ideas. The prospect is sad, but not appalling. [illegible] than thought.

(b) *Empedocles' cosmic cycle*

This section is purely expository. I shall state what I take to have been the Empedoclean world-view; and I shall briefly sketch the basic positions of Anaxagoras, of Philolaus, and of the Atomists. I shall have little more to say about Empedocles' cosmology, which is philosophically unrewarding; but some of my remarks on Empedoclean psychology in a later chapter will refer back to his 'cosmic cycle'. Anaxagoras, Philolaus and the Atomists will receive detailed treatment later on; and Diogenes of Apollonia will get a chapter to himself.

Everything connected with Empedocles' cosmology is now controversial: there is what may be called the traditional view of his theory, which I shall expound and which I believe to be in all essentials true; and there are various heterodoxies, recently advocated with great scholarly power and ingenuity. I shall not enter into any of these issues; and the reader should be warned that my exposition here is more than usually one-sided.

The main text is **31 B 17.1–13**[6] (most of its contents are repeated, sometimes verbatim, in **B 26** and **B 35**):

> I shall tell a double tale; for at one time they[7] increased to be one thing alone
> from being many; and then again they grew apart to be many from being one.
> And two-fold is the generation of mortal things, two-fold their disappearance;
> for the one[8] the collocation of everything both brings to birth and destroys,
> and the other is nourished and flies apart[9] as they again grow apart.
> And they never cease from continuous interchange,
> now by Love all coming together into one,
> now again each carried apart by the enmity of Strife.
> [Thus in so far as they have learned to become one from being many][10]
> and as the one grows apart they become many,
> thus far do they come into being and there is no stable life for them;

The fragment has as its subject the four elemental stuffs or, as Empedocles call them, 'roots (*rhizômata*)': earth, air, fire, water (cf. **B 6**; **B 21.3–8**). According to Aristotle, fire had a place of special importance in Empedocles' system (*GC* 330b20; *Met* 985b1 = **A 36–7**; cf. Hippolytus, **A 31**); but that is not apparent from the fragments. Nor need we pay any heed to the doxographical assertion that the roots had an atomic or corpuscular substructure (e.g., Aëtius, **A 43**).[11] The roots are eternal (cf. **B 7**); they are obliquely characterized in **B 21** and given divine appellations in **B 6**.[12]

The roots are involved in a never-ending cycle of change (194. 6; 12–3; cf., e.g., Aristotle, *Phys* 187a24 = **A 46**). One part of the cycle is dominated by the agency of Love (194. 7), during which the elements gradually commingle into one mass; another part is dominated by Strife (194.8), during which the elements gradually separate out into four distinct masses. The ontological status and the causal functions of these two cosmic powers will be discussed in a later chapter. When Love is supreme, a homogeneous Sphere is formed in which all the roots promiscuously interpenetrate (**B 27**; **B 28**; cf., e.g., Philoponus, **A 41**; Simplicius, **A 52**); and the Sphere is at rest for a period of time.[13] Then the force of Strife grows again; the Sphere breaks up (cf. Eudemus, fr. 110 W; Aristotle, *Met* 1092b6); and the elements eventually become completely separated. It appears that this state, when Strife is totally dominant, is instantaneous.

As the four roots 'run through one another, they become different in aspect' (**B 21. 13**), and their interminglings form the cosmos and everything in it:

> For from these comes everything that was and is and will be—
> trees sprang up, and men and women,
> and beasts and birds and water-dwelling fish,
> and long-lived gods who are first in honour (195: **B 21. 9–12**).

The creative process is described in a pleasant analogy:

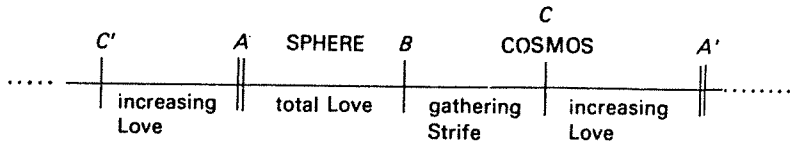
> As when painters decorate offerings—
> men well trained in their craft by skill—
> they grasp the many-coloured pigments in their hands,
> mixing in harmony more of some and less of others,
> and from these they make forms resembling all things,
> creating trees, and men and women,
> and beasts and birds and water-dwelling fish
> and long-lived gods who are first in honour

—so let not your mind be conquered by the falsehood that from anywhere else
is the spring of all the myriad mortal things that are plain to see;
but know this clearly, hearing the tale from a god. (196: B 23; cf. Galen, A 34).

From a few primary colours painters make an imitation world: in the same way, the mixing of the four elements produces the natural world, one proportion making bone (B 96), one blood (B 98), others other stuffs (Aëtius, A 78; Simplicius, *ad* B 96).

The natural world and its production were described in detail in Empedocles' poem *Concerning Nature*: there was a cosmogony, an astronomy, a meteorology; a zoogony; a biology and a botany; remarks on embryology and anatomy, on physiology and psychology—in short, a detailed and often novel natural science in the grand Ionian tradition.

The cosmic cycle rolls on endlessly; a partial map of it may have looked like this:



AA' represents one complete cycle: identical cycles are repeated infinitely often. $AB = BA'$: during AB, for just half the cycle, the elements are homogeneously commingled into the Sphere. At B the hold of Love is relaxed: Strife gradually regains its powers, separating the elements until, at C, they lie completely distinct, arranged about one another in concentric hollow spheres. Then Love increases again, until the Sphere is reformed at A'. C, the point of total Strife, is midway between B and A'.

BC and CA' are mirror images of one another: take any point P on BC and construct P' on CA such that $PC = CP'$; then the state of the world at P is qualitatively indistinguishable from its state at P'. We live in BC the period of increasing strife (Aristotle, *GC* 334a5 = A 42): our world is doomed to destruction; but after that destruction another world will be created, a perfect reflexion of our own. And before and after these twin worlds there have been and will be infinitely many others.

Empedocles' system may have had less order and symmetry than I have ascribed to it; for my account has idealized in some places and ignored serious controversy in others. But few would deny the cosmic cycle a subtle aesthetic fascination; and Empedocles' poetical

style—grand, formulaic, repetitive, hierophantic—adds to that seductive power.[14] Poetry and reason do not always cohabit; and Empedocles has frequently been held to have lost in ratiocinative capacity what he gained in poetical talent. Thus according to Aristotle, 'anyone who says this should not simply state it—he should also give the explanation of it, and not posit it or lay down some unreasoned axiom but bring either an induction or a demonstration' (*Phys* 252a22–5; cf. *GC* 333b22–6). A modern scholar has generalized Aristotle's criticism: 'Imaginative vividness took hold of [Empedocles] with more persuasiveness than did logical consistency, and he inevitably baffles minds not constituted like his own. The important thing in understanding him is to stop thinking at the right moment'.[15]

That criticism is harsh, but not wholly unfair: certainly, we shall look in vain for any argument in favour of Empedocles' cycle; it is a construction of great 'imaginative vividness', but it lacks all rational support. I do not say that it is inconsistent, only that it was, so far as we can now tell, unreasoned. And what holds of the general scheme holds of many of its particular parts: we look in vain for argument, either inductive or deductive. Thus Empedocles confidently gives us a recipe for making bone: it is patent that he never tested his own recipe—a poor intellectual cook. Or again, he says much about the activity of Love and Strife; yet he nowhere explains why Love and Strife are the two active principles in the cosmos, or why they do what they are alleged to do.

But it would be wrong to dismiss Empedocles as a mere fantastic, a writer of versified science fiction. There are fragments which contrive to be both descriptive and illuminating, genuine contributions to natural science; the two long similes about the structure of the eye (B 84) and about the nature of respiration (B 100) are only the most extended examples of that. And there are one or two fragments containing philosophical argument. These philosophical fragments, which I shall quote below, are Eleatic in tone and content: though Empedocles never mentions Parmenides, the many echoes of Eleatic verse in his poem prove that he knew his great predecessor's work;[16] and since Empedocles' cycle is patently un-Eleatic, it is hard to avoid the conclusion that he was consciously striving to answer the Eleatic challenge and to restore Ionian science to its high intellectual place.

So much for Empedocles. Let me now describe in barest outline the other major neo-Ionian systems.

Anaxagoras' cosmology differs considerably from Empedocles'; but in Elea the differences would have seemed trifling. Anaxagoras' world begins in an undifferentiated mass of stuffs, comparable to

Empedocles' Sphere. An active principle, Mind, then stirs the mass into rotatory motion; and that rotation produces our world, the different stuffs in the primordial mass commingling and separating in different amounts and proportions. Like Empedocles, Anaxagoras raised a full Ionian science on these foundations; the doxography preserves much of the detail, even though we have almost nothing of it in Anaxagoras' own words. Anaxagoras' cosmogony ends with the creation: his variegated world did not finally break apart into its elements; nor did the original mass ever reform; nor, consequently, did Anaxagoras follow Empedocles in postulating an infinite sequence of worlds.[17]

Anaxagoras' system is less strange than Empedocles'; and it was expounded in plain prose. Moreover, it was in a strong sense a rational structure: the fragments contain a quantity of argument; and it is clear that Anaxagoras was not content to state, but strove to prove. Much of that argument will be investigated in the next chapter. Finally, observe that in Anaxagoras no less than in Empedocles there are clear traces of Eleatic influence.

Philolaus was a Pythagorean; and some will object to my calling him 'neo-Ionian'. My excuse is simply this: he offered a cosmogony and an astronomy, as all good Ionian scientists did; and he paid some attention to Eleatic arguments, as all good neo-Ionians had to. His system was sensibly different from those of Anaxagoras and Empedocles in all other respects: Philolaus has cosmic 'principles', two in number, but they have curiously abstract and immaterial names. From the union of those principles our world was somehow formed and made intelligible; and the union was carried out under the auspices of Harmony, a force eminently comparable to Empedocles' Love (which indeed is sometimes called Harmonia: e.g., **31 B 27**). That brief sketch will hardly inspire excited anticipation; but I hold out the promise that Philolaus' cosmogony will prove stimulating.

The Atomists 'say that the full and the empty are elements, calling the one "being" and the other "not being"' (Aristotle, *Met* 985b5 = **67 A 6**). Apart from 'the full and the empty', atoms and the void, there is nothing. The atoms, which differ from one another in shape and size, move perpetually through the infinite void. The movement occurs by necessity (**67 B 2**); and in its course the atoms knock against, and sometimes adhere to, one another. Sometimes those adhesions increase in size and complexity; and our own universe is the result of a vast set of such atomic collisions. Not merely the formation of the world but everything else is ultimately explicable in terms of atomic structure: macroscopic qualities and relations rest upon microscopic

form and arrangement; macroscopic changes are but the phenomenal results of microscopic motions.

With the Atomists' adoption of 'the void', and their assertion that 'what is not is', we meet the most far-reaching challenge to the Eleatic philosophy that the Presocratics produced; with the Atomists' thoroughgoing corpuscularianism, and their self-conscious and systematic development of its implications, we meet the most impressive achievement of Presocratic science. The Atomists are often regarded as the *élite* of the Presocratics; of all the early thinkers their thought was nearest to our own—and hence, of course, most rational.

Here, then, are the neo-Ionian systems. That they clash, obviously and fundamentally, with the doctrines of Elea, is a plain fact. And it is plain too that, to some extent at least, their proponents were conscious of the clash.

(c) *Four blind alleys*

The success of the neo-Ionian attack on Elea cannot be judged until its nature has been determined; and since there are several popular misconceptions of the nature of the attack, I begin by mentioning four routes along which the neo-Ionians did not march.

First, it is frequently said that Empedocles' Sphere or *Sphairos* corresponds to the ball or *sphaira* to which Parmenides likened 'what is'. Parmenides 'One' is spherical, homogeneous, and motionless: Empedocles' *Sphairos* is also homogeneous and motionless. After describing the 'One', Parmenides gives an account of the plural, changing world of Mortal Opinion: from the *Sphairos* Empedocles generates the plural, changing world of natural science. Empedocles, in brief, replaces the logical relation between the Way of Truth and the Way of Opinion by a chronological relation between the time of the Sphere and the time of the Cosmos; and thus he 'perpetuates Parmenides' insight, while reconciling it with common sense'.[18]

There are literary links between Parmenides' *sphaira* and Empedocles' *Sphairos*; and perhaps psychologically Empedocles was influenced by Parmenides here. But it is perfectly plain that the Sphere in no way 'perpetuates Parmenides' insight', nor does it marry Eleaticism with science. Even if Parmenides was a spherical monist he would have scorned the *Sphairos*: the *Sphairos* generates the natural world; the *Sphairos* is no more real than the plural world it produces; the *Sphairos* is not sempiternal; nor is it changeless—it lasts for a fixed period of time and then gradually breaks up into the world we know. A silly person might attempt to reconcile Zeno and Antisthenes by urging that for half of his time in the stadium the

runner really is at rest, and that for the other half he moves. Such a reconciliation is ludicrous. No less ludicrous is the suggestion that Empedocles' stable *Sphairos* 'reconciles' Parmenidean metaphysics with Ionian science. I do not believe that Empedocles could have imagined anything so foolish.

The *Sphairos* is irrelevant to the neo-Ionian answer to Parmenides. I suppose that no one will suggest that Anaxagoras' primordial mass, or Philolaus' originative elements, or the little bodies of the Atomists, have any conciliatory tendencies.

Second, it is often observed that the neo-Ionians were, so to speak, axiomatic pluralists: they made it an initial posit that there is a plurality of things or stuffs. Thus Empedocles lays it down that there are four originative and ungenerated 'roots'; Anaxagoras has an indefinite variety of stuffs in his primordial mixture; Philolaus starts from a pair of principles; the atomists begin with an irreducible infinity of bodies. Parmenides, it is then said, observed the old Ionian systems, and found an impossibility in the suggestion that their single primordial stuff should give rise to a plural world. And against Parmenides the neo-Ionians reasoned thus: 'Parmenides was right in denying that a plurality could ever be derived from an ultimate unity; but what if there was no ultimate unity, but a plurality of primary entities which had always existed?'[19] Parmenides, in short, rejects the move from one to many; the neo-Ionians concur, but they counter the argument by presenting cosmogony as a move from many to many: a derived manifold is possible, for all that Parmenides has said, provided only that it derives from a primitive manifold.

It would be tedious to set out all the confusions and inaccuracies in that account of the central feature of Presocratic philosophy; and the account can be rejected by a quick and easy observation. Parmenides objects, not to the generation of a manifold from a unity, but to generation *tout court*. He does not argue, specifically, that nothing can be derived from a unity; he argues, quite generally, that nothing can be derived at all. The account I have just reported ascribes the grossest *ignoratio elenchi* to Empedocles and his fellows; I see no reason to suppose that they had misunderstood Parmenides' message in so crude a fashion. Indeed, on that point at least they were fully aware of the force of the Eleatic argument.

The word '*homoios*' signposts the third alley. Empedocles' roots are 'always utterly homogeneous' (31 B 17.35); for 'all these are fitting to their own parts' (B 22.1). Any parcel of a given elemental stuff has all and only those qualities possessed by any other parcel. In a similar way, Anaxagorean stuffs are 'homoiomerous': the precise

sense of that controversial appellation will be investigated later (see below, pp. 320–2); here it is enough to say that homoiomereity imparts some measure of homogeneous stability to Anaxagoras' world.

The Eleatics argued that the world was *homoios*, homogeneous. The neo-Ionians accepted the argument, but to a limited extent: the elemental stuffs of the world, they admitted, are *homoia*; but that admission is consistent with change and decay. Plainly, that constitutes no answer to Elea: just as the postulation of a temporary Sphere does not reunite science with the Eleatic ban on change, so the admission of homogeneous elements does not unite scientific truth with the assertion that the whole universe is homogeneous. I do not think that Anaxagoras and Empedocles can have seriously supposed that their references to homogeneity constituted an answer to Elea; and I turn to the fourth and final alley.

It is drawn only on the map of Empedocles' thought. In 194.9–13 (= B 26.8–12) Empedocles explains how, in one respect, things 'come into being and there is no stable life for them', while in another respect 'they exist forever, changeless in the cycle'. The language is reminiscent of Parmenides; and we may suspect that Empedocles is offering an answer to Elea. Roughly, Empedocles' position is this: *within* any cosmic cycle there is constant change—birth and decay, alteration and locomotion; but viewed from a higher vantage point the cosmos exhibits an eternal fixity—there is nothing new in the world; each event has occurred already infinitely many times, and will recur infinitely often. There is local change but global stability; for the local changes occur in accordance with unalterable global laws. Thus the Empedoclean universe is, at a global level, Eleatic: its laws do not change; its grand cycles are forever fixed. But that Eleatic stability can be reconciled with the changes observed by the scientist; for the stability itself governs and accounts for those changes.

Now as an answer to Parmenides, that is plainly futile: if Parmenides is right, there is no possibility of change, either at a global or at a local level. Eleatic arguments work, if they work at all, across the board; and if we suppose that Empedocles failed to see that fact, we accuse him of a wretched blindness: as well say that astronomy can be harmonized with Zenonian immobility by the reflexion that the stars always return to their starting points. And in fact, 194.9–13 is not to be construed as an answer to Elea at all: rather, it makes, in somewhat picturesque language, a perfectly sane and sober point. Empedocles is saying, in effect, that the choppings and changings of the phenomenal world do not remove that world

from the domain of rational science, whose first postulate is the existence of some system and stability in the phenomena; for the choppings and changings, though they may seem careless or random, are in fact the manifestations of eternal regularities; behind the phenomena lie stable and strong laws. That is not an original thought in Empedocles, although in 194 it has an idiosyncratically Empedoclean twist; but it is a comprehensible and a true thought—and a thought that has no bearing on the problems raised for science by Eleatic metaphysics.

(d) *Five through roads*

If those four alleys are blind, where are we to go? There are, I think, five main lines of contact between the Eleatics and the neo-Ionians; together they constitute the framework within which the new scientists tried to pursue their craft without falling foul of old Parmenides. First, the neo-Ionians agree with the first theorem of Eleatic metaphysics: generation, the absolute coming into being of real entities, is an impossibility. But, second, they hold that the alteration (in some sense) of existing entities is a possibility; and, third, they believe that locomotion is also possible. Then, fourth, they supply a 'moving cause' which will explain and account for the changes that the world contains; and finally, they reinstate, in a guarded fashion, the methodology of empirical observation. Generation goes, but locomotion stays; locomotion is causally explicable, and in turn will account for alteration; and perception, the first instrument of science, will reveal what locomotions and what alterations take place.

Scientifically speaking, the final point is crucial: in order to return to the rich pastures of Ionian science, the neo-Ionians were obliged to rescue the senses as instruments of discovery and signposts to truth. The complex and ingenious hypotheses of Empedocles, of Anaxagoras, of Philolaus, and of the Atomists are designed to organize and to explain 'the phenomena'; such hypotheses are chimerical if the phenomena have no objective status but remain, as they are in Elea, dreams and delusions of the human fantasy; and the phenomena can only be granted a decent scientific status if our senses, by which the phenomena are apprehended, have some claim to be regarded as dispensers of truth.

Philosophically, the third point is crucial: locomotion must be saved at all costs; for it was, as we shall see, primarily by their defence of the possibility of locomotion that the neo-Ionians hoped to rehabilitate the world of science. Generation and destruction, they

believed, could, with some important reservations, be left in the Eleatic hell of nonentity; and they were surprisingly nonchalant in their attitude towards alteration. But on locomotion they were adamant: *pace* Elea, things can move; and they do move. In that way science gains a toehold in reality, and it can again dare to ascend the lofty cliffs of truth.

Such, I believe, is the essential doctrine of the neo-Ionian counter-reformation. Different thinkers developed it in different ways, and it is their differences which, being intrinsically fascinating, are generally held up for inspection and admiration. Yet it is important to grasp in a general and abstract way the common *nisus* that guided their diverse efforts to escape from the narrow and blinkering tenets of Elea. That *nisus* had nothing to do with the desire to balance periods of change against periods of stability, nor with the hope of securing phenomenal pluralities on the basis of elemental multiplicity. It had everything to do with the possibility of locomotion.

In the next three chapters I shall look into the different systems proposed by the neo-Ionians. The discussion will lead away from the common core of neo-Ionian doctrine. But the core must not be forgotten; and I shall take occasion later to examine it in more detail and to assess its power to defend Ionia against Elea.