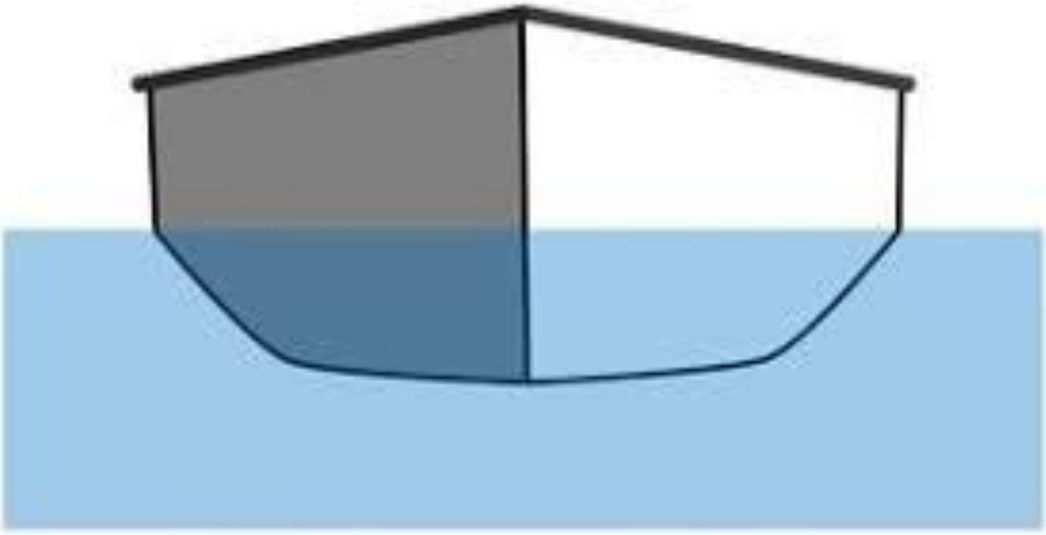
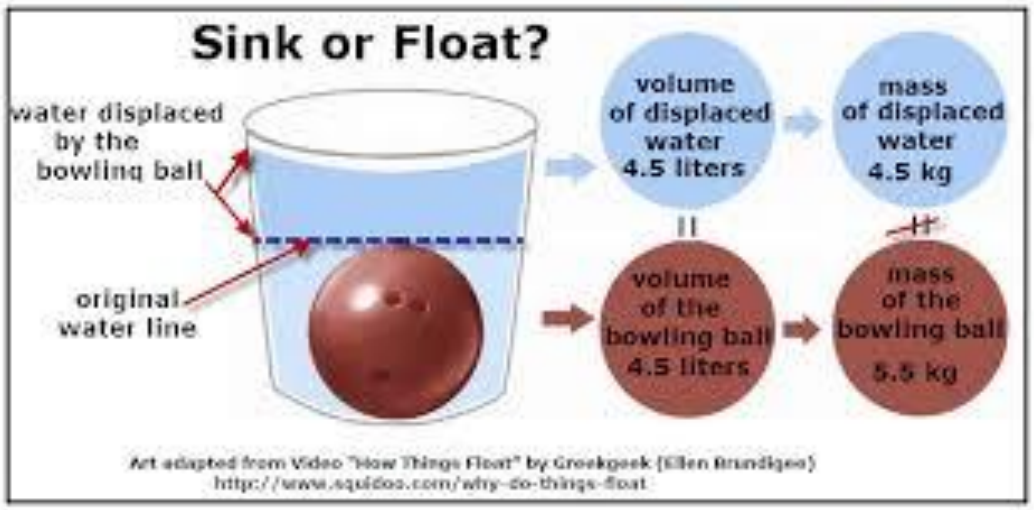
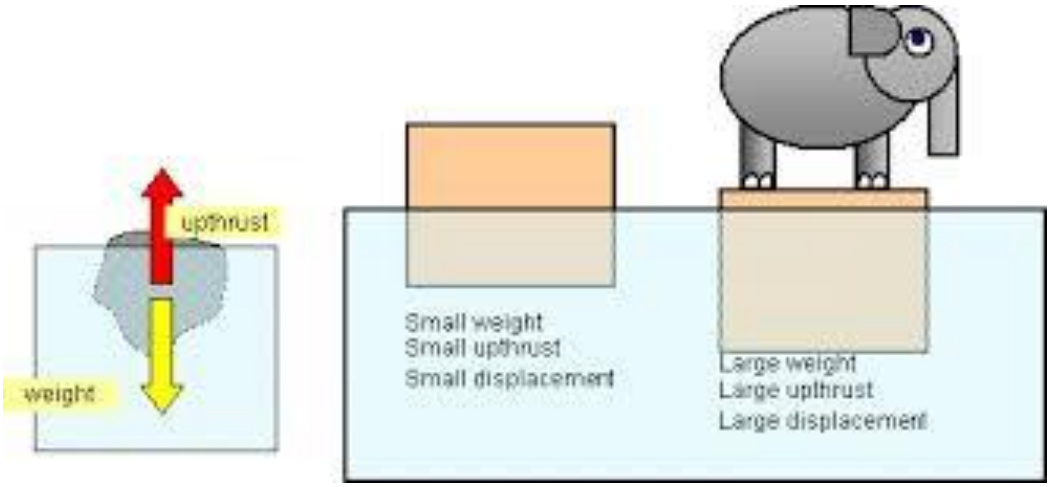
The movement of peoples across expanses of water requires some sort of convenience – a raft or a boat. Swimming is possible for reasonably short distances but not really a form used for migration. Boats and rafts differ in that rafts float because the material they are made of floats without any modification. Boats require displacement.

When any object (boat) displaces a weight of water equal to its own weight, it floats.



Displacement hull





HOW TO GET AROUND THE OCEAN: NAVIGATION
Many people who live near the ocean may venture out onto it on rafts or boats. However, the question of getting around on the water is difficult since there are no “LANDmarks” or “SEAmarks”.

Some peoples rarely go out of the sight of land and so in that case land marks can be used. However open ocean travelling requires something more complicated to get around. The distances involved in navigating the Pacific are far too great to use any kind of land marks. So there has to be another way of getting around. Pacific peoples used several methods for knowing where they were. One of these is astronomical. So here is some astronomy.

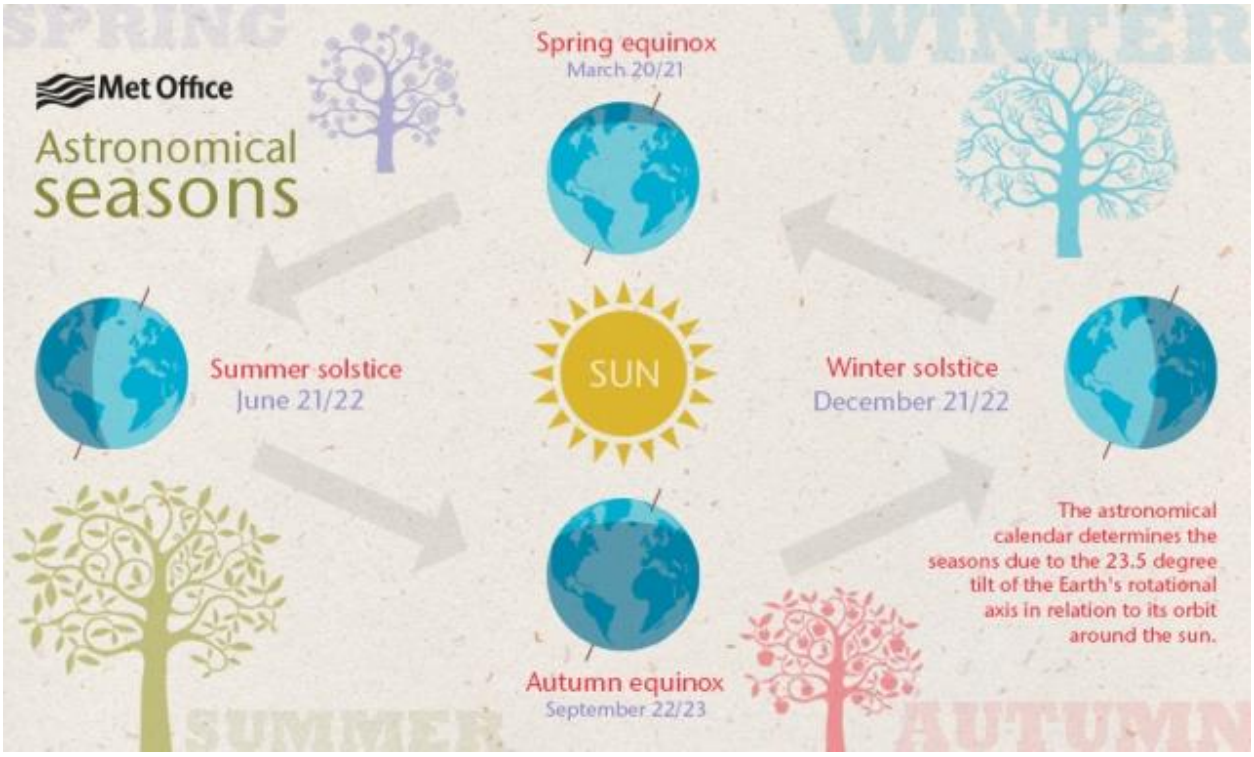
The stars are one possible guide to finding one’s direction. We all know the sun rises in the east and sets in the west, except it doesn’t. First of all the sun APPEARS to rise in the east and set in the west. It is not the sun that is moving, but the earth that is rotating.

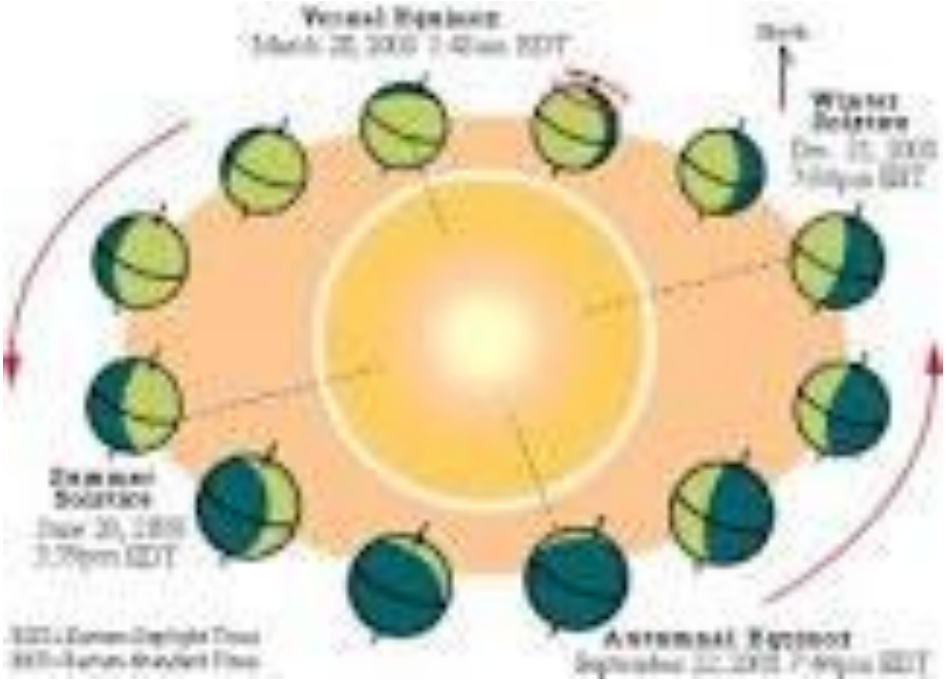
Secondly, the sun does not rise in the east – at least not due east, except twice a year – once on or about March 21 and once on or about Sept. 21. These are the dates of the vernal and autumnal equinoxes. After March 21, the sun “rises” and “sets” further and further north each day until about June 21 (the summer solstice and the longest day of the year). After that is starts to set further and further south each day. One Sept 21 it rises due east and there are 12 hours of daylight and 12 hours of

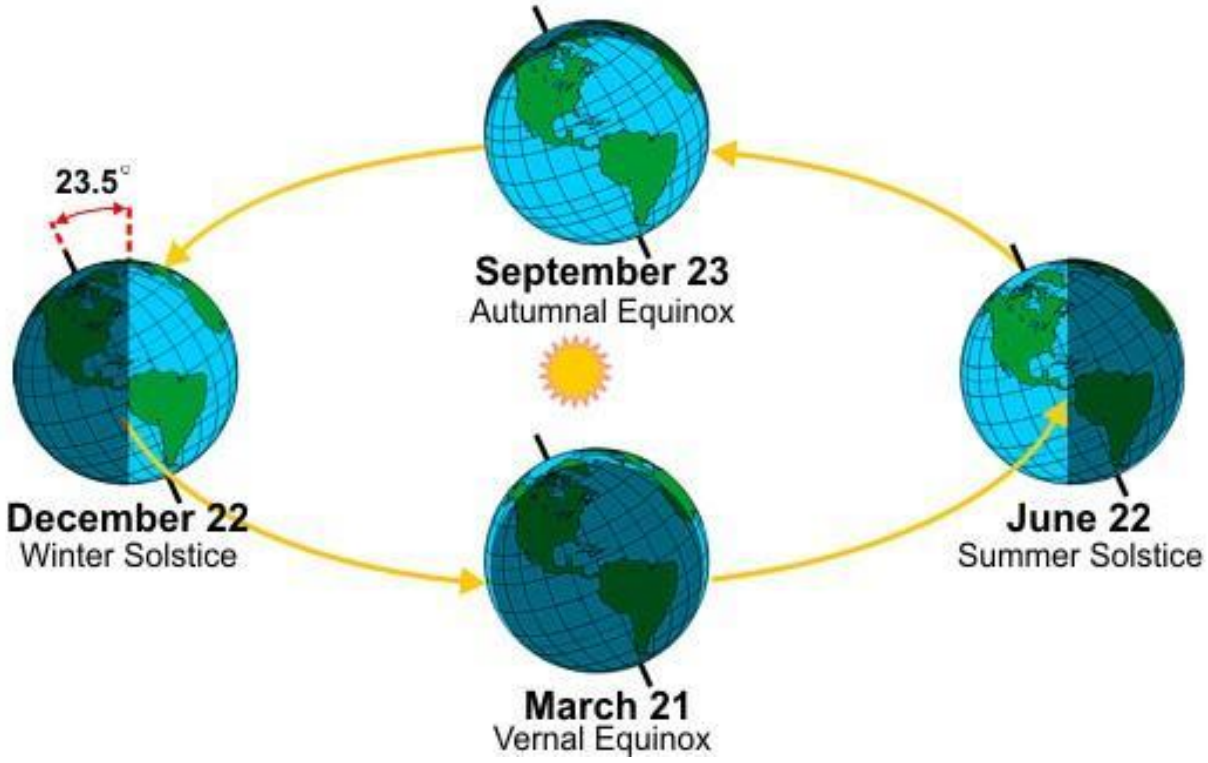
darkness. From the autumnal equinox on, the sun continues to move further south until Dec. 21 – the winter solstice and the shortest day of the year). It appears in roughly the same position for about 3 days and then starts the journey north again.

So while the sun more or less rises in the east and sets in the west, it is only a general direction. Some peoples in the world have 4 directions – NSEW while others have a different 4 - NE, SE, NW, SW. These are the four points that mark the extreme positions of the suns rising and setting. The “Tropic of Cancer” is the furthest point north of the equator where the sun can appear directly overhead. The “Tropic of Capricorn” is the same in the southern hemisphere. The dates on which this happens are the solstices. It happens at the equator on the equinoxes.

The reason for all of this is that the earth is tilted at about 23.5 degrees to the earth’s path around the sun. This is what gives us “seasons”, and explains why the northern hemisphere has winter when the southern hemisphere has summer and vice versa.


SPRING
WINTER
Met Office
Astronomical seasons
Spring equinox
March 20/21
Summer solstice
June 21/22
SUN
Winter solstice
December 21/22
The astronomical calendar determines the seasons due to the 23.5 degree tilt of the Earth's rotational axis in relation to its orbit around the sun.
Autumn equinox
September 22/23
SUMMER
AUTUMN





How the stars appear to rise and set varies with ones LATITUDE

The stars rotate around a “fixed” position which is marked in the sky by the “North Star” called Polaris. At the North Pole, Polaris would be directly overhear. On the equator it would be on the horizon.

So at the North Pole, stars do not rise and set, but circle around the sky. None rise and set.

At the equator ALL stars except Polaris rise and set. Between the two extremes, some rise and set and some do not. Those that do not are called circumpolar stars.

Since the Polaris is directly overhead at the North Pole, and directly on the equator on the equator, then one can tell ones latitude in the northern hemisphere by measuring the number of degrees Polaris is above the horizon.

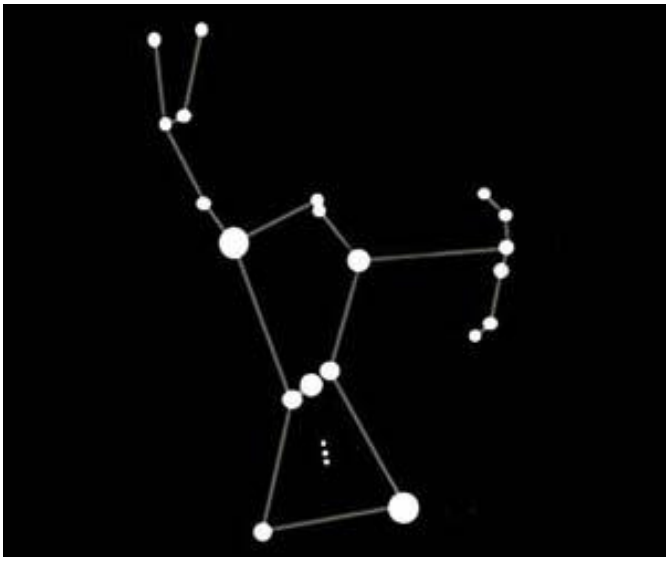
So Latitude is measured in degrees from the equator (0 degrees) to the North Pole (90 degrees North Latitude) or to the South Pole (90 degrees South Latitude). New York is about 40° 45.102'

N latitude. (You must ALWAYS indicate N or S latitude!)

When one travels south of the equator, Polaris disappears below the horizon. There is no nicely placed star over the South Pole the way Polaris is so a different method needs to be used there.

For the Pacific Islanders whose travels take them on either side of the equator a different system was used.

For the West, constellations are figures made by a kind of “connect the dots” approach. Figures are seen like “Orion” or the big dipper (an asterism or a part of a constellation in the case Ursa major or the Greater Bear).



Pacific Island navigation is able to construct “linear” constellations – that is to say a string of stars all of which rise at the same point. So when one of these is over head you would know your latitude!

The Pacific Islanders also “read” currents – the general movement of the water. Between the stars and the currents, they are able to find their way fairly accurately. They also know the positions of certain islands and would be able to recognize them when nearby.

Islands also tend to have clouds over or around them and so seeing specific localized clouds would also be a clue to their position. In some instances, for example at night, the sound of the waves on a beach would indicate there was an island nearby.

The Pacific Islanders made charts showing the currents and the islands and the stars. Some of these are on exhibit in the Peoples of the Pacific Hall at the Museum of Natural History. See if you can find them in the Hall.

HISTORICAL EVENTS LED TO AN AGE OF EXPLORATION

WHICH INVOLVED EUROPEANS SETTING OUT TO FIND NEW TRADING PARTNERS. THESE LED TO THE EUROPEANS DISCOVERING NEW PLACES – BOTH LANDS AND SEAS

In 711, the Moslems had taken over Spain. The Spanish fought them for many years and finally forced the Moslems were driven out Jan 2 1492. This is the same year that Columbus heads out to the New World. A number of explorers travelled to Africa and the "New World" looking for passages to Asia and new trading partners.

From the beginning of the 15th Century, there was a European exploration of the world. Among them were

a. Christopher Columbus (1492) reaches islands in Caribbean
b. Portuguese reach west Pacific (Arabs precede them) and Spanish reach Eastern Pacific
c. Ponce de Leon (Florida 1513);
d. Hernán Cortés (arrived NW 1511 Conquest of Mexico 1591-21)
e. Ferdinand Magellan (1521) first to cross the Pacific
f. Francisco Pizzaro who explored Peru and battle the Inca (1524 and 1526; 1532- 33 conquest of Peru)
g. Fernando De Soto who traveled through the SE US as far as the Mississippi (1539)

Colonies form

a. Roanoke Colony formed and vanishes 1585 (Birthplace of Virginia Dare – first British Child born in NW Becomes the "Lost Colony"
b. Jamestown 1607 (First permanent English settlement)
c. Plymouth 1620

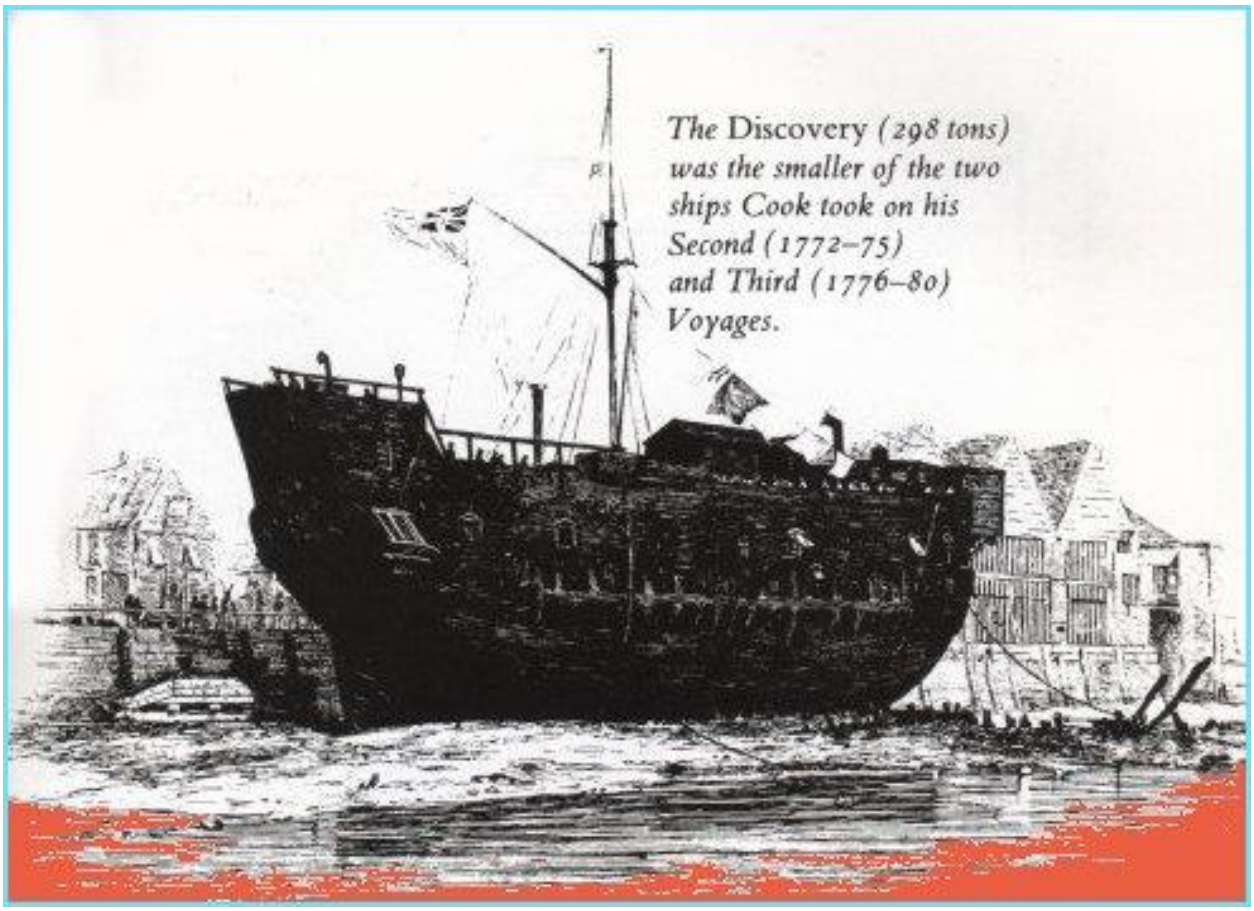
Captain James Cook:
James Cook made three expeditions into the Pacific. The first of the three voyages were 1768-1771

These early expeditions are of course on square rigged ships (mast go across the ship from starboard to port. Crew has to climb in the rigging to haul sails in and so on.

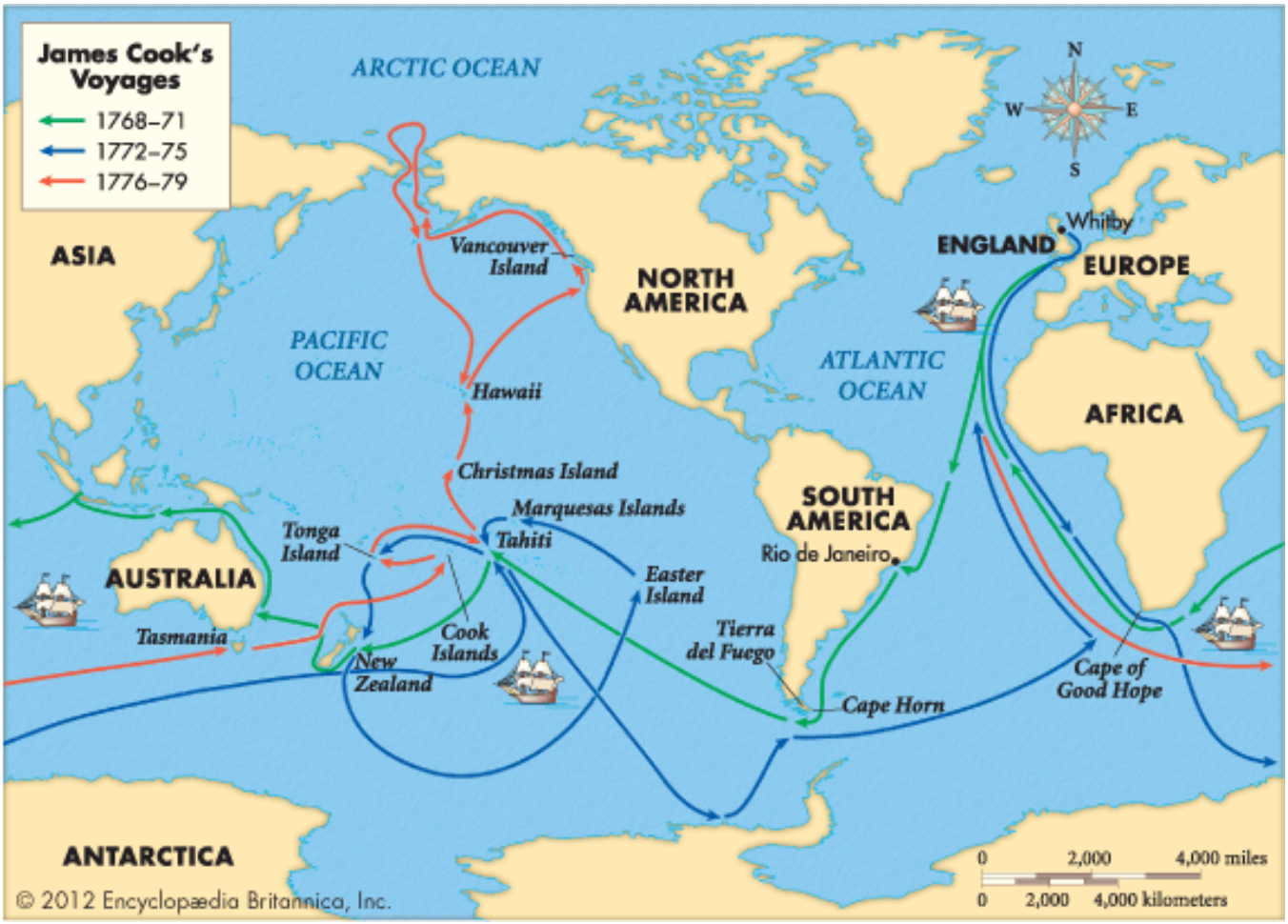
His first ship was the Endeavour, on the second and third voyage his ship was the Resolution. On voyage II he was accompanied by another ship called the Adventure and on the third voyage he was accompanied by the Discovery

The Endeavour (replica)

The Resolution (painting)


The Discovery (298 tons)
was the smaller of the two
ships Cook took on his
Second (1772–75)
and Third (1776–80)
Voyages.

Discovery



CAPT. COOK'S VOYAGES

Captain James Cook set out to locate and map the Islands of the pacific. He made three voyages. On the first his locations on the map were quite good, but on the second voyage they were better. This accuracy was caused by an invention called the chronometer which aided in navigation.

He is known as the first person to circumnavigate the globe in 1771 during which time he made maps of the East Coast of Australia and of New Zealand. He watched diet carefully for his crew and eliminated scurvy a disease caused by a deficiency of vitamin C, characterized by swollen bleeding gums and the opening of previously healed wounds, which particularly affected poorly nourished sailors until the end of the 18th century.

He tried to find a Northwest passage from the Atlantic to the Pacific and found there was none (at the time). He had gotten furs in this area.

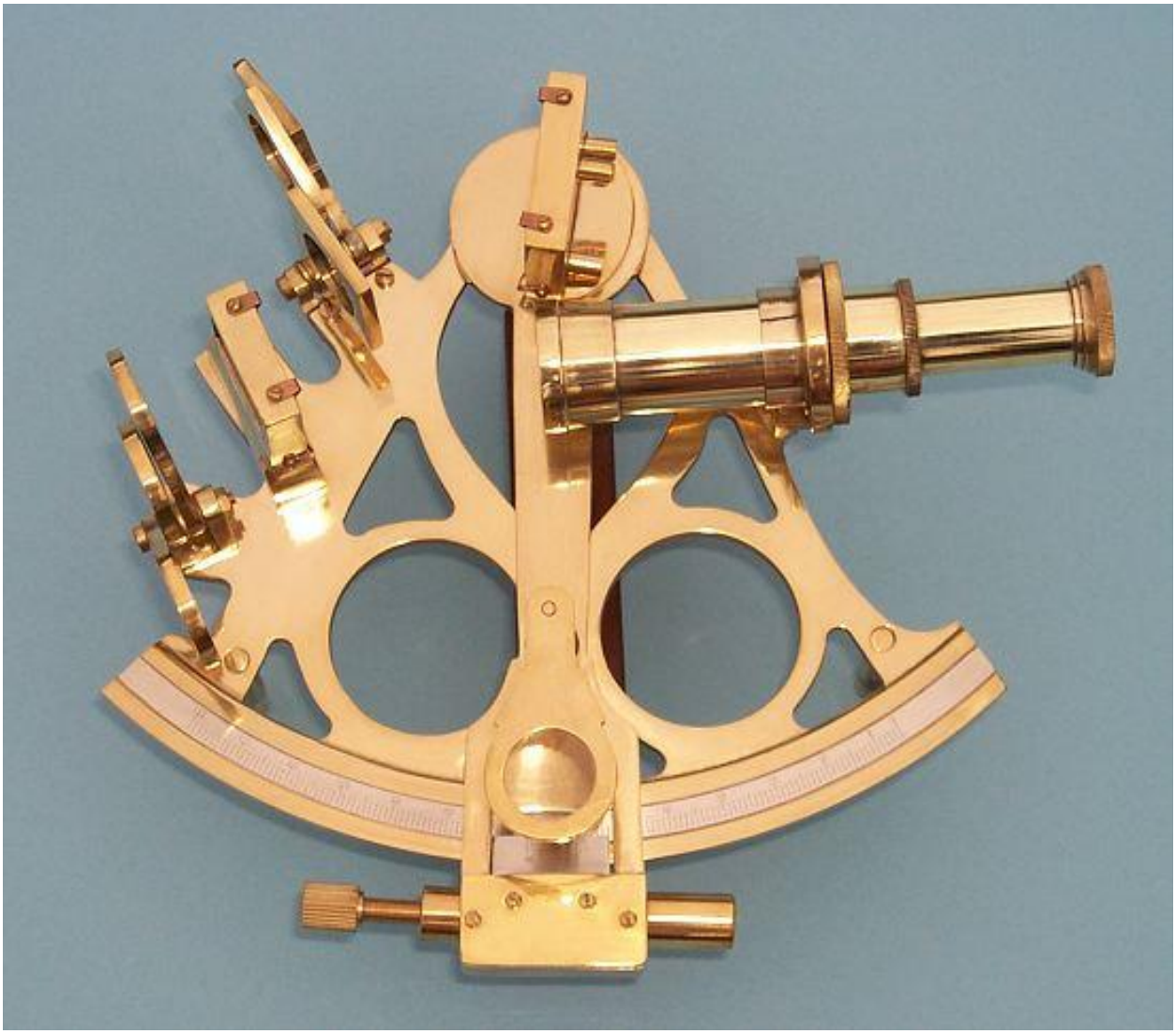
He returned to the Hawaiian Islands in the winter of 1778–1779 and was killed in Kealakekua Bay on Valentine's Day 1779 His sailors found that the furs brought huge amounts of money in China and nearly mutinied to go back to Alaska and get more. This is the start of the fur trade.

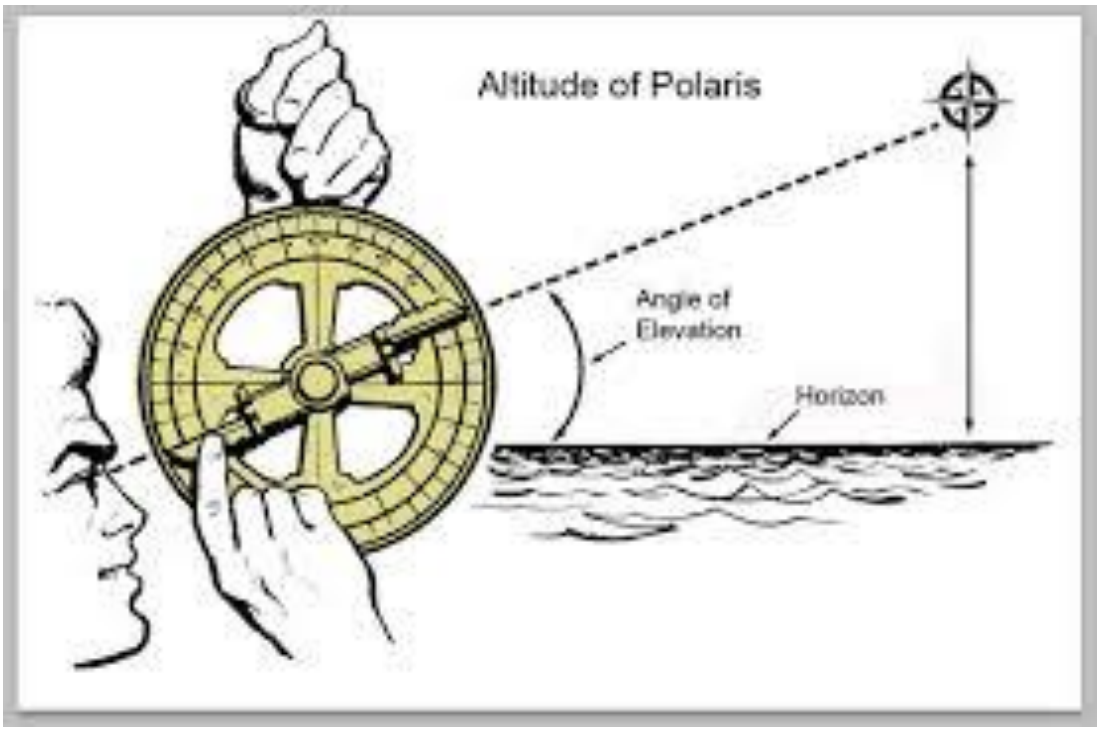
So what was the role of the chronometer in navigation?

LATITUDE AND LONGITUDE

One of the critical problems in ocean travel is the absence of landmarks. The locating of oneself on the ocean is done by locating oneself where 2 lines cross one another. The lines running from north to south are called longitude lines and the ones circling the globe parallel to the equator are called latitude lines. The finding of both lines is done in the past in the west largely astronomically reckoned. There is a form of navigation called dead reckoning which is actually derived from deduced reckoning, in which the navigator estimates t he speed and direction of a vessel and "deduces" where it is.

Finding one's latitude is fairly simple, but requires some knowledge of the stars at night. The earth rotates once on its axis roughly every 24 hours. During the time when the stars are visible, they can be used to determined ones latitude fairly simply. The earth's rotation axis points to the star "Polaris" sometimes called "The Pole Star". If one were standing directly at the North Pole it would be directly overhead at 90 degrees above the horizon. As one travels further south, the pole star would appear to leave its position overhead and finally rest on the horizon - or 0 degrees above the horizon when the observer was on the equator. So one's latitude can be told by measuring how many degrees above the equator the North Star appears on a sextant





and that would be one’s latitude. This works in the northern

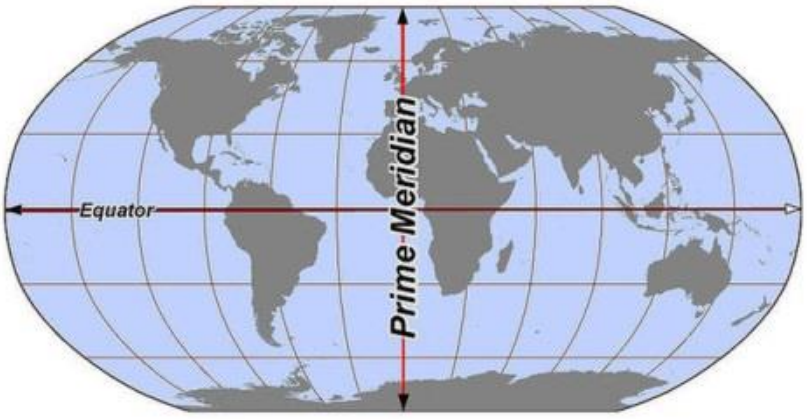
hemisphere. In the southern hemisphere the same principle applies but with a different marker.

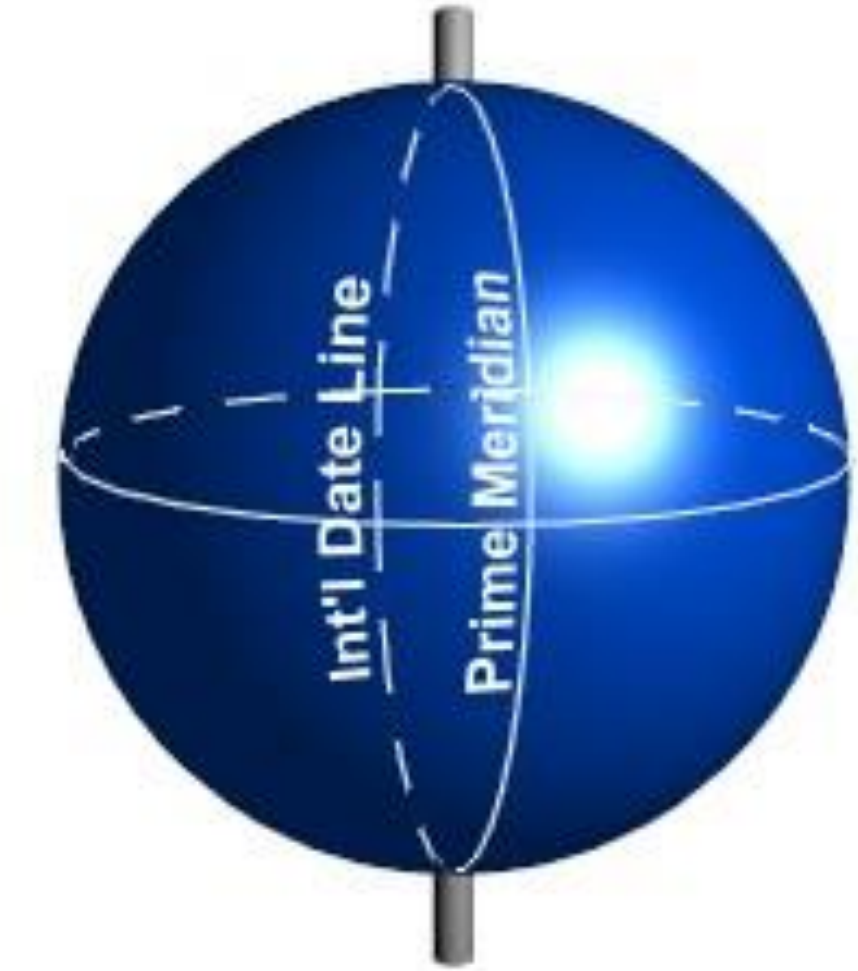
Finding one's longitude is a bit trickier.
The North Pole is an easy point of identification for north. It is the point around which the world rotates. But how does one discover east and west?

Here is a problem. Which of the United States is furthest north? Which is furthest east? Which furthest west? Remember you can go from NY to California by travelling either east or west. One just takes longer!

North? Alaska
South? Hawaii
West? Alaska
East? Alaska

Alaska can be the furthest in two directions because we have to define a starting point from which east and west are measured. That point is recognized as the Greenwich Prime meridian which is the point of the Greenwich observatory in London.





Anything east of that line is considered to be “east longitude” anything west of it is “west longitude”. So the highest number for any place longitudinally is 180 degrees. After that, you are in the other “direction”. If you travel 180 east or west you will meet on the other side of the globe which is roughly the position of the International Date Line. So, since Alaska crosses the International Date Line, it is on both sides – therefore it is the furthest east as well as the furthest west. (remember you always have to mark with your meridian is EAST or WEST)