

II Anaximander on Nature

(a) *Pantological knowledge*

Anaximander was a younger contemporary and a fellow-citizen of Thales; we need not accept the conventional statement that they were teacher and pupil, in order to believe that the younger man knew and was stimulated by his senior's excogitations. Anaximander became 'the first Greek whom we know to have produced a written account *Concerning Nature*' (Themistius, **12 A 7**).¹

Of that work barely a dozen words have survived; but the doxography enables us to judge its scope and pretensions. It was vast: there was a cosmogony, or account of the original formation of the universe; a history of the earth and the heavenly bodies; an account of the development of astronomy, meteorology and biology; and a geography illustrated by a celebrated *mappa mundi*. Nature, *phusis*, embraces every object of experience and every subject of rational inquiry except the productions of human contrivance; and the Presocratic systems of thought were generally spoken of as accounts *Concerning Nature* (*PeriPhuseôs*). An account concerning nature would begin with cosmogony, and proceed to a description of the celestial universe. It would investigate the development of the earth, of terrestrial life, and of the human animal; it would describe the clouds, the rains, and the winds, the rocky structure of the land, and the salt sea. It would rise from the inorganic to the organic, treating of topics botanical and zoological; it would look at the typology of species and the anatomy of individuals. It would turn to the mind, and study the psychology of sensation and action; and it would ask about the extent and the nature of human knowledge, and about the proper place of man in the natural world. An account *Peri Phuseôs* would, in brief, encompass all science and all philosophy.

Thales, we may imagine, first indicated that vast field of intellectual endeavour. Anaximander was the first to map it out; and his chart, with a few additions and modifications, determined the range and aspirations of almost all subsequent thought. Anaximenes, Xenophanes, and even Heraclitus; Empedocles and Anaxagoras and the Atomists: all worked and wrote in the grand tradition of Anaximander: other men are specialists, their specialism was omniscience.²

Even through the thick fog of time which separates us from Anaximander, we can perceive the flashings of 'an intellect of truly amazing grasp and audacity'. The range of his mind was matched by a powerful reasoning capacity and an ingenious imagination. His astronomical system illustrates his intellectual virtuosity: the earth is at the still centre of the turning cosmos; about it lie concentric wheel-rims, one for the stars, one for the moon, one for the sun; the wheel-rims are hollow and filled with fire; and heavenly

bodies are holes in those rims, through which shines the enclosed fire (Aëtius, **A 21–2**). Applications of this theory accounted for the various celestial happenings, and it was worked out with a dedicated mixture of mathematics, insight and fantasy.³

In this chapter I shall discuss first, Anaximander's 'Darwinism'; second, his account of the stability of the earth; and third, that small fragment of his work which contains the earliest extant words of Western Philosophy. My treatment will not exhibit Anaximander as a systematic thinker; but it will, I hope, show the characteristic virtues and vices of his temperament.

(b) *The origin of species*

And again, [Anaximander] says that in the beginning men were born from creatures of a different sort, because the other animals quickly manage to feed themselves, but man alone requires a long period of nursing; hence had he been like that in the beginning too, he would never have survived (**6**: pseudo-Plutarch, **A 10**).

Other reports, which do not agree in detail, make men's first parents fish or fish-like creatures who retained their human offspring in their bellies until they were able to fend for themselves (Hippolytus, **A 11**; Plutarch, Censorinus, **A 30**). A further notice indicates that Anaximander's speculations were not confined to his own species:

Anaximander says that the first animals were born in the moisture, surrounded by prickly barks; and that as they reached maturity they moved out on to the drier parts where their bark split and they survived in a different form (*metabiōnai*) for a brief while (**7**: Aëtius, **A 30**).⁴

Thus a theory of human phylogeny was embedded in a broader account of the origins of animal life.

The theory that life began in the wet parts of the earth was accepted by many of Anaximander's successors.⁵ It is tempting to connect it with another hypothesis:

At first, they say, the whole area around the earth was moist, and as it was dried by the sun the part which vaporized made the winds and the turnings of the sun and the moon, while what was left is the sea; that is why they think that the sea is becoming smaller as it dries out, and that in the end it will at some time all be dry (**8**: Aristotle, *Meteor* 353b6–11=**A 27**).

Theophrastus ascribes the hypothesis to Anaximander (Alexander, **A 27**). The doxography gives no further details, but a remarkable set of observations ascribed to Xenophanes of Colophon, whose life span overlapped with that of Anaximander, gives grounds for conjecture:

Xenophanes thinks that a mixing of the earth with the sea is occurring, and that in time it is being dissolved by the moist. He says he has the following proofs: shells are found in the middle of the land and in the mountains, and he says that in Syracuse in the stone quarries there have been found impressions of fish and of seals [?], and on Paros an impression of laurel in the depth of the rock, and in Malta prints of all sea creatures. And he says that this happened some time ago when everything was covered in mud, and that the impression dried in the mud (9: Hippolytus, **21 A 33**).⁶

Xenophanes' theory was different from Anaximander's in at least one respect; for he held that the earth was gradually getting wetter, not that it was drying out. But in other ways he may have been imitating his Milesian predecessor. Perhaps Anaximander elaborated a cyclical theory of hydration and dehydration; and perhaps he relied on the sort of fossilized evidence that Xenophanes used—for if he had not heard of the findings in Malta and in Syracuse, Paros at least was near home. And scholars plausibly guess that Anaximander observed and was impressed by the gradual silting of the harbour at Miletus and the general recession of the sea along the Ionian coast.

All that suggests an expansive theory of the origins of life: 'The earth is gradually drying out from an originally water-logged condition. The first living creatures, then, will have been of a fishy variety, to whom a watery environment was congenial. Only later, as the earth dried, will land animals have developed from those aquatic aboriginals. And man, in particular, must have had a peculiar sort of ancestor, given the weak and dependent nature of the human infant.'

On the strength of this theory Anaximander has been hailed as the first Darwinian; and there are grounds for praise: the animal species were not, in Anaximander's view, immutably fixed at their creation; and their development was determined by the nature of their environment. Here we have, in embryo, evolution and the survival of the fittest. Both those 'Darwinian' aspects of Anaximander's theory are found, a century later, in Empedocles. Much of Empedocles' zoogony is strange and disputed (see **31 B 57–62**; Aëtius, **A 72**); but he surely held both that the earliest living creatures were very different from those with which we are familiar, and also that many of those early creatures were, for various reasons, incapable of surviving and perpetuating themselves. The Aristotelian doctrine of the immutability of species later gained a stranglehold on men's minds; and it is only just that we should honour Anaximander and Empedocles for their insight.

Nevertheless, praise should not be lavished with fulsome disregard for accuracy; and the grand theory presented to Anaximander is neither as cohesive nor as evolutionary as I have made it seem. First, our sources do not connect Anaximander's hypothesis of a drying earth with his zoogonical theories; and since, according to Aëtius, the first animals were amphibian and lived at a time when the earth already had dry parts, the physical hypothesis may well have been entirely divorced from the zoogonical theories. Anaximander is perhaps more likely to have been moved to his watery zoogony by the sort of considerations which led Thales to adopt water as a 'first principle' (above, p. 11).

Second, there is no trace of evolution, in the sense of gradual change, in Anaximander's theory. Aëtius implies no more than that the first generation of each species emerged from prickly barks or shells. There is no suggestion that this mode of

reproduction occurred more than once; or that the first generation had been preceded by a line of prickly ancestors; or that, once hatched, the first cats and cows, hyenas and horses, differed in any respect from their present descendants. Nor is the speculative origin of mankind evolutionary: it seems probable that the ‘fish-like’ parents of the first men were similar to the prickly cradles of the other animals, the only difference being that the human barks did not split until their contents were at a relatively advanced stage of development. Censorinus (A 30) says that the first men did not emerge ‘until puberty’; if his report is accurate, Anaximander’s motive is transparent: he wants to ensure that the first generation of men will survive long enough to reproduce and care for a second generation. Anaximander did not envisage a long and gradual alteration in the form and behaviour of animal species in response to their changing environment. He did not ask how the species we know came to have the characteristics we observe in them. His question was simply: How did living creatures first come into being and propagate? And his answer was a genial fantasy.

(c) *The earth at rest*

In the orthodox opinion, the early Ionian astronomers are divided by a deep gulf. On the one side stands the majority, whose accounts, though pretentious in design, are in execution crude and sketchy, offering imprecise and piecemeal observations on individual problems with no attempt at synthesis or quantification. On the other side stands the lone figure of Anaximander, ‘the earliest known type of a mathematical physicist, at any rate outside Babylonia’, whose theories rest on a proper scientific methodology ‘critical and speculative rather than empirical’.⁷ Both sides of this contrast are overdrawn: Anaximander was not quite the purist his admirers imagine, and his colleagues were not as different from him as they have been made to appear. Nevertheless, his astronomy remains an astonishing achievement, and nowhere more so than in his account of the earth’s position in the universe.

Anaximander punctured Thales’ water-bed: he realized that any solution to the puzzle of the earth’s stability needed something stronger than an analogy and deeper than a cushion of water (see above, pp. 9–10). His own answer, which Aristotle expounds and discusses at some length (*Cael* 295b10–296a23=A 26) meets these requirements, and enables him to reconcile the apparently conflicting facts that the earth is at rest and that the earth is in mid-space.

Aristotle’s report runs thus:

There are some who say that it [sc. the earth] stays where it is (*menein*) because of the similarity (*dia tēn homoiotēta*); e.g., among the ancients, Anaximander. For what sits in the middle and is similarly related to the extremes has no more reason (*mallon outhen...prosêkei*) to go upwards than downwards or sideways; but it is impossible for it to make a movement in opposite directions at the same time: so of necessity it stays where it is (10: *Cael* 295b10–16=A26).

Aristotle is echoed in the doxography:

[Anaximander says that] the earth is in mid-air (*meteôron*), overpowered by nothing, and staying where it is on account of its similar distance from everything (11: Hippolytus, A 11).⁸

Both Aristotle and Hippolytus speak, in slightly different fashions, of ‘similarity’: their vague references can be filled out in more than one way, and we have no means of knowing which filling is authentic. The interpretation I offer is speculative; but it fits the words of our reports, and it consists with Anaximander’s general cosmology. A *cosmic spoke* is a straight line drawn from the centre of the earth to the boundary of the finite cosmos. A spoke s_1 is *similar* to a spoke s_2 if every point, p_1 , n units from the earth along s_1 is qualitatively indistinguishable from the corresponding point, p_2 , n units from the earth along s_2 . Hippolytus’ text suggests that *all* cosmic spokes are similar; Aristotle implies the weaker supposition that for every cosmic spoke there is a similar spoke opposite to it. (Two spokes are ‘opposite’ if they form an angle of 180° in all planes at the centre of the earth.) In fact, Anaximander needs no more than:

- (1) For any cosmic spoke s_i , there is a distinct spoke s_j such that s_j is similar to s_i , and I shall use (1) as though it were Anaximandrian.

The inference turns, according to Aristotle, on the proposition that the earth does not move because it ‘has no more reason’ to go in one direction than in another. Implicit in this is the second of the ‘two great principles’ on which, according to Leibniz, all reasoning is founded: it is ‘the Principle of Sufficient Reason, in virtue of which we believe that no fact can be real or existent, and no statement true, unless it has a sufficient reason why it should be thus and not otherwise’ (*Monadology*, §32).⁹ The Principle can be applied, and Anaximander’s argument articulated, in more than one way; I shall present the argument as a *reductio*.

Let us suppose that the earth is moving, i.e., that it is travelling along some cosmic spoke, say s_1 ; thus:

- (2) The earth is moving along s_1 .

Anaximander assumes that the motion described in (2) must have some explanation. He is, I suggest, implicitly relying on some such principle as:

- (3) If a is F , then for some ϕ , a is F because a is ϕ .

From (2) and (3) he may validly infer:

- (4) For some ϕ , the earth moves along s_1 because s_1 is ϕ .

Suppose that the explanatory feature of s_1 is G , then we have:

- (5) The earth is moving along s_1 because s_1 is G , and hence, trivially:

- (6) s_1 is G .

Then, by (1) and (6):

- (7) Some s_j , distinct from s_1 is G .

Suppose, then:

- (8) s_2 is G .

At this point, Anaximander needs a further principle, that explanations are ‘universalizable’. An appropriate formula here is:

(9) If a is F because a is G , then if anything is G it is F . Between them, (3) and (9) amount to something like a Principle of Sufficient Reason: (3) asserts that happenings need *some* explanation; (9) indicates how that explanation must be a *sufficient* condition for what it explains.

Now from (5), (8) and (9) there follows:

(10) The earth is moving along s_2 .

Since nothing can move in two directions at once, (2) and (10) are incompatible. Hence, by *reductio ad absurdum*, (2) is false: the earth must stay where it is.

Anaximander's argument is clean and ingenious; and it reveals an awareness of certain central features of our notion of explanation. 'Even if we knew nothing else concerning its author, this alone would guarantee him a place among the creators of a rational science of the natural world.'¹⁰ But the argument is hardly convincing. I ignore certain *a priori* objections to premiss (1): the premiss is a scientific hypothesis—a Popperian conjecture—and not an inductive generalization; and if hypothesis is preferable to induction, the status of (1) is a tribute, not an objection, to Anaximander. Moreover, (1) is no isolated hypothesis: it is part of an elaborate description of the heavens (see above, p. 20), which is designed both to save the phenomena and to guarantee cosmic 'similarity'. Nor will it do to object that Anaximander rules out, *sans* argument, any transcendental differences between cosmic spokes. Anaximander is doing astronomy; and astronomy exists as a science only if the gods do not capriciously intervene in the workings of the world. That there is no transcendental, divine, or capricious intervention in natural processes is a presupposition fundamental to the very enterprise of science.

Nonetheless, premiss (1) will not stand. Despite its ingenuity, Anaximander's astronomy does not work: it ensures the 'similarity' required by (1)—though not the stronger 'similarities' implicit in Aristotle and Hippolytus—but it does not 'save the phenomena'. As an astronomical hypothesis it is falsifiable; and it was immediately seen to be false. Anaximander's argument is scientifically untenable.

Philosophically, there are those who reject the Principle of Sufficient Reason: some attack (3), others attack (9). Opponents of (9) ask why certain features should not simply have an effect on some occasions and not on others: freak weather conditions caused today's typhoon, even though the very same conditions had no devastating effect yesterday. Opponents of (3) may simply point to the occurrence of chance events. More subtle antagonists will ride Buridan's ass: equidistant between two bottles of hay their steed would, were the Principle right, starve to death. In fact, the donkey eats: either there is no explanation for its taking this bottle rather than that, in which case (3) is false; or else the donkey's attraction to this bottle is explained by a feature which that bottle also possesses, in which case (9) is false. This *reductio ad asinum* was anticipated by Aristotle: he compares Anaximander's arguments with 'the argument that a hair which is subject to strong but uniform tension will not break, and that a man who is hungry and thirsty to an extreme but equal degree will abstain alike from food and drink' (*Cael* 295b30–3).

I shall touch on these issues again in later chapters. Here it is enough to remark that the objections to (3) and to (9) are not conclusive against Anaximander; for (3) and (9)—like the prohibition on divine intervention—are, in a certain sense, presuppositions of any scientific astronomy: if either (3) or (9) lapses, then the goal of astronomy itself is unattainable, and we cannot find universal laws explanatory of the celestial phenomena. Any wise man, therefore, will strive to maintain (3) and (9), even if he cannot show them to be true *a priori*; for to abandon them is to abandon the highest ideal of science.

Anaximander's successors are often alleged to have betrayed his memory, retreating to primitive, Thalean, thoughts and quitting the speculative heights to which he had

ascended. Thus Xenophanes said that the earth ‘reaches downward to infinity’ (21 B 28; cf. Aristotle, *Cael* 294a21–8=A 47); and Anaximenes had the earth ‘riding’ on the air (Aëtius, 13 A 20; cf. B 2a). Anaximenes was followed by Anaxagoras and Democritus (Aristotle, *Cael* 294b13–23=13 A 20) and by Diogenes of Apollonia (Scholiast on Basil, 64 A 16a); and his theory became an orthodoxy, alluded to in poetry and prose, and gayed in comedy ([Hippocrates], Euripides, Aristophanes, 64 C 2). Empedocles alone offered something similar to Anaximander; but his theory is only half intelligible, and that half is wrong.¹¹ Anaximander’s argument is once ascribed to Parmenides and Democritus (Aëtius, 28 A 44); and another source has it that ‘Empedocles and Parmenides and almost all the old sages’ adopted it (Anatolius, 28 A 44). But neither of those accounts is trustworthy; and in all probability Anaximander’s argument was not taken up again until Plato laid hands on it.¹²

Nevertheless, I do not think that Anaximander’s successors were primitive revivalists: he saw what Thales had missed, that the earth may rest in mid-air, *meteōros*, without solid support; and his successors did not relinquish that insight. It is true that in Xenophanes’ singular case the earth is *meteōros* only in a Pickwickian sense; but it still differs from Thales’ earth in needing no support: an infinitely extended column of earth need and can have nothing holding it up.¹³ Of the Anaximeneans, one is expressly said to have held that the earth is *meteōros* (Hippolytus, 59 A 42); and it is a reasonable conjecture that the others did too. Like Anaximander, they rejected a support for the earth, and sought to reconcile stability and suspension in mid-air; seeing the faults of Anaximander’s reconciliation, they offered an account which turned on the observed physical characteristics of the stuff filling celestial space, and not on the conjectural mathematical features of space itself. The earth is physically suspended in air; it is not mathematically suspended by abstract reason.

Of the many pieces of evidence the Anaximeneans adduced for their theory (*Cael* 294b22), only one has survived, and that is not particularly impressive (*Cael* 294b13–21=13 A 20). Nor does the Anaximenean theory provide much philosophical pabulum: compared to Anaximander’s argument, it is boring. For all that, Anaximander’s successors were not his inferiors; charmed by the elegance of his suggestion, they were sadly conscious of its failure to save the phenomena, and the views they advanced in its stead were intellectually dull but scientifically progressive.

A modern reader will feel a certain impatience with all this misplaced ingenuity. Why, he will ask, did the Presocratics not abandon the hypothesis of a stable earth and so dissolve their whole problem? The answer is that they were too scientific to do so: Anaximander followed Thales in accepting a stable earth; and he was in turn followed by most of the later Presocratics.¹⁴ A few Pythagoreans dared to displace the earth from the centre of the cosmos and let it run around a central fire; but their view was deemed bizarre, and remained unfashionable (see below, p. 383). For once, common sense held the day: when we stand on the earth we have none of the sensations associated with motion; we do not feel the blast of the wind or see the clouds rushing past in regular procession; and the pit of our stomach assures us that all is at rest. As the great Ptolemy observed, ‘it is perfectly plain from the phenomena themselves’ that the earth is still (*Syntaxis* I.7).

Daily observation confirms the stability of the earth, just as nocturnal observation proves the mobility of the stars. In any case, a moving earth would not solve the

Presocratic problem, but merely displace it. The question Thales raised in connexion with the earth would arise again in connexion with the new cosmic centre: *why*, whatever it is, does it remain still in mid-space?

Progress will be made here not by astronomy but by philosophy: the Presocratics needed a closer understanding of the concept of motion before they could improve their scientific hypotheses. Zeno's work laid the foundations for such an understanding (below, pp. 290–4); but even after Zeno there is little evidence of any reflexion on what we mean when we ascribe motion or rest to heavenly bodies. The only text I know of refers to an obscure and probably fourth-century Pythagorean:

Hicetas of Syracuse, as Theophrastus says, believes that the sky, sun, moon, stars, and in a word all the celestial bodies, are at rest, and that except for the earth nothing at all in the universe moves; and when the earth twists and turns about the axis at great speed, all the effects are just the same as they would be if the earth were at rest and the heavens moved (12: Cicero, 50 A 1).

Hicetas' theory is almost certainly geocentric; his earth revolves on its axis and not about the sun or central fire; and his astronomy is crude and readily refuted. Nonetheless, Hicetas shows some flickering sophistication in his handling of celestial motion; and the Zenonian moral is beginning to be learned.

(d) Τὸ ἀπειρον

The first fragment of Greek philosophy is short, dark, and attractive. Besotted scholars see in it the first strivings toward abstract and metaphysical thought: the fragment, they maintain, breaks new ground in the science of theoretical cosmogony; it introduces the potent notion of infinity into Greek speculation; and it allows us to ascribe to Anaximander a sophisticated and superbly rational theory of the primordial principle of the universe.¹⁵

In this section I shall first set out the famous fragment, together with its doxographical context; then construct an optimistic account of Anaximander's reasonings; and finally criticize that account, reluctantly sprinkling a little cold water on Anaximander's warm reputation. There are very many problems raised by the fragment which I shall not take up.

We owe the fragment to Simplicius, whose text reads as follows (the interpolated numerals are, of course, my own addition):

Of those who say that [the principle] is one and in motion and unlimited, Anaximander, son of Praxiades, a Milesian who became successor and pupil to Thales, said that [i] the unlimited (*apeiron*) is both principle (*archê*) and element (*stoicheion*) of the things that exist, [ii] being the first to introduce this name of the principle. He says that [iii] it is neither water nor any other of the so-called elements, but some other unlimited nature, from which all the heavens and the worlds in them come about; [iv] and

the things from which is the coming into being for the things that exist are also those into which their destruction comes about, in accordance with what must be. [v] For they give justice (*dikê*) and reparation to one another for their offence (*adikia*) in accordance with the ordinance of time—[vi] speaking of them thus in rather poetical terms. And [vii] it is clear that, having observed the change of the four elements into one another, he did not think fit to make any one of these an underlying stuff, but something else apart from these (**13: A 9+B 1**).

The first principle or element of things, the original and originating mass of the universe, was *apeiros*, unlimited. What limits did it lack? Common sense suggests the boundaries of space and time; and scholarship adds the determination by fixed qualities. Thus we might imagine Anaximander's universal starting-point to be spatially infinite, sempiternal, and qualitatively indeterminate: in the beginning, before the cosmogonic moment, there was a mass of qualityless stuff, unlimited in extent and infinitely old. Why conjecture such a strange start for the familiar world? The doxography suggests a mesh of four arguments.

Argument (A) is extracted from sentence [vii] of text **13**. The argument turns on the phenomenon of 'elemental change', and runs as follows:

(1) Each so-called 'elemental' stuff can change into one or more of the other 'elemental' stuffs.

(2) If a stuff S_1 can change into another stuff, S_2 , then neither S_1 nor S_2 underlies all change.

(3) If S is the stuff of all things, then S underlies all change.

Hence:

(4) The stuff of all things is not one of the 'elemental' stuffs.

The changes we observe daily are underlain by the 'elements': we observe modifications of earth, air, fire and water. Hence only those elements are candidates for the post of all things; and their candidacy is defeated by argument (A). The *Urstoff*, we can only conclude, is indeterminate. What underlies even elemental change can have no qualities of its own; it must be Aristotelian 'prime matter', a 'something we know not what' (cf. *Met* 1069b19=**59 A 61**).

Argument (B) is found anonymously in Aristotle: Aëtius (**A 14**) ascribes it to Anaximander.¹⁶ Aristotle is listing reasons why philosophers have been persuaded of the existence of something actually unlimited:

Again, because only in this way will generation and destruction not fail—
if that from which what comes into being is abstracted is unlimited (**14:**
Phys 203b18–20=**A 15**).

Thus:

(5) New things are perpetually being generated.

(6) All generation is the alteration of some pre-existent stuff.

Hence:

(7) There has always existed an infinitely large stock of stuff.

Argument (C) forges a link between (A) and (B); it too comes from Aristotle:

There are some who make the unlimited body [a stuff distinct from the four ‘elements’], and not air or water, in order that the others should not be destroyed by their unlimitedness; for they stand in opposition to one another—e.g., air is cold, water moist, fire hot—and if one of them were unlimited the others would already have been destroyed; but in fact, they say, it [sc. the unlimited body] is something else, from which these [are generated] (**15: Phys 204b22–9=A 16**).

Simplicius (**A 17**) refers the argument to Anaximander; it can be expanded as follows:

(8) The *Urstoff* of everything is spatially infinite.

(9) Each of the four elements is opposed to, i.e. tends to destroy, the other three.

(10) If a is spatially infinite, and a tends to destroy b , then for some n a will destroy b within n units of time.

(11) For any n , the *Urstoff* has existed for more than n units of time.

(12) No element has been destroyed.

Hence:

(13) The *Urstoff* is distinct from each of the four elements.

Argument (*C*) thus uses the conclusion of (*B*) to confirm the conclusion of (*A*): it infers qualitative indeterminacy from spatiotemporal infinity.

Finally, *argument (D)* shows that any unlimited body must be a principle. Again, the text is the *Physics*:

It is reasonable that they all make [the unlimited body] a principle. For [viii] it can neither exist to no purpose, nor can it have any other power except as a principle; for everything either is a principle or is from a principle, and the unlimited has no principle—for then it would have a limit, [ix] Again, it is both ungenerable and indestructible, being a sort of principle. For what has come into being necessarily has an end, and there is an end of every destruction, [x] For this reason, as we say, there is no principle of this but this seems to be a principle of the other things and to encompass everything and to govern everything (as those say who do not propose any other causes apart from the unlimited, such as mind or love); and this is the divine; for it is immortal and deathless, as Anaximander and most of the *phusiologoi* say (**16: 203b4–15=A 15**).

Part [x], it is argued, is certainly Anaximandrian; but [viii]–[x] forms an organic whole: hence [viii]–[x] as a whole is Anaximandrian, and we have before us ‘a second virtual citation from Anaximander’s book, comparable in importance to the famous sentence preserved by Simplicius’.¹⁷ In particular, we can assign to Anaximander the following argument:

(14) Everything is either a principle or derived from a principle.

(15) If a is unlimited, a has no limit.

(16) If a has no limit, a is not derived from a principle.

Hence:

(17) If a is unlimited, a is a principle.

Aristotle here uses ‘unlimited’ to refer to spatial infinity; we should get a slightly better argument if we took ‘unlimited’ to refer to sempiternity: any derivative body is temporally posterior to its source; hence no temporally infinite body can be derivative.

A small nest of intertwined reasonings supports Anaximander’s unlimited principle, and at the same time elucidates its nature. There is an unargued hypothesis that the processes of generation will never give out: generation requires an infinite source; infinity and the generative function alike require an indeterminate source; and any infinite mass can only be a principle of things. The nest is not tidy but it seems cohesive and strong. Was it built by Anaximander? Or are the materials used in its construction late and synthetic? I take the arguments in turn.

An examination of argument (A) demands a nearer look at the passage of Simplicius. Simplicius is quoting Theophrastus, who is quoting Anaximander.

Argument (A) comes from sentence [vii]; and though [vi] shows that Simplicius is certainly reporting some of Anaximander’s own words, [vii] is beyond the boundary of his quotation. (Indeed, it has been cogently argued that [vii] is Simplicius’ own comment on the paragraph [i]–[vi] which he has excerpted from Theophrastus.)¹⁸ Thus argument (A) is Anaximandrian only if Simplicius’ comment on [i]–[vi] is correct. I am not sure how Simplicius reached his opinion: perhaps he supposed that ‘the things that exist’ in [iv] must include the elements; and inferred that [iv]–[v] recognize elemental change. He then ascribed to Anaximander the Peripatetic deduction of a non-elemental stuff. To assess his ascription we must analyse [i]–[vi].

Sentence [v] is fairly clearly the ‘somewhat poetic’ utterance referred to in [vi], and it (or at least most of it) is therefore securely Anaximandrian.¹⁹ What of the earlier sentences? Sentence [ii] has roused passionate debate: did Theophrastus mean to assign the term ‘principle’ or the term ‘unlimited’ to Anaximander? It has, I think, been shown that Theophrastus assigned both terms to Anaximander, ‘the unlimited’ in [ii], and ‘principle’ in another passage (see Simplicius, *in Phys* 150. 18).²⁰ In that case, sentence [i] may well be a close paraphrase of something in Anaximander’s text. Sentence [iii] is more puzzling: its final clause, containing the curious phrase ‘the worlds in [the heavens]’, seems archaic to some scholars; but the reference to the ‘so-called elements’ cannot be Anaximander’s. We infer from [iii] that Anaximander said something to the effect that ‘the principle is not water, nor earth, nor anything of that familiar sort’. But Diogenes Laertius has a subtly different account:

Anaximander said that the unlimited is principle and element, not distinguishing it as air or water or anything else (**17: II. 1=A 1**; cf. Aëtius, **A 14**).

Did Anaximander positively deny that ‘the unlimited’ was water or the like? Or did he rather refrain from asserting that it was water or the like? The question is not merely trifling; for the view that Anaximander’s principle was qualitatively indeterminate loses in plausibility if he did not positively distinguish it from the elements. Yet I do not see that we can answer the question; indeed, we cannot tell whether Simplicius or Diogenes better represents Theophrastus’ judgment.

The doxography conflates sentences [iii] and [iv] (see Cicero, **A 13**; Aëtius, **A 14**); and some modern scholars concur. But [iii] and [iv] seem to state theses which are

perfectly distinct: [iii] deals with the generation of the heavens from ‘the unlimited’, in a word, with cosmogony; [iv] deals with the generation and destruction of ‘the things that exist’, with the production of the furniture of the world from its component stuffs or ‘opposites’ (cf. pseudo-Plutarch, **A 10**).²¹ Sentence [iii] deals with the creation of the cosmos; sentence [iv] with the changes that take place within the cosmos.²²

Sentence [v] connects to [iv] by the particle ‘for’ (*gar*): what connexion is thereby signalled? The sentiment expressed abstractly in [iv] is ancient and popular:

Dust to dust and ashes to ashes,
Into the tomb the Great Queen dashes.

Thus we might suppose that [iv] is, if not a quotation, at least a close paraphrase of Anaximander. And we might ascribe the *gar* to him, thus: ‘Natural objects eventually are resolved into the elements from which they sprang (plants rot and form earth and moisture); for no one element perpetually gains at the expense of another—local gains are followed, in time, by compensating losses. ‘If we connect [iv] and [v] in this way, our interpretation does, I think, support Simplicius’ inference in [vii]; at least, it ascribes elemental change to Anaximander. For on this interpretation the generation of natural objects must, characteristically at least, involve an elemental change: only if, say, the production of rain from cloud is construed as an elemental change of air into water will it constitute an ‘offence’ or encroachment. When clouds yield rain, water gains upon air: to preserve the cosmic balance of stuffs, the rain must at some time turn back into cloud.

The reconstruction is intelligible; but it is not obligatory. Some scholars ascribe [iv] to Theophrastus, and give the connecting particle *gar* to him rather than to Anaximander. The sense of [i]–[vi] is then this: ‘Anaximander made “the unlimited” a material principle, i.e. something from which everything comes and into which it is destroyed again (= [i], [ii]). For (a) he *says* that everything comes *from* “the unlimited” (= [iii]); and (b) he accepts the *general* principle that things are destroyed into what they came from (= [iv]), as his own words (= [v]) show’.²³

This second account of [i]–[vi] is, I think, the more plausible; for it explains the Theophrastan passage as a whole, whereas the ascription of [iv] to Anaximander leaves the connexion between [i]–[iii] and [iv]–[v] inexplicable. As an interpretation of Anaximander it is highly speculative; for [v] does not evidently suggest [iv] as an interpretative gloss. Moreover, it will hardly support Simplicius’ inference in [vii]. For all that, it is likely to represent the original sense of Theophrastus’ argument.

I return to sentence [vii] and argument (*A*). On any account of [i]–[vi], [vii] is at best an ingenious conjecture, applying a Peripatetic thesis about elemental change to a deeply hidden implication of Anaximander’s argument. This is the most favourable construction to be put on [vii]: the most probable construction is that [vii] is a baseless invention. And there is an independent reason for doubting the authenticity of (*A*): premiss (2) is hardly likely to have been embraced by Anaximander. At all events, it was implicitly rejected by his follower Anaximenes, who took air to be the basic stuff of the world and yet was quite happy to let air change into other stuffs.

Perhaps, then, it is argument (*C*) that gives Anaximander’s reason for picking ‘the unlimited’ as his first principle. Premiss (11) is certainly authentic: ‘the unlimited’ was ‘eternal and ageless’ or ‘immortal and deathless’ (Hippolytus, **A 11**; Aristotle, *Phys*

203b14=A 15; cf. B 2).²⁴ Premisses (9) and (12) refer anachronistically to ‘the elements’; but the anachronism is trifling, and (9) and (12) together make a plausible reading of sentence [v] of the fragment. Premiss (10) has a Peripatetic ring to it; yet it might, I think, have been advanced, perhaps in a somewhat crude or metaphorical formulation, by Anaximander.

If we are prepared to ascribe (C) to Anaximander does that make ‘the unlimited’ a qualitatively indeterminate ‘prime matter’? It is perfectly plain that a mass of ‘prime matter’ could not constitute a cosmogonical principle. The *Urstoff* was self-subsistent; and any self-subsistent stuff has definite qualities: a piece of stuff, however airy and abstract, cannot be neither ϕ nor non- ϕ for every value of ϕ . Aristotle, it need hardly be said, was well aware of this (cf., e.g., *GC* 329a10).

But if the ‘unlimited’ was not entirely characterless, what was its character? In several passages Aristotle talks of *phusiologoi* who took as their principle a stuff ‘between’ (*metaxu*) the other elements; and he probably had Anaximander in mind. According to some scholars, Theophrastus thought that Anaximander’s principle was a ‘mixture’ (*migma*) of all stuffs. These passages are all controversial,²⁵ but one thing is fairly clear: if the Peripatetics did actually ascribe a *metaxu* or a *migma* theory to Anaximander, they were whistling in the dark. Anaximander’s text gave them no light; and I guess that they did not know what Anaximander thought, for the excellent reason that Anaximander himself did not know what to think.

Argument (C) assumes, in (8), the spatial infinity of the universe. That proposition is the conclusion of argument (B). The argument is invalid, as Aristotle points out: In order that coming to be should not fail, it is not necessary that there should be a sensible body which is actually unlimited. The passing away of one thing may be the coming to be of another, the whole being limited’ (*Phys* 208a7–10). This objection is overcome by adding a further premiss to (B), viz: (18) The material supplied by the destruction of existing things cannot be used in the generation of new things.

But it is implausible to ascribe (18) to Anaximander. Sentence [iv] of the fragment, whether or not it is Anaximandrian, is not, strictly speaking, incompatible with (18): [iv] does not imply that the dust produced by destroying a thing is equal in mass to the dust consumed in its generation; and it is not grossly implausible to imagine that the processes of generation and destruction involve a certain wastage of stuff. Sentence [v], however, suggests fairly strongly that Anaximander had some sort of equal balancing in mind; and the probability is that he would have rejected (18).

Argument (B) can be repaired without the help of (18); instead of (18) we may add:
(19) The mass of existing things is perpetually increasing.

An adherent of (19) believes that the cosmos is expanding; and there is no direct evidence that any Presocratic held such a belief. But there is a sentence from Anaxagoras which apparently commits him to an expanding universe; and in some respects at least Anaxagoras was a scientific traditionalist.²⁶ If Anaxagoras embraced (19), perhaps he took it from Anaximander.

It is pertinent to quote here a fragment of Anaximander’s pupil, Anaximenes:

Air is close to the incorporeal; and since we come into being by an effluxion of this, it is necessary for it to be both unlimited and rich, because it never gives out (18:13 B 3).²⁷

Anaximenes thus advanced argument (*B*); and he was thereby committed to either (18) or (19). I incline to favour (19), and to take that as some slight evidence for Anaximander's acceptance of (19). Certainly, Anaximenes' adoption of (*B*) makes its ascription to Anaximander more plausible.²⁸

What, finally, of argument (*D*)? The end of [x] is Anaximandrian; and many scholars tie the whole of [x] to him. I shall return to this passage later on; here it is enough to say that Aristotle's text in no way implies this wholesale ascription. Moreover, [ix] is, I think, a version of an argument advanced by Melissus (see below, pp. 194–7); and in that case there is no historical unity underlying the logical unity of [viii]–[ix]. Aristotle himself makes this plain enough; for he refers to 'all' the *physiologoi* at the beginning of the passage, and to 'most' of them at the end. We have no reason to ascribe [viii] to Anaximander; [viii]–[ix] is an Aristotelian concoction, prepared from several different Presocratic recipes.

With arguments (*A*) and (*D*) removed, Anaximander's thought about the material principle of things becomes less complicated; yet it remains rational: the principle must be *apeiros*, or spatially infinite, in order to support perpetual generation; and, being *apeiros*, it must be distinct from any of the ordinary cosmic stuffs. Arguments (*B*) and (*C*) together yield a reasoned structure of thought.

It must be admitted, however, that the grounds for ascribing even (*B*) and (*C*) to Anaximander are uncertain; and that uncertainty can easily be aggravated. A powerful chorus of scholars proposes a new etymology for *apeiros*: it is formed not from alpha privative and the root of *peras* ('limit'), but from alpha privative and the stem of *peraô* ('traverse'); and the etymological meaning of the word is thus 'untraversable'.²⁹ Whether or not this is correct, it is in any case clear that Anaximander could have used *apeiros* of the unimaginably huge: in Homer the sea is *apeirôn*, immense, not infinite. I am inclined to believe that *apeiros* does indeed mean 'unlimited', but that spatio-temporal infinity is not the only criterion of unlimitedness: a mass of stuff may reasonably be called 'unlimited' because of its untraversable vastness, or because its boundaries are indeterminate ('like a fog-bank or the warmth of a fire'), or even because of its qualitative indeterminacy.³⁰

Thus the word *apeiros* does not, in itself, show that Anaximander's *Urstoff* was literally infinite. And if it was not, then argument (*B*) loses its point. Some scholars find the source of Anaximander's conception of his *Urstoff* in Hesiod's description of the horrid chasm between earth and Tartarus (*Theogony* 736–43); that chasm is vast, not infinite. Hence *to apeiron* is not 'the Infinite' but 'the Vast'; and its origin is to be found not in cosmogonical ratiocination but in poetical inspiration. In that case, argument (*B*) is probably a rationalization fitted to Anaximander's semi-poetical utterances by a later and more prosaic age.

We might, I suppose, allow that *to apeiron* is only 'the Vast', and that Hesiod inspired Anaximander. For all that, may not arguments (*B*) and (*C*) have been in Anaximander's mind? 'Why must the original mass have been so huge?'—'To support its innumerable offspring.' 'What can its character have been?'—'Vague and obscure, but certainly distinct from the stuffs familiar to us.'

We find ourselves in a desert of ignorance and uncertainty; so, I suspect, did the Peripatetic historians. It is possible that Anaximander set his views down with luminous clarity, and that the monster time devoured his book before the Peripatetics could read its

pages; but I doubt it, and I suspect that our uncertainty about Anaximander's meaning reflects an uncertainty and lack of clarity in Anaximander's own mind.

Indeed, I guess that Anaximander's interest in cosmogony has been vastly overestimated, and his achievement consistently mispraised. The partial and fortuitous survival of an obscure utterance has given him an undeserved reputation for metaphysics. That sentence, hinting darkly at a huge primordial *tohu-bohu*, was perhaps supported by a sketchy paragraph of argument; and it was undeniably an impressive exordium to Anaximander's book *Concerning Nature*. But in the context of Anaximander's thought as a whole it had little importance: what mattered was the detailed science that followed: the astronomy, the biology, the geography. Anaximander set natural philosophy on the course it was to follow for many centuries: it is no diminution of his genius to say that his contribution to metaphysical philosophy was of less moment.