

# GEOCOGNITION

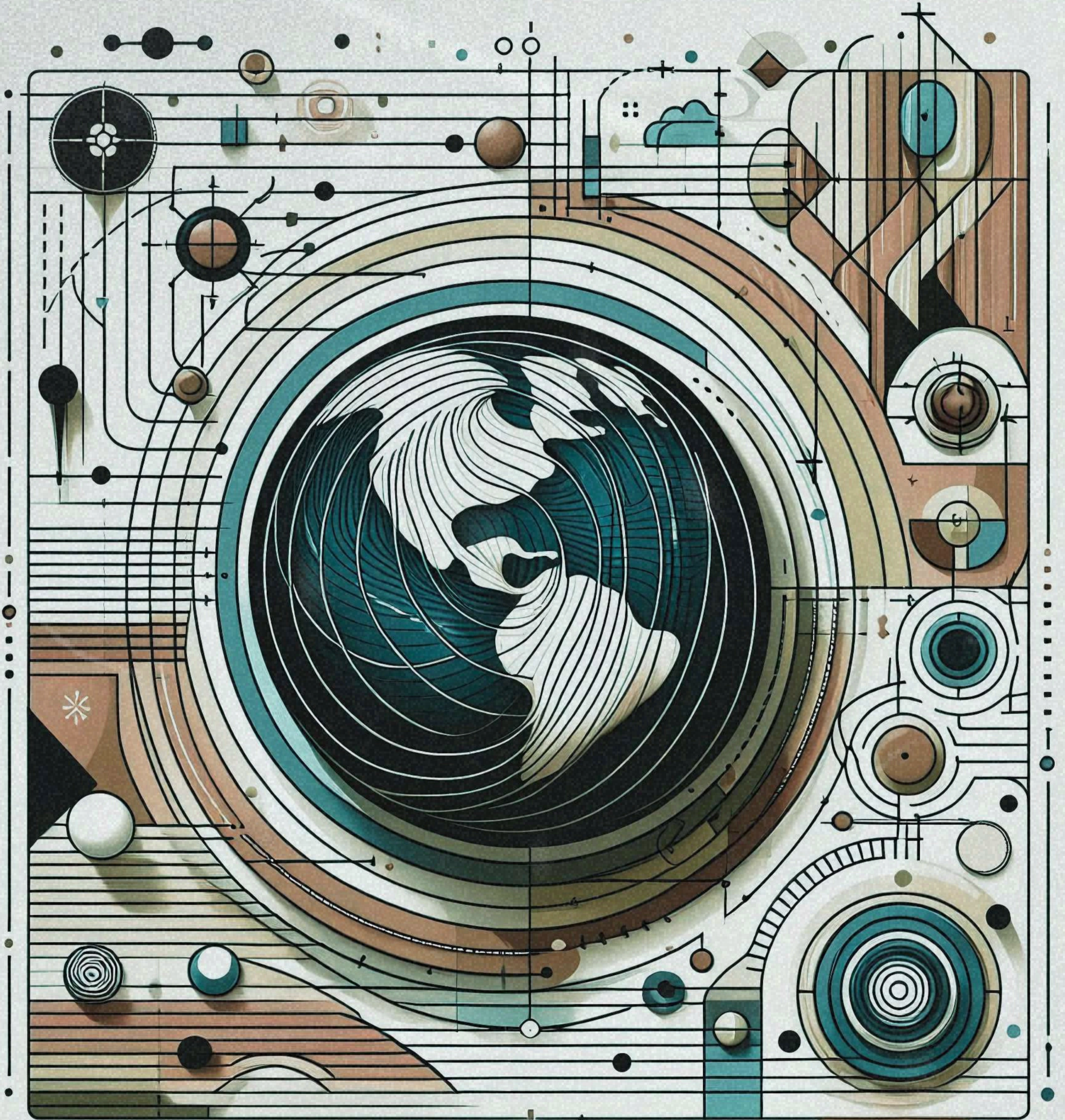
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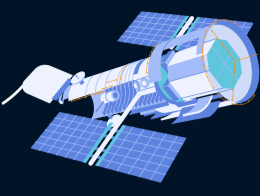
Special Issue :

# EVOLUTION OF MAPPING *technologies*

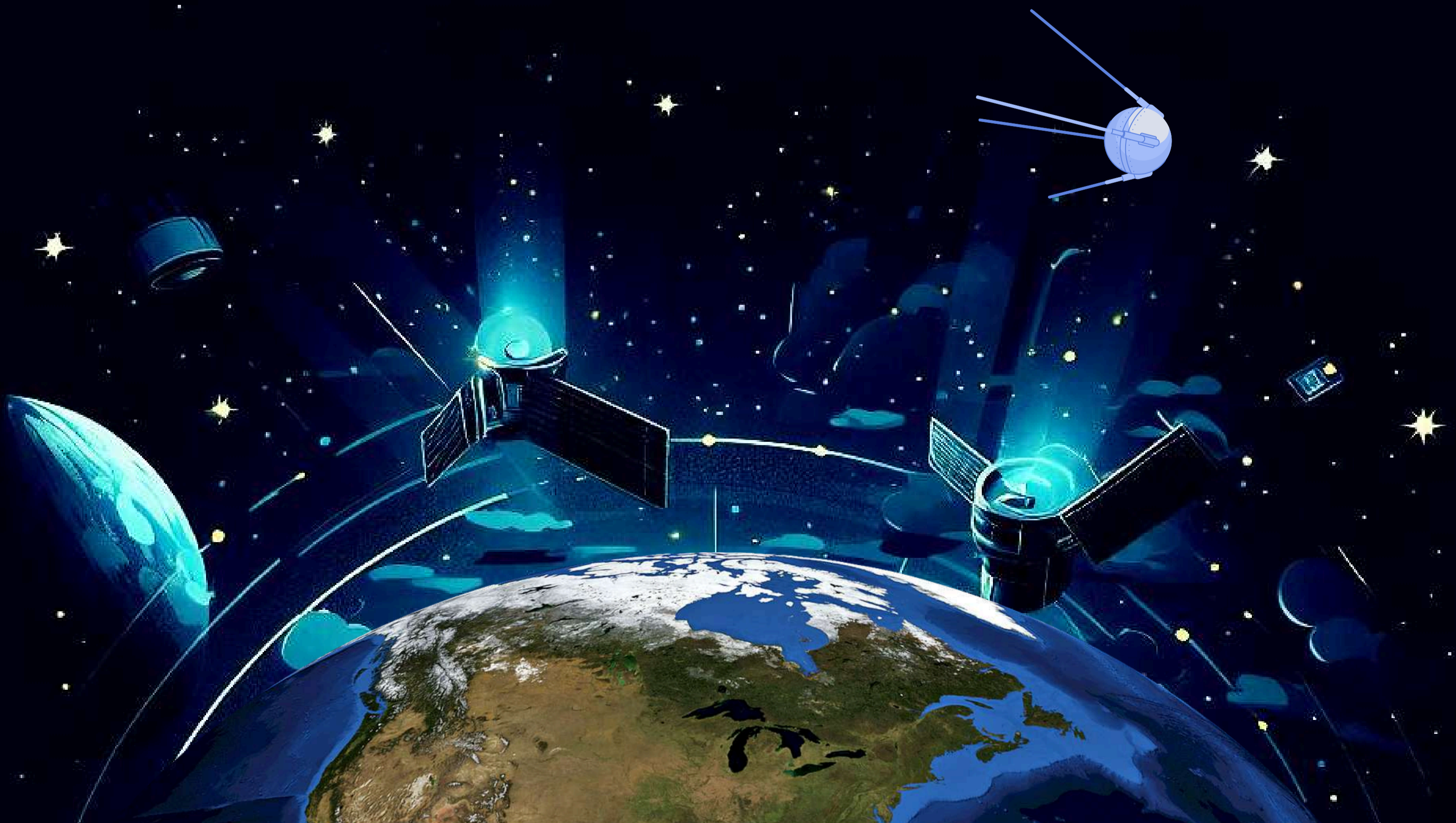




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# Message from the Chief Patron



The Department of Geography relies on collaborative efforts in the teaching-learning process for the learners . The Department started functioning in the academic session 2016-17, which was also the '**FIRST ACADEMIC SESSION**' of Government Girls' General Degree College. It is one of the vibrant departments of our college securing the best academic performance awards in every academic session on the annual meet program amongst the science departments. The faculty members are taking significant efforts to impart experiential learning to the learners by arranging regular field trips to different urban and rural landscapes and organising visits for hands on training programs. I am delighted to note that a new feather on the cap of the department has now been added with the publication of the bi-annual digital newsletter GEOCOGNITION. This will enable the learners of the department to exhibit their creative writings on many interesting and current issues pertaining to their subject .

I wish all the very best to the wonderful students of this department. May you all aim to succeed with flying colors in your future endeavours.

Warmly,  
Dr Syeda Shariqatul Moula Alquadri,  
Principal, GGGDC, Kolkata

# EDITORIAL



Editor  
Dr Rajashree Dasgupta



Advisor  
Dr Suradhuni Ghosh

## **PROGRESSION IN THE MAPPING TECHNIQUES FROM EARLY AGES TO MODERN ERA**

Humans have long recognized the importance of maps to their lives as they use to roam in different places in search of basic needs – food and shelter . Indeed, the history of mapping is traced more than 5,000 years ago. Maps are essentially tools to record the location of places of interest and to provide a source of learning about the geography of the mapped area.

Early maps depicted small areas and were pictorial in nature. While they were crude compared to modern maps, they were able to show the features that the map maker wished to record. The relationship between features on the map and reality on the Earth was often not accurate. A few examples of mapping which occurred before 4 BC include: relatively simple sketches on clay tablets by the Babylonians (see example above); extensive work by the Egyptians to document and record property boundaries; delicate maps on silk from China. The Greeks and Romans continued to refine the art of map making, culminating with the work of Claudius Ptolemaeus (in English Ptolemy). Ptolemy was a geographer, mathematician and astronomer who lived in Roman Egypt. In about 150 AD he famously published a scientific treatise titled *Geographia* (in English *Geography*). This contained thousands of references and maps of various parts of the world – with the network of meridians of longitude and parallels of latitude . This system brought radical changes to European geographic thinking, by imposing mathematical rules to the composition of maps.

During the Middle ages, in the Islamic world, the study of the science of mapping and geography did progress. An excellent example of this is the work of Al-Idrisi, an Arab scholar in the court of King Roger II of Sicily. In the period around 1154 he produced a number of outstanding 'world' maps and geographic books. The first of these books had the delightful title of 'The Amusement of him who desires to traverse the Earth'. It is believed that the influence of Al-Idrisi's work was far reaching with generations of Islamic map makers using his designs as the basis of their maps.

The renaissance period in Europe brought remarkable changes in the field of mapping with the invention of the printing press by Johannes Gutenberg in 1440 .The monasteries no longer dominated map production Furthermore, the discovery of the Americas and expanded contact with the Orient resulted in greater interest in distant places and migration. All these led to a massive expansion in geographic knowledge and mapping. The maps have become more complex and more accurate – particularly as understanding of the Earth, mathematics and geography have expanded.

In the Modern Era the mapping is based entirely on real time information through satellite technology . Remote Sensing data, GIS Softwares , GNSS and GPS have become indispensable tools for modern mapping to provide precise and real time data for any location of the earth and for accurate resource mapping . As a result, maps have become absolutely critical to most fields of human endeavour.

Dr. Rajashree Dasgupta  
HoD, Department of Geography

# ARTICLES ON EVOLUTION OF MAPPING TECHNOLOGIES



# MAPPING INNOVATIONS : TRANSFORMING DATA INTO GEOSPATIAL INSIGHTS



**Tahmina Iqbal**  
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The evolution of mapping technology represents a journey from early rudimentary cartography to the sophisticated digital systems of today. This progression illustrates an increasing precision and capability in mapping techniques.

## 1. From Cartography to GPS

Mapping has ancient origins, with early civilizations like the Babylonians, Egyptians, and Greeks creating the first maps using simple tools and observational techniques. These early maps, such as the Babylonian World Map from the 6th century BCE, were basic and often depicted mythological or trade route-based views rather than accurate geographical details. The Greeks, particularly Ptolemy in the 2nd century CE, made significant strides by introducing the use of coordinates, laying the groundwork for more precise cartographic methods.

The advent of the Global Positioning System (GPS) in the 1970s, and its full operational status by 1995, marked a transformative leap in mapping technology. Developed by the U.S. Department of Defense, GPS utilizes a network of satellites to provide highly accurate location data globally. This innovation revolutionized navigation and mapping by enabling real-time, precise positioning previously unattainable.



## 2. The Dawn of Mapping

Mapping's origins trace back to prehistoric times when early humans created basic representations of their environment. The earliest maps were likely crude, etched onto cave walls or crafted from materials like clay or stone. One of the oldest known examples is the Babylonian World Map, a clay tablet from the 6th century BCE depicting a simplified view of the known world. Ancient Egyptians also produced maps for practical uses such as land allocation and construction, exemplified by the Turin Papyrus Map, which illustrated gold mines and surrounding terrain.

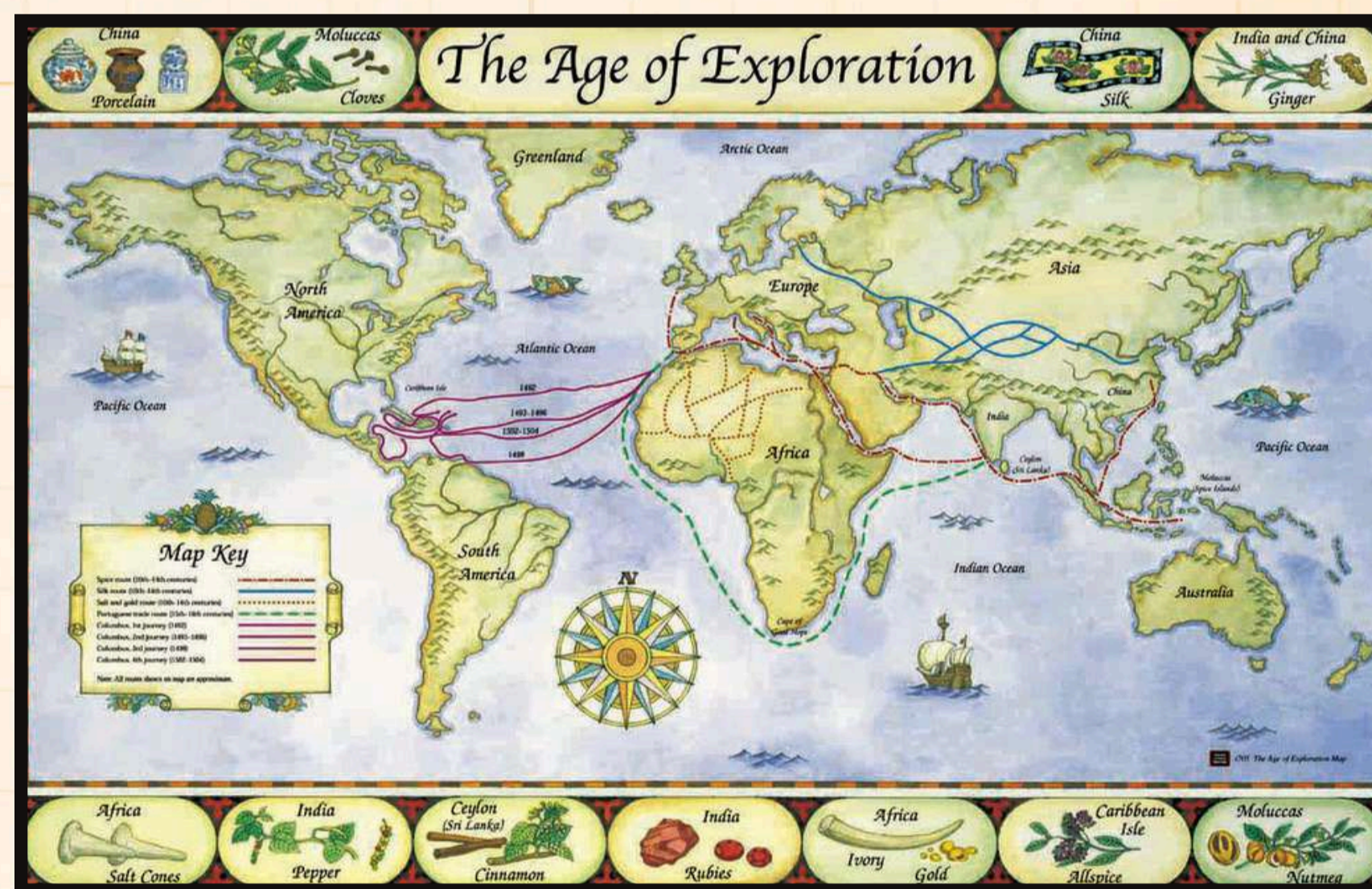
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## 3. The Age of Exploration

The 15th to 17th centuries, known as the Age of Exploration, was a pivotal period for mapping. As explorers like Columbus, Magellan, and Vasco da Gama ventured into uncharted territories, the demand for more accurate maps grew. Advances in navigation instruments, such as the astrolabe and sextant, allowed explorers to measure latitude and longitude more precisely.

Triangulation emerged as a crucial technique during this era. By measuring angles from known points, cartographers could create more accurate depictions of newly discovered lands. Despite the technological limitations of the time, these improved methods led to maps that increasingly mirrored the real world.



## 4. The Advent of Topographical Maps

The 19th century saw the rise of topographical maps, which provided detailed terrain information, including elevations and landforms. These maps were essential for military and civil engineering projects, allowing for effective planning and execution. The development of precise surveying instruments, like the theodolite and leveling instruments, enhanced map accuracy further.

Topographical maps represented a significant advancement by moving beyond basic land depictions to include detailed features such as mountains, valleys, and bodies of water. This level of detail supported diverse applications, from military strategy to land management.

## 5. The Digital Revolution in Modern Mapping: GIS and GPS

The late 20th century ushered in a digital revolution with the introduction of Geographic Information Systems (GIS) and the integration of GPS technology. GIS enables the collection, storage, and analysis of spatial data, allowing for sophisticated mapping and analysis. It supports complex data overlays, spatial queries, and detailed geographic insights.

The fusion of GPS with GIS further revolutionized mapping by providing real-time location data that could be visualized and analyzed immediately. This integration enabled dynamic and interactive mapping applications, transforming how geographic information is utilized for various purposes, including urban planning and environmental monitoring.

## 6. Mapping in the Digital Age

In the digital age, mapping technologies leverage real-time data integration, crowdsourced information, and augmented reality (AR). Modern applications like Google Maps offer interactive, real-time navigation and geographic data, significantly enhancing travel and exploration experiences.

Crowdsourced platforms such as OpenStreetMap enable users to contribute and update mapping information, leading to continually evolving and increasingly detailed maps. AR technology enhances mapping experiences by overlaying digital information onto the physical world, facilitating navigation and spatial interaction.

Advancements in big data and artificial intelligence (AI) further push the boundaries of mapping technology. AI algorithms analyze vast datasets to identify patterns and trends, supporting applications ranging from disaster response to urban planning. The evolution of mapping technology highlights a progression from basic representations to complex, interactive systems that integrate diverse data sources, continuously enhancing our understanding and interaction with the world.



Photo courtesy :

Digital Atlas World Map crafted from chips - an innovative illustration blending technology and geography in the interconnected landscape of the digital age

# ADVENT OF NAUTICAL MAPS : PORTOLAN CHARTS



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Portolan charts are remarkable artifacts of medieval navigation that revolutionized maritime exploration from the late 13th century onwards. These nautical maps provided sailors with essential information about coastlines, maritime routes marking a significant advancement in cartography. The emergence of portolan charts can be traced back to the Mediterranean, where trade and exploration flourished. As maritime trade increased, the need for accurate navigational tools became paramount. Early maps were often simplistic and focused on land features. In contrast, portolan charts were designed specifically for sailors, offering detailed depictions of coastlines and navigational routes. The oldest known portolan chart dates back to around 1290 and is attributed to the Italian cartographer Francesco Beccari.

## Features of Portolan Charts

### 1. Rhumb Lines

One of the most distinctive features of portolan charts is the network of rhumb lines. These lines, radiating from a central compass rose, represent constant compass directions, allowing sailors to plot courses accurately.

### 2. Detailed Coastlines

Portolan charts are renowned for their meticulous representation of coastlines. Unlike other maps of the time, which often exaggerated landforms, portolan charts provided realistic depictions based on actual navigational experience. Sailors could rely on these maps to identify ports, harbors, and notable geographical features.

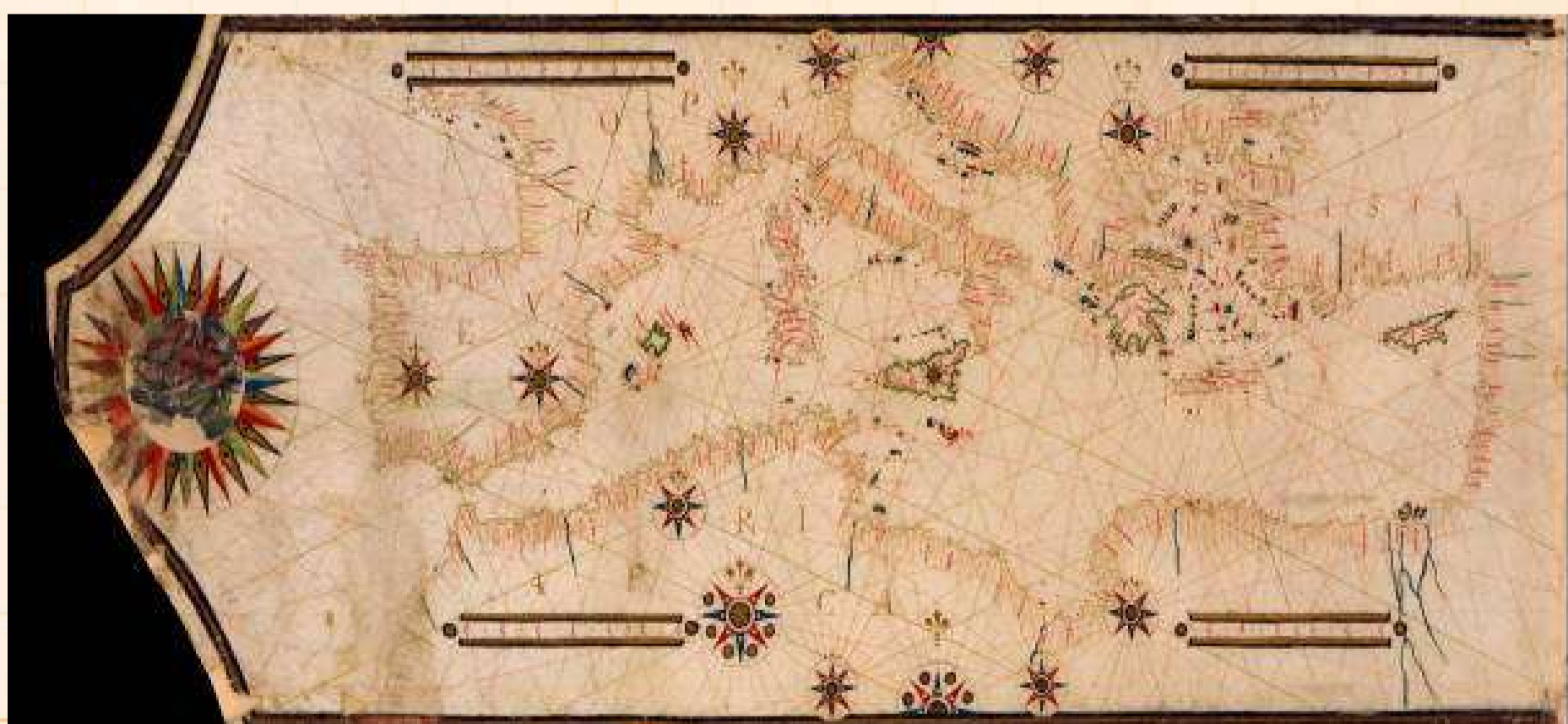


Figure 1: Portolan chart of the Mediterranean Sea, the Black Sea, Sea of Azov and Atlantic coasts of Europe and Africa, 16th century.

### 3. Place Names

The inclusion of place names is another essential characteristic of portolan charts. These names, often written in Latin or the vernacular languages of the time, helped sailors recognize key locations along their routes.

### 4. Distance Indicators

Although portolan charts did not adhere to a uniform scale, many featured distance indicators. These scales allowed sailors to estimate travel times between ports, enhancing their ability to plan voyages.

### 5. Decorative Elements

Portolan charts were not only functional but also visually stunning. Many included decorative illustrations, such as ships, sea monsters, and ornate compass roses. These elements added a unique character to each chart.

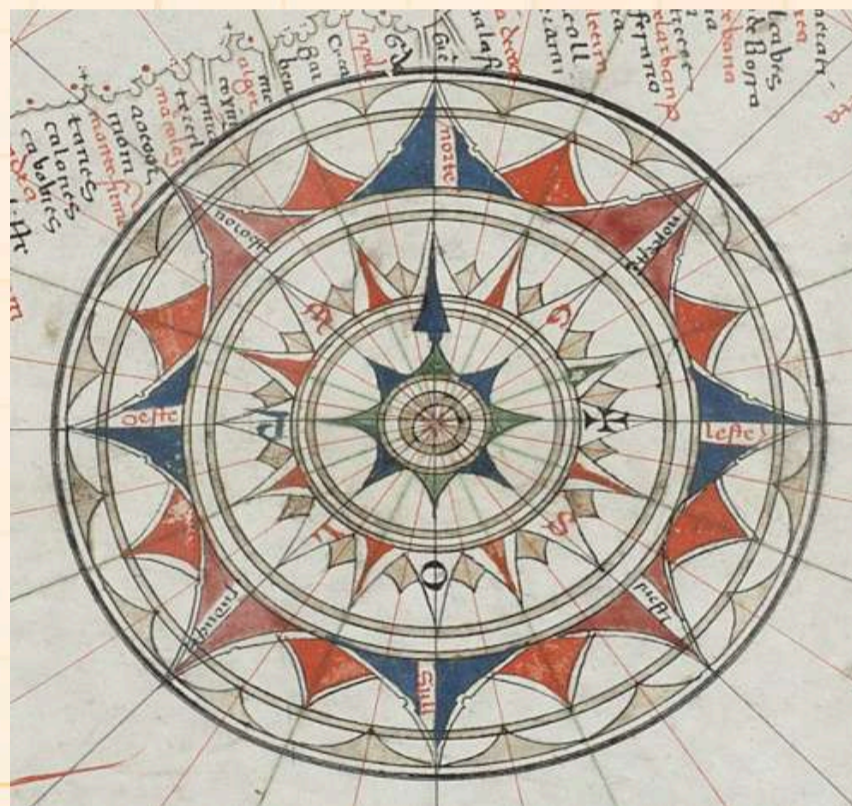


Figure 2: Compass Rose from a Portolan Chart

## The Evolution of Portolan Charts

As navigation techniques advanced, so too did the design and complexity of portolan charts. By the 15th century, these charts began to incorporate new information from explorations beyond the Mediterranean, including the Atlantic and the coasts of Africa and the Americas.

One significant development was the introduction of the "mappa mundi" style, which combined elements of portolan charts with more traditional world maps. This hybrid approach allowed for a broader perspective on global geography while retaining the navigational accuracy that portolan charts were known for.



Figure 3: Mappa Mundi with Portolan Elements

## **The Decline of Portolan Charts**

With the advent of more modern cartographic techniques in the 16th century, the use of portolan charts began to decline. The introduction of longitude and latitude lines, along with the development of more sophisticated navigational instruments, rendered portolan charts less relevant.

## **Significance of Portolan Charts**

Portolan charts were crucial not only for maritime navigation but also for the advancement of geographic knowledge. They provided a template for future mapmakers, helping to shape the evolution of cartography. The precision of portolan charts set a standard for future nautical maps and laid the groundwork for the modern understanding of maritime navigation.

## **Conclusion**

Portolan charts are a fascinating testament to the ingenuity of medieval cartographers and the seafaring tradition. Their detailed representation of coastlines, inclusion of rhumb lines, and decorative artistry highlight the intersection of functionality and aesthetics in navigation. While they may have fallen out of use with the advent of modern cartography, their legacy continues .

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<https://gallery.lib.umn.edu/exhibits/show/portolan-charts/introduction-to-portolan-chart/what-is-a-portolan-chart->

<https://timeandnavigation.si.edu/sites/default/files/multimedia-assets/212-1027151-portolan-chart-by-jorge-aguiar-dl-1027151.jpg>

# THE AGE OF EXPLORATION



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**Department of Geography**

The Era Known as the Age of Exploration, sometimes called the Age of Discovery, officially began in the early 15th century and lasted through 17th century. The period is characterized as a time when the Europeans began exploring the world by sea in search of new trading routes, wealth, and knowledge.

This era is significant because many technological development, Expansion of Knowledge, Economic prosperous had been observed.

When the Ottoman Empire took control of Constantinople in 1453, it blocked Christian European access to the area (East).

In addition, it also blocked access to North America and the Red Sea, Now Europeans started finding new routes and hence age of explorations started. Their main motive behind the exploration was the territorial expansion, Spread Christianity, search for trade route and so on.

### **Portuguese Empire :**

The first of the journey associated with the age of Discovery were conducted by the Portuguese Prince Henry the Navigator changed that encouraging explorers to sail beyond the mapped routes and discover new trade routes to West Africa.

Joao Goncalves Zarco discovered the Madeira Islands in 1419 and the Azores in 1427. Over the coming decades, they would push farther south along the African Coast of present day Senegal 1440's and the cape of Good Hope by 1490. Later in 15th century Vasco Da Gama reached the south western tip of Africa the city of Cape Town established a Portuguese Colony. This opened the way to Indian Ocean and thus established the great trading empire on coast of Africa, the Arabian Peninsula and India.

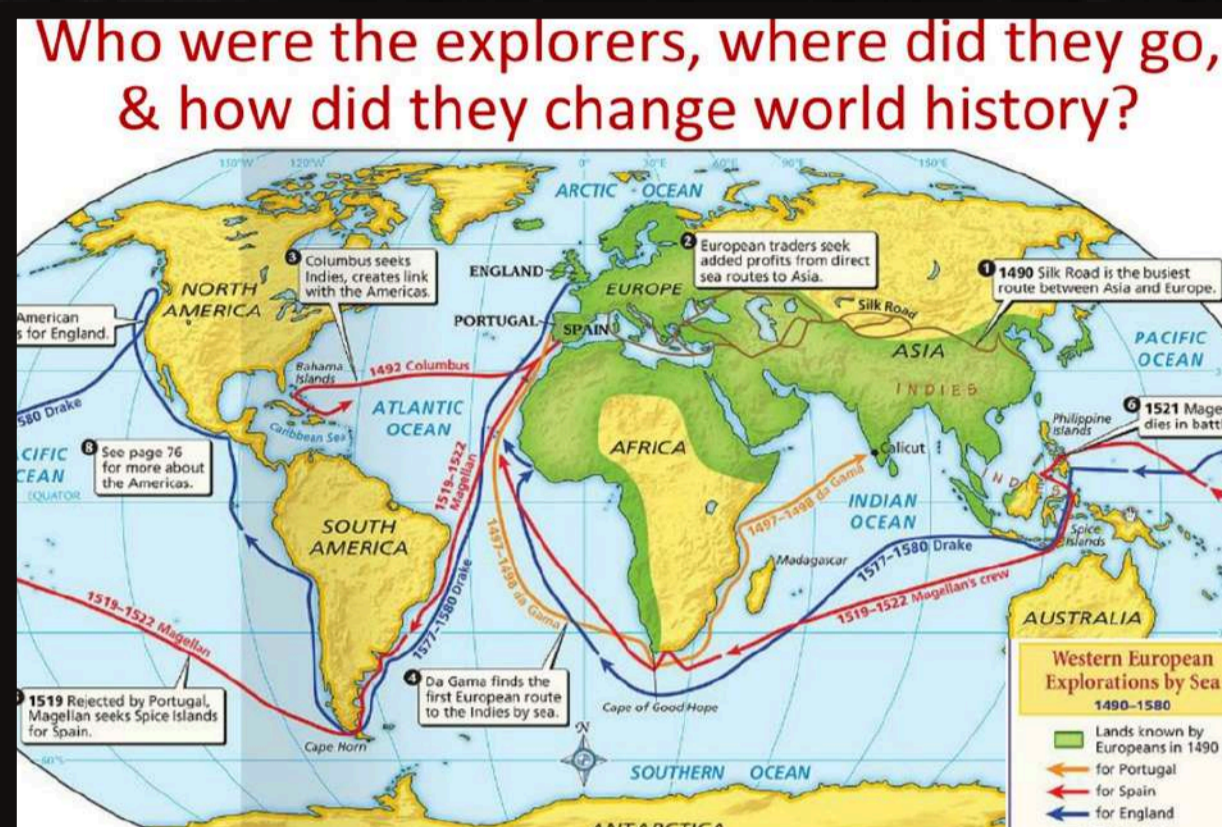
### **Spanish Empire :**

Christopher Columbus an Italian working for the Spanish monarchy made his first journey in 1492. America was unknown till then He sailed for West. Instead of reaching India, Columbus found the Island of San Salvador (Bahamas). He also explored the island of Hispaniola.

Ferdinand Magellan started sailing in 1519. He was the first person to sail through the tip of South America (Straight of Magellan) and cover entire Pacific Ocean. Then comes to Islands of Malaysia, Indonesia and sail to Cape of Good hope and sail back to east. He was the first person who travelled entire world.

## British Empire :

In 1778 captain James Cook of Britain sailed across the south Pacific ocean looking for a mysterious continent in the Southern Hemisphere. He landed on two large islands. Then he sailed west found Modern New Zealand and Australia.



### [Image Source](#)

### Western European Explorations by Sea

#### Technological Advances :

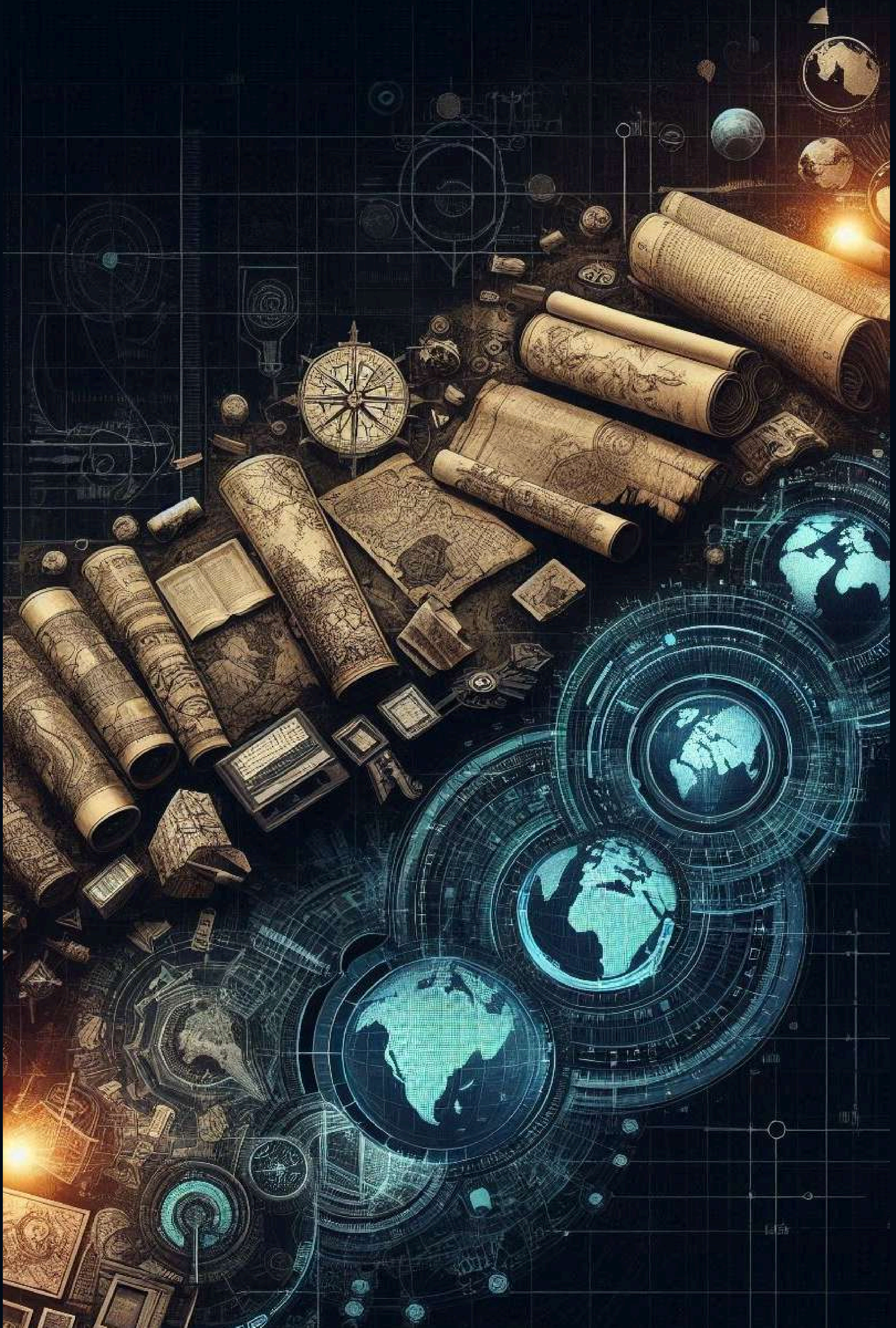
- > Navigational instruments such as Compass, Astrolabe
- > Caravel and Galleon design ships were capable of long ocean Voyages
- > Portolan charts were highly detailed navigation maps indicating wind patterns
- > Gerardus Mercator published world map in such a cartographic projection that constant rhumb-line trajectory were plotted as straight lines.

#### Impacts of the Age of Discoveries :

- > Massive wealth accrued to European colonizers due to trade in goods, Spices and Precious metal.
- > New foods, Plants, and animals were traded between the colonies and Europe.
- > The indigenous peoples were killed off by Europeans due to the combined effect of disease.
- > This impact carries on to this day where many of the world's former colonies still get labelled as the "developing" world and colonizers are first world countries with the majority of the world's wealth.

The Age of Exploration, for instance, has brought the world a heightened transformation concerning trade, cultural exchange, and far-reaching technological advancement. More than that the native people had been exploited and decimated, along with patterns that continued to influence the world to this day.

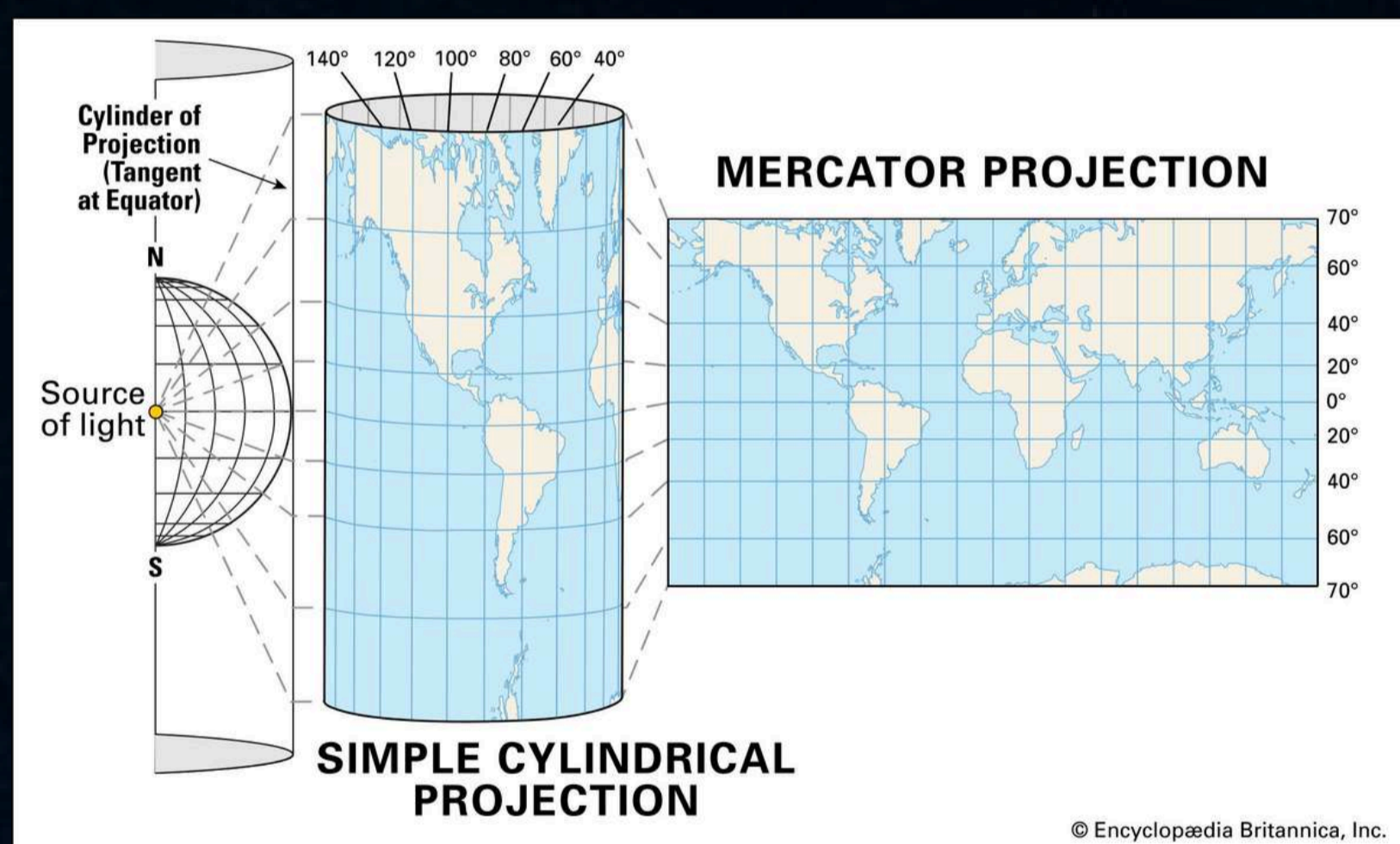
# EVOLUTION OF MAPPING TECHNOLOGIES FROM CARTOGRAPHY TO GPS MAPPING IN THE REVOLUTIONARY WORLD



**Moniba Afifa**  
**Ex- Student (2020-2023)**  
**Department of Geography**

The evolution of mapping technologies from early cartography to the sophisticated Global Positioning System (GPS) illustrates a profound journey of human ingenuity and technological advancement. In antiquity, cartography began with simple depictions on clay tablets or parchment, reflecting early attempts to represent geographical space. Ancient Babylonian maps were rudimentary, more symbolic than precise. Greek scholars like Eratosthenes and Claudius Ptolemy made significant contributions by incorporating geometric principles into their maps. Eratosthenes, through his method of measuring the Sun's angle, estimated the Earth's circumference with notable accuracy, laying the groundwork for future advancements in cartography (Sachs, 2012).

The Renaissance period marked a dramatic shift towards precision in mapping. The introduction of Gerardus Mercator's 1569 cylindrical projection was revolutionary. It allowed sailors to chart straight-line courses with greater accuracy, thus facilitating global exploration and trade (Harley & Woodward, 1987). This period also saw the refinement of triangulation methods, which improved the precision of distance and angle measurements. Topographic maps emerged, depicting detailed elevation and landforms crucial for military and land management purposes (Edney, 1997).



Picture 1 Mercator's Projection {Source: <https://www.britannica.com/>}

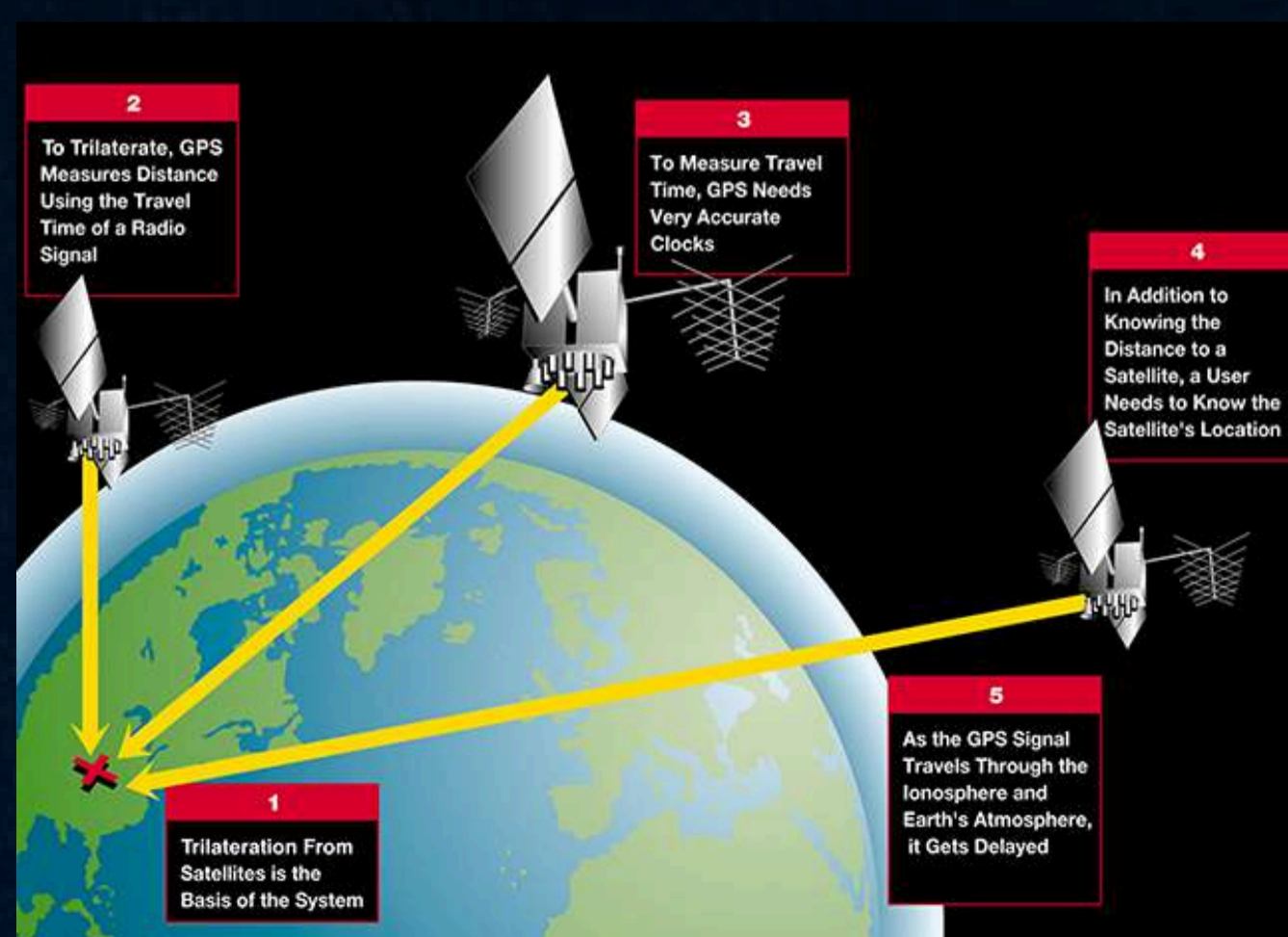
The 20th century brought significant advancements with aerial photography and digital mapping technologies. Aerial photography, introduced in the early 1900s, provided an innovative perspective, allowing for the creation of highly detailed maps of previously inaccessible areas. This advancement was pivotal for military and urban planning applications (Gibson, 2000). The advent of Geographic Information Systems (GIS) further transformed cartography by enabling digital integration and analysis of spatial data. GIS technology facilitated sophisticated geographic information manipulation, essential for various applications, including environmental management and urban planning (Longley et al., 2015).



Picture 2 List of Indian Satellites 1975-2023 {<https://www.geeksforgeeks.org/>}

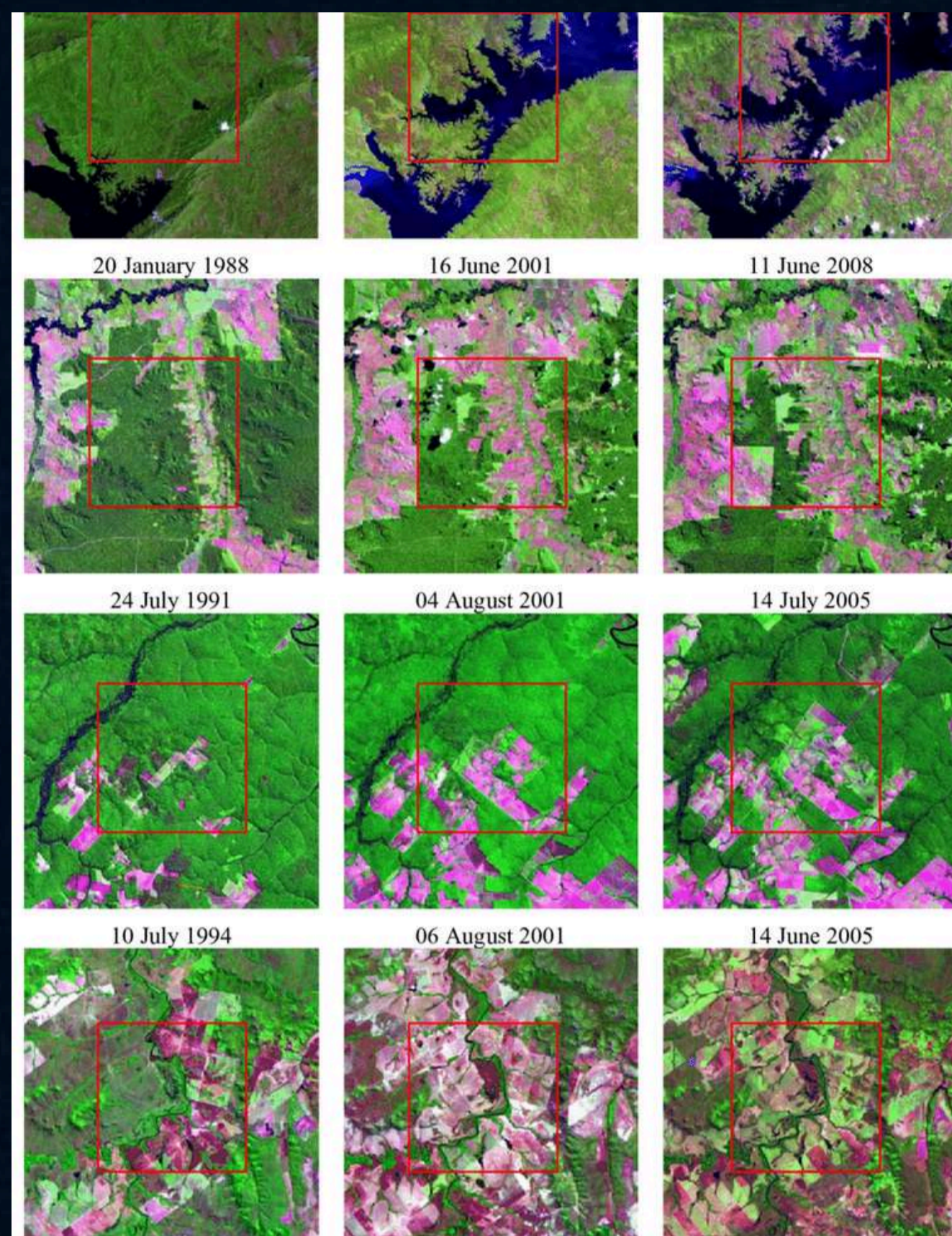
The late 20th and early 21st centuries introduced the Global Positioning System (GPS), a revolutionary development in navigation and mapping. GPS, a satellite-based technology, offers real-time positional data with remarkable accuracy, significantly enhancing navigation and spatial analysis. The integration of GPS with digital mapping platforms, such as Google Maps, has expanded access to advanced mapping tools, providing features like real-time traffic updates and street-level imagery (Craglia et al., 2008).

Looking ahead, the integration of artificial intelligence (AI) and machine learning is poised to further advance mapping technologies. AI algorithms are increasingly used to analyse vast datasets, improving the accuracy and predictive capabilities of maps. Additionally, the convergence of mapping technologies with the Internet of Things (IoT) allows for real-time data collection and analysis, enhancing the functionality of mapping applications. As technological innovations continue to evolve, the potential for more immersive and precise mapping experiences expands, underscoring the transformative impact of these technologies on our understanding and navigation of the world.



Picture 3 How a GPS works. {Source: <https://www.faa.gov/>}

Sun-synchronous satellites offer consistent lighting for monitoring land use and environmental changes over time, while geostationary satellites provide continuous, real-time observations of weather and hazards. Together, they enhance our ability to predict disturbances and visualize land cover, aiding in effective environmental and disaster management.



Picture 4 LANDSAT Imagery {Source: <https://www.researchgate.net/>}

The integration of remote sensing and Geographic Information Systems (GIS) has revolutionized mapping and spatial analysis, transforming these fields into dynamic tools for modelling and prediction. Remote sensing captures detailed Earth data via satellite or aerial imagery, while GIS organizes and analyses this data to produce insightful maps and models. Advanced software platforms such as QGIS, GRASS GIS, ArcGIS, and ERDAS IMAGINE enhance these capabilities, facilitating complex spatial analysis and trend prediction. These tools are pivotal in applications ranging from urban planning and coastal management to environmental conservation, offering valuable insights for decision-making and future planning. The synergy of remote sensing and GIS not only refines traditional mapping methods but also broadens research horizons, enabling more precise and actionable predictions across diverse domains.

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# A TECHNOLOGICAL ODYSSEY IN CARTOGRAPHY



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The advancement of mapping technology has evolved significantly overtime, moving from simple sketches to sophisticated computer programs that can locate locations with startling accuracy. This article looks at the evolution of mapping technology at numerous pivotal points.

### > From Cartography to GPS :

Cartography, or the discipline of making maps, is a long standing blend of art and science. These maps initial drawings were primarily hand-drawn and based on observations of the natural world. Cartographers in the early days made the maps using simple measuring equipments rather than Global Positioning System(GPS) and the proper measures were selected by artistic rather than technical criteria.

### > The Dawn of Mapping :

The beginning of mapping around 2500 BCE, the Babylonians produced clay tablets that depicted geographical features, leading to the criteria of the first maps. Notable contributions were made by ancient Greeks like as Eratosthenes, who determined the circumference of the Earth and produced one of the earliest maps of the world.



Fig. 2. The World Map by Eratosthenes

### > The Age of Exploration :

During the Age of Exploration (15th-17th century), European explorers made maps to record new areas and trade routes. Cartographers such as Gerardus Mercator created projection that enabled precise navigation.



**Fig. 3. Mercator's Projection Map**

**> The Advent of Topographical Maps :**

The development of topographical charts is another important development in mapping technology occurred with the introduction of topographical maps in the 18th and 19th centuries. These maps used contour lines to show elevation variations in addition to geographic characteristics. This breakthrough has a significant impact on resource management, urban planning and military operation. Topographical maps makes a comprehensive understanding of the terrain. The ability to depict landform provides infrastructure construction and environmental planning, laying the ground for modern map techniques.

**> The Digital Revolution in Modern Mapping: GIS and GPS :**

The late 20th century saw a digital revolution that transformed mapping technology once more. GIS have emerged as effective tools for analysing spatial data. GIS enables users to collect, store, manipulate, and visualize geographic data allowing for complex analyses in urban planning, environmental management, and disaster response. Together with GPS technology, GIS has transformed how we collect and interpret spatial data. The combination of these technologies has improved map interactivity and accessibility. Mobile applications now enable users to navigate in real time, find points of interest, and even contribute to crowd-sourced mapping projects. As a result, mapping has become an essential component of daily life, influencing everything from travel to public policy.



**Fig. 5. Geographic Information System (GIS) technology**

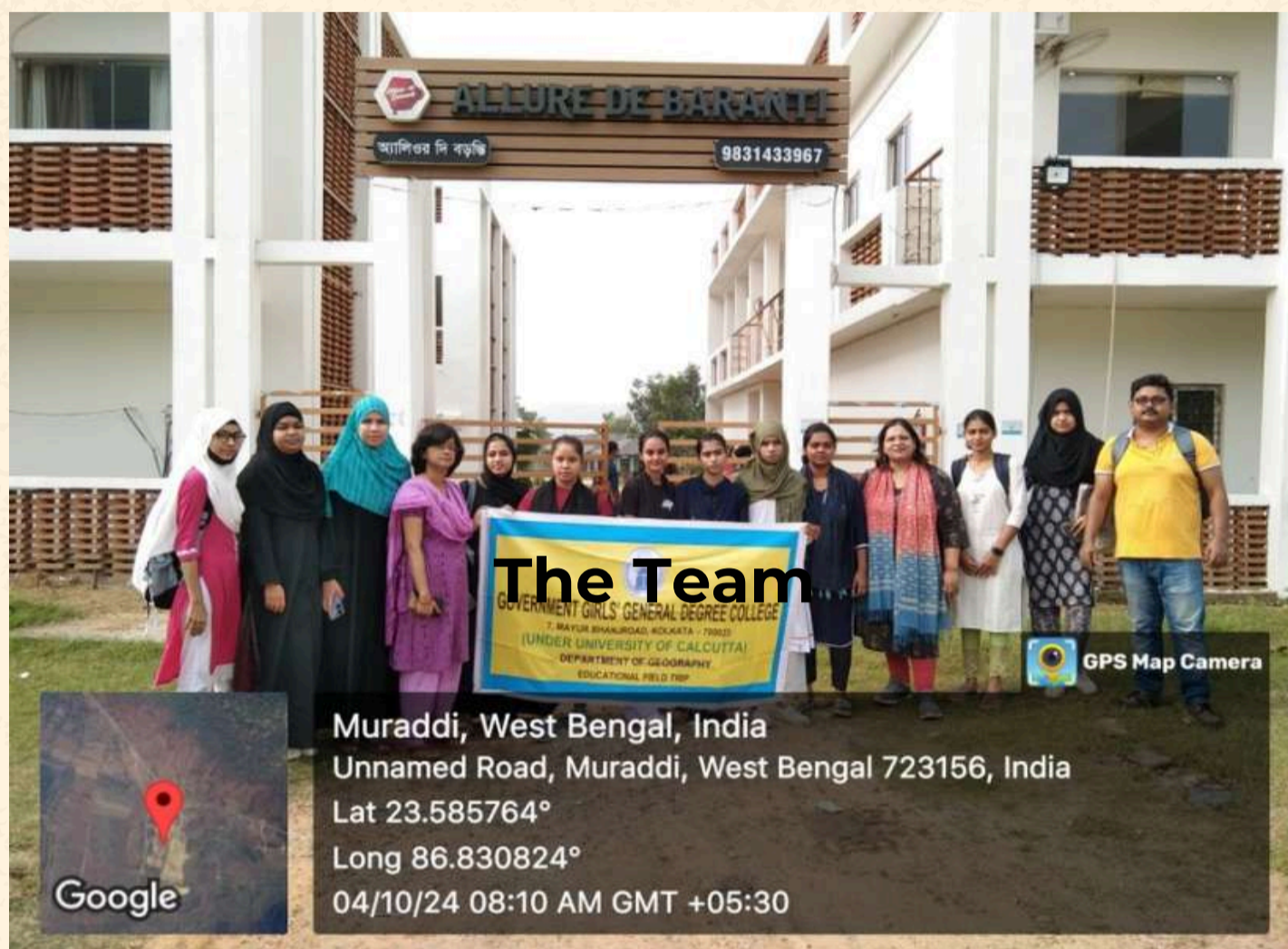
## > Mapping with Digital Age :

Mapping technology is currently evolving at a rapid pace. Digital maps are widely available, accessible via smartphones and online platforms such as Google Maps. Users can get real-time traffic updates, satellite imagery, and even augmented reality features that improve navigation. In conclusion, the evolution of mapping technology reflects humanity's quest for exploration and understanding of our environment. From ancient cartography to modern digital systems like GIS and GPS, each phase has contributed to our ability to navigate and comprehend the world around us. As technology continues to advance, it will undoubtedly shape the future of mapping in ways we can only begin to imagine.

In conclusion, the evolution of mapping technology reflects humanity's quest for exploration and understanding of our environment. From ancient cartography to modern digital systems like GIS and GPS, each phase has contributed to our ability to navigate and comprehend the world around us. As technology continues to advance, it will undoubtedly shape the future of mapping in ways we can only begin to imagine.

# Glimpses of Recent Field Trip

BARHANTI VILLAGE, PURULIYA, WEST BENGAL



The Team



Haat Survey



Instrument Survey



Household Survey



Soil Sample Collection

# *Acknowledgement*

Heartfelt acknowledgement to all those who extended their support for the designing of this newsletter. Gratitude and sincere thanks to the Principal of the college for her inspiration and constant motivation to publish this digital newsletter. Immense thanks to my departmental colleague and Dr. Antara Mukherjee, Faculty member of English Department, Durgapur Government College, West Bengal for her valuable feedback during the creative process. Last but not the least is the immense contributions of our departmental students and Mr. Sayan Mukherjee, Graphic Designer and Illustrator, Geocognition who finally made it possible to publish this digital newsletter on time . Truly fortunate to have such a supportive academic editorial team of students .

# KNOW OUR CONTRIBUTORS



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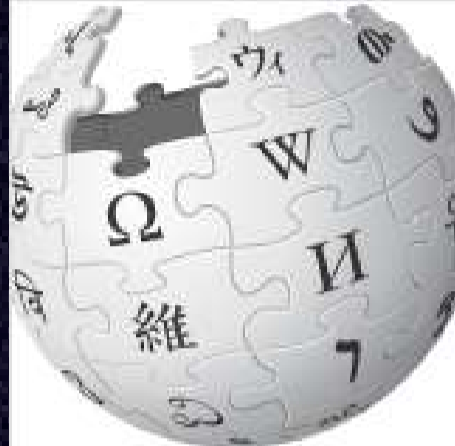
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# *We, the Geography Family*



Mapping the future...

