

## Gloser til fragmenter af de førsokratiske atomister efter Kirk & Raven 2. udg. Kapitel XV.

### Indledning

#### *Eleaterne*

Teorien om atomerne kan bedst forstås som en reaktion på Parmenides' og eleaternes fastholden ved, at 'det værende og kun det værende er', og at forandring, herunder bevægelse, derfor ikke kan finde sted. Læs herom Jørgen Mejer: *Førsokratiske filosoffer Fra Parmenides til Demokrit* (1995). Ny udgave ved Rasmus Sevelsted: *Førsokratiske filosoffer* (2022). Heri findes også en dansk oversættelse af Parmenides' digt.

Der findes en interessant tidlig dansk studie om Demokrit af Ingebog Hammer Jensen: *Den ældste Atomlære* (disp. Kbh 1908). Den giver et godt indblik i tidens naturvidenskabelige begejstring for atomisterne.

**K-R** og **sidetal** henviser til 2. udg. af *The Presocratic Philosophers* af G. S. Kirk & J. E. Raven. Teksten er at finde efter gloserne. Tal markeret med fed i gloserne henviser til paragraffer i *Basis*.

#### *Atomisterne*

**K-R 545 (s. 406-407)** Aristoteles *Om tilblivelse og undergang DK 67 A 7*

Oversættelse i Mejer nr. 106/263

[resumé af eleaternes holdning]

ἔνιοι nogle, dvs. eleaterne

ἀρχαῖος gammel, Aristoteles' betegnelse for førsokratikerne

δοκεῖ + dat det synes for = NN mener, har vedtaget, + *aci* i det følgende. Aristoteles refererer altså sine forgængeres meninger i *aci*

ὅν, τό det værende

ἐξ ἀνάγκης ud fra nødvendighed, nødvendigvis

ἐν ἐτ 7

ἀ-κίνη-τος *adj* u-bevægelig - κινέω bevæger

κενός *adj* tom

μή + abs gen **16.3.3.3** 'hvis ikke κενόν var noget adskilt'

χωρίζω adskiller

αὐ *adv* igen, på den anden side

πολλά *pl.* 'flerheder'

δι-είργω adskiller, τὸ διείργον det der adskiller

[der er et brud i Aristoteles' fremstilling. Det følgende handler specifikt om Leukippos:]

ᾤθη *aor præet af* οἶομαι tror, mener

λόγοι 'argumenter, tankegange, teorier'

αἰσθησις, ἡ sansning

ὁμο-λογέω 'siger det samme, er enig' ὁμολεγούμενα λέγοντες 'idet teorierne sagde ting svarende til sansningen'

ἀν-αιρέω ophæver

γένεσις, ἡ tilblivelse (sml. titlen på Aristoteles' værk *de generatione et corruptione*

φθορά, ἡ undergang

κίνησις, ἡ bevægelse

πλήθος, τό mængde

ὁμο-λογέω + *dat* indrømmer over for

φαινόμενα, τά, 'det man kan se'

κατα-σκευάζω opbygger, konstruerer, NB subst. ptc **16.3.1** ... 'over for dem der opbygger det ene'  
(= eleaterne)  
ὡς ... φησιν + *aci* at han siger, at ... [igen referat]  
ἄνευ *adv* + *gen* uden  
κυρίως *adv* overordnet, absolut  
παμ-πλήρης *adj* hel-fyldt  
τοιούτος **4.6** 'noget sådant' dvs. det fyldte  
ἄ-πειρος *adj* u-begrænset – S er 'atomerne', som endnu ikke har et navn  
ἄ-όρατος *adj* u-synlig  
σμικρότης, ἡ (μικρός) lidenhed  
ὄγκος, τό vægt  
συν-ίσταμαι\* stiller mig sammen med noget, samles  
ποιέω skaber  
δια-λυω opløser

**K-R 555 (s. 413) Aristoteles, *Metafysik* DK 67 A 6**

ἐταῖρος, ὁ ven  
στοιχεῖον, τό byggesten, element  
πλήρης *adj* fuld  
κενός *adj* tom  
στερεός *adj* massiv  
μανός *adj* løs, spredt  
διό derfor  
οὐθὲν μᾶλλον + *gen* **12.5.3** på ingen måde mere end ...  
<...> dette ord er indsat af en filolog og findes ikke i håndskrifterne  
ἐλάττων **3.6**  
σῶμα, τό krop, legeme  
αἴτιος + *gen* skyldig i, årsag til  
ὕλη, ἡ stof ὡς ὕλη 'som stoflig/materiel årsag'  
ὑπο-κειμένη οὐσία, ἡ den underliggende væren/substans  
οἱ ἐν ποιούμετες de som gør ... til ét, altså eleaterne  
πάθος, τό  
γεννάω føder, får til at opstå  
πυκνός *adj* tæt 'fortætning' μανόν 'fortynding'  
ἀρχή, ἡ udgangspunkt, princip  
πάθημα, τό forandring (cf πάθος)  
τρόπος, ὁ måde  
δια-φορά, ἡ forskel, δια-φέρω adskiller mig fra  
σχῆμα, τό facon, form  
τάξις, ἡ rækkefølge  
θέσις, ἡ placering  
ῥυθμός, ὁ rytme (jonisk form)  
δια-θιγή, ἡ berøring  
τροπή, ἡ drejning

**K-R 556 (s. 413-414) Aristoteles *Om Demokrit* – ap. Simplicium in commentario *De caelo* DK 68 A 37**

προσ-αγορεύω benævner, kalder  
τόπος, ὁ sted  
ὄνομα, τό navn  
οὐδέν, τό **17.2** intethed  
ἄπειρος *adj* ubegrænset

οὐσία, ἡ væren  
δέν, τό et kunstord (nemlig οὐδέν uden οὐ = 'noget'), som giver det tomme eksistens NB konjektur!  
ναστός *adj* kompakt  
νομίζω + *aci* mener, at ...  
ἐκ-φεύγω undflyer  
αἰσθησις, ἡ sans  
ὑπ-άρχω + *dat* er tilstede for  
παντοῖος *adj* alskens  
μορφή, ἡ form  
σχῆμα, τό facon  
μέγεθος, τό størrelse  
γεννάω føder, skaber  
συγ-κρίνω sammen-sætter, forbinder  
αἰσθητός *adj* sansbar  
ὄγκος, ὁ vægt, legeme (= atom)

**K-R 556 (s. 414)** Simplicius' kommentar til Aristoteles' *Om himlen*

læg mærke til de mange glosser med *à privativum*

ἄ-πειρος *adj* u-begrænset  
ἄ-τομος *adj* u-overskærbar, u-delelig  
ἄ-δι-αίρετος *adj* u-fra-hinanden-delelig  
ἄ-πάθης *adj* u-påvirkelig  
ναστός *adj* tæt, kompakt  
ἄ-μοιρος *adj* uden del i  
δι-αίρεσις, ἡ adskillelse

**K-R 562 (s. 416 i fodnoten)** Aristoteles *Om tilblivelse og ophør*

οἶομαι τάληθες ἐν τῷ φαίνεσθαι mener, at det sande <ligger> i det at vise sig = i det sansbare  
ἐν-αντίος *adj* modsat  
σχῆμα, τό form

**K-R 566 (s. 416-417)** Diogenes Laertios = DK 67 A1

NB: Diogenes refererer atomisternes tanker i én lang *aci*!

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κόσμος, ὁ verden  
δια-λύω op-løser  
ἀπο-τομή, ἡ af-skæring  
παντοῖος *adj* alskens  
ἀθροίζω samler  
δίνη, ἡ hvirvel  
ἀπ-εργάζομαι skaber, forårsager  
προσ-κρατέω tager til i styrke  
παντο-δαπῶς *adv* på alle måder  
κυκλέω drejer rundt som et hjul  
δια-κρίνομαι udskiller  
χωρίς *adv* for sig selv  
ἰσόρ-ροπος *adj* ligevægtig  
μηκ-έτι ikke længere  
περι-φέρομαι bevæger mig rundt  
λεπτός *adj* lille  
χωρέω går væk

τὸ ἔξω κενόν 'det ydre tomme'  
δι-αττάομαι sier fra (med en si)  
συμ-μένω holder sammen  
περι-πλεκω om-fletter  
συν-κατα-τρέχω løber sammen  
σύστημα, τό system, struktur  
σφαιρο-ειδής *adj* kugle-formet

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ὑμην, ὁ hinde (hymen)  
ἀφ-ιστημι står for sig selv  
περι-έχω omfatter  
ἀντ-έρεις, ἡ mod-stand  
περι-δινέω hvirvler rundt  
λεπτός 31  
πέριξ *adv* = περί rundtom  
συρ-ρέω flyder sammen  
συν-εχής *adj* sammenhængende  
ἐπί-ψαυσις be-røring  
ἐν-έχομαι holder fast i  
αὐξω forøger  
ἐπ-έκ-κρισις, ἡ udskillelse  
ἐπι-ψάω berører  
ἐπι-κτάω erhverver foruden = tiltager i vækst  
κάθ-υγρος *adj* temmelig våd  
πηλ-ώδης *adj* ler-agtig  
ξηραίνω tørrer  
ἐκ-πυρόω sætter i brand  
ἄστηρ, ὁ stjerne  
ἀπο-τελέω medfører

**K-R 564 (s. 417) Aëtios**

χιτών, ὁ chiton, mandsdragten

ὑμην **562**

περι-τείνω om-spænder

ἀγκιστρο-ειδής krog-lignende – atomerne har altså kroge, som kan hage sig fast i hinanden

ΤΕΛΟΣ

## The Atomists: Leucippus of Miletus and Democritus of Abdera

### INDIVIDUAL CONTRIBUTIONS, AND DATES

**539** Simplicius *in Phys.* 28, 4 (= Theophrastus *Phys. op. fr.* 8) Λεύκιππος δὲ ὁ Ἐλεάτης ἢ Μιλήσιος (ἀμφοτέρως γὰρ λέγεται περὶ αὐτοῦ), κοινωνήσας Παρμενίδῃ τῆς φιλοσοφίας, οὐ τὴν αὐτὴν ἐβάδισε Παρμενίδῃ καὶ Ζενοφάνει περὶ τῶν ὄντων ὁδόν, ἀλλ' ὡς δοκεῖ τὴν ἐναντίαν.

**540** Diogenes Laertius x, 13 τοῦτον (*sc.* Ἐπίκουρον) Ἀπολλόδωρος ἐν Χρονικοῖς Ναυσιφάνους ἀκοῦσαί φησι καὶ Πραξιφάνους· αὐτὸς δὲ οὐ φησιν, ἀλλ' ἑαυτοῦ ἐν τῇ πρὸς Εὐρύλοχον ἐπιστολῇ. ἀλλ' οὐδὲ Λεύκιππόν τινα γεγενῆσθαι φησι φιλόσοφον οὔτε αὐτὸς οὔτε Ἐρμαρχος, ὃν ἐνιοί φασι (καὶ Ἀπολλόδωρος ὁ Ἐπικούρειος) διδάσκαλον Δημοκρίτου γεγενῆσθαι.

**541** Cicero *Academica priora* II, 37, 118 Leucippus plenum et inane; Democritus huic in hoc similis, uberior in ceteris.

**542** Diogenes Laertius ix, 34 Δημόκριτος Ἠγησιστράτου, οἱ δὲ Ἀθηνοκρίτου, τινὲς Δαμασίππου, Ἀβδηρίτης ἦ, ὡς ἐνιοί, Μιλήσιος. . . ὕστερον δὲ Λεύκιππῳ παρέβαλε καὶ Ἀναξαγόρα κατὰ τινάς, ἔτεσιν ὧν αὐτοῦ νεώτερος τετταράκοντα. . . (41) γέγονε δὲ τοῖς χρόνοις, ὡς αὐτὸς φησιν ἐν τῷ Μικρῷ διακόσμῳ, νέος κατὰ πρεσβύτην Ἀναξαγόραν, ἔτεσιν αὐτοῦ νεώτερος τετταράκοντα. συντετάχθαι δὲ φησι τὸν Μικρὸν διάκοσμον ἔτεσιν ὕστερον τῆς Ἰλίου ἀλώσεως τριάκοντα καὶ ἑπτακοσίοις. γεγόνον δ' ἂν, ὡς μὲν Ἀπολλόδωρος ἐν Χρονικοῖς, κατὰ τὴν ὀγδοηκοστὴν ὀλυμπιάδα (460–457 B.C.), ὡς δὲ Θρασύλος, ἐν τῷ ἐπιγραφομένῳ Τὰ πρὸ τῆς ἀναγνώσεως τῶν Δημοκρίτου βιβλίων, κατὰ τὸ τρίτον ἔτος τῆς ἐβδόμης καὶ ἐβδομηκοστῆς ὀλυμπιάδος (470/69), ἐνιαυτῷ, φησί, πρεσβύτερος ὧν Σωκράτους.

**539** Leucippus of Elea or Miletus (both accounts are current) had associated with Parmenides in philosophy, but in his view of

reality he did not tread the same path as Parmenides and Xenophanes, but rather, it seems, the opposite path.

540 Apollodorus in the *Chronicles* says that Epicurus was instructed by Nausiphanes and Praxiphanes; but Epicurus himself denies this, saying in the letter to Eurylochus that he instructed himself. He and Hermarchus both maintain that there never was a philosopher Leucippus, who some (including Apollodorus the Epicurean) say was the teacher of Democritus.

541 Leucippus postulated atoms and void, and in this respect Democritus resembled him, though in other respects he was more productive.

542 Democritus, son of Hegesistratus (or by other accounts of Athenocritus or Damasippus), a citizen of Abdera or, as some say, of Miletus... Later he met Leucippus and, according to some, Anaxagoras also, whose junior he was by forty years... As he himself says in the *Little World-system*, he was a young man in the old age of Anaxagoras, being forty years younger. He says that the *Little World-system* was composed 730 years after the capture of Troy. He would have been born, according to Apollodorus in the *Chronicles*, in the eightieth Olympiad; according to Thrasyllus, in his book entitled *Preparation for Reading the Works of Democritus*, in the third year of the seventy-seventh, being one year (as he says) older than Socrates.

Leucippus was generally agreed to have evolved his theory of atoms in answer to the Eleatic elenchus: so Aristotle in 545 below. He was even assumed by late sources to have been an Eleatic; according to Diogenes Laertius ix, 30 (DK 67A1) he was a pupil of Zeno. This we need not believe: it is not suggested by Aristotle, and is the kind of thing which might easily be asserted by Sotion and the other succession-writers. Miletus is given as his alternative birth-place; the *a priori* reasons for this are not so strong, though he obviously revived some Milesian astronomical theories; it might therefore be true. He may of course have visited Elea, but the Eleatic doctrines were known in Athens, and Melissus, against whom Leucippus perhaps chiefly reacted (cf. pp. 398ff., 408f.), was an Ionian. Singularly little was known about Leucippus, in any case, and in 540 his very existence seems to be denied by Epicurus and Hermarchus. But Epicurus is intent on proving his own originality; Burnet (*EGP*, 330 n. 2) suggested that all Epicurus said was something like Λεύκιππον οὐδ' εἰ γέγονεν οἶδα, meaning 'I don't consider Leucippus worth discussing'. Alternatively, the emphasis might have been on the word φιλόσοφον: there was no *philosopher* Leucippus (i.e. Leucippus was no philosopher).

Unlike Leucippus, Democritus was the subject of a large number of anecdotes told by ancient writers (see e.g. Diog. L. IX, 34ff., DK 68A 1; selections below, p. 406 n. 1). But he remains a scarcely less shadowy figure: the stories are mere fictions. All we can be sure of is that he came from Abdera, the city of his elder contemporary Protagoras, and that he did indeed associate with Leucippus.

It is clear from 545 that Aristotle considered Leucippus to be the inventor of atomism, and this is accepted by Theophrastus (in the continuation of 539, *Simpl. in Phys.* 28, 7ff.). Much harder to assess is Democritus' contribution to the theory. In his reports of it Aristotle normally writes simply of 'Leucippus and Democritus' and when later doxographical passages refer to one of the philosophers only, it is in general unsafe to infer that the doctrine in question is special to him.<sup>1</sup> But we have evidence that Democritus was particularly preoccupied with the epistemological basis of atomism; and no doubt he was responsible for working out many of its detailed applications, as for example in the theory of perception, which Theophrastus presents as his without any mention of Leucippus (*de sensu* 49ff., DK 68A 135). Otherwise, as Cicero implies (541), Democritus wrote on a wide range of topics presumably left untouched by Leucippus (cf. pp. 405-6 below), showing himself in this variety of interests a typical author of the sophistic age.

<sup>1</sup> The attempt of C. Bailey, in *The Greek Atomists and Epicurus*, to distinguish the views of the two thinkers, has not found much support. See the criticisms of Guthrie, *HGP* II, 382 n. 2, and (on particular points) of Furley, *Two Studies in the Greek Atomists*, 94-5, and M. C. Stokes, *One and Many in Presocratic Philosophy* (Washington, D.C., 1971), 334 n. 15, 335 n. 20.

The date of Leucippus is not known independently, except from such guesses as that he was a pupil of Zeno. Democritus, however, evidently gave a clue to his own age in his work the *Little World-system*: he was about forty years younger than Anaxagoras. This fits Apollodorus' date in 542 (born 460-457 B.C.) better than Thrasyllus', of some ten years earlier. In any case, if Democritus accepted 1184 B.C. as the year of the capture of Troy (and this, the Eratosthenic epoch-year, was merely the commonest of several dates), then the composition of the *Little World-system* (on which see the next section) would be placed too early, in 454. The probability is that it was written after 430. Leucippus, presumably, was somewhat older, and his *floruit* (i.e. the composition of the *Great World-system*) might be put around 440-435. A possible *terminus ante quem* is provided by Theophrastus' statement (598) that Diogenes of Apollonia derived some of his ideas from Leucippus; for Diogenes was already parodied in the *Clouds* of 423 B.C. (614).

## WRITINGS

543 Diogenes Laertius ix, 45 (DK 68A 33) τὰ δὲ βιβλία αὐτοῦ (sc. Δημοκρίτου) καὶ Θρασύλος ἀναέγραφε κατὰ τάξιν οὕτως ὡσπερὶ καὶ τὰ Πλάτωνος κατὰ τετραλογία. (46) ἔστι δὲ ἠθικὰ μὲν τάδε... φυσικὰ δὲ τάδε: [tetralogy III] Μέγας διάκοσμος (ὅν οἱ περὶ Θεόφραστον Λευκίππου φασὶν εἶναι), Μικρὸς διάκοσμος, Κοσμογραφίη, Περί τῶν πλανητῶν...

543 Thrasyclus listed his books in order by tetralogies, just as he did Plato's books. His ethical works comprised the following... The physical books were these: The *Great World-system* (which Theophrastus' followers say was by Leucippus), the *Little World-system*, the *Cosmography* and *On the Planets*...

It is true that the *Great World-system* is usually assigned to Democritus, since he was the elaborator of atomism and, apart from Epicurus, its chief exponent. Epicurus himself would presumably have credited it to Democritus. But Theophrastus' opinion in 543 counts for much: Aristotle came from a city in Thrace, and both he and his pupil Theophrastus devoted special works to Democritus. They were evidently aware of the distinction between Leucippus and Democritus, whereas it is natural that when the distinction became forgotten all early atomistic works should be attributed to Democritus. We may therefore provisionally accept Theophrastus' view that Leucippus wrote the *Great*, Democritus the *Little World-system*<sup>1</sup>; with the possible modification that the former may have been a compendium of Leucippus' cosmological work with other, later, atomistic additions. One other work is attributed to Leucippus, namely *On Mind*: the quotation from him by Aetius (569) is assigned to this work, which may, of course, have been a section of the *Great World-system*. The content of this fragment would certainly not be foreign to that work, and might have formed part of an attack on the concept of Mind in Anaxagoras.

<sup>1</sup> It seems probable that this work contained a description of the origin of civilization and culture, and that part of the description in Diodorus i, 7-8 (DK 68B 5, 1) goes back to Democritus by way of Hecataeus of Abdera (see G. Vlastos, *AJP* 67 (1946), 51ff.). However, Diodorus certainly used more than one Ionian source for this section, and it can be conceded that the account of cosmogony in i, 7 is not primarily atomistic.

Democritus, on the other hand, must have been one of the most prolific of all ancient authors. Thrasyclus (or Thrasyllus), who arranged Plato's dialogues in tetralogies, did the same for Democritus according to 543: there were thirteen tetralogies (comprising fifty-two

separate works, some no doubt quite short) divided between the following general headings: Ethics (2 tetralogies), Physics (4), Mathematics (3), Music, including literature and language (2), Technical subjects (2). There were additional works which were probably not genuine.<sup>1</sup> It is a tantalizing misfortune, and a reflexion of later taste, that the considerable number of fragments that have survived (not all of which are certainly genuine) are nearly all taken from the ethical works.

<sup>1</sup> Among the works classed as Ὑπομνήματα and not included by Thrasyllus (Diog. L. ix, 49, DK 68A 33) are five concerned with foreign travel, for example a Chaldaean and a Phrygian dissertation. The attribution is perhaps related to the many stories in our ancient biographical sources that Democritus travelled extensively: for example 544 Diog. L. ix, 35 φησὶ δὲ Δημήτριος ἐν Ὀμωνύμοις καὶ Ἀντισθένης ἐν Διαδοχαῖς ἀποδημῆσαι αὐτὸν καὶ εἰς Αἴγυπτον πρὸς τοὺς ἱερέας γεωμετρίαν μαθησόμενον καὶ πρὸς Χαλδαίους εἰς τὴν Περσίδα, καὶ εἰς τὴν Ἐρυθρὰν θάλασσαν γενέσθαι. τοῖς τε Γυμνοσοφισταῖς φασὶ τινες συμμίξει αὐτὸν ἐν Ἰνδίᾳ καὶ εἰς Αἰθιοπίαν ἐλθεῖν. (*Demetrius in his Homonyms and Antisthenes in his Successions say that he travelled to Egypt to visit the priests and learn geometry, and that he went also to Persia, to visit the Chaldaeans, and to the Red Sea. Some say that he associated with the 'naked philosophers' in India; also that he went to Aethiopia.*) Another story is that Xerxes left Chaldaean overseers in Democritus' father's household, from whom Democritus learned much. There may have been some basis in fact for these stories of foreign contact. According to another anecdote Democritus said that he visited Athens, but that no one recognized him.

#### METAPHYSICAL PRINCIPLES

545 Aristotle *de gen. et corr.* A8, 325a2 (DK 67A 7; first part of extract is continued at 530) ἐνίοις γὰρ τῶν ἀρχαίων ἔδοξε τὸ ὄν ἐξ ἀνάγκης ἔν εἶναι καὶ ἀκίνητον· τὸ μὲν γὰρ κενὸν οὐκ ὄν, κινήθηναί δ' οὐκ ἂν δύνασθαι μὴ ὄντος κενοῦ κεχωρισμένου, οὐδ' αὖ πολλὰ εἶναι μὴ ὄντος τοῦ διείργοντος – τοῦτο δ' οὐδὲν διαφέρειν, εἴ τις οἶεται μὴ συνεχές εἶναι τὸ πᾶν ἀλλ' ἄπτεσθαι διηρημένον, τοῦ φάναι πολλὰ καὶ μὴ ἔν εἶναι καὶ κενόν. εἰ μὲν γὰρ πάντη διαιρετόν, οὐθὲν εἶναι ἔν, ὥστε οὐδὲ πολλὰ, ἀλλὰ κενὸν τὸ ὅλον· εἰ δὲ τῇ μὲν τῇ δὲ μὴ, πεπλασμένῳ τινὶ τοῦτ' ἔοικέναι. μέχρι πόσου γὰρ, καὶ διὰ τί τὸ μὲν οὕτως ἔχει τοῦ ὅλου καὶ πληρές ἐστι, τὸ δὲ διηρημένον; ἔτι δ' ὁμοίως ἀναγκαῖον μὴ εἶναι κίνησιν... (a23) Λεύκιππος δ' ἔχειν ῥήθη λόγους οἵτινες πρὸς τὴν αἴσθησιν ὁμολογούμενα λέγοντες οὐκ ἀναιρήσουσιν οὔτε γένεσιν οὔτε φθορὰν οὔτε κίνησιν καὶ τὸ πλῆθος τῶν ὄντων. ὁμολογήσας δὲ ταῦτα μὲν τοῖς φαινομένοις, τοῖς δὲ τὸ ἔν κατασκευάζουσιν ὡς οὐκ ἂν κίνησιν οὔσαν ἄνευ κενοῦ, τό τε κενὸν μὴ ὄν καὶ τοῦ ὄντος οὐθὲν μὴ ὄν φησιν εἶναι· τὸ γὰρ κυρίως ὄν παμπλήρες ὄν. ἀλλ' εἶναι τὸ τοιοῦτον οὐχ ἔν, ἀλλ' ἄπειρα τὸ πλῆθος καὶ ἀόρατα διὰ σμικρότητα τῶν

ὄγκων. ταῦτα δ' ἐν τῷ κενῷ φέρεσθαι (κενὸν γὰρ εἶναι), καὶ συνιστάμενα μὲν γένεσιν ποιεῖν, διαλυόμενα δὲ φθοράν. ποιεῖν δὲ καὶ πάσχειν ἢ τυγχάνουσιν ἀπτόμενα (ταύτη γὰρ οὐχ ἐν εἶναι), καὶ συντιθέμενα δὲ καὶ περιπλεκόμενα γεννᾶν. ἐκ δὲ τοῦ κατ' ἀλήθειαν ἐνὸς οὐκ ἂν γενέσθαι πλήθος οὐδ' ἐκ τῶν ἀληθῶς πολλῶν ἐν, ἀλλ' εἶναι τοῦτ' ἀδύνατον· ἀλλ', ὡσπερ Ἐμπεδοκλῆς καὶ τῶν ἄλλων τινὲς φασὶ πάσχειν διὰ τῶν πόρων, οὕτω πᾶσαν ἀλλοίωσιν καὶ πᾶν τὸ πάσχειν τοῦτον γίνεσθαι τὸν τρόπον, διὰ τοῦ κενοῦ γινομένης τῆς διαλύσεως καὶ τῆς φθορᾶς, ὁμοίως δὲ καὶ τῆς αὐξήσεως, ὑπεισδυομένων στερεῶν.

546 Aristotle *Phys.* A3, 187a1 (DK 29A22) ἐνιοὶ δ' ἐνέδοσαν τοῖς λόγοις ἀμφοτέροις, τῷ μὲν ὅτι πάντα ἐν, εἰ τὸ ὄν ἐν σημαίνει, ὅτι ἔστι τὸ μὴ ὄν, τῷ δὲ ἐκ τῆς διχοτομίας, ἄτομα ποιήσαντες μεγέθη.

545 For some of the ancients thought that what is must necessarily be one and motionless, since the void is non-existent and there could be no motion without a separately existing void, and again there could not be a plurality without something to separate them. And if someone thinks the universe is not continuous but consists of divided pieces in contact with each other, this is no different, they held, from saying that it is many, not one, and is void. For if it is divisible everywhere, there is no unit, and therefore no many, and the whole is void. If on the other hand it is divisible in one place and not another, this seems like a piece of fiction. For how far is it divisible, and why is one part of the whole like this – full – and another part divided? Again, it is necessary similarly that there be no motion . . . But Leucippus thought he had arguments which would assert what is consistent with sense-perception and not do away with coming into being or perishing or motion, or the plurality of existents. He agrees with the appearances to this extent, but he concedes, to those who maintain the One, that there would be no motion without void, and says that the void is non-existent, and that no part of what is is non-existent – for what is in the strict sense is wholly and fully being. But such being, he says, is not one; there is an infinite number, and they are invisible because of the smallness of the particles. They move in the void (for there *is* void), and when they come together they cause coming to be, and when they separate they cause perishing. They have effects and are affected wherever they happen to be in contact (contact does not make them one), but when they are compounded together and entangled they create something. From what is truly one no plurality could come into being, nor a unity from what is truly a plurality – that is impossible. But as Empedocles and some

of the other philosophers say that things are affected through their pores, so in his view all alteration and all being affected comes about in this way: dissolution and destruction, and similarly growth, occur when solid objects slip in through the void.

**546** Some gave in to both of these arguments – to the argument that all is one if what is signifies one thing, by saying that what is not exists, and to the argument from dichotomy, by positing atomic magnitudes.

Aristotle plausibly presents Leucippus' theory of infinitely numerous invisible particles moving in a void as intended to reconcile the evidence of our senses with Eleatic metaphysics. Accordingly neither the reliability of sensory evidence nor the validity of Eleatic reasoning is accepted by Leucippus without qualification. The atomists' chief disagreements with the Eleatics are succinctly (but anonymously) described in **546**.<sup>1</sup> (i) Leucippus posited the existence of not-being, which (following Melissus) he identified as void. As **545** stresses, he was thus able to account for the possibility of motion and plurality (the two principal features of sensory experience he regarded as veridical), by endorsing the Eleatic thesis that they can exist only if void does.<sup>2</sup> (ii) The atomists rejected Zeno's attempt to show that the members of a plurality are infinitely divisible, and therefore subject to absurd consequences. **545** does not make it very clear exactly how Leucippus phrased his response to the version of Zeno's argument it reproduces. His attitude to it is perhaps indicated by the sentence beginning: 'From what is truly one...' If so, it looks as though he accepted that the notion of divisibility – whether divisibility 'everywhere' or only 'up to a point' – is indeed intolerable, and accordingly declared that none of *his* infinite plurality of particles is divisible, but each is a true unity.<sup>3</sup> This stress on the unity of his particles suggests that in reacting thus to Zeno he was exploiting Melissus' conclusion in **537**: 'So, then, if there were a plurality, things would have to be of just the same nature as the one.' Leucippus presumably agreed both with Melissus' premiss, that our senses are misleading guides to the nature of pluralities, and with his conclusion, that if there is to be a plurality, each of its members must be such as Melissus' one being is. And indeed, he goes on to endow his own particles with some of the properties which Melissus in **533** and **534** holds to derive ultimately from unity and being – notably being full, lack of internal change, and impassivity (cf. **555–7**).<sup>4</sup> (It is curiously hard to find a text which explicitly calls the atoms uncreated and imperishable, although this is implied by the frequent description of atoms and void as elements and principles: e.g. **555**.)

<sup>1</sup> This passage was construed as referring to Plato and Xenocrates by the ancient Greek commentators (see Simplicius *ad loc.*). But Ross (*ad loc.*), followed e.g. by Furley, *Two Studies*, 81–2, convincingly argues that Aristotle is thinking of the atomists.

<sup>2</sup> This thesis is reliably attested elsewhere for Melissus alone among the Eleatics, and only for the case of motion. Leucippus' own assumption of a connexion between void and plurality has to be inferred from Aristotle's text, as it was by Philoponus *ad loc.* (DK 67A 7). Perhaps it is more a deduction from such a text as Parmenides fr. 8, 22–5 (297) than an explicit Eleatic doctrine. It is worth noting that Anaxagoras and Empedocles apparently thought they could construct physical systems impervious to Parmenides' critique of mortal opinions without employing the concept of void, perhaps because they wrote before Melissus (see 470, 536). But Empedocles' theory of pores in the body actually presupposed the existence of the void which he formally denied, according to Aristotle (*de gen. et corr.* 325b1).

<sup>3</sup> This train of thought is also ascribed to Democritus: Aristotle *Met.* 1039a9, DK 68A 42 (cf. 579). Elsewhere Aristotle suggests that Democritus reacted to the Eleatic argument by agreeing that division at every point entails absurdities, but that he therefore accepted the second horn of the dilemma: division must come to a stop when it reaches indivisible magnitudes or atoms (*de gen. et corr.* 316a33–317a2, DK 68A 48b; discussed e.g. by Furley, *Two Studies* I, ch. 6, Stokes, *One and Many*, 222–4, Barnes, *Presocratic Philosophers* II, 50–8. It is very unclear how much of this actually goes back to Democritus or the Eleatics).

<sup>4</sup> Where Eleatic positions described in 545 can be precisely identified they are invariably Melissan: thus the inference 'not divided, therefore not in motion' apparently envisaged in the sentence 'Again, . . .' recalls 547 Melissus fr. 10, Simplicius in *Phys.* 109, 32 εἰ γὰρ διήρηται, φησί, τὸ ἔόν, κινεῖται· κινούμενον δὲ οὐκ ἂν εἴη. ('If what is has been divided', he says, 'it is in motion; but it would not be in motion.') And 530 (the continuation of the first part of 545) makes a specific reference to Melissus' doctrine of the unlimited extent of what is. So there is little doubt that in Aristotle's eyes it is particularly Melissus' version of Eleatic doctrine which influenced Leucippus. Later accounts which make atomism a development of Eleaticism, and Leucippus, for example, a pupil of Zeno (Diog. L. IX, 30, DK 67A 1, Hippolytus *Ref.* I, 12, 1, DK 67A 10), were probably derived from the Aristotelian assessment; cf. Theophrastus in 539. But this is a case in which Aristotle's essential judgement makes such excellent historical sense that we cannot attribute it to over-schematization of the relations between his philosophical forebears.

#### THE EVIDENCE OF THE SENSES

##### (i) *Scepticism*

548 Aristotle *Met.* Γ5, 1009b7 ἔτι δὲ καὶ πολλοῖς ζώων ὑγιαίνουσι τάναντία περὶ τῶν αὐτῶν φαίνεσθαι καὶ ἡμῖν, καὶ αὐτῶ δὲ ἐκάστῳ πρὸς αὐτὸν οὐ ταῦτὰ κατὰ τὴν αἴσθησιν αἰεὶ δοκεῖν. ποῖα οὖν τούτων ἀληθῆ ἢ ψευδῆ, ἄδηλον· οὐθὲν γὰρ μᾶλλον τάδε ἢ τάδε ἀληθῆ, ἀλλ' ὁμοίως. διὸ Δημόκριτός γέ φησιν ἥτοι οὐθὲν εἶναι ἀληθὲς ἢ ἡμῖν γ' ἄδηλον.

549 Democritus fr. 9, Sextus *adv. math.* vii, 135 Δημόκριτος δὲ ὅτε μὲν ἀναιρεῖ τὰ φαινόμενα ταῖς αἰσθήσεσι καὶ τούτων λέγει μηδὲν φαίνεσθαι κατ' ἀλήθειαν, ἀλλὰ μόνον κατὰ δόξαν, ἀληθὲς δὲ ἐν τοῖς οὖσιν ὑπάρχειν τὸ ἀτόμους εἶναι καὶ κενόν· 'νόμῳ' γάρ φησι 'γλυκύ, [καὶ] νόμῳ πικρόν, νόμῳ θερμόν, νόμῳ ψυχρόν, νόμῳ χροίη, ἔτεῃ δὲ ἄτομα καὶ κενόν'.

550 Democritus frs. 10 and 6–8, Sextus *adv. math.* vii, 136 (continues 553) καὶ πάλιν φησὶν (fr. 10)· 'ἔτεῃ μὲν νυν ὅτι οἶον ἕκαστον ἔστιν <ῆ> οὐκ ἔστιν οὐ συνίεμεν, πολλαχῆ δεδήλωται'. ἐν δὲ τῷ Περὶ ἰδεῶν (fr. 6)· 'γιγνώσκειν τε χρή, φησὶν, ἄνθρωπον τῷδε τῷ κανόνι, ὅτι ἔτεῃς ἀπήλλακται'. καὶ πάλιν (fr. 7)· 'δηλοῖ μὲν δὴ καὶ οὗτος ὁ λόγος, ὅτι ἔτεῃ οὐδὲν ἴσμεν περὶ οὐδενός, ἀλλ' ἐπιρρυσμῆ ἐκάστοισιν ἡ δόξις'. καὶ ἔτι (fr. 8)· 'καίτοι δηλον ἔσται, ὅτι ἔτεῃ οἶον ἕκαστον γιγνώσκειν ἐν ἀπόρῳ ἔστί.'

548 Again, the same things appear quite the opposite to many of the animals when they are in good health as they do to us, nor does one individual always make the same judgements about how things appear to him so far as sense-perception is concerned. Which of them, then, are true or false is unclear, for these are no more true than those, but of equal standing. This is why Democritus, at any rate, says that either nothing is true, or it is unclear to us.

549 Democritus sometimes does away with what appears to the senses, and says that none of these appears according to truth but only according to opinion: the truth in real things is that there are atoms and void. 'By convention sweet', he says, 'by convention bitter, by convention hot, by convention cold, by convention colour: but in reality atoms and void.'

550 And again he says (fr. 10): 'Now that in reality we do not grasp what each thing is or is not in character, has been made clear in many ways'. And in *On Forms* (fr. 6): 'A man must know by this yardstick that he is separated from reality.' And again (fr. 7): 'This argument too shows that in reality we know nothing about anything; but for each of us there is a reshaping – belief.' And further (fr. 8): 'Yet it will be clear that to know in reality what each thing is in character is baffling.'

Although Leucippus held that the senses reliably report that there are many things and that there is motion, nonetheless he must have believed false much of what they tell us, particularly as concerns the nature of such pluralities. For his commitment to Eleatic principles

required him to hold that nothing which truly is can change or come into being or perish. It was evidently Democritus, however, who developed a thorough critique of the trustworthiness of the senses.

In 548 Aristotle explains that Democritus was persuaded to take up his own position by the sorts of consideration which led Protagoras to the alternative view that every appearance is true, but true relatively to the man who experiences it: thus one and the same wind *is* hot (for you) if it appears hot to you, and *is* cold (for me) if it appears cold to me.<sup>1</sup> Whereas Protagoras concludes that both appearances are true, Democritus, not prepared to abandon an objective conception of truth, decides that neither can be. Aristotle thus attributes to him a reason for distrusting the senses independent of Melissus' critique in 537. The attribution is supported by independent evidence that Democritus rejected Protagoras' theory of truth, and took issue with him over his use of the οὐ μᾶλλον principle (the principle 'no more this than that').<sup>2</sup> And it is attractive to interpret Democritus' treatment of secondary qualities in 549 in this light: the contradictions in appearances exemplified in the case of the wind show not that the appearances are relatively true, but rather that it could only be an arbitrary decision on our part to call the wind hot *or* cold. In any event, 549–50 supply ample evidence (cf. also fr. 117) that, as Aristotle and Sextus maintained, Democritus did indeed commit himself to a far-reaching scepticism about the reliability of the senses – if not, indeed, about the possibility of knowledge of any kind whatsoever.

<sup>1</sup> Cf. 551 Protagoras fr. 1, Sextus *adv. math.* vii, 60 πάντων χρημάτων μέτρον ἐστὶν ἄνθρωπος, τῶν μὲν ὄντων ὡς ἔστιν, τῶν δὲ οὐκ ὄντων ὡς οὐκ ἔστιν. (*Man is the measure of all things, of those that are that they are, of those that are not that they are not.*) The wind example, taken from Plato *Theaet.* 151E ff., is very likely original.

<sup>2</sup> See fr. 156, Plutarch *adv. Colot.* 1108F; Sextus *adv. math.* vii, 389, DK 68A 114. The atomists employed the principle more widely than Plutarch allows: see e.g. p. 415 n. 2; cf. Barnes. *The Presocratic Philosophers* II, 251–7.

## (ii) Confirmation

552 Democritus fr. 125, Galen *de Med. empir.* p. 113 Walzer τάλαινα φρήν, παρ' ἡμέων λαβοῦσα τὰς πίστεις ἡμέας καταβάλλεις; πτώμα τοι τὸ κατάβλημα.

553 Democritus fr. 9, Sextus *adv. math.* vii, 136 (after 549) ἐν δὲ τοῖς Κρατυνηρίοις, καίπερ ὑπεσχημένος ταῖς αἰσθήσεσι τὸ κράτος τῆς πίστεως ἀναθεῖναι, οὐδὲν ἥττον εὐρίσκεται τούτων καταδικάζων. φησὶ γάρ· ἡμεῖς δὲ τῶ μὲν ἔόντι οὐδὲν ἀτρεκέες συνίμεν, μεταπίπτου

δὲ κατὰ τε σώματος διαθήκην καὶ τῶν ἐπεισιόντων καὶ τῶν ἀντιστηριζόντων.<sup>7</sup>

554 Democritus fr. 11, Sextus *adv. math.* VII, 138 (after 550) ἐν δὲ τοῖς Κανόσι δύο φησὶν εἶναι γνώσεις· τὴν μὲν διὰ τῶν αἰσθήσεων τὴν δὲ διὰ τῆς διανοίας, ὧν τὴν μὲν διὰ τῆς διανοίας γνησίην καλεῖ προσμαρτυρῶν αὐτῇ τὸ πιστὸν εἰς ἀληθείας κρίσιν, τὴν δὲ διὰ τῶν αἰσθήσεων σκοτὴν ὀνομάζει ἀφαιρούμενος αὐτῆς τὸ πρὸς διάγνωσιν τοῦ ἀληθοῦς ἀπλανές. λέγει δὲ κατὰ λέξιν· ‘γνώμης δὲ δύο εἰσὶν ἰδέαι, ἡ μὲν γνησίη, ἡ δὲ σκοτὴ· καὶ σκοτὴς μὲν τάδε σύμπαντα, ὄψις, ἀκοή, ὄδμή, γεῦσις, φαῦσις. ἡ δὲ γνησίη, ἀποκεκριμένη δὲ ταύτης.’ εἶτα προκρίνων τῆς σκοτὴς τὴν γνησίην ἐπιφέρει λέγων· ‘ὅταν ἡ σκοτὴ μηκέτι δύνηται μήτε ὀρῆν ἐπ’ ἔλαττον μήτε ἀκούειν μήτε ὀδμᾶσθαι μήτε γεύεσθαι μήτε ἐν τῇ ψαύσει αἰσθάνεσθαι, ἀλλ’ ἐπὶ λεπτότερον...’

552 Wretched mind, do you take your assurances from us and then overthrow us [*sc.* the senses]? Our overthrow is your downfall.

553 In the *Confirmations*, although he had promised to assign the power of assurance to the senses, he is none the less found condemning them, for he says: ‘But we in actuality grasp nothing for certain, but what shifts in accordance with the condition of the body and of the things which enter it and press upon it.’

554 But in the *Canons* he says there are two kinds of knowing, one through the senses and the other through the intellect. Of these he calls the one through the intellect ‘legitimate’, attesting its trustworthiness for the judgement of truth, and that through the senses he names ‘bastard’, denying it inerrancy in the discrimination of what is true. To quote his actual words: ‘Of knowledge there are two forms, one legitimate, one bastard. To the bastard belong all this group: sight, hearing, smell, taste, touch. The other is legitimate, and separate from that.’ Then, preferring the legitimate to the bastard, he continues: ‘When the bastard can no longer see any smaller, or hear, or smell, or taste, or perceive by touch, but finer...’<sup>1</sup> (*After Barnes*)

<sup>1</sup> Here the text breaks off in mid-sentence.

552 and 553 indicate that Democritus’ scepticism was not so thoroughgoing that he denied the senses any positive role at all in epistemology. His title *Confirmations* suggests he would have envisaged the mind as replying thus to the senses’ complaint that in 549–50 they are rejected entirely: ‘Not so. You *tell* us very few truths about the

world (except that it contains many things in motion). In particular, you tell us nothing objectively true about what individual things are like (NB ἕκαστον 550). But you do *confirm* the truth of the theory of atoms and void which I have worked out using the genuine sort of judgement constituted by *a priori* Eleatic reasoning (554). For example, my theory holds that combinations of atoms *must* be merely temporary because of the constant collisions to which atoms are subject: you falsely report births and deaths, but in so reporting you confirm the actual existence of the events which the theory says must occur. Again, my theory holds that perception involves an interaction between object and observer which depends on the character of each and *must* therefore vary from case to case (553). One of you says: "the wind is hot", another in another person says: "the wind is cold": again you lie, but what you say shows that my theory predicts what actually happens.<sup>1</sup>

<sup>1</sup> This valuation of the senses as supplying confirmation of the truth is probably what underlies Aristotle's claim that the atomists hold that 'truth lies in the appearances' (562); cf. *Met.* 1009b12 (DK 68A 112), *de an.* 427a21-b6.

## ATOMS AND THE VOID

555 Aristotle *Met.* A4, 985b4 (DK 67A6) Λεύκιππος δὲ καὶ ὁ ἑταῖρος αὐτοῦ Δημόκριτος στοιχεῖα μὲν τὸ πλήρες καὶ τὸ κενὸν εἶναι φασί, λέγοντες τὸ μὲν ὄν τὸ δὲ μὴ ὄν, τούτων δὲ τὸ μὲν πλήρες καὶ στερεόν, τὸ ὄν, τὸ δὲ κενὸν καὶ μανόν, τὸ μὴ ὄν· διὸ καὶ οὐθὲν μᾶλλον τὸ ὄν τοῦ μὴ ὄντος εἶναι φασίν, ὅτι οὐδὲ τὸ κενὸν (ἔλαττον) τοῦ σώματος· αἴτια δὲ τῶν ὄντων ταῦτα ὡς ὕλην. καὶ καθάπερ οἱ ἐν ποιοῦντες τὴν ὑποκειμένην οὐσίαν τᾶλλα τοῖς πάθεσιν αὐτῆς γεννώσι, τὸ μανόν καὶ τὸ πυκνὸν ἀρχὰς τιθέμενοι τῶν παθημάτων, τὸν αὐτὸν τρόπον καὶ οὗτοι τὰς διαφορὰς αἰτίας τῶν ἄλλων εἶναι φασίν. ταύτας μέντοι τρεῖς εἶναι λέγουσι, σχῆμά τε καὶ τάξιν καὶ θέσιν· διαφέρειν γὰρ φασί τὸ ὄν ῥυσμῶ καὶ διαθιγῆ καὶ τροπῆ μόνον. τούτων δὲ ὁ μὲν ῥυσμὸς σχῆμά ἐστιν, ἡ δὲ διαθιγῆ τάξις, ἡ δὲ τροπῆ θέσις· διαφέρει γὰρ τὸ μὲν A τοῦ N σχήματι, τὸ δὲ AN τοῦ NA τάξει, τὸ δὲ Z τοῦ N θέσει.

556 Aristotle *On Democritus ap. Simplicium de caelo* 295, 1 (DK 68A 37) Δημόκριτος... προσαγορεύει δὲ τὸν μὲν τόπον τοῖσδε τοῖς ὀνόμασι, τῶ τε κενῶ καὶ τῶ οὐδενὶ καὶ τῶ ἀπείρω, τῶν δὲ οὐσιῶν ἑκάστην τῶ τε δενὶ καὶ τῶ ναστῶ καὶ τῶ ὄντι. νομίζει δὲ εἶναι οὕτω μικρὰς τὰς οὐσίας ὥστε ἐκφυγεῖν τὰς ἡμετέρας αἰσθήσεις· ὑπάρχειν δὲ αὐταῖς παντοίας μορφᾶς καὶ σχήματα παντοῖα καὶ κατὰ μέγεθος

διαφοράς. ἐκ τούτων οὖν ἤδη καθάπερ ἐκ στοιχείων γεννᾶται καὶ συγκρίνει τοὺς ὀφθαλμοφανεῖς καὶ τοὺς αἰσθητοὺς ὄγκους. [δὲ Α, δειν] Diels, cf. DK 68B 156.]

557 Simplicius *de caelo* 242, 18 (DK 67A 14) οὗτοι γὰρ (*sc.* Λεύκιππος, Δημόκριτος, Ἐπικουρος) ἔλεγον ἀπείρους εἶναι τῶν πλήθει τὰς ἀρχάς, ἃς καὶ ἀτόμους καὶ ἀδιαιρέτους ἐνόμιζον καὶ ἀπαθεῖς διὰ τὸ ναστάς εἶναι, καὶ ἀμοίρους τοῦ κενοῦ· τὴν γὰρ διαίρεσιν κατὰ τὸ κενὸν τὸ ἐν τοῖς σώμασι ἔλεγον γίνεσθαι...

555 Leucippus and his associate Democritus hold that the elements are the full and the void; they call them what is and what is not respectively. What is is full and solid, what is not is void and rare. Since the void exists no less than body, it follows that what is not exists no less than what is. The two together are the material causes of existing things. And just as those who make the underlying substance one generate other things by its modifications, and postulate rarefaction and condensation as the origin of such modifications, in the same way these men too say that the differences [*sc.* in their elements] are the causes of other things. They hold that these differences are three – shape, arrangement and position; being, they say, differs only in ‘rhythm, touching and turning’, of which ‘rhythm’ is shape, ‘touching’ is arrangement and ‘turning’ is position; for A differs from N in shape, AN from NA in arrangement, and Z from N in position.

556 Democritus... calls space by these names – ‘the void’, ‘nothing’, and ‘the infinite’, while each individual substance he calls ‘thing’ [*i.e.* ‘nothing’ *without* ‘no’], the ‘compact’ and ‘being’. He thinks that substances are so small as to elude our senses, but they have all sorts of forms and shapes and differences in size. So he is already enabled from them, as from elements, to create by aggregation bulks that are perceptible to sight and the other senses.

557 They [*sc.* Leucippus, Democritus, Epicurus] said that the first principles were infinite in number, and thought they were indivisible atoms and impassible owing to their compactness, and without any void in them; divisibility comes about because of the void in compound bodies...

Having considered the atomists’ attitude both to Eleatic principles and to the senses, we are now in a position to explore the system they erected on the bases laid in 545–6, 548–50, and 554. 555–7 (cf. also *Simpl. in Phys.* 28, 7–27, from Theophrastus) give fuller information about atoms and void. Reality is assigned to what is corporeal or

solid, which is held to be equivalent with the full (cf. Melissus, 534), and hence excludes void or interstices of any sort. But according to 557 what is full and solid must be indivisible, or in other words an atom (presumably only physically, not notionally, indivisible, since for example atoms differ in size (556)).<sup>1</sup> Atoms are conceived of as very small, in fact so small as to be invisible (556), although Democritus may have held that 'it is possible for there to be an atom the size of the universe' (Aetius I, 12, 6, DK 68A47). They are scattered throughout infinite void, and are infinite in number and shape.<sup>2</sup> It is above all in shape and arrangement that they differ from each other (555-6): all 'qualitative' differences in objects (which are conglomerates of atoms), therefore, are dependent on quantitative and local differences alone. Void, although it is identified as what is not, is accorded existence. It is hard to see how the atomists justified this paradox. Perhaps their point was that, when a place is occupied by nothing, then insofar as the occupant - 'the empty' - is nothing it does not exist, but insofar as it occupies a place it does exist. On this interpretation, void is not (as 556 assumes) 'space' or 'place' but a more mysterious entity, the negation of substance.<sup>3</sup>

<sup>1</sup> Other texts give other reasons for the indivisibility of atoms: e.g. 558 Simplicius in *Phys.* 925, 10 (DK 67A13) Λεύκιππος μὲν καὶ Δημόκριτος οὐ μόνον τὴν ἀπάθειαν αἰτίαν τοῖς πρώτοις σώμασι τοῦ μὴ διαίρεσθαι νομίζουσιν, ἀλλὰ καὶ τὸ σμικρὸν καὶ ἀμερές, Ἐπικούρου δὲ ὕστερον ἀμερῆ μὲν οὐχ ἡγείται, ἄτομα δὲ αὐτὰ διὰ τὴν ἀπάθειαν εἶναι φησι. (*Leucippus and Democritus hold that it is not only their impassibility which is the reason why the primary bodies cannot be divided, but the fact that they are small and partless. But Epicurus in the later period does not think them partless, but says that they are indivisible because of their impassibility.*) The notion that smallness could make anything indivisible is extremely curious, and has often been taken for doxographical confusion by scholars unwilling to believe anything but good of Leucippus and Democritus. Certainly Simplicius' attempt to gloss 'small' by 'partless' smacks of an attempt to read Epicurean preoccupations back into the earlier atomists; and this same doctrine of Leucippus is reported elsewhere without the gloss (Galen *de elem. sec. Hippocr.* I, 2 (DK 68A49)). But this very divergence of testimony points to the authenticity of the basic idea. It remains obscure, however, and it is unsafe to adduce it in support of the thesis that atoms were conceived by Leucippus and Democritus as *notionally* indivisible (as is maintained by Guthrie, *HGP* II, 396, 503-7 and Furley, *Two Studies* I, ch. 6; cf. also Stokes, *One and Many*, 225ff.; *contra* Barnes, *The Presocratic Philosophers* II, 50-8).

<sup>2</sup> The distribution of bodies throughout the infinite void was probably inferred by use of the οὐ μᾶλλον principle: 559 (= 112) Aristotle *Phys.* Γ4, 203b25 ἀπείρου δ' ὄντος τοῦ ἔξω, καὶ σώμα ἄπειρον εἶναι δοκεῖ καὶ κόσμοι· τί γὰρ μᾶλλον τοῦ κενοῦ ἔνταῦθα ἢ ἔνταῦθα; (*If what lies outside [sc. the heavens] is infinite, so too, it seems, is body, and worlds too. For why should they be here rather than there in the void?*) The same principle was employed in arguing that they were infinite in number and shape: 560 Simplicius in *Phys.* 28, 8 (from Theophrastus), DK 67A8 οὗτος ἄπειρα καὶ ἀεὶ κινούμενα ὑπέθετο στοιχεῖα τὰς ἀτόμους καὶ τῶν

ἐν αὐτοῖς σχημάτων ἄπειρον τὸ πλῆθος διὰ τὸ μηδὲν μᾶλλον τοιοῦτον ἢ τοιοῦτον εἶναι. (*Leucippus posited an infinite number of elements in perpetual motion – the atoms – and held that the number of their shapes was infinite, on the ground that nothing is such rather than such.*) Perhaps Democritus then concluded that there was no reason not to apply it also to the question of the size of atoms, too: 561 Dionysius *ap. Eusebium P.E.* xiv, 23, 3 (DK 68A43) τοσοῦτον δὲ διεφώνησαν (*sc. Ἐπίκουρος καὶ Δημόκριτος*) ὅσον ὁ μὲν ἐλαχίστας πάσας καὶ διὰ τοῦτο ἀνεπαίσθητους, ὁ δὲ καὶ μεγίστας εἶναι τινὰς ἀτόμους, ὁ Δημόκριτος, ὑπέλαβεν. (*To this extent they [sc. Epicurus and Democritus] differed, that one supposed that all atoms were very small, and on that account imperceptible; the other, Democritus, that there are some atoms that are very large.*) No doubt he would have explained that very large atoms are to be found only in parts of space distant from our universe. The atomists took the hypothesis of an infinity of shapes to account for the infinite variety of sensory appearances: 562 Aristotle *de gen. et corr.* A1, 315b6 (DK 67A9) ἐπεὶ δ' ὦντο τάληθες ἐν τῷ φαίνεσθαι, ἐναντία δὲ καὶ ἄπειρα τὰ φαινόμενα, τὰ σχήματα ἄπειρα ἐποίησαν, ὥστε ταῖς μεταβολαῖς τοῦ συγκειμένου τὸ αὐτὸ ἐναντίον δοκεῖν ἄλλω καὶ ἄλλω, καὶ μετακινεῖσθαι μικροῦ ἐμμειγνυμένου καὶ ὅλως ἕτερον φαίνεσθαι ἐνὸς μετακινήθεντος· ἐκ τῶν αὐτῶν γὰρ τραγωδία καὶ κωμωδία γίνεται γραμμάτων. (*Since they thought that the truth lies in appearance, but the appearances are contrary and infinite, they made the shapes infinite, so that the same thing will appear contrary to one man and to another through changes in the compound, and it will be altered by a small admixture and appear altogether different because of that single alteration. For tragedies and comedies are composed from the same letters.*)

<sup>3</sup> The interpretation is advanced by D. N. Sedley, 'Two conceptions of vacuum', *Phronesis* 27 (1982), 179–83. On the more usual view, void is not absolute Newtonian space, but the empty space which exists only where atoms are not, thus forming gaps between them. Sedley argues that the atomists had no reason to call *that* non-existent, and observes that by parity of treatment 'the full' would have to be full space – whereas we know that it is what fills space, the moving atoms. With his interpretation the atomists' use of 'nothing' echoes precisely Parmenides' paradoxical use of it to refer to what negative existentials would be about if they were about anything (293, 296), and 'void' or 'empty' is just another designation of that.

#### THE FORMATION OF WORLDS

563 Diogenes Laertius ix, 31 (DK 67A1) τὸ μὲν πᾶν ἄπειρόν φησιν (*sc. Λεύκιππος*)...τούτου δὲ τὸ μὲν πλήρες εἶναι, τὸ δὲ κενόν...κόσμος τε ἐκ τούτου ἀπείρους εἶναι καὶ διαλύεσθαι εἰς ταῦτα. γίνεσθαι δὲ τοῦς κόσμους οὕτω· φέρεσθαι 'κατὰ ἀποτομὴν ἐκ τῆς ἀπείρου' πολλὰ σώματα παντοῖα τοῖς σχήμασιν εἰς μέγα κενόν, ἅπερ ἀθροισθέντα δίνην ἀπεργάζεσθαι μίαν, καθ' ἣν προσκρούοντα <ἀλλήλοις> καὶ παντοδαπῶς κυκλούμενα διακρίνεσθαι χωρὶς τὰ ὅμοια πρὸς τὰ ὅμοια. ἰσορρόπων δὲ διὰ τὸ πλῆθος μηκέτι δυναμένων περιφέρεσθαι, τὰ μὲν λεπτὰ χωρεῖν εἰς τὸ ἔξω κενόν, ὥσπερ διαττώμενα· τὰ δὲ λοιπὰ 'συμμένειν' καὶ περιπλεκόμενα συγκατατρέχειν ἀλλήλοις καὶ ποιεῖν πρῶτόν τι σύστημα σφαιροειδές. (32) τοῦτο δ'

οἶον 'ύμένα' ἀφίστασθαι περιέχοντα ἐν ἑαυτῷ παντοῖα σώματα· ὧν κατὰ τὴν τοῦ μέσου ἀντέρεισιν περιδινουμένων λεπτόν γενέσθαι τὸν πέριξ ὑμένα, συρρεόντων ἀεὶ τῶν συνεχῶν κατ' ἐπίψαυσιν τῆς δίνης. καὶ οὕτω γενέσθαι τὴν γῆν, συμμενόντων τῶν ἐνεχθέντων ἐπὶ τὸ μέσον. αὐτόν τε πάλιν τὸν περιέχοντα οἶον ὑμένα αὔξεσθαι κατὰ τὴν ἐπέκκρισιν [Heidel, ἐπέκρυσιν MSS] τῶν ἔξωθεν σωμάτων· δίνη τε φερόμενον αὐτόν, ὧν ἂν ἐπιψαύση, ταῦτα ἐπικτᾶσθαι. τούτων δὲ τινὰ συμπλεκόμενα ποιεῖν σύστημα, τὸ μὲν πρῶτον κάθυγρον καὶ πηλῶδες, ξηραυθέντα δὲ καὶ περιφερόμενα σὺν τῇ τοῦ ὄλου δίνῃ εἴτ' ἐκπυρωθέντα τὴν τῶν ἀστερῶν ἀποτελέσαι φύσιν. (Cf. also Aetius I, 4, I-4, DK 67A 24.)<sup>1</sup>

564 Aetius II, 7, 2 Λεύκιππος καὶ Δημόκριτος 'χιτῶνα' κύκλω καὶ 'ύμένα' περιτείνουσι τῷ κόσμῳ διὰ τῶν ἀγκιστροειδῶν ἀτόμων συμπεπλεγμένον.

565 Hippolytus *Ref.* I, 13, 2 (DK 68A 40) λέγει δὲ ὁμοίως Λευκίππῳ (sc. Δημόκριτος) περὶ στοιχείων, πλήρους καὶ κενοῦ. . . ἔλεγε δὲ ὡς ἀεὶ κινουμένων τῶν ὄντων ἐν τῷ κενῷ· ἀπίρους δ' εἶναι κόσμους καὶ μεγέθει διαφέροντας. ἐν τισὶ δὲ μὴ εἶναι ἥλιον μηδὲ σελήνην, ἐν τισὶ δὲ μείζω τῶν παρ' ἡμῖν καὶ ἐν τισὶ πλείω. (3) εἶναι δὲ τῶν κόσμων ἄνισα τὰ διαστήματα καὶ τῇ μὲν πλείους, τῇ δὲ ἐλάττους, καὶ τοὺς μὲν αὔξεσθαι, τοὺς δὲ ἀκμάζειν, τοὺς δὲ φθίνειν, καὶ τῇ μὲν γίνεσθαι, τῇ δ' (ἐκ)λείπειν. φθείρεσθαι δὲ αὐτοὺς ὑπ' ἀλλήλων προσπίπτοντας. εἶναι δὲ ἐνίους κόσμους ἐρήμους ζῶων καὶ φυτῶν καὶ παντὸς ὕγροῦ.

563 Leucippus holds that the whole is infinite . . . part of it is full and part void . . . Hence arise innumerable worlds, and are resolved again into these elements. The worlds come into being as follows: many bodies of all sorts of shapes move 'by abscission from the infinite' into a great void; they come together there and produce a single whirl, in which, colliding with one another and revolving in all manner of ways, they begin to separate apart, like to like. But when their multitude prevents them from rotating any longer in equilibrium, those that are fine go out towards the surrounding void as if sifted, while the rest 'abide together' and, becoming entangled, unite their motions and make a first spherical structure. This structure stands apart like a 'membrane' which contains in itself all kinds of bodies; and as they whirl around owing to the resistance of the middle, the surrounding membrane becomes thin, while contiguous atoms keep flowing together owing to contact with the whirl. So the earth came into being, the atoms that had

been borne to the middle abiding together there. Again, the containing membrane is itself increased, owing to the attraction of bodies outside; as it moves around in the whirl it takes in anything it touches. Some of these bodies that get entangled form a structure that is at first moist and muddy, but as they revolve with the whirl of the whole they dry out and then ignite to form the substance of the heavenly bodies.

**564** Leucippus and Democritus envelop the world in a circular 'cloak' or 'membrane', which was formed by the hooked atoms becoming entangled.

**565** Democritus holds the same view as Leucippus about the elements, full and void... he spoke as if the things that are were in constant motion in the void; and there are innumerable worlds, which differ in size. In some worlds there is no sun and moon, in others they are larger than in our world, and in others more numerous. The intervals between the worlds are unequal; in some parts there are more worlds, in others fewer; some are increasing, some at their height, some decreasing; in some parts they are arising, in others failing. They are destroyed by collision one with another. There are some worlds devoid of living creatures or plants or any moisture.

<sup>1</sup> It looks as though *συμμένειν*, *ὑμῆν*, and (in **564**) *χιτῶν* were actually derived from atomist contexts. The phrase *κατὰ ἀποτομήν ἐκ τῆς ἀπείρου* (*sc.* *χώρας*) is closely paralleled in the Epicurean letter to Pythocles (*Ep.* II, 88; DK 67A 24). Diogenes might have derived it from Democritus; but it is also possible that *συμμένειν*, *ὑμῆν*, *χιτῶν*, as well as *κατὰ ἀποτομήν*, are merely Epicurean.

The account in **563** of the formation of worlds (formally attributed to Leucippus, but no doubt representing the general views of Democritus also) is fairly detailed, but full of difficulties. The first stage is when a large collection of atoms becomes isolated, as it were, in a large patch of void. The second stage is when they form a whirl or vortex. How this occurs we cannot tell; it must happen 'by necessity',<sup>1</sup> as the result of a particular combination of their separate atomic movements, and a vortex would presumably not necessarily or commonly arise out of the circumstances of the first stage alone. The vortex-action causes like atoms to tend towards like.<sup>2</sup> (There is a good deal of reminiscence of Anaxagoras in all this: in him *Nous* started a vortex and similar particles came together to form bodies, **476** and pp. 372f.)<sup>3</sup> The larger atoms congregate towards the middle, the smaller ones are squeezed out (**575**). A kind of membrane or garment (**564**) encloses the whole: whether this is formed by the smaller and extruded atoms (as suggested by Aetius, DK 67A 24), or

whether these are thrust right out of the *σύστημα* into the void (as suggested in 563), is uncertain. Other atoms come into contact with the extremity of the revolving mass and are drawn within the membrane. Certain of these atoms become ignited by the speed of the revolution (563 *ad fin.*) and so form the heavenly bodies; the bulkier ones at the centre 'stay together' (*συμμένειν*) to form the earth. Diogenes Laertius continues, after the end of 563, with a description of cosmological details which are not particularly enlightening, but show us that here Leucippus tended to accept, not very critically, the old Ionian theories. One important and highly conservative idea of Leucippus is that the earth is flat, shaped like a tambourine (*τυμπανοειδής*, Aetius III, 10, 4); Democritus slightly emended this (*ibid.* 10, 5), but retained the overall flatness. Both appear to have held that the earth was tilted downward towards the south.<sup>4</sup> Since there are innumerable atoms and an infinite void, there is no reason why only one such world should be formed; Leucippus and Democritus therefore postulated innumerable worlds, coming-to-be and passing away throughout the void (563 *init.*, 565). They are the first to whom we can with absolute certainty attribute the concept of innumerable worlds (as opposed to successive states of a continuing organism), one which is reached entirely on the *a priori* grounds described above.<sup>5</sup> The doxographers, however, certainly attributed the idea of plural worlds (whether coexistent or successive) to some Ionians, conceivably by an error initiated by Theophrastus (see pp. 123ff., also pp. 379f.). Democritus, according to 565, seems to have embellished the idea by observing that there is no need for each world to have a sun and moon, and so on, or to have waters and give rise to life: the random nature of the cosmogonical process 563 would not always produce the same result. For example, if there were no further atoms to be attracted close to the outer membrane of a world, that world would presumably have no heavenly bodies.<sup>6</sup>

<sup>1</sup> So 566 Diogenes Laertius IX, 45 (on Democritus) πάντα τε κατ' ἀνάγκην γίνεσθαι, τῆς δίνης αἰτίας οὔσης τῆς γενέσεως πάντων, ἣν ἀνάγκην λέγει. (*Everything happens according to necessity; for the cause of the coming-into-being of all things is the whirl, which he calls necessity.*) The whirl or vortex is called necessity because it produces the necessary (mechanical and *theoretically* determinable) collisions and unions of atoms: so 567 Aetius I, 26, 2 (Π. οὐσίας ἀνάγκης) Δημόκριτος τὴν ἀντιτυπίαν καὶ φορὰν καὶ πληγὴν τῆς ὕλης. (*[On the nature of necessity] Democritus means by it the resistance and movement and blows of matter.*) In Aristotelian terms, combinations can be said to take place by *chance*: 568 Aristotle *Phys.* B4, 196a24 εἰσὶ δὲ τινες οἱ καὶ τοῦρανοῦ τοῦδε καὶ τῶν κόσμων πάντων αἰτιῶνται τὸ αὐτόματον ἀπὸ ταύτομάτου γὰρ γενέσθαι τὴν δίνην καὶ τὴν κίνησιν τὴν διακρίνασαν καὶ καταστήσασαν εἰς ταύτην τὴν τάξιν τὸ πᾶν. (*There are some who make chance the cause both of these heavens and of all the worlds: for from chance arose*

*the whirl and the movement which, by separation, brought the universe into its present order.*) For Aristotle they are chance events because they do not fulfil any final cause; but the atomists emphasized the other aspect of non-planned mechanical sequences, i.e. as necessity. So in the only extant saying of Leucippus himself: 569 Fr. 2, Aetius I, 25, 4 οὐδὲν χρήμα μάτην γίνεται, ἀλλὰ πάντα ἐκ λόγου τε καὶ ὑπ' ἀνάγκης. (*Nothing occurs at random, but everything for a reason and by necessity.*) Every object, every event, is the result of a chain of collisions and reactions, each according to the shape and particular motion of the atoms concerned.

<sup>2</sup> Democritus illustrates this traditional rule of the behaviour of things, both animate and inanimate, in 570 Fr. 164, Sextus *adv. math.* VII, 117 καὶ γὰρ ζῶα, φησὶν, ὁμογενέσι ζῴοις συναγελάζεται ὡς περισσότεραι περισσότεραῖς καὶ γέραναι γεράνοισι καὶ ἐπὶ τῶν ἄλλων ὡσαύτως. <ὡς> δὲ καὶ ἐπὶ τῶν ἀψύχων, καθάπερ ὄραν πάρεστιν ἐπὶ τε τῶν κοσκινουμένων σπερμάτων καὶ ἐπὶ τῶν παρὰ ταῖς κυματωγαῖς ψηφίδων... (*For creatures (he says) flock together with their kind, doves with doves, cranes with cranes and so on. And the same happens even with inanimate things, as can be seen with seeds in a sieve and pebbles on the sea-shore...*) (similar grains, he continues, and pebbles of the same shape, congregate under the action of sieve or waves). The mechanical tendency of objects of similar shape and size to sort together under the influence of motion is especially relevant to atomism, of course, and goes beyond the naïve view of Homer, *Od.* XVII, 218, that 'god always leads like to like'.

<sup>3</sup> According to Simplicius, Democritus held that the vortex was 'separated off': 571 Fr. 167, Simplicius *in Phys.* 327, 24 ἀλλὰ καὶ Δημόκριτος, ἐν οἷς φησὶ 'δῖνον ἀπὸ τοῦ παντὸς ἀποκριθῆναι παντοίων ἰδεῶν' (πῶς δὲ καὶ ὑπὸ τίνος αἰτίας μὴ λέγει), ἔοικεν ἀπὸ ταῦτομάτου καὶ τύχης γεννᾶν αὐτόν. (*When Democritus says that 'a whirl was separated off from the whole, of all sorts of shapes' (and he does not say how or through what cause), he seems to generate it by accident or chance.*) The idea of the initiator of the cosmogonical process being 'separated off' may go back to Anaximander (see 121 and pp. 131ff.).

<sup>4</sup> So 572 Diogenes Laertius IX, 33 (on Leucippus) ἐκλείπειν δ' ἥλιον καὶ σελήνην τῷ κεκλίσθαι τὴν γῆν πρὸς μεσημβρίαν· τὰ δὲ πρὸς ἄρκτωρ αἰεὶ τε νίφεσθαι καὶ κατὰ ψυχρὰ εἶναι καὶ πηγνυσθαι. (*Eclipses of sun and moon are due to the tilting of the earth towards the south; the regions towards the north are always under snow and are very cold and hard-frozen.*) Most scholars have assumed a gap after σελήνην, 'moon', so that some other phenomenon than eclipse is explained by the tilting of the earth. The order of subjects in Diogenes is against a gap; but the tilting of the earth would be so utterly unsuitable as an explanation of eclipses that it seems reasonable to postulate either a textual displacement or a total misunderstanding by Diogenes or his sources. The tilting of the earth remains; it explains both the slant of the zodiac and the differences of climate, and is conceivably related to, though very different from, Anaximenes' theory that the sun is hidden behind high northern parts at night. Eclipses had already been correctly explained by Empedocles and Anaxagoras. Cf. also Aetius III, 12, 1-2 (DK 67A 27 and 68A 96).

<sup>5</sup> Compare the well-known saying of Democritus' pupil Metrodorus of Chios, that it is strange for one ear of corn to be produced in a great plain, and for one world in the boundless.

<sup>6</sup> It looks as though there is a reference here to Anaxagoras fr. 4 (498; the recurrence of the phrase παρ' ἡμῖν may be accidental). It is not at all certain, however, that that fragment described entirely separate worlds with separate suns

and moons; if it did, then the fact that every world had the same structure justifies G. Vlastos' reference (*Philos. Rev.* 55 (1946), 53f.) to 'the teleological streak in Anaxagorean physics', and his suggestion that Democritus' theory may be a 'conscious refutation' of it.

## THE BEHAVIOUR OF ATOMS

(a) *Weight*

573 Aristotle *de gen. et corr.* A8, 326a9 καίτοι βαρύτερόν γε κατὰ τὴν ὑπεροχὴν φησιν εἶναι Δημόκριτος ἕκαστον τῶν ἀδιαιρέτων.

574 Theophrastus *de sensu* 61 (DK 68A135) βαρὺ μὲν οὖν καὶ κοῦφον τῷ μεγέθει διαίρει Δημόκριτος... οὐ μὴν ἄλλ' ἔν γε τοῖς μεικτοῖς κουφότερον μὲν εἶναι τὸ πλεόν ἔχον κενόν, βαρύτερον δὲ τὸ ἔλαττον. ἐν ἐνίοις μὲν οὕτως εἶρηκεν· (62) ἐν ἄλλοις δὲ κοῦφον εἶναί φησιν ἀπλῶς τὸ λεπτόν.

575 Simplicius *de caelo* 712, 27 (DK 68A61) ...οἱ περὶ Δημόκριτον οἴονται πάντα μὲν ἔχειν βάρος, τῷ δὲ ἔλαττον ἔχειν βάρος τὸ πῦρ ἐκθλιβόμενον ὑπὸ τῶν προλαμβανόντων ἄνω φέρεσθαι καὶ διὰ τοῦτο κοῦφον δοκεῖν.

576 Aetius I, 3, 18 (DK 68A47) Δημόκριτος μὲν γὰρ ἔλεγε δύο (*sc.* ταῖς ἀτόμοις συμβεβηκέναι), μέγεθός τε καὶ σχῆμα, ὁ δὲ Ἐπίκουρος τοῦτοις καὶ τρίτον βάρος προσέθηκεν... I, 12, 6 Δημόκριτος τὰ πρῶτά φησι σώματα (ταῦτα δ' ἦν τὰ ναστά) βάρος μὲν οὐκ ἔχειν, κινεῖσθαι δὲ κατ' ἀλληλοτυπίαν ἐν τῷ ἀπείρω.

573 Yet Democritus says that each of the indivisible bodies is heavier in proportion to its excess [*sc.* of size].

574 Democritus distinguishes heavy and light by size... Nevertheless in compound bodies the lighter is that which contains more void, the heavier that which contains less. Sometimes he expressed it thus, but elsewhere he says simply that the fine is light.

575 ...Democritus' school thinks that everything possesses weight, but that because it possesses less weight fire is squeezed out by things that possess more, moves upwards and consequently appears light.

576 Democritus named two [*sc.* properties of atoms], size and shape; but Epicurus added a third to these, namely weight... – Democritus says that the primary bodies (that is, the solid atoms) do not possess weight but move in the infinite as the result of striking one another.

The texts in which Aristotle and Simplicius discuss the basic

properties of atoms (e.g. 555-7) are silent on the question whether they possess weight; and indeed reports of the views of Anaxagoras and Empedocles are similarly uninformative on this topic (493 is obviously no more than interpretation of 489, inspired by Aristotle's general remarks in 117). 573-6 present apparently contradictory opinions about Democritus' position, which has in consequence been the subject of disagreement among scholars. (Leucippus is not mentioned in these passages, and presumably did not think that the subject demanded special treatment.)

Aristotle in 573 is quite clear that for Democritus the atoms *had* weight, and that the weight depended on their size; his opinion is supported by Theophrastus (574) and (on the first point) by Simplicius (575). Indeed it is difficult to see how the atomists could have avoided holding some form of this view, since bodies in our world do as a matter of experience seem to have weight, and since the fullness and homogeneity of atoms means that difference in size is the only conceivable determinant of difference in weight. But it looks as though 576 contradicts 573-5. How is the contradiction to be explained? (i) One popular solution, advocated e.g. by Burnet (*EGP*, 341-6) and adopted in KR, holds that the testimonies in 573-5 should be referred only to bodies located in a world, or more generally bodies subject to a vortex. Larger objects tend to move towards the centre of a whirl, and it is then convenient to express the fact that their 'downward' motion is a function of their greater size by saying that they are heavier than smaller objects closer to the circumference. But in themselves bodies have no weight, i.e. no tendency to move 'downwards'; in a vortex-free void their movements are solely determined by collisions (and, of course, size and shape), and there is no reason to describe them as heavy or light. It is just this point which is adverted to by Aetius in 576. (ii) Explanation (i) accords great respect to 576, and has to import a considerable theoretical apparatus to sustain such confidence in Aetius. It is altogether simpler to take 573-5, which are after all the opinions of more trustworthy authorities, at their face value, as descriptions true of Democritean atoms without restriction. Weight, then, is an absolute property of atoms, albeit not one on which Democritus had a great deal to say. It is true that he would probably have no ready answer to the question of what weight in a vortex-free void consists in, where it is not expressed in a tendency to move downwards. But that very difficulty suggests a reason why Aetius came to misrepresent Democritus' view as he did in 576. He has just mentioned Epicurus' view (1, 12, 5), according to which atoms move

downwards through the void in virtue of their weight, but in other directions as a result of collisions (which in turn were notoriously explained as the consequence of random swerves: cf. e.g. Diog. L. x, 61, Lucretius II, 216-42). He may have found Epicurus' position so obvious that he inferred: since Democritus' atoms do *not* move downwards in a void, they cannot have weight.<sup>1</sup>

<sup>1</sup> See further on weight D. O'Brien, 'Heavy and light in Democritus and Aristotle', *JHS* 97 (1977), 64-74; or (more voluminously) O'Brien, *Democritus, weight and size* (Paris, 1981).

(b) *Motion*

577 Aristotle *de caelo* Γ2, 300b8 διὸ καὶ Λευκίππῳ καὶ Δημοκρίτῳ, τοῖς λέγουσιν ἀεὶ κινεῖσθαι τὰ πρῶτα σώματα ἐν τῷ κενῷ καὶ τῷ ἀπειρῳ, λεκτέον τίνα κίνησιν καὶ τίς ἢ κατὰ φύσιν αὐτῶν κίνησις.

578 Aristotle *On Democritus ap. Simplicium de caelo* 295, 9 (continuing 556) στασιάζειν δὲ καὶ φέρεσθαι ἐν τῷ κενῷ διὰ τὴν ἀνομοιότητα καὶ τὰς ἄλλας εἰρημένας διαφοράς, φερομένας δὲ ἐμπίπτειν καὶ περιπλέκεσθαι...

579 Aristotle *de caelo* Γ4, 303a5 φασὶ γὰρ (*sc.* Λευκίππος καὶ Δημοκρίτος) εἶναι τὰ πρῶτα μεγέθη πλήθει μὲν ἄπειρα, μεγέθει δὲ ἀδιαίρετα, καὶ οὐτ' ἐξ ἑνὸς πολλὰ γίνεσθαι οὔτε ἐκ πολλῶν ἕν, ἀλλὰ τῇ τούτων συμπλοκῇ καὶ περιπαλάξει πάντα γενεῖσθαι.

580 Alexander *in Met.* 36, 21 οὔτοι γὰρ (*sc.* Λευκίππος καὶ Δημοκρίτος) λέγουσιν ἀλληλοτυπούσας καὶ κρουόμενας πρὸς ἀλλήλας κινεῖσθαι τὰς ἀτόμους.

581 Aetius I, 23, 3 Δημοκρίτος ἐν γένος κινήσεως τὸ κατὰ παλμὸν ἀπεφαίνετο.

582 Simplicius *in Phys.* 1318, 35 (DK 68A 58) καὶ ἔλεγον κατὰ τὴν ἐν αὐτοῖς βαρύτητα κινούμενα ταῦτα διὰ τοῦ κενοῦ εἰκοντος καὶ μὴ ἀντιτυποῦντος κατὰ τόπον κινεῖσθαι· περιπαλάσσεσθαι<sup>1</sup> γὰρ ἔλεγον αὐτά.

<sup>1</sup> περιπαλαίσεσθαι MSS, em. Diels.

577 So Leucippus and Democritus, who say that their primary bodies are always in motion in the infinite void, ought to specify what kind of motion – that is, what is the motion natural to them.

578 They struggle and move in the void because of the dissimilarities between them and the other differences already mentioned; and as they move they collide and become entangled...

**579** For they [*sc.* Leucippus and Democritus] say that their primary magnitudes are infinite in number and indivisible in magnitude; the many does not come from one nor one from many, but rather all things are generated by the intertwining and scattering around of these primary magnitudes.

**580** For they [*sc.* Leucippus and Democritus] say that the atoms move by mutual collisions and blows.

**581** Democritus said there was only one kind of motion, that due to vibration.

**582** They said that, moving by virtue of the weight in them, they [*sc.* the atoms] move through the void which yields and does not resist them; for they said that they are 'scattered around'.

It is evident from **577** and other similar complaints by Aristotle, as well as from the lack of positive information on this point, that neither Leucippus nor Democritus gave any full account of an *original* motion of atoms – the motion, that is, which causes collisions, not that which is caused by collisions. Indeed, since atoms and the void have always existed, there is every reason to suppose that there must always have been motion, and consequent collisions. For atoms are in motion now: why should they ever not have been (cf. Parmenides' argument from sufficient reason against coming into being at **296**, 7–9, which the atomists may have had in mind in the present context; see also Aristotle *Phys.* 252a32, *de gen. animalium* 742b17)? To enquire, therefore, as Aristotle does, what was the 'natural' motion of atoms is less pertinent than at first appears. However, if the atomists were forced to define an 'original' motion they could presumably say that it was a random motion, with no tendency in any atom to move in one direction rather than another. It is clear that collisions would very soon take place, and that the original motion would progressively be supplanted by the secondary motions which result from collision and rebound.

The regular motion of atoms, and perhaps the only one which Leucippus and Democritus fully envisaged, is due to rebounds of atoms after collision. The character of the ensuing motion will be determined, no doubt, by the weight, shape, and antecedent motions of the colliding bodies. Collisions of atoms result either in 'intertwining' (συμπλοκή), if the atoms are of congruent shape, or in 'being scattered around' (περιπάλαξις), if not – that is, in rebounding in one direction or another. This is what is meant by Aristotle in **579** (cf. **582**). Aetius in **581** assigns a special type of motion to Democritus, namely παλμός or 'vibration' (the verbal root of which is the same

as that of περιπάλαξις; Bailey (*The Greek Atomists and Epicurus*) actually interpreted περιπάλαξις in 579 in the sense of παλμός, though not very plausibly). There is little doubt that Aetius is here reading an Epicurean idea into Democritus; Epicurus used this word to describe the invisible oscillation which, as he conceived, atoms underwent when confined in a complex body (Epicurus *Ep.* I, 43; cf. Bailey, p. 332).<sup>1</sup>

<sup>1</sup> LSJ gives the meaning of περιπάλαξις as 'collision, combination' of atoms, though that of περιπαλάσσεσθαι is given as 'to be hurled around'. Both translations are imperfect. The meaning of παλάσσεσθαι is 'to be shaken about, or sprinkled', and that of its simpler form πάλλειν is 'to shake'. A transitional stage to the Epicurean παλμός-interpretation is perhaps seen at Theophrastus *de sensu* 66 *fin.* (DK 68A 135). In 579 Aristotle simply means that things are produced by the entanglement and rebound of atoms; the latter does not of itself produce γένεσις, but is necessary for its continuity.

(c) *The formation of bodies*

583 Aristotle *On Democritus ap. Simplicium de caelo* 295, 11 (continuing 578) ... φερομένους δὲ (*sc.* τὰς ἀτόμους) ἐμπίπτειν καὶ περιπλέκεσθαι περιπλοκὴν τοιαύτην ἢ συμψαύειν μὲν αὐτὰ καὶ πλησίον ἀλλήλων εἶναι ποιεῖ, φύσιν μέντοι μίαν ἐξ ἐκείνων κατ' ἀλήθειαν οὐδ' ἦντιναοῦν γενεᾶ· κομιδῆ γὰρ εὐηθες εἶναι τὸ δύο ἢ τὰ πλείονα γενέσθαι ἂν ποτε ἔν. τοῦ δὲ συμμένειν τὰς οὐσίας μετ' ἀλλήλων μέχρι τινὸς αἰτιᾶται τὰς ἐπαλλαγὰς καὶ τὰς ἀντιλήψεις τῶν σωμάτων· τὰ μὲν γὰρ αὐτῶν εἶναι σκαληνά, τὰ δὲ ἀγκιστρῶδη, τὰ δὲ κοῖλα, τὰ δὲ κυρτά, τὰ δὲ ἄλλας ἀναρίθμους ἔχοντα διαφορὰς· ἐπὶ τοσοῦτον οὖν χρόνον σφῶν αὐτῶν ἀντέχεσθαι νομίζει καὶ συμμένειν ἕως ἰσχυροτέρα τις ἐκ τοῦ περιέχοντος ἀνάγκη παραγενομένη διασειση καὶ χωρὶς αὐτὰς διασπείρη.

584 *Simplicius de caelo* 242, 21 (continuing 557) ... ταύτας δὲ τὰς ἀτόμους ἐν ἀπείρῳ τῷ κενῷ κεχωρισμένους ἀλλήλων καὶ διαφερούσας σχήμασί τε καὶ μεγέθεσι καὶ θέσει καὶ τάξει φέρεσθαι ἐν τῷ κενῷ καὶ ἐπικαταλαμβανούσας ἀλλήλας συγκρούεσθαι, καὶ τὰς μὲν ἀποπάλλεσθαι, ὅπη ἂν τύχωσιν, τὰς δὲ περιπλέκεσθαι ἀλλήλαις κατὰ τὴν τῶν σχημάτων καὶ μεγεθῶν καὶ θέσεων καὶ τάξεων συμμετρίαν καὶ συμμένειν [Diels, συμβαίνειν MSS] καὶ οὕτως τὴν τῶν συνθέτων γένεσιν ἀποτελεῖσθαι.

583 ... As they [*sc.* the atoms] move they collide and become entangled in such a way as to cling in close contact to one another, but not so as to form one substance of them in reality of any kind whatever; for it is very simple-minded to suppose that two or more

could ever become one. The reason he gives for atoms staying together for a while is the intertwining and mutual hold of the primary bodies; for some of them are angular, some hooked, some concave, some convex, and indeed with countless other differences; so he thinks they cling to each other and stay together until such time as some stronger necessity comes from the surrounding and shakes and scatters them apart.

**584** . . . these atoms move in the infinite void, separate one from the other and differing in shapes, sizes, position and arrangement; overtaking each other they collide, and some are shaken away in any chance direction, while others, becoming intertwined one with another according to the congruity of their shapes, sizes, positions and arrangements, stay together and so effect the coming into being of compound bodies.

These passages state more precisely what has been outlined in earlier extracts, e.g. **545** and **563**, namely how atoms make up the visible complex bodies of our experience. As a result of collision between atoms those which are of congruous shape do not rebound but remain temporarily attached to one another: for example a hook-shaped atom may become involved with an atom into whose shape the hook fits. Other congruous atoms colliding with this two-atom complex then become attached, until a visible body of a certain character is formed. It is emphasized that no real coalescence of atoms takes place: they simply come into contact with each other, and always retain their own shape and individuality. When a complex of atoms collides with another complex it may be broken up into smaller complexes or into its constituent atoms, which then resume their motion through the void until they collide with a congruous atom, or complex, once again.

There are considerable difficulties in this account. What part does the principle of like-to-like play? This principle, illustrated by Democritus in **570**, is used in the description of world-formation; for in **563** atoms of all shapes come together in a great void, and like tends to like when the smaller atoms go to the periphery, the bulkier ones to the centre. It is likeness of size rather than shape that seems to be primarily in question here; and it is only in a vortex that the sorting of sizes takes place. In the collisions of atoms *not* primarily subject to a vortex, i.e. either outside the scattered areas of world-formation, or within a formed world where the vortex-action may be modified, coalescence is due to congruence (which implies difference, so far as *σμπλοκή* is concerned, and not similarity) rather than to the principle of like-to-like. **584** tells us that this congruence

must operate in respect of shape, size, position, and order. But this is not a complete solution, since we are told of one particular shape of atom that cannot be subject to any obvious type of congruence with others of its shape, but which does nevertheless combine to make up a single type of complex (or rather two different but connected types). This is the spherical atom, of which both soul and fire were evidently held to be composed.<sup>1</sup> Soul, it might be argued, is regarded (as elsewhere in the fifth century) as scattered throughout the whole body; but even so some conjunction of soul-atoms seems necessary. Fire is a clearer case, for it is distinctly visible, and must be composed of spherical atoms and no (or very few) atoms of another shape. How did these atoms come together? They cannot have become implicated with or hooked on to one another, as a result of collision; rather they must have become conjoined by the operation of the principle of like-to-like. It seems, therefore, that Aristotle in 583 is misleading in implying that all examples of συμμένειν, i.e. of the formation of apparently stable complex bodies, are due to *implication* of atoms: there are occasions when other types of συμμετρία (see 584), especially *similarity* of shape and size, are more relevant.

<sup>1</sup> Aristotle asserts in several passages that for the atomists soul- and fire-atoms were spherical, because they had to be mobile and penetrative: e.g. 585 *de an.* A2, 405a11 τῶν δὲ σχημάτων εὐκίνητότατον τὸ σφαιροειδὲς λέγει (*sc.* Δημόκριτος)· τοιοῦτον δ' εἶναι τὸν τε νοῦν καὶ τὸ πῦρ. (*Democritus says that the spherical is the most mobile of shapes; and such is mind and fire.*) Compare *ibid.* 404a5 (DK 67A 28), where soul is said to be recruited by the inhalation of spherical atoms from the atmosphere – an idea analogous perhaps, to that of Heraclitus in 234. Aristotle occasionally implies that the soul *is* fire, because of this community of shape; but the truth is that a spherical atom is neither soul nor fire, it is just a spherical atom. It takes on secondary properties only in association with other atoms; in the context of an animal body it is soul, in other contexts it is fire (cf. Cherniss, *Aristotle's Criticism of Presocratic Philosophy*, 290 n.). Nevertheless, the similarity of shape explains how soul can be nurtured from the atmosphere (which is not besouled, but contains some fire). Apart from soul (equivalent to mind according to Aristotle's account of atomism) and fire, no details have survived about which shape of atom gave rise to which secondary characteristics, except in the case of sensation – sharp atoms produce salty tastes, etc. (see 591 below). Aristotle understood that air and water (and earth, probably) were conglomerations of all shapes of atoms, πανσπερμιαί: 586 *de caelo* Γ4, 303a12 ποῖον δὲ καὶ τί ἐκάστου τὸ σχῆμα τῶν στοιχείων οὐθὲν ἐπιδιόρισαν (*sc.* Λεύκιππος καὶ Δημόκριτος), ἀλλὰ μόνον τῷ πυρὶ τὴν σφαῖραν ἀπέδωκαν· ἀέρα δὲ καὶ ὕδωρ καὶ τὰλλα μεγέθει καὶ μικρότητι διεῖλον, ὡς οὔσαν αὐτῶν τὴν φύσιν οἶον πανσπερμίαν πάντων τῶν στοιχείων. (*They [sc. Leucippus and Democritus] did not further define what particular shape belonged to each of the elements but merely attributed the sphere to fire; air, water and the rest they distinguished by magnitude and smallness, as if their substance was a sort of mixture of seeds of all the elements.*) If this is accurate, then the atomists may have taken over the idea from Anaxagoras (see p. 373).

## SENSATION AND THOUGHT

**587** Aristotle *de sensu* 4, 442a29 Δημόκριτος δὲ καὶ οἱ πλεῖστοι τῶν φυσιολόγων ὅσοι λέγουσι περὶ αἰσθήσεως ἀτοπώτατόν τι ποιοῦσιν· πάντα γὰρ τὰ αἰσθητὰ ἀπὸ τῶν ποιοῦσιν.

**588** Aetius IV, 8, 10 Λεύκιππος Δημόκριτος Ἐπίκουρος τὴν αἴσθησιν καὶ τὴν νόησιν γίνεσθαι εἰδώλων ἔξωθεν προσιόντων· μηδενὶ γὰρ ἐπιβάλλειν μηδετέραν χωρὶς τοῦ προσπίπτοντος εἰδώλου.

**589** Theophrastus *de sensu* 50 (DK 68A 135) ὄραῖν μὲν οὖν ποιεῖ (*sc.* Δημόκριτος) τῇ ἐμφάσει· ταύτην δὲ ἰδίως λέγει· τὴν γὰρ ἐμφασιν οὐκ εὐθύς ἐν τῇ κόρῃ γίνεσθαι, ἀλλὰ τὸν ἀέρα τὸν μεταξὺ τῆς ὄψεως καὶ τοῦ ὀρωμένου τυποῦσθαι συστελλόμενον ὑπὸ τοῦ ὀρωμένου καὶ τοῦ ὀρώοντος· ἅπαντος γὰρ αἰεὶ γίνεσθαι τινα ἀπορροήν. ἔπειτα τοῦτον στερεὸν ὄντα καὶ ἀλλόχρων ἐμφαίνεσθαι τοῖς ὄμμασιν †ὑγροῖς†· καὶ τὸ μὲν πυκνὸν οὐ δέχεσθαι τὸ δὲ ὑγρὸν διέναι...

**590** Alexander *de sensu* 56, 12 εἰδῶλα γὰρ τινα ὁμοίμορφα ἀπὸ τῶν ὀρωμένων συνεχῶς ἀπορρέοντα καὶ ἐπίπτοντα τῇ ὄψει τοῦ ὄραῖν ἠτιῶντο. τοιοῦτοι δὲ ἦσαν οἱ περὶ Λεύκιππον καὶ Δημόκριτον...

**587** Democritus and the majority of natural philosophers who discuss perception are guilty of a great absurdity; for they represent all perception as being by touch.

**588** Leucippus, Democritus and Epicurus say that perception and thought arise when images enter from outside; neither occurs to anybody without an image impinging.

**589** Democritus explains sight by the visual image, which he describes in a peculiar way; the visual image does not arise directly in the pupil, but the air between the eye and the object of sight is contracted and stamped by the object seen and the seer; for from everything there is always a sort of effluence proceeding. So this air, which is solid and variously coloured, appears in the eye, which is moist(?); the eye does not admit the dense part, but the moist passes through...

**590** They attributed sight to certain images, of the same shape as the object, which were continually streaming off from the objects of sight and impinging on the eye. This was the view of the school of Leucippus and Democritus...

It is a necessary consequence of the atomist doctrine, that everything consists of atoms and void, that all sensation should be explained as

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<sup>1</sup> E.g. ο  
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broken up  
voice.)

## ETHICS

**593** De  
μέλλοντα  
ἂν πράσο

a form of contact or touch (587). The soul consists of spherical atoms (585) spread through the body, and the mind was presumably regarded as a concentration of soul-atoms. Thus thought is a process analogous to sensation, and takes place when the soul- or mind-atoms are set in motion by the impingement of congruent atoms from outside (588). A full account of Democritus' detailed explanation of the different senses is given by Theophrastus in his *de sensu*, §§49-83 (DK 68A 135); this account may contain some Peripatetic distortion and elaboration, but shows that Democritus, on this and on other subjects, went to great pains to work out the detailed mechanism of the atomic theory. The fullest, and least satisfactory, description is of vision. Leucippus had evidently (590) taken over the Empedoclean theory (pp. 309f.) that effluences, now described as images, εἶδωλα, are given off by objects and affect the sense-organs. Democritus then held (589) that the visual image (ἔμφασις) in the pupil is the result of effluences (ἀπορροαί) both from the seen object and from the observer; these meet and form a solid impression (ἐντύπωσις) in the air, which then enters the pupil of the eye. The other senses are explained more simply, and with emphasis on the different effects of different sizes and shapes of atom;<sup>1</sup> none of the explanations stands close examination, and Aristotle and Theophrastus were able to make some very pertinent criticisms. We do not know, for example, how Democritus explained the sense of touch: as all senses depend ultimately on this sense, it is obviously a problem how sight or taste, for example, differ from it.

<sup>1</sup> E.g. of taste, 591 Theophrastus *de sensu* 66 (DK 68A 135) τὸν δὲ πικρὸν (sc. χυλὸν) ἐκ μικρῶν καὶ λείων καὶ περιφερῶν, τὴν περιφέρειαν εἰληχότων [-α MSS, Diels; -ων scripsi] καὶ καμπᾶς ἔχουσιν· διὸ καὶ γλίσχρον εἶναι καὶ κολλώδη. ἄλμυρὸν δὲ τὸν ἐκ μεγάλων καὶ οὐ περιφερῶν, ἀλλ' ἐπ' ἐνίων μὲν σκαληνῶν... (*Bitter taste is caused by small, smooth, rounded atoms, whose circumference is actually sinuous; therefore it is both sticky and viscous. Salt taste is caused by large, not rounded atoms, but in some cases jagged ones...*) Sound is transferred when the particles of voice or noise mingle with similar particles in the air (and thus, presumably, form εἶδωλα): 592 Aetius IV, 19, 3 (DK 68A 128; probably from Poseidonius, according to Diels) Δημόκριτος καὶ τὸν ἄερα φησὶν εἰς ὁμοιοσχήμονα θρύπτεσθαι σώματα καὶ συγκαλινδεῖσθαι τοῖς ἐκ τῆς φωνῆς θραύσμασι. (*Democritus says that the air is broken up into bodies of like shape and is rolled along together with the fragments of the voice.*)

## ETHICS

593 Democritus fr. 3, Stobaeus *Anth.* IV, 39, 25 τὸν εὐθυμεῖσθαι μέλλοντα χρῆ μὴ πολλὰ πρήσσειν, μήτε ἰδίη μήτε ξυνη, μηδὲ ἄσος' ἂν πράσσει, ὑπὲρ τε δύναμιν αἰρεῖσθαι τὴν ἔωυτοῦ καὶ φύσιν· ἀλλὰ

τοσαύτην ἔχειν φυλακὴν, ὥστε καὶ τῆς τύχης ἐπιβαλλούσης καὶ ἐς τὸ πλεόν ὑπηγεομένης, τῷ δοκεῖν κατατίθεσθαι καὶ μὴ πλέω προσάπτεσθαι τῶν δυνατῶν. ἢ γὰρ εὐογκίη ἀσφαλέστερον τῆς μεγαλογκίης.

**594** Democritus fr. 191, Stobaeus *Anth.* III, 1, 210 ἀνθρώποισι γὰρ εὐθυμίη γίνεται μετριότητι τέρψιος καὶ βίου συμμετρίη· τὰ δ' ἐλλείποντα καὶ ὑπερβάλλοντα μεταπίπτειν τε φιλεῖ καὶ μεγάλας κινήσεις ἐμποιεῖν τῇ ψυχῇ· αἱ δ' ἐκ μεγάλων διαστημάτων κινούμεναι τῶν ψυχῶν οὔτε εὐσταθέες εἰσὶν οὔτε εὐθυμοί. ἐπὶ τοῖς δυνατοῖς οὖν δεῖ ἔχειν τὴν γνώμην καὶ τοῖς παρεούσιν ἀρκέεσθαι, τῶν μὲν ζηλουμένων καὶ θαυμαζομένων ὀλίγην μνήμην ἔχοντα καὶ τῇ διανοίᾳ μὴ προσεδρεύοντα, τῶν δὲ ταλαιπωρεόντων τοὺς βίους θεωρεῖν ἐννοούμενον ἃ πάσχουσι κάρτα, ὅκως ἂν τὰ παρεόντα σοι καὶ ὑπάρχοντα μεγάλα καὶ ζηλωτὰ φαίνηται, καὶ μηκέτι πλειόνων ἐπιθυμῶντι συμβαίνει κακοπαθεῖν τῇ ψυχῇ. ὁ γὰρ θαυμάζων τοὺς ἔχοντας καὶ μακαριζομένους ὑπὸ τῶν ἄλλων ἀνθρώπων καὶ τῇ μνήμῃ πᾶσαν ὥραν προσεδρεύων ἀεὶ ἐπικαινουργεῖν ἀναγκάζεται καὶ ἐπιβάλλεσθαι δι' ἐπιθυμίην τοῦ τι πρήσσειν ἀνήκεστον ὧν νόμοι κωλύουσιν. διόπερ τὰ μὲν μὴ δίξεσθαι χρεῶν, ἐπὶ δὲ τοῖς εὐθυμῆσθαι χρεῶν, παραβάλλοντα τὸν ἑαυτοῦ βίον πρὸς τὸν τῶν φαυλότερον πρησσόντων, καὶ μακαρίζειν ἑωυτὸν ἐνθυμῶμενον ἃ πάσχουσιν, ὁκόσῳ αὐτέων βέλτιον πρήσσει τε καὶ διάγει· ταύτης γὰρ ἐχόμενος τῆς γνώμης εὐθυμότερόν τε διάξεις καὶ οὐκ ὀλίγας κῆρας ἐν τῷ βίῳ διώσει, φθόνον καὶ ζῆλον καὶ δυσμενίην.

**593** The man who is going to be in good spirits must not do too much, neither in private nor in public, nor, whatever he does, must he aspire beyond his natural power. But rather he must be so much on his guard that, even when chance comes his way and points to more, in his judgement he can lay it aside and not put his hand to more than what lies in his power. The right load is a safer thing than a large load.

**594** For good spirits come to men through temperate enjoyment and a life commensurate. Deficiencies and excesses tend to turn into their opposites and to make large motions in the soul. And such souls as are in large-scale motion are neither in good balance nor in good spirits.

One should keep one's mind, then, on things in one's power, and be quite satisfied with things at hand, taking little notice of those who are envied or admired and not dwelling in thought upon them. One should look at the lives of those in trouble, bearing in mind how mightily they are suffering. In this way, things at hand

and at your disposal may well appear great and enviable; yours will no longer be a case of suffering in soul through desire for more.

For he who admires those blessed with possessions and the congratulations of other men and who dwells every hour on the memory is ever compelled to plot something new and to throw himself, through desire, into doing something irremediable and illegal.

That is why one must not seek things there; one must be in good spirits over things here, comparing one's own life with that of those doing worse. One must congratulate oneself, laying their sufferings to heart, on how much better one is doing and carrying on than they are. For if you keep to this mind, you will both carry on in better spirits, and you will ward off some considerable curses in life – envy, jealousy and malice.

Of the sixty works ascribed to Democritus in Thrasyllus' catalogue (DK 68A33) only eight were classified as 'ethical', the best-known of these being one *Περὶ εὐθυμίας* or *On Good Spirits*. But over four-fifths of his surviving *verbatim* fragments are concerned with ethics. Most of them, including the most substantial pieces, have come down to us in the vast anthology compiled by John of Stobi in the fifth century A.D. There is also a collection of 86 *gnomai* ascribed to 'Democrates', which overlap with Democritean material in Stobaeus and are generally regarded, with five exceptions, as genuine fragments of Democritus.

The fragments in DK cover a wide range of subjects – good spirits and how to avoid depression (3, 189, 191, 285), fortune (119, 172–4) and folly (197–206), child-rearing (275–80) and education (178–82, 228), pleasure and prudence (74, 188, 207, 232–5), favours (92–6) and friendship (97–101, 106), political questions (245, 248–55, 265–6) and the punishment of wrongdoers (356–62), to name only a few. They vary in style from the verbosely ornate to the graphic and gnomic, with some of the shorter fragments showing signs of abbreviation by anthologists. The content of some seems embarrassingly close to Socratic or later doctrines. The authenticity of almost any fragment can usually be attacked on some ground or other.

A notable exception is fragment 3 (593), a much quoted sentence which probably began the *Peri Euthumies*. Its message is one of traditional common sense: it is safer to reject the blandishments of good luck and to stay within the limits of one's own natural ability. Other fragments (176, compare 210, 197) draw the same contrast between chance and nature. But 'nature' is not for Democritus the

overriding moral authority that it was for some contemporary sophists, since one's nature can be 'transformed' by teaching (fr. 33). Men can extend their natural abilities; faced with deep water, for instance, they can take swimming-lessons (fr. 172). None the less, restricting oneself to what is in one's power must often mean renouncing much that, unfortunately, is not in one's power. Fragment 191 (594), almost certainly from the same work *On Good Spirits*, shows how to make the renunciation bearable. Men attain good spirits through enjoyment that avoids extremes of want and satiety (unlike the debauchery described in fr. 235) and through a life 'commensurate' with such enjoyment or perhaps with their own natural abilities; anything else makes for upheavals in the soul, precluding stability and good spirits. The opening of the fragment bristles with abstract terms all of which might just have some technical, scientific meaning. It constitutes our principal evidence for the view that Democritus based his ethical doctrines upon his physics. But a literal interpretation of the paragraph in terms of atomistic psychology leaves a confusing picture; and it seems easier, in view of what follows, to interpret the 'large-scale motions' and so forth as metaphorical. What is certain, and highly important, is that Democritus here is directing our moral attention inwards, as Socrates did, to the state of our souls. Only, the Democritean 'care of the soul' is not a quest for universal truths. His concern, in this fragment as in others (283, 284, 219), is with our subjective well-being, that 'what you have may seem great and enviable to you'. Democritus' work *On Good Spirits* thus belongs to the literature of undogmatic practical ethics, alongside the treatises on curing anger and the 'consolations' designed to cure grief. His main advice, that you should gain contentment by taking those worse off than yourself as your point of reference, was to be a stock-in-trade of such literature. Its tone, rational, paradoxical and a bit unfeeling, recurs elsewhere in the fragments – for instance, in the argument that it is wiser to adopt than to beget a child, because only then can you choose the sort you want (fr. 277). A political motive for the advice appears in the third paragraph, with the claim that disregard of it can lead to crime and revolutionary politics (ἐπικαινουργεῖν has the implications of νεωτερίζειν). Fragment 252 expresses the view, common in the fifth century, that the well-being of the state should be the paramount consideration. But this, as other fragments (notably 255) make clear, depends on the voluntary public-spiritedness of its citizens. Law can only be of benefit, if people are willing to obey it (fr. 248). An external constraint, it cannot on its own prevent their 'sinning in secret' (fr.

181). Hence Democritus' interest in the inner, psychological motives for right conduct, in 'conviction, understanding and knowledge' (fr. 181), in the sanctions of guilty conscience (fr. 262, 297), in 'respect for oneself' – and not just for other people's opinion – as a 'law for the soul' (fr. 264). Hence, too, his interest in remedies for antisocial attitudes, such as envy which can lead to civil strife (fr. 245) and so to the ruin of the whole community (fr. 249). By following the advice of 594, Democritus' reader might not only put himself into better spirits; he might also become less of a menace to his fellow-citizens. In thus encouraging a certain civic virtue, Democritus was carrying on the work of poets and moralists before him.<sup>1</sup>

<sup>1</sup> Some of the pithier sayings have a specifically Heraclitean ring, e.g. fr. 171: 'Happiness does not reside in cattle or gold; the soul is the dwelling-place of one's good or evil genius (*daimon*)' (cf. Heraclitus fr. 9 and 119 [= 247]), or fr. 246: 'Service abroad teaches self-sufficiency; barleybread and a straw mattress are the pleasantest medicines for hunger and fatigue' (cf. Heraclitus fr. 111 [= 201]). The Heraclitean echoes are doubtless intentional.

#### CONCLUSION

Atomism is in many ways the crown of Greek philosophical achievement before Plato. It fulfilled the ultimate aim of Ionian material monism by cutting the Gordian knot of the Eleatic elenchus. Much as it owed not only to Parmenides, Zeno and Melissus, but also to the pluralist systems of Empedocles and Anaxagoras, atomism was not, however, an eclectic philosophy like that of Diogenes of Apollonia. It was in essence a new conception, one which was widely and skilfully applied by Democritus, and which through Epicurus and Lucretius was to play an important part in Greek thought even after Plato and Aristotle. It also, of course, eventually gave a stimulus to the development of modern atomic theory – the real nature and motives of which, however, are utterly distinct.