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Anaxagoras and Infinite Divisibility

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In 1957 John Raven announced that no one ever disputed the claim that "Anaxagoras really believed in the infinite divisibility of matter."[1] No doubt he was right about that, and Raven like all his predecessors and most of his successors proceeded to interpret Anaxagoras' complex and vaguely expressed theory of matter on the assumption that one central feature of it was the infinite divisibility of particles of matter.

But times change, and we live in a more skeptical age. Malcolm Schofield[2] has recently challenged the claim that Anaxagoras used a notion of infinite divisibility in his theory of matter. Unfortunately, Schofield's skepticism is uncharacteristically timid here, and he never provides a clear statement of his reasons for questioning the traditional view, nor attempts a demonstration of its weakness or a sketch of what the theory of matter would look like without this venerable fixed point. Schofield restricts himself to redescribing it as "unlimited smallness"[3] and pointing out that "infinite divisibility" is not an expression which represents ideas in which Anaxagoras shows an interest.

Jonathan Barnes' recent discussion of Anaxagorean physics[4]

[1] P. 377 in G. S. Kirk and J. E. Raven, *The Presocratic Philosophers*; first edition, Cambridge 1957. In the second edition (1983, with additional material by Malcolm Schofield), this claim is not altered (p. 367).

[2] *An Essay on Anaxagoras* (Cambridge 1980).

[3] P. 79. But infinite divisibility returns on p. 81.

[4] In *The Presocratic Philosophers*, vol. 2 (London 1979). There is little change in the second edition (in one volume, 1982).

fills some of the gaps. For he argues that a central element in the traditional view, the claim that Anaxagoras believed that matter had particulate structure, is false. This, I think, is correct. For as Schofield emphasizes, division of matter is not a prominent theoretical concept in Anaxagoras' fragments;[5] in its place we find mixture and separation, which need not refer to particles of matter at all, but are equally suited to the idea that matter exists in the form of non-particulate stuffs which can be blended—as pastes or liquids are combined, perhaps, rather than as grainy substances like salt and flour which are sifted together.

I shall take as given, then, the view that Anaxagoras' notion of the structure of matter does not include the belief that it is particulate. On the traditional view, one reason why Anaxagoras believed in infinite divisibility was that it was necessary to make the claim of universal mixture (all is in all) consistent with the idea of particulate matter. As William Mann points out in a recent article, abandoning particles thus removes a powerful motivation for adopting a theory of infinite divisibility.[6] Mann, unfortunately, fails to ask the obvious question: did Anaxagoras, then, believe in infinite divisibility? He tamely accepts the received dogma.

Further probing is still needed, and I want to do a bit of that work in this paper. I will first buttress the view that there is no need to posit infinite divisibility for Anaxagoras by outlining the reasons for finding it *prima facie* implausible that he would believe in infinite divisibility, and I shall suggest very briefly one reason why Anaxagoras has been interpreted so often in the traditional way. This should keep the burden of proof squarely on the shoulders of the supporters of the traditional view. Here I shall principally use observations made by others. Second, I shall try out some ideas about what will replace infinite divisibility in Anaxagoras' theory of matter. For Barnes has seen that if particles, infinitely divisible, are banished, then a new understanding of "indefinite smallness" is needed. He offers such an interpretation himself; but I think that one can do better. Moreover,

[5] For a different view, see D. Sider, *The Fragments of Anaxagoras* (Meisenheim am Glan: Anton Hain 1981 = *Beiträge für Klassische Philologie* 118), pp. 56–57, which I find unconvincing. Professor Woodbury suggests that Anaxagoras' term μοῖρα contains a reference to division. But this is not a necessary implication of the term. The reference to cutting with an axe in fragment B 8 is a metaphor for separation, not a literal reference to the division of matter.

[6] "Anaxagoras and the *Homoiomere*," *Phronesis* 25 (1980), 246.

as Mann properly stresses, "indefinite largeness" is as important to Anaxagoras as is smallness. Any story about the former should work, *mutatis mutandis*, for the latter. I hope that one merit of my own interpretation over Barnes' is that it will account for the use of largeness and other quantity terms, as well as smallness. The key point, however, is that giving up infinite divisibility creates a need for fresh hypotheses about smallness and largeness in the fragments of Anaxagoras; the field for new speculation here is still wide open.

The idea that matter is infinitely divisible, however familiar it may now be or may have been to Aristotle, is not an intuitively obvious one, nor is it a natural one. One would not expect any given philosopher to employ it without a definite motivation, either in the work of someone else or in his own. The possibility that Anaxagoras developed the notion as a result of the theoretical demands of his own analysis of matter cannot be dismissed out of hand. But recent observations have, as we have seen, removed the familiar theory about how such a doctrine arose from Anaxagoras' own problems and positions. Most scholars until recently (I think particularly of Cornford, Raven, and Guthrie) have seen the external stimulus in the works of Zeno of Elea. Zeno did develop several dialectical arguments against the possibility of motion and plurality which turned on the infinite divisibility of matter and space, and it is often thought that Anaxagoras was reacting critically to these in putting forth his own theory of the infinite divisibility of matter. But there are problems in this traditional view, both philosophical and chronological.

First, as David Furley, Malcolm Schofield, and Jonathan Barnes have argued,[7] the "response" of Anaxagoras to Zeno, if that is what it is, is feeble indeed. Their observations need not be repeated in detail. Anaxagoras, if he is responding to Zeno, is indulging in mere counterassertion and not employing arguments against him. Furley, in fact, points out that the similarities indicate, if anything, a response by Zeno to Anaxagoras.[8]

And it is just as well that we need not view Anaxagoras as reacting to Zeno, since recent work has indicated that Anaxagoras' writings were probably produced earlier in the fifth century than used to be assumed.[9] The most powerful case on this point is made by Wood-

[7] Barnes, p. 35, Schofield, pp. 80–82, David Furley, "Anaxagoras in Response to Parmenides," *Canadian Journal of Philosophy*, Supp. Vol. 2 (1976), 76–80.

[8] *Op. cit.* (above, note 7), p. 78.

[9] J. Mansfeld, "The Chronology of Anaxagoras' Athenian Period and the Date of his Trial," *Mnemosyne* 32 (1979), 39–60; 33 (1980), 17–95, is the major exception among recent authors. For discussion see L. E. Woodbury, "Anaxagoras and Athens," *Phoenix* 35 (1981), p. 306, n. 28.

bury,[10] who argues that Anaxagoras' philosophical impact began in the 470s and that his activity at Athens was over by, at the latest, 450. It is noteworthy, Woodbury reminds us, that Plato represents Socrates as having access only to Anaxagoras' book. By the time Socrates was a young man the book of which we have fragments was written and Anaxagoras was gone. Zeno, according to Plato, would still have been able to talk with the young Socrates.[11] Nothing in Plato's picture of Athenian intellectual life in Socrates' youth encourages us to see Anaxagoras as replying to Zeno.[12]

As to the absolute dates of Zeno's and Anaxagoras' books little can be *known*. Both Schofield and Furley[13] point out the weakness in the traditional argument that Anaxagoras wrote after 467 B.C., on the grounds that his theory that the heavenly bodies are glowing stones must have been influenced by the fall of the meteorite at Aigospotamoi in that year. It is more likely that he wrote *before* the meteorite fell, since he is credited with predicting its fall. This is closer to the truth if the meteorite confirmed the theory rather than suggesting it.

Furley and Barnes properly emphasize that all of the philosophical characteristics of Anaxagoras are adequately accounted for if we see him as reacting only to Parmenides. Schofield's book-length study led him to similar views, and he sees Anaxagoras as an "archaic sage," rather than as an up-to-date dialectician engaged in the sophisticated debate of the mid-fifth century. O'Brien's detailed examination of the relative dates of Empedocles and Anaxagoras confirms this.[14] Anaxagoras is the earlier thinker according to all of the external evidence. Particular weight must be put on the evidence of Alcidamas,[15] who made Zeno and Empedocles contemporaries and pointed out that Anaxagoras had influenced Empedocles.

I conclude, then, that unless the best recent work on the subject is all in error, there is no reason to suspect that Zeno influenced Anaxagoras at all, and some to suggest that he in fact wrote *after* Anaxagoras. At all events, we may take it that Anaxagoras wrote

[10] See previous note. Note also Sven-Tage Teodorsson, *Anaxagoras' Theory of Matter*, Goteborg: Acta Universitatis Gothoburgensis, 1982, pp. 8–9.

[11] Although his book in defense of Parmenides *is* described as a product of Zeno's younger days (*Parmenides* 128d–e).

[12] Teodorsson, pp. 70–71, supposes that Anaxagoras reacted not only to Zeno but also to Leucippus.

[13] Schofield, p. 34, Furley, p. 77.

[14] D. O'Brien, "The Relation of Anaxagoras and Empedocles," *Journal of Hellenic Studies* 88 (1968), 93–113.

[15] Diogenes Laërtius 8. 56.

independently of Zenonian influence. The external motivation for Anaxagoras to develop a theory of the infinite divisibility of matter is also gone.

Why, then, have so many scholars and philosophers been so willing to see Anaxagoras in this light? In addition to the chronological error with relation to Zeno, we may point to a feature of the Aristotelian and Epicurean[16] doxographical traditions. I refer to the tendency of Aristotle and his commentators (especially Simplicius)[17] to group Anaxagoras with the atomists because of certain alleged similarities in their views about the *ἀρχαί*. In the Peripatetic scheme, Anaxagoras and Leucippus and Democritus all held that the *ἀρχαί* were *ἄπειροι*. This is a tidy grouping, even though Aristotle correctly supposed that the *ἄπειροι ἀρχαί* would be quite different in significance in the two systems. Anaxagoras, on Aristotle's view,[18] held that the *ἀρχαί* were an indefinite number of kinds of stuffs, while the atomists believed in a literally infinite number of atoms. But the tendency to see Anaxagoras as a believer in an infinite number of particles, which, however, were not *ἄτομοι*, was so strong that Aëtius, repeating perhaps Theophrastus,[19] describes him in atomistic terms as believing in *λόγῳ θεωρητὰ μόρια*. So Anaxagoras becomes a non-atomistic particle theorist, like Leucippus except that his particles are not *ἄτομοι*. This doxographical tradition is also prominent in Lucretius' famous account of Anaxagorean physics,[20] in which bones, for example, come to be from "tiny and minute bits of bone" and flesh from "tiny and minute bits of flesh," and so forth.

But this association with and alleged similarity to Leucippan atomism is unsupported by Anaxagoras' own words. For there particles are never mentioned.[21] It is the doxographical habit of grouping Anaxagoras with the atomists which introduces particles. And of course, once particles are introduced into his system, it is inevitable that they be interpreted as infinitely divisible, in order to account

[16] See Teodorsson, pp. 20–21, who properly emphasizes both doxographic errors throughout his short book.

[17] Simplicius, *In Phys.*, p. 453. 1–3, 458. 26 ff., 461. 9 ff., 461. 30 – 462. 3, 1069. 20–25, 1120. 20–24, 1254. 20 ff., 1266. 33–36.

[18] A 43.

[19] A 46; cf. Barnes p. 22. It is also possible that the Epicurean tradition is at work here, since the terminology used is otherwise best attested for that school. Julia Annas pointed out that at Sextus *Pyrrh. hypot.* 1. 147 *ὁμοιομερῆ* are mentioned alongside atoms and *ἐλάχιστα* as candidates for being *τῶν ὄντων στοιχεῖα*. This too suggests the doxographical tendency of the Epicurean school.

[20] A 44 = *On the Nature of Things* 1. 833–879.

[21] The term *μοῖρα* is as close as one can get to an Anaxagorean term for particle. See note 5 above.

for what he does say about the structure of matter, in particular to maintain consistency with the claim that there is a portion of everything in everything.[22]

My own hypothesis about Anaxagoras' theory of matter can best be tested by applying it to the preserved fragments in detail; it proposes new and rather special interpretations for Anaxagoras' key theoretical terms referring to quantities. I concede at the outset that some of these suggested interpretations are strange; but there has yet to be an interpretation of his theory which did not have some strange and perhaps incredible feature, and I doubt that there ever will be. It is obvious, to me at any rate, that some of the difficulty of Anaxagoras' fragments derives from his attempt to say quite new and difficult things with the limited resources of ordinary Greek, without coining new technical terms. This would have made his book difficult for his contemporaries too and helps to explain why it was so easy for his theories to be misunderstood by later doxographers. Some re-evaluation of his words is essential if any progress is to be made in understanding his theory. So I ask the reader to ponder the suggested meanings for familiar terms as an hypothesis, and to consider the economy and efficiency of this hypothesis in accounting for Anaxagoras' fragments in the context of fifth-century intellectual history.

The reasons for the various suggestions I make about the meaning of quantity terms in Anaxagoras will be clear in the course of the discussion. But it will be helpful if I state at the outset the proposals I am making. I intend to interpret the following Greek terms thus:

πλῆθος: amount, the total quantity of any stuff found in the universe.

μέγεθος: largeness, the characteristic of being separated out and so distinguishable from other stuffs.

σμικρότης: smallness, the characteristic of being mixed and so not distinguishable from other stuffs.

These suggested definitions have emerged from a reading of the

[22] Aristotle follows out this line of reasoning in *Physics* 1. 4. Teodorsson, oddly enough (pp. 74 ff.), argues that Anaxagoras employed the concept of infinite divisibility but not that of particle. I should also emphasize at this point that although Aristotle's discussions are the source of the particulate interpretation of Anaxagoras' theory (note for example ὄγκοι at *Physics* 1. 4, 187a37) Aristotle himself seems never to attribute to Anaxagoras the idea of infinite divisibility. In *Physics* 1. 4 he pursues a line of thought based on his own reflections about Anaxagoras, and in the course of this (187b7–188a18) introduces the idea in question. But in his actual accounts of what Anaxagoras believed the suspect notion is not to be found.

fragments themselves, with no prior assumptions about the meaning of these terms, which are obviously central to Anaxagoras' theory.[23] The interpretation I propose is not the only one possible; in effect, it competes with Barnes' view. I claim that it is more plausible and compatible with the fragments than that interpretation. But if it seems to be at least a serious contender, then my present aim will have been accomplished. Now to the most important of the fragments. Fragment one:

> All things*[24] were together, indefinite both in amount and in smallness. For the small too was indefinite. And since all things were together, nothing was distinct because of smallness. For air and aither covered all things, both of them being indefinite—for these things are greatest among the totality both in amount and in greatness.

The first observation to make is about the word πλῆθος, which I render "amount." As others have seen,[25] there is no need to translate it as "number" with its implications of countable units, at least not in fifth-century Ionic prose.[26] But even if it is translated in that way, it does not follow that particles are meant; it could, as Aristotle seems

[23] The unusual interpretation I propose for *μέγεθος* and *σμικρότης* is not without support of a sort from another philosopher, Empedocles, who is also trying to grapple with Parmenides' legacy of argument. His "roots" are always the same in total amount. Yet they dwindle (*φθίνει*) into each other when they are mixed together (by love) and grow (*αὔξεται*) when separated (by strife): B 26.2. Surely "dwindling" suggests becoming "smaller" and "growing" suggests becoming "larger" in much the same sense which I propose for Anaxagoras. Of course, the One of Empedocles also "grows" as the elements shrink (B 17.1, 17.16). But the One is not a permanent thing meeting Parmenidean standards, as the roots and Anaxagoras' *χρήματα* are. It is not clear whether mixing and separation in Empedocles involve particles of matter. This is perhaps suggested by Aristotle at *De Sensu* 441a3 ff., where he seems to be assimilating Empedocles to an atomistic theory, and at *Metaphysics* A, 984a9–11: *ταῦτα γὰρ ἀεὶ διαμένειν καὶ οὐ γίγνεσθαι ἀλλ' ἢ πλήθει καὶ ὀλιγότητι.* But the way in which the mixture occurs does not affect my point here. Quite possibly Empedocles did not explicitly address the question whether his theory involved particles, just as he seems not to have thought through the question whether his theory of pores should commit him to a belief in the existence of void.

[24] When marked with an asterisk, "things" is a direct translation of *χρήματα*.

[25] E.g. Barnes, p. 16; D. Lanza, *Anassagora: Testimonianze e Frammenti*, Firenze: La Nuova Italia, 1966, *ad loc.*

[26] Herodotus uses *πλῆθος* for "amount" in this way; see 1.204.1 for a parallel to Anaxagoras' phrase "indefinite in amount." *πολύς*, in the singular, means simply "much," and *πλῆθος* is the corresponding noun for this sense as well as for the sense "many" which is expressed by the plural *πολλά*. In addition, Henry Mendell points out that Plato uses *πλῆθος* to govern mass nouns as well as count nouns, confirming that such a use is quite respectable even in classical Attic prose. Examples (many more could be found): *Phaedrus* 279c, *Theaetetus* 158d, *Politicus* 269b. Sider's interpretation of *πλῆθος* (pp. 45, 58–60) is complex and, in my opinion, implausible.

to have seen, refer to the number of kinds of basic stuffs found in the original mixture and now in the world we observe. Still, I prefer the interpretation of it as referring to the total amount of each stuff, for reasons which will become apparent.

Second, what is meant by "smallness" when it is applied to the ἀρχαί, the ἄδηλα χρήματα of the mixture? We are told that "since all things were together, nothing was distinct [ἔνδηλον] because of smallness." Traditionally this is taken to mean that the particles are simply too small to be seen—just like atoms. On the other hand, Barnes, focussing on fragments 3 and 6, understands smallness differently. It is not particles which are "small," according to Barnes, but portions or shares in mixed substances.[27] But this, while *perhaps* making sense in fragments 3 and 6, is clearly out of place in fragment 1. It is preferable to develop a view of large and small which will apply to all the fragments and which will have it refer to the χρήματα themselves, rather than to portions or shares of them. For that is how Anaxagoras speaks in fragment 1; Anaxagoras nowhere refers, not even in fragment 6, to small and large *portions*, as Barnes' view demands, but always to portions of what is itself large or small.

Consequently we look elsewhere for an interpretation of smallness; and we have an explanation drawn from Anaxagoras' own fragments which points in a different and more satisfactory direction. In fragment 4b we read, "before these things were separated off [sc. from the mixture], when because all things were together no color [or surface, χροιή] was distinct either; for the commingling of all things prevented this." The χρήματα meant are then specified:[28] they are the pairs of opposites, wet-dry, hot-cold, etc. In fragment 1 "smallness" was responsible for the indistinctness; here the mixture is responsible for the same feature. Therefore I would hypothesize that smallness, for the χρήματα, is simply the condition of being thoroughly distributed in the mixture. There need be no reference to the size of discrete particles, as the traditional theory requires, nor even, as Barnes' view would have it, to the quantity of a portion expressible numerically or at any rate algebraically. Similarly, "largeness," to which reference is made presently, will on this hypothesis be the condition of being separated off and so distinguishable; not bigness of the particles or of the portions of a stuff. Barnes' interpretation, in fact, introduces the idea of numerically expressible fractional shares and apparently does so *only* to give sense to the idea of large and

[27] The idea of small portions first appears on p. 33.

[28] Earth and the σπέρματα seem to be distinguished from the opposites—because, I think, they are reducible to them; earth, seeds, etc. are derivative. See below.

small shares of a stuff. But not only is the idea of fractional shares not even hinted at in the fragments; the concepts which Barnes uses it to explain—"small" and "large" portions or shares—are also not Anaxagorean.

Fragment 1 itself says something about the reason for the lack of distinctness of things. It is because air and aither cover or dominate the mixture. Here I must take a position on a contentious issue.[29] I do not think that air and aither are *identifiable* components of the mixture; i.e. they are not χρήματα in the sense that the opposites are. Rather, like earth and the seeds mentioned in fragment 4b, they are only "virtually" present in the mixture, by which I mean that the opposites needed to make them up are present. After all, fragment 2 tells us that air and aither have to be separated off from the mixture

[29] Barnes retains the view that real stuffs (ἐόντα χρήματα) include many ordinary macroscopic stuffs, such as air, bread, and cheese. As far as I can see, Anaxagoras never says this. Aristotle does, but I think that he misunderstands Anaxagoras. My own view, that the ἐόντα χρήματα (i.e. the elemental entities which alone obey Parmenidean rules of permanence) are only the opposites and that everything else including the seeds, the so-called Empedoclean elements, and flesh, bone, etc. is derivative and disobedient to Parmenidean rules of permanence, is close to Vlastos' position ("The Physical Theory of Anaxagoras," pp. 323–53 in R. E. Allen and D. J. Furley edd., *Studies in Presocratic Philosophy*, vol.2, London 1975). For he holds that the seeds, flesh, earth, etc. *are* just the opposites; his account of the relation of seeds etc. and powers on pp. 337–38 is attractive and, I believe, correct, although I suspect that it is inconsistent with other statements he makes about the status of seeds etc. But because he accepts the authenticity of fragment 10 (now put in some doubt by Schofield, *op. cit.*, pp. 135 ff. and "Doxographica Anaxagorea" *Hermes* 103 [1975], 1–24), Vlastos presents his own position in a manner which I find unclear if not contradictory. For while denying that the flesh or the seeds of flesh, e.g., are anything over and above the powers, he still maintains that they are just as "primordial" and "elemental." This would be redundant and to my mind implausible. It seems to be a result of three factors: (1) the continued acceptance of the authenticity of fragment 10; (2) a degree of reliance on the doxographical tradition, which I believe distorts Anaxagoras' theory on just this point; (3) a failure to see that the term χρῆμα should be restricted to the opposites in all but a very few cases where it is loosely used to refer to perceptible objects too. My own view is that Anaxagoras held that all macroscopic phenomenal entities are derivative and do not obey Parmenidean canons, that they are mere φαινόμενα to be explained by reference to the underlying ἄδηλα which compose them—i.e. that they are epiphenomena of true ὄντα. This interpretation of Anaxagoras would give point to Aristotle's claim (*De Caelo* 302a28–b5, *Gen. Corr.* 314a 24–30) that the "Empedoclean" elements are treated as derivative (σύνθετα) by Anaxagoras. It would also help to explain the interest of Sextus (fragments 21, 21a, A 97; cf. Cicero, *Academica* 1. 44, 2. 100) in him as a believer in the unreliability of sense perception in grasping the truth about the physical world. Less important, perhaps, but still not negligible is the fact that Aëtius mentions μόρια αἵματος γεννητικά in A 46, which shows that one branch of the dubious doxographical tradition preserved an awareness that the ἀρχαί were not meant to be the same stuffs as the macroscopic objects made up of them.

too (here referred to as the surrounding "muchness"—*τὸ πολὺ τὸ περιέχον*); and fragment 15 describes how earth emerges from the separating off and moving together of the dense, wet, cold, and dark, and how aither emerges by the same process from the rare, hot, and dry. Fragment 16 has similar implications.

Fragment 15:

The dense and wet and cold and the dark gathered here, where earth now is, but the rare and the hot and dry moved out to the forward part of the aither.

Fragment 16:

From these things being separated off earth is compounded. For water is separated off from the clouds and earth from the water and from the earth stones are compounded by the cold and these [i.e. the stones] move out more than water.[30]

Earth, air, etc. are in the mixture only in the sense that the opposites (i.e. the *χρήματα*) sufficient, when separated, to make them up are in the mixture. These non-elemental stuffs (i.e. the opposites which constitute them) can be separated off, and then earth, etc., will appear. "Seeds" are probably of similar status; i.e. they are the presence in the mixture of the opposites sufficient to produce, when separated, the observable object of which it is said to be the seed. The term "seeds" need not, as Barnes stresses,[31] suggest a discrete particle, although there must be something special about the seed. Perhaps observable objects (like men and trees) which are individuated and countable come from seeds, while stuffs like earth, air, etc. are said to come directly from the "earth" which is in the mixture in the form of the appropriate opposites.[32] To say that earth is in the mixture means only that there is enough dense, wet, cold, and dark in it to produce what we see as earth; to say that the seed of x is in it is to say that there is enough of each of the needed opposites in it to produce x.

The reason why the virtual presence of air and aither helps to

[30] Barnes (n. 18, pp. 295–96) denies that these two fragments imply the non-elemental character of earth, aither, etc., following on this point Michael Stokes ("On Anaxagoras," *Archiv für Geschichte der Philosophie* 47 [1965], 218–21, 16–19). But Stokes and Barnes, like Lanza and everyone else who relied on Diels' edition of Simplicius, believed that *⟨ἡ γῆ⟩* in fragment 15 was an emendation; thus they could dismiss it. Sider however (*op. cit.*, p. 115) points out that *γῆ* is in fact found in *every* manuscript of Simplicius; the words of Anaxagoras pretty clearly do imply that the opposites are elemental and earth etc. are not.

[31] P. 21.

[32] Perhaps, as Schofield suggests (pp. 126 ff.), only living things grow from seeds.

make the mixture indistinct is presumably that the qualities which make up these visible manifestations are in themselves more indeterminate to perception than others. The dominance of them in the mixture, therefore, tends to account for the indistinctness of the evenly mixed whole. The last sentence of fragment 1, then, supports the claim that these things are indefinite in amount and it does so by appealing to observable facts about the present, separated state of the world. For now (note the change in tense) "these *are* the greatest among the totality of things, both in amount [πλῆθος] and in greatness [μέγεθος]." Thus fragment 1 shows the inadequacy of interpreting πλῆθος as number; air and aither may be the largest visible masses, but they are not the most numerous. Moreover, on the proposed interpretation the contrast between πλῆθος and μέγεθος is meaningful. These two things are both the greatest in total amount (πλῆθος) and now the most separated (greatest in μέγεθος).

Of course, only when the separation has occurred, *now* rather than *then*, can one refer to greatness or largeness. For the separation has produced discernible, countable bodies. The revolution which causes the separation is to be envisaged as beginning in the center of what is now the cosmos and expanding outwards.[33] The surrounding remainder, therefore, is still in the primordial state of mixture; and this mass is indefinite in amount, as fragment 2 tells us.

> For both air and aither are separated off from the "much" which surrounds; and what surrounds is, itself, indefinite in amount.

This is a very old picture of the cosmogonic process—going back at least to Anaximander—and Anaxagoras' acceptance of it hardly singles him out as a revolutionary thinker. The terms πολύ and πλῆθος here may thus be translated in accordance with our hypothesis, giving them no reference to countable bits or shares.

So far I have said nothing about the central oddity of Anaxagoras' system, his claim that in some sense the total mixture of all the χρήματα or basic elements in his system is still a feature of our present world of separated and differentiated objects, of "large" objects as I am interpreting the term. This claim, of course, is the key move in Anaxagoras' attempt to deal with Parmenides' demonstration that nothing could come to be from what is not or vanish into what is not. There could be no "coming into being" or "being destroyed" of any thing, be it substance or attribute (to use anachronistic terms). So these apparent phenomena had to be reduced to a derivative status, by interpreting them as the "mixing together" and

[33] See fragment 12.

"distinguishing" of the χρήματα which truly exist and meet Parmenidean standards of permanence. Fragment 17 summarizes the position Anaxagoras' theory is meant to support:

> On coming to be and being destroyed the Greeks do not hold correct opinions. For no thing* comes to be nor is destroyed, but is mixed together and distinguished from existing things*. And thus they would correctly call "coming to be" being mixed and "being destroyed" being distinguished.

Since there can be no radical, genuine change and since observation tells us that virtually anything can emerge from anything else even now, as a spark from flint, water from stones (in dripping caves), air from water and flesh from food, Anaxagoras concluded that it must still be the case that everything is in everything. This is perhaps an unnecessarily sweeping generalization, since there are some emergences which do not occur, but it is in keeping with Anaxagoras' bold speculative temperament. Besides, as Simplicius pointed out (A 45), if you follow a chain of emergences through serially it may perhaps turn out that all things do emerge from all things indirectly. But whether even this is true is an empirical question which neither Anaxagoras nor Simplicius (nor I) had the patience to try to answer.

It is this requirement, imposed by the defense of change in a Parmenidean framework, that all things *still* be in all things which gives Anaxagoras' system its unique character and his interpreters the greatest need for ingenuity. Here we must look closely at fragments 3, 5, and 6. These fragments present the quantity terms we have been examining in a new light and will put any hypothesis about the meaning of smallness, bigness, and "muchness" to its most severe test.

Let us look first at fragment 3, which Simplicius explicitly says is about the ἀρχαί, i.e. the ἐόντα χρήματα.

> Nor is there something which is itself the least of the small, but it [the small] is always lesser (for what is cannot not be); but also, there is always a greater than the great. And it [the great] is equal in amount to the small, but each is, with respect to itself, both great and small.

Let me point out first that this is one of the fragments which has been thought to represent Anaxagoras' response to Zeno. Indeed, Zeller inserted an explicit reference to division into the fragment by emending the admittedly difficult τὸ μὴ in τὸ γὰρ ἐὸν οὐκ ἔστι τὸ μὴ οὐκ εἶναι to τομῇ: what is cannot not be by division. This emendation is widely rejected on the textual level, although Diels–Kranz persevere

by saying that the idea of division is easily supplied from the context. But is this so?[34]

"Nor is there something which is itself the least of the small." On my hypothesis this states that there is no limit to how thoroughly things can be mixed (while for Barnes it states that there is no limit to how small a portion can be taken for consideration; but this raises many problems, including one about how one could individuate, count, or measure, such portions or shares; no such measurement is needed on my interpretation). "The small" is what is well distributed in a mixture; the term applies to χρήματα, not to portions or shares (μοῖραι). And if everything is to come from everything, even on the observable level, then there must be a bit of each χρῆμα in each thing. And if the hot, for example, is to be in ice,[35] then there will be very little of it indeed: it must be very well mixed. To allow for all possible cases, we must set no limit to the thoroughness of the mixture. The point of the explanatory parenthesis ("for what is cannot not be") will be that unless this kind of mixture is possible, everything cannot be in everything, which would mean that anything could not emerge from anything, which would mean that some cases of change would entail radical coming into being or destruction (i.e. what is would not be). But this is impossible, according to Parmenides; so this kind of mixture must be possible. Thus on my reading the observation that "what is cannot not be" *is* apposite here—it is not the "simple truism" innocent of Eleaticism which it turns into on Barnes' view.[36]

The statement that there is always a greater than the great follows. For the great (or the big) is what is separated off, and if there is always more of x in y, then you can in principle separate more of it off, producing a "bigger" product. The statement that the big is equal to the small in amount also follows. For if it is *always* possible to get more x out of y, the separated and the unseparated x must both be indefinite (ἄπειρον). As such they are "equal" in amount. For it is reasonable to suppose that two amounts, both being indefinite, are "equal" even if one does not give this a sophisticated arithmetical

[34] If emendation is needed, Schofield's excision (pp. 156–57, n. 15) of τὸ is by far the preferable attempt. Teodorsson's (p. 72) and Sider's (pp. 54–57) revival of τομῇ μὴ οὐκ εἶναι is a superfluous intrusion into the text until we have independent reasons for crediting Anaxagoras with the idea of infinite divisibility.

[35] Or in the cold—I do not think that it matters much whether the slogan "all in all" uses the word "all" univocally or applies it first to χρήματα and second to observable entities. In so far as the latter are derivative, as I think that they are, the distinction is not significant.

[36] P. 34.

precision. Here again πλῆθος can refer to a non-countable amount, not to a countable plurality of particles (which are infinitely divisible), nor to a plurality of portions or shares expressible in numbers or algebraic symbols, as Barnes' view would hold.[37]

The fragment concludes,[38] "with respect to itself each thing is both great and small." The difficulty here is to decide what "each" refers to. Is it "each χρῆμα" i.e. each of the ἀρχαί? This is what the context might suggest. Or is it "each thing" in the sense of macroscopic objects? Or "each of the big and small"? The latter is less likely in that one would expect ἑκάτερον, although it would give the word a referent in the immediate context, which neither of the other options provides. On balance the question may not be too important, as the sense of the fragment is underdetermined anyway. Still, I prefer the first interpretation, if only because Simplicius tells us that this fragment is about the ἀρχαί.[39]

With respect to itself, one might say, each thing is large insofar as it is separated off into identifiable objects, and small insofar as it is not, being mixed either in the περιέχον or with all the other χρήματα. This would be the result of taking "each" to refer to the χρήματα and adopting my hypothesis. The hot, in its totality, is both large and small simply because some of it is separated off and some of it is not. On this interpretation, therefore, fragment 3 will be referring to a time after the cosmogonic separation has begun; for otherwise there would be nothing "large" in the postulated sense. But this already follows from my interpretation of the rest of the fragment.

Fragment 5 also deals with this stage: "These things having been distinguished thus," it begins. It goes on to deal with what is true of all the χρήματα, presumably taken distributively.

> These things having been distinguished thus, one must recognize that all are in no way lesser or more (for it is impossible [lit. unmanageable] for there to be more than all) but all are always equal.

Each one is always equal to itself, being neither less nor greater than it is. It is better to see this as repeating the main point of fragment 3, that each χρῆμα has equal bigness and smallness, rather than to

[37] On both of these views Anaxagoras comes out as holding a suspiciously sophisticated, although approximately correct, view about the equality of all infinite sets—see, for example, Barnes, p. 35; Vlastos, pt. III and n. 75, and C. Strang, "The Physical Theory of Anaxagoras," pp. 361–80 in Allen and Furley (above, note 29). Such a modern insight is hard to attribute to our "archaic sage," who mentions neither particles, nor small and large portions/shares, nor sets of such entities.

[38] See Sider, p. 61.

[39] This is Barnes' preference too.

take it as merely saying tautologically that there are as many kinds of χρήματα as there are.

Fragment 6 continues the exploration of the characteristics of matter when separation has begun. In particular, it deals with an important corollary of the thesis that total mixture is always a fact about the χρήματα despite separation, viz. the claim that nothing is totally isolated (χωρισθῆναι) from other things. Thus it provides the groundwork for fragment 8 and, less obviously, for fragment 7 which says that one does not know the amount of things separated off either in word or in fact. This ignorance is inevitable if one cannot isolate and count discrete bits of matter or even distinguishable portions.

But to return to fragment 6:

> (A) And since there are shares of the great and the small equal in amount, in this way too all would be in all. Nor can it/they/something[40] be isolated, but all have a share of each. (B) Since the least cannot exist, it/they/something could not be isolated nor come to be by itself, but just as in the beginning, so now, all are together.

The first point (A) Anaxagoras is making is that the equality of shares (μοῖραι) or portions of the big and small (i.e. the distinguished or separated and the unseparated parts of each χρῆμα or stuff) is a reason for holding the thesis of total mixture. Since on the present interpretation the equality in amount of big and small is a statement of the perpetual possibility of further separation, this really *is* a ground for holding the thesis of total mixture. For total mixture is made necessary, among other reasons, by Anaxagoras' belief in the perpetual possibility of further separation. Without such a belief, a central reason for believing that total mixture still is the case, after separation as well as before, would disappear.

The second point made (B) is that the fact that there is no least (as asserted in fragment 3) is a reason for holding that the total isolation of a χρῆμα is impossible. It is because "there is no least," i.e. on my interpretation because there is no limit to how well something can be blended, that we believe that isolation is impossible and so that total mixture is still the case. Since the blending of one χρῆμα into another cannot be limited, isolation or separation of a χρῆμα cannot be completed.

Here we may claim an advance over the traditional interpretation of fragment 6, which Schofield follows,[41] and over Barnes.[42] For on these readings the possibility of indefinite or infinite smallness of

[40] It is unclear what the subject of the verb is or whether it might be impersonal.
[41] Pp. 91–93.
[42] P. 36.

countable particles or portions must be taken, not as a reason for holding the non-isolation thesis, but as asserting a facilitating condition, as stating that one reason for *not* holding it does *not* obtain. For on the traditional understanding of smallness (to which Barnes seems to revert in despair), a limit to it, i.e. a form of atomism, would make it impossible to accept total mixture. On such an interpretation Anaxagoras is only entitled to conclude "it could be the case that it is not isolated," not the stronger "it could not be the case that it is isolated." On the present interpretation the stronger reading, which is wanted here, *is* justified.

The final sentence of fragment 6 is difficult on all interpretations; indeed Barnes[43] trivializes it. "And many things are present in all, and [these things are] equal in amount in the greater and lesser of the things separated off." I would expand it thus: in all things there are many χρήματα (an understatement) and these χρήματα are equal in amount in both the greater and the lesser of the objects separated off. The equality in amount of χρήματα in *anything* follows well enough, but the terms *greater* and *lesser* must, I fear, be interpreted differently here than they are when used in reference to χρήματα. For now they are used of the macroscopic distinct objects, not of the χρήματα themselves, and therefore they must have the ordinary sense of big and small. This ambiguity of quantity terms, depending on whether they are applied to macroscopic objects or to χρήματα is an annoying feature of Anaxagoras' style;[44] but it is not unparalleled. For even the term χρῆμα is occasionally used of objects on the macroscopic level,[45] although usually it refers to the stuffs or ἀρχαί which are subject to total mixture and are the genuine, fully real entities (ἐόντα χρήματα) which obey Parmenidean rules of permanence.

Here I must conclude. Although the fragments have not been exhaustively reviewed, I have touched on the most difficult texts, the ones which provide the most rigorous test for my theory about the meaning of "small" and "large" in Anaxagoras. I believe that the rest of the fragments can be readily fitted into the framework provided. I should briefly review what I think are the strengths of this interpretation. Anaxagoras himself never speaks of division, infinite or otherwise (except for the figurative reference in fragment 8) and it is historically implausible that he should have conceived of

[43] P. 36.

[44] Also found in fragment 12, p. 38. 4–5 DK. See also μέγιστα in fragment 1, used in the ordinary sense.

[45] As in fragment 9 (where νῦν signals the atypical usage) and *possibly* in fragment 17, p. 40. 21 DK.

infinite divisibility. His central concepts are mixture and separation, producing distinctness or indistinguishability of basic stuffs such as hot and cold. He gives one clear hint himself in the surviving fragments about how the quantity terms "small" and "large" are to be interpreted when they refer to the basic stuffs, and this hint involves only the mechanisms of separation and mixture. I have tried to show that this hint can be followed out consistently in the interpretation of the fragments. If I am correct, there are no references to small and large countable particles of matter in the fragments, or even to numerically expressible smaller and larger portions of stuffs. This, I think, is more what we should expect of an Ionian physicist who responded first to Parmenides' challenge to the concept of change, without reference to the work of Zeno or Leucippus. The resulting theory is strange; but Anaxagoras will be that on any interpretation. The theory has a good chance of being closer to the truth, I suggest, than other currently held theories about Anaxagoras, if only because its strangeness goes further toward providing an interpretation of his work which is internally consistent and compatible with his position in the historical development of Greek thought.[46]

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