

ANCIENT CELESTIAL SPHERES FROM GREECE

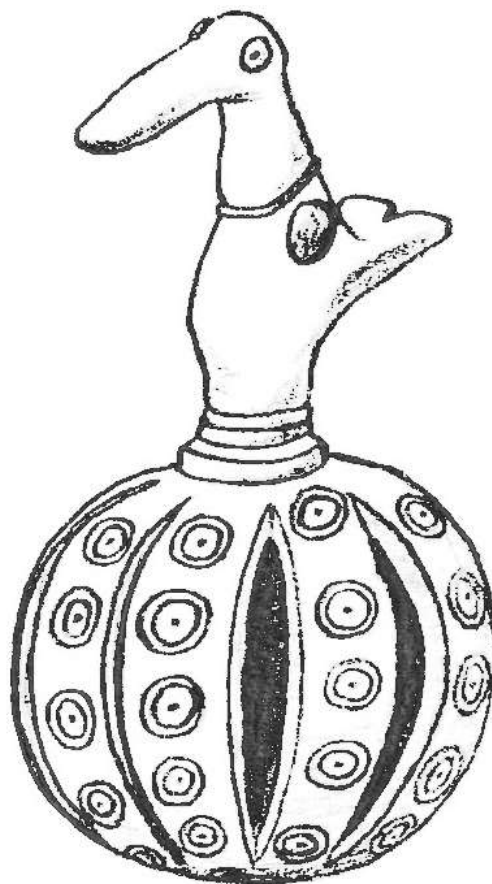
S. Dimitrakoudis, P. Papaspyrou, V. Petoussis, X. Moussas

Section of Astrophysics, Astronomy and Mechanics, Department of Physics,
University of Athens, Panepistimopolis, GR 15783 Zographos, Greece

Abstract: We present several ancient celestial spheres from the 8th century B.C. found throughout Greece, mainly in Thessaly, at the temple of Itonia Athena, but also in Olympia and other places. These celestial spheres have an axis, equator and several meridians and they have several markings with the symbol of stars (today's symbol for the Sun) $\odot$. Such instruments could have been used to measure the time, the latitude of a location, or the coordinates of stars.

Keywords: archaeoastronomy, history of astronomy, celestial spheres, seals, Greek astronomy, votives, ancient sky map

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By the 8th century BC, the transition from the Geometric to the Archaic Age was producing the first signs of a renaissance of Greek civilization, after the collapse of the Mycenaean order and the subsequent wars that left Greece depopulated. The Olympic Games were revived in 776 BC, the Homeric epics were becoming popular throughout the Hellenic world, and Hesiod produced the first detailed Theogony, as well as his *Works and Days*, that contained a repository of the cosmological (and meteorological) knowledge of that era. The accepted wisdom of those days only dimly foreshadowed the amazing series of scientific and philosophical revolutions that were to occur only a couple of centuries later.

At that time, as we know from Hesiod, the earth was considered to be flat, possibly disk shaped, while the heavens were spherical, endlessly revolving around the still Earth. Many of the constellations catalogued in antiquity had been named by the early Archaic age, as had many of the brightest stars (Orion, Ursa Major, Ursa Minor, Bootes, Sirius, Arcturus, the Pleiades and Hyades). The colonization of the Mediterranean and the Black Sea had boosted the mercantile and navigational experience of those early Greeks, who, venturing far from their native ports, had almost certainly used the position of fixed stars for navigational purposes. Aratus mentions (although some centuries later) that Greek seamen used the constellation of Ursa Major for navigational purposes, while the Phoenecians relied on Ursa Minor to chart their courses on the sea.

The sphere of the heavens had already been incorporated in mythology, with the titan Atlas holding it on his shoulders. In later ages, a variety of devices were invented to calculate the time or latitude of a place, by comparing the position of the Sun or another star with respect to the horizon. Those devices ranged from the simple casting of the Sun's shadow on a graduated quadrant pitch circle, to elaborate astrolabes and celestial spheres crafted during the Hellenistic Age. In earlier ages, sun-dials (dating from the 15th century BC in Egypt, and possibly the Aegean region as well) had provided the first small scale application of astronomical observations for the practical needs of people (large scale applications consisted of the study of yearly and monthly variations of the Sun, Moon and stars, for the creation of farming calendars, and are evidenced by the astronomical orientation of Neolithic monuments in Europe and elsewhere). However, of that particular age little is known concerning possible advancements in astronomical devices, or the possible existence of astronomical relics from the Mycenaean Age. An archeological hint in that direction may be inferred from certain pendant offerings discovered in Thessaly, Macedonia and the rest of the Greek world, corresponding to that period.

Archaeological excavations at the temple of Itonia Athena in Philia, a religious and political center of the Thessalian League, by D.R. Theocharis in 1962-67 [14-17], Angeliki Pilali-Papasteriou and Aekaterina Papastamou-Papaevthymiou in 1980 [13], and Imma Kilian-Dirlmeier in 1997-2001 [18], have unearthed a number of bronze votive artifacts, perhaps pendants, whose form resembles a representation of the celestial sphere, and may be indicative of a larger, more functional device. These

artifacts correspond to a period in time when such offerings to the gods were very common.

Of the numerous bronze artifacts discovered in that site, each unique in its details, those that are sphere-shaped can be classified into three broad categories. The first category consists of objects whose main feature is a hollow bronze sphere, decorated with symbols traditionally associated with stars, and an upper extension in the form of one or two birds. Three artifacts of this type have been unearthed at the temple of Itonia Athena, with heights ranging from 5 cm to 7 cm. On the first one, the solid bronze sphere is decorated with three 'parallel circles' (Fig. 1) formed by star symbols (the astronomical symbol we still commonly use for the Sun). The second is characterized by seven meridian incisions (Fig. 2), in between of which the star symbols are repeatedly crafted. The third (Fig. 3) is similar to the second, in that the same pattern is seen, only on a larger scale. This one has ten meridian incisions, and two bird-shaped protrusions, as opposed to only one in the previous two artifacts.

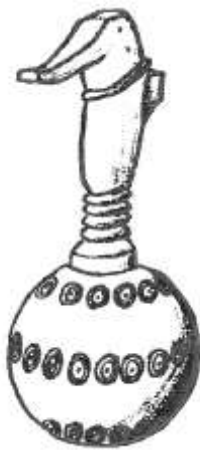


Fig. 1

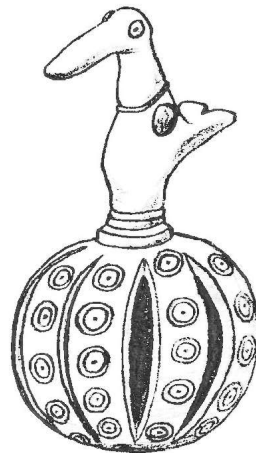


Fig. 2

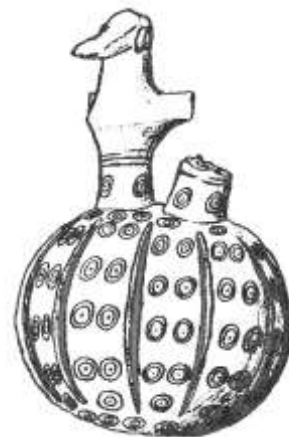


Fig. 3

The second category can be broken down to two sub-categories. The first one is represented by two artifacts. Their characteristics are a spherical main body, made up of bronze foils that form an equator and four or six meridians (respectively), an upper part in the form of one or two birds (respectively), and a lower part, in the form of a hollow cylindrical extension, that perhaps fitted onto a pole (reminiscent of a 14th-13th c. BC Mycenaean scepter discovered in Cyprus, with the same decorative motive of two birds on a sphere, Fig.6). The foils are all curved (where not damaged), and they are decorated with the same star (sun) symbols found on the previous artifacts (Figs. 4, 5).



Fig. 4

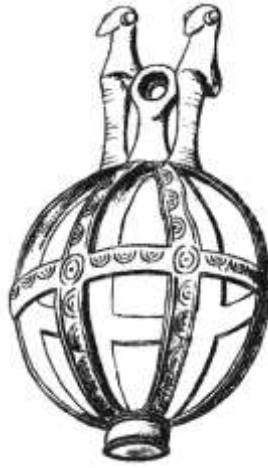


Fig. 5



Fig. 6

These objects are the ones that bear the closest resemblance to the armillary spheres that were to become very common in subsequent centuries.

The second sub-category is the most numerous, with representative artifacts found not only at the temple of Itonia Athena, but also at temples of Zeus and Artemis in Thessaly, in Olympia, and Macedonia. They appear to be a simplified sub-category of the second category objects, having the same basic form as the first sub-category, but with rougher, undecorated straight foils. The number of meridians ranges from four to nine, the lower extension is rarely made to accommodate a pole (it is mostly flat, curved, or in some cases conical), and the top part resembles a variety of forms; birds (overwhelmingly), abstract geometrical forms, animals (artifact from Olympia), and humans (artifact from Macedonia). Some examples from this category can be seen in figures 10-15.



Fig. 10



Fig. 11



Fig. 12



Fig. 13



Fig. 14



Fig. 15

The third category consists of artifacts that incorporate more than one sphere into their design. A representative artifact from Philia is a bronze horse-shaped object, whose legs are made of two identical spheres, with four meridians each (Fig. 16). Another example comes from Olympia, where a hollow bronze pole incorporates two spheres (of four meridians), before culminating in a bird-shaped protrusion (Fig. 17). In both cases the spheres are undecorated (as in category 2b). In these cases the hollow sphere is degraded from being the core of the artifact to being a simple decorative element. If there is indeed some sequence of imitations originating from an astronomically useful original, this category represents the furthest deviation from the initial votive intent.



Fig. 16



Fig. 17

Another group of bronze offerings, similar to the sphere-shaped ones and with possible astronomical allusions, are the seal-shaped or disk-shaped artifacts. As with the spherical variety, there is a bird-shaped upper part. In these cases, however, it is attached to a flat lower segment, at an angle that varies from zero to ninety degrees.

The artifacts from the temple of Itonia Athena with the upper part perpendicular to the lower part (seal-shaped) are displayed in figures 18-22. In all cases the bottom of the lower segment has a relief, perhaps used as an actual seal. In the first artifact, the relief consists of three concentric circles, the outer one delineating the seal's border. Between that and the two inner circles there are seven circular holes, one of them not completely punched through. The seven holes are not crafted in regular intervals, but the composition as a whole is not without a sense of symmetry. It is possible that the circles may represent the known planets around the earth. The shallow seventh circle may or may not have some special significance. It is worth noting that during that era the planet Venus was considered to be two distinct planets, the Morning Star (Augerinos) and the Evening Star (Hesperinos). The same applied to Mercury, who was called Mercury (Hermes) when he appeared after sunset, and Apollo when he was seen before dawn. Therefore the known planets were seven, plus the Sun and Moon, bringing the total number up to nine. It is unclear whether the holes in the first seal represent some of the known planets, the Pleiades, or nothing of astronomical context.

The second seal has an elaborate geometrical relief of semicircles forming what appears to be a double axe symbol (or perhaps an archaic abstract rendering of the celestial sphere projected on a plane). The double axe had been a popular symbol of power among the Minoans and the Mycenaeans, and continued to be so, throughout the next millenium, all over Greece. The third seal has a simple 'X' pattern, while the top of the lower segment is engraved with zig-zag lines. The fourth seal is a curious artifact, in that the seal relief is an empty circle. The fifth seal is shaped like a Boeotean shield (also reminiscent of a double axe, or an abstract rendering of the waxing and waning of the moon).

A more unusual seal-shaped artifact is the one in figure 23. In this case, the upper part is tilted at an angle of approximately 45°, a unique feature among the artifacts studied. The seal relief is a clockwise swastika (depicted counter-clockwise if used as a seal), a common Indo-European symbol that has been theorized (by Carl Sagan and X. Moussas independently) to be associated with comets (in accordance with ancient depictions of comets in the form of a swastika).

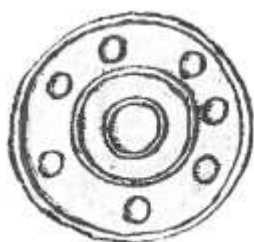
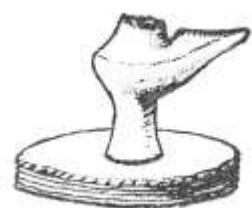


Fig. 18

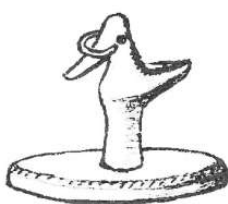


Fig. 19

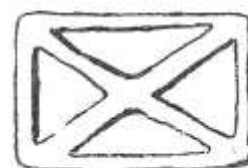


Fig. 20

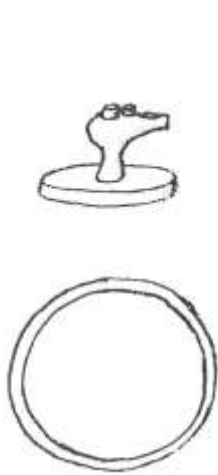


Fig. 21



Fig. 22



Fig. 23

A number of disk-shaped bronze artifacts from Thessalian temples are on display at the Archeological Museum in Athens. In most cases the disk is undecorated, but in one artifact (Fig. 24) it is adorned with 17-18 star symbols, identical to the ones on the spherical objects already mentioned. The density and regular positioning of the symbols precludes the representation of some star map. They are, most likely, just a star-themed decoration.

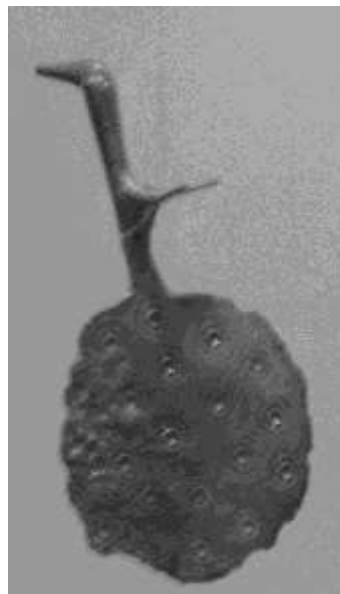


Fig. 24

The great diversity within the not so great quantity of astronomically linked votive artifacts is a testament more to our ignorance of the particulars of that time period, than to any new insight obtained through parallelism and conjecture. Written documents in that era were scarce, and only the more popular of the first epics have survived to this age. Through these epics, fragments of astronomical wisdom stare

back at us in artistic purity, detached from the prosaic details of their discoveries and the means used by those inclined to study them. The birth of natural philosophy overshadowed the more empiric achievements of the multitude of star-gazers of aeons past, to the effect that Eudemus (a pupil of Aristotle), in his work 'the History of Astronomy' wrote that Thales was the first man who undertook the study of astronomy. In the Geometric age, the study of the stars was probably conducted by priests, men whose inclination was the drafting of practical calendars and not scientific curiosity, and whose names were not recorded in history books. The artifacts presented here may shed some dim light into that dark period (made all the darker in contrast to the more documented centuries that followed), if the assumptions made about their decorative origin are correct.

The main source of our investigations remains the excellent monograph of Kilian-Dirlmeier [18]. It is an excellent piece of work that embraces in an exhaustive and systematic way all the current archeological knowledge we possess at the moment about the numerous findings of the sanctuary, and as far as we know, it serves this purpose uniquely till today. This is followed with some useful extracts from the bibliography of the above cited work, that are general in character, thus serving as an introduction, or of specific nature, dealing with the archeological research in the sanctuary. The history of the archeological investigations in Philia are presented in [7], [9], [10], [13], [14], [15], [16] and [17]. One could mention among them the works of K. Kilian in [5], [6], [8], and these of I. Kilian-Dirlmeier in [11] and [12]. Some archeological remarks about Thessaly are given in [1] and [2]. Two collections of miniatures are mentioned in [3] and [4].

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