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Evolution Of Geographical Thought In India: Classical To Contemporary

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Preface
The study of geographical thought in India is indeed an under-explored field, especially when compared to the extensive research in Western counterpart. While ancient Indian texts and traditions contain rich geographical knowledge, formalizing it into a distinct discipline, documenting its evolution has received less attention. Looking back at the roots of Indian geography discloses very rich and strong Indian intellectual heritage, a legacy of over 2000 years old. However, the formal foundations of academic geography in India were laid in the colonial period as late as 1920s. Beginning in the 8th century, India was exposed to Islamic geographical concepts and ideas and Muslim geographers began to take place beside Hindu scholars in contributing to the maturing of geographical study in India. The arrival of the British and other European colonial powers in the 17th century forced a transformation of Indian intellectual circles. Indian geography's progress in the modern times has been spectacular after Independence. After freedom, geography acquired new functions in the context of national development, expansion of the educational system and strengthening of planning projects. The complete image of Indian geographical thought demands a thorough critical screening of the inherited wealth from the past and the contemporary practices which together have decisive influences on the future directions.
Indian geographical thought has deep roots in Vedic times and is evident in ancient texts like the Vedas, Upanishads, and epics like the Mahabharata and Ramayana. These texts contain descriptions of regions, spatial relationships, and cosmological concepts. Indian geographical thought is often integrated philosophical, cosmological and even spiritual perspectives, which differed from the more empirically-focused Western tradition. The interconnectedness of different fields of knowledge, such as philosophy, cosmology and mathematics has enriched the broader understanding of geography in India. Unfortunately, there has been a lack of a systematic reporting of Indian geographical thought.
This research paper sheds light on the unique contributions of ancient Indian scholars and their perspectives along with the subsequent developments in the discipline. Studying Indian geographical thought provides valuable insights into the ancient Indian texts, oral traditions and other sources,. A thorough review of the inherited geographical knowledge from the past and contemporary practices is necessary to understand the evolution of geographical thought in India. The contributions of the ancient period, alongside medieval knowledge and later colonial influences laid the foundation for the development of modern geography in India. The paper seeks to acknowledge these evolutionary trends in India. Since the roots of Indian Geographical Thought lie in its Classical Phase of development, the discussion on this section is relatively more elaborated. Reclaiming and integrating the rich traditional Indian geographical knowledge provides a more holistic understanding of the Indian landscape and its cultural significance. A deeper understanding of Indian geographical thought indicates the development of a unique methodological framework for studying the Indian context and contributing to global geographical discourse. This paper explores the nature and trends of geographical thought in India linking the Classical phase to Contemporary. *In this attempt, the author records her sincere appreciation to National Social Science Documentation Centre (NASSDOC) for providing relevant study material. An acknowledgement is also due to the staff of libraries of ICSSR and RTL for laying at disposal the data and information on related issues.*

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I. Introduction

Occupying a strategic location in Asia, Indian history is at crossroads of cultures from China to Europe. The past is the key to the present. The roots of geography in India lie in Classical Antiquity, although the professionalization in it came much later. The quest for learning in this direction in earlier times has played a decisive role in shaping future growth of the discipline in India. Here geography has undergone significant transformations over the years, influenced by various factors including technological advancements and socio-

economic changes. Ancient Indians possessed great knowledge and applied them for the benefit of community in all areas of human development. Science and technology in ancient India covered all the major branches of human knowledge and activities, In fact, several inventions and discoveries believed to have originated from the Western world have been studied centuries earlier by our ancestors.

The geographical studies in India, in fact, began with the dawn of Indian Civilization in ancient times. Scholarly observations of both the Eastern and Western civilizations had begun in pre-historic times. Some of the first truly geographical studies occurred more than four thousand years ago in the regions often referred to as "the cradle of civilization". Indus Valley was one of these, others being Mesopotamian, Chinese and Nile Valley civilizations. These civilizations were first to explore the places and spaces within and outside their homelands. The history and evolution of Indian geographical thought, stretching over many centuries, is not an affair of continuous and smooth progress. In general, Geography took about 2000 years to evolve as a scientific discipline as we know today. Through the past, the knowledge of geographical nature has infiltered till present in the form of various fields of learning, terminologies, concepts and techniques. Geography has evolved as an integrating field of study assimilating wisdom from various schools of thought from ancient to modern times, namely, (Greek & Roman, Indian and Chinese in the Ancient period, Arab in Medieval period, and German, French, American, British and Soviet in Modern period. These schools have endowed geography from various concepts, terminologies and techniques refining its methodology from time to time. The contemporary methodology and the subject matter of Geography is a reflection of this assemblage.

The evolution of geographical thought in India progressed from a classical period with rich knowledge embedded in ancient texts like the Vedas and Puranas, where geographical concepts were integrated with religious and philosophical ideas, to a contemporary phase heavily influenced by the colonial period, marked by the introduction of modern scientific methods and a focus on post-independent national development needs. Although geography emerged as a formal discipline with the efforts of British scholars, the early Indian scholars had a well-developed understanding of the discipline, showcasing a deep knowledge of the Cosmos and Planet Earth often intertwined with mythology and cultural narratives. Valuable geographical information is contained in Hindu mythology, philosophy, epics, history and sacred laws. Major sources of information are *Ramayana, Mahabharata, Vedas, Puranas* and the works of Buddhists and Jains. Apart from religious records, the travellers' accounts give the description of different regions of the world. All these sources reveal that India had close links with the neighbouring lands and Indian scholars were familiar with the geographical conditions of China, Southeast Asia, Central Asia and Mesopotamia. The contributions of Indian scholars in the ancient period are parallel to that of Greeks and Romans. The scholars from outside the field (non-geographers) have made valuable contributions to our subject matter since beginning. Notable have been saints & sages, philosophers, cartographers, astronomers, mathematicians, historians, geologists, scientists and travellers.

The study of the history and evolution of geographical thought in India presents significant challenges and opportunities. While Western geographical thought has been extensively studied, the contributions of Indian geographical thought are less well-documented. This is probably due to certain reasons as: (i)Limited Documentation: scholarly works on the development of Indian geographical thought are not as readily available or systematically compiled as those in Western traditions; (ii)Interdisciplinary Nature: Indian geographical thought is deeply intertwined with philosophy, religion, and cultural practices; (iii) Influence of Western Models: Since the colonial era, there has been a tendency to adopt Western geographical frameworks, potentially overshadowing indigenous knowledge systems and approaches; and (iv) Lack of Indigenous Models: Indian geographers have often relied on Western models and methodologies, hindering the development of a distinct and robust Indian geographical tradition. The paper acknowledges the Indian journey of seeking geographical knowledge. Exploring the history of Indian geography can reveal unique perspectives on various fields of geographical learning. The Indian geographers can better address contemporary challenges related to, for instance, development, environmental sustainability and cultural diversity by penetrating historical roots of geographical thinking; by analysing texts like the Vedas, Puranas, and Upanishads for geographical concepts and cosmological understandings; by examining the role of Hinduism, Buddhism, and other religious traditions in shaping geographical perceptions and practices, by exploring how different geographical regions of India have developed unique geographical knowledge systems and cultural landscapes and by evaluating the impact of British colonialism on the development of geography as a discipline in India and the subsequent shift towards Western paradigms. Thus, while the history and evolution of Indian geographical thought presents a complex and challenging area of study, it also offers significant opportunities to enrich the discipline and develop a more precise understanding of the relationship between geography, culture, and the environment in India.

The important objectives of study to be achieved are as follows:

- To reconstruct past of geography and trace its roots in antiquity;

- To search for literary evidences related to developments of geographic nature in Ancient History with special reference to Oriental (Indian) world;
- To find out the nature of geographical knowledge inherited by the Indian scholars since ancient to contemporary times;
- To acknowledge contribution of various scholars with their disciplines of learning in which lie the roots of geographic development in India; and
- To explore the ancient geographical traditions that have been bequeathed to successive generations in the form of philosophies, methodologies, theories, literature, terminologies and fields of study.

Five Evolutionary Key Phases may be identified to understand the discipline's state and development through time in India, viz.

1. Classical (Pre-Colonial) Geographical Knowledge
2. Geography during the Middle Ages
3. Colonial Period Developments
4. Post-Independence Era
5. Contemporary Indian Geography

Classical Indian Geographical Knowledge

The Classical phase here covers developments during Ancient and Early Medieval period. As stated, the ancient texts contain detailed geographical information about the country and the surrounding regions. From the times of Vedic period, the great culture of India has presented humanity with a gold mine of discoveries and inventions (Will Durant), The ancient Indian sages (*Rishis*) were adepts in all fields known and unknown to humanity. At the roots of geographical knowledge lie the works of ancient Indians in various fields of Learning as mentioned in Table-1.

Table-1: The Earliest Known Indian Scholars & Contributions

Name	Field	Contribution
Acharya Kapil (3000 BC)	Cosmology	*the founder of Samkhya Philosophy*
Acharya Bharadwaj (800 BC)	Aviation technology.	*Yantra Sarvasva*
Baudhāyana, (800 BC)	Mathematics.	*Sulba Sutra*
Acharya Charak (600 BC)	Medicine.	*Charak Samhita*
Acharya Kanad (600 BC)	Physics	*Atomic Theory*
Acharya Sushrut (600 BC)	Medicine (Surgery)	*Sushruta Samhita*
Gautama Buddha (563 to 483 BC)	Philosophy	*Founder of Buddhism*
Pānini (400 BC).	Grammar	*Ashtadhyayi*
Nagarjuna (100 AD)	Chemistry	*Ras Ratnakar," Rashrudaya & Rasendramangal*
Âryabhatta I (476–550 AD)	Mathematics & Astronomy	Aryabhatiya *&Arya-Siddhanta*
Varahamihir (499-587 AD)	Astrology & Astronomy	*Bruhad Samhita" & Bruhad Jatak*
Brahamgupta (598-668)	Mathematics & Astronomy	*Brahmasphutasiddanta & Khandakhadyaka.*
Bhāskara I (600 - 680).	Mathematics &. Astronomy.	*Mahaantabhaskariya & Laghubhaskariya*
Adi Shankara (788 AD - 820 AD)	Philosophy	*Founder of 4 mathas ("monasteries")*
Aryabhata II (about 920)	Mathematics & Astronomy	*Maha-Sidhanta/ Arya-Sidhanta*
Sridharacharya (AD 991)	Mathematics	*Patiganita & Trisatika.*
Brahmadeva (1060- 1130)	Mathematics & Astronomy	*Karanaprakasa*
Bhaskaracharya (1114-1183 AD)	Algebra	*Sidhanta Siroman*

India's priceless heritage is unveiled by Acharya Kapil, who contended that *Prakriti* and *Purusha*[1] are the mother of cosmic creation and all energies. With this he contributed a new chapter in the science of cosmology. Acharya Bharadwaj was an ardent promoter of mechanical sciences, making outstanding discoveries in aviation science, space science and flying machines. Baudhāyana is noted for formulating appendices to the Vedas giving rules for the construction of altars. Acharya Charak, crowned as the 'Father of Medicine', was one of the principal contributors to the ancient art and science of Ayurveda, a system of medicine and lifestyle thought to be developed about 5000 years ago. As the founder of "Vaisheshik Darshan"- one of six *darshanas* (philosophical systems) of India - Acharya Kanad was the pioneer expounder of realism, law of causation and the atomic theory. A surgeon

and teacher of Ayurveda**,** Acharya Sushruta was recognized as a genius in medical science. Gautama Buddha (Siddhārtha Gautama) was a spiritual teacher who founded Buddhism. Panini is known for his Sanskrit grammar, particularly for his formulation of the rules of Sanskrit morphology in grammar. Nagarjun was an extraordinary wizard of science producing maiden discoveries and inventions in the faculties of chemistry and metallurgy. Aryabhata I was the first in the line of great mathematician-astronomers from the classical age of Indian mathematics and Indian astronomy. His work was of great impact on the Indian astronomical tradition, and influenced several neighbouring cultures through translations. Not only India's first satellite Aryabhata is named after him, the lunar crater Aryabhata is also named in his honour. A Research Institute for Astronomy, Astrophysics and atmospheric sciences has been named as Aryabhata Research Institute of observational sciences (ARIES) near Nainital, India. One of the eminent polymaths of ancient period was Varahamihira, the rishi-scientist surviving through his unique contributions to the science of astrology and astronomy. Brahmagupta, another Indian mathematician and astronomer, was the head of the astronomical observatory at Ujjain that was the foremost mathematical center of ancient India at that time. He wrote two texts on mathematics and astronomy: the *Brahmasphutasiddhanta* (The Opening of the Universe) and the *Khandakhadyaka.* The *Brahmasphutasiddhanta* is the earliest known text to treat 'zero' as a number in its own right and this work is a compendious volume of astronomy. Bhāskara I was a 7th century Indian mathematician making considerable contributions to the study of fractions. Sridharcharya known for his method of multiplication, was not only very popular among later Hindu writers, but also for transmitting his knowledge to the West. Brahamdeva is known for commentaries on *Aryabhatiya.* As a genius in algebra, Bhaskaracharya is regarded, almost without question, as the greatest mathematician of all time. He reached an understanding of the number systems and solving equations that was not to be achieved in Europe for several centuries. His work in Algebra, Arithmetic and Geometry catapulted him to fame and immortality. Lastly, Adi Shankara was an Indian philosopher who consolidated the doctrine of *Advaita Vedanta*, the most influential sub-school of *Vedanta.*

The contribution of the classical Indian scholars to the various fields of geographical study, is fascinating and it came through various fields of learning as Philosophy, Cosmology, Astronomy & Astrology, Mathematics (Arithmetic, Algebra, Geometry & Algorithm), Science & Technology (Physics, Chemistry & Metallurgy, Civil engineering & architecture, Aviation, Shipbuilding & navigation,), Medicine (Medical science, Surgery, Human Anatomy, Ayurveda) and Linguistics (Table-2).

Table-2: Contributors to Classical Fields of Learning in India

Field	Contributors
• Philosophy	Adi Shankara, Madhava and Ramanuja
• Cosmology, Astronomy& Astrology	Kapil, Aryabhata-I, Brahmagupta, Varahamihira and Lata Deva
• Mathematics	Aryabhata, Varahamihira, Brahmagupta, Bhaskara I, Mahavira, and Bhaskara II
• Science & Technology	Kanada, Nagarjun, Bhardwaj
• Medicine	Sushrut, Charak,
• Linguistics	Panini

In the history of the Indian subcontinent, following the establishment of a Vedic culture, the development of philosophical and religious thought gave rise to various schools (*Darshanas*) of Hindu philosophy.[2] Hinduism was a major development of the early Vedic religion. Different systems of Indian philosophy and learning developed a mutual harmony and amity, wholesomeness and integrity in their core. Astronomy**(** *Khagola-shastra*)[3] is one area which interested the early Indians. In India the first references to astronomy, interwoven with astrology, are to be found in the Rig Veda, dated around 2000 B.C. Since ancient times Indians have involved the planets (*Grahas*) with the determination of human fortunes and deified the Sun, Stars and Comets. The astronomical observations in ancient India, carried on howsoever crude instruments, did enrich the knowledge scholars about the Universe (Cosmos).Unlike today's scientists relying on powerful telescopes and sophisticated computers to formulate cosmological theories, in former times, people got their information from traditional books of wisdom and the ancient schools of philosophy. Followers of India's ancient culture, for example, learned about the cosmos from scriptures like the *Srimad-Bhagavatam*, or *Bhagavata Purana* and the *Samkhya* School of Thought. The cosmology of the *Bhagavata Purana* is a sophisticated system of thought combining practical understanding of astronomy with spiritual conceptions to produce a meaningful picture of the universe and reality. The ancient Indian scholars dealt with many problems pertaining to Cosmology (the science of Universe), Cosmogony (the origin of Universe) and Cosmography (the description of Universe).[4]

In India, mathematics has its roots in Vedic literature., containing treatises authored by Indian mathematicians in which were set forth a number of mathematical traditions for the first time. *Vedic* literature is replete with concepts of zero, the techniques of algebra and algorithm, square root and cube root. The Arabs borrowed so much from India the field of mathematics that even the subject of mathematics in Arabic came to known as '*Hindsa*' which means 'from India. Aryabhatta's Magnum Opus, *Aryabhatiyam,* is the unparallel

treatise of Hindu mathematics up to the time. These mathematical concepts were transmitted to the Middle East, China, and Europe and led to further developments that now form the foundations of many areas of mathematics. Excavations at Harappa, Mohenjo-daro and other sites of the Indus Valley Civilization (IVC) have uncovered evidence of the use of "practical mathematics"[5]. The people of the IVC used a standardized system of weights and mass produced weights in regular geometrical shapes. The inhabitants of Indus civilization also tried to standardize measurement of length to a high degree of accuracy. They designed a ruler—the *Mohenjo-daro ruler*—whose unit of length (approximately 1.32 inches or 3.4 centimetres) was divided into ten equal parts. In the seventh century, two separate fields, arithmetic (which included mensuration) and algebra, began to emerge in Indian mathematics. The two fields would later be called *pāṭī-gaṇita* (literally "mathematics of algorithms") and *bīja-gaṇita* (lit. "mathematics of seeds," with "seeds"—like the seeds of plants—representing unknowns with the potential to generate, in this case, the solutions of equations). The contribution of ancient Indian scholars may, precisely, be identified towards various branches of Mathematics, as Numerals, the Concept of Zero, Arithmetic, Algebra, Geometry, Algorithm, Trigonometry & calculus (Rana, 2014, Ancient Tradition in Geography).

Besides the pure sciences like Physics and Chemistry, Aviation, Metallurgy, Civil Engineering & Architecture, along with Linguistics reflect great acquirement of the ancient Indians in the domain of Science & Technology. Interestingly, the concepts of atom (*Anu, Parmanu*) and relativity (*Sapekshavada*) were explicitly stated by an Indian philosopher nearly 600 years before the birth of Christ. From the Vedic times, Indians have classified the material world into four elements viz. Earth (*Prithvi*), fire (*Agni*), air (*Maya*) and water (*Apa*). To these was added a fifth one viz. *Ether* or Akasha. These five elements or *Pancha Mahabhootas* were identified with the various human senses of perception viz. Earth with Smell, Air with Feeling, Fire with Vision, Water with Taste and Ether with Sound. Since beginning the Indians had perceived the material world as comprising these five elements. The Indian philosophers believed that except Akash (ether), all other elements were physically palpable and hence comprised miniscule particles of matter. The last miniscule particle of matter which could not be subdivided further was termed *Parmanu*. (a combination of *Param*, meaning Beyond, and *Anu* meaning Atom). Indian theories about the atom are greatly abstract, enmeshed in philosophy and theology. Parallel to the development of the concepts of atom and atomic permutations and combinations in physics there also was a similar development of ideas in the area of Chemistry.(*Rasayan Shastra*), Along with chemistry, the Indians had acquired proficiency in the area of Metallurgy.. Indian steel and iron were reportedly being used by the Romans for manufacturing armour as well as cutlery (Birodkar, S.). Keeping these references apart, it is in India itself that we find actual objects that reflect the advancement of the technique of smelting. Ashoka pillar at Mehrauli, New Delhi and another iron pillar in Karnataka stand proof of India's metallurgical heritage. Another instance of Indian metallurgy is the copper statue of Gautama Buddha found at Sultan Ganj in Bihar. There are many such examples that bear testimony to the excellence in smelting metals achieved in India in ancient times.

The discovery of urban settlements of Mohenjodaro and Harappa indicate existence of civil engineering & architecture, which blossomed to a highly precise science and found expression in innumerable monuments of ancient India. Besides, the medical science in ancient India was promoted through the works of Charak and Sushrut. Innovative discoveries have been made in the fields of, for instance, human anatomy, embryology, pharmacology, blood circulation and various diseases. Charak's *Charaka-Samhita* describes the medicinal qualities and functions of about 100,000 herbal plants. Translated into Persian and Arabic in the eighth century, it represents a major advance over the superstitious ways of treating medical problems. *Sushruta Samhita* is another unparalleled work of the medical science of ancient India.. It is known for its amazing surgical procedures of accuracy and curative efficacy. Many Indian ideas of medicine were incorporated into the Unani system of medicine of the Arabs. The learning of Indian curriculum in late classical times had at its heart a system of grammatical study and linguistic analysis. The core text for this study was the *Aṣṭādhyāyī* of Pāṇini, the *sine qua non*e of learning. Pāṇini's grammar can be considered to be the world's first formal system, well before the 19th century innovations of Gottlob Frege[6] and the subsequent development of mathematical logic. His technique was rediscovered by the logician Emil Post[7] and is now a standard method in the design of computer programming languages. Panini formulated 3,959 rules of Sanskrit morphology .His *Ashtadhyayi* is the foundational text of the earliest known grammars of Sanskrit. It is the earliest known work on descriptive linguistics, generative linguistics, and stands at the beginning of the history of linguistics itself.

Geographical Inheritance

All the above observations of the ancient Indian scholars generated quest for learning in the fields of the study of Universe, Earth and Indian Subcontinent.

The Universe (*Brahamand*) and its origin remained a point of speculation among all the ancient civilizations and the scholars of Vedic and Puranic period also gave a considerable thought to this, conceiving it as very immense and wide to be described. The *Srimad-Bhagavatam* presents an earth-centred conception of the Cosmos (Figure-1). *Bhagavatam* describes that the universe lies within a series of spherical shells which is divided in two by an earth plane called *Bhu-mandala*. In its centre (Figure -2) is the circular "island" of *Jambudvipa*, with

nine subdivisions (Figures- 2, 4 & 5), including *Bharata-varsha* or India. In the centre of Jambudvipa stands the cone-shaped *Sumeru Mountain*[8], which represents the world axis and is surmounted by the city of Brahma, the universal creator.

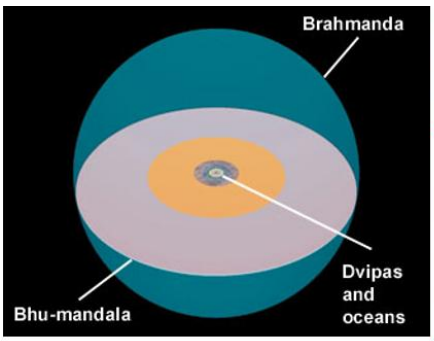

Figure- 1: Brahmanda

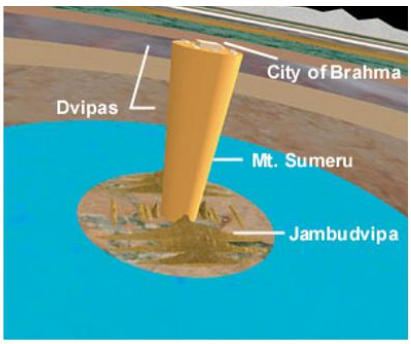

Figure -2: Bhu-Mandala

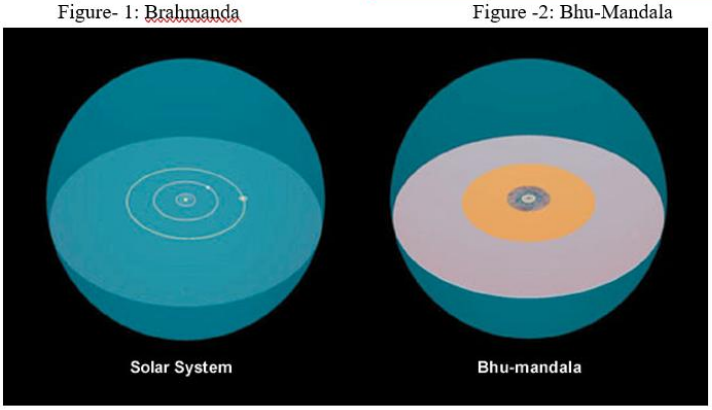

Figure -3: The Ecliptic Model

Bhu-mandala can be compared with an astronomical instrument called an astrolabe of ancient Greeks. On the astrolabe, an off-cantered circle represents the orbit of the sun—the ecliptic (Figure-3). The Earth is represented in stereographic projection on a flat plate, called the mater. The ecliptic circle and important stars are represented on another plate, called the rete. Different planetary orbits could likewise be represented by different plates, and these would be seen projected onto the Earth plate when one looks down on the instrument. Not only does the *Bhagavatam* use the ecliptic model, it presents the orbits of the sun, the moon, planets, and important stars on a series of planes parallel to *Bhu-mandala* (Figure-1). *Bhu-mandala* matches the solar system closely and its structures correspond with the planetary orbits of solar system. The solar system is nearly flat. The sun, the moon, and the traditionally known planets—Mercury through Saturn—all orbit nearly in the ecliptic plane. If we compare the rings of *Bhu-mandala* with the orbits of Mercury, Venus, Mars, Jupiter, and Saturn, we find several close alignments that give weight to the hypothesis that *Bhu-mandala* was designed as a map of the solar system.

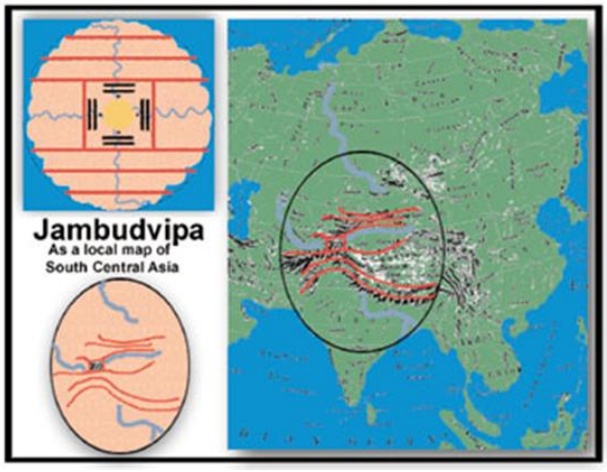

Figure-4: Jambudvipa

A series of *dvipas,* or 'islands,' and oceans make up *Bhu-mandala*. In its centre is the circular 'island' of Jambudvipa (Figure-4), whose most prominent feature is the cone-shaped Mount Meru. The *Srimad-Bhagavatam* tells of innumerable universes. Each one is contained in a spherical shell surrounded by layers of elemental matter that mark the boundary between mundane space and the unlimited spiritual world. The region within the shell (Figure -1) is called the Brahmanda, or "Brahma egg." *Bhu-mandala* divides it into an upper, heavenly half and a subterranean half, filled with water. *Bhu-mandala* itself is divided into a series of geographic features, traditionally called *dvipas,* or "islands," *varshas,* or "regions," and oceans. *Jambudvipa* (Figure-4), the central hub of *Bhu-mandala*, can be understood as a local topographical map of part of south-central Asia. *Jambudvipa* represents the northern hemisphere of the Earth globe. Six horizontal and two vertical mountain chains divide *Jambudvipa* into nine regions, or *varshas* (Figure-4). The southernmost region is called *Bharata-varsha* which corresponds to India plus adjoining areas of south-central Asia.

There is an old Sanskrit Sloka (couplet):*"Sarva Dishanaam, Suryaha, Suryaha, Suryah"* (Iyenger,2016*)* meaning there are suns in all directions. In other words, it was recognized that the sun is also a star, though the nearest one. Aryabhata was the earliest to discover that the orbits of the planets around the Sun are ellipses. He is the first known astronomer to have used a continuous system of counting solar days. Aryabhata's book, *Aryabhattiya,* gives a logical explanation to the theory of solar and lunar eclipses. Aryabhata declared that eclipses are caused due to the shadows casted by the Earth and the moon. Aryabhata correctly explains the causes of eclipses of the Sun and the Moon. His value for the length of the year at 365 days 6 hours 12 minutes 30 seconds is remarkably close to the true value. Aryabhata proposed the geocentric model of the solar system. In the Geocentric model of the solar system, as described by Aryabhata, the Sun and Moon are each carried by epicycles which in turn revolve around the Earth. In this model, the motions of the planets are each governed by two epicycles, a smaller *manda* (slow) epicycle and a larger *śīghra* (fast) epicycle. The order of the planets in terms of distance from earth are taken as: the Moon, Mercury, Venus, the Sun, Mars, Jupiter, Saturn, and the asterisms. Most historians of astronomy consider that this two epicycle model reflects elements of pre-Ptolemaic Greek astronomy.

Interestingly, besides proposing the geocentric model, Aryabhata also laid the foundation for the concept of Gravitation. The concept of the existence of some tractive force (force of gravity) that governs the falling of objects to the earth and their remaining stationary after having once fallen; as also determining the positions which heavenly bodies occupy, had been recognized. What Copernicus and Galileo propounded was suggested by Aryabhata nearly 1500 years ago. *Siddhanta Shiromani* (written in 1150) of Bhaskara II consists of two parts: *Goladhyaya* (sphere) and *Grahaganita* (mathematics of the planets). In his book 'Siddhant Shiromani' Bhaskaracharya also mentions about force of attraction the gravity, discovered centuries later by Newton. Brahmagupta, in the 7th century had said about gravity that "Bodies fall towards the earth as it is in the nature of the earth to attract bodies, just as it is in the nature of water to flow". The term *Guru-tva-akarshan* can be interpreted to mean, 'to the attracted by the *Guru* (Master), the sun. The sun (Surya) was one of the chief deities in the Vedas. He was recognized as the source of light (*Dinkara*), source of warmth (*Bhaskara*). In the Vedas it is also referred to as the source of all life, the centre of creation and the centre of the spheres. While the male gender is applied to refer to the sun, the earth (*Prithivi*, *Bhoomi*, etc.,) is generally referred to as a female.

The lndian Astronomers, like Aryabhatta and Varahamihira, made close approaches to the concept of Helicentrism. The heliocentric theory of gravitation was, a thousand years later, articulated by Copernicus and Galileo. However, unlike our modern scientists, the ancient Indian astronomers believed in geo-centric universe, i.e. the Earth at the centre and the Sun being as one of its planets (*Grah*). In the Rigveda, there is a description of 34 heavenly bodies including the Sun, the Moon, five *Grah* (Planets) and 27 constellations. The five Planets have been described as the five Gods. But, the astronomers of Puranic period established nine planets, viz. the Sun, the Moon, the Mars (*Mangala*), the Mercury (*Budha*), the Jupiter (*Brahaspati*), the Venus (*Shukra*), the Saturn (*Shani*), *Rahu* and *Ketu*. The astrophysical characteristics of some of these planets have been described in the classical literature. For instance, Mercury has been shown with green colour, Venus with white, Mars with red, Jupiter with yellow and Saturn with black. The heliocentric idea existed in a rudimentary form in the days of the Rig Veda and was refined further by astronomers of a later age. In his book, Aryabhata presented astronomical and mathematical theories in which the Earth was taken to be spinning on its axis and the periods of the planets were given with respect to the sun (in other words, it was a deference to heliocentrism).In Aryabhata's model, the *śīghrocca*, the basic planetary period in relation to the Sun, is seen by some historians as a sign of an underlying heliocentric model. He states that the Moon and planets shine by reflected sunlight. Instead of the prevailing cosmogony where eclipses were caused by pseudo-planetary nodes *Rahu* and *Ketu*, he explains eclipses in terms of shadows cast by and falling on earth. Subsequent Indian astronomers improved on these calculations, but his methods provided the core. Considered in modern English units of time, Aryabhata calculated the sidereal rotation as 23 hours 56 minutes and 4.1 seconds; the modern value is 23:56:4.091. Similarly, his value for the length of the sidereal year at 365 days 6 hours 12 minutes 30 seconds is close to reality. Thus it has been suggested that Aryabhata's calculations were based on an underlying heliocentric model in which the planets orbit the Sun. The

study of astronomy in Bhaskara's works, too, is based on a model of the solar system which is heliocentric and whose movements are determined by gravitation. Heliocentrism had been talked about in 499 by Aryabhata, who argued that the planets follow elliptical orbits around the Sun. Along with him, Brahmagupta and Bhaskara as well accurately defined many astronomical quantities, including, for example, the length of the sidereal year, the time that is required for the Earth to orbit the Sun, as 365.2588 days which is same as in *Suryasiddhanta*[9]. The modern accepted measurement is 365.2563 days, a difference of just 3.5 minutes.

The concept of *Prithvi* (Earth) was the most basic in the study of geography. It has been profusely used in the Vedas and Puranas. The study of the earth or Prithvi has been called *Bhugol* or Geography. The use of the term *Bhugol* for the discipline of Geography is the most appropriate and clearly suggests that the ancient Indians endorsed the earth being a sphere, and not a flat disc as believed by some of their parallel civilizations. In 499 A.D., the Indian astronomer Aryabhatta had already defined the shape of the Earth in his work *Aryabhateeyam*, as: *Mrujjalashikhivaayumayo Bhoogola: sarvatho vruttha***:** [Meaning: Earth which is made of soil, water, fire and air is circular when viewed from all sides. i.e., The Earth is spherical]. Ancient Indian astronomers propounded the theory that the earth is a sphere. Their estimates of the circumference of earth came close to truth. In *Surya Sidhanta*, Latadeva speaks about the axis of the ground and calls it *Sumeru*. "That the earth is a sphere and that it turns around its axis" was known to Indian Varahmihira and other astronomers well before Copernicus. In the field of astronomy, Aryabhatta was the first to infer that the Earth is spherical and it rotates on its own axis which results in day and night. He even concluded that the moon is dark and shines because of the light of sun. He made an accurate approximation the circumference and diameter of the earth.[10] His working was later adopted by the Greeks and then by Arabs. Aryabhata was the first astronomer to make an attempt at measuring the Earth's circumference since Erastosthenes (circa 200 BC).This approximation was a significant improvement over the computation by the Greek mathematician, Eratosthenes (c. 200 BC). The works Brahmagupta also represent a significant contribution to mathematical and astronomical knowledge. Brahmagupta estimated that the circumference of the earth was 5000 yojanas (a yojana ibeing around 7.2 kms). Calculating on this basis we see that the estimate of 36,000 kms as the earth's circumference comes quite close to the actual circumference known today.

Besides sphericity, the earth studies of ancient Indian scholars also dealt with its origin, eclipses, size and dimensions, latitudes, longitudes and local time, directions or cardinal points, earthquakes and volcanoes, atmosphere and seasons, and its physical divisions. As far as the origin of the earth is concerned, They believed in the solidification of earth from gaseous matter. The earth's crust, according to them, is made of hard rocks (*sila*), clayey material (*bhumih*) and sandy material (*asma*). The Puranas mention the earth to be apparently floating on the water like a sailing boat on the river. They were also aware of the fact that there is more land surface in the Northern Hemisphere. The ancient Indian scholars were aware of the causes of occurrences of eclipses (*grahanas*). Some rituals and ceremonies of the Indian society were being performed on the days when eclipses occurred. It was well known to the ancient Indian scholars that the earth is an oblate spheroid flattened at the poles. Also, its equatorial diameter is greater than its polar diameter. The estimates made in *Suryasidhanta* respect to earth's volume, its equatorial circumference, mass or weight were very close to those established in the modern period. *Akshansh* and *Deshantar* are the terms used for 'latitudes' and 'longitudes' respectively in the ancient Indian literature. Puranas have a reference of three imaginary lines of latitudes passing through Equatorial belt, North Pole and South Pole. Accordingly, three major regions have been identified in the Literature, viz. Equatorial (*Nirakshadesha*), Northern Polar (*Meru*) and Southern Polar (*Bhadvanala*). The South Pole (*Nadir*) was truly considered as the antipode of the North Pole (*Zenith*), i.e. diametrically opposite to it. However, the world was not believed to exist beyond Equator, as the region here was compared to hell of the earth. The Eastern part, on the other hand, was believed to be 'the land of Gods'. This thinking is in consonance with that of the Europeans in the Early Medieval period, when the Dark Ages prevailed and the East in *T-in-O' Maps*[11] was assumed to be the place of *Adam* and *Eve*. The ancient Indian scholars have also drawn Prime Meridian. These imaginary lines, the position of Sun and various stars have helped them to determine local time at various places. In Rigveda, there is formulated the idea of four main directions, viz. *Purva* (East), *Paschim* (West), *Uttar* (North) and *Dakshin* (South). By adding Zenith and Nadir it was raised to six. But, afterwards, ten directions have been frequently mentioned in the Puranic literature. The designation of these directions in the Puranas is significant in the sense that it bears concept of the Gods dominating in each of these directions. The ten directions and the ruling deity of each is mentioned below (Table 3):

Table 3: Cardinal points & the Ruling Daities as per Puraninc Literature

DIRECTION	**RULING DEITY**
Purva (East)	*Indra* (The God of Rain)
Agneyay (Southeast)	*Agni* (The God of Fire)
Dakshina (South)	*Yama*(The God of Death)
Nairitya (Southwest*)*	*Niriti* (The God of Disaster)

Paschim (West)	*Varuna* (The God of Water)
Vayavya (Northwest)	*Marut/Vayu* (The God of Air)
Uttar (North*)*	*Kubera* (The God of Wealth)
Isana (Northeast*)*	*Isa* (The God of Power)
Urdhava (Zenith*)	*Brahma* (The Creator of Universe)
Adhoh (Nadir^*)*	*Sesanaga* (The Universal Ocean)

*The point directly above the observer
^ The point directly below the observer

The knowledge regarding the earthquakes, atmosphere, weather, climate and seasons in this period is excellent. For 'earthquakes' the term *bhukamp* has been used in Puranas. It was assumed that the deities of Air, Fire and Water cause the earthquakes. The ancient Indian scholars have identified the vacuum between the earth and the heaven as *Antariksha*. Although, it is not clear whether it referred to 'space' or 'atmosphere', they were undoubtedly aware of its vast extent or thickness and the occurrence of various weather phenomena here, as rain, winds, clouds, lightening, fog, and frost etc. Ramayana furnishes a lot of this kind of information. Bhaskaracharya has conceived the thickness of *Antariksha* around the earth to be 12 *yojans* (or 96 kms; one *yojan* being equal to about 8 kms.). As far as the knowledge about the seasons is concerned, it is based largely on the studies in India. Rigveda mentions five seasons. In Valmiki Ramayan, however, six seasons have been identified. They are listed below (Table 4).

Table 4: The Seasons as mentioned in Ancient Indian Literature

SEASON	**MONTHS**
Basant (Spring)	*Chaitra-Baisakh* (March-April)
Grishma (Summer*)*	*Jyestha-Asadh* (May-June)
Prourit/Varsha (Rainy)	*Shravan-Bhadrapad* (July-August)
Sharad (Autumn)	*Ashvin-Kartik* (September-October)
Hemant (Winter)	*Mangsir-Paus* (November-December)
Shishir (severe Winter)	*Magh-Phagun* (January-February)

In spite of the fact that the ancient period, the knowledge about various parts of the world was limited due to the poor means of communication and transportation, the descriptions exist in Puranas of the division of the world into several regions, on the basis of available information. Although incorrect, the term *Dwipa* has been used to designate various realms (continents) of the earth. Accordingly, the known world during the Puranic period was divided into seven *Dwipas* or 'regions' (Figure-5). These divisions exclude the American Continents, Greenland, England and Antarctica, since they were discovered only during Age of Discovery in the late medieval period. The regions, as depicted in Figure- 5, seem to have derived their names from the existing popular vegetation here.

Figure-5: The Puranic Dwipas

These seven regions were known as Jambu, Krauncha, Kusha, Plaksha, Pushkara, Shaka and Shalmali (Fig.8.5). Jambu dwipa lies in the center of all these continents. In today's context, Jambu covers present Central Asia from North to South, including India, or the region north of Salt Sea. Jambu, in fact, is a bush found in Himalayan region. Kusha extends over present Middle East and most of Africa. The name is taken from a sacred grass, *Kusa*, used in brahmanical ceremonies. The Eastern Asia and adjoining lands form Pushkara. The Mediterranean region forms Plaksha. Shalmali represents the region of Eastern Africa and Madagascar Island. This region is rich in *Salmala*, the silk-cotton tree, found on the margins of Equatorial regions of monsoon lands with moderate rainfall. Most of current Europe was Kraunca. Lastly, Shaka forms South-East Asia and adjoining Island groups. Hot and moist climate and thick evergreen forests characterize the region.

The geographical knowledge of ancient period about Indian Sub-Continent, on the other hand, is related to its identification, people & culture and relief & drainage. In Vedic and Puranic literature, the entire country from Himalayas to Kanyakumari has been referred to as *Bharatvarsha*. This name has both geographical and historical significance.

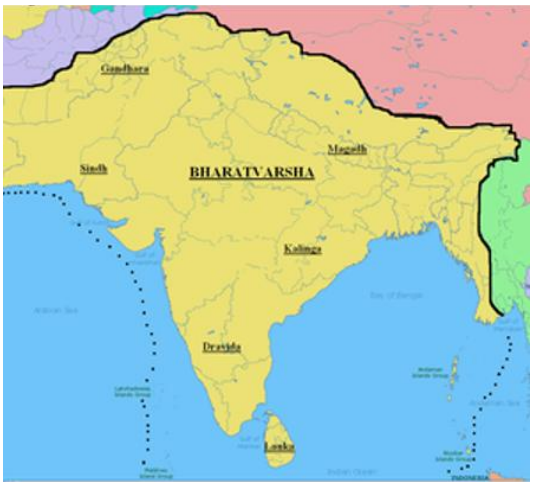

Figure-6: Baratvarsha of Vedic Period

Bharata's paramount position as founder of modern India is imbibed in the consciousness of Indians, but mainly through sources of Hindu mythology and Hindu religious works. According to the Mahabharata, Bharata's empire covered all of the Indian subcontinent, Afghanistan and Persia. The Republic of India is also known as Bharat after Bharata.[12] This *Bharatvarsha,* in ancient times was divided into *Nav-Khandas* (nine divisions)- eight shown as part of Greater India and the 9th surrounded by the sea (i.e. present day Sri-Lanka). Certain parts of the country are very distinctively mentioned in the ancient Indian literature. They are, for instance, *Sapta-Sindhu* (Punjab Plains), *Aryavarta* (the Aryan domain) and the region of Indus valley or the Upper Gangetic Plains. The Vedas, Epics and Puranas make mention of a series of mountains in *Bharatvarsha*. They are, for example, Himalayas *(Himavat*), existing like a bow in its northern part and divided into *Antagiri* (Inner Himalayas) and *Bahyagiri* (Outer Himalayas); *Kailash Parbat*, the abode of *Apsaras* (nymphs) and *Devas* (Deities) and rich in diamonds, minerals and other precious stones; *Vindhayans*, the extensive mountains with hundreds of peaks, variegated trees and creepers; *Mahendra Mali*, the Eastern Ghats; *Sahyadri*, the Western Ghats; *Rika*, the mountain range from Ken to Ton rivers north of Vindhayans; and *Suktiman*, the mountains of Khandera, Ajanta and Golkunda. The descriptions are also available for a number of Himalayan and other Inland rivers. Rigveda has mentioned various rivers originating from Himalayas, viz. Ganga, Yamuna, Brahamputra, Saraswati, *Satudri* (Sutlej), *Asikni* (Chenab), *Vitasta* (Jhelum), *Arjikeya* (upper part of Indus), *Susoma* (Savan), *Sindhu* (Indus), *Kubha* (Kabul), Gomati (Gomala), *Krumu* (Kurrum), etc. Among the inland river the important ones that get a mention are Narmada, Tapti (Tapi), Godavari, Krishna, Cauvery and Tungbhadra. However, the most elaborate descriptions exist about Ganga and Brahamputra. The religious flavour is very strong in these descriptions, as the rivers have been considered sacred, to be worshipped as Goddesses in the Hindu mythology.

Indian Geographical Thought during the Middle Ages

The medieval period in India saw a blending of indigenous geographical knowledge with external influences. The most significant feature of this period was that the Indians came into contact with the Arabs. The influence became more prominent when the Muslims established their empire in India. The arrival of Arab scholars and their writings had significant impact on geographical thought in India. Muslim scholars brought with them Islamic geographical concepts and ideas, enriching the existing knowledge base in India. Key contributions came from scholars like Al-Biruni, Ibn Battuta and Abul Fazl. Their writings offered valuable

insights into the geography of India and beyond. One of the most important writings of this time is Al-Beruni's *Tarikh – i – Hind* where he describes the geography of India. *Tarikh Al-Hind*, also known as *Kitab ul-Hind,* is a comprehensive account of Indian society. It provides valuable insights into India during Mahmud of Ghazni's era[13], based on Al-Biruni's observations and studies between 1017 and 1030. The book offers a detailed survey of Indian life, encompassing religion, philosophy, astronomy, alchemy, social customs, and more. It serves as a valuable primary source for understanding the socio-religious conditions of India during the 11th century. Al-Biruni's approach is described as having a modern scientific attitude and sympathetic insight, devoid of religious prejudice. Al-Biruni extensively quotes from the texts like *Gita* & *Puranas* and *Samkhya* Philosophy demonstrating his engagement with Indian intellectual traditions.

Writings like Ibn Battuta's *travelogue* and Abul Fazl's *Ain-i-Akbari* (a volume of the *Akbarnama*) documented their experiences and observations during their travels, contributing to geographical knowledge. The *Ain-i-Akbari*, written by Abu'l Fazl, is a 16th-century document detailing the administration and culture of the Mughal Empire under Emperor Akbar. It provides valuable insights into the empire's organization, revenue system, military, and social customs. The *Ain-i-Akbari* is a crucial historical source for understanding the Mughal Empire's administrative framework and Akbar's policies. It meticulously describes the Mughal administrative structure, including the roles of officials, the revenue system and the military organization. The document provides rich information about the traditions, culture, and social customs of the people living in India during Akbar's reign. It includes detailed statistical information on various aspects like crops, yields, prices, wages, and revenues, offering a quantitative perspective on the empire. The *Ain-i-Akbari* is a vital source for historians studying the Mughal Empire, providing a detailed account of Akbar's reign and administration.

Ibn Battuta's travelogue, titled *Rihla,* which translates to "The Journey",is a detailed account of his extensive journeys, observations, experiences, and encounters during his travels across the Islamic world and beyond, spanning roughly 30 years and 75,000 miles. His writings offer valuable insights into the social, economic, and political landscape of the 14th century, particularly within the Muslim world. Ibn Battuta spent time in India during the reign of Muhammad bin Tughluq and his accounts offer a unique perspective on the political and social life of the Delhi Sultanate. Ibn Battuta's travels covered a vast area, including North Africa, West Africa, the Middle East, Central Asia, South Asia, Southeast Asia, and China. The *Rihla* is considered a valuable historical document, providing insights into the geography, cultures, social structures, and trade routes of the time. The *Rihla* offers a glimpse into the daily life, customs, and political dynamics of the 14th century, providing a rich source of information for researchers.

The arrival of Islam and the establishment of Muslim empires in India significantly impacted geographical thought. The arrival of Islamic empires led to increased interaction between Indian and Islamic scholars, fostering an exchange of geographical knowledge. The Indian geographical thought expanded due to increased contact through trade and Muslim rule. While the formal study of geography as an academic discipline emerged later, Indian scholars contributed to geographical knowledge through observations, travelogues and accounts of their interactions with different regions. While traditional cosmological views persisted, new perspectives emerged from interactions with Islamic scholars and travellers. Influenced by Arab scholars and travellers, the medieval period saw a shift towards more empirical observations and descriptions. Arab scholars focused on direct observations of soil, production and economic aspects of the region. Arab geographical knowledge, including Indian contributions, later influenced European scholarship, especially after the 15th century. Along with the expansion of Islamic empires, the influence of religious texts continued. The Puranas kept on be a major source of geographical knowledge, often describing the world in mythological and symbolic terms. Ancient Indian concepts of cosmology and the interconnectedness of humans and nature continued to shape geographical thinking. While cosmological views were prominent, there was also a growing body of practical geographical knowledge related to trade routes, navigation, and resource management. Besides, although not as advanced as in some other parts of the world, Indian cartography saw some development, particularly in the context of regional maps and architectural plans. The Bhakti movement[14], which gained prominence during this period, also contributed to geographical understanding by emphasizing the interconnectedness of all things and the importance of local landscapes.

During the medieval period, the geographical boundaries of the known world extended. Medieval India witnessed a wider understanding of geographical boundaries. This era saw an expansion of the known world for Indians, with trade and migration stretching to regions like Cambodia and China, and even to Greece. The arrival and establishment of Muslim rule in India led to a flourishing of cultural and intellectual exchange, particularly in the realm of geography. Indian scholars and travellers expanded their understanding of the world through interactions with different regions and cultures.

Consequently, the Indian scholars demonstrated a keen interest in regional descriptions, as evidenced by their knowledge of regions like China, Southeast Asia, Central Asia, and Trans-Oxus Asia. The geographical knowledge and perspectives developed during this period laid a foundation for further exploration and understanding of the world in subsequent eras. The Impact of medieval period developments can be seen

especially on Cartography Regional, Physical and Mathematical Geography. Indian geographical knowledge, including the concept of a spherical earth and the division of the world into nine parts, was transmitted to the Arabs and influenced their understanding of geography. Muslim scholars also made significant advancements in mathematical geography, including the study of latitude and longitude and the development of astronomical instruments. Unlike the more descriptive approach of some earlier Indian geographical works, Muslim scholars also emphasized the scientific aspects of geography, including the study of natural phenomena and the relationship between geography and other fields like astronomy.

Muslim influence significantly shaped geographical thought in India, particularly during the medieval period. Muslim scholars and travellers introduced new concepts, methodologies, and a broader perspective to the existing Indian geographical knowledge. This included advancements in cartography, regional geography, and the study of human-environment interactions, enriching the field with both scientific and cultural insights. Muslim scholars excelled in cartography, refining map-making techniques and developing tools like the astrolabe and quadrant. They also adopted and adapted Indian cartographic systems, including the division of the world into nine parts. Muslim geographers made notable contributions to regional and physical geography, studying the characteristics of different regions, including their climate, vegetation, and human populations.

In conclusion, Indian geographical thought during the medieval period was a dynamic and evolving field, influenced by religious beliefs, interactions with other cultures, and the practical needs of daily life. While traditional cosmological views persisted, new perspectives and knowledge systems emerged, contributing to a richer and more diverse understanding of the world.

Colonial Period Developments (18th-early 20th Century)

In fact, the formal foundations of academic geography in India were laid in the colonial period, when the British geographical thought and methods influenced the development of the discipline in India. Geography solidified as a powerful academic field in India primarily during this period. The pre-colonial period lacked a distinct academic form of the discipline as the geographical knowledge was primarily found embedded in religious and philosophical texts. The colonial period, on the other hand, established surveys, gazetteers, and other systematic studies, transforming geographical understanding into a conventional field of learning. Ancient Indians possessed practical knowledge of their environment, crucial for agriculture, trade, and navigation, though it wasn't systematized. Further, due to limited means of communication and travel, geographical knowledge was largely confined to the subcontinent and surrounding regions.

The British were particularly interested in mapping the subcontinent for military and administrative purposes, and in identifying and exploiting natural resources. During British rule in India, geographical thought was shaped by the British transmission of "new geography" through universities, leading to the establishment of geographical associations and the formalization of geographical studies in the Indian education system in the early 20th century. The formalization of geography as a discipline was driven by British administrative and resource-based interests.

Notable Indian geographers emerging during this period, included, for instance, N. Subramanyam from Chennai, R.N. Dubey from Allahabad, K.S. Ahmad from Lahore, Tahir Rizvi from Aligarh and S.C. Chatterjee from Patna. While the discipline of geography was still in its early stages, these scholars contributed to the development of geographical thought in India. The formalization of geography as an academic discipline in India began in the 1920s, but it was still in its early stages. Geography began emerging as an independent discipline in India when a number of colleges with under-graduate classes began and geographical societies and associations were established during colonial period. Some of the prominent societies include, for instance, the Curzon Geographical Society, Aligarh (1925); Madras Geographical Society, Madras (1926); Patna College Geographical Society, Patna (1929); Calcutta Geographical Society, Calcutta (1933) and Bombay Geographical Association, Bombay (1935).

Practitioners of Geography have been mostly concerned to use it as a tool to measure, collect, organize and document the geographical facts of India since British time. Survey of India was established in 1767 with an objective of preparing maps and providing greater details of resource availability, potentiality and connectivity with the international market. Seeking precision in locating and measuring the land, the surveyors imported instruments like plane table (1793), prismatic compass (1815) and theodolite (1819) from their homeland but no Indians were found either trained or involved in this large venture. In the same vein many other departments with an objective of appraising the country's resource potential were set up but geography's education and training never got required attention in spite of the fact that knowledge and understanding of local geography is essential ingredient for any such endeavour.

During the colonial period in India, geographical thought and practices were significantly shaped by British colonial influence, leading to the development of scientific surveys, modern cartographic techniques, and the emergence of Indian geographical societies and journals. The British established formal institutions for geographical study, including various Surveying organizations. To promote their knowledge of the territories

and the resources the Britishers set up a number of Surveys like the Survey of India followed by Geological, Zoological, Botanical, Linguistic, Archaeological and Anthropological Surveys, periodically producing gazetteers, reports, and census and climatic data. Besides the establishment of various Surveys which provided valuable geographical data, the publications like the "Indian Geographical Journal" and the "Geographical Review of India" fostered the dissemination of geographical knowledge. British colonial rule in India spurred geographical studies to map, survey, and understand the land for administrative control, resource extraction, and strategic purposes. However, at the end of the British period, the discipline of geography was still in its pre-embryonic stage as Indian scholars were not interested in this field; the possible reason may be lack of professionalism of the discipline vis-a-vis the continued relevance of geology in the earth studies (Adhikari, 2010).

The major developments during Colonial period have been two-fold, viz. Transmission to "New Geography" and Formalization of Geographical Studies. The British introduced and promoted "new geography" to their colonies, including India, through universities. This led to the establishment of the first geographical association in India at Lahore in 1920, followed by others in Aligarh (1924) and Patna (1927). As the expansion of colonial empires spurred the need to map and understand new territories, leading to the establishment of numerous colleges offering geography courses and the creation of geographical societies focused on research and exploration in those colonial regions. The arrival of British colonial powers led to the systematic survey and mapping of India using modern techniques, introducing a scientific approach to geography. The establishment of colleges and geographical societies in India facilitated the formal study and development of Academic Geography. Colonial interest led to a focus on mapping natural resources, land use patterns, and demographic studies for administrative purpose. During the colonial period (18th to early 20th century), geographical thought shifted from descriptive mapping to a more analytical and systematic approach, influenced by colonialism's need to understand and control territories, with the rise of regional geography and the establishment of geographical associations playing a crucial role. Here's a more detailed breakdown of the developments in geographical thought during this period:

i. Rise of Regional Geography: Colonial powers needed to understand the diverse regions they controlled, leading to the development of regional geography, which focused on the collection of descriptive information about places and the proper methods for dividing the earth into regions. Colonial geographers often focused on regional geography, which was seen as essential for understanding the physical conditions, resources, and populations under colonial control. They divided India into various zones based on geographical features. Colonial geography also had a significant impact on land management, resource extraction, and infrastructure development in India.
ii. Establishment of Geographical Associations and Societies: To promote geographical knowledge and research, geographical associations and societies were founded during this period, playing a vital role in disseminating geographical knowledge and promoting geographical research.
iii. Influence of Colonialism: Colonialism's need to understand and control territories led to a shift in geographical thought, moving beyond purely descriptive mapping to a more analytical and systematic approach.
iv. Focus on Human-Environment Interaction: Geographers began to explore the relationship between humans and their environment, with a focus on how people adapted to and interacted with their surroundings.
v. Development of Subdisciplines: The period saw the establishment of subdisciplines like historical geography and the conservation of natural resources and the environment.
vi. Quantitative Revolution: In the early 20th century, a paradigm shift known as the quantitative revolution sought to develop a more rigorous and systematic methodology for the discipline, as a response to the inadequacy of regional geography to explain general spatial dynamics.
vii. Scientific Surveys and Cartography: The British established various surveys (e.g., Survey of India, Geological Survey) to gather detailed information about the country's resources, topography, and people. These surveys introduced modern cartographic techniques, including the use of precise maps and scientific methods for data collection. Gazetteers, census reports, and statistical data became important sources of geographical knowledge.
viii. Emergence of Indian Geographical Societies and Journals: The colonial period saw the establishment of geographical associations and societies, such as the National Geographical Society of India, which played a crucial role in promoting geographical research and disseminating knowledge. Journals like the "Indian Geographical Journal" (Madras) and the "Geographical Review of India" (Calcutta) became platforms for sharing geographical findings and debates.

Post-Independence Era (Mid-20th Century onwards)

The colonial period marked a significant phase with the introduction of scientific surveys and modern cartographic techniques by British geographers. Post-independence Indian geography, on the other hand, has evolved to address national development needs and global environmental challenges. Indian geographers started applying geographical knowledge to address national development challenges like agricultural planning, urbanization, and environmental management. There emerged various Specialized Fields of geographical study. Geography as an independent discipline at the higher education level had started in the early 20th century. Since then, there has been constant change in its content, philosophy and methodology as a consequence of changing paradigms which has been stressed and emphasized at different fora in different forms. The first conspicuous effort in this direction was in Aligarh Muslim University (Jan.1956) where an international seminar was organized by the department of geography. The seminar explicitly accepted a shift from traditional to modern approach. *'Mere enumeration of facts in their sequential order might have been the scope of geography in the past, but as geography is understood by us, it comprehends all the sciences, opens all vistas and embraces all knowledge and is essentially based on the synthesis of the observed and analysed facts of the landscape- humanized or natural- in relation to man. These facts are dissected, analysed and correlated to obtain an appraisal of the landscape in its entirety which makes it distinctive personality different from others (*Alam, S. (2009)*.'* The progress of geography as an independent discipline in independent India can be best understood through its development in a series of sequential phases (Rana, 2013). These phases are: (1) The Formative Stage: Pre-1950s; (2)The Informative Stage: The 1950s; (3)The Confirmative Stage: The 1960s; and (4)The Reformative Stage: Since 1971.

The Formative Stage represents the first generation of the Indian geographers who were trained in other related disciplines. They chose geography only as their professional career. Among these who left their marks on the history of geography in India are H.L. Chhibber, S.P. Chatterjee, R.N. Dubey, M.B. Pithawalla, G. Kuriyan, K.S. Ahmad, S.M. Ali, N.K. Bose and C.D. Deshpande. Although their wide-ranging research interests covered various branches of geography, but their methodology was similar i.e. the ideographic way of description. The geographical associations and societies founded during the colonial period played a vital role in further disseminating geographical knowledge and promoting geographical research. A number journals like *Indian Geographical Journal* (Madras), *Geographical Review India* (Calcutta), *Geographer* (Aligarh) and *Bulletins of National Geographical Society of India* began their publications.

The Informative Stage, the second phase immediately after Independence, gave geography a national base. The torch bearers in this stage were O.H.K Spate and D.L Stamp. The monumental work of Spate, *India and Pakistan* (1952) laid strong foundations for the discipline. Apart from this the work of R. L. Singh, *Banaras: An Urban Geography* (1955) brought urban geography in the forefront. In this phase the year 1956 holds a significant place as the National Atlas and Thematic Organisation (NATMO) was established under the leadership of S.P. Chatterjee. It gave impetus to the growth and development of geographical teaching and research at universities. On the eve of India's independence only four universities- Aligarh, Calcutta, Allahabad and Banaras- offered postgraduate studies in geography. By 1950, four other universities – Agra, Punjab (Chandigarh), Madras and Patna started postgraduate programmes in geography. The result was that in the next 30 years the discipline saw tremendous growth in India.

The most important event of the Confirmative Stage was the 21st International Geographical Congress held in New Delhi in 1968 under the presidentship of S.P. Chatterjee. Apart from these, now nearly 36 universities started offering geography as a post-graduate subject. The number of societies and associations also increased and this time they came up with academic journals.

The Transactions of the Indian Geographers (Patna), Deccan Geographer (Secunderabad), Geographical Outlook (Ranchi), Indian Journal of Geography (Jodhpur), Geographical Knowledge (Kanpur), Geographical Viewpoint (Agra), and the two Hindi journals known as Uttar Bharat Bhoogol Patrika (Gorakhpur) and Bhoodarshan (Udaipur) are to name a few. Several branches of geography came up; important being Economic geography, Human geography, Physical geography, Regionalisation and regional planning, Cartography, Geographical thought and Historical geography.

The Reformative Stage of geography's development in India, beginning around 1971, is characterized by the adoption of new methodologies and a shift towards addressing regional development and planning. This stage saw further increase in the number of geography departments, with a focus on applying Western models to Indian geographical studies. There was also a growing awareness of global trends in geographical thought and a move towards more critical self-reflection on Indian geography's identity. The number of geography departments in Indian universities grew significantly during this period, reaching 48 by 1971.The Reformative Stage saw the introduction of new research methods and approaches, influenced by global trends in geography. The emphasis on regional development and planning, saw a reflection in a growing need to address regional disparities and challenges within India and Indian geographers began applying theoretical frameworks and models developed in the West to analyse Indian geographical contexts. There was a greater awareness of the evolving landscape of geographical thought internationally, leading to more critical engagement with global

debates and research. This stage also involved a process of self-contemplation, with geographers questioning the existing paradigms and seeking to establish a stronger, more independent identity. In 1972, the Indian Council of Social Science Research (ICSSR), New Delhi came up with a project report with a title "*Survey of research in Geography*"; and identified eight branches of geography have reached high level in their development. These are – economic geography; geography and planning; human geography; historical geography; political geography; regional geography, methodological review and research methods.

The above trends clearly show the shifts and paradigmatic changes that Indian geography went through in post-Independence period. These include, for instance, (a) Acceptance of quantification (b) Model building; (c) Development of methods related to observation and data handling; (d) Importance to social processes; (e) Integration of data with socio-cultural phenomenon and (f) Implication of research to overall development. This shows that the Indian geography since independence has moved much ahead as rather being dependent on Anglo-American geography it is moving in different directions without the baggage of dualisms and dichotomies. The credit for this goes to the leaders of first generation which include – V.L. Prakasa Rao ,R. L. Singh ,P. Dayal ,M. Shafi , G. S. Gosal , S. M. Alam ,Moonis Raza and R. P. Mishra. By 2000, there were as many as 50 societies and associations and they are playing pivotal role in disseminating and promoting geographical studies and research throughout the country. Various new branches emerged which are shown in Table 5., along with their contributors.

Table-5: Contemporary Fields of Geographic Study in India and the Contributors

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1. Regional Development & Planning……. C.D. Deshpande, K.V. Sundaram, C.R. Pathak & R.P. Mishra
2. Urban Geography…….R.L. Singh, R.B. Singh & R. Ramachandran
3. Climatology……..P. Dayal
4. Regional Geography……O.H.K. Spate & L.S. Bhatt
5. Administrative Geography……..Gopal Krishnan & Suryakant
6. Agricultural geography……M.Shafi. Jasbir Singh & Majid Hussain
7. Geography of Heath……Raiz Akhtar, Jayati Hazra & Jayashree De
8. Geomorphology……..H.L. Chibber, S.P. Chatterjee, R.P. Singh,
1. Enayat Ahmad, Savindra Singh, S.R. Basu, S.C. Mukhopadhyay,V.S. Kale, A. Kar& R.C. Tewari
9. Gender Geography…….Saraswati Raju
10. Political Geography……. R.D. Dikshit, C.P. Singh, R. L. Dwivedi,
1. Sawaranjeet Mehta, S. Adhikari. R.N.P. Sinha &
2. Govind Saran Singh
11. Population Geography……..G.S .Gosal, R.C. Chandana, Gopal Kishan,
1. Sawaranjeet Mehta & M.S. Gill
12. Social Geography…….A. Ahmad & M. Ishtiaque
13. Cultural Geography……..A. B. Mukherjee & Kashi Nath Singh
14. Economic Geography……S.P. Chatterjee
15. Resource Geography……R.P. Mishra & B. Thakur
16. Transport Geography…….H. Ramachandran
17. Cartography &

a. Thematic Mapping……..S. M. alam, B.K. Roy, A. Ramesh, L.R. Singh & Ashish Sarkar

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Contemporary Indian geography

Indian geographical thought has deep roots in ancient Indian texts like the Vedas and Upanishads, which emphasized the relationship between nature and humanity, laying the foundation for indigenous knowledge systems. The arrival of British and other European powers brought new perspectives and methodologies, influencing the development of academic geography in India. Contemporary geographical thought is a result of this dynamic interaction between classical Indian thought, Western influences, and the evolving needs of a developing nation. Contemporary geographical thought in India reflects a diverse range of approaches, building upon both classical Indian perspectives and modern Western influences. It encompasses various subfields and Research areas as listed in Table-4. A key aspect is the integration of quantitative and qualitative methods, alongside a growing emphasis on applied geography and sustainable development. Geography in India significantly expanded after independence, particularly in university

education, due to the efforts of prominent geographers and the establishment of institutions like National Atlas & Thematic Mapping Organization (NATMO).

Table-4: Contemporary Key Subfields and Research Areas in India

i. Human Geography: Studies human-environment interactions, population distribution, settlement patterns, and cultural landscapes.
ii. Economic Geography: Focuses on resource utilization, regional development, and the spatial patterns of economic activities.
iii. Environmental Geography: Investigates the impact of human activities on the environment and explores sustainable practices.
iv. Regional Geography: Analyses the unique characteristics and spatial patterns of different regions in India.
v. Regional Planning: Deals with the planning and development of specific regions, considering social, economic, and environmental factors.
vi. Applied Geography: Utilizes geographical knowledge and techniques to address practical problems in various sectors.
vii. Historical Geography: Examines the spatial patterns of past human activities and their evolution over time.
viii. Geographical Thought: Explores the evolution of geographical ideas and methodologies.
ix. Methodological Approaches (Quantitative & Qualitative):Quantitative Methods Involve the use of statistical techniques, spatial analysis, and modelling to study spatial patterns and relationships. Geospatial technologies like GIS (Geographic Information System) and remote sensing are increasingly used in various geographical studies. Qualitative Methods, on the other hand, employ interviews, case studies, and ethnographic research to understand human experiences and perspectives. However, there's a growing trend towards integrating quantitative and qualitative methods to provide a more comprehensive understanding of geographical phenomena.
x. Emphasis on Sustainability: Growing awareness of environmental issues has led to a greater focus on sustainable development and resource management.
xi. Focus on Social Justice: Geographers are addressing issues of social inequality, poverty, and marginalization in different regions.
xii. Interdisciplinary Approach: Geography is increasingly engaging with other disciplines like sociology, economics, and environmental science to address complex problems.
xiii. Cultural Turn: There's a growing interest in understanding the cultural dimensions of space and place.

In essence, contemporary geographical thought in India is characterized by its diversity, its engagement with both classical Indian and modern Western ideas, and its relevance to the country's social, economic, and environmental challenges. Recent research strives to integrate traditional knowledge systems with modern geographical methods to understand local environmental dynamics. There is an increased focus on studying the impacts of climate change and environmental degradation on Indian landscapes and communities. Environmental issues have become increasingly significant in geographic studies, driven by concerns over climate change, pollution, and biodiversity loss. Research on the impacts of climate change on various regions in India helps in understanding vulnerabilities and formulating adaptive strategies. Studies often utilize GIS and remote sensing for climate modelling and impact assessment. Geographic studies also contribute to conservation efforts by identifying critical habitats, assessing environmental impacts, and suggesting conservation strategies. Initiatives like Project Tiger and various biodiversity conservation projects rely heavily on geographic research. The Table-6 records Major Themes in Environmental Geography in Contemporary times.

Table-6: Major Themes in Environmental Geography in Contemporary times.

Theme	Focus Areas
Climate Change	Impact assessment, adaptation strategies
Biodiversity	Habitat conservation, species distribution
Pollution	Air and water quality monitoring, impact studies
Natural Resources	Sustainable management, resource mapping

Regional planning and development have emerged as central themes in Indian geography, addressing the diverse socio-economic conditions across different parts of the country. The special focus of contemporary research in this direction is on Regional Disparities and Sustainable Development Studies focus on addressing regional imbalances by analysing factors like resource distribution, economic activities, and infrastructure

development. Policies aimed at reducing these disparities have been a major area of research. Emphasis on sustainable development has led to studies on environmental conservation, sustainable resource management, and eco-friendly practices. Geographic research contributes to formulating policies that balance economic growth with environmental sustainability. Socio-economic geography is getting boosted by examining the spatial aspects of social and economic processes, addressing issues like population dynamics, urbanization, and economic activities. Research in Population Studies includes demographic analysis, migration patterns, and population distribution, providing insights for policy formulation. The rapid urbanization in India has led to studies on urban growth patterns, infrastructure development, and socio-economic impacts. Geographic research helps in understanding and managing urban sprawl and associated challenges. Table-7 lists the key Research focus in this field. Various cartographic organisations assisting in this direction are listed in Table-8.

Table-7 key Research focus in Socio-Economic field in India

Area	Key Research Focus
Population Dynamics	Demographic analysis, migration studies
Urbanization	Urban growth, infrastructure, socio-economic impacts
Economic Geography	Industrial distribution, resource allocation
Health Geography	Spatial analysis of health services, disease distribution

Table-8: Key Organizations and Their Contributions to Indian Cartography

Organization	Contributions
ISRO	Satellite imagery, Bhuvan platform, disaster management tools
Survey of India	Topographic mapping, geospatial data services
NRSC (National Remote Sensing Centre)	Remote sensing applications, data dissemination
NATMO (National Atlas and Thematic Mapping Organisation)	Thematic maps, national atlases

The Methodological developments and application of various qualitative and quantitative techniques to geographic research has also been creditable (Table-9). Quantitative methods in geographic research involve statistical techniques and mathematical models to analyse spatial data. Techniques like spatial statistics and simulations help identify patterns, relationships, and trends in geographic phenomena. Qualitative methods provide in-depth insights into human-environment interactions through field surveys, ethnographic studies, and participatory approaches. These methods are essential for understanding local contexts and cultural practices.

Table-9: Methodological Innovations in Indian Geography

Methodology	Applications
Spatial Statistics	Pattern analysis, trend prediction
Modelling and Simulation	Urban planning, environmental impact assessment
Field Surveys	Ethnographic studies, local context analysis
Participatory Approaches	Community mapping, participatory GIS
Big Data and Geo-Informatics	Large dataset analysis, real-time data visualization
AI and Machine Learning	Image classification, predictive modeling

The adoption of quantitative methods has enhanced the analytical rigor in geographic studies. Statistical techniques and mathematical models are widely used for spatial analysis. Techniques like spatial autocorrelation,

regression analysis, and cluster analysis are used to study patterns and relationships in spatial data. These methods help in identifying trends and making predictions. Mathematical models and simulations are employed to study complex geographic phenomena. These tools are used in areas like urban modelling, environmental impact assessment, and resource management.

Qualitative research methods, as Field surveys and various Participatory Approaches , on the other hand, complement quantitative techniques by providing in-depth insights into human-environment interactions. Field surveys and ethnographic studies are essential for understanding local contexts, cultural practices, and community perspectives. These methods are particularly useful in rural and indigenous studies. Participatory GIS and community mapping involve local communities in the data collection and analysis process, ensuring that research addresses their needs and priorities.

The integration of technology in geographic research has opened new avenues for data collection, analysis, and visualization. The availability of big data from various sources like social media, mobile devices, and sensors has enhanced geographic research. Geo-informatics techniques are used to analyse and visualize large datasets, providing new insights into spatial phenomena. Artificial Intelligence and Machine Learning algorithms are increasingly used in geographic research for tasks like image classification, pattern recognition, and predictive modelling. These technologies improve the efficiency and accuracy of spatial analysis. Technology has revolutionized modern cartography in India by enhancing accuracy and efficiency through GIS, remote sensing, and digital mapping. Platforms like ISRO's Bhuvan[15] provide valuable geospatial data for various applications.

Thus, Contemporary trends in Indian geography reflect a dynamic field that continually adapts to new challenges and opportunities. The integration of advanced technologies like GIS, remote sensing, and AI has transformed cartographic practices and spatial analysis. Thematic contributions in areas like regional development, environmental geography, and socio-economic studies address critical issues facing the country. Methodological advancements, including the use of quantitative, qualitative, and participatory approaches, have enhanced the depth and breadth of geographic research. As India continues to develop and face new environmental and socio-economic challenges, the role of geography in informing policy and practice will remain crucial.

II. Conclusion

the genesis of geography in India lie in Antiquity, although the professionalization came much later. The medieval period in India saw a blending of indigenous knowledge with external influences. The arrival of British and other European powers brought new perspectives and methodologies, influencing the development of academic geography in the country. The evolution of geographical thought in India progressed from a period with rich knowledge embedded in ancient texts to a contemporary phase heavily influenced by the colonial period, marked by the introduction of modern scientific methods and a focus on post-Independence national development needs. A thorough review of the inherited geographical knowledge from the past and contemporary practices as showcased helped to understand this evolution. In real sense, Geography as a professional discipline in India is only about hundred years old. In the time span of less than 100 years geography as a discipline has witnessed massive change in its content, methodology and philosophy. There is a shift from qualitative to quantitative approach and from conventional cartography to computer aided cartography, remote sensing and GIS. Clearly, Indian geography is today at an important turning point. The foundation laid down after Independence by geographers is being challenged by newly developed or introduced methodologies or research techniques.

Notes

1. In Samkhya philosophy, Prakriti is the eternal, fundamental substance of the material world—the active, inert principle that undergoes transformation and creates the universe, including the body and mind. Purusha is the pure, unchanging consciousness, the immaterial, passive "knower" or spirit that witnesses all activity within Prakriti but does not act itself. The interaction between these two dualistic principles forms the basis of reality and creation.
2. The ancient Indian philosophy belongs to six *āstika* and three *nastika* schools of thought[2], or *darshanas* (literally, "views"). The former accept the Vedas as supreme revealed scriptures, whereas the other three do not accept the Vedas as supreme. The āstika schools are: (1) Samkhya a dualist exposition of mind and matter; (2) Yoga, a school emphasizing meditation closely based on Samkhya; (3) Nyaya or logics; (4) Vaisheshika, an empiricist school of atomism; (5) Mimamsa, an anti-ascetic and anti-mysticist school of orthopraxy; and (6) Vedanta, opposing Vedic ritualism in favour of mysticism. Vedanta came to be the dominant current of Hinduism in the post-medieval period. The nāstika schools are Buddhism, Jainism and Cārvāka, a skeptical materialist school.
3. The word Khagola is derived from the famous astronomical observatory at the University of Nalanda, which was the center of education for scholars from the world all over.

4. Four types of theories have been advanced about the origin of the Universe. These are the theories of: Artistic Origin; Mechanical Origin; Instrumental Origin; and Philosophical Origin. As per the Theory of Artistic Origin, the universe has been compared to a house and Rigveda mentions a number of Gods who contributed their skills to the construction and completion of the Universe by weaving various materials into a pattern, and shaping the universe by blasting and smelting. The Theory of Mechanical Origin suggests the sacrifice (or disintegration) of a primeval body known as *Adi-Purush*. Various elements of the Universe were believed to be the results of dismemberment of Adi-Purush as a part of sacrifice ceremony. The scholars having faith in the Theory of Philosophical Origin believed that there was nothing earlier, i.e. no atmosphere, no sky, no days and nights, etc. The space was empty (a vacuum). Within this a unit was born on its own, perhaps due to inherent heat and it hardened with time. This led to the formation of the Universe later. The Theory of Instrumental Origin, on the other hand, talks about the occurrence of two parent bodies, from which the Universe was created. *Agni* (God of Fire), *Indra* (God of Rain), *Rudra* (God of Storm) and other gods are mentioned as having being instrumental in the creation of the *Dharti* (Earth) and *Swarga* (Heaven)- the twin parents of the whole Universe. The union of these two produced the Sun. The Sun is considered as the most important agent in the creation of the world. It is the soul of all that 'moved' or that 'not moved'. It has been later identified as Rajapati, Vishwakarma and sometimes with the 'Golden Egg' and 'Unborn Being'. This 'Unborn Being' is also named as *Atma* (Soul) who produced the Universe through intermediary body.
5. Practical mathematics refers to the application of mathematical concepts to real-world situations. It involves using math skills to solve problems encountered in everyday life, various professions, and academic disciplines. Examples include budgeting, comparing prices, calculating area, and understanding sports statistics.
6. Friedrich Ludwig Gottlob Frege (1848-1925) was a German philosopher, logician, and mathematician. He was a mathematics professor at the University of Jena, and is understood by many to be the father of analytic philosophy, concentrating on the philosophy of language, logic, and mathematics.
7. Emil Leon Post (1897-1954) was an American mathematician and logician. He is best known for his work in the field that eventually became known as computability theory.
8. Mount *Sumeru*, also known as Mount Meru, is a significant mythological mountain in Hindu, Jain, and Buddhist cosmology, representing the center of the universe and the axis mundi. It is not a specific, identifiable mountain on Earth but rather a symbolic representation of the cosmos and a focal point for spiritual and philosophical concepts.
9. The *Surya Siddhanta* is an influential ancient Indian astronomical treatise in Sanskrit, containing rules for calculating planetary motions, time, and celestial body diameters within a geocentric model.
10. Aryabhata accurately calculated the Earth's circumference as 24,835 miles, which was only 0.2% smaller than the actual value of 24,902 miles. Aryabhata's computation of Earth's circumference as 39,968.0582 kilometers, is quite close to the the actual value of 40,075.0167 kilometers.
11. A *T-in-O map*, also known as an *Orbis Terrarum* or O-T map, is a type of early world map that represents the known world as a circle (O) divided into three parts by a T-shape formed by bodies of water. The "T" typically represents the Mediterranean Sea, the Nile, and the Don River, separating the continents of Asia, Europe, and Africa.
12. The Aryans gave it. According to one school of thought, the name is derived after the name of *Bharat*, the ruling king. Bharata according to Hindu legend was the first king to conquer all worlds as known to the Vedic Aryans, uniting it into a single entity which was named after him as Bharatvarsha. Bharata is regarded as the first and only emperor to rule all of India. Shown in Figure 6 is the approximate extent of Bharatvarsha, the land ruled by Bharata. Archeological evidence of Bharata's kingdom and reign is scarce. Bharata is construed by many historians as having been an Indo-Aryan king, and as king he unified the entire Indian subcontinent with the Dravidian peoples and other indigenous peoples as his subjects.
13. Mahmud of Ghazni's era refers to the period of his rule as Sultan of the Ghaznavid Empire, from 998 to 1030 CE. His reign is marked by extensive military campaigns, particularly in India, and significant cultural development in his capital, Ghazni.
14. The Bhakti movement was a significant Hindu devotional movement that swept across India between the 7th and 17th centuries, emphasizing personal devotion to a deity as a path to salvation. It challenged traditional religious practices, particularly the caste system, and promoted equality and social reform. The movement originated in South India with the Alvars and Nayanars, and later spread to North India, influencing Hinduism and impacting various social and cultural aspects of Indian life.
15. ISRO's Bhuvan portal is a free, web-based Indian geospatial platform that provides access to satellite imagery, thematic maps, and geospatial data for visualization, analysis, and public consumption, primarily focused on India.

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