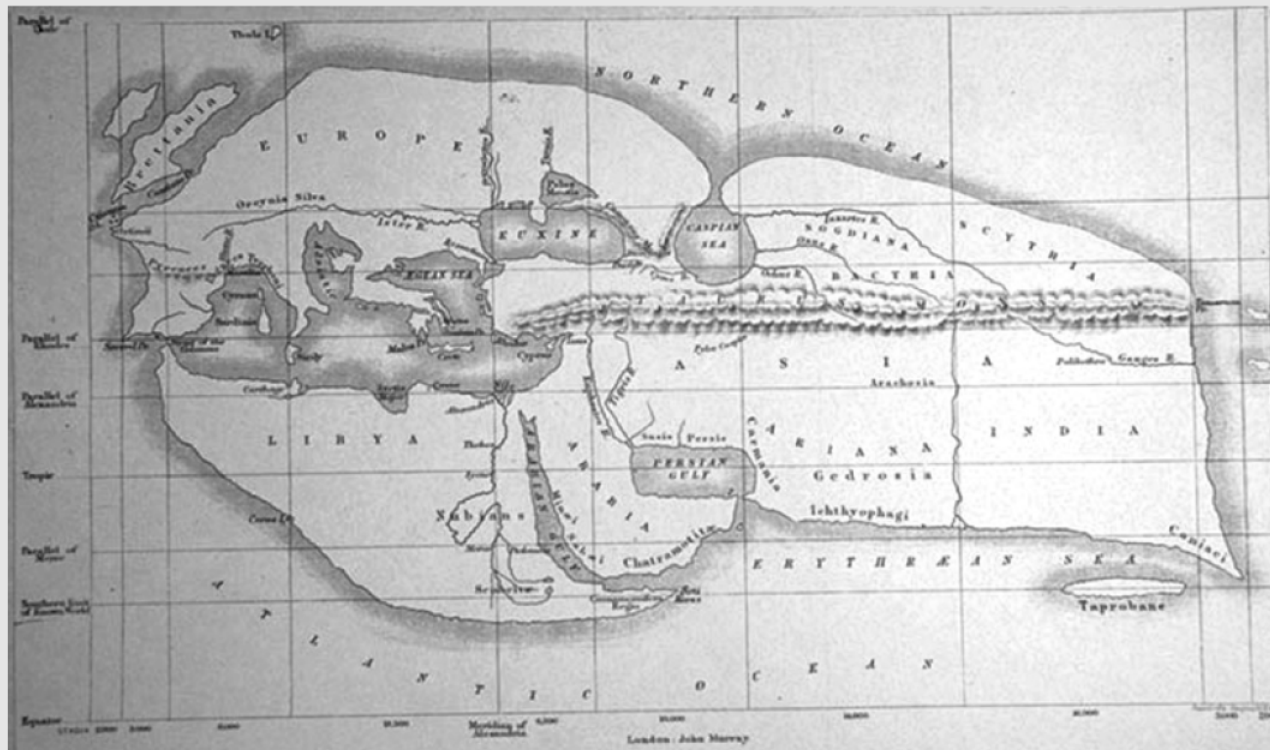


CHAPTER 2

HISTORY AND DEVELOPMENT OF GIS



- The earliest known maps were drawn on parchment to show the gold mines at Coptes during the reign (1292 – 1225 B.C.) of Rameses II of Egypt.
- At a later date, the Greeks acquired cartographic skills and compiled the first realistic maps.
 - They began using a rectangular coordinate system for making maps around 300 B.C.
 - The Greek mathematician, astronomer, and geographer Eratosthenes (ca. 276 – 194 B.C.) laid the foundations of scientific cartography.
- One of the earliest known maps of the world was constructed by Claudius Ptolemaeus of Alexandria (ca. A.D. 90 – 168).

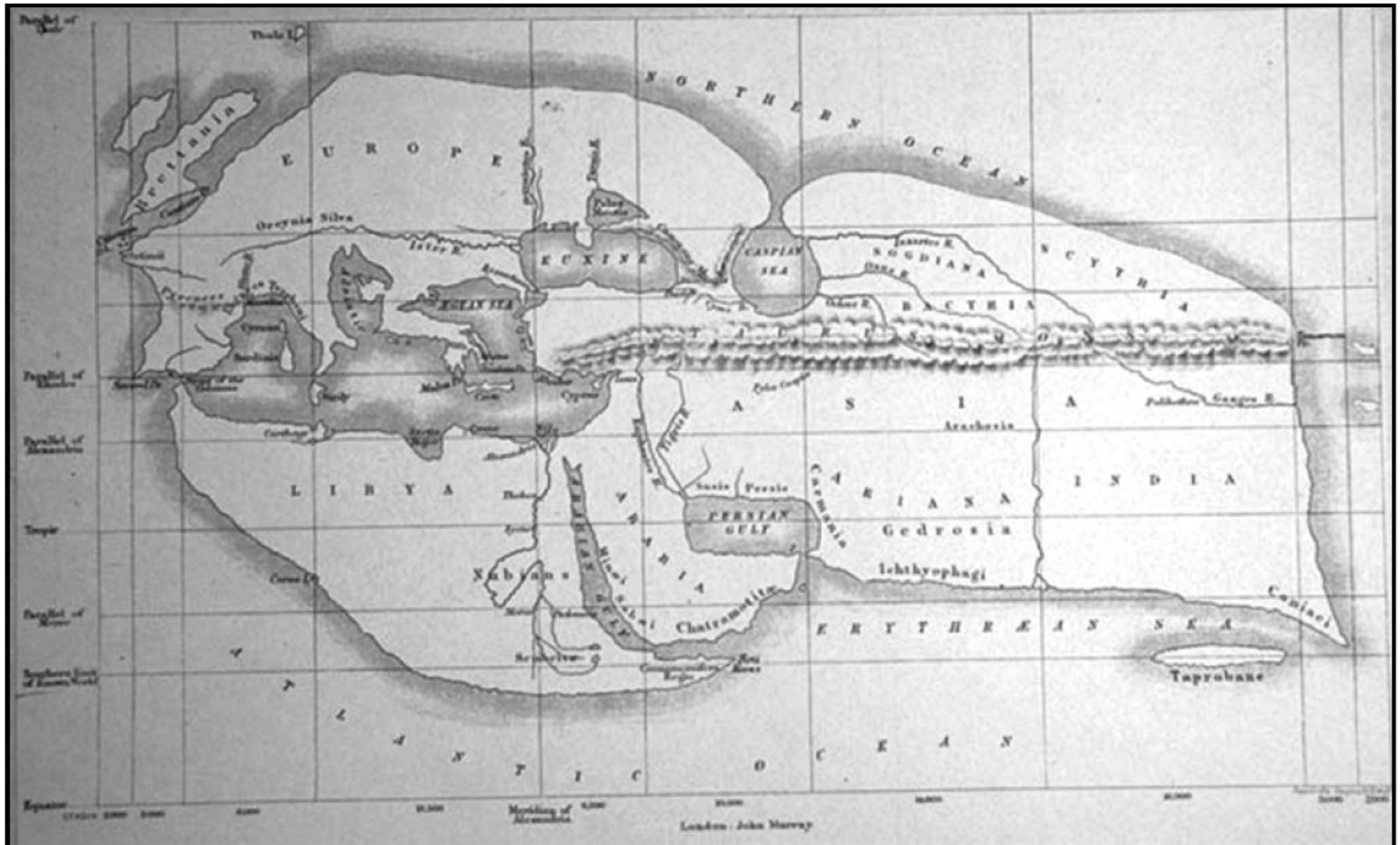


Figure 2.1: The map prepared by Eratosthenes.

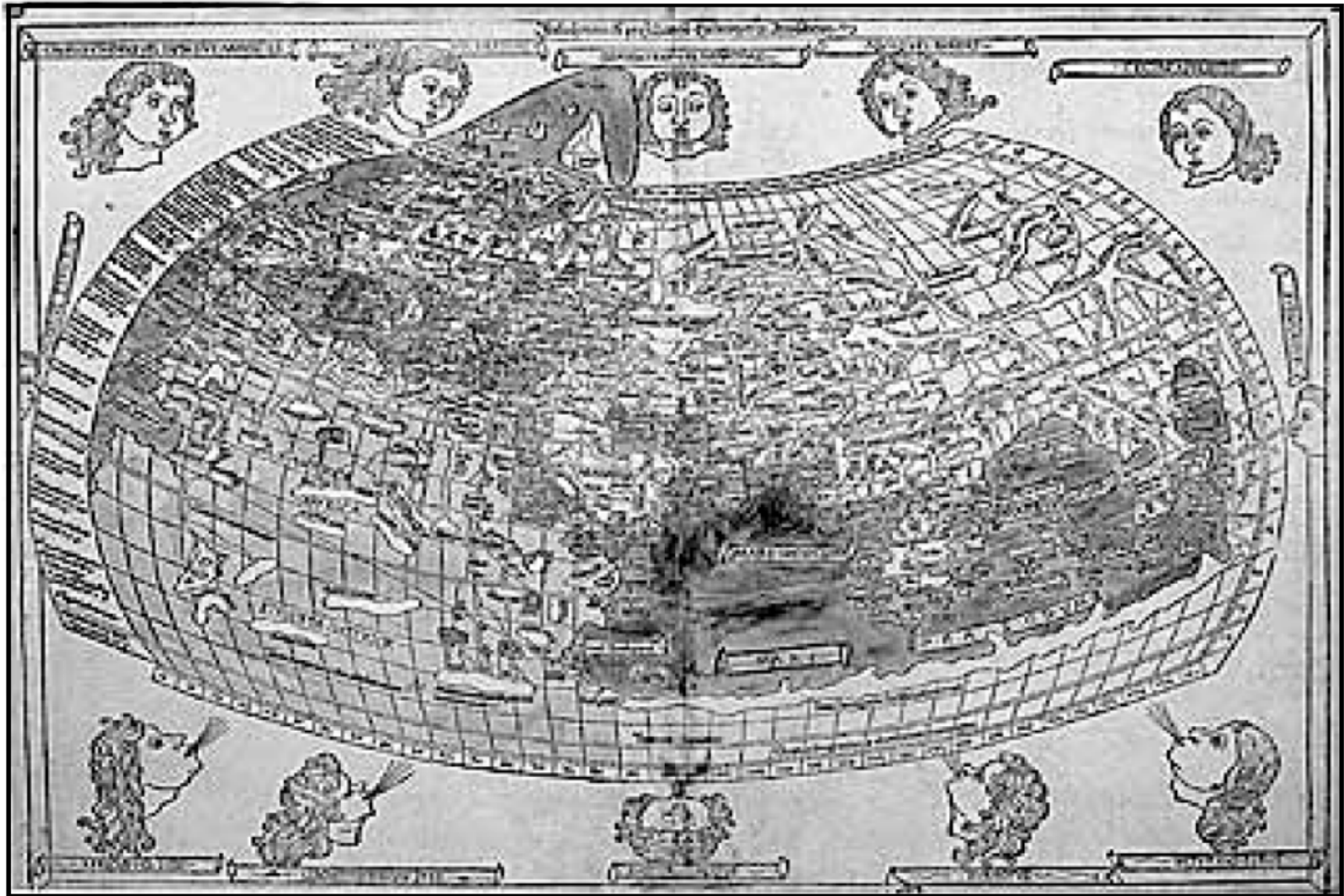


Figure 2.2: Ptolemy's map of the world, about A.D. 150, republished in 1482. Notice the use of latitude and longitude lines and the distinctive projection of this map.

- The Romans were more concerned with tabulations and registers.
 - The Romans first employed the concept to record properties, in the *capitum registra*, literally, 'land register'.
 - Both the ancient Egyptians and the Romans taxed property, property registration was early systematized to assure tax revenues.
- The earliest maps were drawn almost exclusively to facilitate commercial sea voyages.
 - Coasts were meticulously detailed and harbours were plumbed, while interiors remained unknown, apart from details of important trade and caravan routes.

- The Middle Ages
 - The Arabs were the leading cartographers of the Middle Ages.
 - European cartography degenerated as the Roman Empire fell.
 - But, in the fifteenth century, Claudius Ptolemaeus's *Geographia* was translated into Latin to become the then existent view of the world.
 - In many countries property registry thrived.
 - The best known example is the Domesday Book, the record of the lands of England compiled in 1086 for the first Norman king, William the Conqueror (1027–87).



Figure 2.3: Al-Idrisi's map of the world, 1456. He completed a map of the known world in the 12th century. Drawn with south at the top, this later example has been inverted for easier viewing.



Figure 2.4: World Map of the 15th Century - This map of the known world was produced, probably in late-15th century Genoa, by Paolo Toscanelli, and represents the extent of European knowledge before their exploratory voyages of the 1490s began. It shows that virtually no progress had been made in European geography since the 2nd century, when the Greek geographer Ptolemy collected the information on which this map is based. The Mediterranean coastline is easily recognizable, but the Indian Ocean coast is very inaccurate and the interiors of Asia and Africa are guesswork. It seems that Toscanelli was the first to put forward the idea of reaching Asia by sailing westwards—an idea taken up enthusiastically by Christopher Columbus.

- The travels and explorations of Marco Polo, Christopher Columbus, Vasco da Gama, and others resulted in increased trade; the need for geographical information increased.
 - Ordnance developments, such as the introduction of artillery, made maps important in military operations, and military agencies became the leading mapmakers.
 - In many countries, the military mapmakers became responsible for both topographic land maps and navigational charts.
 - The introduction of mass printing techniques enabled maps to be produced as consumer articles rather than as works of art

- Until the nineteenth century, geographical information was used mostly for trade and exploration by land and sea and for tax collection and military operations.
- With evolving infrastructures, such as roads, railways, telegraph and telephone lines, and gas and water supplies, planning these facilities required information about the terrain beyond that commonly available.
 - As planning advanced, specialized maps became more common.
 - The first geological map of Paris was compiled in 1811.
 - In 1838, the Irish government compiled a series of maps for the use of railway engineers, which may be regarded as the first manual geographical information system.
- New applications arose for property registers and maps as builders needed to compile overviews of affected properties in order that their owners might be justly compensated.

- Many countries began compiling statistical information relating to urban planning in the early nineteenth century.
 - By 1837 the British Registrar General's Office had amassed extensive population statistics.
 - Property mapping in the late nineteenth century aimed to wrest order from chaos.
- Photogrammetry, the technique of making measurements from photographs, developed rapidly in the 1920s and 1930s,
 - After World War II, photogrammetry became widely used in mapmaking, mostly for maps in scales from 1:500 to 1:50,000.

ADVANTAGES OF GIS OVER MANUAL METHODS

- The manual methods
 - The difficulty with the manual overlay method was that they may be published at different scales or projections.
 - The more layers of maps included in the analysis and the more complex they become, the more the likelihood of human error entering the analysis and the longer the process takes.
- GIS
 - The GIS can take maps from different sources and register them easily and is consistent in its analysis of multiple layers of map data.
 - It is also faster than manual methods of analysis, allowing the flexibility to try alternate variables in analysis.

FIRST AUTOMATIC PROCESSING OF GEOGRAPHICAL INFORMATION

- By the late 1950s and early 1960s, second-generation computers using transistors became available, outperforming their vacuum-tube predecessors.
 - Meteorologists, geologists, and other geophysicists began using electronic mapmaking devices.
 - Initially, the quality was poor, not least because automatic drawing machines had yet to be developed.
- The first geographical information system was constructed by the government of Canada in the late 1960s, and by modern standards was both unbelievably crude and expensive.
 - It required a large mainframe computer, and its output was entirely in the form of tables.
- Later, in the United States, a similar system, MIDAS, began processing data on natural resources.
- Since the mid-1950s, computers have been used in the United States to simulate traffic flows in relation to population distribution.

IMPORTANT MILESTONES IN THE DEVELOPMENT OF GIS

- Factors which caused the change in cartographic analysis:
 - Computer technology- improvements in hardware, especially graphics
 - Development of theories of spatial processes in economic and social geography, anthropology, regional science
 - Increasing social awareness, education levels and mobility, awareness of environmental problems.
- The boost to GIS development began in mid 1960s, when Canada Geographic Information System (CGIS) made an effort to identify the nation's land resources and their existing and potential uses.
- The second burst of activity occurred in the late 1960s in the US Bureau of the Census, in planning the tools needed to conduct the 1970 Census of Population.
 - The DIME program (Dual Independent Map Encoding) created digital records of all US streets, to support automatic referencing and aggregation of census records.

- The first automated cartography developments occurred in the 1960s, and by the late 1970s most major cartographic agencies were already partly computerized.
- Remote sensing also played a significant part in the development of GIS, as a source of technology as well as a source of data.
- GIS really began to take off in the early 1980s, when the price of computing hardware had fallen to a level that could sustain a significant software industry and cost effective applications.

Box 3: The stages of GIS development

<i>Stage</i>	<i>Period</i>	<i>Description</i>	<i>Characteristics</i>
<i>The Era of Beginning</i>	1960 – 1975	<i>Pioneering</i>	<ul style="list-style-type: none"> • <i>individual personalities important</i> • <i>mainframe-based systems dominant</i>
<i>The Era of Innovation</i>	1975 – 1980	<i>Experiment and practice</i>	<ul style="list-style-type: none"> • <i>local experimentation and action</i> • <i>GIS fostered by national agencies</i> • <i>much duplication of efforts</i>
<i>The Era of Commercialization</i>	1980 – 2000	<i>Commercial dominance</i>	<ul style="list-style-type: none"> • <i>increasing range of vendors</i> • <i>workstation and PC systems becoming common</i> • <i>emergence of GIS consultancies</i>
<i>The Era of Exploitation</i>	2000 onwards	<i>User dominance</i> <i>Vendor competition</i>	<ul style="list-style-type: none"> • <i>embryonic standardization</i> • <i>increasing use of PC and networked systems</i> • <i>systems available for all hardware platforms</i> • <i>internet mapping launched</i>

Source: Adopted from Heywood, Cornelius and Carver, 2004.

❖ The Microprocessor

- The development of powerful workstations in the mid–1980s led to an increasing acceleration in the use of GIS.
- The spread of PCs spurred user-friendly operations and programs capable of processing in ways previously not possible, for example, by considering the logical connections in geographical data.
- Increases in microprocessor computing capacity made the processing of digital and satellite images and other types of raster images commercially available in the mid-1980s.
- In the late 1980s, computing capability became widely accessible as microprocessors were used for a multitude of devices from household appliances and automobiles to an extensive range of specialized instruments.

- For GIS users, microprocessors have improved such devices as:
 - Surveying instruments
 - GPS (global positioning system)
 - Digitizing table
 - Scanners
 - Environmental monitoring satellites and data presentation systems, including graphic displays, electrostatic plotters, and laser printers

RECENT DEVELOPMENTS

- Data networks have opened up a whole new range of opportunities for geographical data search and distribution.
 - They have considerably increased the value of GIS, particularly since common data have become more easily accessible.
- The most spectacular development in the GIS arena has occurred in the field known as multimedia.
 - Multimedia techniques are based on the combination of elements such as figures, text, graphics, pictures, animation, sound, and video.
 - Multimedia brings geospatial information into living maps and makes complex information understandable to those who are not technically sophisticated.

- Flight simulators are perhaps the best-known example of the application of data technology to create near real-life situations, thus making them ideal for use in training.
 - The concept behind flight simulators has now been adopted for other activities and is known as virtual reality.
 - Virtual reality and GIS have many features in common and are becoming more and more integrated