

RICHARD LAVENHAM'S "DE CAUSIS NATURALIBUS": A CRITICAL EDITION

Author(s): RONDO KEELE

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RICHARD LAVENHAM'S *DE CAUSIS NATURALIBUS*:
A CRITICAL EDITION

BY RONDO KEELE

A work of natural science dating from the second half of the fourteenth century, Richard Lavenham's *De causis naturalibus* (henceforth *DCN*) is a theoretically simple, brief, and sometimes fanciful compendium of lore, Aristotelian science, and Christian authority on a variety of meteorological topics. A fair range of authorities and subjects is discussed in this relatively short work, from Augustine to Aristotle and from the cause of rainbows to the source of the tides. Neither an in-depth treatise nor a focused commentary, *DCN* is rather a summary of the mechanics of sun-caused exhalations in the sublunar region and of the various phenomena these exhalations produce.

This complete edition of *DCN* consists of three parts: first, an introduction, which includes a discussion of the manuscripts, the basic content of the book, and the apparatus; second, the edition itself, with apparatus and references; finally, a complete English translation.

INTRODUCTION

Manuscripts

The manuscript tradition of *DCN* consists of nine witnesses, to which I have assigned the following sigla:¹

A = Oxford, All Souls College, MS 81, fols. 18r–28v.²

B = Bodleian, MS Lyell 36, fols. 20r–21v (near complete fragment).

¹ Detailed descriptions of some of the manuscripts of *DCN* can be found in the following sources: for **A**, Andrew G. Watson, *A Descriptive Catalogue of the Medieval Manuscripts of All Souls College Oxford* (Oxford, 1997); for **M**, Paul Vincent Spade and Gordon Anthony Wilson, *Johannis Wyclif Summa insolubiliū*, *Medieval and Renaissance Texts and Studies*, 41 (1986): x–xvi; for **S**, Edward J. L. Scott, *Index to the Sloane Manuscripts in the British Museum* (London, 1904), and Paul Vincent Spade, “The Treatises *On Modal Propositions* and *Hypothetical Propositions* by Richard Lavenham,” *Mediaeval Studies* 35 (1973): 49–59; for **V**, Paul Vincent Spade, “Notes on Some Manuscripts of Logical and Physical Works by Richard Lavenham,” *Manuscripta* 19 (1975): 139–46. This list of extant MSS of *DCN* is from Richard Sharpe, *A Handlist of Latin Writers of Great Britain and Ireland Before 1540* (Turnhout, Belgium, 1997), 490. Many thanks to Paul Vincent Spade for his advice and encouragement on this project.

² *A Descriptive Catalogue of the Medieval Manuscripts of All Souls College Oxford* mistakenly attributes several more pages in **A** (28v lin. 11–31r lin. 1) to *DCN*. This extra material does cover topics that are similar in content to *DCN*, but it can be shown to be

- C** = Cambridge University Library, MS Hh. 4.13, fols. 55r–58r.
D = Trinity College, Dublin, MS 605, pp. 439–45.
M = Oxford, Magdalen College, MS lat. 38, fols. 9r–10v.
O = Oxford, Corpus Christi College, MS 132, fols. 84v–88r.
R = British Library, MS Royal 12 E xvi, fols. 5r–9v.
S = British Library, MS Sloane 3899, fols. 59v–64r.
V = Venice, Biblioteca Nazionale Marciana, MS Z. lat. 300, fols. 59v–63r.

These nine MSS can be divided in the first instance into the *longum genus*, consisting of MSS **V**, **S**, **R**, **C**, and **O**, and the *breve genus*, consisting of MSS **M**, **A**, **D**, and **B**. The MSS of the long group all differ from each of the MSS of the short group in the same general way. Long group MSS, however they otherwise differ among themselves, all contain these sections of text, in the following order: (1) a prologue, (2) a table of contents listing sixteen questions to be discussed, and finally, (3) the body of the work, consisting of sixteen questions and answers. The short group MSS, however they otherwise differ among themselves, all contain these sections of text: (1) a table of contents, listing thirteen questions to be discussed (questions 1–12 correspond directly to questions 1–12 as listed in the long group, while question 13 corresponds to question 15 in the long group), and finally, (2) the body of the work, consisting of thirteen questions and answers. In short, the MSS of the *breve genus* all lack the prologue and questions 13, 14, and 16 as these questions occur in the *longum genus*.

The short group MSS represent a shortening of the preexisting tradition of longer MSS, rather than the reverse (i.e., the long version MSS are not expansions of the short version MSS). Hence, the long version MSS are clearly closer to the archetype. The two main arguments for this conclusion are as follows. First, the oldest dated MSS in the tradition, **V** and **S** (both late fourteenth century), are long version MSS, while every MS in the short group whose date is known is later than either **V** or **S**. Second, the content of the material lacking in the short group can be more plausibly explained as an omission from the long group rather than an addition to the short group. That this is so can be seen by examining the content of *DCN* and the codices surrounding the short group MSS.

Both of the oldest dated MSS in the tradition, **V** and **S**, are bound into codices that contain collected works of the author, Richard Lavenham. By contrast all of the short MSS (except **M**) are bound into much longer codices that contain practical manuals and charts of various sorts — for example, astrological charts and tracts, medicinal recipes, and alchemical treatises.

genetically unrelated to *DCN*, since it does not occur in any of the older manuscripts. Despite what the *Descriptive Catalogue* says, *DCN* ends on 28v, lin. 10 in MS **A**.

Further, the thirteen questions that occur in the short MSS are all more practical in nature, as opposed to the more theoretical type of questions (i.e., 13, 14, and 16) which occur in all and only long version MSS. While it is possible that a short version of the book was expanded to include certain theoretical discussions, the dates and the context of the codices suggest a shortening, since it is more likely that a longer work would be edited for inclusion in a practical and eclectic handbook than it is that a short practical work would be expanded in a theoretical direction for inclusion in a “complete works” codex.

Structural evidence exists for this conclusion as well. Questions 1–12 (as numbered in the long group) have only a loose *quaestio* format and seem to be *pro forma* in the format of actually disputed material, that is, in the form of questions under direct disputation in a university context. Questions 13, 14, and 16 (as numbered in the long group) are different — they have a more robust disputational structure, that is, affirmative and negative arguments, followed by the author’s response, and then replies to objections.

Question 15, which was selected from the last four questions for inclusion in the short MSS, might seem not to fit this picture, since it deals with some more advanced theoretical topics. However, careful examination shows that this question ends with a list of quasi-stellar phenomena (e.g., comets) that are caused by vapor, and therefore is closer in content and style to questions 1–12 than it may seem at first. Hence, the presence of question 15 in short group MSS does fit the hypothesis offered here.

In addition to long and short groups, the MS tradition divides again, for the long group is itself clearly subdivided into two groups, which I call **Γ** (=VS), and **Δ** (=RCO). The short group (=MADB) I refer to as **Σ**. This further division of the long group is based on similarity of variants, and the case for this division is not hard to make — any random sampling of the full range of variants will reveal how often the MSS in these subgroups read with each other, both on substantive variants and in more trivial matters such as word order and synonymous word choice (e.g., *iste/illic*).

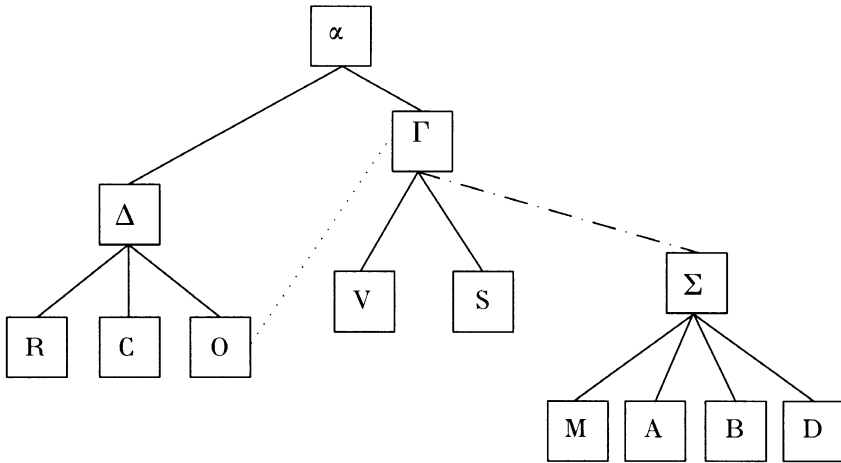
I have taken MS **S** to be the primary source for the edition, including trivial matters of formulation and word order, and have taken **R** to hold next authority as a representative of the **Δ** group. In addition, I rely on **M** as a kind of tiebreaker MS when a choice between **S** and **R** variants is otherwise unmotivated. More will be said further on about precisely how I have used these three MSS in editorial decision making, as well as on my policy on emendation, but first more details of the MSS relations must be presented.

Unfortunately, no exact, detailed stemma construction is possible for DCN. Although several of the MSS in the **Σ** group are known by external

evidence to be later in the tradition, and although the entire Σ group is, for reasons already mentioned, clearly derivative of Γ and/or Δ type MSS, and, although the Γ MSS are both dated, and R and C are unfortunately undated, and O is demonstrably contaminated with V and/or its ancestor. Thus, while it is easy enough to see that the entire Σ group should be relegated out of prominence into the lower limbs of a stemma, little more certainty than this can be achieved in establishing the relations of the remaining five MSS, other than the broad groupings already established, for one MS in the Δ group is contaminated and the two others are without dates. The situation is made worse by the fact that the contamination in O cannot be localized and ignored; while O clearly belongs in group Δ with R and C , it noticeably follows V into error on enough occasions to warrant suspicion. Hence the contamination O causes has crossed between the Γ and Δ groups, rendering moot any attempt to order these five MSS in detail.

Despite the impossibility of a very detailed stemma, there is clear evidence for the overall superiority of S . O is of little use in establishing the archetype, since most of the readings it has are accounted for in either VS or RC . R and C are not among the dated MSS in their respective codices; hence little external evidence is available for choosing for them or between them. V and S on the other hand are known to be old, late fourteenth century in fact, not far from when *DCN* was likely written, since Lavenham died very late in the fourteenth century or very early in the fifteenth. Thus, while R and C may indeed be relatively old (and I suspect they are), V and S are known to be very close to any reasonable conjecture on the date of the archetype. In addition, V and S preserve certain longer formulations and explanations that R and C tend to shorten; for example, R and C sometimes omit large stretches of argument in later theoretical questions, which arguments are in fact contained in V and S . Both of these factors, viz., relative completeness and clear, favorable dates, suggest strongly that either V or S should be the basis of the edition.

The choice between V and S is not difficult to make — S is by far the better manuscript. Though it has suffered some physical damage and is written in a somewhat untidy hand, S often preserves the truth on readings where V falls into error, both in cases of grammatical error and lapses in sense, as well as in at least one case of an incorrect reference. V also contains several homoeoteleuta that S does not, and in those cases S reads with the other MSS. This in itself is enough to suggest that, unless S itself is contaminated (no evidence of this is present), V is not the exemplar (however far removed) for S . For all these reasons I have chosen S as the best MS to represent the tradition. A diagram representing visually the outline of the MS relations upon which this decision is based might perhaps be useful for reference:



The dashed line of descent between Γ and Σ represents the relatively large lapse of time between the Σ MSS and any common ancestor with the Γ MSS or one of the Γ MSS itself (this gap might be as large as 100 years). The dashed line between Γ and O represents the contamination, previously discussed, between O and either V or its relatives.

All these considerations on relations among manuscripts suggest the following policy regarding variant readings, which I have followed throughout: as the most reliable, and one of the oldest documented texts, S deserves to be followed as long as it is not clearly in error and no significantly better reading exists in another reliable witness. However, which of the remaining witnesses should be regarded as reliable texts in cases in which the readings in S must be supplemented or challenged? It seems clear that, if at all possible, the best representatives from each of the remaining MS groups, namely Δ and Σ , should be chosen for consultation in cases of failure in S . I have therefore weighed the other witnesses as follows. Since R is not evidently contaminated, unlike O , and, since R is superior to C in ways that are analogous to superiority of S over V , R deserves to be the most serious challenger to the readings in S . Likewise among the MSS of the Σ group, having considered the number and frequency of clear errors as well as relative dates, I chose M as the most reliable representative of that group.

My procedure then has been to follow S in all variants, both trivial and significant, unless (1) S is clearly wrong, though this doesn't happen often, or unless (2) R poses a significant challenge in that it offers an equally plausible significant variant. In situations of type (1), that is, where S is clearly wrong, my policy has been to emend with MS authority if possible, looking

first to **R**, and then to **M**. The only exception to this policy occurs in questions 13, 14, and 16. There **M** can be of no use, since it has no readings at all for these questions, and in 13, 14, and 16 **R** reads very differently from **S** in several places. In exceptional circumstances of this sort, since there can be no better help from any other Δ or Σ MSS, I have relied on the only other remaining MS in the tradition, namely **V**, to emend lapses in **S**, and simply recorded *in apparatu* the sharply differing readings contained in **R** and the other Δ MSS. If in cases of type (1) no authoritative solution could be found to emend lapses in **S** — that is, if the readings of **R** and **M** are equally implausible, I made it my policy simply to emend by conjecture; fortunately this procedure turned out to be required in only a single instance. As a result, every word in the edition save one bears some manuscript authority or other, according to the policies just discussed.

In situations of type (2), that is, where **S** is not obviously in error and **R** offers an equally plausible significant variant against **S**, I have simply made a choice, having considered carefully the evidence for the two opposed readings and having allowed the greater presumed weight of **S** and the readings in **M** to help settle the issue. If, in situations of type (2), I found that I was facing a pair of significant variants in **S** and **R** with nothing to suggest one over the other where **M** could not be a tiebreaker since it had some third significant variant or no reading at all (i.e., on questions 13, 14, and 16), I have chosen **S** by default. Although I have ultimately always considered readings on an individual basis, by general policy I have not allowed **M** variants individually to constitute a challenge to the readings in **S** where the two differ; **M** has merely been a tiebreaker between **S** and **R**.

Content

Of Lavenham himself (fl. 1380) few detailed and reliable accounts are recorded, although Emden gives us enough material to compose a useful sketch.³ His birth date is not given, and the earliest fact we have about him is that he became a friar of the Carmelite order at Ipswich. His theological training was at Oxford, and, judging by his prolific and varied publication list, he seems to have enjoyed a fruitful intellectual career, having turned his mind to many of the important theological and philosophical topics of his day. Perhaps as many as sixty-three treatises can be attributed to him with some plausibility, and at least twenty-four short treatises attributed to him are copied out in MS **V** alone. In addition to topics in logic, Lavenham wrote commentaries on the Bible and on Aristotle. Although it does not pre-

³ The basis of this account of Lavenham's life can be found in A. B. Emden, *A Biographical Register of the University of Oxford to A. D. 1500* (London, 1957), 2:1109–10.

cisely fit the category, since it draws on various non-Aristotelian sources, perhaps *DCN* is best classified under this last heading.

Paul Vincent Spade, who has edited a number of Lavenham's logical treatises, asserts that Lavenham was not a particularly original thinker on logical subjects, but that the derivative character of his thought actually increases his importance to scholars, since his dissemination of the opinions of other people can be of great advantage to those interested in the views of his sources.⁴ Similar remarks apply to the present work as well, and perhaps even more so, since the sheer number of different sources Lavenham cites in *DCN* is well beyond the usual number of sources for a logical tract, and since in *DCN* Lavenham does little to advance the discussion of meteorological phenomena beyond the depth already achieved in his sources. Thus, the present edition may be of some interest to historians of science, and Spade's assessment of Lavenham as a derivative thinker receives support and extension from a study of *DCN*; in science, as in logic, Lavenham seems to have been a summarizer and a synthesizer of the work of others.

The date of Lavenham's death is a matter of dispute. Emden records a collision of authorities on certain matters of Lavenham's ecclesiastical career, as well as the issue of his death. The earliest possible date we have is 1381, when he was reputedly killed with Simon Sudbury, then archbishop of Canterbury. This early date conflicts with two other accounts, however, one of which suggests the date 1383, the other of which attributes to Lavenham an early fifteenth-century tract against John Purvey. However, Emden claims that the dating of the tract is not conclusively established, nor is there anything in the dating or content of the MSS of *DCN* that would shed any more light on the question; hence it is still possible that Lavenham died late in the fourteenth century.

DCN is a work on what we would call meteorological and geological phenomena, or, in language more suited to the time, sublunary phenomena. In order, the first twelve questions are about the natural causes of: thunder and lightning, the rainbow, dew, rain and hail, the salinity of the sea, the tides, springs, why springs are warm in the winter and cold in the summer, why wines do not freeze, why the earth holds the center of the universe, earthquakes, and the winds. The last four questions, of which only question 15 appears in the Σ group, exhibit greater theoretical sophistication, and all of them deal with issues concerning the formation of clouds and the nature

⁴ Spade has expressed this view in print on several occasions. See his "Richard Lavenham's *Obligaciones*," *Rivista critica di storia della filosofia* 2 (1978): 225–26; and idem, with Gordon Anthony Wilson, "Richard Lavenham's Treatise *Scire*," *Mediaeval Studies* 46 (1984): 1–2.

of vapor. In order, these final four questions ask: whether clouds can be generated in the upper part of the air, whether clouds can be generated in the middle region of the air, whether vapor is the material composing winds and clouds, and, finally, whether vapor is a substance or an accident, and if a substance, whether simple or mixed.

The sources Lavenham relies on for his responses are both ancient (Aristotle, Bede, Macrobius, Homer) and contemporary (Robert Grosseteste, Simon of Genoa, Urso of Salerno), pagan (Homer and Macrobius) and Christian (Augustine and Bede). Despite the wide variety of sources, it is fair to say that Aristotle's *Meteorology* is the primary source for both the specific answers to questions and to the general system of physics that underlies them.

But *DCN* is not primarily a commentary on the *Meteorology*, as was said above. Neither can it be considered a detailed discussion of any of the topics it takes up; most answers are quite brief and sketchy. In tone and focus the work seems more in line with the tradition of encyclopedias, except that it has a relatively narrow range of topics. Lavenham's intent in writing *DCN* seems to have been straightforwardly to present compressed, nonexperimentally based answers to basic questions about natural sublunary phenomena, and to do so by freely drawing on any authoritative sources he knew.

What is somewhat puzzling is why the work was copied as often as it was. Nine extant manuscript copies are a relatively large number for such a short, unoriginal work. Understanding this popularity is closely connected with another puzzling thing about this book, namely, why it was shortened precisely as it was in the Σ tradition.

As I explained above, the evidence clearly indicates that the long version was shortened to the short version and not the reverse. I also indicated that one strong argument for this fact proceeds from the content of the material that was cut and the kind of contexts in which the short group MSS are bound. The presence of short version MSS in codices that are astrological and alchemical handbooks strongly indicates that the compilers of those codices were interested in the mechanics of vapor in the sublunary region but were less interested in theoretical questions such as the status of vapor as substance. This practical interest in vapor strongly suggests that the main connection between astronomy, alchemy, and meteorology in *DCN* (and hence in the surprising popularity of the work) lies in the humor theory of medicine.

In the medieval period it was thought that certain bodily humors were associated with the hot/cold and the moist/dry principles in planets. Therefore, the hot/cold and the moist/dry principles of the planet that held influence at the time of a person's birth determined that person's temperament

and also the physical diseases to which he was susceptible. But *DCN* presents a systematic summary of precisely how certain combinations of these four qualities affect or create meteorological phenomena. Thus, those who copied *DCN* (and especially those who shortened it and copied the shortened version), already interested as they were in the four qualities in the celestial realm, may simply have wanted to have a broader understanding of how these qualities worked in the sublunary region. Or there may have been an even more practical connection — people may have thought that the weather could affect health and temperament in some way analogous to the way that the planets affected health and temperament.

However, like many other medieval books, *DCN* does not state very explicitly why it was composed or why it was radically edited. The most the text reveals about the reason for its composition is that it is “not only useful but also delightful to know the hidden cause of things.” Any more certain speculation on the purpose of this short work and its alteration must await more detailed comparative study.

Apparatus

The primary difficulty in compiling an apparatus for *DCN* has been the sheer number of manuscripts in the collation. In order to keep the apparatus to a reasonable size I have designed it to record only select variants, according to the following principles. (1) The variants in **S** that were not adopted as the basis of the text are almost always noted, since **S** is otherwise the primary basis of the text. (2) Significant variants that are reasonable alternatives to those I have selected are included. These are most often variants taken from **R** or **M**. (3) Variants occurring exclusively in **D**, **A**, or **B** are usually not listed, unless they are independently interesting. (4) Variants which are not probable from the point of view of sense but which are interesting for what they reveal about MS relations are included. There is a fair number of these variants. (5) In questions 13, 14, and 16, where the **Δ** and **Γ** MSS depart from each other significantly in certain passages, I have included the (relatively) long **Δ** variants. (6) Trivial variants of spelling and word order, as well as variations in formulaic phrases (e.g., “dico” instead of “respondeo et dico”) are not included unless they fall under one of the other categories above.

I have viewed the MSS in microfilm only. All the material that I have marked as added in the margins or above the line may be assumed to be in the same hand as the main text. Spelling has been normalized using the *Oxford Latin Dictionary*, except that I distinguish “j” from “i,” and “v” from “u.”

ABBREVIATIONES

< . . . >	suppletum ab editore
abbr.	abbreviatio
add.	addidit
coni.	coniecit
del.	delevit
exp.	expunxit
gl.	glossa
homoeot.	homoeoteleuton
illeg.	illegibilis
i.m.	in margine
inv.	invertit
lac.	lacuna
lect.	lectio
lin.	linea
om.	omisit
rescr.	rescripsit
scr.	scripsit
seq.	sequitur
sig. transp.	signa transpositionis
sup. lin.	supra lineam
term.	terminatio

EDITION
 <De Causis Naturalibus>
 <Prologus>¹

<1> Deus et natura nihil frustra operantur ut dicit Aristoteles primo *Caeli et mundi*.^a Hoc enim claret² diligentius advertenti quia deus nihil frustra superius operatur et natura nihil³ frustra hic inferius operatur. Pro primo sufficit exemplum Aristotelis in primo libro *Meteororum*⁴ ubi quaerit: “Quare ignis et aer sunt viciniore orbi caelesti?” Et respondet: “Quia sic disponit⁵ deus gloriosus et sublimis ad conservationem⁶ machinae mundalis quia si ignis” inquit, “vicinior nobis esset⁷ quam aqua vel aer tunc combureret totum quod est super terram.”^b

<2> Pro secundo sufficiunt verba Aristotelis primo *Politicorum* capitulo quinto ubi⁸ sic: “Natura nihil imperfectum facit neque frustra.”^c “Plantas,” inquit, “dat natura gratia⁹ animalium et animalia sunt gratia¹⁰ hominum.”^d “Necessarium¹¹ est,”¹² inquit “hominum¹³ gratia¹⁴ ipsa omnia fecisse naturam.”^e Hoc¹⁵ etiam ex verbis¹⁶ Aristotelis secundo libro¹⁷ *Physicorum* ubi sic:¹⁸ “Planta facit radices non sursum sed deorsum gratia¹⁹ vegetandi,²⁰ facit enim folia propter fructuum novellorum protectionem et fructus producit propter suae speciei conservationem.”^f

<3> Ex quo processu patet quod verba quae praemiseram veritatis fulmine²¹ roborantur videlicet quod²² deus et natura nihil frustra operantur. Et

¹ *Solum genera longa*(Γ, Δ) *prologum continent. Σ incipit* Felix qui . . . in ¶ 3 V=59v^b31; R=5r1; C=55r1; O=84v1; S=59v26. ² claret] declarat Δ. ³ V=60r^a1.

⁴ *Meteororum*] *metaphysicorum* V 3 *ethicorum* RC *ethicorum* tertio O. ⁵ disponit] disposuit Δ. ⁶ ad conservationem] *om.* Δ. ⁷ S=60r1 ⁸ ubi] ut S.

⁹ *natura gratia*] *gratia ipsa omnia feciste natura sed ipsa omnia feciste del.* O id est causa *gl. sup. lin.* S. ¹⁰ id est causa] *gl. sup. lin.* S. ¹¹ *gratia hominum necessarium*] *gratia necessarium hominum sed cum sig. trans., cum transpositione lect. est* gratia hominum necessarium O. ¹² est] *om.* Δ. ¹³ *hominum*] *om.* Δ. ¹⁴ *gratia*] id est causa *gl. sup. lin.* S. ¹⁵ hoc] et RO est C. ¹⁶ *verbis*] *dictis* Δ. ¹⁷ *libro*] *om.* Δ. ¹⁸ inquit] *seq.* Δ. ¹⁹ *gratia*] id est causa *gl. sup. lin.* S. ²⁰ *vegetandi*] *vegetando* Δ. ²¹ *quae praemiseram veritatis fulmine*] *praemissa in veritatis fulmine* RC. ²² *quod*] *om.* Δ.

^a *On the Heavens* 271a35.

^b This reference gave most of the scribes difficulty. S is the only witness that gets the source of this quotation right. V cites *Metaphysics* and RCO cites 3 *Ethicorum*. It turns out to be in *Meteorology* 340a32–340b4.

^c *Politics* 1256b20–22.

^d *Politics* 1256b15–17.

^e *Politics* 1256b20–22.

^f *Physics* 199a25–30.

quia non solum est²³ utile verum etiam delectabile rerum²⁴ causas occultas cognoscere, dicente poeta: “Felix²⁵ qui potuit²⁶ rerum cognoscere causas.”^{27g} Hinc est quod libellus iste *De causis naturalibus* merito²⁸ intitulatur quia in eo de causis principaliter agitur et tractatur.

<Tabula Quaestionum>²⁹

<4> In hoc igitur libello quaeritur primo quae sit causa naturalis tonitruum et coruscationis. Secundo quae sit causa naturalis iridis. Tertio quae sit causa naturalis roris. Quarto³⁰ quae sit causa naturalis pluviae et grandinis. Quinto quae sit causa naturalis³¹ salsedinis maris. Sexto³² quae sit causa naturalis fluxus et refluxus eiusdem. Septimo quae sit causa naturalis fontium.³³ Octavo quae sit causa naturalis quare fontes calidi sunt in hieme et frigidi in aestate. Nono quae sit causa naturalis³⁴ quare³⁵ vina raro aut numquam³⁶ congelascunt. Decimo quae sit causa naturalis³⁷ quare terra semper medium tenet. Undecimo quae sit causa naturalis terrae motus. Duodecimo quae sit causa naturalis venti et agitationis ventorum. Tertio decimo quaeritur an nubes possint generari in superiori parte aeris.³⁸ Quarto decimo³⁹ an nubes possint in media regione aeris generari.⁴⁰ Quinto decimo an vapor sit materia ventorum et nubium. Sexto decimo an vapor sit substantia vel accidens, et si substantia⁴¹ an corpus simplex vel mixtum.⁴²

<Textus>

<5> Prima⁴³ ergo quaestio fuit talis: quae sit causa naturalis tonitruum et coruscationis. Ad hanc quaestionem respondeo et dico quod causa naturalis est extinctio ignis in nube humida. Unde Aristoteles tertio libro *Meteororum*: “Sicut,” inquit, “ferrum ignitum⁴⁴ submersum in aqua facit stridorem sic⁴⁵ vapor calidus et siccus elevatus de terra et per elevationem inflammatus⁴⁶

²³ est] *om.* **Δ**. ²⁴ rerum] veras **Δ**. ²⁵ **Σ** incipit. **M**=9r1; **A**=18r10; **D**=p. 439 lin. 1; **B**=20r1. ²⁶ potuit] poteret **RC** poterit **MB**. ²⁷ rerum cognoscere causas] causas cognoscere rerum **Δ**. ²⁸ merito] *om.* **ΔΣ**. ²⁹ *quaestiones dinumerantur i.m.* **SA**. ³⁰ **A**=18v1. ³¹ naturalis] *om.* **CA**. ³² sexto] sexta **D**. ³³ **V**=60r^b1. ³⁴ quae sit causa naturalis] *om.* **Δ**. ³⁵ quare] quia **S**. ³⁶ aut numquam] *sup. lin.* **S**. ³⁷ quae sit causa naturalis] *om.* **Δ**. ³⁸ quaeritur . . . aeris] quae sit causa naturalis vapor sit in materia ventorum et nubium et **M** an vapor sit materia ventorum et nubium et cetera ut patet in sequentibus **A** quae est causa naturalis an vapor est materia ventorum et nubium **D** an vapor sit materia ventorum et nubium et sic finis **B**. ³⁹ **Σ** *solum tredecim quaestiones habet* **S**=60v1. ⁴⁰ **R**=5v1. ⁴¹ substantia vel accidens et si substantia] *om., homoeol.* **V**. ⁴² quarto decimo . . . simplex vel mixtum] *om.* **Σ**. ⁴³ **A**=19r1. ⁴⁴ **O**=85r1. ⁴⁵ sic] ut **S**. ⁴⁶ **C**=55v1.

^g Vergil, *Georgica* 2: 490.

tangit nubem humidam. Et causat sonitum qui tonitruus dicitur. Sonus ergo ille tonitruus dicitur⁴⁷ et inflammatio apparens coruscatio appellatur.”^h Et sic⁴⁸ patet solutio primae quaestionis.⁴⁹

<6> Secunda quaestio fuit talis: quae foret⁵⁰ causa naturalis iridis.⁵¹ Ad hanc quaestionem respondeo breviter et dico quod causa naturalis est oppositio⁵² nubis roridae contra solem in qua solis radii imprimuntur. Unde ante pluviam vapor⁵³ elevatus de terra et inclusus in nube resolvitur in rorem et tunc nubes rorida generatur⁵⁴ quae quidem nubes⁵⁵ si sit opposita soli recipit infra se solis radios. Et talis informatio radiorum in nube rorida iris dicitur. Unde iris nihil aliud⁵⁶ est nisi nubes rorida soli opposita radiis solis multipliciter⁵⁷ informata. Unde oportet quod iris fiat semper⁵⁸ per oppositionem ad solem. Et haec est causa quare iris de mane apparet⁵⁹ in occidente, in vespere in oriente, in⁶⁰ meridie in aquilone.ⁱ Dicit⁶¹ tamen Aristoteles in libro *Meteororum* quod iris fit per diem ex radio⁶² solis et per noctem ex radio⁶³ lunae. “Non tamen,” inquit, “apparet iris in nocte nisi bis in quadraginta⁶⁴ annis.”^{65j} Et sic patet solutio secundae quaestionis.

<7> Tertia quaestio fuit talis: quae foret causa naturalis roris. Ad hanc quaestionem respondeo breviter et dico quod causa naturalis roris est elevatio vaporis frigidi et humidi congregati in nube in inferiori parte⁶⁶ mediae regionis aeris parvo frigore concurrente. Et dicit Aristoteles secundo libro

⁴⁷ tonitruus dicitur sonus ergo ille tonitruus dicitur] tonitruus dicitur *fortasse homoeot.*
Δ. ⁴⁸ sic] *om.* **VM** similiter **S.** ⁴⁹ et sic patet solutio primae quaestionis] *om.*
Δ. ⁵⁰ foret] est **Δ** fuit **AB.** ⁵¹ **A=19v1.** ⁵² est oppositio] suppositio **V** est
 appositio **RC.** ⁵³ vapor] est **B om. MD, om., sed add. i.m. M.** ⁵⁴ **V=60v^a1.**
⁵⁵ nubes] nube **S.** ⁵⁶ aliud] *abbr. incerta R.* ⁵⁷ multipliciter] *abbr. incerta V.*
⁵⁸ fiat semper] *inv. OΣ, sed semper abbr. incerta D.* ⁵⁹ **M=9r^b1.** ⁶⁰ **D=p. 440 lin.**
 1. ⁶¹ **A=20r1.** ⁶² radio] radiis **RCO, sed term. incerta RC.** ⁶³ radio] radiis
O. ⁶⁴ quadraginta] quinquaginta **DB, abbr. incerta O.** ⁶⁵ annis] *add. quod est*
 terribile signum **A.** ⁶⁶ parte] *om. S.*

^h *Meteorology* 369a25–369b7. This explanation follows Aristotle fairly well, although he did not talk about burning iron in conjunction with thunder and lightning in the *Meteorology*.

ⁱ See *Meteorology* 373a30–374a1. Aristotle’s discussion of the rainbow is much more extensive and mathematically complicated.

^j *Meteorology* 372a22–29, except that Aristotle says fifty years, not forty. Only two witnesses, **D** and **B**, which are late in the tradition and otherwise relatively unreliable, actually correctly read “fifty” instead of “forty.” However, **S**, the basis of the edition, has “forty,” and I believe that the autograph was likewise in error; thus I have selected the variant that I believe is authentic although it results in an inaccurate citation of Aristotle. Whether the readings in **D** and **B** are the result of a scribal correction or a scribal mistake cannot be determined.

Meteororum quod non fit ros⁶⁷ nisi quando auster⁶⁸ flat, nam ventus australis⁶⁹ sua humiditate rorem generat⁷⁰ et nutrit, quem aquilo sua⁷¹ cursitate⁷² et intensa⁷³ frigiditate⁷⁴ comprimit et constringit.^{75k} Et ros in herbarum summatibus guttatim se⁷⁶ recolligit et vim⁷⁷ veneni⁷⁸ in venenosis animalibus reprimat. Unde serpentes latitantes inter herbas⁷⁹ parum solent transeuntes laedere quamdiu flores et gramina sunt in rore.¹ Et tantum pro solutione tertiae quaestionis.

<8> Dominus Lincolnensis *Super librum Meteororum*: “In hieme,” inquit, “non est ros nisi raro, quia tunc ut communiter frigus est excessivum⁸⁰ et vincit caliditatem.” “Sed,” inquit, “quando⁸¹ sic est⁸² quod caliditas aeris⁸³ et frigiditas loci, vel frigiditas aeris et caliditas⁸⁴ loci se habent in aequali proportione tunc generatur ros.”^m

<9> Quarta quaestio fuit talis: quae foret causa naturalis⁸⁵ pluviae et grandinis. Ad hanc quaestionem respondeo breviter et dico secundum Aristotelem tertio⁸⁶ *Meteororum* quod causa naturalis pluviae est elevatio vaporis frigidi et humidi per calorem solis qui quidem vapor postea per⁸⁷ elongationem solis condensatur et resolvitur in aquam propter frigus praedominans.ⁿ “Et quia,” inquit Aristoteles,⁸⁸ “sol plus elongatur a nobis in hieme quam in aestate et⁸⁹ in nocte quam in die, ideo plures sunt pluviae in hieme quam

⁶⁷ R=6r1. ⁶⁸ auster] ventus australis Σ. ⁶⁹ australis] mixta Δ. ⁷⁰ rorem generat] lac. O; S=61r1. ⁷¹ A=20v1. ⁷² cursitate] siccitate VΣ. ⁷³ intensa] abbr. incerta D. ⁷⁴ frigiditate] frigiditatem V. ⁷⁵ constringit] term. incerta O. ⁷⁶ se] folia Δ; “s” scr. sed del. B. ⁷⁷ vim] vi O om. A. ⁷⁸ veneni] venenum OA om. DB. ⁷⁹ herbas] gramina Δ. ⁸⁰ excessivum] excessivus RC scr. male, rescr. i. m. clarior A. ⁸¹ V=60v^b1. ⁸² sic est] est ita RC est illa vel est ita abbr. incerta O est ros A est] sup. lin. M. ⁸³ caliditas aeris] inv. A aeris validitas B. ⁸⁴ caliditas] term. invisibilis in religatione D; B=20v1. ⁸⁵ A=21r1. ⁸⁶ tertio] secundo Δ. ⁸⁷ O=85v1. ⁸⁸ inquit Aristoteles] oblitteratum S. ⁸⁹ et] etiam V oblitteratum S.

^k See *Meteorology* 347a35–347b11.

¹ This interesting claim about snakes, and the previous claim about poisonous animals in general, are not found in the *Meteorology*. However, such ideas can be found in medieval lore. For the connection between snakes and dew, consider this passage from Isidore of Seville, *Etymologies Livre XII, Des Animaux*, ed. Jacques André (Paris, 1986), 163–65, in the section on serpents (my translation): “Moreover, all serpents are cold by nature, neither do they bite except when they become warm. For when they are cold, they touch nothing, and hence their poisons do more harm in the day than in the evening. Nighttimes, in fact, they shake with trembling, and rightly so, because they are cold in the nocturnal dew.”

^m Grossesteste’s *Commentary on the Meteorology* is not among his extant works according to S. Harrison Thomson, *The Writings of Robert Grossesteste, Bishop of Lincoln 1235–1253* (Cambridge, 1940).

ⁿ *Meteorology* 346b15–347a11.

in⁹⁰ aestate et plures sunt pluviae⁹¹ in nocte quam in die.⁹⁰ Item causa naturalis⁹² grandinis est elevatio vaporis frigidi et humidus in⁹³ tempore⁹⁴ caliditatis qui fugiens calorem aeris recipitur ad interiora⁹⁵ nubis et illa⁹⁶ materia coagulata in nube vocatur grando, et quia calor concurrat ad generationem grandinis ideo in aestate frequentius fiunt grandines⁹⁷ quam in hieme.^{98P} Et sic patet solutio quartae quaestionis.

<10> Sed hic notandum quod sicut dicit Beda⁹⁹ et Januensis¹⁰⁰ materia pluvialis numquam resolvitur in aquam nisi per calorem vaporem frigidum expellentem. Unde, in tempore multum frigidum non pluit, sed post¹⁰¹ gelu. Et in aestate fiunt vehementiores pluviae. Quare? Quia calor vehementius expellit frigidum et resolvit nubem in aquam.^q

<11> Quinta¹⁰² quaestio fuit talis: quae foret causa naturalis salsedinis maris. Ad hanc¹⁰³ quaestionem respondeo breviter et dico quod causa naturalis est ista: quia dum calor solis elevat de mari vaporem subtilem tota grossities quae praefuit¹⁰⁴ in vapore remanet et¹⁰⁵ per calorem solis¹⁰⁶ aduritur. Et sic salsa redditur et¹⁰⁷ ex mixtione¹⁰⁸ aqua salsa efficitur, nam sicut aqua

⁹⁰ **M**=9v^a1. ⁹¹ in nocte quam . . . pluviae] in nocte quam in die ideo plures sunt pluviae *homoeot.* in "pluviae" **V** in nocte quam in die ideo plures sunt pluviae in hieme quam in aestate et plures **RO** in nocte quam die ideo plures sunt pluviae in hieme quam in aestate et plures **C** plures sunt pluviae *homoeot.* in "et" **S** plures erunt pluviae *sed* erunt *add. sup. lin. et homoeot.* in "et" **A**. ⁹² causa naturalis] *om.* **S**. ⁹³ **C**=56r1. ⁹⁴ tempore] *oblitteratum* **S**. ⁹⁵ interiora] *oblitteratum* **S**. ⁹⁶ illa] ita **RC** illa *vel* ita *abbr. incerta* **O** alia **V**. ⁹⁷ **A**=21v1. ⁹⁸ **D**=p. 441 lin. 1. ⁹⁹ Beda] Beba **M**. ¹⁰⁰ Januensis] Januentis **D**. ¹⁰¹ post] plus **O** potius **A**. ¹⁰² **R**=6v1. ¹⁰³ hanc] *om.* **S**. ¹⁰⁴ **V**=61r^a1. ¹⁰⁵ et] quae **ΓΣ**. ¹⁰⁶ **A**=22r1. ¹⁰⁷ **S**=61v1. ¹⁰⁸ mixtione] illius connixtione **Δ** *add.* aquae cum terra **A** id est illius vaporum *sup. lin.* **A**.

^o Aristotle often puts it more generally, not in terms of the seasons and the change from day to night, but rather in terms of the sun approaching and receding. See *Meteorology* 346b15–347a11 and *Meteorology* 360a4–6.

^p See *Meteorology* 348b1–30.

^q Neither rain nor hail are significant topics in any of Bede's extant works, though brief characterizations of weather phenomena occur in *De ratione temporum* and *De natura rerum*. See also *De constitutione mundi*, which the PL suggests may have been written by Bede. (All these works are in vol. 90 of the PL.) According to *Orbis Latinus*, "Jannuensis" refers either to Genoa or Geneva, but Genoa seems the far more plausible of the two; see *Orbis Latinus: Lexikon lateinischer geographischer Namen des Mittelalters und der Neuzeit*, ed. Johann Georg Theodor Graesse et al., Band 2, E–M (Braunschweig, 1972), 270. Although it cannot be determined with any certainty, the reference here could be to a Simon of Genoa, who compiled a medical dictionary around 1290; see Steven A. Epstein, *Genoa and the Genoese, 958–1528* (Chapel Hill, 1996).

collata cum cinere¹⁰⁹ fit salsa, sic aqua maris mixta cum vapore grosso adusto per solum salsa efficitur.^r

<12> Ex quibus patet quod aqua maris non est essentialiter salsa sed accidentaliter, quod patet¹¹⁰ per experimentum quod ponit Aristoteles,¹¹¹ quoniam si homo acceperit¹¹² vas cereum¹¹³ novum et clausurit eius orificium et¹¹⁴ eiecerit ipsum in mare vacuum per diem et noctem intrabit in ipsum aqua dulcis. Et ratio est quia cera¹¹⁵ est corpus porosum et ideo aqua subtilis intrat per poros, et grossities aquae¹¹⁶ intrare non potest. Et illud experimentum in terminis ponit Aristoteles tertio¹¹⁷ *Meteororum*¹¹⁸ in capitulo de ventis et ibidem dicit quod aqua salsa est gravis et aqua dulcis subtilis.^s

<13> Et ad hoc ponit notabile experimentum. “Si,” inquit, “sal dissolvatur in aqua dulci secundum magnam quantitatem deinde¹¹⁹ proiciatur in illa ovum invenitur ovum natans super aquam¹²⁰ propter grossitiem¹²¹ eiusdem aquae.” “Sed in aqua dulci,” inquit¹²² “submergitur ovum.”^{123t} Haec ibidem.¹²⁴

<14> Sexta quaestio fuit talis: quae foret causa naturalis fluxus et refluxus maris. Ad hanc quaestionem respondeo breviter et dico quod causa naturalis fluxus et refluxus maris secundum Macrobius et Lincolnensem est luna.^u Nam sicut adamas¹²⁵ trahit ferrum post se sic luna trahit¹²⁶ et movet post se oceanum. Unde in ortu lunae intumescit mare et crescit ex parte orientali et decrescit ex parte occidentali. Et e converso in eius occasu crescit¹²⁷ ex parte occidentis¹²⁸ et decrescit¹²⁹ ex parte orientis.¹³⁰

¹⁰⁹ aqua collata cum cinere] collata **V** aqua conmixta cum cinere **RC** aqua collata in cinerem **M** aqua cum cinere mixta **O** aqua collata in cinere **ADB**. ¹¹⁰ quod aqua . . . quod patet] *om. fortasse homoeol.* **MB**. ¹¹¹ aristoteles] philosophi **O**. ¹¹² acceperit] acciperet **VA** accipiat **A**. ¹¹³ vas cereum] vas sereuum **MD** sereuum **A** cereuum **B** id est instrumentum de cera concavum *sup. lin.* **A**. ¹¹⁴ et] cum cera et **MB** cum cera fortiter et **A** cum sera et **D**. ¹¹⁵ cera] sera **D** cerum **B**. ¹¹⁶ grossities aquae] grossities aqua **V** grossies aqua **M** grossies aquae **D** grossissies aqua **B** *add.* id est salsedo **A**. ¹¹⁷ **A**=22v1. ¹¹⁸ Meteororum] methecorum **D**. ¹¹⁹ **M**=9v^b1. ¹²⁰ deinde . . . aquam] deinde proiciatur ovum natans super aquam **V** esse supernatabit in illa *sed* “esse” *abbr. incerta* **R** esse supernatabit in ista **C** supernatabit in illa **O** deinde ponatur in illa ovum et invenitur ovum natans super aquam **A**. ¹²¹ grossitiem] grossiium **MD** grossissiem **B**. ¹²² dulci inquit] salsa statim **A**. ¹²³ ovum] esse **RC** *sed* “esse” *abbr. incerta* **R** *om.* **OA**. ¹²⁴ haec ibidem] haec ille ibi **V** et patet solutio **M** *om.* **ADB**; ibidem] *abbr. incerta* **S**. ¹²⁵ adamas] adamans **RC** naturaliter *seq.* **A**. ¹²⁶ **O**=86r1; **A**=23r1. ¹²⁷ crescit] *add.* decrescit **B** luna **RCDB** mare in *seq.* **A**. ¹²⁸ occidentis] occidentali *sed del., add.* orientali **B**. ¹²⁹ decrescit] crescit **B**. ¹³⁰ orientis] occidentali **B**.

^r See *Meteorology* 2.2, especially 357a30–357b8 and 358a11–25.

^s *Meteorology* 359a1–7.

^t *Meteorology* 359a11–17.

^u It is widely held that Aristotle had no real knowledge of the tides. If this is so, it is not surprising that Lavenham must abandon his reliance on Aristotle for the majority of this question. Grosseteste has a well-developed theory of the lunar mechanism of the tides; see,

<15> Et secundum quod luna plus vel¹³¹ minus proficit¹³² in lumine sic plus vel minus in suo fluxu se extendit vel¹³³ retrahit ipsum mare. Lincol-nensis sic habet in terminis: “Cursus maris sequitur cursum lunae tam illum quem rapta firmamenti facit in die naturali quam illum quem proprio motu contra raptum firmamenti facit in mense.¹³⁴ Uterque enim motus potest¹³⁵ dividi in quattor quartas¹³⁶ et secundum hoc in die naturali sunt¹³⁷ duo fluxus et duo refluxus. Cum enim luna ascendit in utroque hemispherio secundum rectam¹³⁸ sphaeram mare fluit sive¹³⁹ crescit. Et cum luna descen-dit in utroque¹⁴⁰ mare decrescit.”^v

<16> “Sed alia,” inquit, “causa cursus maris est secundum Aristotelem coartatio laterum¹⁴¹ et constrictio eorum.¹⁴² Cum enim per virtutem¹⁴³ caeles-tem mare ascendat¹⁴⁴ in suo medio fluit ad latera¹⁴⁵ qua¹⁴⁶ per obstacula¹⁴⁷ riparum vel per aquas via contraria currentes¹⁴⁸ repercussa. Partes aquae constringuntur ad medium sui iterum impellentes.”^w

¹³¹ D=p. 442 lin. 1. ¹³² proficit] deficit Δ proficitur A perficit B.
¹³³ V=61r^b1. ¹³⁴ B=21r1. ¹³⁵ R=7r1. ¹³⁶ quartus] quadrangulis A.
¹³⁷ A=23v1. ¹³⁸ rectam] certam S. ¹³⁹ C=56v1. ¹⁴⁰ utroque] add. hemi-
spherio VOΣ. ¹⁴¹ laterum] literum A. ¹⁴² eorum] earum VSB. ¹⁴³ virtu-
tem] abbr. falsa V. ¹⁴⁴ ascendat] ascendit ΔΣ. ¹⁴⁵ ad latera] ab altera V ad
terram Δ ad litora A. ¹⁴⁶ qua] coni. quam FRMO quod C vel A quia D qui fluxus
B. ¹⁴⁷ obstacula] substacula Δ sed partim del. O. ¹⁴⁸ currentes] concurrentes
RC percurrentes O.

for example, Robert Grosseteste, “Quaestio de fluxu et refluxu maris,” ed. and trans. Richard C. Dales, *Isis* 57 (1966): 455–74. The reference to Macrobius is puzzling, since he does not hold that the moon is the cause of the tides at all. In fact, it is quite clear that Macrobius held a “polar” or *refusio* theory of the tides, which he details in the very influential *Commentary on Cicero’s Somnium Scipionis*. There he asserts that the Earth is covered by an equatorial ocean and a meridional ocean that divide the dry land into four quarters. The equatorial ocean flows like a river into the meridional ocean, causing it to flow from the equator to the poles in both hemispheres. The eventual collision of these flowing waters at the poles sends them rebounding back to the equator, causing an ebb and flow that is felt in every connected body of water. These resulting movements are just the tides. See Macrobius, *Commentary on the Dream of Scipio*, trans. William Harris Stahl (New York, 1952), 300–304. Macrobius was very influential on medieval geographers, and his views on tidal mechanics are clearly and unequivocally stated in a work that was widely circulated. Thus, either Lavenham got it wrong here or he had a work of Macrobius, now lost, that contained a *lunar* theory of the tides instead.

^v *Locus non inventus*.

^w Again, Grosseteste is being cited. I cannot find the precise source of the quotation, but see Aristotle, *Meteorology* 354a6–10.

<17> Septima quaestio fuit talis: quae foret causa naturalis fontium. Ad hanc quaestionem respondet Dominus Lincolnensis *Super librum Meteororum*^x sic: “Loca,” inquit “montuosa¹⁴⁹ sunt valde¹⁵⁰ porosa unde sicut spongia plena porum¹⁵¹ attrahit aquam similiter illa loca attrahunt aquam ex diversis partibus terrae manantem¹⁵² ad locum unum et fit huiusmodi attractio¹⁵³ major vel minor secundum quod aqua est subtilior et magis depurata. Et ob hoc inquit quandoque erumpunt fontes in summitate montium aliquando circa medium et aliquando in pede illam autem porositatem oportet esse spissam ita quod aqua elevata non possit remeare¹⁵⁴ per eosdem meatus per quos¹⁵⁵ ascendit.” Haec ibidem.¹⁵⁶

<18> Octava quaestio fuit talis: quae sit causa naturalis quare fontes calidi sunt in hieme et frigidi in¹⁵⁷ aestate. Ad hanc quaestionem¹⁵⁸ Macrobius in quarto libro¹⁵⁹ *Saturnalia*¹⁶⁰ valde sensibiliter¹⁶¹ respondet:¹⁶² “Quia calor in hieme suum fugiens contrarium petit interiora fontium ex cuius praesentia¹⁶³ ora fontium calefiunt. In aestate verso econtrario frigus fugiens calorem in terrarum¹⁶⁴ ima demergitur et aquas inficit et eas frigidas facit. Et propter consimilem,” inquit, “causam in Aegypto¹⁶⁵ quae regionum aliarum calidissima est, vina non calida sed frigida in virtute nascuntur.”¹⁶⁶ “Et causa est,” inquit, “quia frigus fugiens calorem in terrarum ima demergitur et radicibus vitium fortiter adhaeret et talem dat qualitatem succo inde nascenti.”^y

<19> Nona¹⁶⁷ quaestio fuit talis: quae foret causa naturalis quare vina raro aut numquam congelascunt. Hanc quaestionem movet Macrobius in libro superius¹⁶⁸ allegato et dicit quod Homerus¹⁶⁹ dicebat quod causa naturalis foret ista quia vina calida sunt in virtute¹⁷⁰ et hoc ex se et ideo raro aut numquam gelu stringuntur. Sed tunc replicat: “Cur,” inquit “vina gelu non stringuntur¹⁷¹ licet calida sint¹⁷² cum oleum aequae calidum sit et tamen sae-

¹⁴⁹ S=62r1. ¹⁵⁰ A=24r1. ¹⁵¹ porum] poris RC pororum MDB porosa O om. A. ¹⁵² manantem] manentem ΔAB. ¹⁵³ M=10r^a1. ¹⁵⁴ remeare] remare V remanere Δ. ¹⁵⁵ quos] consequens RC. ¹⁵⁶ ibidem] abbr. incerta S. ¹⁵⁷ V=61v^a1. ¹⁵⁸ octava . . . quaestionem] ad octavam de califactione fontium in hieme RC ad octavam quaestionem de califactione fontium in hieme O. ¹⁵⁹ quarto libro] inv. AB. ¹⁶⁰ saturnalia] naturalium A. ¹⁶¹ sensibiliter] singulariter MB significat O suaviter A scencialiter lect. incerta D add. sic VΔ. ¹⁶² A=24v1. ¹⁶³ praesentia] puritia O perversione A. ¹⁶⁴ in terrarum] intrans Δ. ¹⁶⁵ aegipto] egito D. ¹⁶⁶ D=p. 443 lin. 1. ¹⁶⁷ O=86v1. ¹⁶⁸ A=25r1. ¹⁶⁹ R=7v1. ¹⁷⁰ virtute] abbr. falsa V. ¹⁷¹ sed tunc . . . non stringuntur] constringuntur om., fortasse homoeot. in “constringuntur” B; stringuntur] constringuntur AB. ¹⁷² sint] sunt VΔAB fuit M.

^x No such work of Grosseteste’s is extant.

^y *Saturnalia* 7. 8.

pius congelascit?" Et respondet: quia oleum spissius est vino et quae spissiora sunt facilius¹⁷³ condensantur.^{174z}

<20> Decima quaestio fuit talis: quae foret causa naturalis quare terra medium semper tenet. Ad hanc quaestionem respondet Urso¹⁷⁵ in *Afforissimis*, afforissimo 33¹⁷⁶ in commento,¹⁷⁷ ubi sic: "Si aequalis a duobus extremis alicuius rei fiat attractio necessario¹⁷⁸ illud quod trahitur in medio collocatur. Unde si inter duos adamantes¹⁷⁹ ferrum ponatur, propter aequalem utriusque attractionem motus in¹⁸⁰ medio loco detinetur immobile. Et si in domo tota ex lapide magnete¹⁸¹ constructa pavimento excepto, si globus ferreus immitteretur dum aequaliter ex omni parte traheretur, in medio globus penderet."

<21> "Et conformiter,"¹⁸² inquit, "a firmamento terra undique aequaliter tracta medium tenet. Unde centrum ipsius indicatur cum¹⁸³ aequali attractione nec¹⁸⁴ potest ad inferiora magis deprimi nec ad altiora extolli." "Unde¹⁸⁵ si possibile foret," inquit, "quod aliquis ab hac superficie superiori usque ad aliam oppositam superficiem¹⁸⁶ superiorem¹⁸⁷ terrae lineariter perforaret et massam plumbi immitteret usque ad centrum terrae non ultra¹⁸⁸ centrum seu medium punctum caderet sed motum naturalem compesceret et a motu cessaret."^{aa} Haec Urso.¹⁸⁹ Et sic patet solutio decimae quaestionis.

<22> Undecima¹⁹⁰ quaestio fuit talis: quae foret causa naturalis terraemotus. Ad hanc quaestionem respondeo breviter et dico quod causa naturalis terraemotus est ventus agitato in ventre terrae. Unde Aristoteles tertio *Meteororum* sicut ventus agitato in ventre hominis sonitum facit et exitum quaerit sic ventus intrans concavitates terrae ipsam commovet et agitat et non cessat donec terram alicubi abrumpat et scindat.^{bb} Et ibidem dicit Aristoteles quod terra in natura sua est sicca cum ergo pluit humectatur et sol agit in eam et elevat ex ea vaporem siccum¹⁹¹ sed¹⁹² vapor grossus remanens agitur in ventre terrae et terraemotum facit.^{cc}

¹⁷³ facilius] citius **Δ**. ¹⁷⁴ vino . . . condensantur *om.* **V**. ¹⁷⁵ urso] ursus **Δ**. ¹⁷⁶ in afforissimis afforissimo 33] in afforissimis 33 afforissimo **V** afforissimo **Δ** in afforibus afforissimis 33 **M**. ¹⁷⁷ commento] conjuncto **V** convinso **RC**. ¹⁷⁸ **M**=10r^b1. ¹⁷⁹ **A**=25v1. ¹⁸⁰ **V**=61v^b1. ¹⁸¹ magnete] magnato **O** magnate **A** magnete *abbr. incerta* **V** *add.* immutteretur dum aequaliter ex omni parte traheretur, *sed exp.* **M**. ¹⁸² conformiter] *oblitteratus* **S** *abbr. incerta* **M**. ¹⁸³ **C**=57r1. ¹⁸⁴ **S**=62v1. ¹⁸⁵ **B**=21v1. ¹⁸⁶ superficiem] *abbr. incerta* **V**. ¹⁸⁷ superiorem] *om.* **Δ**. ¹⁸⁸ **A**=26r1. ¹⁸⁹ haec urso] *om.* **VΔΣ**. ¹⁹⁰ **D**=p. 444 lin. 1. ¹⁹¹ siccum] *abbr. falsa* **M**; **A**=26v1. ¹⁹² sed] *illeg.* **S**.

^z *Saturnalia* 7.12.

^{aa} Urso of Salerno's (d. 1225) *Afforisms* has not been edited.

^{bb} *Meteorology* 366a2–5 and 366b14–367a1.

^{cc} *Meteorology* 365b21–29.

<23> Et dicit ibidem Aristoteles quod in locis in¹⁹³ quibus fit concursus maris et agitatio undarum eius ac in locis cavernosis fit vehemens terraemotus.^{dd} Sed in locis arenosis¹⁹⁴ non fit terraemotus, secundum Aristotelem in libro *De vegetabilibus*,¹⁹⁵ nam in locis interius cavernosis et¹⁹⁶ exterius in superficie duris,¹⁹⁷ sicut sunt¹⁹⁸ loca montium, accidit terraemotus; sed in locis omnino porosis non accidit de facili terraemotus propter vaporis facilem eventationem nec in locis valde duris et compactis¹⁹⁹ propter partium compressionem.^{ee} Et sic patet solutio undecimae quaestionis.

<24> Duodecima²⁰⁰ quaestio²⁰¹ fuit²⁰² talis: quae foret causa naturalis venti et agitationis ventorum. Ad hanc quaestionem respondeo breviter et dico quod causa naturalis venti est ista: dum enim vapor frigidus et siccus elevatur de terra per calorem solis, postea ille idem vapor repercutitur ab aestu vel ab aere hebente in se caliditatem et talis repercussio causat agitationem in aere. Propter quod dicit Aristoteles tertio *Meteororum* quod principium flatus venti seu agitationis eiusdem est de sursum sed materia ex qua fit est deorsum.^{ff} Verumtamen²⁰³ sicut ibi docet Aristoteles duo sunt prohibentia esse ventorum videlicet frigus excessivum et calor excessivus. Nam frigus²⁰⁴ excessivum²⁰⁵ constringit terram sicut patet in gelu quod vapores de ea ascendere non possunt. Item calor excessivus adurit²⁰⁶ terram et consumit²⁰⁷ vapores.^{gg} Et sic patet solutio duodecimae quaestionis.

<25> Tertia decima²⁰⁸ quaestio an nubes possint²⁰⁹ generari in superiori parte aeris. Et videtur quod sic quia quodlibet elementum est natum transmutari in aliud, secundum Aristotelem²¹⁰ primo *De generatione*,^{hh} cum ergo aer sit elementum sequitur quod²¹¹ potest transmutari in naturam aquae et qua²¹² ratione ex una parte aeris potest fieri aqua²¹³ eadem ratione ex quacumque alia²¹⁴ parte aeris potest fieri aqua per transmutationem naturalem, ergo ex parte superiori aeris potest fieri aqua. Sed ex aere non potest fieri

¹⁹³ R=8r1. ¹⁹⁴ arenosis] arnosis S; V=62r^a1. ¹⁹⁵ vegetabilibus] regiminibus A
et plantis seq. M. ¹⁹⁶ M=10v^a1. ¹⁹⁷ duris] auris M aeris ADB. ¹⁹⁸ sunt]
sicca A inde seq. S. ¹⁹⁹ compactis] compactus S. ²⁰⁰ O=87r1.
²⁰¹ A=27r1. ²⁰² fuit] fueret S. ²⁰³ verumtamen] sumptum RC sumptum est O
verumtamen D om. A abbr. illeg. del. B. ²⁰⁴ A=27v1. ²⁰⁵ et . . . excessivum
om., homoeot. Δ. ²⁰⁶ adurit] urit Δ. ²⁰⁷ S=63r1; D=p. 445 lin. 1. ²⁰⁸ Σ tertiam decimam quaestionem non continet.
aristotelem] per philosophum Δ. ²⁰⁹ possint] possunt VΔ. ²¹⁰ secundum
V. ²¹³ parte . . . aqua] parte RC om. O. ²¹⁴ alia] om. Δ. ²¹² qua] aqua

^{dd} *Meteorology* 366a24–26.

^{ee} See the pseudo-Aristotelian *On Plants* 822b35–823a15.

^{ff} *Meteorology* 361a25–b1.

^{gg} *Meteorology* 361b14–35.

^{hh} *On Generation and Corruption* 331a12–16.

aqua nisi per²¹⁵ condensationem, ergo pars aeris superior est apta condensari.²¹⁶ Sed aerem condensari ut vult²¹⁷ Aristoteles nihil aliud est quam nubem generari,ⁱⁱ ergo superiori parte aeris potest generari nubes. Ad oppositum tamen est Aristoteles in primo *Meteororum* prope principium.^{jj}

<26> Ad quaestionem respondeo tenendo partem negativam quaestionis quia ultra medium intersticiam aeris sive ultra mediam aeris regionem non possunt nubes naturaliter generari. In cuius evidentiam refert Augustinus tertio libro *Super Genesi ad litteram* quod mons²¹⁸ Olympi est ita excelsus²¹⁹ quod transcendit omnes aeris turbines.²²⁰ In hunc montem philosophi in principio anni solebant ascendere cum spongiis et ibidem quosdam characteres in pulvere facere quos quidem characteres²²¹ in fine anni integros inveniebant; quod fieri non posset si cacumen montis ventis²²² aut pluviis aut nubibus turbaretur.^{223kk}

<27> Dico ergo quod ultra medium intersticiam²²⁴ aeris non generantur nubes nec possunt naturaliter generari.²²⁵ Et ad argumentum in oppositum dico quod licet ex aliqua parte aeris possit generari aqua non tamen ex qualibet parte aeris quocumque modo se habente potest aqua generari, quia aliqua pars aeris est in tantum calida quod ex ipsa non est nata fieri nubes²²⁶ quia nubes fit²²⁷ ex aere congregato²²⁸ et inspissato per frigus. In parte ergo superiori aeris propter vehementem caliditatem causata ex motu supracaelestium corporum non potest nubes generari. Et sic patet solutio tertiae decimae quaestionis.²²⁹

²¹⁵ V=62r^b1. ²¹⁶ aeris potest fieri aqua per transmutationem . . . apta condensari] et per consequens aer in parte superiori potest condensari **RC** et per consequens aer in frigiditate parte condensatur **O**. ²¹⁷ vult] *abbr. illeg. S om. Δ*. ²¹⁸ ergo superiori parte aeris . . . quod mons] ad illam dicitur quod solum in media regione aeris potest nubes generari unde secundum Augustinus arens **Δ**. ²¹⁹ excelsus] excessus **RC**. ²²⁰ turbines] turpidiens **RC** turpitudinis **O**. ²²¹ in pulvere . . . characteres] *om., homoeol. C*. ²²² R=8v1; C=57v1. ²²³ montis . . . turbaretur] turbaretur ventis et imbribus **RC** non turbaretur ventis et imbribus **O**. ²²⁴ medium intersticiam] mediam regione **Δ**. ²²⁵ nec . . . generari] *om. Δ*. ²²⁶ in oppositum dico . . . fieri nubes] negatur quod qua ratione ex una parte aeris et sic quia propter calorem ignis et calorem generatam ex motibus supracaelestibus non possunt nubes generari in illa parte **RC** negatur quod qua ratione ex parte aeris et cetera quia propter calorem ignis et calorem generatum ex motibus supracaelestibus non possunt imbres generari in illa parte **O**. ²²⁷ fit] generatur **RC** generantur **O**. ²²⁸ congregato] aggregato **Δ**. ²²⁹ in parte ergo . . . quaestionis] et sic **RC** et **O**.

ⁱⁱ *Meteorology* 436b31–32.

^{jj} *Meteorology* 340a24–340b32.

^{kk} *De Genesi contra Manichaeos* 1.15. The sponges are applied to their noses to help them breathe the thin air; see Augustine, *De Genesi contra Manichaeos libri III*, PL 34:173–218.

<28> Quarta decima²³⁰ quaestio an nubes possunt in media aeris²³¹ regione generari. Et videtur quod non quia nubes generantur per frigiditatem inspissantem²³² sed in media aeris regione non est frigiditas quia tunc aer esset frigidus et humidus²³³ et sic nulla qualitate prima²³⁴ differret ab aqua, ergo in media aeris regione non possunt nubes generari. Ad²³⁵ oppositum tamen est Aristoteles in loco quo prius.^{ll}

<29> Ad hanc quaestionem respondeo tenendo partem affirmativam quaestionis et pro responsione ad argumentum in contrarium, notandum²³⁶ quod aer in suprema regione sua²³⁷ habet calorem excessivum et vehementem propter motum corporum caelestium,²³⁸ nam caelestia corpora²³⁹ per motum generant calorem²⁴⁰ in suprema aeris regione. Item aer in inferiori parte sui habet in calorem excessivum propter refractionem solarium radiorum. Sed²⁴¹ in media aeris regione est caliditas temperata quae similis est tepiditati aquae quae aequaliter participat de frigiditate et caliditate et quia non est ibi calor excessivus sicut in suprema aeris regione et²⁴² in inferiori²⁴³ parte aeris. Ideo potius dicitur ibi esse frigiditas quam caliditas. Secundum quosdam illa tamen frigiditas non sufficit ad generationem nubium sine aliqua frigiditate superveniente.

<30> Unde dicit Albertus et bene quod vapor frigidus et humidus per calorem existentem hic inferius ex refractione solarium radiorum calescit²⁴⁴ sed²⁴⁵ cum vapor ille perveniret²⁴⁶ ad mediam aeris regionem derelinquitur²⁴⁷ vapor propriae naturae²⁴⁸ et iterum frigescit sicut si quis calefaceret aquam et eam poneret in aliquo loco in quo non²⁴⁹ esset magna caliditas, illa caliditas cito diminueretur et illa frigiditas superveniens inspissat vaporem et sic generatur²⁵⁰ nubes.^{mm} Et per²⁵¹ hoc patet responsio ad argumentum et ad materiam quaestionis quartae decimae.²⁵²

²³⁰ Σ quartam decimam quaestionem non continet. ²³¹ V=62v^a1. ²³² inspissantem] om. Δ . ²³³ et humidus] om. Δ . ²³⁴ nulla qualitate prima] non Δ .
²³⁵ S=63v1. ²³⁶ ergo in media . . . contrarium notandum] respondeo et dico Δ .
²³⁷ sua] om. Δ . ²³⁸ corporum caelestium] supracaelestium Δ . ²³⁹ caelestia corpora] corpora supracaelestia Δ . ²⁴⁰ calorem] caliditatem Δ . ²⁴¹ O=87v1.
²⁴² et] vel Δ om. V. ²⁴³ inferiori] infima Δ . ²⁴⁴ calescit] calefit V Δ .
²⁴⁵ sed] tamen Δ om. V. ²⁴⁶ perveniret] om. Δ . ²⁴⁷ derelinquitur] derelinquit RC delinquit O. ²⁴⁸ vapor propriae naturae] propriam naturam Δ . ²⁴⁹ non] om. O. ²⁵⁰ generatur] generari VRC. ²⁵¹ V=62v^b1. ²⁵² et per . . . quartae decimae] om. Δ .

^{ll} This could mean either *On Generation and Corruption* 331a12–16 or *Meteorology* 340a24–340b32.

^{mm} *Locus non inventus.*

<31> Quinta decima quaestio fuit talis: an²⁵³ vapor sit materia ventorum et nubium. Et dico quod sic quia vapor est materia omnium eorum quae generantur in superiori aeris regione²⁵⁴ et omnium eorum quae generantur in media aeris regione.²⁵⁵ Unde vapor calidus et siccus elevatus de terra per calorem solis ascendit ultra mediam aeris regionem et inflammatur ibi ab igne et ex illo vapore inflammato diversae²⁵⁶ res generantur, sicut stella comata, ardens draco, assub ascendens, et²⁵⁷ assub descendens.²⁵⁸ⁿⁿ

<32> Unde vapor calidus et siccus qui exhalatio²⁵⁹ dicitur elevatur de terra usque ad sphaeram²⁶⁰ ignis. Et ignis inflammat²⁶¹ unam partem²⁶² illius et apparet stella et dicitur stella comata quia²⁶³ videtur habere comas. Et aliquando talis materia inflammata apparet ardens draco et aliquando talis materia inflammata²⁶⁴ alicuius ascendit²⁶⁵ propter subtilitatem et apparet quasi stella ascendens.²⁶⁶ Et aliquando talis materia inflammata²⁶⁷ descendit propter grossitiem²⁶⁸ et apparet in nocte quasi stella cadens et dicitur assub descendens, nam si materia²⁶⁹ inflammata ascendit tunc vocatur assub ascendens, et si²⁷⁰ talis materia inflammata descendat vel cadat tunc vocatur assub descendens.²⁷¹ Item vapor frigidus et humidus est materia multorum quae generantur in media aeris regione sicut pluviae,²⁷² nivis, grandinis.²⁷³ Et vapor frigidus et siccus est materia ventorum. Ex quibus omnibus²⁷⁴ patet quod si nullus numquam²⁷⁵ foret vapor,²⁷⁶ nulla foret nubes, nulla foret pluvia, nulla foret tempestas, vel procella.²⁷⁷

²⁵³ quinta decima . . . an] quinto decimo quaeritur an **V** ad quintam decimam quaestionem concedo quod **Δ** tertia decima quaestio fuit talis an **Σ**. ²⁵⁴ superiori aeris regione] superiori parte aeris **RC** inferiore parte aeris **O**. ²⁵⁵ omnium . . . regione] similiter medio **Δ**. ²⁵⁶ **A**=28r1. ²⁵⁷ et] *om.* **VDB**. ²⁵⁸ assub descendens] *om.* **V**. ²⁵⁹ exhalatio] ex aliquo **Δ** exactio **A**. ²⁶⁰ sphaeram] regionem **Δ**. ²⁶¹ inflammat] inflammatur **S**. ²⁶² **R**=9r1. ²⁶³ quia] qui **Γ**. ²⁶⁴ apparet . . . inflammata] *om.*, *homoeol.* **A**. ²⁶⁵ **S**=64r1. ²⁶⁶ **M**=10v^b1. ²⁶⁷ apparet ardens draco . . . inflammata] *om.* **B**; talis materia inflammata] *om.* **Δ**. ²⁶⁸ grossiciem] grossionem **D** grossissiem **B**. ²⁶⁹ **B**, *imperfectum, desinit*; **B**=21v39. ²⁷⁰ si] sic **S**. ²⁷¹ nam si materia inflammata . . . descendens] *om.* **CA** si ascendat dicitur assub ascendens **RO**. ²⁷² **A**=28v1. ²⁷³ pluviae nivis grandinis] pluviae nives grandines **Δ** pluviae nix grandines **MD** pluvia nives grando **A**. ²⁷⁴ omnibus] *om.* **VA**. ²⁷⁵ numquam] *om.* **ΔMAD**. ²⁷⁶ vapor] *add.* nulla foret pluvia nulla foret tempestas *sed del. cum va sup. lin.* **V**. ²⁷⁷ nulla foret tempestas vel procella] esset et sic **R** esset **CO** vel procella] nihil procella **V** nulla foret procella **M** nulla procella foret **A** nec nulla foret procella **D** et sic patet solutio tertiae decimae quaestionis et ultimae *seq.* **M**

ⁿⁿ *Assub* is derived from the Arabic and is a technical term, used in Latin translations of Aristotle as the equivalent of “stella cadens,” according to the editor of John Gower, *Confessio Amantis: The Complete Works of John Gower*, ed. G. C. Macaulay (Oxford, 1901), 3:242. Hence, an “assub” is simply what we call a “shooting star” today (see *Mittelalteinisches Wörterbuch* 1 [Munich, 1967], 1086).

<33> Sexta decima²⁷⁸ quaestio fuit talis: an vapor sit substantia vel accidens et si substantia numquid²⁷⁹ sit corpus simplex vel mixtum. Ad istam quaestionem respondeo breviter et dico quod vapor non est accidens sed substantia et ratio est quia accidens non potest migrare de subjecto in subjectum. Sed si vapor foret accidens tunc migraret accidens de subjecto in subjectum eo quod vapor elevatur de terra in aerem quare sequitur quod vapor non est accidens sed substantia.

<34> Sed ulterius cum quaeritur numquid vapor sit corpus simplex vel mixtum. Ad hoc respondeo et²⁸⁰ dico quod est corpus simplex et non mixtum et ratio est quia ad veram mixtionem requiritur²⁸¹ quod²⁸² quaelibet pars mixti²⁸³ sit mixta, secundum Aristotelem,⁰⁰ sed sic non est de vapore, ergo et cetera. Item corpus simplex resolvitur a corpore simplici et non corpus mixtum sed vapor resolvitur a corpore simplici ut a terra vel ab aqua, ergo et cetera.

<35> Sed hic ulterius posset quaeri quomodo vapor siccus et calidus elevatur de terra cum terra non habeat huiusmodi qualitates, nam²⁸⁴ terra non est calida et sicca sed frigida et sicca. Ad hoc²⁸⁵ respondeo et dico quod per refractionem²⁸⁶ solarium radiorum calor est terrae incorporatus. Et ratione caloris²⁸⁷ radiorum²⁸⁸ solis habet terra caliditatem et haec est ratio quare ex terra possunt huiusmodi vapores calidi et sicci generari.²⁸⁹ Et sic patet solutio quaestionis.²⁹⁰ Explicit tractatus *De causis naturalibus* per Lavinham.²⁹¹

et sic patet solutio tertiae decimae quaestionis et ultimae cum omnibus praecedentibus de impressionibus secundum aristotelem primo libro Meteororum *seq.* **A** et sic patet solutio tertiae decimae et ultimae quaestionis explicit tractus de causis naturalibus et sic **D MAD** *desinunt*; **M**=10v^b13; **A**=29v10; **D**=p. 445 lin. 25. ²⁷⁸ **Σ** sextam decimam quaestionem non continet. ²⁷⁹ **V**=63r^a1. ²⁸⁰ vapor non est accidens sed substantia et ratio est . . . respondeo et] est substantia et non accidens ex hoc quod migrat de uno loco ad alium locum ulterius **RC** est substantia et non accidens ex hoc quod migrat de uno loco in alium locum ulterius **O**. ²⁸¹ et ratio . . . requiritur] ad hoc enim quod aliquid sit mixtum oportet **Δ**. ²⁸² **O**=88r1. ²⁸³ **C**=58r1 ²⁸⁴ nam] ex hoc quod **Δ**. ²⁸⁵ hoc] *om.* **S**. ²⁸⁶ refractionem] *abbr. incerta* **S**. ²⁸⁷ caloris] caliditatis **Δ**. ²⁸⁸ calor est terrae . . . solis] *om., homoeot.* **V**. ²⁸⁹ generari] et elevari et sic *seq.* **R** et elevari et cetera *seq.* **C** et elevari *seq.* **O C desinit** **C**=58r9. ²⁹⁰ et sic patet solutio quaestionis] et sic patet solutio sextae decimae quaestionis **V** et sic finiuntur solutiones sedecim quaestionum **R** et sic patent solutiones sedecim quaestionum **O**; **RO desinunt**; **R**=9r27; **O**=88r11. ²⁹¹ **VS desinunt**; **V**=63r^a27; **S**=64r29.

⁰⁰ Possibly a reference to *On Generation and Corruption* 328a9–12.

TRANSLATION
 <On Natural Causes>
 <Prologue>

<1> God and nature do nothing in vain, as Aristotle says in the first book of *On the Heavens*. This is clear to those who attend diligently to the issue, because God does nothing in vain in the upper world and nature does nothing in vain in this lower world. In the first place, an example from Aristotle in the first book of the *Meteorology* will suffice to show this. There he asks “Why are fire and air in the vicinity of the orb of the heavens?” and he responds: “Because the glorious and sublime God set it up this way for the preservation of the worldly machine, for if fire were closer to us than water or air are, then fire would have burned up everything that exists above ground.”

<2> Secondly, an example from the words of Aristotle in the first book of the *Politics*, chapter 5, will suffice. It runs thus: “Nature makes nothing imperfectly nor anything in vain.” “Plants,” he continues, “nature gives for the sake of animals, and animals for the sake of human beings.” “It is necessary,” he says, “that nature made everything for the sake of human beings.” Again, this becomes clear from the words of Aristotle in the second book of the *Physics*, where it runs thus: “A plant makes roots, not above the ground but rather below, for the sake of its growth; it makes leaves for the protection of the tiny fruit buds, and it produces fruit for the conservation of its own species.”

<3> From the preceding it is obvious that the words that I set out before, namely, that God and nature do nothing in vain, are strengthened by the support of truth. And because it is not only useful but also delightful to know the hidden cause of things, the poet says: “Happy is he who has been able to know the causes of things.” Hence it is that this little book is rightly called *On Natural Causes*, because in it the subject of causes is taken up and discussed in a primary way.

<List of Questions>

<4> Therefore, in this little book, it is first asked — What is the natural cause of thunder and lightning? Second — What is the natural cause of the rainbow? Third — What is the natural cause of dew? Fourth — What is the natural cause of rain and hail? Fifth — What is the natural cause of the salinity of the sea? Sixth — What is the natural cause of the ebb and flow of the sea? Seventh — What is the natural cause of springs? Eighth — What is the natural cause <that explains> why springs are hot in the winter and cold in the summer? Ninth — What is the natural cause <that

explains> why wines never or rarely freeze? Tenth — What is the natural cause <that explains> why the earth always holds the center? Eleventh — What is the natural cause of earthquakes? Twelfth — What is the natural cause of the winds and of the gusting of the winds? Thirteenth — Can clouds be generated in the upper part of the air? Fourteenth — Can clouds be generated in the middle region of the air? Fifteenth — Is vapor the material of the winds and clouds? Sixteenth — Is vapor a substance or an accident, and, if it is a substance, is it a simple or a compound body?

<Text>

<5> The first question was as follows: What is the natural cause of thunder and lightning? To this question I respond and say that the natural cause of thunder is the extinction of fire in a moist cloud. Hence, Aristotle, in the third book of the *Meteorology*, puts it like this: “Just as burning iron makes a hissing sound when it has been submerged in water, so too hot, dry vapor touches a moist cloud after it has been elevated from the earth and inflamed through rising. This reaction causes a sound that is called ‘thunder.’ That sound, therefore, is called ‘thunder’ and the flame that appears is called ‘lightning.’” Thus the solution of the first question is revealed.

<6> The second question was as follows: What is the natural cause of the rainbow? To this question I respond briefly and say that the natural cause is the opposition of a dewy cloud to the sun, in which cloud the rays of the sun are imprinted. Hence, after vapor has risen from the earth and been bound up in a cloud, but before it falls as rain, it becomes resolved into dew. At that point, a dewy cloud is generated which, in fact, if it is in opposition to the sun, takes in the sun’s rays. Such a formation of rays in a dewy cloud is called a “rainbow.” Hence, a rainbow is nothing but a dewy cloud formed by various means in opposition to the rays of the sun, and it is nothing other than this. Hence it is always required that a rainbow be made in opposition to the sun. This is the reason why the rainbow of the morning appears in the west, in the evening in the east, and at midday at the zenith. Nevertheless, Aristotle says in the book *Meteorology* that a rainbow made during the day comes from a ray of the sun, and one made during the night is from a ray of the moon. “Nevertheless,” he says, “the rainbow has only appeared at night twice in forty years.” Thus the solution of the second question is revealed.

<7> The third question was as follows: What is the natural cause of dew? To this question I respond briefly and say that the natural cause of dew is an elevation of cold, moist vapor that, due to a small of rush of cold, has been gathered in a cloud in the lower part of the middle region of the air. Aristotle says in the second book of the *Meteorology* that dew is not produced except when the south wind blows, for the wind of the south creates

and sustains dew by means of its own moisture, which moisture the north wind curbs and suppresses by means of its frenetic movement and intense cold. Dew in the tops of plants collects itself, drop by drop, and suppresses the power of poison in poisonous animals. Hence, ground snakes, while among plants, are seldom in the habit of striking passersby for as long as the flowers and the grass are in dew. So much for the solution of the third question.

<8> The Bishop of Lincoln, in his *Commentary on the Meteorology* says: "In the winter there is no dew except rarely, because at that time in particular the cold is quite commonly extreme and it conquers the heat." "But," he says, "when it does happen that the heat of the air and the coldness of the location or the coldness of the air and the heat of the location hold themselves in equal portions, at that time dew is generated."

<9> The fourth question was as follows: What is the natural cause of rain and hail? To this question I respond briefly and say that, according to Aristotle in the third book of the *Meteorology*, the natural cause of rain is when an elevation of cold moist vapor, raised through the heat of the sun, is subsequently (1) condensed as the sun recedes, and then (2) resolved into water on account of a predominating cold. "Because," Aristotle says, "the sun is a farther distance from us in the winter than in the summer, and in the night than in the day, there are therefore more rains in the winter than in the summer and in the night than in the day." Likewise, the natural cause of hail is an elevation, in warm weather, of cold moist vapor which, while fleeing the heat of the air, is received into the inside of a cloud. That vaporous material, once it has coagulated in the cloud, is called "hail." Because the heat speeds up the process of generating hail, hailstones occur more frequently in the summer than in winter. Thus the solution of the fourth question is revealed.

<10> But it should be noted that, as Bede and Januensis say, rainy material is never resolved into water except through heat expelling the cold vapor. Hence, when it is very cold it does not rain, except after a frost. In the summer violent rains are produced. Why is this? Because the heat violently expels the cold and resolves the cloud into water.

<11> The fifth question was as follows: What is the natural cause of the salinity of the sea? To this question I respond briefly and say that the natural cause is as follows: when the heat of the sun raises a subtle vapor above the sea, all of the thick material which was present in the vapor remains behind and is scorched by the heat of the sun. In this way the salinity of the sea is restored, and salt water is brought about from the mixture. For, just as water mixed with ash is salty, so also the water of the sea, mixed with a vapor that is thick and scorched through the sun, is caused to be salty.

<12> From consideration of these matters it is clear that the water of the sea is not salty essentially, but rather accidentally. <It is also> clear through an experiment that Aristotle lays out — since, if a person takes a new wax jar, closes its opening, and throws it, empty, into the sea for a day and a night, fresh water will enter into it. And the reason is because wax is a porous body and hence fresh water enters through the pores, but the thick material of salt water cannot enter. Aristotle describes this experiment in so many words in the third book of the *Meteorology* in the chapter on winds, and in that same place says that salt water is heavy and fresh water is subtle.¹

<13> And to this last point <viz., that salt water is heavy and fresh water is subtle> he sets out a notable experiment: “If salt is dissolved in fresh water in large quantities, and then an egg is put in it, the egg will be found floating on top of the water due to the water’s thickness, but in fresh water,” he says, “an egg sinks.”² These remarks all occur in the book just cited.

<14> The sixth question was as follows: What is the natural cause of the ebb and flow of the sea? To this question I respond briefly and say, according to Macrobius and the Lincolnite, that the natural cause of the ebb and flow of the sea is the moon. For just as a magnet drags iron after itself, so the moon drags and moves the ocean after itself. Hence, at the time of the rising of the moon the sea arises, goes up from the eastern part and goes down from the western part. And, contrariwise, at the time of the setting of the moon, the sea goes up from the western part and down from the eastern part.

<15> In addition, as the moon shows more or less in light, so the sea swells or retracts itself in its own ebb and flow. The Lincolnite has it thus, in so many words: “The movement of the sea follows the movement of the moon, both the course which the moon makes during the natural day [i.e.,

¹ This experiment is in the *Meteorology* together with the rest of Aristotle’s discussion of the salinity of the sea, and, as odd as it sounds, he really does recommend using a wax jar. But the experiment then seems absurd, since wax repels water and does not filter it. H. D. P. Lee, the editor and translator of the Loeb edition of the *Meteorology*, suggests that something has gone wrong at this point, and mentions a conjecture to emend the text’s *kérinon* (=waxen) with *keraminon* (=earthenware); see note *a* in Aristotle, *Meteorologica*, ed. and trans. H. D. P. Lee, 2d ed., Loeb Classic Library (Cambridge, Mass., 1952), 158. The textual problem seems to have persisted as far as Lavenham’s source for the *Meteorology*.

² This experiment is discussed in the *Meteorology* immediately after the wax jar experiment. The experiment can be tried at home, and it does work. Modern books and science kits for children often include this very same experiment, exactly as described in the *Meteorology* and *DCN*. Note that it does take a rather large quantity of salt in order to make the egg float.

during the 24-hour day], having been grasped by the firmament, and also the other course which it makes during the month by its own motion, in opposition to the dragging of the firmament. Both of these motions can be divided into four quarters, and, following this division, during the natural day there are two ebbs and two flows of the sea. When the moon ascends in each of the hemispheres, the sea, following the straight course of the moon's sphere, flows or goes up, and while the moon descends in each of the hemispheres, the sea goes down."

<16> "But," he says, "another reason for the movement of the sea is, according to Aristotle, the narrowing of the ocean's sides and the subsequent constriction of the sea. When the sea rises up in its middle by celestial power, it flows to the sides, where, through the barrier of the riverbanks or through waters rushing the opposite direction, it is rebounded. When these parts of the water are pushed back to the middle of the sea, they become compressed."

<17> The seventh question was as follows: What is the natural cause of springs? To this question the Bishop of Lincoln responds in his *Commentary on the Book of the Meteorology*. There he says: "Mountainous places are highly porous. Hence, just as a sponge full of pores attracts water, similarly these places attract water to a single location as it trickles in from various parts of the earth. An attraction of this kind occurs to a greater or lesser degree according to whether the water is more subtle <or less> subtle, and more purified <or less> purified. And, on account of this, whenever springs erupt on the summit of the mountain, and sometimes when they erupt near the middle or in the foothills, it is proper likewise that the porosity of the earth is dense enough that the raised water cannot flow back down through those same channels by which it ascended." These remarks all occur in the book just cited.

<18> The eighth question was as follows: What is the natural cause <that explains> why springs are hot in the winter and cold in the summer? To this question Macrobius, in the fourth book of the *Saturnalia*, very sensibly responds: "Because heat, fleeing its own contrary in the winter, seeks the interior of springs. The mouths of the springs are then warmed from the heat's presence. In the summer, on the contrary, the cold, fleeing the heat, is plunged into the depths of the earth, infecting the waters and making them cold. And, for similar reasons, in Egypt, which, among various regions is the hottest, it is not hot wines, but rather wines cold in nature that are produced. And the cause of this is because the cold, as it flees the heat, is plunged into the depths of the earth and there it adheres strongly to the roots of the grape vines, and gives a cold quality to the juice which is produced from these plants."

<19> The ninth question was as follows: What is the natural cause <that explains> why wines rarely or never freeze? Macrobius turns to this question in the previously mentioned work, *Saturnalia*, and says that Homer says that this is the natural cause: because wines are warm in potency by their very nature, and for this reason they rarely or never become compressed by frost. But then Macrobius retorts: “Granting that warm things may sometimes be compressed, since oil is equally warm as wine and oil congeals more often than wine does — why are wines not compressed during a frost <even if they are warm>?” Macrobius answers himself: “Because oil is thicker than wine, and those things which are thicker are more easily made dense.”³

<20> The tenth question was as follows: What is the natural cause <that explains> why the earth always holds the middle? To this question Urso responds in *Afforisms*, Afforism 33, in the commentary, where it runs thus: “If an attraction is made on a thing, and the attraction comes from two equal extremes, it is necessary that the thing being pulled on be located in the middle. Hence, if iron is placed between two magnets, because of the equality of each attraction its movement is held in check in the middle. If an iron globe were put inside a house that was built completely from magnetic stone except for the floor, while it were equally pulled from all sides, the globe would hang in the middle.”

<21> “And similarly,” he says, “the earth holds the middle, being equally pulled from all sides by the firmament. Hence, it is said, the center of the earth can neither be pulled down any lower nor be raised up any higher while under an equal attraction. Moreover, if it were possible for someone to bore from the outer surface of the earth straight through all the way to the other side, and to drop a mass of lead <down into the hole> toward

³ *DCN* makes it sound as though Macrobius believed that wine does not freeze because it is hot, and that he simply quotes Homer with approval and then replies to an objection concerning oil. The real situation is much more complicated than this. In fact, there is an after-dinner debate in the *Saturnalia* over the question of why wines never or only rarely freeze, and the correct understanding of Homer’s phrase *aithopa oionon* [flaming wine] at *Iliad* 1.462 is called into question in that discussion, not quoted with simple approval. The implicit argument and explanation that Macrobius is criticizing is this: (1) wines are hot by nature, because Homer uses the phrase *aithopa oionon*; (2) things hot by nature do not easily freeze; (3) therefore, wines do not easily freeze. In the *Saturnalia*, objections are raised against both premises; against premise (1), “*aithopa oionon*” can mean “sparkling wines,” and against premise (2), oil, which is at least as hot as wine, *does* in fact congeal. Premise (1) can be fixed by abandoning the forced reading of Homer, and premise (2) can be saved by noting that the thickness of a liquid affects its tendency to freeze; hence, the fact that oil does not freeze does not show that wine is cold, but that it is relatively thin. The summary in *DCN* is accurate in general drift but unfaithful to the complexities in its source.

the center of the earth, it would fall down just to the center of the earth — not beyond, but to the exact middle — and, <having reached the center, the equal attraction> would restrain the natural motion <of the lead> and it would cease to move.” These remarks all occur in Urso’s book. And thus the solution of the tenth question is revealed.

<22> The eleventh question was as follows: What is the natural cause of earthquakes? To this question I respond briefly and say that the natural cause of earthquakes is gusting wind in the belly of the earth. Hence, Aristotle, in the third book of the *Meteorology*, says that just as agitated wind in the belly of a human being makes a sound and seeks an exit, so too wind, passing into the caverns of the earth, displaces that very same earth and sets it into violent motion, and this wind does not cease until it rends and splits the earth somewhere. And in the same place Aristotle says that earth is dry in its nature; therefore, when it rains and the earth becomes moist, the sun works upon it and raises a dry vapor from it. But then the remaining heavy vapor becomes violently agitated in the belly of the earth and creates an earthquake.

<23> And Aristotle also says in that same passage that in areas in which there is a rushing of the sea and a violent movement of its waters, and likewise in cavernous areas, there are extremely intense earthquakes. However, in sandy regions there are no earthquakes, according to Aristotle in the book *On Plants*, for although in internally cavernous lands and in lands externally hard on the surface, as for example mountainous locations, earthquakes do occur; nevertheless in lands that are entirely porous earthquakes will not occur with any facility, due to the easy venting of the vapor, nor do earthquakes occur in regions that are extremely hard and compact, due to the tightness of the soil. And thus the solution of the eleventh question is revealed.

<24> The twelfth question was as follows: What is the cause of the wind and the gusting of the winds? To this question I respond briefly and say that the natural cause of the wind is this: when cold dry vapor is elevated from the earth through the heat of the sun, it is subsequently forced back down, either because of its surging trajectory, or because the air contains a certain amount of heat in it. A repercussion of this sort causes a gust in the air. It is on account of this that Aristotle says, in the third book of the *Meteorology*, that the starting point of the blowing or gusting of the wind is above, but the material that constitutes it comes from below. Nevertheless, just as Aristotle teaches therein, there are two impediments to the existence of winds, namely, excessive cold and excessive heat. For excessive cold so condenses earth (as is apparent in the formation of frost) that vapors cannot ascend from it, and, likewise, excessive heat scorches the earth and consumes its vapors. And thus the solution of the twelfth question is revealed.

<25> The thirteenth question was whether clouds can be generated in the upper part of the air. It seems that indeed they can, because any element is apt to be transformed into another element, according to Aristotle in the first book of *On Generation*. Therefore, since air is an element, it follows that it can be changed into the nature of water. For this reason, water can be made from one part of the air, and for that same reason water can be made through a natural transformation from any other part of the air. Therefore, water can be made from the upper part of the air. But it is not possible that water be made from air except through condensation; therefore the upper part of the air is suitable for condensing. But the condensing of air, as Aristotle says, is nothing other than the generation of a cloud; therefore, a cloud can be generated in the upper part of the air. Against this, nevertheless, is Aristotle near the beginning of the first book of the *Meteorology*.

<26> To this question I respond by tending toward the negative part of the question, because beyond the middle interval of the air or beyond the middle region of the air it is not possible for clouds to be generated naturally. In evidence of this claim, Augustine says, in the third book of *The Literal Meaning of Genesis*, that Mount Olympus is so high that it transcends any disturbance of the air. The philosophers tend to go onto this mountain at the beginning of the year with sponges, and there they draw certain characters <i.e., letters, numbers, or figures> in the dust, which characters they then find intact <when they go back> at the end of the year. This could not happen if the summit of the mountain was disturbed by wind or rain or clouds.⁴

<27> I say, therefore, that beyond the middle interval of the air, clouds are not generated; nor is it possible for them to be generated naturally. And to the opposing argument I say that although water can be generated from some region of the air, nevertheless, it cannot be generated from every part of the air without taking into account the way the air exists at a given

⁴ This strange reference to Augustine is worth considering in detail. From Augustine, *De Genesi contra Manichaeos* 1.15 [my translation]: “For that mountain in Macedonia, which is called Olympus, is said to be of so great a height, that on its peak no wind is detected, neither do clouds form, because its peak exceeds all the moist air in which birds normally fly. . . . This information has been brought back by those who, it is said, customarily ascend to the peak of the famous mountain once a year and there write certain marks in the dust. (I do not know what rites draw them up there.) They find these same marks intact the next year. . . . Because of the thinness of the air of that place . . . they would not be able to make it up there unless they applied moist sponges to their noses. . . .” Thus the use of the sponges becomes clear — the philosophers soak them with water and then apply them to their noses as they climb the mountain so that they can breathe the thin air. See also Augustine, *The Literal Meaning of Genesis*, trans. John Hammond Taylor (New York, 1982), 1:75–76. See also *Odyssey* 6.42–45 where Homer describes the same airless Olympus.

place, because some parts of the air are so hot that it is not natural for clouds to be made from them, because a cloud is made from air collecting and thickening through cold. In the upper part of the air, therefore, due to vehement heat caused from the motion of the supercelestial bodies, a cloud cannot be generated. Thus the solution of the thirteenth question is revealed.

<28> The fourteenth question was whether clouds can be generated in the middle region of the air. It seems that they cannot, because clouds are generated through a condensing cold, but in the middle region of the air it is not cold, because if it were, then air would be cold and moist, and so would differ in none of its essential qualities from water; therefore, clouds cannot be generated in the middle region of the air. Nevertheless, for the opposing view is Aristotle in the passage previously mentioned.

<29> To this question I respond by tending to the affirmative part of the question, and for a response to the contrary argument, it ought to be noted that air in the very highest region holds excessive and violent heat within itself due to the motion of the celestial bodies, for the celestial bodies generate heat in the highest region of the air through their motion. Likewise, air in the lower region holds excessive heat within itself due to the refraction of solar rays. But the heat in the middle region of the air has been tempered, and is similar to the tepidness of water that has an equal share of both cold and heat. Because of this, it is not so excessively hot in the middle region as it is in highest part of the air and in the lower part. Hence it is said to be cold there in the middle region, rather than hot. According to certain people, however, the cold in the middle region is nevertheless not sufficient for the generation of clouds without some additional, supervening cold.

<30> Hence Albert says, and well he should, that cold humid vapor becomes warmed <and rises> through the heat which is brought about here in the lower region from the refraction of solar rays. However, when that vapor arrives at the middle region of the air it leaves behind its acquired nature <i.e., its heat> and once again becomes cold (just as if someone were to warm up water and place it some place in which there were little heat, its heat would quickly diminish). But then this supervening cold thickens the vapor, and a cloud is therefore generated. And through this the response to the argument and to the material of the fourteenth question is made clear.

<31> The fifteenth question was as follows: Is vapor the material of the winds and clouds? I say that this is in fact the case, because vapor is the material of all the things that are generated in the upper region of the air, and of all the things that are generated in the middle region of the air. Hence, hot dry vapor elevated from the earth through the heat of the sun

ascends beyond the middle region of the air and becomes inflamed there from fire. From that inflamed vapor various things are generated, such as the comet, the burning dragon, the rising *assub* and the falling *assub*.⁵ <32> Hence, hot dry vapor, which is called an “exhalation,” becomes elevated from the earth all the way through to the sphere of fire. That fire inflames one part of the vapor and a star appears, and this is called a *stella comata* because it seems to have *coma* <“hair”>. And sometimes such inflamed material appears as the “burning dragon,” and sometimes such material, having become inflamed, ascends due to its subtlety, and becomes visible as a rising star. And sometimes such material, having become inflamed, descends due to its heaviness and becomes visible in the night as a falling star and is called a falling *assub*, for if the inflamed material ascends then it is called a rising *assub* and if the inflamed material descends or falls then it is called a falling *assub*. Likewise, cold moist vapor is the material of many things that are generated in the middle region of the air; for example, it is the material of rain, of snow, and of hail. Also, cold dry vapor is the material of the winds. From these considerations it is plain that

⁵ In *Meteorology* 1.4–5, Aristotle explains apparently diverse atmospheric phenomena as the result of hot dry exhalations being ignited by heat from the motion of the celestial sphere. These various phenomena (e.g., comets and shooting stars) differ only in appearance, and so are classified by appearance; the names of the phenomena are thus often indicative of their respective appearances. When the celestial sphere ignites hot, dry exhalation that is extended lengthwise in the atmosphere, for example, it produces a “goat” if it throws off sparks when it burns (the sparks resemble the gamboling of a goat), and a “torch” if it does not (341b30–33). Medieval astronomers, astrologers and alchemists took over the exact same explanation for these events, but in some cases the names were changed. In *DCN*, *stella comata* clearly refers to the “bearded star” that we know as a “comet” today. *Ardens draco* may refer either to meteor showers occurring in the constellation Draco, or to meteor showers that in some way resemble a dragon (as in the case of “goat” above). “Assub” is an Arabic technical term, used in Latin translations of Aristotle as the equivalent of *stella cadens* (Gower, *Confessio Amantis*, 523); hence, an assub is simply what we call a “shooting star” today. *DCN* identifies “ascending” and “descending” assubs. This classification probably refers to whether the shooting star seems to be traveling up or down relative to the observer (see *Mittelateinisches Wörterbuch* 1 [Munich, 1967], 1086). John Gower’s (fl. fourteenth century) *Confessio Amantis* 7.344 mentions the assub as one of four possible appearances of burning exhalation in the sky. From Gower, *Confessio Amantis*, 242:

And forto spoken over this / In this partie of thair it is / That men fulofte sen be
nythe / The fyr in sondri forme alyhte. / Somtime the fyrdrake it semeth, / And so
the lewed poeple it demeth; / Somtime it semeth as it were / A Sterre, which that
glydeth there: / Bot it is nouthor of the tuo, / The Philosophre telleth so, / And seith
that of impressions / Thurgh diverse exalacions / Upon the cause and the matiere /
Men sen diverse forme appiere / Of fyr, the which hath sondri name. / Assub, he seith,
is thilke same, / The which in sondry place is founde, / Whanne it is falle down to
grounde, / So as the fyr it hath aneled, / Lich unto slym which is congeled.

if there never were any vapor, there never would have been any clouds, nor any rain, nor any tempests, nor any storms.

<33> The sixteenth question was as follows: Is vapor a substance or an accident, and if it is a substance, is it a simple body or a compound one? To this question I respond briefly and say that vapor is not an accident but a substance, and the reason is because an accident is not able to migrate from subject to subject. But if vapor were an accident then an accident would migrate from subject to subject, insofar as vapor is in fact elevated from the earth <one subject> into the air <another subject>. For this reason it follows that vapor is not an accident but a substance.

<34> But it was asked in the initial question whether vapor is a simple body or a compound one. To this I respond and say that it is a simple body and not a compound one, and the reason is because for a true compound it is required that every part of the compound body be compounded, according to Aristotle. However, this is not the case concerning vapor; therefore, etc. Likewise, a simple body is resolved from a simple body and a compound body is not, but vapor is resolved from a simple body, as for example from earth or from water; therefore, etc.

<35> But then this might be asked: How is hot dry vapor elevated from the earth, when earth does not have qualities of this kind, for earth is not hot and dry but rather cold and dry? To this I respond and say that, through the refraction of solar rays, heat is incorporated into the earth. And by reason of the heat of the rays of the sun the earth holds some heat in it, and this is the reason why vapors of the hot and dry kind can be generated from the earth. And thus the solution to the question is revealed. Here ends the treatise *De causis naturalibus* by Lavenham.

Indiana University