Introduction to Geography

Till a few decades back, the study of Geography implied only a catalogue of names and a student of Geography felt quite satisfied if he could commit to memory such facts as the names of continents and oceans, the depths of seas and bays, the length of rivers and the height of mountains. Geography was recognized as a description of the world and its inhabitants. But the Geography of today is not merely a description or interpretation of the regions of the world. It is an enquiry, a study of the causes, an attempt to find out the why and how of all those facts and factors that go to influence the life of man on this planet. Modern Geography studies earth as the home of man. It attempts to find out the relationship between man and his environment. It depicts the geographical conditions under which man lives and works. In other words, it studies man's adaptation to the environment in which he lives and works.

Definition of Geography

The study of the physical features of the earth and its atmosphere, and of human activity as it affects and is affected by these, including the distribution of populations and resources and political and economic activities.

Physical Geography

Physical Geography is the study of physical features of the earth. This includes study of landforms, drainage forms, water bodies and shorelines, minerals, soils, climate, natural vegetation and life of animals.

Human Geography

Human Geography studies the man-made features of the earth. This includes cultural elements such as the density and pattern of population, the utilization of land, the types of and materials for the buildings and the means of transportation and communication.

Human Geography is further divided into

Passive or static human geography: It deals with the action of nature upon man.
Active or dynamic human geography: It deals with the reaction or action of man upon nature.

Factors which go to influence, determine and condition the distribution and activities of man

The physical features, climate, vegetation and animal life all go to determine the life and activities of man in the different areas of the world. Of these main factors, the physical features and the climate are the most important and they exert the determining influence on the occupation and settlement of man in the different areas of the world. The type of vegetation in any region is controlled to a very great extent by the configuration of land and the climatic condition.

Physical features

These include the configuration of land, its various formations, the drainage systems, mineral content of the rocks and the soils. Man's habitats, occupations, his mode of living and his

capacity for work are primarily and directly influenced by the physical features of a particular area.

Climate
Climate is an extremely powerful factor so far as the occupancy of an area by man is concerned. The working capacity of man and his capacity to produce economic wealth is also determined by factors like temperature, rainfall and winds which are included in the climate of an area.

Vegetation
The vegetation depends upon both the physical features and the climate. The growth of plants and trees is determined by the texture of soil, the range of temperature and the amount of moisture supply.

Animal Life
The animal life is determined directly and apparently by the vegetation cover but the primary influence is that of climate and physical features.

Earth: Shape, Size and Structure

Earth, with an average distance of 92,955,820 miles (149,597,890 km) from the sun, is the third planet and one of the most unique planets in the solar system. It formed around 4.5 to 4.6 billion years ago and is the only planet known to sustain life. This is because of factors like its atmospheric composition and physical properties such as the presence of water over 70.8% of the planet allow life to thrive. Earth is also unique however because it is the largest of the terrestrial planets (one that have a thin layer of rocks on the surface as opposed to those that are mostly made up of gases like Jupiter or Saturn) based on its mass, density, and diameter. Earth is also the fifth largest planet in the entire solar system.

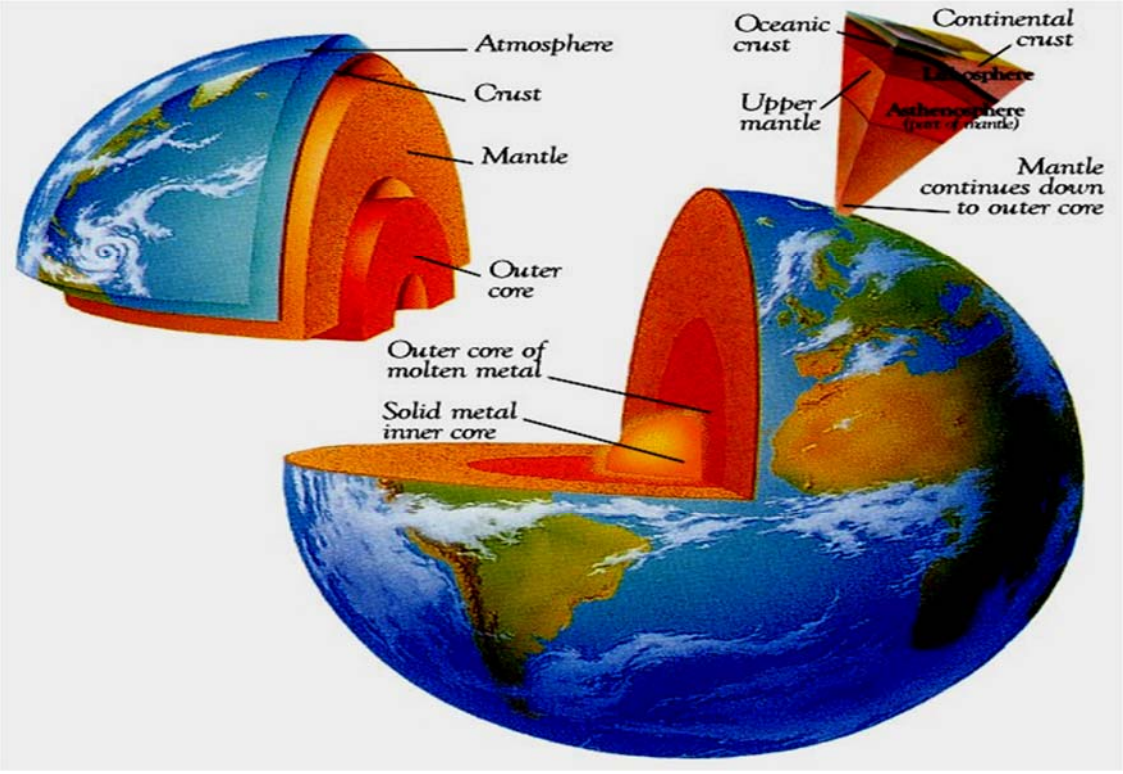
Earth's Size

As the largest of the terrestrial planets, Earth has an estimated mass of 5.9736×10^{24}kg. Its volume is also the largest of these planets at 108.321×10^{10}km^3. In addition, Earth is the densest of the terrestrial planets as it is made up of a crust, mantle, and core. The Earth's crust is the thinnest of these layers while the mantle comprises 84% of Earth's volume and extends 1,800 miles (2,900 km) below the surface. What makes Earth the densest of these planets; however, is its core. It is the only terrestrial planet with a liquid outer core that surrounds a solid, dense inner core. Earth's average density is 5515×10 kg/m^3. Mars, the smallest of the terrestrial planets by density, is only around 70% as dense as Earth.

Earth is classified as the largest of the terrestrial planets based on its circumference and diameter as well. At the equator, Earth's circumference is 24,901.55 miles (40,075.16 km). It is slightly smaller between the North and South poles at 24,859.82 miles (40,008 km). Earth's diameter at the poles is 7,899.80 miles (12,713.5 km) while it is 7,926.28 miles (12,756.1 km) at the equator. For comparison, the largest planet in Earth's solar system, Jupiter, has a diameter of 88,846 miles (142,984 km).

Structure of the earth

At the earth's center is an inner core, its radius is 1070 km. It is solid and very dense because it exists under extremely high pressure; it is also magnetized, rich in iron and nickel and very hot (5000˚ C). The inner core is surrounded by a transition zone about 700 km thick which is in turn surrounded by a 1700 km thick layer of liquid material, together they form outer core. The liquid material of the outer core is similar in composition to the inner core but cooler (4000˚ C). The next largest mass of material of any of the layers (about 70% of the earth's volume). This layer is 2835 km thick; it is less dense than the core, still cooler (1500-3000˚ C) and composed of magnesium-iron silicates. The outer part of the mantle is thought to be rigid, while the inner region is deformable and flows slowly over the deeper mantle. The earth's outermost layer is the cold, rigid; thin (10-65km) that is the crust. The crust divided into SIAL and SIMA layers. The SIAL is the upper layer contains mainly silicon and aluminium elements. SIMA is the lower layer dominates silicon and magnesium elements. SIMA layer forms the bottom of the ocean and is known as pyrosphere. The boundary between the crust and the mantle is the Mohorovicic discontinuity named for it's discover (Mohorovicic) and usually called the Moho. The Moho is a boundary at which there is sudden change in the chemical composition and the speed of seismic waves. The mantle just below the crust is rigid, solidified, basalt-type rock, fused to the crust but at the same time separated from it by the Moho. This rigid layer of crust and upper mantle is the lithosphere. The sub-region of the mantle extending about 250km below the lithosphere is the asthenosphere. The lithosphere is less dense than the asthenosphere, both continental and oceanic lithosphere float on the asthenosphere. There is a fundamental difference between the crust under the land and under the ocean both in thickness and composition. The continental crust averages about 35km in thickness and the ocean crust averages about 11km including the overlying water. The main rock type of the continents is grainite while that of the oceanic crust is gabbro. Grainites and gabbros are both rocks that have formed from the cooling of magma. Continental crust has a density of 2.8g/cm³ and oceanic crust has a density of 3.0g/cm³.



Latitude and Longitude

To determine the location of a position on the earth's surface, we use a grid of reference lines that are superimposed on the earth's surface and cross at right angles. These grid lines are called lines of latitude and longitude. Some lines of latitude and longitude have great significance in geographical studies.

Latitude

The angular distance of any place north or the south of the equator is called the latitude of that place. The lines of latitude are called parallels. The equator is marked at 0˚ latitude and other latitude lines are drawn around the earth parallel to the equator, northward to 90˚ N or the North Pole and southward to 90˚ S or the South Pole. The parallel of 0˚ is called the equator; those of 23.5˚ N and S are known as the tropics of Cancer and Capricorn respectively and the 66.5 ˚N and S are known as the Arctic and Antarctic circles respectively.

Characteristics of latitude

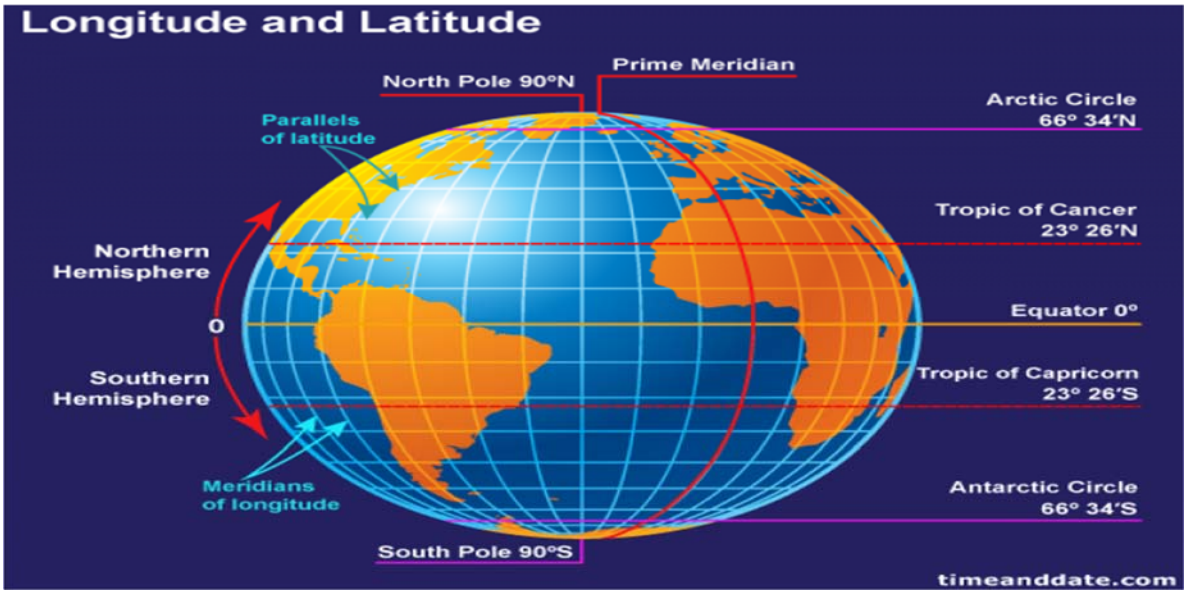
- Latitudes are parallel to one another and hence are called parallels.
- They always remain equal distance apart and along true east-west.
- All parallels except the equator are small circles.
- The latitudes are expressed in degrees, minutes and seconds, e.g. 23˚ 5′ 23"

Longitude

The angular distance of any place east or west of the Prime Meridian is called the longitude of that place. Lines of the longitude are called meridians. Among the longitudes, the 0˚ or the meridian of Greenwich is known as the prime meridian and the opposite it on the globe i.e. the 180˚ longitude is called the International Date Line. It passes through the central Pacific Ocean. All longitude lines form great circles. Only the equator is a great circle of latitude. Any circle at the earth's surface with its center at the earth's center is a great circle.

Characteristics of Longitudes

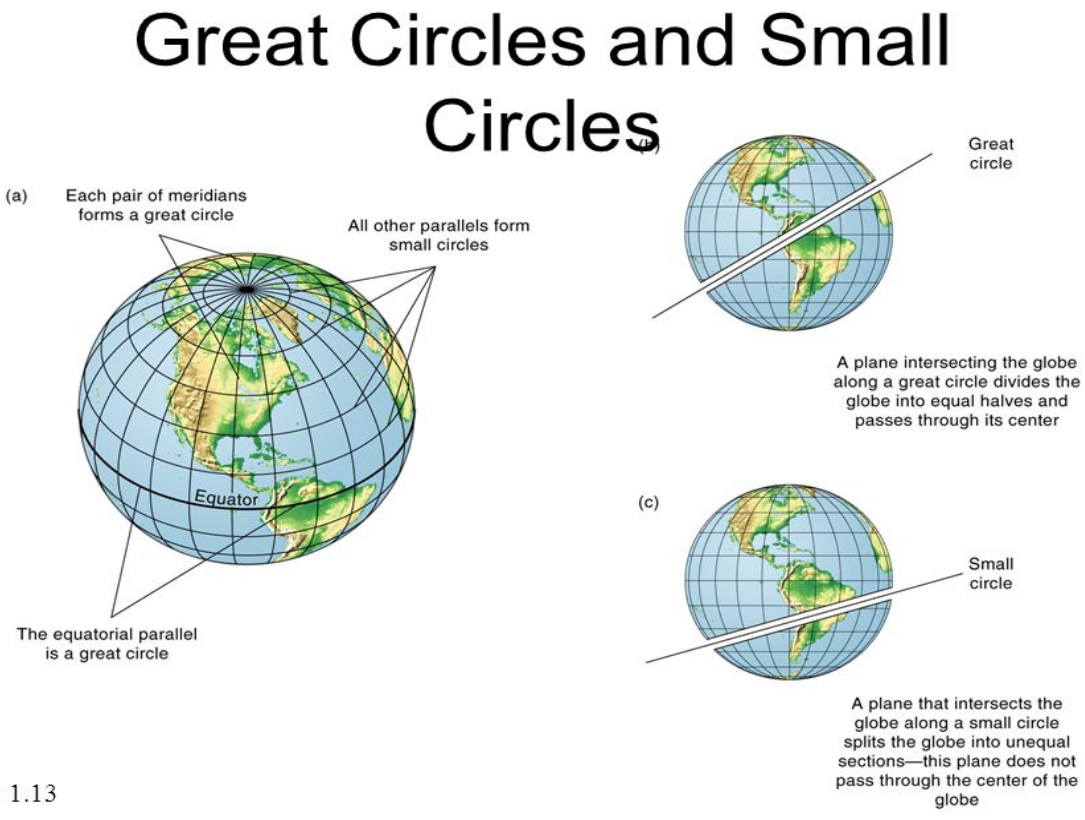
- All meridians run in a true north-south direction.
- Meridians spaced farthest apart at the equator and converge at the poles.
- All longitude lines form great circle.



Great circles:

A great circle is defined as any circle drawn on a globe (or another sphere) with a center that includes the center of the globe. Thus, a great circle divides the globe into two equal halves. Since they must follow the circumference of the Earth to divide it, great circles are about 40,000 kilometers (24,854 miles) in length along meridians. At the equator, though, a great circle is a little bit longer as the Earth is not a perfect sphere.

In addition, great circles represent the shortest distance between two points anywhere on the Earth's surface. Because of this, great circles have been important in navigation for hundreds of years but their presence was discovered by ancient mathematicians.



Distribution of continents and oceans

Continents are the largest unit of landmasses on the earth. The continents include Europe, Asia, North America, South America, Australia and Antarctica. All continents together constitute less than one-third of the earth's surface that means more than two-thirds of the earth's surface are covered with water. Two-third of the continental land mass is located in the Northern Hemisphere. Less than 35% of the total land is found south of the equator, and between 50 and 65 S there is essentially no land at all. In this area oceans are essentially connected.

Generally, the continents are antipodal to the ocean basins (i.e. ocean basins are found on the opposite side of the earth from continental masses). For example, there is an antipodal relationship between the continental Antarctic region and the Arctic Ocean and the Pacific Ocean lies opposite of Africa and Europe. The continental areas above sea level comprise about 29% of the earth's surface. However, from a geological point of view, a submerged continental shelf is also part of a continent. Inclusion of the shelf area increases the extent of the continents to 35% of the globe. The earth's average land elevation is 820m above sea level; the highest point is the summit of Mt .Everest (8,850) and the lowest point is the shore of the Dead Sea at 410m below sea level.
Seas and oceans account for 71% of the total area of the earth's surface. The ocean basins also have an uneven distribution on the earth's surface. They are not evenly distributed and most of them are found in the Southern Hemisphere. The 4 largest oceans of the world are: Pacific Ocean, Atlantic Ocean, Indian Ocean and Arctic Ocean. The total volume of the ocean is about 1350 million cubic kilometers. The average depth of the ocean is 3729m. The ocean floor can be subdivided into two major divisions called the continental margin and the ocean basin or deep sea. The Pacific Ocean is the largest ocean, having an area and volume greater than the Atlantic and Indian Ocean. The Atlantic Ocean is a relatively narrow ocean. The surrounding continents are Africa, South America, Europe and North America. The Indian Ocean, somewhat triangular in shape is situated mainly south of the equator. The Arctic Ocean is somewhat circular in shape and is considerably shallower than the other oceans.

MAP PROJECTIONS

Introduction

A map projection is a way to represent the curved surface of the earth on the flat surface of a map. A good globe can provide the most accurate representation of the earth. However, a globe is not practical for many of the functions for which we require maps. The need for map projections arises from the very fact that an ordinary globe is rendered useless for reference to a small country. Map projections allow us to represent some or the earth's entire surface, at a wide variety of scales, on a flat, easily transportable surface such as a sheet of paper. Map projections also apply to digital map data, which can be presented on a computer screen.

Classification of Map Projections

There are hundreds of different map projections. The process of transferring information from the earth to a map causes every projection to distort at least one aspect of the real world-shape, area, distance or direction. Each map projection has advantages and disadvantages; the appropriate projection for a map depends on the scale of the map, and on the purposes for which it will be used. The properties of a map projection may also influence some of the design feature of the map. Some projections are good for small areas, some are good for mapping areas with a large east-west extent and some are better for mapping areas with a large north-south extent. Map projection varies with the size and location of different areas on the earth's surface. While conical and zenithal projections are commonly used for mid-latitudes and polar regions, cylindrical projections are referred for equatorial lands. Projections also vary with the purpose of the map. While transferring the globe on a plane surface, the following facts should be kept in view- preservation of area, preservation of shape and preservation of bearing i.e. direction and distance.
It is, however, very difficult to make such a projection even for a small country in which all the above qualities may be well preserved. Any one quality may be thoroughly achieved by a certain map projection only at the cost of others.

Based on Quality

So the following groups of projections have been made according to the quality they preserve,

- Equal area or homo-graphical projections
- Correct shape or orthomorphic projections
- True bearing or azimuthal projections.

Based on different bases

Following classifications may be suggested depending on different bases;

A. Based on the method of constructions

- Perspective
- Non-perspective

B. Based on the developable surface used

- Conical
- Cylindrical
- Azimuthal or zenithal
- Conventional

C. Based on the preserved qualities

- Homolographic or equal area.
- Orthomorphic

- Azimuthal or true bearing projections.

D. Based on the position of tangent surfaces

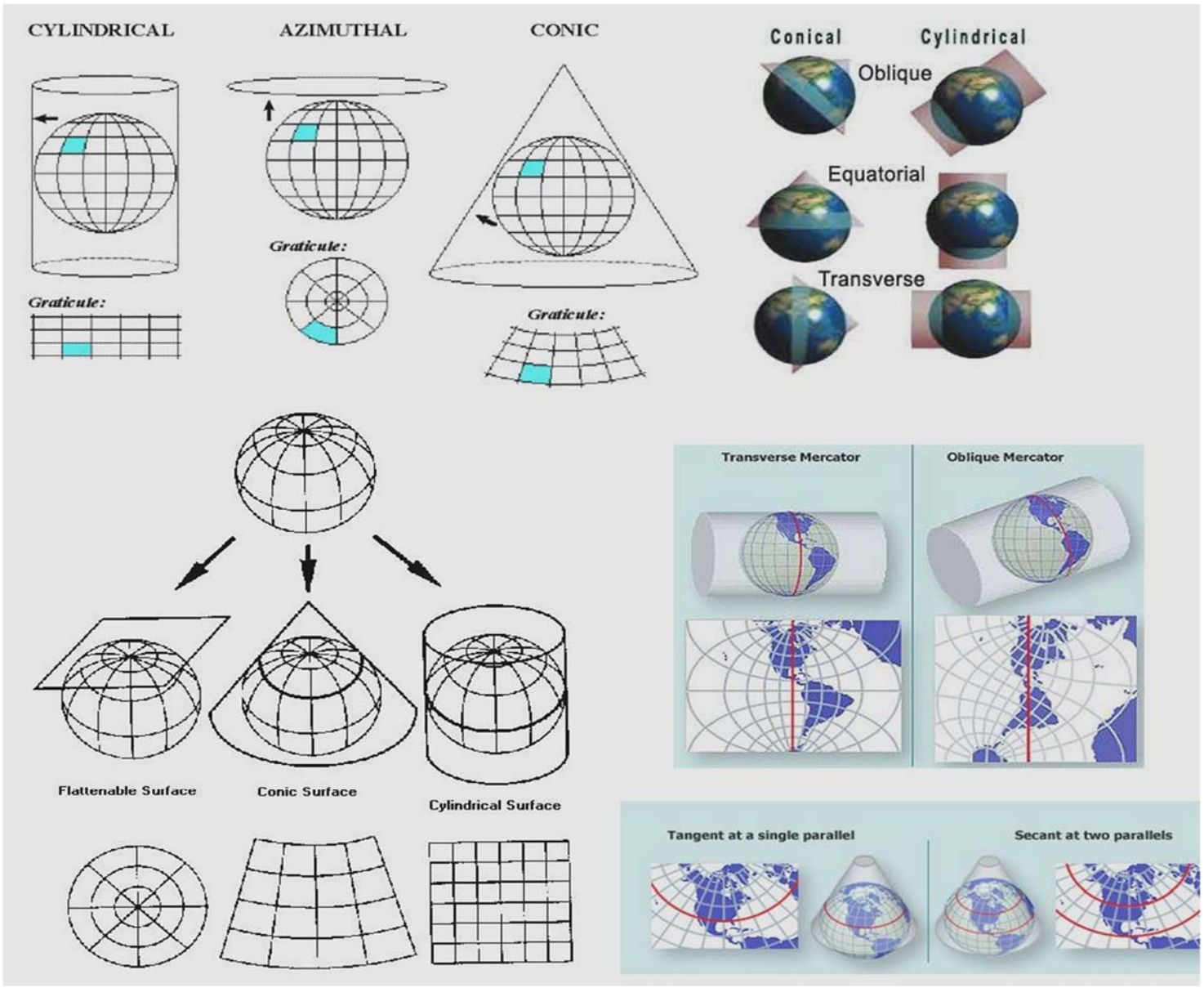
- Polar
- Equatorial or Normal
- Oblique

E. Based on the position of view point or light

- Gnomonic
- Stereographic
- Orthographic
- Others

F. Based on Geometric shape

- Rectangular
- Circular
- Elliptical
- Butterfly shape
- Others



Zenithal Projection

A projection that maintains accurate directions (and therefore angular relationships) from a given central point is called an azimuthal or zenithal projection. In this map projection, the direction from a given central point to any other point is shown correctly. These projections are used for aeronautical charts and other maps where directional relationships are important.

Conical Projection

A conical projection projects information from the spherical earth to a cone that is either tangent to the earth at a single parallel or that is secant (cutting the sphere or spheroid along a line or lines) at two standard parallels. Once the projection is complete, the cone is unwrapped to form a flat surface. The lines where the cone is tangent or secant are the places with the least distortion.

Cylindrical Projection

A cylindrical projection projects information from the spherical earth to a cylinder. The cylinder may be either tangent to the earth along a selected lines or may be secant (intersect the earth) along two lines. Imagine that once the earth's surface is projected, the cylinder is unwrapped to form a flat surface. The lines where the cylinder is tangent or secant are the places with the least distortion. A Mercator projection is created using a cylinder tangent at the equator. Mercator projection is better for navigation because compass courses are easy to determine.

Map scale

The scale of a map on any projection is always important and often crucial to the map's usefulness for a given purpose. The distance is indicated by the scale. The scale shows the proportion that the distance between two points on the map bear to the distance between the same two points on the ground. There are three ways of representing this proportion: 1) a statement of scale 2) a lined or plane scale 3) representative fraction. A statement of scale expresses the relationship in words, for e.g., 1cm represents 1km. A linear or plain scale represents the same relationship by means of a line with marked upright divisions. Representative fraction (RF) is a fraction whose numeration one represents a length on the map and whose denominator indicates how many times this length has to be multiplied to get the same distance on the ground.

Cartography

Cartography is the study and practice of making maps. Combining science, aesthetics, and technique, cartography builds on the premise that reality can be modeled in ways that communicate spatial information effectively.

The History of Cartography

The history of cartography goes much further back in history than the time when the subject was designated by a name and a definition. Several prehistoric cave paintings have been recorded as time-worn maps, and artifacts have been preserved hoping that they bear evidence to the location of lost cities, towns, and treasure deposits of the ancient world. A wall painting, dated to the 7th Millennium BC, might be one of the oldest maps in the world. This painting is believed to represent the location of Çatalhöyük, a city in ancient Anatolia.

The modern form of cartography started to develop from the 6th Century BC onward. Ancient Greeks and Romans served as pioneers in this development. The contributions of Anaximander, a Greek philosopher, and Ptolemy, a multi-talented Greek genius, are most notable in this regard. The former was credited with the production of the first documented map of the world while the latter produced *Geographia*, a treatise on Cartography. Soon, by the 8th Century, Arabic translations of cartographic work by the Greeks were being made by the Arabian scholars. In 1154, the Arabic scholar, Muhammad al-Idrisi prepared a medieval atlas incorporating knowledge of the world gathered by Arabic merchants.
Further east, the ancient and thriving civilizations of India and China also produced stalwarts in the field of ancient cartography. Indian astronomers and cartographers had already started mapping the Pole Star and other constellations using age-old mapping systems. The State of

Qin in China is associated with the production of some of the oldest extant maps of the world, some dating as far back as the 5th Century BC.
Such inventions as the telescope, the compass, and the sextant soon came to revolutionize the world of cartography. It triggered the Age of Exploration from the 15th Century through the 17th Century. During this time, the European cartographers conducted extensive surveys, explored unexplored lands, and created detailed maps, representing the entire world on small pieces of paper. The world's oldest extant globe was produced in 1492 by the German cartographer Martin Behaim. Soon, more inventions, discoveries, and explorations gave rise to the modern forms of cartography, the science and art of map-making.

Map generalization

A good map has to compromise between portraying the items of interest (or themes) in the right place on the map, and the need to show that item using text or a symbol, which take up space on the map and might displace some other item of information. The cartographer is thus constantly making judgments about what to include, what to leave out and what to show in a slightly incorrect place. This issue assumes more importance as the scale of the map gets smaller (i.e. the map shows a larger area) because the information shown on the map takes up more space on the ground. A good example from the late 1980s was the Ordnance Survey's first digital maps, where the absolute positions of major roads were sometimes a scale distance of hundreds of meters away from ground truth, when shown on digital maps at scales of 1:250,000 and 1:625,000, because of the overriding need to annotate the features.

Landscape

A landscape is the visible features of an area of land, its landforms, and how they integrate with natural or man-made features. A landscape includes the physical elements of geophysically defined landforms such as (ice-capped) mountains, hills, water bodies such as rivers, lakes, ponds, and the sea, living elements of land cover including indigenous vegetation, human elements including different forms of land use, buildings, and structures, and transitory elements such as lighting and weather conditions. Combining both their physical origins and the cultural overlay of human presence, often created over millennia, landscapes reflect a living synthesis of people and place that is vital to local and national identity. The character of a landscape helps define the self-image of the people who inhabit it and a sense of place that differentiates one region from other regions. It is the dynamic backdrop to people's lives. Landscape can be as varied as farmland, a landscape park, or wilderness. The Earth has a vast range of landscapes, including the icy landscapes of polar regions, mountainous landscapes, vast arid desert landscapes, islands, and coastallandscapes, densely forested or wooded landscapes including past boreal forests and tropical rainforests, and agricultural landscapes of temperate and tropicalregions. The activity of modifying the visible features of an area of land is referred to as landscaping.