

# Empedocles' Account of Wine (fr.81) and Premodern Oenology

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*Vitis a vino, id a vi. – Varro<sup>1</sup>*  
*Der Wein ist saftig, Holz die Reben,*  
*Der hölzerne Tisch kann Wein auch geben.*  
*Ein tiefer Blick in die Natur!*  
*Hier ist ein Wunder, glaubet nur! – Goethe<sup>2</sup>*

**D**OUBT was formerly entertained, from Plato onward, over whether Homer knew about boiling meat, and not only roasting, since “he sets only roast meats on his tables.”<sup>3</sup> In the epoch-making *Prolegomena to Homer* Wolf responded that the poet must have known that meat can also be boiled: after all, someone who put cauldrons over fires could not “have been totally ignorant of the devices of cooking.”<sup>4</sup> From silence, Wolf observed, one cannot safely infer ignorance. And, in any event, to doubt such a thing now may seem an act of idle antiquarian curiosity. Even so, this paper raises a similar doubt:

<sup>1</sup> *Ling.* 5.37, where Varro is etymologizing: “*Vitis* (‘vine’) from *vinum* (‘wine’), this (viz., *vinum*) from *vis* (‘strength’).” Translations are my own unless noted otherwise.

<sup>2</sup> *Faust* I.2286–89 (spoken by Mephistopheles): “Wine is sappy, wood is the vine, / the wood table is able to give good wine. / A deeper glimpse into Nature’s secret! / Here is a wonder, only believe it!” (Liberties taken for meter and rhyme.) See the overlapping citation in R. Eisler, *Orphisch-dionysische Mysteriengedanken in der christlichen Antike* (Leipzig 1925) 134 n.5, who says about the underlying conception in this passage what the present paper seeks to establish at greater length: “Auch das ist antik.”

<sup>3</sup> F. A. Wolf, *Prolegomena to Homer*, transl. A. Grafton et al. (Princeton 1985) 96. See Plato *Resp.* 404B–C, and Wolf for further citations.

<sup>4</sup> For cauldrons over fires see e.g. *Il.* 21.362.

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Did Empedocles—or Homer or, for that matter, any ancient Greek—understand that wine comes to be through the fermentation of grape juice? However ignorant of yeast and alcohol,<sup>5</sup> surely (one presumes) they recognized that the fermentation of the juice after pressing is the most vital part of vinification and thus, in mythical terms, the birth of Dionysus.<sup>6</sup>

Although the causal relations between grape juice and wine may seem too obvious for us to entertain that doubt, it is forced upon us by Empedocles' claim that "wine is water from bark, rotten in wood" (31 B 81 D.-K.). The majority of those who have recently translated or commented on it, namely Wright, Longo, Inwood, Graham, McKirahan, Mansfeld, and Primavesi, have reasonably concluded that the fragment refers to fermentation in a wooden container, such as the familiar barrel. There is, however, no independent evidence that the Greeks of Empedocles' time ever used wooden fermentation vessels, but, as we shall see, abundant evidence that they used only clay. Furthermore, from its ancient citations and parallels, fr.81 emerges clearly as an account of grape wine in general, and not one of a special variety or unusual mode of production. Consequently, it seems that this "wood" can only be the wood of the living vine, and so we must look to another flock, led by much earlier scholars—namely Sturz, Karsten, Steinhart, Diels, Millerd, Bignone, and Eisler, followed more recently by Bollack, Gallavotti, Gemelli Marciano, and Picot—who judged that the fragment refers to wine somehow coming to be within the vine. Yet, how could a definition of wine that refers only to the liquid in the vine be

<sup>5</sup> See T. Boulay, "Les techniques vinicoles grecques, des vendanges aux Anthestéries," *DHA Suppl.* 7 (2012) 95–115, at 95; M. Nelson, *The Barbarian's Beverage: A History of Beer in Ancient Europe* (New York 2005) 1; J.-P. Brun, *Le vin et l'huile dans la Méditerranée antique* (Paris 2003) 49; H. Diels, "Die Entdeckung des Alkohols," in *Kleine Schriften zur Geschichte der antiken Philosophie* (Darmstadt 1969) 409; and §4 below.

<sup>6</sup> See e.g. C. Anghelina, "The Drunken World of Dionysos," *Trends in Classics* 9 (2017) 113–161, at 121; A. Buttitta, "Préface," in D. Fournier et al. (eds.), *Le ferment divin* (Paris 1991) x.

thought remotely adequate, unless the juice of the grape were also assumed to be wine prior to fermenting? A ready Wolfian response might be: Of course Empedocles knew that fresh “wine” has to be fermented to become the familiar beverage, and simply took this for granted in his account, since he and his audience were less interested in grape juice than in wine. As we shall see, however, the cumulative evidence from Empedocles and other authors makes that position untenable.

The main argument of this paper is that Empedocles held that water becomes wine already within the living wood of the vine. Prior scholars have registered this doctrine in Empedocles and elsewhere, but, to my knowledge, no attempt has been made to collect and analyze the evidence in order to establish this conclusively for fr.81 or for the broader tradition.<sup>7</sup> We begin with a preliminary discussion of the fragment and a review of its modern and ancient interpretations (§2). The hypothesis that the “wood” is the vine will gain credibility through relevant aspects of Empedocles’ thought (§3). Further support will come from proof that he was far from alone in this regard (§4). Corroborated by many parallels, our solution to fr.81 will also illuminate vexed passages in Homer and Euripides, not to mention less debated ones in many other authors. As we shall see, the notion that wine assumes its proper nature already in the vine, and its corollary, that fermentation after pressing does not change the wine’s nature, are surprisingly widespread and persistent even into the eighteenth century. Study of fr.81 thus uncovers a

<sup>7</sup> Amid the vast literature on ancient wine (some of which is cited below), W. F. Otto, *Dionysus: Myth and Cult* (Bloomington 1965) ch. 12 and 13, Eisler, *Orphisch-dionysische Mysteriengedanken* 134–135, W. Pater, *Greek Studies* (London 1895) 5–6, 19–22 (from “A Study of Dionysus: The Spiritual Form of Fire and Dew”), and R. B. Onians, *The Origins of European Thought about the Body, the Mind, the Soul, the World, Time, and Fate* (Cambridge 1951) esp. 215–219, did perhaps more than anyone to broach the problem of “the juice of the vine” examined here. For cautious observations about unfermented must conceived as wine in antiquity, see the rich studies of S. Kourakou-Dragona, *Vine and Wine in the Ancient Greek World* (Athens 2016) 43, and O. Mladenova, *Grapes and Wine in the Balkans: An Ethno-Linguistic Study* (Wiesbaden 1998) 467–478.

deeply rooted conception that persisted well into the modern period, echoing still in Goethe.

## 2. *The fragment and its prior interpretations*

Quoted already by Aristotle but preserved in full only by Plutarch,<sup>8</sup> the text comprises a single hexameter line:

οἶνος ἀπὸ φλοιοῦ πέλεται σαπὲν ἐν ξύλῳ ὕδωρ  
 οἶνος MSS. : οἶον Scaliger apud Stephanum<sup>9</sup>  
 ἀπὸ φλοιοῦ MSS. : ἀποφλοίου Karsten<sup>10</sup> : ὑπὸ φλοιῷ Méziriac<sup>11</sup>

Wine is water from bark, rotten in wood

This tentative translation, aimed at being uncontentious, glosses over several ambiguities. But interpretation hinges primarily on two words: φλοιοῦ and ξύλῳ.

Firstly, φλοιός normally designates bark; far less commonly, a fruit's rind or skin.<sup>12</sup> Some scholars, relying on the commoner meaning, have asserted that the passage of water through the vine's bark—and not the roots—is meant, although it is somewhat puzzling (but not, as we shall see, unparalleled) that Empedocles would specify water coming from the bark rather than

<sup>8</sup> *Quaest.nat.* 912B–C; see also the partial, modified citation at 919D. The other citations: Arist. *Top.* 127a17–19; Alex. Aphr. *In Top.* 357.12; Anon. *In Tht.* 24.39 (referring to *Top.*). See below for discussion.

<sup>9</sup> Scaliger offered οἶον in his appendix to Stephanus, *Poesis Philosophica* (Geneva 1573) 216, but kept οἶνος in his own collection, MS. *Scal.* 25, 106<sup>r</sup>; on that collection see P. Marzillo, “Scaliger als Gräzist und Forscher antiker Philosophie,” *Mitteilungen des Sonderforschungsbereichs 573* 2 (2010) 35–43, who generously shared a scan of the manuscript.

<sup>10</sup> S. Karsten, *Empedoclis Agrigentini carminum reliquiae* (Amsterdam 1838), translates this coinage from φλοῖω as “*exaestuans*”; see n.28 below.

<sup>11</sup> G. Xylander, *Plutarchi Chaeronensis Moralia* II (Basel 1570) 912, translates “sub cortice” but reads ἀπὸ φλοιοῦ and suggests no correction in the appended *Variae Lectiones* 66. The emendation was proposed by Bachet de Méziriac in marginalia to a copy of Stephanus, *Plutarchi Chaeronensis quae extant opera* (Geneva 1572) in Leiden. Méziriac was followed by H. Stein, *Empedoclis Agrigentini fragmenta* (Bonn 1852), and (P.?) Friedländer ap. D.-K. ad loc.

<sup>12</sup> *Elym.Magn.* s.v. φλοιός glosses it with λέπος.

the roots or both; perhaps it is better to think of the wine (i.e., after the water has rotted) as coming “from bark” in some sense, as the word order suggests (see §3). Yet it is also possible that the meaning of φλοιός here is extended, as three scholars have maintained, such that ἀπὸ φλοιοῦ describes the water or the wine as having been pressed “from the flesh (of the grape),” or as coming “from the foliage,” or, perhaps, as coming “from the sap.”<sup>13</sup> Formerly some emended the phrase to ὑπὸ φλοιῶ (“under bark”), which makes easier sense at least if we are prepared to think of the water rotting within the vine, but is unnecessary.

As translated above the fragment may seem to demand that the water that constitutes wine be thought of as “rotting” or fermenting “in wood” (ἐν ξύλῳ) in the sense of a wooden container. And yet, until relatively recently, scholars took ξύλῳ to be the wood of the vine. Diels, for example, wrote, “sensus videtur esse: aqua ex aere, ergo a corticis parte (non a radice) ingressa in vitem et intus putrefacta vertitur in vinum,”<sup>14</sup> but offered no explanation for this or for his concluding command: “noli cogitare de vino in dolio condito.”<sup>15</sup> *Pace* Diels, we know that ξύλον is normally used of wood cut for some purpose, such as burning or shipbuilding. The obvious conclusion, then, is that Empedocles must be referring to wine fermenting in a wooden container like the familiar barrels, hogsheads, butts, and tuns, etc. So argued Wright (226):

<sup>13</sup> M. R. Wright, *Empedocles: The Extant Fragments* (New Haven 1981) 125–226, arguing that φλοιοῦ refers to the grape skin (and flesh), takes ἀπὸ φλοιοῦ as modifying ὕδωρ (= juice) rather than οἶνος; J. Bollack, *Empédocle II* (Paris 1969) 226, takes φλοιοῦ as “sap” (“sève”); and C. Gallavotti, *Empedocle: Poema fisico e lustrale* (Milan 1975) 245, as “foliage” (“pampini”).

<sup>14</sup> *Poetarum philosophorum fragmenta* (Berlin 1901) 137: “the sense seems to be: water from the air, having entered therefore into the vine from part of the bark (not from the root) and putrefied within is turned into wine.” Cf. K. H. A. Steinhart, “Empedokles,” in J. S. Ersch et al. (eds.), *Allgemeine Encyclopädie der Wissenschaften und Künste* (Leipzig 1840) 98; C. E. Millerd (Smertenko), *On the Interpretation of Empedocles* (diss. Univ. Chicago 1908) 88 n.1.

<sup>15</sup> “Do not think of wine stored in a cask.” Diels’ use of *dolium* for a wooden vessel is post-classical.

In wine making, after the pressing, the juice and skins of the grapes are put into wooden casks or vats (which is surely the meaning of ἐν ξύλῳ, for ξύλον is wood cut and put to some use); fermentation is induced spontaneously by the (yeast) particles present [...] on the skin.

This eminently rational (and familiar) account supports and clarifies Wright's translation: "Water from the skin, fermented in wood, becomes wine." Around Wright a consensus has been steadily growing: Mansfeld, Primavesi, McKirahan, Graham, Inwood, and Longo have understandably concurred.<sup>16</sup>

There is, however, one empirical obstacle to that account, unmentioned in the scholarship so far: the ancient Greeks seem never to have used wooden vessels for fermenting wine, but only clay.<sup>17</sup> In contrast with the ubiquitous earthenware, the archaeological evidence for wooden vessels is strictly negative, and of

<sup>16</sup> J. Mansfeld and O. Primavesi, *Die Vorsokratiker* (Stuttgart 2011) 559, agree with Wright most clearly: "Wein ist Wasser, das von der Traubenschale getrennt wurde und anschließend im Holzfass verfault ist." R. D. McKirahan, *Philosophy before Socrates*<sup>2</sup> (Indianapolis 2010) 315, evidently also follows Wright: "Wine is water from grape skin fermented in wood"; likewise D. W. Graham, *The Texts of Early Greek Philosophy* (New York 2010) 379: "wine is juice from the skin fermented in wood"; and B. Inwood, *The Poem of Empedocles*<sup>2</sup> (Buffalo 2001) 131: "wine is water from the skin [of the grape], rotted in wood." O. Longo, "Acqua e vino," in P. Scarpi et al. (eds.), *Storie del vino* (Milan 1991) 15, writes that ἐν ξύλῳ means, "evidentemente, nel legno del tino," so too O. Longo, "Le liquide qui ne fermente pas," in *Le ferment divin* (Paris 1991) 37–46, at 37; but Longo does not cite Wright, and may have reached the same conclusion independently.

<sup>17</sup> So e.g. H. W. Parke, *Festivals of the Athenians* (Ithaca 1977) 107; R. J. Forbes, *Studies in Ancient Technology* III (Leiden 1955) 111 (both without supporting evidence). The closest connection between the early Greeks and cooperage that I have seen is the molecular evidence (from a clay jar) presented by P. E. McGovern, *Ancient Wine* (Princeton 2003) 260–262, which suggests that Minoan wine makers used oak somehow, perhaps a barrel, as McGovern clearly prefers to think, although he admits the exiguous evidence is also consistent with chips or resin.

course we could not expect any to have survived.<sup>18</sup> Yet our proof is no mere *argumentum ex silentio*. Depictions, both pictorial and textual, of wine making and storage in early Greek contexts regularly feature clay vessels but never wooden ones.<sup>19</sup> To be sure, grapes were usually gathered in a wicker basket (τάλαρος, *qualus*, etc.), and elements of the press (ληνός, *torculum*, etc.) were often made of wood, but wine was not left to ferment in basket or press.<sup>20</sup> Upon treading or pressing, the wine was usually funneled first into a capacious and wide-mouthed clay jar called

<sup>18</sup> That is not to say that it is impossible, only extremely rare. See K. D. White, *Farm Equipment of the Roman World* (Cambridge 1975) 143, on ancient *cupae* surviving in Germany and Britain, and now C. Cheung, *Dolia: The Containers that Made Rome an Empire of Wine* (Princeton, forthcoming) 183, for an updated discussion.

<sup>19</sup> For pictorial evidence see e.g. J. H. Oakley, *A Guide to Scenes of Daily Life on Athenian Vases* (Madison 2020) 62 and 88–90, esp. the vintage scene with buried πίθοι dated to ca. 550, fig. 4.5 (Ruhr-Universität Bochum, S 1075); C. Isler-Kerényi, *Dionysus in Archaic Greece* (Leiden 2007) pl. 68 (*Para* 65), 84 (*Addenda* 62); G. M. Hedreen, *Silens in Attic Black-figure Vase-painting* (Ann Arbor 1992) pl. 16.a–b (*ABV* 259.26); F. Lissarrague, *The Aesthetics of the Greek Banquet* (Princeton 1990) pl. 5 (*Addenda* 57), a lively scene by the Gela painter, and 7 (Würzburg 208); the archaic scenes of satyrs pressing grapes into half-buried πίθοι in T. H. Carpenter *Dionysian Imagery in Archaic Greek Art* (Oxford 1986) 86 and 92 with pl. 20.A (*ABV* 151.22) and B (*Para* 65). Textual evidence: e.g. *Il.* 9.469, Hippoc. *Morb.sacr.* 16, Diod. 4.12.3, *Geopon.* 6.3, LSJ s.vv. κέραμος and κέραμος II.1; and for Roman sources, Lucr. 6.233, Columella *Rust.* 12.44.5, Plin. *HN* 35.158–160, Juv. 14.308–309.

<sup>20</sup> Sometimes the shallow trough of the press, in which grapes were trodden or pressed (not the deep vat, ὑπολήνιον or *lacus*, into which must was collected for fermentation) was wooden, as seen on numerous vases studied by B. A. Sparkes, “Treading the Grapes,” *BABesch* 51 (1976) 47–64, e.g. fig. 12 (Brussels R 278). But the wine was immediately drained from those (typically portrayed with spouts, as on the above-mentioned vase) into the fermentation vat or, more commonly, jars (e.g. *Anth.Pal.* 9.403, Cato *Agr.* 113.1). For discussion see J. Yates, “Torculum,” and W. Ramsay, “Vinum,” in W. Smith, *A Dictionary of Greek and Roman Antiquities* (London 1878) 1137–1138 and 1200–1209; Forbes, *Studies* III 111 and 131–138; E. K. Dodd, *Roman and Late Antique Wine Production in the Eastern Mediterranean* (Oxford 2020) 54–59.

a πίθος (*pithus, dolium*),<sup>21</sup> and then, after fermentation, either kept in the πίθος or transferred to a smaller, narrower ἀμφορεύς (*amphora*) for storage or transportation—or put in a still smaller container such as a wineskin (ἄσκός, βύρσα, *uter*).<sup>22</sup> In addition, several authors, possibly starting with Herodotus but otherwise much later, remark on the use of wooden containers for wine in other, typically northern, parts of the world, revealing that they were not completely unknown, but remained unusual even for the Romans until much later.<sup>23</sup> Empedocles of Acragas, a fifth-century Sicilian, could not have offered a general account of wine in terms of something so foreign. Yet fr.81 was understood

<sup>21</sup> Sometimes the fermenting containers, like the presses, were cut out of rock: Diod. 13.83.3 tells of “three hundred πίθοι cut from the rock itself,” belonging to an Acragan of the early third century; Nonn. *Dion.* 12.331–334 has Bacchus carving a μυχός in rock when discovering wine. For vats carved in rock near Acragas (modern Agrigento) see F. De Angelis, *Archaic and Classical Greek Sicily* (New York 2016) 285, 306–307.

<sup>22</sup> See Forbes, *Studies* III 111, 118, and White, *Farm Equipment* 112–115.

<sup>23</sup> Hdt. 1.194 describes what may be palm-wood wine-casks used by Armenians: βίκους φοινικηίους [...] οίνου πλέους, where the reading φοινικηίους, designating palm-wine or Phoenician wine rather than palm-wood (or Phoenician) casks, is preferred by some (cf. the palm-wine at 1.193 and the φοινικηίου οίνου κάδον at 3.20); for comment see S. Morewood, *A Philosophical and Statistical History of the Inventions and Customs of Ancient and Modern Nations in the Manufacture and Use of Inebriating Liquors* (Dublin 1838) 18; R. A. McNeal, *Herodotus, Book I* (Boston 1986) ad loc.; Nelson, *The Barbarian’s Beverage* 139 n.14. Likewise, πέλλαι γὰρ ξύλινοι πίθοι κτλ. is read in the codd. of Pind. fr.104b.5 Snell-Maehler, but Wilamowitz-Möllendorff, “Lesefrüchte,” *Hermes* 34 (1899) 224, corrected it to ξύλινα, which makes much better sense modifying πέλλαι, “milk-pails,” although one can see how a later copyist could have transferred the epithet. Firm evidence: Strab. 5.1.8, 12, on wooden *pithoi* in northern Italy among the Illyrians and Celts; Hdn. 8.4.4, on barrels being used to create a bridge there; and Plin. *HN* 14.132, 16.50, on wooden *vasa* for wine in the Alps and Gaul. On the history of barrels and their absence in the Mediterranean, see Forbes, *Studies* III 111 and 119; White, *Farm Equipment* 142–143, 145; I. Tamerl, *Das Holzfass in der römischen Antike* (Innsbruck 2010); and esp. Cheung, *Dolia* ch. 8, for a current study of the gradual replacement of clay *dolia* by wooden *cupae* etc., including illuminating remarks about the dearth of appropriate wood in the Mediterranean.



by Aristotle and Plutarch to be a general account, as we shall see, and it finds parallels in other general accounts. So Diels was justified after all: we must not think of Empedocles' ξύλον as a cask.

We are left therefore with Empedocles claiming that water becomes wine in the wood of the vine itself, with no mention of the pressing of the grapes or the fermentation of the juice. Two solutions to this paradox have been offered that skirt the obvious conclusion. The simplest is to question the meaning of οἶνος: so Sandbach says that “οἶνος here seems to mean, not wine, but grape-juice.”<sup>24</sup> But this, we shall see, cannot stand. The second solution is to emend the text drastically with van der Ben, so that wine is no longer identified with water in the vine.<sup>25</sup> After all (547),

what comes about in the grapes is *not* wine, but the grapes' juice is used for *making* wine, a process that takes place outside grapevine and grapes. So οἶνος must be replaced with καρπός. Empedocles would never have sacrificed clarity to produce a metaphor that was unhelpful to his exposition, even though very successful in Homer's ἄμπελοι, αἵ τε φέρουσιν / οἶνον ἀριστάφυλον, καὶ σφιν Διὸς ὄμβρος ἀέξει (*Od.* 9.110[–111: “vines, which bear / fine-graped wine, and for them Zeus's rain causes growth”]).

The charity shown to Empedocles is perhaps unsurpassed, but the distrust of the received text is exceptionable on several grounds. The resemblance of fr.81 to Homer's lines, together with the facts that “the words [of the fragment] were clearly

<sup>24</sup> Sandbach ad loc. in *Moralia* XI (Cambridge [Mass.] 1965), endorsed by L. Sensasono, *Plutarcho: Cause dei fenomeni naturali* (Naples 2006) 157 n.24, but rightly doubted by M. Meeusen, *Plutarch's Science of Natural Problems: A Study with Commentary on Quaestiones Naturales* (Leuven 2016) 381.

<sup>25</sup> N. van der Ben, *Empedocles' Poem on Natural Philosophy* I (2019) 102, [https://www.academia.edu/40459174/Empedocles\\_Poem\\_on\\_natural\\_philosophy](https://www.academia.edu/40459174/Empedocles_Poem_on_natural_philosophy), gives the following text and translation for fr.81: οἶνος (...) ἀέξεται ἐν σταφυλῆσι) / καρπός ἀπὸ χθονός, ἣ τρέφει ἀμπέλου ἐν ξύλοι ὕδωρ, “(i.e. the juice used for making) wine: the fruit (in the grapes takes its growth) from the earth, which provides the water in the wood of the vine with the nourishment.”

known to our sources as [Plutarch preserves them],”<sup>26</sup> and that those sources (as we shall see) did not condemn the received text as absurd, might have made van der Ben doubt the self-evidence of his notions about wine and their relevance here.

Most of the other scholars who have dealt with the fragment take the wood to be the living wood of the vine.<sup>27</sup> Among them are two current scholars and two from recent decades, namely Picot, Gemelli Marciano, Gallavotti, and Bollack, who—like most of their predecessors—offered no argument in support.<sup>28</sup> Also noteworthy is Partington’s cursory treatment in *A History of Chemistry*, if only because the author, with a much broader perspective on the history of science than that of most who have written about fr.81, shows no difficulty with the idea that water turns to wine by rotting in the vine, and likewise offers no support.<sup>29</sup> At the same time, the reader must be grateful for the exceptional curiosity of one of Empedocles’ earliest editors, Sturz, who pondered, “Forsitan Empedocles, ut ita sentiret, motus eo est, quod vites vidisset tempore verno lacrymare. Potuit igitur statuere, lacrymas illas vitium, quae in ligno remanent, con-

<sup>26</sup> van der Ben, *Empedocles’ Poem* 546.

<sup>27</sup> Ambiguous are W. E. Leonard, *The Fragments of Empedocles* (Chicago 1908) 41, and K. Freeman, *Ancilla to The Pre-Socratic Philosophers* (Cambridge [Mass.] 1962) 60, the former based on Diels’ second edition, the latter on the fifth; also ambiguous is the translation of A. Laks and G. Most, *Early Greek Philosophy* V.2 (Cambridge [Mass.] 2016) 579.

<sup>28</sup> J.-Cl. Picot, *Empédocle sur le chemin des dieux* (Paris 2022) 290 n.61, draws some support, however, from his account of λιπόξυλος (Emp. fr.21.2, 71.1) as referring to living wood; M. L. Gemelli Marciano, *Die Vorsokratiker*<sup>2</sup> II (Berlin 2013) 247 and 411, notes Diels’ comment and translates, “Wein ist von der Rinde [des Weinstockes] her eingedrungenes, im Holz verfaultes Wasser.” See also Gallavotti, *Empédocle* 245; Bollack, *Empédocle* II 227 and III 524–526; E. Bignone, *Empédocle* (Turin 1916) 459; Karsten, as noted above, read ἀποφλοῖον, a coinage the intended sense of which is revealed in his translation: “vinum est exaestuans humor in vitis ligno putrefactus” (“wine is a foaming liquid in the vine’s wood putrefied”).

<sup>29</sup> J. R. Partington, *A History of Chemistry* I (London 1970) 20–21.

coctas fieri vinum.”<sup>30</sup> Attending to observable characteristics of the grapevine, such as the weeping that Sturz mentions, may indeed help us to better understand fr.81, by bringing us closer to experiences that ancient authors such as Empedocles might have had with the vine (we will return to this below). Finally, in a study of Orphic-Dionysian ideas, Eisler situated fr.81 among intriguing parallels representing wine as a mixture of fire and water and as coming directly from the vine.<sup>31</sup> Curiously, Eisler claimed that the conception shared by Empedocles comes from an ancient tradition of making intoxicating drinks out of tree sap: evidently a wine from ash tree sap, akin to birch beer, was once consumed in ancient Sumer and England—but not Greece.<sup>32</sup> Appealing as this beverage sounds, then, Eisler seems to be barking up a better tree when noting the warming effect of wine and linking Empedocles' φλοιοῦ with Dionysus' cult titles Φλεύς and Φλοῖος, which suggest that the idea of grape wine as “fire-water” coming ἀπὸ φλοιοῦ (whatever its precise meaning) was likely rooted in more immediate experiences.<sup>33</sup>

Before we consider the fragment in light of the rest of what we know about Empedocles' thought, it will be helpful to examine the passages in which Aristotle and Plutarch quote it. First, Aristotle in the *Topics* quotes from it for an example of one sort of erroneous attribution of genus: “Likewise neither is wine

<sup>30</sup> F. W. Sturz, *Empedocles Agrigentinus* II (Leipzig 1805) 627: “Perhaps Empedocles was moved to think this by the fact that he had seen vines weep in springtime. He could therefore conclude that those tears of the vines that remain in the wood, when concocted become wine.” For the watery sap of the vine as δάκρυον ἀμπέλου or *vitis lacryma* see Theophr. *Caus.pl.* 3.15.2; Plin. *HN* 32.71; F. M. Löwenstein, *Lexicon Medico-Galeno-Chymico-Pharmaceuticum* (Frankfurt 1661) s.v. *Rebensafft* (sic); J. S. Heinsius, *Allgemeine Schatz-Kammer der Kauffmannschafft* II (Leipzig 1741) s.v. *lacryma vitis*; Mladenova, *Grapes and Wine* 126–128.

<sup>31</sup> Eisler, *Orphisch-dionysische Mysteriengedanken* 134–135, where Dante (see below) is cited in addition to Goethe (n.2 above).

<sup>32</sup> Cf. the French drink *frénette*.

<sup>33</sup> Note also Φλεών, a name for Dionysus in Ael. *VH* 3.41, and Φλοιώ, a Bacchante in Nonn. *Dion.* 21.80; and see Karsten, *Empedoclis* 236.

rotten water, just as Empedocles says ‘water rotten in wood’: for it is simply not water” (*Top.* 127a17–19).<sup>34</sup> Neglecting to object on the basis of his own distinction between concoction (πέψις, or the composition of substances by heat) and putrefaction (σῆψις, or decomposition by heat),<sup>35</sup> Aristotle more notably raises no objection to ἐν ξύλῳ, but only rejects the claim that wine is water.

Plutarch, for his part, seems to have had no quibble with Empedocles’ account. In the first of two quotations of fr.81, he brings it to bear on the problem of why plants seem to be nourished more by rains than by irrigation (*Quaest.nat.* 912B–C):

The rain-waters’ readiness to change is proven by their putrefactions: for they putrefy more easily than river-waters and well-waters, and concoction seems to be a putrefaction, as Empedocles attests by saying, “Wine is water from bark, rotten in wood.” Or is the readiest and easiest thing to blame the sweet and wholesome character of rain-water, which is immediately driven in by the wind?

Plutarch’s testimony here, combining fr.81 with the following alternative explanation, is important in two regards: first, for the persistent beliefs that water can rot and (despite Aristotle’s efforts) that putrefaction and concoction are the same; second, for the interest in the capacity of a plant—such as the vine—to absorb water from the air, and therefore through the bark.

When Plutarch quotes fr.81 again later in the same work, it is cited in response to the question, “Why does a vine sprinkled with wine, especially with the wine from itself, dry up?” (919D).<sup>36</sup>

<sup>34</sup> Alex. Aphr. and the commentator (n.8 above) add nothing relevant. But cf. Arist. *Mete.* 382b: “the species of water are such as these: wine, urine, whey,” noted by Longo, in *Storie del vino* 15, and Onians, *Origins* 229; and *Metaph.* 1016a, 1044b–1045a.

<sup>35</sup> See *Gen.an.* 777a11, *Mete.* 379b–381b, and G. Freudenthal, *Aristotle’s Theory of Material Substance* (Oxford 1995) 22–23.

<sup>36</sup> The difference between the modern and the ancient conception is revealed again in the Loeb translation, which renders τῷ ἐξ αὐτῆς (“with the [wine] from itself”) as “with wine made from its own grapes”; cf. also Meeusen, *Plutarch’s Science* 465.

Several explanations are offered, including the possibility that wine, being “rotten,” as Empedocles says, may add a heat that damages the vine. Yet Plutarch concludes with another suggestion that sheds further light on our fragment (919D–E):

Or is even this rather contrary to nature for the vine, to receive that which departed from it coming back into it? For of the moisture in plants, that which cannot nourish nor be added to it nor be a part of the plant is filtered out [...]

With this, Plutarch more clearly intimates what the opening question suggests, namely that he would readily understand Empedocles to be speaking of wine as a substance constituted within the vine.

What is clear so far, then, is that Empedocles locates the production of wine not in any wooden fermentation vessel, but in the vine itself, as the putrefaction or rotting of water, and involving bark either as the part in which the liquid is thought to move to the grapes, or as the part through which water is absorbed from the air (or perhaps both). Aristotle and Plutarch have given decisive evidence to support the interpretation followed by most scholars before the end of the last century. For further support of that interpretation, we turn now to a sketch of Empedocles' other relevant doctrines (§3) and then the broader contexts of fr.81 in the poetical and scientific traditions from Homer to Pasteur (§4).

### 3. *Empedocles' doctrines*

The foundation of Empedocles' philosophy is the theory of the four immortal elements, earth, water, air and fire, and their cyclical reunion and dissolution under the alternating powers of Love and Strife.<sup>37</sup> Like most other aspects of his thought, Empedocles' biological theory is founded upon postulated mixtures

<sup>37</sup> For an introduction to Empedocles see W. K. C. Guthrie, *A History of Greek Philosophy* II (Cambridge 1965) ch. 3, or Wright, *Empedocles* 1–86. For a challenge to the representation of the four “elements” that compellingly dwells on their divine multifariousness (such that water becoming wine is perhaps still more plausible), see Picot, *Empédocle* ch. 13.

of those four elements, combining through Love but developing articulated forms through a productive tension between Love and Strife.<sup>38</sup> The formation of plants and animals results from the action upon earth of water and fire in particular, the latter serving to thicken, harden, and draw upwards.<sup>39</sup> Central to this theory, both on its own and as an anticipation of later theories, is the role of heat in the formation of each nature.

From the earth in which the other elements are differentially mixed following a period of perfect cosmic union, Empedocles evidently thought that trees “grow from the heat in the earth separating off, so that they are parts of earth, just as the embryos in the stomach are parts of the womb” (Aët. 5.26.4). Thanks to Aristotle’s and Theophrastus’ criticism of Empedocles’ account of plant growth, we learn that he explained the downward growth of the roots as driven by the downward motion of earth, and, contrariwise, the upward growth of shoots, etc., as driven by fire.<sup>40</sup> “Fruits,” accordingly, “are excesses (or residues) of the water and fire in the plants” (Aët. 5.26.4), propelled upward through the plant and out of the branches by fire’s domination of the mixture.<sup>41</sup> Moreover, fire’s role, in moving upward and

<sup>38</sup> See e.g. fr.96, Arist. *De an.* 408a, and Guthrie, *History* ch. 3.L.

<sup>39</sup> See fr.62 (“whole-natured forms [...] having a share of water and fire,” emerging from the earth when “fire sent them upward”), 96 (bones made of earth, water, fire), 98 (all four elements producing blood and flesh), 9 (for an emphasis on fire’s role in birth and death), and P.Strasb.gr. inv. 1665–6 d.11–18 (for a related account of fire’s role in zoogony); see also Aët. 5.27.1 (concerning the growth of animals due to heat). Cf. K. Freeman, *The Pre-Socratic Philosophers: A Companion to Diels, Fragmente der Vorsokratiker* (Oxford 1949) 193, and C. Ferella, “Empedocles and the Birth of Trees: Reconstructing P.Strasb. Gr. Inv. 1665–6, ens. D–F 10B–18,” *CQ* 69 (2019) 75–86.

<sup>40</sup> Arist. *De an.* 415b28–416a9; Theophr. *Caus.pl.* 1.12.5. Their criticism concerns his alleged failure to present a unified origin of growth. Aristotle speaks of πῦρ, Theophrastus of αἰθήρ (probably not giving an alternative or supplementary account, but only identifying αἰθήρ with πῦρ).

<sup>41</sup> Karsten, *Empedoclis* 463 n.223, paraphrases this as describing “concocti humoris effluvium” (“effluvium of concocted liquid”), “[s]icut ipse Empedocles vinum appellat” (“just as Empedocles himself calls wine”).

outward and solidifying the outer layers of things,<sup>42</sup> makes it conceivable that Empedocles thought it was in the bark of the vine especially that water is putrefied by heat into wine.

Of course, fruits are not mere excesses or waste, like excrement.<sup>43</sup> Fruits are rather analogous to eggs, as “tall trees egg-lay (ῥοτοκεῖ) olives first” (fr.79). Praised by Aristotle (*Gen.an.* 731a1–6), the analogy implicit in the metaphorical ῥοτοκεῖ is noteworthy for our purposes, because it shows Empedocles theorizing fruit as a plant’s direct offspring, with its nature already established; grapes were presumably thought of along the same lines. Related evidence comes in Aristotle’s subsequent criticism of Empedocles for describing milk as πύον (“pus”), and therefore as “rotten” blood, since Empedocles again confuses concoction with putrefaction.<sup>44</sup> The analogy of milk as “pus” with wine as “rotten water” suggests that the juice of the grape was conceived as being the essential nutriment provided by—after “rotting” in—the parent plant. And the paradox in these descriptions of milk and wine is softened by Galen’s testimony that Empedocles regarded all digestion as a sort of “rotting.”<sup>45</sup>

The water that mingles with the fire, creating the juice and then the fruit, is naturally drawn up from the roots, but also from the surrounding air (presumably as rain, dew, or humidity). Plutarch reports, “Plants are preserved unperceivingly from the atmosphere (ἐκ τοῦ περιέχοντος), as Empedocles says, by drawing

<sup>42</sup> For contextualization see A.-L. Therme, “Les vivants, empreintes de leur biotope dans les zoogonies d’Anaximandre et Démocrite,” *Cahiers philosophiques* (forthcoming), and S. Trépanier, “Empedocles on the Origin of Plants: *PStrasb. gr. inv.* 1665–1666, Sections d, b, and f,” in C. Vassallo (ed.), *Presocratic and Papyrological Tradition* (Berlin 2019) 271–297.

<sup>43</sup> Cf. Freeman, *The Pre-Socratic Philosophers* 193, and Partington, *History* 21.

<sup>44</sup> Fr.68, following Aristotle and Wright: Arist. *Gen.an.* 777a presents the fragment as containing a metaphor of putrefaction, and πύον is the only candidate; as Wright, *Empedocles* 221, observes, one may see in πύον a pun on πύος (“beestings”), rather than taking πύον as a variant of πύος (so D.-K., LSJ); cf. Gallavotti 239. See Arist. *Mete.* 379b for comparison of πύον and γλεῦκος (“must”).

<sup>45</sup> *De def. med.* 99 (XIX 372 Kühn), cf. 31 A 77 D.-K. and Pl. *Phd.* 96B2–3.

suitable water” (*Quaest.conv.* 688A). Plutarch’s “from the atmosphere” cannot belong to Empedocles’ own words, but indicates that he took Empedocles to refer to the surrounding air.<sup>46</sup> Theophrastus indicates the same when quoting one of the Empedoclean compounds that play unusually upon his own name, namely ἐμπεδόκαρπα (“ever-fruited,” fr.78): according to Theophrastus, Empedocles attributed such vegetal flourishing to “a certain mixture of the air” (*Caus.pl.* 1.13.2).<sup>47</sup> This would support the interpretation of fr.81 according to which ἀπὸ φλοιοῦ relates to airborne water passing “from bark” into wood.

At the same time, it is reported that Empedocles held the distinct characters of different soils responsible for the distinct characters of wines: Aëtius (5.26.4) reports that Empedocles thought that

the differences among juices arise as alterations of the multipartite nature <of earth> and of plants, since they draw in different ways the homoeomerics from what nourishes them, just as in the case of vines: for the differences among these do not make wine good, but the differences of the soil nourishing it.

It is not clear how to reconcile Aëtius’ report with the evidence just discussed, but I would hesitantly note for now that while Aëtius is speaking of differing wines, the account suggested by the other evidence may concern wine *qua* wine.

The tension between the two schemes—i.e., taking the water that becomes wine to come either from the earth through the roots or from the air through the bark—brings us back to the problem of the word φλοιός. As noted above, some scholars have

<sup>46</sup> Besides not making position, the term came into use only later. τὸ περιέχον is commonly translated as “the environment,” but this is often misleading, since it usually denotes ὁ περιέχων ἀήρ (“the surrounding air”) or αἰθήρ (“aether”): see LSJ s.v. περιέχω and L. Spitzer, “Milieu and Ambiance: An Essay in Historical Semantics,” *Ph&PhenR* 3 (1942) 2–5; and cf. Plutarch’s own usage at e.g. *Adv.Col.* 1123C and *De fac.* 933E, 938A–B, 941F.

<sup>47</sup> The other compound is ἐμπεδόφυλλα (“ever-leafing,” fr.77); Plut. *Quaest.conv.* 649C, relates it to Empedocles’ notion that evergreens have “a certain symmetry of pores” that absorb and release nutriment.



argued that φλοιός in fr.81 designates not bark but either “skin” (Wright) or “foliage” (Gallavotti) or “sap” (Bollack). Their arguments rely on fr.80, a sadly incomplete sentence:

οὔνεκεν ὀνίγονοι τε σίδαι καὶ ὑπέρφλοια μῆλα

wherefore both late-born pomegranates and *hyperphloious* apples

In the ambiguous *hapax* ὑπέρφλοια, the prefix, ὑπέρ-, is clear enough; the second element, -φλοια, less so. Analogous compounds rely primarily on the commonest meaning of φλοιός, which would make this “super-barky”; the remaining analogous forms seem to relate to rind or skin,<sup>48</sup> giving us “super-rindy” or “super-skinned.”<sup>49</sup> However, since φλοιός itself derives from φλοῖω (LSJ “burst out, swell, be in full vigour or bloom”), which in turn derives from φλέω (“to teem with abundance”), some have been inclined toward meanings that seem more appropriate to “teeming” or “swelling” fruit. Plutarch, who also preserves fr.80, encourages this: puzzling over Empedocles’ ὑπέρφλοια apples, he provides two possible explanations: either (i) the compound uses φλοιός to designate, as the rarer form φλόος allegedly does, “the freshness and bloom of the fruits [...] since the freshness and bloom remain in the apple most of all fruits,” or (ii) it uses ὑπέρ- in a spatial sense and refers, as Plutarch’s grandfather suggests, to the apple’s unusually “rindy” core that surrounds the seeds and is in turn surrounded by the flesh, so that ὑπέρφλοια would refer to the apple’s flesh being “over-the-rind.”<sup>50</sup> His grandfather gained no followers, but the first option inspired various translations more appropriate to ripe fruit, such as “luxuriant” or “rigogliosi” (LSJ, Gallavotti), “succulent” (LSJ, Wright), “débordent de suc” (Bollack), “übersaftig” (Diels-

<sup>48</sup> Cf. γεραίοφλοιος, δασύφλοιος, κακόφλοιος, λαχύφλοιος, λευκόφλοιος, ῥυτιδόφλοιος, τραχύφλοιος, ὑγρόφλοιος.

<sup>49</sup> A. Willi, *Sikelismos: Sprache, Literatur und Gesellschaft im griechischen Sizilien* (Basel 2008) 211, translates hesitantly: “mit einer Schale überzogen(?)” So also Laks and Most, *Early Greek Philosophy* V.2 577 (“thick-skinned”).

<sup>50</sup> *Quaest.conv.* 683F, 684A–B. For φλόος, a rarer form of φλοιός that normally means “skin,” Plutarch cites Arat. *Phaen.* 335.

Kranz). As noted above, Wright then applied the meaning “skin” to φλοιός,<sup>51</sup> while Gallavotti argued that it denotes the luxuriant foliage,<sup>52</sup> and Bollack the sap. These three proposals are not unattractive, but because the majority of our evidence leads us to think that φλοιός refers to bark, it seems safest to conclude that it does so in fr.81. Nevertheless, the considerations behind those proposals contain a valuable lesson: as the etymology suggests, this bark may be most appropriately conceived as vigorous and teeming with liquid. This would allow ἀπὸ φλοιοῦ to modify either the water, as being absorbed into the wood “from bark,” or the wine, as coming “from bark” that carries it into the grapes.

This brings us back to Sturz’s suggestion that Empedocles may have been thinking of the “tears” of vines. Either from fresh cuts to the shoots or the bark, or through the cuts from the prior season’s pruning, vines may weep a more or (in the latter case, which is the vernal phenomenon Sturz mentions) less watery sap. This would give another reason for Empedocles’ notion that wine, as water rotten in wood, comes from bark. But further considerations along these lines belong to what follows.

Finally, there remain several tantalizing clues for Empedocles’ further treatment of wine, which reveal a prominence in his thought that may attest to the seriousness of his account in fr.81. Another Empedoclean compound, ἀμπελοβά[ωνα (“vine-mounting”), describes the missing final member of a series of phenomena that Empedocles promises to adduce as proofs of his doctrine.<sup>53</sup> Fr.91 notes the propinquity of wine and water:

ὔδωρ οἴνω μᾶλλον ἐνάρθμιον, ἀντάρ ἐλαίω  
οὐκ ἐθέλει...

water is more inclined to unite with wine, but with oil  
it does not want...

<sup>51</sup> Wright is endorsed by Meeusen, *Plutarch’s Science* 382.

<sup>52</sup> Gallavotti’s translation (59): “dal rigoglio (degli acini) diventa vino l’elemento dell’acqua suppurata dentro i tralci.”

<sup>53</sup> *P.Strasb.gr. inv.* 1665–1666, a(ii) 28, where Martin and Primavesi fill the rest of the line with βότρυν (“grape-cluster”); οἴνον also makes position.

Unfortunately, as Aristotle complains with apparent reference to this text, Empedocles' account of how water mixes with wine (and how anything mixes with anything else) is unclear (*Gen.an.* 747a34–b8). Porphyry observes that Empedocles' vision of a prior, pristine age ruled by Aphrodite (fr.128) involves sacrifices that are wineless (νηφάλια, *Abst.* 2.20).<sup>54</sup> By analogy with Empedocles' vegetarianism, this could imply a proscription of wine; yet an anecdote of Empedocles as a guest at a symposium in which wine is served (Diog. Laert. 8.64), in conjunction with the absence of any negative characterization of wine elsewhere in his fragments or testimonia, suggests the opposite. It seems that Empedocles did not anticipate the later doctrine concerning the propinquity of wine and *blood*.<sup>55</sup> One might also wonder which Empedoclean verses Aristotle had heard recited by uncomprehending people drunk on wine (*Eth.Nic.* 1147a18–21, b12)—but it was presumably not the commonsensical fr.81. Lastly, can it be coincidence that the Strasbourg papyrus of Empedocles is stained by drops of a liquid either amber or red?<sup>56</sup>

In this section, we have seen that Empedocles held that fruit is formed from a mixture of fire and water propelled upward through the wood of the plant by fire's natural motion; that he spoke of the importance of water absorbed through the bark as well as the influence of the soil; and that comparison with Empedocles' use of ὑπέρφλοια suggests that ἀπὸ φλοιοῦ, when construed as meaning “from bark,” likely evokes a bark full of liquid, and may apply either to the water or to the wine. Together, these features reinforce a simple account of wine as

<sup>54</sup> Note that νηφάλια also required νηφάλια ξύλα, i.e. both wine and the burning of vine wood were excluded, according to Crates and Philochorus as reported by the scholion to Soph. *OC* 100 (*FGrHist* 362 F 4, 328 F 194).

<sup>55</sup> On that doctrine see J. Jouanna, *Greek Medicine from Hippocrates to Galen* (Leiden 2012) 184.

<sup>56</sup> For “ambrée, variant selon les endroits d'un jaune clair à un orange prononcé,” see A. Martin and O. Primavesi, *L'Empédocle de Strasbourg* (Berlin 1999) 3; for red, R. Janko, “Empedocles, On *Nature* I 233–364: A New Reconstruction of *P. Strasb. gr. Inv.* 1665–6,” *ZPE* 150 (2004) 5–6.

formed by the alteration of water through an admixture of fire in the vine. In the next section, we will see that each of the principal aspects of Empedocles' account is echoed in—or itself echoes—other authors, beginning already with Homer.

#### 4. *Empedocles' contexts from Homer to Pasteur*

Representations of wine as deriving directly from vines, with little or no mention of grapes, are found easily in Greek poetry, including Empedocles' predecessors and contemporaries. Simonides says that “new wine does not yet put to the test last year's gift of the vine” (fr.602 *PMG*). Pindar condenses the notion into characteristically bold phrases: wine is “child of the vine” (*Nem.* 9.52), indicating that the nature of wine is inherited directly from the vine, and “dew of the vine” (*Ol.* 7.2), intriguingly linking it with dew.<sup>57</sup> Two of the best pieces of evidence, both dealing with Polyphemus the Cyclops, have been debated and demand closer analysis.

We have already seen the Homeric Cyclopes' “vines, which bear / fine-graped wine.” As with Empedocles, some have suggested that this οἶνος must be unfermented juice or grapes.<sup>58</sup> This is clearly motivated by Polyphemus' susceptibility to the wine Odysseus provides and by Euripides' representation of Polyphemus as being entirely ignorant of the stuff. Yet in Homer the particular wine given to the Cyclops is described by Odysseus as

<sup>57</sup> See the helpful list of parallels to *Nem.* 9.52 in B. K. Braswell, *A Commentary on Pindar Nemean Nine* (Berlin 1998) ad loc., and add to Braswell's list *Anacreont.* 56.7 West, *Ach. Tat.* 2.2.3. On *Ol.* 7.2, W. J. Verdenius, *Commentaries on Pindar I* (Leiden 1987) ad loc., remarks that wine seems to have been “regarded as a ‘pregnant’ form of water.”

<sup>58</sup> F. H. Stubbings, “Food and Agriculture,” in *A Companion to Homer* (London 1962) 524, wonders whether οἶνος in this context may “only mean *grapes*.” A. Heubeck and A. Hoekstra, *A Commentary on Homer's Odyssey II* (Oxford 1989) ad loc., are right to deny Stubbings' suggestion, but misleadingly comment, “The ἄμπελοι yield (= allow to grow) wine from excellent grapes.” See also Nelson, *Barbarian's Beverage* 4, 119 n.7. Note the priority in the phrasing: wine is the direct object, and it is not the grapes that are fine-wined, but the wine that is fine-graped.

incredibly strong, being normally diluted with water at a ratio of 1:20 (*Od.* 9.209–210); and Polyphemus himself, having referred to the wine that the island produces, exalts the wine Odysseus gives him as ambrosial and nectareous (9.357–359), and, when recounting what happened, speaks of being overpowered by wine (516) in a manner inconsistent with the Cyclopes' ostensible ignorance.<sup>59</sup> The easiest solution is therefore that Polyphemus, knowing only a weaker and unsavory wine from untended vines, was unprepared for such a supernacular drink.<sup>60</sup> We conclude that the Cyclopes' vines do in fact bear wine.

In Euripides' *Cyclops*, on the other hand, the titular character is definitely unacquainted with wine when the play begins. One particular response from Polyphemus, newly schooled in the divine drink's basic features, provides the best contemporary parallel for Empedocles' use of ξύλον—and for the confusion arising from the usual sense of ξύλον mixed with an anachronistic understanding of wine.<sup>61</sup> Earlier in the play, Odysseus related that when he first offered the wine, he said to Polyphemus that it comes “from vines” (*Cyc.* 414). Later, after drinking more, Polyphemus echoes this derivation from the vine, exclaiming

παπαί, σοφόν γε τὸ ξύλον τῆς ἀμπέλου. (572)

Hoo-wee, the wood of the vine is wise indeed.

When earlier scholars comment on this line, some pause only over σοφόν, but some indicate that they understand this to be about the vine that produces wine, as in Paley's paraphrase: “Ah! a clever tree was that, which bore the grape!”<sup>62</sup> Recent scholars,

<sup>59</sup> Cf. Kourakou-Dragona, *Vine and Wine* 5.

<sup>60</sup> To borrow a word from Stubbings; see *OED* s.v. “supernacular.” Cf. L. Gorton, *Through the Grapevine: Tracing the Origins of Wine* (diss. Ohio State Univ. 2014) 62 n.78; C. Vandermersch, *Vins et amphores de Grande Grèce et de Sicile IV<sup>e</sup>–III<sup>e</sup> s. avant. J.-C.* (Naples 1994) 25; and R. A. S. Seaford, *Euripides: Cyclops* (Oxford 1984) ad 121–124.

<sup>61</sup> For another outstanding contemporary parallel, note the generative power of the rotting ξύλον in Antiph. fr.15 Pendrick.

<sup>62</sup> F. A. Paley, *Euripides, with an English Commentary* III (London 1860) ad loc.

in contrast, have puzzled and even despaired over what this could possibly mean. First, Arnott ventured an imaginative pair of explanations: “ξύλον refers partly to the woody rod of the vine which supports the grape-bearing branches, and partly to the ξύλον as an instrument of punishment.”<sup>63</sup> Ussher, after insightful remarks supporting the prior consensus, grants that Arnott may be right.<sup>64</sup> O’Sullivan and Collard, understanding “wood of the vine” as a kenning for wine, write more cautiously that “no interpretation of ξύλον (‘wood’) so far offered seems completely convincing, given the lack of comparable uses of the word to cast any light on its appearance here.”<sup>65</sup> Finally, Hunter and Laemmle likewise despair.<sup>66</sup> But this aporia is readily soluble in

See also P. B. Shelley, *The Cyclops of Euripides* (Oxford 1882) 19, and the Loeb translations of A. S. Way, *Euripides II* (London 1912) 577, and, bucking the recent trend, D. Kovacs, *Euripides. Cyclops Alcestis Media* (Cambridge [Mass.] 1994) 127. For commentary see J. G. C. Höpfnér, *Euripidis Cyclops* (Leipzig 1789) 214: “Herrlich ist der Rebensaft. Wein is doch ein herrlich Getränke” (n.b. that *Rebensaft* [“vine-sap”] had become a poetical term for wine, but was originally applied, like *Rebenwasser*, to the sap of the vine or the *lacryma vitis*; see n.30 above); J. Paterson, *The Cyclops of Euripides* (New York 1900) ad loc.: “‘Sage and savory’. Compare Omar Khayyam, ‘The twisted tendril ... a blessing we should use, should we not?’”; J. Henson, *The Cyclops of Euripides* (London 1902) ad loc.

<sup>63</sup> W. G. Arnott, “Parody and Ambiguity in Euripides’ *Cyclops*,” in R. Hanslik et al. (eds.), *Antidosis: Festschrift für Walter Kraus* (Vienna 1972) 28.

<sup>64</sup> R. G. Ussher, *Euripides: Cyclops* (Rome 1978) ad loc., first remarks: “In the *Cyclops*’ view it takes on the attributes of the man who claims knowledge of it (567). τὸ ξύλον ... ἀμπέλου, i.e. ἡ ἄμπελος [...] ξύλον, of *live wood* [...] as commonly in Theophrastus (*HP I 2. 6*).” Likewise Seaford, *Euripides* ad loc., says that perhaps Arnott is right about the club, after commenting helpfully “that Po. may be projecting his new mental state onto the wine.”

<sup>65</sup> P. O’Sullivan and C. Collard, *Euripides: Cyclops and Major Fragments of Greek Satyric Drama* (Oxford 2013) ad loc.

<sup>66</sup> R. Hunter and R. Laemmle, *Euripides: Cyclops* (Cambridge 2020) ad loc., suggest that emending it to “an expression with ῥοή would suit very well,” so as to speak of the “vine’s stream” as at *Cyc.* 123 (ἀμπέλου ῥόας) and *Bacch.* 281 (ἀμπέλου ῥοῆς); note incidentally that LSJ s.v. ῥοή gloss the Euripidean phrase with “the juice of the grape.”

combination with fr.81: just as earlier scholars had it, Polyphemus is praising the “wood of the vine” as the remarkably wise maker of wine.

Roman poets provide similar evidence, but two will suffice for our purposes here. Lucretius speaks of wine as the “fluid of vine-born (*vitigeni*) liquor” (5.14–15, cf. 6.1072). In the *Appendix Vergiliana* we read that “not yet does the little vine swell with sweet Bacchus” (*Lydia* 12).<sup>67</sup>

Their poetical contexts might discourage us from taking these passages as evidence of anything but metonymy (i.e., “vine” instead of “grapes”) or synecdoche (“vine” standing in for “vine and grapes”). And, to be sure, there must be some synecdoche at least, of the sort that seems common enough still in oenological discourse. However, more prosaic sources attest more clearly to the notion that the vine-stock is the source of the wine.

Sad to say, the “shipwreck of antiquity” lost many prose works that must have touched on our problem. One notes with particular dismay the absence of anything from Democritus, who reportedly claimed to know all of the types of vines in Greece,<sup>68</sup> and the scanty remains of the Peripatetic research program on wine and drunkenness.<sup>69</sup> Among those extant, one especially illuminating and presumably influential discussion is found in Plato's *Timaeus*, where the eponymous speaker categorizes wine among the other juices, distinguishing it as being one

<sup>67</sup> Cf. Pentadius 2.15 and Nonn. *Dion.* 12.298–301.

<sup>68</sup> Plin. *HN* 14.20.

<sup>69</sup> See M. Petrova, “Aristotle on Wine and Intoxication,” in A. P. Mesquita et al. (eds.), *Revisiting Aristotle's Fragments* (Berlin 2020) 83–89; W. W. Fortenbaugh, “On *Problemata* 3: Wine-Drinking and Drunkenness,” in R. Mayhew (ed.), *The Aristotelian Problemata Physica* (Leiden 2015) 100–101; M. G. Sollenberger, “Identification of Titles of Botanical Works of Theophrastus,” in W. W. Fortenbaugh et al. (eds.), *Theophrastean Studies III* (New Brunswick 1988) 18. For other lost treatises see Plin. *HN* 14.120; K. D. White, *Roman Farming* (Ithaca 1970) 14–40; Dodd, *Roman and Late Antique Wine Production* 17–22.

of the few “fiery” juices,<sup>70</sup> and, among these, as being uniquely able to heat both the body and the soul (*Ti.* 59E–60A):

Indeed most forms of water that are mixed with each other—the whole genus of those distilled through the plants from the earth, the so-called juices (or saps, *χυμοί*)—since, on account of the mixtures they are dissimilar, they produce many sorts that are nameless, but four forms, which are fiery (*ἔμπυρα*) and have become especially conspicuous, have received names: the one capable of heating the soul along with the body is wine...

Unique as it is, wine is not alone in being “distilled” through a plant from the earth, nor in being “fiery,” and the pithy account strongly suggests that wine was thought to gain its capacity to heat the soul already within the vine. So much is suggested also by Posidonius: “For wine is nothing other than water endowed with qualities by a vine (*ὕδωρ ὑπ’ ἀμπέλου πεποιωμένον*).”<sup>71</sup> Galen, discussing the difference between watery wine and the stronger stuff, says, “Watery wine has had the least alteration in the wood of the vine (*ἐν τῷ ξύλῳ τῆς ἀμπέλου*).”<sup>72</sup> Even Galen thus echoes Empedocles and Euripides’ Polyphemos by speaking of water becoming wine in the *ξύλον* of the vine.

After this and the evidence seen above (§2) from Aristotle and Plutarch, it may suffice to note that the Latin species name still in use for the common grapevine traces as far back as the first century CE, namely *Vitis vinifera*, which in turn is a calque of a Greek phrase that is found already in Dioscorides, *ἄμπελος οἰνοφόρος*: that is, not the “grape-bearing,” but the “*wine*-bearing vine.”<sup>73</sup> Current scientific terminology thus preserves the basic

<sup>70</sup> The others are *ἔλαιον* (“oil,” esp. of the olive), *μέλι* (“honey”), and *ὀπός* (“the acid juice of the fig-tree, used as rennet,” LSJ), which appears in similes of curdling milk in *Il.* 5.902 and Empedocles fr.33.

<sup>71</sup> Fr.309a Theiler, amid an interesting discussion about digestion. Posidonius is echoed verbatim by Nemes. *Nat.hom.* 1.8, and less completely by [Zonar.] *Lex.* s.v. *οἶνος*.

<sup>72</sup> *In Hippoc. Acut.* 3.36 (XV 669 K.). Cf. Athen. 32A.

<sup>73</sup> *Mat.med.* 4.181.1, 5.1.1; see also Oribasius *Coll.med.* 11.1.40. The nomen-



notion seen already in Homer, and in Latin terms found together already in late antiquity. But earlier Romans, too, thought that wine comes from the vine, as we saw in Lucretius and in the first epigraph above from Varro, who etymologizes further in this connection, proposing that “*vindemiator* (‘grape-gatherer’) is said either because he gathers *vinum* (‘wine’) or because they *demunt* (‘gather’) it from the *vitis* (‘grapevine’)” (*Ling.* 5.94), and likewise “*vitis* (‘grapevine’), because it is the origin of *vinum* (‘wine’)” (5.102).<sup>74</sup> The regular silence concerning the grape, its pressing, and the fermentation of its juice, is of course almost incredible from a modern perspective.<sup>75</sup>

Some ancient authors, on the other hand, did attend more to the changes apparently brought about by the ripening of the fruit as well as those effected after pressing and through fermentation, but the general emphasis remained on the vine and the fruit as formed upon it.<sup>76</sup> This is neatly shown by Cornutus, in

clature originally distinguished the plant not from other grapevines (as the distinction between *vitis vinifera* and *vitis labrusca*), but from similar climbing plants; see LSJ s.v. ἄμπελος. The earliest use that I have found of the Latin is in [Apul.] *Herb.* 67.10, where we read *vinifera vitis* (in reverse order). The name long remained in use, as e.g. G. Horst, *Herbarium Horstianum* I (Marburg 1630) 219, 285, gives both *vitis vinifera* and ἄμπελος οἰνοφόρος; but current use was established by C. Linnaeus, *Species Plantarum* (Stockholm 1753). Cf. *Raphia vinifera*, whose sap becomes palm-wine.

<sup>74</sup> See also Lucretius’ apparently punning *vini vis*, 3.474. On the derivation of *vitis* from *vinum* Varro is followed by Horst, *Herbarium* 219; and Rabelais refers to the derivation of *vinum* from *vis* in discussing how “de vin divin on devient” (*Pantagruel* 5.44). Cf. also Trimalchio’s *vita vinum est* (Petron. *Sat.* 34.7), discussed by Onians, *Origins* 216, 227.

<sup>75</sup> That is not to say that grapes are not commonly mentioned, even as the immediate source of wine (as in e.g. Eur. *Bacch.* 279), or that they are never implicitly included in references to the synecdochic vine. The (mostly Roman) agricultural authors often focus on the grape, as one would expect, and the preservation of must as such, yet, being characteristically practical and not often indulging in theoretical asides, they do not offer any clear evidence (to my mind) for or against my argument; further study is needed.

<sup>76</sup> One outstanding passage is Aesch. *Ag.* 970–971, where Clytemnestra

his allegoresis of the myth of Dionysus' two births, first from his mother Semele, before she was incinerated by Zeus' thunderbolt, then from Zeus' thigh, where he had been hidden for the remainder of gestation; accordingly, wine's

first birth is the one through the ripening of the fruit, which occurs when the sun's heat is at its peak, and the second is the one through the treading (of the grapes), when it is squeezed out by the feet.<sup>77</sup>

Fermentation after pressing is again ignored, and the basic assumption is unmistakable: the nature of wine is formed within and upon the vine.

When other authors, such as Aristotle, Theophrastus, Pliny, and Galen, discuss the alteration that occurs during fermentation, that alteration is not presented as a fundamental transformation of the wine. Like many other biological products, wine was thought to be naturally warm, and in fact its characteristic effects were thought to result from its peculiar sort of innate heat (recall Plato).<sup>78</sup> What we single out as fermentation was held to be another natural stage of the maturation of the wine, when its innate heat overpowered the other elements and thereby increased or at least became more manifest.<sup>79</sup> Pre-modern ignorance of yeast fostered a firmly-rooted assumption that wine was an autonomous and healthy development of the juice expressed by the vine into the fruit.<sup>80</sup> By contrast, wine's turning

speaks of "when Zeus makes (τεύχει) wine from the bitter unripe grape" ἄπ' ὄμφακος πικρᾶς / οἶνον. And in Eur. *Alc.* 757 a servant speaks of the "unmixed wine of a black mother," μελαίνης μητρὸς εὔζωρον μέθυ.

<sup>77</sup> *Theol. Graec.* 30.58–59. Cf. Diod. 3.62.5, where he is born first ἐκ γῆς, then ἐκ τῆς ἀμπέλου.

<sup>78</sup> See e.g. [Arist.] *Pr.* 876a4–6.

<sup>79</sup> See e.g. Gal. *Nat. Fac.* 2.9.135. I think this is how we must interpret Plin. *HN* 23.45: "Let us recall that [wine] is juice which by fermenting has made powers for itself from must (*ferendo vires e musto sibi fecerit*)." Cf. *HN* 14.83.

<sup>80</sup> The assumption that wine's fermentation is a result of its nature is made still clearer in contrast with beer, esp. as discussed in Theophr. *Caus. pl.* 6.11.2,

into vinegar was considered a decomposition or putrefaction that spoiled the nature of the wine.<sup>81</sup>

Yet perhaps the most striking evidence for the ancient understanding of wine comes in two discussions from learned authors who puzzle over the surprisingly rare observation that γλεῦκος or *mustum* (“new wine” or “must,” i.e. the juice when freshly pressed or even after fermentation)<sup>82</sup> is the *least* intoxicating sort of wine.<sup>83</sup> Given the common practice of tasting the freshly pressed must (and eating grapes), it is astonishing that so few ancient authors observed its lesser potency; remarkably, some even represent the must immediately after pressing as producing drunkenness.<sup>84</sup> But two texts clearly register the difference: the first is by Plutarch and the second by Macrobius, who copies Plutarch almost exactly. Plutarch sets the stage for a discussion

where beer’s “rotting” involves a departure from the grain’s nature; for the contrast between wine and beer and further references see Nelson, *Barbarian’s Beverage* 36, 80, and “To Your Health! The Role of Beer in Ancient Medicine,” in W. H. Salazar (ed.), *Beer* (New York 2016) 3–6.

<sup>81</sup> E.g. Arist. *Metaph.* 1044b31–34, Theophr. *Caus.pl.* 4.7.5–6.

<sup>82</sup> Note that *mustum* is, in origin, a shortened form of *vinum mustum* (“new” or “young wine”) as in Cato *Agr.* 115.1; as the marked member of the pair, it could be contrasted with normal *vinum*.

<sup>83</sup> These are the only two discussions I have found, but from Plutarch’s reference to Aristotle (see below) we know that Aristotle discussed the problem. Cf. S. Morala Fernández, *El vino y la vid en la antigua Grecia* (Madrid 2019) 192. There is a related problem in *Mete.* 387b9–14, where Aristotle writes that ὁ γλυκὺς οἶνος (“sweet wine”), though called wine, neither tastes winey nor intoxicates. This γλυκὺς οἶνος has been mistaken by some as a synonym of γλεῦκος and therefore as proof that Greeks recognized that must is not yet wine: so Kourakou-Dragona, *Vine and Wine* 43, and E. Lewis, *Alexander of Aphrodisias, On Aristotle’s Meteorology 4* (Ithaca 1996) 144 n.233. This thorny passage from Aristotle demands a separate treatment, but note that at e.g. *Mete.* 379b30, 380b32, 384a5, and 385b3, he uses γλεῦκος apparently to denote something distinct from γλυκὺς οἶνος, and see LSJ s.v. γλυκὺς II.a.

<sup>84</sup> Nonn. *Dion.* 12.197–206, 360–397; Nemes. *Ecl.* 3.41–54; *Anth.Pal.* 11.64. Note also γλευκοπότης (“must-drinker”), used of Satyrs (*Anth.Pal.* 6.44) and Pan (*Anth.Plan.* 16.235). Plin. *HN* 14.17 jests(?) that grapes preserved in must *vinu suo inebriantur*, “are drunk on their own wine.”

of the problem of “why new wine (τὸ γλεῦκος) is least intoxicating” at a symposium during the Theban equivalent of the Pithoigia, the “jar-opening” festival (*Quaest.conv.* 655E–F):

So my father performed the sacrifice as usual, and after the meal, when the wine was being praised, he proposed to the philosophical lads among us to seek an account of how new wine is least intoxicating. To many of us then this seemed a paradox and incredible.

Yet four explanations are readily supplied: (i) new wine is so cloyingly sweet that one simply cannot consume enough to become intoxicated; (ii) sweetness combats drunkenness (as bread and honey are said to be given to those who have had too much to drink), so that the sweetness of new wine counteracts its other effects;<sup>85</sup> (iii) new wine is heavy and therefore, according to Aristotle,<sup>86</sup> passes more quickly through the stomach and has less time to intoxicate; and (iv) new wine contains much air and water, of which the former is released during fermentation and the latter through aging. Plutarch notably presents the third and fourth explanations as being the more obvious, but casts doubt upon none. Macrobius (*Sat.* 7.7.14–20) only alters the setting, and unambiguously focuses upon the effects of *mustum* immediately after pressing. No one in Plutarch’s or Macrobius’ account suggests that wine’s power to intoxicate derives from a substantial change during fermentation.<sup>87</sup>

In the epochs that follow, many more authors display the same basic notions we have found in fr.81. Augustine of Hippo and Romanos the Melodist both indicate that wine is made by the vine.<sup>88</sup> The Irish Augustine, in considering the natural transformations of water, says that when “it is infused through the tree of the vine (*vitis arborem*), it is changed into the taste and color of

<sup>85</sup> Cf. [Arist.] *Pr.* 3.17 on cabbage juice as a cure for crapulence.

<sup>86</sup> Fr.726 Gigon. Cf. [Arist.] *Pr.* 3.12, 22.

<sup>87</sup> Cf. the useful H. Immerwahr, “New Wine in Ancient Wineskins: The Evidence from Attic Vases,” *Hesperia* 61 (1992) 128.

<sup>88</sup> August. *Serm.* 126.3; Rom. Mel. 13.15.5–6 Maas-Trypanis.

wine.”<sup>89</sup> Hildegard of Bingen explains how it happens:<sup>90</sup>

The vine has a fiery heat and humidity. But that heat is so strong, that its juice turns into another manner of flavor than other trees or than other plants have. [...] Wine, moreover, which is born from the vine (*quod de vite nascitur*), if it has been pure, provides for the drinker good and healthy blood.

Alexander Neckam, for his part, describes the production of wine with what at first seems a paraphrase of fr.81:<sup>91</sup>

In the wood of the vine watery liquid rots,  
And dew coming from the ground passes over into wine.

Dante Alighieri says much the same in an analogy between the formation of a human being and the formation of wine, only neglecting the “rot” and focusing on the agency of the sun.<sup>92</sup> Shakespeare, too, speaks of vines’ “marrows” producing “liquorish draughts” (*Timon of Athens* IV.iii.194–197), and Francis Bacon reveals in an elaborate metaphor that he shared the standard view that fermentation is only a matter of purging and clarifying the wine (*Novum Organum* 1.123).<sup>93</sup> Even as the “spirit of wine” or

<sup>89</sup> Augustinus Hibern. *De mirabilibus sacrae scripturae* 1.18 (PL 35 2165).

<sup>90</sup> Hildegard de Pingia *Physica* 3.54 (PL 197 1245).

<sup>91</sup> *Suppletio defectuum* 1.1269–1270 (ed. P. Hochgürtel). In the riddling passage from which these lines are taken, Neckam compares the mundane transformation of water in the vine to the miracle performed by Jesus, “the true vine” (Jn 15:1), in turning water into wine (Jn 2:1–11). Cf. also Thomas Aquinas, *Summa Theologica* 3 qu. 74 ans. 5 (esp. ad 3).

<sup>92</sup> *Purg.* 25.76–78: “And in order that you marvel less at my language, / consider the heat of the sun that thus makes wine, / joined to the liquid that pours from the vine.” This passage is cited as a parallel for fr.81 by Bignone, *Empedocle* 459, and by Eisler, *Orphisch-dionysische Mysteringedanken* 135 n.5. For commentary see the fourteenth-century J. della Lana, *Comedia di Dante degli Allaghieri col Commento* (Bologna 1866–1867) ad loc., and, following della Lana, R. Hollander, *Purgatorio* (New York 2003) ad loc. F. Redi, *Bacco in Toscana. Ditirambo* (Florence 1685) *Annotazioni* 6, cites this and Empedocles on fruit as water and fire (sadly not fr.81) to legitimize his own bold verses (2.7–10), cited by H. W. Longfellow, *The Divine Comedy of Dante Alighieri* (Boston 1867) ad loc.

<sup>93</sup> See also e.g. Horst, *Herbarium* 288.

“water of life”—or, as we would say, ethyl alcohol<sup>94</sup>—came to be isolated and utilized by Bacon and others, it was assumed to be already present in the wine, fermentation only freeing it from the other, interfering components of the juice.<sup>95</sup> Noël-Antoine Pluche, in his influential *Spectacle de la nature* of 1735, wrote of how incredible it is that the otherwise useless wood of the vine can produce something as ravishing as wine.<sup>96</sup> Incredible indeed! The second epigraph above shows Goethe, too, playing upon the same notion later that century. In sum, Empedocles’ account of wine, properly understood, can be seen to echo in countless authors throughout the millennia from Homer’s Polyphemus to Goethe’s Mephistopheles.

The scientific discoveries of the eighteenth and nineteenth century would gradually muffle those echoes until it became possible for recent scholars to read fr.81 in utter contradiction of the entire prior tradition. First, it was hypothesized by Antoine Lavoisier that alcohol is not present in the grape’s juice to begin with, but is derived from sugar.<sup>97</sup> Well into the nineteenth century, discussions reveal the novel theory still in its infancy: Joannes Bresciani, for instance, explains in a scholastic manner that through fermentation sugar becomes alcohol, “cui postea

<sup>94</sup> Note that “ethyl” and “ethanol” come from “aether.”

<sup>95</sup> See F. Sherwood Taylor, “The Idea of the Quintessence,” in E. A. Underwood (ed.), *Science, Medicine and History I* (New York 1953) 247–265, esp. 257 and fig. 4; J. S. Fruton, *Fermentation* (Boston 2006), esp. 23, 33, 47; and V. D. Boantz, “Fermentation,” in D. Jalobeanu et al. (eds.), *Encyclopedia of Early Modern Philosophy and the Sciences* (Cham 2022) 669–670. The connection between wine and vine in early modern literature is illuminated especially by G. Bachelard, *Earth and Reveries of Repose* (Dallas 2011) ch. 10, “Alchemists’ Wines and Alchemists’ Vines,” especially when read with Bachelard, *The Formation of the Scientific Mind* (Manchester 2002) ch. 6.

<sup>96</sup> *Le spectacle de la nature II* (Utrecht 1735) 324.

<sup>97</sup> A. Lavoisier, *Traité élémentaire de chimie I* (Paris 1789) ch. 13, esp. 150–151. For Lavoisier’s achievement in this regard, including how “his formulation of the process [...] comprised the first representation of a chemical process in the form of an equation,” see Boantz, in *Encyclopedia of Early Modern Philosophy* 680, and Fruton, *Fermentation* ch. 3.

vinum inebriantem suam debet virtutem.”<sup>98</sup> Yet it was the discoveries of Louis Pasteur that finally purged the misconception that reigned for millennia prior, since Pasteur was able to prove that vinification is not an autonomous and spontaneous development of the nature of wine, but a result of the presence of the precious yeast, the very same that had been thought to “corrupt” the grain into beer, now understood to be an organism with a life of its own.<sup>99</sup>

Vestiges of the ancient account have not been entirely erased, however. In addition to the memory preserved in the species name *Vitis vinifera* noted above, we have the modern terms for the vascular tissues of the grapevine (and other woody plants): phloem (< φλοιός), the inner bark that directs fluids from the leaves down to the rest of the plant, and xylem (< ξύλον), the wood that draws fluids up from the roots. In a grapevine, the phloem is found just under the outer bark, and after it the xylem, surrounding the central pith; an incision or a cross-section of a thick and healthy specimen in the warmer months may therefore give the impression that the sap is flowing just under the outer bark; perhaps Empedocles had made some such observations of the vine’s anatomy. Although these precise terms are inventions of the nineteenth century,<sup>100</sup> they patently derive from a long use of the terms employed already in Empedocles’ fr.81.

There is, finally, the evidence of the delightfully rhyming words “wine” and “vine” themselves, which derive, after all, from the same word, Latin *vinum*: “wine” by way of Germanic

<sup>98</sup> *De vite vinifera et speciantim de vino* (Ticino 1841) 10: “to which afterward the wine owes its own inebriating virtue.” For context see F. Schlenk, “Early Research on Fermentation – A Story of Missed Opportunities,” in A. Cornish-Bowden (ed.), *New Beer in an Old Bottle: Eduard Buchner and the Growth of Biochemical Knowledge* (Valencia 1997) 43–50.

<sup>99</sup> See L. Pasteur, *Studies on Fermentation. The Diseases of Beer: Their Causes, and the Means of Preventing Them* (London 1879) ch. 5, and J. Tyndall, *Essays on the Floating-Matter of the Air in Relation to Putrefaction and Infection* (New York 1888) ch. 4.

<sup>100</sup> Evidently coined by C. Nägeli, *Beiträge zur wissenschaftlichen Botanik* (Leipzig 1858) 9; see *OED* s.v. “phloem.”

*Wein* (< *vinum*), and “vine” by way of French *vigne* (< *vinea* < *vinum*), borrowed later as a result of contact with French viticulture.<sup>101</sup> The vine, that is to say, is the winery plant.<sup>102</sup> These two common words themselves thus attest to the persistence of the belief that wine comes from the vine.

### 5. *Conclusion*

Given the superabundant parallels and the absence of any sound evidence to the contrary, we conclude that Empedocles attributes the production of wine *qua* wine not to the process we know as the fermentation of juice, but to the “rotting” of water by the action of fire within the vine. We have seen that the ignorance of fermentation among the ancient Greeks and the subsequent European tradition was still deeper than prior scholarship has revealed. Indeed, it seems that only two authors, Plutarch and Macrobius, directly address the surprising fact that must or new wine does not seem to inebriate as mature wine does. Their explanations of this phenomenon never raise a doubt about whether it was already wine, possessing already its proper “inebriating virtue,” as Bresciani termed it; instead, they suggest various reasons why its power was simply concealed or counteracted. Most other authors ignore fermentation in their accounts of how wine comes to be; and among those who do not, fermentation was generally regarded as a process of loss, as a release of air and of sweetness caused by wine’s innate heat, which, as we saw already in Plato, was held to be the cause of its special power. Simply put, wine was long thought to be water that had been transformed by a sort of cooking in the wood of the vine.

That old notion was presumably still common knowledge for the scholars of the late nineteenth and early twentieth century, who in any event did not feel compelled to note the gulf between the new understanding of wine and what they took to be Em-

<sup>101</sup> L. Gorton, “Revisiting Indo-European ‘Wine,’” *JIES* 45 (2017) 1–26.

<sup>102</sup> This may surprise only speakers of American English, in which “vine” is used very loosely.



pedocles' view, or to adduce any parallels. The subsequent trajectory of the interpretations of fr.81 provides a valuable reminder for the study of antiquity. What has become self-evident as a result of the scientific (and other) developments of recent centuries should not be allowed to blind us to the strangeness of ancient conceptions. Sometimes it is our own instincts, more than those of earlier scholars, that deserve to be put in doubt. In this instance, such doubt has led us to a clearer understanding of Empedocles' account of wine and, with it, of all premodern oenology. With this in mind, myriad passages about the "mystic vine" may deserve to be reread with renewed understanding.<sup>103</sup>

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<sup>103</sup> Tib. 3.6.1, *mystica vitis*. This paper's argument was tested in germ on my dissertation committee at the University of Chicago, and then on my colleagues and students at Colgate University, as well as at IAPS 7, the Physis kai Phuta seminar and SCS panel, Cornell's "Wine Culture," and symposia of the Haines, Nelsons, and Washes. Special thanks are due to Rebecca and Albert Ammerman, Liz Asmis, Emily Austin, Geoffrey Benson, Rose Cherubin, Jenny Strauss Clay, Emlyn Dodd, Chris Faraone, Michael Fontaine, Gottfried Heinemann, Austen Hufford, Luke Lea, Orestis Karatzoglou, Lisa King (Colgate's ILL Coordinator), André Laks, Arnaud Macé, Luke Parker, Mark Payne, Naomi Rood, Kirk Sanders, David Sider, Bill Stull, Anne-Laure Therme, Jeremy Thompson, Daniel Tober, Simon Trépanier, Simon van Zuylen-Wood, Justine Vanden Heuvel, Stephen White, D. David Williams, Joseph Zehner. Prior drafts were generously read and greatly improved by Roger Brock, Alessandro Buccheri, Caroline Cheung, Franco De Angelis, Lowell Edmunds, Leopoldo Iribarren, Branden Kosch, Boris Maslov, Patrick McGovern, Krista Nelson, Max Nelson, Thomas Nevin, Jean-Claude Picot (qui m'apprend à ne pas faire feu—ni à faire du vin—de tout bois), the editors, and three anonymous readers. After such tremendous help, remaining errors can only be my own.