"Απειρος and Circularity

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The attempt to connect ἀπειρος with the notion of circularity is not a novel concept. The way was indicated as far back as Aristotle, who includes in his Physics under the discussion of the theoretical possibility of the existence of the ἀπειρον, the 'infinite', a mention of the application of the adjective to objects such as rings which are uniform and characterized by the absence of a bezel.¹ Porphyry, whose investigation of ἀπειρος and circularity I shall consider at length in the body of this essay, collected several examples of import similar to that of Aristotle’s ring. More recently Cornford concluded that it actively has the meaning 'circular'.² The latter two discussions, of which Porphyry’s is dependent upon Aristotle and Cornford’s practically a restatement of Porphyry, have both gone awry and have convinced no one who has considered the matter carefully. I, too, believe that their position is substantially untenable, but I am, however, prepared to grant that this was a result more of their method than of what they intuitively sensed. I intend to demonstrate here that ἀπειρος may indeed be related to a notion of circularity in itself, but that this is a latent meaning and therefore seldom expressed with absolute clarity, and that this meaning of ἀπειρος by itself was obscured after Pythagorean doctrine spread and gained notice. Furthermore, I submit that Ὀκεανός, the River Okeanos, is the primal concept behind the idea of circularity in it and that it is from here that the picture of the circular ἀπειρος which Porphyry presents has its origin.

I want to approach ἀπειρος first of all by considering its etymology. In so doing I must stress the fact that ἀπειρων, ἀπειρεῖος, ἀπειρείος and ἀπειριτος are all epic variants of ἀπειρος, which dominates later prose usage. Moreover, these epic variants tend to have their own restricted formulaic usages, as ἀπειρείος does, for instance, in the

¹ Ph. 3.4-8 contains a general discussion of ἀπειρος. The example of the ring is in Ph. 207a2–7.
Homer's phrase ἀπερείς ἕπονα. Considering the narrow range of these individual words and their eventual telescoping into ἀπειρος, we may consider their etymologies together and not make serious distinctions among them.

The root of all these words is Indo-European *per, which had an 'end-directed' signification. Kahn has well argued that the alpha-privative in ἀπειρος negates not the noun πέρας but the verbal root *per-, which may be seen in πείρω, περάω, περαίνω, as well as in numerous preverbs, such as πρό, παρά and περί. Schwyzner goes so far as to say that "παρά und die Nebenform παραί gehören etymologisch zunächst mit πάρος 'früher' zusammen, weiter auch mit περί, πέρα, πρό, πρός, usw." When one further considers that περί may appear as πέρ and that πέρα is often joined in compounds in the form περ-, it is easy to see that confusion could arise between different, developed denotations of *per-. Frisk, for example, glosses πέρα as "darüber hinaus, weiter, länger, mehr, jenseits," while he glosses περί as "ringsum, überaus, durchaus." Contrast these developments to the original *per-, which Schwyzner says meant "im Hinausgehen, Hinübergehen über, im Durchdringen."

Among modern philologists Schulze was the first to stress the περί aspect of ἀπειρος or, more accurately, of ἀπειροτος. He analyzed ἀπειροτος as *a-peri-itos and explained the suffix -itos as drawn from ἱέναι, for which he compared ἐμαίνω and the Latin orbita; he translated it as that which 'circumiri nequit'. He allowed, however, that it was possible that it might mean 'transire', with the -peri- equivalent to Latin per. Nevertheless, it has been his first explanation which later philologists have accepted. Bechtel agreed with Schulze in his identification of -itos with ἱέναι, and he gave an equivalent translation

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5 In the Iliad 11 times with ἕπονα; once with ἑνα in both the Iliad and the Odyssey.
7 Kahn, AOGC 232. Ann L. Bergren, The Poetics of a Formulaic Process: Etymology and Usage of πείρας in Homer and Archaic Poetry (Diss. Harvard 1973), stresses the *per significance of πείρας as 'goal-oriented'.
8 Ed. Schwyzner, Griechische Grammatik II (Munich 1939–53) 491f; cf. also H. Frisk, Griechische etymologisches Wörterbuch (Heidelberg 1960–72) s.v. περί.

Schwyzner, op.cit. (supra n.6) II. 499f: "Diese Bedeutungen kennt auch noch das Griechische; doch ist hier wie im Indisch-Iranischen 'rings um, um' die Hauptsbedeutung geworden. Ursprünglich war von περί in dieser Bedeutung ἄμφι 'zu beiden Seiten' verschieden; doch verblasste der Unterschied, bes. bei ἄμφι."
9 W. Schulze, Quaestiones epicæs (Gütersloh 1892) 116 n.3.
of ἀπειρωτός as that "um den man nicht herum gehen kann." More recently Chantraine has said that it "pourrait ... signifier 'dont on ne peut faire le tour' de ἀ-περι-ωτός." Thus he too relies upon Schulze's comparison with ἀμαξιτός and assumes that the base of the word is a negated *περ(i). Frisk, however, is troubled by the -i- in -itos; Schwyzer offers a qualitative interpretation which satisfies neither Chantraine nor Frisk.

The significance of ἀπειρος, keeping in mind its *περ root, is 'what cannot be passed over from end to end' with a connotation of circular movement; Kahn maintains that this easily passes into the sense of 'immense, enormous' in relation to human perspective, a sense associated with Homeric usage. The Heraclitean concept of circularity and the applicability of ἀπειρος to a circle I shall consider below when I examine Porphyry's arguments.

On the whole, then, it is best to posit the connection of ἀπειρωτός and hence ἀπειρος (from *ἀπέρως ἀπειρος by metathesis, as ἀπερεῖςιος = ἀπειρέιςιος) with περί. ἀπειρος, moreover, is often associated with perι-compounds, especially περιέχω, in philosophic speculation. Aristotle informs us that Anaximander (as is likely, to judge from the context) stated that his ἀπειρον surrounded (περιέχειν) the world. Anaximenes replaced Anaximander's τό ἀπειρον as ἀρχή with an ἀπειρος ἀή; he still allowed it to surround the world. Elsewhere

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9 F. Bechtel, Lexilogus zu Homer (Halle 1914) 49.
10 P. Chantraine, Dictionnaire étymologique de la langue grecque (Paris 1968-) s.v. ἀπερεῖςιος.
11 See Frisk, op.cit. (supra n.6) s.v. ἀπερέειςιος; Schwyzer, op.cit. (supra n.6) I.106 n.3.
12 Kahn, AOGC 232f. Porphyry, Quaestionum Homericarum ad Iliadem pertinentium reliquiae 14.200 (fasc. II pp.189ff ed. H. Schrader, Leipzig 1882), had already hinted at the relative quality of ἀπειρος, when he wrote that 
ημαῖνει δὲ τὸ ἀπειρον καὶ τὸ πεπερασμένον μὲν τῇ ἑαυτοῦ φόσει, ἡμεῖς δὲ ἀπειρείςιον (regarding Schrader's text, see infra n.30). G. J. M. Bartelink, who wrote the articles on ἀπειρωτός and ἀπειρος in Lexicon des frühgriechischen Epos fasc. VI (Göttingen 1969), stresses that the endlessness is relative to the viewer. See also P. J. Bicknell, "τὸ ἀπειρον, ἀπειρος ἀήρ and τὸ περιέχον," Acta Classica 9 (1966) 39.

Aristotle says that certain philosophers granted the ἄπειρον the right and prerogative of τὸ πάντα περιέχειν καὶ τὸ πᾶν ἐν ἑαυτῷ ἐχεῖν. Aristotle replaced it, however, in his scheme with the οὐρανός. In this scheme the οὐρανός encloses a complete system. It is the function of τὸ πᾶν to surround, not the ἄπειρον, which Aristotle defines as a potential but not realized whole; the ἄπειρον is a mere part, and so it is impossible that it should embrace and define anything. This follows, according to Aristotle’s logical system, for two reasons. First, in his division of causes he defines the ἄπειρον as material cause: οὐ περιέχει ἀλλὰ περιέχεται, ἡ ἄπειρον ... περιέχεται γὰρ ὡς ἡ ὕλη ἐντὸς καὶ τὸ ἄπειρον, περιέχει δὲ τὸ εἴδος. Aristotle’s discussion in these sections fairly bristles with περιέχω in its many forms, with active and passive forms opposed to one another. He is upbraiding those philosophers who have granted to the ἄπειρον (= material cause) the prerogative of the formal cause, that of defining and outlining the whole, in this case, the world.

Aristotle is here changing the ἄπειρον from the external factor that it was in Anaximander, Anaximenes and others into an internal factor. Beyond a matter of the four causes, Aristotle is also faced with the problem of a body infinite in extension. Such a thing appears impossible within Aristotelian terminology, since “body is defined as that which is limited by a surface.” To the end of Physics 3.6 he is occupied with exposing the fallacies involved in equating ἄπειρον and τὸ πᾶν (= δόλον). This is in keeping with the overall tenor of Physics 3.4–8, which is a general discussion on the possibility of the existence of infinity.

ἄπειρος predominates (though not necessarily in the sense of ‘infinite’), but they consider it uncertain that Anaximander intended precisely this. Certainly, however, Aristotle understood the word as ‘infinite’, and in his discussion ‘qualitatively indeterminate’ (i.e. amorphous) expectedly gives way to an overriding emphasis on Form. One should imbibe the salutary warning of Guthrie, however, that with Anaximander we are not at a stage where “distinctions between different uses of the same word are possible” (op.cit. I.86; cf. 109).

It is likewise not the aim of this paper to consider the question of innumerable worlds in Anaximander. Recent discussions of this problem (with references to earlier work) may be found in Kirk and Raven, op.cit. 121–23; Kahn, AOGC 46–53; and Guthrie, op.cit. I.106–15.

14 Ph. 207a19.
15 ibid. 207a25–b1. Cf. also Cael. 312a12–13, φαμέν δὲ τὸ μὲν περιέχον τοῦ εἴδους εἶναι, τὸ δὲ περιεχόμενον τῆς ὤλης.
16 Cf. the language of Pl. Ti. 31a4 and 31a8 in a similar context. Also note LSJ περιέχω I.1.b.
We obviously have to deal with two senses of the ἀπειρον: in the first, that of the earlier physicist-philosophers, it is external and active (περιέχει), while in the second view, that of Aristotle, it has become an internalized phenomenon and is now a passive factor (περιέχεται).

At the same time as he is involved in changing the orientation of the ἀπειρον, Aristotle alters its definition to keep it in agreement with his concept of the infinite as always undefined and incomplete: οὐ γὰρ οὐδὲν ἔξω, ἀλλ’ ὁ δὲ ἐξ ἔστιν, τοῦτο ἀπειρὸν ἔστιν. The basis for his definition of it is the principle of infinite division and addition which he enunciates just prior to this. To be sure, when Anaximander stated that the ἀπειρον surrounded all things, he probably assumed that all of space was occupied with his ἀπειρον, and therefore that it was a type of διόν. This, however, was unacceptable to later philosophers. In the Timaeus, for instance, Plato speaks of a cosmos which contains ἐν διόν ἐκαστὸν (of its four constituent elements) and which leaves μέρος οὐδὲν οὐδὲνος ... ἔξωθεν, but on the contrary is "whole and wholly complete." Furthermore, he describes this sphere as ἐκ μέσου πᾶν πρὸς τὰς τελευτάς ἐκοῦ ἀπέχον, which is, moreover, reminiscent of the explanation generally accepted for Parmenides' 'sphere', where πείρατα are imposed upon it (fr.8) to serve as the confines of an unvarying reality. Guthrie notes that the argument for confining all reality within bounds seems to be that "what is apeiron is essentially unfinished, incomplete, never a perfect whole however much of it one may include." Parmenides, of course, did not say this in so many words; it is, however, a valid extrapolation of his doctrine from the viewpoint of Aristotelian terminology. The trail leads irrevocably back from Aristotle, to the Timaeus, to Parmenides; following the lead of Plato, Aristotle is making a fundamental return to a position taken (but with serious objections concerning the existence of anything ἀπειρον) by Parmenides. Yet it is not until Aristotle that we can see an explicit definition of the status of the ἀπειρον, and it is in the course of his definition that he manifestly diverges from Parmenides, both because Parmenides absolutely

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18 Ph. 207a1.
19 Solmsen, op.cit. (supra n.13) 120–22.
20 Ti. 32c5–33a7.
22 Guthrie, op.cit. (supra n.13) II.38.
denied the existence of an ἀπειρον and also because he did not posit a physically existent sphere.

In attempting to define further the nature of the ἀπειρον, Aristotle indicates that it is that which is ἀδιεξήτητον, ‘incapable of being crossed from side to side’. In part his reason for saying this is because the infinite always has something further to be negotiated. Almost certainly he owes something for this conception of the ἀδιεξήτητον ἀπειρον to Zeno’s paradoxes of motion, particularly the first one (Ph. 239b11–14), which may be complemented by an infinite regress to disallow the possibility of motion entirely or (as here) the possibility of reaching a terminus. Elsewhere in the Physics Aristotle uses similar language, once in defining the sense in which something is ‘intraversable’ (τὸ ἀδύνατον διελθεῖν) and again in his disquisition on circular motion at the end of the Physics (διελθεῖν δὲ τὴν ἀπειρον [sc. φορὰν] ἀδύνατον). 23 Solmsen has opined that the source of the concept of an ἀδιεξήτητον for Anaximander’s thought is Hesiod, Theogony 736ff. The poets, he thinks, had not yet discovered the possibility of ‘absolute’ infinity; a space demanding more than a year to negotiate boggles the simple mind and is felt to be (practically) infinite. 24 This is very close to the manner in which Porphyry and Kahn arrive at a relativistic concept of ἀπειρον, which they find confirmed in Homer. It is for this reason that Homer, while he describes both the earth and sea as ἀπειρον, nonetheless imposes πείρατα upon them—their πείρατα are so distant relative to the capacity of the Homeric man for travel that they are, for all intents, beyond the grasp of the mortal imagination.

It is Ὀκεανός, of course, which provides the πείρατα for the earth, and, conversely, the earth’s shores are the inner πείρατα for the River Okeanos. According to Bergren, “the πείρατα γαῖης is the earth’s physical extremity . . . it is the line between opposite elements.” It is thus coextensive with the πείρατα Ὀκεανοῦ. Bergren maintains that the most archaic signification of πείρα in Greek is the concrete designation of the earth’s extremity and that every time πείρατα

23 Ph. 204a14, 204a4, 265a19–20. Cf. also the comment on Zeno in Ph. 233a22, τὸ μὴ ἐνδεχε-σθαι τὰ ἀπειρα διελθεῖν. Porphyry recalls Aristotle’s terminology in the phrase ἀδιεξήτητον ἀπειρον (p.192.24 ed. Schrader [supra n.12]). Also, Simpl. in Phys. 470–71 opposes ἀπειρος to διεξόδητος and διαπορευτός.


\[ \gamma a i n o \] denotes the end of the earth in Homer (which it does in all but one instance of the phrase), the context includes the streams of Okeanos. 28 Even as the earth, described as \( \alpha p e i r o n \), is delimited at its boundaries by Okeanos, so Okeanos, which provides the \( \pi e r a t a \) to the earth, is itself \( \alpha p e i r o n \), since it lies even beyond the earth’s immeasurable magnitude and therefore surpasses it in distance from our hypothetical observer, as well as because it has a circumference obviously larger than the \( o r b i s \ terrarum \) and is an unbroken circle, according to one implication of the later Heraclitean fragment. Extrapolating from Anaximander’s point of view, then, Okeanos would be a physical, geometrical representation of \( \tau o \ \alpha p e i r o n \) (and so itself becomes \( \alpha p e i r o c \)) because it encircles (\( \pi e r i \chi e i \)) the earth, which is itself \( \alpha p e i r o n \), according to the relativistic Homeric interpretation.

Aristotle is the first to remark that a uniform ring which has no socket for a gemstone may be called \( \alpha p e i r o c \): \( k a i \ \gamma \alpha r \ \tau o u s \ \varepsilon a k t u l i o u s \ \alpha p e i r o u c \ \lambda e g o u c \ \tau o u s \ \mu \eta \ \varepsilon x o n t a c \ \varepsilon f e n d o n \eta n \), \( o t i \ \alpha i e i \ \tau i \ \varepsilon x o \ \varepsilon c t i \ \lambda a m b \alpha n c e i n \). To be sure, he goes on to reproach this (colloquial?) usage for a lack of precision: \( k a o \ \omicron o i \delta \eta a t a \ \mu e n \ \tau i n \ \varepsilon x o n t e c \), \( o u \ \mu e n t o i \ \kappa u r i o s \). \( d e i \ \gamma \alpha r \ \tau o u t o \ \tau e \ \u p a r c h e i n \) \( k a i \ \mu e n t o p o t e \ \tau o \ \alpha u t o \ \lambda a m b \alpha n c e b a i \). \( e n \ \delta e \ \tau \acute{\omega} \ \kappa u k l w \ \o u \ \varepsilon g i n n e i a t \ \o u t w o \ \\alpha l l \ \alpha i c i \ \tau \acute{\omega} \ \varepsilon f e \varepsilon \chi e s \ \mu o n o n \ \varepsilon t e r o n \). He concludes by associating this with his opposition of \( \tau o \ \alpha p e i r o n \) and \( \tau o \ \pi a n \) and with his concept of \( \delta d i e \xi \gamma \eta t o n \): \( \alpha p e i r o n \ \mu e n \ \o u n \ \varepsilon c t i n \ \o u \ \k a t a \ \tau o \ \pi o c o n \ \lambda a m b \alpha n c e i n \ \alpha i e i \ \tau i \ \lambda a m b \alpha n c e i n \ \varepsilon c t i n \ \varepsilon x o \). \( o u \ \delta e \ \mu e n \d e n \ \varepsilon x o \), \( \tau o u t \ \varepsilon c t i \ \tau e l e i o n \) \( k a i \ \d o l o n \). 26

That a circle may be called \( \alpha p e i r o c \) is evidently a developed geometric concept, 27 which the early philosophers seized upon as a convenient and intriguing method to express that continuity which remains unbroken, temporally or otherwise. Heraclitus, fr.103

25 Bergren, \textit{op.cit.} (\textit{supra} n.5), goes on to say that \( \pi e r a t a \) denotes not a physical material as such but the function of anything that binds or defines, and which forms the limit of anything’s outward extension.
26 Ph. 207a2–9.
27 This is Kahn’s argument in “Anaximander and the Arguments Concerning the \textit{Apeiron} at Physics 203b4–15,” in \textit{Festschrift Ernst Kapp} (Hamburg 1958) 28f [hereafter \textit{Kahn, “Anaximander”}], This idea may well be indebted to medical concepts; see Kahn, “Anaximander” 25–27, and G. S. Kirk, \textit{Heraclitus: The Cosmic Fragments} (Cambridge 1954) 113–15. Hesychius picks up the geometrical possibilities when he glosses \( \alpha p e i r o n \) as \( \pi o l o \), \( \delta e n e c t o n \) (confusing what are actually two different words), \( p e r e f e r e s \), \( s t r o g y l o u s \), \( d a i \ \tau o \ \mu e t e \ \alpha r c h \ \mu e t e \ \pi e r a c \ \varepsilon x e i n \). Latte, in his ed. of Hesychius (Copenhagen 1953), notes that this explanation was borrowed from Diogenianus of Heraklea, a Greek grammarian of Hadrian’s time; this shows the continuity and persistence of this explanation.
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ξυνόν (γὰρ) ἀρχή καὶ πέρας ἐπὶ κύκλου, quoted by Porphyry in his discussion of the circularity implied in ἀπειρος, does not mean to imply more than the coincidence of the beginning and end in a circle, for here Heraclitus is concerned with the coupling of opposite quantities; but it very early came to be associated with the idea of continuous motion, which can only be found on a circle. Thus Aristotle echoes this idea more than once, as when he says τὸν δὲ κύκλῳ εὑματο κᾶτὰ τόπος δὴν ἡρξάτο καὶ εἰκ δὲν τελευτᾶ, and when he says that continuous motion is possible only on a circle, since elsewhere οὐ γὰρ συνάπτει τῇ ἀρχῇ τὸ πέρας. In addition Alcmaeon is quoted in the Problemata on human mortality as follows: τὸν γὰρ ἀνθρώπου φήσιν Ἀλκμαῖον διὰ τοῦτο ἀπάλλυθοι, ότι οὐ δύνανται τὴν ἀρχὴν τῷ τέλει προσάψαι. It is at once obvious, particularly if one considers the possibility that this may have been a common saying, that Aristotle has in the former instance paraphrased Alcmaeon. Porphyry's quotation from Heraclitus was undoubtedly influenced by Aristotle, who was himself influenced by Heraclitus.

Aristotle's remarks on the annular possibilities of ἀπειρος evidently intrigued Porphyry, for when he was compiling his Quaestiones Homericae he devoted several pages to an exegesis of the various senses of ἀπειρος. His lemma was Iliad 14.200f: εἰμι γὰρ ὄψομεν πολυφόρβον πείρατα γαίης, ὡς Ωκεανὸς τε, θέων γένεσιν, καὶ μνημέα Τηθῶν. In his subsequent discussion Porphyry indicates various senses of ἀπειρος:

1. ἣ κατὰ μέγεθος ἣ κατὰ πλῆθος,
2. the relativistic ἀπειρος already noted,
3. that associated with objects of exceeding beauty, and
4. that connected with circular or spherical objects. It is in the context of the last meaning that Porphyry quotes the Heraclitus fragment to which I have already referred. He continues by quoting several

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28 Cael. 279b2, Ph. 264b27. To Aristotle's quotations we may add the similar sentiments of [Arist.] MXG 977b4 (= Diels-Kranz 21 a 28) on Xenophanes (apropos a sphere, however) and 974a9–11 (= Diels-Kranz 30 a 5) on Melissus (of temporal continuity).

29 [Arist.] Pr. 916a33–35.

30 My discussion of Porphyry is based on pp.189ff of Schrader's ed. (supra n.12). Schrader's bold reconstruction of the text of Porphyry can no longer be accepted; see H. Erbse in Zetemata 24 (1960) 17–77. The long comment on ll. 14.200 here under discussion comes from Codex Ven. B (manus secunda) and so (following Erbse) its authenticity is beyond doubt. The philosophical nature of the argument also is an indication of its Porphyrian origin. (I am indebted to Professor Henrichs for his help in resolving my questions on the text of Porphyry.)

31 The division of ἀπειρος into ἣ κατὰ μέγεθος ἣ κατὰ πλῆθος is at least as old as Zeno; cf. Diels-Kranz 29 b 1, b 3 and Simpl. in Phys. 22.9 (= Diels-Kranz 13 a 5).
references in poets which associate ἀπειρος and unbroken circularity, on the basis of which Cornford concluded that in classical Greek it may actually and actively entail circularity.\textsuperscript{32} As other scholars have shown, however, the fact that round objects are spoken of as ἀπειρος by poets in a few instances need not imply that all unlimited objects are considered round, but rather that the notion of circularity is contained in the nouns to which the adjective is attached.\textsuperscript{33} Porphyry, moreover, not only leads astray those who refer to him, but he is led astray by his own sources when he says that Homer believed in a spherical earth: ὅστε εὐνάγεται, εἴπερ ἣ γῆ πεπερασμένη ῥήθεισα ἀπειρος πάλιν ἔρρηθη, μὴ διὰ τὸ μὴ ἑξίτητον αὐτὴν εἶναι κατὰ μέγεθος εἰρήθαι ἀπειρον, διὰ δὲ τὸ εφαιοειδῆ εἶναι καὶ τοιαύτην αὐτὴν κατὰ σχῆμα ὑπειλήφθαι. Porphyry likely had Heraclitus, the composer of the Homeric allegories, in mind when he wrote this; the passage of Homer cited as the lemma and the general tone of the disquisition confirm it. Heraclitus first of all cites the movements of the winds as a proof that Homer believed in τὸ τοῦ κόσμου εφαιοειδὲς. Later he writes that ἀπειρον δ’ ἀν ὁ κύκλος ὄνομάζοντο δικαίως, ἐπειδὴ ἂν ἄφθανον ἐκτὶ δεῖξαι πέρας ἐν αὐτῷ τε. Lastly he quotes as the ‘clearest’ proof of the spherical world the symbol of Achilles’ shield.\textsuperscript{34}

Heraclitus and Porphyry were not the only ones who thought that Homer had believed in a spherical world; Eustathius also makes this same mistake, perhaps misled by the Porphyry passage, but, if not, at

\textsuperscript{32} The references are Ar. fr.250 (Edmonds); Aesch. fr.379 (Nauck\textsuperscript{3}); Eur. Or. 25 and fr.941 (Nauck\textsuperscript{4}). Cornford, \textit{Principium Sapientiae} (supra n.2) 173, also quotes Empedocles fr.28, where he takes ἀπειρον Σφαῖρος κυκλοερηθε as one extended phrase meaning ‘spherical’.

\textsuperscript{33} See, among others, G. Vlastos’ review-article on Cornford, \textit{Principium Sapientiae} (supra n.2) in \textit{Gnomon} 27 (1935) 74 n.2; H. B. Gottschalk, “Anaximander’s Apeiron,” \textit{Phronesis} 10 (1965) 51–53; and Bicknell, \textit{op.cit.} (supra n.12) 41. Bicknell maintains that τὸ ἀπειρον in Anaximander is spherical, arguing thus: Cornford will have been correct in regarding this \textit{apeiron} as a spherical thing, but not because the word bears of itself any such sense. The \textit{apeiron} is spherical because in its original state it was coterminous with the present cosmos, which appears spherical to the observer (or rather hemispherical, for the other half “follows from the observation of the movements of the heavenly bodies and is demanded by the dictates of symmetry”).

\textsuperscript{34} Heraclitus, \textit{Allégories d’Homère}, chs. 47–48 (ed. F. Buffière [Paris 1962]). Such comments as Heraclitus and Porphyry present are in large part from the common stock of allegorical interpretation in existence concerning Homer. A neoplatonist such as Porphyry would be aware of these interpretations, and it is difficult to believe that this particular lemma and disquisition are unrelated to Heraclitus. On Heraclitus’ own predilections, \textit{cf. infra} n.38. Lastly, as Professor Henrichs advises me, earlier glosses on ἀπειρον γαῖαν (as well as Heraclitus’ comments) demonstrate the anteriority of the argument to the Porphyrian state.
least ultimately misled by the same body of allegorical scholia behind all these interpretations; the old error persists. According to Heidel the confusion in our sources between the circle and the sphere is common. This is due in part to the ambiguity of the term ετρογγύλος, which may mean either ‘round’ or ‘spherical’. In the fifth century B.C. the term was not used exclusively—or even generally—with reference to a sphere. Heidel further asserts that Posidonius is likely to have credited Parmenides with positing a spherical world, and he also says that Posidonius was “at least the proximate source for the statements of Aetius (3.10.1) that Thales and the Stoics and their respective adherents taught the sphericity of the earth and for the assertion of Diogenes Laertius (2.1) that Anaximander held that doctrine.” Certainly no one now believes that Homer or Hesiod (or Thales and Anaximander) conceived of the earth as spherical (not even Cornford said that). Hippolytus (Haer. 1.6.3 = Diels-Kranz 12 A 11), moreover, informs us that Anaximander believed in a circular but flat earth. To the best of our knowledge Plato (Phd. 108B ff) was the first to conceive of a spherical earth in the center of a cosmic sphere.

The key to this discussion of the spherical earth lies, I submit, in the train of thought which Heraclitus the Allegorizer presents to us. For Heraclitus ἀπειρος and sphericity < circularity are inextricably entwined with the description of Achilles’ shield in the Iliad. Nor is this surprising, for the oblong body-shield purports to show the world surrounded at its edges by the River Okeanos. The Hesiodic Scutum presents a similar picture of Okeanos, flowing round the rim and


38 This obviously is an easy error to commit, judging by the number of scholars who have so erred. See Owen, op.cit. (supra n.21) 95ff, for a convincing denial that Parmenides meant us to understand his system as establishing a spherical world. Diogenes Laertius elsewhere (8.48) has a rather vague and confusing statement assigning a ‘round’ earth to various philosophers; see Heidel, op.cit. (supra n.36) 73, and Sweeney, op.cit. (supra n.2) passim.

enclosing the other scenes of the shield. The belief in an outer river which surrounds the fringes of the inhabited world is ancient, common to Mesopotamian legend and Egyptian lore long before it became a fixture in Greek civilization. Indeed, a Babylonian world-map on a cuneiform tablet now located in the British Museum shows the earth encircled by this outer river. Herodotus shows the extent of this belief when he ridicules Homer and the contemporary map-makers because they represented the circular earth as surrounded by the River Okeanos. The Greeks also shared with the Egyptians the belief that the sun, after setting in the west, journeys back to the east along Okeanos; the Greeks had it sail in a golden bowl (representing the sun itself), the Egyptians in a ship.

Some Homeric usages aid in the attempt to associate Okeanos and ἀφόρροος in the sense of an unbroken circular river. First of all, there is ἀφόρροος, 'Okeanos' flowing back into itself (as it encircles the earth). Homer uses the word twice, both times of Okeanos, once in the Iliad apropos the structure of Achilles' shield and once in the Odyssey. Eustathius (ad Od. 20.65) glosses the word as follows: 'Ἀφόρροος δὲ Ὠκεανός ὁ κύκλῳ τῆς γῆς περινοστῶν καὶ ἀφ πάλιν ἐπὶ τὸ αὐτὸ ἱκνούμενον κατὰ τὸ, περιτελλομένοιν ἐνιαυτῶν. οὶ δὲ παλαιοὶ φράζουσι καὶ οὕτως ἀφόρροος, ὁ εἰς ἐαυτὸν ἀναλύων ἐν τῷ εἰλείθαι κύκλῳ περὶ τῆν γῆν. The thought behind Iliad 18.402f (... περὶ δὲ ῥόος Ὄκεανοι...)
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άφρησεν μορφήν μέεν άσπερον) is very similar, where περί...μέεν provides the idea of circularity and άσπερον the notion of continuity. Okeanos is the circling stream which joins its end to its beginning and, as such, is a primary model for the evolution of the Heraclitean circle, and so it fulfills the definition of άπειρος as that which cannot be circumnavigated.

Homer never applies άπειρος directly to Okeanos; he uses the *aper-family with γαία and πόντος. From his usage of it with the latter we may conclude that he associates it with the notion of annular circularity. For instance, in Odyssey 10.194f Odysseus climbs a rocky lookout and observes an island την πέρι πόντος άπειρον εκτειφάνωνται, "which the sea encircles in an unbroken ring." The sense in Hymn. Hom.Ven. 120 (παῦςομεν, άμφι δ' ομιλος άπειροτος εκτειφάνωτο) may well be similar, though here άπειροτος could mean 'uncounted'. These usages, associated with άμφι or περί, recall the associations with περιέξω. Homer adds two more words to our list, άμφιάλος (used five times in the Odyssey, always in the phrase άμφιάλω 'Θάκη) and περιφροντος (used once in the Odyssey, of Crete). Eustathius connects άμφιάλος with the line of the Odyssey quoted above when he writes την δε κατ' αυτήν νήσου, περι πόντος άπειρον εκτειφάνωται, ήγουν κύκλω περιέχει ως άμφίάλον. Thus the idea that Okeanos binds together and encircles the earth is transferred to passages in which the sea encircles an island—the River Okeanos is to the earth as the sea is to an island. Thus circular continuity advances from Okeanos to πόντος.

inconsistency lies in Penelope's wish: she wants to be carried off to the end of the world (=Okeanos) and go down to Hades to see Odysseus. She is thinking either of the underground sources of Okeanos (or Okeanos as the source of other rivers) or perhaps of Acheron-like appearances of rivers from below ground, since such places were commonly considered to afford descent to the underworld. This is not merely Hades as the land beyond the πελάτα γαίς found in Od. 4.563 and the Nekyia of Book 11. (In formulaic terms, the phrase must be related to προχορήσει ποταμων, in Od. 11.242, etc., but this does not demean the importance of the transfer.)

See R. Mondolfo, El Infinito en el pensamiento de la antigüedad clásica, transl. F. González Rlos (Buenos Aires 1952) ch. 5. It is wrong to translate άπειροτος here as 'impossible to traverse'. Odysseus has in fact just crossed this strait. The circularity implied in it is made emphatic by εκτειφάνωται. To be sure, the phrase could mean merely 'surrounded by a huge expanse of sea', and πόντος in the sense of 'a path over dangerous terrain' would not hinder this; cf. W. B. Stanford in his edition of the Odyssey (London 1967) ad loc. But the use of περί...εκτειφάνωται seems to me against this; cf. LSJ s.vv. στεφανώω and περιστεφανώω, esp. the reference to [Arist.] Mund. 393b17.
An intriguing possibility is afforded by the connection of \( \text{\acute{a}πε\'ιρων} \) with \( \pi\'οντος \). Accustomed as we are because of our world overview to our capability of sailing the open seas without worry regarding the status of our ultimate destination, we often forget that the Greeks historically tried to avoid such voyages and instead preferred to sail along the coastline, occasionally island-hopping as was possible through the Cyclades. Consider, then, a northern voyage around the Aegean: during the winter months when sailing would be prohibited this would properly be an \( \text{\acute{a}πε\'ιρων} \pi\'οντος \) in the sense of that which cannot be circumnavigated. The use of \( \text{\acute{a}πε\'ιρων} \) in the phrase ‘Ελλησ-\( \pi\'οντος \text{\acute{a}πε\'ιρων} \) (II. 24.545) and the uses with \( \gammaα\iotaα \) then are secondary and generalized, and they mean more simply ‘huge, immense’, the transference of meaning which Kahn favors and which I have mentioned above.\(^{45}\)

Seligman considers Okeanos to be a highly developed antecedent of Anaximander’s \( \text{\acute{a}πε\'ιρων} \). He is particularly impressed by the iconographic significance of Okeanos as a source for the development of the metaphysical \( \text{\acute{a}πε\'ιρων} \), and for this he rightly refers to the Babylonian cuneiform tablet. In addition he mentions the French orientalist Clermont-Ganneau, who posited that an optic mythology has preceded every aural mythology and that a pictorial representation regulated the conceptual, abstract product of mythology. The concrete myth of Okeanos, on this theory, preceded the metaphysical symbol of the \( \text{\acute{a}πε\'ιρων} \).\(^{46}\)

We must take account of the astral and temporal qualities of \( \text{\acute{a}πε\'ιρων} \). The Greek notion of time was not strictly linear, but circular, stretching infinitely into the past and future with some remote junction. As such it was always connected with the astral phases. Eternity as a philosophic concept first appears in a dialectical analysis of \( \alpha\ρχή \) and \( \pi\'ε\omicron\ α\omicron\) \( \alpha\omicron\) \( \sigma\omicron\) \( \acute{a}ρχη \) and \( \pi\'ε\omicron\ α\omicron\) \( \alpha\omicron\) \( \sigma\omicron\), but the source of the temporal concept is the phases of the heavenly bodies and the seasons.\(^{47}\) This is the source of Alcmaeon’s saying in Problemata 916a33–35 (supra p.132; cf. Ph. 264b27) and may also be the origin of Anaximander’s belief, reported in [Plut.] Stromateis 2 (= Diels-Kranz 12 A 10), that generation and

\(^{45}\) It is interesting that the phrase ‘Ελλησ\( \pi\'οντος \text{\acute{a}πε\'ιρων} \) attracted Gibbon; see Decline and Fall II.145 in Bury’s 6th ed. (London 1913).
\(^{46}\) The reference to Ch. Clermont-Ganneau is to his L’Imagerie phénicienne et la mythologie iconologique chez les Grecs (Paris 1880) p.xvii.
\(^{47}\) See Kahn, “Anaximander” 28, and the sources quoted by him there; cf. also Guthrie, op.cit. (supra n.13) I.351–53.
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destruction occur εξ ἀπειρον αἰώνος ἀνακυκλουμένων πάντων αὐτῶν, a variation on the Homeric phrase which employs περιτελλόμενοι with the particular time period in question. Indeed, temporal infinity is one of the basic types of infinity which Aristotle allows (Ph. 206a9–b3). Kahn goes so far as to say that the idea of incessant recurrence in the eternal life of nature, as opposed to the ἀρχή and πέρας of mortals, is the origin of the eternal motions of the Milesians and of 'eternity' in general.48

One problem in analyzing the early significance of ἀπειρος is to assess correctly its relationship, very noticeable later, with πέρας. Certainly Homer calls the earth ἀπειρον but still places πειρατα upon it. Yet Homer is far from opposing the two terms in a figura etymologica; they do not occur next to one another there. At the very earliest it may be Anaximander who opposes the two, but we cannot be certain since we have so little of his actual wording and since later information about him and explanations of his doctrine are often expressed in terminology developed after his lifetime. Aristotle’s explanation of ἀπειρον as an ἀρχή in Physics 203b7–8 connects it with τέλος and πέρας; this entire discussion is commonly considered to be directed primarily at Anaximander,49 yet we have no certain grounds for positing that he specifically associated ἀπειρον and πέρας. Moreover, regarding the suggestion that he may have argued for the infinitude of his ἀπειρον on the basis of its having neither an ἀρχή nor a πέρας, we are faced with the use of Aristotelian-Peripatetic terminology, where ἀρχή is the material principle, the substratum, and in the Aristotle passage it carries this significance in addition to its sense of ‘beginning’. It certainly bears this signification in the problematic passages of Simplicius (in Phys. 24.13= Diels-Kranz 12 A 9.5) and Hippolytus (Haer. 1.6.2= Diels-Kranz 12 A 11).50 On the other hand, Anaximander may well have described the ἀπειρον as αἰών ... καὶ ἀγήρω (Hippol. Haer. 1.6.1= Diels-Kranz 12 B 2) and ἀθάνατον ... καὶ ἀνώλεθρον (Arist. Ph. 203b13), usages for which there is prior warrant;51 the

49 As Solmsen, op.cit. (supra n.13) 109–14. This is also the basis of Kahn’s argument in “Anaximander.” Cf. Sweeney, op.cit. (supra n.2) 74ff, esp. 87–92.
50 The problem of the ἀρχή is summarized in Kirk and Raven, op.cit. (supra n.13) 104–08.
51 See Kahn, AOGC 43, and Solmsen, op.cit. (supra n.13) 114 n.19. Though Anaximander may have used these adjectives to express privation of γένεσις and βάνατος or φθορά, he is unlikely to have expressed his argument in terms of the abstracts γένεσις and φθορά them-
reported in Aētius (1.3.3 = Diels-Kranz 12 A 14) is possibly the phraseology of Anaximander, but far more likely it is applied to him by Aētius (or his source) on the basis of its similarity to the other qualifying phrases, its common use (in prose and poetry) from the fifth century onwards, and particularly on the basis of its use in Aristotle in describing infinity in Physics 204b21 and Metaphysics 1066b33 (ἀπειρον δὲ τὸ ἀπεράντως διεστηκός). That Aristotle connected ἀπειρον with πέρας as its negative partner admits of little doubt, as we may gather from Physics 203b7–85 and 207a1–15, as well as from his discussion of τὸ διεγέρθη in Physics 204a3–6.

Aristotle’s collocation of ἀπειρον—πέρας is an opposition which we encounter first of all in the Pythagoreans. We know for certain that Aristotle was cognizant of the Pythagorean association of these terms since he reproduces it in the Table of Opposites in Metaphysics 986a23–26 (cf. 990a8–9). It is certainly not until after the Pythagoreans posited the opposition that the association of ἀπειρον with πέρας became so important and dominated subsequent thought insofar as ἀπειρον was thenceforth considered the negative of πέρας.53

Though mention of ἀπειρον would have been anathema to Parmenides, whose use of πέρας serves to mark not a limit in time but rather the invariancy of the subject, Melissos dissents (fr.2) from his stand on time (past, present, future) by granting the existence of these states and of ἀπειρον.54 The fragments of a later Pythagorean, Philolaus, show the same opposition (Diels-Kranz 44 B 1, B 2; cf. A 9).55

53 Thus Solmsen, op.cit. (supra n.13) 116, and Bicknell, op.cit. (supra n.12) 39.
55 The fragments ascribed to Philolaus may not be his, but may rather have been
Otherwise among the Presocratics ἀπειρος tends generally to be utilized in several contexts, all of which parallel our own sense of ‘countless’, ‘boundless’, or ‘infinite’. It may have a temporal significance, as in [Plut.] Stromateis 2 and 7 (= Diels-Kranz 12 A 10 and 68 A 39), ἐξ ἀπειρου αἰῶνος (or χρόνου), but probably its most frequent context is that of τὸ κατὰ μέγεθος or τὸ κατὰ πλῆθος.\(^{56}\)

What can we conclude about ἀπειρος then? I believe that we may assert that the notion of circularity is indeed inherent in it. That it ever actively in itself had this sense is doubtful on the basis of our present evidence; no incontrovertible example of it can be produced. It is significant, however, that ἀπειρος is often used in conjunction with words compounded of περί. Okeanos certainly represents a pre-Greek, non-Indo-European forerunner of the ἀπειρον πόντος; Homer presents indications of this. Although only a conjecture, I submit that it may represent the Greek abhorrence of sailing the open seas, especially during the wintry season. Finally, the collocation of ἀπειρον and πέρας, based on an etymological association which is seemingly obvious and therefore plausible, dates only from Pythagorean times, after which it has been generally accepted as valid.\(^{57}\)

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\(^{56}\) For example, Simpl. in Phys. 22.9 (= Diels-Kranz 13 A 5); Diog.Laert. 9.44; Anaxag. fr.1 (= Diels-Kranz 59 B 1); but above all Zeno (Diels-Kranz 29 B 1, B 3). The reason for its appearance is obvious. Zeno was denying motion (and plurality) by establishing limits within a regression (and progression) in an infinite, geometrical series. Cf. Porphyry’s analysis, supra.

\(^{57}\) I am grateful to Professors G. E. L. Owen, T. Irwin and A. Henrichs, and to Dr Martha C. Nussbaum for help with this essay.