LECTURES

LECTURE ONE

What has been the impact of the Ocean on people? Many varied responses – some emotional, some practical and scientific. WHAT DO YOU THINK OF WHEN YOU THINK OF THE OCEAN? You can see some of this on the slide show as well

What do you think of, when you look at the shore line?

Do you think of a beach like Coney Island?

Do you think of a nice sandy beach?

Malibu beach

Or do you think of this?

Bali Beach Polluted

This is a major problem for today’s shorelines. There is a tremendous amount of garbage piling up in both the water itself and then washing up on beaches where there are people already littering.

The shore is not just a problem in terms of people and refuse, but it also a dangerous area when the ocean can come up on the land in very dangerous ways – storm surges and tsunami can be very problematical to coastal dwellers as people along the Gulf and Atlantic Coasts have known.

The coastline also has rocky shores that can cause serious damage to ships

What about the open ocean? Do you think of it as nice and calm and blue with the sun shining and getting a nice tan (leading to skin cancer?)

Do you think of it at sun set or sun rise looking very beautiful?

Or do you think of it in a storm, with huge waves swamping ships?

What life is in the ocean? There are big scary things like sharks (who are less dangerous than taking selfies. More people are killed each year taking selfies than are killed by sharks!)

There are small things that are almost invisible like jelly fish, with tentacles that have nematocysts that can sting and kill. Some jellyfish can kill a person in less than a minute

People all over the world who live near water develop methods of getting around on it. This replica of the Mayflower, called the Mayflower II is berthed in Plymouth, Mass.

It crossed the Atlantic in 1957 and then travelled up and down the east coast of the US. This is a “tall ship”. There are many kinds which are determined by the way the ship is rigged and

how the sails are set. A square rigged ship like this has sails which go across the ship. The last sail on this vessel is a “fore and aft” rigged sail which runs along the length of the ship. This particular vessel is called a barque.

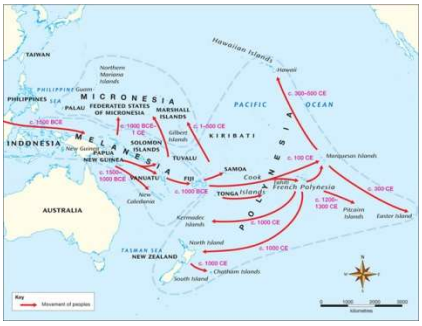
Other people have “outrigger canoes” and “kayaks” and many other forms of water going vessels.

This picture shows Japanese boats involved in whaling back in samurai times.

From boats carry one person, to ships that carry thousands like this huge cruise ship, there is enormous variation in size and style of the vessel.

Ships are used for transporting goods of all kinds and some of them are enormous as well.

Ships are used for moving people and cargo around and have allowed for migrations of people to new lands. This has happened in many parts of the world, but the peopling of the Pacific Islands is one of the wonders of navigation.



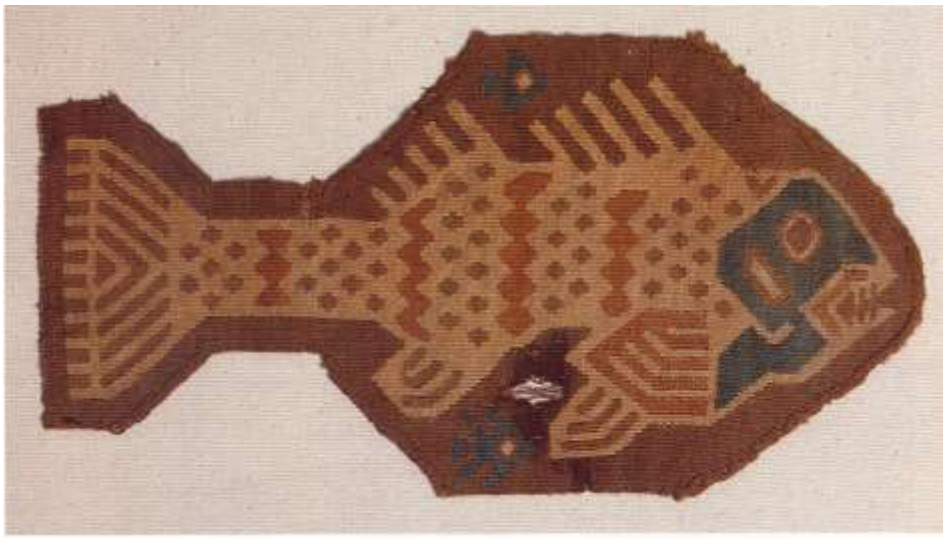
People are affected in many ways by the sea. People are moved by it emotionally and this often manifests itself in art.

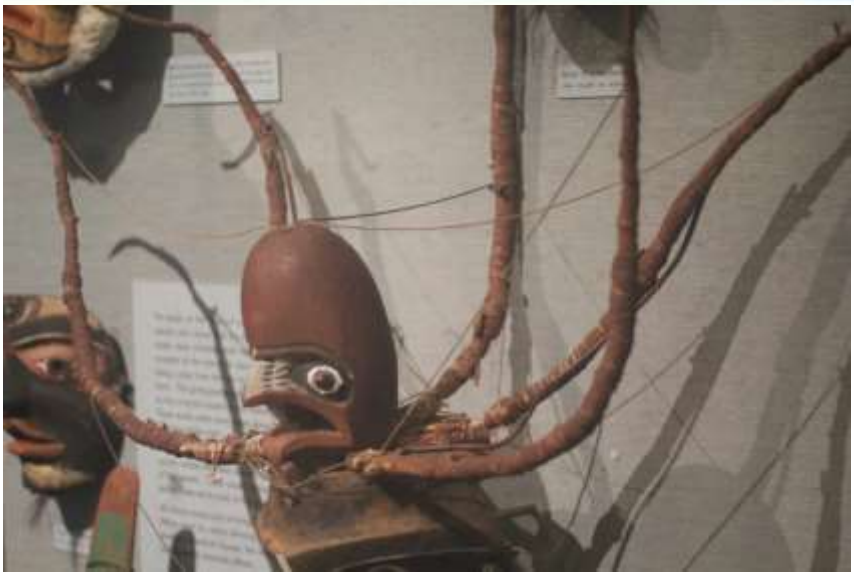
1. Artistic associated often with emotional responses.
    a. Painting

This painting of a great wave in Tokyo bay shows a wave towering over Mt. Fuji.

    b. Three dimensional arts (Sculpture etc.)

These are some material representations of marine life: an octopus mask from the NW Coast of the Americas, pottery and textiles designs from Peru and some sculpture in the US.

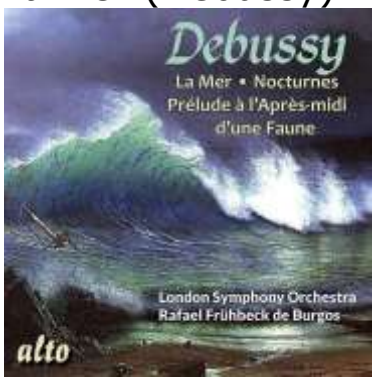




In addition to these, sea farers often have time on their hands and in the old days when rope work was considered much more crucial (see the ship rigging on tall ships), art forms around rope work developed. Some etching, called scrimshaw, was made on sperm whale teeth and other bits of ivory. Sailors also made clever "ships in bottles"

c. Music
    i. Sailor songs "sea chanties"
        1. "Blow the Man Down"
        2. "What Shall We do with the Drunken Sailor?"
    ii. Pop music
        1. "Ebb tide"
        2. "Shrimp boats are a-comin'"

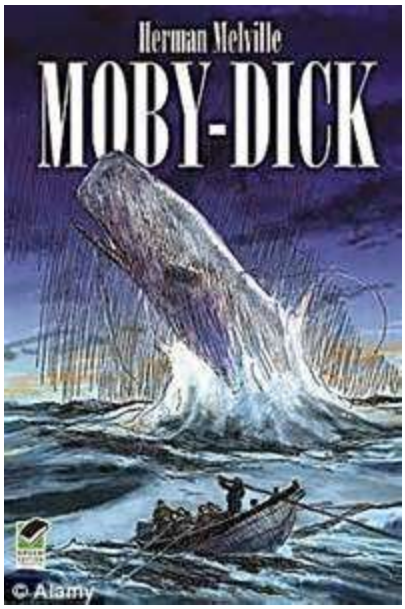
    iii. Classical music
        1. *La Mer* (Debussy)



        2. *Peter Grimes* (Britten)
        3. *Der fliegende Holländer* (Wagner)

d. Designs
    i. Designs can be found in many places: textiles, pottery and so on

e. Literature
    i. Novels
        1. Moby Dick



2. Two Years before the Mast

ii. Poems

1. Sea Fever (Masefield)

2. The Rime of the Ancient Mariner (Coleridge)
3. Full Fathom Five (Shakespeare)

f. Films
    i. Documentary
        1. Blue Planet
        2. Man of Aran
        3. Victory at Sea

2. **Recreational and Economic**

a. The "Blue Economy" is a term covering the overall economic contribution of the oceans and coasts to the national economy. It also advocates the need to address how to keep these national assets functioning. Many people are looking toward innovative ways to examine the critical ocean and coastal resource management issues. Some research demonstrates that ocean and coastal resources are very valuable, and that a healthy ocean with a well-managed coastline will help with a strong economy. Some researchers have data that show that in 2014, the coastal economy contributed 83.7% of the total U.S. GDP and 81.5% of total U.S. employment. Current problems with the environment which are leading to rising sea levels and increasingly powerful and unpredictable storms are leading to the degradation of many critical natural resources such as coastal wetlands. This threatens to significantly damage much of the aspects of the economy the nation has historically relied on.

b. Activities on the beaches and other kinds of shorelines lead to multimillion dollar businesses. They involve things like pleasure boating including jet skiing, water

skiing, recreational fishing, cruise ships, whale watching.

c. One organization reports that in 2010, the ocean economy employed about 2.8 million people and produced $258 billion worth of goods and services. But, according to NOEP (National Ocean Economics Program), an additional 2.6 million jobs and $375 billion were indirectly associated with or induced by ocean industries. Taking this multiplier effect into account, NOEP says that the ocean economy contributes roughly 4.4 percent of total U.S. GDP (Gross Domestic Product). That's not huge, but it is more than America's creative industries (recently estimated to contribute 3.2 percent of U.S. Gross Domestic Product) or agriculture.

d. The two most significant aspects deal with mineral extraction and the tourism & recreation sectors. The "minerals" sector includes offshore drilling and exploration of oil and natural gas. This business is thriving. Going to the seashore for vacations impacts another number of industries (hotels, food, etc.) It is held that nearly three out of every four ocean economy jobs are in tourism & recreation, but 65 percent of the ocean economy's GDP comes from other sectors. The workers in the minerals sector, who account for only 5 percent of ocean-related employment, contribute over six times that to the total ocean-related GDP.

3. **Food and Transportation**

a. For centuries, it was thought that the ocean could supply an inexhaustible supply of food. We know this is not true. Human populations have grown at a frightening rate and we may soon approach 10 billion.

The use of fertilizers on the land has proved dangerous in some ways and the collapse of fishing industries does not bode well. This will require that we produce ever greater amounts of food from both the land and ocean. The development of aquaponics and aquaculture (the equivalent of agriculture on the land) is one possibility.

b. The movement of goods and people across the oceans is another important aspect of businesses involved with the ocean. While general transportation by passenger ship is relatively rare for long trips, cruise ships have taken over moving people for multi day tours around various islands and countries.

4. **Law Enforcement**

a. The seas constituted a *nullus res* something belonging to no one, however many laws have been promulgated relative to the ocean. Some of these have to do with "claiming" a part of the sea – like exclusive economic zones. As a result of a United Nations Convention on the Law of the Sea (1973-1982) and came into force in 1994 one year after Guyana became the 60th nation to sign it. It mad many changes including extending what had been a 3 mile limit out to 200 miles which gives countries. This overruled the old Freedom of the Seas ideas in this the earlier times. Nations now wanted control of local waters relative mineral resources, to protect fish stocks, to deal with pollution and so on. The United States Coast Guard has 4 basic missions (a) military (b) law enforcement (c) marine safety and (d) environmental protection. The many laws that have been passed from boating while intoxicated to the Marine Mammal Act and the like are often enforced by the USCG.

b. A number of government agencies are also involved. The department of fisheries, the Environmental Protection Agency are just a few.

c. The armed forces are also involved with the oceans, perhaps none more than the Coast Guard, which deals with much law enforcement on the ocean including illegal alien and drug interdictions, piracy, marine safety and environmental protection.

Another aspect of law enforcement that has returned with something of a vengeance is piracy. Not the kind with Johnny Depp where a bunch of people are going around trying to kill dead pirates?!?!?!? Or stealing from the internet, but piracy on the high seas

5. **Scientific**

a. Science is in some ways an "artifact" of the enlightenment. It is hard to say when "science" began since a definition if science is difficult. Early Greek and Roman "naturalists" may be seen for example, as scientists, but not in the modern sense of the word.

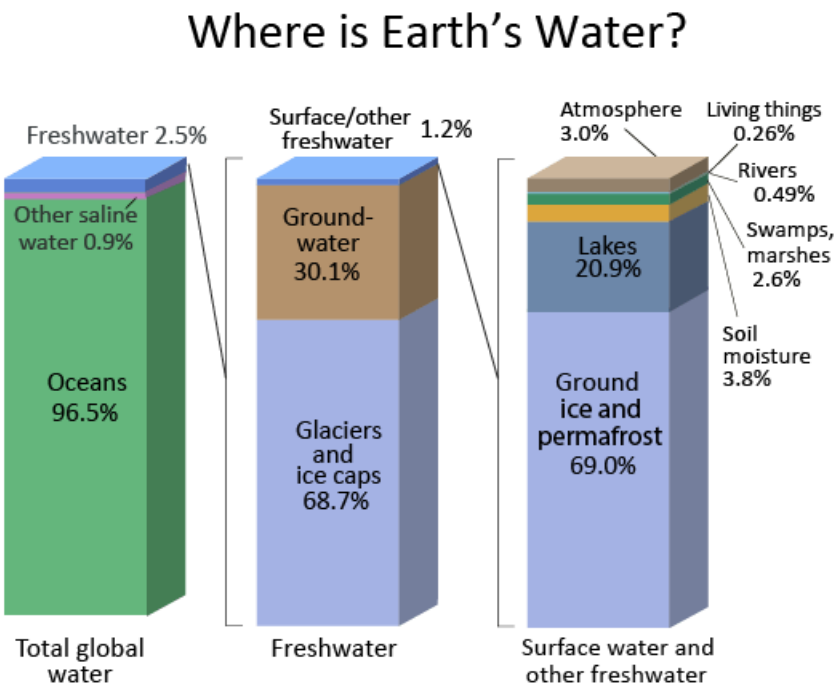
b. Modern science is associated with the enlightenment and the age of reason which is slowly being chipped away by post modernists.

c. Scientific studies of the ocean come late, since the age of exploration has a great impact on the scientific area. The sea is not easily studied and even now, we know more about the surface of the moon than we know about the bottom of the ocean.

d. The study of the ocean involves many disciplines. The physical properties of the ocean are study by physics, chemistry, geology or earth and environmental studies. Biology has an entire division known as marine biology. The social sciences also look at the ocean and the people involved with it. Anthropology and archaeology look at the historical developments of the sea faring as well as the way the sea is involved with many cultures. History, sociology, political science and law are all disciplines that as part of their history have looked at the sea. Maritime law is of major importance in shipping, fishing, and many other areas.

6. The ocean covers most of the planet. All the oceans are connected so there is really only one ocean. For reasons we will talk about later it is possible and reasonable to divide the ocean into many parts – the Arctic Ocean; the North and South Atlantic Ocean; the North and South Pacific Ocean; the Indian Ocean and the Southern Ocean. So while there maybe 7 "oceans" that are often named – there is really only one large body of water.

7. Most of the earth's water is in the ocean – about 96.5 percent. About .9% of the water outside the ocean is saline ("salty") while about 2.5 percent is fresh water. Of the 2.5 % of the earth's water that is "fresh" about 68.7% is in glaciers. Ground water contains about 30.1 of the fresh water while lakes contain about 20.9 percent. Of the remainder about 3% is in the atmosphere; 2.6% in swamps and marshes, 0.49% in rivers and about .26% in living things!



Source: Igor Shiklomanov's chapter "World fresh water resources" in Peter H. Gleick (editor), 1993, Water in Crisis: A Guide to the World's Fresh Water Resources.
NOTE: Numbers are rounded, so percent summations may not add to 100.

8. Living things are called the "biosphere" which is like the "atmosphere" which is the air. There is also the "hydrosphere" which is the watery part of the world and the lithosphere which is made of the rocks. Chemicals move from one sphere to the other. The amount of time a chemical spends in any sphere is called its "residence time"

   Atmosphere: the air around the planet
   Biosphere: living organisms on and around the planet
   Hydrosphere: the watery part of the world
   Lithosphere: the mineral part of the world
   Residence time: The amount of time that a chemical remains in a given sphere.

9. **BIASES**

WHAT ARE BIASES AND WHY ARE THEY IMPORTANT?

BIASES

This is something we need to take seriously. It can pervade many things including science. It is most likely to impact the interpretation of the data. One aspect we should note is called “anthropomorphism” which is the attributing of human characteristics to non-humans. A classic example is seeing porpoises or dolphins as “happy” because of their “smile”. The animal is not smiling that is just the way the dolphin’s mouth is shaped. It appears that if we see something that looks human we interpret it that way.

Biases can be personal or cultural and can easily affect the interpretation of many things including data. This is something that many social scientists (even those who are not post-modernists) are interested in. Some are very deeply rooted in the culture or the person's own background and are often invisible to the people involved.

In social science and especially anthropology, there are two terms of importance: ethnocentrism and cultural relativism. These are terms which are often misused so we need to look at them carefully.

Ethnocentrism is trying to impose the categories of one culture onto another in an attempt to analyze the culture. Cultural relativism is the opposite – it means trying to see the culture in its own terms. You don't have to like them, just see how the society is working.

These two terms should be kept distinct from moral relativism and moral absolutism. These have to do with morality not analysis.

An easy example of ethnocentrism and cultural relativism comes from linguistics. For a long time Latin was seen as the "perfect language" so any deviation from Latin grammar was considered improper – even if you were looking at English which is a Germanic language and not a Romance one.
In Latin, verbs have 6 forms

Porto - I carry	portamus – we carry
Portas - You (sing) carry	portatis - You (plural) carry
Portat – he, she or it carries	portant – they carry

English has only 2 forms:

I, you, we, they	carry
He, she, it	carries

But generations of school children had to say:

I carry, you singular carry, he she or it carries, we carry, you plural carry, they carry. Latin has 6 forms, English should too.

This is clearly imposing a Latin structure onto English (other languages by the way have many more forms than Latin!

If we just say English has 2 forms, Latin has 6 we are being "culturally relative". If you are both have six then you are imposing the structure of one on the other.

Moral relativism and moral absolutism are problems about correctness in terms of moral behavior not structure. Some people, for example, have analyzed the caste system in India looking at how it functions in India. Many who did so did not like the system and thought it immoral. So they could be both culturally relative and morally absolute simultaneously.

The concept of “emics” and “etics” relates to the idea that a single event can be interpreted differently. The event is etic, the interpretation is emic.

LECTURE TWO

1. The oceans cover about 71 percent of the Earth’s surface. Maybe the planet should have been called “Water” or “Ocean” but there is a kind of “people-centrism” which makes us the center of things. So since we live on the land, we call the planet Earth.

2. There is one and only one ocean. Although there is only one, it is divided into different parts all called “oceans” like the Atlantic and Pacific. (see the power point)

3. Water is made of a molecule (something which is made up of atoms). This particular molecule is made on 2 atoms of hydrogen and one atom of water. Hence the chemical formula H20.

4. All the water on earth is divided generally into fresh water and salt water. Fresh water - with nothing in it but water does not appear anywhere on earth naturally. There is always something mixed in it. Salt water contains salt, but also many other chemicals and minerals. All these together are taken as "salt".

The oceans cover about 71 percent of the Earth’s surface. Maybe the planet should have been called “Water” or “Ocean” but there is a kind of “people - centrism” which makes us the center of things. So since we live on the land, we call the planet Earth.

We talk about 7 oceans but a look at a map will show how many there really are.

(Oceans map)

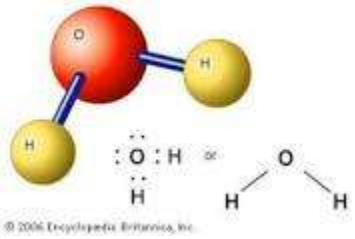
Just one.

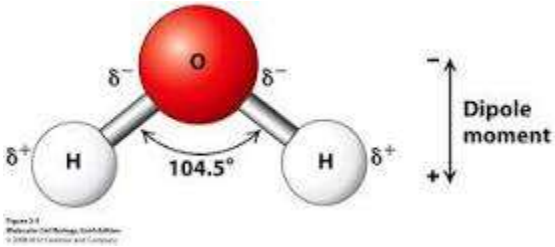
There are grounds for dividing it up into areas like North Atlantic, South Atlantic, North Pacific, South Pacific, Indian, Southern and Polar Oceans. But the number 7 is common in many things in the west. There are 7 days in a week (why?) 7 seas, 7 wonders of the world – the 7th son of a 7thson and so on. We rarely give these any thought, but they are there. They sort of hide in the subconscious, but not too deeply. Other things are much further down and we barely are aware of them. We all (hopefully) know how to make questions in English, but can you give me the rule? Many people will tell you that you raise your voice at the end of a sentence. So what happens with sentences like “What are we having for dinner tonight, mother?” or “What’s that lying in the road ahead (What’s that lying in the road, a head? What do you do with a stiff, neck?) But what about “When does the next train leave?” “Where did I put my book?” what happens when you raise your voice there?

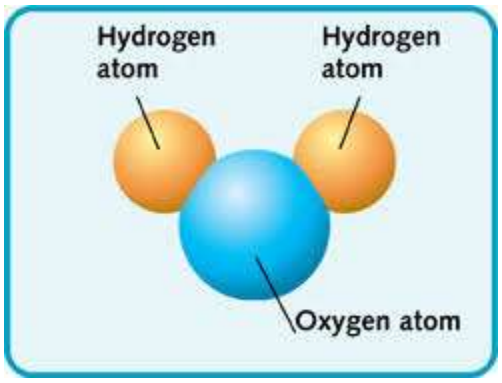
We need to start looking at the ocean by looking at it physically.

WHAT IS THE CHEMICAL NATURE AND SOME OF THE PROPERTIES OF WATER?

Leaving biases to the back of our minds, consider the nature of water







Water is made of a molecule which is 2 parts hydrogen and one part oxygen. Chemically this is H_2O. Water is a requirement of life. It is what makes up all the oceans and seas and lakes, rivers and so on in the world. But water hardly ever occurs in total isolation. Both fresh water and salt water are mixed in most cases with oxygen at least in part of the body of water. In fact as we will

discover, not all things in the water are equally distributed. In this course we are dealing with the ocean which is made of salt water. Salt water is not simply water with salt, but it has many different minerals in it.

According to Stanford University in the US, seawater contains 47 minerals and metals. Starting with the most abundant and proceeding to the least abundant, these are:

chloride, with a concentration of 18 980 parts per million (ppm) in seawater,
sodium (10 561 ppm),
magnesium (1 272 ppm),
sulphur (884 ppm),
calcium (400 ppm),
potassium (380 ppm),
bromine (65 ppm),
inorganic carbon (28 ppm)
strontium (13 ppm).
boron (4.6 ppm),
silicon (4 ppm),
organic carbon (3 ppm),
aluminum (1.9 ppm),
fluorine (1.4 ppm),
nitrogen in the form of nitrate (0.7 ppm),
organic nitrogen (0.2 ppm),
rubidium (0.2 ppm),
lithium (0.1 ppm),
phosphorous in the form of phosphate (0.1 ppm),
copper (0.09 ppm),
barium (0.05 ppm),
iodine (also 0.05 ppm),
nitrogen in the form of nitrite (also 0.05 ppm) and
nitrogen in the form of ammonia (once more 0.05 ppm).
arsenic (0.024 ppm),
iron (0.02 ppm),
organic phosphorous (0.016 ppm),

zinc (0.014 ppm),
manganese (0.01 ppm),
lead (0.005 ppm),
selenium (0.004 ppm),
tin (0.003 ppm),
caesium (0.002 ppm),
molybdenum (also 0.002 ppm)
uranium (0.0016 ppm).
gallium (0.0005 ppm),
nickel (also 0.0005 ppm),
thorium (also 0.0005 ppm),
cerium (0.0004 ppm),
vanadium (0.0003 ppm),
lanthanum (also 0.0003 ppm),
yttrium (also 0.0003 ppm),
mercury (once more 0.0003 ppm),
silver (also 0.0003 ppm),
bismuth (0.0002 ppm),
cobalt (0.0001 ppm) and, finally,
gold (0.000008 ppm).

Altogether, there are some 50 quadrillion tons (that is, 50 000,000 000 000 000 tons) of minerals and metals dissolved in all the world's seas and oceans. To take just uranium, it is estimated that the world's oceans contain 4.5 - billion tons of the energy metal
.
Salt water has different qualities than fresh water. Among them is the fact that they freeze at different temperatures. Fahrenheit used for 0 degrees the temperature at which brine (Brine is a high-concentration solution of salt (usually sodium chloride) in water. In different contexts, brine may refer to salt solutions ranging from about 3.5% (a typical concentration of seawater) freezes - in this case a solution where water becomes saturated. When this is used as 0 degrees then fresh water freezes at 32 degrees. One finds different parts of the ocean exhibiting different amounts of salinity.

Fresh water (< 0.05%)
Brackish water (0.05–3%) (estuaries)
Saline water (3–5%) (“salt water” – oceans etc. Sea water about 3.5%)
Brine (> 5%) (results from evaporation of “salt water” – salt lakes etc,)

The freezing point of water lowers as salt concentration increases. The ocean’s salinity varies a bit since more salt can occurs in warmer water.

	Kelvin	Celsius	Fahrenheit	Rankine
Absolute zero(by definition)	0° K	-273.15°C	−459.67°F	0 °R
Freezing point of brine (by definition (on Fahrenheit scale only)	255.37 K	−17.78°C	0°F	459.67 °R
Freezing point of water	273.15 K	0°C	32°F	491.67 °R
Triple point of water (by definition)	273.16 K	0.01°C	32.018F	491.688 °R
Boiling point Of water	373.1339 K	99.9839 °C	211.97102°F	671.64102 °R

Another interesting property of water is that it behaves oddly compared to other materials. As water gets colder and colder it becomes, like other materials, denser. However as it actually

freezes, the water molecules align in specific ways that cause it to become less dense. This is apparent since one can see that ice floats on water, indicating it is less dense than the water and hence buoyant. We will talk more about this an buoyancy in general later. In dealing with temperatures, we can see that there are many different scales possible. Fahrenheit is one, Celsius is another. Kelvin is yet another that uses absolute zero as a starting point and the Rankin scale does the same. The difference between these two is the size of the degree. Kelvin uses the larger Celsius degree, which is 1.8 times larger than the Fahrenheit degree.

WHY ARE DEFINITIONS IMPORTANT IN SCIENCE?

DEFINITIONS
Definition is an important part of science and one of the first things scientists need to do is to define their terms. Typically there are three kinds of definition or meanings:

Usage

Usage definitions which are the ones found in the dictionary and talk about the way people use the word. Frequently a good dictionary will give many examples of how the word has been used.

Denotational
Many words have denotational meanings – those which say what the word refers to.

Connotational

In many cases words have connotational meanings. These give some indication of what the person’s feelings are toward the referent. Countries change names sometimes because of

connotational meanings. The two words may refer to the same piece of real estate but the connotations are different.

Emotional

This is when the referential aspect of the word largely disappears and the word is used solely to express a strong emotion. In different cultures (languages) the “swear” words are often in completely different areas of the semantic domains. Some languages like English lean towards words that have to do with excrement and sex. Other cultures tend to supernatural things or plants and vegetables or some animals (which English does too). Chinese uses sex in verbal abuse; Japanese does not.

Another is an scientific definition which is a specialized definition used by scientists which restricts meaning to a very particular meaning and tries to lose the connotational meanings associated with usage definition The problems here are that scientific definitions may be completely opposite of the usage ones. For example “myth” often means something which is untrue (That is just a myth). Technically, for folklorists and anthropologists a myth is a story believed to be true and sacred. So when an anthropologist says “The Bible is a myth” it means it is a story taken to be true and sacred, not that it is untrue.

Similarly, the word “theory” technically means an explanation for something that has been repeatedly tested and no contradictions have been found. It is miles away from being a hunch or wild guess as it is sometimes used in usage.

At the museum of American Museum of Natural History there is a model of a blue whale which the signage indicates is the biggest animal that ever lived. There is also a Titanosaur – a kind of

dinosaur – where the signage proclaims that this is the biggest animal that ever lived. What is the problem?

(a) The whale sign went up before the titanosaur was discovered so the “biggest animal” has changed
(b) “Big” is not technically defined. Does it mean “longest”? The Blue whales get to be 110 feet or so. The Titanosaur measures some 121 feet. Titanosaur wins.
(c) “Big” is not technically defined. Does it mean “body mass”? The titanosaur has a very long skinny neck and a very long skinny tail. The Blue Whale has nothing skinny. Which has the greater body mass? Who wins this time?

CONCEPTIONS TIME. TIMES - OF VARIOUS SORTS

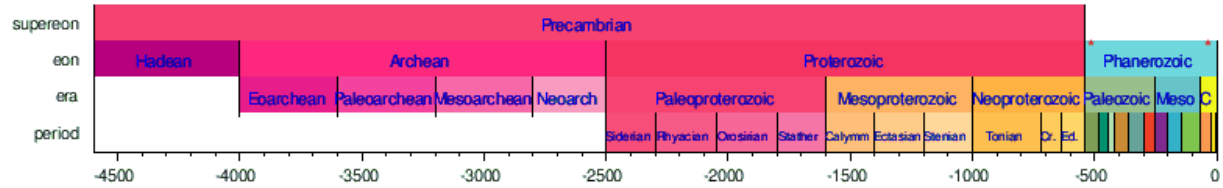
Time and tide wait for no man. Interestingly enough both words have the same origin. Time comes in many forms. Not only are there cultures that operate on different calendars (solar and lunar) but also the idea of time is quite different before and after the invention of the clock or chronometer. People tend to think in terms of their own life spans. Many scientists see things in geological time which is much longer and virtually incomprehensible to people.

There are many kinds of time scales and ways to measure it. Human time frame is usually measured in seconds, minutes, hours, days, years and decades and occasionally centuries and millennia. Sometimes the word “generations” is used to refer to a period of about 20 to 25 years

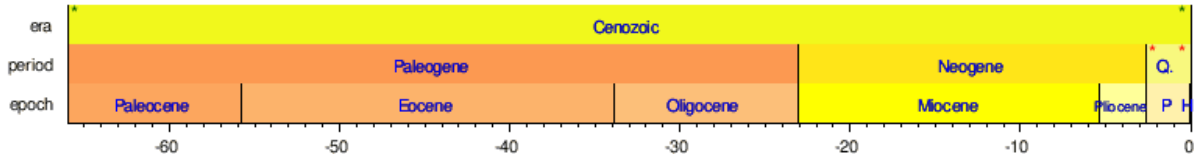
Geological time on the other hand is much greater. It is not unusual to talk of millions of years.

Time is divided into eons, eras, periods, epochs and ages.

So what sometime seems like a long long time on a human time frame may just be a blip on a geological time frame.

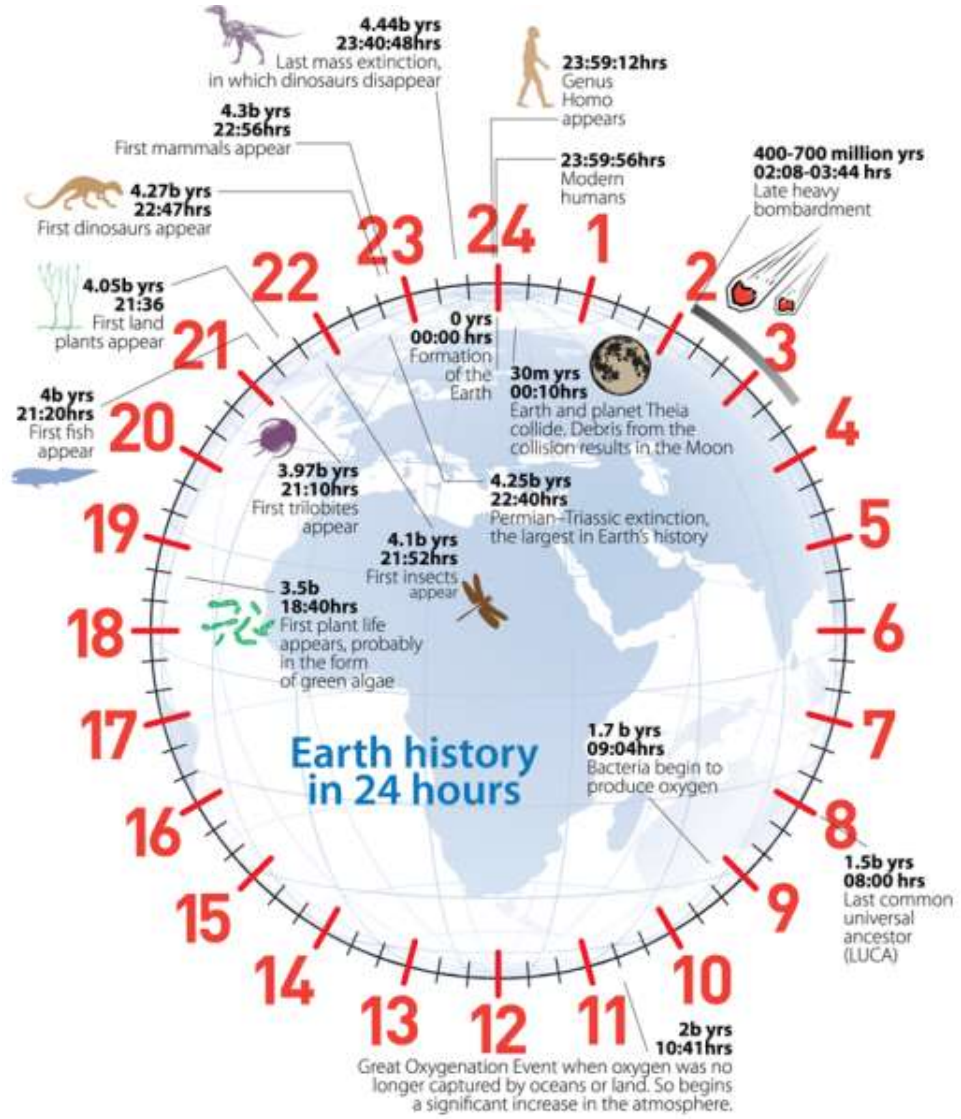


(Precambrian time)



(geological ages)

When we think of the history of the earth as being reduced to a single 24 hour period, humans appear only in the last minute.



(geological 24 hour clock)

HOW DOES THE CHANGING EARTH HAVE AN IMPACT ON LIFE FORMS – ESPECIALLY HUMAN MIGRATIONS

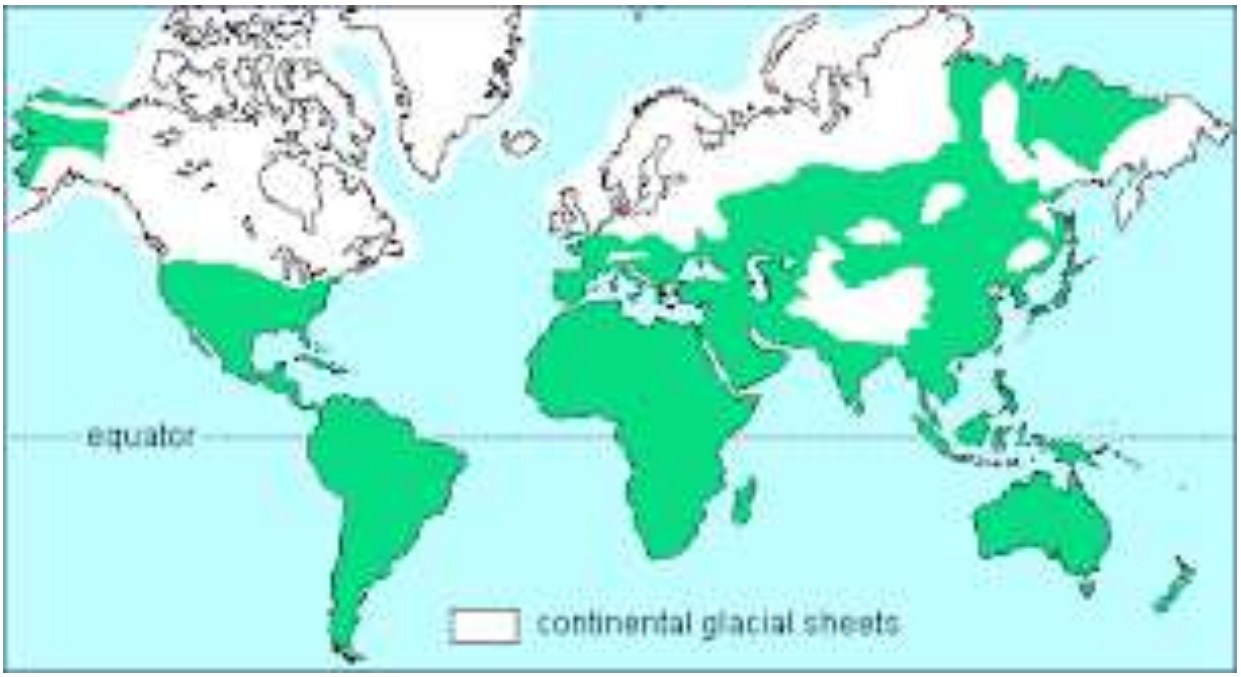
So when the earth seems unchanging, it is only when we think in human terms not geological ones. The oceans are changing just as much as the land is. Many events that happen on the land, also happen under the ocean and have huge impacts on the rest of the world.

Movement of the tectonic plates under the ocean has caused many changes in the earth's surface. In some cases, a major blockage of land has appeared and separated a single area of the sea into 2 separate parts as happens in Latin America. This has much importance in the evolution in some animals who having one species and breeding community finds itself with 2 which may know head off into different evolutionary directions.

In addition the Earth has undergone a number of "ice ages" during which time the polar caps expanded and glaciers moved further and further south. As they move south, the push material in front of them. When they reach their southernmost point and start to retreat as the world heats up, they leave behind a terminal moraine – a large pile of material they pushed before them. The glacier came as far south as NY on the east coast and the terminal moraine is Eastern Parkway. The ice came even further south in the center of the country. As the glacier forms the water to make it up comes from the ocean. So as the glacier comes down from the north, the sea levels drop as well.

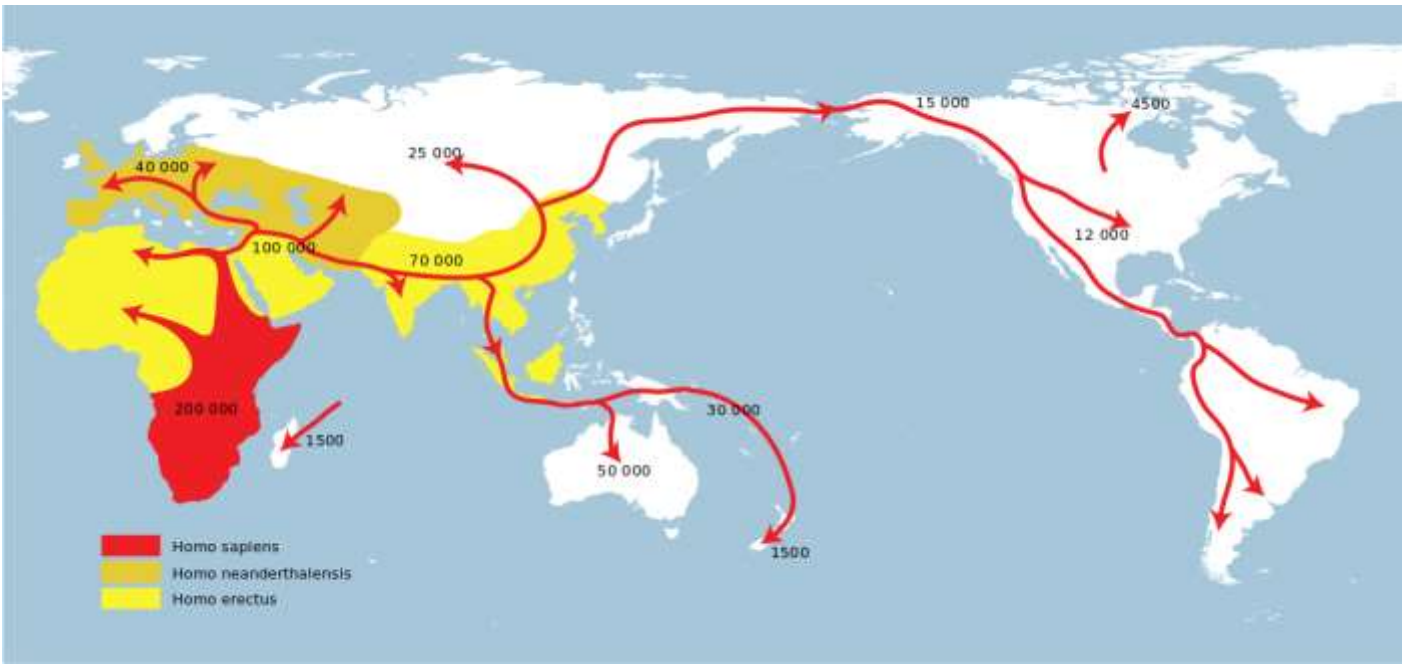
Migrations have been hindered and facilitated by appearance of the ice ages. As the glaciers descend from the north and the tops of mountains, they require water to form the ice. This water is water that has ultimately come from the ocean. So as the glaciers descend, the sea levels also lower. As the sea levels lower, the shore line recedes and more and more land appears.

(ice age (last) - extent of ice1)



(ice age (last) - extent of ice2)

The area between Southeast Asia and Australia and New Guinea drops in sea level and many islands appear as land is uncovered. About 50,000 years ago, people made their way across this area into Australia and New Guinea and began to populate the Pacific. It would be many more years before the other Pacific Islands much further out in the ocean would become populated.



(human migration1)

The area between N. America and Asia is now separated by a short stretch of water known as the Bering Strait – a stretch of ocean about 55 miles across. However, in the strait there are islands so traveling from Asia to the Americas by this route is, even today, possible without being out of sight of land. Between Russia and the US the distance is about 2.5 miles. So you can actually see Russia from Alaska!

(Bering strait)

This is the path believed to be the one by which the original colonizers of N. American arrived, although there was at one point a land mass there called Beringia

(Beringia)

Movement across the continent
from East to West was probably slow. Interestingly enough, the earliest sites are found in S. America, leading to the idea that the migrations may have been along the coast line, which at the time, would have been much further out. Hence early sites in N. America would now be submerged. The S. American sites however are on ranges high above the water. So, sites there would not have been covered by rising water levels as they were in the north.

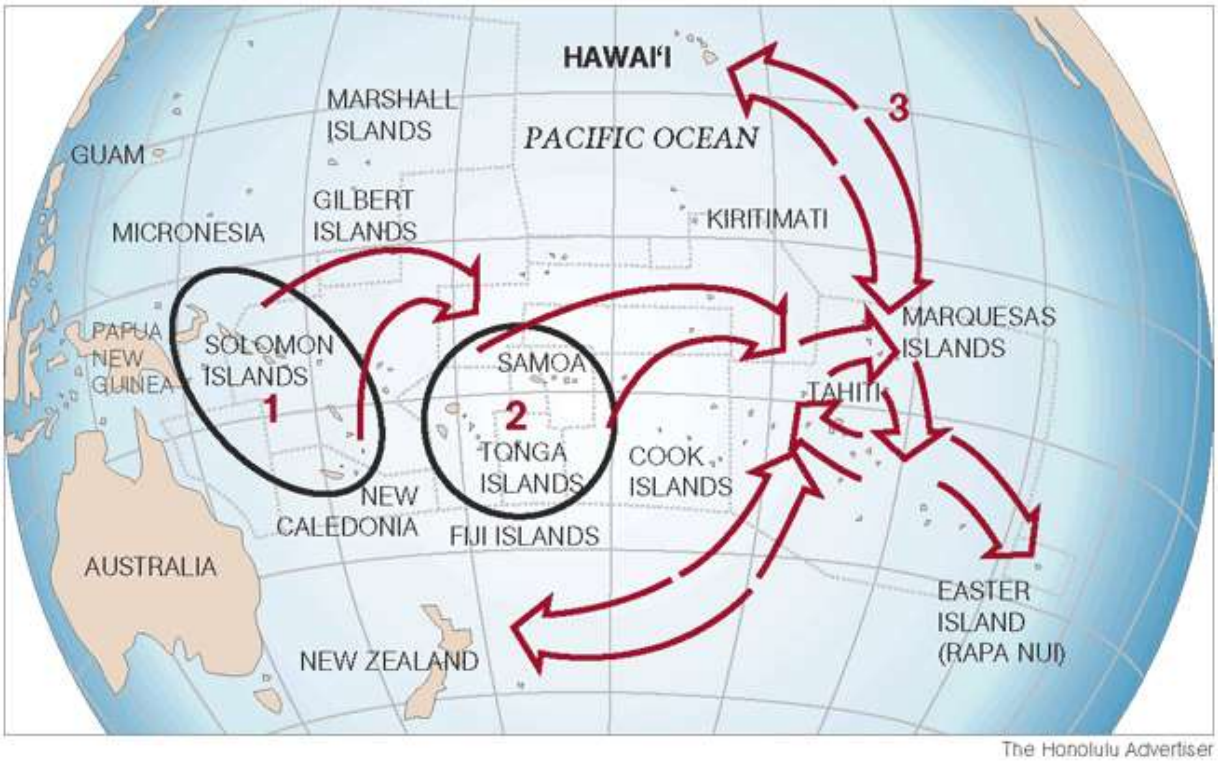
Monte Verde is an archaeological site in southern Chile, located near Puerto Montt, Southern Chile, which has been dated to as early as 18,500 BP (16,500 B.C.).

Although there are many theories about the populating of the Americas which postulate early arrivals from many places, the archaeological and genetic data basically deny those claims.

The populating of the Pacific is the last major population movement into un occupied territory, although the Vikings also moved into an unoccupied Iceland.

Carbon dating and other techniques are leading archaeologists to a new view of the settlement of eastern Polynesia – supported by Polynesian cultural tradition – which suggests a comparatively recent settlement of eastern Polynesia and the existence of a vibrant voyaging and trading culture.

1. Voyagers left the region of New Guinea, Solomon Islands, Vanuatu and New Caledonia about 3,000 years ago, in 1000 to 800 B.C.
2. They arrived in the Fiji-Tonga-Samoa region, where they spent as much as 1,500 years before sailing out of Samoa, perhaps no earlier than 500 A.D.
3. While orthodox theory suggests a central east Polynesia jumping-off area in the Marquesas-Society Islands area, new archaeological work suggests the voyagers kept moving and quickly established a regional homeland – a multi-archipelago Polynesian homeland connected by active canoe voyaging, a single language and culture. Hawai'i was among the early settlements in 800 to 1000 A.D., perhaps established about the same time voyagers found the Marquesas, Tahiti and other islands. Outliers like Aotearoa (New Zealand) and Rapa Nui (Easter Island) may have been settled as late as 1200 A.D.



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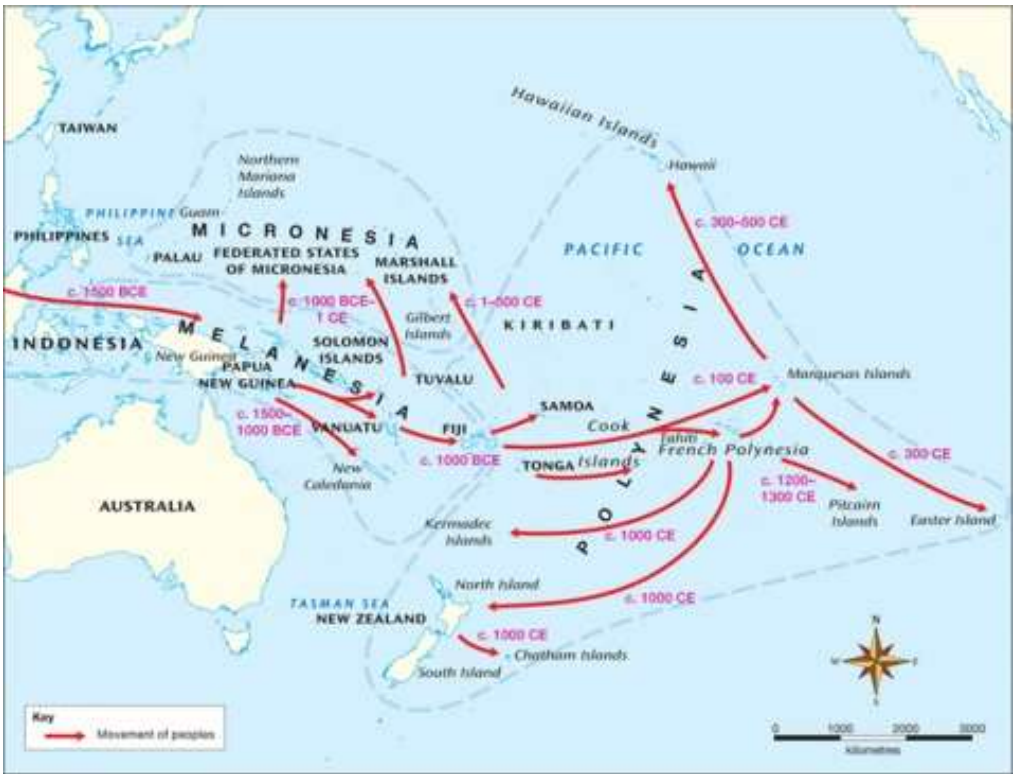
(PolynesiaMigrations2)

The earliest movement into the Pacific has already been mentioned – that is the one to Australia and New Guinea.



(peopling of pacific)