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BICKNELL, P. J.
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Early Greek Knowledge of the Planets.

By

Peter J. Bicknell.

Monash University, Clayton, Australia.

In a recent article,¹ D. R. DICKS impugns the doxographical notices² which indicate that Anaximander distinguished planets from fixed stars and also the view of many modern scholars³ that Anaximenes did the same.⁴ In DICKS' opinion, it is doubtful whether the planets were recognized as such by the Greeks before the fifth century B.C.; "careful observation over an extended period would be necessary to differentiate them from the fixed stars (compare Venus, the brightest planet, as the morning and evening stars in Homer)"⁵.

¹ D. R. DICKS, "Solstices, Equinoxes and the Presocratics", JHS 86 (1966), p. 30.

² Aetius 2.15.6 (DK.12 A 18) where Anaximander is coupled with Metrodorus of Chios and Krates. A reference to the planets as well as that to the moon has clearly fallen out of the text of Hippolytus Ref. 1.6.5. (DK.12 A 11) at DK. p. 84 line 15.

³ For example, Sir THOMAS HEATH, Aristarchos of Samos, pp. 42-3, and W. K. C. GUTHRIE, A History of Greek Philosophy, vol. 1, pp. 135 ff. Their view is based on Aetius 2.14.3 (DK.13 A 14) where they emend *ἐνιοί* to *ἐνίοις* and take the *ἀστὲρα* "fixed like nails in the crystalline" as fixed stars and the *ἀστέριας* compared to fiery leaves as the planets. The planets being made free-floating, Anaximenes could explain their motion relative to the fixed stars in the same way as he accounted for declination of the moon and the movement of the sun between the solstices—as due to their being blown from a consistent orbit by gusts of wind (Aetius 2.23.1—DK. 13 A 15). Some (for example, J. LONGRIGG, "κρυσταλλοειδῶς" CQ 59 (1965), pp. 249-251) have argued that a crystalline heaven studded with fixed stars is not Anaximenean and that Aetius is mistaken. It is true that the Pseudo-Plutarch of the Stromateis and Hippolytus do not mention it in their extracts on Anaximenes, but, as K. FREEMAN (Companion to Diels-Kranz, p. 72) pointed out, the comparison of the stars in the crystalline firmament to nails has an unmistakably Milesian flavour. See also note 13 below.

⁵ See, for example, Iliad 22.318 (Hesperos) and Odyssey 13. 93-4.

Set out step by step, Dicks' argument would seem to run as follows.

1. Venus is the brightest planet and until Venus was recognized as a planet no other celestial body could have been.
2. Recognition of the planetary nature of Venus implies recognition of the identity of the morning and evening stars.
3. The first Greek to identify the morning and evening stars was Parmenides⁶ who was at work at the beginning of the fifth century.
4. No planet, consequently, can have been recognized as such by the Greeks before the fifth century B.C.

In what follows, I shall suggest that step 2 is fallacious; the morning and evening stars, not identified until Parmenides, were separately distinguished from the fixed stars at least as early as the seventh century. In addition I hope to show beyond reasonable doubt that the planetary nature of at least one other heavenly object was recognized by the time of Anaximander and Anaximenes.

At Laws 821 c Plato puts the following remarks into the mouth of Kleinias the Cretan, one of his shadowy interlocutors:

ἐν γὰρ ὃν τῷ βίῳ πολλὰς εὐπαρα καὶ αὐτὸς τὸν τε εὐσφῶρον καὶ τὸν ἑσπερὸν καὶ ἄλλας τὰς οὐδέποτε ἰούσας εἰς τὸν αὐτὸν ὁρῶμεν, ἀλλὰ πάντῃ πλανημένους, τὸν δὲ ἥλιον που καὶ σελήνην ὁρώμενς τὰῦτα αἰ πάντες ἐγνωσιώμεθα.

("during my life I have often observed how Eosphoros and Hesperos and certain other celestial bodies never travel on the

⁶ Aetius 2.15.4 (DK. 28 A 40 a); Diogenes Laertius 9.23 (cf. 8.14 as emended by Casaubon) on the authority of Favorinus and Callimachos. Diogenes (loc. cit.; cf. Pliny N.H. 2.37) notes an alternative ascription of the identification to Pythagoras. This was either due to a mistaken attribution of Parmenides' poem (see Diogenes 9.23; does another wrong ascription lie behind the notion of the author of CRAMER, Inedita 3. 413. 16 that "recognition of the identity of Eosphoros and Hesperos was first made by Ibykos of Rhegion?"), or to the practice of members of the Pythagorean brotherhood (of which Parmenides was a member—Diogenes 9.21; Strabo 6.252; Proklos in Parm. I. p. 619.4; Photios Bibl. c. 249) of ascribing their own discoveries to the master (see Cicero ND. 1.10 and Diogenes 8.46).

same path, but wander all over the place; in the case of the sun and moon, of course, we all know that they behave like this all the time.)

It was evidently possible for Plato to conceive of observers of the heavens who, while realising that both the morning and evening 'stars' changed their position relative to the fixed stars, were unaware of or did not accept their identity. For such, Eosphoros and Hesperos were two different planets. It is likely, indeed certain, that Venus in its two aspects would have been the first of the planets to be recognized by the Greeks as such, both on account of its great brilliance,⁷ and of the rapidity of its West to East motion on the celestial sphere. It is simply not true that such recognition cannot have preceded realization that Hesperos and Eosphoros were one and the same body. The change of position of Venus relative to the fixed stars is conspicuous over even a fraction of the period during which it is morning or evening star, and it is scarcely conceivable that it passed unnoticed by farmers, sailors and early physikoi until as late as the fifth century.

Although not identified, Eosphoros and Hesperos cannot but have been distinguished from the fixed stars at a very early date, and distinguished they certainly were by the seventh century. In two lines (381-2) of the Theogony, Hesiod writes τὸς δὲ μετ' ἄστερα τίκτεν εὐσφῶρον Ἥφρηέηια ἄστρα τε λαμπρότατα, τὰ γ' οὐρανὸς ἑορπαίνουσα.

It is difficult, and it would surely be perverse, to resist the conclusion that ἄστερα and ἄστρα are deliberately contrasted.⁸ Hesiod regarded Eosphoros as different to the fixed stars, the constellations with which the sky is wreathed. The obvious difference is that the position of Eosphoros alters with respect to its stellar neighbours. Hesiod, then, recognized that the morning star is a wanderer and he must obviously have recognized that the same was the case with its evening counterpart. Exactly how much farther back than Hesiod knowledge of the planetary

⁷ Note Ilad 22.318; Sappho frag. 32 E; Pindar Isthmian 4.24.

⁸ Compare West's remark in his commentary, p. 271.

nature of Venus Eosphoros and Venus Hesperos goes, it is impossible to say.⁹

Choiboboskos, a grammarian of the sixth century A.D. has the following note on the word *μεσώνυξ*: *εἰς τῶν ἐντὰ πλανητῶν παρὰ τοῖς Ἰνδουροείοις ὀνομάζονται μέγιστα Σησίχορος*. (Choiboboskos at Bekker *Anecdota* 3.1397).

As far as I am aware, this passage has been overlooked by historians of astronomy. It surely shows quite conclusively that at least as early as the lifetime of Stesichoros, whose dates were 632–556, at least one other planet besides Eosphoros and Hesperos had been recognized. The name Mesonux which is applicable to all of the outer planets, was clearly chosen to distinguish the first of them of which the Greeks became aware from the inner planet Venus (Eosphoros plus Hesperos), which, unlike them, is never observed in the middle of the night. A possible identification of Mesonux is with the conspicuous Jupiter, but Jupiter moves slowly among the stars and probability favours Mars whose West to East motion is much more rapid and which at perihelic opposition (when dramatic retrogression occurs) is the brightest

⁹ Homeric usage appears to make no distinction between *δωρῆες* and *δωροι*; at *Iliad* 22.317 Hesperos is an *δωρῆς* but *εἶτα μετ' δωρῶν πυρὸς ἀνελήν*; at *Iliad* 5.5 and elsewhere Sirius is an *δωρῆς* (at *Theognis* 1040, it is worth noting, Sirius is an *δωρον*) which word can also be used of a fireball (*Iliad* 4. 75–77). Does this terminological indifference necessarily imply that the poet was unaware of a distinction between Venus and the fixed stars? Hardly: if it did, we would then have to suppose similar ignorance on the part of the post-Hesiodic Sappho who writes (*frag.* 32 E) of Hesperos as *δωρῆων πᾶντων ὁ καλῆτος*, and, much worse, on the part of the still later Pindar who was close to the intellectual advances of his age; Pindar (*Isthmian* 4.24) describes Hesperos as *θαρρὸς δωρονος ἐν ἄλκῃ*. Unlike Hesiod, who had practical reasons for observing and distinguishing the motions of the heavenly bodies and who compiled an *Astrologia*, Sappho and Pindar were pure poets, unconditioned to observe terminological niceties. Add to this the fact that, in the case of the lyric poet, metrical exigency is a powerful determinant of vocabulary. The Homeridae too were artists only, and it might be argued that their vocabulary also was determined by special factors, in their case by the fact that *δωρῆς*, *δωρῆες* and *δωρα* were indiscriminately incorporated into formulae going back to a time before any planets had been distinguished.

object in the sky except for Venus. The ambiguous name Mesonux, generally abandoned sometime after the discovery of other outer planets in favour of "Puroeis (aster)"¹⁰ (the fiery planet)¹¹ or the "aster of Ares"¹², was apparently retained by certain Pythagoreans.

It will be clear by now that there is not the slightest reason to doubt the doxographers' categorical statements to the effect that Anaximander distinguished planets from fixed stars, and the implication of their evidence that Anaximenes held the former to be free-floating fiery discs like the sun and moon, subject like them to wind-induced perturbations, in distinction from the fixed stars attached to a crystalline firmament.¹³ The planets of the pre-Parmenidean Ionians¹⁴ will have numbered at least three; Venus in its two aspects and Mars. They could have known of the planetary nature of Jupiter also, but its recognition is just as likely to have post-dated Parmenides' identification of Eosphoros and Hesperos and a temporary reduction, for those who were aware of and who accepted it, of the number of known

¹⁰ The earliest appearance of *πυρῆες* as Mars is in the Pseudo-Aristotelian *de Mundo* (399 a 9) which probably dates to the third century B.C. (for example, at 392 a 25 ff. the planets are given in the 'Pythagorean' order—Saturn, Jupiter, Mars, Mercury, Venus, Sun, Moon—rather than the 'Chaldean'—Saturn, Jupiter, Mars, Sun, Venus, Mercury, Moon). By 200 B.C. the former order was all but obsolete. At *Epinomis* 986 e it is stated that our Mercury, a few lines later described as Hermes' planet, has as yet no name. The implication is that the long known planets, Venus and Mars, did have names in Plato's time, as well as divine associations. If Puroeis is little earlier than the *de Mundo*, then the name the *Epinomis* author has in mind is Mesonux.

¹¹ Is the allusion to fire's brightness or to their red glow? The earliest extant Greek reference to the redness of 'The Red Planet' is Plato *Republic* 617 e.

¹² See note 21 below.

¹³ See note 3 above. Ion of Chios (*lyric fragment* 2E) writes of *ἄστρον ἀποφύρων δωρῆα*. Has Ion Anaximenes' description of Venus in mind? Note the employment of *δωρῆα*.

¹⁴ Anaximander, Anaximenes, Xenophanes and Heraclitus. The doxography does not mention any planetary theory in connection with the two last mentioned.

planets from three to two, Hesperos—Eosphoros¹⁵ (Venus) and Mesonux (Mars).

From the Epinomis¹⁶ we learn that the elusive and inconspicuous Mercury,¹⁷ the other inner planet, had not long been recognized when that dialogue was written. The same would certainly be true of Saturn and it could be true of Jupiter.¹⁸ It is conceivable that it was Demokritos who revealed their existence,¹⁹ although

¹⁵ The names Hesperos and Eosphoros (or its variant—see Ion frag. 2 and Euripides frag. 929) persisted in use long after their identification as one body: see Ion and Euripides, loc. cit.: Euripides Ion 1149; Plato Timaios 39c; Aristotle EN 1129b 28 and Metaph. 987a.

¹⁶ Epinomis 986c. The dialogue I take to be a late effort of Plato reworked by Philp of Opus.

¹⁷ The planet is only seen at near greatest elongation; it begins to come into view some 17 to 10 days before evening elongation and vanishes in 6–7 days. This occurs every 116 days. The planet can be observed in evening and morning twilight low down near the horizon.

¹⁸ Saturn takes 29 years to complete a circle of the zodiac. A retrogression occurs once every 378 days. Jupiter circles the zodiac in 12 years and retrogression occurs once every 390 days.

¹⁹ According to Seneca NQ. 7.3.2, Democritus . . . subtilissimus antiquorum omnium suspicari se ait plures stellas esse quae currant, sed nec numerum illarum posuit nec nomina, nondum comprehensis quinque siderum cursibus. The meaning is surely that Demokritos knew of the five planets Saturn, Jupiter, Mars, Venus and Mercury, but not of their motions (Plato at Timaios 39c stresses how restricted such knowledge was at a time when Endoxos and others were having some success with the problem), not that he did not even know of all of the canonical five. It could, I suppose, be argued however that Aetius 2.13.3 (DK. 68 A 86), if trustworthy, militates against crediting him with knowledge of Mercury, especially as, if Hippolytus (Ref. 1.13.4 = DK. 68 A 40) is correct, he paid special attention to relative distances of the planets. According to Aetius 4.7a *μὲν ἀναστὰς πρὸς τὸν ἥλιον δὲ ταῖς τοῖς πλανήταις ἐφ' οἷς ἦσαν ποικίλοις ὁδοῖς*, Ought he not to have placed Mercury between sun and moon together with its fellow inner planet? Not, I suggest, if his knowledge of this planet was based only on Babylonian hearsay. Endoxos was probably the first to study Mercury's motion empirically; he calculated a synodic period of 110 days—Simplicius de Caelo 495 ff. Demokritos speculation (presumably in his book on the planets—Thrasyllos at Diogenes 9.46) about the existence of other planets besides the canonical five was no doubt bound up with a view first enunciated by Anaxagoras (see Aristotle Meteor. 3426 b25 etc.) that comets were conjunctions of one or more planets (for Demokritos

not the details of their motions, to the Greeks, having learnt of it in the course of his travels in Babylonia.²⁰ It is to Demokritos too that the divine associations of the planets among the Greeks and thence the Romans may be owed; Hermes (Mercury), Aphrodite (Venus), Ares (Mars), Zeus (Jupiter), Kronos (Saturn) are, of course, the closest equivalents the Greeks could find for Nabu, Ishtar, Nergal, Marduk and Ninib respectively, whom the Babylonians linked with the five planets of the ancient world.²¹

cometary theory see Aristotle loc. cit. Aetius 3.2.2.—DK. 59 A 81 etc.). Anaxagoras, of course, did not know of all of the canonical five. Cleomedes 1.3.16 and Nigidius Figulus (see Aulus Gellius 14. 11–12) also speculated about the existence of extra planets. Nigidius' reasons were probably astrological; the Hamburg school of astrology founded by ALFRED WITTE some 40 years ago takes into account the motions of *eight* hypothetical trans-Neptunian planets in compiling horoscopes!

²⁰ See Diogenes 9.35; Aelian VH. 4.20, and earlier and more reliable, Strabo 15.703.

²¹ The associations with divinities appear first in Plato; see Timaios 38 d—Hermes; Epinomis 987 b ff.—Aphrodite, Hermes, Kronos, Zeus and Ares. For the same associations in Aristotle, see Metaph. 10736 32 ff. Some of the planets were on occasion associated with different deities, either on the basis of non-Babylonian foreign equations or with astrological motivation. Besides the orthodox affiliations the de mundo reports associations of Mercury with Apollo (cf. Pliny NH. 2.39) and Venus with Hera. Of Venus, Pliny NH. 2.37 writes that there had been great competition in giving it a name; "some have called it Juno (Hera), others Isis (cf. Ptolemy, Tetrabibl. 2.3.23), others Mater Deum (no association with Athene is ever mentioned as Velikovsky would have done well to note!). Again according to Pliny (cf. Theon 130 and Macrobius Sat. 1.19.7) Mars was by some connected with Herakles. It is conceivable that the appellations of *παῖδες* (first extant in this sense at de mundo 392 a 25—GUNDL, RE Planeten col. 203) is certainly wrong in regarding it as standing for Venus at Theogony 987; Aristarchos' *μύκων* makes more sense than the *μύκων* of the MSS) and *παῖδες* (first extant thus at de mundo, loc. cit.) for Jupiter and Saturn are also Babylonian derivations rendering Kaimann and Dapinu respectively.

ADDITIONAL NOTES

A.

In his article, Dicks, to say the least, comes close to arguing that the fact that the Greek word *πλανήτης* does not appear in the sense of "planet" until Xenophon Mem. 4.7.5. tells in favour of his extreme view as to the lateness of recognition of planets among the Greeks. The fact is surely that physikoi found sufficient for their purpose such periphrases as *πλανώμενοι ἄστερες* or *πλανητὰ ἄστροα*²² and felt no need to add a new sense²³ to *πλανήτης*.

The Xenophon passage runs as follows: τοὺς πλάνητάς τε καὶ ἀσταθμήτους ἀστέρας γινώσκει καὶ τὰς ἀποστάσεις αὐτῶν ἀπὸ τῆς γῆς καὶ τὰς περιόδους καὶ τὰς αἰτίας αὐτῶν ἡγεθῆντας καταρτίζεσθαι ἰσχυρῶς ἀπέρεπε (the subject is Sokrates). One gets the impression that study of and speculation about the planets was long and well established at the time of his writing.²⁴

B.

PORPHYRY, Vit. Pythag. 41: ἔλεγε (the subject is Pythagoras) δέ τινα καὶ μυστικῶ τρόπῳ συμβολικῶς, ἃ δὴ ἐπὶ πλέον Ἀριστοτέλης (frag. 196 Rose²⁵) ἀνέγραψεν, οἷον ὅτι τὴν θάλατταν μὲν ἐκάλει εἶναι δάκρυον, τὰς δὲ ἄκτους Ἰέας Χεῖρας, τὴν δὲ Πλειάδα Μουσῶν ἡγῶν, τοὺς δὲ πλάνητας κύμας τῆς Περαεπόρης ...

CARDINI²⁵ is doubtless right in explaining that Persephone equals Selene equals Artemis. Whoever of the Pythagoreans really formulated the definition, it sounds primitive enough and may be taken as further evidence of early, at least as early as the turn of the sixth century, Greek recognition of planets.

²² See, for example, Plato Timaios 38c; Laws 821 b and c; Aristotle Metaph. 1073 b 22; Meteor 342 b 28.

²³ For the normal sense, see Plato Rep. 371 d.

²⁴ Xenophon may have Anaxagoras especially in mind on whom see note 19 above, and also perhaps Empedokles who held views about the planets similar to those of Anaximenes (see Aetius 2.13.11—DK. 31 A 54).

²⁵ CARDINI, Pitagorici—Testimonianze e Frammenti, vol. 3, p. 245.