Pre-historic Times: Pre-historic man was the first to apply reason to the satisfaction of his every day needs. Originally, he grew no cultivated vegetable, felled no forest, and extirpated no useful plant. He depended upon spontaneous animal and vegetable growth for food and clothing.

Pre-historic man, however, was very observant. As he lived under climatic variations, he observed his surroundings. He had time to gaze at the stars and follow their motions. He observed the changes of seasons with their alternations of temperature, and of length of day and night, the general condition and movements of the atmosphere, the relative extent and distribution of land and water. He studied the behaviour of the wild animals which he hunted. And above all, he learnt to distinguish between edible and poisonous plants and to find suitable materials for his implements and weapons.

Though nothing really fundamental had taken place to alter man's relationship to his environment or surroundings, yet it was in pre-historic times that man acquired the first notions of his environment and heralded the beginnings of what in course of time, came to be known as 'Geography'.

Whether there are any records of the beginnings of geography in pre-historic times, the few that are available reveal that early man handed on the knowledge of his relationship with his environment by word of mouth and it is undoubtedly due to his teachings that proto-historical and
and ancient geography or geographical knowledge was born.

Further contributions to the making of geography came from neolithic man who first conceived the brilliant idea of sowing seeds himself, of becoming a food producer rather than a food gatherer, when he domesticated plants and animals and thereby invented agriculture.

Such were the achievements of man in relation to his environment at the rising of the great urban civilizations of recorded antiquity in Egypt, Mesopotamia, Phoenicia, Israel, India, and China.

By 3000 B.C., man in Egypt, Mesopotamia, and the Indus Valley in the Indian sub-continent, had ceased to be a primitive farmer. Instead of self-sufficient, independent villages along river valleys, well-organised states had been created within which there was much economic specialization and considerable trade with remote peoples in other states. There was concentration of population and a marked increase in the amount of food obtainable for consumption.

Egypt and Mesopotamia, and later China, had developed irrigation which resulted in large farm yields, safety from drought, and protection against rivers in flood. The introduction of the traction plow, made of wood, and pulled by oxen, also made for greater production from the soil. As man learned more about agriculture, he domesticated new plants and a wide range of vegetables.
As far as water was concerned, at first it was pumped from rivers or stored in large basins when rivers overflowed. But man eventually learned to sink wells assuring a year-round supply of water and then proceeded to devise aqueducts capable of carrying the water from its source to distant cities. All of these developments gave man an ever-increasing margin beyond want in his food supply, and enabled him to devote more time to the improvement of his environment and especially his tools, weapons, and modes of transportation.

The means of communication for commercial or cultural contacts between different countries was entirely by land at the beginning. Rafts or canoes and sea-going vessels were employed later but marine navigation was sparsely used in the ancient world.

The history of geographical discovery tells of the evolution of the map of the world from its simplest and most elementary beginnings in antiquity to the highly specialized form which is known today.

The first people who need be considered are the Minoans whose civilization in Crete spread to the lands of the eastern Mediterranean, and may even have reached the Atlantic. The island of Crete was naturally favoured for the dispersion of culture, and the Minoans came to know Egypt, and to exchange products with the Egyptians as early as 2000 B.C.

Later they extended their knowledge to Cyprus and the Levant in the east,
and to Sicily and Italy in the west. Perhaps, too, they learned something of the whole of the Western Mediterranean, although of this there is no certainty. But by the year 1000 B.C. the unsettled conditions in the Mediterranean region led to a cessation of Minoan activity.

Egypt: Egypt entered history at about 3000 B.C. but excavations have revealed a civilization stretching at least as far back as 1440 B.C. However, some of their contributions to the development of geographical knowledge could be listed as follows:

1. The Egyptians divided the year into twelve months of thirty days each, and into three equal seasons of four months each.

2. The Egyptians must certainly have had a valid method of finding the true north. Lacking compasses, they must have relied on astronomical observations. Though there is no evidence of the methods used, it is probable that they started with simple observations, perfecting the results as they went along.

3. The Egyptians were in the habit of naming everything they saw in the sky. Thus the planets were 'stars' which never rest! Venus was the morning star, and so on. They were also acquainted with some of the constellations such as The Great Bear, etc.,

4. The Egyptians invented instruments for astronomical observations, among them: (a) the Merkhet, which was used chiefly for nocturnal observations, (b) Sundials, for measuring the direction of shadows, and (c) Water-clocks, to determine the correct time during the day and night.
Though Egyptian knowledge as mentioned above was purely descriptive, and often inaccurate, the Egyptian people had a love for truth in all senses of the word. This attitude of mind is borne out by their entire civilization, by their material and technical achievements in agricultural methods, in the construction of canals, pyramids and temples, and by their artistic perfection, and, above all, by using these disciplines for introducing greater accuracy and efficiency in their everyday lives. They drew crude maps of their regions. They ventured early enough on the sea. They were conversant with navigation on the Nile with its dunes and swamps in the deltaic region.

Mesopotamia: The first records from Mesopotamia are clay tablets dating back to about 3500 B.C. They were engraved by means of pointed reeds, and the resulting script is called cuneiform, that is, wedge-shaped. Once engraved, the tablets were left to bake in the sun. Hundreds of thousands of such clay tablets have been discovered, many in an excellent state of preservation.

The first people to have used the cuneiform symbols were the Sumerians, a small nation inhabiting a small region in the lower valley of the Tigris and the Euphrates.

Sumerian scribes compiled lists of sign, which were never considered exhaustive but extended all branches of knowledge. There were lists of utensils, of garments, of buildings, of food, and drink; of gods, stars, countries, rivers, and mountains; of human organs, human types, trades, and social classes. Generally, the names were grouped in families or species, each represented by a distinctive idographic symbol.
Sumerian science of lists contributed to the development of geography. The Sumerians dealt exclusively with the local topography of their own parishes, provinces, mountains, rivers, canals, lakes and seas. The Akkadians extended their predecessors' geographic horizon.

The Babylonian view of the universe was that the earth was a flat disc floating on the ocean. Its centre was Babylon. This conception was the basis of the only map of the world dating from the neo-Babylonian period. Other maps were purely local, and gave the plans of towns, town quarters, canals, or buildings. Animals were grouped into a given family; a special sign distinguished all fishes.

The Babylonians had lists of constellations and planets, of the eclipses, visibility of the moon and the planets, length of seasons. The Seleucid documents mention the Babylonians developed a theory about the lunar cycle, and incidentally about the motion of the planets.

The Babylonians were well equipped for observing the stars and planets. Their instruments included:

1. The Gnomon, the simplest instrument known in antiquity for measuring the length of shadows by which noon, and the solstices, winter and summer, were indicated.

2. The Clepsydra, a graduated cylindrical vessel used for indicating time during bad weather and at night.

3. The Polos, an instrument exclusively Mesopotamian, which consisted of a hollow hemisphere able to catch the sun's rays and on whose surface the path of the sun was traced by means of a shadow. A simple inspection of the
shadow would establish the time of day and year.

**Phoenicia**: Contributions of the Phoenicians go back to the fifteenth, sixteenth, and eighteenth centuries, B.C. Clay tablets have been found in the excavations at Ugarit, a town on the coast of Syria, facing Cyprus. The Phoenician year was divided into twelve lunar months of uncertain order and having names mostly, unlike the Babylonian or Assyrian.

The Phoenicians made more significant contributions in navigation than any other people of this period for they became the greatest traders, colonizers, and explorers of the ancient world. In fact, the Phoenicians succeeded to the Minoans as leaders in geographical exploration. They too were helped by certain geographical advantages in their homeland, the coastline of their territory throwing off peninsulas and islands, resulted in making harbours sufficiently good for ships of light draught. The Phoenician cities grew up on this coastline, and local products like the cedar-trees, the sands (useful for the glass industry), or the murex from which purple was obtained, formed the basis of trade, while through the mountains or along the coastal plains routes led to the richer countries of Mesopotamia and Egypt.

**Israel**: The Hebrews considered the universe to be divided by the earth into an upper firmament, heaven, and a lower firmament, the void (which was the same view as the Babylonians). Their cardinal points were based on Palestine: the west was called the sea, that is, the Mediterranean, and the south was called Negev, after the desert between Palestine and Egypt. Their calendar was
essentially founded on the lunar month beginning with the first visibility of the crescent moon. The year consisted of twelve successive months. The ancient Israelites knew but a small corner of the earth and their geographical knowledge was nothing original but borrowed from their neighbours.

India: In the case of India, however, even before the dawn of recorded history the early inhabitants of that sub-continent had contacts with the outside world. Trade relations matured into cultural relations and there was an interchange of ideas and materials as time passed.

There are references in the Rig-Veda to the 'treasures of ocean', 'gains of trade', 'ship with a hundred oars', 'shipwreck', etc. These references show that Vedic Aryans in ancient India knew the ocean and sailed in ships to distant lands. The doubts about the knowledge of ancient Indians of the sea have been set at rest by the finds in the Indus Valley which indicate that the inhabitants had ocean-going ships and connections by sea with Sumer.

India's contact with the outside world was carried on both by land and sea routes. Important routes connected India to her neighbours on the west, north, and east.

These are the general lines on which geographical knowledge or ideas developed in the various centres of ancient civilization. Though still imbued with magical and utilitarian concerns, these ideas gave geography its first great impetus.

Greece: At about 1000 B.C., while the contributions to human knowledge were developing along almost independent lines in India and China, they were falling
into a steep decline in Egypt and other countries of the Near East. In fact, the contributions of near-eastern countries were being completely eclipsed by the magnificent achievements of Greece which led to a far deeper and more abstract conception of the role and structure of all aspects of man in relation to his environment. Actually, the Greeks succeeded to the Phoenicians, and with them progress was more continuous and knowledge more certain. Their earliest notions, as revealed in the Homeric poems, were very limited, for although certain facts stand out with almost striking clarity, their geographical horizon was not far distant from Greece.

The Greeks who were heirs to Eastern knowledge gathered over the centuries, gradually fashioned all human knowledge into an intellectual discipline in its own right. Human knowledge became more scientific, involved the same methodological approach, the same research into causes, the same reduction of facts to a small number of principles, and hence the same rejection of myths in favour of rational sciences.

The remarkable expansion of 'Greece' which began about the year 800 B.C. materially contributed to the growth of geographical knowledge. In this unsystematic movement of fishermen, merchants, pirates and colonists the Greeks spread themselves over the Mediterranean waters, and by the year 500 B.C., had some general knowledge of the whole of their shores. Egypt and the coasts of Cyrene were known by about 650 B.C. Sicily had been reached by 800 B.C. The Straits of Gibraltar discovered about 650 B.C. and Massila dates from about 600 B.C. In the Adriatic, and particularly on the eastern shore,
Greek traders were active especially buying the Black Sea fish and the minerals of North Asia Minor, thereby gaining an increasing knowledge of the coastal fringe.

The Greeks were primarily interested in two aspects of geographical knowledge, coastal charts and mathematical geography. Both these interests reflect national traits...their love of sailing and of abstract thinking. Later, when historians entered the field with graphic accounts of military expeditions, they had an opportunity to gain an intimate knowledge of distant interior regions. The Greeks did not develop most aspects of geography to the high level they attained in some other branches of knowledge. Their accomplishments in mathematical geography, however, are among the most impressive developments contributing to this field.

Though related to the oldest of human skills... agriculture, hunting, and fishing,... the Greeks were making the first recorded attempts to bring order into a vast number of previously unrelated phenomena and to categorize the various branches of knowledge.

The first Milesian scholars, among them Thales (c.580 B.C.) a physician, mathematician, astronomer, and geographer, all in one, admitted no bounds to the field of their investigations. These scholars endeavoured to give rational explanations of material phenomena, and to suggest increasingly rational hypotheses about the structure of matter and the architecture of the universe. Their investigations embraced all branches of knowledge
though all of them were mainly concerned with the nature and origin of matter, the form of the universe, and the laws governing it.

Thales is said to have visited Egypt, observed the action and flooding of the Nile, and to have brought back some Egyptian ideas of measuring the ground after the landmarks had been obliterated by the inundation of the Nile. He was also the first man to state that the moon was illuminated by the sun. He achieved fame by predicting an eclipse of the sun. Thales contributed to the development of mathematical geography.

Anaxagoras (c. 562–522 B.C.) was also of the same opinion as Thales about the illumination of the moon when he declared that the sun lends its brightness to the moon and that the moon is inhabited like the earth. He also said that the earth is flat in shape and remains suspended because of its size, that the sea is produced from the waters of the earth and from the rivers which flow down to it, and that the rivers took existence from rainfall and the waters in the earth. His other contributions included his views on eclipses, winds, thunder, lightning, earthquakes, hail, rainbow, and that the cause of the rise of the Nile is the melting of the snow in Ethiopia.

Empedocles (born before 490, fl. c. 455 B.C.) of Acradas in Sicily, a
politician and scientific thinker, gave his views on the earth, sun, moon, stars, sky, breadth of the earth, summer and winter, lightning, and thunderbolt. He thought that rocks and stones are produced through the action of hot waters and that the moon's borrowed light circles
Anaximander (born in 610 B.C.), a disciple of Thales, introduced apparently from Babylon the 'gnomon' (sundial) and 'polos' (a concave hemisphere). He was aware of the inclination of the solar and lunar 'rings' to the ecliptic but cannot be called its discoverer since it was known in Asia long before him. He was, however, the first to propound that the earth was curved rather than flat.

Anaximander constructed the first celestial sphere and the first map or flat 'Pinax' or tablet of the inhabited earth in bronze. He was the first to draw an outline of the land and the sea and may therefore be called the 'Father of Cartography'.

Anaximander gave his views on the depth and breadth of the earth, the circle of the sun and the moon in comparison with the earth, the cause of the winds, thunder, lightning, whirlwinds, hurricanes, etc. He wrote on the origin of the sea and was of the opinion that the sea was gradually drying up, becoming less, and in the end would be wholly dried up. He taught that the earth had no support which was contrary to the belief of Thales and his predecessors. Finally, Anaximander believed that there are several co-existent worlds or universes, our universe being not the only one.

Anaximenes of Miletus (fl. before 491 B.C.) a philosopher, was the first to have distinguished between planets and stars. He made a map representing the earth as having four unequal sides. He believed that the earth
is broad, that the sun is hidden by the higher parts of the earth, and that earthquakes take place during droughts and again during heavy rains. His views about the air we breathe, lightning, and the rainbow have also been recorded.

Philolaos, a contemporary of Socrates, believed that the earth is carried round the fire in a circle with an oblique curve in the same way as the sun and the moon. He perfected the earlier belief that all celestial bodies were spherical, that the stars revolved in concentric spheres, and that the cosmos was divided into a sub-linear world and a celestial zone. He also asserted that the earth is one of the stars, that it produces day and night by its circular course round the centre with reference to the sun.

According to Leucippos of Miletus of uncertain date, the planets and stars revolved about the earth, their common centre, and the moon was closest to us while the sun was most distant. He declared that thunder is produced by the violent outburst of fire confined within very thick clouds.

Heraklides (c. 388-315 B.C.), a pupil of Plato, asserted that the apparent motion of the sphere of fixed stars was due to the rotation of the earth about its axis, that the earth moved from the west about the poles and completed one revolution every day. He had no doubt that the earth was the centre of the universe and that the sun and most planets revolved directly about it. Geocentricism was affirmed. Later, Plato and Aristotle raised it into a dogma.
From about the middle of the fifth century until the early fourth, before the Christian era, there were a group of Greeks, among them, Plato, (427-347 B.C.), who were interested in scientific principles and methods, in the structure of the primary elements of the universe, and in the laws governing the cosmos as a whole.

Plato’s ideas about the earth and about political and physical geography form a very small proportion of the total bulk of his writings. For all these, he put forward bold hypotheses of his own in his writings, such as, the Republic, the Timaeus, the Laws, and the Epinomis. All his proposed systems had certain factors in common: the sphericity of the universe, the sphericity of all celestial bodies including the earth, the central position and immobility of the earth, and the circular motion of celestial bodies at various distances from the earth, the sphere of the fixed stars being the most distant.

To these general views, Plato, in his ‘Republic’, added the following considerations: the moon which has no light of its own but reflects the light of the sun, is the celestial body closest to the earth, with Venus, Mercury, Mars, Jupiter, and Saturn following in that order. The sun, Venus, Mercury, revolve at equal speeds and are equidistant from the earth. Other planets and particularly the stars, travel more quickly since they are farther from the earth. The stars and planets all revolve in the same direction with the exception of Mars which apparently follows a retrograde orbit.
In the 'Timaeos', Plato propounded further modifications and additions among them, the listing of the planets in order of their distance from the earth. In the 'Laws', he added new facts of the planets and stressed the importance of explaining the apparent irregularities of the celestial revolutions.

In the 'Epinomis', which according to some scholars is the work of one of Plato's pupils, the dimensions of the world have been increased as well as that of the planets from the earth. Though no exact distances are mentioned, it is stated in the Epinomis that the stars are immense and that the sun in particular is much larger than the earth.

Other contributions of Plato to our knowledge of geography included his belief that the Greeks dwelt in a small part of the earth and that many other men dwelt in many other parts in many regions like the land of the Greeks. He also stated that everywhere round the earth were many hollows of all shapes and sizes into which water, mist, and air, flowed together. He gave his views on periodical upheavals on the earth's land-mass, and emphasized the importance of geographical situation to city-states, namely, near sea coasts, which gave good harbours for trade and other purposes.

Aristotle (384-322 B.C.), and his pupils have contributed much to the development of geographical knowledge. Scientists reading the Aristotellean books are astonished by the wealth of detail and even more so by the broadness and complexity of his outlook. He opened up the main
fields of enquiry in various fields, including geographic distribution and ecology. In each field, he assembled facts, described and discussed them, and drew philosophic conclusions.

Aristotle stressed the study of man. He gave leading place to observation. He had some definite knowledge of ecology, the relation not only between living beings and their physical environment, but also between living beings and their biological environment.

By recording a large quantity of facts and observations coming within the different departments of geographic knowledge, Aristotle has laid the foundations of scientific geography. In fact, his work represents the end of the older period of Greek philosophic knowledge and forecasts the new.

Aristotle studied, observed, and wrote about the sphericity of the earth before the epoch-making explorations of Alexander and before Pytheas's great voyage. He argued that the earth is a sphere from the tendency of matter to fall towards a centre, from the fact that in an eclipse of the moon, the earth throws a round shadow on its satellite, and from the appearance and disappearance of constellations as one travels from north to south. He also tried to define, on scientific principles, the limits of the zones listed by his predecessors, maintaining that the temperate zone extends from the tropic to the arctic circle which he probably conceived in a modern sense. He was of the opinion that in the south temperate zone,
winds similar to those in the north should blow but in an opposite direction, and that the south wind which comes from the torrid zone is bigger, stronger, and hotter than the north, and that it reaches farther than the north wind does in the other.

Aristotle maintained that those who live in the cold climate of Europe are spirited but un-intelligent and un-skillful; that they are un-organized and do not rule over others though they are free; that Asiatics are reverse of this, and that the Greek race, situated between them, are both spirited and intelligent.

Further, Aristotle gave his views on the proper territory and site for the ideal city-state: it would depend on the slopes of the land, direction of wind, within easy reach for the transmission of its yield of crops, be connected with the sea both as regards security and good provision of necessities and with possibilities of imports and exports. It should also be well placed for administrative and military activities, have an abundant supply of water and springs, or be provided with a large number of receptacles to store rain water. According to him, fortified sites or citadel-sites suit an oligarchy and a monarchy, level grounds suit a democracy, and several strong places are preferred by aristocracy.

Aristotle's knowledge of other parts of the world is evident from his views that the earth is surrounded by water and that the greatest rivers are seen to flow from the greatest mountains. He cites, as an example, the case of the Caucasus and Parnassus (Hindukush) Mountains as the biggest mountains
both in mass and height and that the most numerous and greatest rivers are found to flow from them.

Aristotle's views on the length of the inhabited world convinced him that there were many settled areas in which many nations dwelt. His records reveal that during his time there was the belief that there were many large lakes. He also made attempts to find explanations for earthquakes thereby starting a new branch of science, seismology.

Theophrastos, Aristotle's pupil and successor, is credited for the classification of plants, their geographical distribution, and plant ecology. In his 'History of Plants', there are constant references to the 'habitat' of the different trees and shrubs, together with remarks on the climates which are most suitable for their development. Mountain growths were distinguished from those of the lowlands, and some of these were compared with the corresponding vegetation in the known world.

Hecateos of Miletus, (fl. c. 510-490 B.C.), a Greek traveller, visited Egypt. He compiled the first purely geographical work of the whole earth as he knew it, giving information about towns and peoples, as well as about geographical features, and about navigation and land travel. He imagined the countries of the world as a vast ring of which the Mediterranean Sea formed the centre and the ocean the outer edges. He adopted and greatly improved a map representing the inhabited earth made by his predecessors like Anaximenes and Anaximander. His improved map accompanied his geographical work as was the custom of geographers to illustrate their descriptions with maps.
According to Hecataeos, the geographer was not expected to concern himself with presumably uninhabited or uninhabitable parts of the earth. The geographer should be concerned with that part of the earth known or believed to be inhabited. In his writings, Hecataeos gives his views on oceans, land-masses, their outlines and boundaries, and especially on Egypt calling it the 'gift of the river(Nile)', like Herodotus. He included Libya with Asia.

Hecataeos has sometimes been called the 'Father of Geography' since he was the first to systematize that subject and overcome the difficulties that present themselves in the early stages of such a science and though a far greater stimulus was given to the study by the writings of Herodotus, the works of Hecataeos in the form of a general survey of the inhabited world on a regional basis are considered the beginnings of what is termed today as 'Regional Geography'.

The plentiful records of Herodotus who was born in the fifth century, B.C. however, were primarily historical. He travelled widely to gain knowledge visiting as much of the known world at that time. He has left records and reminiscences of his visits in which a vast amount of geographical material is available. His accounts relate to 'General' geography, to the shapes of continents, the courses of rivers and mountain chains, to climatic influences, to the products of the soil, and objects of commerce. Though much of the information was scrappy and inaccurate, and did not profess to be writing a geographical account, he was able to add
considerably to geographical knowledge especially that of the continent of Asia.

Other contributions from the writings of Herodotus include his views about the shape of the earth, flooding of the Nile, and, above all, his investigation of the various tribes that inhabited the countries of which he treated, their physical characteristics, and their manners and customs.

Thus, while admitting that the field of knowledge had grown considerably at the time of Herodotus, it was he who is considered to have been largely responsible for defining more clearly the geographic horizon.

During the fourth century B.C., there appeared a number of purely descriptive geographies, rather indirectly. For example, Ephoros of Cyme, in his 'General History', included much geographical material. Among his thirty-one books, there was one devoted to Europe and another to Asia and Africa. He made serious attempts at ethnography and historical geography.

Ephoros commented on the flooding of the Nile, on the advantage of location of countries near seas with harbours, and the utility of the sea as a guide, as it were, for descriptions of places. He gave the limits of the known world, the location of India on the east, Ethiopia on the west, and other locations such as those of Iberia, etc. Finally, Ephoros said that the peninsula of Asia Minor is inhabited by sixteen nations, three of them Greek, the rest barbarian.

Pytheas (c.300 B.C.), the Greek astronomer of Massalia, has contributed
much to geographical knowledge through his voyage to outlying parts of Europe. From some of the materials available, there is great wealth of information on the wonders of the ocean and the strange sights about the northwest of Europe.

Pytheas described the route of the voyage which mentioned coasting Spain and Gaul, sailing right round Britain, landing here and there, and even making journeys in the interior. He described the customs of the inhabitants, their food habits, and ways of farming. He mentioned that he saw Ireland and even heard of Norway and then took another voyage as far as the Elbe.

Having determined very accurately the latitude of Massalia, Pytheas could provide indications by which several parallels of latitude could be laid down. He observed the tides in the Atlantic Ocean and maintained that flood tides occur when the moon waxes, ebb tides, when the moon wanes. His voyage also disclosed information, for the first time, perhaps, of the life of those dwelling in the frozen zone above Britain, and of the very short duration of the nights there.

About the same time as Pytheas, there appeared the first works on mathematical geography written by Eudoxus of Cnidos who made attempts to evaluate the dimensions of the terrestrial globe. He wrote a textbook of the stars and dealt with various other questions of physical geography.

But from the point of view of descriptive geography, there was another
Eudoxos of Cyzicus, who claimed to have made two voyages from Egypt to India and back, apparently during political disturbances in South Arabia, some time between 120 and 125 B.C. He was blown some way down East Africa on his second return and so learnt of the southern trend of Africa. From his alleged voyages right round Africa, he proved that the inhabited earth at that time was embraced by the ocean all round.

One of Aristotle’s first pupils, Dicaearchos of Messina (fl. c. 320–300 B.C.) is well known for his contributions to map-making. His world was not very different from Hecataeos but it is definite that he grossly underestimated the size of the earth. He was, however, the first geographer who attempted the scientific measurement of the height of mountains especially those in Greece.

Thus, the Greeks, by their observations and discoveries, and even by their errors, but, above all, by their brilliant hypotheses about the structure of the universe as a whole, and of its elements, paved the way for future advances in geographical knowledge. They created geography as a science, and with the Romans, as will be seen later, discovered a large part of the old world. Most of the technical terms in geography, as in other sciences, are taken from Greek usage or formed from the Greek language. Their thoughtful ideas which were largely speculation but partly knowledge, about the earth as a whole, its body in the heavens, about the earth’s atmosphere, hydrosphere, and lithosphere, including smatterings of geology and climatology, as revealed in the system of zones, their knowledge and ideas of the earth’s separate
continents and countries and peoples therein, their experiences of the
different seas and the oceans, and above all, their attempts to draw a
mathematical chart of the inhabited earth, all these contributed to the
foundations of the science of geography.

India: But it was not the Greeks alone who laid these foundations. Taking
the case of India, again, about the same period, there are records to
show that Indian culture was dominant throughout Indo-China, from Burma
to China, and in the islands from Sumatra and Java to the Philippines. It
is well known that the Hindus were one of the greatest navigating and
colonizing peoples at that time. There have been mutual influences between
the Indians and the Greeks. Arabic tradition indicates that there was a
large amount of Indian influence on early Arab learning in various fields
thereby contributing to the expansion of knowledge in all fields, including
geography.

In the 'Kautiliya Arthasastra', a book written by Kautiliya, the Prime
Minister of Chandra Gupta of the Maurya Dynasty, there are records which
deal with every phase of life with sections on mining, roads, trade, and
trade routes, irrigation, plants, ships and shipping, animals especially
cattle, mechanical contrivances, and other technical matters.

Rome: The Roman contribution to geographical knowledge was restricted to
some lucid though fairly unoriginal discussions by Seneca on meteorologi-
cal and geographical questions, to modifications of Greek ideas, and to
such compilations as Pliny's 'Natural History'. In fact, there are only two
geographical works in Latin, one written by Pomponius Mela, which is a mere resume, and the other, by Pliny, as mentioned above. The geographical parts of the latter are both un-skilful in the arrangement of facts and uncritical in its treatment of them.

The sixteen books of Pliny's 'Natural History', have been devoted to plants and plant remedies. The most interesting books from the point of view of geography are those dealing with arboriculture and agriculture. Pliny also attempted to explain by climate the dark skin of the negroes and their frizzled hair, as also the blond complexions of northern Europeans. He also believed that people in warm climates are relatively dull, and that people of cool climates have greater vigour and courage.

Other contributions of the Romans of that period related to other branches of geography, especially Economic Geography: the Romans perfected methods of building roads, bridges, aqueducts, canals, vaults and steps, and of manufacturing glass and metal articles, some of the ideas having been learnt from the Etruscans, masters of land irrigation and swamp drainage.

Graeco-Roman: Though the Romans lacked the scientific mind of the Greeks, they were more practical than philosophical in outlook. They were primarily concerned with commercial and administrative problems, including plans for military conquests. Military campaigns and extension of trade routes produced much new data but little attempt was made to organize it scientifically. However, there appeared during this period some historians who were also explorers and travellers, among them, Polybius, (c.210-128, B.C.), who travelled
extensively in western Europe and neighbouring parts of Africa, including a follow-up of Hannibal's route across the Alps. His forty-one books on 'History' are well illustrated by means of geography and this is due to his extensive travels. In one of these books, he writes on geography and its relation to history.

Polybius is remarkable for his scientific use of geographical facts in historical writing. He argued that 'what man wants to know is not so much the fact that a thing took place, as the way in which it happened', and with this aim in mind he always endeavoured, for example, to relate strategy to the build of the country.

In his book on the regions of the earth under the Equator, he shows further interest in zones and climatology. He says that these regions are inhabited and have more temperate climates than places in which people dwell round the furthest parts of the torrid zone. His statements have been adduced from previous explorers of these parts and from conclusions from the natural movement of the sun.

Polybius had some interest in physical geography. This is revealed in his views on the height and rugged nature of mountains, on the erosive powers of rivers, on deposits of alluvium, while describing the places he had visited. He has also recorded the length of the Mediterranean in a direct course from two points and has described the voyage he took along the African coast.
By far an important authority on geography than many of his predecessors and contemporaries was Posidonios of Apamea (135–c. 51, B.C.) He was a Stoic philosopher, traveller and writer who included geography in his studies. His travels included places in the neighbourhood of the Mediterranean but also to the interior of Spain, Gaul and Britain where he was the first to investigate not only the physical but also the psychological characteristics of different nations. He proposed an explanatory theory that all differences in peoples are due to climatic factors. He named zones according to ethnical characteristics and held the view that men, like animals, and plants, prosper only in their natural regions.

Posidonios investigated other aspects of geography and meteorology, such as fogs, winds, clouds, rain areas, gulfs, isthmuses, continents, etc. He made the best of all ancient measurements of the diameter of the sun and of its distance from the earth, and improved on earlier measurements of the earth's diameter. He was also the first to have pointed out that the sun looks much larger on the horizon than it does in the mid-sky. His observations on tides at the mouth of the Thames River when he visited Britain are significant. He was convinced that the earth was filled with countless kinds of verdure, deep wooded forests, lofty mountains, and cities founded by man. From his widespread travels and his extensive knowledge of the related literature, he was able to classify earthquakes and volcanic eruptions in far greater detail than Aristotle. He also investigated the effects of earthquakes on the contours of the earth.
These and other writers of the period were concerned with itineraries or topographical dictionaries. There were, however, two outstanding workers who interestingly enough wrote in Greek and who contributed much to the development of geographical knowledge during their time, by their writings.

The first of these, Strabo (63 B.C.-A.D.36), summarized the geographical knowledge of his time in seventeen volumes. His *Geographia* in the first century B.C. is the best and most comprehensive treatise on the known world, particularly of the Roman Empire. It has no parallel in the rest of the surviving literature of the Greeks. In fact his *Geographia* has been described not only the most important geographical work that has come down to us from antiquity but unquestionably the most important ever produced by any Greek or Roman writer. He collected all the available geographical material and reduced it to order thus preserving a vast body of matter which would otherwise have been lost, and leaving a comprehensive system of Geography. He claims to have travelled extensively.

Strabo's writings in geography contain topographic and physical as well as historical and political leanings of the subject. In fact, his writings are so comprehensive that he describes not only the contours of well-known regions and their natural resources but also descriptions of their commerce and politics.

Geological peculiarities had a special attraction for Strabo. He contributed a large collection of facts relating to volcanoes and earthquake movements and gave the effect of the sea, rivers and mountains on the formation of
gulfs, straits, isthmuses, peninsulas and promontories.

Strabo was in agreement with the teachings of the natural philosophers regarding the spherical forms of the universe and heavens and about the tides in rivers and oceans, and believed that the earth is stationary and the sea is convex.

Strabo states the function and importance of geography, its methods and principles. Not only does he everywhere introduce the history of a country side by side with its geography, but he illustrates the one by the other, and endeavours to show the intimate connection that existed between the two. Besides, he traces the influence of the features of a land on the character and history of its inhabitants. He recognized the intrinsic value of geography. For him, it was not only an aid in the task of government but it also acquainted one with the occupants of the land and ocean and vegetation, fruits and peculiarities of the various quarters of the earth and showed the relationship between man and his environment.

Remarks such as these in which the modifying power exercised by external nature over the history is traced, are the most original features in Strabo's work and go far to justify the title of 'The Philosophy of Geography' which has been applied to it. In fact, his scholarly treatise on the fundamental laws of geography was the first of its kind up to this time. Strabo was a Regional Geographer in the true sense of the term.

The other important figure, Ptolemy (Claudius Ptolemaios of Alexandria, 150 A.D.), who lived at the height of Rome's power, has among his well-known writings, a geographical treatise in eight books. He was concerned primarily with mathematical geography and in his first book he deals with
the principles of mathematical geography and of the projections of maps, together with the length and breadth of the habitable world. The eighth book though concerned more with astronomy than geography, contains the length of the longest day at each of the most important positions which had already been determined on his maps. The remaining six books contain tables which give the names of the places marked on the maps of the separate countries, their boundaries, the latitude and longitude of each, and other remarks for purposes of explanation. As mentioned above, Ptolemy was more interested in mathematical geography but his contributions made significant additions to the map of the world in other countries. He mentioned for the first time the Carpathians and the river Volga in Europe. In his account of Asia, there is reference to the Altai Chain, and the direct route for trade to China through the interior of that land. In his accounts of Africa, he gave much fresh information about a good part of the country including the sources of the main stream of the Nile as being found in two lakes which were fed by the snows of a mountain range.

However, though all his writings were not original, there were a considerable number of original contributions. For instance, Ptolemy added nothing to the solar theory of Hipparchos but made basic changes in the latter's theory of the moon and of the small planets. His catalogue contained at least three hundred more stars than Hipparchos. His advances on the work of his predecessors in the field of cartography, gave us a system of projections which in many respects approximates to that which is in general use at the present
day, including a modification of the simple conic, a fore-runner of 'Bonne's Projection'.

Ptolemy's 'Geography' marks a turning point in the history of the science not only by its scope and by the fame it enjoyed right up to the Renaissance, but also by its scientific quality. Though most of his ideas were wrong, at least he bears witness to the spread of geographical knowledge from the Aegean to the borders of China.

Another stalwart of mathematical geography of that period was Eratosthenes of Cyrene (c. 275-195 B.C.), the chief librarian at the great library at Alexandria, founded by Ptolemy. This library was the centre of research in this field under the leadership of the master, Eratosthenes, who is sometimes called the 'Father' of mathematical geography. In fact, he became the founder of the science of geography when he insisted that a true map of the world would have to be based upon astronomically determined positions. It is this enlarged and philosophical view of the subject which constitutes his special merit. The materials at his command were still very imperfect, and the means of scientific observation were wanting according to modern standards. But the methods which he pursued were of a strictly scientific character. His judgement was so sound that he proved in many instances to be better informed and more judicious in his references than geographers of two centuries later.

Eratosthenes divided the earth into five zones, and the inhabited world into
two zones by a single line. Other parallels were accepted and four meridians were laid down, though inaccurate.

The geographical treatise of Eratosthenes is divided into three books. The first of these contained a sketch of the progress of the study of the subject from the earliest times to his own age. The second treated of mathematical and physical geography as mentioned above, including discussions on the formation of the earth and the changes which had taken place in its surface. Part of the third was devoted to descriptive geography at large. Here his accounts describe surface features, coastal outlines, and the natural products of the various countries and races who inhabit them. It is interesting to note that his writings reflect the explorations of Alexander which give much information of the geographical areas in Asia, including India.

Another great mathematical geographer was Hipparchos, who, in his system of 'Climata' or belts of latitude, was the first to place cartography on a mathematical basis by showing how to project the grid of meridians and parallels on to a plane. He may well have been the first to represent meridians by convergent straight lines cutting across curved parallels, three centuries before Ptolemy.

Significant among his contributions was the fact that he combined his observations with those of his predecessors. Some of the previous observations he criticized and developed further. Like Eratosthenes, he was of the opinion that before making a model of the inhabited world, it was necessary to collect
a wealth of authentic astronomical data such as, the ascendancy of the star, the shadow of the gnomon, and the interval between the occurrence of the eclipse of the moon at various places. He measured variations in the apparent diameters of the sun and the moon by a diopter of his own invention, which was greatly superior to that of Archimedes. He explained the inequality of the seasons, and while elaborating his solar theory, made his greatest discovery: the Precession of the equinoxes.

This great discovery went hand in hand with another important contribution by Hipparchos. He listed more than 800 stars in the course of his checking whether they were really fixed. All these contributions made him renowned in his age and gave a tremendous impetus to mathematical geography.

Apart from his contributions in mathematical geography, Hipparchos gave his views on the Atlantic Ocean from the point of view of navigation, about Ceylon as a very big island, and the course of the river Ister, and even located parts of Asia including India, many of these locations being not very accurate.

Aristarchus of Samos (c. 310-230 B.C.), a man of vast learning especially mathematics, agreed with Heraclides that the earth revolves round its own axis. He was, however, the first to propound the theory that the sun is the common centre of the earth and of the planets, and also emphasized that the earth rotated about its axis. Finally, he was convinced that the universe is many times bigger than the one now so called.
Aristarchus wrote on the sizes and distances of the sun and the moon in which he re-examined an earlier problem first posed in the middle of the fourth century. He put forward that the centre of the sun coincided with the centre of the sphere of fixed stars and with his view of the rotation of the earth round its axis, explained the apparent diurnal revolution of the celestial vault. It seems probable that he considered the moon to be a satellite of the earth. It has been recorded that Aristarchus observed the summer solstice in 280 B.C. and that he was the inventor of the scaphe, a sundial.

About the middle of the second century of the Christian era, there arose two outstanding contributors to mathematical geography, Ptolemy, the geographer, already discussed earlier in this section, and Marinos of Tyre.

Marinos developed cartography by projecting a grid of meridians and parallels of a plane map to the 'orthogonal' method, later called 'Mercator's projection. Within the spaces formed by the intersection of the meridians and parallels, he inscribed the places and districts about which information had been attained, their position being determined as far as possible by means of astronomical observation. Marinos, though reducing some of the worst errors, nevertheless left a most misleading picture of the inhabited world.

Though the Greeks were familiar with the detailed description of geographical and astronomical phenomena known as the tides as recorded by Herodotus, and though they were intrigued by the nature of the capricious currents prevailing in a number of the Mediterranean straits, they failed to appreciate the
true nature of this phenomenon until they ventured beyond the Mediterranean, like sailing the Atlantic and Indian waters about 325 B.C. It was only then that they began to relate tides to the motions of the moon. Eratosthenes tried in particular to relate ocean tides to the currents in the straits of Messina and pointed out that the semi-diurnal ebb and flow was closely connected with the position of the moon above or below the horizon.

In the second century, the astronomer Seleucus of Seleucia, discovered that tides were not uniform in all oceans and at all periods of the year. He put forward a meteorological explanation of the phenomenon which agreed with his heliocentric views: in revolving about the earth, though in the opposite sense, the moon compressed and decompressed the ocean.

The best of all ancient explanations of the tides was given by Posidonius, in his 'On the Ocean' on the basis of personal observations. He was the first to distinguish the three tidal periods.

Seneca and Pliny the Elder in the first century, A.D. and Priscianus of Lydia in the fourth, also wrote on the tides based on the findings of Posidonius.

While the tidal theory made little further progress until the sixteenth century, there was one scientist to improve upon Posidonius's analysis: the Venerable Bede who, in the seventeenth century, made a great number of personal observations on the English coast.

Besides the contributions of common man as well as men of science and learning about their immediate surroundings and distant lands, and the associated geographical phenomena which contributed to the growth of geographical
knowledge, there were varied reports of travellers, traders, or soldiers who had returned from foreign campaigns. Some of these were uncertain but quite a few stand out as good ascertained facts of history.

Subsequent centuries produced a host of descriptions, itineraries, explorations, expeditions, guides, summaries and compilations like those of Agathemerous and Solinius none of which led to any significant advances in real geographical knowledge. What information was obtained from closer contact with distant people and from voyages to mysterious regions and particularly to Asia, was at best fragmentary and inaccurate, and was never recorded in special works.

In the course of the brief scientific revival of the fourth century, Pappos the great commentator on the Almagest, also wrote a geography which may well have contained additions and corrections to Ptolemy’s works on the subject.

A brilliant military exploration among the early Greeks which was attended by an enormous advance in geographic knowledge was that of Alexander the Great in his conquest of Western Asia commencing about the year 331 B.C. His brilliant campaigns not only overthrew vast empires and established Greek colonies but almost doubled the geographical knowledge of the Greeks. Vast areas as far as the Ganges (Ganga) in India were revealed and many phenomena in all branches of geography were observed and recorded so much so that his enterprise might claim the character of a scientific expedition in the geographical sense.
The magnitude of the work of Alexander the Great makes it difficult to realize the revolution in geographical knowledge that resulted from his campaigns. The Greeks were brought into contact with a new world and the old, vague rumours of the lands to the east of Mesopotamia were converted into real knowledge of Persia (Iran) and Western India.

Not only were the geographical features of these new countries brought to light, but the campaigns gave the Greeks first-hand knowledge of a great number of isolated facts of which they had hitherto been ignorant. The great mountain chains of Asia and the river system of western India, to mention a few, were important not only for the geography of Asia, but also for the study of geography in general, for the Greeks could find nothing like them in their own country. Thus both in General and in Regional geography, these expeditions were of the greatest importance.

Further knowledge of India came from the embassy of Megasthenes (c. 290 B.C.) who lived for some time in the valley of the Ganges, a region hitherto unvisited by the Greeks, and wrote an account of the country and its people. His knowledge was confined to the great Indo-Gangetic Plain. The most important single feature of Indian agriculture, the summer monsoon, was noticed by Megasthenes, as well as the general social and economic conditions of the people. His work remained the chief authority on India during the classical period.

In summary, it may be said that the Greeks led the way in the development of geographic thought. All the main branches of geography were established by them. They described the lay of the land as well as the character and
customs of the inhabitants. They observed and described places and geographical phenomena, plotted locations, organized data in meaningful categories, and developed theories to explain the world around them; and, in their diverging interests, presented two main aspects of Classical Geography, known as such, up to their time, mainly through the contributions of Strabo and Ptolemy, the encyclopedic description of the known inhabited world, and the mathematical aspects of map construction and place locations.

With the closing of the story of geography in antiquity came the gradual extension of geographical knowledge of other parts of the earth as the new intellectual era progressed and as a vigorous interest in maritime discovery developed.
The Middle Ages: Having traced the development of geographical ideas and knowledge from their infancy to 'Classical' times, we enter an era known as the 'Middle Ages', a collective name covering four clearly distinct periods. The first of these periods extends from the close of classical times until the beginning of about the eleventh century and is generally termed the 'Dark Ages'. This term expresses the regression of scientific learning in medieval Europe, and geography, as a study and a science, like all other arts and sciences, was subject to the same depressing influences.

There was, in general, during this period a lack of geographical enterprise or study for the sake of knowledge, of political dominion, or even of commercial gain. There was little addition to knowledge of the inhabited world. Much of what was written represented only compilation or re-arrangement of information acquired at a much earlier date. In fact, the chief journeys of these centuries (c. A.D. 300-900) were undertaken, and the chief cosmographies or geographies were written, for religious interests, and in a religious spirit. The result was not altogether to the advancement of man's ideas of Mother Earth.

Missionaries were active during this period extending their visits to Scandinavia and even Iceland. To the east, their activities extended to India by 189 A.D., to Abyssinia, by 300 A.D., and to China, by 600 A.D. These missionaries, carrying the Gospel into these remote lands, replaced the trader and explorer, and so geography benefitted very little. They were indifferent to the scientific investigation of nature. Their religious zeal
completely eclipsed their capacity to observe nature and it was the wonders seen with the eye of faith that they reported on their return to their homeland. Their accounts were to astound and amuse rather than to instruct.

Most of the guide-books and accounts of the period, therefore, concerned themselves with statistics and strove to give facts and figures about the countries visited, and were enlivened by strange stories and fables. The writers, mostly cosmographers, in trying to give pictorial form to their conception of the universe, worked exclusively from a basis of faith not reason. Their outlook was purely theological and even their maps of the areas visited bore no relation at all to actual facts.

Later in this period about 985 A.D. Greenland was discovered, and subsequently the coast of North America. Apart from this, the 'Dark Ages' offers very little to the progress of the Earth Science, excepting perhaps a couple like Isidore, Bishop of Seville, (c.600 A.D.) who compiled his 'Etymologies' in which he summed up the contents of geography, and especially agriculture, and another already mentioned previously, the Venerable Bede, who, as we already know, observed the tides on the English coast besides studying the winds, solstices, equinoxes, and the relationship between the tides and the motion of the moon.
The Arabs: Though much movement was going on during this long period of what is known as the 'Dark Ages', it did not add appreciably to acquaintance with the geography of the distant areas visited, either immediately or for many years thereafter, partly because of the absence of printed books until the fifteenth century. But while Europe was filled with religious zeal and with a decay in the expansion of scientific knowledge, the people of the eastern countries were stirred by a thirst for knowledge, especially among the peoples of the Arab World, India, and China.

Arab geographers had no direct contact with those of Europe. Yet, they were able to absorb much of the knowledge of the Classical period, and their chief importance is that they preserved some of the traditions of the classical period in an age when Europe was incapable of appreciating their value. Other factors responsible for stimulating Arab interest in geography were: (a) the immensity of the Arabic Empire extending from the Atlantic to the borders of China, (b) the excellent system of roads left to them by the Romans, (c) the desert routes which encouraged movement and facilitated the pilgrimages demanded by their faith, (d) trade, which arose naturally out of the diversity within the Empire, and, above all, (e) Conquests of former Greek possessions like Syria, Persia, and Bactria, where Greek culture and learning still flourished.

Arab geography was essentially that of Strabo and Ptolemy, and Arabs became the chief navigators of the Mediterranean and the Indian Seas having many great travellers and geographers among them.
The Arabs, far from being mere transmitters of ancient notions, reawakened scientific interest, exercised their critical faculties, and subjected Greek doctrines to the empirical test. As a result of their original concern with the practical application of science, they invented remarkable instruments of astronomy which contributed further to mathematical geography. In fact, the mathematical branch of geography received their most attention, due, in large measure, to the very clear atmosphere of the desert region favouring astronomical observations. They constructed a solar calendar from their observations as a guide to harvests and tax collections.

Accurate calculations of latitude and longitude were made and there were several attempts to ascertain the size of the earth. Their best achievement was the drawing of sea charts though land maps seemed distorted by the love of ornamentation. They excelled in descriptive geography which included excellent regional descriptions especially of India and Arabia, still considered remarkable for the scientific handling of a wealth of regional detail, interwoven with geographical and historical facts.

On the whole, however, it must be recorded that though there was not much development of a real science of geography among the Arabs, yet it was the Arabs who kept Greek learning alive, and it was from their hands that Europe received it as the Dark Ages drew to a close. Arab records are a fitting end to an important interlude in the development of geographical knowledge.
China: The Chinese, too, about this time, did much to develop their astronomical instruments. Chinese cartography had its roots in antiquity though no early maps have survived. Gunpowder, magnets, and printing, three essential factors in changing medieval into modern society, were known in China centuries before they came to Europe.

The Chinese also performed journeys of extraordinary reach, difficulty, and importance. Yet, in their lengthy memoirs and narratives of travel there is surprisingly little geography, rather incidental. However, it is certain that China had intercourse with Rome and other Mediterranean lands, the Arab World, India, Ceylon, and the East Indies.

Of special interest is the description in the Chinese annals of the sea voyages to the Persian Gulf and the accounts of the pilgrim travellers, particularly Fa-Hien and Huien-Tsang, and many others, to India and other parts of the known world up to the eighth century.

As mentioned earlier, the narratives of most of these travels have incidental geographical information and so these records are not considered distinctive or representative enough for further notice except the descriptions of travels in India where much geographical landscape is described incidentally.
The second period of 'The Middle Ages' covering the eleventh and twelfth centuries saw the awakening of Europe and the introduction of Moslem (Arab) ideas. In Europe, there were tremendous shifts of populations leading to the clearing of new land, the growth of towns, the Crusades, revival of commerce, and international contact.

Population movements in Europe led to an unprecedented harnessing of natural forces, draught animals, water and wind. The introduction of new techniques and improvement of harnessing methods to overcome agricultural difficulties in heavy soils resulted in the use of heavy-wheeled ploughs for farming, crop rotation, and the first artesian well in 1126, though known earlier in China. Other innovations for the first time in Europe though known to eastern countries for many centuries before, included sericulture, spinning wheel, manufacture of paper, making of linen, falconry, pickling of herring, improved methods of alcohol manufacture, construction of bridges with segmented arches, sluice gates, dredges, etc.

The Crusades in this period being composed of monks and other learned men as well as curious travellers and traders also contributed to the spread of geographical knowledge, and produced a great interest in commerce.

The third period spanning the thirteenth and fourteenth centuries saw the 'Peak' of The Middle Ages. It was the 'Golden Age' of scholastic science with the emergence of universities where translations of various texts were undertaken.

Long travels were not uncommon during this period and the most romantic
of these medieval travels was that of Marco Polo, two brothers in the middle of the thirteenth century which added to the gradually growing store of information. Accounts of these travels by the younger Marco Polo, a son and nephew, written during the period 1298-99, described portions of Central Asia not visited again for hundreds of years. These travels opened up Oriental trade routes both by sea and overland, put the Spice Islands definitely on the map, and revealed a westward route to the Indies. Another traveller, Odoric, who reached Peiping in 1323, likewise contributed in an important way to the knowledge of eastern Asia.

During this period, many European towns and cities like Venice, Genoa, Marseilles, and others, were interested in eastern trade, carried on partly by overland routes. This led to increased acquaintance with the countries traversed by these highways of commerce. At the same time, sailors were, by the end of the thirteenth and early in the fourteenth, extending knowledge of arées beyond the Strait of Gibraltar to the Azores, the Canary Islands, and Madeira.

Transmission of information acquired was, however, still very slow and errors resulting from preservation of the Ptolemaic traditions persisted in the face of known facts, since it required half a century or more to reach the map makers. Further, geographic fables and geographic facts were so inextricably interwoven that their separation was difficult or even impossible. Yet, with all its deficiencies, this period is full of interesting facts and much of it has a high value in geographical thought as it forms the
link with the fifteenth century which saw the decline of universities and the transformation of science into technology.

As contacts between the Eastern and Western World grew more intimate and more numerous, Western Europe learned of the achievements of ancient and Arabic science. Medieval peoples took a keen interest in concrete achievements and were receptive to all sorts of technical advances, some of them original, others transmitted from the Middle East and the Orient, and many others, made simultaneously though independently.

But geography in this period of the 'Middle Ages' was to assume a new aspect and worlds before unknown were to be comprehended within here domain.

Since the Mediterranean nations had their attention nearly engrossed by land conveyance and navigation of the interior seas by which they practically monopolized Eastern trade over direct routes, the rulers of the exterior coasts of Europe, and especially of the Iberian peninsula began to seek other routes to this field of riches.

Under the scientific and pious Prince Henry, called The Navigator, Portuguese sailors began to assume an important place in the ranks of the contributors to the rapidly growing body of geographic information. These sailors were seeking a new way to the Indies. They pushed, year after year, farther down the coast of Africa along the western side, and in the end, in 1497, the circum-navigation of Africa was accomplished by Vasco da Gama, and a new route to the Spice Islands established. Even after this, the Ptolemaic
beliefs as to the shape of India did not disappear completely, so slowly did knowledge diffuse at that time.

About the same time, Columbus, in trying to find a new route to the East Indies, India, and China, sailed west and discovered the American continent. The fifteenth century thus vastly enlarged the geographical conception of the world.

The true outlines of the New World were not revealed until early sixteenth century, Cabot, Balboa, Cortez, Pizarro, Magellan, and others contributing to this result. Among these navigators, mention must be made of Magellan whose ships accomplished the first circumnavigation of the earth between 1519 and 1522. His adventures to the East had already led him to the distant Moluccas, the Spice Islands. He had passed through the straits which bear his name, and crossed the entire breadth of the Pacific. The key to the East had been found and had disclosed the existence of many, large, rich, and populous islands in the East. The voyage demonstrated once for all the circular shape of the earth and gave practical proof that the earth was larger, and Eurasia smaller, than believed, and that America was a distinct continent. The distance traversed supplied a rough estimate of the size of the earth.

Magellan set geographical knowledge on a surer footing than it had ever been before. He proved the theories of the Greek philosophers about the sphericity, and closed an important epoch in the evolution of geographical knowledge.
The century and a quarter beginning with the year 1490 is known as the "Period of Discoveries". Discoveries broadened geographical knowledge. By the year 1550, practically all the continental shores of the world were known with the exception of those of Australia and the Polar regions. The motives of these explorations at this point, however, were commercial gain though sometimes actuated by religious zeal or as curious travellers. The bewildering mass of new facts from these great explorers and travellers were quickly made available and accessible through the compilations of Hakluyt, Ramusio, and de Bry. These new facts had to be charted. Efforts to do this with the greatest possible accuracy initiated a development in cartography that attained its zenith in the maps of Gerhard Kremer (Mercator, 1512-94), and Abraham Ortelius (1527-98).

In the seventeenth and subsequent centuries, there was a new motive, that is, mostly scientific research, the desire to discover for the sake of discovery. This led to the founding of geographical societies which encouraged such exploration, and governments frequently sent out scientific expeditions. In this way, the remaining portions of the earth were discovered and the general map of the earth completed.

Though the Spanish and Dutch had earlier discovered some coastal areas of Australia, it was left to Cook to complete the coastal survey of this island continent and to discover New Zealand, and many other islands of the Pacific.
The opening up of Africa was the weak of the nineteenth century and it was due largely to the scientific explorations of Mungo Park, Livingstone, and Stanley, into the interior parts of this continent.

At a much earlier time, portions of the Arctic lands of Iceland, Greenland, and Labrador, had been touched, as we have already seen in an earlier section. But it was not till the eighteenth and nineteenth centuries, as a result of scientific explorations that much of the present knowledge of these frozen areas was available. Slowly but surely, unknown areas on the face of earth were shrinking from year to year. And it was only in the early years of the present century when the question of the Poles was settled. Peary in 1909 found the North Pole in the midst of the Arctic Ocean, and Amundsen, in 1911, located the South Pole on a glacier-covered plateau in the Antarctic Continent.

From the beginning of the nineteenth century to the present day, is the development of what is known as 'Contemporary Modern Geography' during which period the interior of the continents have been explored and vast areas carefully surveyed. Many of the problems of geology, climate, plant, and animal life, and ethnographical questions, have been solved giving a better perspective of man in relation to the earth in which he lives thereby contributing largely to the modern concept of the science of geography.