CHAPTER II

Thales of Miletus

DATE

Traditionally the earliest Greek physicist, or enquirer into the nature of things as a whole (**85**), Thales predicted an eclipse which took place in 585 B.C. (**74**). He was presumably not active, therefore, much earlier than the beginning of the sixth century.[1]

[1] The eclipse took place in Ol. 48, 4 (585/4) according to Pliny, *N.H.* II, 53 (DK 11 A 5), who presumably followed Apollodorus; and a year or more later according to the Eusebian scheme (DK 11 A 5). Modern calculations put it on 28 May 585 B.C., i.e. in Ol. 48, 3. Tannery's view that the eclipse predicted by Thales was that of 610 is now rejected. Apollodorus according to Diogenes Laertius 1, 37–8 (DK 11 A 1) put Thales' birth in Ol. 35, 1 (640), his death in Ol. 58 (548–545) at the age of seventy-eight. There is a fault in the mathematics here: probably Ol. 35, 1 is a mistake, by the common confusion of ξ and θ, for Ol. 39, 1 (624). Apollodorus, then, characteristically placed Thales' death around the epoch-year of the capture of Sardis, his *acme* at the time of the eclipse, and his birth the conventional forty years earlier. This accords approximately with a different and slightly earlier dating authority: Demetrius of Phaleron, according to Diog. L. 1, 22 (DK 11 A 1), placed the canonization of the Seven Sages (of whom Thales was a universally accepted member) in the archonship of Damasias at Athens, i.e. 582/1 B.C., the epoch-year of the first restored Pythian festival.

NATIONALITY

62 Diogenes Laertius 1, 22 (DK 11 A 1 *init.*) ἦν τοίνυν ὁ Θαλῆς, ὡς μὲν Ἡρόδοτος καὶ Δοῦρις καὶ Δημόκριτός φασι, πατρὸς μὲν Ἐξαμύου μητρὸς δὲ Κλεοβουλίνης, ἐκ τῶν Θηλιδῶν, οἵ εἰσι Φοίνικες, εὐγενέστατοι τῶν ἀπὸ Κάδμου καὶ Ἀγήνορος...ἐπολιτογραφήθη δὲ (*sc.* Ἀγήνωρ) ἐν Μιλήτῳ ὅτε ἦλθε σὺν Νείλεῳ ἐκπεσόντι Φοινίκης. ὡς δ' οἱ πλείους φασίν, ἰθαγενὴς Μιλήσιος ἦν (*sc.* Θαλῆς) καὶ γένους λαμπροῦ.

63 Herodotus 1, 170 (from **65**) ...Θαλέω ἀνδρὸς Μιλησίου...τὸ ἀνέκαθεν γένος ἐόντος Φοίνικος...

62 Now Thales, as Herodotus and Douris and Democritus say, was the son of Examyes as father and Cleobuline as mother, from

the descendants of Theleus, who are Phoenicians, nobles from the line of Cadmus and Agenor...and he [Agenor] was enrolled as a citizen in Miletus when he came with Neileos, when the latter was exiled from Phoenicia. But most people say that Thales was a true Milesian by descent, and of high family.

63 ...of Thales, a man of Miletus...being a Phoenician by ultimate descent...

The story of Thales' Phoenician ancestry, barely mentioned by Herodotus in **63** (though **62** makes it appear as though he had said more; the references in Douris and Democritus are otherwise unknown), was later much elaborated, partly, no doubt, to support the common theory of the eastern origins of Greek science. If Thales drew the attention of the Milesians to the navigational value of the Little Bear, used earlier by Phoenician sailors (see **78**), this would add to the force of Herodotus' comment. The probability is that Thales was as Greek as most Milesians.[1]

[1] Cf. **64** Herodotus 1, 146 ...Μινύαι Ὀρχομένιοί σφι (*sc.* the Ionian colonists) ἀναμεμείχαται καὶ Καδμεῖοι καὶ Δρύοπες... (*...Minyans from Orchomenus are mixed with them [the Ionian colonists], and Cadmeians and Dryopes...*). Thus Thales' 'Phoenician' ancestors were probably Cadmeians from Boeotia and not full-blooded Semites. His father, Examyes, seems to have had a Carian name. Herodotus went on to say that even the ostensibly purest Ionian families were mixed by intermarriage with Carian women.

PRACTICAL ACTIVITIES

65 Herodotus 1, 170 χρηστὴ δὲ καὶ πρὶν ἢ διαφθαρῆναι Ἰωνίην Θαλέω ἀνδρὸς Μιλησίου ἐγένετο (*sc.* ἡ γνώμη), τὸ ἀνέκαθεν γένος ἐόντος Φοίνικος, ὃς ἐκέλευε ἓν βουλευτήριον Ἴωνας ἐκτῆσθαι, τὸ δὲ εἶναι ἐν Τέῳ (Τέων γὰρ μέσον εἶναι Ἰωνίης), τὰς δὲ ἄλλας πόλιας οἰκεομένας μηδὲν ἧσσον νομίζεσθαι κατά περ εἰ δῆμοι εἶεν.

66 Herodotus 1, 75 ὡς δὲ ἀπίκετο ἐπὶ τὸν Ἅλυν ποταμὸν ὁ Κροῖσος, τὸ ἐνθεῦτεν, ὡς μὲν ἐγὼ λέγω, κατὰ τὰς ἐούσας γεφύρας διεβίβασε τὸν στρατόν, ὡς δὲ ὁ πολλὸς λόγος Ἑλλήνων, Θαλῆς οἱ ὁ Μιλήσιος διεβίβασε. ἀπορέοντος γὰρ Κροίσου ὅκως οἱ διαβήσεται τὸν ποταμὸν ὁ στρατός (οὐ γὰρ δὴ εἶναί κω τοῦτον τὸν χρόνον τὰς γεφύρας ταύτας) λέγεται παρεόντα τὸν Θαλῆν ἐν τῷ στρατοπέδῳ ποιῆσαι αὐτῷ τὸν ποταμὸν ἐξ ἀριστερῆς χειρὸς ῥέοντα τοῦ στρατοῦ καὶ ἐκ δεξιῆς ῥέειν, ποιῆσαι δὲ ὧδε· ἄνωθεν τοῦ στρατοπέδου ἀρξάμενον διώρυχα βαθέαν ὀρύσσειν ἄγοντα μηνοειδέα, ὅκως ἂν τὸ στρατόπεδον ἱδρυμένον κατὰ νώτου λάβοι, ταύτῃ κατὰ τὴν διώρυχα ἐκτραπόμενος

ἐκ τῶν ἀρχαίων ῥεέθρων, καὶ αὖτις παραμειβόμενος τὸ στρατόπεδον ἐς τὰ ἀρχαῖα ἐσβάλλοι, ὥστε ἐπείτε καὶ ἐσχίσθη τάχιστα ὁ ποταμὸς ἀμφοτέρῃ διαβατὸς ἐγένετο.

65 Useful also was the opinion, before the destruction of Ionia, of Thales, a man of Miletus, being a Phoenician by ultimate descent, who advised the Ionians to have a single deliberative chamber, saying that it should be in Teos, for this was in the middle of Ionia; the other cities should continue to be inhabited but should be regarded as if they were demes.

66 When he came to the Halys river, Croesus then, as I say, put his army across by the existing bridges; but, according to the common account of the Greeks, Thales the Milesian transferred the army for him. For it is said that Croesus was at a loss how his army should cross the river, since these bridges did not yet exist at this period; and that Thales, who was present in the army, made the river, which flowed on the left hand of the army, flow on the right hand also. He did so in this way: beginning upstream of the army he dug a deep channel, giving it a crescent shape, so that it should flow round the back of where the army was encamped, being diverted in this way from its old course by the channel, and passing the camp should flow into its old course once more. The result was that as soon as the river was divided it became fordable in both its parts.

Herodotus provides important evidence for Thales' activities as statesman and engineer (also as astronomer, **74**). Such versatility seems to have been typical of the Milesian thinkers, whom it is tempting to consider too exclusively as theoretical physicists. Thales, especially, became a symbol for ingenuity of a mathematical and geometrical kind: ἄνθρωπος Θαλῆς ('the man's a Thales'), says a character in Aristophanes (*Birds* 1009) of Meton the town-planner; and Plato (*Rep.* 600A) coupled him with Anacharsis. Herodotus, it is true, did not believe the story in **66** about Thales diverting the river Halys, but he did not deny that this is the sort of thing Thales might have done. There probably were crossings over the Halys, but Croesus' army might not have found them; Herodotus was rightly cautious, although the grounds of his suspicion were not certainly correct. He went on to mention a variant account by which the river was totally diverted into a new bed; the story, therefore, may have been widespread. The circumstantial and restrained nature of the version of **66** suggests that it contained a kernel of truth.[1]

[1] For a far more sceptical account of Thales' ideas one can refer to D. R. Dicks, *CQ* N.S. 9 (1959), 294–309.

TRADITION OF A VISIT TO EGYPT

67 Aetius I, 3, 1 Θαλῆς...φιλοσοφήσας δὲ ἐν Αἰγύπτῳ ἦλθεν εἰς Μίλητον πρεσβύτερος.

68 Proclus *in Euclidem* p. 65 Friedl. (from Eudemus) (DK 11 A 11) Θαλῆς δὲ πρῶτον εἰς Αἴγυπτον ἐλθὼν μετήγαγεν εἰς τὴν Ἑλλάδα τὴν θεωρίαν ταύτην (*sc.* τὴν γεωμετρίαν)...

67 Thales...having practised philosophy in Egypt came to Miletus when he was older.

68 Thales, having first come to Egypt, transferred this study [geometry] to Greece...

It was the custom to credit the sixth-century sages (notably, for example, Solon) with visits to Egypt, the traditional fountain-head of Greek science. Thales as the earliest known Greek geometer had a special reason for being associated with the home of land-measurement.[1] The implication of **67** that he spent a considerable time there is unique and not persuasive. That he did visit Egypt, however, is possible enough; several of his achievements are quite plausibly located there (e.g. **79**; see also p. 88), and Miletus' relations with its colony Naucratis were so close as to make a visit by any prominent citizen, trader or not, perfectly feasible.

[1] Cf. **69** Herodotus II, 109 δοκέει δέ μοι ἐνθεῦτεν γεωμετρίη εὑρεθεῖσα εἰς τὴν Ἑλλάδα ἐπανελθεῖν. *(It seems to me that geometry was discovered from this source [sc. re-measurement of holdings after the Nile flood] and so came to Greece.)*

Further, Thales appears in Aetius as the holder of a theory about the flooding of the Nile which is one of three already recorded by Herodotus:

70 Herodotus II, 20 (there are two particularly improbable theories about the cause of the flood) τῶν ἡ ἑτέρη μὲν λέγει τοὺς ἐτησίας ἀνέμους εἶναι αἰτίους πληθύειν τὸν ποταμόν, κωλύοντας ἐς θάλασσαν ἐκρέειν τὸν Νεῖλον.

71 Aetius IV, 1, 1 Θαλῆς τοὺς ἐτησίας ἀνέμους οἴεται πνέοντας τῇ Αἰγύπτῳ ἀντιπροσώπους ἐπαίρειν τοῦ Νείλου τὸν ὄγκον διὰ τὸ τὰς ἐκροὰς αὐτοῦ τῇ παροιδήσει τοῦ ἀντιπαρήκοντος πελάγους ἀνακόπτεσθαι.

70 Of these, one theory says that the Etesian winds are the cause of the river flooding, by preventing the Nile from running out into the sea.

71 Thales thinks that the Etesian winds, blowing straight on to

Egypt, raise up the mass of the Nile's water through cutting off its outflow by the swelling of the sea coming against it.

Aetius probably depends on a lost Peripatetic treatise, of which traces have survived in other sources (Diels, *Doxographi Graeci* 226f.): therefore his information may be reliable and not, as is nevertheless possible, a purely speculative ascription. If Thales did advance this theory then he may have seen the Nile himself; though it should be remembered that he could easily have got the relevant information (that the Etesian winds blow in Egypt too), and even the idea, from Milesian traders.

ANECDOTES ABOUT THALES AS THE TYPICAL PHILOSOPHER

72 Plato *Theaetetus* 174A ...ὥσπερ καὶ Θαλῆν ἀστρονομοῦντα, ὦ Θεόδωρε, καὶ ἄνω βλέποντα, πεσόντα εἰς φρέαρ, Θρᾷττά τις ἐμμελὴς καὶ χαρίεσσα θεραπαινὶς ἀποσκῶψαι λέγεται, ὡς τὰ μὲν ἐν οὐρανῷ προθυμοῖτο εἰδέναι, τὰ δ' ὄπισθεν αὐτοῦ καὶ παρὰ πόδας λανθάνοι αὐτόν.

73 Aristotle *Politics* A11, 1259a9 ὀνειδιζόντων γὰρ αὐτῷ διὰ τὴν πενίαν ὡς ἀνωφελοῦς τῆς φιλοσοφίας οὔσης, κατανοήσαντά φασιν αὐτὸν ἐλαιῶν φορὰν ἐσομένην ἐκ τῆς ἀστρολογίας, ἔτι χειμῶνος ὄντος, εὐπορήσαντα χρημάτων ὀλίγων ἀρραβῶνας διαδοῦναι τῶν ἐλαιουργείων τῶν τ' ἐν Μιλήτῳ καὶ Χίῳ πάντων, ὀλίγου μισθωσάμενον ἅτ' οὐδενὸς ἐπιβάλλοντος. ἐπειδὴ δ' ὁ καιρὸς ἦκε, πολλῶν ζητουμένων ἅμα καὶ ἐξαίφνης, ἐκμισθοῦντα ὃν τρόπον ἠβούλετο πολλὰ χρήματα συλλέξαντα ἐπιδεῖξαι ὅτι ῥᾴδιόν ἐστι πλουτεῖν τοῖς φιλοσόφοις ἂν βούλωνται, ἀλλ' οὐ τοῦτ' ἐστὶ περὶ ὃ σπουδάζουσιν. (Cf. also Diog. L. 1, 26 (DK 11A1), from Hieronymus of Rhodes, and Cicero *Div.* 1, 49, 111.)

72 ...just as, Theodorus, a witty and attractive Thracian servant-girl is said to have mocked Thales for falling into a well while he was observing the stars and gazing upwards; declaring that he was eager to know the things in the sky, but that what was behind him and just by his feet escaped his notice.

73 For when they reproached him because of his poverty, as though philosophy were no use, it is said that, having observed through his study of the heavenly bodies that there would be a large olive-crop, he raised a little capital while it was still winter, and paid deposits on all the olive presses in Miletus and Chios, hiring them cheaply because no one bid against him. When the

appropriate time came there was a sudden rush of requests for the presses; he then hired them out on his own terms and so made a large profit, thus demonstrating that it is easy for philosophers to be rich, if they wish, but that it is not in this that they are interested.

Neither of these stories is likely to be strictly historical, even though they originated in the fourth century B.C. at the latest, before the great period of fictitious biography in the third and second centuries. They well demonstrate how at a comparatively early date Thales had become accepted as the typical philosopher; though **72**, one of the oldest versions of the absent-minded professor theme, would have had more point if applied to someone not so notoriously practical in his interests as Thales. The detail of the witty slave-girl is added to make the whole situation more piquant; possibly it is a vestige of a separate and mildly malicious joke at the philosopher's expense. Plato liked making fun of the Presocratics, a truth frequently overlooked in the interpretation of certain less obvious passages.

THE PREDICTION OF THE ECLIPSE, AND OTHER ASTRONOMICAL ACTIVITIES

74 Herodotus 1, 74 διαφέρουσι δέ σφι (*sc.* τοῖσι Λυδοῖσι καὶ τοῖσι Μήδοισι) ἐπ' ἴσης τὸν πόλεμον τῷ ἕκτῳ ἔτει συμβολῆς γενομένης συνήνεικε ὥστε τῆς μάχης συνεστεώσης τὴν ἡμέρην ἐξαπίνης νύκτα γενέσθαι. τὴν δὲ μεταλλαγὴν ταύτην τῆς ἡμέρης Θαλῆς ὁ Μιλήσιος τοῖσι Ἴωσι προηγόρευσε ἔσεσθαι, οὖρον προθέμενος ἐνιαυτὸν τοῦτον ἐν τῷ δὴ καὶ ἐγένετο ἡ μεταβολή.

75 Diogenes Laertius 1, 23 δοκεῖ δὲ κατά τινας πρῶτος ἀστρολογῆσαι καὶ ἡλιακὰς ἐκλείψεις καὶ τροπὰς προειπεῖν, ὡς φησιν Εὔδημος ἐν τῇ περὶ τῶν ἀστρολογουμένων ἱστορίᾳ· ὅθεν αὐτὸν καὶ Ξενοφάνης καὶ Ἡρόδοτος θαυμάζει. μαρτυρεῖ δ' αὐτῷ καὶ Ἡράκλειτος καὶ Δημόκριτος.

76 Dercyllides *ap.* Theon. Smyrn. p. 198, 14 Hiller Εὔδημος ἱστορεῖ ἐν ταῖς Ἀστρολογίαις ὅτι Οἰνοπίδης εὗρε πρῶτος τὴν τοῦ ζῳδιακοῦ λόξωσιν [Diels; διάζωσιν ms] καὶ τὴν τοῦ μεγάλου ἐνιαυτοῦ περίστασιν, Θαλῆς δὲ ἡλίου ἔκλειψιν καὶ τὴν κατὰ τὰς τροπὰς αὐτοῦ περίοδον, ὡς οὐκ ἴση ἀεὶ συμβαίνει.

74 In the sixth year of the war, which they [Medes and Lydians] had carried on with equal fortunes, an engagement took place in which it turned out that when the battle was in progress the day

suddenly became night. This alteration of the day Thales the Milesian foretold to the Ionians, setting as its limit this year in which the change actually occurred.

75 Some think he was the first to study the heavenly bodies and to foretell eclipses of the sun and solstices, as Eudemus says in his history of astronomy; for which reason both Xenophanes and Herodotus express admiration; and both Heraclitus and Democritus bear witness for him.

76 Eudemus relates in the *Astronomy* that Oenopides first discovered the obliquity of the Zodiac and the cycle of the Great Year, and Thales the eclipse of the sun and the variable period of its solstices.

The prediction of the eclipse must have been based on a long series of empirical observations, not upon a scientific theory of the true cause of eclipses. The cause was unknown to Thales' immediate successors in Miletus and therefore, presumably, to him. If the contrary was implied by Eudemus in **76** (it is asserted by Aetius, e.g. II, 24, 1, DK 11 A 17*a*), then Eudemus was guilty of drawing a wrong conclusion from the undoubted fact of Thales' prediction. The Babylonian priests had made observations of eclipses of the sun, both partial and total, for religious purposes, at any rate since 721 B.C.; and by the sixth century they had probably established a cycle of solstices (or less plausibly of lunations) within which eclipses might occur at certain points. It is overwhelmingly probable that Thales' feat depended on his access to these Babylonian records; see further Kahn, *Anaximander and the Origins of Greek Cosmology* (New York, 1960), p. 76 n. 2. We know that many cultivated Greeks visited Sardis at this period,[1] and relations with Ionia were naturally particularly close. Some scholars have argued that Thales' information more probably came from Egypt, with which he had other contacts; but there is no evidence that sufficiently detailed observations, over a long enough period, were made and recorded by the Egyptian priests. Even on the Babylonian data it could not be predicted that an eclipse would be visible at a particular point. Priests were despatched to different parts of the Babylonian empire when a possible eclipse was due, and even within this large area the expected phenomenon was sometimes not visible. Further, no precise date could be predicted, only broad limits of time. Thus Thales appears to have said that an eclipse was likely to occur within a certain year.[2] It was pure chance that it happened on the day of the battle and so seemed especially remarkable, and to some degree a matter of luck that it was visible near the Ionian area at all.

[1] **77** Herodotus I, 29 ...ἀπικνέονται ἐς Σάρδις ἀκμαζούσας πλούτῳ ἄλλοι τε οἱ πάντες ἐκ τῆς Ἑλλάδος σοφισταί...καὶ δὴ καὶ Σόλων... (*...there arrived at Sardis in this bloom of its wealth all the sages from Greece...among whom came Solon...*).

[2] Some scholars have felt a whole year to be too large a period, and have tried to restrict the meaning of ἐνιαυτόν in **74** to the summer solstice (by which the year-interval could be gauged); but there is no satisfactory evidence for such a usage.

The information added by Eudemus in **75** and **76**, that Thales predicted solstices and noted that their cycle is not always equal (by which is probably meant the slight variations in length of the solar seasons, as divided by solstices and equinoxes), is more straightforward. All that would be needed would be a rather long series of observations with a solstice-marker, a ἡλιοτρόπιον of some kind, such as was connected with Pherecydes (**47**), to mark the bearings of the sun at its most northerly and southerly points in the year – that is, the summer and winter solstices. Alternatively a *gnomon* or stable vertical rod, by which the length of the sun's shadow could be exactly recorded, would suffice. This was said by Herodotus to be a Babylonian invention (**97**), and its introduction was credited to Anaximander and not to Thales (**94**). However, measurement of shadows was certainly involved in the computation of the height of pyramids ascribed to Thales (p. 85), and one cannot be completely confident that the observation of the sun's zenith by similar means was unknown to him. The technique seems obvious to us now, and might be thought to have occurred to anyone who had reached Thales' by no means primitive stage of celestial observation. Diogenes (I, 24, DK 11 A 1) added that Thales discovered the passage of the sun from solstice to solstice, and the relation of the diameter of sun and moon to their orbits. The former phrase is very vague, and might imply no more than the knowledge that the sun moves between the tropics – which Thales obviously possessed. But it perhaps refers to the discovery of the inclination of the Zodiac, which Eudemus in **76** ascribed to Oinopides of Chios over a century later. Diogenes' second piece of information is quite anachronistic, for Thales cannot have thought that the heavenly bodies had orbits, since they did not pass under the earth (which was not made free-swinging until Anaximander); at the most they had semi-orbits, and the ratio of diameter to celestial path would be twice that given.[1]

[1] The determination of this ratio was a recurrent problem in Greek astronomy, which might naturally come to be associated with the earliest known astronomer. The ratio suggested in Diogenes, 1:720, implies a sexagesimal measurement of the circle of the ecliptic such as was adopted by the Babylonians: so A. Wasserstein, *JHS* 75 (1955), 114–16. Cf. Herodotus II, 109 (**97**), also II, 4.

One further observation is attributed to Thales, again with a possible implication that he may be indebted to foreign sources:

78 Callimachus *Iambus* 1, 52, fr. 191 Pfeiffer (DK 11 A 3*a*)

...ἦν γὰρ ἡ νίκη
Θάλητος, ὃς τ' ἦν ἄλλα δεξιὸς γνώμην
καὶ τῆς Ἀμάξης ἐλέγετο σταθμήσασθαι
τοὺς ἀστερίσκους, ἢ πλέουσι Φοίνικες.

78 ...for the victory belonged to Thales, who was clever in judgement, not least because he was said to have measured out the little stars of the Wain, by which the Phoenicians sail.

This is part of the apocryphal story of the cup (in some versions, tripod) which had to be presented to the wisest man living: Thales was the first, and in some versions also the final, choice, but he modestly sent it on to Bias, and he to others of the Seven Sages. The 'little stars of the Wain' are the Little Bear (cf. Aratus *Phaen.* 39, with scholion); this constellation, because its revolution is smaller, provides a more accurate fixed point than the Great Bear or Wain as a whole (as opposed to the Pole star itself). σταθμᾶσθαι strictly means 'to measure', but sometimes, more vaguely, 'to mark out, define' (Σ on Pindar *Ol.* 10, 53). The probable meaning is that Thales defined the Little Bear, and drew the attention of Milesian sailors to its navigational usefulness. Diogenes Laertius, 1, 23, interpreted the lines of Callimachus as meaning simply that Thales 'discovered' the Little Bear. Ionian sailors may previously have neglected it, since for all except long open-sea crossings the more conspicuous Great Bear was adequate.

Thus the ἀστρολογία, the study of heavenly bodies, mentioned as characteristic of Thales by Plato (**72**) and Aristotle (**73**),[1] seems to have comprised these activities: the lucky prediction of an eclipse, probably with the aid of Babylonian tables; the measurement of solstices and their variations, possibly undertaken in part for calendar-making purposes; and the study of star-groups, perhaps mainly as a navigational aid.

[1] Cf. also **75**, where nothing is otherwise known of the references to Thales by Xenophanes, Heraclitus and Democritus.

MATHEMATICAL DISCOVERIES

79 Diogenes Laertius 1, 27 ὁ δὲ Ἱερώνυμος καὶ ἐκμετρῆσαί φησιν αὐτὸν τὰς πυραμίδας ἐκ τῆς σκιᾶς, παρατηρήσαντα ὅτε ἡμῖν ἰσομεγέθης ἐστίν.

80 Proclus *in Euclidem* p. 352 Friedl. (DK 11 A 20) Εὔδημος δὲ ἐν ταῖς Γεωμετρικαῖς ἱστορίαις εἰς Θαλῆν τοῦτο ἀνάγει τὸ θεώρημα (*sc.* that triangles having one side and its adjacent angles equal are themselves equal)· τὴν γὰρ τῶν ἐν θαλάττῃ πλοίων ἀπόστασιν δι' οὗ τρόπου φασὶν αὐτὸν δεικνύναι τούτῳ προσχρῆσθαί φησιν ἀναγκαῖον.

79 Hieronymus says that he [Thales] actually measured the pyramids by their shadow, having observed the time when our own shadow is equal to our height.

80 Eudemus in the *History of Geometry* refers this theorem to Thales; for the method by which they say he demonstrated the distance of ships out at sea must, he says, have entailed the use of this theorem.

In **79** Hieronymus of Rhodes attributes to Thales the simplest possible method of measuring the height of a pyramid. Thales might conceivably have learned this from the Egyptians; or it is not impossible that the pyramids were merely local colour, to fit the tradition of a visit to Egypt. Pliny (*N.H.* XXXVI, 82, DK 11 A 21) gave the same account, but a more complex variant appears in Plutarch, *Sept. sap. conv.* 2, 147A (DK 11 A 21), that the height of a pyramid is related to the length of its shadow exactly as the height of any mensurable vertical object is related to the length of *its* shadow at the same time of day. It is probable, though not certain, that Hieronymus is here dependent on his near-contemporary Eudemus (whose book on the history of geometry and mathematics, as opposed to his history of astronomy, Diogenes himself does not appear to have used for Thales); if so, there is a probability that Thales used the simpler method. On the other hand, the more complex one is based on an argument from similar triangles analogous to that ascribed to him by Eudemus in **80**, as a means of measuring the distance of ships out at sea. Provided the height of the observer above sea-level were known, this calculation could be made with the aid of a primitive theodolite, two sticks (one as a sight-line, the other as an approximate level-line) pivoting on a nail. It is to be observed that Eudemus credited Thales with a knowledge of similar triangles only on the *a priori* ground that he could not otherwise have performed this kind of calculation. Yet a man may make an empirical use of a rudimentary angle-measurer without forming an explicit theory about the principles involved, and certainly without stating those principles as a geometer.[1] Three other theorems attributed to Thales by Proclus following Eudemus, in the same commentary as **80** (DK 11 A 11) – circle bisected by diameter; angles at base of isosceles triangle are

equal; vertically opposed angles are equal – are, again, probably just the neatest abstract solutions of particular practical problems associated with Thales. All this is very much a matter for conjecture: my own guess would be that Thales did gain a reputation with his contemporaries for carrying out various far from straightforward empirical feats of mensuration, without necessarily stating the geometry that lay behind them. This is perhaps confirmed by the fact that Thales' Milesian successors seem to have paid little attention to mathematical theory.

[1] Burnet, *EGP*, 45f., observed that a knowledge of the Egyptian *seqt* ratio (a trigonometrical approximation) could have produced a solution of both problems. In view of the possibility of Thales' acquaintance with Egypt, and his analogous use (it is assumed) of an empirical Babylonian formula, this explanation can by no means be excluded. – Pamphila's report in Diog. L. 1, 24 that Thales inscribed a right-angled triangle in a circle 'and sacrificed an ox' is entertaining, if not convincing (cf. pp. 334f. below).

WRITINGS

81 Simplicius *in Phys.* p. 23, 29 Diels Θαλῆς δὲ πρῶτος παραδέδοται τὴν περὶ φύσεως ἱστορίαν τοῖς Ἕλλησιν ἐκφῆναι, πολλῶν μὲν καὶ ἄλλων προγεγονότων, ὡς καὶ Θεοφράστῳ δοκεῖ, αὐτὸς δὲ πολὺ διενεγκὼν ἐκείνων ὡς ἀποκρύψαι πάντας τοὺς πρὸ αὐτοῦ. λέγεται δὲ ἐν γραφαῖς μηδὲν καταλιπεῖν πλὴν τῆς καλουμένης Ναυτικῆς ἀστρολογίας.

82 Diogenes Laertius 1, 23 καὶ κατά τινας μὲν σύγγραμμα κατέλιπεν οὐδέν· ἡ γὰρ εἰς αὐτὸν ἀναφερομένη Ναυτικὴ ἀστρολογία Φώκου λέγεται εἶναι τοῦ Σαμίου. Καλλίμαχος δ' αὐτὸν οἶδεν εὑρετὴν τῆς ἄρκτου τῆς μικρᾶς λέγων ἐν τοῖς Ἰάμβοις οὕτως... [**78**, ll. 3–4], κατά τινας δὲ μόνα δύο συνέγραψε Περὶ τροπῆς καὶ Ἰσημερίας, τὰ ἄλλ' ἀκατάληπτα εἶναι δοκιμάσας.

83 Suda s.v. (from Hesychius) (DK 11 A 2) ...ἔγραψε περὶ μετεώρων ἐν ἔπεσι, περὶ ἰσημερίας, καὶ ἄλλα πολλά.

81 Thales is traditionally the first to have revealed the investigation of nature to the Greeks; he had many predecessors, as also Theophrastus thinks, but so far surpassed them as to blot out all who came before him. He is said to have left nothing in the form of writings except the so-called 'Nautical Star-guide'.

82 And according to some he left no book behind; for the 'Nautical Star-guide' ascribed to him is said to be by Phokos the Samian. Callimachus knew him as the discoverer of the Little Bear,

and wrote as follows in his *Iambs*... [**78**, lines 3–4]; while according to some he wrote only two works, *On the Solstice* and *On the Equinox*, considering the rest to be incomprehensible.

83 ...he wrote on celestial matters in epic verse, on the equinox, and much else.

These passages show that there was profound doubt in antiquity about Thales' written works. It is plain, at all events, that there was no work by him in the Alexandrian library, except the dubious 'Nautical Star-guide' (cf. also **96**). Aristotle appears not to have seen any book by him, at least on cosmological matters; he was extremely cautious in ascribing opinions to him, using the expressions 'deriving the supposition perhaps from...', 'the account which they say Thales gave' (**85**, **84**), and 'from what they relate' (**89**). Aristotle was not necessarily conscientious in using original sources; Theophrastus, as a professed historian of earlier philosophy, should have been conscientious (though he was not always so, in fact), but he evidently had little to add to Aristotle about Thales (except for the minor amendment implied by the conjecture in **81** that Thales *did* have predecessors). Eudemus made some positive assertions about Thales as geometer and astronomer (**75**, **76**, **80**), but we have seen on **80** that these were sometimes very speculative; they were perhaps partly based on the quasi-legendary biographical tradition, and do not imply that Eudemus had seen written works by Thales.

Diogenes' doubt in **82** about the 'Nautical Star-guide' was shared by Plutarch, *de Pyth. or.* 18, 402E (DK 11 B 1), who added that the work in question was in verse; we may thus conjecture that this was the verse work described by Hesychius in **83** as περὶ μετεώρων. Lobon of Argos (a disreputable stichometrist of the second century B.C.), according to Diog. L. 1, 34, said that Thales wrote 200 hexameters. Only mild suspicion is expressed in **81**, where any uncertainty implied by καλουμένης is perhaps restricted to the nature of the title. But this last sentence almost certainly contains Simplicius' own judgement and not that of Theophrastus, the paraphrase of whom seems to end before λέγεται. Diogenes' information in **82**, that the work was also ascribed to one Phokos of Samos, almost settles the matter; any astronomical work of archaic appearance might naturally be credited to Thales, but works actually by Thales would not be alternatively ascribed to men of comparative obscurity. It is possible that the 'Nautical Star-guide' was a genuine sixth-century work similar to the hexameter Ἀστρολογία of Cleostratus of Tenedos (DK ch. 6) or the so-called Hesiodic Ἀστρονομίη (DK ch. 4): so Diels

and others have assumed. It is also possible that it was a Hellenistic forgery. Diogenes in **82** is a little worried by Callimachus' mention in **78** of a particular nautical star-aid ascribed to Thales; but this need not have been described by Thales in writing. However, there is nothing inherently improbable in Thales having recorded such aids to navigation, a plausible enough activity for a practical sage in a maritime centre: but it was probably not in the 'Nautical Star-guide' known to the Hellenistic world that he did so. The other works mentioned in **82**, on the solstice and the equinox (only the latter in **83**), are unlikely, from their similar contents, to have been separate books. Simplicius in **81**, and those recorded in **82** who thought that Thales left no book, evidently did not accept this work as genuine. Thales studied the solstices according to Eudemus in **75** and **76**, and it would be on the ground of this known interest that such a work would be ascribed to him. Once again, however, it must be remembered that observations of solstices and of star-risings and -settings were widely made in the archaic period, and also set down in verse, partly in the attempt to establish a satisfactory calendar: see Cleostratus fr. 4 (DK6B4) and the Hesiodic *Astronomy* (DK4B1-5). Observations about the Hyades and the setting of the Pleiades were also attributed to Thales (scholion on Aratus 172, Pliny *N.H.* XVIII, 213; DK 11 B 2, 11 A 18); the latter observation, incidentally, was accurate for the latitude of Egypt, not that of Greece.

The evidence does not allow a certain conclusion, but the probability is that Thales did not write a book; though the ancient holders of this view might have been misled by the absence of a genuine work from the Alexandrian library, and also by the apophthegmatic nature of the wisdom assigned to the Seven Sages in general.

COSMOLOGY

(i) *The earth floats on water, which is in some way the source of all things*

84 Aristotle *de caelo* B13, 294a28 οἱ δ' ἐφ' ὕδατος κεῖσθαι (*sc.* φασὶ τὴν γῆν). τοῦτον γὰρ ἀρχαιότατον παρειλήφαμεν τὸν λόγον, ὃν φασιν εἰπεῖν Θαλῆν τὸν Μιλήσιον, ὡς διὰ τὸ πλωτὴν εἶναι μένουσαν ὥσπερ ξύλον ἢ τι τοιοῦτον ἕτερον (καὶ γὰρ τούτων ἐπ' ἀέρος μὲν οὐθὲν πέφυκε μένειν, ἀλλ' ἐφ' ὕδατος), ὥσπερ οὐ τὸν αὐτὸν λόγον ὄντα περὶ τῆς γῆς καὶ τοῦ ὕδατος τοῦ ὀχοῦντος τὴν γῆν.

85 Aristotle *Met.* A3, 983b6 τῶν δὴ πρῶτον φιλοσοφησάντων οἱ πλεῖστοι τὰς ἐν ὕλης εἴδει μόνας ὡήθησαν ἀρχὰς εἶναι πάντων· ἐξ οὗ

γὰρ ἔστιν ἅπαντα τὰ ὄντα, καὶ ἐξ οὗ γίγνεται πρώτου καὶ εἰς ὃ φθείρεται τελευταῖον, τῆς μὲν οὐσίας ὑπομενούσης τοῖς δὲ πάθεσι μεταβαλλούσης, τοῦτο στοιχεῖον καὶ ταύτην ἀρχήν φασιν εἶναι τῶν ὄντων, καὶ διὰ τοῦτο οὔτε γίγνεσθαι οὐδὲν οἴονται οὔτ' ἀπόλλυσθαι, ὡς τῆς τοιαύτης φύσεως ἀεὶ σῳζομένης... δεῖ γὰρ εἶναί τινα φύσιν ἢ μίαν ἢ πλείους μιᾶς ἐξ ὧν γίγνεται τἆλλα σῳζομένης ἐκείνης. τὸ μέντοι πλῆθος καὶ τὸ εἶδος τῆς τοιαύτης ἀρχῆς οὐ τὸ αὐτὸ πάντες λέγουσιν, ἀλλὰ Θαλῆς μὲν ὁ τῆς τοιαύτης ἀρχηγὸς φιλοσοφίας ὕδωρ εἶναί φησιν (διὸ καὶ τὴν γῆν ἐφ' ὕδατος ἀπεφαίνετο εἶναι), λαβὼν ἴσως τὴν ὑπόληψιν ταύτην ἐκ τοῦ πάντων ὁρᾶν τὴν τροφὴν ὑγρὰν οὖσαν καὶ αὐτὸ τὸ θερμὸν ἐκ τούτου γιγνόμενον καὶ τούτῳ ζῶν (τὸ δ' ἐξ οὗ γίγνεται, τοῦτ' ἐστὶν ἀρχὴ πάντων), διά τε δὴ τοῦτο τὴν ὑπόληψιν λαβὼν ταύτην καὶ διὰ τὸ πάντων τὰ σπέρματα τὴν φύσιν ὑγρὰν ἔχειν· τὸ δ' ὕδωρ ἀρχὴ τῆς φύσεως ἐστὶ τοῖς ὑγροῖς.

84 Others say that the earth rests on water. For this is the most ancient account we have received, which they say was given by Thales the Milesian, that it stays in place through floating like a log or some other such thing (for none of these rests by nature on air, but on water) as though the same argument did not apply to the water supporting the earth as to the earth itself.

85 Most of the first philosophers thought that principles in the form of matter were the only principles of all things; for the original source of all existing things, that from which a thing first comes-into-being and into which it is finally destroyed, the substance persisting but changing in its qualities, this they declare is the element and first principle of existing things, and for this reason they consider that there is no absolute coming-to-be or passing away, on the ground that such a nature is always preserved... for there must be some natural substance, either one or more than one, from which the other things come-into-being, while it is preserved. Over the number, however, and the form of this kind of principle they do not all agree; but Thales, the founder of this type of philosophy, says that it is water (and therefore declared that the earth is on water), perhaps taking this supposition from seeing the nurture of all things to be moist, and the warm itself coming-to-be from this and living by this (that from which they come-to-be being the principle of all things) – taking the supposition both from this and from the seeds of all things having a moist nature, water being the natural principle of moist things.

Our knowledge of Thales' cosmology depends virtually completely on these two passages, with the cryptic addition of **89–91**. Apart from

Aristotle's own criticism and conjecture, they assign two propositions to Thales: (1) the earth floats on water (like a piece of wood or something of the sort); (2) the 'principle' of all things is water (in Aristotle's sense of ἀρχή as explained in the first half of **85**, i.e. the original constituent material of things, which persists as a substratum and into which they will perish). (1) was professedly known to Aristotle only indirectly, on the information of others; further, it is impossible to tell whether the supporting argument (solid things do not rest on air, but they do on water, therefore the earth floats on water) was also derived from the reports of Thales, or whether it was entirely supplied by Aristotle. His final objection, that Thales has solved nothing because he would still have to find something to support the water that supports the earth, shows how little Aristotle understood the probable nature of Thales' way of thinking; Thales would almost certainly still accept the popular conception of the underparts of earth stretching down so far that the problem almost disappeared, as in Homer (1) and long after Thales in Xenophanes (3). The probable direct origin of Thales' idea of the earth floating on water was from non-Greek mythological accounts (pp. 92f.); the device might have attracted him in part because it provided support for the earth, but it is by no means certain that Thales felt this to be a serious problem, and most improbable in any case that he worked out the theory for himself as a conscious answer to that problem. As for proposition (2), Aristotle evidently knew nothing beyond what he wrote, since the reasons given for Thales' choice of water are professedly conjectural (λαβὼν ἴσως...). The first half of **85** is quoted to show the kind of analysis and terminology which Aristotle (and following him Theophrastus[1] and thus the subsequent doxographical tradition) applied to the early physicists or natural philosophers, the φυσικοί – those who, according to Aristotle, posited solely, or primarily, the first (material) of his four causes. His application of a single rigid analysis to his predecessors, while justly and usefully emphasizing certain resemblances between them, is also a source of confusion. Thus Thales' 'principle' (in Aristotle's sense) and Heraclitus' 'principle' (fire according to Aristotle) were clearly, for Thales and for Heraclitus themselves, very different kinds of thing. In fact, all we know about Thales' views on water (apart from that the earth floats on it) is that, in a hearsay and probably much abbreviated and somewhat distorted form, they appeared to the not over-discriminating Aristotle to fit his own idea of a material ἀρχή. Yet it is possible, contrary to Aristotle's automatic assumption, that Thales declared earth to *come from* water (i.e. to be solidified out of

it in some way) without therefore thinking that the earth and its contents *are* somehow water, that they have any continuing relation to it (beyond the fact that the earth floats on water) except perhaps that of a man to his remote ancestors. See further pp. 93f.

1 Theophrastus' abbreviated account of Thales' material principle is given by Simplicius, *in Phys.* p. 23, 21 Diels (= Theophrastus *Phys. op.* fr. 1), DK 11 A 13. It is a close parallel of Aristotle in **85**, using in many parts the same phraseology. It adds one more conjectural reason for Thales' choice of water, that corpses dry up (τὰ νεκρούμενα ξηραίνεται): this perhaps came from Hippon (see next n.), who is probably credited with a similar argument in Anon. Lond. XI, 22 (DK 38 A 11), i.e. in a Peripatetic source. The addition occurs also in Aetius.

The reasons conjectured by Aristotle in **85** for the importance attached by Thales to water as a constituent of things are mainly physiological.[1] From the analogy of his immediate successors we might have expected Thales to have adduced meteorological reasons, more conspicuously, in support of the cosmic importance of water.[2] Yet we must beware of exaggerated generalizations like that implied in Burnet's view that sixth-century thinkers were almost exclusively interested in meteorological (in the strict sense, including astronomical) phenomena. It is undoubtedly true that the *scientific* study of medicine began in the fifth century B.C., and that analogies between the world and details of human structure become much commoner then. Yet chapter 1 has shown the strongly genealogical colouring of much pre-philosophical Greek speculation, and also the importance of the analogy of physiological reproduction. In the case of Thales there are reasons for thinking that his explanation of the world was influenced not only by this variegated traditional background of earlier Greek quasi-mythological cosmogonical versions, but also by a specific cosmological idea derived directly, perhaps, from further east.

1 It seems more probable than not that Aristotle took them from Hippon of Samos (or of Rhegium, Croton, or Metapontum), who in the second half of the fifth century B.C. revived and modified the idea of water as constituent material of things. Hippon, whose intellect Aristotle did not admire, evidently had strong physiological interests. Cf. in particular **86** Aristotle *de an.* A 2, 405b1 τῶν δὲ φορτικωτέρων καὶ ὕδωρ τινὲς ἀπεφήναντο (*sc.* τὴν ψυχήν), καθάπερ Ἵππων· πεισθῆναι δ' ἐοίκασιν ἐκ τῆς γονῆς, ὅτι πάντων ὑγρά· καὶ γὰρ ἐλέγχει τοὺς αἷμα φάσκοντας τὴν ψυχήν, ὅτι ἡ γονὴ οὐχ αἷμα. *(Of the cruder thinkers some actually declared it [sc. the soul] to be water, like Hippon; they seem to have been persuaded by the seed of all things being moist. In fact he refutes those who say that the soul is blood; because the seed is not blood.)* Note that there is a good deal of conjecture in this, too. Against the assumption that Aristotle's conjectured reasons for Thales' choice of water were derived from Hippon is that the additional reason given in

Theophrastus (see previous note) probably did come from Hippon, and might therefore have been expected to be included by Aristotle.

[2] As in **87** Heraclitus Homericus *Quaest. Hom.* 22 ἡ γὰρ ὑγρὰ φύσις, εὐμαρῶς εἰς ἕκαστα μεταπλαττομένη, πρὸς τὸ ποικίλον εἴωθε μορφοῦσθαι· τό τε γὰρ ἐξατμιζόμενον αὐτῆς ἀεροῦται, καὶ τὸ λεπτότατον ἀπὸ ἀέρος αἰθὴρ ἀνάπτεται, συνιζάνον τε τὸ ὕδωρ καὶ μεταβαλλόμενον εἰς ἰλὺν ἀπογαιοῦται· διὸ δὴ τῆς τετράδος τῶν στοιχείων ὥσπερ αἰτιώτατον ὁ Θαλῆς ἀπεφήνατο στοιχεῖον εἶναι τὸ ὕδωρ. *(For moist natural substance, since it is easily formed into each different thing, is accustomed to undergo very various changes: that part of it which is exhaled is made into air, and the finest part is kindled from air into aither, while when water is compacted and changes into slime it becomes earth. Therefore Thales declared that water, of the four elements, was the most active, as it were, as a cause.)* These reasons certainly stem from a Stoic source – there is much Stoic phraseology – and may well be entirely conjectural. According to Theophrastus, evidently, Thales used water and its products to explain earthquakes (**88**: this depends on the special conception that the earth *rests on* water), also winds and movements of stars (Hippolytus *Ref.* 1, 1); but these would scarcely provide the reason for Thales adopting the theory in the first place.

The near-eastern origin of part of Thales' cosmology is indicated by his conception that the earth floats or rests on water. In Egypt the earth was commonly conceived as a flat, rimmed dish resting upon water, which also filled the sky; the sun sailed each day across the sky in a boat, and also sailed under the earth each night (not round it, as in the Greek legend, e.g. **7**). In the Babylonian creation-epic Apsu and Tiamat represent the primeval waters, and Apsu remains as the waters under the earth after Marduk has split the body of Tiamat to form sky (with its waters) and earth. In the story of Eridu (seventh century B.C. in its youngest extant version), in the beginning 'all land was sea'; then Marduk built a raft on the surface of the water, and on the raft a reed-hut which became the earth. An analogous view is implied in the Psalms (where also Leviathan is an analogue of Tiamat), where Jahweh 'stretched out the earth above the waters' (136, 6), 'founded it upon the seas, and established it upon the floods' (24, 2). Similarly Tehom is 'the deep that lieth under' (Gen. xlix. 25), 'the deep that coucheth beneath' (Deut. xxxiii. 13).[1] Against this profusion of parallel material from the east and south-east for the waters under the earth, there is no comparable Greek evidence apart from Thales. The naïve Greek conception of a river Okeanos *surrounding* the earth (ch. 1 §2) is not strictly comparable (for it is clear that there is no Okeanos under the earth), although it was probably a much earlier development, in a different direction, of the widely-diffused near-eastern generic concept of the earth rising in the midst of the primeval waters – a concept almost certainly not native to the Greek-speaking peoples, whose home before the migrations into the Greek peninsula lay far from the

sea. Similarly, although the isolated references in *Iliad* book XIV (**8** and **9**) to Okeanos as origin of all things were also probably based upon the same near-eastern concept, from a slightly different aspect, they contain no implication of the special idea that the earth floats on water, and so are unlikely to have been the origin of Thales' assertion of this idea. For any more general contention that the earth came from, or is maintained by, water, Thales would no doubt be encouraged and gratified to have the apparently native Homeric precedents. Thus Thales' view that the earth floats on water seems to have been most probably based upon direct contact with near-eastern mythological cosmology. We have already seen that he had associations both with Babylonia and with Egypt. The idea that the earth actually floats upon water was more clearly and more widely held in the latter of these countries; and the conjecture might be hazarded that Thales was indebted to Egypt for this element of his world-picture.[2]

[1] These instances are cited by U. Hölscher in his convincing discussion of Thales, *Hermes* 81 (1953), 385-91. Some of the material is treated in ch. 1, especially pp. 11ff. For the idea of Nun, the Egyptian primeval ocean, supporting the earth, see also the remarks of J. A. Wilson, *Before Philosophy* 59ff., and H. Frankfort, *Ancient Egyptian Religion* (N.Y., 1948), 114.

[2] Thales evidently used the floating-earth idea to explain earthquakes: **88** Seneca *Qu. nat.* III, 14 (presumably from Theophrastus, through a Posidonian source): ait enim (*sc.* Thales) terrarum orbem aqua sustineri et vehi more navigii mobilitateque eius fluctuare tunc cum dicitur tremere. *(For he [Thales] said that the world is held up by water and rides like a ship, and when it is said to 'quake' it is actually rocking because of the water's movement.)*

The cosmological scope of the idea is, however, limited; and it seems reasonable to conclude from Aristotle's information in **85** that Thales also thought that the world *originated* from water, since this is implicit in the near-eastern mythologies and is stated in the Homeric Okeanos-passages which are thought to be based on those mythologies. Thales may have rationalized the idea from a Greek mythological form like the Homeric one; he may also have been directly influenced (as he seems to have been for the special detail that the earth floats on water) by foreign, perhaps Egyptian versions. Even more uncertainty attaches to a problem that has already been foreshadowed: are we justified in inferring from the Peripatetic identification of Thales' water as 'material principle' that he believed the visible, developed world to *be* water in some way? This is the normal interpretation of Thales; but it is important to realize that it rests ultimately on the Aristotelian formulation, and that Aristotle, knowing little about Thales, and that indirectly, would surely have

found the mere information that the world originated from water sufficient justification for saying that water was Thales' material principle or ἀρχή, with the implication that water is a persistent substrate. It must be emphasized once more that no such development was necessary, and that it was not implicit in the near-eastern concepts which were ultimately Thales' archetype. Thales might have held that the world originated from an indefinite expanse[1] of primeval water, on which it still floats and which is still responsible for certain natural phenomena, without also believing that earth, rocks, trees or men are in any way *made of* water or a form of water. There would be a remote ancestral connexion, no more. On the other hand Thales *could* have made the entirely new inference that water is the continuing, hidden constituent of all things. Certainly his near successor Anaximenes believed that all things were made of air (but he had thought of a way in which this could be so: air takes on different forms when compressed or rarefied), and it is invariably assumed that he was extending and refining a line of thought initiated by Thales. It would be imprudent entirely to reject this assumption, which goes back to Theophrastus and Aristotle. The physiological reasons instanced by Aristotle, that all living things depend on water for nourishment, that the sperm is moist, and so on, although conjectural, are of a kind that might well have struck Thales. With other indications (e.g. the Homeric statement that the surrounding Okeanos is the source of all springs and rivers, **6**) they could have led him to the conclusion that water, as well as being the cosmogonical source, is also involved in the very essence of the developed world. On the other hand one must remain aware of the possibility that Aristotle was simply making his own kind of inference, in the absence of other information, from Thales' belief that the world originated from water and that water still plays a major part in the cosmos by supporting the earth.

[1] Thales would have accepted Simplicius' judgement (*in Phys.* 458, 23, DK 11 A 13) that water was, for him, ἄπειρον; though for Thales this would mean 'limitless', i.e. of indefinite extent, and not 'infinite', and be a natural assumption rather than a consciously propounded theory. Simplicius was more seriously misleading in asserting (*in Phys.* 180, 14) that Thales, like Anaximenes, generated by means of the condensation and rarefaction of his material principle. This is a purely schematic judgement based on an over-rigid dichotomy in Aristotle (**104**). Theophrastus only found the device explicitly used in Anaximenes; see **142**.

Two things, then, have emerged from the present discussion: (i) 'all things are water' is not necessarily a reliable summary of Thales'

cosmological views; and (ii) even if we do accept Aristotle's account (with some allowance, in any event, for his inevitably altered viewpoint), we have little idea of *how* things were felt to be essentially related to water.

(ii) *Even apparently inanimate things can be 'alive'; the world is full of gods*

89 Aristotle *de an.* A 2, 405a19 ἔοικε δὲ καὶ Θαλῆς, ἐξ ὧν ἀπομνημονεύουσι, κινητικόν τι τὴν ψυχὴν ὑπολαβεῖν, εἴπερ τὴν λίθον ἔφη ψυχὴν ἔχειν ὅτι τὸν σίδηρον κινεῖ.

90 Diogenes Laertius 1, 24 Ἀριστοτέλης δὲ καὶ Ἱππίας φασὶν αὐτὸν καὶ τοῖς ἀψύχοις μεταδιδόναι ψυχῆς, τεκμαιρόμενον ἐκ τῆς λίθου τῆς μαγνήτιδος καὶ τοῦ ἠλέκτρου.

91 Aristotle *de an.* A 5, 411a7 καὶ ἐν τῷ ὅλῳ δέ τινες αὐτὴν (*sc.* τὴν ψυχὴν) μεμεῖχθαί φασιν, ὅθεν ἴσως καὶ Θαλῆς ᾠήθη πάντα πλήρη θεῶν εἶναι.

89 Thales, too, seems, from what they relate, to have supposed that the soul was something kinetic, if he said that the [Magnesian] stone possesses soul because it moves iron.

90 Aristotle and Hippias say that he gave a share of soul even to inanimate [*lit.* soulless] objects, using Magnesian stone and amber as indications.

91 And some say that it [soul] is intermingled in the universe, for which reason, perhaps, Thales also thought that all things are full of gods.

The two passages from Aristotle's *de anima* allow us to conjecture, but no more, about Thales' vision of the whole world as somehow alive and animated. Aristotle himself was reporting second-hand evidence, and his statements are jejune and cautious (although in **89** εἴπερ need not, and probably does not, express doubt, while ἴσως in **91** qualifies ὅθεν and not the assertion that follows). The concluding words of **91**, 'all things are full of gods', occur also in Plato, in a probably conscious but unattributed quotation.[1] **90** cites the sophist and polymath Hippias as an earlier source than Aristotle for Thales' attribution of motive power to Magnesian (magnetic) stone, to which is added amber, which becomes magnetic when rubbed. Presumably the addition is from Hippias, who may well have been Aristotle's source here.[2]

[1] **92** Plato *Laws* 10, 899b ἔσθ' ὁστις ταῦτα ὁμολογῶν ὑπομενεῖ μὴ θεῶν εἶναι πλήρη πάντα; *(Is there anyone who will accept this and maintain that all things are* not *full of gods?)* The context deals with souls being called gods; it is quite in Plato's

style to introduce, rather laboriously, a familiar phrase to enlighten an unfamiliar argument of his own, without naming the author. His use of the words in question is important, in any case, because it shows that they are not simply an Aristotelian summary. They could (in direct speech) be a genuine quotation from Thales; they have a totally different appearance from the banal apophthegms hopefully assigned to Thales in Demetrius of Phaleron's collection (*ap.* Stob. III, 1, 172, DK 10, 3). Aristotle repeated them, with the substitution of ψυχῆς for θεῶν and without attribution, at *Generation of Animals* Γ 11, 762a21.

[2] Snell, in *Philologus* 96 (1944), 170–82, showed that Hippias was quite possibly the source of Aristotle's other remarks on Thales, including the comparison with older ideas on Okeanos etc. (11, cf. 12). The fragment of Hippias quoted by Clement, DK 86 B 6, shows that he made a collection of key passages on similar topics from Homer, Hesiod, Orphic writings, and Greek and other prose-sources. He was therefore the earliest systematic doxographer.

All that Aristotle seems to have known in 89 was that Thales thought that magnetic stone possesses soul because it is able to move iron; but the further inference, that for Thales the soul was something motive, is clearly legitimate. Soul, whether it was associated with breath, blood, or spinal fluid, was universally regarded as the source of consciousness and life. A man is alive, he can move his limbs and so move other things; if he faints, it means that his soul has withdrawn or become incapacitated; if he dies, it has become permanently so, and the 'soul' that goes squeaking down to Hades in Homer is a mere shadow, because it is dissociated from the body and can no longer produce life and movement. It is a common primitive tendency to regard rivers, trees and so on as somehow animated or inhabited by spirits: this is partly, though not wholly, because they seem to possess the faculty of self-movement and change, they differ from mere stocks and stones. Thales' attitude was not primitive, of course, but there is a connexion with that entirely unphilosophical animism. It should be noted, however, that his examples are of a different order; magnetic stone looks as unalive as could be, and cannot move or change itself, only a certain kind of external object. Thus Thales appears to have made explicit, in an extreme form, a way of thinking that permeated Greek mythology but whose ultimate origins were almost prearticulate. Now it is possible that our second piece of specific information, 91, is a generalization based on this very conclusion that certain kinds of apparently inanimate object are alive, possess soul, because they have a limited power of movement. 'All things are full of gods':[1] the chief distinguishing marks of the gods are that they are immortal, they enjoy perpetual life, and that their power (their life-force, as it were) is unlimited, it extends both over the animate and over the inanimate world. Thus the assertion may well imply (since even apparently dead things like stone may

possess soul of a kind) that the world as a whole manifests a power of change and motion which is certainly not even predominantly human, and must, both because of its permanence and because of its extent and variation, be regarded as divine, as due to the inherence of some form of immortal ψυχή.[2]

[1] Or of daimons, according to the paraphrase in Aetius after Theophrastus: 93 Aetius I, 7, 11 Θαλῆς νοῦν τοῦ κόσμου τὸν θεόν, τὸ δὲ πᾶν ἔμψυχον ἅμα καὶ δαιμόνων πλῆρες· διήκειν δὲ καὶ διὰ τοῦ στοιχειώδους ὑγροῦ δύναμιν θείαν κινητικὴν αὐτοῦ. *(Thales said that the mind of the world is god, and that the sum of things is besouled, and full of daimons; right through the elemental moisture there penetrates a divine power that moves it.)* The juxtaposition of the two statements from Aristotle is not significant. The last sentence is Stoic in form and content; the first clause (Θαλῆς...θεόν), too, is entirely anachronistic, and probably due to Stoic reinterpretation. It was repeated by Cicero, *de natura deorum* I, 10, 25, who added that god, as mind, made the world out of water. A considerable number of recognizably fictitious opinions, like this one, were attributed to Thales by puzzled or unscrupulous doxographers and biographers. Compare, perhaps, the 30,000 daimons of Hesiod *Works and Days* 252ff.

[2] The claim by Choerilus of Iasus (3rd–2nd cent. B.C.) and others, recorded in Diog. L. I, 24 (DK 11 A 1), that according to Thales the soul was immortal, obviously arose as an illegitimate conclusion from this kind of argument, and is again due to Stoic perversion (primarily) of the type of 93. Thales could have distinguished clearly between the human ψυχή and the divine life-force in the world as a whole, at the same time as implicitly recognizing their underlying connexion.

The precise nature of Thales' belief that all things are full of gods is obviously not determinable. Even along the line of interpretation suggested above there is one notable uncertainty: did Thales make the bold induction, from the observation about Magnesian stone and amber, that *all* apparently inanimate things really possess soul to some degree? Or was Burnet right in maintaining (*EGP* 50) that 'to say the magnet and amber are alive is to imply, if anything, that other things are not'? In itself the fragmentary observation implies nothing either way. Nor does the assertion that all things are full of gods, even if it is closely connected with the observation about magnetic stone, necessarily imply that the universal induction was made; for just as one can say in English 'this book is full of absurdities' without meaning that every single thing in it is absurd, so πλήρης in Greek could mean 'containing a great number of', as well as 'absolutely filled out by'. *A priori*, it perhaps seems more probable that Thales meant that all things in sum (rather than each single thing) were interpenetrated by some kind of life-principle; although there would be many kinds of matter from which this life-principle, with its kinetic power, might be absent. The point was that the range of soul, or of

life, was much greater than it appeared to be. Thales was giving an explicit and individual statement of a broad presupposition common to all the early physicists, that the world was somehow alive, that it underwent spontaneous change, and (what irritated Aristotle) that there was therefore no need to give any special account of natural change. This presupposition is still sometimes called 'hylozoism'; but this name implies too strongly that it is something uniform, determinable, and conscious. In fact the term applies to at least three possible and distinct attitudes of mind: (*a*) the assumption (conscious or not) that all things absolutely are in some way alive; (*b*) the belief that the world is interpenetrated by life, that many of its parts which appear inanimate are in fact animate; (*c*) the tendency to treat the world as a whole, whatever its detailed constitution, as a single living organism. (*a*) is an extreme, but in view of the universalizing tendency of Greek thought not an impossible, form of the general presupposition; in a way it might be said to be exemplified by Xenophanes. Thales' belief, it has been suggested, approaches close to (*b*). (*c*) is implicit in the old genealogical view of the world's history described in chapter 1, which still persisted to some extent under the new rationalized form of philosophical cosmogony. Aristotle is seen at his most perspicuous in **116**, where, perhaps with Thales especially in mind, he shows himself aware of the possibility of this kind of attitude.[1]

[1] The spears in the *Iliad* (XI, 574 etc.) which are 'eager to devour flesh', and other similar cases, are sometimes cited as an indication that the animistic view was an old one. Animism is, of course, as old as man himself, and it arises out of the failure to objectify one's experience of the outside world, a technique which requires some practice. The Homeric expressions are better described as a literary conceit, like the pathetic fallacy – a deliberate rejection of the technique.

CONCLUSION

Thales was chiefly known for his prowess as a practical astronomer, geometer, and sage in general. His prediction of the eclipse was probably made feasible by his use of Babylonian records, perhaps obtained at Sardis; he also probably visited Egypt. His theory that the earth floats on water seems to have been derived from near-eastern cosmogonical myths, perhaps directly; water as the origin of things was also a part of these myths, but had been mentioned in a Greek context long before Thales. His development of this concept may in itself have seemed to Aristotle sufficient warrant for saying that Thales held water to be the ἀρχή, in its Peripatetic sense of a

persisting substrate. Yet Thales could indeed have felt that since water is essential for the maintenance of plant and animal life – we do not know what meteorological arguments he used – it remains still as the basic constituent of things. Although these ideas were strongly affected, directly or indirectly, by mythological precedents, Thales evidently abandoned mythic formulations; this alone justifies the claim that he was the first philosopher, naïve though his thought still was. Further, he noticed that even certain kinds of stone could have a limited power of movement and therefore, he thought, of life-giving soul; the world as a whole, consequently, was somehow permeated (though probably not completely) by a life-force which might naturally, because of its extent and its persistence, be called divine. Whether he associated this life-force with water, the origin and perhaps the essential constituent of the world, we are not told.

CHAPTER III

Anaximander of Miletus

DATE, BOOK, AND SCIENTIFIC ACTIVITIES

94 Diogenes Laertius II, 1–2 (DK 12 A 1) Ἀναξίμανδρος Πραξιάδου Μιλήσιος· οὗτος ἔφασκεν ἀρχὴν καὶ στοιχεῖον τὸ ἄπειρον, οὐ διορίζων ἀέρα ἢ ὕδωρ ἢ ἄλλο τι... εὗρεν δὲ καὶ γνώμονα πρῶτος καὶ ἔστησεν ἐπὶ τῶν σκιοθήρων ἐν Λακεδαίμονι, καθά φησι Φαβωρῖνος ἐν Παντοδαπῇ ἱστορίᾳ, τροπάς τε καὶ ἰσημερίας σημαίνοντα, καὶ ὡροσκοπεῖα κατεσκεύασε. καὶ γῆς καὶ θαλάσσης περίμετρον πρῶτος ἔγραψεν, ἀλλὰ καὶ σφαῖραν κατεσκεύασε. τῶν δὲ ἀρεσκόντων αὐτῷ πεποίηται κεφαλαιώδη τὴν ἔκθεσιν, ἣ που περιέτυχεν καὶ Ἀπολλόδωρος ὁ Ἀθηναῖος· ὃς καί φησιν αὐτὸν ἐν τοῖς Χρονικοῖς τῷ δευτέρῳ ἔτει τῆς πεντηκοστῆς ὀγδόης ὀλυμπιάδος (547/6 B.C.) ἐτῶν εἶναι ἑξήκοντα τεττάρων καὶ μετ' ὀλίγον τελευτῆσαι (ἀκμάσαντά πη μάλιστα κατὰ Πολυκράτη τὸν Σάμου τύραννον).

95 Suda s.v. Ἀναξίμανδρος Πραξιάδου Μιλήσιος φιλόσοφος συγγενὴς καὶ μαθητὴς καὶ διάδοχος Θάλητος. πρῶτος δὲ ἰσημερίαν εὗρε καὶ τροπὰς καὶ ὡρολογεῖα, καὶ τὴν γῆν ἐν μεσαιτάτῳ κεῖσθαι. γνώμονά τε εἰσήγαγε καὶ ὅλως γεωμετρίας ὑποτύπωσιν ἔδειξεν. ἔγραψε Περὶ φύσεως, Γῆς περίοδον καὶ Περὶ τῶν ἀπλανῶν καὶ Σφαῖραν καὶ ἄλλα τινά.

94 Anaximander son of Praxiades, of Miletus: he said that the principle and element is the Indefinite, not distinguishing air or water or anything else... he was the first to discover a *gnomon*, and he set one up on the Sundials(?) in Sparta, according to Favorinus in his *Universal History*, to mark solstices and equinoxes; and he also constructed hour-indicators. He was the first to draw an outline of earth and sea, but also constructed a [celestial] globe. Of his opinions he made a summary exposition, which I suppose Apollodorus the Athenian, also, encountered. Apollodorus says in his *Chronicles* that Anaximander was sixty-four years old in the second year of the fifty-eighth Olympiad [547/6 B.C.], and that he died shortly afterwards (having been near his prime approximately during the time of Polycrates, tyrant of Samos).

95 Anaximander son of Praxiades, of Miletus, philosopher, was a kinsman, pupil and successor of Thales. He first discovered the equinox and solstices and hour-indicators, and that the earth lies in the centre. He introduced the *gnomon* and in general made known an outline of geometry. He wrote *On Nature*, *Circuit of the Earth* and *On the Fixed Stars* and a *Celestial Globe* and some other works.

(i) *Date*

If Thales earned the title of the first Greek philosopher mainly because of his abandonment of mythological formulations, Anaximander is the first of whom we have concrete evidence that he made a comprehensive and detailed attempt to explain all aspects of the world of man's experience. He was younger than Thales, but probably not by much. Burnet (*EGP* 51) inferred from the latter part of **94** that the chronographer Apollodorus found definite evidence, perhaps in a summary version of his book, that Anaximander was sixty-four in 547/6 B.C.; and that his death 'soon afterwards' was placed by Apollodorus in the next year, the epoch-year of the capture of Sardis. (The last clause of **94** is presumably a mistake: Polycrates did not come to power until *c.* 540 B.C. and died *c.* 522.) If this is so, then Thales and Anaximander died in the same Olympiad, and Anaximander was only fourteen years younger than Thales (n. on p. 76).[1] Anaximander was called the 'successor and pupil' of Thales by Theophrastus (**101** A), also his kinsman, companion, acquaintance or fellow-citizen in the later doxographical tradition. In most cases this kind of statement need only imply that the one was thought to come from the same city as, and to be somewhat younger than, the other.[2] If there were fixed dates both for Thales (the prediction of the eclipse in 585/4) and for Anaximander (for the information that he was sixty-four in 547/6 was presumably available also to Theophrastus), the *a priori* basis for Theophrastus' conjecture would be a reasonable one.

[1] That Thales and Anaximander are not separated by the conventional Apollodoran 40-year interval (see next note) is in favour of 547/6 being a non-arbitrary date. It is true that, if Anaximander could be made the master of Pythagoras, then his birth should be eighty years earlier than the latter's *floruit* (which Apollodorus placed in 532/1), and he would be very close to 64 (in fact 65) in 547/6. According to the evidence of Hippolytus (*Ref.* 1, 6, 7, DK 12 A 11) even Apollodorus was wrong by one year, since Hippolytus gives the birth-year as Ol. 42, 3 (610/9 B.C.) instead of Ol. 42, 2. What is significant, however, is that Anaximander's age was known for a particular year which was not his *floruit* and not necessarily that of his death, although it was close to his death. Further, no

connexion of Pythagoras with Anaximander is known in the great majority of our sources (only in Porphyry *Life of Pythagoras* 2, after Apollonius, presumably of Tyana, and in Apuleius *Florida* 15, 20). Nevertheless, the possibility cannot be entirely excluded that Apollodorus' dating of Anaximander was arbitrarily hinged to his Polycrates–Pythagoras system. This might help to account for the last clause of **94**.

[2] The arrangement of the early philosophers into 'schools', and into masters and pupils within these schools, was initiated by Theophrastus and systematically applied in the *Successions* of Sotion, *c.* 200 B.C. Apollodorus used the latter work, and normally assumed a 40-year interval in age between master and pupil.

(ii) *Anaximander's book*

The book-titles ascribed to Anaximander in **95**, presumably from Hesychius, should be regarded with reserve. It was the custom with Alexandrian writers to supply titles, in the absence of definite evidence, to suit an early thinker's known interests. 'On nature' was a standard comprehensive title which tended to be assigned to all those whom Aristotle called φυσικοί, that is, to almost all the Presocratics.[1] That Anaximander certainly wrote a book of some kind is shown both by Theophrastus' incontrovertible quotation in **101** A, and possibly by Diogenes' information in **94** that there was a 'summary exposition', which he took to be by the philosopher himself. What Diogenes knew of may have been a later summary (produced either by a pupil or, more probably, in the fourth century B.C. or later); or it may have been the original work, whose short, perhaps discontinuous, and apophthegmatic nature was not what was normally expected of a philosophical book.[2] It is not clear whether it was from this source that Apollodorus determined the year in which Anaximander was sixty-four; it seemed probable to Diogenes, though that age is considerably greater than the average for authorship.[3] Theophrastus had access to at least one original sentence, but seems to have lacked full information about Anaximander's originative substance. The possibility cannot be ignored that he, too, used a summary or handbook, partly at least in the form of a collection of excerpts, and one which concentrated on cosmology, anthropology and so on rather than on the nature of the parent-material. On the other hand, Anaximander himself might have offered little information on the originative substance.

[1] Cf. **96** Themistius *Or.* 26 p. 383 Dindorf (Ἀναξίμανδρος) ἐθάρρησε πρῶτος ὧν ἴσμεν Ἑλλήνων λόγον ἐξενεγκεῖν περὶ φύσεως συγγεγραμμένον. *([Anaximander] was the first of the Greeks whom we know who ventured to produce a written account on nature.)* Thales was thought not to have written a book, at any rate one of a general cosmological kind: see pp. 87f. One of the objections to Περὶ φύσεως as a genuine sixth-century book-title is that φύσις is probably not used in the

collective sense, 'Nature', before about the middle of the fifth century (cf. Kirk, *Heraclitus, the Cosmic Fragments* (Cambridge, 1954), 227ff.). Gorgias' sardonic title Περὶ φύσεως ἢ περὶ τοῦ μὴ ὄντος implies that Περὶ φύσεως was common *in his time*, but no more than that. On the other hand, the addition of a word like χρημάτων or ἁπάντων to φύσεως would make the usage possible. The fact remains that Περὶ φύσεως was indiscriminately applied to any work of a vaguely physical nature: cf. e.g. pp. 166f. for Xenophanes' poetry; also Kahn, *Anaximander and the Origins of Greek Cosmology* (New York, 1960) p. 6 n. 2.

[2] For Pherecydes' roughly contemporary book see p. 51. – We do not know how many words a papyrus roll is likely to have held in the sixth century B.C. The letters were probably large (papyrus should have been relatively cheap in Miletus, from Naucratis), and the total product quite short. See p. 356 and n. 2 for Anaxagoras' book.

[3] The elder Pliny (*N.H.* II, 31, DK 12A5) stated that Anaximander discovered the obliquity of the Zodiac in this same Olympiad, the fifty-eighth; but the ascription of this discovery is probably false (p. 104 n.), and Pliny perhaps merely misapplied Apollodorus' dating.

(iii) *Scientific activities: (a) the gnomon*

Anaximander did not *discover* the gnomon, as **94** claims (the gnomon is a set-square or any vertical rod whose shadow indicates the sun's direction and height): compare

97 Herodotus II, 109 πόλον μὲν γὰρ καὶ γνώμονα καὶ τὰ δυώδεκα μέρεα τῆς ἡμέρης παρὰ Βαβυλωνίων ἔμαθον οἱ Ἕλληνες.

97 The Greeks learned from the Babylonians of the celestial sphere and the *gnomon* and the twelve parts of the day.

95 may be correct, nevertheless, in suggesting that Anaximander *introduced* the gnomon into Greece. We cannot be sure, however, that Thales did not use some form of the instrument (p. 83), and it is possible that Anaximander gained the credit by accident, or because his use of the gnomon was more sophisticated. No special discoveries involving its use were assigned to him which were not also assigned to Thales; but he may have gained notoriety by the incident referred to by Favorinus in **94**. The statement that Anaximander set up a gnomon in Sparta ἐπὶ τῶν σκιοθήρων is mysterious. A σκιόθηρον (or σκιοθήρης) was a sun-dial, but the prepositional phrase cannot mean anything like 'for a sun-dial' or 'for the benefit of the sun-dials', and perhaps there was a prominence in Sparta later known as 'the sun-dials', from the gnomon or gnomons that existed there; ἐπί, then, would be local. ὡροσκοπεῖα in **94** and ὡρολογεῖα in **95** imply that the ground near the gnomon was calibrated so as to give the time of day, as well as the position of the sun on the ecliptic and so the season of the year. For another association of Anaximander with Sparta see n. on p. 105.[1]

[1] Pliny *N.H.* II, 187 (DK 13A 14*a*), held that it was Anaximenes who first demonstrated in Sparta the 'horologium quod appellant sciothericon', and who discovered the use of the gnomon. This is probably a mistake by Pliny, who tended to confound his facts in writing about early astronomy. He attributed the discovery of the obliquity of the Zodiac to Anaximander (p. 103), but Eudemus in 76 probably assigned this to Oenopides. The full comprehension of the ecliptic doubtless belonged to the fifth century; that the sun moves from north to south and back was known much earlier – and certainly, for example, by Thales.

(iii) *Scientific activities: (b) the map*

98 Agathemerus I, 1 Ἀναξίμανδρος ὁ Μιλήσιος ἀκουστὴς Θαλέω πρῶτος ἐτόλμησε τὴν οἰκουμένην ἐν πίνακι γράψαι· μεθ' ὃν Ἑκαταῖος ὁ Μιλήσιος ἀνὴρ πολυπλανὴς διηκρίβωσεν, ὥστε θαυμασθῆναι τὸ πρᾶγμα.

99 Strabo I, p. 7 Casaubon ...τοὺς πρώτους μεθ' Ὅμηρον δύο φησὶν Ἐρατοσθένης, Ἀναξίμανδρόν τε Θαλοῦ γεγονότα γνώριμον καὶ πολίτην καὶ Ἑκαταῖον τὸν Μιλήσιον. τὸν μὲν οὖν ἐκδοῦναι πρῶτον γεωγραφικὸν πίνακα, τὸν δὲ Ἑκαταῖον καταλιπεῖν γράμμα πιστούμενον ἐκείνου εἶναι ἐκ τῆς ἄλλης αὐτοῦ γραφῆς.

98 Anaximander the Milesian, a disciple of Thales, first dared to draw the inhabited world on a tablet; after him Hecataeus the Milesian, a much-travelled man, made the map more accurate, so that it became a source of wonder.

99 ...Eratosthenes says that the first to follow Homer were two, Anaximander, who was an acquaintance and fellow-citizen of Thales, and Hecataeus the Milesian. The former was the first to publish a geographical map, while Hecataeus left behind a drawing believed to be his from the rest of his writings.

These passages are obviously based on the same one statement by Eratosthenes, as is Diogenes' remark in **94** that 'Anaximander first drew an outline of land and sea'. Diogenes' addition, 'but he also constructed a sphere' (that is, a map of the heaven), is unsubstantiated and, in the light of Anaximander's theory of the heavenly bodies (pp. 134ff.), improbable. The general nature of his map can probably be inferred from the following passage:

100 Herodotus IV, 36 γελῶ δὲ ὁρῶν γῆς περιόδους γράψαντας πολλοὺς ἤδη καὶ οὐδένα νόον ἐχόντως ἐξηγησάμενον· οἳ Ὠκεανόν τε ῥέοντα γράφουσι πέριξ τὴν γῆν, ἐοῦσαν κυκλοτερέα ὡς ἀπὸ τόρνου, καὶ τὴν Ἀσίην τῇ Εὐρώπῃ ποιεύντων ἴσην.

100 I smile when I see that many have drawn circuits of the earth, up to now, and none of them has explained the matter

sensibly: they draw Okeanos running around the earth, which is drawn as though with a compass, and make Asia equal to Europe.

It is a reasonable assumption that the (probably Ionian) maps referred to here resembled that of Anaximander as improved by his fellow-citizen Hecataeus; and therefore that Anaximander produced a circular plan in which the known regions of the world formed roughly equal segments; see further Kahn, *op. cit.*, 81–4. His empirical knowledge of geography was presumably based in part on seafarers' reports, which in Miletus, as a commercial centre and founder of colonies, would be both accessible and varied. The philosopher himself was said to have led a colonizing expedition to Apollonia (the city on the Black Sea, presumably), cf. Aelian *V.H.* III, 17 (DK 12A3). Otherwise his only known foreign contacts are with Sparta.[1]

[1] Apart from the sun-indicator story in **94**, Cicero related (*de divinat.* I, 50, 112, DK 12A5*a*) that Anaximander warned the Spartans to move into the fields when an earthquake was imminent. One is reminded of miraculous predictions assigned to Pherecydes and Pythagoras (pp. 52f.); but as a citizen of Miletus, in the earthquake belt, Anaximander would have had special experience. The modern Thessalians, for example, know that an earthquake is imminent when the storks become agitated. At all events Anaximander seems to have visited Sparta, otherwise two separate anecdotes about him would hardly be located there.

THE NATURE OF ANAXIMANDER'S ORIGINATIVE SUBSTANCE, τὸ ἄπειρον (THE INDEFINITE)

Part of Theophrastus' account of Anaximander's originative material is preserved by Simplicius. It is disputed whether Simplicius derived this and similar doxographical extracts direct from a version of Theophrastus, or by the medium of Alexander's lost commentary on the *Physics*; some extracts certainly came from this source. A more important question is whether Simplicius, or Alexander, was using the full edition of Theophrastus, or the two-volume summary, or an even shorter compendious account. The long surviving fragment on sensation, also in Simplicius, is on a very much larger scale than the extremely cursory extracts on the material principle, which suggests that they were derived from different versions of Theophrastus; the latter probably do not come from the complete edition. Hippolytus and the author of the pseudo-Plutarchean *Stromateis* also have doxographical summaries of Anaximander; they follow Theophrastus less closely than does Simplicius (whose text in **101A** 'can be treated as largely identical with that of Theophrastus' according to Kahn,

op. cit., 33), but provide confirmation and expansion at certain points. They also cover a greater range of subjects, some of which (e.g. zoogony, astronomy) are dealt with at greater length than the question of the ἀρχή. Simplicius' extract is printed in the left-hand column of **101**, with the corresponding parts of the two subsidiary versions alongside. Briefer and less accurate versions of this doxography appear in **94** and in Aetius (1, 3, 3, DK 12A14). It should be remembered that the passages in **101** are versions of *Theophrastus'* view of Anaximander; it will be seen that, so far as the material principle was concerned, he differed little from Aristotle, from whom some of his phraseology is directly derived. He quoted one original sentence (bold type in **101**A; see pp. 117ff.); this need not imply that he had seen the whole of Anaximander's book, as is almost invariably assumed. If he did see the whole, either it was very obscure about the originative stuff or he was untypically obtuse.

101 Versions of Theophrastus' account of Anaximander's originative substance:

A. Simplicius *in Phys.* 24, 13; DK 12A9

τῶν δὲ ἓν καὶ κινούμενον καὶ ἄπειρον λεγόντων Ἀναξίμανδρος μὲν Πραξιάδου Μιλήσιος Θαλοῦ γενόμενος διάδοχος καὶ μαθητὴς

ἀρχήν τε καὶ στοιχεῖον εἴρηκε τῶν ὄντων τὸ ἄπειρον,

πρῶτος τοῦτο τοὔνομα κομίσας τῆς ἀρχῆς.

λέγει δ' αὐτὴν μήτε ὕδωρ μήτε ἄλλο τι τῶν καλουμένων εἶναι στοιχείων, ἀλλ' ἑτέραν τινὰ φύσιν ἄπειρον,

ἐξ ἧς ἅπαντας γίνεσθαι τοὺς οὐρανοὺς καὶ τοὺς ἐν αὐτοῖς κόσμους.

B. Hippolytus *Ref.* 1, 6, 1–2; DK 12A11

Θαλοῦ τοίνυν Ἀναξίμανδρος γίνεται ἀκροατής. Ἀ. Πραξιάδου Μιλήσιος· ...

οὗτος μὲν ἀρχὴν καὶ στοιχεῖον εἴρηκε τῶν ὄντων τὸ ἄπειρον,

πρῶτος ⟨τοῦτο⟩ τοὔνομα καλέσας τῆς ἀρχῆς.

(πρὸς δὲ τούτῳ κίνησιν ἀίδιον εἶναι, ἐν ᾗ συμβαίνει γίνεσθαι τοὺς οὐρανούς.)

...οὗτος ἀρχὴν ἔφη τῶν ὄντων φύσιν τινὰ τοῦ ἀπείρου,

ἐξ ἧς γίνεσθαι τοὺς οὐρανοὺς καὶ τὸν ἐν αὐτοῖς κόσμον.

C. Ps.-Plutarch *Strom.* 2; DK 12A10

...Ἀναξίμανδρον Θάλητος ἑταῖρον γενόμενον

τὸ ἄπειρον φάναι τὴν πᾶσαν αἰτίαν ἔχειν τῆς τοῦ παντὸς γενέσεώς τε καὶ φθορᾶς,

ἐξ οὗ δή φησι τούς τε οὐρανοὺς ἀποκεκρίσθαι καὶ καθόλου τοὺς ἅπαντας ἀπείρους ὄντας κόσμους.

ταύτην δ' ἀίδιον εἶναι καὶ ἀγήρω, ἣν καὶ πάντας περιέχειν τοὺς κόσμους.

ἐξ ὧν δὲ ἡ γένεσίς ἐστι τοῖς οὖσι, καὶ τὴν φθορὰν εἰς ταῦτα γίνεσθαι **κατὰ τὸ χρεών·**

λέγει δὲ χρόνον ὡς ὡρισμένης τῆς γενέσεως καὶ τῆς οὐσίας καὶ τῆς φθορᾶς.

ἀπεφήνατο δὲ τὴν φθορὰν γίνεσθαι καὶ πολὺ πρότερον τὴν γένεσιν ἐξ ἀπείρου αἰῶνος ἀνακυκλουμένων πάντων αὐτῶν.

διδόναι γὰρ αὐτὰ δίκην καὶ τίσιν ἀλλήλοις τῆς ἀδικίας κατὰ τὴν τοῦ χρόνου τάξιν, ποιητικωτέροις οὕτως ὀνόμασιν αὐτὰ λέγων.
(What follows is Simpl., not Theophrastus.)

(λέγει δὲ χρόνον...)

A

Of those who say that it is one, moving, and infinite, Anaximander, son of Praxiades, a Milesian, the successor and pupil of Thales,

said that the principle and element of existing things was the *apeiron* [indefinite, *or* infinite],

being the first to introduce this name of the material principle.

He says that it is neither water nor any other of the so-called elements, but some other *apeiron* nature,

from which come into being all the heavens and the worlds in them.

B

Now Anaximander was the disciple of Thales. Anaximander, son of Praxiades, of Miletus:...

he said that the principle and element of existing things was the *apeiron*,

being the first to use this name of the material principle.

(In addition to this he said that motion was eternal, in which it results that the heavens come into being.)

...he said that the material principle of existing things was some nature coming under the heading of the *apeiron*, from which come into being the heavens and the world in them.

C

...Anaximander, who was the companion of Thales,

said that the *apeiron* contained the whole cause of the coming-to-be and destruction of the world,

from which he says that the heavens are separated off, and in general all the worlds, being *apeirous* [innumerable].

This nature is eternal and unaging, and it also surrounds all the worlds.

He talks of Time as though coming-to-be and existence and destruction were limited.

He declared that destruction, and much earlier coming-to-be, happen from infinite ages, since they are all occurring in cycles.

And the source of coming-to-be for existing things is that into which destruction, too, happens 'according to necessity;

for they pay penalty and retribution to each other for their injustice according to the assessment of Time',

as he describes it in these rather poetical terms.

(He talks of Time...)

(i) *Did Anaximander call the originative substance* ἀρχή*?*

Most modern critics (including Kahn, *op. cit.*, 29–32) think that Theophrastus named Anaximander as the first to have used ἀρχή (literally 'beginning' or 'source') as a special term for the originative substance. They infer this from πρῶτος τοῦτο τοὔνομα κομίσας τῆς ἀρχῆς in **101** A, its equivalent in **101** B, and one further context in Simplicius (*in Phys.* 150, 23) where Anaximander is described as πρῶτος αὐτὸς ἀρχὴν ὀνομάσας τὸ ὑποκείμενον. Burnet, however (*EGP* 54 n. 2), maintained that what Theophrastus said was simply that Anaximander was the first to call the material principle (ἀρχή in its normal Peripatetic sense) by the name τὸ ἄπειρον, without further qualification. This, indeed, is the most obvious sense of the extract from Theophrastus, **101** A, while in **101** B τοῦτο has presumably dropped out by haplography before τοὔνομα. The other passage of Simplicius is more difficult: its most obvious meaning is 'being the first to call the substratum of the opposites ἀρχή', but Burnet explained it as meaning 'being the first to name the substratum of the opposites as the material cause' (that is, because according to Aristotle the opposites in Anaximander were specifically produced from the originative stuff). Burnet's interpretation, while admittedly not the most apparent meaning of the clause in isolation, is certainly more relevant to the trend of Simplicius' argument. Further (a point ignored by Kahn in his discussion), Theophrastus had used the word ἀρχή in his remarks on Thales as already reported by Simplicius (*in Phys.* 23, 23, DK 11 A 13), with no special note that Thales himself

did not actually use this word – a note that would perhaps have been natural if Theophrastus had gone on to assert that Anaximander was its originator. It is possible, of course, that Simplicius misunderstood Theophrastus' comment about ἀρχή and ἄπειρον. The whole question is of limited importance; it still seems probable, however, that no technical use of ἀρχή by Anaximander was implied *by Theophrastus* – the use he referred to was of τὸ ἄπειρον.

(ii) *What did Anaximander mean by* τὸ ἄπειρον*?*

102 Aristotle *Phys.* Γ4, 203a16 οἱ δὲ περὶ φύσεως πάντες ὑποτιθέασιν ἑτέραν τινὰ φύσιν τῷ ἀπείρῳ τῶν λεγομένων στοιχείων, οἷον ὕδωρ ἢ ἀέρα ἢ τὸ μεταξὺ τούτων.

102 All the physicists make the infinite a property of some other nature belonging to the so-called elements, such as water or air or that which is intermediate between these.

First, it is advisable to isolate the Peripatetic, and so also the doxographical, interpretation of τὸ ἄπειρον. Aristotle, curiously enough, mentioned Anaximander by name only four times, but made several probable references to his primary substance (e.g. **109** *fin.*). There is little doubt that he took ἄπειρον in Anaximander, and in the monists in general, to mean primarily 'spatially infinite'. This is suggested in **102**. In **108**, part of his discussion of the concept of infinity, Aristotle attributes some specific quality, presumably that of the intermediate in the case of Anaximander (pp. 111ff.), to the material principles of all the φυσικοί who recognize the infinite. Theophrastus seems to have felt that Anaximander had given his primary substance a name which described its spatial property, but which said nothing except by implication (that it was not identified with any of the later 'elements') about its qualitative properties. Thus in **101** A line 2, and in other such classifications, ἄπειρον means 'infinite'; it is 'neither water nor any other of the so-called elements, but some other infinite nature from which come all the heavens...' (Anaximander's heavens being infinite in number for Theophrastus).[1]

[1] The words ἑτέραν τινὰ φύσιν ἄπειρον seem to echo Aristotle's radically different ἑτέραν τινὰ φύσιν τῷ ἀπείρῳ in **102**, especially since the wider contexts of the two phrases have much in common. This superficial similarity of phraseology suggests that Theophrastus had made himself familiar with his master's discussion of infinity in the *Physics* before he set about summarizing the theories of Anaximander.

It is, however, uncertain that Anaximander himself intended τὸ

ἄπειρον to mean precisely 'the spatially infinite'. We may legitimately doubt whether the concept of infinity was apprehended before questions of continuous extension and continuous divisibility were raised by Melissus and Zeno. ἄπειρον means 'without boundary, limit, definition'; this indefiniteness is spatial in early usages, as in the ἀπείρονα πόντον of Homer (Anaximander's ἄπειρον is presumably from ἄπειρος, of which ἀπείρων is a more poetical equivalent), and as in Xenophanes (3), who said that the earth went down ἐς ἄπειρον, indefinitely, i.e. beyond the imagination or the concern of men. Now Anaximander certainly assumed the original stuff to have been indefinitely huge in extent; but he perhaps gave formal expression to this idea by saying that this stuff 'surrounded all things' (**108**), and might not have felt this characteristic (which must have been assumed as a matter of course by Thales, see n. on p. 94) to be sufficiently remarkable to be applied as sole description, that is as 'the spatially indefinite'. We might expect any such single description to refer first to the *kind* of substance, not to its commonly assumed vastness of extent. Thus Cornford and others argued that τὸ ἄπειρον meant 'that which is internally unbounded, without internal distinctions', i.e. that which is indistinct, indefinite in kind. There is no need to stress *internal* divisions,[1] but the general point seems not improbable: for Anaximander the original world-forming stuff was indefinite, it resembled no one kind of matter in the developed world. Yet no parallel early use of ἄπειρος in a certainly non-spatial sense can be cited, and this is in favour of retaining the interpretation 'spatially indefinite'. In any case the lack of positive identification was conspicuously implied. Either τὸ ἄπειρον meant 'the spatially indefinite', and was implied to be indefinite in kind because it was not formally identified as fire, air, water or earth (to use Theophrastus' terms of **101A**); or Anaximander intended it to mean primarily 'that which is indefinite in kind', but naturally assumed it also to be of unlimited extent and duration – properties which, when expressed, would be expressed in terms of all-inclusiveness and divine immortality.[2]

[1] Nor is it easy to accept the suggestion of Diels and Cornford that the ἄπειρον was conceived as circular or spherical, cf. ἄπειρον ἀμφίβληστρον at Aeschylus *Ag.* 1382, ἄπειρος of a ring in Aristophanes and Aristotle, etc. It is impossible to prove that any particular application of the word that was feasible in the archaic period was entirely absent from Anaximander's mind; but the intention seems to have been to deny any fixed determination. See further Kahn, *op. cit.*, 231ff.

[2] Cherniss, *Aristotle's Criticism of Presocratic Philosophy* (Baltimore, 1935), 377f., maintained that Anaximander meant ἄπειρον ⟨τὸ πλῆθος⟩, i.e. 'with an indeterminate number of internal divisions'. But in this case ἄπειρον would have to be expressly qualified by a word implying number, as in Anaxagoras frr. 1 and 2 (**467**, **488**).

(iii) *The Indefinite as an intermediate substance in Aristotle*

103 Aristotle *de gen. et corr.* B5, 332a19 ...οὐκ ἔστιν ἓν τούτων (*sc.* πυρός, ἀέρος, ὕδατος, γῆς) ἐξ οὗ τὰ πάντα· οὐ μὴν οὐδ' ἄλλο τί γε παρὰ ταῦτα, οἷον μέσον τι ἀέρος καὶ ὕδατος ἢ ἀέρος καὶ πυρός, ἀέρος μὲν παχύτερον καὶ πυρός, τῶν δὲ λεπτότερον· ἔσται γὰρ ἀὴρ καὶ πῦρ ἐκεῖνο μετ' ἐναντιότητος· ἀλλὰ στέρησις τὸ ἕτερον τῶν ἐναντίων· ὥστ' οὐκ ἐνδέχεται μονοῦσθαι ἐκεῖνο οὐδέποτε, ὥσπερ φασί τινες τὸ ἄπειρον καὶ τὸ περιέχον.

104 Aristotle *Phys.* A4, 187a12 ὡς δ' οἱ φυσικοὶ λέγουσι, δύο τρόποι εἰσίν. οἱ μὲν γὰρ ἓν ποιήσαντες τὸ σῶμα τὸ ὑποκείμενον, ἢ τῶν τριῶν τι ἢ ἄλλο ὃ ἔστι πυρὸς μὲν πυκνότερον ἀέρος δὲ λεπτότερον, τἆλλα γεννῶσι πυκνότητι καὶ μανότητι πολλὰ ποιοῦντες ...οἱ δ' ἐκ τοῦ ἑνὸς ἐνούσας τὰς ἐναντιότητας ἐκκρίνεσθαι, ὥσπερ Ἀναξίμανδρός φησι καὶ ὅσοι δ' ἓν καὶ πολλά φασιν εἶναι, ὥσπερ Ἐμπεδοκλῆς καὶ Ἀναξαγόρας· ἐκ τοῦ μίγματος γὰρ καὶ οὗτοι ἐκκρίνουσι τἆλλα.

> **103** ...There is no *one* of these things [fire, air, water, earth] from which come all things; and certainly nothing else beside these, such as something half-way between air and water, or air and fire, being thicker than air and fire and finer than the others: for that will be air and fire, simply, together with contrariety; but one of the two opposites is a privation – so that it is impossible for the intermediate ever to exist in isolation, as some say the infinite [*apeiron*] and the surrounding does.
>
> **104** Two types of explanation are given by the physicists. Those who have made the subsisting body *one*, either one of the three or something else which is thicker than fire and finer than air, generate the rest by condensation and rarefaction, making it into many...But the others say that the opposites are separated out from the One, being present in it, as Anaximander says and all who say there are one and many, like Empedocles and Anaxagoras; for these, too, separate out the rest from the mixture.

Aristotle, when listing various monistic theories of the φυσικοί, on a number of occasions speaks of a substance *between* the elements – normally between fire and air or between air and water.[1] In three or four of these passages it looks as though Anaximander is meant as the proponent of an intermediate substance, not because he is

directly named but because the substance is implied to have been called simply τὸ ἄπειρον. In **103** the people who said that 'the ἄπειρον and the surrounding' existed on its own, in isolation from the elements, appear from the terminology (cf. **108**) to be Anaximander and followers; see also **109**, where the intermediate between water and air is said to 'surround all the heavens, being boundless'. Now Aristotle in **102** declared that all the φυσικοί who envisaged it gave some specific description of the infinite (τὸ ἄπειρον); we may ask what description Anaximander was deemed by Aristotle, when he wrote those words, to have given, if not as an intermediate – which is, indeed, actually mentioned in that passage as a typical description. Were it not for one passage, namely **104**, there would be no difficulty in accepting that Aristotle had Anaximander in mind in most, at any rate, of his references to an intermediate material principle. One of Aristotle's most acute ancient commentators, Alexander of Aphrodisias, did in fact accept this; so, usually, did Simplicius. Yet in **104**, on the only possible interpretation, Aristotle placed the intermediate substance and Anaximander in opposed groups.[2] Various unenlightening guesses have been made about the historical author of the intermediate-substance theory; but a careful study of all Aristotle's references indicates that Anaximander was, after all, in his mind – although Anaximander in fact held no such theory. Aristotle evidently felt that Anaximander's (for Aristotle) 'infinite' ἀρχή must have had *some* expressible relationship to the so-called elements; and there are some passages (e.g. **105**) in which he wrote simply of τὸ παρὰ τὰ στοιχεῖα, 'that which is beside the elements', not identifiable with any one of them, and not of τὸ μεταξύ or τὸ μέσον. By this formulation one possibility was that it was intermediate between two elements; another, that it was a mixture of them all. In **104** Aristotle seems to take the latter view; but he elsewhere considered the former possibility, and had arrived at the theoretical hypothesis of an intermediate (a hypothesis which he himself, of course, regarded as untenable: cf. **103**) as a by-product of his reflections on Anaximander. That he had no explicit historical example in mind, however, is shown by his variation of the elements between which the intermediate came. Usually when he mentioned an intermediate in lists of possible primary substances he had Anaximander in mind, though he also tended to add the intermediate indiscriminately to any such list for the sake of exhaustivity. It is so added in **104**, where, as the result of a different type of critique, he applies the mixture-interpretation to Anaximander by name; see also pp. 113f.; Kahn, *op. cit.*, 44–6; Hussey, *The Presocratics* (London, 1972),

p. 71; Kirk, 'Some problems in Anaximander', *CQ* N.S. 5 (1955), 24ff.; M. Whitby, *Mnemosyne* 35 (1982), 225–47.

[1] Apart from **102**, **103**, **104**, **109**, cf. *Met.* A7, 988a30; 989a14; *Phys.* A6, 189b1; *de gen. et corr.* B1, 328b35.

[2] It might be argued that τὸ ἕν, the One, is common to both groups, therefore that Anaximander might occur in each. But the contrast is really between those who retain the One as a substratum, and those who (like Anaximander) do not.

(iv) *Why 'the Indefinite' and not a specific originative substance?*

105 Aristotle *Phys.* Γ5, 204b22 ἀλλὰ μὴν οὐδὲ ἓν καὶ ἁπλοῦν εἶναι ἐνδέχεται τὸ ἄπειρον σῶμα, οὔτε ὡς λέγουσί τινες τὸ παρὰ τὰ στοιχεῖα, ἐξ οὗ ταῦτα γεννῶσιν, οὔθ' ἁπλῶς. εἰσὶ γάρ τινες οἳ τοῦτο ποιοῦσι τὸ ἄπειρον, ἀλλ' οὐκ ἀέρα ἢ ὕδωρ, ὡς μὴ τἆλλα φθείρηται ὑπὸ τοῦ ἀπείρου αὐτῶν· ἔχουσι γὰρ πρὸς ἄλληλα ἐναντίωσιν, οἷον ὁ μὲν ἀὴρ ψυχρός, τὸ δ' ὕδωρ ὑγρόν, τὸ δὲ πῦρ θερμόν· ὧν εἰ ἦν ἓν ἄπειρον ἔφθαρτο ἂν ἤδη τἆλλα. νῦν δ' ἕτερον εἶναί φασι ἐξ οὗ ταῦτα.

106 Aristotle *Phys.* Γ4, 203b15 τοῦ δ' εἶναί τι ἄπειρον ἡ πίστις ἐκ πέντε μάλιστ' ἂν συμβαίνοι σκοποῦσιν... ἔτι τῷ οὕτως ἂν μόνως μὴ ὑπολείπειν γένεσιν καὶ φθοράν, εἰ ἄπειρον εἴη ὅθεν ἀφαιρεῖται τὸ γιγνόμενον.

105 But yet, nor can the infinite body be one and simple, whether it be, as some say, that which is beside the elements, from which they generate the elements, or whether it be expressed simply. For there are some people who make what is beside the elements the infinite, and not air or water, so that the rest be not destroyed by their infinite substance; for the elements are opposed to each other (for example, air is cold, water moist, and fire hot), and if one of those were infinite the rest would already have been destroyed. But, as it is, they say that the infinite is different from these, and that they come into being from it.

106 Belief in infinity would result, for those who consider the matter, for the most part from five factors... further, because only so would generation and destruction not fail, if there were an infinite source from which that which is coming-to-be is derived.

These passages present two possible motives for the idea of the Indefinite as primary substance. The reason in **105** – that the infinite primary substance, if identified with a specific world-constituent, would swamp the other world-constituents and never allow them to develop – is assigned to those who posited an ἄπειρον substance 'beside the elements', i.e. not identical with any of them. When Aristotle used this formulation he usually, though not necessarily

invariably, had Anaximander in mind (§(iii)), and Simplicius in his comment on the passage (*in Phys.* 479, 33) ascribed this reason to Anaximander. On the other hand the totally different reason suggested in **106** – that an infinite source-material ensures that coming-to-be within the world shall not fail for want of material – is given as Anaximander's by Aetius (I, 3, 3, DK 12A4) and by Simplicius elsewhere (*de caelo* 615, 15, DK 12A17). Aetius' attribution suggests that Theophrastus applied the motive of **106** to Anaximander; but we cannot be sure that he did not apply that of **105** also, and in either case he was probably working from what Aristotle had said.

Most modern critics have accepted **106** as giving Anaximander's true motive, and many have rejected **105** as not (in spite of appearances) applying to Anaximander. Thus Cherniss called the argument in **105** 'the peculiarly Aristotelian argument of the necessary equilibrium of contrary forces'. It is true that it is expressed, naturally enough, in an Aristotelian form. But Anaximander had postulated a comprehensive balance between opposed substances (see **110** with discussion), and might well have reasoned in some such way as this: 'Thales said that all things originated from water; but water (which we see in the form of rain, sea and rivers) is opposed to fire (the sun, the fiery aither, volcanoes etc.), and these things are mutually destructive. How then can fire have become such a prominent part of our world, if it were from the beginning constantly opposed by the whole indefinitely-extended mass of its very opposite? How, indeed, can it have appeared at all, for a single moment? The warring constituents of our world, then, must have developed from a substance different from any of them – something indefinite or indeterminable.' (Aristotle's interpretation of ἄπειρον as 'infinite' does not affect this issue.)

As for **106**, Aristotle himself pointed out its fallacy:

107 Aristotle *Phys.* Γ8, 208a8 οὔτε γάρ, ἵνα ἡ γένεσις μὴ ἐπιλείπῃ, ἀναγκαῖον ἐνεργείᾳ ἄπειρον εἶναι σῶμα αἰσθητόν· ἐνδέχεται γὰρ τὴν θατέρου φθορὰν θατέρου εἶναι γένεσιν, πεπερασμένου ὄντος τοῦ παντός.

> **107** Nor, in order that generation may not fail, is it necessary for perceptible body to be *actually* infinite: for it is possible for the destruction of one thing to be the generation of the other, the sum of things being limited.

But this was precisely Anaximander's view of physical change – that there is no wastage: opposed substances make retribution *to each other*

for their encroachments (pp. 119ff.). Provided the balance is maintained, all change in the developed world takes place between the same original quantity of separate, opposed substances. (It may be noted that **105** gives a reason for positing a *qualitatively* indefinite primary substance, **106** for a *spatially* indefinite, or infinite, substance; cf. pp. 109f.)

(v) *The Indefinite is all-enfolding and all-controlling(?), divine and immortal*

108 Aristotle *Phys.* Γ4, 203b7 ...τοῦ δὲ ἀπείρου οὐκ ἔστιν ἀρχή ...ἀλλ' αὕτη τῶν ἄλλων εἶναι δοκεῖ, καὶ περιέχειν ἅπαντα καὶ πάντα κυβερνᾶν, ὡς φασιν ὅσοι μὴ ποιοῦσι παρὰ τὸ ἄπειρον ἄλλας αἰτίας οἷον νοῦν ἢ φιλίαν· καὶ τοῦτ' εἶναι τὸ θεῖον· ἀθάνατον γὰρ καὶ ἀνώλεθρον, ὥσπερ φησὶν ὁ Ἀναξίμανδρος καὶ οἱ πλεῖστοι τῶν φυσιολόγων.

109 Aristotle *de caelo* Γ5, 303b10 ἔνιοι γὰρ ἓν μόνον ὑποτίθενται, καὶ τοῦτο οἱ μὲν ὕδωρ, οἱ δ' ἀέρα, οἱ δὲ πῦρ, οἱ δ' ὕδατος μὲν λεπτότερον ἀέρος δὲ πυκνότερον· ὃ περιέχειν φασὶ πάντας τοὺς οὐρανοὺς ἄπειρον ὄν.

> **108** ...of the infinite there is no beginning...but this seems to be the beginning of the other things, and to enfold all things and steer all, as all those say who do not postulate other causes, such as mind or love, above and beyond the infinite. And this is the divine; for it is immortal and indestructible, as Anaximander says and most of the physical speculators.
>
> **109** For some posit one substance only, and this some posit as water, some as air, some as fire, some as finer than water and thicker than air; which they say surrounds all the heavens, being infinite.

The assertion in **108** that the primary substance 'enfolds all and steers all' is assigned to those who according to Aristotle imagined an infinite primary stuff but no separate cause of motion – certainly, therefore, to the Milesians, Heraclitus, and Diogenes of Apollonia. 'Steers all' obviously reproduces Presocratic terminology, and the whole phrase 'enfolds all things and steers all' may form a single rhythmical unit. Anaximander, who is mentioned below in connexion with another phrase describing the same subject, and who is probably referred to in **109** in connexion with περιέχειν, could have been its author.[1]

[1] περιέχει is presumably genuine in Anaximenes fr. 2 (**160**), even if some of its context is reworded; Anaxagoras (who is not in question in the Aristotelian passage) certainly used τὸ περιέχον in fr. 2 (**488**). κυβερνᾶν, of the steering of

cosmic constituents or events, occurs in Heraclitus fr. 41 (**227**), Parmenides fr. 12, 3 (**306**), Diogenes of Apollonia fr. 5 (**603**). The two words could, of course, have been combined by Aristotle from different sources.

It is not easy, however, to see what manner of control could be exercised on all things by Anaximander's Indefinite. The Greek does not necessarily mean that the steering is due to the enfolding – both properties independently are natural ones for something conceived as divine – but it probably implies it. Again, the metaphor of steering does not necessarily entail a conscious and intelligent agent, for the steering of a ship can be regarded as a purely mechanical process, with reference to changes of direction imposed by the steering mechanism and not to the intentions of the navigator. Yet if the Indefinite was envisaged as somehow divine (**108** *ad fin.*), this favours the assumption of purposeful action. Possible methods of control are the following: (1) by means of surrounding or enfolding: either (*a*) by preventing the further expansion of the differentiated world ('all things'), or (*b*) by making good the waste involved in change in the world; (2) by being immanent in all things, or some things, and providing either (*a*) motive power or life-force, or (*b*) a principle or rule or law of change; (3) by having initiated the world in such a way as to provide a continuing rule or law of change. (1, *b*) was implied in **106**, but it was argued on pp. 114f. that this is unlikely to be valid for Anaximander; the same argument applies to (1, *a*). (2, *a*) would perhaps apply to Thales; (2, *b*), rather than (3), to Heraclitus (pp. 187–8, 199). (2), as well as (1), seems unlikely for Anaximander, for the Indefinite clearly cannot have been imagined as *immanent* in the developed world, even in the way that Thales' world was somehow interpenetrated with a divine life-substance; the Indefinite was probably so named because it was not identical with anything in nature. (3), however, could apply to Anaximander: it is feasible that the control exercised on all things was through the law of retribution between opposites, a law (or manner of behaviour) which was initiated when the first opposed substances appeared within the Indefinite and which still governs all change in the world. Nevertheless, it remains true that Aristotle *could* have had in mind someone other than Anaximander – Heraclitus, perhaps, or Diogenes of Apollonia – in the first part of **108**, and particularly, perhaps, in the phrase 'steers all things'.

The ascription of the idea of περιέχειν to the monists is repeated in **109**; here again the infinite material suggests Anaximander, though it surrounds not 'all things' but 'all the heavens'. This statement seems to have been taken up by Theophrastus (**101**), who

evidently thought that it implied separate first heavens, each enclosing a separate world: see pp. 122ff. for the idea of innumerable worlds. But Aristotle's phrase could be due to his using οὐρανοί in a special sense, as the spheres of the sun, moon and stars (cf. *de caelo* A9, 278b9); he might naturally apply his own analysis of the cosmos (based on the Eudoxan–Callippean scheme) to Anaximander, with his separate circles for the heavenly bodies (pp. 134ff.), and intend nothing more than one complex world.

In the latter part of **108** we are told that the enfolding stuff 'is the divine; for it is immortal and indestructible, as Anaximander says and most of the physicists'. It is legitimate to suppose that the words 'immortal and indestructible' were intended to belong to Anaximander himself, though others said something similar. According to Theophrastus as reported in **101** B, however, the phrase was ἀίδιον καὶ ἀγήρω. There is a Homeric formula used of gods or their appurtenances, 'immortal and free from old age': so at *Od.* v, 218 (to Calypso), ἡ μὲν γὰρ βροτός ἐστι, σὺ δ' ἀθάνατος καὶ ἀγήρως (cf. also *Il.* II, 447). Short epic formulas often found their way into archaic prose, and it seems likely that this, rather than the somewhat repetitive equivalent in Aristotle, was the original form.[1] At all events Anaximander seems to have applied to the Indefinite the chief attributes of the Homeric gods, immortality and boundless power (connected in his case with boundless extent); it seems not improbable that he actually called it 'divine', and in this he was typical of the Presocratic thinkers in general.

[1] Especially since the two words are applied to the structure of the natural world, in a description of philosophical contemplation, by Euripides (fr. 910 Nauck²): 'observing the unageing structure of immortal Nature', ἀθανάτου καθορῶν φύσεως κόσμον ἀγήρω.

(vi) *The Indefinite is not in eternal motion, nor is it a mixture*

(These further points concerning the Indefinite are discussed under 'Cosmogony', pp. 126ff.)

THE EXTANT FRAGMENT OF ANAXIMANDER

110 Simplicius *in Phys.* 24, 17 (repeated from **101** A) ...ἑτέραν τινὰ φύσιν ἄπειρον, ἐξ ἧς ἅπαντας γίνεσθαι τοὺς οὐρανοὺς καὶ τοὺς ἐν αὐτοῖς κόσμους. ἐξ ὧν δὲ ἡ γένεσίς ἐστι τοῖς οὖσι, καὶ τὴν φθορὰν εἰς ταῦτα γίνεσθαι 'κατὰ τὸ χρεών· διδόναι γὰρ αὐτὰ δίκην καὶ τίσιν ἀλλήλοις τῆς ἀδικίας κατὰ τὴν τοῦ χρόνου τάξιν', ποιητικωτέροις οὕτως ὀνόμασιν αὐτὰ λέγων.

110 ...some other *apeiron* nature, from which come into being all the heavens and the worlds in them. And the source of coming-to-be for existing things is that into which destruction, too, happens, 'according to necessity; for they pay penalty and retribution to each other for their injustice according to the assessment of Time', as he describes it in these rather poetical terms.

(i) *Extent*

Simplicius is undoubtedly quoting from a version of Theophrastus' history of earlier philosophy, and from the section on the material principle, περὶ ἀρχῆς. The concluding clause, a judgement on Anaximander's style, shows that what immediately precedes is a direct quotation. Thus κατὰ τὴν τοῦ χρόνου τάξιν, which many have held to be a Theophrastean paraphrase of κατὰ τὸ χρέων, should provisionally be accepted as original.[1] διδόναι – ἀδικίας is certainly original, and well exemplifies the poetical style noted by Theophrastus. κατὰ τὸ χρεών, too, should probably be accepted as by Anaximander: χρεών retained a marked poetical colouring (except in the special usage χρεών ἐστι) until the expression τὸ χρεών became popular in the Hellenistic period as a circumlocution for death. It is the most plausible restoration in Heraclitus fr. 80, κατ' ἔριν καὶ χρεών (for χρεώμενα), to give a similar phrase to the one under discussion. The preceding words, ἐξ ὧν – εἰς ταῦτα γίνεσθαι, have been much disputed. The use of the abstracts γένεσις and φθορά, well established in Peripatetic but not (from the other extant evidence) in Presocratic vocabulary, suggests that these belong to Theophrastus. The sentiment, too, looks Peripatetic: it is a close restatement of one of Aristotle's basic dogmas about the primary substance of the physical monists, 'all things are destroyed into that from which they came-to-be' (*Phys.* Γ5, 204b33; cf. also **85** l. 3). Theophrastus was given to quoting single words or phrases; thus he could have quoted the concluding phrase of a sentence, the rest of which he had paraphrased, in order to emphasize the connexion with the following sentence which he quotes in full. See further under § (v).

[1] Theophrastus certainly used similar phraseology himself, notably τάξιν τινὰ καὶ χρόνον ὡρισμένον (of Heraclitus). But this is very different from the bold personification of τὴν τοῦ χρόνου τάξιν, on which see also § (iv).

(ii) *The meaning of the main assertion*

The context shows that Theophrastus regarded the quotation as appropriate to the view he had just attributed to Anaximander, that

'all the heavens and the worlds in them' came from the Indefinite. ἐξ ὧν... (the plural is presumably generic) adds that, since they came from the Indefinite, they will also return to it 'of necessity; for they pay penalty and retribution to each other...' It appears from the version of ps.-Plutarch, **101** c, that by 'the heavens and the worlds in them' Theophrastus was referring to ἄπειροι κόσμοι, innumerable worlds. But there is a very strong objection to understanding the words quoted from Anaximander to refer to innumerable worlds coming-to-be from, and being destroyed into, the Indefinite. ἀλλήλοις shows that retribution is made *mutually* between the parties who are the subject of the sentence. Can we really believe that the divine Indefinite commits *injustice* on its own products, and has to pay them recompense? This, surely, is intolerable; but if so, then Theophrastus (whatever he meant by the 'heavens' and 'worlds') mistook the proper application of Anaximander's dictum.[1] It has long been observed that the things which commit injustice on each other must be equals, different but correlative; and that these are most likely to be the opposed substances which make up the differentiated world.[2]

[1] Kahn, *op. cit.*, 34f., considers the mistake to belong just to ps.-Plutarch, not to Theophrastus; but his suggestion (p. 50) that κόσμος in the latter might refer to some lower 'arrangement', of earth or atmosphere, is hardly convincing.

[2] G. Vlastos, *CP* 42 (1947), 171f., following Cherniss, tried to show how the ultimate balance between opposites could be reconciled with the reabsorption of the world into the Indefinite: when this happens, he said, the opposites finally settle up accounts with each other (not with the Indefinite). But if the principle of justice applies in the present world, it is not easy to see how such a drastic change, affecting all its constituents, as the return of the world to the Indefinite could ever come about.

(iii) *The opposites*

It will be seen later (**118**, **121**) that the production of something that could be described as 'opposites' was an essential stage of cosmogony for Anaximander; it is therefore reasonable to assume that they played an important part in the developed world. The interplay of opposites is basic in Heraclitus, who seems to have deliberately corrected Anaximander by his paradox 'strife is *justice*' (fr. 80, **211**). Anaximander is the first in whom the concept of opposed natural substances (which recurs in Heraclitus, Parmenides, Empedocles, Anaxagoras, and in the Pythagoreans certainly as early as Alcmaeon) clearly appears. Doubtless he was influenced by observation of the main seasonal changes, in which heat and drought in summer seem to be pitted against cold and rain in winter. The constant interchange

between opposed substances is explained by Anaximander in a legalistic metaphor derived from human society; the prevalence of one substance at the expense of its contrary is 'injustice', and a reaction takes place through the infliction of punishment by the restoration of equality – of more than equality, since the wrong-doer is deprived of part of his original substance, too. This is given to the victim in addition to what was his own, and in turn leads (it might be inferred) to κόρος, surfeit, on the part of the former victim, who now commits injustice on the former aggressor. Thus both the continuity and the stability of natural change were motivated, for Anaximander, by means of this anthropomorphic metaphor. The main opposites in cosmogony were the hot substance and the cold substance – flame or fire and mist or air. These, with which are associated dryness and moisture, are also the main cosmological opposites, most notably involved in the large-scale changes in the natural world. They were probably isolated by Heraclitus (fr. 126) before ever they were elevated to the form of standard irreducible elements by Empedocles. Caution must be shown, to be sure, about the opposites in Anaximander: it is possible, for example, that the Peripatetics substituted their own more abstract formulations, the hot and the cold and so on, for more concrete expressions used by Anaximander himself. For him, the world may have been made up of substances which, while they each possessed individual tendencies contrary to those of some of the others, need not have been formally described as opposites, that is, for example, as the hard and the soft; but simply as fire, wind, iron, water, man, woman and so on.

(iv) '*The assessment of Time*'

The concluding phrase of the quotation, 'according to the assessment of Time', elaborates the injustice-metaphor. What kind of assessment does Time make? The word τάξις suggests the ordaining of punishment by a judge or, more aptly, the assessment of tribute as in the Athenian tribute-lists. In these cases what is ordained or assessed is the *amount* of the punishment or payment; this can hardly be the primary purpose of *Time's* assessment. Time must presumably control the time-limit for payment; the amount would be fixed, as total restitution plus a proportionate *amende*. The idea of a time-limit is appropriate: the injustice of summer has to be made good within the roughly equal period of winter, that of night during the period of day, and so on. No uniform period can be meant; Time makes the assessment to meet the particular case. That the additional idea of inevitability is implicit in the remarkable personification of Time

here may be indicated by the strikingly similar 'trial conducted by Time' in Solon, roughly a generation before Anaximander:

111 Solon fr. 24 Diehl, lines 1–7

ἐγὼ δὲ τῶν μὲν οὕνεκα ξυνήγαγον
δῆμον, τί τούτων πρὶν τυχεῖν ἐπαυσάμην;
συμμαρτυροίη ταῦτ' ἂν ἐν δίκῃ Χρόνου
μήτηρ μεγίστη δαιμόνων Ὀλυμπίων
ἄριστα, Γῆ μέλαινα, τῆς ἐγώ ποτε
ὅρους ἀνεῖλον πολλαχῇ πεπηγότας·
πρόσθεν δὲ δουλεύουσα, νῦν ἐλευθέρα.

111 Why did I cease before I gained the objects for whose sake I brought together the people? The great mother of the Olympian deities would be my best supporting witness for this in the court of Time – black Earth, whose boundary-stones, fixed in many places, I once removed; formerly was she enslaved, now is she free.

Here Earth justifies Solon's claim because *with the lapse of time* she has become free; that is what Time's trial signifies. No pre-determined time-limit is intended here. Elsewhere in Solon, too, it is the inevitability of retribution that is stressed again and again; so in Anaximander, we may infer, injustice must *inevitably* be punished, sooner or later in time – but here the periods, since they are those of the great seasonal changes, as well as other less important ones, must be supervised and assessed appropriately to each case.

(v) *The original of Theophrastus' paraphrase*

It has been suggested on pp. 118f. that (literally) 'from what things coming-to-be is for the things that are, destruction, too, takes place into these' may be a paraphrase by Theophrastus of something in Anaximander which Theophrastus thought could be recast in terms of the common Aristotelian formula. If that statement in Anaximander immediately preceded Anaximander's dictum about the retribution of opposites (as the transitional phrase κατὰ τὸ χρεών may suggest), then it too was presumably concerned with the behaviour of opposites in the developed world. One sentiment, I suggest, which Anaximander might have expressed in this context, and which could have deceived Theophrastus in the way indicated, was that *opposing substances pay recompense each to its own opposite and to no other*; for example the hot substance to the cold, and not to the heavy or the hard. This is a necessary hypothesis for Anaximander's theory of cosmic stability, obvious to us but not so obvious then, since Heraclitus also had to

emphasize it for his own special purposes. The axiom may have been stated in terms so general, and possibly in a context so incomplete, that Theophrastus was able to mistake its proper reference.

INNUMERABLE WORLDS

(i) *Successive rather than coexistent*

Plural worlds of some kind were attributed to Anaximander by Theophrastus: '...some other substance of infinite spatial extent, from which come into being all the heavens and the worlds in them' (**101A**). The fragment, about things paying to each other the penalty for injustice, was adduced as somehow relevant to this process; in this Theophrastus seems to have been mistaken (p. 118f.). In the doxographical versions of Theophrastus we learn that these plural worlds were ἄπειροι, i.e. infinite or innumerable. There has been much controversy as to whether these innumerable worlds were successive in time (so that our world will eventually pass away, to be succeeded by another, and so on), or coexistent. Zeller supported the former interpretation, Burnet the latter; Cornford demonstrated the fallacy of many of Burnet's arguments and reinstated the Zellerian interpretation in general favour (see *CQ* 28 (1934), 1ff., and *Principium Sapientiae*, 177ff.).

(ii) *But are even successive worlds plausible in Anaximander?*

I have elsewhere suggested (*CQ* N.S. 5 (1955), 28ff.) that Anaximander may in reality have believed in *no* type of innumerable worlds; and this suggestion (which receives support from Kahn, *op. cit.*, 46–53) is further argued here.

If coexistent worlds might be suggested to some people (though not, as it happens, to Anaximander, who saw them as apertures in rings of fire, pp. 135ff.) by the heavenly bodies, there is nothing whatever in 'the appearance of nature' to suggest *successive* worlds – successive separate worlds, that is (for such are clearly meant by both Theophrastus or his successors and his modern followers), as distinct from successive changes in the state of the one continuing world. These last are envisaged in the mythical catastrophes by fire and flood described in Plato's *Timaeus*, 22C–E, or in Deucalion's flood, and were to some extent suggested by natural phenomena; cf. pp. 139f. But there was no reason to assume that the whole world was going to be destroyed, or that if destroyed it would be succeeded by another. It would be contrary both to the whole mythical background of Greek thought and to the dictates of common sense to believe in a cycle of

separate worlds; and their appearance in Anaximander would be most surprising. But to anyone already familiar with Empedocles' radical changes of the σφαῖρος (pp. 295ff.) and with the atomist theory of Leucippus and Democritus, of innumerable worlds coming-to-be and passing away throughout infinite space (pp. 416ff.), and already perhaps prone to misinterpret Heraclitus as having postulated a succession of worlds (p. 200 n.), the oddity would not be conspicuous. Given a specific motive Theophrastus or his reproducers might, therefore, have made a false and anachronistic attribution. Such a motive, it is suggested, was provided by the atomists' arguments for innumerable worlds, as succinctly and influentially restated by Aristotle in the following passage.

(iii) *Atomist arguments applied by Theophrastus to Anaximander?*

112 Aristotle *Phys.* Γ4, 203b23 ...διὰ γὰρ τὸ ἐν τῇ νοήσει μὴ ὑπολείπειν καὶ ὁ ἀριθμὸς δοκεῖ ἄπειρος εἶναι καὶ τὰ μαθηματικὰ μεγέθη καὶ τὸ ἔξω τοῦ οὐρανοῦ· ἀπείρου δ' ὄντος τοῦ ἔξω, καὶ σῶμα ἄπειρον εἶναι δοκεῖ καὶ κόσμοι· τί γὰρ μᾶλλον τοῦ κενοῦ ἐνταῦθα ἢ ἐνταῦθα:

> **112** ...through not giving out in our thought, number seems to be infinite, and also mathematical magnitudes and what lies outside the heaven. But if what lies outside is infinite, body also seems to be infinite, and worlds too: for why should they exist more in one part of the void than in another?

This passage gives the fifth and most important motive, according to Aristotle, for the development of a concept of infinity. The argument that if what is outside the heaven is infinite then body is infinite, and that if body is infinite then worlds are infinite, is derived from the atomists, of whom Aristotle was undoubtedly thinking here. But the infinite worlds are necessitated by the hypothesis of infinite body, whether or not this is in turn argued (as by the atomists) from infinite void. On this reasoning Theophrastus might have been impelled to assume that the first and most notable believer in infinite body (as he thought τὸ ἄπειρον to imply) – namely Anaximander – also posited infinite worlds. These would behave like the atomists' in that they would be coexistent and also successive – that is, coming-to-be and passing away continually. The assumption that all innumerable worlds are of this kind appears to be made by Aristotle in the latter part of **116**. If we find evidence that Theophrastus treated Anaximander's worlds as *both* coexistent *and* successive, this will suggest strongly that he was applying atomistic reasoning to Anaximander.

(iv) *The doxographical evidence may suggest that Theophrastus applied atomist-type worlds to Anaximander*

If one turns to the doxographical sources for further elucidation of Theophrastus' views, the evidence is found to be confused and to some extent corrupt. Thus one of our twin sources for Aetius (ps.-Plutarch; cf. Aetius II, 1, 3, DK 12A17) assigns innumerable worlds only to the atomists, while the other (Stobaeus) assigns them in addition to Anaximander, Anaximenes, Archelaus, Xenophanes(!), and Diogenes of Apollonia. Neither version can correctly represent Theophrastus; but both could have arisen from a generalization of the atomistic arguments. There was a further confusion in Aetius (I, 7, 12, DK 12A17) between the innumerable-world hypothesis and the common opinion that the stars were gods. These confusions (which are seen also in Cicero) are unlikely to have been caused by a simple statement in Theophrastus that Anaximander postulated successive worlds. Two important witnesses had quite definite views:

113 Simplicius *in Phys.* 1121, 5 οἱ μὲν γὰρ ἀπείρους τῷ πλήθει τοὺς κόσμους ὑποθέμενοι, ὡς οἱ περὶ Ἀναξίμανδρον καὶ Λεύκιππον καὶ Δημόκριτον καὶ ὕστερον οἱ περὶ Ἐπίκουρον, γινομένους αὐτοὺς καὶ φθειρομένους ὑπέθεντο ἐπ' ἄπειρον, ἄλλων μὲν ἀεὶ γινομένων ἄλλων δὲ φθειρομένων, καὶ τὴν κίνησιν ἀίδιον ἔλεγον....

> **113** For those who supposed the worlds to be infinite in number, like the associates of Anaximander and Leucippus and Democritus and afterwards those of Epicurus, supposed them to be coming-to-be and passing away for an infinite time, with some of them always coming-to-be and others passing away; and they said that motion was eternal....

This comment on **112** is probably Simplicius' own, and does not directly reproduce Theophrastus. Simplicius might, however, be expected to be influenced by the Theophrastean interpretation; and indeed the same interpretation appears in a source earlier than Simplicius, and one which is dependent on the Theophrastean tradition through a different channel (there is a confusion with Anaxagoras in the first part):

114 Augustinus *de civ. dei* VIII, 2 non enim ex una re sicut Thales ex umore, sed ex suis propriis principiis quasque res nasci putavit (*sc.* Anaximander). quae rerum principia singularum esse credidit infinita, et innumerabiles mundos gignere et quaecumque in eis oriuntur; eosque mundos modo dissolvi modo iterum gigni existimavit, quanta quisque aetate sua manere potuerit.

> **114** For he [Anaximander] thought that things were born not from one substance, as Thales thought from water, but each from its own particular principles. These principles of individual things he believed to be infinite, and to give birth to innumerable worlds and whatsoever arises in them; and those worlds, he thought, are now dissolved, now born again, according to the age to which each is able to survive.

Worlds coming-to-be and passing away throughout space (or the Indefinite) are surely intended here; 'quanta... potuerit' suggests an irregularity which is foreign to the idea of a sequence of single worlds, but which is essential to the atomistic conception.[1]

[1] A passage in Cicero (*de natura deorum* I, 10, 25, DK 12A17) which ascribes to Anaximander worlds rising and setting 'longis intervallis' might point in the same direction, though certainty is impossible because of the ambiguity of 'intervallis' (spatial or temporal?).

Thus two sources independent of each other, the one indirectly and the other directly influenced by the tradition from Theophrastus, assigned atomistic worlds to Anaximander. Further, such an ascription by Theophrastus himself, of worlds both coexistent and successive, would provide a reason for the confusion between the two in some parts of the doxographical tradition on Anaximander.

(v) *Further considerations against and for the hypothesis*

Two difficulties in this interpretation must be mentioned.

(*a*) It is possible from **109** that Aristotle meant to attribute plural worlds to the monistic physicists in general; the infinite primary substance, they said, 'surrounds all the heavens (οὐρανούς)'. To meet this, it was proposed on p. 117 that Aristotle was using οὐρανοί in his special sense of 'celestial spheres'; he meant 'everything enclosed by the first heaven' and (perhaps because of the analogy of Anaximander's circles) expressed this concept in language appropriate to his own cosmology. Certainly in **108** the infinite primary substance is said to enclose simply 'all things', and there is no suggestion elsewhere in Aristotle of innumerable separate worlds before the atomists.

(*b*) If Theophrastus thought that anyone who posited infinite material should also posit innumerable worlds like the atomists, why did Simplicius write in **147** (the continuation of **113**) that *Anaximenes*, whose primary substance was described as infinite by Theophrastus and Simplicius, believed in successive *single* worlds? The distinction from Anaximander is puzzling on any interpretation. But Heraclitus and Diogenes are mentioned as sharing the belief; Simplicius

certainly ascribed successive worlds to Heraclitus, and he may have thought that Anaximenes should be classed with him, as a believer in a specific primary substance, rather than with Anaximander and the atomists, whose ἀρχή was undifferentiated. There is also a possibility that Anaximenes does not belong here at all: see n. on p. 151. Nevertheless these two pieces of evidence, puzzling as they are, cannot be regarded as neutralized. On the other side there were three special characteristics of Anaximander's cosmology which might well have encouraged an innumerable-world interpretation: (1) the theory that the earth was surrounded by a number – perhaps an indefinite number of rings of the celestial bodies (pp. 134ff.); (2) the theory that the earth was drying up, which was probably part of a wider theory of cycles of change on the earth's surface – a succession of κόσμοι in the sense of local arrangements (pp. 138ff.); (3) the potential ambiguity of the fragment known to Theophrastus. This fragment seems properly to have described the interaction of substances within the world, but Theophrastus misapplied it to interaction between the world and the Indefinite. Thus (1) might help to suggest coexistent worlds, (2) and (3) successive ones. Theophrastus may have applied atomistic arguments and imposed upon Anaximander worlds that were both.

COSMOGONY

(i) *'Eternal motion' and vortex: are they relevant to Anaximander?*

115 Hippolytus *Ref.* 1, 6, 2 (from **101B**) ...κίνησιν ἀίδιον εἶναι, ἐν ᾗ συμβαίνει γίνεσθαι τοὺς οὐρανούς.

116 Aristotle *Phys.* Θ1, 250b11 πότερον γέγονέ ποτε κίνησις...ἢ οὔτ' ἐγένετο οὔτε φθείρεται ἀλλ' ἀεὶ ἦν καὶ ἀεὶ ἔσται, καὶ τοῦτ' ἀθάνατον καὶ ἄπαυστον ὑπάρχει τοῖς οὖσιν, οἷον ζωή τις οὖσα τοῖς φύσει συνεστῶσι πᾶσιν;...ἀλλ' ὅσοι μὲν ἀπείρους τε κόσμους εἶναί φασι, καὶ τοὺς μὲν γίγνεσθαι τοὺς δὲ φθείρεσθαι τῶν κόσμων, ἀεί φασιν εἶναι κίνησιν...ὅσοι δ' ἕνα, ⟨ἢ ἀεὶ⟩ ἢ μὴ ἀεί, καὶ περὶ τῆς κινήσεως ὑποτίθενται κατὰ λόγον.[1]

117 Aristotle *de caelo* B13, 295a7 ἀλλὰ μὴν εἴ γε ἔστι κίνησίς τις κατὰ φύσιν, οὐκ ἂν ἡ βίαιος εἴη φορὰ μόνον οὐδ' ἠρέμησις· ὥστ' εἰ βίᾳ νῦν ἡ γῆ μένει, καὶ συνῆλθεν ἐπὶ τὸ μέσον φερομένη διὰ τὴν δίνησιν. ταύτην γὰρ τὴν αἰτίαν πάντες λέγουσιν ἐκ τῶν ἐν τοῖς ὑγροῖς καὶ περὶ τὸν ἀέρα συμβαινόντων· ἐν τούτοις γὰρ ἀεὶ φέρεται τὰ μείζω καὶ τὰ βαρύτερα πρὸς τὸ μέσον τῆς δίνης. διὸ δὴ τὴν γῆν πάντες ὅσοι τὸν οὐρανὸν γεννῶσιν ἐπὶ τὸ μέσον συνελθεῖν φασίν.

115 ...motion was eternal, in which it results that the heavens come into being.

116 Did motion come into being at some time...or did it neither come-to-be nor is it destroyed, but did it always exist and will it go on for ever, and is it immortal and unceasing for existing things, being like a kind of life for all natural objects?...But all who say that there are infinite worlds, and that some of them are coming-to-be and others passing away, say that motion always exists...while all who say that there is one world, whether eternal or not, make an analogous supposition about motion.

117 Yet if indeed there is some kind of natural motion, there would not be enforced motion only, or enforced rest; so that if the earth now stays in place by force, it also came together to the centre by being carried there because of the vortex. (For this is the cause that everyone gives, through what happens in water and in air; for in these the larger and heavier objects are always carried toward the centre of the vortex.) Therefore all who generate the heaven say that the earth came together to the centre.

[1] ⟨ἢ ἀεί⟩ (Ross) is supported by the comments of both Themistius and Simplicius. The sense is that those who postulate one eternal world also postulate eternal motion; those who postulate one non-eternal world do not. Note that successive single worlds (which would require eternal motion) are not included in this analysis.

Theophrastus evidently stated that the Indefinite was characterized by an eternal motion, which was somehow responsible for the innumerable worlds. He likewise attributed eternal motion to Anaximenes, presumably because, like Anaximander, Anaximenes did not specify anything that could obviously act as a cause of change. Aristotle frequently rebuked the monists for this very fault; but **116** shows that he could on occasion understand their ways of thinking better than his pupil Theophrastus. There he considers an ungenerated motion which is 'deathless', which inheres in things as a kind of life. He was thinking of Thales, perhaps (p. 98); but the phrase 'immortal and unceasing' reminds one of the phraseology which he attributed to Anaximander, among others, in **108**; he probably realized, then, that for Anaximander change in the cosmos was bound up with the divinity, the power of life and movement, of the Indefinite. What Theophrastus had in mind as Anaximander's 'eternal motion' was probably some more explicit, mechanical kind of motion like that of the atomists, who are mentioned indirectly in the latter part of **116**; we have seen (pp. 124f.) that Theophrastus may well have grouped Anaximander with the atomists over the

question of innumerable worlds. Some modern scholars (e.g. Burnet) have held that Anaximander postulated a confused agitation like the winnowing motion in Plato's *Timaeus*; others (e.g. Tannery) have assigned a circular motion to the Indefinite. Both are equally unlikely. It is highly improbable that Anaximander himself ever isolated this question of motion; the Indefinite was divine, and naturally possessed the power to move what and where it willed. To define its properties further would defeat Anaximander's purpose.

One often reads of a vortex or vortices in Anaximander. There is in fact no evidence for this apart from Aristotle in **117**, a highly involved piece of *a priori* reasoning. But in any case Anaximander was presumably not in Aristotle's mind when he wrote this passage; for shortly afterwards (**123**) he is distinguished from the majority of the physicists on the ground that his earth remained at the centre by equilibrium and not by conventional kinds of 'force'. This distinction and the subsequent discussion come as an appendix to the discussion of vortex-action, which is no longer under consideration; thus it may be accepted that Aristotle was talking loosely in saying in **117** that 'all who generate the heaven say that the earth came together to the centre', if this implies more than accretion. Vortices are not associated in our doxographical sources with anyone before Empedocles, though Aristotle's generalization in **117** would surely have led Theophrastus to mention earlier occurrences, had he been able to find them. It is, nevertheless, just possible that what was separated off from the Indefinite in the first stage of Anaximander's cosmogony was a vortex, see p. 132; what is quite out of the question is either that the whole Indefinite was in vortex-motion, or that the diurnal movement of the heavenly bodies is due to this cause (which would not suit the earth's equilibrium in **123**). The tendency of heavy bodies to the centre is assumed in most early cosmogonies. This may have been due in part, as implied in **117**, to the observation of vortex-action in everyday experience; but in part it simply reflected the obvious arrangement of the components of the visible cosmos.

(ii) *How did the opposites come from the Indefinite?*

118 Aristotle *Phys.* A4, 187a20 (from **104**) οἱ δ' ἐκ τοῦ ἑνὸς ἐνούσας τὰς ἐναντιότητας ἐκκρίνεσθαι, ὥσπερ Ἀναξίμανδρός φησι καὶ ὅσοι δ' ἓν καὶ πολλά φασιν εἶναι, ὥσπερ Ἐμπεδοκλῆς καὶ Ἀναξαγόρας· ἐκ τοῦ μίγματος γὰρ καὶ οὗτοι ἐκκρίνουσι τἆλλα.

119 Simplicius *in Phys.* 24, 21 (continuing **101A**) δῆλον δὲ ὅτι τὴν εἰς ἄλληλα μεταβολὴν τῶν τεττάρων στοιχείων οὗτος θεασάμενος

οὐκ ἠξίωσεν ἕν τι τούτων ὑποκείμενον ποιῆσαι, ἀλλά τι ἄλλο παρὰ ταῦτα· οὗτος δὲ οὐκ ἀλλοιουμένου τοῦ στοιχείου τὴν γένεσιν ποιεῖ, ἀλλ' ἀποκρινομένων τῶν ἐναντίων διὰ τῆς ἀιδίου κινήσεως.

118 But the others say that the opposites are separated out from the One, being present in it, as Anaximander says and all who say there are one and many, like Empedocles and Anaxagoras; for these, too, separate out the rest from the mixture.

119 It is clear that he [Anaximander], seeing the changing of the four elements into each other, thought it right to make none of these the substratum, but something else beside these; and he produces coming-to-be not through the alteration of the element, but by the separation off of the opposites through the eternal motion.

It is almost certain from the first sentence of **119** that Simplicius is no longer quoting Theophrastus, but giving his own paraphrase of what he has just quoted. In the second sentence he partly depends on the analysis by Aristotle in **104**. There are two notable differences between his comment and the Aristotelian original: (*a*) the opposites are separated *out* (ἐκκρίνεσθαι) in Aristotle, separated *off* (ἀποκρινομένων) in Simplicius; (*b*) Simplicius, but not Aristotle, said that the separation was due to the eternal motion. Now it has been argued by U. Hölscher (*Hermes* 81 (1953), 258ff.) that Simplicius in the second sentence of **119** (as at *in Phys.* 150, 22) is simply and solely enlarging on Aristotle, and reproduces no Theophrastean interpretation whatever; this passage, therefore, is not good evidence for Anaximander unless Aristotle is reliable in **118**. But, the argument continues, Aristotle was prone to read his own simple bodies, and two pairs of basic opposites, into everything, and he perverted Anaximander by substituting separating *out* for separating *off* from the Indefinite, thus making this into a mixture of opposites. Theophrastus attributed separating *off* to Anaximander, but of the innumerable worlds and not of opposites (ἀποκεκρίσθαι in **101C**); and this, according to Hölscher, was the proper application of the word. Against this ingenious theory the following points may be made. The mention of the eternal motion by Simplicius is Theophrastean and not Aristotelian in source (see **115**); so, apparently, is his use of the verb for separating *off*. Therefore, while it is agreed that he was not here quoting Theophrastus, he probably did have Theophrastus' assessment of Anaximander in mind. Further, Hölscher has not succeeded in convincingly destroying a most damaging piece of evidence, passage **121**. This continuation of ps.-Plutarch's doxography

in **101**c states that 'the productive from the eternal of hot and cold was separated off at the beginning of this world', and continues with details of the cosmogony. This, though garbled, represents Theophrastus, and shows that Theophrastus accepted separation off from the Indefinite, and opposites, as involved in Anaximander's cosmogony. Since the extant fragment (**110**) suggests that the world is still composed of opposites, it seems legitimate to accept from both Theophrastus and Aristotle that opposites were involved in cosmogony.

Nevertheless, we may accept the warning about ἐκκρίνεσθαι in Aristotle; it seems quite likely that this is a distortion of ἀποκρίνεσθαι. And according to **121** what was separated off was not opposite substances (flame and mist) but something that produced them. This might have been a kind of seed, it might have been a vortex; there was perhaps a confusion in the tradition (see p. 132). At all events we have no right to assume with Aristotle that the opposites were *in* (ἐνούσας) the Indefinite, and were separated *out* of it; still less may we define the Indefinite as a mixture, as Aristotle perhaps did.[1] The Indefinite was not clearly defined and analysed by Anaximander; but this does not mean, of course, that he might not have been making it behave, in respect of its products, in some way like a compound – either a mechanical mixture or a fusion.[2] If the opposites arose directly from the Indefinite by being separated off, as Simplicius states in **119**, then the Indefinite was being unconsciously treated as unhomogeneous; for separation off cannot simply imply the isolation of one part of the Indefinite, that part which becomes the world; it implies this *and* some change in the isolated part. If this change was not the appearance of opposites, but of something productive of them, then one might infer that the Indefinite was the kind of thing that contained, for example, sperms or embryos; but that still does not mean that Anaximander thought of it as being of a specific character.

[1] Cf. **120** Aristotle *Met.* Λ1, 1069b20 ...καὶ τοῦτ' ἐστὶ τὸ Ἀναξαγόρου ἓν (βέλτιον γὰρ ἢ ὁμοῦ πάντα) καὶ Ἐμπεδοκλέους τὸ μίγμα καὶ Ἀναξιμάνδρου, καὶ ὡς Δημόκριτός φησιν *(...and this is the One of Axaxagoras (for this is a better description than 'all things together') and the mixture of Empedocles and of Anaximander, and what Democritus describes)*. If **118** is doubtful, this passage certainly seems to attribute a mixture to Anaximander; although G. Calogero suggests Ἀναξιμάνδρου ⟨τὸ ἄπειρον⟩.

[2] As suggested by Cornford and by Vlastos (*CP* 42 (1947), 170–2). Theophrastus is quoted by Simplicius (**492**) as saying that the mixture of all things in Anaxagoras could be regarded as 'one substance indefinite both in kind and in size', and that he would resemble Anaximander – but whether in the idea of *mixture* is not clear.

(iii) *The actual formation of the cosmos*

121 Ps.-Plutarch *Strom.* 2 (continuing **101**c and **122**A; DK 12 A 10) φησὶ δὲ τὸ ἐκ τοῦ ἀιδίου γόνιμον θερμοῦ τε καὶ ψυχροῦ κατὰ τὴν γένεσιν τοῦδε τοῦ κόσμου ἀποκριθῆναι καί τινα ἐκ τούτου φλογὸς σφαῖραν περιφυῆναι τῷ περὶ τὴν γῆν ἀέρι ὡς τῷ δένδρῳ φλοιόν· ἥστινος ἀπορραγείσης καὶ εἴς τινας ἀποκλεισθείσης κύκλους ὑποστῆναι τὸν ἥλιον καὶ τὴν σελήνην καὶ τοὺς ἀστέρας. (Continues at **134**.)

> **121** He says that that which is productive from the eternal of hot and cold was separated off at the coming-to-be of this world, and that a kind of sphere of flame from this was formed round the air surrounding the earth, like bark round a tree. When this was broken off and shut off in certain circles, the sun and the moon and the stars were formed.

This passage (supplemented, for the heavenly bodies, by Hippolytus in **125**) is virtually our only authority for Theophrastus' report of the details of the cosmogonical process in Anaximander. The *Stromateis* are usually less accurate than either Simplicius or Hippolytus in reproducing Theophrastus (cf. **101**); but it cannot be doubted that the present passage is based on him, and the citation of the bark-simile, which looks as though it is derived from Anaximander himself, suggests that in places, at least, the passage follows Theophrastus fairly closely.

The phrase ἐκ τοῦ ἀιδίου, 'from the eternal', perhaps means 'from the Indefinite', which was described as immortal.[1] 'The productive from the eternal of hot and cold ... was separated off' is still difficult. γόνιμος (productive) was a favourite Peripatetic word, which usually retained some flavour, if only a slight one, of biological generation. In the fifth century, on the other hand, γόνιμος only occurs twice, in Euripides and Aristophanes – the latter use being a weakened metaphor – except for a special medical-technical use (of critical periods in disease; the biological meaning is almost suppressed) in the Hippocratic *Visits*. It seems unlikely, therefore, that it is an Anaximandrean term; and in view of occurrences of the word, especially in Plutarch, as a dead metaphor with no biological implications we cannot be sure that it was here intended to represent generation of a biological kind, however remotely. This must be emphasized because of the popularity of Cornford's suggestion that this stage in Anaximander corresponds with the production of a cosmogonical egg in 'Orphic' accounts (on which see pp. 23–9). It

would not be surprising to find that Anaximander resorted to the old mythological medium of sexual generation to account for the most difficult stage in world-formation – the production of heterogeneous plurality out of a single source, and that, here, an Indefinite one. One would not, however, expect a crude and explicit device like the egg; and the evidence is not certainly in favour of any such sexual device, however metaphorical. A completely different suggestion was made by Vlastos (*CP* 42 (1947), 171 n. 140), that τὸ γόνιμον was not a thing so much as a process. A vortex, for instance, might well account for the appearance of opposites; for the phraseology we may compare Democritus fr. 167, δῖνον ἀπὸ τοῦ παντὸς ἀποκριθῆναι ('a vortex was separated off from the whole').[2] Yet, apart from the considerations raised under § (i) above, why did Theophrastus not simply use the word δῖνος or δίνη to describe a process completely familiar to him, and one which would further have emphasized the resemblance of Anaximander and Anaxagoras (n. 2 on p. 130)? If he had used the word, we should not have this vague circumlocution in ps.-Plutarch. It is at least a possibility that Theophrastus himself was in doubt about this first stage, perhaps through lack of full information, and used a vague expression to cover himself; but he would not have *invented* an intermediary between the Indefinite and the opposites (which could have been more easily produced, as in **118**, directly), and judgement must be reserved on its character.

[1] Another possibility is that the whole phrase means 'that which was capable from all time of producing...' In this case we should expect ἐξ ἀιδίου, without the article. But the insertion of ἐκ τοῦ ἀιδίου between τὸ and γόνιμον, on the other interpretation, is almost as strange. In any case, the tortuosity of expression is not immediately due to Anaximander, and the obscure meaning is not greatly affected either way. On Anaximander's possible vagueness, see the neat analysis by J. Barnes, *The Presocratic Philosophers* (London, 1979) I, 43.

[2] That 'separating off' can be applied to the products of a vortex, as well as to the vortex itself, is demonstrated by Anaxagoras fr. 9 *init.*, οὕτω τούτων περιχωρούντων τε καὶ ἀποκρινομένων ὑπὸ βίης τε καὶ ταχυτῆτος... ('these things thus revolving and being separated off by force and speed...').

The nature of the hot (substance) and cold (substance) thus cryptically produced appears from what follows in ps.-Plutarch: they are flame and air-mist (the inner part of which is assumed to have condensed into earth). The ball of flame fits closely round the air, as closely as bark grows round a tree; this can be the point of the simile, which does not necessarily suggest that the flame is annular (though the eventual shape of the earth is cylindrical, see **122**). So far, then, something has been isolated in the Indefinite which produces flame and air-mist; earth condenses at the core, flame fits

closely round the air. Now the ball of flame bursts, breaks up into circles which are enclosed by mist which has also expanded (cf. **125**), and forms the heavenly bodies. From **132** we learn that the moist earth is dried by the sun, the remnants of the moisture being sea.[1]

[1] It is possible that **121** contains other signs of biological–embryological language, apart from the dubious γόνιμον. H. C. Baldry (*CQ* 26 (1932), 27ff.) pointed out that ἀπόκρισις was used in embryological treatises to describe the separation of the seed from the parent; φλοιός could be used of a caul, and was perhaps used in a similar sense by Anaximander – see **133**; ἀπορρήγνυσθαι is sometimes used of a new growth detaching itself from the parent body (which it can hardly mean here, *contra* Heidel and Baldry). But none of these words has an exclusively embryological sense; they are common terms (except φλοιός, which most frequently means 'bark') which would naturally be applied to both embryology and cosmogony.

COSMOLOGY: THE PRESENT STRUCTURE OF THE WORLD

(i) *The earth*

122 (A) Ps.-Plutarch *Strom.* 2

ὑπάρχειν δέ φησι τῷ μὲν σχήματι τὴν γῆν κυλινδροειδῆ, ἔχειν δὲ τόσουτον βάθος ὅσον ἂν εἴη τρίτον πρὸς τὸ πλάτος.

(B) Hippolytus *Ref.* I, 6, 3

τὸ δὲ σχῆμα αὐτῆς (*sc.* τῆς γῆς) γυρόν, στρογγύλον, κίονος λίθῳ παραπλήσιον·[1] τῶν δὲ ἐπιπέδων ᾧ μὲν ἐπιβεβήκαμεν, ὃ δὲ ἀντίθετον ὑπάρχει.

[1] ὑγρόν, χίονι MSS; κίονι Aetius III, 10, 2 (DK 12A25). γυρόν (Roeper) is plausible for the impossible ὑγρόν; originally meaning 'curved' (e.g. of a hook, or of hunched shoulders), it came to mean also 'round'. στρογγύλον, then, may be an interpolated gloss. I have emended χίονι to κίονος, *exempli gratia*; perhaps we should read κίονι λιθίνῳ (cf. Diels, *Doxographi Graeci*, 218); in any case the sense is not in doubt. (Kahn, *op. cit.*, 55f., is unconvincing.)

123 Aristotle *de caelo* B13, 295b10 εἰσὶ δέ τινες οἳ διὰ τὴν ὁμοιότητά φασιν αὐτὴν (*sc.* τὴν γῆν) μένειν, ὥσπερ τῶν ἀρχαίων Ἀναξίμανδρος. μᾶλλον μὲν γὰρ οὐθὲν ἄνω ἢ κάτω ἢ εἰς τὰ πλάγια φέρεσθαι προσήκει τὸ ἐπὶ τοῦ μέσου ἱδρυμένον καὶ ὁμοίως πρὸς τὰ ἔσχατα ἔχον· ἅμα δ' ἀδύνατον εἰς τἀναντία ποιεῖσθαι τὴν κίνησιν, ὥστ' ἐξ ἀνάγκης μένειν.

124 Hippolytus *Ref.* I, 6, 3 (preceding **122**B) τὴν δὲ γῆν εἶναι μετέωρον ὑπὸ μηδενὸς κρατουμένην, μένουσαν δὲ διὰ τὴν ὁμοίαν πάντων ἀπόστασιν.

122 (*A*) He says that the earth is cylindrical in shape, and that its depth is a third of its width. (*B*) Its shape is curved, round,

similar to the drum of a column; of its flat surfaces we walk on one, and the other is on the opposite side.

123 There are some who say, like Anaximander among the ancients, that it [the earth] stays still because of its equilibrium. For it behoves that which is established at the centre, and is equally related to the extremes, not to be borne one whit more either up or down or to the sides; and it is impossible for it to move simultaneously in opposite directions, so that it stays fixed by necessity.

124 The earth is on high, held up by nothing, but remaining on account of its similar distance from all things.

The earth is shaped like a column-drum; men live on its upper surface. There is no question of the meaning being (as Kahn thinks) that the earth's surface is concave – or convex for that matter. The term γυρός refers to its round section, in accordance with the traditional view (see p. 11 above on Okeanos); cf. LSJ s.v. γῦρος. Nor does the mention of an undersurface in **122B** imply that it, too, was inhabited (*contra* Kahn, 56 and 84f.). It is three times as wide as it is deep – a ratio which is analogous to the distances of the heavenly bodies (pp. 135f.). Its evident stability is explained in a new way which represents a radical advance on Thales' idea that it *floated* on water (an idea revived and modified by Anaximenes, p. 153). What the earth is at the centre of, presumably, is the rings of the heavenly bodies, of which the sun's is the largest (**125**). Anaximander was not talking of the world as a whole, or saying that *it* was at the centre of the Indefinite, though he would doubtless have accepted this if the idea were put to him. At all events he completely broke away from the popular idea that the earth must be supported by something concrete, that it must have 'roots'; his theory of equilibrium was a brilliant leap into the realms of the mathematical and the *a priori* – one which he would not have been tempted to take, it might be suggested, if vortex-action had been applied in his cosmogony and was at hand, as it were, to explain the stability of the earth. On the broader implications of Anaximander's theory see further Kahn, *op. cit.*, 76–81.

(ii) *The heavenly bodies*

125 Hippolytus *Ref.* 1, 6, 4–5 τὰ δὲ ἄστρα γίνεσθαι κύκλον πυρὸς ἀποκριθέντα τοῦ κατὰ τὸν κόσμον πυρός, περιληφθέντα δ' ὑπὸ ἀέρος (cf. **121**). ἐκπνοὰς δ' ὑπάρξαι, πόρους τινὰς αὐλώδεις, καθ' οὓς φαίνεται τὰ ἄστρα· διὸ καὶ ἐπιφρασσομένων τῶν ἐκπνοῶν τὰς ἐκλείψεις γίνεσθαι. τὴν δὲ σελήνην ποτὲ μὲν πληρουμένην φαίνεσθαι ποτὲ δὲ μειουμένην παρὰ τὴν τῶν πόρων ἐπίφραξιν ἢ ἄνοιξιν.

εἶναι δὲ τὸν κύκλον τοῦ ἡλίου ἑπτακαιεικοσαπλασίονα ⟨τῆς γῆς, ὀκτωκαιδεκαπλασίονα δὲ τὸν⟩ τῆς σελήνης, καὶ ἀνωτάτω μὲν εἶναι τὸν ἥλιον, κατωτάτω δὲ τοὺς τῶν ἀπλανῶν ἀστέρων κύκλους.

126 Aetius II, 20, 1 Ἀναξίμανδρος (*sc.* τὸν ἥλιόν φησι) κύκλον εἶναι ὀκτωκαιεικοσαπλασίονα τῆς γῆς, ἁρματείῳ τροχῷ παραπλήσιον, τὴν ἀψῖδα ἔχοντα κοίλην, πλήρη πυρός, κατά τι μέρος ἐκφαίνουσαν διὰ στομίου τὸ πῦρ ὥσπερ διὰ πρηστῆρος αὐλοῦ. (Cf. Aetius II, 25, 1, DK 12A22, for the moon.)

127 Aetius II, 21, 1 Ἀναξίμανδρος (*sc.* φησὶ) τὸν μὲν ἥλιον ἴσον εἶναι τῇ γῇ, τὸν δὲ κύκλον ἀφ' οὗ τὴν ἐκπνοὴν ἔχει καὶ ὑφ' οὗ περιφέρεται ἑπτακαιεικοσαπλασίῳ τῆς γῆς.

128 Aetius II, 16, 5 Ἀναξίμανδρος ὑπὸ τῶν κύκλων καὶ τῶν σφαιρῶν ἐφ' ὧν ἕκαστος βέβηκε φέρεσθαι (*sc.* τοὺς ἀστέρας φησίν).

125 The heavenly bodies come into being as a circle of fire separated off from the fire in the world, and enclosed by air. There are breathing-holes, certain pipe-like passages, at which the heavenly bodies show themselves; accordingly eclipses occur when the breathing-holes are blocked up. The moon is seen now waxing, now waning according to the blocking or opening of the channels. The circle of the sun is 27 times the size of ⟨the earth, that of⟩ the moon ⟨18 times⟩; the sun is highest, and the circles of the fixed stars are lowest.

126 Anaximander [says the sun] is a circle 28 times the size of the earth, like a chariot wheel, with its felloe hollow and full of fire, and showing the fire at a certain point through an aperture as though through the nozzle of a bellows.

127 Anaximander [says] that the sun is equal to the earth, but that the circle from which it has its breathing-hole and by which it is carried round is 27 times the size of the earth.

128 Anaximander [says that the heavenly bodies] are carried by the circles and spheres on which each one goes.

The sun and moon are each an aperture in separate solid rings like the felloes of cartwheels. These rings consist of fire surrounded by air (regarded as concealing mist), and out of the single aperture in each of them fire emerges like air from the nozzle of a bellows; the similes of the cartwheels and the bellows perhaps derive from Anaximander himself. Eclipses, and phases of the moon, are due to a total or partial blocking of the aperture; typically, no motive is given for this blockage. The aperture of the sun is the same size as the surface (presumably) of the earth (**127**) – a remarkable view contradicted by

Heraclitus in fr. 3; the diameter of its wheel is twenty-seven times as great as this (twenty-eight times in **126**).[1] The moon-wheel is nineteen earth-diameters (or eighteen, presumably) across; the obvious lacuna in **125** has been filled after Aetius II, 25, 1, which gives the corresponding information to **126** for the moon, only adding that the circles of sun and moon lie obliquely. The star-wheels (on which see below), although we are not told so, were presumably of nine (or ten) earth-diameters, being nearest to the earth (**125** *fin.*). Thus Anaximander gave the structure of the world a mathematical basis, developing the assumption (seen already in Homer and Hesiod, cf. **1** with comment) that it is orderly – even then in a crudely quantifiable way – and determinable. His proportionate distances may have influenced Pythagoras.

[1] This larger figure (28*x*) cannot represent the distance from the outer, as opposed to the inner, edges of the celestial circle if diameters are meant; for 2, not 1, should then be added to the multiple, to give 29*x*. If the radius and not the diameter were intended the figures given would hold: but 'the circle of the sun is twenty-seven times that of the earth' (**125**, **126**) – the earth whose 'breadth' is specified in **122** – implies clearly enough that the diameter is really meant. In that case the larger figure might represent the diameter from outer edge to outer edge, the smaller one that from points half-way between the outer and inner edges of the actual felloe of air – assuming, what seems reasonable, that the felloe is one earth-diameter thick.

The stars present certain difficulties. (*a*) **125** *fin.* mentions the fixed stars as closest to the earth. Possibly, as Diels thought, there is another lacuna here and the planets were mentioned too. That the fixed stars and the planets were at the same distance from the earth is perhaps implied by Aetius II, 15, 6 (DK 12 A 18), and is suggested by the series of proportionate distances: 1 (diameter of earth)–*x*–18 (moon-ring)–27 (sun-ring). Here *x*, the missing distance, must be that of the stars and planets: it must be 9, to fit into the series, and there is no vacant number to allow a different distance for stars and planets. (*b*) **128** mentions both circles and spheres of the stars (while **125** has a circle of stars at the beginning, circles at the end). The two are incompatible; possibly a sphere for the fixed stars, rings for the planets were meant. But this is inconsistent with the argument that fixed stars and planets must be at the same distance from the earth; there would not be room for both a sphere and rings. Indeed a sphere, although the simplest explanation of the fixed stars, is impossible: the cosmogonical account (**121**) showed that a ball of flame broke up, or broke away from the mist round the earth, and was then shut into circles (obviously of air-mist) which composed sun, moon and stars. There is no possibility, let alone any mention, of part of the sphere of flame

remaining as a sphere after it had broken away. Thus it must be assumed that each star, including the planets, has its own wheel; these wheels are equal in diameter and are inclined on countless different planes. They do not obscure the sun and moon (cf. e.g. Homer *Il.* XX, 444ff.; XXI, 549). If their centre is the same as the centre of the earth, the circumpolar stars (which do not set) are unexplained – as they would be even by a sphere; and yet if their centres were at different distances up and down the earth's axis, which could account for some stars not setting, they would be likely to infringe the equilibrium described in **123** and **124**. Probably Anaximander did not think of these difficulties. The movement of the sun on the ecliptic, the declination of the moon, and the wanderings of the planets were probably explained as due to wind (see **132**); the east-to-west movements were due to rotation of the wheels (cf. φέρεσθαι in **128**) in the planes of their circumferences.

It is plain that much of Anaximander's astronomy is speculative and aprioristic – which is not to say that it is mystical or poetical exactly (see Kahn, *op. cit.*, 94f.). Rather, the symmetry of the universe that was already assumed in Homer and Hesiod is developed further, made more precise, and more closely related to 'commonsense' observation of a somewhat incomplete and casual kind.

(iii) *Meteorological phenomena*

129 Hippolytus *Ref.* I, 6, 7 ἀνέμους δὲ γίνεσθαι τῶν λεπτοτάτων ἀτμῶν τοῦ ἀέρος ἀποκρινομένων καὶ ὅταν ἀθροισθῶσι κινουμένων, ὑετοὺς δὲ ἐκ τῆς ἀτμίδος τῆς ἐκ τῶν ὑφ' ἥλιον ἀναδιδομένης· ἀστραπὰς δὲ ὅταν ἄνεμος ἐκπίπτων διιστᾷ τὰς νεφέλας.[1]

[1] ἐκ τῆς ἀτμίδος – ἀναδιδομένης Cedrenus; the MSS give an obviously corrupt reading (DK I p. 84 n.) which implies if anything that the exhalation is from the earth. A dual exhalation was imposed also on Heraclitus (p. 202 n. 1); it was probably a refinement by Aristotle. Cedrenus (11th cent. A.D.) is sometimes correct: e.g. his ἐκπίπτων in **129** is shown by **130** to be correct against MSS ἐμπίπτων.

130 Aetius III, 3, 1–2 (περὶ βροντῶν ἀστραπῶν κεραυνῶν πρηστήρων τε καὶ τυφώνων.) Ἀναξίμανδρος ἐκ τοῦ πνεύματος ταυτὶ πάντα συμβαίνειν· ὅταν γὰρ περιληφθὲν νέφει παχεῖ βιασάμενον ἐκπέσῃ τῇ λεπτομερείᾳ καὶ κουφότητι, τότε ἡ μὲν ῥῆξις τὸν ψόφον, ἡ δὲ διαστολὴ παρὰ τὴν μελανίαν τοῦ νέφους τὸν διαυγασμὸν ἀποτελεῖ.

131 Seneca *Qu. nat.* II, 18 Anaximandrus omnia ad spiritum rettulit: tonitrua, inquit, sunt nubis ictae sonus... (see DK 12 A 23).

129 Winds occur when the finest vapours of the air are separated

off and when they are set in motion by congregation; rain occurs from the exhalation that issues upwards from the things beneath the sun, and lightning whenever wind breaks out and cleaves the clouds.

130 (On thunder, lightning, thunderbolts, whirlwinds and typhoons.) Anaximander says that all these things occur as a result of wind: for whenever it is shut up in a thick cloud and then bursts out forcibly, through its fineness and lightness, then the bursting makes the noise, while the rift against the blackness of the cloud makes the flash.

131 Anaximander referred everything to wind: thunder, he said, is the noise of smitten cloud...

These passages suggest that Anaximander shared in, and perhaps to a large degree originated, a more or less standard Ionian way of accounting for meteorological (in our sense) events. The chief elements of this scheme are wind, the evaporation from the sea, and the condensed masses of vapour which form the clouds. All testimonies on the subject are, of course, based on Theophrastus, whom we may suspect of not always resisting the temptation to supply 'appropriate' explanations, where none existed, of certain natural phenomena which he thought interested all Presocratics. The explanation of wind in **129** (cf. also Aetius III, 7, 1, DK 12A24) is very involved; note that it is somehow due to 'separation off' of the finest part of air. Rain is caused by the condensation (presumably) of moist vapours evaporated by the sun; wind causes most other phenomena (**130**, **131**), including, probably, the movements north and south of sun and moon. **132**, with **133**, is ambiguous on this point – it could be the exhalation (as Kahn thinks, *op. cit.*, p. 66) rather than the winds themselves, that cause these movements, although **131** suggests that the latter is what Aristotle meant. The emphasis on wind, a product of air, might in any case suggest a degree of conflation with Anaximenes; he gave the same explanation of lightning as Anaximander but in an appendix to **130** is distinguished as having cited a special parallel (oars flash in water; see **158**). On this and §(iv) see further Kahn's interesting discussion, *op. cit.*, 98–109. On p. 102 he stresses the parallel between the meteorological fire of lightning, emanating from wind, and that of the celestial rings.

(iv) *The earth is drying up*

132 Aristotle *Meteor.* B1, 353b6 εἶναι γὰρ τὸ πρῶτον ὑγρὸν ἅπαντα τὸν περὶ τὴν γῆν τόπον, ὑπὸ δὲ τοῦ ἡλίου ξηραινόμενον τὸ

μὲν διατμίσαν πνεύματα καὶ τροπὰς ἡλίου καὶ σελήνης φασὶ ποιεῖν, τὸ δὲ λειφθὲν θάλατταν εἶναι· διὸ καὶ ἐλάττω γίνεσθαι ξηραινομένην οἴονται καὶ τέλος ἔσεσθαί ποτε πᾶσαν ξηράν... Alexander *in Meteor.* p. 67, 11 (DK 12A27) ...ταύτης τῆς δόξης ἐγένετο, ὡς ἱστορεῖ Θεόφραστος, Ἀναξίμανδρός τε καὶ Διογένης.

132 For first of all the whole area round the earth is moist, but being dried by the sun the part that is exhaled makes winds and turnings of the sun and moon, they say, while that which is left is sea; therefore they think that the sea is actually becoming less through being dried up, and that some time it will end up by all being dry ...of this opinion, as Theophrastus relates, were Anaximander and Diogenes.

It is helpful to have Theophrastus' attribution reported by Alexander (and confirmed by Aetius III, 16, 1), although it must be noted that the only name mentioned by *Aristotle* in connexion with the drying up of the sea is that of Democritus (*Meteor.* B3, 356b10, DK 68A100). Aristotle had previously mentioned (*Meteor.* A14, 352a17) that those who believed the sea to be drying up were influenced by local examples of this process (which, we may note, was conspicuous around sixth-century Miletus); he himself rebuked them for their false inference, and pointed out that in other places the sea was gaining; also, there were long-term periods of comparative drought and flood which Aristotle called the 'great summer' and 'great winter' in a 'great year'.[1]

[1] Here Aristotle may be aiming particularly at Democritus, who thought that the sea was drying up *and that the world would come to an end.* Anaximander need not have thought this any more than Xenophanes did; in fact Aristotle might have been rebuking Democritus in terms of the earlier cyclical theory. – There may well be a special reference to Anaximander in Aristotle's words (*Meteor.* B2, 355a22) 'those who say...that when the world around the earth was heated by the sun, air came into being and the whole heaven *expanded*...' (cf. **121**).

It is clear that if Anaximander thought that the sea would dry up once and for all this would be a serious betrayal of the principle enunciated in the extant fragment (**110**), that things are punished for their injustice; for land would have encroached on sea without suffering retribution. Further, although only the sea is mentioned, it is reasonable to conclude that, since rain was explained as due to the condensation of evaporation (**129**), the drying up of the sea would lead to the drying up of the whole earth. But could our whole interpretation of the fragment as an assertion of cosmic stability be wrong; could the drying up of the earth be the prelude to reabsorption

into the Indefinite? This it could not be, since if the earth were destroyed by drought that would implicitly qualify the Indefinite itself as dry and fiery, thus contradicting its very nature; and, in addition, the arguments from the form of the fragment still stand. The principle of the fragment could, however, be preserved if the diminution of the sea were only one part of a cyclical process: when the sea is dry a 'great winter' (to use Aristotle's term, which may well be derived from earlier theories) begins, and eventually the other extreme is reached when all the earth is overrun by sea and turns, perhaps, into slime.

That this is what Anaximander thought is made more probable by the fact that Xenophanes, another Ionian of a generation just after Anaximander's, postulated cycles of the earth drying out and turning into slime: see pp. 176–8. Xenophanes was impressed by fossils of plant and animal life embedded in rocks far from the present sea, and deduced that the earth was once mud. But he argued, not that the sea will dry up even more, but that everything will turn back into mud; men will be destroyed, but then the cycle will continue, the land will dry out, and men will be produced anew. For Anaximander, too, men were born ultimately from mud (**133, 135**). The parallelism is not complete, but it is extremely close: Xenophanes may have been correcting or modifying Anaximander. Anaximander, too, was familiar with the great legendary periods of fire and flood, in the ages of Phaethon and Deucalion; impressed by the recession of the sea from the Ionian coastline he might well have applied such periods to the whole history of the earth.

ZOOGONY AND ANTHROPOGONY

133 Aetius v, 19, 4 Ἀναξίμανδρος ἐν ὑγρῷ γεννηθῆναι τὰ πρῶτα ζῷα φλοιοῖς περιεχόμενα ἀκανθώδεσι, προβαινούσης δὲ τῆς ἡλικίας ἀποβαίνειν ἐπὶ τὸ ξηρότερον καὶ περιρρηγνυμένου τοῦ φλοιοῦ ἐπ' ὀλίγον χρόνον μεταβιῶναι.

134 Ps.-Plutarch *Strom.* 2 ἔτι φησὶν ὅτι κατ' ἀρχὰς ἐξ ἀλλοειδῶν ζώων ὁ ἄνθρωπος ἐγεννήθη, ἐκ τοῦ τὰ μὲν ἄλλα δι' ἑαυτῶν ταχὺ νέμεσθαι, μόνον δὲ τὸν ἄνθρωπον πολυχρονίου δεῖσθαι τιθηνήσεως· διὸ καὶ κατ' ἀρχὰς οὐκ ἂν ποτε τοιοῦτον ὄντα διασωθῆναι.

135 Censorinus *de die nat.* 4, 7 Anaximander Milesius videri sibi ex aqua terraque calefactis exortos esse sive pisces seu piscibus simillima animalia; in his homines concrevisse fetusque ad pubertatem intus retentos; tunc demum ruptis illis viros mulieresque qui iam se alere possent processisse.

136 Hippolytus *Ref.* 1, 6, 6 τὰ δὲ ζῷα γίνεσθαι ⟨ἐξ ὑγροῦ⟩ ἐξατμιζομένου [Diels, -όμενα MSS] ὑπὸ τοῦ ἡλίου. τὸν δὲ ἄνθρωπον ἑτέρῳ ζώῳ γεγονέναι, τουτέστι ἰχθύι, παραπλήσιον κατ' ἀρχάς.

137 Plutarch *Symp.* VIII, 730E (DK 12A30) διὸ καὶ σέβονται (*sc.* Σύροι) τὸν ἰχθῦν ὡς ὁμογενῆ καὶ σύντροφον, ἐπιεικέστερον Ἀναξιμάνδρου φιλοσοφοῦντες· οὐ γὰρ ἐν τοῖς αὐτοῖς ἐκεῖνος ἰχθῦς καὶ ἀνθρώπους, ἀλλ' ἐν ἰχθύσιν ἐγγενέσθαι τὸ πρῶτον ἀνθρώπους ἀποφαίνεται καὶ τραφέντας, ὥσπερ οἱ γαλεοί,[1] καὶ γενομένους ἱκανοὺς ἑαυτοῖς βοηθεῖν ἐκβῆναι τηνικαῦτα καὶ γῆς λαβέσθαι.

[1] Emperius' γαλεοί for the impossible MSS παλαιοί is a brilliant emendation based on another passage in Plutarch, *de soll. an.* 33, 982A, where the shark is said to produce an egg, then to nurture the young inside itself until it is bigger; Aristotle had noted this at *Hist. animalium* Z10, 565b1. But 'like sharks' may well be a parenthetical remark by Plutarch (note the case: nominative not accusative), who knew about them indirectly from Aristotle; he would naturally quote them as an illustration of Anaximander's idea.

133 Anaximander said that the first living creatures were born in moisture, enclosed in thorny barks; and that as their age increased they came forth on to the drier part and, when the bark had broken off, they lived a different kind of life for a short time.
134 Further he says that in the beginning man was born from creatures of a different kind; because other creatures are soon self-supporting, but man alone needs prolonged nursing. For this reason he would not have survived if this had been his original form.
135 Anaximander of Miletus conceived that there arose from heated water and earth either fish or creatures very like fish; in these man grew, in the form of embryos retained within until puberty; then at last the fish-like creatures burst and men and women who were already able to nourish themselves stepped forth.
136 Living creatures came into being from moisture evaporated by the sun. Man was originally similar to another creature – that is, to a fish.
137 Therefore they [the Syrians] actually revere the fish as being of similar race and nurturing. In this they philosophize more suitably than Anaximander; for he declares, not that fishes and men came into being in the same parents, but that originally men came into being inside fishes, and that having been nurtured there – like sharks – and having become adequate to look after themselves, they then came forth and took to the land.

This is virtually all the information we have about Anaximander's evidently brilliant conjectures on the origins of animal and human

life. The first living creatures are generated from slime (elsewhere called ἰλύς) by the heat of the sun: this became a standard account, and even Aristotle accepted spontaneous generation in such cases. The observation behind the theory was perhaps that of mud-flies and sand-worms which abound in the hot sand at the edge of the sea. Yet the first creatures were not of that kind, but were surrounded by prickly barks – like sea-urchins, Cornford suggested. Aetius (**133**) seems to preserve special information about these first creatures, which presumably were prior to the fish-like creatures in which men were reared. The use of φλοιός here reminds one of the bark-simile in the cosmogonical account (**121**); both ball of flame and prickly shell broke away from round the core (here περι- not ἀπορρήγνυσθαι).

The meaning of the concluding words of **133** is disputed; but μετα- in new late-Greek compounds usually implies change rather than succession, and the sense is probably that the creatures, emerged from their husks, lived a different life (i.e. on land) for a short time longer. Possibly Anaximander had some conception of the difficulties of adaptation to environment.[1] This would be no more startling than his intelligent observation that man (with nine months' gestation and many years' helplessness) could not have survived in primitive conditions without protection of some kind. This consideration led to the conjecture that man was reared in a kind of fish – presumably because the earth was originally moist, and the first creatures were of the sea.

[1] Kahn, *op. cit.*, 69, may be right in saying that a short life was the consequence of their difficult mode of birth.

Anaximander's is the first attempt of which we know to explain the origin of man, as well as of the world, rationally. Moreover the general principles of the development of birth are similar (see **121** in particular): moisture is contained in a bark-like covering, and heat somehow causes an expansion or explosion of the husk and the release of a completed form within. Not all Anaximander's successors concerned themselves with man's history (they were more interested in his present condition), and none surpassed him in the thoughtful ingenuity of his theories. Incomplete as our sources are, they show that his account of nature, though among the earliest, was one of the broadest in scope and most imaginative of all.

CHAPTER IV

Anaximenes of Miletus

HIS DATE, LIFE AND BOOK

138 Diogenes Laertius II, 3 Ἀναξιμένης Εὐρυστράτου Μιλήσιος ἤκουσεν Ἀναξιμάνδρου, ἔνιοι δὲ καὶ Παρμενίδου φασὶν ἀκοῦσαι αὐτόν. οὗτος ἀρχὴν ἀέρα εἶπε καὶ τὸ ἄπειρον. κινεῖσθαι δὲ τὰ ἄστρα οὐχ ὑπὸ γῆν ἀλλὰ περὶ γῆν. κέχρηταί τε λέξει Ἰάδι ἁπλῇ καὶ ἀπερίττῳ. καὶ γεγένηται μέν, καθά φησιν Ἀπολλόδωρος, περὶ τὴν Σάρδεων ἅλωσιν, ἐτελεύτησε δὲ τῇ ἑξηκοστῇ τρίτῃ ὀλυμπιάδι (528–525 B.C.).

138 Anaximenes son of Eurystratus, of Miletus, was a pupil of Anaximander; some say he was also a pupil of Parmenides. He said that the material principle was air and the infinite; and that the stars move, not under the earth, but round it. He used simple and economical Ionic speech. He was active, according to what Apollodorus says, around the time of the capture of Sardis, and died in the 63rd Olympiad.

It may be doubted whether the chronographical tradition knew more about Anaximenes' date than the statement of Theophrastus (**140**) that he was an associate of Anaximander. The Succession-writers would establish him in the next philosophical generation to Anaximander, and Eratosthenes, followed by Apollodorus, would choose a suitable epoch-year for his *acme*, i.e. the age of forty. The obvious epoch-year was that of the capture of Sardis by Cyrus, 546/5 B.C. (= Ol. 58, 3; Hippolytus *Ref.* I, 7, 9, DK 13 A 7, gave Ol. 58, 1, complicated in the Suda, 13 A 2). This puts his birth around the *acme* of Thales, his death around the commonly-chosen age of sixty, and makes him twenty-four years younger than Anaximander. This is all quite hypothetical; but we may accept what seems likely from his thought, that he was younger than Anaximander; while his active life can scarcely have continued far into the fifth century (Miletus was destroyed in 494 B.C.).[1]

[1] The MSS of Diogenes in **138** reverse the position of περὶ τὴν Σάρδεων ἅλωσιν and τῇ ἑξηκοστῇ τρίτῃ ὀλυμπιάδι. Diels emended (as printed here). G. B.

Kerferd points out (*Mus. Helvet.* 11 (1954), 117ff.) that if the capture of Sardis were that of 498 B.C., and γεγένηται meant (as it certainly can, and perhaps should) 'was born' rather than 'flourished', then the MS text could be correct *if* Anaximenes died at the age of 30 or less. But it is unlikely that Apollodorus would have ignored Theophrastus' connexion of Anaximenes with Anaximander (who according to Apollodorus was dead by 528); or that he would have used two separate captures of Sardis as epochs (he certainly uses that of 546/5). Further, Hippolytus (DK 13A7) supports a *floruit* at or near 546/5.

About Anaximenes' life and practical activities we know practically nothing (cf. n. on p. 104). From the stylistic judgement in **138**, however, it is clear that he wrote a book, a part of which at least must have been known to Theophrastus, from whom the criticism presumably emanates. The 'simple and unsuperfluous' Ionic may be contrasted with the 'rather poetical terminology' of Anaximander (**110**).

AIR IN ANAXIMENES

(i) *Air is the originative substance and basic form of matter; it changes by condensation and rarefaction*

139 Aristotle *Met.* A3, 984a5 Ἀναξιμένης δὲ ἀέρα καὶ Διογένης πρότερον ὕδατος καὶ μάλιστ' ἀρχὴν τιθέασι τῶν ἁπλῶν σωμάτων.

140 Theophrastus *ap.* Simplicium *in Phys.* 24, 26 Ἀναξιμένης δὲ Εὐρυστράτου Μιλήσιος, ἑταῖρος γεγονὼς Ἀναξιμάνδρου, μίαν μὲν καὶ αὐτὸς τὴν ὑποκειμένην φύσιν καὶ ἄπειρόν φησιν ὥσπερ ἐκεῖνος, οὐκ ἀόριστον δὲ ὥσπερ ἐκεῖνος ἀλλὰ ὡρισμένην, ἀέρα λέγων αὐτήν· διαφέρειν δὲ μανότητι καὶ πυκνότητι κατὰ τὰς οὐσίας. καὶ ἀραιούμενον μὲν πῦρ γίνεσθαι, πυκνούμενον δὲ ἄνεμον, εἶτα νέφος, ἔτι δὲ μᾶλλον ὕδωρ, εἶτα γῆν, εἶτα λίθους, τὰ δὲ ἄλλα ἐκ τούτων. κίνησιν δὲ καὶ οὗτος ἀίδιον ποιεῖ, δι' ἣν καὶ τὴν μεταβολὴν γίνεσθαι.

141 Hippolytus *Ref.* 1, 7, 1 Ἀναξιμένης... ἀέρα ἄπειρον ἔφη τὴν ἀρχὴν εἶναι, ἐξ οὗ τὰ γινόμενα καὶ τὰ γεγονότα καὶ τὰ ἐσόμενα καὶ θεοὺς καὶ θεῖα γίνεσθαι, τὰ δὲ λοιπὰ ἐκ τῶν τούτου ἀπογόνων. (2) τὸ δὲ εἶδος τοῦ ἀέρος τοιοῦτον· ὅταν μὲν ὁμαλώτατος ᾖ, ὄψει ἄδηλον, δηλοῦσθαι δὲ τῷ ψυχρῷ καὶ τῷ θερμῷ καὶ τῷ νοτερῷ καὶ τῷ κινουμένῳ. κινεῖσθαι δὲ ἀεί· οὐ γὰρ μεταβάλλειν ὅσα μεταβάλλει, εἰ μὴ κινοῖτο. (3) πυκνούμενον γὰρ καὶ ἀραιούμενον διάφορον φαίνεσθαι· ὅταν γὰρ εἰς τὸ ἀραιότερον διαχυθῇ, πῦρ γίνεσθαι, ἀνέμους δὲ πάλιν εἶναι ἀέρα πυκνούμενον, ἐξ ἀέρος ⟨δὲ⟩ νέφος ἀποτελεῖσθαι κατὰ τὴν πίλησιν, ἔτι δὲ μᾶλλον ὕδωρ, ἐπὶ πλεῖον πυκνωθέντα γῆν καὶ εἰς τὸ μάλιστα πυκνότατον λίθους. ὥστε τὰ κυριώτατα τῆς γενέσεως ἐναντία εἶναι, θερμόν τε καὶ ψυχρόν.

139 Anaximenes and Diogenes make air, rather than water, the material principle above the other simple bodies.

140 Anaximenes son of Eurystratus, of Miletus, a companion of Anaximander, also says, like him, that the underlying nature is one and infinite, but not undefined as Anaximander said but definite, for he identifies it as air; and it differs in its substantial nature by rarity and density. Being made finer it becomes fire, being made thicker it becomes wind, then cloud, then (when thickened still more) water, then earth, then stones; and the rest come into being from these. He, too, makes motion eternal, and says that change, also, comes about through it.

141 Anaximenes...said that infinite air was the principle, from which the things that are becoming, and that are, and that shall be, and gods and things divine, all come into being, and the rest from its products. The form of air is of this kind: whenever it is most equable it is invisible to sight, but is revealed by the cold and the hot and the damp and by movement. It is always in motion; for things that change do not change unless there be movement. Through becoming denser or finer it has different appearances; for when it is dissolved into what is finer it becomes fire, while winds, again, are air that is becoming condensed, and cloud is produced from air by felting. When it is condensed still more, water is produced; with a further degree of condensation earth is produced, and when condensed as far as possible, stones. The result is that the most influential components of generation are opposites, hot and cold.

139, together with **150** and **159**, is all that Aristotle had to say about Anaximenes by name, and our tradition depends on Theophrastus, who according to Diogenes Laertius V, 42 wrote a special monograph on him (see pp. 3f.). A short version of Theophrastus' account of the material principle is preserved by Simplicius in **140**. In the present case Hippolytus' version is longer than Simplicius', but inspection of **141** shows that this is mainly due to wordy expansion and additional (sometimes non-Theophrastean) interpretation. However, the expression πίλησις (πιλεῖσθαι), 'felting', for the condensation of air, is found also in ps.-Plutarch's summary (**148**) and probably comes from Theophrastus; it was a common fourth-century term and need not have been used in this form by Anaximenes himself, contrary to what Diels and others say.

For Anaximenes the originative stuff was explicitly the basic form of material in the differentiated world, since he had thought of a way

in which it could become other components of the world, like sea or earth, without losing its own nature. It was simply condensed or rarefied – that is, it altered its appearance according to how much there was of it in a particular place. This met the objection which Anaximander may well have felt against Thales' water (**105** and pp. 113f.), and which encouraged him to postulate an indefinite originative material. Anaximenes' air, too, was indefinitely vast in extent – it surrounded all things (**108** and **160**), and was thus described as ἄπειρον, infinite, by Theophrastus. It is questionable exactly what he meant by air. ἀήρ in Homer and sometimes in later Ionic prose meant 'mist', something visible and obscuring; and Anaximander's cosmogony included a damp mist, part of which congealed to form a slimy kind of earth (pp. 132, 142). Anaximenes probably said (**160**) that all things were surrounded by πνεῦμα καὶ ἀήρ, 'wind (or breath) and air', and that the soul is related to this air; which suggests that for him ἀήρ was not mist but, as Hippolytus in **141** assumed, the invisible atmospheric air. This is confirmed by the fact that he evidently described winds as a slightly condensed form of air (**140, 141**).

Now atmospheric air was certainly not included as a world-component by Heraclitus (e.g. **218**), and its substantiality – that is, corporeality – needed to be emphasized by Anaxagoras (**470**). It looks, then, as though Anaximenes simply assumed that some part, at least, of the atmospheric air was substantial, and indeed the basic form of substance; although he did not offer any notable demonstration of its substantiality and so convince his immediate successors. This assumption would be a very remarkable one; though it must be remembered that πνεῦμα in the sense of breath was certainly regarded as existing, and yet it was invisible. It was not, however, totally insensible; its presence was revealed by tangible properties – in Hippolytus' terms by 'the cold and the hot and the moist and the moving'. Atmospheric air, on occasions, makes itself known by none of these things.

The main forms assumed by air as a result of condensation and rarefaction were outlined by Theophrastus. They are obvious enough, and were clearly based on observation of natural processes – rain coming from clouds, water apparently condensing into earth, evaporation, and so on. Such changes were accepted by all the Presocratics; it was only Anaximenes who explained them solely in terms of the density of a single material.[1] It may be asked why *air* was specified as the normal or basic form of matter; from the point of view of natural change within the world, water, equally, might

be basic, with air as a rarefied variant. In view of **160** (pp. 158ff.), where cosmic air is compared with the πνεῦμα or breath which is traditionally conceived as the breath-soul or life-giving ψυχή, it seems that Anaximenes regarded air as the breath of the world, and so as its ever-living, and therefore divine, source; see also p. 161. Moreover air might have seemed to possess some of the *indefinite* qualities of Anaximander's originative stuff (not being naturally characterized by any particular opposite); in addition it had the advantage of occupying a large region of the developed world. Anaximenes seems at first sight to have abandoned the principle of general opposition in the world (it was shortly to be revived in a more Anaximandrean form, though with some modification, by Heraclitus), and so to have lost even the metaphorical motives, of injustice and retribution, for natural change. Yet one pair of opposites, the rare and the dense, took on a new and special significance, and it could legitimately be argued that all changes are due to the reaction of these two: see further p. 149. In addition, no doubt, Anaximenes shared Thales' assumption that matter was somehow alive, which would be confirmed by the constant mobility of air – especially if this was only accepted as being air when it was perceptible. Theophrastus, as usual, reduced these assumptions to the formula of 'eternal motion', adding that all change would depend on this motion.

[1] Cf. **142** Simplicius *in Phys.* 149, 32 ἐπὶ γὰρ τούτου (*sc.* Ἀναξιμένους) μόνου Θεόφραστος ἐν τῇ ἱστορίᾳ τὴν μάνωσιν εἴρηκε καὶ πύκνωσιν, δῆλον δὲ ὡς καὶ οἱ ἄλλοι τῇ μανότητι καὶ πυκνότητι ἐχρῶντο. *(For in the case of him [Anaximenes] alone did Theophrastus in the* History *speak of rarefaction and condensation, but it is plain that the others, also, used rarity and density.)* There is no difficulty here (and no need for drastic expedients like the supposition that μόνου means πρώτου): 'the others' (e.g. Hippasus and Heraclitus in DK 22 A 5) were loosely described by Theophrastus as using condensation, but only Anaximenes explicitly used the rare and the dense as an essential part of his theory. Simplicius then slightly misunderstood Theophrastus' comment on Anaximenes.

It appears that according to Theophrastus ('the other things, from these' in **140** *fin.*, also in a vague and inaccurate paraphrase in **141** *init.*; cf. Cicero *Acad. pr.* II, 37, 118, DK 13 A 9) Anaximenes did not think that every kind of natural substance could be explained as a direct form of air, but that there were certain basic forms (fire, air, wind, cloud, water, earth, stone) of which other kinds were compounds. If true, this is important, since it makes Anaximenes the pioneer of the idea that there are elements from which other objects are compounded – an idea first formally worked out by Empedocles. Yet it seems questionable whether this interpretation is justified.

There is no other evidence that anyone before Empedocles tried to give a detailed account of any but the main cosmic substances; having invented a device to explain diversity, it would be more in the Milesian character for Anaximenes to have adhered to it; and Theophrastus was prone to add just such generalizing summaries, often slightly misleading, to a specific list.[1] Yet the difficulty of air turning into rocks or myrtle-bushes might indeed have struck Anaximenes, and suggested the advantages of mixture as an additional mechanism (see Guthrie, *HGP* I, 122f.). In any event, J. Barnes has a point when he rejects the idea of Anaximenes as a 'Presocratic Boyle' and of his physics as 'fundamentally quantitative' (*op. cit.*, I, 45f.).

[1] A more certainly false interpretation is that which makes Anaximenes the forerunner of atomism. He cannot have conceived of matter as continuous, it is argued; therefore, since there can be more or less of it in the same space, it must have been composed of particles which can be more or less heavily concentrated. But it seems unlikely that anyone before Heraclitus bothered about the formal constitution of matter, or about precisely what was involved in condensation, which could be simply an objective description of certain observed processes.

(ii) *Hot and cold are due to rarefaction and condensation*

143 Plutarch *de prim. frig.* 7, 947F (DK13B1) ...ἢ καθάπερ Ἀναξιμένης ὁ παλαιὸς ᾤετο, μήτε τὸ ψυχρὸν ἐν οὐσίᾳ μήτε τὸ θερμὸν ἀπολείπωμεν, ἀλλὰ πάθη κοινὰ τῆς ὕλης ἐπιγιγνόμενα ταῖς μεταβολαῖς· τὸ γὰρ συστελλόμενον αὐτῆς καὶ πυκνούμενον ψυχρὸν εἶναί φησι, τὸ δ' ἀραιὸν καὶ τὸ 'χαλαρόν' (οὕτω πως ὀνομάσας καὶ τῷ ῥήματι) θερμόν. ὅθεν οὐκ ἀπεικότως λέγεσθαι τὸ καὶ θερμὰ τὸν ἄνθρωπον ἐκ τοῦ στόματος καὶ ψυχρὰ μεθιέναι· ψύχεται γὰρ ἡ πνοὴ πιεσθεῖσα καὶ πυκνωθεῖσα τοῖς χείλεσιν, ἀνειμένου δὲ τοῦ στόματος ἐκπίπτουσα γίγνεται θερμὸν ὑπὸ μανότητος. τοῦτο μὲν οὖν ἀγνόημα ποιεῖται τοῦ ἀνδρὸς ὁ Ἀριστοτέλης... (Cf. *Problemata* 34, 7, 964a10.)

143 ...or as Anaximenes thought of old, let us leave neither the cold nor the hot as belonging to substance, but as common dispositions of matter that supervene on changes; for he says that matter which is compressed and condensed is cold, while that which is fine and 'relaxed' (using this very word) is hot. Therefore, he said, the dictum is not an unreasonable one, that man releases both warmth and cold from his mouth: for the breath is chilled by being compressed and condensed with the lips, but when the mouth is loosened the breath escapes and becomes warm through its rarity. This theory Aristotle claims to be due to the man's [*sc.* Anaximenes'] ignorance...

Plutarch seems to have had access to a genuine citation from Anaximenes: the word χαλαρός, 'slack', if no more, is definitely said to be his, and there is no reason to doubt it. Conceivably Plutarch depends on a lost passage of Aristotle; the passage from the Aristotelian *Problems* discusses the phenomenon in the manner suggested in the continuation of **143**, but without naming Anaximenes. The example of breath was evidently cited by Anaximenes as showing that rarefaction and condensation of air can produce, not merely obvious variations like those of hardness and softness, thickness and thinness, but a variation of the hot and the cold which seems to have little directly to do with density. On this evidence alone one would expect the instance to be part of an argument that condensation and rarefaction can produce quite unexpected alterations, and so could be responsible for every kind of diversity.

Hippolytus in **141**, however, suggests that hot and cold play a vital part in coming-to-be; in other words Anaximenes still attributed special importance to the chief cosmogonical substances in Anaximander, the hot stuff and the cold stuff. There is no mention of this in Simplicius' extract from Theophrastus (**140**), but Hippolytus or his immediate source is unlikely to be entirely responsible for it. It is, however, difficult to see how these opposed substances could be basic in Anaximenes' scheme of things, and it seems highly probable that Theophrastus, seeing that some prominence was given to hot and cold in Anaximenes, suggested that they were for him, as they were for Aristotle and for Theophrastus himself, one of the essential elements of γένεσις. (The Peripatetic simple bodies were composed of prime matter informed by either hot or cold and either wet or dry.) This interpretation is anachronistic, and leaves us free to accept the natural one suggested by Plutarch himself, expressed though it still is in Peripatetic terms. But can even Anaximenes have thought that temperature varied directly with density? There is such a thing, for example, as hot stone or cold air. This difficulty might not have occurred to him, since in general it is true that the ascending scale of density represents also a descending scale of temperature, from fire down to stones; air itself normally not striking one (at any rate in the Mediterranean) as consistently either hot or cold. Alternatively, the instance of breath compressed by the lips might seem to illustrate that density *can* affect temperature, without implying that it always does so to the same degree.[1]

[1] The instance of the breath is one of the first recorded Greek uses of a detailed observation to support a physical theory. Note, however, (i) that it is not strictly an 'experiment', i.e. the deliberate production of a chain of events the unknown

conclusion of which will either confirm or deny a prior hypothesis; (ii) that because of lack of control and of thoroughness the conclusion drawn from the observation is the exact opposite of the truth; (iii) that the word λέγεσθαι may suggest that the observation was a common one, not made for the first time by Anaximenes.

(iii) *Air is divine*

144 Cicero *de natura deorum* I, 10, 26 post Anaximenes aera deum statuit eumque gigni esseque immensum et infinitum et semper in motu, quasi aut aer sine ulla forma deus esse possit... aut non omne quod ortum sit mortalitas consequatur.

145 Aetius I, 7, 13 Ἀναξιμένης τὸν ἀέρα (*sc.* θεὸν εἶναί φησι)· δεῖ δ' ὑπακούειν ἐπὶ τῶν οὕτως λεγομένων τὰς ἐνδιηκούσας τοῖς στοιχείοις ἢ τοῖς σώμασι δυνάμεις.

146 Augustinus *de civ. dei* VIII, 2 iste (*sc.* Anaximander) Anaximenen discipulum et successorem reliquit, qui omnes rerum causas aeri infinito dedit, nec deos negavit aut tacuit; non tamen ab ipsis aerem factum, sed ipsos ex aere ortos credidit.

144 Afterwards, Anaximenes determined that air is a god, and that it comes into being, and is measureless and infinite and always in motion; as though either formless air could be a god... or mortality did not attend upon everything that has come into being.
145 Anaximenes [says that] the air [is god]: one must understand, in the case of such descriptions, the powers which interpenetrate the elements or bodies.
146 He [Anaximander] left Anaximenes as his disciple and successor, who attributed all the causes of things to infinite air, and did not deny that there were gods, or pass them over in silence; yet he believed not that air was made by them, but that they arose from air.

The first and third of these passages assert that according to Anaximenes a god or gods came into being from the primal air; Hippolytus also, in the first sentence of **141**, wrote that 'gods and things divine' arose from air. Theophrastus, therefore, probably said more than that Anaximenes' primal air itself was divine (cf. Aristotle's assertion in **108** that Anaximander and most of the physicists considered their originative stuff to be divine). It is probable, then, that Anaximenes himself said something about gods; it may be reasonably inferred that this was to the effect that such gods as there were in the world were themselves derived from the all-encompassing

air, which was truly divine. If so, Anaximenes might be a precursor of Xenophanes and Heraclitus in their criticisms of the deities of conventional religion; though there is no evidence that Anaximenes went so far as actually to deny their existence, any more than Heraclitus did. That air itself was divine is implied both by Aristotle's generalization and by Aetius in **145**, who gives a Stoicizing description of the kind of divinity involved as 'powers permeating elements or bodies', i.e. a motive and organizing capacity that inheres in varying degrees in the constituents of the world.[1]

[1] It has sometimes been maintained (e.g. by Burnet, *EGP*, 78) that Anaximenes' gods are innumerable worlds. This is because according to Aetius I, 7, 12 and Cicero *de natura deorum* I, 10, 25 *Anaximander's* innumerable worlds were called gods (DK 12 A 17). These statements seem to have arisen from a confusion of the innumerable worlds with the stars; and Cicero cannot possibly have had the same kind of evidence for Anaximenes, since in the very next sentence, **144**, he only mentions *one* god as coming into being (and confusedly describes it as infinite, i.e. as primal air). There are in fact only two doxographical indications that Anaximenes postulated innumerable worlds: Aetius II, 1, 3 (Stob. only; see p. 124) and **147** Simplicius *in Phys.* 1121, 12 γενητὸν δὲ καὶ φθαρτὸν τὸν ἕνα κόσμον ποιοῦσιν ὅσοι ἀεὶ μέν φασιν εἶναι κόσμον, οὐ μὴν τὸν αὐτὸν ἀεί, ἀλλὰ ἄλλοτε ἄλλον γινόμενον κατά τινας χρόνων περιόδους, ὡς Ἀναξιμένης τε καὶ Ἡράκλειτος καὶ Διογένης καὶ ὕστερον οἱ ἀπὸ τῆς Στοᾶς. *(All those make the one world born and destructible who say that there is always a world, yet it is not always the same but becoming different at different times according to certain periods of time, as Anaximenes and Heraclitus and Diogenes said, and later the Stoics.)* Here Simplicius appears to assign *successive* worlds to Anaximenes. One possible reason for this is given on p. 126; but Simplicius' passage is very closely based on Aristotle *de caelo* A 10, 279b12 (DK 22 A 10), in which Empedocles, not Anaximenes, precedes Heraclitus; and the possibility of contamination cannot be excluded. There is far less reason to assign innumerable worlds to Anaximenes than to Anaximander, from the state of the doxographical evidence; though something was probably said on the subject by Theophrastus, on the grounds that Anaximenes, too, postulated what Theophrastus considered to be an infinite originative stuff (see pp. 123ff.).

COSMOGONY

148 Ps.-Plutarch *Strom.* 3 (cf. DK 13 A 6) ...γεννᾶσθαί τε πάντα κατά τινα πύκνωσιν τούτου (*sc.* ἀέρος) καὶ πάλιν ἀραίωσιν. τήν γε μὴν κίνησιν ἐξ αἰῶνος ὑπάρχειν· πιλουμένου δὲ τοῦ ἀέρος πρώτην γεγενῆσθαι λέγει τὴν γῆν πλατεῖαν μάλα· διὸ καὶ κατὰ λόγον αὐτὴν ἐποχεῖσθαι τῷ ἀέρι· καὶ τὸν ἥλιον καὶ τὴν σελήνην καὶ τὰ λοιπὰ ἄστρα τὴν ἀρχὴν τῆς γενέσεως ἐκ γῆς ἔχειν. ἀποφαίνεται γοῦν τὸν ἥλιον γῆν, διὰ δὲ τὴν ὀξεῖαν κίνησιν καὶ μάλ' ἱκανῶς θερμότητα λαβεῖν [Zeller; θερμοτάτην κίνησιν λαβεῖν codd. plurimi].

149 Hippolytus *Ref.* 1, 7, 5 γεγονέναι δὲ τὰ ἄστρα ἐκ γῆς διὰ τὸ τὴν ἰκμάδα ἐκ ταύτης ἀνίστασθαι, ἧς ἀραιουμένης τὸ πῦρ γίνεσθαι, ἐκ δὲ τοῦ πυρὸς μετεωριζομένου τοὺς ἀστέρας συνίστασθαι.

> **148** ...and all things are produced by a kind of condensation, and again rarefaction, of this [*sc.* air]. Motion, indeed, exists from everlasting; he says that when the air felts, there first of all comes into being the earth, quite flat – therefore it accordingly rides on the air; and sun and moon and the remaining heavenly bodies have their source of generation from earth. At least, he declares the sun to be earth, but that through the rapid motion it obtains heat in great sufficiency.
> **149** The heavenly bodies have come into being from earth through the exhalation arising from it; when the exhalation is rarefied fire comes into being, and from fire raised on high the stars are composed.

Anaximenes presumably gave an account of the development of the world from undifferentiated air; as with Anaximander, only ps.-Plutarch summarizes the subject in general, and he does little more than apply the obvious changes of air (outlined by Theophrastus with reference to continuing natural processes, cf. the present tense of γίνεσθαι in **140**) to what could be an *a priori* cosmogonical pattern. Only in the case of the formation of the heavenly bodies is there detailed information; here Hippolytus in **149** is almost certainly right as against the last sentence of **148**, which seems to impose on Anaximenes ideas from Xenophanes (ignition through motion) and Anaxagoras (the same, and sun made of earth; cf. pp. 155f. for a similar confusion with Empedocles). The heavenly bodies (ἄστρα) certainly originate from the earth, but only in that moist vapour is exhaled or evaporated from (the moist parts of) earth; this is further rarefied and so becomes fire, of which the heavenly bodies are composed. The formation of the earth had occurred by the condensation of a part of the indefinitely-extended primal air. No reason is even suggested for this initial condensation, except possibly the 'eternal motion'; as with Anaximander, this was Theophrastus' way of expressing the capacity of the divine originative stuff to initiate change and motion where it willed.[1]

[1] As with Anaximander, there is no ground for positing a vortex in Anaximenes except Aristotle's generalization in **117**; in Anaximenes' case there is not even the mysterious 'producer of the hot and the cold' to be accounted for. Yet Anaximenes was not implicitly excepted from the generalization, as Anaximander may have been (p. 128). However, Aristotle had reason a few lines earlier, **150**, to class Anaximenes with Anaxagoras and Democritus (they all assumed that the earth remains stable because of its breadth); the two others certainly postulated a vortex, and so Aristotle might have been content to class Anaximenes with them in this respect too – if he was not simply being careless in his use of 'all', πάντες, in **117**. Of course, as Zeller pointed out, vortex-action would produce the variations of pressure required for a cosmos; though Anaximenes did not in fact explain the heavenly bodies by direct rarefaction of the extremities.

COSMOLOGY

(i) *The earth is flat and rides on air*

150 Aristotle *de caelo* B13, 294b13 (DK 13A20) Ἀναξιμένης δὲ καὶ Ἀναξαγόρας καὶ Δημόκριτος τὸ πλάτος αἴτιον εἶναί φασι τοῦ μένειν αὐτήν (*sc.* τὴν γῆν)· οὐ γὰρ τέμνειν ἀλλ' ἐπιπωματίζειν τὸν ἀέρα τὸν κάτωθεν, ὅπερ φαίνεται τὰ πλάτος ἔχοντα τῶν σωμάτων ποιεῖν· ταῦτα γὰρ καὶ πρὸς τοὺς ἀνέμους ἔχει δυσκινήτως διὰ τὴν ἀντέρεισιν.

> **150** Anaximenes and Anaxagoras and Democritus say that its [the earth's] flatness is responsible for it staying still: for it does not cut the air beneath but covers it like a lid, which flat bodies evidently do; for they are hard to move even for the winds, on account of their resistance.

Anaximenes seems to have consolidated the conception of the earth as broad, flat and shallow in depth – 'table-like' according to Aetius III, 10, 3 (DK 13A20) – and as being supported by air. This idea was closely followed by Anaxagoras and the atomists (**502** *init.* and p. 419), who in details of cosmology conservatively selected from the earlier Ionian tradition. That the earth was supported by air was obviously an adaptation, encouraged no doubt by the observation of leaves floating in the air, of Thales' idea that the earth floated on water. Aristotle in the continuation of **150** was wrong in suggesting that support is provided because the air underneath is trapped and cannot withdraw; for Anaximenes the surrounding air was unbounded in any way, and was doubtless unthinkingly supposed to support the earth because of its indefinite depth – and because leaves do float on air. Theophrastus, judging from **148**, **151**, and Aetius III, 15, 8 (DK 13A20), wrote that according to Anaximenes the earth *rides*, ἐποχεῖσθαι, on air; the verb occurs in Homer and could well have been used by Anaximenes. Aristotle's 'covers the air below like a lid' is probably his own expression, an improvement perhaps on Plato's reference (*Phaedo* 99B) to an unnamed physicist – Anaximenes or Anaxagoras or the atomists or all of them – who 'puts air

underneath as a support for the earth, which is like a broad kneading-trough'.

(ii) *The heavenly bodies*

151 Hippolytus *Ref.* 1, 7, 4 τὴν δὲ γῆν πλατεῖαν εἶναι ἐπ' ἀέρος ὀχουμένην, ὁμοίως δὲ καὶ ἥλιον καὶ σελήνην καὶ τὰ ἄλλα ἄστρα πάντα πύρινα ὄντα ἐποχεῖσθαι τῷ ἀέρι διὰ πλάτος.

152 Aetius II, 13, 10 Ἀναξιμένης πυρίνην μὲν τὴν φύσιν τῶν ἄστρων, περιέχειν δέ τινα καὶ γεώδη σώματα συμπεριφερόμενα τούτοις ἀόρατα.

153 Aetius II, 23, 1 Ἀναξιμένης ὑπὸ πεπυκνωμένου ἀέρος καὶ ἀντιτύπου ἐξωθούμενα τὰ ἄστρα τὰς τροπὰς ποιεῖσθαι.

154 Aetius II, 14, 3 4 Ἀναξιμένης ἥλων δίκην καταπεπηγέναι τὰ ἄστρα τῷ κρυσταλλοειδεῖ· ἔνιοι δὲ πέταλα εἶναι πύρινα ὥσπερ ζωγραφήματα.

155 Aetius II, 22, 1 Ἀναξιμένης πλατὺν ὡς πέταλον τὸν ἥλιον.

156 Hippolytus *Ref.* 1, 7, 6 οὐ κινεῖσθαι δὲ ὑπὸ γῆν τὰ ἄστρα λέγει, καθὼς ἕτεροι ὑπειλήφασιν, ἀλλὰ περὶ γῆν, ὡσπερεὶ περὶ τὴν ἡμετέραν κεφαλὴν στρέφεται τὸ πιλίον. κρύπτεσθαί τε τὸν ἥλιον οὐχ ὑπὸ γῆν γενόμενον ἀλλ' ὑπὸ τῶν τῆς γῆς ὑψηλοτέρων μερῶν σκεπόμενον καὶ διὰ τὴν πλείονα ἡμῶν αὐτοῦ γενομένην ἀπόστασιν.

157 Aristotle *Meteor.* B1, 354a28 πολλοὺς πεισθῆναι τῶν ἀρχαίων μετεωρολόγων τὸν ἥλιον μὴ φέρεσθαι ὑπὸ γῆν ἀλλὰ περὶ τὴν γῆν καὶ τὸν τόπον τοῦτον, ἀφανίζεσθαι δὲ καὶ ποιεῖν νύκτα διὰ τὸ ὑψηλὴν εἶναι πρὸς ἄρκτον τὴν γῆν.

151 The earth is flat, being borne upon air, and similarly sun, moon and the other heavenly bodies, which are all fiery, ride upon the air through their flatness.

152 Anaximenes says that the nature of the heavenly bodies is fiery, and that they have among them certain earthy bodies that are carried round with them, being invisible.

153 Anaximenes says that the heavenly bodies make their turnings through being pushed out by condensed and opposing air.

154 Anaximenes says that the stars are implanted like nails in the 'ice-like'; but some say they are fiery leaves like paintings.

155 Anaximenes says the sun is flat like a leaf.

156 He says that the heavenly bodies do not move under the earth, as others have supposed, but round it, just as if a felt cap

turns round our head; and that the sun is hidden not by being under the earth, but through being covered by the higher parts of the earth and through its increased distance from us.

157 Many of the old astronomers were convinced that the sun is not carried under the earth, but round the earth and this region; and that it is obscured, and makes night, through the earth being high towards the north.

That the heavenly bodies were created by the rarefaction into fire of vapour from the earth was asserted in **149**. Like the earth, they ride on air (**151**); though since they are made of fire, as **151** and **152** confirm, and since fire is more diffuse than air, there is a difficulty which Anaximenes may not have seen in making them rest on air in the same way as the denser earth does. That the movements of the sun on the ecliptic, of the moon in declination, and perhaps of the planets, are caused by winds (which are slightly condensed air, cf. **140**) is suggested by **153**; Aristotle had referred at *Meteor.* B1, 353b5 and B2, 355a21 (**609**) to old writers who had explained the first two of these three celestial motions in just this way. **154** creates a difficulty, however, in stating that the ἄστρα (which can mean all the heavenly bodies, or the fixed stars and the planets, or just the fixed stars) are attached like studs to the ice-like outer heaven (which according to **156** would be hemispherical), and not floating free. This could only apply to the fixed stars; but we hear nothing more about the 'ice-like', and indeed the concept of a solid outer heaven is foreign to the little that is known of Anaximenes' cosmogony and to the other details of cosmology. The same term was applied three times by Aetius to Empedocles' heaven (which would be spherical), and at II, 13, 11 he said that Empedocles' fixed stars were bound to the 'ice-like', while the planets were free. It appears that this concept may have been mistakenly transferred to Anaximenes. The second part of **154** is introduced as an opinion held by 'some people'; but since Anaximenes certainly held the heavenly bodies to be fiery, and since **155** compares the sun to a leaf, it looks as though he is the author of the opinion that they were fiery leaves, and as if the text is astray. What the comparison to paintings implies is quite uncertain. If Anaximenes *is* meant, the ἄστρα in question could be the heavenly bodies in general, or (if the first part is accepted) they could be the planets, which would be distinguished, as by Empedocles, from the fixed stars on the 'ice-like'. Presumably this last term refers to the apparent transparency of the sky; it represents an improvement, from the empirical point of view, on the Homeric solid metal bowl (p. 9).

Such an improvement would not be uncharacteristic of Anaximenes; but the attribution of this view to him remains very doubtful.[1]

[1] W. K. C. Guthrie (*HGP* I, 136f.) ingeniously suggested that the simile might be a physiological one, since in Galen's time, at least, ἥλος could be used for a spot or lump growing on the pupil of the eye, while the cornea itself was sometimes described as 'the ice-like membrane'. This membrane was regarded as viscous, not as solid; which removes one difficulty of the attribution to Anaximenes. Yet the confident statement (*op. cit.*, p. 137) that Anaximenes 'regarded the world as a living and breathing creature' surely goes too far.

The inaccuracy of doxographical attributions, particularly in Aetius, is probably demonstrated by the second part of **152**. It is usually assumed that Anaximenes postulated these invisible celestial bodies in order to explain eclipses; but according to Hippolytus 1, 8, 6 (DK 59 A 42) Anaxagoras, too, believed in them. Yet Anaxagoras knew the true cause of eclipses, therefore he cannot have postulated the invisible bodies for this purpose. The previous sentence in Aetius explains all: Diogenes of Apollonia invented these bodies to explain meteorites like the famous one which fell at Aegospotami in 467 B.C. (**608**). Anaxagoras, too, had probably been persuaded by this notable event to account for meteorites; but Anaximenes had no such good reason, and the theory was probably projected on to him from his assumed follower Diogenes. In any case the theory concerned meteorites and not eclipses.[1]

[1] Eudemus(?) in the sequel to **76** (DK 13 A 16) assigns to Anaximenes the discovery that the moon shines by reflected light. This is incompatible with the belief that the moon is fiery, and is probably due to another backward projection, this time of a belief common to Parmenides (DK 28 A 42), Empedocles (**370**), and Anaxagoras (**500**).

The heavenly bodies do not pass under the earth, but (as in the pre-philosophical world-picture, where the sun, at least, floats round river Okeanos to the north: see pp. 12f.) they move round it, like a cap revolving round our head as Hippolytus adds in **156**. This image is scarcely likely to have been invented by anyone except Anaximenes. The cap in question is a close-fitting, roughly hemispherical felt cap; conceivably it supports the dubious implication of **154** that the heaven can be regarded as a definite (though perhaps a viscous) hemisphere, carrying the fixed stars. As has been remarked, this is merely a refinement of the naïve view of the sky as a metal bowl. The second part of **156** adds that the sun is hidden (that is, in its passage from the west back again to the east) 'by the higher parts of the earth' (also by its greater distance; this may be a doxographical addition). If the sun does not go under the earth, some explanation has to be

given of why it is not visible at night. But do the 'higher parts' refer to high mountains in the north – the mythical Rhipaean mountains, that is – or to the actual tilting of the flat earth on its horizontal axis? The latter explanation was certainly ascribed to Anaxagoras, Leucippus, and Diogenes, who were strongly influenced by Anaximenes in cosmological matters. This tilting would explain how the stars could set, supposing that they are somehow fixed in the heaven: they rotate on the hemisphere (whose pole is the Wain) and pass below the upper, northern edge of the earth but not below its mean horizontal axis. Yet attractive as this interpretation is, it is made very doubtful by **157**; here Aristotle refers to the theory of 'higher parts' (again, in ambiguous terms) as being held by many of the old astronomers. But his context, which is concerned with showing that the greatest rivers flow from the greatest mountains, in the north, makes it quite clear that he understands 'the earth being high to the north' to refer to its northern mountain ranges. It must be assumed that Aristotle was thinking in part of Anaximenes, details of whose cosmological views were known to him (cf. **150**, **159**); Anaxagoras and Leucippus, then, either made an advance on Anaximenes here or were themselves misinterpreted later. A serious difficulty in the tilted-earth hypothesis is that the earth would not thus float on air, but would slip downwards as leaves do; this applies also to Leucippus' earth. The cap-image must illustrate the hemispherical shape of the sky, not its obliquity; it is difficult, indeed, to see why the cap should be imagined as being tilted on the head. Thus Anaximenes appears to have accepted the broad structure of the naïve world-picture, but to have purged it of its more obviously mythological details like the sun's golden bowl (which presumably helped to conceal its light during the voyage north).

(iii) *Meteorological phenomena*

158 Aetius III, 3, 2 Ἀναξιμένης ταὐτὰ τούτῳ (*sc.* Ἀναξιμάνδρῳ), προστιθεὶς τὸ ἐπὶ τῆς θαλάσσης, ἥτις σχιζομένη ταῖς κώπαις παραστίλβει. III, 4, 1 Ἀναξιμένης νέφη μὲν γίνεσθαι παχυνθέντος ἐπὶ πλεῖον τοῦ ἀέρος, μᾶλλον δ' ἐπισυναχθέντος ἐκθλίβεσθαι τοὺς ὄμβρους, χάλαζαν δὲ ἐπειδὰν τὸ καταφερόμενον ὕδωρ παγῇ, χιόνα δ' ὅταν συμπεριληφθῇ τι τῷ ὑγρῷ πνευματικόν.

159 Aristotle *Meteor.* B 7, 365b6 Ἀναξιμένης δέ φησι βρεχομένην τὴν γῆν καὶ ξηραινομένην ῥήγνυσθαι καὶ ὑπὸ τούτων τῶν ἀπορρηγνυμένων κολωνῶν ἐμπιπτόντων σείεσθαι· διὸ καὶ γίγνεσθαι τοὺς σεισμοὺς ἔν τε τοῖς αὐχμοῖς καὶ πάλιν ἐν ταῖς ὑπερομβρίαις· ἔν τε γὰρ

τοῖς αὐχμοῖς, ὥσπερ εἴρηται, ξηραινομένην ῥήγνυσθαι καὶ ὑπὸ τῶν ὑδάτων ὑπερυγραινομένην διαπίπτειν.

158 Anaximenes said the same as he [Anaximander], adding what happens in the case of sea, which flashes when cleft by oars. – Anaximenes said that clouds occur when the air is further thickened; when it is compressed further, rain is squeezed out, and hail occurs when the descending water coalesces, snow when some windy portion is included together with the moisture.

159 Anaximenes says that the earth, through being drenched and dried off, breaks asunder, and is shaken by the peaks that are thus broken off and fall in. Therefore earthquakes happen in periods both of drought and again of excessive rains; for in droughts, as has been said, it dries up and cracks, and being made over-moist by the waters it crumbles apart.

Anaximenes is said to have given the same explanation of thunder and lightning, in terms of wind, as Anaximander; see **130** and comment. The oar-image may be original. Clouds, rain, hail and snow are mainly due to the condensation of air, as one would expect; this was indicated by Theophrastus in **140**, and Aetius (also Hippolytus, *Ref.* 1, 7, 7–8, DK 13 A 7) adds further details. Winds, too, are slightly condensed air (**140**), and according to Hippolytus the rainbow was due to the reflexion of different sun-beams by air. Aristotle in **159** gives a relatively full account of Anaximenes' explanation of earthquakes, and it is notable that air plays no part in this whatever.

THE COMPARISON BETWEEN COSMIC AIR AND THE BREATH-SOUL

160 Aetius 1, 3, 4 Ἀναξιμένης Εὐρυστράτου Μιλήσιος ἀρχὴν τῶν ὄντων ἀέρα ἀπεφήνατο· ἐκ γὰρ τούτου πάντα γίγνεσθαι καὶ εἰς αὐτὸν πάλιν ἀναλύεσθαι. οἷον ἡ ψυχή, φησίν, ἡ ἡμετέρα ἀὴρ οὖσα συγκρατεῖ ἡμᾶς, καὶ ὅλον τὸν κόσμον πνεῦμα καὶ ἀὴρ περιέχει· λέγεται δὲ συνωνύμως ἀὴρ καὶ πνεῦμα. ἁμαρτάνει δὲ καὶ οὗτος ἐξ ἁπλοῦ καὶ μονοειδοῦς ἀέρος καὶ πνεύματος δοκῶν συνεστάναι τὰ ζῷα... (For continuation see DK 13 B 2.)

160 Anaximenes son of Eurystratus, of Miletus, declared that air is the principle of existing things; for from it all things come-to-be and into it they are again dissolved. As our soul, he says, being air holds us together and controls us, so does wind [*or* breath] and

air enclose the whole world. (Air and wind are synonymous here.) He, too, is in error in thinking that living creatures consist of simple and homogeneous air and wind...

The underlined words here are often accepted as a direct quotation from Anaximenes. There must, however, have been some alteration and some rewording; for the sentence is not in Ionic (cf. **138**), and it contains one word, συγκρατεῖ, which could not possibly have been used by Anaximenes, and another, κόσμον, which is unlikely to have been used by him in precisely this sense.[1] That the sentence does, however, represent some kind of reproduction of a statement by Anaximenes is shown by Aetius' comment that 'air' and 'wind [*or* breath]' have the same meaning here, and also by the fact that the comparison with the soul complicates the simple Aristotelian criticism which Aetius is reproducing, that Anaximenes did not specify a moving cause. On the other hand the use of φησί, 'he says', does not guarantee a direct quotation in this kind of writing. περιέχει, of air enfolding all things, is quite likely to be Anaximenean, cf. **108**; while the concept of the soul as breath (one suspects that πνεῦμα, not ἀήρ, originally stood in the first clause) is certainly an archaic one – compare the Homeric distinction between the life-soul, which normally seems to be identified with the breath, and the sensory and intellectual soul normally called θυμός. τὸν κόσμον could have replaced e.g. simply ἅπαντα, 'all things'. The degree of rewording, then, is probably not very great; unfortunately we cannot determine whether, or how far, it affected the exact point and degree of comparison.

[1] συγκρατεῖν is otherwise first used in Plutarch (twice), then in second-century A.D. medical writers and Diog. L. (of restraining the breath etc.); also in the *Geoponica* and the Christian fathers. It is an unnatural compound which could only have occurred in the Κοινή; it is really a compendium for συνέχειν καὶ κρατεῖν. This is illustrated in Plutarch *Phocion* 12, συνεκράτει τὸ μαχιμώτατον τῆς δυνάμεως: he kept control of his troops by keeping them together (on a hill-top). κόσμος originally means 'order', and it is probably not established in the meaning 'world-order' until the middle of the fifth century B.C. It must have been used in *descriptions* of the order apparent in nature much before then, and probably by early Pythagoreans; Pythagoras himself is credited with using κόσμος = οὐρανός, but this is perhaps an over-simplification (Diog. L. VIII, 48). Heraclitus' κόσμον τόνδε (**217**) is probably transitional to the later and widely accepted usage, which appears unequivocally for the first time in Empedocles fr. 134, 5 (**397**). For a full discussion of κόσμος see Kahn, *op. cit.*, 219–39; and see n. 1 on p. 161 below for the possibility of (later) influence from Diogenes of Apollonia.

As it stands the comparison is not very clear: 'Breath and air enclose (surround) the whole world in the way that our soul, being

breath, holds us (i.e. our bodies) together and controls us.' The similarity in the two cases cannot just be that of the subject, air, without further implication; it would be pointless to say, for example, 'just as air dries moisture, so does it fill balloons'. Four possibilities, out of many, may be mentioned: (i) συγκρατεῖ in Aetius has replaced a simple notion like συνέχει, and the meaning is 'air holds us together, from inside, and the world together, from outside, ⟨and therefore man and the world are more alike than at first appears⟩, *or* ⟨and therefore air is operative in the most diverse kinds of object⟩'. (ii) περιέχει carries with it the implication of καὶ κυβερνᾷ, cf. **108**. The meaning would then be 'as our soul holds the body together and so controls it, so the originative substance (which is basically the same stuff as soul) holds the world together and so controls *it*'. (iii) 'The soul, which is breath, holds together and controls man; therefore what holds together and controls the world must also be breath or air, because the world is like a large-scale man or animal.' (iv) 'The life-principle and motive force of man is, traditionally, πνεῦμα or the breath-soul; ⟨πνεῦμα is seen in the outside world, as wind;⟩ therefore the life-principle of the outside world is πνεῦμα; ⟨therefore wind, breath, or air is the life and substance of all things⟩.'

Now it has been seen that the form συγκρατεῖ is impossible for Anaximenes, but the question also arises whether even a verb like συνέχει could, for him, have described the relation of the soul to the body. The fact is that the idea of the soul *holding together* the body has no other parallel in a Presocratic source, or indeed in any Greek source before Aristotle. The concept involved is admittedly not a complex one; for when the life-soul departs, the body, or most of it, obviously disintegrates, it is no longer held together. Nevertheless the absence of parallels, together with the knowledge that Anaximenes' terminology has certainly been tampered with at this point, makes it unwise to accept the sense even of συνέχει here. This damages (ii), but not (i) and (iii); their main arguments can be restated with the substitution of 'possess', for example, in place of 'hold together (and control)'; for Anaximenes could certainly have held that the soul *possesses*, ἔχει, the body, meaning that it permeates the whole of it (cf. e.g. Heraclitus fr. 67*a*); and possibly, even, that it controls it. (iv) avoids emphasizing συγκρατεῖ, and depends in part on the fact that Anaximenes' is the first extant use of the word πνεῦμα, which became common (both for breath and for gust of wind) with the tragedians; its possible dual application *could* have led Anaximenes to the parallelism of man and the world. Indeed all three remaining interpretations, (iv) and the revised forms of (i) and (iii), express this

parallelism in one form or another; it is the essence of the statement to be interpreted.

Beyond that, to the particular form of the inference that must have been based upon it, we can hardly hope to penetrate with certainty. Yet the fully developed and clear-cut use of the inference from the known microcosm, man, to the unknown macrocosm, the world as a whole, does not otherwise appear until the latter part of the fifth century, under the influence, it is thought, of the new interest in theoretical medicine at that time; it is perhaps unlikely to occur in such a plain form as (iii) so early as Anaximenes. It is possible, moreover, that he did not argue so logically as even (i) or (iv) suggest; rather that a conjecture about the world was *illustrated* by reference to man and the soul, just as a dogma about the cause of lightning was illustrated by the example of the oar-blade, or that about the heavenly bodies by that of the cap on the head. This would be more plausible as the first stage in the development of the man–world argument, and accords with Anaximenes' known use of imagery.

All this is necessarily very conjectural. It remains uncertain to what extent Anaximenes was tending to treat the world itself as alive, as a kind of huge animal organism; it has been noticed that, although he introduced a thoroughly rational description of change, Anaximenes in some respects clung to the framework of the popular, non-philosophical world-construction, and so might retain more of the old anthropomorphic attitude than at first sight seems probable. However, his perception that air is the cosmic equivalent of the life-soul in man goes far beyond that attitude; it must, in fact, have been an important motive for his choice of air as the originative substance.[1] The mention of soul is important in itself; apart from **89** it is the first Presocratic psychological statement to survive – though the actual structure of the soul envisaged, as breath, belonged to an age-old popular tradition. Another conception of the soul, as made of the fiery aither which also fills the outer sky, was accepted from another channel of the popular tradition by Heraclitus, who was also to develop the assumption, probably implicit in Anaximenes, that man and the outside world are made of the same material and behave according to similar rules.

[1] It is perhaps odd that Aristotle did not name Anaximenes at *de an.* A2, 405a21, where 'Diogenes and some others' are named as holding the view that the soul is air; Aristotle is arguing that the Presocratics made the soul out of their ἀρχή. Plato, *Phaedo* 96B (what we think with is air), was probably referring to Diogenes (cf. pp. 444f.), who held that soul was *warm* air, thus perhaps conjoining the view of soul as aither or fire. There is no reason to think with Vlastos (*AJP* 76

(1955) 364 and n. 56) that Diogenes was here exclusively indebted to Anaximenes; nor is it probable (as Karin Alt argued, *Hermes* 101 (1973), 129ff.) that Aetius in **160** has confused Anaximenes with Diogenes, at least in the οἷον ἡ ψυχή... statement. That is very different, in tone and sophistication, from e.g. **602**, even if Aetius' further comment (...δοκῶν συνεστάναι τὰ ζῷα) could apply to Diogenes.

CONCLUSION

Anaximenes is the last of the great Milesian thinkers. He was obviously indebted to Anaximander, but also probably to Thales, to whose concept of the originative stuff as an actual component of the world he was enabled to return by his great idea of condensation and rarefaction – an observable means of change by which quantity controls kind. This idea was probably accepted by Heraclitus and submerged in a system of a rather different nature; for after the Milesians the old cosmogonical approach, according to which the most important object was to name a single kind of material from which the whole differentiated world could have grown, was both enlarged and moderated. New problems, of theology and of unity in the arrangement, rather than the material, of things, exercised Anaximenes' successors Xenophanes and Heraclitus – although they too (even though the former migrated) were Ionians. Still more basic departures from the Milesian tradition were made in the west. But when the fifth-century thinkers of the east and the mainland (Anaxagoras, Diogenes, Leucippus and Democritus) had recovered from the western elenchus of the Eleatics, it was to the Milesians, and particularly to Anaximenes, that they chiefly turned for details of cosmology; not so much because of the great intuition of a kind of cosmic breath-soul, as because those details had been in part adapted from, and were still protected by, the popular, non-scientific tradition.

CHAPTER V

Xenophanes of Colophon

DATE AND LIFE

161 Diogenes Laertius IX, 18 (DK 21 A 1) Ξενοφάνης Δεξίου ἢ, ὡς Ἀπολλόδωρος, Ὀρθομένους Κολοφώνιος...οὗτος ἐκπεσὼν τῆς πατρίδος ἐν Ζάγκλῃ τῆς Σικελίας διέτριβε καὶ ἐν Κατάνῃ....γέγραφε δὲ ἐν ἔπεσι καὶ ἐλεγείας καὶ ἰάμβους καθ' Ἡσιόδου καὶ Ὁμήρου, ἐπικόπτων αὐτῶν τὰ περὶ θεῶν εἰρημένα. ἀλλὰ καὶ αὐτὸς ἐρραψῴδει τὰ ἑαυτοῦ. ἀντιδοξάσαι τε λέγεται Θαλῇ καὶ Πυθαγόρᾳ, καθάψασθαι δὲ καὶ Ἐπιμενίδου. μακροβιώτατός τε γέγονεν, ὡς που καὶ αὐτός φησιν·

(Fr. 8) ἤδη δ' ἑπτά τ' ἔασι καὶ ἑξήκοντ' ἐνιαυτοὶ
βλῃστρίζοντες ἐμὴν φροντίδ' ἀν' Ἑλλάδα γῆν·
ἐκ γενετῆς δὲ τότ' ἦσαν ἐείκοσι πέντε τε πρὸς τοῖς,
εἴπερ ἐγὼ περὶ τῶνδ' οἶδα λέγειν ἐτύμως.
...(20) καὶ ἤκμαζε κατὰ τὴν ἑξηκοστὴν ὀλυμπιάδα.

162 Clement *Strom.* I, 64, 2 τῆς δὲ Ἐλεατικῆς ἀγωγῆς Ξενοφάνης ὁ Κολοφώνιος κατάρχει, ὃν φησι Τίμαιος κατὰ Ἱέρωνα τὸν Σικελίας δυνάστην καὶ Ἐπίχαρμον τὸν ποιητὴν γεγονέναι, Ἀπολλόδωρος δὲ κατὰ τὴν τεσσαρακοστὴν ὀλυμπιάδα γενόμενον παρατετακέναι ἄχρι Δαρείου τε καὶ Κύρου χρόνων.

161 Xenophanes son of Dexios or, according to Apollodorus, of Orthomenes, of Colophon...he, being expelled from his native land, passed his time in Zancle in Sicily and in Catana...He wrote in epic metre, also elegiacs and iambics, against Hesiod and Homer, reproving them for what they said about the gods. But he himself also recited his own original poems. He is said to have held contrary opinions to Thales and Pythagoras, and to have rebuked Epimenides too. He had an extremely long life, as he himself somewhere says: 'Already there are seven and sixty years tossing my thought up and down the land of Greece; and from my birth there were another twenty-five to add to these, if I know how to speak truly about these things.'...And he was at his prime in the 60th Olympiad.