CHAPTER 1

Bearing the heavens

> For he did not practice this art in peasants' huts, or in books, or in sweating rooms (as REGIOMONTANUS lamented of common Astronomers), but did not refuse to zealously pay attention to it in the sky itself, frequently with his very own eyes, using appropriate and well-constructed instruments; and he greatly advanced it by supporting skilled practitioners. In which heroic and truly Atlas-like course he steadfastly persisted, as long as he could regard the stars and the Sun (for the sake of which eyes were allotted to men, as a certain ancient philosopher appositely declared) – to the extent that he did not cease to contemplate this visible and temporal Theatre of Heaven until he crossed from the horizon of time into eternity and, with the aid of GOD, exchanged that eternal and invisible heaven with this other one. Wherefore who will rightly deny that it is entirely appropriate for the astronomical letters produced by so great an Atlas, a prince not only by virtue of his illustrious line, but also in this art, to claim for themselves the principal parts in this book?
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> Tycho Brahe on Landgrave Wilhelm IV of Hesse-Kassel, *Epistolarum astronomicarum liber primus* (1596), Dedication to Landgrave Moritz, (:)4r.[1]

In 1596, the Danish astronomer Tycho Brahe published a selection of his own correspondence. Although the title under which this book of letters appeared, *Epistolarum astronomicarum liber primus*, signified that the volume was to be the first in a series, it was the only volume of Tycho's correspondence to appear in his lifetime. For the most part, Tycho's sole book of *Epistolae astronomicae* consisted of letters that he had exchanged with an astronomically inclined prince, Landgrave Wilhelm IV of Hesse-Kassel, and with Wilhelm's court *mathematicus*, Christoph Rothmann. Wilhelm had died several years before the letters were published. Not inappropriately, therefore, the volume was cast as a memorial to the Landgrave, and

[1] *TBOO* VI, 13.4–18. The 'ancient philosopher' referred to by Tycho is probably not Ovid, as suggested by Dreyer in *TBOO* VI, 347. Cicero and Aristotle are both possibilities, but the most likely candidate is Plato. See Rantzau 1580, 9; Patrides 1982, 85.

dedicated to his son and heir Moritz. In the letter of dedication, and again in a poem of his own composition placed at the end of the work, Tycho praised his deceased correspondent by comparing him with a certain mythical figure: Wilhelm's death was the withdrawal from the Earth of a second Atlas; he was a man who not only ruled over his country, but who was also capable of holding up the heavens.[2] The association of the Titan with Mount Atlas, and hence with a king who had ruled over the inhabitants of north Africa overlooked by that mountain, was an ancient rationalisation of the myth of the giant who supported the heavens on his shoulders. The image of Atlas as bearer of the heavens was therefore an elegant way of referring to an astronomer who was also a prince.

This book takes its title from the idea of Atlas 'bearing the heavens'. It does so partly because its principal theme is the communication of astronomy in the early modern period. The phrase works just as well as a metaphor for the conveyance of astronomical theories, data, and techniques as it does as a description of the legendary task of the Titan. In the chapters which follow, four main modes of astronomical communication are considered: the exchange of letters, the production and use of books, the manufacture and transfer of ownership of instruments, and the movement from one site to another of individual practitioners. Investigation of these various forms of communication can shed considerable light on the study of the heavens in the early modern period. In particular, it reveals a great deal about one of the most striking features of the astronomical culture of the era, the emergence and development of an international astronomical community. The fundamental nature of the connection between modes of communication and the existence of a community is not difficult to grasp. Clearly, no such community could have existed in the absence of contact between individuals studying the heavens at different locations. But recognising this fact is only the first step in developing an understanding of how the astronomical community actually operated.

In this book, I have chosen to focus quite narrowly on the ways in which one of the best-known astronomers of the late sixteenth century engaged with the international astronomical community and other contemporary audiences. The centrality of Tycho Brahe to my study is another reason for using the phrase 'bearing the heavens' as its title. For as we shall see, Landgrave Wilhelm IV was not the only individual whom Tycho sought to represent as a latter-day Atlas – the image was one with which he himself was also keen to be associated. The reasons why Tycho considered himself

[2] *TBOO* VI, 340.10–11.

worthy of being viewed as an Atlas-like figure are closely related to the reasons why he makes a good focus for this examination of the late sixteenth-century astronomical community. His standing and reputation as an astronomer, both in the period and today, derive partly from the programme of high-quality astronomical work which he devised and pursued at Uraniborg, his observatory on the island of Hven, and partly from the nature of his engagement with other astronomers and their writings. Tycho, it could be argued, was as assiduous and meticulous with respect to the communication of astronomical material as he was about the labour of observing. This is one of the claims that this book will explore and develop.

A third reason for calling this work 'bearing the heavens' is that the motif that the phrase relates to, the task and role of the mythical King Atlas, provides some interesting insights into the culture of astronomy in the early modern period. This was a culture which valued more than just technical expertise in the study of the heavens, crucial as that was. Acquaintance with classical literature and imagery was also of importance to the scholarly elite, since it aided in the representation of astronomical endeavours and hence in the promotion of the art. A mythico-historical figure such as Atlas could be of considerable use when it came to making claims about the intrinsic nobility and importance of studying the heavens. The variety of ways in which this classical imagery was deployed is instructive. It appeared in the liminal verses and the prose sections of printed books, in letters and other manuscript texts, and in orations delivered on formal occasions. It also found expression in visual form, being employed in the context of astronomical diagrams and instruments whose practical roles were complemented by, or subordinate to, some symbolic or decorative function. The propagation of the 'heaven-bearing' motif therefore illustrates the full range of ways in which astronomical ideas were shared and conveyed. Admittedly, the communication of allegorical representations of astronomy via elegiac verse or highly ornamented, essentially decorative, scientific instruments might seem of little relevance to the evolution of technical astronomy. However, as recent scholarship has made clear, the principal site at which both literary virtuosity and artisanal splendour were appreciated, the early modern court, was also one of the key places where technical astronomy was sustained and developed.[3] Study of the period use of the image of Atlas 'bearing the heavens' reveals something of the importance to sixteenth-century astronomers of princely patronage and courtly aspirations. It can also illustrate the richness of the connections

[3] Biagioli 1993; Jardine 1998.

that existed between individual members of the international scholarly community. As well as reading one another's works, and sharing in a common intellectual heritage, sixteenth-century astronomers and writers on the heavens knew each other personally. They met, often as a result of travels undertaken for the sake of education or in search of employment, and subsequently corresponded; in a few cases, they were joined by a familial relationship. And even when they did not know one another directly, they were often separated from one another by just one or two intermediaries. Frequently, in fact, such mediated relationships were possible through more than one mutual acquaintance or chain of shared contacts. For this reason amongst others, therefore, consideration of the motif of Atlas as bearer of the heavens provides a point of entry into the subject-matter of this study.

1 *COELIFER*: ATLAS AS BEARER OF THE HEAVENS

> Long-haired Iopas, once taught by mighty Atlas, makes the hall ring with his golden lyre. He sings of the wandering moon and the sun's toils; whence sprang human kind and the brutes, whence rain and fire; of Arcturus, the rainy Hyades and the twin Bears; why wintry suns make such haste to dip themselves in Ocean, or what delay stays the slowly passing nights. (Virgil, *Aeneid*, I.740–746)[4]

The *Epistolae astronomicae* was not the first published work to present Landgrave Wilhelm IV as an astronomer of note. Inspired to study the heavens by Peter Apian's exquisite *Astronomicum Caesareum* (1540), Wilhelm had been tutored in mathematics by one of the sons of the instrument-maker and cartographer Gerard Mercator (1512–1594). He started making his own astronomical observations in the late 1550s and, *c.*1560, he established what has often been considered the first true observatory in western Europe at Kassel.[5] These astronomical activities were rapidly publicised: Wilhelm, his instrument-maker Eberhard Baldewein (*c.*1525–1593), and one of the instruments at the Kassel observatory, a large astronomical quadrant, were all mentioned by the mathematician Andreas Schöner (1528–1590) in his book *Gnomonice*, published in 1562.[6] Andreas, who was the son of the Nuremberg professor of mathematics Johannes Schöner (1477–1547), had acquired personal experience of the astronomical activity at Kassel during a brief period of employment there between 1559 and 1560, and was able to refer to specific observations carried out at the Landgrave's observatory.[7]

[4] As translated by Fairclough 1967–1969.
[5] Leopold 1986, 15–16; Hamel 1998, 9. See also *ADB* XLIII, 32–39; *DSB* XIV, 358–359.
[6] Schöner 1562, 89v, 90v, 93r. For Schöner, see Zinner 1979, 527–528.
[7] Leopold 1986, 16. For Andreas' father, see Coote 1888; Schottenloher 1907; *DSB* XII, 199–200.

Subsequently the educational reformer Petrus Ramus (1515–1572) praised the Landgrave's astronomical efforts, remarking in his *Prooemium mathematicum* of 1567 that it was as if Wilhelm had transported Alexandria to Kassel; as if the ancient astronomer Claudius Ptolemy, with his observational armillaries and rulers, had arrived in Germany.[8] In 1580, Heinrich Rantzau (1526–1599), Governor of the Danish Duchy of Holstein, lauded both Wilhelm and Tycho in the *Catalogus* of astrologers he compiled and published, also placing particular emphasis on astronomical instruments: Wilhelm, along with Tycho's royal patron King Frederick II, was commended for commissioning 'globes, clocks, and mathematical machines, from which can be seen the risings and settings of the signs and the heavenly houses, as well as the conjunctions of the Sun and the Moon and the rest of the planets, and the increases and decreases of the days'.[9]

All three of these authors were concerned with promoting the study of the mathematical arts: Schöner, presumably, because it was the basis of his livelihood, Ramus as part of his campaign for the reform of education in his native France, and Rantzau with particular reference to the pursuit of astrology.[10] In each case, mention of princely interest in mathematics may have been helpful to their cause. The idea that it would be was, at any rate, a major premiss of Rantzau's work; as its full title indicated, it largely consisted of a list of the emperors, kings and princes who had esteemed, honoured, and practised the astrological art. Tycho may or may not have been acquainted with Ramus' text. Having briefly met the Frenchman in 1570, he later professed to be unimpressed by his philosophy, and in particular by the nature of his calls for the reform of astronomy.[11] He may not have felt inclined, therefore, to seek out his publications. At some point in his life, however, he seems to have read Schöner's *Gnomonice*, and noted his mention of the Landgrave.[12] And he certainly knew Rantzau's work, most likely in the form of the augmented edition that was issued at Leipzig in 1584. The year after this version appeared, he addressed a poem

[8] Ramus 1567, 267: 'Guilielmus Landgravius Hessiae videtur Cassellas Alexandriam transtulisse: Sic Casellis artifices organorum observandis sideribus necessariorum instruxit, sic quotidianis per instructa organa observationibus oblectatur, ut Ptolemaeus ex aegypto in germaniam cum armillis & regulis venisse videatur.' On Ramus see *DSB* XI, 286–290; Margolin 1976; Sharratt 1976; Grafton and Jardine 1986, 161–209.

[9] Rantzau 1580, 29–30: 'Fridericus II, Rex Daniae, et Guilhelmus Landtgravius Hassiae hoc nostro tempore summo studio et cura, globos, horologia, et machinas mathematicas fieri curant, ex quibus ortus et occasus signorum ac domos caelestes, nec non coniunctiones Solis ac Lunae, caeterorumque planetarum incrementa ac decrementa dierum ac noctium, conspicere possunt . . .' On Rantzau, see *ADB* XXVII, 278–279; Steinmetz 1991; Lohmeier 2000; Oestmann 2004; Zeeberg 2004.

[10] Keller 1985, 351; Allen 1966, 84–85; Evans 1984, 263.

[11] *TBOO* VI, 88.25–89.12; Thoren 1990, 33–34.

[12] *TBOO* II, 40.1–8.

to Rantzau that registered his dissatisfaction with the somewhat slighting description it gave of Uraniborg, his domicile and observatory on the island of Hven, as a *specula*, that is a 'watchtower' or 'lookout post'.[13] Tycho had good reason to feel aggrieved: by 1584 the patronage of King Frederick II, in conjunction with his own not inconsiderable resources as a Danish noble, had transformed Hven into a major centre for astronomy, and Uraniborg was much more than a tower occasionally used for observational work.[14] If it was the enlarged *Catalogus* that Tycho saw, then he may well have noticed that it listed among the historic practitioners of astrology one, 'Atlas the Moor, who is also called Iapetus, son of Libya; who ruled in Africa, taught the theory of the sphere, and on a certain occasion predicted the future from the stars'.[15] Nevertheless, the immediate model for Tycho's description of Wilhelm in the *Epistolae astronomicae* as 'so great an Atlas' was no more Rantzau's book than it was Ramus' or Schöner's. Inspiration came instead from a more specifically eulogistic text, the funeral oration composed for the Landgrave by Hieronymus Treutler (1566–1607), professor of rhetoric at the Hessian University of Marburg.[16]

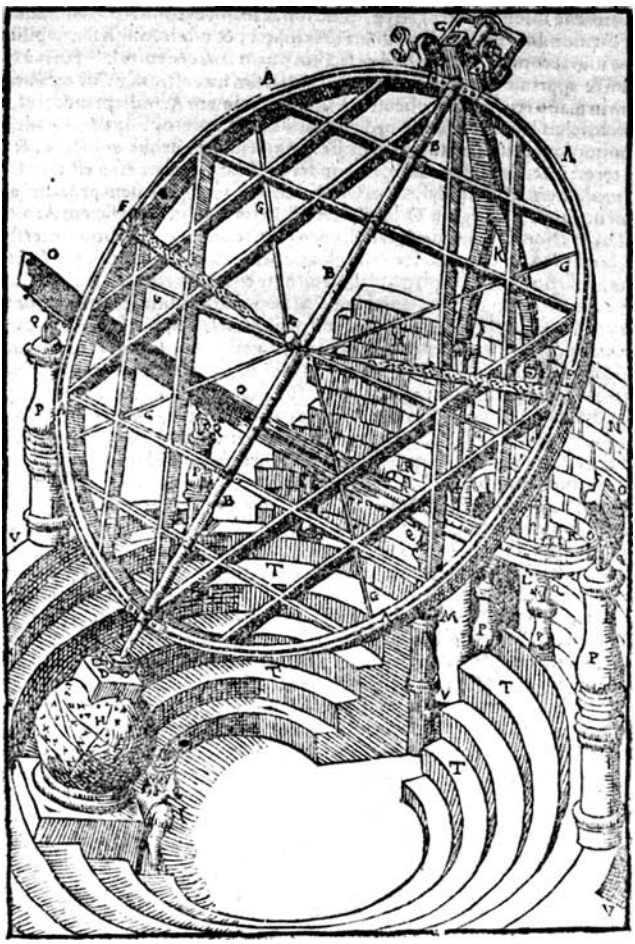
Tycho quoted the relevant section of the oration in his dedicatory letter to Wilhelm's son Moritz: 'while he lived, our Prince, no differently than Atlas, that most ancient king of Mauretania, supported the sky, as if on his shoulders, and never laid down that very heavy burden of astronomical matters'.[17] The analogy that Treutler was drawing was slightly richer than a simple comparison of the physical effort of the Titan, bearer of the heavens, with the intellectual effort of Wilhelm, their careful investigator. Notions of kingship and the intimation of a shared interest in actual astronomical labour were also involved. But even a reader who was insensitive to these subtleties would have been able to see that Tycho employed the image repeatedly in his edition of the letters. Besides the identification of Wilhelm with Atlas in the dedication and in the memorial poem at the close of the work, Tycho made reference in the preface of the book to Nicolaus Copernicus (1473–1543) and 'that more-than Atlas-like work of his, *On*

[13] Rantzau 1580, 30; Rantzau 1584, 75–76; *TBOO* IX, 187–190, esp. 189.3–8; Nørlind 1970, 359–360.
[14] Thoren 1990, 144–219; Christianson 2000, 58–124.
[15] Rantzau 1584, 15: 'Atlas Maurus, qui & Iapetus dictus est, Libyae filius, qui in Africa imperavit, Sphaerae rationem docuit, & ex astris futura certo eventu praedixit.'
[16] For Treutler, see *ADB* XXXVIII, 585–587; Gundlach 1927, 318.
[17] Treutlerus 1592, 82: 'noster non aliter ac Atlas vetustissimus ille Mauritaniae Rex, coelum humeris quasi suis, dum vixit, sustinuit: nunquam gravissimam illam rerum astronomicarum sarcinam deposuit'; *TBOO* VI, 13.36–40.

the Celestial Spheres'.[18] Somewhat more significantly, he also contrived to have himself compared to the Titan in five of the six poems with which the letter-book opened – poems that were written by individuals such as Albertus Voitus, professor of poetry at the University of Wittenberg, and Nathan Chytraeus (1543–1598), rector of the Bremen gymnasium and a highly esteemed writer of verse.[19] In the texts with which Tycho chose to frame his edition of his correspondence with the Kassel astronomers, therefore, reference to Atlas played an important role in linking Wilhelm, Tycho and, to some extent, Copernicus. Since, at the time of the work's publication, two of these three individuals were deceased, it would not have taken too much imagination on the part of a reader to recognise here the suggestion of a prestigious, successively inherited office, now occupied by the lord of Uraniborg.

While the prominence given to the Atlas motif in the *Epistolae astronomicae* should probably be attributed to its appearance in Treutler's speech, Tycho's awareness and use of this imagery predated his reading of the published oration. In a letter to Christoph Rothmann of 1589, for example, Tycho had exhorted the *mathematicus* to see to it that, by his 'Atlas-like labours', others might come to enjoy the fruits of the Landgrave's patronage of astronomy.[20] The Titan also appeared in letters sent to Tycho by others. The Scottish historian and poet George Buchanan (1506–1582), who was interested enough in the heavens to labour over a verse *Sphaera*, a work of didactic astronomical poetry, for the best part of three decades, mentioned him in 1575; quoting from Ovid's *Metamorphoses*, he declared of Tycho's *De nova stella* (1573) that the astronomer had set an example which encouraged others to 'aspire to ride the clouds, and to take position on stout Atlas' shoulder'.[21] And in 1587, the Rostock professor of medicine and astronomy, Heinrich Brucaeus (1531–1598), sent Tycho a letter in which he commended a young man who had sought to travel to Denmark particularly in order 'to greet you, who is called another Atlas, bearing the heavens on his shoulder'.[22] Long before the *Epistolae astronomicae* was published, moreover, Tycho had incorporated the figure of Atlas into one of his

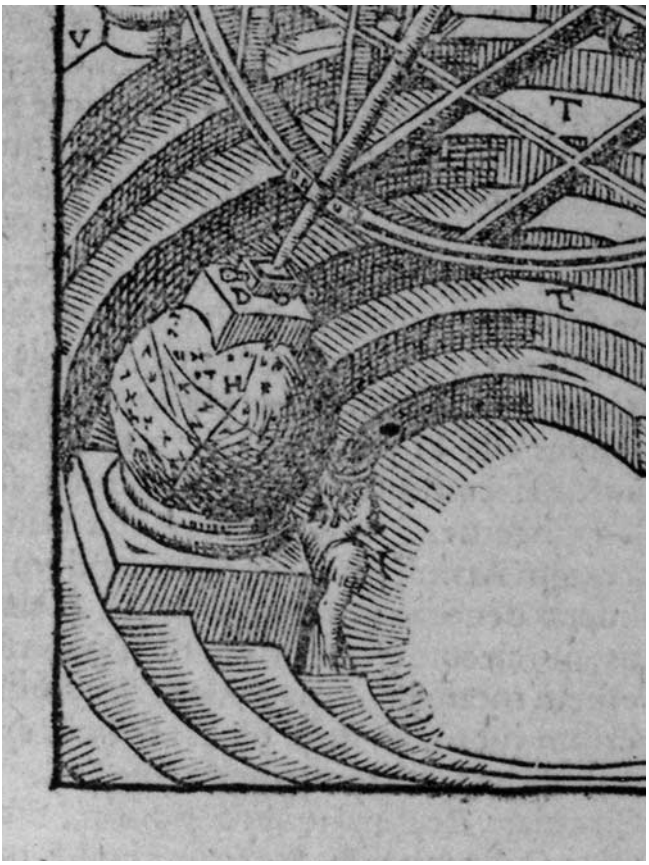
[18] *TBOO* VI, 23.42–24.2.
[19] *TBOO* VI, 5–8. On Voitus, whose dates are not known, see Jöcher 1750–1751, IV, 1698. For Chytraeus, see *ADB* IV, 256; *DBE* II, 326; Lohr 1975, 712; Elsmann, Lietz and Pettke, 1991.
[20] *TBOO* VI, 200.10–12.
[21] *TBOO* VII, 21.34–22.1; Miller 1977–1985, II, 375. For Buchanan and his *Sphaera*, see Naiden 1952; McFarlane 1981, esp. 355–378.
[22] *TBOO* VII, 114.11–14. Brucaeus also employed this imagery in a later letter to Tycho; see *TBOO* VII, 142.17–20. For Brucaeus himself, see *ADB* III, 374–375.



1.1 (a) Tycho's 'great equatorial armillary of one-and-a-half circles', as illustrated in his *Astronomiae instauratae mechanica* (Wandsbek, 1598), but reproduced here from the later 1602 'edition' of the work sold under the Nuremberg imprint of Levinus Hulsius.

observing instruments, the one he referred to as the great equatorial armillary of one-and-a-half circles (Fig. 1.1).[23] This instrument, and the significance of the Atlas mount with which it was equipped, were described in a 1591 account of the instruments on Hven which the Danish astronomer sent to the Landgrave.[24] It is even possible, therefore, that Treutler picked out

[23] *TBOO* V, 64–67. On the date of the instrument's fabrication see Thoren 1990, 173–174.
[24] *TBOO* VI, 276.36–278.41.



1.1 (b) Detail of this illustration, showing the instrument's mount: the crowned figure of Atlas, bearing the heavens in the form of a celestial globe. Courtesy of the Whipple Library, University of Cambridge.

the Atlas motif from documents which originated at Uraniborg. Although he had no particular reason to be aware of the Hessen astronomical communications during the lifetime of the Landgrave, it seems likely that, placed in the situation of having to praise his deceased prince for possessing such unusual enthusiasms, he had inspected this material in search of inspiration. Indeed, one reason for Tycho's citation of Treutler in the dedication to Moritz was that he had remarked in his oration that publication of the Landgrave's correspondence with the Danish astronomer would make evident to all how assiduously Wilhelm had practised astronomy, and how

devoted he was to the elimination of the errors to be found in astronomical tables.[25] This statement, which Tycho used in justifying his decision to produce the *Epistolae astronomicae*, shows that Treutler had at least some knowledge of the contents of the letters.

It seems most likely, however, that Treutler arrived at his use of the Atlas motif without assistance from Tycho. The association of the Titan with the study of astronomy was certainly widespread enough by the time of Wilhelm's death. The primary vehicles for establishing and propagating that association were the classical texts, and the manuals derived from them, that encapsulated and interpreted ancient mythology. In particular, Virgil's *Aeneid* and Ovid's *Metamorphoses*, whether studied at first or second hand, rendered a range of descriptions of the ancient deities accessible to literate men, and to those who employed them. There were also multiple visual antecedents – increasingly so as classical mythology was mined by early moderns for use in emblems, medals and impresa, royal entry festivals and other courtly spectacles. The image shown in Fig. 1.2, for example, comes from *The Cosmographicall Glasse* (1559), a work by the English physician and astrologer William Cuningham (1531–1586).[26] The picture shows Atlas resting on one knee as he bears the heavy burden of the ten heavenly spheres, with a banner giving both his name and the epithet *Coelifer*, 'bearer of the heavens'. The plaque at the bottom paraphrases Virgil: 'He sings of the wandering moon and the sun's toils; of Arcturus, and the rainy Hyades and the twin Bears'. This text is slightly misleading if taken as a caption; in the *Aeneid* it was not Atlas, but his student Iopas, who sang of these things. Nevertheless, it serves to anchor the image to a classical source which connected Atlas and astronomy in a manner highly appropriate to the nature of the book. To judge from the catechismal form that Cuningham employed, the work was intended to serve as an introductory textbook, albeit for gentlemen rather than schoolboys. Its purpose was didactic, therefore, and its subject-matter was cosmography, the mathematical study of both the heavens and the Earth. In both respects it might be thought similar to the song supposedly taught to Iopas by Atlas.

The representation of the cosmos resting on the shoulders of the Atlas combines two forms of celestial schemata. One is that provided by the concentric circles representing the ten spheres of heaven and the elemental divisions of the sublunary realm: the *primum mobile*, crystalline heaven, firmament of the fixed stars, Saturn, Jupiter, Mars, Sun, Venus, Mercury, Moon, Fire, Air, Water, Earth. Such a conception of the cosmos can be found, so drawn, in numerous medieval and early modern manuscripts

[25] Treutlerus 1592, 83; *TBOO* VI, 14.2–8. [26] Cuningham 1559, 50; Taylor 1954, 26–27, 172, 318.