SEMESTER II –CORE COURSE V
DEVELOPMENT OF GEOGRAPHICAL THOUGHT

CODE – 18KP2GO5

UNIT I: Ancient Geographical Thought - Greek contribution to Physical geography, Mathematical geography – Contribution of Romans: Strabo, Ptolemy – Arab contribution to geography - Contribution of Ancient Indians -Major exploration and discoveries:Contribution of Megallan,Vascodagama, James cook and Christopher Columbus

Contribution of Greeks in the Field of Geography

Eratosthenes, the ancient Greek scholar is called the "father of geography". He was the first one to use the word geography and he also had a smallscale notion of the planet that helped him to determine the circumference of the earth.

The Greek scholars provided a framework of concepts and models that guided the western thinking for many centuries. Their period is known as the 'Golden Age of Greece'.

The Greeks made tremendous advancements in the fields of geomorphology, climatology and oceanography. Among the ancient Greek scholars Herodotus, Plato, Aristotle, Eratosthenes is the chief ones.

Socrates (470/469–399 B.C.E.) is remembered for his teaching methods and for asking thought-provoking questions. Instead of lecturing his students, he asked them difficult questions in order to challenge their underlying assumptions - a method still used in modern day law schools. Because Socrates wrote little about his life or work, much of what we know comes from his student Plato.

Plato (428/427–348/347 B.C.E.) studied ethics, virtue, justice, and other ideas relating to human behaviour. Following in Socrates' footsteps, he became a teacher and inspired the work of the next great Greek philosopher, Aristotle. Aristotle (384–322 B.C.E.), while also interested in ethics, studied different sciences like physics, biology, and astronomy. He is often credited with developing the study of logic, as well as the foundation for modern-day zoology.

Homer

The epics of Homer, especially the Iliad and the Odyssey which contain the episodes of Trojan War (1280 - 1180BC) provide excellent accounts of historical geography of the then known world. Four winds coming from different directions are brilliantly described in his

writings.

However, Homer had his limitations because he was essentially a poet and not a geographer. Formal study of the subject became pronounced with the works of Thales, Anaximander, Hecataeus, Herodotus, Plato, Aristotle, Erastothenes, and Hipparchus.

Thales of Miletus

Miletus, a town located near the mouth of the river Menderes, on the eastern side of the Aegean Sea, rose to fame in the 6th and 71h century B.C. with Thales, a brilliant Greek thinker.

He was the first Greek genius, philosopher, and traveller concerned with the measurement and location of things on the surface of the earth. He is credited with several basic theorems of geometry.

He formulated six brilliant geometric propositions which were indeed path breaking in ascertaining latitude and longitude of places. That

- the circle is divided into two equal parts by its diameter;
- the angles at either end of the base of an isosceles triangle are equal;
- when two parallel lines are crossed diagonally by a straight line the opposite angles are equal;
  the angle in a semicircle is a right angle;
- the sides of the two similar triangles are proportionate and two triangles are congruent if they have two angles; and,
- a side respectively equal are some geometric principles put forward by Thales.
- In consequent years pondering over the shape of the Earth, Thales visualised earth as a disc floating in water.

Anaximander

Anaximander was a contemporary off Thales, and though his junior by a few years, contributed no less to classical geography. He devised an innovative instrument, the gnomon a sundial to measure time. Where there is ample sunshine, set a pole vertically above a flat surface and watch the varying position of the sun.

Then to measure time, calculate the length and direction of the shadow cast by the vertical pole. At noon the shadow is the shortest, while at sunset or sunrise it is the longest. Anaximander prepared a world map, placing Greece at the centre surrounded by other Eurasian parts. It was a pioneering work.

- Thus Anaximander and Thales are regarded as the founder of the mathematical tradition in the study of geography in ancient Greece.

Hecataeus

Miletus was filled with pride again when Hecataeus, born around 475 B.C., a gifted thinker, established a literary tradition, opposed to the mathematical tradition established by Thales andAnaximander.

His book Ges - Periodos (Description of the Earth) is regarded as the first attempt to put together available knowledge about the world systematically. Thus it is with reason that Hecataeus is acclaimed as the "Father of Geography".

Hecataeus's work was divided into two parts. The first documented geographical information about Europe, while the second dealt with Libya, which was the known section of land that is located in present day Africa and Asia.

The first volume provided vivid accounts of the Greek shores and the European coast of the Aegean Sea. Later, Hecataeus went on to add the geography of Adriatic, Italy and Spain. In the second volume he described Hellespont, the southern coast of Euxine up to Caucasia, Asia-Minor, Syria, Egypt and Libya.

Hecataeus endorsed the views of his predecessors of earth being a circular plane with Greece at the center. In fact this little world was surrounded by water, with two equally divided landmasses, Europe in the north and Libya in the south, with Greece occupying the center.

You will be surprised to find a description of India in the work of Hecataeus. He not only plotted India but also mentioned the Indus, several cities as well as many tribes, foremost among which were the Gandari people who occupied the country between the upper Indus and the valley of Kabul.

Herodotus

Although you may be familiar with Herodotus (485-425 B.C.) as the father of history but his significantly original contributions towards geography cannot be disregarded.

Herodotus's view of interdisciplinary study, treating history geographically and geography historically, may be especially understood in the present context, where we seek to understand any phenomenon in the light of totality rather than specificity.

Thus he pioneered a novel, synthetic approach to study the discipline.

Herodotus born at Halicarnassus in the 5th century B.C., lived at Athens, the centre of Hellenic culture. His views about the shape of the earth departed from those of Hecataeus, accepting instead the Homeric view that the earth was a flat disc over which the sun travelled in an arc from east to west.

In fact it was Herodotus who first drew a meridian on the world map. He theorized the flow of the Nile, and was the first geographer to regard the Caspian as an inland sea, opposed to what his contemporaries considered an arm of the Northern Ocean.

Herodotus divided the landmass of the world into three continents, Europe, Asia and Libya (Africa). While he described Europe and Asia in some detail, his knowledge of Asia was confined mainly to the Persian Empire.

Aristotle

Arguing from the particular to the general, inductive reasoning was Aristotle's gift to theorists. He believed that the best method of building a reliable theory was to begin with the observation of empirical facts.

Aristotle thus successfully laid the foundation of world's first paradigm to guide research procedures.

Aristotle was perhaps one of the earliest determinists. He proposed varying habitability of the earth with varying latitude and established it as a function of distance from the equator. Well, that would mean, that living close to the equator with its searing heat would be impossible, and the poles would be inhabitable too as one would hardly want to constantly face the chilling winds and cold weather.

Aristotle formulated four fundamental principles of scientific explanation

(a) Answering the question;

(b) Finding what makes the thing the way it is, and that includes a description of its nature and essential characteristics, specifying the kind of matter, and the substance out of which it is made;

(c) Telling what caused the process through which the thing becomes what it is; and finally

(d) The purpose the thing fulfils.

Erastosthenes

Erastosthenes (276-194 B.C.) is credited to have coined the term geography! How? Well, he added `ge' meaning earth, to `graphe' meaning study, and viola we have `geography'. Erastosthenes was the author of the first formal text on geography, `The Geographica'. Born in a Greek colony Cyrene, Libya, he was educated here and later at Athens.At Athens the highest academic honour of the times was bestowed on him, when he was invited by the ruler of Egypt, Ptolemy Euergetes to be appointed as a librarian of the museum at Alexandria. Under the guidance ofErastosthenes, the museum metamorphosed into an eminent center of

astronomical research.Erastosthenes is known to have identified five climatic zones, a torrid zone, two temperate zones, and two frigid zones.While the area 24° north and south of the equator was designated as the torrid zone, the areas 24° from each pole were the frigid zones. The areas in between were the two temperate zones. Erastosthenes also attempted to determine how far our earth is from the sun and the moon.

Hipparchus

Hipparchus succeeded Erastosthenes as the librarian at the museum of Alexandria, around 140 B.C. He was the first to divide the circle into 360 degrees, based on Assyrian arithmetic. An instrument devised by him, the `astrolabe', was used for the determination of longitudes and latitudes. It opened up many avenues, making it possible to measure latitude at sea by simply observing the angle of the polar star.

Hipparchus's another brilliant work was the conversion of a three dimensional sphere into a two dimensional plane, which facilitated the representation of the earth on paper.

If you have ever read the fine print at the bottom of each page in an Atlas, you would be familiar with projections. Here is where it all began. Hipparchus devised two kinds of projections, orthographic and stereographic, which allowed the curved sphere of the earth to be converted into plane surface on sound mathematical principles.

Contributions of Greeks in the field of Physical Geography:

The Greeks made remarkable development in the field of physical geography. Greece was the land of great physical and topographical diversity, which provided an impetus to the growth and development of physical geography. Greece was the land of high mountains, perennial and seasonal rivers, limestone areas, and the land of occurrence of diverse phenomena like earthquakes, volcanoes and tides. These diversities made Greeks think in this field.

The work of the Greeks contain numerous references to mountains, delta building, change of weather, winds, rains, earthquakes and their causes, volcanoes and the transformation in the topographic features. Aristotle explained the phenomena of expansion of land in the shallow seas and the formation of delta by the river Nile.

The Greeks believed that all perennial rivers have their source in high mountain ranges. Plato explained how depletion of forests leads to depletion of soil fertility and turning of a fertile land into a barren topography. Plato considered man as an active agent who changes the face of the earth.

Greeks also studied about the oceans and seas and distinguished the varying properties of their coastlines, salinity, waves, tides and winds.

Aristotle and Herodotus observed the phenomenon of tides in Red Sea. Aristotle even mentioned about tides in his book Meteorvlogica, but the cause of tidal waves he attributed to the winds. It was Posidonius, who after careful observation, said that at new moon and full moon when the sun and the moon are in conjunction, the tides are the highest whereas at the first and the last quarter's they are the lowest.

The Greeks also recognized four major winds of different properties and directions. These winds were called bores (north wind), eurus (east wind), notus (south wind), zephyrus (west wind).

The Greeks divided the world into five climatic zones- torrid, two temperate and two frigid zones. They were familiar with the fact that Libya is the land which experiences high temperature. They believed that Libyans are black due to the high temperature. Aristotle believed that the parts near to equator (the Torrid Zone) and the parts away from the equator (the frigid zones) are uninhabitable.

Occurrences of frequent earthquakes in the mountain regions of Greece attracted the attention of Greek thinkers. Anaximender described earthquakes as fractures of crust of the earth, which were produced by passing through a process of drying, after having previously been saturated with moisture. According to Aristotle, earthquakes and volcanoes are caused by winds (gases) which were confined beneath the surface of the earth and were trying to find a vent.

The Greeks also made careful observations of the volcanoes and associated volcanoes with earthquakes. The Greek scholars also recognized differences in flora and fauna of the different parts of the world.

Contributions of Greeks in the Field of Mathematical Geography:

There were many Greek scholars who were engaged in determining the shape and size of the earth and distances and latitudes with the help of astronomical observations. Anaximander introduced an instrument called 'gnomon'. With the help of gnomon he measured the latitudes of important places and prepared the first map of world to scales. Thales and Anaximander are considered as the founders of mathematical geography. Thales and Aristotle established the spherical shape of the earth. Eratosthenes calculated the circumference of the earth as 250,000 stadia (25,000 miles). Herodotus, Anaximander, Hipparchus and Eratosthenes draw the parallels of latitudes also.

THE ROMANS

Romans carried forward the Greek tradition of contributions to the development of geography. The fields of historical and regional geography saw considerable progress, with Strabo and Ptolemy being the leading proponents, and Polybius and Posidonius contributing significantly to the study of physical geography.

Contribution of Romans in the Field of Geography

After the Greeks, the political power passed into the hands of Romans. The Romans' major contribution was mainly in the field of historical and regional geography but they also made contributions in the field of physical and mathematical geography. Among the Romans, Strabo and Ptolemy contributed the most.

After the Greeks, the Romans contributed appreciably to the growth and development of graphical knowledge. The romans were more practical and philosophical in their outlook. They were primarily concerned with the commercial and administrative problems and plans for military conquest. The knowledge of geography was necessary both for effective administration and trade. Hence, Romans made major contribution to historical and regional geography.

1. Strabo (64 BC – 20 AD)

Strabo was born in Amesia (Turkey) about 50 miles to the south of Black Sea coast in about 64 BC. He is considered as 'Father of Regional Geography', he stressed on the division of the world into natural and not into political boundaries.

His most important work is "Geographica'. In this he has tried to compile all the then knowledge of mathematical, physical, political and historical geography in form of general treatise. Geographica consisted of 17 volume – first 2 (1-2) volume about introduction, next 8 (3-10) volume about Europe, next 6 (11-16) volume about Asia and last 1 (17) volume about Africa (Libya)

His other work is 'Historical Memoir'. He wrote 43 volumes under the title **Historical Memoirs.**

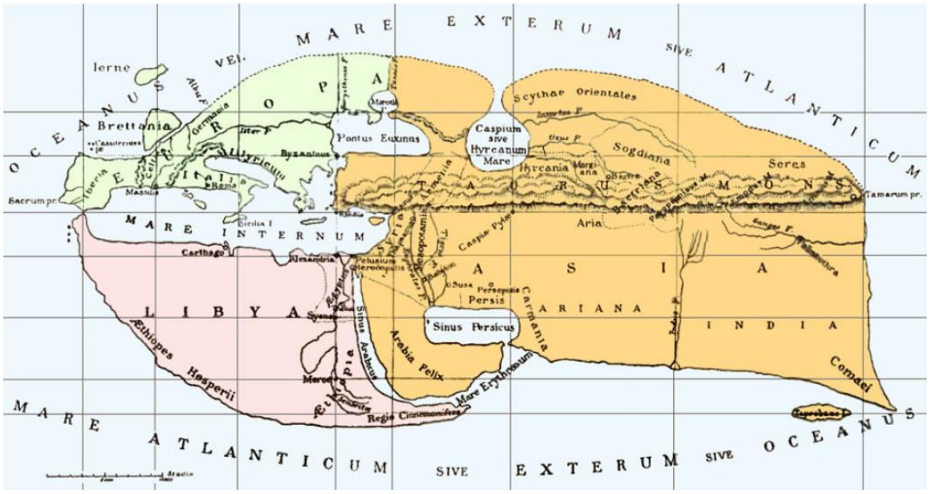
Strabo was the first scholar who has led the foundation of chorological writings in geography. He was the first to declare geography as chorological science.

Chorology - The study of places and regions. Causal relations between geographical phenomena occurring within a particular region and the study of the spatial distribution of organisms

He was in agreement with Aristotle about the spherical shape of the Earth about the belief the Earth is situated in the centre of the universe. He visualized the Earth as an oblong. He considered the Caspian as an inland sea and placed Taprabone (Sri Lanka) to the west of Indian Peninsula.

His writings are found in the form of quotations. In Physical Geography, he propounded the theory of alternate elevation and depression of extensive areas.

He compiled large amount of material to highlight the changes that have taken place due to the changes in the sea level and due to volcanic eruptions and earthquakes.



Key Points: Strabo is considered as the Father of regional geography

- Division of world by natural boundaries.
- He Declare that geography as a Chorological Science.
- His book Historical Memoir with 43 volume
- Geographical treatise or Geographica 17 Volume comprising four branches- Mathematical, Physical, Political & Historical Geography.
- **Geographica 17 volume**
- First 2 volume (1-2) = Introduction
- Next 8 volume (3-10) = Devoted to Europe
- Next 6 volume (11-16) = Devoted to Asia

- Last 1 volume (17) = Libya (Africa)
- Shape of earth Spherical (Geocentric Concept)
- Caspian Sea Inland Sea & connected with Northern ocean
- Theory of alternate elevation and depression of extensive areas.

2. Ptolemy (90 AD – 168 AD):

Claudius Ptolemy was a native of Egypt. He lived and wrote at Alexandria about the middle of the second century BC. He was a genius who developed sound principles of Mathematical Geography. His writings inspired the geographers and explorers of the Great Age of Discovery (fourteenth to sixteenth centuries to explore the **Terra Incognita** i.e., unknown land.)

Ptolemy's main contribution was in the field of Mathematical Geography. He made use of the material of Marinus and Hipparchus in writings and cartographic work. His best known works are the Syntaxis – Popularly known as the **Almagest** and **The Outline of the World**. The book, "Almagest, deals with the complicated problems of Astronomy and Mathematical Geography.He in agreement with Aristotle about the belief that the Earth is the spherical in shape and situated in the centre of the universe (geocentric concept).

His second most important work **'The Geography'** also known as **'The Guide to Geography'** deals with theory of map projection. It consists of catalogue of places with their latitudes and longitudes and describes briefly each continent, country and tribe.

He asserted that 'Geography is a science which deals with the art of map-making'.

A major contribution of Ptolemy to cartography has been the use of the graticule of latitude and longitude and the mathematical construction of the projection for his map. He also provided detailed accounts of the known world. He plotted the Gangetic Gulf (Bay of Bengal) for the first time.

His other minor works include "The Optics' and The Tetrabiblos' which deal with reflection and refraction respectively. These works are in field of astronomy. He also promulgated the concept of "Terra-Australis Incognita' which declared that Indian Ocean is a closed sea. This idea was probably borrowed from Hipparchus.

Despite all the omissions and commissions, Ptolemy prepared a good map of the world and his concept of Terra Incognita helped in the discoveries of Australia, South America, and Antarctica.

Key Points:

- Developed sound principles of mathematical Geography.
- He opined that-"Geography is a science which deals with the art of map-making"
- Shape of the Earth= Spherical (Geocentric)
- Major work/Book
    - The Syntaxis- popularly known as 'The Almagast'- great contribution on classical Astronomy.
    - Guide to Geography –consisted of 8 volumes. Opens with an excellent theory of map projection.
- He promulgated the concept of "Terra-Australis-Incognita"
- Minor work – The optics & The Tetrabiblos.

Contribution of Arabs in the Field of Geography

The followers of Prophet Mohammad made significant contributions in the field of geography from 8th to 13th century. The Arabs were the great contributors in the field of mathematical, physical and regional geography. Their achievements in climatology, oceanography, geomorphology, linear measurements, determination of cardinal points, limits of habitable world, sprawl of continents and oceans are highly appreciable.

The Muslim geographers' immense contribution in the field of geography, oceanography, and related sciences paved the way for understanding of geography and discovery and exploration of new parts of the earth.

Arab geographers and scholars have played a significant role in the evolution and development of Geography as a discipline since medieval times. The Arabs built upon the original base provided by the geographers of Ancient Greece, whose works had been translated into Arabic.

Thus, while Europe had entered into the "dark age", marred by the decline of scientific learning, the Arabs revived Geography. The great ascendancy of scientific inquiry in Arabia can be attributed to several factors.

Under the influence of Islam, the society was transformed from a multitude of tribes, divided by inter-tribal feuds into integral components of a larger, all inclusive identity, based on adherence to a common set of religious beliefs and practices.

The conquest of regions such as Spain and Portugal also provided stimulus to the rise of interest in geographical learning. Additionally, the Arab monopoly over the spice trade between India and Europe necessitated travels between places spread over a large expanse of territory.

Owing to these travels, Arabs gained considerable knowledge about geographical environment in tropical regions.

With the widening of geographical horizon, the Arabs approached scientific learning with alacrity. As Baghdad (founded in 726 A.D.) became a major centre of learning, major scientific works on Astronomy and Geography were translated into Arabic. As for instance, during the rule of MamunAbbasi (786 A.D.), *Almagest* (written by Ptolemy) was translated into Arabic under the title *Soratolarz* (meaning, shape of the Earth). In addition, new texts were written after duly incorporating the new knowledge derived from the records of

observations made by Arab merchants and explorers. Another of Ptolemy's books, *Tetrabiblon* was also translated into Arabic under the title *al-Makalat al-arbąa*. Other Greek texts translated into Arabic, include *Timael* (Ar: *Asarol-o-lomeeye*), edited by Plato and *Decaelo (*Ar: *Asma-ol-Alam)* and *Metaphysics (*Ar: *Mabaddo-tabeeye)* edited by Aristotle.

Arabs took keen interest **in the size, geometry and puerility of the Earth; the oceans, particularly the causes of tides; geomorphologic processes; regional climatic divisions; the distribution of flora and fauna; and the creation and use of various tools – especially maps.** With the acquisition of mapping skills came the development of world maps called ***Mappa Mundi* including *Pslater, Marino, Sanuto, Borgain, East World, Fra Moura, and the Image de Munde.***

Idrisi (1100-1156 A.D.) constructed a silver plan sphere, showing the world, as well as a 70-part world map.

The exploratory voyages undertaken by Arabs led to revival in geographical learning. Owing to Ibn-Hakul's excursion to the south of the equator (between 943 to 973 A.D.), the wrong notion regarding the inhabitability of the torrid zone (as perpetuated by Aristotle) was abandoned.

Al-Masudi reported the phenomenon of Monsoon winds, while travelling down the East coast of Africa upto Mozambique.

Al-Maqsidi had corroborated (in 985 A.D.) that the climate of any place is not only a function of its latitude, but also of its position on the east or west side of a landmass. He also proved that most of the Earth's landmass lies to the north of the equator.

Muqaddasi was a pioneer of fieldwork and believed that geographical fact can only be experienced personally through observation. His book titled *AhsanolTaghaseem* (meaning, the main divisions of the world) was based on many field trips in parts of the Islamic world. Based on his various observations, he divided the Islamic territories into 14 regions with relevant maps pertaining to their physical and human properties.

Al-Idrisi (around 1099-1180 A.D.) contradicted and corrected many Greek ideas, including those put forth by Ptolemy. In his book on Geography (1154 A.D.), he corrected the Greek idea about the Indian Ocean being a closed sea. He also amended the positions of many rivers including the Danube and the Niger.

The habitability of the Torrid Zone was also validated by the great Arab explorer IbnBatuta, who reported the existence of an Arab trading post 20 degrees south of the Equator. He travelled extensively during the fourteenth century and wrote detailed accounts of his travels for posterity.

Ibn-Khaldun (1342-1405 A.D.). In the introduction to the book *Muqaddimah*, he identified two sets of influences on man's progress (i.e., history): one, the physical (natural) environment, and two, the social environment derived from culture and belief. This distinction between the two sets of influences was a notable intellectual achievement for his time.

Ibn-Khaldun had "discovered the true scope and nature of geographical inquiry." Thus, Ibn-Khaldun's idea can be considered as a precursor to the evolution of the discipline into two distinct branches, viz., human geography and physical geography.

Ibn-Khaldun is also credited with presenting one of the earliest concepts of the life cycle of states. According to him, the tribe and the city are two distinct stages in the evolution of social organisation in a desert environment. While the nomads represented the primitive stage of social organisation, the city dwellers represented the last stage in the development of social life.

Thus, Arabs played an intrinsic role in the historiography of Geography. While Europe itself had forgotten the Greek heritage in geography, the Arabs held the banner aloft by translating the major Greek works in Geography and adding on to the existing knowledge. With the help of these translations and contacts with Arabia, the Europeans revived geography as a living science in the fifteenth century.

Contribution of India in the Field of Geography

Indian geography has a long history. The main sources of ancient Indian geographical works are the Vaidikas, the Ramayana, the Mahabharata, the work of Buddhists, Jains and the Puranas.

Travel accounts of Chinese and Arab travellers to India provided valuable information about the places they travelled, particularly the travel accounts of Chinese pilgrims like Hiuen Tsang, Fa-Hien, and Sung-Yun, and the Arab travellers like Ibn-Batuta and Al-Beruni.

A number of European travellers who toured India during 16th, 17th and 18th centuries also narrated and recorded their experiences which contain information about the various geographical aspects of India.

The ancient Indian scholars had a very good knowledge of the various dwipas (continents), mountain systems, rivers, fauna and flora of the brahmatvarsa (subcontinent) and the land lying in its vicinity.

The work has done by Varahmihira, Brahmagupta, Aryabhatta, Bhaskaracharya, Bhattila, Utpala, Vijaynandi and others have made substantial development in the field of astronomy, mathematical geography and cartography.

The ancient Indian literature describes the Universe as brahmand, which means very immense and wide.

The ancient Indian astronomers believed in the geocentric Universe.

They were also conscious of the causes of grahnas (eclipses).

They believed in the spherical shape of the earth.

About the size of the earth, no definite information was given in Vedic and Puranic literature, but later literature of the 5th and 6th centuries A.D on astronomy gave some convincing information about the dimensions of the earth which is as follows:

Dimensions of the Earth

Source	*Yojanas*	*Miles*	*Kms*
Pancha Siddantika (verse-18)	1018.6	8148.8	13038
Aryabhatta (verses)	1050.0	8400.0	13440

They were also conscious of the importance of akshansa (latitudes) and deshantra (longitudes) in the determination of a point or place on the surface of the earth.

The Puranas and the Vedic literature also gave descriptions of the mountains and rivers of Bharatvavsha.

The Puranas also mention the mountains like the Himavat, Uttra-kuru, Uttar-Madra, Trikakud (Hindukush), Vindhya, Durdura and Mahendra.

The Rig Veda mentioned about the various rivers like the Ganga, Yamuna, Saraswati, Sutudri (Sutlej), Parusni (Ravi), Asikni (Chenab), Vitasta (Jhelum) and Sindhu (Indus).

According to the Vedic information, river Ganga is said to flow from the Vindusarovar (Gangotri). There is also a mention of river Lauhitya (Brahmaputra) which debouches at Dihang near Sadya (Assam).

The Geographical Explorations of the 15th and the 16th Centuries

Geographical exploration holds a very important place in the history of Europe and even in the world history. It was due to these discoveries that the world became a smaller place. By the beginning of the 15th century, big ships were built and the magnetic compass was invented.

The Birth of the Age of Exploration

Many nations were looking for goods such as silver and gold, but one of the biggest reasons for exploration was the desire to find a new route for the spice and silk trades.

When the Ottoman Empire took control of Constantinople in 1453, it blocked European access to the area, severely limiting trade. In addition, it also blocked access to North Africa and the Red Sea, two very important trade routes to the Far East.

The first of the journeys associated with the Age of Discovery were conducted by the Portuguese. Although the Portuguese, Spanish, Italians, and others had been plying the Mediterranean for generations, most sailors kept well within sight of land or traveled known routes between ports. Prince Henry the Navigator changed that, encouraging explorers to sail beyond the mapped routes and discover new trade routes to West Africa.

Portuguese explorers discovered the Madeira Islands in 1419 and the Azores in 1427. Over the coming decades, they would push farther south along the African coast, reaching the coast of present-day Senegal by the 1440s and the Cape of Good Hope by 1490. Less than a decade later, in 1498, Vasco da Gama would follow this route all the way to India.

The Discovery of the New World

While the Portuguese were opening new sea routes along Africa, the Spanish also dreamed of finding new trade routes to the Far East. Christopher Columbus, an Italian working for the Spanish monarchy, made his first journey in 1492. Instead of reaching India, Columbus found the island of San Salvador in what is known today as the Bahamas. He also explored the island of Hispaniola, home of modern-day Haiti and the Dominican Republic.

Columbus would lead three more voyages to the Caribbean, exploring parts of Cuba and the Central American coast. The Portuguese also reached the New World when explorer Pedro Alvares Cabral explored Brazil, setting off a conflict between Spain and Portugal over the newly claimed lands. As a result, the Treaty of Tordesillas officially divided the world in half in 1494.

Columbus' journeys opened the door for the Spanish conquest of the Americas. During the next century, men such as Hernan Cortes and Francisco Pizarro would decimate the Aztecs of Mexico, the Incas of Peru, and other indigenous peoples of the Americas. By the end of the Age of Exploration, Spain would rule from the Southwestern United States to the southernmost reaches of Chile and Argentina.

Opening the Americas

Great Britain and France also began seeking new trade routes and lands across the ocean. In 1497, John Cabot, an Italian explorer working for the English, reached what is believed to be the coast of Newfoundland. A number of French and English explorers followed, including Giovanni da Verrazano, who discovered the entrance to the Hudson River in 1524, and Henry Hudson, who mapped the island of Manhattan first in 1609.

Over the next decades, the French, Dutch, and British would all vie for dominance. England established the first permanent colony in North America at Jamestown, Va., in 1607. Samuel du Champlain founded Quebec City in 1608, and Holland established a trading outpost in present day New York City in 1624.

Other important voyages of exploration during this era included Ferdinand Magellan's attempted circumnavigation of the globe, the search for a trade route to Asia through the Northwest Passage, and Captain James Cook's voyages that allowed him to map various areas and travel as far as Alaska.

The End of the Era

The Age of Exploration ended in the early 17th century after technological advancements and increased knowledge of the world allowed Europeans to travel easily across the globe by sea. The creation of permanent settlements and colonies created a network of communication and trade, therefore ending the need to search for new routes.

It is important to note that exploration did not cease entirely at this time. Eastern Australia was not officially claimed for Britain by Capt. James Cook until 1770, while much of the Arctic and Antarctic were not explored until the 20th century. Much of Africa also was unexplored by Westerners until the late 19th century and early 20th century.

Contributions to Science

The Age of Exploration had a significant impact on geography. By traveling to different regions around the globe, explorers were able to learn more about areas such as Africa and the Americas and bring that knowledge back to Europe.

Methods of navigation and mapping improved as a result of the travels of people such as Prince Henry the Navigator. Prior to his expeditions, navigators had used traditional portolan charts, which were based on coastlines and ports of call, keeping sailors close to shore.

The Spanish and Portuguese explorers who journeyed into the unknown created the world's first nautical maps, delineating not just the geography of the lands they found but also the seaward routes and ocean currents that led them there. As technology advanced and known territory expanded, maps and mapmaking became more and more sophisticated.

These explorations also introduced a whole new world of flora and fauna to Europeans. Corn, now a staple of much of the world's diet, was unknown to Westerners until the time of the Spanish conquest, as were sweet potatoes and peanuts. Likewise, Europeans had never seen turkeys, llamas, or squirrels before setting foot in the Americas.

The Age of Exploration served as a stepping stone for geographic knowledge. It allowed more people to see and study various areas around the world, which increased geographic study, giving us the basis for much of the knowledge we have today.

Impact of the Age of Exploration

The era known as the Age of Exploration, sometimes called the Age of Discovery, officially began in the early 15th century and lasted through the 17th century. The period is characterized as a time when Europeans began exploring the world by sea in search of new trading routes, wealth, and knowledge. The impact of the Age of Exploration would permanently alter the world and transform geography into the modern science it is today.

- Explorers learned more about areas such as Africa and the Americas and brought that **knowledge** back to Europe.
- **Massive wealth** accrued to European colonizers due to trade in goods, spices, and precious metals.
- Methods of **navigation and mapping** improved, switching from traditional portolan charts to the world's first nautical maps.

- **New food, plants, and animals** were exchanged between the colonies and Europe.
- **Indigenous people were decimated** by Europeans, from a combined impact of disease, overwork, and massacres.
- The workforce needed to support the massive plantations in the New World, led to the **trade of enslaved people**, which lasted for 300 years and had an enormous impact on Africa.
- The impact **persists to this day**, with many of the world's former colonies still considered the "developing" world, while colonizers are the First World countries, holding a majority of the world's wealth and annual income.

Contribution of voyages and discoveries

Ferdinand Magellan

In search of fame and fortune, Portuguese explorer **Ferdinand Magellan** (c. 1480-1521) set out from Spain in 1519 with a fleet of five ships to discover a western sea route to the Spice Islands. En route he discovered what is now known as the Strait of Magellan and became the first European to cross the Pacific Ocean.

The voyage was long and dangerous, and only one ship returned home three years later. Although it was laden with valuable spices from the East, only 18 of the fleet's original crew of 270 returned with the ship.

Magellan himself was killed in battle on the voyage, but his ambitious expedition proved that the globe could be circled by sea and that the world was much larger than had previously been imagined.

Ferdinand Magellan's Early Years

Ferdinand Magellan (c. 1480–1521) was born in Sabrosa, Portugal, to a family of minor Portuguese nobility. At age 12 Ferdinand Magellan and his brother Diogo traveled to Lisbon to serve as pages at Queen Leonora's court.

While at the court Magellan was exposed to stories of the great Portuguese and Spanish rivalry for sea exploration and dominance over the spice trade in the East Indies, especially the Spice Islands, or Moluccas, in modern Indonesia. Intrigued by the promise of fame and riches, Magellan developed an interest in maritime discovery in those early years.

Clove was the most valuable spice in Europe during Magellan's day. It was used to flavour food, but Europeans also believed that its essence could improve vision, its powder could relieve fevers and that it could enhance intercourse when mixed with milk.

In 1505, Magellan and his brother were assigned to a Portuguese fleet headed for India. Over the next seven years, Magellan participated in several expeditions in India and Africa and was wounded in several battles.

In 1513 he joined the enormous 500 ship, 15,000 soldier force sent by King Manuel to Morocco to challenge the Moroccan governor who refused to pay its yearly tribute to the Portuguese empire.

The Portuguese easily overwhelmed the Moroccan forces, and Magellan stayed on in Morocco. While there he was seriously wounded in a skirmish, which left him with a limp for the rest of his life.

Magellan: From Portugal to Spain

In the 15th century, spices were at the epicenter of the world economy, much like oil is today. Highly valued for flavoring and preserving food as well as masking the taste of meat gone bad, spices like cinnamon, clove, nutmeg and especially black pepper were extremely valuable.

Since spices could not be cultivated in cold and arid Europe, no effort was spared to discover the quickest sea route to the Spice Islands.

Portugal and Spain led the competition for early control over this critical commodity. Europeans had reached the Spice Islands by sailing east, but none had yet to sail west from Europe to reach the other side of the globe. Magellan was determined to be the first to do so.

By now an experienced seaman, Magellan approached King Manuel of Portugal to seek his support for a westward voyage to the Spice Islands.

The king refused his petition repeatedly. In 1517, a frustrated Magellan renounced his Portuguese nationality and relocated to Spain to seek royal support for his venture.

When Magellan arrived in Seville in October 1517, he had no connections and spoke little Spanish. He soon met another transplanted Portuguese named Diogo Barbosa, and within a year he had married Barbosa’s daughter Beatriz, who gave birth to their son Rodrigo a year later.

The well connected Barbosa family introduced Magellan to officers responsible for Spain's maritime exploration, and soon Magellan secured an appointment to meet the king of Spain.

The grandson of King Ferdinand and Queen Isabella, who had funded Christopher Columbus's expedition to the New World in 1492, received Magellan's petition with the same favor shown by his grandparents.

Just 18 years old at the time, King Charles I granted his support to Magellan, who in turn promised the young king that his westward sea voyage would bring immeasurable riches to Spain.

Strait of Magellan

On August 10, 1519 Magellan bade farewell to his wife and young son, neither of whom he would ever see again, and the Armada De Moluccas set sail. Magellan commanded the lead ship *Trinidad* and was accompanied by four other ships: the *San Antonio*, the *Conception*, the *Victoria* and the *Santiago*.

The expedition would prove long and arduous, and only one ship, the *Victoria*, would return home three years later, carrying a mere 18 of the fleet's original crew of 270.

In September 1519 Magellan's fleet sailed from Sanlúcar de Barrameda, Spain, and crossed the Atlantic Ocean, which was then known simply as the Ocean Sea. The fleet reached South America a little more than one month later. There the ships sailed southward, hugging the coast in search of the fabled strait that would allow passage through South America. The fleet stopped at Port San Julian where the crew mutinied on Easter Day in 1520.

Magellan quickly quelled the uprising, executing one of the captains and leaving another mutinous captain behind. Meanwhile Magellan had sent the *Santiago* to explore the route ahead, where it was shipwrecked during a terrible storm. The ship's crew members were rescued and assigned out among the remaining ships. With those disastrous events behind them, the fleet left Port San Julian five months later when fierce seasonal storms abated.

On October 21, 1520 Magellan finally entered the strait that he had been seeking and that came to bear his name. The voyage through the Strait of Magellan was treacherous and cold, and many sailors continued to mistrust their leader and grumble about the dangers of the journey ahead.

In the early days of the navigation of the strait, the crew of the *San Antonio* forced its captain to desert, and the ship turned and fled across the Atlantic Ocean back to Spain. At this point, only three of the original five ships remained in Magellan's fleet.

Magellan: Circumnavigating the Globe

After more than a month spent traversing the strait, Magellan's remaining armada emerged in November 1520 to behold a vast ocean before them. They were the first known Europeans to see the great ocean, which Magellan named *Mar Pacifico*, the Pacific Ocean, for its apparent peacefulness, a stark contrast to the dangerous waters of the strait from which he had just emerged.

In fact, extremely rough waters are not uncommon in the Pacific Ocean, where tsunamis, typhoons and hurricanes have done serious damage to the Pacific Islands and Pacific Rim nations throughout history.

Little was known about the geography beyond South America at that time, and Magellan optimistically estimated that the trip across the Pacific would be rapid. In fact, it took three months for the fleet to make its way slowly across the vast *Mar Pacifico.*

The days dragged on as Magellan's crew anxiously waited to utter the magic words "Land, ho!" At last, the fleet reached the Pacific island of Guam in March 1521, where they finally replenished their food stores.

Magellan's fleet then sailed on to the Philippine archipelago landing on the island of Cebu, where Magellan befriended the locals and, struck with a sudden religious zeal, sought to convert them to Christianity.

Magellan was now closer than ever to reaching the Spice Islands, but when the Cebu asked for his help in fighting their neighbors on the island of Mactan, Magellan agreed. He assumed he would command a swift victory with his superior European weapons, and against the advice of his men, Magellan himself led the attack.

The Mactanese fought fiercely, and Magellan fell when he was shot with a poison arrow. Ferdinand Magellan died on April 27, 1521.

Magellan would never make it to the Spice Islands, but after the loss of yet another of his fleet's vessels, the two remaining ships finally reached the Moluccas on November 5, 1521. In the end, only the *Victoria* completed the voyage around the world and arrived back in Seville, Spain, in September 1522 with a heavy cargo of spices but with only 18 men from

the original crew, including Italian scholar and explorer Antonio Pigafetta. The journal Pigafaetta kept on the voyage is a key record of what the crew encountered on their journey home.

Impact of Ferdinand Magellan

Seeking riches and personal glory, Magellan's daring and ambitious voyage around the world provided the Europeans with far more than just spices.

Although the trip westward from Europe to the east via the Strait of Magellan had been discovered and mapped, the journey was too long and dangerous to become a practical route to the Spice Islands.

Nevertheless, European geographic knowledge was expanded immeasurably by Magellan's expedition. He found not only a massive ocean, hitherto unknown to Europeans, but he also discovered that the earth was much larger than previously thought.

Finally, although it was no longer believed that the earth was flat at this stage in history, Magellan's circumnavigation of the globe empirically discredited the medieval theory conclusively.

Though Magellan is often credited with the first circumnavigation on the globe, he did so on a technicality: He first made a trip from Europe to the Spice Islands, eastward via the Indian Ocean, and then later made his famous westward voyage that brought him to the Philippines. So he did cover the entire terrain, but it was not a strict point A to point A, round the world trip, and it was made in two different directions.

His slave, Enrique, however, was born in either Cebu or Mallaca and came to Europe with Magellan by ship. Ten years later, he then returned to both Cebu (with Magellan) and Mallaca (after Magellan died) by ship on the armada's westward route. So Enrique was the first person to circumnavigate the world in one direction, from point A to point A.

Ferdinand **Magellan** was the first Sea Explorer to circumnavigate around the globe and prove that the Earth was a sphere, rather than a flat piece of land. **Magellan** also discovered the Spice Islands, also known as the East Indies or Moluccas Islands, during the expedition.

Vasco da Gama

Extraordinary voyages of the Portuguese explorer Vasco da Gama (1460-1524). This man was one of the most successful explorers from the Age of Discovery (the period in 15th-17th Century history where Europeans engaged in extensive exploration around the globe).

the Cape of Good Hope, Africa in 1488. The Portuguese then wanted to go further and reach India to establish trade for spices. In 1492, da Gama commanded the defense of Portuguese colonies against the French in Guinea. Then he set sail for India with four ships: the Sao Gabriel, the Sao Rafael, the Berrio and one other cargo ship.

Vasco da Gamma and his crew would have used a variety of navigation aids that would have been available during this period in history, including: astrolabes, charts, compasses, and traverse boards.

These navigational aids were used to measure the angle between objects above the ocean, such as the horizon, sun or stars. This would have enabled the calculation of the ships position at sea. Nothing quite like the GPS technology we have today.

So, in 1497 the crew sailed down the coast of Africa and made a short journey into the Atlantic, before swinging back to reach the south of Africa and the Cape of Good Hope.

The explorers passed round the Cape of Good Hope and sailed up the east coast of Africa, and then crossed the Indian Ocean to reach Calicut (now Kozhikode) by May 1948. This was the first totally water-based route to India.

This was the first of many journeys to India for the Portuguese, making Portugal one of the most important trading and naval powers in the Indian Ocean. When da Gama reached India, his final destination, he bought spices and silk cloth.

He left again for Portugal in 1499. On da Gama's second voyage, he made stops in Africa, and when visiting Mombasa (now Kenya) he made a peace treaty between Africa and Portugal.

That peace treaty was the first ever treaty of peace and friendship between an African country and a European country. While he was there he put up a monument, the original is no longer present but a replacement monument has been built.

In 1502 da Gama destroyed the Arab trading centers in India and along Africa's East coast and set up Portuguese trading centers, securing Portugal's position as one of the most important global trading powers.

Later, in 1524, after da Gama had set up many trading centers King John III named him Viceroy to India. During that same year he also became Admiral of India.

Unfortunately, later that year, he died in Cochin, his body was returned to Portugal however many memorials remain worldwide recognising his efforts in global exploration and trade expansion.

The tomb of Vasco da Gama lies in the Jerónimos monastery in Portugal.

The achievements and effects of the journeys of da Gama stretch far beyond the borders of Portugal, and this is reflected by the global spread of memorials to the man who pioneered trade with India.

The memorial in Durban, South Africa provides a further example, unveiled in 1897, 400 years after Da Gama was first sighted in this area.

A truly remarkable man who ultimately changed the dynamics of exploration and trade in the age of discovery.

Captain James Cook

The Geographic Adventures of Captain Cook, 1728–1779

James Cook was born in 1728 in Marton, England. His father was a Scottish migrant farmworker who allowed James to apprentice on coal carrying boats at the age of eighteen. While working in the North Sea, Cook spent his free time learning math and navigation.

Searching for something more adventurous, in 1755 he volunteered for the British Royal Navy and took part in the Seven Years War and was an instrumental part of the surveying of the St. Lawrence River, which helped in the capture of Quebec from the French.

Cook's First Voyage

Following the war, Cook's skill at navigation and interest in astronomy made him the perfect candidate to lead an expedition planned by the Royal Society and Royal Navy to Tahiti to observe the infrequent passage of Venus across the face of the sun.

Precise measurements of this event were needed worldwide to determine the accurate distance between the earth and the sun.

Cook set sail from England in August 1768 on the Endeavor. His first stop was Rio de Janeiro, then the Endeavor proceeded west to Tahiti where camp was established and the transit of Venus was measured.

After the stop in Tahiti, Cook had orders to explore and claim possessions for Britain. He charted New Zealand and the east coast of Australia (known as New Holland at the time).

From there he proceeded to the East Indies (Indonesia) and across the Indian Ocean to the Cape of Good Hope at the southern tip of Africa. It was an easy voyage between Africa and home; arriving in July 1771.

Cook's Second Voyage

The Royal Navy promoted James Cook to Captain following his return and had a new mission for him, to find Terra Australis Incognita, the unknown southern land.

In the 18th century, it was believed that there was much more land south of the equator than had already been discovered. Cook's first voyage did not disprove claims of a huge landmass near the South Pole between New Zealand and South America.

Two ships, the Resolution and the Adventure left in July 1772 and headed to Cape Town just in time for the southern summer. Captain James Cook proceeded south from Africa and

turned around after encountering large amounts of floating pack ice (he came within 75 miles of Antarctica).

He then sailed to New Zealand for the winter and in summer proceeded south again past the Antarctic Circle (66.5° South). By circumnavigating the southern waters around Antarctica, he indisputably determined that there was no habitable southern continent.

During this voyage, he also discovered several island chains in the Pacific Ocean.

After Captain Cook arrived back in Britain in July 1775, he was elected a Fellow of the Royal Society and received their highest honor for his geographic exploration. Soon Cook's skills would again be put to use.

Cook's Third Voyage

The Navy wanted Cook to determine if there was a Northwest Passage, a mythical waterway that would allow sailing between Europe and Asia across the top of North America.

Cook set out in July of 1776 and rounded the southern tip of Africa and headed east across the Indian Ocean.

He passed between the North and South islands of New Zealand (through Cook Strait) and towards the coast of North America.

He sailed along the coast of what would become Oregon, British Columbia, and Alaska and proceeded through the Bering Strait.

His navigation of the Bering Sea was halted by the impassable Arctic ice.

Upon yet again discovering that something did not exist, he continued his voyage.

Captain James Cook's last stop was in February 1779 at the Sandwich Islands (Hawaii) where he was killed in a fight with islanders over the theft of a boat.

Cook's explorations dramatically increased European knowledge of the world. As a ship captain and skilled cartographer, he filled in many gaps on world maps.

His contributions to eighteenth century science helped propel further exploration and discovery for many generations.

Christopher Columbus

The explorer Christopher Columbus made four trips across the Atlantic Ocean from Spain: in 1492, 1493, 1498 and 1502. He was determined to find a direct water route west from Europe to Asia, but he never did. Instead, he stumbled upon the Americas. Though he did not really "discover" the New World—millions of people already lived there—his journeys marked the beginning of centuries of exploration and colonization of North and South America.

During the 15th and 16th centuries, leaders of several European nations sponsored expeditions abroad in the hope that explorers would find great wealth and vast undiscovered lands. The Portuguese were the earliest participants in this "Age of Discovery," also known as "Age of Exploration."

Starting in about 1420, small Portuguese ships known as caravels zipped along the African coast, carrying spices, gold, slaves and other goods from Asia and Africa to Europe

Christopher Columbus: Early Life

Christopher Columbus, the son of a wool merchant, is believed to have been born in Genoa, Italy, in 1451. When he was still a teenager, he got a job on a merchant ship. He remained at sea until 1476, when pirates attacked his ship as it sailed north along the Portuguese coast.

The boat sank, but the young Columbus floated to shore on a scrap of wood and made his way to Lisbon, where he eventually studied mathematics, astronomy, cartography and navigation. He also began to hatch the plan that would change the world forever.

The First Voyage

At the end of the 15th century, it was nearly impossible to reach Asia from Europe by land. The route was long and arduous, and encounters with hostile armies were difficult to avoid. Portuguese explorers solved this problem by taking to the sea: They sailed south along the West African coast and around the Cape of Good Hope.

But Columbus had a different idea: Why not sail west across the Atlantic instead of around the massive African continent? The young navigator's logic was sound, but his math was faulty. He argued (incorrectly) that the circumference of the Earth was much smaller than his contemporaries believed it was; accordingly, he believed that the journey by boat from

Europe to Asia should be not only possible, but comparatively easy via an as-yet undiscovered Northwest Passage.

He presented his plan to officials in Portugal and England, but it was not until 1492 that he found a sympathetic audience: the Spanish monarchs Ferdinand of Aragon and Isabella of Castile.

Columbus wanted fame and fortune. Ferdinand and Isabella wanted the same, along with the opportunity to export Catholicism to lands across the globe. (Columbus, a devout Catholic, was equally enthusiastic about this possibility.)

Columbus' contract with the Spanish rulers promised that he could keep 10 percent of whatever riches he found, along with a noble title and the governorship of any lands he should encounter.

He kept a detailed diary during his first voyage. Christopher Columbus's journal was written between August 3, 1492, and November 6, 1492 and mentions everything from the wildlife he encountered, like dolphins and birds, to the weather to the moods of his crew. More troublingly, it also recorded his initial impressions of the local people and his argument for why they should be enslaved.

"They … brought us parrots and balls of cotton and spears and many other things, which they exchanged for the glass beads and hawks' bells," he wrote. "They willingly traded everything they owned … They were well-built, with good bodies and handsome features …They do not bear arms, and do not know them, for I showed them a sword, they took it by the edge and cut themselves out of ignorance. They have no iron …They would make fine servants … With fifty men we could subjugate them all and make them do whatever we want."

Columbus gifted the journal to Isabella upon his return.

Christopher Columbus's Later Voyages

About six months later, in September 1493, Columbus returned to the Americas. He found the Hispaniola settlement destroyed and left his brothers Bartolomeo and Diego Columbus behind to rebuild, along with part of his ships' crew and hundreds of enslaved indigenous people.

Then he headed west to continue his mostly fruitless search for gold and other goods. His group now included a large number of indigenous people the Europeans had enslaved. In lieu of the material riches he had promised the Spanish monarchs, he sent some 500 slaves to

Queen Isabella. The queen was horrified—she believed that any people Columbus "discovered" were Spanish subjects who could not be enslaved—and she promptly and sternly returned the explorer's gift.

In May 1498, Columbus sailed west across the Atlantic for the third time. He visited Trinidad and the South American mainland before returning to the ill-fated Hispaniola settlement, where the colonists had staged a bloody revolt against the Columbus brothers' mismanagement and brutality. Conditions were so bad that Spanish authorities had to send a new governor to take over. Meanwhile, the native Taino population, forced to search for gold and to work on plantations, was decimated (within 60 years after Columbus landed, only a few hundred of what may have been 250,000 Taino were left on their island). Christopher Columbus was arrested and returned to Spain in chains.

In 1502, cleared of the most serious charges but stripped of his noble titles, the aging Columbus persuaded the Spanish crown to pay for one last trip across the Atlantic. This time, Columbus made it all the way to Panama—just miles from the Pacific Ocean—where he had to abandon two of his four ships after damage from storms and hostile natives. Empty-handed, the explorer returned to Spain, where he died in 1506.

Legacy of Christopher Columbus

Christopher Columbus did not "discover" the Americas, nor was he even the first European to visit the "New World." (Viking explorer Leif Erikson had sailed to Greenland and Newfoundland in the 11th century.)

However, his journey kicked off centuries of exploration and exploitation on the American continents. The Columbian Exchange transferred people, animals, food and disease across cultures. Old World wheat became an American food staple. African coffee and Asian sugar cane became cash crops for Latin America, while American foods like corn, tomatoes and potatoes were introduced into European diets.

Today, Columbus has a controversial legacy—he is remembered as a daring and path-breaking explorer who transformed the New World, yet his actions also unleashed changes that would eventually devastate the native populations he and his fellow explorers encountered.

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UNIT IV:Four Traditions in Geography - Quantitative revolution- Paradigms in Geography- Dualism of Dichotomies - Systems concept -Regional Concept.

Four Traditions in Geography

Geographer William D. Pattison introduced his four traditions of geography at the annual convention of the National Council for Geographic Education in 1963. With these precepts, Pattison sought to define the discipline by establishing a common vocabulary in the geographic community at large. His goal was to create a lexicon of basic geographical concepts so that the work of academics could be easily interpreted by laymen. The four traditions are the Spatial or Locational Tradition, the Area Studies or Regional Tradition, the Man - Land Tradition, and the Earth Science Tradition. Each of these traditions is interrelated, and they are often used in conjunction with one another, rather than alone.

The **four traditions** are:

1) Spatial or Locational **tradition**,
2) Area studies or Regional **tradition**,
3) Man - land **tradition**, and
4) Earth science **tradition**.

Each of these traditions is interrelated, and they are often used in conjunction with one another, rather than alone.

Spatial analysis is a type of **geographical analysis** which seeks to explain patterns of human behaviour and its **spatial** expression in terms of mathematics and geometry, that is, locational **analysis**. Examples include nearest neighbour **analysis** and Thiessen polygons.The Locational Tradition attempts to explain the course of human settlements in terms of location, growth, and in relation to other locales.

The core concept behind the Spatial Tradition of geography relates to the indepth analysis of the particulars of a place such as the distribution of one aspect over an area using quantitative techniques and tools that might include such things as computerized mapping and geographic information systems, spatial analysis and patterns, aerial distribution, densities, movement, and transportation.

Area Studies or Regional Tradition

Unlike the Spatial Tradition, the Area Studies Tradition determines as much as it is possible to glean about a particular place in order to define, describe, and differentiate it from other

regions or areas. World regional geography, along with international trends and relationships are at its center.

Man-Land Tradition

The focus of the Man-Land Tradition is the study of the relationship between human beings and the land they live on. Man -Land looks not only at the impact people impose on their local environment but conversely, at how natural hazards can influence human life. Along with addition population geography, the tradition also takes into account the ramifications that cultural and political practices have on the given area of study as well.

Earth Science Tradition

The Earth Science Tradition is the study of planet Earth as the home to humans and its systems. Along with the physical geography of the planet, focuses of study include such things as how the planet's location in the solar system affects its seasons (this is also known as Earth - sun interaction) and how changes in the lithosphere, hydrosphere, atmosphere, and biosphere impact human life on the planet. Offshoots of the Earth Science Tradition of geography are geology, mineralogy, paleontology, glaciology, geomorphology, and meteorology.

Four geography concepts illustrate the varied nature of the science and provide a pluralistic basis for uniting professional and pedagogical geography and for promoting communication with laymen.

The spatial tradition, based on interest in geometry and movement, separates aspects of distance, form, direction, and position from events themselves. Ancient Greek sailing records first showed this perspective; school teachers and research geographers of central-place theory show it today.

The second tradition, area studies, focuses on the nature and character of places, emphasizing literature and history. The academic community recognizes this second tradition, although technical vocabulary isolates professionals from lay teachers.

The third tradition, the man-land interrelationship, initially had an environmental perspective and then changed to a cultural one. Today, its acceptance is seen in studies of resource use and conservation.

Earth science, the fourth tradition, studies concrete aspects of the physical world. Although geology-based college courses overemphasize physical geography and some social studies curricula reject it, earth science does provide a unified view of the earth as man's habitat.

Quantitative Revolution:

The **application of statistical and mathematicaltechniques, theorems and proofs in understanding geographical systems** is known as the 'quantitative revolution' in geography.

The **main objectives of the quantitative revolution** in geography were as under:

1. To change the descriptive character of the subject (geo + graphy) and to make it a scientific discipline;

2. To explain and interpret the spatial patterns of geographical phenomena in a rational, objective and cogent manner;

3. To use mathematical language instead of the language of literature, like 'After in the Koppen's classification of climate which stands for the 'tropical rainforests';

4. To make precise statements (generalizations) about locational order;

5. To test hypotheses and formulate models, theories and laws for estimations and predictions;

6. To identify the ideal locations for the various economic activities so that the profit may be maximized by the resource users; and

7. To provide geography a sound philosophical and theoretical base, and to make its methodology objective and scientific.

In order to achieve these objectives, the preachers of quantitative techniques stressed on field surveys for the collection of data and empirical observations.

Statistical methods were first introduced into geography in the early 1950s (Burton, 1963). Consisting mainly of descriptive statistics, there was also some attempt at hypotheses testing using, for example, chi - square.

Bivariate Regression Analysis followed shortly but it was not until the 1960s that the General Linear Model was fully explored. It was I. Burton who published a research paper, 'The Quantitative Revolution and Theoretical Geography' in the Canadian Geographer in 1963.

The inspiration for mathematical modelling came from at least two sources: first Social Physics, which focused initially on the 'Gravity Model' and, second Neoclassical Economics which influenced geography principally through the regional science movement and 'Location Theory'.

Although geographers borrowed several models from economics and sociology, e.g., the 'Crop Intensity Model' of J.H. Von Thunen (1826), Alfred Weber's model of 'Industrial Location' (1909), Christaller (1893-1969) was the first geographer who made a major contribution to location theory in his study of Central Places in Southern Germany.

Subsequently, American urban geographers developed theoretical models of urban places. It was during the post Second World War period that A. Ackerman (1958) encouraged his pupils to concentrate on quantification cultural processes and systematic geography.

Weaver, another American geographer, delineated crop combination regions in Middle West (1954) by applying the standard deviation technique which brought quantitative revolution in agricultural geography.

Hager strand became interested in the possibilities of investigating the process of innovation with the help of mathematical and statistical methods. He was able to construct a general 'Stochastic Model' of the process of diffusion.

Empirical studies indicated that the movement of persons between two urban centres was proportional to the product of their populations and inversely proportional to the square of the distance between them.

Stewart pointed out the isomorphic (equal form or structure relationship between this empirical generalization and Newton's law of gravitation. Thereafter, this concept became known as the 'Gravity Model'.

In other branches of the discipline, e.g., population, regional, economic, cultural and political geography a number of statistical techniques were gradually diffused.

Thus, the diffusion of quantitative techniques steadily took place in the 1960s. In Britain Richard Chorley and Peter Haggett, both from Cambridge University, applied quantitative techniques vigorously and inspired the new generation to adopt sophisticated statistical and mathematical tools and techniques to explain and interpret geographical patterns and spatial relations.

Advantages of Quantitative Techniques:

(i) All the techniques are firmly based on empirical observations and are readily verifiable.

(ii) They help in reducing a multitude of observations to a manageable number of factors.

(iii) They allow the formulation of structured ideas and theories which can be tested under the assumed conditions.

(iv)They help in deriving suitable models to understand the interaction of the evolved factors and their process within the models and with reference to observed facts.

(v) They help in identifying tendencies and desired trends, laws and theoretical concepts.

Disadvantages of Quantitative Techniques:

(i) The theories and models developed on the basis of empirical data, do not take into account the normative questions like beliefs, emotions, attitudes, desires, hopes and fears and, therefore, cannot be taken as the tools explaining exact geographical realities.

(ii) The over enthusiastic preachers have sacrificed many good qualitative statements which were quite useful.

(iii) They also demand sophisticated data which are rarely attainable outside the developed countries.

(iv)It has been found that generalisation done with the help of these techniques is bringing exaggerated results.

(v) The factorial designs depend on the use of the costly computer time and considerable financial assistance which are rarely available to the individual researcher of areal variation.

Geographical Paradigms

Geography had to confront many evolutionary and methodological problems.

It passed from the descriptive and teleological phase to the quantitative, radical and dialectical materialism stage. Various methodologies have been adopted to give precise and reliable description of places in literary as well as mathematical languages.

A natural law is "a generalization of unrestricted range in time and space"; in other words, a generalization with universal validity. Geographical laws are not like the precise laws of the natural sciences. The geographical laws are empirical in nature and therefore cannot be placed in the category of laws of the natural sciences.

All the empirical laws, formulated mainly in the social sciences, are valid for a specific place and specific time and are therefore termed as models, structured ideas of paradigms. Looking at the variation in the nature of laws, Harvey gives the concept of law about the types of models and paradigms that developed in geography during the last one hundred and fifty years.

If we begin with the period of **Carl Ritter** who is considered as one of the founders of modern geographical thought and an advocate of **empiricism** in the discipline, it may be said that he used **inductive method** as a framework for his presentation of data and as a means to arrive at some simple empirical generalization.

Ritter asserted that all phenomena are spatially distributed according to the plan of God for mankind. The major problem of the teleological philosophy is that such a philosophy cannot be tested empirically and therefore does not qualify as scientific explanation.

Nevertheless, it has the characteristics of a paradigm.

Ritter's **teleological approach** is generally taken to mean that a phenomenon is explained in relation to the purpose it is believed to serve.

The '**holistic-synthesis'** of organic relationships is strongly related to teleological explanatory models. This approach is reflected in most of the semantic religions and their philosophies.

The post - Ritter period was dominated by **Darwin** who revolutionized the entire philosophy of science and brought a **cause and effect approach** in explaining spatial distribution of phenomena. It was during this period that geographers and scientists started thinking

seriously about the nature of geography, and **concentrated on the issue, whether geography can be regarded as a science.**

Darwin laid the foundation of the **deterministic approach** in geography. In his opinion, the natural conditions determine the socio cultural development of a society.

After Darwin, scientists were looking for the controlling laws of nature and to a considerable extent adopted a **nomethetic (general law - making) approach**.

At this stage, inductive arguments were increasingly replaced by **hypothetic deductive methods.** Researchers, starting from inductive arrangements of their observations or from intuitive insight, tried to devise for themselves a priori **models of the structure of reality.**

These were used to **postulate a set of hypotheses** which could be confirmed, corroborated or rejected by **testing empirical data through experiment**.

The theories postulated about **the evolution of landforms, normal cycle of erosion**, etc.

The **heartland theory by William Morris Davis and Mackinder** fell under this category of geographical models.

As a result of these paradigms**, geography acquired recognition and respect in the community of sciences**. But human geography showed a stunted growth.

At this stage, **Vidal de La blache** and his followers laid stress **on possibilism** and declared that man is not a passive agent ruled by the forces of nature which play their role and determine man's destiny and shape human society.

For this purpose, a large number of micro - level studies were conducted which was a **regional approach** and thus geography became an **'idiographic' or a 'regional' science**.

In the terminology of Kuhn, geomorphology and determinism represented the first paradigm phase in geography.

Determinism, however, had a short span of life and it was **replaced by possibilism** and the French School of Regional Geography.

The possibilists developed the approach that to understand a society and its habitat **field study** is most important.

Although possibilism and regional geographical school developed new paradigms and became very popular, these could not remove the deterministic model. Thus, the

deterministic explanatory model survived side by side with possibilism. Kuhn has termed this period as '**revolutionary phase'.**

After the Vidalian tradition, the major concern of geographers became **to study regions**. **George Chabot** went to the extent of saying that "regional geography is the centre around which everything converges".

Regional geography flourished in France and got diffused in the neighbouring countries. But, later on, this approach also became inadequate to explain the regional personality, and therefore, a period of crisis in the discipline emerged.

It brought about **quantitative revolution and functional approach** in geography. Now geographers began using more models, especially in the field of human geography. Many of them have been strongly pleading for system analysis.

From the description given above about the **development of geographical paradigms, models, laws and theories,** it may be inferred that complete revolutions in geography have not taken place.

Numerous schools of thought are marching side by side in search of new paradigms which can help in ascertaining the geographical personality of a region. Geographers are dividing themselves in the category of **positivists, pragmatists, phenomenologists, existentialists, idealists, realists and dialectical materialists**. This is a crisis phase with revolution which shall lead to new paradigm phase.

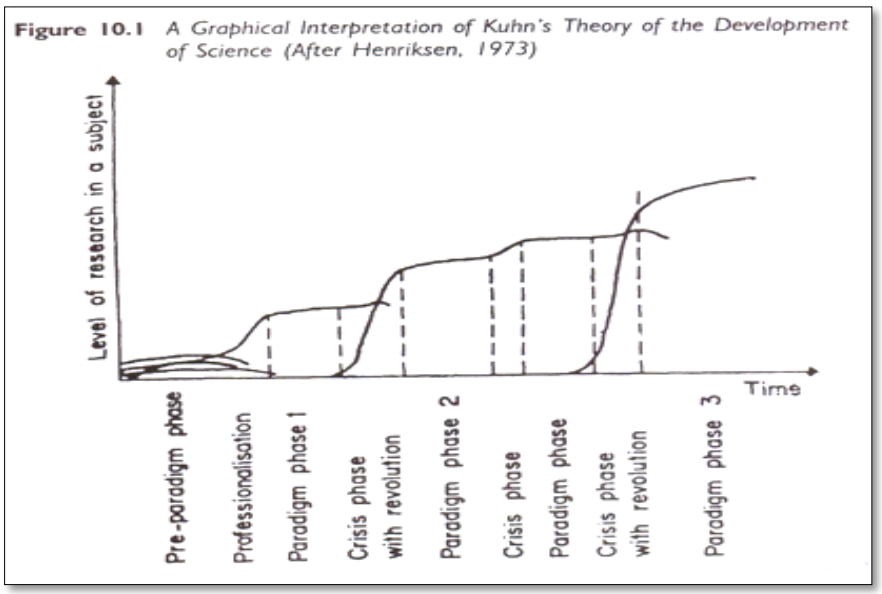

Figure 10.1 *A Graphical Interpretation of Kuhn's Theory of the Development of Science (After Henriksen, 1973)*

Kuhn in his postulate advocated that the development of science consists of Pre – paradigm phase, Professionalization, paradigm phase 1, Crisis phase with revolution, Paradigm phase 2, Paradigm phase, Crisis phase with revolution, Paradigm phase 3 and so on. This concept is graphically plotted by Henriksen. It shows that the scientific knowledge progresses and develops like a plateau. There are sudden upheavals and then abrupt rise which is followed by smooth and slow progress.

The first phase i.e., the pre – paradigm period is marked by conflicts among several distinct schools which grow around individual scientists. This period is also characterized by a rather indiscriminate collection of data over a very wide field and by a low level specialization. This period is full of communication among various schools of thoughtand with other scientists and laymen. One school of thought does not consider itself to be any more scientific than the other.

From the pre – paradigm phase, scientific development marches and centers into professionalization. Professionalization takes place when one of the conflicting schools of thought begins to dominate the others and thus a clear answer to the questions raised is given. A particular school of thought may dominate because it develops new methods or put questions which come to be regarded as more interesting or significant. New researches are thereby undertaken and research makes progress. Kuhn argues that Mathematics and Astronomy left the pre – paradigm phase in antiquity, whereas in parts of social sciences the transitions may be occurring today.

The third phase is a paradigm phase. This phase is characterized by a dominating school of thought, which has, often in quite a short span of time, supplanted others. A paradigm is established which leads to concentrated research within a clearly distinguishable problem area – an activity described as ‘normal science’.

After the ‘normal science’ phase, there occurs stagnation in research which leads to chaos and turmoil. This period may be termed as ‘temporary dark phase’ in the development of scientific knowledge. This crisis phase with revolution is the starting point for the paradigm phase 2, which in turn, is followed by crisis, revolution and paradigm continues throughout the history of science and helps in the advancement and decline of societies.

In this dynamic world, the period of ‘normal science’ is sooner or later replaced by a crisis phase. This occurs because more and more problems get accumulated which cannot be solved

within the framework of the ruling paradigm. Either more observations shake the underlying theory or a new theory is developed which does not accord with the stipulation of the ruling paradigm. The crisis phase is characterized by a reassessment of former observational data, new theoretical thinking and free speculation. This involves basic philosophical debates and a thoroughgoing discussion of methodological questions.

The crisis phase ends when it appears either that the old paradigm can solve the critical problems after all, allowing a period of normal science to be resumed, or that no significantly better theory to solve the problems can be developed and thus consequently, research must continue for a further period within the old paradigm. Otherwise the crisis phase ends when a new paradigm attracts a growing number of researchers.

In case the crisis phase terminates owing to the acceptance of a new paradigm, it becomes the inaugural point of the revolutionary phase. This involves a complex break in the continuity of the research, with a comprehensive reconstruction of the theoretical structure of knowledge. The understanding of the truth itself and the scientists' perception of the world can take on a new dimension. The acceptance of the new paradigm gives recognition to the new and younger scientists. The new researchers start competing with the old established scientists. The new scientists generally cannot convince the old scientists soon pass away and their following becomes weak.

The exchange of one paradigm for another is not a wholly rational transaction. The new paradigm will generally provide solutions to the problems which the old one found difficult to resolve before. It is seldom possible to argue logically that the new paradigm is better than the old.

Kuhn's paradigm gives a very scientific explanation of the growth phases of scientific knowledge. This model, like all the other paradigms, has also its merits and demerits. Kuhn's paradigm has provided an opportunity to the younger research workers to postulate new theories without justifying their researches objectively.

Kuhn's theories have had a positive influence on modern science in that they facilitated the acceptance of new theories and frameworks of understanding which may widen our knowledge and perception, but may have negative influence in giving well – organized groups of poorly – qualified people a legitimate entry into research.

Dichotomy and Dualism in Geography

Dichotomy means branching of subject into 2 parts - Dualism also stands for dichotomy. Dualism refers to existence of two contrasting or separate entities alongside.
Geography has a legacy of dualism in its content and methodology. Right from classical period Geographers have been dividing subject into 2 parts; Human and physical geography. Over a period of time, several other dichotomies emerged out of which some are General Vs Regional geography, Physical Vs Human geography, Historical Vs Contemporary geography, Deterministic Vs Possibilistic geography.
Bernhard Varen, aka Verenius introduced the dualism of general (Universal) geography and special (particular) geography, which led to the development of 'systematic' and '**regional**' geography. Thus, **Varenius** was the first scholar who laid the foundation of the dichotomy of systematic **vs**. **regional** geography.

There are five dichotomies and dualisms in geography:

1. Contemporary vs Historical geography
2. Physical vs Human geography
3. Deterministic approach vs possibilistic approach
4. Regional vs System approach
5. Functional vs formal approach

Contemporary vs Historical geography:

Some geographers emphasized the importance of historical geography, as it deals with past geographical features. Because of the following reason, the study of the historical aspect of geography is needed:

We get the information about the physical and cultural landscape evolution

- Evolution of settlement pattern through time, from unplanned settlements to planned city planning
- Past hazardous data. Example submergence and the emergence of the island, tsunami, and earthquake destruction, etc.
- Geographical changes through time, for example, peneplain, plateau, the evolution of mountain, etc

Some geographer emphasized the importance of the study of contemporary geography, as need of people has evolved, as geographer do not want to waste the energy and time to study historical data.

Because of the following reasons, the study of contemporary geography is important:

- Due to climate change, there is a need for a sustainable way of planning.
- Solid waste management, plastic, pollutions are contemporary issues
- Due to technological advancement, now humans can create an artificial environment, artificial minerals, many more.

Physical vs Human geography

The **physical geography** school of thought emphasized the study of geography as a separate entity where the influence of man is neglected.

- Physical geography studies the physical features of the earth.
- Study of landform, climate, vegetation, mountain building, etc, comes under physical geography.

The **Human geography** school of thought emphasized the role of humans, culture, language, society, etc, in geography.

Give more importance to man and environment relations. In physical geography, humanly considered passive elements, but in human geography, man is active, passive, or both. The same applied to the environment also; nature can be active, passive, or both.

Under this, we study, cultural geography, language, demographic, economic growth and development, model theory related to industry and economy development, social study.

Deterministic approach vs. possibilistic approach

Determinism

Environments control the course of human action. Human action is not supreme, the environment decides what people should do.

The following geographer supported the determinism philosophy:
Darwin: Survival of the fittest

- **Aristotle:** As per Aristotle views
- Cold climate region people: Brave and powerful but weak-minded.

- Hot climate region people: Physically weak and timid but high in intelligence.
- **Strabo:** Roman geographer explains how, slope, relief, climate.all were work of nature
- **Al Masudi:** In Syria, gay and humorous people found in water abundance area, dry area people are short-tempered
- **Carl Ritter,:** narrow eyelids of Turkish people were the effect of the desert in humans
- **Humboldt:** The mode of life of mountainous people is different from plain areas.

Possibilism

The concept of Possibilism came as a reaction to environmental determinism. In the environment determinism, the human was made as a passive element. Possibilism theory says the world is full of possibilities, it is up to man how they are using it.

- There are no necessities but everywhere possibilities
- Nature provides many possibilities, and possibilities can be increased through knowledge, innovation, and technological advancement
- Man is not a passive element, man is the active agent. Man can create, alter, destroy the environment

Systematic and Regional Geography;

Regional Geography :

Hartshorne defines it as the study of all the features of a given region, any two-dimensional area of interest. The first objective is to learn and record the facts of the world within the region, to describe the region's "contents", and therefore describe the region itself. The second objective is to understand the region as an independent entity, as well as a reality within a broader context.

Regional geography has often sought an explanation of local idiosyncrasies. Regional geography in the traditional sense seeks to bring together in an aerial setting various matters and it is the study of the geography of regions. Special geography was primarily intended as a description of individual countries and world regions. It was difficult to establish laws in the special geography where human beings are involved, whose behaviour is always

unpredictable. Special geography, nevertheless, helped in the formulation of hypothesis and structured ideas.

Systematic (General) Geography:

It deals with processes that operate through space, in an attempt to understand and explain them. Most systematic geography is done through "case studies", which in geography are generally regional. But the point is to be studying a phenomenon that is presumed to be universal, to operate identically elsewhere (subject to conditions, of course); any results are meant to be generalizable.

Systematic geography certainly makes use of the facts that belong to regional geography and produces its own descriptions. It was concerned with the formulation of general laws, principals and generic concepts. Systematic geography drew inspiration from the existing systematic sciences with a search for universal and generic concepts. In brief, general geography deals with the whole world as a unit. It was, however, mainly restricted to physical geography, which could be understood through natural laws. This dichotomy between 'general' and 'regional' was first raised by Bernhard Varen (also known as Varenius) in the 17th century.

SYSTEM ANALYSIS

Geography deals with complex relationships of living and non living organisms in an ecosystem. System analysis provides a framework for describing the whole complex and structure of activity. It is, therefore, peculiarly suited to geographic analysis since geography deals with complex multivariate situations. It was because of this advantage that Berry and Chorley suggested system analysis and general system theory as the basic tools for geographic understanding. In the opinion of Chorley (1962), there is great significance of system analysis in geographical studies.

System consists of:

(i) A set of elements identified with some variable attributes of objects.

(ii) A set of relationships between these attributes of objects and the environment.

(iii) A set of relationships between these attributes of objects and the environment.

Behaviour of a System:

Behaviour of a system means interrelationships of the elements, their reciprocal effect on each other. Behaviour has to do therefore, with flows, stimuli, and responses, inputs and outputs and the like. We can examine both the internal behaviour of a system and its transactions with the environment. If the environment undergoes a change, then, at least one element in the system is affected.

The effect of these affected elements is transmitted throughout the system until all connected elements in the system are affected. This constitutes a simple stimulus response, or input-output system without feedback to the environment:

The behaviour is described by the equations (deterministic or possibilistic) connect the input with the output.

Structure of a System:

A system is composed essentially of three components:

1. A set of elements;

2. A set of links; and

3. A set of links between the system and its environment.

Elements of a System:

Elements are the basic aspects of every system, structure, function, development. From the mathematical point of view, an element is a primitive term that has no definition, like the concept of point in geometry. Nevertheless, the structure of a system is the sum of the elements and the connections between them. Function concerns the flows (exchange relationships) which occupy the connections. Development presents changes in both structure and function which may take place over time.

Links or Relationships:

The second component of a system is links (relationships). The links in a system which connect the different elements in it have been shown.

These are as follows:

(i) Series relation.

(ii) Parallel relation.

(iii) Feedback relation.

(iv) Simple compound relation.

(v) Complex compound relation.

Three basic forms of relationships can be defined as under:

(i) Series Relation:

This is the simplest and is characteristic of elements connected by an irreversible link. Thus, ai—aj forms a series relation and it may be observed that this is the characteristic cause and effect relation with which traditional science has dealt. This relationship can be explained by taking an example from India. The productivity of rice in Punjab depends on irrigation available or cultivation of saffron in the valley of Kashmir is due to the Karewa soil.

(ii) Parallel relation:

This relationship occurs when two or more elements affect a third element, or inversely when one element affects two or more others. It may be noted from Figure 10.4 that ai and aj are affected by some other element ak. For example, the precipitation and temperature variables

influence vegetation and vegetation, in turn, influences the amount of rainfall received and the general temperature conditions.

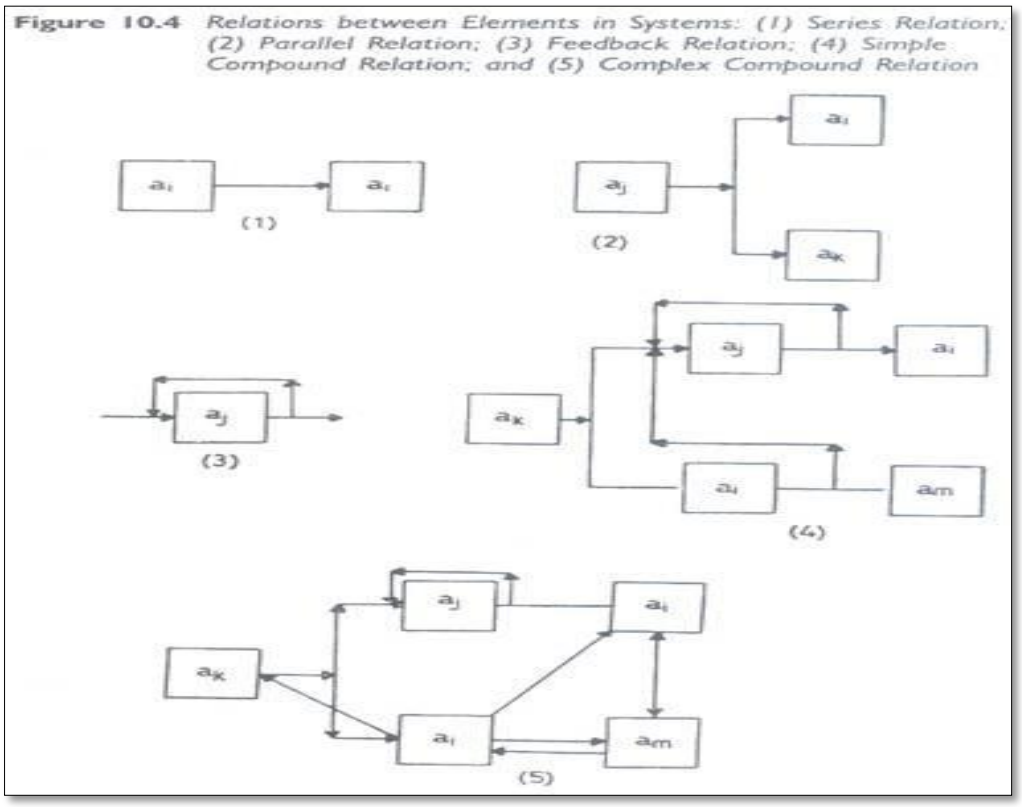

Figure 10.4 *Relations between Elements in Systems: (1) Series Relation; (2) Parallel Relation; (3) Feedback Relation; (4) Simple Compound Relation; and (5) Complex Compound Relation*

(iii) Feedback Relation:

A feedback relation is the kind of link that has been newly introduced into analytic structures. It describes a situation in which one element influences itself. For example, the leguminous crops sown in a field enrich nitrogen in the soil and thus the crops get themselves affected. The feedback relationship may be direct, positive, negative or no feedback. An example of the direct feedback is: A influences B which in turn influences A, or it may be indirect, with the impulse from A returning to it via a chain of other variables.

The main advantages of system analysis are:

1. There is need to study systems rather than isolated phenomena;

2. There is need to identify the basic principles governing systems;

3. There is value in arguing from analogies with subject matter; and

4. There is need for general principles to cover various systems.

REGIONAL ANALYSIS

Regional analysis is an attempt to **understand** social and cultural organization in terms of spatial differentiation and organization.

Region is a dynamic concept which has been defined differently by different geographers.

In the concluding part of the 19th century, the French geographers like Vidal de La blache called the areas of similar physical and cultural characteristics as pays.

A more comprehensive and widely acceptable definition of region can be given as "an area having the homogeneity of the physical and cultural phenomena". It has also been defined as "an area that is differentiated from other areas according to the specified criteria".

Herbertson (1905) was the first to divide the earth into major natural regions on the basis of climatic parameters and thus having some links with the determinism. On the smaller scale, geographers attempted to identify individual areas with particular characteristics.

The fundamental idea behind the small geographic regions was to show some distinct individuality, if not necessarily entire homogeneity through a study of all its geographical features, i.e. structure, climate, soils, vegetation, agriculture mineral and industrial resources, settlement and distribution of population.

Attributes of Region:

(i) Regions have location:

All regions—physical or cultural—are often expressed in the regional name such as the Middle East, the South-East Asia, the North-West Europe, the Far East, etc.

(ii) Regions have spatial extent:

The homogeneous physical and cultural attributes of the earth surface have spatial (areal) extent. For example, the Thar Desert, the Sahara Desert, the Latin America and Anglo-America cover certain areas of the earth surface. Thus, regions are not in abeyance; they have a personality on the ground.

(iii) Regions have boundaries:

Each region—physical or cultural—has a boundary. The boundary of a region is drawn at the outer edge where the phenomenon (feature) no longer occurs or dominates. For example, where the Himalayas and the Siwaliks end, the Indo-Gangetic plains begin, and where the Gangetic plains end, the Deccan plateau begins.

Similar may be the case of the language regions in India. There is a line of demarcation between the Telugu, Tamil and Malayalam regions in India.

(iv) Regions may be either formal or functional:

Formal regions are areas of essentially uniformity throughout in one or limited combination of physical or cultural features. The equatorial region, the monsoon region, the Sahel region (Africa), the Tundra region, the mountainous region are the examples of formal physical regions.

Similarly, we may observe the homogeneity of language, religion, ethnicity and lifestyle in certain areas. Such regions are known as the formal cultural regions. Whatever the basis of its definition, the formal region is the largest area over which a valid generalization of attribute uniformity may be made. Whatever is stated about one part of the region holds true for its other parts also. Up to 1960, most of the regions demarcated by geographers used to be formal regions.

Functional region, in contrast, is a spatial system defined by the interactions and connections that give it a dynamic, organizational basis. Its boundaries remain constant only as long as the interchanges establishing it remain unaltered. 'City region' may be cited as a good example of functional region. The city region is "an area of interrelated activities, kindered interests and common organizations, brought into being through the medium of the routes which bind it to the urban centres".

We can delineate the commuting regions of Delhi, Bombay, Calcutta or any one of the metropolitan and mega cities. Similarly, functional regions of the national capital of India may be demarcated by taking the supply of milk, fruits, vegetables and newspapers. The functional region is, however, a dynamic concept which changes in space and time.

(v) Regions are hierarchically arranged:

Although regions vary in scale, type and degree of generalization, none stands alone as the ultimate key to areal understanding. Each defines only a part of the spatial (regional) reality.

On a formal regional scale of size progression the Ganga-Yamuna Doab may be seen as part of the Upper Gangetic Plain, which in turn is a portion of the Sutlej-Ganga Plain. Similarly, the Central Business District (CBD) of Delhi (Connaught Place) is one land use complex in the functional regional hierarchy that describes the spatial influences of the city of Delhi and the National Capital Region of which it is the core.

(vi) Regions have transitional boundaries:

Generally, regions do not have sharp boundaries. In most of the cases their boundaries are transitional. It means there is some overlapping of one phenomenon over the other.

Classification of Regions:

The regions may be classified as under:

(i) Regions based on physical characteristic.

(ii) Regions based on cultural characteristics.

(iii) Regions based on an amalgamation of the physical and cultural variables.

(i) Physical Regions:

The simplest of all regions to define, and easiest to recognize is the formal region based on a single variable or single characteristic. The island is land, not water, and its unmistakable boundary is naturally given where the one element (land) passes to the other (water). The dense forest may break dramatically upon the open grassland. The nature of change is singular and apparent.

(a) Landform regions:

The landform regions are classified and demarcated on the basis of structure, relief, configuration, genesis and age. These regions are independent of human influence and unaffected by time on the human scale. Landforms constitute basic, naturally defined regions of physical geographic concern. The Himalayan system, the Vindhyan system, the Aravalli system, the Alpine system, the Kashmir valley, the Brahmaputra valley, plateaus and mountains, humid landform areas, dry landform areas, and glacial areas are some of the examples of the landforms regions.

(b) Climate region:

A specific area in various combinations of climatic elements (temperature, rainfall etc.) may be recognized as a climatic region. Numerous attempts have been made to identify and classify climatic regions: (a) based on latitudinal temperature zones, we have the torrid, temperate, and frigid zones; and (b) based on temperature, rainfall and climatic effects, we have Koppen's, Thornthwait's and Miller's climatic regions.

(a) Air masses:

An air mass is a vast body of air whose physical properties (temperature and humidity) are more or less uniform in the horizontal plane.

On the basis of these characteristics:

(i) Arctic, (ii) polar-continental, (iii) polar-maritime, (iv) tropical- continental, (v) tropical-maritime, (vi) equatorial air masses, and (vii) the monsoon. The climatic regions are dynamic in nature. Climates like vegetation and soils change through time by natural process or by the action of humans. Boundaries shift as witness the recent migration southward of the Sahara.

(d) Ecosystems as regions:

Ecosystem is an ecological concept defining the relationship between a set of living and non-living objects. One of its clearest definitions was given by Fosberg (1963) who states:

Ecosystem is a functioning, interacting system composed of one or more living organisms and their effective environment, in a biological, chemical and physical sense. It is a concept applicable at any scale ranging from the planet earth as an ecosystem down to the smallest patch of moss and lichen on a rock surface.

(ii) Cultural Regions:

A cultural region refers to an area over which the cultural traits of human group may be identified. The culture and cultural environment of human groups (ethnic groups) varies from place to place. This variation in cultural traits results into variation in human occupation and his organization of space.

Some of the important cultural regions are:

(i) population regions, (ii) linguistic regions, (iii) religious regions, (iv) agricultural regions, (v) industrial regions, and (vi) transport and trade regions.

(a) Population regions:

Population and its demographic attributes constitute an important aspect of cultural landscape. To delineate an area into the high density and low density areas is known as population regions. The age and sex composition, birth, death and growth rates patterns, the literacy, occupations and patterns of migration may also be delineated. All these are known as population regions.

(b) Language regions:

All over the world, different social groups speak different languages. The delineation of different language areas on a map is known as language region. Taking language as the criterion, the world may be divided into: (i) Indo-European, (ii) Indo-Iranian, (iii) Sino-Tibetan, (iv) Afro-Asiatic (Arabic), (v) Austro-Asiatic, (vi) Amerindian, and (vii) Negro language regions.

(c) Religious regions:

The world may be divided on the basis of religions, e.g., regions of Christianity, Islam, Judaism, Hinduism, Buddhism, Sikhism and Jainism. Each religion has its own basic tenets.

(d) Political regions:

The most rigorously defined formal cultural region is the national state. Its boundaries are carefully surveyed and in many cases are marked by fences and guard posts. There is no question of any arbitrarily divided transition zone. This rigidity of a country's boundaries, its unmistakable placement in space and the trapings—flag, anthem, army, government—that are uniquely its own give to the state an appearance of permanence and immutability not common in other, more fluid cultural regions.

(e) Economic regions:

Economic regionalization is among the most frequent, familiar and useful employment of the regional method. The economic regions in geography identify economic activities, and resources over space. The economic region serves as a useful tool for planning and a framework for the manipulation of the people, resources and economic structure of a formal region. Problems like poverty, hunger, outmigration, cultural deprivation, underdevelopment and malnutrition may be systematically examined with the help of economic regions. Economic regions are generally delineated with the help of several socio-economic indicators.

(f) Natural resource regions:

The unevenly distributed resources upon which the people depend for existence are logical topics of interest in regional concept. Resource regions are mapped, and their raw material qualities and quantities are discussed. The availability of resources, their role in the development industries and tertiary sector has great planning importance. We can delineate world into oil, natural gas, coal and iron ore regions.

(g) Urban regions (megalopolis):

Urban centres may be formal or functional regions. Cities and urban centres are the areas of production, exchange, administration, distribution and consumption. They have hierarchical structure. Internally, they show complex patterns of land use and functions.

(h)Agricultural regions:

These are: wheat, rice and jute regions of India; and cotton belt, corn belt and wheat belt of U.S.A.

(i) Industrial regions:

Industrial regions are demarcated by taking into consideration the industrial parameters. Hoogly basin, Bombay- Ahmedabad region, Madra-Coaimatre region, Delhi industrial region, Donetz basin (Ukrain), Central industrial region (Moscow), Rhine region, Saar basin (Germany), Tokyo region, Kobe and Yakohama region (Japan), and Birmingham and London industrial regions of U.K. are some of the examples of industrial regions.

(j) Mental regions (mental map):

Mental region is a distorted egocentric image of place. The images which constitute mental maps (the political, social, cultural, and economic values) held by men blend into an overall image about the space around him. This image or mental map differs from person to person. For example, primitive societies, particularly, have distinctive views about place and earth.

Regionalism:

Regionalism, also known as sub-nationalism, is a concept of political geography. It is a movement which seeks to politicize the territorial predicaments of its regions with the aim of protecting or furthering its regional interest. Generally, regionalism is based on ethnicity, caste, creed, language, colour or culture. Regionalism also aims at achieving autonomy and local power (political and economic both).

Regionalism may help in overcoming and solving some of the socio-political and economic problems of its supporter, but it is a big barrier in the process of national integration. In India also, there seems to be an emerging trend of regionalism.

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