The Geodesy Corner

HOW THE FLAT EARTH GOT ROUND : "AN ANCIENT HISTORY"

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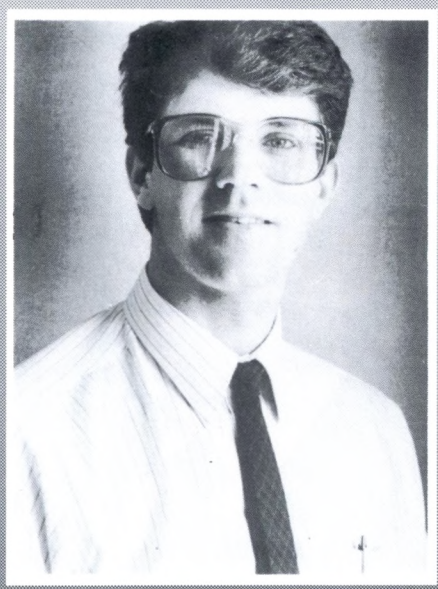

Long before the start of recorded history, the origins of the earth's natural, physical and spiritual properties were being studied by ancient civilizations.

Several thousand years before the birth of Christ, (2000-4000 BC) it is known that the Babylonian and Egyptian empires were discovering the bases for mathematical and astronomical principles. It is a shame that the knowledge of what took place so long ago was merely a memory, and was recounted only through tales told to the first recorders of history about 1000 BC. It is not entirely true that the science of writing letters and figures began in 1000 BC. In fact, around 1650 BC, an Egyptian scribe called Ahmose wrote a treatise summarizing the ancient Egyptian mathematics, but little of the written word has been found from before this time. With the virtual elimination of the Aegean civilization in ancient Crete around 1480 BC, the age of discovery was put on hold until 700 or 800 BC. At this time, with the emergence of a "technological revolution" - the ability to produce metal products - the birth of a new civilization took place. Once again, the profound yet elementary questions of who and what we are came to the fore.

At the time of this new Greek era, there was not an abundance of educated persons capable of the discoveries that would follow. Most of the learned were labelled "philosophers", and their studies included everything from astronomy, medicine, astrology and philosophy to cult rituals and pagan worship.

One of the first philosophers to go on record with a version of what the earth looked like was the Greek Thales (b. 625 BC). It is thought that much of his work in lunar and solar motion was based on knowledge he had gained from travels to ancient Babylonia and Egypt. However, his own beliefs of the earth involved the notion that water was the key to the universe, and that the earth was a flat disk floating on an infinite ocean.

A pupil of Thales, a fellow named Anaximander, is known to be the first person to draw a map of the earth as he saw it. He envisioned a cylindrical earth (to explain the change in star positions as he travelled) about an east-west axis. He also noted that the stars rotated about the Pole star, thus coming up with the idea that the sky was a complete sphere. As opposed to Thales, Anaximander thought that the fundamental element of the universe was a mystical formless mass, although he still believed Thales' theory that life originated with water.

Yet another Greek philosopher, Anaximenes, decided that Thales had the correct notion about the earth as a flat plane or disk, but he added his idea of a fundamental substance to the equation. He thought that air was the root of the universe, and he would have a flat earth, surrounded by water, suspended by compressed air.

About the time of the deaths of Thales, Anaximander and Anaximenes, came the birth of Pythagoras (580 BC). Apart from his teachings of Pythagoreaism, a secretive cult with quite odd beliefs, and his work in mathematics, Pythagoras was the first to speculate the earth was a sphere. He also postulated on the motions of the planets, sun and moon, and his beliefs would remain valid until Kepler revolutionized orbital theories in the late 16th century AD. Carrying on the rationalist thinking of Thales, Hecataeus, a contemporary of Pythagoras, built upon the map-making work of Anaximander. He took the world as it was then known, and divided it into a north half and a south half, with Europe and Asia representing the respective halves. In this depiction, the Mediterranean Sea

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formed the dividing line and - as was common at the time - the focal point. Again, the "world" was surrounded by a vast body of water which he labelled Oceanus.

Over the next hundred or so years, navigators, astronomers and philosophers from the Greek and Phoenician civilizations followed with slightly different versions of the earth's form and size. Some were of the "flat earth" school, while others followed Pythagoras's spherical theories. It was also through this period, especially in Greece, that moral philosphy was taking over from natural philosopy, or science, as the accepted area of interest. With the teachings of philosophers such as Socrates and Plato, the study of the natural earth took a back seat for a while. It was not until some two hundred years after Hecataeus that a new map of the earth was drawn by a Greek astronomer name Eudoxus (b. 408 BC). In his works he also created a map of the stars, with divisions of the sky in terms of degrees of latitude and longitude. As we know now, these would later be applied to the earth's surface.

Among his many postulates and discoveries, one of the most important theories the great Greek philosopher Aristotle (b. 384 BC) proposed, was the reasoning behind a spherical earth. He suggested that, since stars in the south disappear, and stars in the north appear as one travels northward, the earth must be round. If it were flat, he said, all stars would be equally visible from all points on its surface. At the same time as Aristotle was revolutionizing science, the Greek geographer Dicaearchus described his version of the world, and was the first to consider the map of the world as part of a sphere. He built upon the discoveries of some of the explorers of the time, and was able to describe a line of latitude from east to west. This line showed how all points on the line saw the noonday sun at equal angles from the zenith.

Elaborating upon the work of Dicaearchus, was a Greek geographer and explorer called Pytheas (b. 300 BC). He was able to determine latitude of his home town, and was the first to point out that tides could be the result of influence by the moon. Although these ideas are entirely commonplace in the modern world, one must remember the difficulty these ancient scientists had in actually proving their theories, let alone getting anyone to believe them.

By the time the Greek Eratoshenes came on the scene, the idea of a spherical earth was becoming accepted by scholars. Eratoshenes is generally regarded as being one of the fathers of geodesy, and among his many discoveries, it is his historical measurement of the latitude between Alexandria and Aswan that made him most famous. This measurement determined the radius of the earth to be 6267 kilometres - not bad for using range poles and angles to the sun. At this point in history, Eratoshenes' world included Europe and Britain, Asia and India, and Africa south to about the Arabian Gulf. In addition, all this land was, according to Eratoshenes, surrounded by one interconnected ocean, a theory which would not be proved until Magellan circumnavigated the world in the early 16th century.

The age of more modern theories of the earth's size and shape began again in earnest in the 13th and 14th centuries, at which time many new, perhaps more scientific, discoveries were made. However, to talk about the developments from this era to the present would take a great deal more space, of which I have no more.

Thus, the earth had at last become round, and man and woman alike could live comfortably in the knowledge that they would not fall off, dare they journey too far. But didn't someone just ask me if I wanted to join the Flat Earth Society ....

Next time in the Geodesy Corner - The Connection between Datums and Ellipsoids.

REFERENCES:

1. *Asimov, Issac. Asimov's Biographical Encyclopedia of Science and Technology. ISBN 0-385-17771-2.*
2. *Vanicek, Petr and Edward J. Krakiwsky. 1982. Geodesy: The Concepts. ISBN 0-444-86149-1. New York: North-Holland Publishing Company.*
3. *The History of Science and Technology - A Narrative Chronology. ISBN 0-87196-475-9, Vol 1.*

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