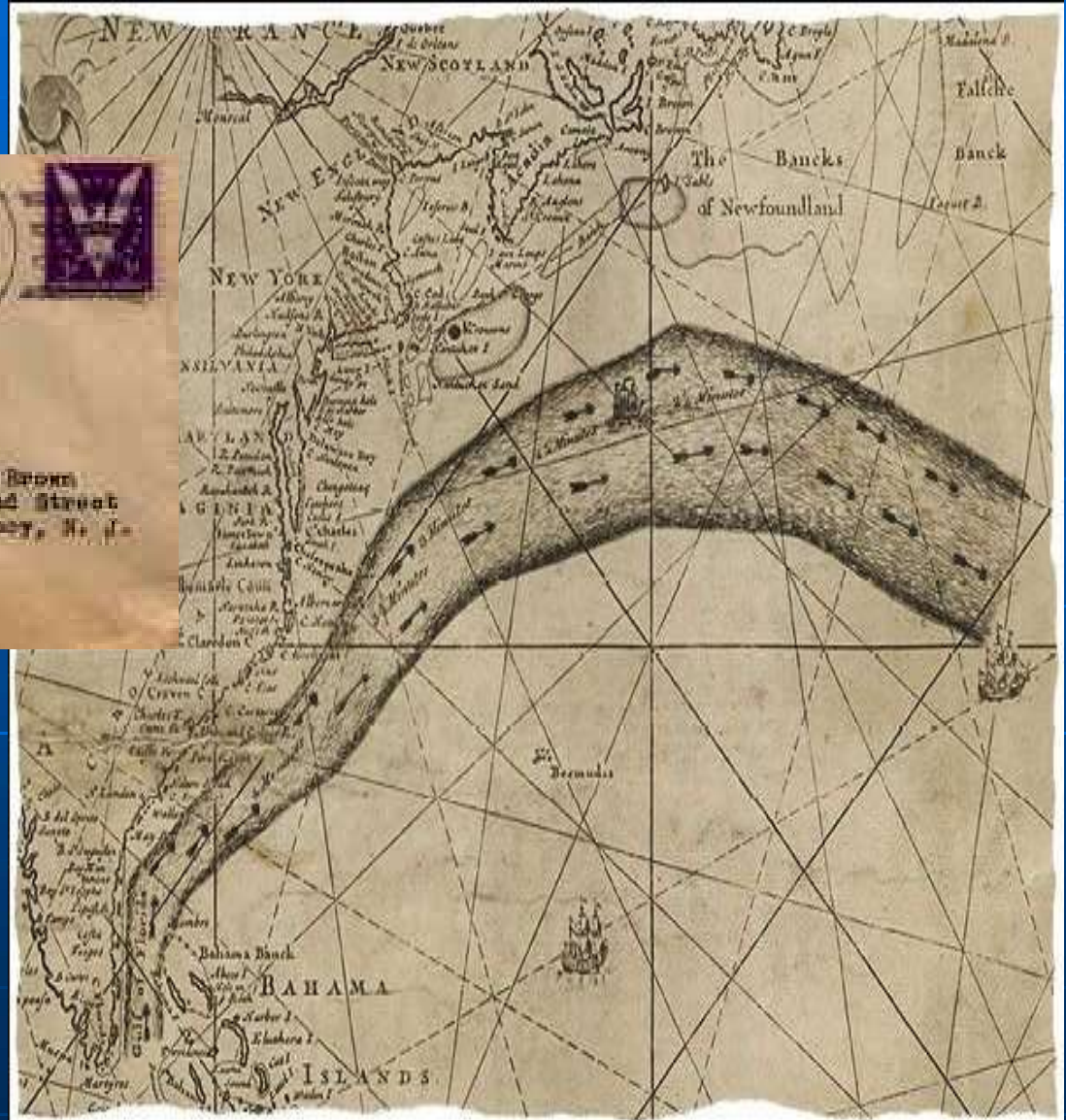
- Benjamin Franklin, US postmaster, wanted to know why it took longer for mail to come from Europe to America than vice versa
  - Later he drew an accurate map of the Gulf Stream



The first submarine was constructed by Cornelius and Oliver of Holland, in the year 1615, from 1 of long pine. It was propelled by 12 men, and submerged to a depth of twelve feet. This occurred in 1615.



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



## Drebbel's 1st Submarine

# Ben Franklin's Gulf Stream- Image 1



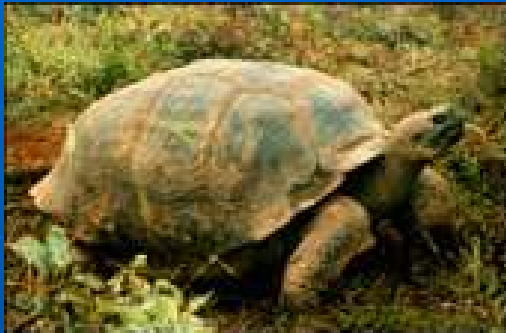
- Matthew Fontaine Maury:  
American Naval Officer
  - “The Father of Oceanography”
  - Studied currents and other physical aspects of the sea
  - 1855 analyzed the logbooks of navy ships and published the first books on oceanography called
    - *The Physical Geography of the Sea*

# 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.







*vandenburghi*



*porteri*



*chatamensis*



*abingdoni*



*hoodensis*



*unknown*

# Galapagos Tortoise

[http://www.youtube.com/watch?v=Qd-1\\_CjgGCQ&safe=active](http://www.youtube.com/watch?v=Qd-1_CjgGCQ&safe=active)



Marine Iguana

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

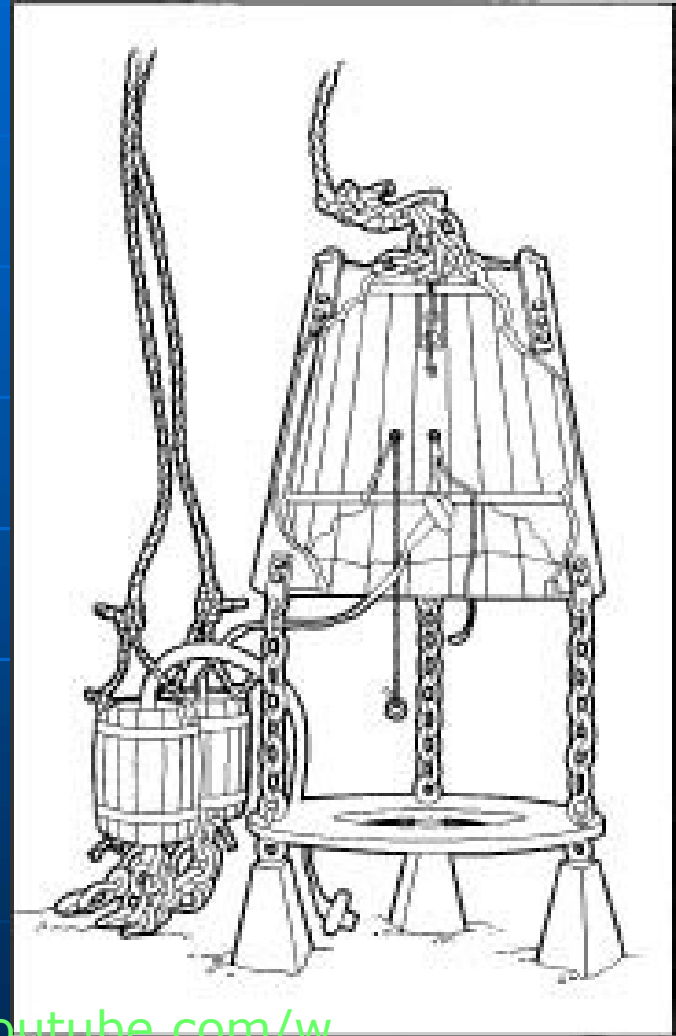
- **HMS *Challenger***- 1873-1876

- 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

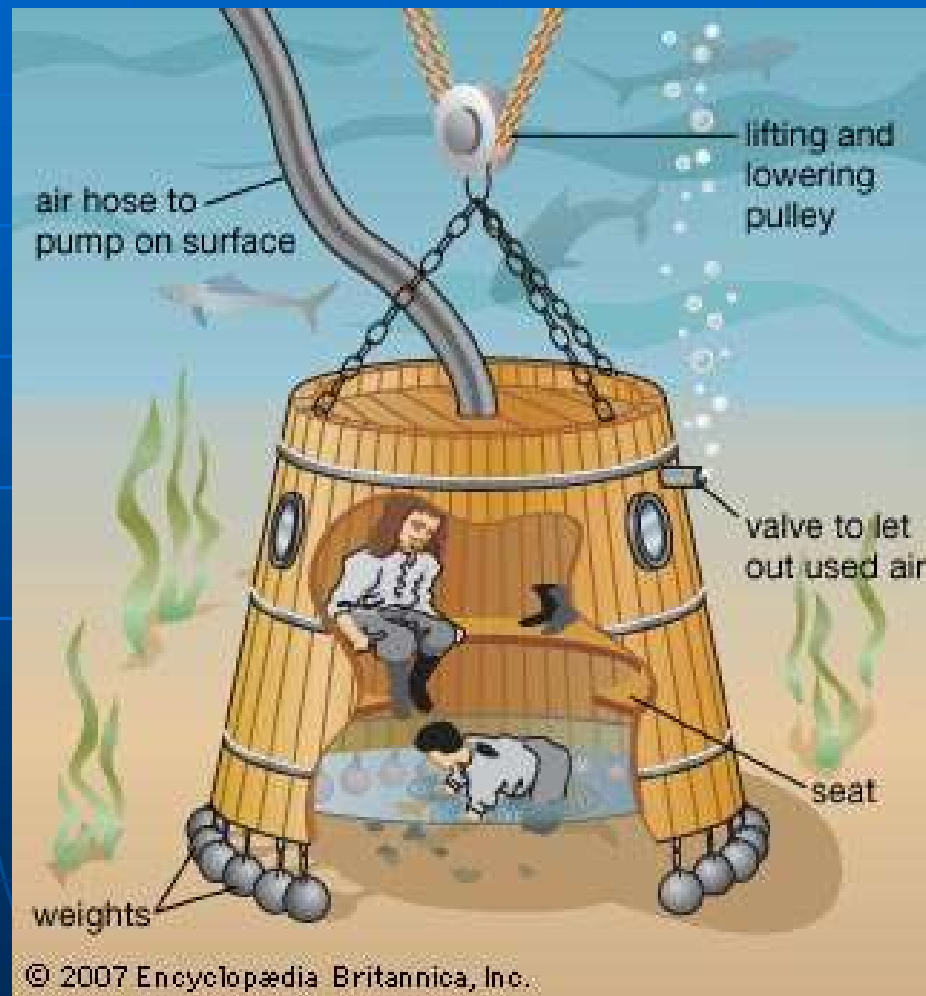
# Exploring the Ocean

- Under world called Inner Space
- 2500 B.C., glass was discovered and the first mask was made
- In the 17<sup>th</sup> 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

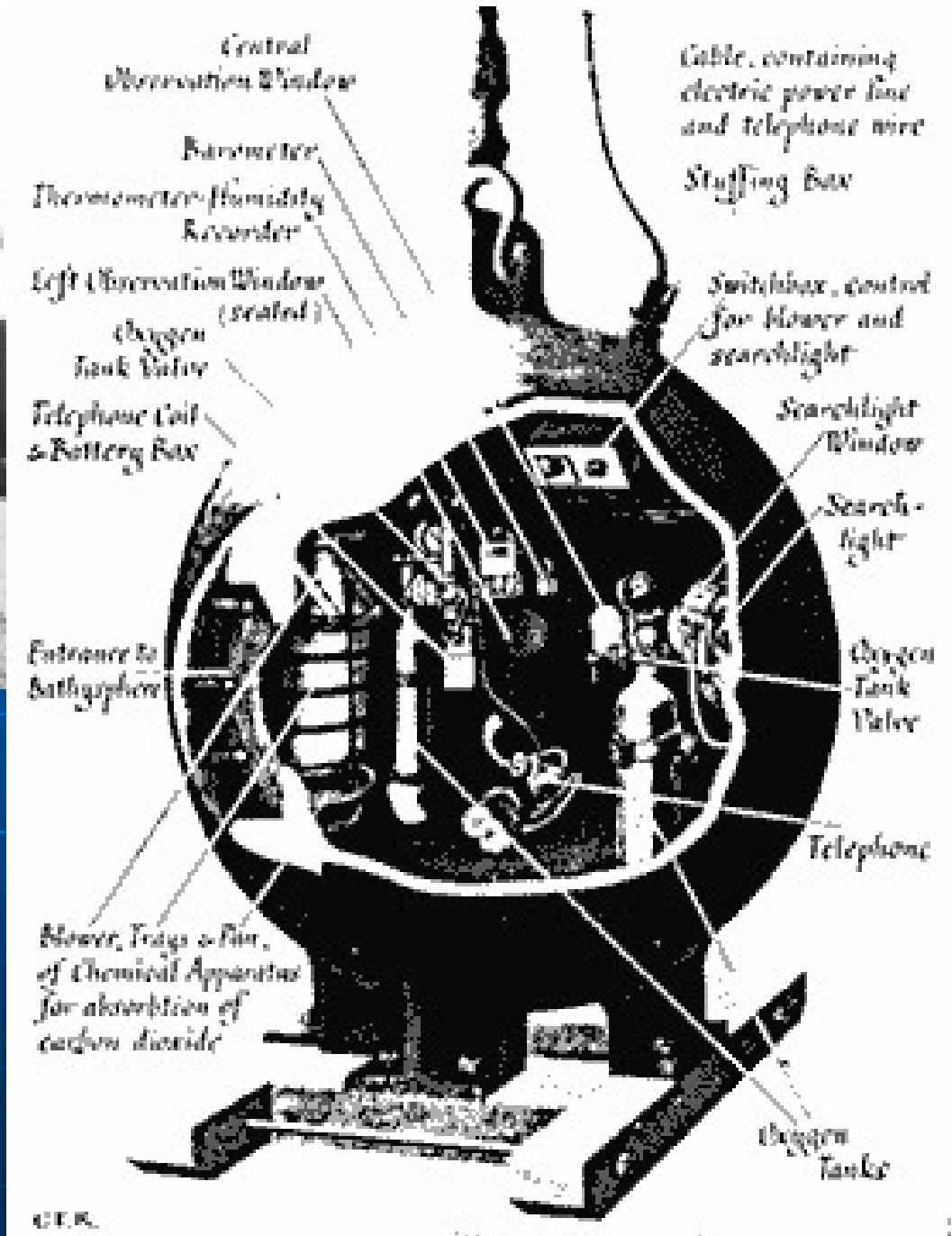
# The Modern Scuba Tank

- 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

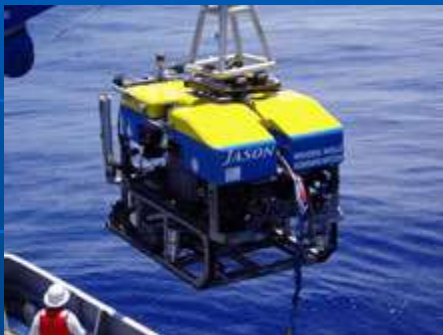
# Diving Vessels

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

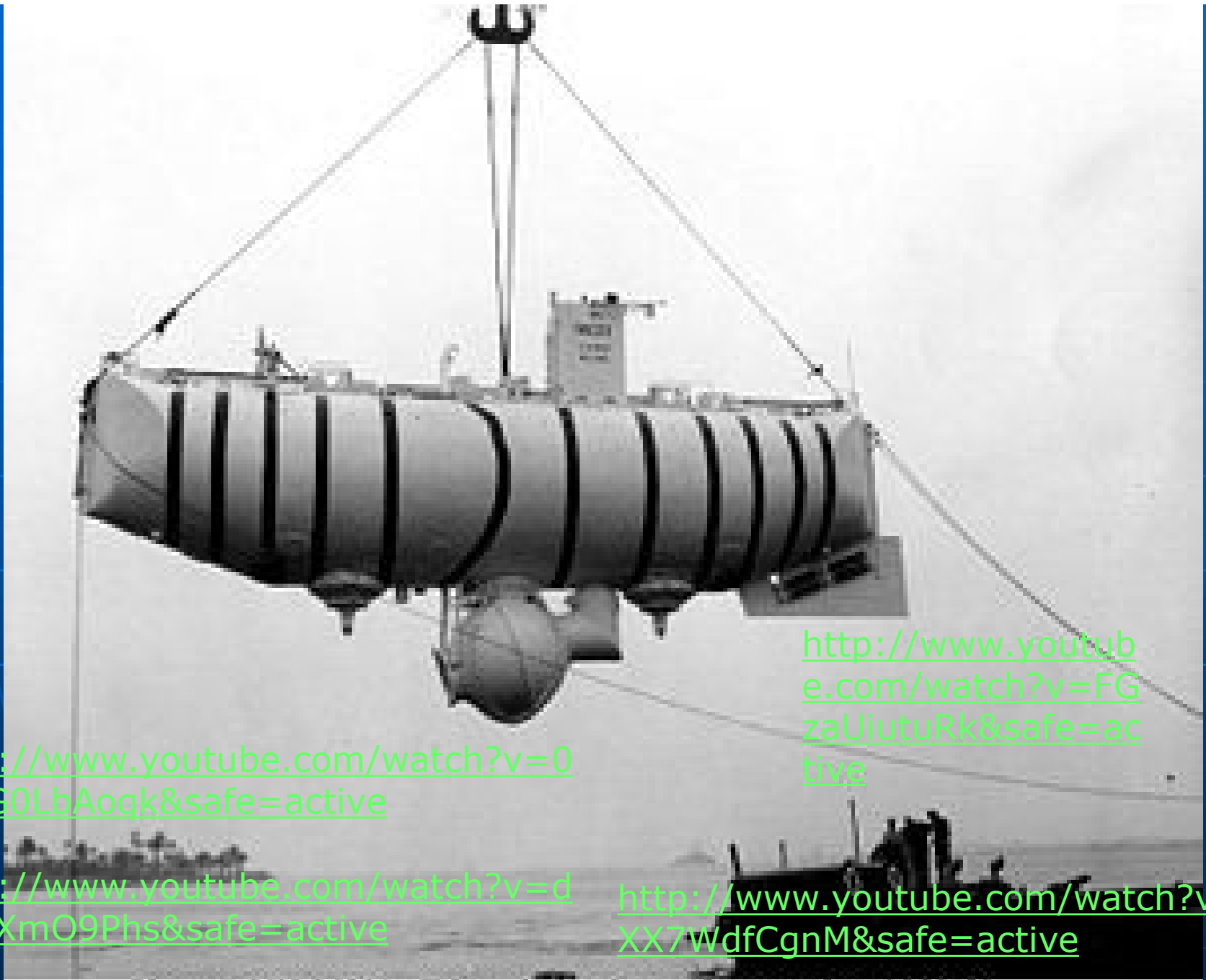


# Buoyancy

- 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>

<http://www.youtube.com/watch?v=dC0hXmO9Phs&safe=active>

<http://www.youtube.com/watch?v=5XX7WdfCgnM&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](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](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.

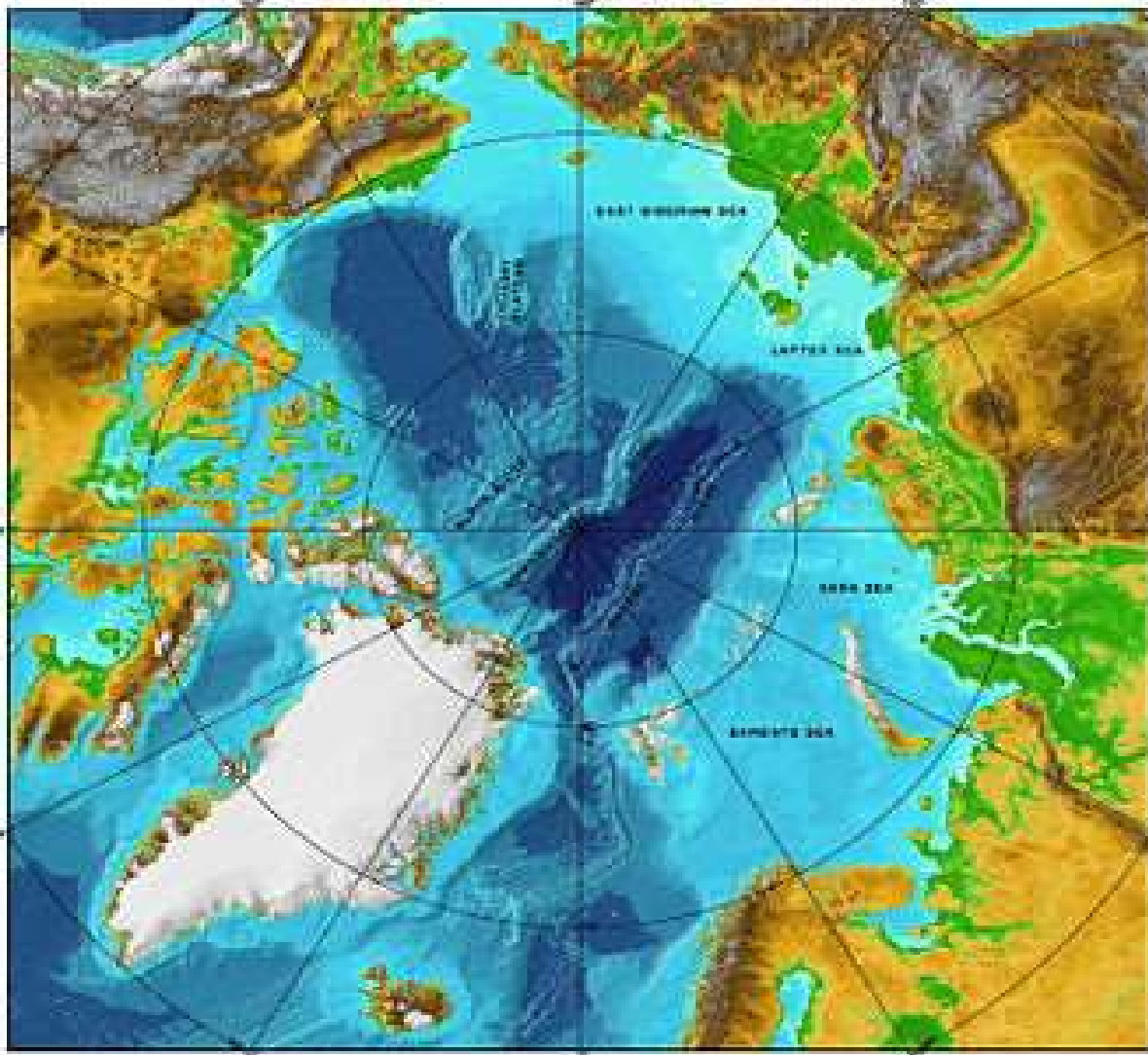
# The 5 Oceans

- Arctic
- Pacific
- Indian
- Antarctic
- Atlantic

# Arctic Ocean

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





Bathymetry and topographic data



SOCC  
 500m boundary  
 1000m boundary  
 2000m boundary

Water with 200m  
 500m boundary  
 1000m boundary

Islands larger than 10,000 sqm plotted in white  
 (minimum 10 sqm) using the same 5-degree  
 parameters as in the rest of the map.



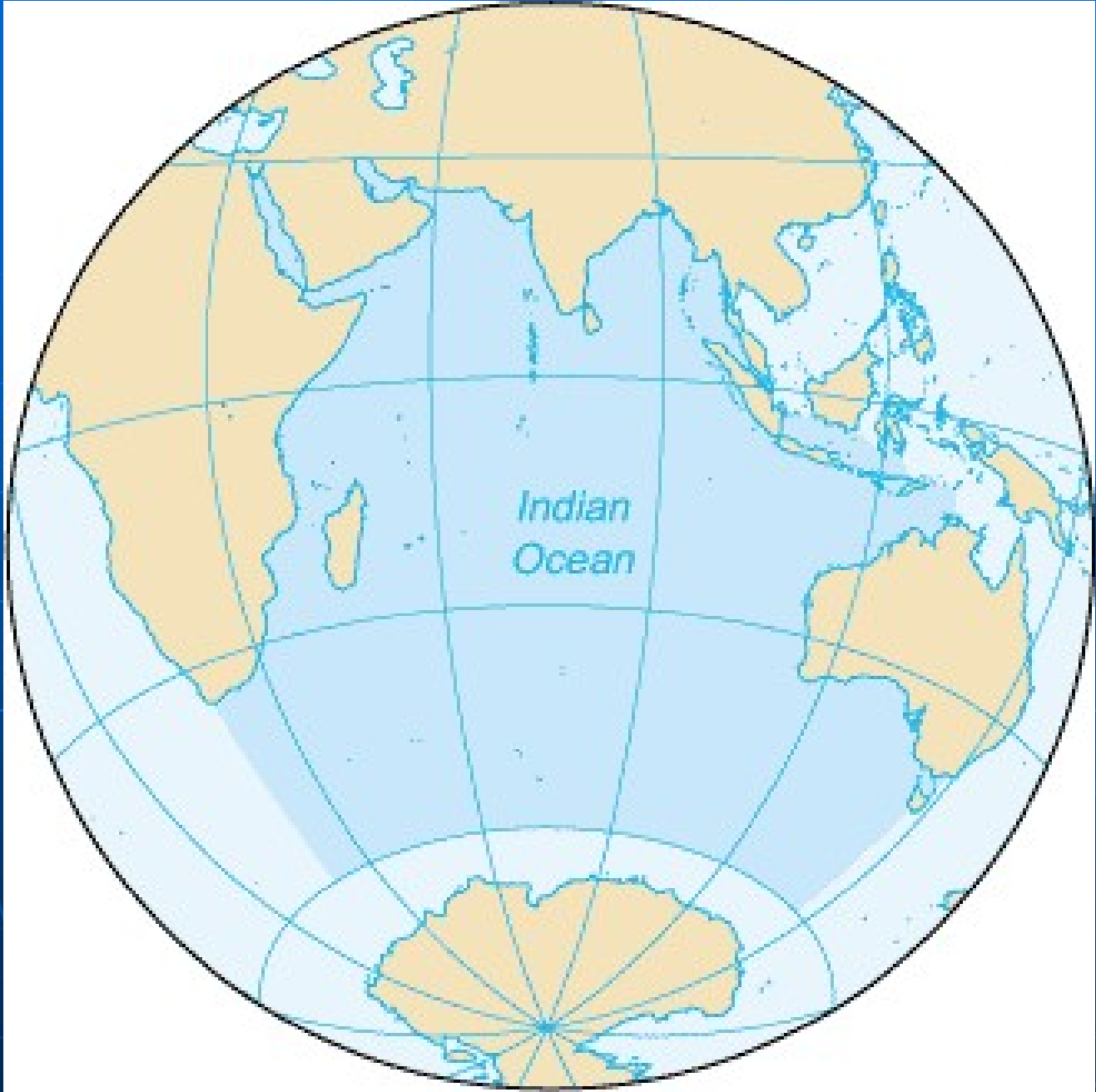
# Pacific Ocean

- 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



