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OENOPIDES OF CHIOS AND THE DERVENI PAPYRUS

The cosmology presupposed in the work of an unknown author which the Derveni papyrus fragmentarily preserves (henceforth the Derveni author) seems to be founded on the same principle as the poorly known cosmology Parmenides developed in the second part of his didactic epic. According to the Derveni author, "the things that are now come to be from preexisting things";[1] more precisely, "the things that are exist always, and the things that are now come to be from the preexisting things".[2] The early Ionian cosmologists thought that one of the basic substances, out of which the cosmos is made, turned into all the other basic substances during the cosmogony, with nothing to serve as a continuing Aristotelian substrate of change; it changes constantly into them in a regulated manner after the cosmogony and vice versa, on scales much smaller than the cosmic scale, thereby causing all that occurs in the cosmos.[3] Parmenides countered that a cosmology cannot be well-founded unless it posits a number of "things that are" or "beings": basic substances with stable natures, all of them thus completely unchangeable, coeval, and eternal. Their original relations on the large scale of the universe changed due to the application of an external "force", so as for the structure called cosmos, a derivative existent, to arise. Within this structure, the rela-

1) Col. XVI.2: ἐκ τῶν ὑπαρχόντων τὰ νῦν ὄντα γίνεται. On the expression τὰ νῦν ὄντα and the verb ὑπάρχειν see Th. Kouremenos / G. M. Parássoglou / K. Tsantsanoglou, The Derveni Papyrus Edited with Introduction and Commentary. Studi e Testi per il Corpus dei Papiri Filosofici Greci e Latini 13 (Florence 2006) 214–15.

2) Col. XVI.7–8: τὰ ὄντα ὑπῆ[ρ]χεν ἀεί, τὰ δὲ | νῦν ἐόντα ἐκ τῶν ὑπαρχόντων γίν[ε]ται.

3) Although Heraclitus seems to reject the notion of cosmogony (see DK 22 B 30) and to criticize the earlier Ionians, he agrees with them that the basic substances in the cosmos undergo reciprocal changes on scales smaller than the cosmic scale (see DK 22 B 31a–b). See D. W. Graham, Explaining the Cosmos: The Ionian Tradition of Scientific Philosophy (Princeton 2006) 85 for a clear formalization of the early Ionian cosmological model ("the generating substance theory", as Graham aptly calls it), and ch. 5 for the Heraclitean criticism of this cosmological model.

tions between the basic substances continue to change on various smaller scales than the cosmic scale ultimately due to the action of the said "force", bringing about and destroying a large variety of transient derivative existents.[4]

In the second part of his epic, Parmenides built on this model a detailed cosmology with only two basic substances, named "light" and "night" and identified by Aristotle with fire and earth, and an "attractive force", personified as a goddess of sexual union governing their mixing together; this process brought about the cosmogony, perhaps out of an original state of disorderly arrangement of the basic substances, and henceforth causes everything that takes place in the cosmos.[5] Parmenides' cosmological model does not necessarily limit the number of basic substances to two, nor does it specify their character. After Parmenides, it was fleshed out in wildly different ways.[6] Anaxagoras posited an indefinitely large, perhaps infinite, number of basic substances (χρήματα): all observable stuffs (e. g. air, ether, earth but also flesh, blood and bone) and qualitatively determinate kinds of stuff conceived of as substances (such as the hot and cold, wet and dry, light and dark). Empedocles, on the other hand, singled out only four observable substances, namely earth, water, air, and fire, the famous four elements, which he called "roots" (ῥιζώματα), each having its own sensible properties. The atomists Leucippus and Democritus posited as basic substances an infinite number of unobservable and indivisible corpuscules, completely and homogeneously full, solid, and unbreakably hard masses partly filling an infinite void; the atoms do not have the properties of any sensible substance, such as earth, but only shape, size, ordering, and orientation within an ordering.[7] Diogenes of Apollonia thought that a single Parmenidean basic substance he identified as air can yield a plurality of derivative sub-

4) See the formalization of this cosmological model in Graham (above, n. 3) 224; cf. 227.

5) For light and night see DK 28 B 8.53–61 and B 9. For the identification of light and night with fire and earth respectively see Arist. Metaph. A 5, 986b18–987a1 = DK 28 A 24. The goddess is mentioned in DK 28 B 12; cf. Stob. 1.22.1a and Graham (above, n. 3) 227. DK 28 B 11 clearly suggests that Parmenides presented a cosmogony in the second part of his philosophical epic.

6) The following outline is not concerned with the generation of motion.

7) On atomism and the Parmenidean cosmological model see Graham (above, n. 3) 269–71.

stances, which make up the cosmos and everything in it, all by itself – it need only undergo phase changes, as we would say, which take on different forms.[8]

The number of the basic substances in the cosmology the Derveni author deals with is unclear.[9] What is said in col. XVI.2 and XVI.7–8 (quoted in n. 1–2) leaves no doubt that more than one basic substance is at play. One such substance is certainly air, which the Derveni author also calls "Mind": in col. XVII.2–3, air is said to be eternal in contrast to the derivative substances, "the things that are now". But how many are the other basic substances? What are they? A fire-dominated mixture of "things that are", mentioned in col. IX.5–6, is probably the disorderly pre-cosmic condition, from which the cosmos arose through the action of air. It seems that the Derveni author posits more than two "things that are", air and fire being causally prominent among them. "Things that are", however, can also mean "things that are now" (col. XIX.1, 6). Not everything in the pre-cosmic mixture need be a basic substance.[10]

Earth might be another of the basic substances, provided that, in col. XVIII.1, a reference to it can be restored;[11] water, mentioned in col. XXIII.12, could be another.[12] The Derveni author speaks of τὸ ψυχρόν in col. XXI.1, one of Anaxagoras' substantialized properties,[13] but it is unclear whether the term refers collectively to cold basic substances, e. g. water and earth, or to the property "being cold" conceived of as a matter that is present in anything with this property. λαμπρότης, mentioned in col. XXV.1, as well as the hypothetical but plausible θερμότης, with which λαμπρότης was most probably connected through a copulative conjunction in the lost part of the clause, might refer to a property of the fire from which

8) For Diogenes as an Eleatic neo-Ionian monist see Graham (above, n. 3) ch. 10.

9) For detailed discussion see G. Betegh, The Derveni Papyrus: Cosmology, Theology and Interpretation (Cambridge 2006) 259–265 and Kouremenos et al. (above, n. 1) 32–37.

10) Apart from a few basic substances, the mixture might have contained those "things that are now" which are presupposed by the rest. Cf. the modern distinction between elementary particles and elements.

11) See Kouremenos et al. (above, n. 1) ad loc. If the supplement is correct, col. XVIII.1–2 need not suggest that earth derives from air. For this possibility see Betegh (above, n. 9) 262–65.

12) Cf. Betegh (above, n. 9) 261–62.

13) See DK 59 B 12 and 15.

the Sun formed at the beginning of the cosmogony. Alternatively, these property-nouns might stand for τὸ λαμπρόν and τὸ θερμόν, qualities conceived of as stuffs making up the Sun, for they are always present where fire can be found and account for the sensations caused by fire. If so, τὸ λαμπρόν and τὸ θερμόν, again two of the Anaxagorean property-stuffs,[14] are another pair of basic substances. Ambiguous is also the Derveni author's reference to the constituents of the Moon as the whitest, λευκότατα, of all kinds of matter in col. XXV.1–2: whatever lunar matter might be, it can have the property of "being white" to the highest degree, or τὸ λευκόν can be its quantitatively predominant ingredient.[15]

The Derveni author as a dualist: the parallel case of Oenopides of Chios

There is a piece of evidence backing up the cautious hypothesis that in the cosmology of the Derveni author, as in Parmenides', there are only two basic substances.[16] These are air and fire, not Parmenides' earth and fire. If so, no matter how many ingredients in the disorderly pre-cosmic mixture of "things that are" there might be, fire is the only one of them which is an eternal "thing that is": the others are "things that are now", derivative substances made up of fire and air.[17] Their formation was the first stage in the cosmogony, no trace of which survives in the portions of the text preserved in the papyrus, and they will perhaps decay into their basic constituents only when the cosmos dissolves.[18] They are more basic than the cosmos and all transient things that are in it at any time, and among whose constituents they are, but not as basic

14) See again DK 59 B 12 and 15 (in B 15 τὸ λαμπρόν is plausibly supplemented from B 12).

15) On lunar matter see Betegh (above, n. 9) 246 (cf. 261), Kouremenos et al. (above, n. 1) ad loc.

16) P. Boyancé, Remarques sur le Papyrus de Derveni, REG 87 (1974) 103 has suggested that in the cosmology of the Derveni author there is only one basic substance, air, from which all other substances derive. But this is very unlikely. Cf. Betegh (above, n. 9) 265.

17) Air might be in the mixture only as their constituent; see Kouremenos et al. (above, n. 1) 39.

18) On the death of the cosmos see Kouremenos et al. (above, n. 1) on col. XVII.8.

as air and fire. The pre-cosmic mixture is said to have consisted of "things that are", without any specification; this is compatible with the presence in it of a first tier of "things that are now", out of which the rest arose. The Derveni author, finally, posits no substantialized properties; like Empedocles, he only considers the properties of the basic substances as basic.

The piece of evidence in question concerns Oenopides of Chios (DK 41), a slightly younger contemporary of Anaxagoras, and thus a fifth-century-BC figure.[19] It can very well suggest that not all post-Parmenidean cosmologists jettisoned Parmenides' dualism,[20] a trend to which the Derveni author would have been the sole exception in positing air and fire alone as basic substances, and comes from Sextus Empiricus (PH 3.30–31 = DK 41 A 5):

> συντόμως δὲ καὶ περὶ τῶν ὑλικῶν καλουμένων ἀρχῶν λεκτέον. ὅτι τοίνυν αὗταί εἰσιν ἀκατάληπτοι, ῥᾴδιον συνιδεῖν ἐκ τῆς περὶ αὐτῶν γεγενημένης διαφωνίας παρὰ τοῖς δογματικοῖς. Φερεκύδης μὲν γὰρ ὁ Σύριος γῆν εἶπε τὴν πάντων εἶναι ἀρχήν, Θαλῆς δὲ ὁ Μιλήσιος ὕδωρ, Ἀναξίμανδρος δὲ ὁ ἀκουστὴς τούτου τὸ ἄπειρον, Ἀναξιμένης δὲ καὶ Διογένης ὁ Ἀπολλωνιάτης ἀέρα, Ἵππασος δὲ ὁ Μεταποντῖνος πῦρ, Ξενοφάνης δὲ ὁ Κολοφώνιος γῆν καὶ ὕδωρ, Οἰνοπίδης δὲ ὁ Χῖος πῦρ καὶ ἀέρα, Ἵππων δὲ ὁ Ῥηγῖνος πῦρ καὶ ὕδωρ, Ὀνομάκριτος δὲ ἐν τοῖς Ὀρφικοῖς πῦρ καὶ ὕδωρ καὶ γῆν, οἱ δὲ περὶ τὸν Ἐμπεδοκλέα καὶ τοὺς Στωικοὺς πῦρ ἀέρα ὕδωρ γῆν …[21]

We cannot be sure that the two principles Oenopides posited, air and fire, are like the Parmenidean basic substances, earth and fire, or the Empedoclean roots, and unlike the earth and water of Xenophanes, which seem to have been assumed to turn into each other in good Ionian fashion, earth being the originative substance out of which water and a number of other basic substances, all of them intertransformable, arose.[22] Unfortunately, that Oenopides dates back most probably wholly to the fifth century BC is not of much help here, for Hippon of Rhegium, who is mentioned by Sextus after Oenopides in the passage quoted above, must have been a contemporary of Oenopides, but seems to have conceived of water

19) See Procl. In Euc. 65.21–66.8 (Friedlein). On Oenopides see now I. M. Bodnár, Oenopides of Chios: A survey of the modern literature with the ancient testimonia, Max-Planck-Institut für Wissenschaftsgeschichte Preprint 327 (2007) http://www.mpiwg-berlin.mpg.de/Preprints/P327.PDF (accessed 30-11-2010).

20) Cf. Graham (above, n. 3) 227–28.

21) See also S. E. M. 9.361 and Ps.-Gal. Phil. Hist. 18. Cf. Lucr. 1.712–713.

22) On Xenophanes see Graham (above, n. 3) 70–73.

as an Ionian basic substance, which transformed into, at least, fire (further details of his cosmology are lost).[23] Being an astronomer and mathematician, Oenopides might be assumed to have been more sophisticated than Hippon, whom Aristotle judges to be unworthy of consideration as a cosmologist, and thus to have followed in the footsteps of Parmenides, who is credited with some important astronomical discoveries in our sources;[24] a further, in this context possibly important, point of connection between Parmenides and Oenopides is a shared interest in the Milky Way, which interested Democritus and Anaxagoras, too.[25]

We can assume that (a) the Derveni author was influenced by Oenopides, as regards the basic substances: the astronomer's air and fire (a_1) were like Xenophanean earth and water, but the Derveni author integrated them into a Parmenidean cosmology, or (a_2) were Parmenidean basic substances to begin with, adopted by the Derveni author for his own fleshing out of the Parmenidean cosmological model. Alternatively, it may be that (b) the Derveni author adopted wholesale the cosmology of Oenopides, provided that the Chian did have a cosmology and did not just speak vaguely of air and fire as basic substances in, e. g., an astronomical context.[26] About Oenopides as a cosmologist, apart from what Sextus says, we perhaps know one more thing, which might point to a further interesting parallel between the astronomer and the Derveni author, as we will see next, or perhaps to an equally interesting divergence. It is only parallels between their cosmologies that we can claim to be able to establish with some degree of confidence. For

23) See Arist. Metaph. A 5, 983b33–984a4 = DK 38 A 7 (Hippon is implicitly paralleled with Thales in having posited water as a single universal material principle), and cf. DK 38 A 3.

24) For Aristotle's criticism of Hippon see previous note.

25) Parmenides mentions the Milky Way in DK 28 B 11; for Anaxagoras and Democritus see the account in Arist. Mete. A 8, 345a25–31 = DK 59 A 80 and DK 68 A 91; for Oenopides and the Milky Way see DK 41 A 10, quoted below.

26) That "Oenopides is unlikely to have set forth any physical doctrine or developed a cosmology of his own" has recently been argued by L. Zhmud, The Origin of the History of Science in Classical Antiquity (Berlin / New York 2006) 261–62. Although Oenopides might not have set forth a detailed cosmology, there is no good reason to doubt that he identified air and fire as basic substances, perhaps in his discussion of the Milky Way and the Sun. Cf. R. Netz, Eudemus of Rhodes, Hippocrates of Chios and the Earliest Form of the Greek Mathematical Text, Centaurus 46 (2004), esp. 276–77.

any influence could conceivably have run from the Derveni author to Oenopides or radiated to both, independently of each other, from an unknown common source, though, as we will see below, there is some evidence pointing to the probable influence of Oenopides on the Derveni author.

A further cosmological parallel: the role of air

The further interesting parallel between Oenopides and the Derveni author could be the attribution of intelligence, and of the role of not only the initiator of the cosmogony but also of the cosmic governing principle and god, to one of the two basic substances, air. The Derveni author calls air "Mind", as already said, and also claims that air is god, who wanted the cosmos and all things in it to come into being and be as they are (col. XXV.9–12). According to a brief notice in Stobaeus (1.1.29b), under the heading "that god is the demiurge of beings and governs the universe through the reason of providence, and what his nature is", it is the cosmic soul that Diogenes, Cleanthes, and Oenopides identify with god:

> Διογένης καὶ Κλεάνθης καὶ Οἰνοπίδης τὴν τοῦ κόσμου ψυχὴν [sc. θεὸν εἶναι].[27]

The view, familiar from Stoicism, of god as "world-soul",[28] which Stobaeus attributes not only to Cleanthes, undoubtedly the Stoic, but also to a Diogenes and an Oenopides, without specifying their geographic origin, led to the hypothesis that the Diogenes in question cannot be the fifth-century-BC philosopher from Apollonia, according to whom air, the only basic substance in the universe, possesses intelligence, is god and the soul of living beings, and has arranged everything in the cosmos as best as possible (see DK 64 B 5; cf. B 3). He must be a Stoic, Diogenes of Babylonia perhaps, so Oenopides, together with whom this Diogenes is mentioned alongside Cleanthes, must be a Stoic, too, not the fifth-century-BC mathematician and astronomer from Chios.[29] Even if Stobaeus

27) DK 41 A 6. Cf. ps.-Plu. Plac. 881D11–12, on which see Bodnár (above, n. 19) 23.

28) Cf. e. g. Cic. N.D. 1.39 = part of S.V.F. 2.1077 (Chrysippus).

29) See Zhmud (above, n. 26) 260 n. 134; cf. Bodnár (above, n. 19) 11 n. 30.

speaks of Diogenes of Babylonia and not of Apollonia, there is no need to conjure up a Stoic Oenopides.[30] Given, moreover, that the Derveni author and Oenopides of Chios might have posited the same two basic substances, air and fire, the mention of the Chian astronomer and mathematician in Stobaeus' notice can be understood to suggest that Oenopides conceived of air in the same terms as the Derveni author, which means that the Diogenes mentioned alongside Oenopides by Stobaeus could very well be the fifth-century-BC Diogenes of Apollonia, who shared with the Derveni author, hence conceivably with Oenopides, too, the conception of air as an intelligent, demiurgic god. Whether Diogenes and Oenopides spoke of god as "world-soul" or not, this term, of undoubted Stoic provenance in the doxographical testimony, can be justifiedly applied to their conception of god, for Cleanthes, too, thought of god, the "world-soul", as a specific substance that is sentient and intelligent.[31] But Cleanthes identified god with fire.[32] It is thus conceivable that Stobaeus mentioned Oenopides alongside the Stoic because it was fire and not air that the Chian thought of as god, in which case (b) should at least be qualified.

The astronomical discovery of Oenopides and the Derveni author

Oenopides and the unknown Derveni author, moreover, share a noteworthy interest in the Sun. According to Theo of Smyrna (198.14–199.8 Hiller), whose source is Eudemus of Rhodes (fr. 145 Wehrli), Oenopides found the "belting" of the zodiac (DK 41 A 7), and others, then, measured the inclination of the zodiac to the celestial equator.[33] According to the testimony of Stobaeus (1.23.3; cf.

30) See Bodnár (above, n. 19) 11 n. 30 and A. Laks, Diogène d'Apollonie. Edition, traduction et commentaire des fragments et témoignages (Sankt Augustin ^{2}2008) 237.

31) Cf. Laks (above, n. 30) 237.

32) See D. Hahm, The Origins of Stoic Cosmology (Columbus OH 1977) 140–56.

33) The celestial equator is the equator of the so-called celestial sphere, which is concentric with the Earth, and bright points of which are thought to be the stars visible at night to an Earth-based observer: it is coplanar with the equator of the Earth, and it can be assumed that it is not the Earth but the comparatively enormous celestial sphere that rotates once a day, on an axis which is an extension of the Earth's own axis of rotation, but in the opposite direction to that of the Earth's true rota-

ps.-Plu. Plac. 888C12–D2), Oenopides appropriated the discovery of the inclination of the zodiac from Pythagoras (DK 41 A 7), whereas Diodorus Siculus reports that Oenopides, who spent some time in Egypt, learned among other things from the Egyptian priests that the plane of the circular annual path of the Sun, the ecliptic, forms an angle with the plane of the celestial equator, and that the direction of the Sun's motion along this oblique circle is opposite to the diurnal rotation (1.98.2–3 Bertrac = DK 41 A 7).[34]

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tion – all basic phenomena caused by the true rotation of the Earth take place as observed. The celestial sphere is fictional, but in ancient cosmology was considered real, and is a notion still useful in astronomy. The zodiac is a zone on the celestial sphere defined by the constellations through which we see the Sun pass in a year as it moves around the Earth, a reflection of the Earth's own true orbiting of the Sun. The plane of the Earth's orbit ("the ecliptic") is not perpendicular to our planet's rotational axis and forms an angle with its equator: thus the projection of the Sun's annual orbit around the Earth on the celestial sphere (which is a great circle on that sphere, like its equator, and is confusingly also called "ecliptic", in a geocentric sense of the term) is seen to be at an angle to the celestial equator, like the zodiac, too. Theo seems to rely on the authority of Eudemus indirectly, through the intermediary of Dercyllides, a later Platonist; for his dates, probably the first century AD, see H. Tarrant, Thrasyllan Platonism (Ithaca NY 1993) 72–76, J. Mansfeld, Prolegomena: Questions to be Settled Before the Study of an Author or a Text (Leiden 1994) 64. For the view that Oenopides can be plausibly assumed to have also measured the inclination of the zodiac and the ecliptic to the celestial equator see K. von Fritz, Oinopides, RE XVII (1937) 2260–61; cf. Zhmud (above, n. 26) 265 with n. 161. Diels has emended διάζωσιν, "belting", in Theo's report to λόξωσιν, "inclination". However, this is unnecessary. "The belting of the zodiac" can be plausibly understood as the by no means self-evident fact that the zodiacal constellations mark off a zone of the celestial sphere. If this is what Oenopides realized, then he also discovered that the zodiac is inclined to the celestial equator, whether he also measured the obliquity or not, and discovered the ecliptic, too.

34) The testimony of Stobaeus is suspect, given the Neopythagorean tendency of late authors to credit Pythagoras with many important astronomical discoveries (see W. Burkert, Lore and Science in Ancient Pythagoreanism [Cambridge MA 1972] 324–25 with n. 10). In view of the association in the biographical tradition of Alcmaeon of Croton, who might have been older than Oenopides, with Pythagoras (DK 24 A 1), the testimony that Alcmaeon had recognized the eastward motion of the wandering celestial objects (DK 24 A 4), which could suggest knowledge among the Pythagoreans of at least the zodiac prior to Oenopides, are not above suspicion; on Alcmaeon's date see the literature cited in G. E. R. Lloyd, Methods and Problems in Greek Science (Cambridge 1991) 168 n. 6. Philolaus of Croton, a Pythagorean and a contemporary of Oenopides, seems to have known of the obliquity of the ecliptic; see C. A. Huffmann, Philolaus of Croton (Cambridge 1993) 250–52 (cf. 1–6 for the dates of Philolaus). But no source credits him with the discovery of the ecliptic, or just of the zodiac.

We cannot be sure about what exactly Oenopides discovered.[35] Most probably he showed, in some sort of geometrical way, that the zodiacal constellations, whose stars are seen to march steadily westwards if observed regularly after sunset in the course of a year, define a zone on the celestial sphere, oblique to the celestial equator;[36] next, he perhaps concluded that, in a year, the Sun moves eastwards along a circle on a plane passing through the zodiacal belt and thus marking off a great oblique circle of the celestial sphere.[37] In the cosmology of the Derveni author, the paramount importance of the Sun is evinced by the assertion that, unless air, or Mind, had not wanted the cosmos and everything in it to exist, it would not have made the Sun, probably the first part of the cosmos to emerge from the primordial condition in the cosmogonical

35) Cf. J. Evans, The History and Practice of Ancient Astronomy (New York 1998) 58. The reports about the discovery of the zodiac, perhaps of the ecliptic as well, by Oenopides are dismissed for no good reason as unhistorical by A. C. Bowen, Oenopides, in: D. J. Zeyl (ed.), Encyclopedia of Classical Philosophy (Westport CT 1997) 357; see Bodnár (above, n. 19) 5–6.

36) This hypothesis builds on the suggestion in Evans (above, n. 35) 58. The simple procedure with a dioptra described by Euclid in the first proposition of his *Phaenomena* for showing that the Earth is in the middle of the cosmos can be used to show that the zodiacal constellations mark off a zone of the celestial sphere, and Oenopides might well have used it. As for how Oenopides might have discovered the obliquity of this zone, see the plausible suggestion about the discovery of the obliquity of the ecliptic by L. Brack-Bernsen, The Path of the Moon, The Rising Points of the Sun, and the Oblique Great Circle on the Celestial Sphere, Centaurus 45 (2003) 16–31 (as to whether the discoverer of the obliquity of the ecliptic was Oenopides, the author is agnostic; but see D. Panchenko, Who Found the Zodiac? Antike Naturwissenschaften und ihre Rezeption 9 [1999] 33–44). There is no good Greek evidence for a full set of the zodiacal constellations until the fifth century BC. They were probably taken over from the Babylonians (cf. Evans [above, n. 35] 39–40); knowledge of the zodiacal constellations might have spread to Greece thanks to a poem by the late-sixth-century-BC Cleostratus of Tenedus, as J. K. Fotheringham, Cleostratus, JHS 39 (1919) 164–84 has suggested. However, the Babylonians did not think in terms of the celestial sphere, and there is no evidence that they conceived of the zodiac as a belt; see F. Rochberg, The Heavenly Writing: Divination, Horoscopy and Astronomy in Mesopotamian Culture (Cambridge 2004) 126–27. That the fifth-century-BC Oenopides could not possibly have operated with the concept of the celestial sphere, which might already be presupposed by the cosmology of Anaximander, is highly unlikely.

37) This would be a hypothesis to explain why the stars of the zodiacal constellations, setting on the western horizon soon after sunset, change throughout the year, until the Sun is seen after a year to set against the same stellar backdrop as it did at the beginning of the cycle.

process, of a certain sort and size (col. XXV.9–12). Which properties the Sun is thought by the Derveni author to have apart from size is unclear. Shape and makeup, spherical and fiery respectively, are unlikely to be implicit here. It is perhaps either the uniqueness of the Sun in the cosmos or its fixed position right in the "middle" thereof that are meant, the latter of which is probably referred to in col. XV.3–5, or both.[38] If we do not ascribe heliocentrism to the Derveni author, the only possibility left, as regards the position of the Sun in his cosmology, is that the Sun is assumed to revolve round the Earth, which is at the center of a spherical cosmos, along a circle on a plane cutting the cosmos in two halves; the points of this circle, moreover, are assumed to be equidistant from the centre and the periphery of the spherical cosmos; perhaps, lastly, the Sun is also assumed to divide the five planets known in antiquity and the Moon, which together with the Sun are the seven wandering celestial objects, into two equinumerous groups – the Moon, Mercury, and Venus are located inside, or below, the solar circle, Mars, Jupiter, and Saturn outside, or above, it. The said circle can be identified only with the ecliptic. Now, allowing for the absence of any reference to the shape of the cosmos in the fragments of the work transmitted by the Derveni papyrus, in light of the possible points of contact between Oenopides and the Derveni author, the latter's indirect reference, and attribution of a fundamental cosmological role, to the ecliptic might be added to them.

Before it became understood among the Greeks that the annual path of the Sun is a single circle, whose projection on the celestial sphere is a great circle of that sphere oblique to its equator, it would have been impossible to maintain, within the framework of a geocentric cosmology, that the Sun has a fixed position in the middle of the cosmos, unless this only meant that the wandering celestial objects, which are located between the center of the cosmos and its periphery, are divided by the Sun into two trios, or unless one was completely indifferent to astronomical niceties. Let the annual path of the Sun be understood as a spiral having as coils of equal diameter the diurnal circles of the Sun sandwiched be-

38) For the position of the Sun in the "middle" of the cosmos of the Derveni author and its possible cosmological importance see Kouremenos et al. (above, n. 1) on col. XV.4–5.

tween the tropics, the diurnal circles of the Sun at the solstices.[39] If so, the position of the Sun, conceived of as that of a point of its (almost) circular path followed in a day, is not in the middle of the cosmos, in the sense of this point being equidistant from the Earth, at the center of the cosmos, and the cosmic periphery, as well as on a plane cutting the cosmos in two halves: for each day the Sun travels along a different diurnal circle, so it is on a place bisecting the cosmos only twice a year, at the equinoxes, when its diurnal circles are coplanar with the celestial equator, and its distance, moreover, from the center and the periphery of the cosmos varies daily throughout the year. When it became known, however, that the annual path of the Sun is actually a single circle, whose projection on the celestial sphere is one of its great circles and thus cuts it in two halves, it was naturally tempting to extend this nice symmetry to the position of the Sun in the cosmos, so as to let any point of the Sun's real annual path bisect the distance from the centre of the cosmos to its circular periphery. Placing the Sun in the middle of the other six wandering celestial objects could well be a further result of this symmetry-generalization.

39) The circular path of the Sun in the sky, unlike that of a star, is not the same every day, for the Sun participates in the diurnal, westward rotation of the celestial sphere and simultaneously moves in the opposite direction along the ecliptic. At equinoxes, its projection almost coincides with the celestial equator, which is bisected by the observer's horizon – this is why at equinoxes the hours of daylight and darkness are equal. At solstices, however, it almost coincides with two small circles of the celestial sphere parallel to, and equidistant from, the celestial equator, one to the north, with its largest part above the horizon, and the other to the south, with its largest part below the horizon. These circles are the tropics of Cancer, where the Sun is at summer solstice, when the time of daylight is the longest during the year, and of Capricorn, where the Sun is at winter solstice, when the time of daylight is at its annual minimum. Between a solstice and an equinox, the projections of the successive diurnal paths of the Sun coincide very closely with parallel small circles of the celestial sphere sandwiched between a tropic and the celestial equator; over the course of a year, the Sun's path is thus a spiral, which is traced out twice in this period. Spirals are described by the Moon and the planets, too, a coil corresponding to a diurnal revolution. In our extremely few sources for the early history of Greek astronomy, the spirals of the planets, the Sun, and the Moon are first mentioned by Plato, in his *Timaeus*, alongside the correct explanation of the phenomenon (39a5–b2).

Oenopides and the Derveni author on the Sun as guardian of the cosmic order

The Derveni author's view that, unless Mind had not wanted the cosmos and everything in it to exist, it would not have made the Sun of a particular sort and size entails that the cosmic order would be disrupted if the Sun ballooned up or shrank, or if comparable celestial fireballs appeared in the heavens, or, in view of the above, if the Sun left the ecliptic, or if the obliquity of the ecliptic changed, or if the direction of the Sun's motion on the ecliptic reversed, or if the speed of this motion changed. We can be quite confident that the Derveni author explicitly associated the preservation of the cosmic order with the stability of the size of the Sun, which is guaranteed by the action of Mind (col. XXV.3–12).[40] For the rest we can only speculate. However, if we are right in assuming that, by the Derveni author's lights, a change in the orbit of the Sun would cause a disruption of the cosmic order, here we have perhaps another parallel with Oenopides. He seems to have held the view that the stability of the orbit of the Sun is contingent on the preservation of moral order, which the astronomer would have conceived of as part of the cosmic order. For he is said to have believed that the Sun originally moved on the plane of the Milky Way, and thus at a considerably steeper inclination to the celestial equator, but was diverted to its present course, whose background are the zodiacal constellations, and also reversed the direction of its motion, which thus was originally not from west to east but from east to west, like that of the diurnal rotation, on account of the banquet of Thyestes (Ach. Tat. Isagoga 55.18–21 Maass = DK 41 A 10):

> ἕτεροι δέ φασιν, ὧν ἐστιν καὶ Οἰνοπίδης ὁ Χῖος, ὅτι πρότερον διὰ τούτου [sc. τοῦ γαλαξίου] ἐφέρετο ὁ ἥλιος, διὰ δὲ τὰ Θυέστεια δεῖπνα ἀπεστράφη καὶ τὴν ἐναντίαν τούτῳ πεποίηται περιφοράν, ἣν νῦν περιγράφει ὁ ζῳδιακός.[41]

40) See Kouremenos et al. (above, n. 1) on col. XXV.10–11 and IV.2–3.

41) Aristotle, Mete. A 5, 345a11–18, seems to attribute the view that the Milky Way is the former path of the Sun to some Pythagoreans contrasted with others of the same group who held another view on the nature of the Milky Way. However, the contrast can be between those Pythagoreans who tried to explain the Milky Way and anonymous others, non-Pythagoreans, i. e. Oenopides, who thought of the Milky Way as the former path of the Sun. Aristotle does not mention the banquet of Thyestes.

(Par)etymology and cosmology

A final possible point of contact between the Derveni author and Oenopides is the interest in the aetiological (par)etymology of divine names from expressions used in cosmology, via the identification of the god, whose name is to be etymologically accounted for, with a basic item of the cosmic furniture. The Derveni author assumes that Κρόνος, whom he identifies with air / Mind, has been given this name because air / Mind caused collisions among the particles of the basic substances when it started the cosmogony, i. e. that Κρόνος derives from the expression ὁ κρούων Νοῦς (col. XIV.7–10). Oenopides is said to have thought along quite similar lines that Apollo, whom he identified with the Sun, is called Λοξίας on account of the fact that the annual course of the Sun is a circle which is oblique to the celestial equator, in other words that the name Λοξίας derives from the description of the ecliptic as ὁ λοξὸς κύκλος, "the oblique circle" (Macrob. Sat. 1.17.31 = DK 41 A 7.4):

> Λοξίας *cognominatur, ut ait Oenopides*, ὅτι ἐκπορεύεται τὸν λοξὸν κύκλον ἀπὸ δυσμῶν ἐπ' ἀνατολὰς κινούμενος, *id est quod obliquum circulum ab occasu ad orientem pergit* [. . .].[42]

Conclusion

As already said, we cannot go beyond cautiously drawing a few parallels between the Derveni author and Oenopides. Virtually all evidence about Oenopides is late, some pieces of it are confusing and others disputed, but the possibility of more than one interesting similarity between him and the Derveni author hints that associating the two might not be a fantasy. If Oenopides did discover the ecliptic, the Derveni author's possible indirect reference, and attribution of great importance, to this great circle, within a cosmology that can be brought easily into line with the meager testimonies about the views of the Chian astronomer on the basic substances and god, might suggest that the Derveni author borrowed at least the basics of his cosmology from Oenopides, as proposed in (a), not from an unknown common source.

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42) The report has been assumed to be about the putative Stoic Oenopides mentioned above.

One would like to know whether Oenopides pioneered the interpretation of myth and religion as cosmological allegory that attracted even Aristotle;[43] and if so, to what end he put it, as well as whether the baroque cosmological allegoresis of an Orphic poem by the Derveni author served the same end or not. But the answers to these questions are beyond our reach.[44]

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43) See Kouremenos et al. (above, n. 1) 57–58.

44) I wish to thank the editors for their helpful comments.