**TITLE:** *World according to Anaximander and Anaximenes*
**DATE:** *6th century B.C.*
**AUTHORS:** *Anaximander and Anaximenes of Miletus*
**DESCRIPTION:** Homer *(#105)* was thought to have lived somewhere in Ionia, the culturally Greek area of Asia Minor, perhaps not too far from Miletus, where Greek rational science was born and Greek mapmaking began. Early rational attempts to describe the earth, if not to map it, were abstract and theoretical. Along with other Greek cities in Asia Minor, Miletus benefited from numerous intellectual, economic, and cultural stimuli which fostered scholarly and rational activity Until its destruction by the Persians in 494, it was a wealthy center of trade, in contact with the scientific and artistic achievements of the Near East and Egypt. Its citizens openly engaged in political debate. The laws they formulated were intended both to engender citizen consent and to express the political will of the majority; in addition, a widely disseminated and fully alphabetic script rendered the laws easily accessible.

The philosophical analog to political debate and open discussion is critical inquiry, which forms the foundation of rational science. As a vigorous center of commercial and colonizing activity, Miletus was likely a hub of varied geographic information circulated by sailors in port, and it was from this environment that geographic theory and empirical frameworks were developed. Early Greek terrestrial maps probably reflected both practical and abstract aims: to demonstrate the physical relationship between places as well as to prove a sense of order in the world and human (that is, Ionic Greek) control over that world order.

Early efforts to produce terrestrial maps lacked a strictly empirical tradition. In contrast, sky maps were developed from both abstract geometric principles and from direct observations of the risings and settings of stars, carefully recorded. Sky maps had both theoretical (cosmology) and practical (astrology and calendars) applications. Although early Greek cartographic initiatives in all likelihood derived from Babylonian and Egyptian traditions, the evidence for the transmission and reception of the relevant mathematical concepts is circumstantial at best. Only in the third century B.C. do the paths of transmission become securely detectable. Otherwise, the earlier Greek evidence is either entirely lost or survives merely quoted without context in scant fragments.

This monograph shows a reconstruction by Arthur Cavanagh of the world-view as conceived by the Ionian Anaximenes of Miletus. As the successor to Anaximander, and the third in the series of Ionic philosophers, Anaximenes is said (by Aristotle) to have held that the earth was of irregular quadrangular form, in consequence of its pressing it down like the lid of a vessel. This concept consists of a rectangular world supported by compressed air. Shown here in the modern reconstruction are the Mediterranean Sea and a circumfluent *Ocean Sea*. Anaximenes maintained also that the sun and stars did not descend beneath the earth, and rise again at its other extremity, which appears to have been the prevalent doctrine in his day, but that they were carried around the earth, at a great distance, and that the light of the sun was intercepted during the night by high mountains.

The age of Anaximenes has not been determined with certainty, but he was certainly intermediate between Anaximander of Miletus and Anaxagoras, and may be regarded as having flourished in the last half of the sixth century B.C.

Anaximander (Ancient Greek: Ἀναξίμανδρος), (born 610 *BC*, Miletus—died 546/545 *BC*) was a pre-Socratic Greek philosopher who lived in Miletus, a city of Ionia. He belonged to the Milesian school and learned the teachings of his master Thales. He

succeeded him and became the second master of that school where he counted Anaximenes and Pythagoras amongst his pupils. A Greek philosopher, often called the founder of astronomy, he apparently wrote treatises on geography, astronomy, and cosmology that survived for several centuries and made a map of the known world. He was the first thinker to develop a cosmology. A rationalist, he prized symmetry and used geometry and mathematical proportions to help map the heavens; his theories thus departed from earlier, more mystical conceptions and foreshadowed the achievements of later astronomers. Whereas earlier theories had suggested that the earth was suspended or supported from elsewhere in the heavens, Anaximander asserted that the earth remained unsupported at the center of the universe because it had no reason to move in any direction.

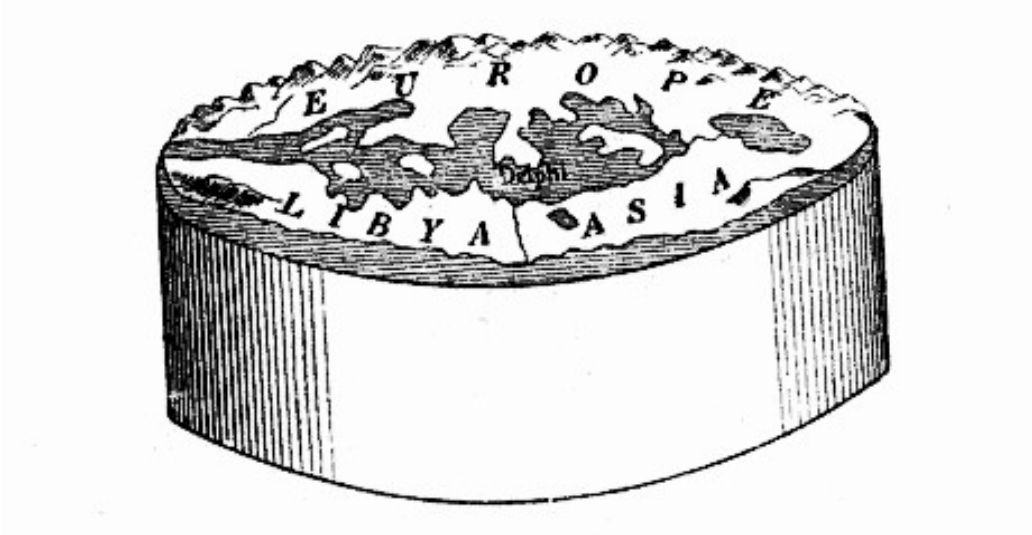
Anaximander of Miletus was not only the first Greek to be credited with drawing a map in the formal sense according to Eratosthenes, but he also engaged in broad intellectual pursuits and may even have founded a colony, perhaps on the Black Sea. Among the geographic titles attributed to him are *Circuit of the Earth, On Fixed Stars,* and *Celestial Globe*. We cannot be certain of the content of these works or even of their existence. It is also debated whether Anaximander wrote a commentary on his map or on the construction of his celestial globe. Even so, works with the titles cited, whether real or apocryphal, imply an informed preoccupation with both celestial and terrestrial cartography, and it seems credible that Anaximander was motivated to give a rational and critical account of the origin of the cosmos and the spread of human civilization. He believed that the same forces underlying the creation of the cosmos continued to guide it, and that these forces accounted for meteorological phenomena and climatic conditions.

Anaximander's terrestrial map comprised an outline (*perimetron*) of the earth and sea; the late antique Greek geographer Agathemerus (ca. 400) adds that Anaximander "dared to draw" a map of the *oikoumene* [inhabited world] on a *pinax* (tablet), a Greek word used both of painted panels and of bronze tablets. It is impossible to reconstruct with any reliable accuracy either the map or even its shape and size, let alone Anaximander's written account. His treatise perhaps began with a cosmological introduction; then, by combining history, astronomy, and geography, it may well have proceeded in lecture format to discuss the arrangement of natural and man-made landmarks, cities, and climate as revealed in the pictorial map. His geographic successors followed this approach.

Anaximander envisioned the world as a shallow but broad cylinder, its depth one third of its width, "like a stone column," hanging freely in the air, equidistant from other celestial objects, the upper face of which alone is inhabited. This cylinder, he states, is one-third as high as its diameter, and it floats freely in the centre of the celestial vault, because there is no reason why it should move to one side rather than the other. Leucippus, Democritus, Heraclitus, and Anaxagoras all adopted this purely imaginary form. Europe made the northern half, and *Lybia* [Africa] and Asia the southern. All scholarly reconstructions of his map envision a flat circle of earth surrounded by the stream of Ocean. His *oikoumene* was seemingly divided into thirds, namely, Europe, Asia and Libya, separated by the Nile and *Phasis* rivers and the Mediterranean Sea and Black Sea. There is no consensus regarding the relative sizes of the landmasses, let alone the map's center: Delphi, Delos, and Miletus have all been proposed. The shape of the *oikoumene* is further disputed. His map may have incorporated a three-point coordinate

system, corresponding to the rising and setting of the sun on the days of the equinoxes and solstices.

Anaximander is also said to have constructed a celestial globe, placing the earth at the center, following the pattern noted above on Achilles' shield. Anaximander devised ratios for relative distances between celestial bodies, placing the sun, equal in size to the earth, in a terrestrial orbit of twenty-seven times the diameter of the earth; the radius of the moon's orbit was eighteen times the earth's diameter, a progression of multiples of the number nine. The distance of the sphere of fixed stars, which he placed closest to the earth, was presumably nine times the earth's diameter. The ratios of this celestial map have been connected to architectural proportions, and, intriguingly, Anaximander's approach to drafting both celestial and terrestrial maps may have derived from architecture. Like an architect designing a temple, a cartographer would sketch a frame of the *oikoumene* on bronze or wood and build up his plan of the world from it. To both his cosmic and terrestrial plans Anaximander applied a tripartite division together with the rules of proportionality and symmetry which guided Mediterranean architecture, especially column drums; he is known to have compared the earth to a stone column. Clearly, his efforts were further guided by the practical applications of mathematics.




*A modern interpretation of Anaximander's world concept*

The Homeric conception of the world represented as a flat, rectangular-shaped land surrounded by a continuous ocean-stream remained a popular notion in the Greek world even after many philosophers and scientists had accepted the theory of the sphericity of the earth enunciated by the Pythagoreans and subjected to theoretical proof by Aristotle (*see #104*). In this interpretation the world is like a plateau on the top of a mountain; inside this, close to the surface of the earth, lies the *House of Hades*, the *Realm of Death*, and beneath it *Tartarus*, the *Realm of Eternal Darkness*. The plateau of the earth is surrounded by *Oceanus*, the world river, and from its periphery rises the fixed dome of the sky. The sun, the moon, and the stars rise from the waters at the edge of the dome, move in an arc above the earth, and then sink once again into the sea to complete their course beneath the *Oceanus*. The atmosphere above the mountain of the earth is thick with clouds and mist, but higher up is the clear *Æther* with its starry ceiling.

Anaximander's bold use of non-mythological explanatory hypotheses considerably distinguishes him from previous cosmology writers such as Hesiod. It confirms that pre-Socratic philosophers were making an early effort to demystify physical processes. His major contribution to history was writing the oldest prose document about the universe and the origins of life; for this he is often called the "Father of Cosmology" and founder of astronomy. However, pseudo-Plutarch states that he still viewed celestial bodies as deities.

Anaximander was the first to conceive a mechanical model of the world. In his model, the earth floats very still in the centre of the infinite, not supported by anything. It remains "in the same place because of its indifference", a point of view that Aristotle considered ingenious, but false, in *On the Heavens*. Its curious shape is that of a cylinder with a height one-third of its diameter. The flat top forms the inhabited world, which is surrounded by a circular oceanic mass.

Such a model allowed the concept that celestial bodies could pass under it. It goes further than Thales' claim of a world floating on water, for which Thales faced the problem of explaining what would contain this ocean, while Anaximander solved it by introducing his concept of "infinite" (*apeiron*).

At the origin, after the separation of hot and cold, a ball of flame appeared that surrounded the Earth like bark on a tree. This ball broke apart to form the rest of the universe. It resembled a system of hollow concentric wheels, filled with fire, with the rims pierced by holes like those of a flute. Consequently, the sun was the fire that one could see through a hole the same size as the earth on the farthest wheel, and an eclipse corresponded with the occlusion of that hole. The diameter of the solar wheel was twenty-seven times that of the earth (or twenty-eight, depending on the sources) and the lunar wheel, whose fire was less intense, eighteen (or nineteen) times. Its hole could change shape, thus explaining lunar phases. The stars and the planets, located closer, followed the same model.

Anaximander was the first astronomer to consider the sun as a huge mass, and consequently, to realize how far from earth it might be, and the first to present a system where the celestial bodies turned at different distances. Furthermore, according to Diogenes *Laertius* (II, 2), he built a celestial sphere. This invention undoubtedly made him the first to realize the obliquity of the Zodiac as the Roman philosopher Pliny the Elder reports in *Natural History* (II, 8).

He saw the sea as a remnant of the mass of humidity that once surrounded earth. A part of that mass evaporated under the sun's action, thus causing the winds and even the rotation of the celestial bodies, which he believed were attracted to places where water is more abundant. He explained rain as a product of the humidity pumped up from the earth by the sun. For him, the earth was slowly drying up and water only remained in the deepest regions, which someday would go dry as well. According to Aristotle's *Meteorology* (II, 3), Democritus also shared this opinion.

Both Strabo and Agathemerus (later Greek geographers) claim that, according to the geographer Eratosthenes, Anaximander was the first to publish a map of the world. The map probably inspired the Greek historian Hecataeus of Miletus (#*108*) to draw a more accurate version. Strabo viewed both as the first geographers after Homer.

Local maps were produced in ancient times, notably in Egypt, Lydia, the Middle East, and Babylon. They indicated roads, towns, borders, and geological features. Anaximander's innovation was to represent the entire inhabited land known to the ancient Greeks.

Such an accomplishment is more significant than it at first appears. Anaximander most likely drew this map for three reasons. First, it could be used to improve navigation and trade between Miletus' colonies and other colonies around the Mediterranean Sea and Black Sea. Second, Thales would probably have found it easier to convince the Ionian city-states to join in a federation in order to push the Median threat away if he possessed such a tool. Finally, the philosophical idea of a global representation of the world simply for the sake of knowledge was reason enough to design one.

Surely aware of the sea's convexity, he may have designed his map on a slightly rounded metal surface. The center or "navel" of the world (**ὀ**μφαλός γ**ῆ**ς/omphalós gẽs) could have been Delphi, but is more likely in Anaximander's time to have been located near Miletus. The Aegean Sea was near the map's center and enclosed by three continents, themselves located in the middle of the ocean and isolated like islands by sea and rivers. Europe was bordered on the south by the Mediterranean Sea and was separated from Asia by the *Pontus Euxinus* [the Black Sea], the Lake Maeotis, and, further east, either by the *Phasis River* (now called the Rioni) or the *Tanais.* The Nile flowed south into the ocean, separating *Libya* (which was the name for the part of the then-known African continent) from Asia.

Anaximenes, without giving a precise opinion as to the form of the earth, made it out to be supported on compressed air (see below), though he gave no idea as to how the air was to be compressed. Plato thought to improve upon these ideas by making the earth cubical. The cube, which is bound by six equal faces, appeared to him the most perfect of solids, and therefore most suitable for the earth, which was to stand in the centre of the universe.

**Location:** *(map only exists as reconstruction)*
**References:**
Talbert, R.J.A., Georgia Irby, *Ancient Perspectives*, 2012, pp. 89-91.
Dilke, O.A.W., *Greek and Roman Maps*, pp. 21-24, 56, 81.