Mapmakers

2. Going Places!

Harini Nagendra

Harini Nagendra has worked extensively with satellite images, and their interpretation into maps, for ecological analysis. During this process she became interested in the history of mapmaking, and how things were done in the pre-satellite days. Hence, this article! Her other research interests include the study of landscape organization and dynamics at various scales, and the design of computer-based visual aids to help in teaching ecology.

Earlier mapmakers in pre-BC times tended to have local, detailed knowledge about their localities. The increase in the frequency of long distance voyages played a major role in changing the scale of map, as well as developing the science of global mapping to a further degree. In the 2nd century AD, Ptolemy in Alexandria made the first detailed world map on a globe. His main contribution to the science of mapping was to develop the system of curved parallels and meridians (latitudes and longitudes) which we use today to map the world, based on a system devised by his contemporary, Marinos. Previous to this, the grids used for mapping had been straight instead of curved and difficult to use when drawing maps of a round earth on a globe (*Box* 1). He described India in his maps, based on the reports of Alexandrian merchants who had traded and travelled to India. However, their reports led him to greatly exaggerate the size of Sri Lanka, and shrinking the southern peninsula of India to accommodate this large island, so that India looked rather peculiar. Details about the interior of India were practically nonexistent. He got the position of the Himalayas as well as the direction of flow of the Ganges accurately though.

After Ptolemy's maps, although travel between different parts of the world continued to increase, the quality of Western maps did not improve too much for a while. This was largely due to the intervention of the Christian Church, which negated the idea of a spherical earth based on theological reasons (*Box* 2). This so-called 'Great Interruption' lasted from the fourth to the fourteenth century, during which most geographers gave up all ideas of spherical planets, for fear of being branded heretics and burnt at the stake. Maps were drafted in accordance with classical religious literature, and Christian geographers who lacked facts

Previous part of the series:
1. The Province of Philosophers, *Resonance*, Vol.4, No.4, 6–11, 1999.

Box 1. Segmenting the Planet – Ptolemy's Grids

It was Ptolemy who systematized a scheme for partitioning the spherical globe into segments. He defined the task of a cartographer as that of '*surveying the whole in its just proportions*', that is drawing maps to scale. This requires a network of lines covering the area of interest, to fix the exact position of points. Erastothenes, Hipparcus and other earlier scholars developed the idea of such a network of lines; the precursors to what we today call latitude and longitude. Ptolemy added that the extent and shape of the earth should be taken into consideration while developing such a system. He adopted a system of parallels in which each line was chosen so that the length of the longest day differs from one parallel to another by a quarter of an hour or 15′. There were a total of 21 such lines, covering what he believed to be the entire inhabited world. His meridians were placed a third of an hour apart, and since to Ptolemy the known world spanned 12 hours (or 180°), there were 36 longitudinal lines. Most importantly, he developed a system for depicting the spherical earth on a flat surface, using a projection system wherein the meridians were straight lines equidistant at the equator and converging at the North Pole, and the parallels were arcs of circles. This method preserves areal relationships, but fails to keep angles correct. It was used widely for centuries, until a satisfactory method of preparing maps in which angles are preserved was developed in the sixteenth century.

Box 2. The Appeal of Symmetry

Life is believed to have a penchant for symmetry – humans certainly do! Human imagination has given the earth several symmetrical shapes at different points in time. Square earths appealed to several people – ancient Peruvians imagined a box-shaped earth, while the Aztecs saw the universe as five squares – one large central one and four surrounding this. Ancient Egyptians saw the whole world as a perfect egg, guarded at night by that great white bird, the moon. The Gnostics, Christian mystics of the first and second century AD, also fancied the world as an egg lodged in the womb of the Universe. Several early Greek writers like Aeschylus and Ephorus strongly believed that the known world was in fact a parallelogram, with the equator neatly bisecting it. Their 'equator' followed the longitudinal axis of the Mediterranean, and depicted Asia Minor exactly midway in this inhabited parallelogram – hence being 'ideal' to live in! By the 5th century BC however, Greek scholars like Plato realised that the earth was not flat – which of course meant it had to be spherical on aesthetic grounds alone – a sphere being the most perfect mathematical form! Physical evidence for this was also found – but this clashed with classical Christian theories of the Antipodes. The Church therefore quickly opposed ideas of a spherical Earth, and during the period of the 'Great Interruption', from the 4th–14th century, it was banned on pain of death – after which it slowly regained favour again! In the meantime, unaffected by all these changes, the Chinese continued with their conception of a flat earth covered by a rectangular grid, and conceded that the earth was round only in comparatively recent times!

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to fill their landscapes, filled them with fantasies.

While Christian geography in Europe was following this route, other civilizations were still advancing their knowledge of the earth. Independently of Ptolemy, the Chinese had developed a rectangular map-grid for the earth, which they believed was flat. This tradition may even have reached the Arabs, as the Arab geographer Al-Idrisi made his world map in 1150 with a rectangular, flat grid unlike that developed by Ptolemy. The much-travelled Mongol tribes must also have had excellent knowledge of land routes, as they did most of their travelling on horseback over very large distances – although no information on the maps they used survives.

Although trade continued between Asia and Europe, European traders themselves never got to see India or China. Goods from these countries would reach the Levant ports in the eastern Mediterranean, from which Italian and Frankish merchants had to collect them. The Muslim Turk traders did not allow them to advance further into Asia. As a result, tall tales about mysterious Asia flourished. For instance Isodore of Seville, in the early seventh century, authoritatively placed 'Paradise' on a world map, in easternmost Asia. Following this, most medieval maps included the location of Paradise in Asia. In fact in the fourteenth century, John Mandeville even added an account of Paradise to his map, identifying the four rivers that flowed out of Paradise as the Ganges, Tigris, Euphrates and Nile. Mythical creatures were represented on these maps, as well as monster races of men, headless, noseless, with strange umbrella like feet and other weird imaginations.

Needless to say, these world maps were mainly used by intellectuals and were often distinct from those road and sea maps used by local travellers. These maps were more realistic, as lives depended on their accuracy. During the period of the Great Interruption, mariners collected information about the coasts along the Mediterranean, and noted such information down for other sailors to follow, or passed it on by word of

mouth. These coast charts of the Mediterranean, according to historians of cartography, are the world's first 'true maps'. They are the first known maps to lay down large parts of the earth's surface based on close observation, rather than imagination. Although these maps were fairly accurate, the mappers somehow seemed to lose their powers of observation when they talked about land areas, adding fanciful accounts of weird creatures and strange lands. Unknown lands were invariably depicted as inhabited by monsters, and having great wealth. This of course stimulated the curiosity and greed of subsequent explorers, who in turn returned with their tall tales!

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The West's picture of exotic lands like India, China and Africa was highly coloured by such maps (see *Figure* 1), as well as tales told by travellers like Marco Polo. In an epic twenty-four year journey along the fabled 'Silk Route' in the thirteenth century, he travelled extensively through Asia and brought back a host of new information on these hitherto unknown lands. In 1512 AD Alfonso d'Albuquerque, a Portugese Governor of part of India, wrote to the King of Portugal that he was sending to him a map of South East Asian sea routes made by a Javanese. Although this map has not survived, this indicates that by this time better maps of at least the coastline of India were available. Such travellers brought with them much more authentic information on Asia, but Ptolemy's maps with exaggerated pictures of the wealth of large parts of Asia and Africa were still widely accepted. This led in large part to the exploration and subsequent colonisation of these countries by Europe during and after the fifteenth century AD.

The first Europeans to explore the idea of colonising Asia and Africa were the Portuguese. In 1291, the Vivaldo brothers set out with two ships to find a route around Africa to India, but their ship mysteriously vanished on the way. Further travel was hindered by the belief that near the equator was a sea of boiling water that would kill anyone who tried to cross. However, by the late fifteenth century, Islam's expanding strength in east Africa made travel along previously known routes difficult for the

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70 *Woodcut Map of Africa, Munster, 1540*

Figure 1. Woodcut map of Africa, 1540. Note the strange looking men and creatures.
(Courtesy: Dorset Press, New York, USA)

Portuguese. It became essential for them to find an alternate route via the equator, and a voyage past the equator proved that there was no boiling water there. In 1498, in an extremely courageous journey, Vasco da Gama discovered a sea route to Asia across the southern tip of Africa, reaching Calicut on the West Coast of India. Of course, this was not a new discovery, just new to Europe! The Arabs and Indians had been trading with each other for centuries before that. Indeed, Vasco da Gama had to hire an Arab to pilot his ship for him! Based on these travels, the Portuguese drew a detailed world map, which depicted the Indian coastline fairly accurately, and showed the path to India. This map was highly sought after by the rest of the world, and a copy was later smuggled out of Portugal and sold to the Italians.

Mapmaking and travelling in Europe were by this time becoming more tightly linked, and maps consequently more accurate.

Coinciding with this, or maybe causing it, was the increased interest in commercial trade. Regents from several parts of the world began to realise the amount of money that could be got from trade with countries in Asia and Africa. They began to fund more ships to discover trade routes, and make trade a regular source of money for their empire.

Queen Isabella of Spain sponsored Columbus's historic voyages between 1492 and 1502. Originally a mapmaker, he made several charts of which none survive – a sketch of the coast made by him however still survives (*Figure* 2), enabling one to get a feel for the very sketchy maps based on which these explorers conducted such lengthy and hazardous voyages. Soon after Columbus's expeditions, Magellan's epic voyage round the world in 1519–1522 confirmed once and for all that the world was round and could be circumnavigated. The cost in terms of human life was enormous – out of the 250 men who set out, only 18 survived, and Magellan himself died in the attempt. A description of the voyage by a sailor reads in part '*we ... ate the ox-hides, which were under the main-yard and also the sawdust of wood and rats...*' What motivated men such as these to carry out such journeys can only be guessed at. The dangers involved seem only to have spurred them along, and increased their courage, determination and of course greed – all of these were finally commercial enterprises, where if risks were enormous, so were the rewards.

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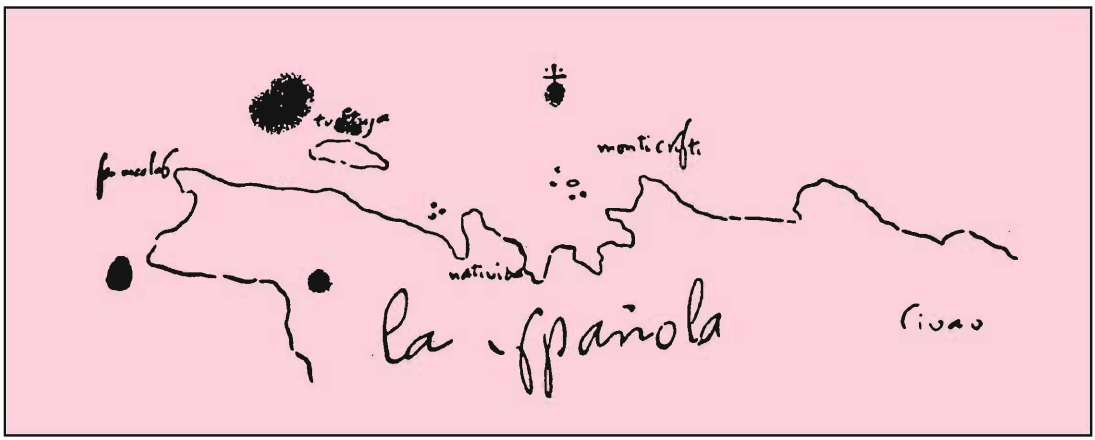


Figure 2. Sketch of the Northwest coast of Hispaniola by Christopher Columbus.
(Reproduced from John Noble Wilford, *The Mapmakers – The Story of the Great Pioneers in Cartography from Antiquity to the Space Age*, Vintage Books, 1982.)

In 1492, an agreement between the Portuguese and Spanish had divided up the entire world into two halves, one that would belong to Spain and the other to Portugal.

After Magellan's voyage, the level of trade and conquests in various parts of the world increased even further. Slowly, the Portuguese empire spread. They built towns in Goa and Calicut in India, and Malacca in Malaysia. Knowledge of the seas and accurate charts provided the main impetus, and maps became important state possessions, to be smuggled out by spies who literally risked their lives in doing so. Another issue too became important – by mapping a land, could a nation claim to own it? Certainly, the Europeans seemed to think so. In 1492, an agreement between the Portuguese and Spanish had divided up the entire world into two halves, one that would belong to Spain and the other to Portugal. India fell in the Portuguese half, and India then got a Portuguese Governor.

At the same time as this however, more scientific issues in mapping were being discussed and pondered. Such discussions brought forth major advances in the methodology of mapping, and laid the foundations of cartography as we know it today. These will be narrated in the next article.

Suggested Reading

[1] **John Noble Wilford, *The Mapmakers*, 1st edn. Knopf, New York, 1981.**

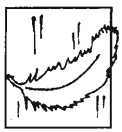
[2] **R V Tooley, *Maps and Mapmakers*, 6th edn. Crown, New York, 1978.**

[3] **John Goss, *The Mapmaker's Art: An Illustrated History of Cartography*, Rand McNally, Skokie, IL 1993.**

[4] **Daniel J Boorstin, *The Discoverers: A History of Man's Search to Know his World and Himself*, Vintage Books, New York, 1985.**

Address for Correspondence
Harini Nagendra
Centre for Ecological Sciences
Indian Institute of Science
Bangalore 560 012, India.

Units: The Mooney Unit



The plasticity of raw, or unvulcanized, rubber is sometimes given in terms of the torque on a disc situated in a cylindrical vessel containing rubber at a temperature of 100°C. The vessel rotates at 2 revolutions per minute and the torque on the disc after the vessel has been rotating for T minutes is measured on an arbitrary scale calibrated between 0 and 200. The number of the scale indicates the plasticity of the rubber in Mooney units, the result being expressed as so many Mooney units in T minutes. The unit is named after Dr Melvin Mooney, who devised the method in 1934.

H G Jerrard and D B McNeill, *A Dictionary of Scientific Units Including Dimensionless Numbers and Scales* (Chapman and Hall, London and New York, 1980), p.90.