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THE WORLD MAP BY ANAXIMANDER (MILETUS, 5TH CENTURY BC): MODELING GEOGRAPHICAL SPACE AT THE BEGINNING OF SCIENCE

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ABSTRACT

According to the Greeks science began in Miletus (Ionia) in the 6th century BC, linked to the need to provide rational explanations about the functioning of nature. In a context in which the mythical-religious perspective appeared with limited utility for a society that notably expanded its ethnocultural ties, Anaximander (610-546 BC) made important contributions to the understanding of the origin, the structure of the universe, the Earth and drafted the first map of the world in his book on nature. This study includes a hypothetical construction of the map and analyzes each of its components as concrete spatial elements of conceptual aspects that are present in the most distant antecedent of the modeling of geographic space within the framework of Geography as a spatial science.

Keywords: Geography, Ionian Science, Anaximander, Ancient Cartography, Flat Earth

EL MAPA DEL MUNDO DE ANAXIMANDRO (MILETO, SIGLO V AC): MODELANDO EL ESPACIO GEOGRÁFICO EN EL COMIENZO DE LA CIENCIA

RESUMEN

Conforme a los griegos, la ciencia comenzó en Mileto (Jonia) en el siglo VI AC, se vincula a la necesidad de brindar explicaciones racionales acerca del funcionamiento de la naturaleza. En un contexto en el que la perspectiva mítico-religiosa se presentaba con limitada utilidad para una sociedad que ampliaba notablemente sus vínculos etnoculturales, Anaximandro (610-546 AC) realiza importantes contribuciones para la comprensión del origen, la estructura del universo, la Tierra y llegar a la realización del primer mapa del mundo en su libro sobre la naturaleza. El presente trabajo incluye

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una construcción hipotética del mapa y analiza cada uno de sus componentes como elementos espaciales concretos de aspectos conceptuales que se encuentran presentes en el antecedente más lejanos del modelado del espacio geográfico en el marco de la Geografía como ciencia espacial.

Palabras claves: Geografía, Ciencia Jónica, Anaximandro, Cartografía antigua, Tierra plana

INTRODUCTION

The first attempts made by Western culture to rationally explain the world took place in Miletus (Ionia) in the 6th century BC, when science began as a way of thinking that attempted to move away from mythical-religious explanations with the intention of understanding how nature (φύσις) works through the analysis of its characteristics and behaviours.

The continuous expansion of knowledge about nature would develop for almost four centuries, until Eratosthenes (276-194 BC) measured with great precision the diameter of the Earth's sphere by trigonometry[2] and delimited a specific field of study for the construction of knowledge about our planet, which he called Geography (γεωγραφία). Although the concept alludes to its precise etymology which corresponds to the representation of the Earth, Geo=Earth, Graphy=to chart, to record, to draw, to represent[3] it´s possible to be verified in studies at different scales, from planet earth to the ecumene as human habitat[4].

After its inception and consolidation, the search for antecedents showed that the world map by Anaximander (610-546 BC) was the first result produced with a geographical purpose. It is an intellectual development that represented an important epistemological advance and was positioned as the first geographical contribution to nascent scientific rationality[5]. It constitutes the basis for advancing in the formulation of new explanations as a conceptual system of geometric construction for the formulation of hypotheses[6].

With the intention of analysing its conceptual scope, this paper focuses on Anaximander's map of the world as a result of rationalist and quantitative abstraction. It is the first example that supports the use of mathematics as the language of science

2 Roller, Duane (2010). *Eratosthenes´Geography.* New Jersey, Princeton University Press.

3 Ortega Valcárcel, José (2000). *Los horizontes de la Geografía. Teoría de la Geografía.* Barcelona, Ariel.

4 Rojas López, José & Enrique Gómez Acosta (2010), "Tiempos del pensamiento geográfico"; en: *Archivo Arquidiosesano de Mérida*, Estudios 9.

5 Buzai, Gustavo D (2017), "El mapa de Anaximandro: primer aporte geográfico a la racionalidad científica"; en: *Boletín de Estudios Geográficos*, n° 108, p 33-48.

6 Bunge, Mario (2003). *Emergencia y convergencia.* Barcelona, Gedisa.

and geometry as the language of spatial forms, both to understand geographical space and to act in it.
The main objective is to put the first map of the world in context, as a worldview and at the beginning of Geography as a spatial science.

GEOGRAPHICAL STUDIES: TEMPORAL AND SPATIAL CONTEXT

Although the term Geography had not yet been coined, Anaximander's map of the world can be considered the first geographical production and one of the first contributions to the beginnings of science.
The historical analysis of Geography as a science in Archaic and Classical Greece[7]-[8]-[9]-[10] allowed the possibility of constructing a timeline occupied by the main scientists related to rationalist and quantitative Geography.
The beginning can be dated to the 6th century BC when the mythico-religious aspects transmitted by Homer through the epic poems of The Iliad (Ἰλιάς) and The Odyssey (Ὀδύσσεια) were considered insufficient to understand the world. These books were used in the teaching of Greek mythology through stories of anthropomorphic gods, in this sense, for centuries they were important in entrenching ethno-cultural identity by generating a national sentiment[11] among geographically dispersed city-states that together formed Hellas (Ἑλλάς), a term used to denote the Greeks' region of identity in a highly fragmented geographical space.
In Miletus (Ionia, Asia Minor, now Turkey) appeared the so-called Ionian School, composed of a group of thinkers who tried to find rational explanations for the total manifestations of nature. Its greatest exponents were Thales (625-547 BC), Anaximander and Anaximenes (585-528 BC), who gained great recognition for their valuable intellectual advances.
Science based on the construction of rational and systematic knowledge arises. Thales can be considered the first scientist to attempt to understand the world through this original approach and to provide a date that can be considered the beginning of the history of European[12] science, when on 28 May 585 BC the solar eclipse he

7 Aujac, Germaine (1975). *La géographie dans le monde Antique*. Paris, Presses Universitaires de France.

8 Prontera, F (2003), "Otra forma de mirar el espacio: geografía e historia en la Grecia antigua"; en: *Monografías,* n° 19. Málaga, Centro de Ediciones de la Diputación de Málaga.

9 Jacob, Christian (1991). *Géographie et ethnographie en Gréce ancienne*. Paris, Armand Colin.

10 Cuprie, Dirk L (2011*). Heaven and Earth in Ancient Greek Cosmology, From Thales to Heraclides Ponticus*. New York, Springer.

11 McPhail, Cameron (2015). *The Roles of Geographical Concepts in the Construction of Ancient Greek Ethno-cultural Identities, from Homer to Herodotus: An Analysis of the Continents and the Mediterranean Sea*. PhD Thesis. Dunedin, University of Otago.

12 Sagan, Carl (1982). *Cosmos.* Barcelona, Planeta.

had predicted took place[13]. His disciple, Anaximander, used experimentation for the construction of knowledge[14-15-16] and made contributions of great importance, including the publication of the first scientific book, thus completing all stages of the research process[17]. It is possible to affirm that his active participation in the emergence of science and the construction of the first map of the world are elements that allow us to consider him the first geographer, although Geography had not yet been created as a field of knowledge.

From a geographical perspective, it is of interest to analyse why this revolution in thought took place in a peripheral region of Hellas and not in one of the major cities of Greece, Asia, Egypt, Mesopotamia, India or China. The major population centres held established ideas that were difficult to change[18]. In Ionia new urban centres emerged that were structured by the commercial confluence of seafarers from Europe, Asia and Africa, and these links showed the impossibility of sustaining a single thought; there was a great exchange, not only of merchandise, but also of histories and ideas that supported a critical attitude.

When different religious ideas appeared in the same territory and, as a result, different gods superimposed their powers in the same geographical space, the doubt arose as to which of them would be the true one. An impossible answer, because if there was a real one, all the others had been an invention of the priests and this could be in all cases. In the attempt to overcome the mythical-religious explanations, an attempt was made to understand the world by searching for nature's own principles. Knowledge was not obtained dogmatically through faith, but could be constructed rationally and this was the scientific attitude.

Analysing a period of eight centuries, from the 6th century BC to the 2nd century AD, we can discover the first historical alternation between quantitative (comprehensive) and qualitative (descriptive) thinking, that of a Geography linked to general, regular, modellable aspects, and a Geography linked to the study of population and history in the ecumene. An alternating succession of perspectives of approximately two centuries in length emerges, the modellable contributions with Anaximander (6th Centrury BC), Erathostenes (2nd Century BC) and Ptolemy (2nd Centrury AD) and the historical contributions with Homer (8th Centrury BC), Herodotus (4th Century BC) and Strabo (year zero). These great approaches of thought will accompany modern

13 Lledó, Emilio (1979). *Los primeros filósofos. Universitas*. Barcelona, Salvat, p 31-7.

14 Kirk, Geoffrey S, John E Raven, John & Malcoln Schofield (2009). *The Presocratic Philosophers*. Cambridge, Cambridge University Press.

15 Cuprie, Dirk L, Robert Hahn & Gerard Naddaf (Eds) (2003). *Anaximander in Context: New studies in the origins of Greek philosophy.* Albany, State University of New York Press.

16 Gregory, Andrew (2016). *Anaximander. A Re-assessment*. New York, Bloomsbury Academic.

17 Rovelli, Carlo (2011). *The First Scientist: Aneximander and His Legacy*. Yardley, Westholme Publishing.

18 Sagan, Carl, Anne Druyan & S Soter (1980). *Cosmos*, TV program, Chapter 7: The Backbone of Night.

Geography in the positivism-historicism succession until today[19] and the changes in regular periods will be understood as paradigm changes[20].
Geography in ancient Greece, in the period analysed, shows for the first time the existence of cycles of scientific thought[21]. In the contributions made by Thales and Anaximander we can find the beginning of Quantitative Geography[22] giving the basis to a paradigm that participates with centrality for millennia[23].

SCIENTIFIC CONTRIBUTIONS OF ANAXIMANDER

Currently, no original documents of Anaximander's work are preserved, in this sense, it is only possible to make use of doxography, that is bibliographical quotations made by ancient writers who studied the thought of philosophers and scientists. The studies we have consulted, in general, refer to a fundamental reference work that reconstructs pre-Socratic thought from the analysis of original texts preserved from the first analysts of the period[24].
In these works there are important references for the reconstruction of philosophical perspectives and, in the case of Anaximander, collects original contributions in philosophical, cosmological, geographical and biological aspects[25]. These aspects will be presented below and converges with the construction of the first map of the world.

BOOK

Ancient librarians and historians, in the absence of the original texts, attributed titles according to the subject studied by the author
Doxography: Anaximander was "the first of the Greeks to our knowledge who ventured to publish a treatise *On Nature*"[26].

19 Buzai, Gustavo D (2004). *Geografía Global.* Bs As, Lugar Editorial.

20 Kuhn, Thomas S (1970). *The Structure of Scientific Revolutions*. Chicago, The Chicago University Press.

21 Vilá Valentí, Joan (1983). *Introducción al estudio teórico de la Geografía*. Barcelona, Ariel.

22 Martin, Geoffrey J & Preston E James (1993). All *Possible Worlds. A History of Geographical Ideas*. New York, John Wiley & Sons.

23 Aneas, Susana (2005), "Los primeros veinte siglos de Geografía"; en: *Revista de Geografía*, vol 7, n° 9, p 49-57.

24 Diels, Hermann & Walther Kranz (1952), "Die Fragmente der Vorsokratiker. (Fragments of the Pre-Socratics)", vol I, 1922, 1934 and 1952 editions, 1954 to 1966. Reprints (Cited as DK).

25 Couprie, Dirk L (2001), "Anaximander (c 610-546 BCE)"; in: Fieser, James & Bradley Dowden (Eds) *Internet Encyclopedia of Philosophy*. http://www.iep.utm.edu/anaximan/

26 Themistius, *The Private Orations*, 36, p 317.

On Nature was the first subject of scientific publication[27], and although not the title of the book, it can be considered the first treatise of Geography[28]. The fragments of the complete doxography allow the delineation of a worldview. Its content shows reflections about the universe, planet earth, time and geographic space, whose representations allow the realization of the world map.

ORIGIN

The first philosophers had an initial concern for the origin (ἀρχή, *Arkhé*) of everything known. In contrast to Thales who considered it water, Anaximander conceptualized it as indeterminate, unlimited or infinite (*Apeiron*).
Doxography: "Anaximander, the son of Praxiades, was a native of Miletus. He laid down as his principle and element that which is unlimited without defining it as air or water or anything else. He held that the parts undergo change, but the whole is unchangeable"[29], "there is a body distinct from the elements, the boundless, which is not air or water, in order that the other things may not be destroyed by their infinity. The elements are in opposition to each other: air is cold, water moist, and fire hot. Therefore, if any one of them were infinite, the rest would have ceased to be by this time. Thus, he said that what is infinite is something other than the elements, and from it the elements arise"[30].

> 'unlimited' cannot be derived from any other principle, but is itself regarded as the principle of the other things, 'embracing and governing all'. "So the 'unlimited' cannot be derived from any other principle, but is itself regarded as the principle of the other things, 'embracing and governing all'. Water plays a central role in the beginning of life on the planet. Life originated in water and simple forms evolved into more complex forms in the continuous adaptive change of species.
> Doxography: "Living creatures came into being from moisture evaporated by the sun. Man was originally similar to another creature-that is, to a fish"[31].

It is thus possible to consider that the theory of evolution formulated by Charles Darwin (1809-1882) was proposed 2.500 years earlier.
The *apeiron* (infinity) produces the origin of the universe. Today, science explains it through the Big Bang theory, a cosmological model that considers the beginning as

27 Kirk, Geoffrey S, John E Raven & Malcolm Schofield (2009). *The Presocratic Philosophers.* Cambridge, Cambridge University Press.

28 Heidel, William A (1921), "Anaximander´s Book, the Earliest Known Geographical Treatise"; in: *Proceedings of the American Academy of Arts and Sciences,* vol 56, n° 7, p 239-88.

29 Diogenes Laertius, *The Lives, Opinions and Remarkable Sayings of the Most Ancient Philosophers*, II, p 1-2.

30 Aristotle. *Physics*, 3.3.

31 Hippolytus. *Refutatio Omnium Haeresium*, 1.6.6.

a big explosion that created space and time. However, although it is the most widely accepted explanation, modern cosmology reorients it to explain its evolution[32] and the origin remains undetermined, so Anaximander's consideration is still valid[33].

UNIVERSE

Anaximander considers that the origin of the universe took place from a rotation of elements that produce differentiation between cold and heat. In the cold centre there is the earth, the air and the clouds, from there three concentric spheres, successively corresponding to the stars, the moon and the sun, these spheres are like dark curtains with holes that allow the light of the fire to pass through from the distant heat zone[34-35].
Doxography: "Anaximander says that the Stars are borne by the circles and spheres on which each one is mounted"[36], "The sun is the highest body, and lowest are the circles of the fixed stars"[37], "Anaximander located both planets and fixed stars below the moon"[38], "That the earth, which is of spherical shape, lies in the midst, occupying the place of a centre"[39].
The consideration of the spherical universe as a cosmological structure was maintained until the scientific revolution in the 15th century initiated by the publication of *De revolutionibus orbium coelestim* by Nicolaus Copernicus[40], a period in which the scientific bases of Geography as a spatial science are found[41].

SUN AND MOON

Considering that the sun's rays reach the earth's surface in parallel, he was able to conclude that the sun is the most distant celestial body with a size much larger than

32 Gangui, Alejandro (2009). *Cosmología.* Bs As, Ministerio de Educación.

33 Theodosiou, Efstratios; Mantarakis, P; Dimitrijevic, Milan; Manimanis, Vassillos & Danezis, E (2011). "From the infinity (Apeiron) of Aneximander in Ancient Greece to the Theory of Infinite Universe"; in: *Modern Cosmology, Astronomical and Astrophisical Transactions,* n° 27, n° 1, p 162-176.

34 Kahn, Charles H (1994). *Anaximander And The Origins of Greek Cosmology,* Indianapolis, Hackett Publishing.

35 Couprie, Dirk L (1995) "The Visualization Of Anaximander´s Astronomy"; *en: Apeiron*, n° 28, n° 3, p 159-181.

36 Aëtius, *On the opinion of the philosophers,* II, 16, 5

37 Hippolytus, *Refutatio* …, I, 6, 5.

38 Aëtius, *On the opinión* …, II, 15, 6

39 Diogenes Laertius, *The Lives*, 2,1.

40 Copérnico, Nicolás (1965) [1543]. *Las revoluciones de las esferas celestes*. Buenos Aires, Eudeba, libro I, Los Fundamentos.

41 Buzai, Gustavo D (2016) "La Geografía como ciencia espacial. Bases conceptuales de la investigación astronómica vigentes en la Geografía Cuantitativa"; en: *Revista Universitaria de Geografía,* n° 25, n° 1, p 11-30.

that of the earth. Sunlight and moonlight arrive through tubes that pass through the dark curtain of the celestial sphere. The arrangement of the celestial spheres is in the order presented in the previous topic.
Doxography: "According to Anaximander, the sun is a circle twenty-eight times the size of the earth and resembles a chariot wheel. The felloe is hollow and filled with fire. At a certain point it allows the fire to shine out through an orifice, as though through the nozzle of a pair of "bellows"[42]. "The moon is a circle nineteen time size of the earth. Resembling a chariot wheel hollow and full of fire like that as the sun. It lies oblique also like the sun and has one blow-hole like the nozzle of a pair of bellows"[43]; "The circle of the moon eighteen times larger and the sun is highest, the circles of the fixed stars lowest"[44]; "According to Anaximander, the moon is eclipsed when the orifice in the wheel becomes blocked"[45].
It is a geocentric system formed by the flat Earth in the center and several concentric spheres around it. The Sun is in the most distant sphere.

EARTH

> That the earth, which is of spherical shape, lies in the midst, occupying the place of a centre. The cosmological view suggests that it is impossible for the Earth to be supported, but that it is stable at the centre by equidistance to all the elements that make up the spherical universe. Doxography: "Its form is cylindrical (*kylindroeidés*), with a depth one third of its width"[46]. "Its shape is curved, round, similar to a drum of a column; of its flat surfaces we walk on one, and the other is on the opposite side"[47]. "The earth remains aloft, unsupported by anything, because of its equidistance from everything"[48]. "There are some who say that the earth remains in place because of similarity, as did Anaximander among the ancients; for a thing established in the middle, with a similar relationship to the extremes, has no reason to move up or down or laterally; but since it cannot proceed in opposite directions at the same time, it will necessarily remain where it is"[49].

Anaximander's Earth resembles a slice of a column with a diameter three times longer than its height and on its upper flat face is the world modelled on the map. In this way, the universe doubles in size when considering the space below and not visible.

42 Aëtius, *On the opinión …,* II, 20, 1.

43 Aëtius, *On the opinion,* II, 25, 1.

44 Hyppolitus, *Refutatio Omnium Haeresium,* 1.6, p 1-7.

45 Aëtius, *On the opinión …*, II 29, 1.

46 Pseudo-Plutarch, *Stromatesis,* 2.

47 Hyppolytus, *Refutatio …,* 1.6.3.

48 Hyppolytus, *Refutatio …,* 1.6.3-4.

49 Aristotle, *De Caelo Comentaria*, B.13.

TIME MEASUREMENT

Anaximander was an empirical philosopher. In the analysis of the time dimension, his experiment included systematic measurements of the movement of the shadows of a rod perpendicular to the earth's surface to accurately determine the length of the year and the seasons. Men had used rods for centuries for fighting and Anaximander put them to use in scientific experimentation[50].

Doxography: "He was the first inventor of the gnomon and set it up for a sundial in Lacedaemon, as is stated by Favorinus in his *Miscellaneous History*, in order to mark the solstices and the equinoxes; he also constructed clocks to tell the time"[51.] "He was the first to construct *gnomons* for the identification of solstices, time spans, *horai* and the equinox"[52].

The gnomon is the part of the sundial that casts the shadow on a graduated scale to measure time. The time dimension presents the dynamics necessary to see regular natural processes. Regularity makes it possible to predict future events and generates the basis for a science that formulates laws of how they work.

GEOGRAPHICAL SPACE: THE WORLD MAP

The map of the world has an important relationship with the shape of the Earth[53] and presents a new way of approaching geographical space based on the abstraction generated by geometric modelling. This theoretical-methodological result initiated the development of cartographic representations centred on what Isaac Newton (1643-1727) called *absolute space*[54], in Geography represented by the Earth's surface within a coordinate system.

Based on the world map by Anaximander and incorporating data obtained from different geographical explorations[55], in the possibilities offered by a *holographic space*, Hecataeus (550-476 BC) presents cartographic representation as a geographical tool for practical use.

Doxography: "Anaximander of Miletus, a pupil of Thales, was the first man bold enough to draw the inhabited world on a tablet; after him, Hecataeus of Miletus, a/ much- travelled man, made it more accurate so that it was greatly admired"[56]. "Eratosthenes declares that the first two successors of Homer were Anaximander, a

50 Sagan, Carl, Druyan, Anne & Soter, S (1980). Obra citada.

51 Diogenes Laertius. *The Lives,* II 1-2.

52 Eusebius of Caesarea, *Praeparatio Evangelica*, 10.14.11

53 Jacob, Christian (1991). Obra citada.

54 Rusell, Bertrand (1983). *El conocimiento humano.* Bs As, Orbis.

55 Gómez Espelosín, F J (2010). *El descubrimiento del mundo. Geografía y viajeros en la Geografía antigua*. Madrid, Akal.

56 Agathemerus, "A Sketch of Geography"; en: *Epitome*, I, 1.

pupil and fellow-citizen of Thales, and Hecataeus of Miletus; that Anaximander was the first to publish a geographical map, and that Hecataeus left behind a work on geography, a work believed to be his by reason of its similarity to his other writings"[57]. "He was the first to draw on a map the outline of land and sea"[58].

From the bibliographical analysis, different approaches were made to the reconstruction of Anaximander's map of the world. Its shape was circular and considered the existence of two large land masses, Europe and Asia, each occupying practically half of the circumference[59]-[60]. This configuration is mentioned in the critique of geometrical rationality by Hordotus (488-425 BC).

Doxography: "I laugh to see how many people have now drawn maps of the earth, not one of them showing the matter reasonably. For they draw Ocean as encircling the earth, which they think is round as if drawn with a compass, and they make Asia as big as Europa"[61]. Anaximander did not make the map as a tool for practical use, but it was a graphic representation used in support of a worldview. Its update, made by Hecataeuous, introduces relevant geographical features and makes it closer to reality. Most of the representations found today are based on the latter map, where the circular surface is divided into three parts, occupied by Europe, Asia and Libya (now Africa). The map was drawn using the support provided by a *pinax*, a polished board made of wood, stone or metal. Later the concept came to consider the whole formed by the material base and the illustration, although it could also contain a catalogue with ordered information[62]. The basic features of Anaximander's map are presented in Figure 1 as a simplified conceptual model that we have based on a map made from the writings of Homer[63].

Figure 1. Cartographic model

57 Estrabón, Isaac Casaubon, I, p 7.

58 Diógenes Laercio, "Vidas de los filósofos más ilustres", 2, p 1-2.

59 Haidel, William A (1937). *The Frame of the Ancient Greek Maps. With the Discussion of the Discovery of the Sphericity of the Earth. American*; en: *Geographical Society,* New York.

60 Herodoto, *Histories*, IV 36.

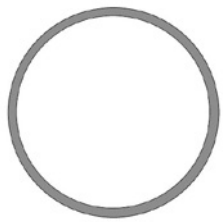
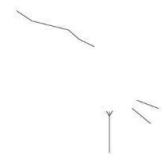
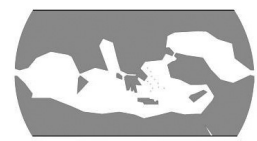
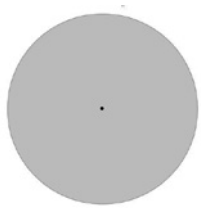
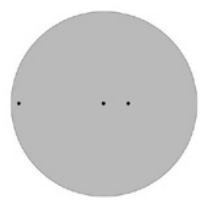
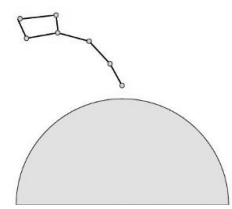
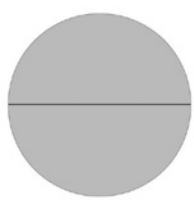
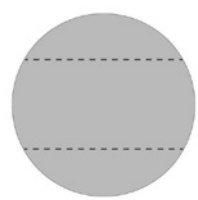
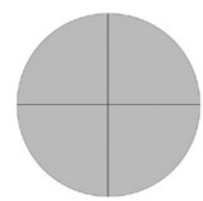
61 Herodoto, *Histories*, IV 36.

62 Jacob, Christian (1991). Obra citada.

63 George Philip & Sons, Liverpool (1855). Herrmann, Albert (1931). Die Erdkarte der Urbibel. Braunschweig: Kommisionsverlag von Georg Westermann.

The structure of the map allows us to approach the study of its central concepts through the spatial distribution of water, land, empirical locations and abstract alignments. Figure 2 presents its components in detail.

Figure 2. Conceptual elements

Water	 A-Ocean	 B-Seas	 C-Rivers
Land	 D-Europe	 E-Asia	 F-Ecumene
Localization	 G-Centre	 H-Alignment	 I-Orientation
Alignments	 J-Jonic Ecuator	 K-Paralels	 L-Quadrants

The circular form is central to the worldview provided by science from its birth until the scientific revolution at the beginning of modernity[64]. The shield of Achilles used in his fight against the Trojan Hector is described in detail as a work of art (*ekphrasis*) in the Iliad by Homer[65] including relief images of the worldview of archaic Greece. The centre is occupied by the Earth, the sea, the Sun, the Moon and the constellations, in intermediate rings it includes various images of human activities and the outer edge contains the linear flow of the river ocean (Ὠκεανός) framing the totality. This perspective is continued by Thales in considering water as the beginning of everything and that everything is made of water. Anaximander's geographical construction coincides with this arrangement (Figure 2A).

Doxography: "the Ocean encircling the earth, which is round as drawn with compasses"[66].

Other elements of water are included, seas such as the Mediterranean and Euxine (Black Sea) (Figure 2B) and rivers (Figure 2C), mainly the Ister in Europe and Nile, Tigris y Euphrates in Asia.

Mainland is a concept used to differentiate the context opposite the sea. It includes islands, with the possibility of circumnavigation and complete cartographic representation, and continents, as extensions impossible to be fully mapped. The Anaximander map considers two continents located on both sides of the Mediterranean Sea, Europe to the north (Figure 2D) and Asia to the south (Figure 2E). In a wide central zone is the ecumene or inhabited space (Figure 2F), a temperate zone that favours human settlement and leads one to consider the Earth as the home of humanity. Towards the extremes of the continents there are hypothetical spaces, where life is not possible by evident geographical determinism, to the north because of the extreme cold and to the south because of the extreme heat. The limits touch the circumference at the precise location where the sun rises and sets at the summer solstice in the north and the winter solstice in the south (Figure 2K)

The centre of the map is a point that represents the location of Delphi (Figure 2G).

Doxography: "So the ancients drew the inhabited world as round, and in the middle lay Greece, and in the middle of this lay Delphi; for it holds the navel of the earth"[67].

This means that the map, although it was a remarkable advance in scientific rationality, is still not completely separated from the mythico-religious worldview since the sanctuary at Delphi was the site of the *onphalos*, a carved stone in the shape of a half-egg that Zeus left to mark the navel of the earth, the point at which men unite with the Earth-Mother (γαῖα, Gaea, Gaia). Religious centrality is not discarded, although it is now integrated into a harmonious geographical order in

64 Copérnico, Nicolás (1965). Obra citada.

65 Homer, *Iliad* [book 18, lines 478-608]

66 Herodoto, *Histories,* IV, 36

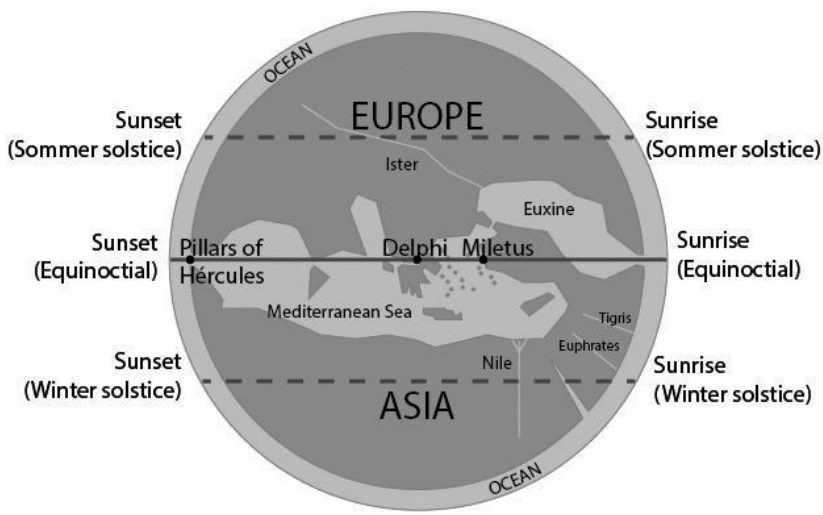
67 Agathemerus, *A Sketch*, 1.2.

which the eagles of Zeus become a configuration of parallel and central meridian (Figure 2L) with geometric coherence to world space[68]. Two other aligned locations are added to the centre, a point to the West at the Pillars of Hercules (now Strait of Gibraltar) and a point to the East corresponding to Miletus (Figure 2H).

The orientation of the map is made by considering the sky in its usefulness for localisation. The constellation Ursa Minor was considered by Phoenician navigators and included by Thales as an indicator of North in his practical book for navigation[69]; (Figure 2I), where its alpha star (α), Polaris, is taken as close to the celestial pole and around which the night sky revolves, a celestial region that would be determined more accurately by Pytheas (350-285 BC) three centuries later. The angle of 38° 30′ of Polaris above the night horizon of Delphi was calculated by Anaximander and this measurement would later be considered as the latitude of the site.

By drawing a line connecting the three locations (Figure 2H) and extending it to the edges of the circumference, the map is divided into two equal halves. The Pillars of Hercules, Delphi and Miletus are located in the middle of the world, on what can be called the Ionian Equator[70] (Figure 2J). By calculating the regularities of sunrise and sunset throughout the year, using the gnomon to discover the extremes through the maximum shadows produced during the solstices, two lines can be constructed parallel to the equator (Figure 2K) as Ionian Tropics, which schematically limit the extent of the ecumene[71].

Figure 3. Composition of conceptual elements



68 Lorite Mena, José (2003). *Jenófanes y la crisis de objetividad griega.* Murcia, Universidad de Murcia.

69 Weinberg, Steven (2015). *To Explain the World: The Discovery of Modern Science*. New York, Harper.

70 Couprie, Dirk L (2011). Obra citada.

71 Cuprie, Dirk L (2011). Obra citada. Chapter 6, p 80-81.

A perpendicular line to the Ionian equator passing through the centre divides the map into four quadrants of similar size from what could be considered the prime meridian (Figure 2L). Some authors question this meridian when considering the possibility of using physical-natural aspects. A vertical alignment at the mouths of the Ister in Europe and the Nile in Asia would make it pass east of Miletus[72] or through Siena[73] where the gnomon does not produce shadows during the summer solstice.

As has been seen, Anaximander's map of the world is a significant scientific development and although it verifies continuity with ancient mythology, its contents shows the beginning of rational practice in the intention of explaining the world[74] and, in this case, through the first geographical contribution[75].

CONCLUSIONS

When human thought begins to separate itself from mythical-religious explanations in the search for answers about nature by using rational deductions to discover its regularities and casual processes[76], the first global cartographic representation emerges as a result. The realisation of Anaximander's map of the world involves an important level of abstraction that includes the ecumene and unknown geographical spaces.

Through an intellectual attitude that contemplates the greater breadth in the origin and structure of the universe, the map is presented as a synthesis in the worldview. The universe formed by spheres, holding the flat Earth as a piece of column in the centre and the geographical configuration is found on its upper face. Geometry shows spatial regularity and the use of the *gnomon* (the sun dial's shadow device) temporal regularity.

Although Geography, as a field of scientific knowledge, was formulated two centuries after Anaximander's map of the world was made, the analysis of its antecedents indicates that this representation is the first geographical contribution in the initial development of science. It supports the formulation of rational and systematic knowledge in a delimitable and measurable graphical representation that focuses on spatial distributions on the earth's surface.

Anaximander's map of the world shows the fundamental need to think in terms of geographical space. It constitutes a conceptual synthesis and a starting point for the modelling of geographical space as a fundamental element in the study of the spatial dimension of society.

72 Naddaf (2003). Obra citada.

73 Hahn, R (2010). *Archaeology and the Origins of Philosophy.* Albany. State University of New York Press.

74 Lloyd, Geoffrey (1970). *Early Greek Science: Thales to Aristotle.* Nueva York, Norton.

75 Buzai, Gustavo D (2017). Obra citada.

76 Lloyd, Geoffrey (1987). *Magic, Reason and Experience.* Cambridge, Cambridge University Press.