

Chapter 3

Thales and Anaximander

1. Thales

If we take it that “philosophy” must embrace, not just “wise” reflections upon human behavior and the human situation, but the reflective study of the world as a whole, and of our place in the natural environment, then the history of our discipline began with someone who did not yet think of himself as a “philosopher” at all — for the word did not yet exist — but as an “inquirer” into physical phenomena of all kinds, and a thoughtful observer of political institutions and social customs: Thales, son of Examydes, of Miletos.

His name appears in every list of the Seven Sages; and he is often mentioned first among them. Most of the stories about his ethical “wisdom” must be regarded as myths rather than as history. But we can take it that he was a leading citizen in his own community, and was well known, and widely respected in the other Greek cities of Ionia. Herodotos reports with approval, the tradition that he advised the Ionian cities to form a federation with its center of government in Teos. Diogenes Laertios (writing hundreds of years later) claims that he advised the Milesians not to make an alliance with Croesus — but this story sounds like the wisdom of hindsight (11 A 1, A 4).ⁱ

Plutarch reports that Thales was engaged in trade. He was certainly quite well off, and his wealth may have come from commercial ventures of various kinds. If there is any truth in the story

that he cornered the olive presses in the spring, and made a great profit because he foresaw a bumper crop, it is just testimony to a lucky guess (A 11).ⁱⁱ But it is more probably a fiction invented by the friends of philosophic wisdom to counter libels like the story that Thales fell into a well because he was looking up at the stars (A 9).ⁱⁱⁱ

Certainly, Thales was interested in the stars. His most famous scientific exploit was the prediction (according to Herodotos) that there would be an eclipse before the end of a certain year (A 5 — Herodotos I, 74). There *was* an eclipse visible in Ionia on 28 May 585 BCE — and it happened during a battle between the Lydians and the Medes. So this Olympic year became the established date of Thales' *akme* (conventionally his fortieth birthday). It is a reasonable guess that he was born about 625 BCE.

Just what his successful forecast was based upon, we cannot say. He was a traveller, and an observer of the stars for purposes of navigation (A 3a).^{iv} In one way or another, he probably had access to some Babylonian (or more probably, Egyptian) knowledge of astronomy. No doubt there was an element of luck in the successful prediction, but it is not quite in the same class as the supposed forecast of a bumper crop of olives. Thales did not know that the earth is a sphere, so he could not make anything like a “scientific prediction”; but he may have learned a rule of thumb by which he could say whether an eclipse was likely or not likely in a given period. If he was known to have said that “there *could be* an eclipse in this year” — and then it actually happened on the day of a battle — his reputation would be made. (Of course, if his understanding of the rule was imperfect, and he actually said “there *will be* an eclipse,” this would have produced the same result.)

It was his “stargazing” knowledge that became most celebrated later on. Simplicios credited him with a book on *Nautical Astronomy*; and some other anonymous Alexandrian scholars claimed that he wrote treatises on the solstice and the equinox (B 1).^v But none of our earliest witnesses (down to Aristotle and his students) know of any published writings by Thales. Whatever notes he made and left to his associates in Miletos, probably did not reach a wider public under his name.

There probably were notes about mathematics, and especially about ways of applying mathematics to practical problems. Everyone agreed that the study of geometry in Greece began with Thales. Our evidence is very late; but it is plausible to believe that it goes back to Hippias the Sophist, who is the earliest authority that we have, and a serious student of mathematics into the bargain. Proclus ascribes several theorems to Thales, mainly about triangles.^{vi} Thales did not “prove” theorems; he *stated* them, and he probably *used* some of them (having accepted them intuitively) in performing such feats as calculating the height of a pyramid by measuring its shadow, and estimating the distance of a ship at sea.^{vii} (He travelled to Egypt, and he was supposed to have learned his geometry there. The Egyptians could certainly have shown him how to measure the height of a pyramid.)

Herodotos refused to believe the report that Thales helped Croesus get his army across the river Halys, by diverting one part of the stream. He thought that Croesus could have used the bridges that were already built. But if there *were* convenient bridges, it is somewhat surprising that a false tradition about Thales had already arisen by the time that Herodotos arrived. We should probably trust his report here rather than his scepticism (A 6 — Herodotos I, 75).

2. The principle of divine life

It was known to his associates, and his earliest successors, that Thales regarded the whole world as *alive*. “Some say,” says Aristotle in his treatise *On the Soul*, “that it [soul] is mixed in the whole. Perhaps that is why Thales thought that all things are full of gods, too” (*On the Soul* 411 a 78). If anything we have can count as Thales’ actual words, it is this maxim “Everything is full of gods.”^{viii} This is his one clear statement about “the whole”; and we should notice that he did not speak of it as one whole at all, but as a variegated collection of many divine powers. For him, there were two great communities of living things: “the Gods,” who are “deathless,” and humans (with animals and plants) who die. “The Gods,” he thought, are here in the world, all around us. They may be elsewhere, in their own place, as the poets say. But that is not our concern. We must

discover them in the order of our world, where they can actually be observed. Here is this piece of stone which draws iron to it quite “magically” (A 22); and this piece of amber attracts things if we rub it (A 1).^{ix} At these points, the gods are showing themselves. There is a “soul” in the lodestone, and in the amber; and unlike *our* souls (our life-principles) it is immortal. It does not die, and disappear. It is a “god.”

If the gods are here with us, and all things are full of a divine life that takes many forms, can we actually identify the chief of all the gods? Where is the true Zeus, the father and king of gods and men? Homer knows, and so do most of the mythmakers. The true God is not really Zeus at all — the Sky Father. Homer knows him as Ocean, the sea that encircles the whole Earth.^x But those who identified the Sea God, Poseidon, as the Earthquake God understood the real significance of the oceanic encirclement. Ocean goes all round the Earth, because the Earth is floating in it; it is underneath us.^{xi} It is in the cosmic sea, that the deathless life principle most truly abides.

Aristotle says more than once that Thales believed the Earth was floating on water; this provides the safest key for the dictum that the whole tradition ascribes to him: “All things are water.” Aristotle himself argued that Thales said “the earth rests on water” *because* he believed that Water was the material principle (i.e. the “stuff” out of which everything is made). I take this to be no more than a hypothesis — a postulate made on the basis of what Aristotle had read in the pages of the later physical philosophers, who did leave published books. It is about as sure as anything in this uncertain territory can be, that Thales said “everything is *in* the water”; and he may have said that “everything comes *from* the water” (which would have satisfied Aristotle that he was talking about the material principle). He may even have said “everything has been *made by* the water” (since he probably read Homer in that sense).^{xii} But it is very doubtful that he ever thought (or meant) that “everything is *made out of* water.” He was interested in *where the life-energy comes from* by which the abiding order of things is maintained; and so were most of his immediate successors — even when their “principles” did actually answer Aristotle’s question about the original “stuff” as well.^{xiii}

Aristotle did not know for certain why Thales had given the status of original principle to Water. He speculates that it was because “the nourishment of everything is moist, and heat itself comes from the moist, and lives by it . . . and because the seeds of everything have a moist nature, and water is for moist things the principle of their nature” (*Metaphysics* 983a, 20-7). He *may* have been guided by what he knew about the views of Anaximander; but it is more likely that he is ascribing to Thales, what seem to him to be “good reasons” in his own philosophy of nature. In that case, we cannot attach any historical value to his opinion; and when Aristotle is driven to open guessing we have reached the limit of our probable knowledge of Thales.

3. Anaximander

Thales was more famous than his successors; and he seems to deserve his reputation as a great inquirer. But Anaximander of Miletos, who was a friend and collaborator of his, was the first truly great speculative thinker. He wrote a book, which survived for some centuries at least; so our information about his views, though very fragmentary and incomplete, is more reliable than the tradition about Thales.

It seems probable that Anaximander began his book by announcing his own name and age; for the Alexandrian scholar Apollodoros, who supplies us with so much of our early chronology, was able to say that Anaximander was sixty-four in the Olympic year 547/6 BCE (A 1).^{xiv} In that case he was born in 511/10, and was perhaps fifteen years younger than Thales. It is safe to assume that they worked and talked together; but the “pupil” or “student” relation that some ancient authors ascribe to them should not be taken seriously. They were men of leisure with common interests.

Like Thales, Anaximander was a traveller. We hear of him setting up a sundial in Sparta; and leading the expedition that established the Milesian colony of Apollonia on the Black Sea (A 1, A 3).^{xv} The understanding of what can be learned from the “gnomon” (central spike) of a circular

sundial (solstices, etc., as well as time of day) probably came from Babylonian sources, so he may have gone that far afield (A 4).^{xvi}

The report that he drew a map of the world (A 1, A 6) provides a plausible context for his cosmological theorizing. His map would have had three neat divisions: “Europe,” “Asia,” and “Libya” (North Africa west of the Nile). He conceived of the Earth’s surface as the top of a drum-like solid with a diameter three times as great as its depth. The Ocean flowed in a great circle round the concave land-mass (with the Mediterranean in its central “hollow”). The “Air” — which Anaximander thought of as naturally dark — was a great sphere round that; and the heavenly lights were caused by a kind of “cartwheel” structure that allowed the light of three spheres of fire to pass through the dark air to the Earth. The outermost sphere of fire is that of the Sun. When that spoke of the wheel is passing over us, all other lights are drowned in its universal radiance (and — if there are no clouds — the Air becomes completely transparent). Next below the Sun-hole (which is on the outermost ring of the cartwheel), is the sphere from which the Moon’s light comes to us when the Sun-hole is below the horizon; and below that is the sphere from which the light of the stars reaches us. The sphere of the sunlight was twenty-seven earth-diameters distant from us; that of the Moon was eighteen diameters distant; and that of the “stars” was closer. Perhaps it was nine diameters away — but there may be a good reason why this number is not found in our sources.^{xvii} Eclipses occur when the “breathing holes” through which the lights appear to us are somehow blocked; and the Moon waxes and wanes as its hole opens and closes in an orderly periodic way.

According to Eudemos (who was deeply concerned with the problem, and certainly ought to have known what he was talking about) Anaximander was the first to discuss the size and distance of the planets (A 19).^{xviii} If we take this as an indication that Anaximander thought that the five visible “star” planets were at various distances *between* nine and eighteen diameters away, we can account for the fact that *no* distance for the “sphere of the stars” is given in our reports. Anaximander would seem to have been more interested in a mechanical construction upon *a priori* mathematical principles than in observational astronomy. But he was certainly interested in the size of the *sun*; for he is reported to have said that it was the same size as the Earth (A 21, Aetios).^{xix}

This was one of Anaximander's great leaps of imaginative projection. Even Anaxagoras only hazarded the guess later on, that the Sun was larger than the Peloponnese (59 A 1). But Anaximander's bold hypothesis about the Sun pales into insignificance when set beside his argument as to the reason why the Earth stays still in the *center* of the system. Thales had supposed that the Earth was like a concave board floating in the water. Aristotle commented that the Ocean would have to rest on something likewise (*On the Heaven* 294a, 28-34). Anaximander saw that problem clearly before anyone else raised it. He laid it down that the Earth was in the center of the world-system because that was its place. *It did not rest on anything* (*On the Heaven* 295, 11-6).^{xx} The cosmic order was quite different from the order of things on the surface of its central drum. The *kosmos* was a slightly flattened — i.e. a little bit egg-shaped — sphere, completely surrounded by the Boundless (perhaps at a distance of thirty-six Earth diameters in all directions?).^{xxi}

4. The Boundless and the Birth of the World

Anaximander's earth-drum was not *floating* in water. The Mediterranean Sea was in the middle of his tripartite map; and Ocean was all round the map; but Ocean did not have to be (and perhaps it was not) *on* the drum head. Like the Earth, the surrounding Water probably stayed where it was because that was the place that it was held in. All round it (above, below, and on the horizons) were spheres of dark air and bright fire. But none of them were deathless (or "divine"). The divine governing power was a "boundless" or "infinite" substance which encompassed the whole system of determinate (finite) elements.

The postulation of the Boundless (*Apeiron*) was Anaximander's second great leap of imaginative understanding. First, the Boundless was literally (spatially) *infinite*. Secondly, it was an intellectual kind of substance. It had no determinate *sensible* appearance of its own. All sensibly determinate things or states emerged out of it, and (in their due time) returned to it. It was a material substance, and all forms of matter originated from it. Thus we can reasonably claim that the

Boundless was the original material cause in Aristotle's sense; but that was not what was most important about it for Anaximander.

To insist on what Aristotle said about it, is to miss the most important point. "Things" *originate out of* the Boundless, because *it makes them do so*. Anaximander thinks of the relation between the Boundless and the *kosmos* like a "theologian," rather than as a "physical theorist." *Kosmos*-formation begins when the Boundless "ejaculates" a seed from which "the Hot and the Cold" develop (A 10).^{xxii} It does this (or has done it) an infinite number of times.

We do not strictly have to say that the Boundless is spatially infinite just because of the claim that it generates an infinite number of worlds; for Anaximander was probably thinking first of an infinite *sequence* of worlds. It is quite clear that the Boundless is "immortal," i.e., *infinite in time*. Aristotle says that Anaximander called it "deathless and imperishable" (A 15); and Hippolytos reports that it was "eternal and ageless" (A 11)^{xxiii} But the argument for its spatial infinity is also very powerful.^{xxiv}

In the first place, the claim that the Earth need not rest on anything comes from a mind that is aware of the problem about the infinite regress of "bearers." So when the Earth is viewed as the center of a spherical system with several levels ending in the "Boundless," the question "Does the Boundless *go on extensively* for ever?" must naturally occur to Anaximander.

When we take account of the fact that the Boundless is not just a reservoir, but a controlling generative power, it seems highly probable that Anaximander supposed that it has produced or is producing other world-systems elsewhere. He certainly did not think of Earth, Air, Water and Fire as eternal natural *elements*. They were "opposites" which "separated out" of the Boundless. Perhaps he had already *identified* them as "the Hot (Fire), the Cold (Air), the Wet (Water) and the Dry (Earth)";^{xxv} but in any case, it was the abstract opposites that were important in his thought. He was the thinker who called the "divine origin" the *arche* (beginning, principle); and as he saw it, things could not "begin" with any of the great visible *parts* of the world system, because it was the

natural tendency of each to consume or transform the others. Earth eats up the rain, water puts out fire, and fire turns a pot of water into steam (i.e. “air”).

We can see one of the main reasons why Anaximander postulated the Boundless in the very words of the one fragment from his book that has come down to us. Simplicios (relying on the account given by Aristotle’s pupil, Theophrastos) reports:

He was the first to introduce this word *arche* [beginning, principle]. He says that it is neither water nor any other of the so-called elements, but another infinite [*apeiron*] nature out of which all the heavens and the *kosmoi* in them come to be. But *coming to be and destruction for the things that are is out of and into the same things in accordance with what must be. For they give justice and reparation to one another for their injustice in accordance with the ordering of time.* He speaks thus in rather poetic terms (A 9).

Whether everything that I have italicized is a direct quotation is a highly controversial matter. Some scholars accept only the second sentence (or the second sentence with “in accordance with what must be”). I have taken the generous view, because even if the statement about “coming to be and destruction” is not a direct quotation, it certainly conveys Anaximander’s own views. We can be sure of this, because it does not connect directly with what Simplicios says in introducing it. We *expect* the “rather poetic” quotation to be about the Boundless — which is absolutely unique and singular. But instead it is about a set of plural things that come to be from other things and pass back into those things when they are destroyed. This cycle of coming-to-be and passing-away is “in accord with what must be” (*to chreōn*);^{xxvi} and in the cycle, these same things “give right (*dike*) and penalty (*tisis*) to each other for their wrongdoing (*adikia*).” This happens “according to the *taxis* [the arrangement in order] of time.” The Boundless appears here only as the implied source, or maintaining cause, of “what must be” or of “the *taxis* of time.”

The “*taxis* of time” is enormously influential in Anaximander’s mind. There is a stable temporal order of things in our world. Partly it is an order in which the things change their places, but do not apparently change in themselves. Day and night, the Sun, Moon and stars, come and go; but they seem to be just the same at each new appearance. The temporal order of *mortal* things is different. Spring brings new plants and insects; winter sees them die. Other living things grow and decay over a number of seasons; but they are changing all the time, and nothing lasts for ever.

Anaximander asked himself how far this “arrangement of time” extends, how far the cycle of generation and decay is “what must be” universally. And he concluded that generation and decay are indeed universal. All *permanence* is seasonal and cyclic. *Inside* the world-system, everything comes to be from something else; and it eventually passes back into that other thing “when its time is up” — i.e., the other thing comes to be again out of it.

It is not clear how Anaximander conceived these things that come out of one another reciprocally. Reflection on our reports suggests such “things” as “light and darkness”; reflection on the most obvious *taxis* of time suggests “spring, summer, autumn and winter”; the subsequent tradition of physical speculation suggests the “opposites” hot, cold, wet and dry; what we know about Thales suggests earth and sea. It is safest to assume that Anaximander was conscious of all of these shapes of alternation, and that he had not yet begun to sort them out.^{xxvii}

The most important pair of opposite “things” was certainly “life and death.” We cannot be quite sure that Anaximander believed in the *spatial* infinity of the Boundless, because it is so clear that he believed that world-systems *lived and died*. In this limit-case of cosmic generation and destruction, the Boundless itself becomes one of the opposites. World-systems come into being *out of* the Boundless; and they pass back into the Boundless when they perish. They come into existence gradually — like eggs hatching; and in the end they decay and die. While they exist, the Boundless — which has produced them — maintains “right” in their internal relations. It keeps any opposite from going too far. It causes the tides to turn, and the seasons to change.

But cosmic justice is very rough and ready; Thales probably knew that “Libya” was bounded by a great desert waste, in which water and plant life were rare and localized. Xenophanes knew that fossilized sea-shells were found on high ground. Herodotos (II, 12) reports this from Egypt. Did Thales also hear about this (or see it himself) in Egypt? and did Xenophanes first learn of it from Anaximander’s book, rather than from the observations that he made or heard about in Sicily, Paros and Malta (21 A 33)? We simply do not know.

That the relations of Earth and Sea were temporally cyclic, like the small-scale seasons that govern all human, animal and plant life, is a hypothesis that would have occurred readily enough to Anaximander as soon as he had any evidence to suggest it. For he postulated the *birth* of our world-system as a whole, without any evidence at all. Later students thought that his Boundless was a “mixture.” But Anaximander seems to have said that it was a divine power which “encompasses” the world system, and “steers” the process by which the world is “separated out” from the Boundless (A 15).^{xxviii} The “steering” of our world-system towards maturity began when “the germ of hot and cold from the eternal was separated at the birth of this cosmos, and from it a ball of flame grew round the air about the earth, like bark for a tree. When this ball burst and was enclosed in certain circles, the sun, moon and stars came into existence” (A 15).^{xxix} We have to say “bark for a tree” here; but the Greek *phloios* covers *any* organic containing membrane. Anaximander thinks of his drum-like earth and sea (which are cold) being initially contained within an unstable shell of fire and air (hot). This shell bursts apart into distinct layers. Perhaps (as Guthrie suggests) Anaximander imagined it as incubating like an egg in the womb of the Boundless.^{xxx} The process began because the Boundless *ejaculated* something that divided spontaneously into a cold-wet core, and a hot-dry skin. Both parts then differentiated further, into solid and liquid layers in the core, and hot-bright and cool-dark layers in the skin.

5. Mortal Life

The Boundless is the immortal life principle that Thales was looking for in nature. Anaximander expels it out of the order of nature altogether. Everything in the order of nature is mortal. Thales can still claim that there is life in the magnet, or the amber; and Anaximander will agree that all finite organic life came originally out of the sea. But these finite living forces are not *immortal*. It is not true that “all things are full of gods.” “The All” is God, unique, all-encompassing and invisible. It “lays its eggs,” so to speak, everywhere in itself.^{xxxix} There are an indefinite number of them, at all stages of evolution; and as they die (“according to what must be, in the *taxis* of time”) others are generated. *This* will go on for ever. For in time certainly, the God is Boundless. Probably he is Boundless in space as well. Certainly he is Boundless with respect to the senses. He is beyond all of the sensible shapes that succeed one another in the ordering of time. He establishes a world in which finite life can exist; and he maintains stable justice between the forces that are born out of, and pass back into each other, so that finite life can maintain itself, and the finite justice of mortal human communities can be established.^{xxxix}

First, however, we must see how ordinary organic life is generated. Our reports do not tell us anything about plant life. Perhaps Anaximander took it for granted that Mother Earth produced all that spontaneously. Perhaps he said nothing. All of that was simply “in accord with what must be.”

If we believe that the warning of an impending earthquake, which Anaximander gave when he was in Sparta, was based upon empirical evidence (A 5a), we can be sure that he was a keen and knowledgeable observer of the behavior of animals. He seems to have assumed that all animal life originated in the sea. This assumption looks like a conscious development of the theology of Thales, since Anaximander supposed that the sea — or, perhaps, fresh water in a muddy pool — was endowed with the capacity to produce many forms of animal life spontaneously, including some forms that were capable of living and reproducing on land when they reached their proper maturity. It was apparently “Air” that was the “soul” for mortal things (A 29);^{xxxix} but the first living creatures were formed in the sea like little world-systems. Their outer membranes had spines or prickles, like sea-urchins; and before they burst, they rolled out of the sea onto the land. Human generation involved a more complex process; *humans* arose as “fish or animals very like fish, out of heated

earth and water.” The fish-mothers retained them until they reached puberty; and then broke open and sent them forth able to look after themselves (and to breed).^{xxxiv} Anaximander needed a special account of the first genesis of humans, because of our long and helpless infancy period. Plutarch caps the account with an amusing piece of piety: Anaximander is supposed to have discouraged us from eating our primal parents. But this would have been a hard counsel to follow in the Hellenic world; so perhaps, in fact, it is just what he didn’t do (A 30, A 10).^{xxxv}

This theory cannot be counted as a properly evolutionary concept of life (though Anaximander has sometimes been mentioned in the prehistory of the Darwinian hypothesis). Anaximander is only helping out a general view that “life originates in the moist” (which Aristotle was the first to project back upon Thales, for reasons that are now apparent) with *ad hoc* hypotheses to explain life on land, and especially human life. The hypotheses are a testament to the fertility of his imagination, but as feats of creative thought they cannot rank with the stationary, but unsupported, Earth, or the invisible, non-sensible Boundless.

6. The End of the World

As we have noticed, the justice of “what must be” is rather rough and ready. Parts of the Earth are completely parched and desert; Miletos itself, a port where land-routes connect with the ships of mainland Greece and the islands, was steadily silting up. In general, Anaximander thought that water, the source and essential nourishment of mortal life, is drying up and running short. The sea, as it now exists in his time, is only a “small remainder of the primal moisture, the greater part of which has been dried up by the fire” (A 27 end).^{xxxvi} Aristotle tells us that “those wiser in human knowledge . . . say that, at first, the Earth was surrounded by the wet. Then the sun began to dry it up, part of it evaporated and is the cause of winds, and the turnings back of the Sun and Moon, while the remainder forms the sea. So the sea is being dried up, and is growing less, and will end by being some day entirely dried up” (*Meteorologica* 353b).^{xxxvii} The bit about “the turnings back of the Sun and Moon” did not come from Anaximander’s book, though it may come from his younger

contemporary Anaximenes. But the rest fills out Anaximander's view of how the world dies quite nicely. Cosmic justice, and the ordering of time, will eventually break down. When all the water is devoured by the fire, there can only be one season of perpetual heat. At this stage, we must suppose that first the air, and then the Earth is consumed; and "the hot," the triumphant "opposite," passes back into the Boundless, as the only "opposite" that it now has.

This last part is all guesswork. We have only the words of the fragment and the analogy of how the world-system begins, to go on. But it is at least a plausible, and not unworthy conclusion for Anaximander's cosmic drama. The heating and evaporation of water was essential, as Anaxagoras thought, for the original genesis of life (A 11). So the cosmos must begin to die in order that we may live at all.

Notes

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- i. Herodotos I, 170; Diogenes Laertios I, 25.
 - ii. Plutarch, Solon 2. The olive-press story goes back to Aristotle's time at least. Aristotle cites it as evidence that "philosophers can easily be rich if they like" (11 A 10, *Politics* 1259a). But Aristotle himself thought that it had simply been fastened onto Thales.
 - iii. Plato lets Sokrates tell this one — see *Theaetetus* 174a. (Aristophanes told a ribald story of the same sort against Sokrates — *Clouds* 171-3.)
 - iv. Compare Guthrie I, 51 and Barnes, 65.
 - v. Diogenes Laertios I 23 (Barnes, pp. 61, 65). Diogenes says that the *Nautical Astronomy* was actually by Phokos of Samos.
 - vi. For a convenient brief survey, see W.K.C. Guthrie I, 52-54. The Proclus passages are given in Barnes, 64. (See also Diogenes Laertios I, 24 — on Pamphila — Barnes, 66.)
 - vii. This can be done by applying the theorem that triangles with one side and two angles equal are congruent. For a diagram see R. McKirahan (1994, 26). The examples illustrate Thales' probable attitude to geometry. He did not "prove" theorems; but he saw ways of applying some theorems that he was able to grasp intuitively.

- viii. Barnes, 64. Heracleitos seems to have alluded to this dictum in D.-K. 22A9.
- ix. For the lodestone, see Aristotle *On the Soul* 405 a 19-21. Diogenes Laertios mentions amber also (A 1, 24), and since he gives “Aristotle and Hippias as his source, we can certainly trust him this time.
- x. See especially *Iliad* XIV, 201, 246: Ocean and his consort Tethys are the “begetter and mother” of the Gods. Cf. Aristotle *Metaphysics* A 983b.
- xi. That the Earth is in a great sea — above as well as below — is a feature of many Middle Eastern Creation myths. We find it in *Genesis* for instance. Thales may, very probably, have heard more than one version on his travels. But, since we never hear of “the waters above the firmament” in any of our reports about him, I have eschewed all speculation about that. Aristotle says *positively* that Thales thought the earth could “float like a log” (11 A 14, *On the Heavens* 294 a 28-34). In that case, he was not supposing that the world was a cosmic egg, completely immersed in water.
- xii. By his day “Homer” was probably written down, and could be read. But whether Thales did “read” Homer is a matter of speculation.
- xiii. The “Boundless” of Anaximander does satisfy Aristotle’s assumption (perhaps); and the “Air” of Anaximenes certainly answers the “original stuff” question. But this question was *not* the primary one for them; and for some of the later thinkers Aristotle’s question does not correspond with their way of regarding the world at all.

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- xiv. Diogenes Laertios II 2 (Barnes, 71).
- xv. The last “Ionian” philosopher — Diogenes — probably came from *this* Apollonia; so perhaps Anaximander left some “inquiring” friends behind in the colony.
- xvi. Herodotos, II, 109. Thales also was credited with “gnomon” studies and experiments (see 11 A 1 and 12 A 26). Probably they worked together; and their knowledge may have been derived originally from Babylonian travellers visiting Miletos. (According to Pliny the Elder — 13 A 14 — it was Anaximenes who set up the *gnomon* at Sparta. But we hear nothing else about *his* travels; so it is wiser to trust the reports about Anaximander. But probably the researches that Thales began went on without a break.)
- xvii. A 11, A 18, A 21 and A 22 (Hippolytos and Aetios); A 10 (Ps. Plutarch); A 25, Aetios — Barnes, 71-72. Whether the expression “breathing-holes” really comes from Anaximander’s book is uncertain. There is confusion in the reports about the diameters of the higher spheres; and no actual dimension is given in Hippolytos for the lowest sphere of the stars. There are also a number of confusing, and probably confused reports about the heaven — or heavens — of the stars. Quite probably, Anaximander did not give a dimension for this lowest heaven, because he thought that the “stars” — meaning what we call “the planets” — were at several different distances. It seems to me eminently likely that he already had a view of the *fixed stars* like that which we shall find in Anaximenes (but see note 21). The problem of the “heavens” is all mixed up with that of the multiplicity of the worlds — see Guthrie I, 106-115. (For an excellent account of the confusions in the sources, of all the possible interpretations, and of what is surely the most reasonable among them, see G. Naddaf, 1998.)

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- xviii. Simplicios (Guthrie I, 93). Eudemos of Rhodes was a student in Aristotle's school (the Lykeion) who composed a "History of Astronomy" — and for him "the planets" included the Sun and Moon.
- xix. In Anaximander's scheme both the Sun and the Moon (as "planets") were further away than the "stars." According to several testimonies that depend on Theophrastos, the "stars" include the *fixed* stars; but my hypothesis here is that this tradition is mistaken. Eudemos, who counted Anaximander as "the first to discuss the size and distance of the planets," is much easier to interpret plausibly. Even in the work of the later Pythagoreans Philolaos and Archytas, only Sun and Moon would have entered into calculations of *size*. (It is interesting to wonder whether, with the postulate that the Sun's diameter equals that of the Earth, and the engineering mathematics of Thales, Anaximander could have arrived at the number 27 for the radius of the Sun-sphere by an approximative calculation that satisfied him. He was certainly looking for a power of three on *a priori* grounds. His reasoning may have gone the other way: from the assumed 27 Earth-diameters to the conclusion that the Sun has the same diameter as the Earth.)
- xx. Barnes, 74. Since I want to emphasize that the Boundless is *divine*, it is only right to point out also, that Anaximander's theory abolishes the mythical view of the world as divided into the regions of the Gods (Heaven and Underworld) and mortals (the Earth, Sea and Air in between). The concept of *full* homogeneous *space* is before us. (Anaximander does not think the Earth is in the center simply on mathematical *a priori* grounds. It is held in that place *physically* by everything round it — and ultimately by the surrounding Boundless.) The *kosmos* of Thales was consistent with the world of the myths; that of Anaximander is not. (Compare J.P. Vernant, 1983, 178-80.)

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- xxi. The query shows that this part of my proposed reconstruction is a pure hypothesis. The boundary of the *kosmos* would have to be marked by the Fixed Stars. For Anaximander's world-view this is flatly contradicted by the testimony of Hippolytos and Aetios (who locate the Fixed Stars in the innermost sphere). But their reports are confused, and Anaximander must have had some way of deciding where the outer surface of his world-order was — see C.H. Kahn 1960, 61-62 for the texts and 86 for the translations. My attachment to the view that Hippolytos and Aetios were mistaken, springs partly from the further hypothesis of an *outer* Sphere of Fixed Stars, that Pythagoras took over from Anaximander's *kosmos* directly. It was certainly some "Pythagorean" who posited a *spherical Earth* at the center. For a relatively *neutral* discussion of *this* question see Kahn, 1960, 115-117. (My readers should take careful note that all of the "experts" — and the authors of all the other books — accept the testimony of Hippolytos and Aetios without question. But the implicit problem is so immense that we *ought* to be wondering what Theophrastos might have written that could easily be misunderstood. Anyone who stayed awake for just one moonlit night, seriously observing the sky, could establish that the Fixed Stars were beyond the Moon; and Anaximander was a map-maker.)
- xxii. For the justification of my use of "ejaculation" see C.H. Kahn, 1960, 156.
- xxiii. Aristotle, *Physics* 203 b 13; Hippolytos, *Refutation* I 6 (Barnes, 75, 71). Diels gives both sets of adjectives as Anaximander's own words (B 2, B 3).
- xxiv. Guthrie (I, 85) thinks that the concept of spatial infinity required further advances in mathematics. But the arguments that lead from the opposites to the Boundless as "principle," and the sequence of the spheres that lead us to the Boundless as "encompassing," both point towards its spatial infinity. Anaximander was a good reasoner with a mathematical turn of mind. One cannot sensibly formulate the question "What is

beyond (or outside) the Apeiron?” — as one could ask “What is *under* the primal water?” *If anyone had asked Anaximander about it, he would surely have said “it goes on and on forever”; and if he did imagine it as “a vast sphere” (as Cornford suggested with Guthrie’s tentative approval — I, 85) then he would naturally have asked himself “What is the Sphere in? — and would have recognized that giving the Boundless a shape makes the postulate itself pointless. What is probable is that “spatial infinity” remained vague and indefinite, whereas “temporal infinity” forced itself into clear consciousness because of our human resentment of death, and our envy of the “Immortals.”*

- xxv. He *need* not have done this; and there are obvious reasons why he may not have done it. Specifically, the “opposites” can be differentially present in the “elements” (once they are distinguished). Water can be hot, earth can be wet etc. (I shall make no assumptions about this question. We can give a plausible account of Anaximander’s views without deciding it. For a good discussion of the “four elements” see C.H. Kahn, 1960, 119-63. The simple rule-of-thumb for a beginner is that the “elements” belong to Empedokles and the Italians after him. The Ionians always continued to believe in a “prime matter” that was completely plastic.)
- xxvi. I generally write *ch* for the Greek *chi* and *k* for the Greek *kappa*. (But I make an exception for names in which the customary use of *c* for *kappa* has resulted in a familiar *s* sound in the pronunciation. I see no harm in writing “Sokrates”; but it would be foolishly pedantic to change Thucydides or Simplicios.)
- xxvii. This assumption is “safe” because it enables us to be as economical as possible in our postulations when we interpret the actual remains.

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- xxviii. Aristotle, *Physics* 203b, Barnes, 75; Guthrie I, 87-88. We find the “encompassing” description in Anaximenes; the “steering” metaphor (but with a different word for it) is in Heracleitos. But Anaximander is the only member of the early group that Aristotle mentions. It is likely that he was the first to speak of the “immortal, imperishable and divine Boundless” in both of these ways. Both functions appear to be logically necessary to his view.
- xxix. Ps. Plutarch (Barnes, 72-73).
- xxx. Guthrie — I, 91 — thinks the “tree” may have been added to the *phloion* by Theophrastus — but compare the tree metaphor of Pherecydes. Given the columnar shape of the earth the idea may have occurred to either author. But the outer membrane of “flame” is a “ball” — so we can see why Guthrie is doubtful. (C.H. Kahn — 1960, 55-56 — is right to defend *to schema hygron* — “in shape it is watery” — as in the manuscripts of Hippolytos. The Earth is certainly “round” (*gyron*) — but its circularity is defined by Ocean, which flows round a land-mass that is not so regular.)
- xxxi. Anaximander apparently did call the *cosmoi* “gods” (A 17). But the whole problem is obscure — see Guthrie, I, 107, 112.
- xxxii. I say “he” because “Time” is masculine, and maintaining “justice” was a masculine function. But laying and incubating eggs is a female function; and “what must be” like the Apeiron is neuter. Perhaps we ought to say “it”; but the theists who came later (Pythagoras, for example) would have said “he.”
- xxxiii. In view of the importance of “the Wet” in Anaximander’s theory of life, we have to admit

that the Air-concept of Soul *may* have been projected back upon Anaximander from Anaximenes. But Kahn (1960, 114) points out that the breath-soul was a belief of the early Orphics (1 B11 — Aristotle, *On the Soul* 410 b 29).

xxxiv. Plutarch mentions the *galeos* (smooth dogfish) as a model. If Anaximander already knew all or most of what Aristotle knew about this creature, then we have again some evidence that he was a serious biological observer. But we should be very cautious about assuming too much here. Some of what Aristotle “knew” is quite false, so a first origin of his views in older folk-mythology is probable (see Guthrie I, 103-104).

xxxv. Barnes, 73-74. The first two sources in A 30 are Aetios and Censorinus. (Plutarch’s own report would make better logical sense if we suppose that a negative has fallen out: “just as fire consumes the father and mother from which it is kindled . . . so Anaximander does <not> put us off from eating fish” — cf. Guthrie’s note, I, 103.)

xxxvi. From Aetios — see Guthrie, I, 92.

xxxvii. We learn from Alexander of Aphrodisias that Theophrastos ascribed the view that the sea will dry up to Anaximander (12 A 27). The bit about the winds, and the turnings of the Sun and Moon, probably came from Anaximenes. (Diogenes of Apollonia returned to Anaximander’s view that the sea would dry up — 64 A 17.)