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# *DE GENERATIONE ET CORRUPTIONE* 2.3: DOES ARISTOTLE IDENTIFY THE CONTRARIES AS ELEMENTS?

It might seem quite commonplace to say that Aristotle identifies fire, air, water and earth as the στοιχεῖα, or 'elements' – or, to be more precise, as the elements of bodies that are subject to generation and corruption. Yet there is a tradition of interpretation, already evident in the work of the sixth-century commentator John Philoponus and widespread, indeed prevalent, today, according to which Aristotle does not really believe that fire, air, water and earth are truly elemental.[1] The basic premise of this interpretation is that Aristotle takes fire, air, water and earth to be, in some sense, composite bodies and, as such, analysable into simpler constituents. But, of course, an element of bodies is defined by Aristotle himself as something into which bodies can be analysed, and which does not admit further analysis (*Metaph.* 5.3, 1014a26–1014b15; *Cael.* 3.3, 302a14–21). So if fire, air, water and earth *can* be analysed into simpler or more basic constituents, then it would seem to follow that the latter ought to be considered Aristotle's true elements. These are usually identified as the primary contraries hot and cold, dry and wet; many, perhaps most, commentators would insist also upon prime matter as the subject upon which these contraries act.[2]

The best evidence in support of the view that Aristotle identifies the contraries as the elements is believed to be available at *De generatione et corruptione* 2.3. Indeed it is often claimed that Aristotle begins to reserve the term στοιχεῖα for the contraries in that text. In what follows I examine this evidence, and I hope to show that it is found wanting. I shall argue that Aristotle neither explicitly nor implicitly identifies

[1] For Philoponus, see *In Ph.* 16.94.13–15 (Vitelli); *In GC* 205.8–12, 23–5, with 224.1–5 (Vitelli). For modern views, see n. 2.

[2] See e.g. H.H. Joachim, *Aristotle On Coming-to-be and Passing-away* (Oxford, 1922), 104, 137, 191, 200; W.D. Ross, *Aristotle's Physics* (Oxford, 1936), 484 and *Aristotle* (London, 1949[5]), 73, 168–9; I. Düring, *Aristotle's De Partibus Animalium* (Göteberg, 1943), 124; H.R. King, 'Aristotle without *prima materia*', *JHI* 17 (1956), 370–87, at 378; C.H. Kahn, *Anaximander and the Origins of Greek Cosmology* (New York, 1960), 120, 124; F. Solmsen, *Aristotle's System of the Physical World* (Ithaca, NY, 1960), 351, 368; H. Cherniss, *Aristotle's Criticism of Presocratic Philosophy* (Baltimore, 1935), 60, 122; id., *Aristotle's Criticism of Plato and the Academy* (Baltimore, 1944), 160, 171; R. Sokolowski, 'Matter, elements, and substance in Aristotle', *JHPh* 8 (1970), 263–88, at 268–9; C.J.F. Williams, *Aristotle's De Generatione et Corruptione* (Oxford, 1982), 152; D.W. Graham, 'The paradox of prime matter', *JHPh* 25 (1987), 475–90, at 476–7; M. Furth, *Substance, Form and Psyche: An Aristotelean Metaphysics* (Cambridge, 1988), 77, 223; R.J. Hankinson, *Cause and Explanation in Ancient Greek Thought* (Oxford, 1998), 180; M. Crubellier, '*Metaphysics* Λ 4', in M. Frede and D. Charles (edd.), *Aristotle's Metaphysics Lambda* (Oxford, 2000), 137–60, at 142; J. Lennox, *Aristotle: On the Parts of Animals* (Oxford, 2001), 136–7, 180; D. Frede, 'On *Generation and Corrupti*on I 10: on mixture and mixables', in F. de Haas and J. Mansfeld (edd.), *Aristotle: On Generation and Corruption, Book I* (Oxford, 2004), 289–314, at 303 with n. 36; and M. Rashed, *Aristote. De la génération et la corruption* (Paris, 2005), 129. Of these, Joachim, Ross, Solmsen, Cherniss, Sokolowski, Williams and Graham are explicit in their insistence that Aristotle appeals to prime matter.

the contraries hot and cold, dry and wet as στοιχεῖα at *De generatione et corruptione* 2.3. Moreover, I conclude that his procedure in that text points rather to the conclusion that he retains fire, air, water and earth as the elements of bodies, albeit not without a significant qualification. Before examining the textual evidence, however, I want to begin by reviewing briefly some 'theoretical' difficulties for the view that the contraries are, for Aristotle, the genuine στοιχεῖα.

## I

Let us first clarify just what it is that Aristotle takes to be an element, before turning to consider whether the primary contraries could be appropriate candidates for being the elements of bodies.

In general, an element is the 'first constituent out of which something is composed, indivisible in form into another form' (*Metaph.* 5.3, 1014a26–7). To be an element, in other words, is to be the simplest constituent of some compound item. The elements of *bodies* (τὰ στοιχεῖα τῶν σωμάτων), then, if indeed there are more than one (cf. 1014a34–5; *Cael*. 3.3, 302a25), are the ultimate constituents of bodies (*Cael*. 302a14–25).[3] Aristotle seems confident that this is a definition with which everyone would agree (302a18). But what are the ultimate, or simplest, constituents of bodies?

It would appear to have been an opinion already current among Plato's contemporaries that the elements of bodies are fire, air, water and earth.[4] Aristotle himself not only notes this opinion,[5] but often appears content to accept it, most obviously throughout the *De caelo* (see e.g. 1.2, 269a17, 1.3, 270b20–2, 4.3, 310b11–14; cf. also *De an*. 2.5, 417a4–5, *Sens.* 5, 443a9–10, *Ph*. 3.5, 204b34–205a1, *Metaph*. 12.5, 1071a13–14). Nevertheless the prevailing view in the secondary literature is that Aristotle does not *really* accept it. For, according to this view, Aristotle thinks (or comes to think) that fire, air, water and earth admit of further analysis. Thus the things that are popularly called στοιχεῖα are not, for Aristotle, the true elements, because they are not simple but composite.[6] The true στοιχεῖα are their constituents; and these are thought to be (or at least, if prime matter is admitted, to *include*) the primary contraries hot, cold, dry and wet.

Now the first obstacle facing any attempt properly to assess this view is that there is a lack of consensus as to the sense in which fire, air, water and earth are to be understood as 'composite' items. Broadly speaking, we can identify two poles of interpretation in the modern secondary literature. According to one, fire, air, water and earth are 'logically composite', that is, composed out of, or analysable into, *logical* constituents;

[3] By 'bodies' here we understand *natural* bodies, as opposed to e.g. artefacts (see *Ph*. 2.1, 192b8–15). Artefacts, of course, are corporeal; but they are so in virtue of being made from natural bodies, e.g. wood, stone (192b15–20). Aristotle occasionally appears to countenance *mathematical* bodies (*Metaph.* 1.8, 990a15–16; cf. 5.13, 1020a14, 11.1, 1059a38–b2, with 1059b9–14), but these 'objects' are merely abstractions from certain properties of (natural) bodies. In general, natural bodies are the principles of these other 'bodies' (*De an*. 2.1, 412a11–13; cf. *Ph.* 193b24–194a7).

[4] See Pl. *Ti.* 48b–c, with T. Crowley, 'On the use of *stoicheion* in the sense of "element"', *Oxford Studies in Ancient Philosophy* 29 (2005), 367–94, at 378–80; see also *Phlb.* 29a, *Cra.* 408d, *Prt.* 320d.

[5] By his use of the phrase τὰ καλούμενα (or λεγόμενα) στοιχεῖα; see T. Crowley, 'Aristotle's "so-called elements"', *Phronesis* 53 (2008), 223–42.

[6] Indeed it is often thought that Aristotle's use of the phrase τὰ καλούμενα στοιχεῖα indicates his rejection of the popular opinion; but see Crowley (n. 5).

while according to the other, they are 'physically composite', that is, composed out of simpler *physical* or material constituents. Clearly our understanding of the nature of the primary contraries will differ greatly depending on whether we take them to be items revealed by a 'logical' or a 'physical' analysis of fire, air, water and earth.[7] But, on either account, are the contraries plausible contenders for the status of genuine elements of bodies? There are good reasons to think not.

Consider, firstly, 'logical' analysis. This tends to be favoured by those who hold what we might call the 'traditional' view, that is, that fire, air, water and earth are each constituted by prime matter qualified by the appropriate contraries. On this interpretation, fire, air, water and earth are acknowledged to be the simplest *bodies*, but, as they are logically composite, they are not *absolutely* simple, and thus not truly elemental.[8] Evidently the 'elements' this sort of analysis uncovers are incorporeal, or immaterial.[9] For an element of bodies, on this view, has the status of a 'logical' constituent, presupposed or implied in the simplest material bodies (i.e. fire, air, water and earth).[10] Thus a wedge is driven between being 'an element of bodies', and being 'the simplest material constituent of bodies'.

But herein lies the problem: Aristotle seems to be quite clear on the point that the elements of bodies *are* the simplest material constituents of bodies. That this is so is confirmed fairly explicitly at *Physics* 4.1: 'the elements of perceptible things are bodies' (ἔστι δὲ τὰ μὲν τῶν αἰσθητῶν στοιχεῖα σώματα, 209a17; cf. 3.5, 204b22–35). By 'perceptible thing' we understand a thing that has perceptible characteristics: but that, of course, is precisely what Aristotle takes to be a body (see *Cat.* 7, 8a1, *De an*. 3.12, 434b12, *Cael*. 1.7, 275b5–11; cf. *Gen. corr.* 2.1, 329a8–13, *Sens*. 6, 445b9–13). Hence the elements of bodies are bodies, or material entities.[11] Indeed it seems to be something of a methodological principle that the elements of bodies *must* be corporeal. The foregoing quotation from the *Physics* can be read as a specific instance of a general rule that the principles or elements of any class of things should be the same in kind as the things of which they are the principles (see *Cael*. 3.7, 306a9–11).[12] Aristotle's point, presumably, is that the elements of bodies must be such as to explain the nature, or defining features, of bodies. And since the key feature of bodies is that they are

[7] I borrow this distinction between 'logical' and 'physical' analyses from A.R. Lacey, 'The Eleatics and Aristotle on some problems of change', *JHI* 26 (1965), 451–68, at 462, 464.

[8] Thus for Joachim (n. 2) fire, air, water and earth are the simple bodies (see e.g. xxxii, n. 1; 104, 136, 198; but cf. 212–13, 217), but they are not the elements; the genuine elements, i.e. the contraries and prime matter, are 'abstracted by logical analysis' (137, 199, 200). Likewise for Ross (n. 2 [1949$^5$]), 105; cf. 73–4. See also Ross (n. 2 [1936]), 484; W.K.C. Guthrie, *A History of Greek Philosophy, Vol. VI* (Cambridge, 1981), 229; and D.W. Graham *Aristotle: Physics Book VIII* (Oxford, 1999), 81. Cf. Phlp. *In GC* 205.8–12.

[9] Cherniss (n. 2, [1935]), 54, 61, stresses the 'immateriality' of Aristotle's primary contraries (see also Joachim [n. 2], 200–1); while the view that prime matter is incorporeal is a staple of the traditional view; see e.g. Joachim (n. 2), 94, 200, Ross (n. 2 [1949$^5$]), 105; F. Solmsen, 'Aristotle and prime matter: a reply to Hugh R. King', *JHI* 19 (1958), 243–52, at 244; H.M. Robinson, 'Prime matter in Aristotle', *Phronesis* 19 (1974), 168–188, at 168–9; Guthrie (n. 8), 227; Williams (n. 2), 211.

[10] See Joachim (n. 2), 137; Ross (n. 2 [1949$^5$]), 105, 168; Cherniss (n. 2, [1944]), 172; Lacey (n. 7), 462; Guthrie (n. 8), 227. Cf. D. Charles's interpretation of prime matter as a 'logical (or abstract) object', in 'Simple genesis and prime matter', in de Haas and Mansfeld (n. 2), 151–169, at 154–6.

[11] See also *Metaph*. 7.17, 1041b31: στοιχεῖον δ' ἐστὶν εἰς ὃ διαιρεῖται ἐνυπάρχον ὡς ὕλην; cf. 1.4, 985a32, 12.5, 1071a13–14. At *Cael*. 3.3 an element of bodies is said to be that 'into which *other bodies* (τἆλλα σώματα) may be analysed' (302a15–16; cf. a12–13; with *Cael*. 1.2, 268b26, 3.3, 302b5–9, 3.7, 306b1–2).

[12] Cf. Solmsen (n. 2), 259–60.

perceptible, the elements of bodies must be such as to explain the perceptibility of bodies.[13] This entails that the elements themselves must be perceptible;[14] and this in turn entails that they are corporeal. Indeed Aristotle on more than one occasion presents arguments aimed precisely against the thesis that imperceptible, or incorporeal, entities could be the elements of bodies (see e.g. *Cael*. 3.1, 298b35–300a19, 3.8, 306b22–9; *Sens*. 6, 445b3–20; *Metaph*. 14.3, 1090a32–5; cf. *Ph*. 4.1, 209a14–18; *Gen. corr*. 1.2 316a2–4, 1.5, 320b14–17, 1.8, 325b36–326a8).[15] The elements of bodies, then, are the simplest *bodies*. We may happily concede that the latter are *logically* analysable; but it would not follow that any items such analysis reveals are more deserving of the appellation 'elements *of bodies*'.

Now consider the claim that fire, air, water and earth are susceptible to physical analysis. This view, which tends to be held by those who reject prime matter,[16] retains the identification of the simple bodies as the elements of bodies. But it seems the simplest bodies or material entities that Aristotle recognizes are no longer fire, air, water and earth, but the primary contraries hot, cold, dry and wet.[17] Hence the latter are the true elements. Now, given some of Aristotle's metaphysical commitments, this interpretation may seem *prima facie* dubious. For, as some scholars have argued, it would entail that contrary qualities have something of the ontological status of subjects or indeed 'quasi-substances'.[18] But this criticism is perhaps slightly unfair; for the point of this interpretation is precisely that the contraries, in *this* context, are somewhat more 'substantial', as it were, than mere properties or qualities.[19] Nevertheless, that too is a contentious claim (see § V below). In any case, even if we were inclined to concede a certain hypostatization of the contraries, the consequences would be little short of disastrous for Aristotle's general theory of elements.

Take, for instance, his account of elemental transformation. One of the key claims of the *De generatione et corruptione* is that the elements change into each other (*Gen. corr*. 1.1, 314b15–27, 2.1, 329a35–b3 and 2.4; cf. *Cael*. 3.6). Aristotle is particularly critical of Empedocles' conception of the elements, precisely because Empedocles denies that fire, air, water and earth can change into each other (see e.g. *Gen. corr*. 1.1, 314b23–6, 315a3–5; 2.1, 329a35–b2). Now for Aristotle, as for Plato, there is no change between contraries: hot does not become cold, but rather it is some thing or subject that is hot that

[13] See Rashed (n. 2), 153.

[14] Or at least the *sources* of the perceptibility of composite bodies: the sense in which the elements of bodies are perceptible is problematic; see below, § V.

[15] On these occasions, admittedly, the incorporeal items implicated tend to be mathematical entities; but since these are a kind of abstract entities (see *De an*. 3.7, 431b12–17), it would take but slight manipulation to extend the critique to the 'elements' uncovered by 'logical' analysis.

[16] See esp. Furth (n. 2), 76–9, 221–7 and E. Lewis, *Alexander of Aphrodisias. On Aristotle's Meteorology 4* (Ithaca, NY, 1996), 15–23, 34–59. But cf. Sokolowski (n. 2), who favours physical (or 'chemical', 269) analysis, yet accepts prime matter, 277–85.

[17] For Furth (n. 2), 77, the primary contraries are 'the very deepest lying "ultra-simples" … the most ultimate matter of things'; see also Lewis (n. 16), 16–17. King (n. 2), appears to have a similar conception of the contraries, notwithstanding his insistence that fire, air, water and earth are the simplest bodies; see 373, 377–9; likewise M.L. Gill, *Aristotle on Substance* (Princeton, 1989), 75–82, 235–40, 246–7. Cf. Lacey (n. 7), 463; Robinson (n. 9), 183; and M.J. Loux, *Primary Ousia: An Essay on Aristotle's Metaphysics Z and H* (Ithaca, NY, 1991), 250.

[18] Loux's term (n. 17), 250. See also T. Scaltsas, 'Substratum, subject and substance', *AncPhil* 5 (1985), 215–40, at 217–18 and 235 nn. 13, 14.

[19] See King (n. 2), 378; Lacey (n. 7), 463–4; Sokolowski (n. 2), 268–9. Cf. also Solmsen (n. 9), 252 and (n. 2), 347–9, 351; G. Freudenthal, *Aristotle's Theory of Material Substance* (Oxford, 1995), 75–7. See also Graham (n. 2), 482.

becomes a thing that is cold (see *Gen. corr*. 1.1, 322b15–17, 2.1, 329b2–3; and Pl. *Phd.* 102e–103c). It would seem to follow that if hot, cold, dry and wet were the genuine elements, then Aristotle's theory of elements would be nothing more than a rehashing of Empedocles' theory.[20] The claim that the elements can change into and out of each other would be mere window dressing; for the 'genuine elements' would be as unchangeable as Empedocles' 'roots'. It may still be the case that fire, air, water and earth change into each other. But this change would have to be reinterpreted as the rearrangement, or the aggregation and segregation, of the 'genuine elements' hot, cold, dry and wet, rather than genuine generation and corruption.[21] Aristotle, of course, denies that generation and corruption are reducible to aggregation and segregation (cf. *Gen. corr*. 1.2, 317a17–24). Moreover, he argues that generation is distinct from alteration (*Gen. corr*. 1.4), and criticizes the material pluralists among his predecessors, Empedocles in particular, who fail adequately to account for both kinds of changes (1.1, 314b4–17). But were Aristotle to make the contraries his στοιχεῖα then alteration would be as impossible on his theory of elements as it is on Empedocles' theory (314b17–26). In other words, the claim that fire, air, water and earth are physically composite imputes to Aristotle a theory of matter that seems vulnerable to the same problems he finds in Empedocles.

Consider also the effect on Aristotle's theory of elemental motion. In the *De caelo*, Aristotle explains that each of the elements or simple bodies, fire, air, water and earth, has a particular simple movement (1.2, 269a8, 1.3, 270b28, 2.14, 296b30–1, 3.4, 303b5, cf. 3.3, 302b5–9), and the natural movement of a composite (inanimate) body is determined by the dominance of one element or another in its composition (1.2, 268b26–269a5, 269a28–30; 4.4, 311a29–33; cf. *Mete*. 4.7, 383b20–6). A stone, for instance, naturally falls to the ground (3.2, 301b20), because it is mostly made up of earth, the natural movement of which is a simple rectilinear movement downwards (1.2, 269a17, 2.14, 296b27–8, 4.2, 308b14–15; cf. 1.3, 270a3–4). Now were Aristotle to decide that fire, air, water and earth are themselves physically composite, with hot, cold, dry and wet their constituents, then the natural motions of the former would have to be explained in terms of the simple motions of the latter.

But can we reassign the simple motions to the primary contraries? It seems not. This is because all bodies that move up or down do so in virtue of being either light or heavy, or both (1.3, 269b26, 3.2, 301a22–6, 4.1, 307b31–2). The reason why fire moves up, for instance, is because it is absolutely light, and earth moves down because it is absolutely heavy (4.2, 308b13–15, with 4.1, 308a29–31, 4.4, 311a18–21, 311b27); while air and water, and indeed all the composite bodies, are both light and heavy relative to their position and move accordingly (3.2, 301b23, 30; 4.4, 311a22–b5, 4.5, 312a25, 312b2–19). But hot, cold, dry and wet, however we conceive them, cannot be said to be either heavy or light; even in the *De generatione et corruptione*, the locus of their alleged identification as the στοιχεῖα, Aristotle makes it clear that heavy and light are distinct from, and irreducible to, the primary contraries (2.2, 329b18–23).[22] It follows that they cannot

[20] Indeed Empedocles himself may have arrived at his four 'roots' by 'hypostasizing' the contraries; for this interpretation, see J. Burnet, *Early Greek Philosophy* (London, 1930[4]), 228; G.S. Kirk and J.E. Raven, *The Presocratic Philosophers* (Cambridge, 1971 repr. with corrections), 329; but cf. J. Longrigg, 'The "roots of all things"', *Isis* 67 (1976), 420–38, at 424–5.

[21] A point raised by Loux (n. 17), 251.

[22] T. Scaltsas, 'Mixing the elements', in G. Anagnostopoulos (ed.), *A Companion to Aristotle* (Oxford, 2009), 242–59, at 243 misinterprets the reference at 330a24–6 to 'all the other differentiae' (πᾶσαι αἱ ἄλλαι διαφοραί). Aristotle is referring to all the active and passive differentiae (apart from

have attributed to them a natural motion.[23] Clearly, then, if the contraries were indeed the elements revealed by a physical analysis of fire, air, water and earth, then Aristotle would owe us a new account of elemental motion. And yet, even in the *Meteorologica*, which offers significant revisions of the doctrine of the *De caelo*,[24] Aristotle makes it quite clear that he retains the basic tenets of the latter (see *Mete.* 1.2, esp. 339a14–20, 27–30; cf. 1.1, 338a20–6).

These are some of the theoretical problems that would arise if Aristotle were to identify the contraries as the στοιχεῖα. Of course, the existence of such problems does not mean that Aristotle does *not* identify the contraries as the στοιχεῖα. To judge whether or not he does so, we need to look at the textual evidence.

## II

As noted above, in the *De caelo* Aristotle neither expresses nor implies a reluctance to name fire, air, water and earth as the elements or στοιχεῖα of sublunary bodies. But in the *De generatione et corruptione* he seems to suggest that these 'simple bodies' can be analysed into the primary contraries hot, cold, dry and wet. This analysis, so one might argue, implies a development in Aristotle's theory of elements such that, in his 'mature' or considered opinion, fire, air, water and earth are no longer considered to be really simple, and the true στοιχεῖα are hot, cold, dry and wet.[25] Many commentators, for instance Philoponus, Joachim and Ross, to name but a few, insist that Aristotle actually refers to the contraries as στοιχεῖα at the beginning of *De generatione et corruptione* 2.3, thereby confirming that this is his considered opinion.[26] Here is the relevant passage:

> (1) Since the στοιχεῖα are four, (2) and of the four there are six pairings, (3) but contraries cannot be paired with each other (for it is impossible for the same thing to be hot and cold, and again wet and dry), (4) it is clear that the pairings of the στοιχεῖα will be four, hot with dry and wet with hot, and again cold with dry and cold with wet. (5) And these are attached in a reasonable way (κατὰ λόγον) to the apparently simple bodies fire, air, water and earth; for fire is hot and dry, air is hot and wet, for air is like vapour (ἀτμίς), water is cold and wet, and earth is cold and dry, (6) thus the differentiae are reasonably distributed among the primary bodies, and the number of these is according to reason (κατὰ λόγον)
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> (my numbers, 330a30–b7).[27]

hot, cold, dry and wet); hence heavy and light are not included. See Solmsen (n. 2), 337–8, and Williams (n. 2), 159.

[23] See Solmsen (n. 2), 275; Freudenthal (n. 19), 76–7. Heat, however, often seems to be accorded a 'special status' in the biological works; see Freudenthal (n. 19), 77–8.

[24] See e.g. J. Longrigg, 'Elementary physics in the Lyceum and Stoa', *Isis* 66 (1975), 211–29, at 214–15.

[25] See e.g. Hankinson (n. 2), 180.

[26] Phlp. *In GC* 224.1–5; Joachim (n. 2), 213; Ross (n. 2 [1936]), 484; also Kahn (n. 2), 120–1; Sokolowski (n. 2), 269–71; Williams (n. 2), 160; Furth (n. 2), 223; cf. Lacey (n. 7), 464; D. Frede (n. 2), 303. Cf. Lennox (n. 2), 180 on *Part. an*. 2.1, 646a12–24.

[27] Ἐπεὶ δὲ τέτταρα τὰ στοιχεῖα, τῶν δὲ τεττάρων ἓξ αἱ συζεύξεις, τὰ δ' ἐναντία οὐ πέφυκε συνδυάζεσθαι (θερμὸν γὰρ καὶ ψυχρὸν εἶναι τὸ αὐτὸ καὶ πάλιν ξηρὸν καὶ ὑγρὸν ἀδύνατον), φανερὸν ὅτι τέτταρες ἔσονται αἱ τῶν στοιχείων συζεύξεις, θερμοῦ καὶ ξηροῦ, καὶ θερμοῦ καὶ ὑγροῦ, καὶ πάλιν ψυχροῦ καὶ ὑγροῦ, καὶ ψυχροῦ καὶ ξηροῦ. καὶ ἠκολούθηκε κατὰ λόγον τοῖς ἁπλοῖς φαινομένοις σώμασι, πυρὶ καὶ ἀέρι καὶ ὕδατι καὶ γῇ· τὸ μὲν γὰρ πῦρ θερμὸν καὶ ξηρόν, ὁ δ' ἀὴρ θερμὸν καὶ ὑγρόν (οἷον ἀτμὶς γὰρ ὁ ἀήρ), τὸ δ' ὕδωρ ψυχρὸν καὶ ὑγρόν, ἡ δὲ γῆ

At first glance it does seem that Aristotle is calling the contraries hot and cold, dry and wet στοιχεῖα. He begins by saying that the στοιχεῖα are four (a30) – this, certainly, is true if he means fire, air, water and earth; but then he says 'of the four there are six pairings'. If by 'the four' Aristotle means 'the four στοιχεῖα', then he must be referring to the contraries as στοιχεῖα. For what are paired are not fire, air, water and earth, but the contraries hot and cold, dry and wet. At 330a33 (line 4) it seems to be confirmed that the στοιχεῖα are the things that are paired, and indeed that the pairings of the στοιχεῖα are pairings of the contraries. So it appears that the στοιχεῖα at 330a30 and at a33 are not fire, air, water and earth, but the contraries hot and cold, dry and wet.[28]

The first step towards admitting this interpretation is to accept that Aristotle would suddenly switch from calling hot, cold, dry and wet 'contraries' or 'differentiae' (διαφοραί) as he has been doing up to this point, to calling them στοιχεῖα.[29] It is certainly possible that Aristotle might do this. But it is far more sensible, both here and in every other context, to proceed as if Aristotle has not made any unannounced switch in terminology, and to revise this opinion only if the passage under examination fails to make sense on the usual understanding of the terms involved. And, as I shall now argue, 330a30–b7 does make good sense, both internally and in the context of the chapter, if στοιχεῖα is taken throughout to refer, as it usually does, to fire, air, water and earth.

Let us start by considering the concluding lines of the immediately preceding chapter, *De generatione et corruptione* 2.2. In this chapter, Aristotle is concerned with the identification of the primary differentiae of body. This involves two steps: firstly he identifies those perceptible or, more strictly speaking, tangible differentiae of body that are active or passive, and then he reduces these to the two pairs of contraries, hot and cold, and dry and wet. Beyond these, no further reduction is possible. Hence, he concludes, 'there are necessarily these four' (ὥστ' ἀνάγκη τέτταρας εἶναι ταύτας, 330a29), where 'these four' are the primary differentiae (πρῶται διαφοραί) hot, cold, dry and wet. After the chapter division – which is, of course, the work of a later hand – Aristotle continues: 'since (ἐπεὶ δέ) the στοιχεῖα are four, and of the four (τῶν δὲ τεττάρων) the pairings are six …' (330a30–1). I think it is obvious that by 'of the four' Aristotle means 'of the four differentiae'. This is clear from the following lines, where the six pairings are listed as hot and cold, wet and dry, hot and dry, wet and hot, cold and dry, hot and wet. So immediately before and after the reference to στοιχεῖα, Aristotle refers to the differentiae hot, cold, dry and wet as 'the four'. Now those who think that the occurrence of στοιχεῖα at 330a30 is a reference to the differentiae presumably take 'since' (ἐπεί) as referring back to the conclusion at 330a29 (the chapter division might encourage this). If correct, it would follow that 'of the four' at a30 ought to be glossed 'of the four στοιχεῖα', with the implication that the στοιχεῖα are hot, cold, dry and wet. But I want to suggest that, having reduced the differentiae to four, Aristotle now wants to show how these four differentiae are associated with the four στοιχεῖα, that is, the primary or simple bodies fire, air, water and earth.

ψυχρὸν καὶ ξηρόν, ὥστ' εὐλόγως διανέμεσθαι τὰς διαφορὰς τοῖς πρώτοις σώμασι, καὶ τὸ πλῆθος αὐτῶν εἶναι κατὰ λόγον.

[28] See Joachim's commentary on this passage (n. 2), 213–17.

[29] Sokolowski (n. 2) claims that Aristotle is already referring to hot, cold, dry and wet as στοιχεῖα in *Gen. corr*. 2.2; he cites as evidence 329b13 and 329b16–26 (cf. D. Frede [n. 2], 300). He also finds στοιχεῖα used to refer to the contraries at *Gen. corr*. 2.4, 331b27–8 and at 2.7, 334b17–18 and b25; also, 'probably', at 2.5, 333a12 (270 n. 14). He is certainly mistaken about 329b13 and b16–26, and it is extremely doubtful that any of the other passages indicate anything of the sort.

Indeed, to do so, and in particular to show that the differentiae are associated with the στοιχεῖα according to reason (κατὰ λόγον), would appear to be the point of the whole passage (see 330b6–7).

I propose, then, that we read the passage in the following way. At 330a30, Aristotle states that the number of the στοιχεῖα is four. That there are four στοιχεῖα, and that these are the simple bodies fire, air, water and earth, has already been established in the *De caelo* (3.4–5, with 3.3 and 4.5). Moreover, at the very start of *De generatione et corruptione* 2 Aristotle announces that the aim of the book is to consider τὰ καλούμενα στοιχεῖα (2.1, 328b31) – a phrase which picks out fire, air, water and earth (cf. also 328b33–329a5, with 329a35; and 2.3, 330b30–3). It is fairly clear, then, that Aristotle is proceeding on the hypothesis that the στοιχεῖα are fire, air, water and earth. So now, at 330a30, having just concluded that there are four differentiae (2.2, 330a29), Aristotle is reminding us that there are four στοιχεῖα. Thus the number of the differentiae matches the number of the στοιχεῖα.

But, for Aristotle's purposes, this happy correspondence is not enough: for he intends to allocate the differentiae to the στοιχεῖα in pairs. Nor is this an arbitrary whim. Aristotle thinks that the στοιχεῖα are by nature capable of changing into each other (2.4, 331a12–14, 20–1), which means they must be mutually active and passive; but they are so only because the contrary differentiae are distributed among them in the appropriate way, that is, in pairings that render each στοιχεῖον contrary to the others (see 2.2, 329b20–6; 2.4, 331a14–19). Hence there must be a match between the number of the στοιχεῖα and the number of the possible pairs of differentiae. Now an immediate problem is that from four differentiae one gets six pairs. But this problem is easily resolved, as mutual contraries cannot form pairings. For instance, an element can't be hot *and* cold; it can't be dry *and* wet. So we are left with four possible pairings of contraries, and this matches the number of στοιχεῖα. On this reading, the conjunction ἐπεί at 330a30 does not introduce a reiteration of the conclusion in the immediately preceding sentence, but refers rather to the familiar point that the στοιχεῖα are four – fire, air, water and earth. What this entails is that the expression ἐπεὶ δέ introduces a contrast[30] between the number of στοιχεῖα (four) and the number of pairings of differentiae (which, at first count, was six). A paraphrase of 330a30–3 would run as follows: '(1) There are (as we know) four στοιχεῖα, (2) but (δέ) there are six pairs of the four differentiae; (3) mutual contraries, however, do not form pairings.'

This reading resolves the first instance of the term στοιχεῖα at a30. The second instance at a33 is more problematic. For whereas we might expect the conclusion to be that the pairings of the differentiae are four, this is not at all what Aristotle says. The passage continues: '… (4) it is clear that the pairings of the στοιχεῖα will be four: hot and dry, and hot and wet, and also cold and wet, and cold and dry' (330a33–b1). Here, admittedly, it does appear that Aristotle is using the term στοιχεῖα to refer to hot, cold, dry and wet. Nevertheless it is well to pause before rushing to the conclusion that the differentiae are now called στοιχεῖα. Consider again the reason why Aristotle wants to allocate the differentiae to the στοιχεῖα in pairs. That the στοιχεῖα change into each other is an accepted fact (2.2, 329b20–6, 2.4, 331a7, 12–14); to explain it, the στοιχεῖα must by nature be capable both of affecting, and of being

[30] The conjunction ἐπεί could be rendered as 'although', instead of 'since'; cf. *Ph.* 4.2, 217a10 for a possible precedent. As it happens, some MSS have the variant reading ἐπειδὴ δέ, i.e. 'whereas', or 'although', instead of ἐπεὶ δέ (Laurentianus 87.7, Vaticanus 1027 and Vaticanus 253). See LSJ s.v. ἐπεί.

affected by, each other. In other words, each στοιχεῖον must have a pair of differentiae, one of which is active – either hot or cold – and the other passive – either dry or wet (cf. *Mete.* 4.1, 378b12–26). The crucial point here is that these are the differentiae that are said of (λέγεται, 329b26) the στοιχεῖα: possessing these differentiae renders the στοιχεῖα mutually active and passive (see 2.4, 331a14–16). Now, as we have seen, the four differentiae form six pairs. But at 330a33–b1 Aristotle says that it is clear (φανερόν) that 'the pairings of the στοιχεῖα (αἱ τῶν στοιχείων συζεύξεις)' will be four. He explains that two of the six pairs must be ruled out, because, as he puts it, 'it is impossible for one and the same thing (τὸ αὐτὸ καὶ πάλιν) to be hot and cold, or wet and dry' (330a31–3). That is to say, it is impossible for the pair hot and cold to be said of, or predicated as the differentiae of, any one of the στοιχεῖα. To put it another way, a pairing of two active, or two passive, differentiae cannot belong to a στοιχεῖον. But the pairings that match an active with a passive differentia *are* said of the στοιχεῖα; these are the pairings of differentiae that do belong to the στοιχεῖα. What I think we can draw from this is that by 'the pairings' (αἱ συζεύξεις) Aristotle means 'the pairings of the differentiae'. These pairings are 'of the στοιχεῖα' not in the sense that the members of each pair are στοιχεῖα, but in the sense that these pairings are said of, or *belong* to, the στοιχεῖα. Hence what Aristotle is saying is that the pairings of the differentiae that belong to the στοιχεῖα will be four, and in confirmation of this point, he then lists the four pairs of differentiae. The pairings of the στοιχεῖα, then, are the pairings *of the differentiae* of the στοιχεῖα (cf. 1.1, 314b18, for αἱ διαφοραὶ τῶν στοιχείων; cf. also 1.3, 319b1).

One might legitimately ask why Aristotle does not say this clearly and unambiguously, instead of using the potentially (and, more often than not, actually) misleading expression 'pairings of the στοιχεῖα'. To this question there can be no definitive answer. It is certainly notable that Aristotle uses the term διαφοραί once only in the passage under examination (330b6), preferring to refer to hot, cold, dry and wet as 'the four', or 'the contraries' (330a31). But perhaps it is simply so obvious to Aristotle, given what he has said about the necessity of the στοιχεῖα being both active and passive, that it is not the στοιχεῖα themselves, but the differentiae of the στοιχεῖα, that are paired. The fact is that, in the wider context of *De generatione et corruptione* 2, Aristotle shows no interest in pursuing the innovation in the reference of στοιχεῖον that some commentators insist on foisting upon him. Before and after 330a30–b7, hot, cold, dry and wet assume their duties as the differentiae of the στοιχεῖα (see also 2.2, 329a15–26; 2.4, 331a14–16), and from this role we ought to have a more compelling reason to grant them release than the mere instance of the phrase αἱ τῶν στοιχείων συζεύξεις at 330a33. Indeed, at *De generatione et corruptione* 2.5, we find something approaching a confirmation of the interpretation I have offered. Aristotle says there that the στοιχεῖα must be four in number, 'because this is the number of the pairings; for although there are six, two are impossible' (332b3, with 332a10–12). In other words, since there are four pairings, the number of the στοιχεῖα is four. This would make little sense if the στοιχεῖα in question were the members of each pair. It illustrates rather that there must be a distinction between the στοιχεῖα, and the members of each pair. Looking beyond the *De generatione et corruptione*, it is again clear that hot and cold, dry and wet are conceived of as differentiae, rather than as στοιχεῖα. At *De anima* 2.11, for instance, Aristotle explains that the 'differentiae of body *qua* body (αἱ διαφοραὶ τοῦ σώματος ᾗ σῶμα) are those which define the στοιχεῖα, that is, hot cold, dry wet, about which we have spoken before in our discussion of the elements' (423b27–9). Since he refers back to the discussion of the

elements (περὶ τῶν στοιχείων), by which he almost certainly means *De generatione et corruptione* 2 (especially 2.2 and 2.3), Aristotle evidently believes he has established in the latter text that hot and cold, dry and wet are differentiae that define, or belong to the definition of – that is, are *said of* – the elements (cf. also *Mete.* 4.1, 378b10–13).[31]

So, to continue our paraphrase: '(4) it is clear that the pairings of (the differentiae that are said of) the στοιχεῖα will be four'. The number of στοιχεῖα and the number of pairings of the differentiae now match up; it remains to assign each pair to its appropriate στοιχεῖον. In the next line (5), the guiding hypothesis that the στοιχεῖα are the simple bodies fire, air, water and earth is stated explicitly, and the pairings are duly allocated to each according to reason (κατὰ λόγον, 330b2). Hot and dry are allocated to fire, hot and wet to air, cold and wet to water, cold and dry to earth. At 330b6–7 Aristotle again emphasizes the reasonableness of his conclusions. We may paraphrase as follows: '(6) the differentiae are distributed in a reasonable way (εὐλόγως) among the primary bodies (fire, air, water and earth), and the number of them is in accordance with reason (κατὰ λόγον)'. Thus the quandary with which *De generatione et corruptione* 2.3 begins, that is, that the στοιχεῖα are four, while the differentiae make six pairs, is resolved: there are four possible pairs, and each pair corresponds to a στοιχεῖον (cf. 2.5, 332b2–5).

## III

But we are not out of the woods just yet. For the above interpretation of 330a30–b7 faces a major challenge. When Aristotle assigns the four pairings to fire, air, water and earth, he describes the latter as τὰ ἁπλᾶ φαινόμενα σώματα (330b2). Now this is usually translated as 'the apparently simple bodies', but the qualification 'apparently' here is taken by some commentators as an indication that fire, air, water and earth merely *appear* to be the simple bodies. In other words, they are not *really* simple at all.[32] In support of this contention, they claim that the reference to the 'apparently simple bodies' is picked up and explained some twenty lines later, in a passage that rather strikingly begins with the assertion that fire, air, water and earth are 'not simple, but mixed' (330b21–2).[33] I consider that assertion in its context below (§ IV); first, let us examine the phrase τὰ ἁπλᾶ φαινόμενα σώματα.

Aristotle says that the pairings of the differentiae 'follow according to reason the apparently simple bodies (ἠκολούθηκε κατὰ λόγον τοῖς ἁπλοῖς φαινομένοις σώμασι) fire and air and water and earth' (330b1–3). What does he mean by 'apparently' here? Often when Aristotle talks about the appearances, that is, the φαινόμενα, he is referring to the 'observed facts', or the empirical data by which a physical theory must be judged (cf. *An. pr*. 1.30, 46a17–22, *Gen. corr*. 1.1, 315a4, 1.8, 325a26; *Cael*. 3.7, 306a5–7, 16–17; 4.2, 309a25). As he puts it in the *De generatione animalium*,

[31] We need not be disturbed by the reference to hot and cold, dry and wet as differentiae of *body*, rather than differentiae of *the elements*. For hot and cold, dry and wet are the primary tangible contrarieties; they are the minimal features that something must have to be a body. Hence hot and cold, dry and wet are the differentiae, or distinguishing marks, of body *qua* body, as well as the differentiae of the elements. Cf. *Cael*. 3.4, 302b30–303a2, 3.8, 307b19–22.

[32] Joachim (n. 2), 213 and 217; see also Sokolowski (n. 2), 270–1, esp. n. 15; cf. E. Gannagé, *Alexander of Aphrodisias. On Aristotle On Coming-to-be and Perishing 2.2–5* (London, 2005), 43–4, esp. n. 173.

[33] Joachim (n. 2), 212–13, 217; see also Williams (n. 2), 160; Sokolowski (n. 2), 271 n. 15; D. Frede (n. 2), 304 n. 37.

theories are reliable only in so far as they agree with the φαινόμενα (3.10, 760b28–33; cf. *Mete.* 2.4, 360a33–4). Hence an appeal to the φαινόμενα in physical or scientific matters is an appeal to what is observed to be the case (*Cael*. 2.13, 294b4, 4.5, 312b30). The *De generatione et corruptione* is a treatise concerned with physical or scientific matters, therefore we might expect the meaning of the phrase τὰ ἁπλᾶ φαινόμενα σώματα to reflect this; in other words, that by the 'apparently simple bodies' he just intends the observed, or observable, simple bodies.

But the term φαινόμενα can refer to more than the 'observed facts'. Among the φαινόμενα Aristotle tends also to admit the ἔνδοξα, the received or reputable opinions about a subject (see e.g. *Eth. Nic*. 7.2, 1146b27–8).[34] The ἔνδοξα are the opinions, beliefs or judgements that are commonly accepted by everyone, or by the majority, or by the wise, or at least the most notable of the wise (*Top.* 1.1, 100b21–3). The φαινόμενα, then, meaning both the evidence of the senses and the things that are believed and said, either commonly or by the wise, are to be consulted as the 'witnesses and paradigms' of philosophical investigation (*Eth. Eud*. 1.6, 1216b26). Aristotle is certainly aware, of course, of the difference in quality between ἔνδοξα and observed or perceptual evidence, and there are times when he distinguishes the two and calls the latter 'the evidence of the senses' (τὰ φαινόμενα κατὰ τὴν αἴσθησιν, *Cael*. 3.4, 303a23). In physical or scientific matters it is quite clear that the latter are authoritative (3.7, 306a13–17; *Ph.* 8.3, 254a35–b1).[35] Nevertheless it is worth bearing in mind that when Aristotle says that a hypothesis must cohere with the φαινόμενα, while he certainly means that it must agree with (and explain) the facts as established by observation, he will also want to see whether it agrees with the ἔνδοξα (cf. *Ph.* 4.4, 211a7–11; *Cael*. 1.3, 270b4). So when he refers to fire, air, water and earth as τὰ ἁπλᾶ φαινόμενα σώματα at 330b2, it is well to note the implication that these bodies are deemed the simple bodies according to received opinion as well as the evidence of the senses.

But received opinion can be wrong; couldn't the evidence of the senses also be mistaken? 'Earth, Air, Fire, and Water appear to perception to be "simple" bodies', Joachim writes, 'but they are not really so, as reflection will show'.[36] For Joachim, Aristotle's use of the phrase τὰ ἁπλᾶ φαινόμενα σώματα implies a distinction between what *seems* to be on the evidence of perception and what, on the evidence of reasoning, is *really* the case. In other words, Aristotle uses this phrase to indicate that, in his view, there are bodies simpler than fire, air, water and earth that we can discover using our reason.[37]

Now Aristotle certainly does not think that what appears to be the case is always an infallible guide to what is really the case.[38] He does on occasion use the term

[34] See G.E.L. Owen, 'Τιθέναι τὰ φαινόμενα', in S. Mansion (ed.), *Aristote et les problèmes de la méthode* (Louvain, 1961), 83–133.

[35] See R. Bolton, 'Definition and scientific method in Aristotle's *Posterior Analytics* and *Generation of Animals*', in A. Gotthelf and J. Lennox (edd.), *Philosophical Issues in Aristotle's Biology* (Cambridge, 1987), 120–66, at 125–9. Cf. M. Nussbaum, 'Saving Aristotle's appearances', in M. Schofield and M. Nussbaum (edd.), *Language and Logos: Studies in Ancient Greek Philosophy* (Cambridge, 1982), 267–93.

[36] Joachim (n. 2), 213.

[37] For Joachim (n. 2), the 'really-simple bodies' are prime matter informed by the appropriate pairings of the contraries hot, cold, dry and wet (217); cf. n. 59 below.

[38] See the criticism of the view that all φαινόμενα are true, *Metaph.* 4.5–6; cf. *De an.* 1.2, 404a29, 3.3, 428b2–4.

φαινόμενος to mark a distinction between appearance and reality.[39] But it is doubtful that he intends such a distinction on this occasion. Consider, for instance, the passage in *Physics* 3.5, where Aristotle rejects the possibility of an ἄπειρον or infinite body (204b22–35). Some, he says, posit something besides or apart from the elements fire, air, water and earth, an infinite body out of which the elements come to be. But such a body is impossible. Since all things are dissolved into that out of which they come to be, anything apart from air, fire, earth and water would have to be here in the world – but there *appears* to be no such thing (φαίνεται δ' οὐδέν, 204b35; cf. *Metaph.* 11.10, 1066b34–1067a1). Aristotle clearly is not suggesting here that it only *seems* that there is no such thing, with the implication that there may, in fact, be some such thing. The point is rather that another simple body besides fire, air, water and earth ought to be *apparent*. But since nothing appears to the senses to justify the positing of an additional simple body, Aristotle concludes that there isn't any. Hence those simple bodies that *are* apparent, that is, fire, air, water and earth, are the *only* simple bodies (cf. *Gen. corr*. 2.5, 332a2–3).[40]

If we take the *Physics* passage as a guide for our interpretation of τὰ ἁπλᾶ φαινόμενα σώματα, then it seems clear that, when describing them in this way, Aristotle does not intend to suggest that fire, air, water and earth are not really simple. There is no implication, for instance, that reason will discover other bodies, simpler than these 'apparently simple bodies'. For, as the *Physics* passage makes clear, there are no bodies simpler than those that appear to the senses. In other words, Aristotle in using this phrase is not making a distinction between what appears to be the case, and what is really the case.

With this clarification in hand, let us return to the original context where the phrase τὰ ἁπλᾶ φαινόμενα σώματα appears (330b1–5). Note, in particular, how Aristotle is keen to emphasize that his conclusions are reasonable (κατὰ λόγον). His point, I take it, is this. The account of the number and distribution of the differentiae is reasonable, because it coheres with the φαινόμενα about the simple bodies; in other words, the theory coheres with the evidence of the senses, but presumably also with the reputable opinions, or ἔνδοξα, about the simple or primary bodies. Indeed Aristotle's concern for the ἔνδοξα is evident in this passage in his treatment of the differentiae of air. For Aristotle acknowledges the need to justify his claim that air is hot and wet. Presumably some might think that air is not obviously hot and wet – it may appear cold rather than hot.[41] But Aristotle points out that what he means by 'air' is somewhat like vapour (ἀτμίς, 330b4), and this is hot and wet (*Mete.* 1.3, 340b25, 27; 1.10, 347a24; but see n. 62 below). Hence the allocation of the pair 'hot and wet' to air accords with reason.

[39] For instance when he says that sophistry is not really intellectual excellence, but only *appears* to be (ἡ γὰρ σοφιστικὴ φαινομένη μόνον σοφία ἐστί … οὖσα δ' οὔ), *Metaph.* 4.2, 1004b18–19, 26; see also *Metaph.* 12.7, 1072a28, *Gen. corr*. 1.8, 325a21.

[40] Admittedly there is a question about the *sense* in which simple bodies are apparent, or observable; but I postpone it until § V below; all we need at this point is the assurance that '*apparently* simple' does not entail '*not really* simple'.

[41] For Plato's contemporary Philistion of Locri, air is cold (*Anonymus Londinensis* xx, 25, in M. Wellman, *Die Fragmente der sikelischen Ärzte Akron, Philistion und des Diokles von Karystos* [Berlin, 1901], fr. 4). Theophrastus (*Ign.* 25 and 26) and the Stoics likewise took air to be cold (Diog. Laert. 7.137; cf. Cic. *Nat. D*. 2.26–7). Aristotle himself seems sometimes to say that air is cold; see e.g. *Ph.* 3.5, 204b27, with Ross (n. 2 [1936]), 549, and *Resp.* 21, 480a28–b6.

A more significant example of Aristotle's concern for the ἔνδοξα is the fact that in the succeeding passage he immediately embarks on a discussion of his predecessors (330b7–21). I say something more about this discussion below (§ IV). But, to finish off my interpretation of 330a30–b7, I want to draw attention to the way Aristotle introduces that discussion: 'For all who make the simple bodies [their] στοιχεῖα …' (ἅπαντες γὰρ οἱ τὰ ἁπλᾶ σώματα στοιχεῖα ποιοῦντες …, 330b7). There can be no doubt that by στοιχεῖα here Aristotle means fire, air, water and earth. But there can be no doubt either that Aristotle wants to consider the views of all those who say that (one or more of) fire, air, water and earth are the στοιχεῖα precisely because he sees himself as part of that tradition – that is, he too makes the simple bodies his στοιχεῖα. Moreover, he presumably thinks that it is clear, from the immediately preceding passage, that he too makes the simple bodies his στοιχεῖα. This point, together with the arguments I have offered above, must render untenable the claim that by στοιχεῖα at 330a30 and 33 Aristotle means anything other than fire, air, water and earth.

## IV

Now, as we noted earlier, some commentators think that Aristotle describes fire, air, water and earth as 'apparently simple bodies' because in a later passage he says that fire, air, water and earth are not really simple.[42] I have rejected the claim that Aristotle's use of the phrase τὰ ἁπλᾶ φαινόμενα σώματα implies that fire, air, water and earth are not really simple; I turn now to his seemingly explicit *declaration* that they are not really simple. Here is that declaration:

> Fire and air and each of the others that have been mentioned are not simple, but mixed. The simples are similar to these, yet not the same as them, for instance, the one like fire is fiery (πυροειδές), and the one like air airy (ἀεροειδές); and likewise for the others. Fire is an excess of heat, just as ice is of cold; for freezing and boiling are types of excess, the one of cold, the other of heat; so if ice is a freezing of wet and cold, thus also fire will be the boiling of dry and hot (and for this reason nothing comes to be from ice or from fire).
>
> (2.3, 330b21–30).[43]

It seems to me that the crucial interpretative decision here concerns the extension of the phrase '[of the things] that have been mentioned' (τῶν εἰρημένων). Those who think it concerns the 'apparently simple bodies' fire, air, water and earth must presume that its reference extends back to the start of the chapter. For they believe that this passage offers strong evidence that the 'apparently simple bodies' are really 'mixed' or composite bodies, and consequently that there are other items that ought to be considered simpler, and as such truly elemental. But there are reasons to doubt that Aristotle is thinking of the 'apparently simple bodies' when he refers to 'fire, air and the others that have been mentioned'. An alternative reading of the passage, which I shall now defend, is that Aristotle is referring only to fire, air, water and earth as 'mentioned', that is, as

[42] See nn. 32 and 33.

[43] Οὐκ ἔστι δὲ τὸ πῦρ καὶ ὁ ἀὴρ καὶ ἕκαστον τῶν εἰρημένων ἁπλοῦν, ἀλλὰ μικτόν. τὰ δ' ἁπλᾶ τοιαῦτα μέν ἐστιν, οὐ μέντοι ταὐτά, οἷον εἴ τι τῷ πυρὶ ὅμοιον, πυροειδές, οὐ πῦρ, καὶ τὸ τῷ ἀέρι ἀεροειδές· ὁμοίως δὲ κἀπὶ τῶν ἄλλων. τὸ δὲ πῦρ ἐστιν ὑπερβολὴ θερμότητος, ὥσπερ καὶ κρύσταλλος ψυχρότητος· ἡ γὰρ πῆξις καὶ ἡ ζέσις ὑπερβολαί τινές εἰσιν, ἡ μὲν ψυχρότητος, ἡ δὲ θερμότητος. εἰ οὖν ὁ κρύσταλλός ἐστι πῆξις ὑγροῦ ψυχροῦ, καὶ τὸ πῦρ ἔσται ζέσις ξηροῦ θερμοῦ. διὸ καὶ οὐδὲν οὔτ' ἐκ κρυστάλλου γίνεται οὔτ' ἐκ πυρός.

conceived and posited, by his predecessors. Once we place the passage in the context of the chapter as a whole, it becomes clear that this is the most natural reading.

For purposes of reference it is helpful to divide *De generatione et corruptione* 2.3 into four parts of roughly equal length. The first part is that which we have discussed in detail above (§§ II and III). The second part consists of Aristotle's discussion of the views of all those of his predecessors who make the simple bodies their στοιχεῖα (330b7–21).[44] The third part is the one we will now endeavour to interpret (330b21–30). Finally, in the fourth part Aristotle discusses further aspects of the simple bodies and their differentiae (330b30–331a6). Commentators are generally agreed that the second part is intended to support the argument of the first part.[45] In other words, it doesn't further the first part's argument but, like a footnote, comments upon it. For in the second part Aristotle is keen to show that his predecessors, whether they posited one, two or more of fire, air, water and earth as their στοιχεῖα, were also obliged to make use of contrary principles (cf. *Ph.* 1.5, 188b26–30). The details need not detain us: what is important is that it is at the end of this review that Aristotle says that 'fire and air and each of the others that have been mentioned are not simple, but mixed'.

Now, granted that Aristotle's review of his predecessors in the second part is something of a footnote, if you will, to the first part, our question is this: is the third part a return, as it were, to the main text or a continuation of the footnote? That it is the former seems to be the usual presumption. But if it is the latter, then the statement at 330b21 takes on a whole new perspective. For it would mean that the reference to 'fire, air and the others that have been mentioned' is internal to the footnote, and the information that these bodies are 'mixed' would not pertain to the 'apparently simple' bodies. Aristotle's point would be that, while some of his predecessors also name fire, air, water and earth as the στοιχεῖα, *their* fire, air, water and earth are not really simple.

But why favour the latter interpretation? There seem to be three good reasons. Firstly, taking the two middle parts as one long 'footnote' already makes good sense simply from the point of view of the structure of the chapter. Secondly, there is evidence that Aristotle does indeed think that his predecessors posited as στοιχεῖα bodies that are composite, or 'mixed', rather than simple. Thirdly, the 'apparently simple' bodies are correctly identified not with the 'mixed' bodies, but with the 'fiery' and 'airy' (and presumably 'watery' and 'earthy') 'simples' (τὰ ἁπλᾶ). I shall now offer arguments in favour of each of these reasons.

Regarding the structure of the chapter, the whole middle section, from 330b7–30, seems to be as self-contained as if it were in parentheses. Note, for instance, that the discussion in the fourth part does not depend or build upon what has been said in the second and third parts; it seems to presuppose only the first part. Aristotle just carries on his discussion of the simple bodies, identifying their places in the sublunary world (as originally set out in the *De caelo*), and briefly indicating how their contrary differentiae determine their nature and relationships with each other. The most remarkable thing about the fourth part, however, is that Aristotle takes it for granted that the simple bodies are fire, air, water and earth (330b30–3). It is as if he never said that these bodies

[44] Note that Aristotle is not referring to all of his predecessors, as Joachim (n. 2), 213 and Williams (n. 2), 161 seem to think. He is referring just to those who make one, some or all of the simple bodies fire, air, water and earth their στοιχεῖα. This admittedly broad class nevertheless excludes, for instance, Anaxagoras and the Atomists – a point that becomes relevant below.

[45] Joachim (n. 2), 213–14; W.J. Verdenius and J.H. Waszink, *Aristotle on Coming-to-be and Passing-away* (Leiden, 1966$^2$), 54; Williams (n. 2), 160–1.

are 'not simple, but mixed'.[46] But, of course, if he was referring to his predecessors' conceptions of fire, air, water and earth at 330a21, then he never did say that *his own* 'apparently simple bodies' are mixed.

Before arguing that Aristotle believes his predecessors' στοιχεῖα are 'mixed', we need first to clarify what he intends by 'mixed' bodies. Basically, if something is 'mixed', then it is composed of other things, which is to say that it has constituents, and if these are not also mixed, then they are simple (*Cael*. 1.2, 268b26–7; 1.5, 271b17–18; 3.7, 306b1). So when Aristotle says that 'fire, air and the others mentioned are not simple but mixed', he means that they can be analysed into further constituents, or στοιχεῖα. But it ought to be emphasized that by these 'mixed' bodies Aristotle means the ordinary, everyday phenomena that we call 'fire', 'air', 'water', and 'earth'. In the passage quoted above, Aristotle describes fire, that is, 'mixed' fire, as an 'excess of heat' (ὑπερβολὴ θερμότητος, 330b25), and then, on noting that boiling (ζέσις) is a kind of excess, as 'a boiling of dry and hot' (b29). Now that this is a description of the fire with which we are most familiar becomes clear at *Meteorologica* 1.3.[47] For here Aristotle explains that the στοιχεῖον that 'we commonly call fire (ὃ διὰ συνήθειαν καλοῦμεν πῦρ)'[48] is not really fire, 'for fire is an excess of heat and a boiling' (340b22–3). In other words, *ordinary* fire, as opposed to the element we also, usually, call 'fire', is an excess of heat and a boiling. But this, of course, is precisely how he describes 'mixed' fire. The fire that is 'not simple, but mixed', then, is ordinary fire, or fire properly so-called: ignited gas, the state of combustion, or flame.[49] Indeed at *De generatione et corruptione* 2.4 flame (φλόξ) is said to be the best *example* of fire (331b25; he means 'the best example of the στοιχεῖον called "fire"', as is clear from the context) and, both there and in the *Meteorologica*, flame is described as a burning or a boiling of the hot and dry (331a25–6; cf. *Mete.* 1.4, 341b21–2, 4.9, 388a2). Thus it is clear that when he says that fire is 'mixed', Aristotle intends the fire of our everyday experience – or, as Philoponus rather nicely puts it, 'domestic' fire (τὸ διακονικόν).[50]

So the στοιχεῖον that is called 'fire' is something different from 'domestic' fire. The same can be said about 'what we call air' (1.3, 340b23, 339b3), that is, the *element* 'air', and its 'domestic' counterpart,[51] and again for the others. We will say more about this in a moment. For now it is important to see that Aristotle's point at *Mete.* 1.3 is that one

[46] Actually at 330b34 Aristotle does say that, relative to fire and earth, which are pure, water and air are mixed (μεμιγμένα). But this comes immediately after referring to them as 'simple bodies' (330b30–1), and is to do with their natural place and movement (330b31–3). The point recalls the *De caelo* doctrine of elements (see e.g. 1.8, 277b13–24, with 4.4), and looks forward to the *Meteorologica*'s account of air as a vaporous exhalation from water (1.3, 340b2–3, 23–9; 2.4, 360a21–7; see Joachim [n. 2], 139).

[47] That this is so could perhaps be gleaned from the analogy between fire and ice at *Gen. corr*. 2.3, 330b25–30. But it is confirmed at *Mete.* 1.3.

[48] It seems natural to take 'we' here fairly generally or inclusively, as in: the element that *we all* commonly, or habitually, call 'fire'. As noted earlier, that fire, air, water and earth are the elements of bodies seems to be widely accepted amongst Plato and Aristotle's contemporaries; see nn. 4 and 5 above.

[49] Does it follow that that 'pure' elemental fire is not as hot as 'mixed' or ordinary fire, as Rashed (n. 2), 58 n. 1 claims? See § V below, esp. n. 70.

[50] Phlp. *In GC* 228.28; Alexander of Aphrodisias also used this metaphor, according to Gannagé (n. 32), 46.

[51] What is that which is properly called 'air', i.e. 'mixed' air? Aristotle doesn't say, but it is presumably something like cloud, mist, fog, or a damp unhealthy air, such as described in the Hippocratic treatise *Airs, Waters, Places*; see e.g. 6.7, 15.24–5. Cf. *Mete.* 1.9, 346b32–5; and also nn. 41 above and 62 below.

must be careful not to confuse the four elements with the familiar phenomena with which they share their names. Presumably this is an error that people are liable to commit. I would suggest, indeed, that it is an error Aristotle believes his predecessors *did* commit. Consider, for instance, Empedocles' tendency to describe the 'roots' or the elements in terms of their everyday manifestations. Charles Kahn explains that, for Empedocles, the element fire is the sun, but it is also the fire in the hearth, or in the blacksmith's forge; the element water is the sea, but also that which is in wells and rivers.[52] In other words, Empedocles makes fire, air, water and earth his στοιχεῖα, but he characterizes them as if they were 'mixed', rather than simple, bodies.

This might not seem an altogether fair assessment of Empedocles' doctrine.[53] But it does seem to be how Aristotle understood the matter, and moreover he is not alone. Plato in the *Timaeus* argues that fire, air, water and earth are not the true στοιχεῖα, but can be analysed into further constituents which account for their generation and corruption (*Ti*. 48b–c, 53a–d). Although Aristotle rejects Plato's analysis of these bodies,[54] he does agree that fire, air, water and earth – as conceived by his predecessors and in particular Empedocles – must be further analysable. Thus at *De generatione et corruptione* 1.8, in a passage where Empedocles' theory is being compared with that of the Atomists, Aristotle says that Empedocles cannot explain the generation and corruption of the elements, unless he is prepared to admit that fire and the others have their own στοιχεῖα, 'as Plato writes in the *Timaeus*' (325b19–25). Now one might object that Empedocles doesn't need to admit any such thing, since he believes the 'roots' are eternal and immutable. For Aristotle, however, the generation and corruption of the elements is a fact of perception (2.4, 331a8–10; see also § V below). Hence he seems to think that Empedocles ought to have explained this phenomenon and, indeed, that in failing to do so he contradicted himself (cf. 1.1, 315a3–4).[55] So to save the phenomena, and to save Empedocles from self-contradiction, the 'roots' must be conceived as 'mixed', that is, composite bodies analysable into prior elements.

Clearly, then, Aristotle is not convinced that Empedocles' 'roots' should be regarded as truly simple bodies. That this is his view is further borne out by the contrast that he makes between Empedocles and the Atomists, which is based on their respective conceptions of the στοιχεῖα. Whereas Empedocles' explanation of generation and corruption is deemed incomplete because of an alleged confusion in his conception of the στοιχεῖα, the Atomists posit 'primary bodies' (τὰ πρῶτα τῶν σωμάτων) that are described as 'indivisible' (ἀδιαίρετα), and the first constituents out of which things are composed and into which they are dissolved (325b17–19). In other words, *their* primary bodies, unlike Empedocles', are genuinely elemental. But although Empedocles is singled out for criticism here, evidently there are others who face similar difficulties. At 325b13, Aristotle praises the Atomistic theory for being clear and consistent to its principles, 'but', he continues, 'things are less so with others, for instance, Empedocles' (τοῖς δ' ἄλλοις ἧττον, οἷον Ἐμπεδοκλεῖ, 325b15–16; cf. 325b1). Who are these

[52] Kahn (n. 2), 124–5.

[53] At DK 31B21.1–6 Empedocles does characterize the roots in terms of everyday examples, such as the sun and rain, but, as Patricia Curd points out, 'it needs to be borne in mind that these "witnesses" are phenomenal earth, air, fire and water, which are partially mixed versions of the pure roots' (*The Legacy of Parmenides: Eleatic Monism and Later Presocratic Thought* [Princeton, 1998], 158). Nevertheless, for Simplicius (*in Phys.* 33.8–11, 159.13–18), Empedocles' characterization of the roots does not get any more specific than at B21.1–6.

[54] See *Cael*. 3.1, 7 and 4.2; see also *Gen. corr*. 1.1, 315b30, and 2.1, 329a21–4.

[55] See Burnet (n. 20), 230 n. 3 and Joachim (n. 2), 163–4.

'others'? Since they are contrasted with the Atomists, it is reasonable to presume that Aristotle is thinking of all those who posit one or more of fire, air, water and earth as their elements. He is referring, in effect, to 'all those who make the simple bodies their στοιχεῖα', that is, the same group of thinkers that he discusses at *De generatione et corruptione* 2.3 (see 330b8).[56] Now if Empedocles is taken as representative of this group, then the criticism of his elements (that is, that they are further analysable) will presumably apply generally to the group.[57] This means that, at *De generatione et corruptione* 2.3, when Aristotle says that 'fire and air and the others that have been mentioned are not simple but mixed' (330b21), he has in mind the bodies 'mentioned', or posited as the στοιχεῖα of things, by some of his predecessors, chief among them Empedocles.[58]

But does it follow conclusively that the bodies described as 'not simple, but mixed' at 330b21 do not include also the fire, air, water and earth described as 'apparently simple bodies' at 330b2? To clinch this point, we need to show that Aristotle is operating at *De generatione et corruptione* 2.3 with two sets of bodies that are called 'fire, air, water and earth', one set being simple, the other mixed. To put it another way, it remains to show that the 'apparently simple bodies' are identical to the 'simples' (τὰ ἁπλᾶ). Happily this is a reasonably straightforward task. For if we simply pay attention to Aristotle's descriptions of them, it very quickly becomes clear that the 'apparently simple' bodies and the 'mixed' bodies are not the same things; and, as noted earlier, if something is not mixed, then it is simple. Let us compare, then, the descriptions of fire as an 'apparently simple' and as a 'mixed' body.

At 330b3 Aristotle says that fire (πῦρ), by which he means the 'apparently simple body', is hot and dry. These are the differentiae of fire. At 330b23, however, fire (πῦρ) is said to be mixed, and Aristotle distinguishes it from the simple body he calls 'fiery' (πυροειδές). This 'mixed' fire, as we have seen, is an 'excess of heat' and 'a boiling of dry and hot' (330b25, 29). But this means that 'mixed' fire is a boiling of the differentiae of 'apparently simple' fire – or at least an excess of the latter's most distinctive differentia (see 331a5). Consequently the fire that is 'not simple but mixed' is not the same thing as 'apparently simple' fire. They are certainly similar, in so far as they are both, in some sense, hot and dry; but plainly they are not *identical*. Presumably the same goes for 'apparently simple' and 'mixed' air, and the others. Hence the 'fire, air and the others' that are 'mixed' are clearly not the same as the fire, air, water and earth identified as 'apparently simple bodies'.

Naturally this invites the inference that the 'apparently simple bodies' are really what Aristotle calls τὰ ἁπλᾶ. Indeed, in so far as 'mixed' fire and 'apparently simple' fire are somewhat similar, but not identical, their relationship matches that between 'mixed' fire and the 'simple' πυροειδές. For Aristotle explains that the 'simples' are similar in nature or character (τοιοῦτος) to, but not the same as, the 'mixed' bodies (330b23–5). The evidence thus points towards the conclusion that the 'apparently simple bodies' and the 'simples' are two ways of referring to the same things. The only slight question mark

[56] See n. 44.

[57] Similarly Plato's critique of fire, air, water and earth at *Ti.* 48b–c is aimed not exclusively at Empedocles, but at a number of Presocratic doctrines; cf. e.g. 49b–d with Anaximenes, DK 13A5 and A7.

[58] Aristotle includes Plato in this group, referring to a work called 'Plato's *Divisions*' (330b16). This is surprising given what Plato says about fire, air, water and earth in the *Timaeus*. It may well be one of the unwritten doctrines, sporting a theory quite at odds to that of the *Timaeus*, but see Joachim (n. 2), 215–17.

is raised by Aristotle's decision to refer to the 'simples' as πυροειδές and ἀεροειδές, that is, 'fiery' and 'airy', rather than 'fire' and 'air'; and presumably 'watery' and 'earthy' rather than 'water' and 'earth' (ὁμοίως δὲ κἀπὶ τῶν ἄλλων, 330b25). Since the 'apparently simple bodies' were identified without qualification as 'fire', 'air', 'water' and 'earth', this change in terminology might just tempt one to wonder whether τὰ ἁπλᾶ φαινόμενα σώματα and τὰ ἁπλᾶ really are the same things, or whether the latter are items different to, perhaps even simpler than, the former.[59]

But it is well to remember that, when Aristotle distinguishes πυροειδές and ἀεροειδές from πῦρ and ἀήρ, what he means by the latter are the 'mixed' bodies fire and air rather than the 'apparently simple bodies' of the same names; that is, he is contrasting the 'simples' with their 'mixed' counterparts. Moreover, it is important to realise that πυροειδές and ἀεροειδές are not being introduced as technical terms. Aristotle doesn't use either term again[60] and, having made his distinction between simples and mixed bodies, he reverts immediately to calling the simple bodies 'fire', 'air', 'water' and 'earth' (330b30–3). Now what this seems to confirm is that the simple body that is like fire is usually called 'fire', and that like air 'air' – and therein lies the problem that inspires 330b21–30. It is, indeed, essentially the same problem that Aristotle confronts at *Meteorologica* 1.3. The problem is that, since each simple body shares its name with a 'mixed' body, there is a very real possibility that the 'simple' bodies will be confused with their 'mixed' homonyms. What is required, then, is the occasional reminder that the 'mixed' body is not the same as the 'simple body'. By way of giving such a reminder in the *De generatione et corruptione*, Aristotle describes the simple bodies as πυροειδές and ἀεροειδές, 'fiery' and 'airy', and then distinguishes them from 'mixed' or ordinary fire and air; to make the same point in the *Meteorologica*, he qualifies his ascription of the name 'fire' to the outermost στοιχεῖον of the sublunary world by referring to it as 'what we commonly (or habitually) call fire' (340b22; cf. 1.4, 341b19), and immediately denies that it is fire, in the sense of that which burns or is burning.[61]

Now if this reading is correct, then τὰ ἁπλᾶ can be identified with the στοιχεῖα of the *Meteorologica*. The στοιχεῖον that is usually called 'fire' is certainly the sort of thing that could answer to the description 'fiery'. For instance, both the στοιχεῖον called 'fire' and the πυροειδές are said to be 'like [mixed] fire' (*Mete.* 1.3, 340b32, *Gen. corr.* 2.3, 330b23). But it is also clear that the στοιχεῖον that is usually called 'fire' is no less than the 'apparently simple' fire: for both are hot and dry – these are their outstanding characteristics or differentiae (*Mete.* 1.3, 340b26, 1.4, 341b14, 1.7, 344a9; cf. 1.3, 340b14–17). Moreover, ordinary or 'mixed' fire is an excess of the differentiae of the στοιχεῖον (1.3, 340b22–3), as it is of 'apparently simple' fire. That the στοιχεῖα of the *Meteorologica* and the 'apparently simple bodies' are identical is made most explicit, however, in the case of 'air'. Showing a reticence towards using the term 'air' (ἀήρ) for the στοιχεῖον similar to that displayed when dealing with 'fire', Aristotle explains that 'what we call air' (1.3, 340b24) is hot and wet, because it consists of ἀτμίς, that is, the vapour that rises from the water on the surface of the earth when

[59] Joachim (n. 2), 217 understands the 'fiery' body to be 'a really-simple body … a pure example of πρώτη ὕλη informed by … hot-dry'.

[60] Both are quite rare; Plato uses the former at *Leg.* 895c and the latter at *Ti.* 78c, but neither instance is of much relevance.

[61] Nevertheless Aristotle thinks that we are *obliged* to call the element 'fire', as no other name would be as suitable (*Mete.* 1.4, 341b13–18; cf. 2.4, 359b30–2).

heated by the sun (340b25, 27, with 1.4, 341b6–10, 1.10, 347a24, 2.4, 359b28–30, 34–360a1).[62] But recall that at *De generatione et corruptione* 2.3 Aristotle describes the 'apparently simple' body air as hot and wet, and justifies this by saying: 'for air is a sort of ἀτμίς' (330b4). The identity of the 'apparently simple' body and the στοιχεῖον as it is understood in the *Meteorologica* could hardly be made more explicit. It is but a short step to describe the στοιχεῖον that is called 'air' as ἀεροειδές, that is, the 'airy' simple body.

Clearly, then, 'apparently simple' air and ἀεροειδές are two ways of referring to the στοιχεῖον that is called 'air', and the same can be said of 'apparently simple' fire and πυροειδές in relation to the στοιχεῖον that is called 'fire'. What we can conclude from this, I think, is that πυροειδές and ἀεροειδές are somewhat *ad hoc* descriptions of the simple bodies that are usually called 'fire' and 'air', and that Aristotle introduces these descriptions in order to try to emphasize that the simple bodies that are called 'fire' and 'air' (and 'water' and 'earth', that is, the 'apparently simple bodies') are not the same as their 'mixed' or ordinary counterparts. The simple body that causes the things it constitutes to move upwards, coming to rest at the outer limit of the sublunary world, and the more familiar phenomenon that burns the wood in the hearth, cooking our food and keeping us warm, are both called 'fire', but, although similar, they are not the same. Whereas the former is one of the στοιχεῖα from which things come to be, nothing comes to be from the latter (2.3, 330b29–30). The simple but important point that Aristotle is making at *De generatione et corruptione* 330b21–30, and again at *Meteorologica* 1.3, is that there is a difference between the simple bodies or στοιχεῖα, and the mixed bodies with which they share – or, better, *from which they borrow* – their names.

So, to sum up, the items described at 330b2 as the 'apparently simple bodies' are the truly simple bodies. The fire, air, water and earth that are described as 'not simple, but mixed' (330b21), on the other hand, can be identified as the items that have been 'mentioned', or posited as the στοιχεῖα, by Aristotle's predecessors. Hence Aristotle's use of the phrase τὰ ἁπλᾶ φαινόμενα σώματα with reference to fire, air, water and earth offers no support to the claim that he believes that there are other entities, for instance, the contraries hot and cold, dry and wet, that ought to be considered more elemental.

## V

There remains one outstanding issue that needs to be addressed, and that is the issue of the perceptibility of the simple bodies. In my interpretation of the phrase τὰ ἁπλᾶ φαινόμενα σώματα, I emphasize that the simple bodies fire, air, water and earth are apparent to the senses (§ III). But there is a question as to whether the simple bodies are perceptible or not. There is a view, not uncommon in the secondary literature, that Aristotle's στοιχεῖα are not perceptible at all.[63] According to this view, the simple

[62] It is often unclear whether ἀτμίς is by nature hot and wet, or cold and wet. Most of the MSS have θερμόν, 'hot', at 340b27, but many commentators believe this should be emended to ψυχρόν to make it consistent with e.g. 2.4, 360a22–3 and 2.8, 367a34. See Ross (n. 2 [1949$^5$]), 109 n. 4; L. Pepe, *Aristotele Meteorologia* (Milan, 2003), 222–3. Freudenthal (n. 19), 129 n. 51 rejects the emendation; cf. Hankinson (n. 2), 153 n. 12. What is not in doubt is that the sphere of air, where the ἀτμίς ultimately gathers, is hot; see e.g. 360a26–7, cf. also 3.3, 372b30–3, 4.9, 387a24–6. Cf. n. 41 above.

[63] See e.g. Sokolowski (n. 2), 272 n. 18; Lewis (n. 16), 40; Gannagé (n. 32), 43–4.

bodies are 'ideal abstractions'[64] of the 'mixed' fire, air, water and earth that we do perceive. If this is so, then they are in principle imperceptible. Indeed, my own argument in the last section above might seem to point towards a similar conclusion, in so far as it turns on the point that the fire, air, water and earth that we perceive are not the simple bodies that are called 'fire', 'air', 'water' and 'earth'. So which is it? Are the simple bodies perceptible or not? I will not try to offer a full treatment of this question here; nevertheless a few clarificatory remarks are certainly in order.

If we consider what Aristotle usually says about them, then it seems quite clear that the simple bodies must be perceptible, at least in some sense. Take, for instance, Aristotle's insistence that the elements of perceptible bodies are *bodies*, and, as such, perceptible (*Ph*. 4.1, 209a17; see § I above). Moreover, the fairly clear implication of the argument against the infinite at *Physics* 3.5 is that the simple bodies *do* appear to the senses (see § III above); while at *De generatione et corruptione* 2.4 Aristotle states explicitly that the generation of the simple bodies 'is apparent to perception' (κατὰ τὴν αἴσθησιν φαίνεται γινόμενα, 331a8–9). Then there are Aristotle's arguments against the possibility of perceptible bodies being composed of imperceptible constituents (see § I above); it is hard to square these with the claim that the simple bodies are imperceptible in principle.

Arguably the best evidence that the simple bodies are perceptible, however, is the very fact that Aristotle attributes as differentiae to them the perceptible qualities hot, cold, dry and wet (*Gen. corr*. 2.3, 330b1–5, 331a4–5). Admittedly, as noted earlier (§ I), the question of the status of hot, cold, dry and wet in this context is a controversial one. For it is sometimes claimed that hot, cold, dry and wet, *qua* differentiae, are not perceptible qualities, or affections (πάθη) at all.[65] But this is unpersuasive and unsupported. For not only does Aristotle select the differentiae of the elements from those affections that belong to the sense of touch (*Gen. corr*. 2.2, 329b18, and esp. *De an*. 2.11, 423b27–30; see also *Gen. corr*. 1.4, 319b21–4; 2.3, 331a1–3; cf. *Cael*. 3.4, 302b30–303a2, 3.8, 307b19–22), but he also selects them according to the stipulation that they must be such as to render the στοιχεῖα changeable (329b22–4; *Mete*. 4.1, 378b12–26, 31–4). This requirement ought to be all the evidence we need that the simple bodies are perceptible, for changeable things are perceptible.[66]

But this does not mean that the simple bodies are *actually* perceptible, on any natural understanding of what it is to be actually perceptible.[67] If we say that some *x* is actually perceptible, then presumably what we intend is that we can touch it, see it, smell it, taste it. But a simple body, that is, an element of bodies, is by definition a material constituent of a composite body (*Metaph*. 5.3, 1014a26–b15; cf. *Cael*. 3.3, 302a10–12). It follows that the simple bodies are not, as it were, available for *direct* perception: that is, there is nothing that we can see or touch and say of it, '*this* is the simple body fire'. Rather, they

[64] Gannagé's phrase (n. 32), 44 n. 175; for Sokolowski (n. 2) they are 'ideal constructs' (272 n. 18). Cf. Plato's distinction between phenomenal fire and the pure, imperceptible, intelligible form of fire, at *Ti.* 51a–d; cf. also *Phlb.* 29b–c.

[65] Lacey (n. 7), 463: 'the basic qualities are not … qualities in the sense of perceptual qualities'. See n. 19 above.

[66] See e.g. *Metaph.* 1.8, 989b29–33 and 12.1, 1069a3; see also *Cael*. 1.7, 275b5–6. Plato had already made this point (*Phd.* 78d–79a), as Aristotle himself reports (*Metaph.* 1.6, 987a33–4, b6–7).

[67] It is sometimes suggested, or implied, that the simple bodies are indeed actually perceptible: Gill (n. 17), 247, for instance, calls them 'actually perceptible bodies'; cf. Joachim's 'primary perceptible bodies' ([n. 2], 198–9); see also Guthrie (n. 8), 229. Cf. also Loux (n. 17), 243 n. 8 and S. Broadie, '*GC* I 4: distinguishing alteration', in de Haas and Mansfeld (n. 2), 123–50, at 140–1.

are always found *in* a composite, or mixed, body; and it is the latter that we *actually* perceive, and not, or *not directly*, its constituent material elements. As Aristotle puts it elsewhere, the composite is 'obvious' (δήλη) – presumably because this is what we perceive directly; whereas matter is evident 'in a way' (φανερὰ δέ πως καὶ ἡ ὕλη, *Metaph.* 7.3, 1029a30–2).[68] It seems, then, that if the simple bodies are perceptible, and Aristotle repeatedly insists that they are, then they are perceptible in some indirect, or qualified, sense.[69] In other words, it is not the case that we perceive a simple body the way we perceive a 'mixed' or composite body.[70]

How then *do* we perceive them? Presumably by observing actually perceptible, that is, *composite* bodies, and the changes these undergo in reaction to the environment. Consider, for instance, how Aristotle supports his claim that the generation of the simple bodies is 'apparent to the senses' at *De generatione et corruptione* 2.4. He writes: 'for there would be no alteration; for alteration is according to the affections of the tangible things' (331a9–10; see also *Gen. corr*. 2.1, 329a35–b2; cf. *Metaph.* 1.8, 989a26–8).[71] Now alteration (ἀλλοίωσις) is a change in the affections of a substratum such that it persists in its identity through the change (*Gen. corr*. 1.1, 314b1–4, 1.4, 319b10–12). It follows that the simple bodies cannot alter: water, for instance, can't become hot or dry, and remain water. Thus only a non-simple, that is, mixed or composite body can undergo alteration in its affections (cf. *Cat*. 5, 4a10–11). So when he makes his claim that the generation of the simple bodies is apparent to the senses, Aristotle appeals for support to a change that involves composite bodies gaining or losing tangible affections. Why? Presumably because we do not *directly* observe the simple bodies themselves coming to be. The claim that they do so thus appears to be an inference based on the observation of the alteration of sensible composite substances.

This apparent predication of the possibility of alteration on the possibility of elemental change raises many questions that cannot be entered into here. The relevant point for our present purposes is this: the observable phenomenon of alteration is offered as evidence that the simple bodies change into each other. It is indirect evidence: we perceive, as it were, the signs or the after-effects of elemental change. What this seems to suggest is a very intimate connection between the affections or perceptible qualities of composite bodies and the differentiae of simple bodies. I suggest we understand the connection like so: the composite or 'mixed' bodies that we perceive *owe* their perceptible qualities to their constituent simple bodies (cf. *Gen. corr*. 2.6, 334a13–14, *Mete.* 4.4, 382a4). Thus, for instance, if we perceive heat, this is due to our being affected by some hot composite body. But the *cause* of the heat in hot composite bodies is the simple

[68] See W.D. Ross, *Aristotle's Metaphysics: A Revised Text with Introduction and Commentary*, 2 vols. (Oxford, 1924), 2.166; M. Burnyeat, et al. (ed.), *Notes on Book Zeta of Aristotle's Metaphysics* (Oxford, 1979), 16.

[69] Cf. Aristotle's occasional practice of distinguishing composites, described as 'the perceptible bodies' (τὰ αἰσθητὰ σώματα), from the simple bodies; see *Metaph*. 12.1, 1069a30–3; 12.4, 1070b10–19; 14.3, 1090a32–5; cf. 1.8, 989b31–990a18; *Ph.* 4.1, 209a14–17. Cf. Alexander's similar distinction, Diog. Laert. 8.24; DK 58B1a, lines 6–7.

[70] Thus Rashed (n. 2), 58 n. 1 is mistaken when he concludes that elemental fire is 'less hot' than mixed fire, for such a comparison involves the presumption that the element is perceptibly, or tangibly, hot. Cf. D.M. Balme, *Aristotle. De Partibus Animalium I and De Generatione Animalium I* (Oxford, 1972, repr. 1992), 148.

[71] Ἐπεὶ δὲ διώρισται πρότερον ὅτι τοῖς ἁπλοῖς σώμασιν ἐξ ἀλλήλων ἡ γένεσις, ἅμα δὲ καὶ κατὰ τὴν αἴσθησιν φαίνεται γινόμενα (οὐ γὰρ ἂν ἦν ἀλλοίωσις· κατὰ γὰρ τὰ τῶν ἁπτῶν πάθη ἀλλοίωσίς ἐστιν) …

body fire (*Metaph.* 2.1, 993b25–6; see also *Mete.* 4.4, 382b26–b6; cf. Pl. *Ti.* 31b6). The perceptible characteristics of composites, in other words, are explained in terms of their constituents. This is, of course, what Aristotle undoubtedly intends when he identifies the simple bodies as the *sources* or *principles* (ἀρχαί) of the actually perceptible, that is, composite bodies (*Gen. corr*. 2.2, 329b7; cf. 2.1, 329a5–8, 329b3–4).[72]

So, it seems, it is in a somewhat extended sense of 'perceptible', which is applicable not just to those things that are straightforwardly perceptible, but also to the things that are the sources of the perceptibility of the former, that the simple bodies can be said to be perceptible, or to appear to the senses. This, I suggest, is how Aristotle can hold at once that the simple bodies are perceptible, and yet the fire, air, water and earth we actually perceive are not simple but mixed. Hence, even if the simple bodies are not *actually* perceptible entities in themselves, their effects are felt in every perceptible thing.

In this paper I have argued that the textual support for the view that Aristotle identifies the contraries hot and cold, dry and wet as στοιχεῖα is far less persuasive than the prevalence of this opinion in the secondary literature would suggest. On the contrary, what comes across from the foregoing examination of *De generatione et corruptione* 2.3 is Aristotle's clear commitment to the view that fire, air, water and earth, properly understood, are the στοιχεῖα of bodies. The relationship of the contraries to fire, air, water and earth is, I believe, yet to be adequately explained. But, however we understand this relationship, Aristotle's introduction of the former in the *De generatione et corruptione* does not entail the relegation of the latter from the status of elements.[73]

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[72] See also n. 31 above.

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