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UNIT – VIII

Geographic Thought

1. Contributions of Greek Scholars	1
2. Roman Geographers	5
3. Contributions of Arab Scholars	7
4. The Contribution of Chinese to Geography	14
5. Evolution of Geographical Thought in India	17
6. Expeditions to America	35
7. Russian Expedition and Generalisations	38
8. Systematic Geography	42
9. Regional Geography	44
10. Contribution of Carl Ritter to Modern Geography	46
11. Evaluation	55
12. Dualisms in Geographic	62
13. Determinism Versus Possibilism	65
14. Quantitative Geography Versus Behavioural Geography	67
15. Idiographic Versus Nomothetic	69
16. Modernism Versus Post-modernism	71
17. Positivism	73
18. Humanism in Geography	75
19. Geographical Knowledge	78
20. Structuralism in Geography	83
21. Post-Modernism in Geography	91
22. Some important books and writers	98

UNIT – IX

Geographical Techniques

1. Sources of Geographic Information and Data	102
2. Map, Types of Maps Based on Scale	106
3. Types of Maps Based on Function	107
4. Thematic Map	108
5. Choropleth Maps	110
6. Isarithmic or Isopleth map	111
7. Isolines	111
8. Flow maps	114
9. Chorochromatic maps	114
10. Dasymetric Map	115
11. Representation of Data	116
12. Map Projection	120
13. Remote Sensing	124
14. The Electromagnetic Spectrum (EMR), Properties of Electromagnetic Waves	128
15. Visual Interpretation	131
16. Geographic Information System (GIS): History, Components, Data Types, Attribute Data Types	134
17. Digital elevation model or DEM	139
18. Georeferencing	139
19. The Lorenz curve	140
20. Analysis Of Variance (ANOVA)	141
21. T-test	143
22. Morphometric Analysis of River Drainage Basin	145

UNIT – VIII

#Contributions of Greek Scholars in Geography

1. Introduction: Geography as a field of knowledge had its roots in the Greek scholarship. This is not surprising as in the ancient times Greek was one of the well flourished civilizations dating back to 500Bc – 200Bc with its centre in Greece and its surrounding areas. Greek period is rightly called as the "Golden period" because all Greeks provided a framework of concept that guided the western thinking for many centuries. It was the most advanced economy in the world. The Greek philosophers of that time have provided the theoretical and scholarly base for the philosophical thinking through models, concepts, and paradigms which guided Western academia for many centuries. A large number of concepts and theories in the geographical philosophy seem to have an inclination towards the Greek tradition.

2. Roots of Greek Scholarship: The roots of the ancient Greek scholarship are found in the observations, measurements, and generalizations of scholars in Egypt, the cradle of science. The Egyptians had developed ways of measuring land in order to collect taxes. This led to the identification of North-South line. Another major contribution is the art of writing and also manufactured something on which they could write. The Greeks also borrowed from the Mesopotamians and Sumerians. They borrowed the basic principles of algebra from them. The sex agesimal system was also taken which believed that there are 360 days in a year. The Sumerians divided the year into twelve months; each month with 30 days. Even the idea that a circle has 360 degrees is from this scholarship; they had divided the circle of the zodiac into 360 parts. The Greeks came to know about explorations and navigation from the Phoenicians, the settlers of modern Lebanon. These people not only expertise as explorers and merchants; also invented the world's first phonetic alphabets. They even established a port along the shores of the Mediterranean Sea; the most renowned being that in the city of Carthage. The ideas about the celestial bodies were adopted from the observations made by the Babylonians and Assyrians on the movement and position of the celestial bodies which gave birth to the discipline of astrology. All these developments along with the determination of Greek scholars to gain more and more logical and useful knowledge about the earth surface as the home of man laid the roots of geographical thinking.

3. Major Greek Philosophers: In the ancient Greek scholarship, two traditions of geographical studies are found, namely, the mathematical tradition and the literary tradition. It is a common belief that Homer is regarded as the Father of Geography. This is because he introduced the literary tradition through his monumental work 'Odyssey' and 'Iliad'. He described the four winds coming from

different directions and named them Boreas (North), Eurus (East), Notus (South) and Zephyrus (West).

Thales was the first Greek genius, philosopher, and traveller who was concerned with the basic theorems of geometry. He proposed the following six geometric propositions –

- (i) The circle is divided into two equal parts by its diameter
- (ii) The angles at either end of the base of an isosceles triangle are equal
- (iii) When two parallel lines are crossed diagonally by a straight line, the opposite angles are equal
- (iv) The angle in a semi-circle is a right angle
- (v) The sides of similar triangles are proportional
- (vi) Two triangles are congruent if they have two sides and one angle respectively equal.

He visualized earth as a disc floating on water. He was also the first who started the measurement of the earth and location of things on the face of the earth; thus establishing the mathematical tradition. Not only this he laid the foundations of empirical studies that is an explanation can be checked through ground observations and measures; a critique of the traditional unscientific explanations.

Anaximander is credited with the introduction of a Babylonian instrument known as Gnomon into the Greek literary world. Gnomon is a pole set vertically above a flat surface on which the varying position of the sun and other celestial bodies could be measured by the length and direction of the shadow cast by the vertical pole. He is even credited to produce a world map to scale. This map is based on the information gathered from the Sumerians who had an archive of pictorial maps. Interestingly, this map has an ocean encircling the world.

Thales and Anaximander are credited for the initiation of mathematical tradition in geography. The credit for originating the literary tradition goes to Hecataeus. He was a Greek scholar of 6th century BC from Miletus (the center of learning in those days). He was a pioneer scholar and one of the earliest writer of Greek prose. He was the first Greek scholar to classify the information about the then known world and brought it to Miletus. His work is known as "Ges-periods" or Description of the Earth. It was the first systematic description of the then known world, that was published by the end of 6th century BC. Ges-periods describes the places in the vicinity of the Mediterranean Sea which was called as perplus means coastal area. Hecataeus divided his book "Ges-periods" into two parts, part 'A' dealing with geographical information about Europe' and part B dealing with Libya. This book is a blend of the literary tradition and the topographical-ecological tradition.

Hecataeus for the first time gave two approaches for the study of geography:

- (a) Nomothetic or law seeking approach.
- (b) Idiographic approach (descriptive).

Hecataeus prepared the world map but it was based on the map of Anaximander; he had just modified it. He divided it into two parts by drawing a line passing through Hellespont, the Caspian Sea and Caucasus mountains. The northern part he named as Europa and southern part of Libya that includes Africa and Asia.

Herodotus was an outstanding Greek scholar of 5th century BC. There is no exaggeration in the statement to say that Herodotus was the father of history. He is credited with the idea that history must be treated geographically and all geography must be treated historically (James and Martin, 1981). He is also identified as the father of ethnography as he provided a vivid portrayal of cultural traits of people who were unknown to Greeks. His works were based on his own observations during his travels. He contributed both in physical and human geography. Herodotus came up with the concept that Egypt is the gift of the river where he emphasized that silt and mud of river lead to the development of delta. It was he who for the first time gave concept that winds move from cold to hot places. He attempted to measure the age of the earth on the basis of the rate of sedimentation and estimated that one foot of sediment is formed in 880 years. Taking the total sediment strata 158 km thick, Herodotus calculated the age of the earth as 440 million years when the exact age of the earth is 4.6 billion years.

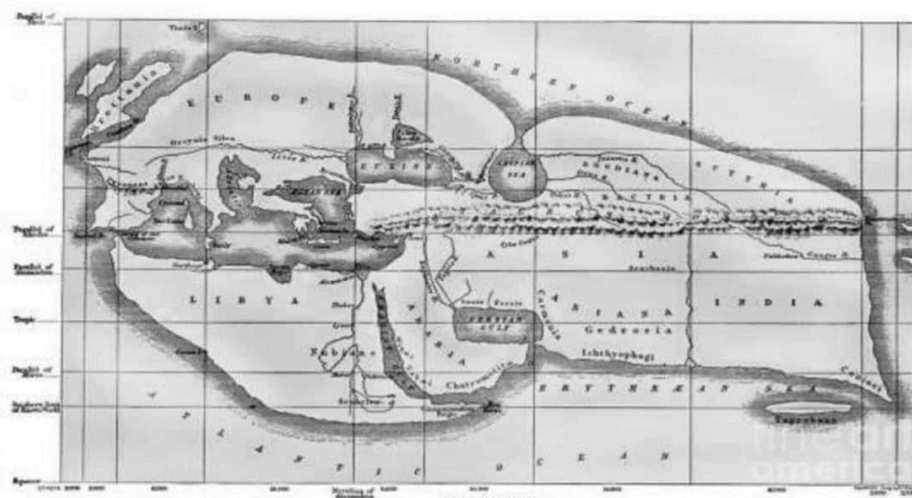
Plato and Aristotle also made valuable contributions in the field of geography. Plato is regarded as the master of deductive reasoning - from the general to the particular. He is considered to be the first scholar who adopted the idea of round earth located in the center of the universe with the other celestial bodies revolving around it in a circular motion. Aristotle provided the first paradigm within the theoretical framework that existed in Europe at that time. He emphasized that the observations which were made through the senses do not provide explanations; especially the scientific explanations. He formulated laws or fundamental principles of scientific explanation, which became a guiding force for the scholars in future centuries. He agreed with Plato that the earth is spherical in shape and went a step further by seeking an explanation for the spherical shape. He even contributed to the branch of human geography when he put forward the concept of variations in habitability on the surface of the earth on the basis of latitudinal position. He opined that the regions nearer to the Equator were uninhabitable and named it as the Torrid Zone. Similarly, the parts of the earth which was away from the Equator and were permanently frozen were also uninhabitable - the Frigid Zone. The population of the Earth lived in the Temperate zone which existed between the Torrid and the Frigid Zones.

Eratosthenes has been regarded as the 'Father of Geography'. He is the one who coined the term Geography, deriving from two words 'ge' meaning 'the earth' and 'graphy' meaning 'to describe'. He is credited to provide the definition of geography as the "study of earth as the home of man". His outstanding contribution for which he is known throughout the world is his measurement of the earth's circumference. He has used Thales theorem – When two parallel lines are crossed diagonally by a straight line, the opposite angles are equal – while measuring the earth's circumference (Figure 3). He has also prepared a world map with respect to correct distance (Figure 4). His remarkable contribution was his text "Geographica". He also delineated the world into five climatic zones: one Torrid Zone, two temperate zones, and two frigid zones. He also measured different latitudes and longitudes. It is for this reason that Eratosthenes is considered as the father of "Geodesy".

Calculation of the Earth's circumference by Eratosthenes



The World Map of Eratosthenes



Hippocrates in his book *On Airs, Waters, Places* explained the man-nature relationship in the context of climatic conditions. Hipparchus established the concept of locating the exact position of each place on the surface of the earth. On the basis of an Assyrian arithmetic, he divided the circle into 360 degrees. He made an attempt of showing the three-dimensional earth on a flat surface. He is credited with devising two projections to do so; these are the stereographic and the orthographic projections. He even pointed out that these projections have their limitations as they can only represent a hemisphere and not the entire world. Thus supported and flourished the mathematical tradition of geography. Another important contribution of Hipparchus is the invention of Astrolabe – an instrument similar to Anaximander's Gnomon but easier to handle. The purpose was to provide accurate measurement of latitude at sea by observing the polestar's angle.

Another important Greek scholar who deserves mentioning is Posidonius. He recalculated the earth's circumference and came to a figure much smaller than that of Eratosthenes (approximately 18000 miles).

Strabo, a Greek scholar, and traveller was highly influenced by the historical topographical tradition of former Greek scholars especially Homer, Hecataeus and Aristotle. He was in acceptance of Aristotle's zones of habitable world – the Ekumene (as defined by Eratosthenes). His biggest contribution is his monumental work 'Geographia' in 17 volumes; a compilation of writings of his predecessors. Out of these 17 books, eight are in Europe, six on Asia and one of Africa (Egypt and Ethiopia). The first two books were devoted to the historical review of the development of geography from the times of Homer.

#Roman geographers

The geographical scholarship in the ancient period is incomplete without the advancements made in the Roman Empire. Although Romans did not contribute at such a large scale that it can be compared to the contributions of the Greeks, the writings and the contribution of Ptolemy cannot be overlooked. He revived the mathematical tradition of Thales which was long forgotten. For him, geography was a science of the art of map-making. This concept was borrowed from the works of earlier Greeks especially Aristotle, Hipparchus, Posidonius and Marinus the Tyre (his teacher). He came up with a monumental work known as "The Almagest" – the standard reference for the study of the movement of celestial bodies for a long time. He even accepted Aristotle's view that the earth was spherical in shape, centered in the universe and remained stationary; the celestial bodies revolving around it in a circular motion. Another significant contribution of Ptolemy was in the field of

map making. He improved and modified previous maps by adopting a projection for the world map which had a graticule of meridians of longitude and parallels of latitudes.

The World Map of Ptolemy



After the completion of the *Almagest*, he started writing *Guide to Geography*, which consisted of eight volumes. In the first volume, he discusses the map projections. In volumes two to seven, he provides a table of latitudes and longitudes so that every place can be given a precise location in mathematical terms. He accepted the idea that the regions near the Equator were uninhabitable because of higher temperatures.

Contributions to various sub-branches of geography

The knowledge about earth has been there through pre-historic times, though in an elementary manner. Greeks were the first to demonstrate the importance and utility of geographical knowledge to the world. They talked of man-environment relationship and stressed that geography as a discipline provides the best understanding of interdependencies between human beings and nature. As already stated they were the ones who developed the concept of geography as the study of earth as the home of man. They laid the foundations of some basic traditions of the discipline – mathematical and literary. Not only this, gave the discipline a scientific inclination, by deliberating on both deductive and inductive reasoning. Greeks developed the framework of descriptive geographical writings which became an essential tool in the coming centuries.

The major contribution of Greeks was in the fields of physical and mathematical geography along with astronomy. Many fundamental concepts have been put forward

by them like accurate measurement of the earth's circumference, earth's position in the solar system; the shape of the earth; ekumene, habitable regions of the world and so on. In the field of cartography, they brought the first map of the world on paper with the help of projections. Even the philosophical foundations of human geography have their roots in the Greek and Roman scholarship; worth mentioning are the writings of Strabo. He laid the foundation of chronological paradigm in geography – the regional approach when he concentrates on different parts of the earth in 17 volumes of his book Geographia. Similarly, Ptolemy's Guide to Geography written in 8 volumes laid the foundation of a comprehensive view of the world.

Conclusions

It would be correctly said that the Greek and Roman scholarship laid the base of scientific geography which left its imprints for centuries to come. The impact is so huge that after the death of Ptolemy it left a vacuum in the history of geographical thinking. As James and Martin (1981) have rightly remarked that after the death of Ptolemy, the geographic horizons that had been widened both physically and intellectually by the Greeks closed in again. It took many centuries before the effort of describing and explaining earth as the home of man got the attention of geographers.

#Contributions of Arab Geographers

Introduction

Muslim geographers in the medieval period made valuable contributions to the geographical thinking unlike their Western counterparts. They are remembered for the concepts, paradigms and theories which still are of vital importance even in present times. The base their knowledge was much wider and enriched than the Christian scholars. Their interest in geography was the product of their geographical surroundings; though it was purely theological in perspective. The rise and spread of Islam from 7th to 14th century further widened their horizons as Muslims started travelling across the world either for religious or economic reasons. In the field of geography the Muslim scholars have made significant contributions in the fields of mathematical, physical, and regional geography. Their knowledge was based on the information gathered on the works of Greeks and other oriental civilizations. Through these observations and analytical reasoning they made noteworthy interpretations on different phenomenon occurring over the surface of the earth especially in the fields of climatology, geomorphology, cartography (determination of cardinal points) and so on. Muslim geography flourished in the city of Baghdad and it became a centre of learning for more than a century.

Historical Background

Most of the Muslim geographers like Al- Maqadisi (945-1000 AD) followed the scientific method while compiling their works. There were three main sources of information, namely, the relevant available literature, personal observations made during their own travel and the information gathered from reliable persons about the lands for which the other two methods were not enough. They were passionate for travelling which is evident from the fact that they believed in collecting information themselves. Examples may be cited of Al-Idrisi's (1100-1166 AD) travels in south, north and west Europe, Ibn Hauqal's (943-969 AD) journeys to eastern part of Europe, Al-Biruni's (973-1050 AD) travels in India, and finally Ibn Battuta's (1304-1368 AD) travels which covered faraway places like India and China along with the entire Muslim World. Ibn Battuta's travels in Africa took him as far south as Timbuktu on the river Niger.

One of the most important characteristic of Muslim scholars was that they brought comprehensiveness within the geographical thinking. The idea of specialization was not there as most of the writings are related to both physical and human geography; they also include facts on history, religion, philosophy, customs, dress and diets. The works of only two Arab geographers can be described as being highly specialized, namely, Al-Dinawari's (d. 805 AD) work on climatology, and AlAsma'ai's (d. 739?) book on plant geography. The Muslim geographic thought that evolved during the Middle Ages can be viewed from two perspectives. In the first case the contributions in geography were highly influenced by the works and writings of oriental civilizations namely Persians, Indians and Greeks. The second perspective holds more importance as here the purpose was not only to correct the wrong concepts passed down from previous civilizations but also make their own innovative contributions. Apart from making wonderful advancements in the field of astronomy and mathematical geography, Muslim geographers even investigated new branches of geography like urban, religious and linguistic geography.

Prominent Arab Scholars

The Muslim scholars in the middle ages made remarkable contribution to the geographical scholarship. Their contribution is of such an importance that some of the theories and concepts given by them still hold an important place in the philosophy of geography. As already stated that the scholars of the Muslim world had more widely and enriched horizons the information thus provided was more realistic in nature; this becomes more important as during middle ages the Christian world was undergoing one of its darkest period and where no new substantial advancement was made. Some of the major contributions of the Muslim scholars have been discussed here.

These scholars have made remarkable observations in the field of physical geography especially climatology. To start with, reference can be made of Al-Balkhi who collected climatic data from the accounts of various Arab travellers and prepared the world's first climatic atlas based on that data entitled Kitab-Al Ashkal in 921. Al-Masudi was another important scholar who hailed from Bagdad. He was a geographer, a historian a world traveller and a prolific writer .He wrote on diverse themes and his important works include Mehraj-al-Duhab, Kitabul Aswat, Kitab Akhbar-Zaman. Al-Masudi described the weather conditions of the places he visited or sailed through and also pointed out that the salt in the seas comes from the land. In the field of study of landforms he appreciated the role of process of erosion and adjustment of streams to structure in the evolution of landforms. He had a clear idea of the spherical shape of the earth. In the field of human geography he tried to study the relationship between human beings and the environment and explained the impact of environment on the mode life and attitude of people (environmental determinism). He even divided the world into seven regions on the basis of language.

Al-Biruni was a Tajik by race and a Persian by culture; his main interests include astronomy, mathematics, chronology, physics, medicine and history. He was a prolific writer; books include Kitab-al-Hind, Al-Qanuan-Almasudi and Tarikul Hind. Kitab-al-Hind (1030) is regarded as his monumental work which deals with the geography of India. He describes the processes shaping the landforms under normal conditions and even identifies the significance of rounded stones in the alluvial deposits in the southern part of the Himalayas. He mentioned that the distribution of rainfall in the peninsular region is controlled by the eastern and western Ghats. He provided detailed information about the source of Indus and explained the phenomena of floods in its basin. He gave the description of the city of Qannauj. He has provided an accurate account of the seasons of India describing the nature of monsoons. He had also studied Indian culture and Hindu beliefs.

In his astronomical writings he discussed and approved the earth's theory of rotation on its axis and correctly calculated the latitudes and longitudes of many places. He provided his views on the origin of universe in his book Al-Tahidi. He explained the phenomena of solar and lunar eclipses .He also attempt to measure the longest and the shortest distance of the moon and the sun from the earth. He studied the relationship of tides with the phases of moon. In geomorphology he compared the fossils discovered in the plans of Arabia, Jurjan and Khwarizmi along the Caspian Sea and suggested the occurrence of sea at these places in the earlier times. One of the most interesting observations made by him is that "at the South Pole the night ceases to exist"

Another scholar who is credited to have made significant contribution to geomorphology is Ibn-Sina. He gave the idea of landscape erosion when he observed that the

streams cut down their valleys when flowing down the mountains. He further states that these streams worn down the mountains in a slow but steady process. He even examined the presence of fossils in the rocks in higher mountains.

Al idrisi was a leading scholar of the 12th century. His most important and famous book was Amusements for Him Who Desire to Travel around the World (1154). His world map is considered as his most important contribution to geography. His map was based on a rough rectangular projection. He had studied Ptolemy's work. His description of Sicily is perhaps the most detailed one and it is of great historical importance. Al Idrisi travelled over a great part of world including Spain, France, England, Sicily, Morocco, Asia Minor and interior parts of Africa. He described the course of many rivers including the Danube and Niger with precision. He did not agree with the Greek's classification of the world into five climatic divisions and provided a more sophisticated classification based on climate.

Ibn Batuta was the greatest Muslim traveler of his time. He spent 28 years in travel and crossed a distance of more than 75000 miles. His primary interest was in people though he has described the physical conditions of various regions that he visited. His description of house types and building materials in deserts is very interesting and informative. Through his experience he labels Morocco as the best of the countries. His book Rihlah provides an insight into the soils, agriculture, economy and political history of the then Muslim world. He came to Delhi on an invitation of Mohd. Tughlak and served as a Qazi of Delhi.

Ibn Khaldun was basically a historian but his writings also have been important as they were based on travel. His most important work is known as Muqaddimah. In his writings, Ibn Khaldun has maintained that the northern hemisphere is more densely populated than the southern. He stated that the population along the equator is sparse, but there is an increasing concentration away from it up to 60 degrees. Further away there is little or no population. He emphasized the role of fertile land in the origin of settlements. He has argued that the origin of the large cities have always been in the form of small settlements. Ibn Khaldun is considered as one of the early environmental determinists as he tried to correlate man and his environment in a scientific way. He is also credited of establishing political geography in the middle period where he discusses the rise and fall of dynasties and empires. He formulated the first concept of life-cycle of the state. In the words of Kimble (1938) "Khaldun may be considered to have discovered the true scope and nature of geographical enquiry but the fact remains that his knowledge of the physical earth is based largely on Greek theory; and his ideas about environment influence are not highly sophisticated."

The period from the fifth and fifteenth centuries was remarkable as several concepts and theories were firmly established. There were improvements in the art of navigation which set the next step for the discovery of the world.

Contribution to different branches of Geography

On the whole, it may be said at the outset that Muslim geographers paid less attention to the physical aspects of geography as compared to the human ones. Nevertheless, there was reference to landforms, oceanography, climatology and biogeography. Here we will discuss their contributions to the various fields or sub-branches of geography.

- (a) **MATHEMATICAL GEOGRAPHY**: The Arab scholars were highly influenced by the Greek ideas about the shape and size of the earth. They considered the Earth as the centre of the universe, around which the seven planets revolved. They made use of the Ptolemy's prime meridian to calculate time and longitudes. This meridian was considered to pass through the Fortunate Islands, Abu Mashar. These scholars made use of the shadow of the sun to determine latitudes; when the shadow happens to be on the meridian. Al Battuta is said to have measured the earth's circumference as 27,000 miles.
- (b) **PHYSICAL GEOGRAPHY**: In physical geography they have made significant contributions to climatology, geomorphology, oceanography and bio-geography. Each one of these are discussed here.

1. **Climatology**: The first climatic atlas is credited to Al-Balakhi who gathered climatic data and information from Arab travellers and prepared the first climatic atlas of the world— Kitab-ul-Ashkal (921). One of them divided the world into 14 climatic regions. His name is Al-Maqdisi who also presented the idea that the southern hemisphere was mostly an open ocean and most of the world's land area was in the northern hemisphere. The doctrine of environmental determinism found roots in the writings of Ibn-Khaldun, Al-Beruni and Al-Masudi who described the influence of climatic conditions on the lifestyle of the people. Ibn-Khaldun further opined that people residing in the warmer parts of the earth were more passionate. He related the dark skin colour of the Negros with the location of their habitat in the warmer region. Al Masudi described Indian monsoons and even elaborated the factors like location, height above the sea level, setting of a place with accordance to mountains or sea and soil type all play a decisive role in the weather and climate of a particular area. Geographers like as Al-Istakhri, Ibn Khordadbeh, and Al-Maqadisi divided world into different climatic regions using the temperature and rainfall indices.

2. **Geomorphology:** Al-Beruni in his Kitab-ul-Hind opined that the stones became round because they had fallen along torrential mountain streams. He also discovered that alluvial soils became finer in texture farther away from mountains. Ibn Sina keenly observed the works of agents of denudation and ascertained that mountain streams erode the slope; the highest peaks occur when the rocks are especially resistant to erosion; the mountains are immediately exposed to the process of wearing down as soon as they rise up. Al-Maqadisi (945-1000 AD) in his book: "The Best Divisions for the Classification of Regions" divided Syria into four geomorphological zones running parallel to the Mediterranean Sea as follows:

- (a) A sand plain running close to the sea.
- (b) A mountainous area with vegetation cover and settlements
- (c) An area of lowlands and depressions with deep river valleys (part of the rift valley) having settlements.
- (d) An area of cold high mountains where Bedouins lived.

Al-Masoudi (895-957 AD) refers to the changing relationship between land and sea. He even talks with reference to a 'geographical cycle' and categorically identifies three stages of rivers - youth, maturity and old-age. He further establishes his point by stating that these three stages are similar to those found even in the lives of plants and animals.

3. **Oceanography:** The most outstanding contribution in the field of oceanography was that the Arab scholars proved that the main reason for tides was the gravitational pull of the sun and the moon. This observation was done by Al-Qazwini. Al-Masudi noted that due to the presence of vegetation and salinity the colour of the ocean water varies from place to place.

4. **Biogeography:** Abu Zeid Al-Ansary (732-825 AD), Abu Said Al-Asma'ai (740-828 AD), Ikhwan AlSafa', and Al-Qazwini. Al-Asma'ai are some of the noteworthy Arab scholars who contributed in the field of plant and animal geography. Al-Qazwini even made an attempt to classify and distribute the natural vegetation of the Arabian Peninsula.

Human Geography

The branch of Human geography interested Arab geographers, and they made contributions to almost all the sub-branches of human geography, that is, cultural, urban, medical, and economic and so on.

- (i) **Cultural Geography:** Ibn Khaldūn divided the population of the world into two categories - nomadic and sedentary; and argued that nomadic life preceded sedentary life of human beings. Scholars like Al-Maqadisi and

Al-Istakhri wrote how physical characteristics of man especially their physique, colour of the skin, temperament, and costumes differs from region to region. Al-Maqadisi along with Al-Hamadani even made reference of the fact that in Arabia people spoke different dialects. Ibn Khaldūn in his book relates that as the Arabs started travelling they blended with the non-Arab communities which resulted in the distortion of their language – Arabic. Some scholars also studied the distribution of other languages in other regions especially Persia.

- (ii) **Urban Geography:** In the field of urban geography these scholars diverted their attention to the studies of urban settlements. They related the concepts of site and situation and even tried to classify towns and cities on the basis of their size. Al-Khwarizmi in his book 'Surat Al-Ard' or 'Description of the Earth' (d. 850 AD) fixed the coordinates for nearly 539 towns. In another monumental work, Al-Bakri (1040–1094 AD) came up with a geographic dictionary of place names where he notes down approximately 5200 sites. Some Muslim scholars like Al-Qazwini (1208–1283 AD) and Ibn Khaldūn (1332–1406 AD) wrote on the relationship that existed between environmental conditions and health in relation to the establishment of new settlements. These scholars also directed their attention on the morphology of urban settlements especially with regard to the internal structure of the towns. The functions of these settlements have also been dealt with. Al-Maqadisi even identified an hierarchical order in his discussion on the settlement system; this was with respect to the size of the settlements. He stated that very large urban centres or capital cities were like Kings while the regional centres were like ministers. He also provided detailed writings on the cities of Makkah, Taif and Jerusalem. One of the works that needs special mention in this field is the model proposed by AlQazwini (1208–1283 AD) for the city of Qazwin in Persia.
- (iii) **Economic Geography:** Ibn Khaldūn made an attempt of defining trade; he stated that it is the act of making profit by buying goods at low prices and selling them at higher prices. Writings also covered famous marketing centres at the local, regional and international levels. Writers gave accounts of the goods that entered into commercial transactions and the routes used for their delivery. There was also reference to the currencies, and the measures and weights in use.

(iv) **Medical Geography:** Another branch in which the Arab and Muslim geographers of the Middle Ages made valuable contribution is the medical geography. Large part of their writings is related to the study of diseases and their occurrence in various regions. Many of them believed that there exists a positive relationship between disease and climate. Yaquıt Al-Hamawi (1179-1229 AD) stated those practicing medicine should have sufficient knowledge about their geography as well. Al-Maqadisi noted that the inhabitants of Baghdad had a low rate of life expectancy. The name of Al-Nuwairy (1287-1342 AD) needs to be mentioned as he identified the places that were known for poisonous animals like snakes and scorpions and also such places where carriers and vectors of disease such as rats, mice, fleas, ticks and flies were found in large numbers. The contribution of these scholars in the pharmacological studies cannot be ignored, they wrote extensively on the extraction of medications from herbs and plants.

5. **Conclusions:** The above account clearly shows that the Arab and Muslim geographers had contributed in a considerable way to geographical scholarship. The Muslims had more advanced culture than did most of medieval Europe, and had made great discoveries in various fields of study (Hasan 1967). They preserved many of the writings of ancient Greek, Roman and other oriental civilizations and made use of them to enrich their knowledge. To sum up one can say that the contributions of Arab and Muslim geographers gave a better understanding to the geographical thought and broadened its horizon as number of sub-branches like regional, mathematical geography and surveying developed. Most of the works of the scholars of the middle Ages were comprehensive in nature as they covered almost all aspects of both physical and human geography.

#The Contribution of Chinese to Geography

Situated in the East Asia, quite far away from the Greeks and Romans, the Chinese made an important contribution to geography, between 200 and 1500 A.D. In fact, they created great tradition of geographical scholarship by portraying information on trade routes and maps and by describing topography and life of the people living in different parts of the then known world. A brief account of their main contribution to geography and cartography has been given in the following paras.

With the collapse of the Western Roman Empire in 476, European geography entered a period of dark stagnation. A few copies of Greek and Roman geographical texts survived, but the Germanic tribes that overran the vestiges of the Roman world had little use for such works. Indeed, many had already been lost, particularly at Alexandria,

where the fire of 47 B.C. had destroyed some 400,000 manuscripts in the Great Library, and the disturbances of A.D. 391 had led to the loss of perhaps 300,000 more works in the Temple of Serapis.

Parallel to, but totally separate from, the Greek and Roman world, a completely different culture of science had meanwhile evolved to the east in China. It was here that the subsequent focus of global intellectual and scientific activity was to be encountered, particularly under the Tang (A.D. 618-970) and Southern Sung (A.D. 1127-1279) dynasties, the latter of which was described so magnificently by the Venetian Marco Polo.

Once again, the emergence of a tradition of geographical writing at this time can be seen in part to have been influenced by military conquests and the need for the emperors to have a sound knowledge of their lands in order to retain their positions of power.

Moreover, the development of paper magnetic needle, trough compass, marine compass and new surveying and cartographic skills enabled the Chinese to produce maps of a quality far surpassing anything being produced in Medieval Europe. The Chinese used co-ordinates and triangulation to produce beautiful maps of China and neighbouring countries. When Marco Polo (1254-1322) wrote an account of his travels of China describing the high level of Chinese learning, his book was widely discounted as a fictitious adventure.

The earliest Chinese geographical document is reputed to be the Yu Kung (Tribute of Yu) within the Shu Ching (Historical Classic) dating from the 5th century B.C. This provides an inventory of the Chou Empire, mainly in terms of its physical geography, and lists the traditional nine provinces, their kinds of soils, their characteristic products, and the waterways running through them. Other ancient travellers' guides, such as the Shan Hai Ching, much of which dates from the 4th century B.C., can also be considered to be geographical, but most include mythological and magical elements together with details of semi-human races and peoples. The father of Chinese geography was Phei Hsiu, who was appointed Minister of Public Works by the Chinese emperor in A.D. 267.

Needham and Wang Ling (1970) suggest that there were five main types of Chinese geography:

1. Anthropological geographies, known as Chih Kung Thu (Illustrations of the Tribute-Bearing Peoples), dating from the mid-6th century A.D.
2. Descriptions of the folk customs of the countries to the south of China (Feng Thu Chi) and descriptions of unfamiliar regions (I Wu Chih) both dating from the 2nd century A.D.