



BRILL

Was Anaximander an Evolutionist?

Author(s): J. H. Loenen

Source: *Mnemosyne*, Fourth Series, Vol. 7, Fasc. 3 (1954), pp. 215-232

Published by: [BRILL](#)

Stable URL: <http://www.jstor.org/stable/4427615>

Accessed: 24/04/2014 01:05

Your use of the JSTOR archive indicates your acceptance of the Terms & Conditions of Use, available at
<http://www.jstor.org/page/info/about/policies/terms.jsp>

JSTOR is a not-for-profit service that helps scholars, researchers, and students discover, use, and build upon a wide range of content in a trusted digital archive. We use information technology and tools to increase productivity and facilitate new forms of scholarship. For more information about JSTOR, please contact support@jstor.org.



BRILL is collaborating with JSTOR to digitize, preserve and extend access to *Mnemosyne*.

<http://www.jstor.org>

WAS ANAXIMANDER AN EVOLUTIONIST?

BY

J. H. LOENEN

I. Status quaestionis

It might be doubted whether there is still reason to study in detail the relation between the biological fragments of Anaximander and the modern theory of evolution. On the other hand, it may be stated that even among authorities there does not exist any agreement on this point. What is more, one makes the somewhat unexpected discovery that no detailed analysis of the biological fragments is to be found in relevant works and articles. Now, opinions may be divided into two groups: the first claims to find biological evolution in the fragments of Anaximander, though in a varying degree, the second refuses to admit any resemblance with modern theories. To the first group may be reckoned such authorities as Überweg-Prächter ¹⁾, Burnet ²⁾ and Diels ³⁾, also Gomperz ⁴⁾, Capelle ⁵⁾ and de Raedemaeker ⁶⁾, and in our country Koster and de Vogel ⁷⁾, though complete evolutionism in the

1) "... hat man nicht ganz mit Unrecht eine gewisse Ähnlichkeit mit der Deszendenztheorie zu finden geglaubt" (Überweg-Prächter, p. 49).

2) "It is sure that Anaximander had an idea of what is meant by adaptation to environment and survival of the fittest and that he saw the higher mammals could not represent the original type of animal" (*E.G.Ph.* 4th ed., 1945, p. 71).

3) "... so nahm Anaximander an, dass auch die Organismen auf der Erde, vor allem der Mensch, eine allmähliche Entwicklung durchgemacht haben ... Sie mussten dem neuen Elemente entsprechend fischartig gebildet sein. Dann aber, als die Erde mehr und mehr austrocknete und die Fischmenschen sich dementsprechend umgebildet hatten, ..." (*Anaximander von Milet*, Neue Jahrb. f. d. klass. Altertum, 1923, p. 73).

4) Th. Gomperz speaks of him as "der erste Darwinist" (*Griechische Denker*, Leipz. 1911-12, I, p. 196).

5) W. Capelle mentions his "denkwürdige Deszendenztheorie" (*Die Vorsokratiker*, Leipz. 1935, p. 88, n. 2).

6) The Belgian author F. de Raedemaeker says in a recent work that Anaximander even surmised the theory of evolution (*De philosophie der Voorsocratici*, Antwerpen-Amsterdam, 1953, p. 35).

7) W. J. W. Koster (*Fragmenten van Griekse denkers voor Socrates*, Zwolle,

strict modern sense is not defended by any author, and opinions even widely differ as to the details of the theory. Most authors restrict the comparison with Darwinism more or less, the result being somewhat vague. The second group, including Zeller¹), Rodemer²) and more recently Rudberg and Erhard³), is far smaller in number. So current opinion still seems to be in favour of an evolutionist interpretation of Anaximander. This being the situation, a careful analysis of all data does not seem to be superfluous.

II. An analysis of the data

From the start it should be emphasized that one condition should be fulfilled. It is necessary to disengage ourselves methodically from the basic idea of modern evolutionism and from our own self-evident opinions, in order to understand Anaximander from his own words and from the basic opinions of contemporary Greek thought.

2nd ed. 1949, p. 29) gives the relevant fragments under the head: theory of evolution, as well as C. J. de Vogel (*Greek Philosophy*, I, *Thales to Plato*, Leiden 1950, p. 8).

1) "... so wird doch diese Ähnlichkeit durch eine genauere Betrachtung derselben wesentlich eingeschränkt" (Vortr. u. Abhandl. III, 1884, p. 38). He thinks there is no question of an evolution of *species* (p. 37).

2) "Ihn aber als Vorgänger solcher Deszendenzlehren zu feiern, wäre durchaus verfehlt" (*Die Lehre der Urzeugung bei den Griechen und Römern*, Giessen 1928, p. 8. Only an extensive summary of this thesis has been published).

3) G. Rudberg, *Biologie und Urgeschichte im ionischen Denken*, Symb. Osl. 20 (1942), p. 1-20 (cf. his earlier article, written in Swedish, *Anaximandros' biologi*, *Eranos* 20 (1921-22), p. 51-57). Only p. 1-4 concern Anaximander's biology. Rudberg concludes: "In Anaximandros' biologischen Fragmenten liegt eigentlich nichts von der modernen Evolutionslehre, sondern ein Versuch, in Anschluss an altem Volksglauben, die Genesis und der Fortbestand des Menschen, und z.T. auch der höheren Tiere, trotz ihrer physischen Wehrlosigkeit zu erklären" (p. 20).—H. Erhard, *War Anaximander Deszendenztheoretiker?*, *Archiv (Sudhoffs) f. Gesch. d. Mediz. u. Naturwiss.* 33 (1940), p. 107-111. This zoologist opposes the opinion of the historian of biology E. Nordenskiöld (*Die Geschichte der Biologie*, deutsch von G. Schneider, Jena 1926).—O. Gigon (*Der Ursprung der Griechischen Philosophie*, Basel 1945) gives his opinion not explicitly, but his short survey of Anaximander's theory seems the opposite of an evolutionist interpretation.

There are in Diels three numbers (all of them A-fragments) which directly concern the origin of organisms: A 10 from Pseudo-Plutarch, A 11 from Hippolytus, A 30 with texts of Aetius, Censorinus and Plutarch. Thus we have five fragments in all. A first important division can be made between those fragments which exclusively concern man (Hippolytus partly, Pseudo-Plutarch, Censorinus and Plutarch) and those dealing with living beings in general (Hippolytus partly, Aetius). It seems best to start our analysis with those referring to men.

(1) An analysis of the data concerning man. We find the following statements. Hippolytus ¹⁾: originally man resembled a fish (A 11). Pseudo-Plutarch ²⁾: man originally was born from living beings of an other species, because man alone of all living beings needs long care in infancy; therefore he would never have survived, if he always had been as he is now (A 10). Censorinus ³⁾: from water and earth originated first, under the influence of the heat of the sun, fishes or fish-like creatures; inside them men came into being and they remained there till the time they had grown up; then the fishes burst and adult men and women who henceforth could feed themselves made their appearances (A 30). Plutarch ⁴⁾: originally men came into being inside fishes and having been fed like sharks they came out as soon as they were able to look after themselves and went ashore. We can say that the general meaning of this remarkable theory is fairly clear: the first men came into being inside fishes, as a matter of fact inside sharks. Even the

1) τὸν δὲ ἄνθρωπον ἐτέρῳ ζῳῷ γεγονέναι, τουτέστι ἰχθύι παραπλήσιον κατ' ἀρχάς (A 11, par. 6, 2nd part). Only an exact paraphrase, not a translation of this and the other fragments is intended.

2) ἔτι φησίν, ὅτι κατ' ἀρχὰς ἐξ ἁλλοειδῶν ζῳῶν ὁ ἄνθρωπος ἐγεννήθη, ἐκ τοῦ τὰ μὲν ἄλλα δι' αὐτῶν ταχὺ νέμεσθαι, μόνον δὲ τὸν ἄνθρωπον πολυχρονίου δεῖσθαι τιτηνήσεως· διὸ καὶ κατ' ἀρχὰς οὐκ ἂν ποτε τοιοῦτον ὄντα διασωθῆναι (A 10, fin.).

3) A. Milesius videri sibi ex aqua terraque calefactis exortos esse sive pisces seu piscibus simillima animalia; in his homines concrescisse fetusque ad pubertatem intus retentos; tunc demum ruptis illis viros mulieresque qui iam se alere possent processisse (A 30).

4) ἐν ἰχθύσιν ἐγγενέσθαι τὸ πρῶτον ἄνθρώπους ἀποφαίνεται καὶ τραφέντας ὥσπερ οἱ γαλεοί, καὶ γενομένους ἱκανοὺς αὐτοῖς βοηθεῖν ἐκβῆναι τηνικαῦτα καὶ γῆς λαβέσθαι (A 30, partly). It may be remarked that γαλεοί is a now generally accepted correction by Emperius for the ms. παλαιοί. Zeller still read παλαιοί and this is the main reason that his analysis was not right.

reason has been preserved in the testimonies: Anaximander noticed that the young of the human species require a prolonged period of nursing. As a result of comparatively recent studies we know with reasonable certainty why Anaximander chose sharks for his purpose. Aristotle already knew—and modern biology has confirmed this—that the so-called *galeus levis* is viviparous, though it is not a mammal. Its young are born from eggs inside the mother's body, which bears the young in the same way as mammals do, till they are able to look after themselves¹). Then they are "born", i.e. they come out. Already Anaximander seems to have known this, and he undoubtedly thought he had found here the animal that could have taken care of the first newborn men. So the general meaning seems to be clear.

As to the details, however, some critical remarks have to be made and some questions to be asked concerning statements which are evidently contradictions or seem to be so. (a) Hippolytus says that man originally resembled a fish, Censorinus states that inside fishes (or fish-like creatures) men were born, who after having grown up made their appearance as men and women. On this point Censorinus and Hippolytus flatly contradict each other (no evolution—evolution). (b) Pseudo-Plutarch says that man was born from (ἐκ) living beings of an other species. Censorinus says: inside fishes (in his), and so does Plutarch (ἐν ἰχθύσιν ἐγγενέσθαι). This seems to be a contradiction; at first sight the meaning of ἐκ is not fully clear: the fish can be the *generating cause* of man, man being born from a fish-egg, or ἐκ may indicate only the place from which man came. Closer inspection, however, makes the first possibility more probable. In fact, there seems to be a fundamental difference between Pseudo-Plutarch and Censorinus: the words τοιοῦτον ὄντα of Pseudo-Plutarch ("when he had been always as he is now") seem to imply that primitive man was biologically different from modern man. Combining this with the words ἐξ ἀλλοειδῶν ζώων we probably have to conclude that Pseudo-Plutarch ascribes to Anaximander

1) Cf. Arist., *Hist. Anim.* Z, 10, 565 b 1 and Plut., *De Soll. Anim.* 33, 982 A. It is a wrong idea that the sharks carried the young in their mouth, as De Raedemaeker thinks (o.c. p. 35); cf. also Burnet, l.c.

the theory that man has evolved from a fish into the modern type of man. In Censorinus, on the other hand, the idea of evolution seems to be absent. So the sources on this point may be divided into two groups: Hippolytus and Pseudo-Plutarch think that primitive man resembled a fish and developed into modern man afterwards, Censorinus and Plutarch say definitely that men (notice the plural) were born inside fishes, clearly not assuming evolution (unless one feels inclined to ascribe to Anaximander the theory of an evolution from fish-egg to full-grown man inside the body of the fishes).

So far the analysis of the data concerning man. The interpretation of these data has to be postponed till the evidence about living beings in general has been examined. From a methodical point of view this seems to be necessary, as this remarkable doctrine has to be interpreted in the light of the general ideas about the generation of living beings in Anaximander's time.

(2) An analysis of the data concerning living beings in general. Hippolytus: living beings come into existence when water is evaporated by the sun ¹). Aetius: the first living beings were generated in the moist element, each enveloped in a prickly bark. Growing older they went on dry land and after the bursting of the bark they changed their way of living ²). An analysis of these

1) τὰ δὲ ζῶα γίνεσθαι <ἐξ ὕγρου> ἐξατμιζομένου ὑπὸ τοῦ ἡλίου (A II, par. 6, first part). 'Εξ ὕγρου is a correction by Diels. The mss. have ἐξατμιζόμενα. This correction seems very probable, and in any case the meaning is clear.

2) 'Α. ἐν ὕγρῳ γεννηθῆναι τὰ πρῶτα ζῶα φλοιοῖς περιεχόμενα ἀκανθώδεσι, προβαίνουσιν δὲ τῆς ἡλικίας ἀποβαίνειν ἐπὶ τὸ ξηρότερον καὶ περιρρηγνυμένου τοῦ φλοιοῦ ἐπ' ὀλίγον χρόνον μεταβιῶναι (A 30). Opinions differ as to the meaning of ἐπ' ὀλίγον χρόνον μεταβιῶναι. Others translate: They lived only a short time after (they survived only a short time), a.o. Zeller (*Vorläge*, p. 39) and Liddell-Scott-Stuart Jones (s.v. μεταβιῶ). The argument of Zeller is that ἐπὶ, not μετά or κατά, is used, while he takes μετα- in the sense of "after". His appeal to ἐπὶ, however, seems far from conclusive and the more probable meaning of μετα- certainly is the one indicating a change. On philological grounds the translation "they changed their way of living" therefore seems preferable. Perhaps the reason why Zeller chose his rendering is his wish to exclude the possibility of evolution. When I prefer the other translation, it is partly because I do not want to take a position which excludes this from the start. On the other hand, it should be remarked that μεταβιῶναι certainly cannot mean that the animals changed in a biological sense. On philological grounds it seems quite impossible to ascribe to -βιῶναι any other meaning

statements concerning living beings in general leads to the following conclusions.

(a) It is a point of primary importance that we can establish the fact that man is not included in these living beings. This implies that all animals were originally in a state different from that of man. It is possible that in the statement of Hippolytus, which concerns the mode of generation of living beings in general, man also is included, but it appears from Aetius that the animal's original condition differed from that of man, for he says they were enveloped by a prickly bark before they went ashore. It is quite inconceivable that the first men, who originally lived in the body of fishes, each should have been enveloped inside the fish by a prickly bark. The possibility that the fishes themselves were enveloped by this prickly bark may be excluded, as we shall see below. In connection with man such a bark, which apparently is only useful as long as the animals live in the water, is never mentioned. Man simply had no need of such a bark, because he lived inside a fish the time he spent in the water. So we may say that only the animals are meant in these statements¹⁾ and that the original state of man must have been different.

(b) Secondly it may be asked, whether all animals without any exception are meant. The answer may seem to be trivial, but nevertheless it is perhaps not needless to remark that in the statement of Aetius only those animals can be meant which afterwards went ashore, viz. those which at present live on dry land, the actual land-animals. The statement of Aetius concerns only the circumstances in which the land-animals came into being. So we have to conclude that only the forefathers of the present land-

than to pass one's life (actions of life often being included, cf. *τα βεβιωμένα*: the actions of life, Demosth. 18, 130). Already at this point the evolutionist interpretation of these words can be rejected. Finally, Rudberg (*o.c.* p. 3, n. 2) proposes to translate *ἐπ' ὀλίγον χρόνον* by "allmählig, nach und nach". Certainly this is far-fetched and his arguments are not convincing. So we have to dismiss this explanation too. A definite decision concerning the two possible translations will have to be postponed until later. For the time being I prefer the translation: they changed their way of living.

1) This remark is directed against Zeller, who thought that this text of Aetius refers to man only (*o.c.* p. 39).

animals were enveloped by a prickly bark, not the marine animals¹). As to the statement of Hippolytus the situation is quite different. He speaks about the causes of the generation of the animals, not about the special circumstances in which they lived at first. So we have no reason to think that these causes are not the same for all animals.

(c) At this point a closer inspection of the testimonies referring to these causes is necessary. Hippolytus only mentions evaporation of water. In the statement of Censorinus, however, we find further information. He describes the generation of fishes or fish-like creatures (in which afterwards men came into being) as *ex aqua terraque calefactis*: as the causes are presumably the same for all animals (as we concluded above), we have to take it that all animals came into existence from water and earth through the influence of the sun, i.e. through a process of *abiogenesis* (*generatio spontanea* or *aequivoca*).

(d) Now we come to a fourth point which is once more of primary importance: what precisely are these $\pi\rho\tilde{\omega}\tau\alpha\ \zeta\tilde{\omega}\alpha$? Are they the first specimens of each species of land-animals still existing at present, or are they the first specimens of a few first species of animals, from which later the other species came forth (cp. the polyphyletic form of modern evolutionism), or, thirdly, are they the first specimens of one first species (cp. the monophyletic form of evolutionism)? In the stage of analysis in which we are at the moment, this question cannot yet be answered definitely, but surely there is no indication in favour of the second and third possibilities. Nothing is said about this question, but there are three words in this fragment which point towards the first possibility, viz. $\pi\rho\beta\alpha\iota\nu\acute{o}\sigma\eta\varsigma\ \tau\tilde{\eta}\varsigma\ \eta\lambda\iota\kappa\acute{\iota}\alpha\varsigma$. From this it is evident that it is the very first animals themselves (in every case individually one and the same animal) that first live in the sea and later go ashore. One may safely exclude the possibility that $\eta\lambda\iota\kappa\acute{\iota}\alpha$ could indicate a period of evolution between two species.

1) That this remark is not superfluous may be seen from the following sentence by De Raedemaeker (*l. c.*): "De vissen waren omgeven met een stekelig omhulsel en in dit laatste ontstond de mens" (in English: "the fishes were enveloped by a prickly wrapping and in the latter man came into being").

Neither can the words ἐπ' ὀλίγον χρόνον μεταβιῶναι be taken to point an evolution after the animals went ashore (cp. p. 219, note 2). So, from our analysis alone, we may conclude with probability that τὰ πρῶτα ζῷα are the first specimens of each species of present land-animals.

(e) Finally attention should be called to the fact that, according to the testimonies, all animals really come into being in the water, that is to say, not in the slime of the earth outside the water (as e.g. Zeller thought) ¹⁾ but in the sea. As for man, this is evident, man being born inside a shark. As to the present land-animals, the same seems to appear from Aetius (ἐν ὕγρῳ; without any addition), while there is no difficulty about marine animals. So all organic life originated in the water, i.e. out of water and earth (mud) at the bottom of the sea.

III. Interpretation

We now have to face the problem how to understand this strange theory, according to which all organic life originated in the sea and, moreover, the first land-animals were enveloped by a prickly bark and the first men were born inside the body of fishes. Which is the central idea, the starting-point of Anaximander? We can only solve this problem by means of a hypothesis which may lead to a more or less probable conclusion, depending on its foundation and its capacity to explain all the facts.

Presumably the central idea is Anaximander's conviction that all animal life originated in the sea through a process of *abiogenesis*. If we look at the results of our analysis from a philosophical point of view and do not let our attention be absorbed by the fantastic feature of the original state of man, this is certainly the most striking aspect of the whole theory. Starting from this hypothesis we have to set ourselves two tasks: (1) to look for the reasons why Anaximander is convinced of this, (2) to deduce from this starting-point the conclusions which Anaximander is likely to have drawn.

The first mentioned task can be divided into two sections: the origin in the sea and the process of *abiogenesis*. Why then does

1) Zeller, *o.c.* p. 50, n. 2.

Anaximander think that all animal life originated in the sea? When we look for an answer, the first possibility is that Anaximander was simply convinced of this without further reasons. It could be a pre-philosophic certainty, a primitive and mythological belief, which his philosophic and scientific reflection found no reason to doubt. As a matter of fact we know that this belief did occur in ancient Greece, beside the myth of Prometheus and the one about the γηγενεῖς. This appears from the first part of the fragment of Plutarch in A 30, which has not yet been mentioned. From this we learn that the descendants of Hellen sacrificed to their ancestor Poseidon and worshipped the fish as being of the same origin, because they thought that man was born in the water, as the Syrians did ¹⁾. Hellen was, as the reader knows, the son of Deucalion and Pyrrha, while by οἱ ἄφ' Ἑλλήνων probably the Thessalian tribe is meant, which in Homer (*Il.* 2, 684) is called Ἑλλήνες. In any case it seems certain that it was a primitive Greek conception that men (and to all appearances all animals as well) came into existence in the sea. So it is quite possible that it was a purely mythological residue in Anaximander's theory. Nevertheless we should like to find a reason not in mythology, but in Anaximander's philosophy. And as a matter of fact this is not difficult. We know with certainty that according to Anaximander originally the entire earth was covered by water, and the sea is only the remaining part of this original world-sea, because the sun has dried up its greater part ²⁾. It is quite plausible that there is a logical connection between this idea of an original world-sea and that of the origin of all organic life in the sea ³⁾. We only have to suppose that at this time a part of the earth had already dried up, because otherwise the first land-animals would not have had the opportunity to go ashore προβαίνουσας τῆς ἡλικίας. So we come to the conclusion that the theory of the origin of all organic life in the sea is not necessarily a purely

1) οἱ δ' ἄφ' Ἑλλήνων τοῦ παλαιοῦ καὶ πατρογενεῖω Ποσειδῶνι θύουσιν, ἐκ τῆς ὑγρᾶς τὸν ἄνθρωπον οὐσίας φῦναι δόξαντες ὡς καὶ Σύριοι· διὸ καὶ σέβονται τὸν ἰχθῦν ὡς ὁμογενῆ καὶ σύντροφον (A 30, 1st part). By the Syrians probably the Assyrians are meant.

2) A 27. This number of Diels contains three testimonies from different sources, viz. Aristotle, Alexander Aphrodisias and Aetius.

3) Gigon (*o.c.* p. 95) and Diels (*l.c.*) already connected these two ideas.

mythological belief, though mythology may not be absent from it. Certainly there is a connection with the theory of Thales that water is the ἀρχή of all things. Yet it should be remembered that already Aristotle suggested that Thales might have been influenced by Greek mythology, which makes Ocean and Tethys the first parents of all things (11 A 12). At any rate we may take it for certain that Anaximander thought that all organic life originated in the sea because the entire earth was originally covered by it.

Still more important is the second aspect of the first question: the *abiogenesis* from water and earth under influence of the sun. After the thorough study of W. Rodemer, mentioned above, there can be no doubt whatsoever that this is a conception which has dominated the biological ideas in antiquity from the first pre-Socratics onwards, not only in popular opinion, but even with philosophers. Greek thought never seems to have found difficulties in the conception of *abiogenesis*. Let us cite Rodemer: "Dem ganzen Altertum galt es als selbstverständlich, dass eine Entstehung von Organismen und sogar unorganischen Stoffen ohne einen Fortpflanzungsakt möglich sei, wenn die erforderlichen stofflichen Voraussetzungen und die den Vorgang fördernden günstigen Begleitumstände gegeben waren" (p. 5). Not only the origin of the first specimen of each species was explained in this way: "Man nahm für eine grosse Reihe von Lebewesen, deren Fortpflanzung man der fehlenden Hilfsmittel wegen gar nicht oder nur unvollkommen beobachten konnte, die jedesmalige neue spontane Entstehung als die einzige Fortpflanzungsmöglichkeit an, bei anderen, bei denen man eine Fortpflanzung zwar gelegentlich beobachtet hatte, liess man die Urzeugung neben der geschlechtlichen Zeugung als gleichbedeutendes Entstehungsprinzip bestehen" (p. 6).

The usual form of this theory of *abiogenesis* was the view that organic life originated in the slime of the earth, while the well-known *semina rerum* were sometimes added since the time of Anaxagoras ¹). So we have to ascribe to Anaximander an *abiogenesis*

1) Xenophanes 21 B 29, 33, cf. A 1, 33; Parmenides 28 A 1 par. 22; Empedocles 31 A 70-75, cf. B 57-62; Democritus 68 A 139, B 5 (in all these fragments we find *abiogenesis* in a strict sense). In later times we find this

of living beings out of the earth, within the original world-sea and under influence of the sunheat, as well on account of current opinion about this process in Anaximander's time as on the strength of the testimonies in A 11 and A 30.

And now we can start with our second task. Is it possible to deduce the conclusions which Anaximander may have drawn, and to explain all the facts? Let us turn to the data concerning animals first. The marine animals evidently can have caused no difficulty: they originated in the sea by mere *abiogenesis* and with that their conditions of life were fulfilled. It is in accordance with this conclusion that we have no testimonies about these animals: they simply presented no problem. As for the land-animals however, Anaximander must have met with difficulties: how is it possible that the present land-animals came into being in the sea? There are *a priori* only two possibilities: either they were originally marine animals, that is to say, biologically different from the present ones and have developed from marine animals into land-animals (evolution), or they were originally protected against the water in such a way that they could live in the sea as land-animals (no evolution).

Which possibility should we choose in the light of the available evidence? In A 30 we find the striking and at first sight incomprehensible information that the animals (i.e. the forefathers of the present land-animals, as we have concluded above) were enveloped by a prickly bark, as long as they lived in the water. No doubt is possible as to the authenticity of this testimony. No later writer could possibly have invented such a queer detail. Besides it is probable that the word *φλοιός* has been used by Anaximander himself. In A 10, too, this word appears, in a context which suggests

view e.g. in Ovidius (*Metam.* I 416-421) and in Minucius Felix (*Octavius* c. 5). Anaxagoras thought that the seeds from which the first organisms were born fell from heaven: 59 A 67, 113, 117. Rudberg, too, has seen that the concept of *abiogenesis* is the central point: "In diesen Fragmenten aus der doxographischen Literatur wird also . . . die *generatio aequivoca* behandelt . . ." (*o.c.* p. 4); cf. also Erhard, *o.c.* p. 109. In connection with Anaximander Rudberg has amply discussed the text in Diodorus Sic., *Biblioth.* I 7. We shall have to deal with his view later, but in any case the passage in Diodorus gives a very clear account of the Greek conception of *abiogenesis* in later times.

its authenticity ¹). This information is of primary importance and in my opinion the most valuable item of all data, because it gives a definite foot-hold to the whole interpretation. Any theory which cannot explain this queer feature must be dismissed. The hypothesis of evolution is of no use here and I cannot see any other possibility than the assumption that this prickly bark had to serve the purpose of protection against the water. For as soon as the animals have left the water they lose (or should we say: get rid of?) this wrapping. Perhaps we can even guess with a certain probability, in what, according to Anaximander, this protection consisted. The prickly bark can have served two purposes: because it is a bark, the animals could float on the surface of the water, in this way escaping the danger of being drowned; secondly they could find protection by it, because it is a prickly, thorny bark ²). As to the details of this theory we are left completely in the dark. We would like to know for instance how these animals fed as long as they lived in the sea, and in connection with this, whether there was an aperture in the bark through which they breathed and fed, and finally, what sort of food they lived on. Perhaps we should even ask ourselves, whether they fed and breathed at all. In short, what was this bark like and whence did Anaximander get this idea? We do not know, and I only see a possibility to answer one of these questions: some way or other they must have fed on food they got from outside the bark and by their own efforts. Otherwise Anaximander would have had no reason to ascribe to man an original condition different from that of the other land-animals,

1) In A 10 it is said that, when the cosmos came into being, a sphere of fire enveloped the air around the earth like a bark envelopes a tree. Diels too remarks: "Wohl Anaximandreich, vgl. A 10" (ad A 30).

2) It does not seem possible to connect the word ἀκανθώδης with a part of a fish. As a matter of fact ἀκανθα can mean the backbone or spine of a fish (e.g. Aeschyl. fr. 275; Aristoph. *Vesp.* 969), and in the plural even the prickles or spines of a hedgehog and of certain fishes (e.g. Arist. *Hist. An.* 530 b 8). But this knowledge (to be found in Liddell-Scott-Stuart Jones) leads us nowhere. It would be quite different, if ἀκανθα could indicate the *fin* of a fish, because in that case one could interpret these prickles as a means of locomotion. In that case we would have to consider once more the possibility that the first animals were fishlike creatures. But as far as I know the word never has this sense. So we are simply left with the meaning of "prickly, thorny".

for we know that his reason was the fact that newborn men cannot take care of themselves. So, if the first animals would not have needed food from without, man would not have needed it either in the same circumstances. It follows from this that presumably we should not regard this bark as a kind of shell like a chrysalis has (Zeller evidently followed this line of thought, *o.c.*, p. 39), because a chrysalis takes no food from without, as Aristotle already remarked ¹⁾).

From all this we must conclude that of the two possibilities stated above, the second represents the view which Anaximander must have held: he did not conceive the idea of an evolution from marine animals into land-animals; the first land-animals must have been biologically identical with the present ones and were certainly not "fischartig gebildet" as Diels said they were (cp. p. 215, n. 3). As for the animals, it may be further remarked that we have not the slightest information on which to build a theory of evolution. The evolutionist interpretation of the words ἐπ' ὀλίγον χρόνον μεταβιῶναι has already been dismissed above. Now we are in a position to understand these words in their exact meaning. We know that the conditions of life of the first land-animals must have been unnatural (imagine e.g. a lion enveloped by a prickly bark), and therefore a fairly sudden and fundamental change in their way of living must have taken place. On the other hand, we can see no reason why the animals should have "survived only a short time". So we have to reject definitely Zeller's interpretation of these words (cp. p. 219, n. 2). But in a way we seem to be justified to say that Anaximander had "an idea of what is meant by adaptation to environment" (Burnet, cp. p. 215, n. 2), but certainly not in the modern sense of a biological adaptation, which would imply a process of organic transformation and the origin of new species. Nor is there anything that points to the idea of a survival of the fittest or to the opinion that the higher mammals could not represent the original type of animal, as Burnet thought (*l. c.*). The

1) Aristot. *Hist. An.* V 19, 551 a 23-b 5. From what has been said it may be fully clear that these animals by no means lived "eine Art Parasitenleben in anderen Tieren", as Rudberg thinks they did (*o.c.* p. 3 and 4). Evidently this author has failed to notice the difference between the animals and man in this respect.

prickly bark can only be explained by assuming that for Anaximander the biological identity of the first animals with the present ones was tacitly understood as a fundamental and unquestioned starting-point.

Now we are in a position to interpret the data concerning man in the light of the results obtained above. We have already seen that on this point the sources can be divided into two groups, Hippolytus and Ps.-Plutarch assuming an evolution from fish into man, Censorinus and Plutarch, on the contrary, stating that men were born inside fishes. So we have to find out which group represents the authentic view of Anaximander. Once more we have to place ourselves in the centre of Anaximander's biological conceptions, viz. the idea of *abiogenesis* of all organic life in the sea, this time combined with his statement that the first newborn men were not able to nurse themselves. We understand immediately that the original condition of man must have been different from that of the other land-animals, because otherwise he would have perished instantly. On the other hand, the reason stated does not imply such arguments as would have induced Anaximander to change his fundamental view of *abiogenesis* in the case of man. The one and only difficulty which seems to have occurred to him, was the problem of nursing in infancy. So man, too, has presumably come into existence through a process of *abiogenesis*. Anaximander had only to solve the problem how the first men had been fed, that is to say, he had simply to look for an animal that could have taken care of the young men. We have already seen why he thought that a certain species of sharks was fit for this task. Therefore Anaximander had to assume that the *abiogenesis* of man had occurred inside the body of a shark.

Knowing the boldness of Anaximander's philosophy and his desire for logical consistency we need not be surprised that he did not shrink from the consequences of his original idea. To us this conception may seem very queer and for this reason we might even be inclined to reject the whole interpretation, but we should not forget the above cited conclusion of Rodemer that the Greeks found no difficulty in the concept of "eine Entstehung von Organismen aus organischen und sogar unorganischen Stoffen ohne

einen Fortpflanzungsakt". We are so familiar with the principle *omne ovum ab ovo* that it is difficult for us to imagine that the Greeks knew nothing of the kind. I see no other way but to accept the logic of the preceding conclusions. But we have still to solve the problem, if possible, how Anaximander conceived about the details of this *abiogenesis* inside the sharks. Have we to think that here too the process took its normal course, viz. that man originated out of earth and water under influence of the sun, i.e. out of inorganic substance? Or should we suppose that in this case it was an *abiogenesis* out of organic substance? The first possibility does not seem very probable, and we seem to be left with the second one, but it is possible that Anaximander not even thought about this question. In any case we have to assume at least that a human embryo originated inside the shark, i.e. without this embryo being the result of an act of procreation of the shark, for we can exclude the possibility that Anaximander imagined an evolution from fish-eggs into grown-up men and women inside the body of the sharks, in the short time available for the process. For us such a supposition would be even more problematic and more unintelligible than an *abiogenesis*, because we cannot conceive of an evolution without many links and without the concept of long periods of time. As this is the only alternative, we cannot reject the idea of an *abiogenesis* of man inside the shark on the ground that this is inconceivable for us. The above conclusions really seem to be the only possible ones.

It follows from this that we have to regard the data of Censorinus and Plutarch as accurate ¹⁾. Therefore a false interpretation must have slipped into the doxographic tradition from which Hippolytus and Ps.-Plutarch got their information. Where this occurred we

1) Only the words *ruptis illis* (the fish must be meant) of Censorinus do not seem to be exact. Plutarch does not mention a bursting of the fishes and this idea itself seems rather queer. In my opinion it is easy to explain how Censorinus got this idea: he (or his source) simply transferred the idea of a bursting from the bark, in which the animals were wrapped (*Aetius*, A 30), to the fishes in which men were born. As the words of *οἱ παλαιοί*, instead of *οἱ γαλεοί*, are evidently a very old corruption, the doxographers were not in a position to understand the theory, and false interpretations could not but appear. Perhaps this also explains, why Censorinus adds his *seu piscibus simillima animalia*, which addition is only found in his testimony.

do not know, but certainly it is not difficult to explain how this false tradition originated and why it found acceptance. The responsible author (whoever he may be) simply took it for granted that, when man came into existence inside a fish, this meant that he originated out of the fish and was originally different from modern man (Ps. Plut.), nay, even that he resembled the fish (Hippol.). As a matter of fact, this is exactly the same error that has been made by modern scholars, as may appear from the quotations in n. 1-7 and from the general, vague and persistent belief that Anaximander was an evolutionist.

The interpretation which has been proposed so far implies that this theory about the origin of first life is a very queer one and must have been peculiar to one man, Anaximander, at least as regards its details. But this assertion contradicts, as a matter of fact, one of the results of Rudberg's study mentioned above (cp. p. 216, n. 3). This author has connected Anaximander's biology with a passage in Diodorus Sic. (*Biblioth.* I 7, especially § 3 and 4), which, in his opinion, has been derived from the μικρὸς διάκοσμος of Democritus, through Hecataeus from Abdera. On this basis he maintains a dependance of later philosophy from Anaximander, in the field of biology as well as in that of the "Urzeitforschung". It is not the place here for a detailed discussion of his theory, but I think that its biological basis is not sound. The process of *abiogenesis*, as it is found in Diodorus (perhaps Democritus really is his source), shows three phases: (1) After the sun had dried up the flooded earth there came into being in the moist element σηπεδόνες ὑμέσι λεπτοῖς περιεχόμεναι ("rottening" substances enveloped by membranes). (2) At night they were fed by the moisture that comes from the atmosphere, at daytime they were hardened by the sun. (3) At last the membranes burst under the influence of excessive heat and various species of animals were born. Rudberg regards this as a further development of Anaximander's biology. He finds a striking parallel between the φλοιός of Anaximander and the ὑμὴν of Diodorus, as well as between the bursting of these wrappings in both cases. To me this seems rather a superficial and accidental resemblance, because the differences are too great. The prickly bark occurs only in the case of the present land-animals and can only

have served the purpose of a temporary protection. What is more, the animals must have fed by their own efforts and on food coming from without the bark. The *ὕμην*, on the contrary, represents a very natural conception, as membranes play an important part in biology, and of course they had to burst one day. Nor should we forget that with Anaximander the animals originated in the sea, not in the mud, and that they went ashore without any help. So I do not see how the membrane could have been a later development of the prickly bark. As to the conception of *abiogenesis* itself, this is not at all peculiar, and we do not know whether Anaximander had a more detailed view about this process. So we have no right, I think, to connect the biology of Anaximander with that of later times. It is quite possible, that there was in fact some connection, but we have no means to prove this, as only the idea of an original world-sea and that of *abiogenesis* are the same in both cases.

To complete this inquiry, Anaximander's biological views are explicitly confronted with the basic ideas of modern evolutionism.

(1) The central idea of modern evolutionism is the conception that the higher *species* developed from the lower ones. With Anaximander an evolution of species is out of the question.

(2) Modern evolutionism explains evolution by natural selection and (or) adaptation to environment. With Anaximander there is no indication for the idea of natural selection, whereas the adaptation to environment which he, in a sense, probably accepted, had no consequences as to the biological structure of the animals, but only as to their habits of living.

(3) Evolutionism finds its arguments in the field of biology and palaeontology. Anaximander, on the contrary, based his strange theory on the idea that all organic life originated in the sea.

(4) The idea of *abiogenesis* which was undoubtedly basic for Anaximander, is not an evolutionist theory, at least as far as modern evolutionism keeps within the bounds of biological science. We may safely state that no biologist is convinced that *abiogenesis* has been proved by purely scientific arguments. Those biologists who take an *abiogenesis* for granted know very well that this is a logical

postulate ¹⁾, i.e. a philosophical conception. On account of the principle *omne vivum a vivo*, which has been established scientifically, one would be even more justified in stating the contrary ²⁾. So even on this point Anaximander is not a precursor of modern evolutionism.

LEIDEN, De Sitterlaan 66 A.

1) Cf. Erhard, o.c. p. 109.

2) It would be more prudent to say: at least as far as we know up to the moment, we can state that all living beings which are known to us are born out of other living beings. Naturally this does not prove the impossibility of *abiogenesis*.

ΠΟΛΛΩΙ ΤΙ

Hdt. I 211, 3 πολλοὺς μὲν σφραγίσαντες ἐφόνευσαν, πολλὰ δ' ἔτι πλεῦνας ἐζώγρησαν. Here and in two similar passages (I 135, VI 78, 2) some mss. have δέ τι. Elsewhere (IV 194, VII 223, 3, VIII 16, 3) all mss. have δ' ἔτι (II 66, 1, III 40, 1, VII 49 are left out of consideration, because these passages do not refer to opposite groups). The reading πολλὰ δέ τι seems to me preferable as the *lectio difficilior*. Cp. ὁλίγω τι πρότερον (IV 79, 2; 81, 2, VI 69, 2, VIII 95), πολλὰ τι πλείστος (III 116, 1, IV 33, 1, V 92 ε, 2). In the last two passages some mss. have the impossible reading πολλὰ δ' ἔτι πλείστα (πλείστους), which throws some suspicion on πολλὰ δ' ἔτι πλεῦνας. Powell (C.Q. 32, 1938, 216), who is followed by Paap (*De Her. reliquiis in pap. et membr. Aeg. servatis*, 12-13), regards τι in ὁλίγω τι πρότερον and πολλὰ τι πλείστος as a dittography of π. But it is improbable that the same dittography should occur at seven different places. It should also be borne in mind that Hdt. has a predilection for the reinforcing τι, cp. I 56, 1 πολλόν τι μάλιστα, I 147, 1 μᾶλλον τι, I 181, 1 οὐ πολλὰ τεφ ἀσθενέστερον, I 192, 2 πολλόν τι κρατίστη, IV 19, 1 οὔτε τι, IV 118, 3 οὐδέν τι μᾶλλον, and Stein on V 33, 2.

ZEIST, Homeruslaan 53.

W. J. VERDENIUS