

ΜΕΡΟΣ ΔΕΥΤΕΡΟΝ
ΙΣΤΟΡΙΑ ΤΗΣ ΦΙΛΟΣΟΦΙΑΣ

ARISTOTLE ON “THE SWEAT OF THE EARTH”*
(DK 31 B 55)

When the early Greek philosophers began to speculate about nature, its processes, and phenomena, they had at their disposal the language of the poets. This language consisted in a rich vocabulary and an array of figures of speech, including similes, allegories, and metaphors¹. It is understandable that the Presocratics adopted and adapted this language in pursuing their scientific interests, whether they wrote in prose or in meter. Among the former we can count Anaximander and Anaximenes; among the latter, Xenophanes, Parmenides, and Empedocles, and Thales too if it is true that the Milesian wrote a poem titled *Astronomy*. We learn about these linguistic preferences from Plutarch: in *On the Oracles of the Pythia* he notes that a number of early Greek philosophers took up the language of poetry, which later generations would soon discard².

If some of the early Greek philosophers used the poetic medium, what differentiated them from the poets? Aristotle addressed this question in *Poetics*, for instance, claiming that although Empedocles wrote in hexameters, he was no poet like Homer. He was a *physiologos*, a student of nature³. With this label Aristotle was referring to Empedocles' aim to reconstruct the natural history of the world by pinpointing its origin in the material *arkhai* (air, fire, earth, and water) and by identifying forces whose interaction affected these elements and explained the world's physical features, from the formation of the earth and the sea to the origin of life in its multiple forms including humans, animals and plants. In this reconstruction of the natural history of the world, the gods were blatantly absent, and the powers involved were the abstract forces of Love and Strife. For Aristotle, content was what made the difference. Yet, while in *Poetics* Aristotle acknowledges that Empedocles was not a poet but a student

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1. On the presence of rhetoric, tropes, and figures of speech in Homer, see Pseud.-PLUTARCH'S *Essay on the Life and Poetry of Homer*.

2. PLUT., *De Pyth. Or.* 18.

3. ARIST., *Poet.* 1447 b 15.

of nature, elsewhere he takes issue with his poetic style, and particularly with his use of metaphors. In this essay I focus on this aspect of Aristotle's reception of Empedocles by examining a particular case: Aristotle's response to fragment 55 where the philosopher from Acragas claims: "The sea is the sweat of the earth"⁴. I first investigate Empedocles' metaphor as a formal device that reveals hidden connections between bodies and processes of nature, then I look at the conception of the natural world that underlies that metaphor, including Empedocles' knowledge regarding the origin of the sea. Ultimately, it will be evident that Aristotle had more than one reason to criticize Empedocles' metaphor, besides the incompatibility with scientific discourse that for him characterizes all metaphorical expressions.

The essay unfolds in four parts. In the first I discuss Aristotle's double standard in his treatment of metaphor in light of *Poetics* and *Rhetoric*, on the one hand, and *Posterior Analytics* and *Topics*, on the other (section 1); in the second, I move on to *Meteorologica* 2, where Aristotle presents a number of Presocratic theories about the origin of the sea. After reviewing, among others, the theories of Anaximander and Empedocles, I show how Aristotle approaches the problem of the origin of the sea tackled by the Presocratics and frames it in new terms (sections 2 and 3). It is in this wider context that Aristotle takes a stance against Empedocles' "the sea is the sweat of the earth" metaphor by revealing and pursuing the analogy implicit in it. The third part of this essay discusses the basis of his disapproval (section 4). I will conclude by presenting some general remarks on Aristotle's interpretation of Empedocles, and the different role that analogies played in their studies of the phenomena of nature (section 5).

1. Aristotle on Metaphor

There is a double standard in Aristotle's treatment of metaphor. In *Poetics* he praises it because it allows poetic diction to avoid banality⁵. Metaphors defeat expectations: as he puts it, "Metaphor consists in assigning a thing the name of something else". Aristotle distinguishes four classes of substitution (and therefore of metaphor): from genus to species, from species to genus, from species to species, and by analogy. This last type is the most popular (cf. *Rhet.* 3, 1411 a) and implies an equality of ratios. Hence this metaphor is also conventionally labeled proportional metaphor. "I call 'by analogy'", Aristotle writes, "cases where b is to a as d is to c : one will then speak of d instead of b , or b instead of d ". Aristotle clarifies his account of the metaphor by analogy with the example "the day's old age" to speak of the sunset. This metaphor works on the equation (b) sunset is to (a) day = as (d)

4. γῆς ἰδρώτα θάλασσαν (DK 31 B 55).

5. *Poet.*, 22 1458 a 18-25.

old age is to (c) life⁶. The same proportional relationship qualifies the sunset and old age with respect to the wholes to which they belong, respectively day and life. Thus the expression “the day’s old age” refers to the sunset, but replaces the word “sunset” with “old age”.

In *Rhetoric*, Aristotle focuses on the ‘fourth type’ of metaphor, the metaphor by analogy, and lauds it as a rapid and pleasant vehicle of knowledge⁷. For him this metaphor is condensed insight. Aristotle relates it to the simile (*eikōn*), which he also regards as a metaphor, albeit one that possesses an extra word⁸. “Metaphor has clarity, sweetness and strangeness”⁹ –and a large family, one could say. Yet, while praising the role of metaphor in poetic and rhetorical discourse, the same Aristotle dismisses the validity of metaphor in science. In *Posterior Analytics* he declares: “If we are to avoid arguing in metaphors, clearly we must also avoid defining in metaphors and defining what is said in metaphorical terms; otherwise we are bound to argue in metaphors” (*Post. An.* 2 97b37-40, transl. by H. Tredennick with a slight modification).

Aristotle claims that one should neither argue by means of metaphors nor try to establish definitions with them. There is an unbridgeable gap between metaphor and explanation: you cannot explain by means of a literary device that functions through shortcuts and is the polar opposite of the apparatus of premises and conclusions that frames scientific explanation¹⁰. “Everything said

6. *Poet.*, 21 1457 b 7-32. On the relation of the first three types to the metaphor by analogy, see G. MOST, *Seming an Being: Sign and Metaphor in Aristotle*, *Creativity and the Imagination. Case Studies from Classical Age to the Twentieth Century*, Amsler M. (ed.) (Newark, DE), University of Delaware Press, 1987, pp. 11-33. Other relevant studies of metaphor in Aristotle include I. TAMBA-MECZ, P. VEYNE, *Metaphora et comparaison chez Aristote*, *REG*, 92, 1979, pp. 77-98; U. ECO, *Semiotics and the Philosophy of Language*, Bloomington, Indiana University Press, 1986; S. LEVIN, *Aristotle’s Theory of Metaphor*, *Philosophy & Rhetoric*, 15, 1992, 24-46; J. KIRBY, *Aristotle on Metaphor*, *AJP* 118, 1997, pp. 517-554, in addition to those cited in the following pages.

7. *Rhet.*, 3 1410 b 6.

8. *Rhet.*, 3 1410 b 3. The extra word is the particle of comparison “like” (*hōs*). See A. NOVOKHATKO *Ancient Theories of Metaphor (metaphorá)*, in: *Encyclopedia of Ancient Greek Language and Linguistics*, Leiden, Brill, vol. 2, 2014, pp. 414-8; on the relationship between *Poetics* and *Rhetoric*, KIRBY, *op. cit.*, and A. LAKS, *Substitution et connaissance: une interprétation unitaire (ou presque) de la théorie aristotélicienne de la métaphore*, *Aristotle’s Rhetoric. Philosophical Essays*, D. FURLEY, A. NEHAMAS (eds.), Princeton, Princeton University Press, 1994, pp. 283-305.

9. *Rhet.*, 3 1405 a.

10. For a discussion of Aristotle’s critique of metaphor in scientific discourse and his use of comparisons in his inquiry into nature, see G. E. R. LLOYD, *The Revolutions of Wisdom: Studies in the Claims and Practice of Ancient Greek Science*, Berkeley/Los Angeles/London, University of California Press, 1987, pp. 183-190, 210-213; see also G. E. R. LLOYD, *The metaphors of metaphora*, *Aristotelian Explorations*, Cambridge, Cambridge University Press, 1996, pp. 208-222, and, more recently, S. M. P. COUGHLIN, 2013, *Method and Metaphor in Aristotle’s Science of Nature. Electronic Thesis and Dissertation Repository*, 2013, Paper 1522, who attributes to metaphor a heuristic role (2013).

metaphorically is unclear”, Aristotle states epigrammatically in *Topics*¹¹. But metaphor’s unsuitability is not its lack of clarity per se, necessarily. Aristotle notes that because metaphors do not rest on premises, the speech that contains them is irrefutable (*anexelengktos*)¹². Thus, metaphors actually derive power from their lack of clarity. Indeed, no matter what type of discourse they are embedded in, metaphors seem to rescue it from systematic objections. They therefore block intellectual exchange and tend to halt epistemic advancement.

Given this hostility to metaphors in philosophical discourse, it comes as no surprise that in *Meteorologica* Aristotle takes Empedocles’ metaphor¹³ “the sea is the sweat of the earth” and fleshes it out in order to prove it wrong. Needless to say, this move is inscribed in Aristotle’s method of engaging with *endoxa* and building a theory by correcting the tradition. In this case, however, he not only corrects previous theories, but also furthers the line of his critique of the use of metaphors in scientific discourse¹⁴. In other words, Aristotle also wants to rectify the mode in which previous doctrines were expressed, and he does so by deconstructing¹⁵ Empedocles’ metaphor, showing why it does not work as an explanatory tool for a natural phenomenon, and thereby disempowering it. At the same time, Aristotle presents a model for interpreting metaphors: one has to uncover the analogies within a given metaphor and question how there can be a sustained and coherent parallel between the elements it equates.

2. From Presocratic Theories about the Origin of the Sea to a New Model

In *Meteorologica* 2, Aristotle focuses on the sea and investigates why it is a volume of salty water, as well as how it came into existence. He offers a synopsis of earlier theories in which the comprehension of the sea’s constitution is intertwined with, and dependent on, an understanding of its origin (*arkhē*). Hesiod thought the sea had sources (*pēgai*)¹⁶, while a number of philosophers –some of whom we can identify through Alexander of

11. *Top.*, 6 139 b 34-5.

12. *SE* 176 b 25.

13. See above note 4.

14. In fact, Aristotle’s discussion of Empedocles’ metaphor in terms of a regular phenomenon of nature, and not as a single event, intersects his more general objection to analogical argument from the standpoint of the theory of syllogism. In this respect, Lloyd remarks that, “it [analogical argument] proceeds from particular case to particular case, whereas for the argument to be valid it must proceed first by a complete induction to a universal rule, which is then applied deductively to the particular case in question in the conclusion” (LLOYD, *op. cit.* 1987, p. 186).

15. I use the verb “deconstruct” here to indicate Aristotle’s operation of unfolding the equations implied in Empedocles’ metaphor and of testing the soundness of the parallels between phenomena that these equations imply.

16. Cf. *Theog.*, 282, 785-792.

Aphrodisias on the authority of Theophrastus— offered a variety of accounts. Despite their theoretical differences, all of these theories share the premise that the sea came into existence at one point in primordial time: it was not eternal¹⁷. Anaximander, and then Diogenes of Apollonia, thought the sea originated from the evaporation of the original moisture surrounding the earth. Dried up by the sun, the water that evaporated became the cause of the winds, as well as the revolutions (*tropai*) of the sun and moon, while that which remained (*to hypolephthen*) gave rise to the sea¹⁸. Empedocles too conceived of the sea as a derivative phenomenon. He considered it an emission of liquid from the earth as it was heated up by the sun¹⁹, and identified this process as the cause of its salty quality²⁰. Others—likely Xenophanes, Metrodorus of Chios and Anaxagoras²¹— agreed that the saltiness of the sea was due to the earth, but envisioned a different process than Empedocles did. For them, just as when water was strained through ashes it became salty, the sea was salty because it was mixed with some residual earth. In other words, the difference between Empedocles and this last set of philosophers rests on the idea that for Empedocles, the salty quality of the sea is due to water secreted from the heated earth, while for the others, it derives from water flowing on the earth and carrying with it earthy particles²².

Resorting to a mix of dialectical and empirical evidence, Aristotle first deals with the idea that the sea may have sources. He divides the water on earth’s surface into running and standing: running water (the water of rivers) flows from sources, while standing water collects into marshes and lakes or is

17. ALEXANDER OF APHRODISIAS contrasts the philosophers for whom the sea came into being with the “theologians” who considered the sea “unoriginated” (*agenētos*) (ALEX. in *Mete.* 2, 1/DK 64 A 17).

18. See respectively DK 12 A 27 and DK 64 A 9, 17; cf. ALEX. in *Mete.* 2, 1; AËT. 3.16.1; C. KHAN, *Anaximander and the Origin of Greek Cosmology*, New York, Columbia University Press, pp. 65-67.

19. Aëtius too identifies the source of heat with the sun (DK 31 A 66), but for the Presocratic of Acragas the situation seems to have been more complex than Aristotle and Aëtius depict. Empedocles’ cosmology includes subterranean fires, on the one hand (DK 31 B 52), and the presence of two suns, on the other. In other words, there is an archetypal sun, constituted by fire, in one of the hemispheres, and a derivative sun, which appears in the opposite hemisphere and is a reflection of the archetypal sun. This is the visible sun (see DK 31 A 56 and DK 31 A 30). On the question of Empedocles’ ‘two suns’, see E. BIGNONE, *Empedocle*, Torino, Fratelli Bocca, 1916, p. 346; J. BOLLACK *Empédocle*, Paris, Minuit, 1969, pp. 264-266; and Kingsley, who *contra* previous scholars thinks that the visible sun is a mass of fire that comes from the depths of the earth and is “fed” by volcanic eruptions (P. KINGSLEY, *Ancient Philosophy, Mystery, and Magic*, Oxford, Oxford University Press, 1995, pp. 50-53).

20. DK 31 A 66, and *Mete.* 2 357a25-8. Further, fragment B 56 (HAPHAËST. *Ench.* 1 p. 2, 13) indicates that Empedocles regarded salt as deriving from a process of crystallization, forced (*oîthein*) by the sun. See section 4 below.

21. See, respectively, DK 21 A 33, DK 70 A 19 (HIPPOCR. *Ref.* I, 14), and DK 59 A 90.

22. *Mete.* 2, 353 b 14-7. This difference in conceiving of the origin of the sea is probably part of a major difference involving how they conceived of the earth’s future (getting wetter, versus getting drier as in Anaximander or Democritus).

made to stand artificially, by the construction of wells. It follows that the sea cannot derive from sources (since only rivers do, and running water becomes standing water by the intervention of man). As for empirical evidence, Aristotle observes that the Hircanian and Caspian seas are separated and their shores are continuously inhabited, yet none of the inhabitants have reported seeing their sources.

Aristotle then proceeds to scrutinize the remaining theories. And as he tackles them, he extends his critique to related and prior problems. In coming into being at one point in the cosmological process, the sea was, for the Presocratics, mistakenly the primary and main body of water from which all other kinds of water derived. This *faux pas* in the study of nature by the Presocratics was due to their assumption that, by analogy with the other elemental bodies (such as earth or air), the sea would be the primary mass of water from which all other water is derived. Xenophanes, for instance, adjusted ‘empirical evidence’ to this theory: he even claimed that rivers would flow both into the sea and also out of it. In fragment 30 he calls the sea the source of water (*pēgē hydatos*), and later he claims that the great high sea (*meḡas pontos*) begets not only winds and clouds, but also rivers (*genetōr potamōn*)²³.

Yet the elevation of the sea to this primordial status makes it difficult for Aristotle to reconcile the existence on the earth of both salty and sweet water: if the sea is the origin of all water, how can one explain the presence of sweet water? This question was at the core of the problem of his predecessors’ theories, and Aristotle believes that an appropriate solution to it should provide a global explanation of water in the sublunar world, including the salty quality of the sea and how it may “independently” coexist with the sweet water of rain and/or rivers. To reach such a solution Aristotle follows a different path of inquiry than his predecessors did. He dismisses the cosmogonical perspective and the problem of the origin (*arkhē*) of the sea, and focuses instead on understanding the natural phenomenon of the cycle of water in relation to its natural place (*topos*)²⁴. The linear sequence according to which the sea came into being after the earth (as the leftover from evaporated primordial moisture or as water carrying particles of earth) is replaced with a cyclical temporality that involves discrete areas of the cosmos:

Water surrounds the earth just as the sphere of air surrounds water and the so-called sphere of fire surrounds that of air –fire being the outermost both on the commonly accepted view and ours. As the sun moves in its course –and by its movement causes change, generation and destruction– it draws up the finest and sweetest water each day and makes it dissolve into vapour and rise into the upper region, where it is then condensed by the cold and falls again to the earth. Nature always wants to do this as we have said above (*Mete.* 2 354b24–34, transl. by H. D. P. Lee, with slight modifications)²⁵.

23. See *Mete.* 2, 354 b 3–19 and DK 21 B 30.

24. Cf. *Mete.* 1, 339 a 11–20, where Aristotle discusses the elements’ respective natural places.

25. Cf. *Mete.* 1, 346 b 16–347 b 13.

As the sun moves across the sky, it makes the “finest and sweetest” water evaporate, and in the upper regions, which are cold, the air condenses, giving rise to rain. Hence water falls again on the earth. Rather than occurring only in a past episode, this process happens regularly and indicates that the sea remains the same “in quality (*eidos*) and quantity (*poson*) though its parts are continually changing”²⁶, as Aristotle will discuss later in the same treatise.

The claim that the amount of water which evaporates is the same as that which falls in the form of rain²⁷ refutes the theory that a part of the evaporated water never returns to the earth because it feeds the sun, and in turn triggers other phenomena. According to this theory, the sun has to move in order to find more nourishment and not die, and its movement creates the solstice. Aristotle criticizes this theory on multiple fronts. First he observes that, in supposing that moisture rises up like flame to nourish the sun, this theory is based on the analogy between the sun and fire. But while the sun is a being, flame (fire) is not, as it changes constantly²⁸. Further, as fire is not fed by the water that it heats, the sun cannot be nourished by water. Finally, the promoters of this theory were focusing on the sun, leaving the existence of other celestial beings unexplained.

Attribution of this theory is uncertain. Heraclitus probably held it²⁹, and there is a possibility that Anaximander and Diogenes held it too –although Aristotle differentiates those who believed that evaporated water causes the wind and the turnings (*tropai*) of the sun and moon from those who believed that evaporated water nourishes the sun³⁰. Whether evaporated water would feed the sun or not, a chain of events like this is untenable for Aristotle³¹, for whom nature is orderly and self-regulated, with a balanced

26. *Mete.* 2, 357 b 27-358 a 2.

27. *Mete.* 2, 355 a 26-34.

28. With this comment Aristotle is also likely replying to those Presocratics that thought that the sun was constituted by fire. Xenophanes, for instance, thought that the sun was made “by fires (*pyrōdes*) gathering together and that it was new every day” (DK 21 A 33).

29. *Mete.* 2, 354 b 35-355 a 33. See Lee’s note in the Loeb Library edition of the *Meteorologica* (H. D. P. LEE, *Aristotle. Meteorologica*, London and Cambridge, Harvard University Press, 1952), but also the next note below.

30. Cf. *Mete.* 2, 353 b 7-11, 2 355 a 21-26 and 2 354 b 35-355 a 21. For a discussion of the difficulties inherent in the differentiation of these theories and their attribution, see KAHN, *op. cit.*, pp. 64-66; cf. G. S. KIRK, J. E. RAVEN, *The Presocratic Philosophers*, Cambridge, Cambridge University Press, 1957, p. 139. In addition, as Kahn remarks (*op. cit.*, p. 103, and p. 132, n. 1), one should understand the role of moisture as food of the sun in light of a common belief in ancient Greek thought according to which water gives rise to fire. So, for instance, in *Metaphysics* Aristotle interprets Thales’ emphasis on water, noticing that for the Milesian water generates and nourishes fire or heat (1 983 b 23). On the other hand, Anaximander envisioned a cosmogonical beginning in which fire grows out of and around primeval moist air, “like bark around a tree”, and must be maintained by it (DK 12 A 10).

31. Besides the preservation of the global amount of water discussed here, a major problem Aristotle has with this theory rests on the neglect of the natural place for water, which is the lowest area at the center of the world and cannot overlap with that of fire, tending to the highest zone of the sublunary world (*Mete.* 2, 355 a 5-7).

and harmonious course³², To assume a diminution in the global amount of water is problematic from the perspective of the consequences this diminution would produce: the slow disappearance of the sea and a radical change in the natural order. If one notices a receding of the sea, for Aristotle this observation indicates not, as it had been assumed, the beginning of a radical change, but a seasonal adjustment that corrects previous excesses in water precipitation. In this respect, Democritus too was wrong in thinking that the sea would eventually disappear. Aristotle compares this belief to an otherwise unknown fable of Aesop³³ in which Charybdis acts as a primordial agent by gulping in the water of the sea. The monster's first gulp let the mountains emerge; her second revealed the islands, and the third will dry the sea up altogether³⁴. Serious philosophers, Aristotle says, should not think in terms of fables (*mythologeîn*).

3. The Cycle of Water and Living Bodies

To ask about the origin (*arkhē*) of the sea, conceived of as both a primordial entity and the source of all water, is, for Aristotle, to ask the wrong question. One should instead investigate the mechanism that produces salty and sweet water, rising sun after rising sun³⁵. Claiming that the “finest and sweetest” water is drawn up and then falls again is only part of the explanation. Indeed, while this type of water evaporates, there is also a body of water that does not “move” because it is heavy. It stays behind in the depth of the earth, which is the natural place for water, both salty and sweet. To exemplify this mechanism Aristotle resorts to an analogy with what happens to the bodies of living beings (*tōn zōōn sōmata*):

For here the food when it goes in is sweet, but the sediment and residue from liquid food is bitter and salty – for the sweet and fresh part of it is drawn off by the natural heat of the body and passes into flesh and the other constituent parts of the body as appropriate. But it would be absurd not to regard the belly as the proper place of fresh liquid food because it vanishes so quickly, but of residue because this is observed to remain. Similar remarks apply to the present subject. The place occupied by the sea is, as we say, the proper

32. For the change in dry and wet areas on the surface of the earth and their ultimate balance, see also *Mete.* 1, 353 a 15-24.

33. A variation of this fable has Zeus and Chaos instead of Charybdis (see *Fab. aes.* 8 Hausrath).

34. *Mete.* 2, 356 b 13-15; cf. G.-J. VAN DIJK, *AINOI, LOGOI, MYTHOI. Fables in Archaic, Classical, and Hellenistic Greek Literature*, Mnemosyne Supplementum, 166, Leiden, Brill, 1997, pp. 251-253.

35. On the issue of salty water in Presocratic doctrines, see Solmsen, who mentions Anaxagoras and Diogenes (F. SOLMSEN, *Aristotle's System of the Physical World: A Comparison with His Predecessors*, Ithaca, NY, Cornell University Press, 1960, p. 424 and n. 128).

place of water, which is why all rivers and all the water there is run into it: for water flows to the deepest place, and the sea occupies the deepest place on the earth. But one part of it is all quickly drawn up by the sun, while the other for the reasons given is left behind. (*Mete.* 1, 355 b 7-21, transl. by H. D. P. Lee)

The body of an animal has the same spatial coordinates as the cosmos: up is up and down is down³⁶. Like the earth in the cosmos, it also has a center, the belly; also like the cosmos, it possesses a heating agent. Although Aristotle does not mention them in this passage, the living body has the heart, the cosmos the sun³⁷. When liquid food is introduced in the body of a living being, it reaches the belly from which the sweet and light part of the food is drawn upwards by the body’s internal heat and processed into blood, nourishing the body in its different constituents. By contrast, the heavy component of the liquid food (which is also bitter) remains behind in the belly. It is the residue (*perittōma*) and is eventually expelled. Aristotle has a lot to say about this physical process in *On the Generation of Animals*, and other treatises. Bonitz identifies two main meanings for *perittōma* (residue) in Aristotle. In both cases it indicates a “body part” that results from the process of nutrition, but each corresponds to a different stage of the processing: the residue can be *secretum*, *excretum*, on the one hand, and *excrementum*, on the other³⁸. The first type of residue in all of its different forms, the useful type, is distributed and employed by the body, and the second, the useless type, is expelled (*GA* 2 738 a 8)³⁹.

Liquid food in the bodies of living beings “moves” according to the same natural “laws” as water in the sublunary world. While light, sweet water evaporates, the heavy and salty water remains *in loco*, and “gives rise” to the body of the sea⁴⁰. Conceived by analogy with the movement of liquid food in the body of a living being, the sea is not the original body of water. So Aristotle claims that “rather than being the source (*arkhē*) of water the sea is the terminus (*teleutē*)”⁴¹, and in this way, he reverses the cosmogonical/cosmological perspective of the Presocratics.

36. Aristotle does not consider this to be the case with plants, whose vertical orientation is the opposite of that of both animals and the cosmos (see *De An.* 2 416 a 2-6). On the spatial coordinates of living beings’ bodies, see A. L. CARBONE, *Aristote illustré. Représentations du corps et schématisation dans la biologie aristotélicienne*, Paris, Classiques Garnier, 2011.

37. For the heart as a principle of heat in the living body, see, for instance, *PA* 2 653 b 5-7.

38. H. BONITZ, *Index Aristotelicus*, Graz, Akademische Druck und Verlagsanstalt, 1955, pp. 585-587.

39. In *GA* 1 724 b 27-8 Aristotle gives us a general definition for *perittōma*: “by residue I mean that which is left over as surplus from the nourishment” (transl. by A. L. Peck). For another application of the analogy between cycle of water and the movement of food in the body of a living being, see also Aristot. *De Somn.* 457 b 20-458 a 10.

40. This explanation should in fact be related to the more general theory of dry and wet exhalations (not discussed in this essay) that frames Aristotle’s study of meteorology; for this theory and how it fits with Aristotle’s general physics of the elements, see M. WILSON, *Structure and Method in Aristotle’s Meteorologica. A More Disorderly Nature*, Cambridge, Cambridge University Press, 2014.

41. *Mete.* 2, 356 a 36-356 b 3.

4. Deconstructing Empedocles' Metaphor

This general critique of the Presocratics' methodological approach to the question of the origin of the sea and the individual theories it produced is the context wherein Aristotle tackles Empedocles' metaphor "the sea is the sweat of the earth". In an illuminating article on the epistemological import of metaphor in Empedocles and Aristotle, Bremen remarks on Aristotle's double approach to Empedocles. On the one hand, in *Poetics* the Stagirite recognizes Empedocles' talent in crafting metaphors⁴²; on the other, in *Rhetoric* he complains about his ambiguity in diction (*lexis*). Empedocles writes in the general mode of the prophets, which is open-ended and undefined so as to release them from any accountability for what they have predicted⁴³. While we may well read in this last comment a critique of Empedocles' use of metaphors, the ambivalence of judgments that emerges from the juxtaposition of *Poetics* and *Rhetoric* indicates, as Laks has remarked, that for Aristotle there is a gap between poetic and rhetorical metaphors, and that poetic metaphors are allowed higher expressive potentialities than rhetorical ones⁴⁴. Be that as it may, in *Meteorologica 2*, Aristotle proceeds with his assessment of ancient doctrines about the origin of the sea, quotes Empedocles' metaphor and holds him accountable for it⁴⁵:

It is equally ridiculous (*geloion*) for anyone to think, like Empedocles, that he has made an intelligible (*saphes*) statement when he says that the sea is the sweat of the earth. Such a statement is *perhaps* satisfactory in poetry, for metaphor is a poetic device (*poiētikon*), but it does not advance our knowledge of nature (*physis*) (Aristot. *Met.* 2 357 a 25-8, transl. by H. D. P. Lee with a slight modification).

Empedocles' metaphor that the sea is the sweat of the earth is inadequate for scientific discourse, Aristotle claims. He attributes both instruction

42. See *Poe.*, 1457 b 7-32, where Aristotle includes among examples of metaphors Empedocles' expression for old age "life's setting sun". On the other hand, Diogenes Laertius reports that in the treatise *On Poets* Aristotle praised Empedocles for being powerful in diction, and "great in metaphors (*metaphorētikos*), and in the use of all other poetical devices" (D.L. 8 57).

43. *Rhet.* 3, 1407 a 37-1407 b 6.

44. See LAKS *op. cit.*

45. In this respect, see *Metaphysics* (1, 985 a 4-7), where Aristotle discusses Love and Strife. He distinguishes between language and thought in Empedocles' work, considering the first as inadequate to express the full import or "potential" of the second. "If one follows up and appreciates the statements of Empedocles with a view to his thought (*dianoia*) and not to his obscure language (*ha psellizetai*), it will be found that Love is the cause of good and Strife of evil" (transl. by H. Tredennick, with slight modifications). *Psellizein* is an interesting verb choice that qualifies the character of the language of early philosophy as inarticulate and, therefore, obscure (see also *Met.* 1, 993 a 15-7). For Aristotle, bringing clarity to the language of Empedocles is a way of assessing the validity of his doctrines.

(*mathēsis*) and knowledge (*gnōsis*) to metaphor in a rhetorical context and acknowledges them as appropriate for a poetic context⁴⁶, but he says that neither meets the epistemological standards required for the study of nature. In fact, it is significant that by using the term “perhaps” in the passage above, Aristotle casts some doubt on whether the expression “the sea is the sweat of the earth” is appropriate even for poetry – in a poetic context too, he suggests, metaphor should have a level of scientific coherence. And indeed it is clear that for Aristotle, even in poetry there are good or bad metaphors. For instance, in *Generation of Animals*, while commenting on Empedocles’ “milk is pus” metaphor (DK 31 B 68), Aristotle remarks that either the Presocratic was wrong (in his belief about pus and milk) or he used a bad metaphor (his metaphor did not suit his doctrine)⁴⁷. In this case, to equate pus with milk was inappropriate because the two body components derived from a different process – milk from the concoction of blood, pus from its decomposition. By contrast, later in *Generation of Animals*, Aristotle fully endorses the metaphorical expression used by the comic poets who make white hair “the frost or mold of old age” and proceeds to explain it in terms of a parallel between the processes regulating the human body and those regulating meteorological phenomena⁴⁸.

Regarding the sea, Aristotle held that Empedocles missed the point again. In *Meteorologica* he proceeds to pin down his evasive language and attempts, in a way, to corner him. He holds the prophet to a scientific standard. Aristotle deconstructs Empedocles’ metaphor into the analogous pairs that constitute the backbone of a metaphor as he has illustrated it in *Poetics*: the sea is to the earth as the sweat is to the body of the living being. In fact, the analogy between the body of the sea and that of a living being resonates well with Aristotle who, we have seen earlier, explains the cycle of water by means of a comparison with the process of digestion of liquid food. Natural bodies (both living and not) can indeed be compared in legitimate ways and with fruitful heuristic results. Under Aristotle’s scrutiny, however, the terms of Empedocles’ analogy are equivocal. If the sea is to the earth as the sweat is to the body of a living being, then one has to explain how “salt sweat is produced in the body from sweet drink”. Does this happen through the loss of the sweet constituent or by the admixture of something salty? And again, if the production of sweat depends on the second type of process, one still has to explain how the admixture of a salty constituent could occur in the context

46. See *Rhet.* 3, 410 b 18-20.

47. Milk derives from a process of concoction, and not putrefaction, as pus does (*GA* 4 777 a 7-13).

48. Indeed, both white hair, on the one hand, and frost and mold, on the other, derive from processes of exhalation (*atmis*) and putrefaction (*sepsis*) (*GA* 4, 5). I owe this quotation to Laks *op. cit.* Significantly, in approving of this metaphor Aristotle also shows that despite his critique of metaphors in scientific discourse he still attributes them a positive value in representing (although in a consolidated way and certainly in the appropriate genre) processes of change involving natural bodies.

of the earth. More generally, Aristotle asks how the earth, when heated by the sun⁴⁹, secretes such a large amount of liquid, as well as why the earth does not sweat today under similar circumstances. For, he adds, “if it used to happen once, it should happen now”. In fact, for Aristotle the present evidence contradicts Empedocles: when dried, the earth absorbs moisture instead of secreting it. How could it have happened otherwise in primordial times⁵⁰?

Aristotle confronts Empedocles’ metaphor with the series of urgent questions delineated above and disempowers it by showing its scientific shortcomings. Pursuing the analogies buried within, he demands the definition of processes, an assessment of the reciprocal equivalence between processes⁵¹, and the validation of empirical observation. In doing so, he also reveals the inadequacy of metaphors in scientific discourse *tout court*. In crystallizing the phenomena of nature into relationships of absolute identity, metaphors obscure and distort the processes themselves. They suppress the analogies, a systematic and “lengthy” consideration of which only can lead for Aristotle to scientific clarity and understanding.

5. Degrees of Resemblance: Metaphors, Analogies, and Identity

Let us digress for a moment and reflect on a problem that is behind both Empedocles’ use of metaphor(s) and Aristotle’s critique of it. To do so we can consult Hume, who in *A Treatise of Human Nature* writes:

All kinds of reasoning from causes or effects are founded on two particulars, the constant conjunction of any two objects in all past experience, and the resemblance of a present object to any of them . . . without some degree of resemblance, as well as union, it is impossible there can be any reasoning. But as this resemblance admits of many different degrees, the reasoning becomes proportionably more or less firm and certain⁵².

49. Aristotle (as later Aëtius) interprets Empedocles’ metaphor by considering the sun the source of heat that makes the earth “sweat”. This reading, however, appears to be a simplification of the phenomena described by Empedocles. Indeed, since the sea originates at a primordial time the source of heat is likely the archetypal fire (and perhaps the subterranean fires) and not the visible fire, which is a reflection of the archetypal sun (see above n. 19). The visible sun is instead involved in the process of crystallization of salt which is referred to in fragment B56 (HAPHAEST. *Ench.* 1 p. 2, 13), belongs to the history of the sea, and corresponds to a later time in the cosmogony. See BOLLACK, *op. cit.*, pp. 305-6, who also remarks that the city of Acragas was notorious in Antiquity for its salt mines and salty swamps (PLIN. *HN* 31, 96).

50. *Mete.* 2, 357 a 29-357 b 19.

51. This is indeed for Aristotle a requirement in the use of proportional metaphors (*Rhet.* 3, 1407 a 17-8).

52. D. HUME, *A Treatise of Human Nature*, London, J. M. Dent & Sons, 1911, vol. 1, p. 142. I owe this reference to G. R. E. LLOYD, *Polarity and Analogy*, Cambridge, Cambridge University Press, 1966, pp. 172-173.

Resemblance between objects and phenomena, is crucial to the process of reasoning, but resemblance is not a given, and it comes in different degrees – and forms, we could add. In this passage Hume is interested in relating the precision of reasoning to the degree of resemblance between entities (which was also Aristotle's concern), raising the question of degrees of resemblance. His aim here is to reconstruct a key step in the process of reasoning, pinpointing it in how a set of two objects that have appeared constantly in conjunction in the past resembles an object in front of us in the present. How do these different objects resemble each other? What points of convergence do they have? And what about their points of divergence? Good resemblances are built upon the first in a way that does not interfere with the second.

The Presocratics too used resemblances in their effort to understand the phenomena and entities of nature. Resemblances for them took the form of analogies, and in their hands analogical thinking became a potent heuristic tool. Anaxagoras is credited with having said that "phenomena are a view of unseen things"⁵³. In other words, what appears makes visible what is hidden, and by using analogies with an object that is known, one can discover objects and processes that are obscure. Empedocles, for instance, gave an explanation of the mechanism of respiration by analogy with the working of a clepsydra (a water-clock). Likewise, he explained sight and the physiology of the eye by referring to a lantern prepared by a man who is braving a stormy night and needs to shelter the light inside the lantern from the winds. In this analogy, the pupil is like the fire inside the lantern projecting its light outside into the world. And as the fire is sheltered by the transparent, linen screens of the lantern, so the fiery pupil is protected by the membranes that surround it⁵⁴.

In the expression "the sea is the sweat of the earth" Aristotle saw a metaphor based on the analogy between the human body and the phenomenon of perspiration, on the one hand, and the body of the earth and the formation of the sea, on the other. In his reading, Empedocles saw the phenomenon pertaining to the human being as the key to understanding the origin of the sea. Aristotle then proceeded to note inconsistencies in the analogy between the two sets of phenomena and thus refuted Empedocles' metaphor and, along with it, the theory it conveys.

At this point of our analysis, however, it is legitimate to question Aristotle's interpretation. Did Empedocles use his expression as a metaphor by analogy in the sense Aristotle assumed he did or did he instead craft a metaphor that, while containing an analogy, went beyond the degree of resemblance that metaphors express for Aristotle⁵⁵? After all, Empedocles

53. DK 59 B 21.

54. DK 31 B 84.

55. In fact, Aristotle's dissatisfaction with Empedocles' "analogy" can be related to his more general critique of the Presocratics' understanding of natural movement. See, for instance, H. CHERNISS, *Aristotle's Criticism of Presocratic Philosophy*, Baltimore, Johns Hopkins Press, 1935, pp. 188-200.

did not refrain from using explicit analogies when discussing the physiology of respiration or that of the eye, and in both of these cases the analogy involved a comparison between a natural phenomenon and an artificial product (i.e. the clepsydra and the lantern). On the other hand, he used metaphors like the “sea is the sweat of the earth” when presenting natural entities and phenomena. He called the ear “a fleshy offshoot”, for instance, and he described the phenomenon of trees’ reproduction by saying that “first tall olive trees lay eggs”⁵⁶. This metaphorical expression turned on the fundamental analogy between fruit (or seed) and egg as organic principles of generation and life. Trees were able to reproduce themselves through seeds, as animals did through their eggs. But given that the analogies at stake in these metaphors indicated common processes and features, did they have a repercussion on the very understanding of the entities that were connected by them? In other words, could it be that Empedocles saw the relationship between the trees and animals, the earth and the human body, as one of identity rather than “connected separation”, as a metaphor by analogy in Aristotle’s conception would lead us to believe?

Bremen realized this difficulty in Aristotle’s interpretation of Empedocles’ metaphors, and he claimed that Aristotle offers analogies between entities and processes, whereas Empedocles describes identity⁵⁷. According to Bremen, for Empedocles metaphors express the identity of phenomena of nature within a cosmological perspective that does not differentiate between living and nonliving entities – that represents them instead as equally embedded in a life-nexus (*Liebeszusammenhang*) and sharing the same origin (the four elements). On this view, the metaphor “the sea is the sweat of the earth” is not based on the comparison or analogy Aristotle pursues in it, or at least it did not claim the degree and form of resemblance to which Aristotle demands that it conform⁵⁸. Empedocles’ metaphor relates sea and sweat to one another in an intimate degree of resemblance that collapses into identity. We may well assume that for Empedocles this collapse into identity was legitimate not only because, as Bremen notices, sea and sweat were then conceived as sharing the same origin (the elements), but also because of the specific mix of elements that composed them. As we learn from Aristotle’s *Parts of Animals*, Empedocles focuses on the mix of the elements that constituted specific parts of the body of a living being, and defines it as “the *logos* of the mixture”, an expression in which *logos* indicates proportion (*PA* 1 642 a 17). Bone, for instance, consists

56. DK 31 B 79.

57. D. BREMEN, Aristoteles, Empedokles und die Erkenntnisleistung der Metapher, *Poetica*, 12, 1980, pp. 363-364, and p. 370. In discussing Empedocles’ metaphor Lloyd contextualizes it in early Greek philosophy, for which the universe as a whole is a living organism and earth itself undergoes cycles of growth and decay (LLOYD, *op. cit.*, 1966, p. 334).

58. Indeed, presumably Empedocles built the identity of sea and sweat upon an initial comparison between them.

of two parts of earth, two of water, and four of fire, for a total of eight parts (*De An.* 1 410 a 1, DK 31 B 96)⁵⁹. In other words, for Empedocles the *logos* of the elemental mixture that made up sea and sweat was equivalent, and likely so was their relation to the elemental formula of the bodies from which they respectively originated (the earth and the flesh of the living being) under specific environmental conditions (the heating of the sun and/or subterranean fires). In reference to animals’ body parts, identity of function and likely constitution is explicitly claimed in Empedocles’ fragment 82, which reads, “Hairs, leaves, the dense feathers of birds are the same (*tāuta*) and the scales on sturdy limbs”⁶⁰. In this fragment, humans, quadrupeds, trees, birds, and reptiles all share the same features: behind the different appearance and texture, color and strength, each animal body is similarly covered and protected. Empedocles may have conceived in the same way, namely under the sign of identity, the relationship between sweat and sea and in turn the relationship between the bodies to which these parts respectively belong, the human body and the body of the earth. In this way, rather than merely explaining an obscure process by a process that was better known, the analogies that supported Empedocles’ metaphors were suppressed within the metaphors themselves in order to highlight the identity between parallel natural phenomena and a philosophical vision that traced a pervasive interconnectedness in nature.

In his search for scientific knowledge, Aristotle violates this identity. He breaks Empedocles’ metaphor down in order to retrace the analogies inherent in it. Empedocles had used “the sea is the sweat of the earth” metaphor to describe a single phenomenon (the origin of the sea), while stressing the identity of sweat and sea, and of the body of a human being and that of the earth. By contrast, Aristotle demands from the metaphor the regularity intrinsic in his vision of the working of nature. He also demands a sustained parallel between the propositions of the uncovered analogy, and when he does not find it, he dismisses the knowledge Empedocles’ metaphor conveys and declares the metaphor ridiculous.

Yet to come back to the question of the degree of resemblance raised at the beginning of this section, Aristotle himself was not immune to the type of critique he subjected Empedocles to, because a focus on resemblance is inherent to analogy. Indeed, when Aristotle discusses the analogy between the cycle of water and the process of digestion, he ignores the divergences between these two processes, pursuing instead their points of contact in different, successive formulations. He stresses different “meteorologically-bent” points – respectively, the natural place of water and the production of

59. This proportion is contested by Picot who offers a different formula (J.-C. PICOT, *La brilliance de Nestis (Empédocle, fr. 96)*, *RPhA*, 26.1, 2008).

60. τὰυτὰ τρίχες καὶ φύλλα καὶ οἰωνῶν πτερὰ πυκνὰ καὶ λεπίδες γίγνονται ἐπὶ στιβαροῦσι μέλεσσιν (DK 31 B 82, transl. by A. Laks and G. Most).

salty water in relation to sweet water⁶¹. And, granted, he is more interested in understanding the process that produces a certain product (salt and sweet water). But in both cases he omits the ramifications of the two sets of phenomena that would not suit the analogy. So, for instance, he ignores the fact that the urine (which corresponds to salty water) is in fact a waste substance of the living body, and, more generally, he leaves aside the more complex role of *perittōma*, residue, in the context of living beings⁶². In this way, Aristotle creates a network of resemblances articulating spatial orientation, movements, and processes, and he tacitly assumes for the sublunar cosmos (or merely glosses over) a “body” as a physical space lacking the “physicality” of a living being. For when compared to a living body, the “body” of the sublunar cosmos seems rather “disembodied”. Thus his analogy between water and liquid food in relation to their natural place operates on the basis of a series of convergences between the phenomena and a parallel omission of their divergences. In a way similar to Empedocles’ metaphor, also Aristotle’s analogy demonstrates the power of language to offer knowledge of the natural world by positing relationships between its entities, but it “works” only to the extent that the analogical terms selected to illustrate the processes involved in producing a given entity are reciprocally relevant. For beyond that, Aristotle’s analogies too may fail to generate scientific explanations that are immune to critique.

Claudia ZATTA
(Siena)

ARISTOTELE SUL SUDORE DELLA TERRA (DK 31 B 55)

Abstract

Questo articolo esamina la critica di Aristotele alla metafora come veicolo di conoscenza nel discorso scientifico. Si concentra su un passo del trattato *Meteorologica 2* in cui, nell’ambito di una valutazione delle teorie presocratiche sull’origine del mare, Aristotele porta degli argomenti contro l’espressione di Empedocle “il mare è il sudore della terra” (DK 31 B 55). Nell’esaminare la posizione di Aristotele sull’origine del mare rispetto alle teorie presocratiche, questo articolo mostra le differenze tra Empedocle e Aristotele rispetto alla concezione della metafora. Per Empedocle le metafore esprimono identità. Per Aristotele, invece, racchiudono analogie. Nella sua critica Aristotele impartisce una lezione d’impianto scientifico. Decostruisce la metafora di Empedocle in un set di analogie e persegue la definizione di processi, la valutazione di equivalenza reciproca tra processi e la verifica dell’osservazione empirica.

Claudia ZATTA

61. *Met.* 2, 355 b 4-19, 357 a 33-3579.

62. See above pp. 8-9.