A Culture of Inquiry: Scientific Thought and its Transmission in the Severn Valley, c. 1090–c. 1150

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Katharine Allan Bader

Abstract

The twelfth century saw the first appearances of translations of Arabic documents into Latin on astronomy and mathematics in England. This thesis will investigate individuals in the twelfth century Severn Valley interested in the new scientific texts: who owned them, how they got them, and how they used them. Specifically, case studies in the reception of the new sciences will be developed for William of Malmesbury, Walcher of Great Malvern, and John of Worcester. These scholars were chosen because sufficient material survives to illustrate a before-and-after picture in their work, reflecting varying reactions to the new knowledge. A regional study of audience reception of the new sciences has not yet been undertaken. The underlying considerations of this thesis are the intellectual and institutional pre-conditions that may have supported these intellectual endeavours in the Severn Valley and also may have been a draw for scholars in the new sciences, such as Petrus Alfonsi and Adelard of Bath, who sought patronage and employment in the area.

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ABBREVIATION LIST

Adelard, *QN*	Adelard, *Quaestiones naturales*, in Charles Burnett, ed. and trans., *Conversations with his Nephew: On the Same and the Different, Questions on Natural Science, and On Birds* (Cambridge: Cambridge University Press, 2006): pp. 81–228.
Adelard, *De eodem*	Adelard, *De eodem et diverso*, in Charles Burnett, ed. and trans., *Conversations with his Nephew: On the Same and the Different, Questions on Natural Science, and On Birds* (Cambridge: Cambridge University Press, 2006): pp. 1–74.
Adelard, *De avibus*	Adelard, *De avibus tractatus*, in Charles Burnett, ed. and trans., *Conversations with his Nephew: On the Same and the Different, Questions on Natural Science, and On Birds* (Cambridge: Cambridge University Press, 2006): pp. 237–268.
Bede, *DT*	Bede, *De temporibus,* in C.W. Jones, ed., *Bedae opera didascalica*, Corpus Christianorum. Series Latina Turnout: Brepols, 1975-1980): pp. 580–611.
Bede, *DTR*	Bede, *De temporum ratione*, in C.W. Jones, ed. *Bedae opera didascalica*, Corpus Christianorum. Series Latina (Turnout: Brepols, 1975–1980): pp. 241–544; C.W. Jones in *Bedae opera de temporibus* (Cambridge, Mass.; Mediaeval Academy of American, 1943); Faith Wallis, trans., *Bede: The Reckoning of Time* (Liverpool: Liverpool University Press, 1999).
Bede, *Historia ecclesiastica*	Bede, *Historia ecclesiastica gentis Anglorum*, in Bertram Colgrave and R.A.B. Mynors, ed. and trans., *Bede's Ecclesiastical History of the English People* (Oxford: Clarendon Press, 1991).
Bubnov, ed., *Opera*	Nicolaus Bubnov, ed., *Opera mathematica (972-1003): Accedunt aliorum opera ad Gerberti libellos aestimandos intelligendosque necessaria per septem appendices distributa* (Berolini: R. Friedländer and Sohn, 1899; reprinted Hildesheim: Georg Olms Verlagsbuchhandlung, 1963).
EHR	*The English Historical Review*
Gerald, *Opera*	Gerald of Wales, *Opera*, vol. 1, ed. John Sherren Brewer (London: Longman, Green, Longman, and Roberts, 1861).
Gesta Stephani	*Gesta Stephani*, ed. and trans. K.R. Potter with introduction and notes by R.H.C. Davis (Oxford: Clarendon Press, 1976).

Henry of Huntingdon, *Historia*	Henry of Huntingdon, *Historia Anglorum*, in Diana Greenway, ed. and trans., *Historia Anglorum: History of the English People* (Oxford: Oxford University Press, 1996).
John, *Chronicle*	*The Chronicle of John of Worcester: The Annals from 450–1066*, vol. II, eds. Reginald R. Darlington and Patrick McGurk, trans. Patrick McGurk and Jennifer Bray (Oxford: Clarendon Press, 1995) and *The Chronicle of John of Worcester: The Annals from 1067 to 1140 with the Gloucester Interpolations and the Continuation to 1141*, vol. III, ed. and trans. Patrick McGurk (Oxford: Clarendon Press, 1998).
Krusch, *Studien* I	Bruno Krusch, *Studien zur Christlich-mittelalterlichen chronologie. Der 84jährige Ostercyclus und seine Quellen* (Leipzig: Veit & comp., 1880).
Krusch, *Studien* II	Bruno Krusch, *Studien zur Christlich-mittelalterlichen Chronologie: Die Entstehung unserer heutigen Zeitrechnung; I. Victorius; Ersatz der fehlerhaften Ausgabe Mommsens in den M.G.; II. Dionysius Exiguus, der Begründer der christlichen Ära* (Berlin: De Gruyter, 1938).
Lattin, *Letters*	Gerbert, *The Letters of Gerbert, with his Papal Privileges as Sylvester II*, trans. Harriet Pratt Lattin (New York, NY: Columbia University Press, 1961).
Marianus, *Chronicon*	Marianus Scotus, *Chronicon*, in George Waitz, ed., *MGH SS* 5 (Hannover: MGH, 1844): pp. 481–568.
Marianus, 'Praefatio'	Anna-Dorothee v. den Brincken, 'Marianus Scottus unter besonderer Berücksichtigung der nicht veröffentlichen Teile seiner Chronik', *Deutsches Archiv für Erforschung des Mittelalters* 17 (1961): pp. 191–238.
MGH	*Monumenta Germaniae Historica*
AA	*Auctores Antiquissimi,* 15 vols. (Berlin: MGH, 1877–1919).
SS	*Scriptores* in folio, 39 vols. (Hannover: MGH, 1824–2009).
Migne, *PL*	*Patrologiae Cursus Completus, Series Latina*, 221 vols. (Paris: 1841–1864).
ODNB	*Oxford Dictionary of National Biography*
Petrus Alfonsi, *Epistola*	Petrus Alfonsi, *Epistola ad peripateticos*, in John Tolan, ed. and trans., *Petrus Alfonsi and his Medieval Readers* (Gainesville: University Press of Florida, 1993): pp. 163–180.
Walcher, *DL*	Walcher, *De lunationibus*, in C. Philipp Nothaft, ed. and trans.,

	Walcher of Malvern, De lunationibus and De dracone: Study, Edition, Translation, and Commentary (Turnhout: Brepols, 2017): pp. 89–191.
Walcher, *DD*	Walcher, *De dracone*, in C. Philipp Nothaft, ed. and trans., *Walcher of Malvern, De lunationibus and De dracone: Study, Edition, Translation, and Commentary* (Turnhout: Brepols, 2017): pp. 193–217.
William, 'Abbreviatio'	Richard Pfaff, 'The 'Abbreviatio amalarii' of William of Malmesbury', *Recherches de Théologie ancienne et médiévale* 48 (1981): pp. 128–171.
William, *Historia*	William of Malmesbury, *Historia Novella*, ed. Edmund King, trans. K.R. Potter (Oxford: Clarendon Press, 1998).
William, *GP*	William of Malmesbury, *Gesta pontificum Anglorum*, ed. and trans. Michael Winterbottom (Oxford: Clarendon Press 2007).
William, *GR*	William of Malmesbury, *Gesta Regum Anglorum*, ed. and trans. R.A.B. Mynors, completed by R.M. Thomson and Michael Winterbottom (Oxford: Clarendon Press, 1998).

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INTRODUCTION

A Culture of Inquiry:

Scientific Thought and Its Reception in the Severn Valley c. 1090–1150

In the eleventh and twelfth centuries, star tables, for example, those associated with al-Khwārizmī, crossed the Mediterranean, moving from Baghdad to Cordoba and Toledo to Marseilles. One of their first areas of transmission in the Latin West appears to have been in and around the bishoprics and cities of Worcester, Bath/Wells, and Hereford. The star tables were some of the first documents in the new wave of Arabic texts translated into Latin to arrive in the early twelfth century. Originally developed in Baghdad in the eighth century, they were used in planetary tracking and astrology. They had been updated in eleventh-century al-Andalus and made their way to the Latin West in the early part of the twelfth century.

Hereford and Worcester, Cirencester and Winchcombe, and Bath are mentioned often in descriptions of this period of transition in the history of science.[1] The primary players in the introduction of the Arabic astronomical texts in the earlier part of the century, Petrus Alfonsi (d. 1130s?), Walcher of Great Malvern (d. 1135), and Adelard of Bath (d. 1152?), are all associated with this geographical area.[2] There is a measure of continuity for the later part of the century with the activities of Robert of Chester (fl. c. 1140–c. 1150) and Roger of Hereford (d. 1198). In

[1] Scholars who are particularly important to this thesis and who have touched on the area include Charles Burnett, 'Mathematics and Astronomy in Hereford and its Region in the Twelfth Century', in David Whitehead, ed., *Medieval Art, Architecture and Archaeology at Hereford* (Leeds: British Archaeological Association, 1995): pp. 50–59; Gillian Evans, 'Schools and Scholars: The Study of the Abacus in English Schools, c. 980–c. 1150', *EHR* 94, no. 370 (1979): pp. 71–89; Jennifer Moreton, 'Before Grosseteste: Roger of Hereford and Calendar Reform in Eleventh- and Twelfth-Century England', *Isis* 86, no. 4 (1995): pp. 562–586; Charles Homer Haskins, *Studies in the History of Medieval Science* (Cambridge, MA: Harvard University Press, 1924); Anne Lawrence-Mathers, 'Computus and Chronology in Anglo-Norman England', in Laura Cleaver and Andrea Worm, eds., *Writing History in the Anglo-Norman World: Manuscripts, Makers and Readers, c. 1066–c. 1250* (Woodbridge: Boydell, 2018): pp. 53–68; Giles Gasper, 'On the Liberal Arts and its Historical Context', in Giles Gasper, Cecilia Panti, Tom McLeish, and Hannah Smithson, eds., *The Scientific Works of Robert Grosseteste. Volume 1, Knowing and Speaking: Robert Grosseteste's* De artibus liberalibus 'On the liberal arts' *and* De generatione sonorum 'On the generation of sounds' (Oxford: Oxford University Press, 2019): pp. 9–35; Richard Southern, *Robert Grosseteste: The Growth of an English Mind in Medieval Europe* (Oxford: Clarendon Press, 1986).

[2] References for these scholars will be presented in the upcoming chapters.

studying the intellectual shifts of this period, historians have primarily focused on the manuscripts that came into England, when they arrived, and who brought them or translated them, with overarching themes of their contribution to the history of science and the future development of scientific studies in learning centres such as the nascent University of Oxford. It is within this framework that scholars such as Charles Homer Haskins, R.W. Southern, and Charles Burnett have discussed the importance of the translation movement to the history of science. This thesis draws on this work and explores the particular circumstances of scholars and individuals within the Severn Valley who may have facilitated the reception of the new learning. It will investigate who may have been interested in the texts, who owned them, how they got hold of them, and how they used them. Specifically, it will explore in-depth reflections on the new sciences in the work of three area scholars, William of Malmesbury (d. 1143), Walcher of Great Malvern, and John of Worcester (d. 1141).

The evidence suggests that the three scholars mentioned above already had an advanced interest in computistical and mathematical studies by the 1120s and were therefore primed, as it were, for new material. Finally, it will be of interest to explore these scholars' respective reactions to the new sciences. In the later years of his writing, for instance, John of Worcester reveals himself to have developed some of the characteristics of an observational astronomer. What follows in the Introduction will outline a rationale for period and place and define the central terminology and definitions used. It is also important to review the political background of the Severn Valley and where this study fits into the historiography of the history of science, as well as describe the variety of historiographical topics that inform this thesis. And finally, in this Introduction, a preview will be given of the arguments and evidence presented in this thesis, organised by chapter.

0.1 DEFINING THE SCOPE OF THIS STUDY

The scope of this investigation is the transmission of the new sciences into England in the early twelfth century, focusing on the period between 1090 and 1150, or roughly from the death of William Rufus to the accession of Henry II. This period also spans the decades between when

Walcher of Great Malvern arrived in England and when texts such as the al-Khwārizmī tables and Abū Ma'šar's *Ysagoge Minor* began to arrive.[3] The period spans the arrival of the first wave of texts of the new learning, but cuts off before the more systematic translation movement, associated in particular with Toledo, began. In this first wave, Petrus Alfonsi and Adelard of Bath are the primary influencers. By the middle of the twelfth century, however, these early texts had been overtaken in importance by other documents of more lasting impact. This thesis will reflect on the first impressions these texts in this first wave may have made on a select audience in the Severn Valley. A study of these first impressions will give insight into why such scholars thought these works were important and will, in part, reveal change or development in their thinking based on that new knowledge.

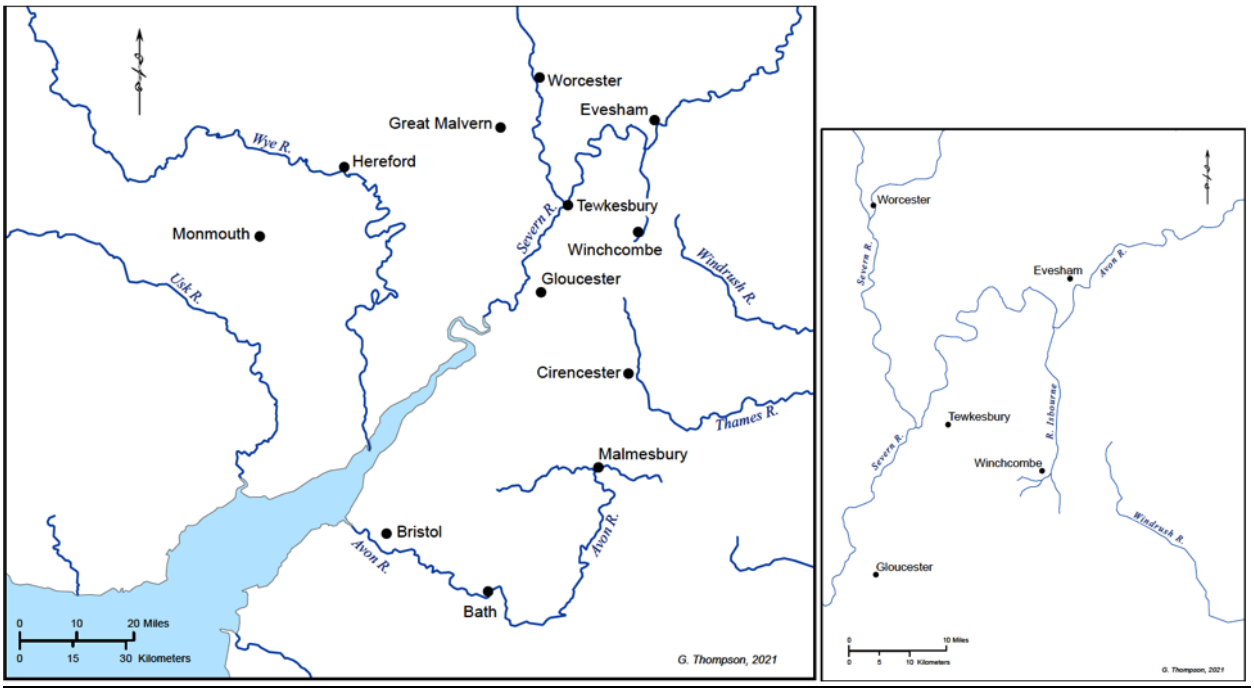
William of Malmesbury, Walcher of Great Malvern, and John of Worcester provide the case studies in this thesis for the reception of the new scientific documents. They are particularly compelling as a group. All three lived within a few days' journey of each other, all were Benedictine monks, and all died within a few years of each other. While not provable, it is also likely that they knew each other. These scholars are particularly important to an analysis of the introduction of the new sciences specifically because they were *not* widely travelled lay or secular translators, as were many involved in the translation movement. Nevertheless, they either read or were aware of the new sciences in this period because they spoke of meeting the translators, they owned or knew of their work, and they used these works in various ways. As such, their impressions, as reflected in their own writings and their collections of the material, are important testimonials to the arrival of the new sciences. The body of the writings of William, Walcher, and John reveal a 'before-and-after' picture, although it is clearly the case that Walcher and John were more explicitly impacted by the new learning than was William.

In this thesis, the terminology of the 'new sciences' will be used more frequently than the normally held convention of the term, the 'Arabic Sciences'. This nomenclature is purposeful. The scientific tradition and translation movement are varied in geographic place of origin, the original scholarship, the path of transmission, and the organisation of knowledge. The focus here

[3] Abū Ma'šar (& Adelard of Bath), *Ysagoge minor*, in Charles Burnett, Keiji Yamamoto, and Michio Yano, eds. and trans., *The Abbreviation of the Introduction to Astrology Together with the Medieval Latin Translation of Adelard of Bath* (Leiden: Brill, 1994).

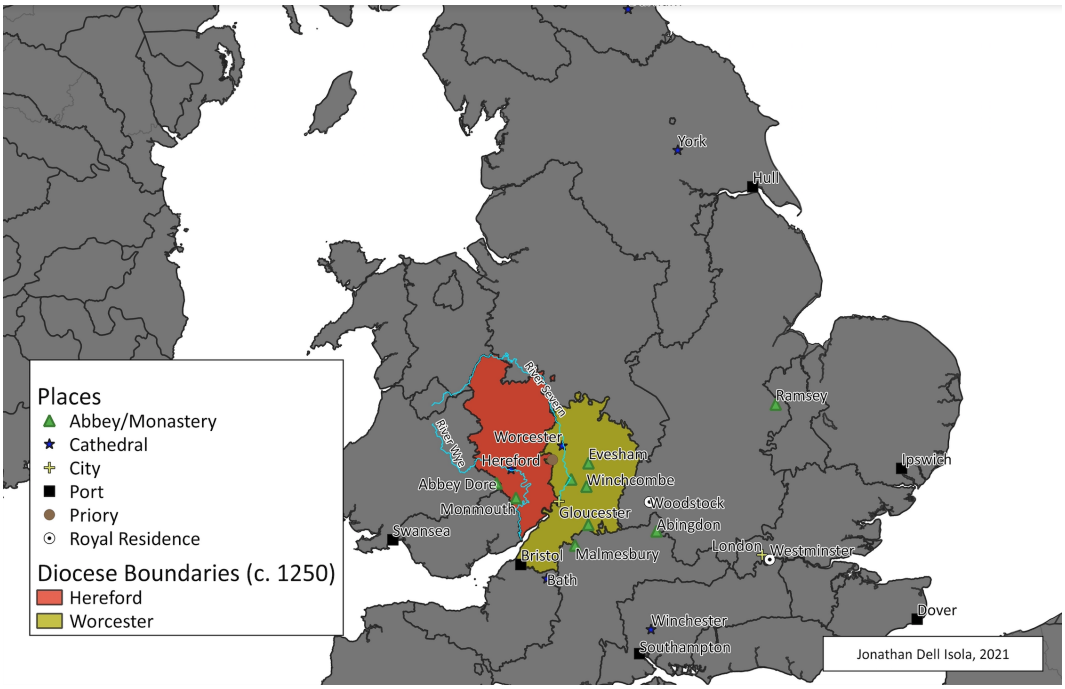
will be on the broad area of scholarship defined by the study of the *quadrivium*, as articulated by Boethius, further defined by Gerbert, and adapted by Petrus and Adelard. Typically, it includes mathematics, music, medicine, and astronomy. The modern scholar should not be made too comfortable by these broad topics, however. In practice in the eleventh and twelfth centuries, these rough categories included areas that the modern scholar may consider to be 'unscientific', such as astrology and necromancy. Also, neither the region of origin nor the transmitters were exclusively Arabic or Muslim. The Greek, Persian, and Jewish traditions in both content and transmission are considered here. This study of the new sciences is also purposely selective in that it will focus on what three writers, William, Walcher, and John, knew about these sciences and how they may have used or reflected on this knowledge. This means that astronomy and astrology feature more prominently in this analysis than medicine or music.

The Severn Valley is defined here as a distinct area, as shown in *Map #1*. This terminology, while to some extent artificial, is based on the geographic, ecclesiastical, economic, and political synergies of the region. For the purposes of this thesis, the Severn Valley includes the cities, monasteries, and bishoprics predominantly along the Severn and Wye rivers from Bristol and Bath in the south and up to the bishopric of Worcester at its northernmost point. The Severn Estuary includes its tributary, the River Wye, to the west, the Severn itself, as well as its short tributary, the Isbourne, and to the east, the Avon.



Map #1: Illustrating the Severn Basin, which includes the River Wye, the Severn, and the Isbourne tributary, as well as the Avon.

The Severn Valley area is also defined in this thesis by ecclesiastical geography. It includes the dioceses of Hereford, Worcester, and parts of Wells and Salisbury; and the monastic communities of Malmesbury, Winchcombe, Tewkesbury, Cirencester, and Dore, as well as Worcester, Malvern, Gloucester, and St. Guthlac's in Hereford. The urban settlements of the Severn Estuary basin were also economically connected. Trade moved from Bristol up the Severn to Gloucester and from there to north-western England in particular. In considering patronage, the territorial boundaries of Robert the Earl of Gloucester, extending from Bristol and up through Gloucester, to Winchcombe and Tewkesbury, also became important. The geographic area of the Severn Valley under consideration is diagrammed in the map below.



Map #2: Illustrates the Dioceses of Hereford and Worcester. The region referred to in this essay as the Severn Valley includes the southern half of these dioceses. (In *Map #3,* below, one can see that the Diocese of Worcester is *roughly* co-equal to the English territories governed by Robert of Gloucester.)

Important to the description of this topography is that this area, however distinct, was not culturally isolated. The merchants of Bristol had established lasting connections to other parts of the world, including Ireland, the Iberian Peninsula, and the Mediterranean. Gloucester was nodal in communication networks from southern Wales to London, and to the Marches and northwest of England. The political climate and domination of the Welsh rulers brought the English kings, including William Rufus and Henry I, into the area, and with them, their retinue. Through these routes, wider connections were made to other areas of Norman activity and influences and centres of intellectual culture, for instance, Mont Saint Michel, Avranches, Rouen, and further afield, Sicily and Antioch.

The monastic and other ecclesiastical connections also allow particular, and sometimes traceable, routes for the transmission of documents. In N.R. Ker's opinion, Worcester and

Winchcombe had long been important religious centres in the area with renowned scriptoriums.[4] These centres had direct relationships with other centres in England, including Canterbury, Ramsay, and Durham, and those on the continent, such as Fleury. The newly established priory of Great Malvern was a dependency of the royally sponsored Westminster Abbey. As will be described in Chapter II, there is some reason to believe that there were area connections to Monte Cassino as well, and the relationship with Mont Saint Michel has already been mentioned. None of this is to hold the Severn Valley region as unique. As noted above, it was only one of many centres important for the transmission and reception of the new learning. Nevertheless, it is the combination of the circumstances, individuals, and institutions at the turn of the eleventh and twelfth century at once that may have been a factor in facilitating the transmission of people, ideas, and texts.

0.2 THE POLITICAL BACKGROUND AND ECONOMIC LANDSCAPE OF THE SEVERN VALLEY

The focus of this thesis will be the reception and use of the new sciences by William of Malmesbury, Walcher of Great Malvern, and John of Worcester. To understand how the new scientific texts may have travelled to the Severn Valley, it will be important to further explore the political and cultural context and influences that may have brought the earliest translators of these works, Petrus Alfonsi and Adelard of Bath, to the area. It will be argued here, for instance, that the policies and court life of William Rufus and Henry I may have provided an alluring environment for those with skills in the new sciences, and the political and economic importance of the Welsh border, in turn, drew the courts to the Severn Valley area. As these themes will be referred to as this thesis progresses, it is important to establish that background.

[4] Neil R. Ker, *English Manuscripts in the Century after the Norman Conquest* (Oxford: Clarendon Press, 1960): p. 7; see also an important discussion of book production in this period by Richard Gameson, *The Manuscripts of Early Norman England (c. 1066–1130)* (Oxford: Oxford University Press, 1999): pp. 1–41.

In the late eleventh and early twelfth centuries, the Severn Valley, as defined in this thesis, was an area of increasing economic and political import. It was important to the English economy and was involved in wider military and trading activity. Gloucester was an important inland port, and Bristol had long been a major entrepot for trade from the south and west, and its merchants were in contact with the Flemish, Norman, Sicilian, Spanish, and Portuguese traders.[5] As noted above, the area described as the Severn Valley refers in this thesis to a large area spanning from Bristol Bay (in this period called the Severn Bay) following the Wye and Severn rivers up as far north as Worcester, though it should be noted that the River Severn extends up through Bridgnorth and Shrewsbury before its origination in Wales. The region also encompasses Bath to the south, Winchcombe and Cirencester to the east, and Hereford to the west. Bristol, Gloucester, and Worcester lie in the Severn Basin; the River Severn itself was deep and wide, particularly in the south, making it a natural boundary as well as a convenient shipping channel for both troops and goods. On the border of Wales, the Severn Valley region was an area where the Norman kings inevitably spent some time in an effort to protect their kingdom.

The Severn Valley was a focal point for much post-conquest political activity. William Rufus, Henry I, Stephen, and Matilda all circulated actively in this area, making Gloucester and Bristol regular destinations for the royal courts. Gloucester, replete with long-standing associations with royal crown-wearing, was particularly favoured by William Rufus. In the late 1080s, he faced rebellion from the marcher barons, Robert de Mowbray and William Eu. He ended this particular struggle by imprisoning Mowbray and blinding and castrating the Count of Eu. William led two unsuccessful campaigns into Wales in 1097. These campaigns and the subsequent castle-building programme kept the king in the western areas and the Severn Valley region. Gloucester, Bristol, Hereford, and Worcester are frequent references on his itinerary and not always in the context of military action.[6] In fact, Gloucester was William Rufus' Christmas palace on several occasions and seems to have been a destination of choice.

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[5] Wendy R. Childs, *Trade and Shipping in the Medieval West*, *Portugal, Castile and England* (Turnhout: Brepols, 2013); Pamela Nightingale, *Trade, Money, and Power in Medieval England* (Aldershot: Ashgate, 2007); David Jacoby, *Medieval Trade in the Eastern Mediterranean and Beyond* (London: Routledge, 2018).

[6] Frank Barlow, *William Rufus* (New Haven: Yale University Press, 2000): pp. 298, 308, and 326.

Henry I, according to Judith Green, did not frequent Gloucester to the extent his brother did, but he was in the area, or close by, much of the time, and for many of the same reasons.[7] After William Rufus' death in a hunting accident, Henry immediately came to England to establish dominance over his other brother, Robert Curthose.[8] Much of this struggle took place in the mid-March region, including the sieges of Shrewsbury and Bridgnorth. Once an established King of England, Henry, like William Rufus, continued to face threats on the Welsh border, bringing him into the area in our period with some frequency. From 1102 to the 1120s, he regularly conducted campaigns on the border. By 1121, according to John of Worcester, he had 'subjected all Wales to his rule'.[9] This may have been an overstatement. Nevertheless, it is clear that Henry reinforced the Welsh Marches with his own appointees and strengthened the border territories.[10] According to Henry's itineraries, other things brought Henry into the area besides war. The analysis carried out by Stephanie Mooers Christelow shows that Henry held court at Gloucester in 1107, Worcester in 1114, then Abingdon and Cirencester in 1132.[11] Henry was most frequently present in the Severn Valley in 1121 and 1127, spending approximately three months each year in the area. Henry's favourite resting place and his personal palace was Woodstock, Wiltshire ('a remarkable place where [Henry] made a dwelling place for man and

[7] Judith Green, *Henry I: King of England and Duke of Normandy* (Cambridge: Cambridge University Press, 2009): p. 299.
[8] William, *GR,* II.275: pp. 504–505; John, *Chronicle,* III, s.a. 1100: pp. 92–93.
[9] John, *Chronicle*, III, s.a. 1121, pp. 150–151: 'totam Waliam sue dicioni subegit'; see also William Farrer, *An Outline Itinerary of King Henry the First* (Oxford: Printed by Frederick Hall, 1919): pp. 95–97.
[10] For Henry I and Wales, see Farrer, *An Outline Itinerary*; C. Warren Hollister, *Henry I,* ed. and completed by Amanda Clark Frost (New Haven: Yale University Press, 2001); R.R. Davies, 'Henry I and Wales', in Henry Mayr-Harting and R.I. Moore, eds., *Studies in Medieval History Presented to R.H.C. Davis* (London: Hambledon Press, 1985): pp. 133–148; Huw Pryce, 'British or Welsh? National Identity in Twelfth-Century Wales', *EHR* 116, no. 468 (2001): pp. 775–801; Bjorn Weiler, 'William of Malmesbury, King Henry I, and the *Gesta regum Anglorum*', in Chris Lewis, ed., *Anglo-Norman Studies, XXI: Proceedings of the Battle Conference 2008* (Woodbridge: Boydell Press, 2009): pp. 157–176; Owain Wyn Jones, 'Brut y Tywysogion: The History of the Princes and Twelfth-Century Cambro-Latin Historical Writing', *Haskins Society Journal* 26 (2014): pp. 209–228, esp. pp. 219–222.
[11] Stephanie Mooers Christelow, 'A Movable Feast? Itineration and the Centralization of Government under Henry I', *Albion: A Quarterly Journal Concerned with British Studies* 28, no. 2 (1996): pp. 187–228.

beast').[12] This is adjacent to the Severn Valley area and an easy journey across Roman Road IV to Cirencester and Gloucester.[13]

During the period between the death of Henry I and the accession of Henry II, the centre of operation for Matilda, Henry I's named heir and the mother of Henry II, was in the wider Severn Valley. She established a stronghold in Bristol and, as will be reviewed further below in Chapter V, [5.3], had residences throughout the area, including Cirencester and Winchcombe. She had support in the area, most notably that of Robert of Gloucester, Henry I's influential bastard son.

Robert of Gloucester was the eldest but illegitimate son of Henry I.[14] The core of his wealth was derived from his marriage to Mabel Fitzhamon, who brought Gloucester, Glamorgan, and Cardiff to the marriage. These territories are diagrammed in *Map #3*. Robert was often portrayed as Henry's right hand. He was instrumental in keeping Normandy and the Welsh Marches under Henry's control. His influence is graphically dramatised in his presence for a large number of Henry I's charters and official business, as can be shown in *Map #4.* He was at Henry's side (as was Stephen) for the oath swearing to Matilda in 1127. Despite a brief period where he appeared to support Stephen after his father's death, his loyalties were to Matilda and the future Henry II. While his political influence has been studied with some assiduousness, his role as patron and benefactor has been touched on only in recent years. The synergies between his territory of influence and the Severn Valley intellectual community should not be ignored and will be discussed further in Chapter III, [3.4].

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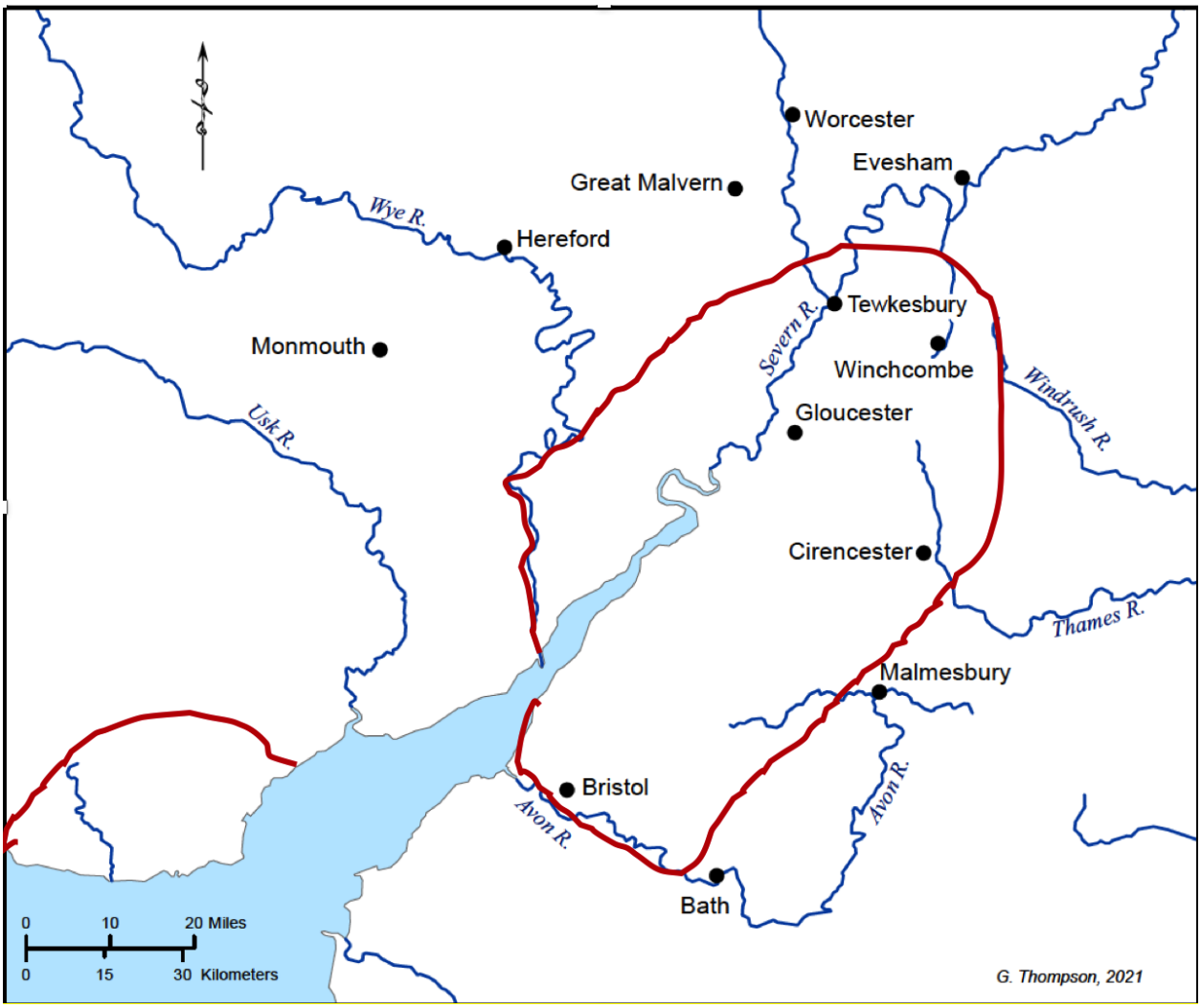
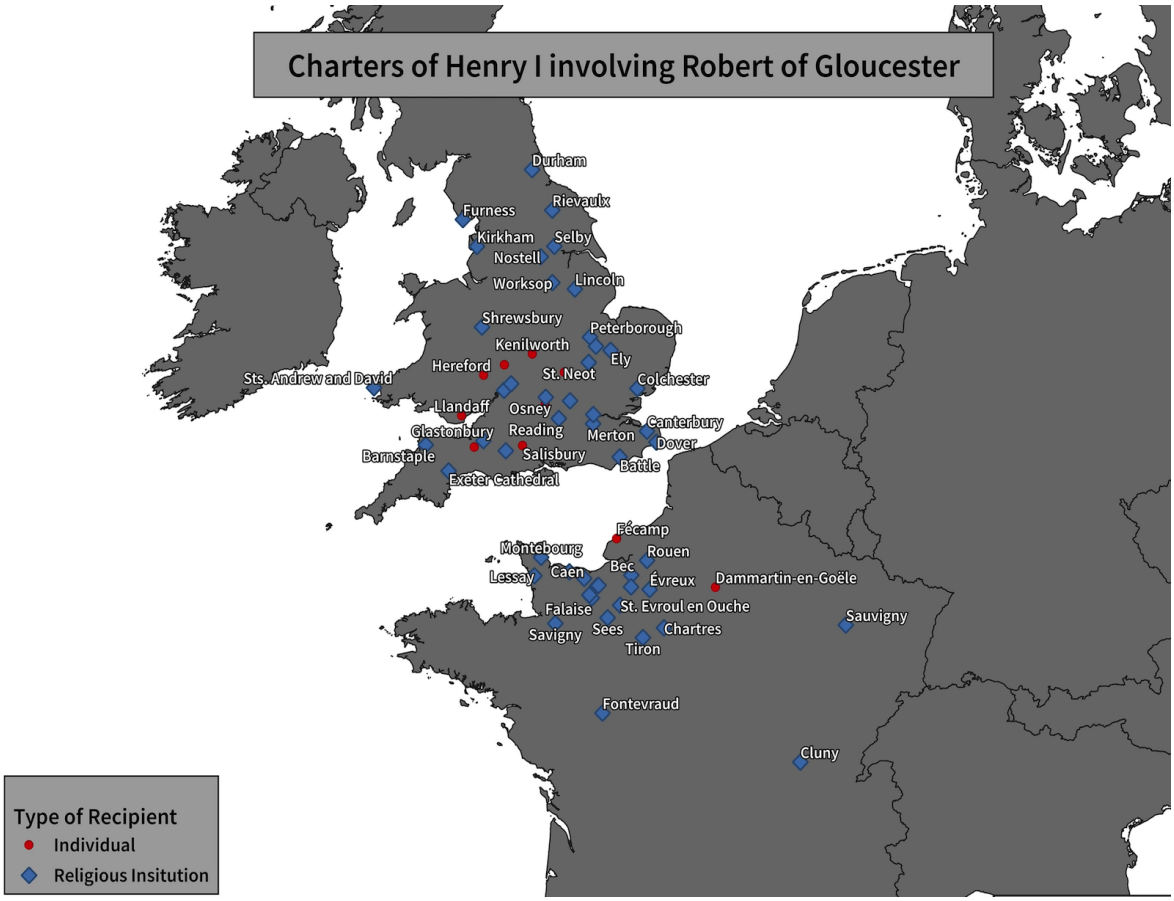
[12] Henry of Huntingdon, *Historia*, VII.34: pp. 470–471: 'Inde iuit rex ad Wdestoc ad locum insignem, ubi rex cohabitatione hominum et fecerat'.

[13] https://www.odysseytraveller.com/articles/roman-roads-britain/ (accessed 08/04/2022); a still useful book to medieval travel routes and recommended by Julia Barrow is John Ogilby, *Britannia, Volume the First* (London, 1695).

[14] Robert Patterson, *The Earl, the Kings, and the Chronicler: Robert Earl of Gloucester and the Reigns of Henry I and Stephen* (Oxford: Oxford University Press, 2019); Kathleen Thompson, 'Affairs of State: The Illegitimate Children of Henry I', *Journal of Medieval History* 29 (2003): pp. 129–151; Sarah Mitchell, 'Kings, Constitution and Crisis: 'Robert of Gloucester' and the Anglo-Saxon Remedy', in Donald Scragg and Carole Weinberg, eds., *Literary Appropriations of the Anglo-Saxons from the Thirteenth to the Twentieth Century* (Cambridge: Cambridge University Press, 2000): pp. 39–56; Robert Patterson, ed., *Earldom of Gloucester Charters: The Charters and Scribes of the Earls and Countesses of Gloucester to A.D. 1217* (Oxford: Clarendon Press, 1973).



Map #3: Outlining the major English territories under Robert of Gloucester's control. Robert's area of influence began just south of Worcester, extending south to Bristol, and was inclusive of Winchcombe, Tewkesbury, and Cirencester. It also included portions of South Wales, west of Cardiff. Robert had influence in Bath and at Malmesbury, though he had no direct authority at either location.



Map #4: Depicting the charters of Henry I, where Robert of Gloucester is known to have been present. Indicates an active presence in major Norman centres, including Mont Saint Michel, Bec, Chartres, and major English centres such as Durham, Ramsey, and, of course, Gloucester.[15]

In part, politics and the Welsh threat brought the Anglo-Norman court to the Severn Valley. But this area was hardly a backwater. It was well connected to its trading hinterland, to the Irish Sea, the Atlantic coasts of France and Iberia, and the western Mediterranean. The geography and economies of the Severn Valley region also shed some light on its importance to the Norman kings and, by extension, its attractiveness to itinerant scholars such as Petrus Alfonsi. In the *Gesta Stephani,* Bristol's place is established as follows:

> Bristol is almost the richest city of all in the country, receiving merchandise by sailing-ships from lands near and far. It lies in the most fertile part of England and by its very situation is the most strongly fortified of all its cities. For just like what we read about

[15] Used to develop this map was Charles Johnson and H.A. Cronne, eds., *Regesta Henrici Primi, 1100–1135*, vol. 2, Regesta Regum Anglo-Normannorum 1066–1154 (Oxford: Clarendon Press, 1956); see also Patterson, ed., *The Earldom of Gloucester Charters*.

> Brindisi [Lucan] it is a part of Gloucestershire that makes the city, narrowing like a tongue and extending a long way, with two rivers washing its sides and uniting one in broad stream lower down where the land ends. There is also a strong and vigorous tide flooding in from the sea night and day; on both sides of the city it drives back the current of the rivers to produce a wide and deep expanse of water, making the harbour quite suitable and perfectly safe for a thousand ships.[16]

In addition to Bristol, Gloucester, though a river port, was a critical centre of internal trade in the area and was an important location for the Anglo-Norman kings. Iron was a prime commodity for both Gloucester and Hereford, notably from the Forest of Dean, and wool went to the continent from the ports of Gloucester and Bristol. Not perhaps surprisingly, wine was a primary import, particularly from Normandy and increasingly from western France.[17] By the mid-twelfth century, Bristol had developed into a city of both economic and political significance. The merchants of Bristol, as noted above, traded widely and had intimate connections to the Flemish mercantile network.[18] Matilda used Bristol as a base of operations in her struggle with Stephen

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[16] *Gesta Stephani*, s.a. 1138: pp. 56–57: 'Est autem Bristoa ciuitas omnium fere regionis ciuitatum opulentissima, ex uicinis peregrinisque terris nauigio uelificante suscipiens mercimonia, in fertiliori Angliae parte constituta, ipso etiam situ loci omnium ciuitatum Angliae munitissima. Sicut enim de Brundusio legimus, quaedam prouinciae Glaornensis pars ad forma linguae restricta et in longum protensa, duobus fluuiis gemina eius latera proluentibus, inque inferiori parte ubi ipsa terra defectum patitur, in unam aquarum abundantiam coeuntibus, efficit ciuitatem. Viua quoque et fortis maris exaestuatio noctibus et diebus abundanter exundans, ex ambabus ciuitatis partibus fluuios ipsos in latum et profundum pelagus regurgitare in seipsos cogit, portumque mille carinis habillimum et tutissimum efficiens...'.

[17] Jane Geddes, 'Iron', in John Blair and Nigel Ramsay, eds., *English Medieval Industries* (London: Hambledon, 1991): pp. 167–188; Susan Rose, *The Wine Trade in Medieval Europe* (London: Bloomsbury, 2011). For the general economic history of the period, see N.J.G. Pound, *An Economic History of Medieval Europe* (London: Longman, 1974); see also note 18 below in this Chapter.

[18] For general context and targeted studies: William Chaloner and Roger C. Richardson, *British Economic and Social History: A Bibliographical Guide* (Manchester: Manchester University Press, 1976); Hilmar C. Krueger and Georges Duby, *The Early Growth of the European Economy: Warriors and Peasants from the Seventh to the Twelfth Century*, trans. (Ithaca, NY: Cornell University Press, 1974); John S. Moore, 'Trade, Money, and Power in Medieval England – By Pamela Nightingale', *The Economic History Review* 62 (2009): pp. 205–206; M.M. Postan, *Medieval Trade and Finance* (Cambridge: Cambridge University Press, 1973); Richard Unger, *The Ship in the Medieval Economy, 600–1600* (Aldershot: Ashgate, 1997); Martin R. Allen, *Mints and Money in Medieval England* (Cambridge: Cambridge University Press, 2012); Rosamund Allen, ed., *Eastward Bound: Travel and Travellers 1050–1550* (Manchester: Manchester University Press, 2004); Nightingale, *Trade, Money, and Power*, see esp. chapter four, 'The Evolution of Weight-Standards and the Creation of New Monetary and Commercial Links in Northern Europe from the Tenth to the Twelfth Century', and chapter seven, 'The King's Profit': Trends in the English Mint and Monetary Policy in the Eleventh and Twelfth Centuries'; Jacoby, 'Economic Function of the Crusader States in the Levant: a New Approach', *Medieval Trade*: pp. 105–191; Richard Gorski, *Roles of the Sea in Medieval England* (Suffolk: Boydell Press, 2012); Wendy R.

and felt confident enough in the stronghold to leave the young future Henry II there in the mid-1140s. It has been suggested that it was in Bristol that Adelard of Bath tutored or came into contact with the prince.[19]

In short, this was an area that would have been tactically critical to the early Norman kings. Keeping this area secure and well-administered would have been of paramount importance. This interest was expressed by the strengthening of political allies such as Robert of Gloucester, as well as by church appointments with men who had strong administrative potential, such as Robert of Losinga and Walcher of Great Malvern.

0.3 A NOTE ABOUT TEXTUAL TRANSMISSION

Groundwork should also be set for the topics of transmission of texts and library collections, setting the Severn Valley within the framework of other areas in England. These topics are by all accounts elusive, though the work of Teresa Webber, Richard Gameson, Michael Lapidge, Charles Burnett, Rodney Thomson, Monica Green, and Francis Newton have gone a long way towards outlining what we can and cannot know about the transmission of texts into England.[20] There is scholarly agreement that the most likely transmission route in this period

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Childs, *Anglo-Castilian Trade in the Later Middle Ages* (Manchester: Manchester University Press, 1978) and *Trade and Shipping*.

[19] Adelard of Bath, *Libellus de opere astrolapsus,* in Bruce Dickey, ed., 'Adelard of Bath: An Examination Based on Heretofore Unexamined Manuscripts' (PhD Dissertation, University of Toronto, 1983): pp. 112–230.

[20] One of the most useful collections of articles on this topic is to be found in Richard Gameson, ed., *The Cambridge History of the Book in Britain: Volume I c. 400–1100* (Cambridge, 2011); this volume includes articles by Gameson, 'From Vindolanda to Domesday', and *ibid*, 'The Circulation of Books between England the Continent, c. 871 – c. 1100', as well as Scott Gwara, 'Anglo-Saxon Schoolbooks', Michael Lapidge, 'The Library of Byrhtferth', and Andy Orchard, 'The Library of Wulfstan of York'; see also the now classic work of Michael Lapidge, *The Anglo-Saxon Library*, (Oxford, 2005), and Rodney Thomson, *Books and Learning in Twelfth-Century England: The Ending of 'alter orbis' : The Lyell Lectures 2000-2001* (Walkern, Herts: Red Gull Press, 2006): for a general discussion of the transmission of scientific texts into England, see Burnett, 'Mathematics and Astronomy' and *ibid*, *The Introduction of Arabic Learning into England* (London: British Library, 1996) as well as his 'The Introduction of Scientific Texts into Britain, c. 1100–1250)', in Nigel Morgan and Rodney M. Thomson, eds., *The Cambridge History of the Book in Britain: Volume II* (Cambridge, UK: Cambridge University Press 2008): pp. 446–453; there has been a good deal of work on medical texts which give us insights into textual transmission in this period, see Rodney Thomson, 'The Library of Bury St. Edmunds Abbey in the

from Europe to England was the shortest route possible – from eastern France (Calais) or Flanders (Bruges) to the London area, Rochester and Canterbury, and from there passing via personal and institutional relationships (discussed below) west to Winchester and Worcester, and north to York and Durham, among others. While other routes across the channel may have developed during the Norman solidification of the English realm, such as those from Rouen and Barfleur, to either Southampton or Bristol, there is no evidence to support that transmission route. Manuscript transmission from Flanders received several boosts in the tenth to eleventh centuries. Of note was the settlement at Bath by King Edmund of churchmen from Saint-Bertin, and according to Gameson, there were continued exchanges between these two establishments.[21] The route from Flanders was, in all likelihood, amplified after the conquest by William's connections to Flanders via his queen, Matilda.

The search for specific routes of transmission for manuscripts is in many ways a misguided or anachronistic effort. While there may have been professional scribes, to our knowledge, there was not a trade in manuscripts.[22] Texts did not yet form part of a commercial trade and their movement was in the hands ('or pockets and bags') of individual clerics and monks and was determined by their personal and institutional connections.[23] A more fruitful effort is to explore the kinds of relationships that may have facilitated exchange.

These personal exchanges and institutional relationships can be traced and documented, and, for expediency, can be grouped into several broad categories. We can, for instance,

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Eleventh and Twelfth Centuries', *Speculum* 47.4 (1972): pp. 617–645 and Teresa Webber, 'Books and their Use Across the Conquest', in T. Licence, ed., *Bury St Edmunds and the Norman Conquest* (Woodbridge, 2014), pp. 160–189, as well as D. Banham, 'Medicine at Bury in the Time of Abbot Baldwin', in T. Licence, ed., *Bury St Edmunds and the Norman Conquest* (Woodbridge: Boydell Press, 2014), pp. 226–246; finally, the work on this by Monica Green deserves special mention: Monica H. Green, 'Medicine in France and England in the Long Twelfth Century: Inheritors and Creators of European Medicine', in Charlotte Denoël and Francesco Siri, eds., *France et Angleterre: manuscrits médiévaux entre 700 et 1200*, *Bibliologia* 57 (Turnhout: Brepols, 2020), pp. 363–388 and her upcoming article, 'In and Beyond the Beneventan Zone: The Transformation of Latin Medicine in the Eleventh Century', to appear in Andrew J. Irving and Richard Gyug, eds., *Brill Companion to the Beneventan Zone* (Leiden: Brill, forthcoming).

[21] Gameson, 'The Circulation of Books'.

[22] Thomson, *Books and Learning,* p. 67.

[23] Personal correspondence (15/04/2022) with Professor Teresa Webber.

determine changes in document provenance through marginalia and other notes, including the stunning astronomical document, Oxford, Corpus Christi 283, from St. Augustine's at Canterbury by the 1200s, but which included notes referring to Winchester and St Albans, and in which the twelfth-century sections may have been done in a western English hand.[24] Through internal textual analysis, we can track the copying and distribution of texts, as Webber has done in her important work on the Salisbury library.[25] There are also records, primarily in personal letters, of churchmen who, having moved to a new appointment, asked or were asked for documents by colleagues from their previous residency. An important and often cited example is Anselm at Bec writing to Lanfranc, then at Canterbury, asking for a copy of the *Rule of St. Dunstan*.[26] Also, we have multiple examples of churchmen and monks bringing texts with them to their new appointments. This includes the Earnwine Psalter brought to Worcester from Cologne by Bishop Ealdred in 1054 (this particularly famous document made several trips back and forth across the channel).[27] Abbo of Fleury appears to have brought his own and Helperic's computus from Fleury to Ramsey.[28] As we will see in Chapter I, Robert of Losinga brought the *Chronicon* of Marianus Scotus from the Lorraine.

Only very rarely, library catalogues and corresponding documents have survived, such as that of Durham, Bury St Edmunds, and Rochester Cathedral.[29] With careful consideration (not all citations come from original sources), the library resources of a scholar can be built from citations and literary influences in their own texts, such as the work done by Andy Orchard on the Aldhelm library at Malmesbury based on Aldhelm's readings, and the readings of William of Malmesbury done by Rodney Thomson.[30] We can, in a few rare instances, trace the copying of

[24] http://sip.mirabileweb.it/manuscript/oxford-corpus-christi-college-283-manuscript/2568 (accessed 20/04/2022); see O. Neugebauer, *The Astronomical Tables of al-Khwārizmī*, Copenhagen 1962, references on p. 241; Rodney Thomson, *A Descriptive Catalogue of the Medieval Manuscripts of Corpus Christi College Oxford* (Woodbridge, Suffolk: D.S. Brewer, 2011): p. 283.
[25] Teresa Webber, *Scribes and Scholars at Salisbury Cathedral, c. 1075–c. 1125* (Oxford: Clarendon Press, 2002).
[26] Gameson, 'The Circulation of Books', esp. p. 367.
[27] Nicholas Brooks, *St. Oswald of Worcester: Life and Influence,* ed. by Nicholas Brooks and Catherine Cubitt (London: Leicester University Press, 1996), p. 218.
[28] Gameson, 'The Circulation of Books', p. 356.
[29] Thomson, *Books and Learning,* p. 23.
[30] Care must be taken in citations, which may easily come from a secondary or encyclopaedic source. Andy Orchard, 'Aldhelm's Library', *Cambridge History of the Book,* Vol. I: pp. 591–605; Rodney

manuscripts and thus map out transmission, such as the distribution of Robert of Losinga's and Walcher of Great Malvern's work from the Severn Valley to Durham, where these houses and ecclesiastical centres had institutional and historical relationships. The transmission of these documents will be discussed in later chapters.

From the evidence available, we know that the major manuscript centres included Canterbury, Rochester, Bury St Edmunds, Ramsey, Thorney, St Albans, Reading, York, Durham, Winchester, Exeter, Salisbury, and, in the Severn Valley region, Bath, Worcester, Gloucester, Llanthony Secunda, Tewkesbury, Malmesbury, and Winchcombe. Beyond the Severn Valley region, advanced computistical works were present in other areas in England , including important computistical documents at Durham (Hunter 100 and Glasgow 85), Ramsey, Thorney, and Peterborough (these under the proximal influence of Abbo and Byrhtferth), as well as Deeping and Reading. Medical documents (some representing the new medical activity in Salerno) that have survived or are known through catalogues are concentrated in Durham and Bury St Edmunds with as many as fourteen texts (five surviving) in Durham, and over ten surviving texts in Bury St Edmunds.[31] The latter may partially be related to the appointment of Abbot Baldwin (1065–1097), who had served as physician to William I and II.[32] Manuscripts reflecting the new sciences in the early to mid twelfth century are rarer. The example of London British Library, Arundel 377 from Ely, contains Adelard's work on the astrolabe and a work by Daniel of Morley, *Liber de naturis inferiorum et superiorum,* but it is a later period document than those under consideration in this thesis.[33] Canterbury also sported an important and cutting edge computistical document containing the work of Gerland in London, British Library Cotton Caligula A.XV.[34] The Canterbury astronomical document Oxford, Corpus Christi 283 mentioned

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Thomson, 'The Reading of William of Malmesbury', *Revue Bénédictine* 85, nos. 3–4 (1975): pp. 362–402; see Bibliography in this thesis for further articles by Thomson on William's readings.

[31] See G.E.M. Gasper and Faith Wallis, 'Salsamenta pictavensium: Gastronomy and Medicine in Twelfth-Century England', *English Historical Review,* 131 (2016): pp. 1353–1385; on Bury St Edmunds, see Thomson, 'The Library of Bury St. Edmunds Abbey', pp. 617–645; Webber, 'Books and Their Use': pp. 160–189; Banham, 'Medicine at Bury': pp. 226–246; Green, 'Medicine in France and England': pp. 363–388.

[32] Banham, 'Medicine at Bury': pp. 226–246.

[33] ww.bl.uk/manuscripts/FullDisplay.aspx?ref=Arundel_MS_377 (accessed 24/04/2022).

[34] 'London, British Library, Cotton Caligula A xv', in 'Innovating Knowledge', ed. by Evina Steinová (Huygens Institute, Amsterdam, 2021), online at https://db.innovatingknowledge.nl/#detail/M0171

above was at St. Augustine's by the 1200s; however, the texts reflective of those in Avranches 235, and London British Library 17808 (texts which will be discussed in Chapters II and V), indicate a provenance of France.[35] According to Rodney Thomson, the handwriting for the sections in question, fols. 141–147 (the al-Khwārizmī tables) indicate a western English hand, returning the argument to the Severn Valley vicinity.[36]

The Severn region is particularly rich in both the more traditional computistical texts and those representative of the new sciences, with lesser representation overall in medicine than that found in Durham or Bury St. Edmunds. The Severn Valley computistical manuscripts discussed in this thesis include Hereford, O.1.6, and British Library Cotton Tiberius E.IV. as well as William of Malmesbury's document Oxford, Bodleian Library F.3.14. A Worcester medical text, Worcester Cathedral Library, MS. F.40, possibly copied in Antioch, and present at the library by the mid twelfth century, foreshadows later collections in this library of work related to Constantine the African, Worcester Cathedral Library, MS. Q.41 and MS. F.85.[37] There are also a number of remarkable texts reflecting the new sciences. For instance, there are two twelfth-century Tewkesbury documents, Cashel GPA Bolton Library, Medieval MS 1,[38] containing Qusta ibn Lūqā's *De differentia spiritus et animae*, and the *Helcep Saracenicum,* which will be explored below in reference to Adelard and his student Ocreatus, and London, British Library,

(accessed 28/01/2022); http://www.bl.uk/manuscripts/FullDisplay.aspx?ref=Cotton_MS_Caligula_A_XV (accessed 24/04/2022).

[35] Charles Burnett, 'Catalogue. The Writings of Adelard of Bath and Closely Associated Works, Together with the Manuscripts in which they Occur', in *Adelard of Bath. An English Scientist and Arabist of the Early Twelfth Century*, ed. by C. Burnett (London, 1987): pp. 163–196; L.L. Busard and M. Folkerts, *Robert of Chester's (?) Redaction of Euclid's* Elements*, the so-Called Adelard II Version* (Basel: Birkhäuser, 1992): pp. 68–69; D. Pingree, *Preceptum canonis Ptolomei* (Louvain-la-Neuve: Academia Bruylant, 1997): pp. 10–11; Charles Burnett, 'Avranches, B.M. 235 et Oxford, Corpus Christi College 283', in *Science antique, science médiévale (Autour d'Avranches 235). Actes du colloque international (Mont-Saint-Michel, 4–7 Septembre 1998)*, eds. L. Callebat and O. Desbordes (Hildesheim; Zürich; New York, 2000): pp. 63–70; F.S. Pedersen, *The Toledan Tables. A Review of the Manuscripts and the Textual Versions with an Edition* (København, 2002): pp. 151–152; Thomson, *A Descriptive Catalogue*: pp. 143–147.

[36] Thomson, *A Descriptive Catalogue*: pp. 143–147.

[37] https://worcestercathedrallibrary.wordpress.com/2018/04/25/constantine-the-african-in-worcester-cathedral-library/ (accessed 24/04/2022); Charles Burnett, 'The Introduction of Scientific Texts into Britain', *Cambridge History of the Book,* Vol. II: pp. 446–453.

[38] Charles Burnett, 'Music and the Stars in Cashel, Bolton Library, MS 1', in Mary Kelly and Charles Doherty, eds., *Music and the Stars: Mathematics in Medieval Ireland* (Dublin: Four Courts Press, 2013): pp. 142–158.

Cotton Cleopatra A.VII, also from Tewkesbury and containing a document, *Collatio Compoti Romani et Arabici*, which attempts to reconcile the Arab and Roman calendars.[39]Other examples stem from the Gloucester area: an early manuscript of Euclid's *Elements*, British Library, Royal 15 A.XXVII (also associated with Ocreatus), originates from Llanthony Secunda near Gloucester while New York, Columbia, Plimpton 161 (containing a cosmology) is also a twelfth-century Gloucester manuscript.[40] Also included should be Worcester documents, Oxford, Bodleian Library, Auct. F.5.19 (a computistical manuscript), Oxford, Bodleian Library, Auct. F.1.9, and Getty Museum Ludwig XII.5. The last two manuscripts will be discussed in some detail in upcoming chapters.

The Severn Valley libraries cannot be said to have outshone those of Canterbury and Rochester, or even Durham; nevertheless, the region can still be characterised, as did Ker, as 'one of the great regions of book production in the 12th century'.[41] Under consideration must also be the topic of survival, which carries a strong element of chance. A combination of fires, war, and the collection patterns for manuscripts after the dissolution of the monasteries has meant that the survival of documents is uneven.[42] The survival of the documents needed to do this case study in the reception of the new sciences may be the single most important factor in being able to undertake this work. As noted above, we have the scientific documents that were owned by two scholars, William of Malmesbury and John of Worcester, and works of their own which reflect the influence of these readings. Symeon of Durham may be the only other English scholar in this period who can provide us with that same context.

0.4 THE RELATED HISTORIOGRAPHY OF THE PERIOD

The thesis that follows approaches the introduction of the new sciences into England from the perspective of a known audience in the Severn Valley, specifically William of

[39] C. Philipp Nothaft, 'Roman vs. Arabic Computistics in Twelfth-Century England: A Newly Discovered Source (*Collatio Compoti Romani et Arabici)*', *Early Science and Medicine,* 20, (2015): pp. 187–208.
[40] Charles Burnett, ed., 'Chapter III', *Numerals and Arithmetic in the Middle Ages* (Farnham: Ashgate Variorum, 2011): pp. 233–234.
[41] Ker, *English Manuscripts*: p. 7
[42] Gameson, 'Circulation of Books': p. 370

Malmesbury, Walcher of Great Malvern, and John of Worcester. It will explore why they may have been interested in the new texts, how they may have acquired these texts, and how they used them. It considers a perhaps serendipitous set of circumstances that may have brought the three monks into the sphere of Petrus and Adelard and their works. This includes what is known of the existing intellectual tendencies within these scholarly communities, the ecclesiastical and monastic connections that allowed for the transmission of texts, and the travels of William, Walcher, and John that may have brought them into contact with new texts and translators. A final consideration is the varied ways these scholars may have been influenced by the new sciences in their own writings.

This approach, a regional study of an audience for the translations of the new sciences, is one that has not yet been undertaken. The wide-ranging and influential works of Lynn Thorndike and David Lindberg, for instance, focus on the history of medieval science and on the progression of scientific awareness and the development and translation of material but offer very little in the way of cultural or political context and for the most part do not address audience and reception beyond that of other 'scientific' scholars and translators.[43] Charles Homer Haskins' foundational works, notably the *Studies in the History of Medieval Science*, outline the progression and nature of the translation movement but do not fully explore the related political and cultural influences at work.[44] And while the place names of the Severn Valley feature in his accounts, his studies are not regionally based. Similarly, political and economic studies, such as Hollister and Green's studies of Henry I, Barlow's of William Rufus, or Duby and Postan on economic history, only indirectly connect the intellectual history in progress at the time.[45]

In a more closely related study to that undertaken in this thesis, R.W. Southern explored the twelfth-century cultural milieu of the Severn Valley area in his introduction to his volume on Robert Grosseteste (d. 1253). Southern's *Robert Grosseteste: The Growth of an English Mind in Medieval Europe* proposes the Severn Valley as the intellectual homeland of Robert Grosseteste with a central argument that Grosseteste was more strongly influenced by the scholarly traditions

[43] Lynn Thorndike, *A History of Magic and Experimental Science during the First Thirteen Centuries of Our Era*, 2 vols. (New York: Macmillan Company, 1923); David Lindberg, *Science in the Middle Ages* (Chicago: University of Chicago Press, 1978).
[44] Haskins, *Studies*.
[45] Krueger and Duby, *The Early Growth of the European Economy*; Postan, *Medieval Trade and Finance*.

of twelfth-century Hereford and Worcester than by the scholarly traditions of Paris.[46] Embedded in his argument was the notion that observational science was a natural outcome of specifically English traditions, best represented in the early twelfth century by Adelard of Bath. Southern's presentation of English exceptionalism was contested particularly by Bruce Eastwood, who noted that not least amongst the issues for the picture Southern offered was that there was very little remarkable about Hereford and its intellectual traditions.[47] Rather, for Eastwood, Grosseteste was better understood as a product of trends present in other places in the Latin West, including, pre-eminently, the University of Paris.

The scholarly argument between Southern and Eastwood highlights a number of problematic areas related to a regional history of intellectual culture. Southern portrays the Severn Valley's Anglo-Saxon intellectual heritage, as sustained by Wulfstan, monk and bishop of Worcester (d. 1095), as critical to the development of new scientific sensibilities. This view presents bias both in terms of regional identity and regional exclusivity. Wulfstan was the only Anglo-Saxon bishop to be retained by William I after the conquest, and his influence was undoubtedly important.[48] The strength of the area's early intellectual traditions, particularly in book production and library collection, was critical in providing a foundation for the introduction of the new texts. But this area is also important because it was a culturally eclectic or 'international' hub and already had been in the Anglo-Saxon period. The Bristol trade network may well lie behind, and over a longer compass, the transmission of texts of Irish origins.[49] The introduction of texts from an originally Arabic context and Islamicate milieu was an extension of this eclectic tradition.

The Severn Valley and its scholars were not so culturally unique that it was the only place in the Latin West where there was a receptive audience to the new sciences. There was

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[46] Southern, *Robert Grosseteste.*

[47] Bruce Eastwood, '*Robert Grosseteste: The Growth of an English Mind in Medieval Europe'* by R.W. Southern, review in *Speculum*, 63 (1988): pp. 233–237.

[48] See Julia Barrow and Nicholas Brooks, eds., *St Wulfstan and His World* (Aldershot: Ashgate, 2005); Emma Mason, *Saint Wulfstan of Worcester, c. 1008–1095* (Oxford: B. Blackwell, 1990).

[49] Moreton, 'Before Grosseteste'; Immo Warntjes, 'Computus as Scientific Thought in Ireland and the Early Medieval West', in Roy Flechner and Sven Meeder, eds., *The Irish in Early Medieval Europe: Identity, Culture and Religion* (London: Palgrave, 2016): pp. 158–178; Joseph Hillaby, 'The English Medieval Jewry, c. 1075–1290: An Introduction', *The Palgrave Dictionary of Medieval Anglo-Jewish History* (Basingstoke: Springer, 2013): pp. 1–15.

early and sustained interest in the sciences in the cathedral school of Liège in the Lorraine, for instance, and continued scientific interest and manuscript evidence in the twelfth-century scholarly communities at Chartres and Mont Saint Michel.[50] There was also a similar scholarly and political topography to the Severn Valley in Durham, including interest in the intricacies of, and contemporary discussions on, computistical thought represented by the compilers of MS Hunter 100 and in the various writings of Symeon of Durham. Durham enjoyed strong, if distant, royal support and the much nearer presence of the Palatine bishops and connections to other scholarly centres, including the Severn Valley religious houses. While arguing for reasons why the translators and their documents arrived in the Severn Valley, this thesis will not argue that this area was culturally exclusive or unique.

Another problem with Southern's argument is the search for modern sensibilities in medieval personalities. Adelard of Bath is often portrayed, by Southern and others, as the 'first English scientist', which carries a significant risk of mischaracterisation, not least in the areas of observation or 'experiment'.[51] Adelard is a complex figure whose work offers us a remarkable and personal picture of the growth of learning in this period. His scholarly abilities and focus show continual evolution and expansion of source material between *De eodem et diverso* (c. 1116) and, late in his career, his translation of Euclid's *Elements*.[52] However, while certain figures in the early twelfth century revealed an inclination towards observational astronomy (including Walcher of Great Malvern and John of Worcester, as will be proposed in Chapters IV & V), it is not clear that Adelard of Bath was one of them. His writings do not include personal astronomical or atmospheric observations. Moreover, Adelard reveals a consistent interest in the use of astronomy for prognostication rather than in furthering the knowledge of lunar or planetary motion (as will be seen in the works of Walcher).

While the Severn Valley was not culturally unique, it is important to recognise that this area does indeed offer a rich and diverse set of material for analysis: the texts and other artefacts available offer us a window into the lives of the scholars in the area and a privileged glimpse into how the new sciences were received and used, which is not always possible to discern in such

[50]See Steven Vanderputten, Tjamke Snijders, and Jay Diehl, eds., *Medieval Liège at the Crossroads of Europe: Monastic Society and Culture, 1000–1300* (Turnhout: Brepols, 2017).
[51] Louise Cochrane, *Adelard of Bath: The First English Scientist* (London: British Museum Press, 1994).
[52] Adelard, *De eodem et diverso*: pp. 1–74; For *Elements* see discussion and notes in Chapter IV, [4.5].

detail in other, even major centres, such as the early schools in Paris, or, slightly later, in Oxford. William of Malmesbury, Walcher of Great Malvern, and John of Worcester were not lay translators travelling to the western and eastern Mediterranean for the new learning. Nonetheless, they were interested in the results of the translation movement, and it is clear that the arrival of these sciences impacted their thinking. It is this individual reception of the new texts that lies at the heart of the present inquiry. The 'scientific' manuscripts that William and John owned are still extant and can be compared to their own intellectual output. In Walcher, an even more marked 'before and after' picture of his own scientific work emerges, reflecting the effects of his encounter with Petrus Alfonsi.

In addition to these individual case studies, the Severn Valley region in the first half of the twelfth century offers an important record as a place where there was royal and ecclesiastical presence and investment. Here there are traces of patronage, difficult to track in this period but so vital for the work of the scholars whose texts are analysed here. This wider material provides another emphasis within the discussion below.

Several more recent scholarly efforts have described and drawn out different aspects of the intellectual climate of the Severn Valley in the twelfth century. In particular, the methodologies and focus of Gillian Evans, Charles Burnett, Anne Lawrence-Mathers, Jennifer Moreton, and Giles E. M. Gasper have influenced the approach of this thesis. Evans and Burnett have laid important groundwork in the consideration of the Severn Valley scholars as a group. Evans developed the notion that there existed a community of scholars in the west of England, the 'mathematical schools of the Severn and Wye Valleys'.[53] Her work on the manuscript tradition of the area *Rithmomachia* mathematical game and the abacus, in what she perceived as the 'English Schools' has been important to this study. She has also tied interest in the mathematical tools to the administrative needs of the bishoprics and royal households in a compelling way. To be clear, this study does not support the existence of a 'school' or an organised intellectual community in this area. Rather, it proposes that there were propitious

[53] Gillian Evans, 'The Rithmomachia: A Medieval Mathematical Teaching Aid?', *Janus* 63 (1976): pp. 257–273, at p. 260; see also Evans, 'Schools and Scholars', pp. 71–89; Gillian Evans, 'From Abacus to Algorism: Theory and Practice in Medieval Arithmetic', *The British Journal for the History of Science* 10 (1977): pp. 114–131.

circumstances, some of which could be considered coincidental, which contributed to the existence of an active audience interested in the new sciences.

Burnett's studies, particularly *Mathematics and Astronomy in Hereford and its Region in the Twelfth Century* (1995) and *The Introduction of Arabic Learning into England* (1996), have also presented a focus on the Severn Valley, the first more explicitly than the second.[54] He suggests that 'a survey of the scholars and manuscripts associated with Hereford and its region from the late eleventh to the late twelfth centuries gives us a good picture of the development of mathematics and astronomy in England as a whole during that period'.[55] In these papers, Burnett surveys the arrival of critical texts and explores the possible connections between manuscripts, texts, and scholars. In the Hereford paper, Burnett touches on many of the elements presented in this thesis, including area interests in the abacus, the astrolabe, and astrology, as well as the intellectual links between key scholars, Robert of Losinga (d. 1095), Walcher of Great Malvern, Petrus Alfonsi, and Adelard of Bath. In his broader study of the introduction of the new sciences into England, Burnett goes further into the Severn Valley manuscript tradition and its connections to continental manuscripts, such as Avranches 235 from Mont Saint Michel. Largely missing from Evans' and Burnett's studies is attention to the intellectual audience of the region.

In this area, the work of Anne Lawrence-Mathers is significant. Her studies, 'William of Malmesbury and the Chronological Controversy' and 'John of Worcester and the Science of History' (both written while this thesis was in progress), explore the topic of reception as reflected in the works of the two Severn Valley scholars.[56] In both these articles, Lawrence-Mathers touches on what may have driven the computistical and astronomical interests of these scholars and how this interest was reflected in their work. She also explores the scholars' relationship to their respective astronomical texts, Oxford, BL, Auct. 3.14 and Oxford, BL, Auct. F.1.9. What follows draws considerable inspiration from Lawrence-Mathers.

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[54] Burnett, *The Introduction of Arabic Learning*; Burnett, 'Mathematics and Astronomy': pp. 50–59.
[55] Burnett, 'Mathematics and Astronomy': p. 57.
[56] Anne Lawrence-Mathers, 'William of Malmesbury and the Chronological Controversy', in Rodney Thomson, Emily Dolmans, and Emily Winkler, eds., *Discovering William of Malmesbury* (Woodbridge: Boydell Press, 2017): pp. 93–106; Anne Lawrence-Mathers, 'John of Worcester and the Science of History', *Journal of Medieval History* 39, no. 3 (2013): pp. 255–274.

Moreton and Gasper have also taken an interest in the Severn Valley region in their discussions of the possible influences at play in the work of Robert Grosseteste. In her article, 'Before Grosseteste: Roger of Hereford and Calendar Reform in Eleventh- and Twelfth-Century England',[57] Moreton states that 'the aim of this article is to explain why the study of the *compotus* flourished in the west country and then to examine its development in these and related treatises'. However 'west country' is to be defined, Moreton's suggestions are convincing on the much longer arc of interest in the *compotus* as a prerequisite to its reinvigoration by influential Lotharingians including Gerland and Robert of Losinga, the latter bishop of Hereford (1079–1095). Moreton also suggests that knowledge of the Jewish calendar had been present in the area since the tenth century and that Jewish influence after the establishment of a post-conquest Jewish community in Hereford played a part in the later influx of Arabic learning in the twelfth century.[58]

In his recent study, 'On the Liberal Arts and its Historical Context', in the first volume of *The Scientific Works of Robert Grosseteste*, Gasper also describes the regional characteristics of Hereford, putting forward his stay at Hereford as important to Robert Grosseteste's development as a scholar.[59] Here the political, economic, and intellectual backgrounds of Hereford are all given a place. Gasper treads carefully in proposing direct causation for the development of Grosseteste's intellectual development or tying him to a particular 'school'. For instance, while Grosseteste's *Compotus* may have been drafted with that of Roger of Hereford in mind, there is no direct evidence that Grosseteste's astronomical leanings were influenced by the Hereford community. This approach has served as a model for this thesis in terms of the integration of the cultural and social context for intellectual history and the caution on linear assumptions in the evolution of medieval thought.

Finally, another important interdisciplinary model for this study has been the collection of articles in the 1995 British Archaeological Association's publication, *Hereford: Medieval Art,*

[57] Moreton, 'Before Grosseteste': pp. 562–586.
[58] *Ibid*. While manuscripts, including those representing Jewish computistical and astronomical traditions, are known to have circulated in the region before the twelfth century, it is nearly impossible to trace this to any wider evidence of Jewish migration. However, we have indications that there was a Jewish presence before that time, and it can be surmised, as Moreton did, that some of their intellectual heritage had come with them.
[59] Gasper et al., *Knowing and Speaking*: pp. 9–35.

Architecture and Archaeology.[60] This volume brings together articles related to the city and see of Hereford, with many essays offering perspectives relevant to the twelfth century. Here, Joseph Hillaby discussed the establishment and endowment of the Diocese of Hereford, Julia Barrow, the administrative advances under Robert of Losinga, Burnett, the mathematical and astronomical heritage of the area after Robert of Losinga, and Malcolm Thurlby, the connections of Hereford cathedral to other architectural initiatives and sculptors in the area. The multi-disciplinary approach shown in this publication was also influential for the scope and approach of what follows in which various disciplinary themes will be leveraged.

The manuscripts associated with the translation movement and the scholars who form the case studies are central to this thesis. In addition, the earlier work of Haskins mentioned above, Evans and Burnett, Millás Vallicrosa, John Tolan, László Sándor Chardonnens, and David Juste have all done much detailed work in analysing the available Alchandrean, mathematical, and astronomical texts and their relationships to each other.[61] Each step taken here offers new insight into distribution and reception. Chardonnens' (and Burnett's) work also explores the connections of the texts to each other within one manuscript. How manuscripts were grouped together tells us a good deal about how they were originally perceived, thus touching on the topic of audience. For instance, as will be seen in Chapter V, [5.6], Burnett suggests in his article on a previously unexplored text, the *Ut testatur Ergaphalau,* that the way the documents are grouped reveals that Adelard's texts may have been originally perceived to be an expansion of the Alchandreana, i.e., as prognosticative works.[62] While moving our understanding of transmission and the audience's perception of these texts forward in essential ways, most of these manuscripts offer little evidence about their direct owners. The manuscripts that are central to *this* study have the advantage of having known individual authors, William of Malmesbury and John of Worcester, who not only collected the texts but also used the material in their works.

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[60] Whitehead, ed., *Medieval Art, Architecture and Archaeology at Hereford*.

[61] José María Millás Vallicrosa, 'La aportación astronómica de Pedro Alfonso', *Sefarad* 3 (1943): pp. 65–105; John Tolan, *Petrus Alfonsi and His Medieval Readers* (Gainesville: University Press of Florida, 1993); László Sándor Chardonnens, *Anglo-Saxon Prognostics, 900–1100: Study and Texts* (Leiden: Brill, 2007); David Juste, *Les Alchandreana primitifs: étude sur les plus anciens traités astrologiques latins d'origine arabe, Xe siècle* (Leiden; Boston: Brill, 2007).

[62] Charles Burnett, 'Adelard, *Ergaphalau* and the Science of the Stars', in Charles Burnett, ed., *Magic and Divination in the Middle Ages: Texts and Techniques in the Islamic and Christian Worlds* (Aldershot: Variorum, 1996): pp. 133–145.

Two Severn Valley manuscripts central to this study, Oxford, Bodleian Library, Auct. F.3.14 and Auct. F.1.9, offer substantial evidence of the progress of intellectual interests in the period, including computistical studies and the transmission of the new sciences. Both these documents have been studied extensively by scholars, including Millás Vallicrosa, László Sándor Chardonnens, John Tolan, Burnett, Stephen McCluskey, and C. Philipp Nothaft.[63] Despite this, very few authors, with Lawrence-Mathers as the exception, have analysed Auct. F.3.14 or Auct. F.1.9 from the perspective of their owners. This thesis will explore what can be known of William's and John's role in collecting the materials in these texts and how they are reflected in their works. This study treats these documents as the primary sources for reflecting on what William and John may have known about the new sciences. John's document, in particular, reveals some of the first traces of the influence of Petrus and Adelard in England.

0.5 THE ARGUMENT AND CHAPTER ORGANISATION

The scholars, communities, patrons, and networks explored in what follows offer a case study describing how the new sciences were received in the early twelfth-century Severn Valley. In so doing, the discussion provides a rationale for the attentive reception of the new texts based on both the intellectual background and the individual interests of the scholars in the area as well as the circumstances that may have contributed to the texts' arrival and distribution in the valley. These circumstances include the political milieu of the area as well as what may be described as an element of serendipity. While it cannot be definitively proved, the appointments of Robert of Losinga and Walcher of Great Malvern by William the Conqueror and Henry I, for instance, may have been part of an effort to stabilise the area. Even if accepted that these two fortuitous appointments carried an element of chance, the scientific sensibilities of area scholars benefited from these appointments nonetheless.

A focus on the people involved in the transmission and reception, the places or venues for early transmission, the relationships between them, as well as the nature and extent of the textual

[63] Stephen McCluskey, *Astronomies and Cultures in Early Medieval Europe* (Cambridge: Cambridge University Press, 1998); C. Philipp Nothaft, ed., *Walcher of Malvern: De lunationibus and De dracone: Study, Edition, Translation, and Commentary* (Turnhout: Brepols, 2017): pp. 83–85.

evidence available, allows the impact of the new learning on William of Malmesbury, Walcher of Great Malvern, and John of Worcester to be demonstrated. In all three cases, a comparison is possible between their learning prior to contact with the new science and their works afterwards. The chapters that follow are structured to enhance this analysis: the first chapter provides the intellectual prerequisites for the discussion; the second describes what can be known about the scientific interests of William, Walcher, and John before Petrus and Adelard arrived; the third addresses the arrival of Petrus and Adelard and some of the patronage opportunities that may have drawn them to the area; and the fourth and fifth chapters describe the impact these new sciences had on our scholars, with a focus on Walcher and John. Some further notes on this outline will be useful.

Chapter I, *The Abacus, the Astrolabe, and Astrology: The Antecedents to the New Sciences in the Severn Valley,* focuses on the intellectual topography of the Severn Valley by the turn of the twelfth century and the scholars of the region. In keeping with this perspective, this chapter will centre around Robert of Losinga, Bishop of Hereford, his education, experience, and influence. Educated in the Lorraine, Robert's appointment and presence arguably amplified the influence of the earlier teachings of Gerbert of Aurillac and the continental cathedral schools, the *quadrivium* and the related instrumentation, the early textual transmission from the Iberian Peninsula, and the *computus* related to the era controversy. While Robert was not the first scholar in the area to reflect on the topics of the *quadrivium*, his status as bishop of Hereford and his close relationship with Wulfstan, Bishop of Worcester, may well have given these studies a renewed vigour. The chapter will describe the interests and sensibilities Robert may have brought with him from the continent, with an emphasis on those topics which had direct relevance to William, Walcher, and John.

Chapter II, *A Matter of Interest: Three Severn Valley Scholars and the Quadrivium,* will focus on what William of Malmesbury, Walcher of Great Malvern, and John of Worcester knew about the topics of the *quadrivium* before the arrival of Petrus and Adelard. Building on the framework set in the previous chapter, it will discuss the institutional context for why and how each of these scholars developed or needed to develop an interest in the sciences and how that interest manifested itself in their work in the early parts of their careers. It will draw on the topics outlined in the previous chapter. For example, John of Worcester directly inherited Robert of

Losinga's interest in the era controversy, Walcher's early work already expanded the area's knowledge of mathematical and astronomical instrumentation, and William was fascinated by the relationship of the sciences to the occult, as represented by the career of Gerbert. An in-depth analysis of William's interests explores Oxford, Bodleian Library, Auct. 3.14, and what questions that evidence raises about intellectual influences already in play in the Severn Valley. From these and other artefacts, a picture can be drawn of what was known to these Severn Valley scholars prior to the introduction of the new sciences after the 1120s. The evidence of their own works shows that these three scholars formed a willing audience by the time the translators and their documents arrived.

Chapter III, *Practitioners, Patrons, and the Introduction of the New Sciences,* will reflect on what may have drawn the translators of new scientific texts to England and the Severn Valley. First, a review of the development of the science of the stars known to Petrus and Adelard will trace their journey to England (though there is scholarly argument over Petrus' arrival). They may have come to England seeking patronage, and the Severn estuary and valley regions, as discussed above, were familiar to Kings William Rufus and Henry I, not least for the ceremonial importance of Gloucester and the strategic importance of the region for domination of the southern March with Wales. Later, during the conflict for the throne between Matilda and Stephen, the South and the West were dominated by Matilda, with Bristol as her stronghold, on the back of the dominant social (and military) position of her half-brother, Robert of Gloucester. It is entirely possible that both Petrus Alfonsi and Adelard (who was originally from Bath) came to the Severn Valley to garner patrons. This chapter will describe some of the characteristics that would have made this region an attractive destination for those with astronomical and astrological skills.

Chapters IV and V, *Walcher of Great Malvern, Petrus Alfonsi, Adelard of Bath and the Use of the New Astronomical Sciences* and *John of Worcester and the Use of the New Astronomical Sciences.* These two chapters concentrate on the impact that the arrival of the new sciences after approximately 1120 had on the work of Walcher of Great Malvern and John of Worcester. In particular, Walcher's interaction with Petrus Alfonsi gave him a new and transformative framework for discussing and predicting lunar eclipses. Walcher used new tools, the sexagesimal system of calculation, and new knowledge, such as the varying rates of the

rotation of the moon and sun, to make more substantial progress in his work on lunar science. By the late 1130s, John of Worcester became aware of Walcher's work, Adelard's translation of the al-Khwārizmī tables, and possibly other texts representing the new sciences. John's computistical and astronomical text, Oxford, Bodleian Library, Auct. F.1.9 (Auct. F.1.9), is reviewed in some detail here, highlighting its synergies with other texts, including Avranches 235 (which included Adelard's translation of Abū Ma'šar's *Ysagoge minor* and the *Liber prestigiorum*), BL, Add. 17808, and CLM 560, that are important to the trail of scientific documents in this period.[64] John's awareness of the texts he owned is reflected both directly and indirectly in his own work. He owned copies of Walcher and Adelard's work and mentions them in his historical narrative. More intriguing is that after being exposed to these works, John began to make detailed astronomical and meteorological observations himself and more so than he had in earlier drafts of his historical work.

Across the discussion, several intersecting themes emerge: the increasing importance of the Iberian Peninsula, the role of patronage in the transmission of the new sciences, including prognostication and why this knowledge was of interest to those in power, and, finally, issues of astronomical instrumentation and general knowledge in this area. The *Concluding Reflections* will review the insights that can be drawn from the material presented. The emphasis of this study has been an analysis of the impact the arrival of the new sciences had on the Severn Valley scholars William of Malmesbury, Walcher of Great Malvern, and John of Worcester. With this perspective, we can observe in these scholars a biographical or personal view of their reactions to the new texts. This study will have also offered suggestions about how the areas of cultural, economic, and political dynamics may have drawn the translators such as Petrus and Adelard to the Severn Valley. Though compelling, especially when viewed together as an area portrait, direct causation cannot be demonstrated.

[64] These manuscripts will be discussed in some detail in Chapter II, [2.8], and Chapter V, [5.6].

CHAPTER I

The Abacus, the Astrolabe, and Astrology:

The Antecedents to the New Sciences in the Severn Valley

> *[Robert of] Losinga was highly skilled in all the liberal arts, and in particular had gone into the abacus, and the reckoning of time by the moon and the course of the stars.*
>
> - William of Malmesbury, *Gesta pontificum*[1]

Robert of Losinga was a key figure in the reception of the new sciences in the Severn Valley. As a scholar trained in the *quadrivium* in Liège, Robert of Losinga's appointment as bishop of Hereford in 1079 was central to invigorating wider scientific interest in the region. Robert was an able administrator who brought with him a mathematical tool kit developed in the tradition of the Lorraine (Losinga is interchangeable with the Lorraine but is the more standard form of Robert's name) and the educational programme promoted by Gerbert. According to William of Malmesbury, Robert had skills in computistical studies and the abacus, as well as in astronomy and astrology (cited above). In addition, and as will be described below, Robert brought a copy of the Marianus Scotus *Chronicle* to England and advocated for the use of the new era it proposed.[2] As suggested by Moreton, the textual evidence in the Severn Valley reveals an already established tradition of book production prior to the conquest, including Irish and Jewish computistical documents.[3] Robert's interests added to this already active arena in the Severn Valley.[4] The level of interest and output that Robert may have generated led Gillian

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[1] William, *GP,* IV.164, pp. 458–459: 'Omnium liberalium artium peritissimus, abacum precipue et lunarem compotum et caelestium cursum astrorum rimatus'.
[2] See Chapter I below.
[3] Moreton, 'Before Grosseteste'; see also Richard Gameson, 'The Circulation of Books between England the Continent, c. 871–c. 1100'.
[4] Moreton, 'Before Grosseteste', and Julia Barrow, 'Robert the Lotharingian (*d.* 1095)', in *ODNB* (Oxford: Oxford University Press, 2004).

Evans, perhaps with scholarly overenthusiasm, to suggest the subsequent formation of a 'school' or organised output.[5]

Robert was one of several Lotharingians appointed to bishoprics and administrative positions by William the Conqueror. Aside from the obvious benefit of replacing key appointments with men of his choosing, those trained in mathematics and the abacus may have seemed particularly attractive to the Conqueror. The use of experts at court is something that his sons, William Rufus and Henry I, seem to have continued.[6] Robert's Lotharingian background is referred to by William of Malmesbury, and his death is also noted in a Liège Cathedral manuscript as that of 'our' Robert.[7] The reputation of Robert's predecessor as Bishop of Hereford, Walter, who was also a Lotharingian, was more mixed. The *Vita Edwardi* describes him as being well trained for office, and William of Malmesbury describes Walter and Giso of Wells as both being 'tolerably learned'.[8] Despite this, Julia Barrow suggests that Walter allowed the Hereford properties to depreciate.[9] His reputation was further coloured by an ignoble death at the hands of his seamstress.[10] Robert's administrative abilities proved to be a stabilising factor in the governance of the see of Hereford.[11]

What Robert also brought with him was an awareness of and enthusiasm for the science of astronomy from the Lorraine. Through him, the studies of the sciences in the Severn Valley would be energised by the knowledge and the tools Gerbert of Aurillac had brought back from

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[5] Evans, 'Rithmomachia': pp. 257–273; Evans, 'Abacus'.

[6] For discussions of William Rufus, Henry I, and their courts, see Anne Lawrence-Mathers, *The True History of Merlin the Magician* (New Haven: Yale University Press, 2012); and Emma Mason, 'William Rufus: Myth and Reality', *Journal of Medieval History* 3, no. 1 (1977): pp. 1–20. Other Lotharingian bishops include Duduc(oc) (Wells, 1033–1060), Walter (Hereford, 1060–1079), Giso (Wells, c. 1060–1088); more information is found in Mary Catherine Welborn, 'Lotharingia as a Center of Arabic and Scientific Influence in the Eleventh Century', *Isis* 16, no. 2 (1931): pp. 188–199, esp. pp. 196–198.

[7] Alain Marchandisse, ed., *L'obituaire de la Cathédrale Saint-Lambert de Liège (XIe–Xve siècles)* (Bruxelles: Palais des académies, 1991): p. 89.

[8] William, *GP*, III.115.14, pp. 382–383: 'Qui essent non usquequaque contempendae scientiae'; Julia Barrow, 'Walter [Walter of Lorraine] (d. 1079?), bishop of Hereford', in *ODNB*; William, *GP*, III.115.13-17: pp. 382–383.

[9] Barrow, 'Walter', *ODNB*.

[10] William, *GP*, IV.163.4–6: pp. 456–457.

[11] Julia Barrow, 'A Lotharingian in Hereford: Bishop Robert's Reorganisation of the Church of Hereford, 1079–1095', in Whitehead, ed., *Medieval Art, Architecture and Archaeology at Hereford*: pp. 29–49.

his travels to Catalonia and which flourished in Liège.[12] While Robert was an invigorating influence on Hereford and the astronomical sensibilities of those in the region, it would be a mistake to paint the entire Severn Valley as a cultural wasteland before Robert's arrival. Bristol was an internationally active port: its slave market took its ships to Ireland, Flanders, France, the Iberian Peninsula, and into the Mediterranean.[13] According to William of Malmesbury, Malmesbury Abbey already sported a good collection of texts before William began adding to the collection.[14] The connections of Worcester and its daughter house, Ramsey, reveal that the Worcester scriptorium was one of the most active in England in the eleventh and twelfth centuries.[15] Wulfstan, the bishop of Worcester, the only Anglo-Saxon bishop William the Conqueror retained post-conquest, oversaw a significant movement for ecclesiastical reform in the diocese and the expansion of the library of the cathedral priory.[16] That Wulfstan extended his

[12] See Vanderputten, Snijders, and Diehl, eds., *Medieval Liège at the Crossroads*; Jay Diehl, 'Origen's Story: Heresy, Book Production, and Monastic Reform at Saint-Laurent de Liège', *Speculum* 95, no. 4 (2020): pp. 1051–1086; C. Stephen Jaeger, *The Envy of Angels: Cathedral Schools and Social Ideas in Medieval Europe, 950–1200* (Philadelphia: University of Pennsylvania Press, 1994).

[13] Janel Fontaine, 'Early Medieval Slave-Trading in the Archaeological Record: Comparative Methodologies', *Early Medieval Europe* 25, no. 4 (2017): pp. 466–488; Childs, *Trade and Shipping*; Jacoby, *Medieval Trade*.

[14] On William of Malmesbury and the Malmesbury collection see Rodney Thomson, 'William of Malmesbury and the Latin Classics Revisited', *Proceedings of the British Academy* 129 (2005): pp. 383–393; Rodney Thomson, 'The Reading of William of Malmesbury', *Revue Bénédictine* 85, no. 3–4 (1975): pp. 362–402, esp. pp. 363–396; Rodney Thomson, 'The Reading of William of Malmesbury: Addenda et Corrigenda', *Revue Bénédictine* 86, no. 3–4 (1976): pp. 327–335; Rodney Thomson, 'William of Malmesbury as Historian and Man of Letters', *Journal of Ecclesiastical History* 29, no. 4 (1978), pp. 387–413; Rodney Thomson, 'The Reading of William of Malmesbury: Further Additions and Reflections', *Revue Bénédictine* 89, no. 3–4 (1979): pp. 312–324, esp. p. 323; M.R. James, *Two Ancient English Scholars: St. Aldhelm and William of Malmesbury* (Glasgow: Jackson, Wylie & Co., 1931); Neil Wright, ''Industriae Testimonium': William of Malmesbury and Latin Poetry Revisited', *Revue Bénédictine* 103 (1993): pp. 482–531; Neil Wright, 'William of Malmesbury and Latin Poetry: Further Evidence for a Benedictine's Reading', *Revue Bénédictine* 101 (1991): pp. 122–153; Hugh Farmer, 'William of Malmesbury's Life and Works', *Journal of Ecclesiastical History* 13, no. 1 (1962): pp. 39–54.

[15] Rodney Thomson and Michael Gullick, eds., *A Descriptive Catalogue of the Medieval Manuscripts in Worcester Cathedral Library* (Cambridge: Published on behalf of the dean and chapter of Worcester Cathedral by D.S. Brewer, 2001): pp. xx–xxiv.

[16] Helen Foxhall Forbes, 'Making Books for Pastoral Care in Late Eleventh-Century Worcester: Oxford, Bodleian Library, Junius 121 and Hatton 113 + 114', in Peter Clarke and Sarah James, eds., *Pastoral Care in Medieval England: Interdisciplinary Approaches* (Abingdon, Oxon.: Routledge, 2019): pp. 29–66; see also, Richard Gameson, 'St Wulfstan, the Library of Worcester and the Spirituality of the Medieval Book', in Barrow and Brooks, eds., *St Wulfstan and His World*: pp. 59–104; Richard Gameson, 'Book Production and Decoration at Worcester in the Tenth and Eleventh Centuries', in Nicholas Brooks

friendship to Robert of Losinga was one of the factors that may have made Robert's impact so complete.[17] According to Orderic Vitalis, Wulfstan actively promoted Robert's work by directing John of Worcester to continue Marianus Scotus' *Chronicle.*[18]

The elements of Robert's educational background influenced the scientific and computistical interests of William of Malmesbury, Walcher of Great Malvern, and John of Worcester, as they had developed before the arrival of the new sciences. To fully understand the impact of Robert's training and his influence in the Severn Valley, it is useful to step back and outline the computistical and astronomical tradition in which he was raised. In this chapter, the more established learning within cathedral and monastic communities will be briefly examined, as well as (at the turn of the twelfth century) the newer or more exotic learning represented by Marianus Scotus and following in the tradition of Gerbert.

This chapter will contain a review of the long-standing astronomical knowledge carried over from the Roman period, discussing to what use the early monastic and ecclesiastical communities put this knowledge and what advances they may have made. Here, the focus will be on both the timekeeping and calendrical needs of the church, for example, when to pray and when to celebrate major events such as Easter. These ancient traditions formed the basis of much of the learning available in both continental and English centres (Worcester, Ramsey, and Durham) throughout the eleventh century. Also, the computistical skills that supported the horological and calendrical needs of these communities informed the training of monastic community leaders such as Bede, Abbo of Fleury, and Robert of Losinga. The importance of many of these traditions continued into the twelfth century, as will be demonstrated in the examination of the careers of William of Malmesbury, Walcher of Great Malvern, and John of Worcester in Chapter II.

It will also be essential to discuss the more avant-garde intellectual trends promoted by Robert of Losinga in the Severn Valley and embraced in varying ways by William, Walcher, and

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and Catherine Cubitt, eds., *St. Oswald of Worcester: Life and Influence* (London: New York: Leicester University Press, 1996): pp. 194–243.

[17] See section (1.6) below for relevant work on Robert of Losinga.

[18] Orderic Vitalis, *The Ecclesiastical History of Orderic Vitalis,* Vol. II, Books III and IV, in Marjorie Chibnall, ed. and trans., (Oxford: Clarendon Press, 1969): pp. 186–187: 'Johannes… iussuque uenerlibilis Wlftani pontificis et monachi supredictis cronicis inseruit'.

John. It will therefore be important to look at the acceptance of the sciences brought from the Iberian Peninsula by Gerbert and to discuss the further developments of the *quadrivium* in the cathedral schools based on this knowledge and the newly introduced tools, such as the abacus and the armillary sphere. Also of related import and interest is the evolution of computistical thought away from the topic of the dating of Easter and purely ecclesiastical needs to the development of the historical era and to independent analyses of the rotations of the sun and moon. These issues were top of mind for William, Walcher, and John in the early part of the twelfth century; they were, in fact, far more interested in these more alluring intellectual topics than in the Bedan corpus.

Finally, the analysis will return to the specifics of Robert's influence in the Severn Valley as he brought to the region the weight of these traditions (old and new) from the continent. Here, his relationship to the Marianus Scotus *Chronicle,* his contributions to the era controversy, and his possible role in the introduction of the abacus to England will be addressed. Also, the textual evidence for his influence, particularly in the Severn Valley, Ramsey, and Durham (connected intellectual areas in England), will be explored.

1.1 ASTRONOMY AND THE LITURGICAL CALENDAR 500-950 A.D.

The mathematical and sidereal sciences of the earlier Middle Ages are one of a number of areas where the achievements of early medieval scholars have tended, wrongly, to be diminished in traditional narratives of the history of science.[19] While, on the whole, astronomical knowledge was inherited from the classical period and late antiquity, for example, the Roman and Early Christian encyclopaedic tradition, a wide range of sources was available and utilised. Examples included the Platonic tradition, the Greek poet, Aratus (d. 240 A.D.), and his poem, the

[19] The conception of this period as the 'Dark Ages' is best typified by the insertion of four blank pages for the Middle Ages by Henry Williams, *The Great Astronomers* (New York: Simon and Schuster, 1930): pp. 99–102; Another example is the Wikipedia article on the 'History of Science', which skips from 'Arabic Astronomy' to the 'Rise of the University', with nothing in between, https://en.wikipedia.org/wiki/History_of_science (accessed 08/04/2022); see McCluskey, *Astronomies*: p. ix; Stephen McCluskey, 'Gregory of Tours, Monastic Timekeeping, and Early Christian Attitudes to Astronomy', *Isis* 81, no. 1 (1990): pp. 8–22, esp. p. 9.

Phaenomena.[20] This poem, as well as the *De astronomica* of Hyginus (d. 17 A.D.), gave an introduction to the constellations, with the rules for their risings and settings, and of the circles of the spheres.[21] Roman astrology was also known to the West in Julius Firmicus Maternus' *Mathesis*, a work composed of summaries of late Hellenistic science and star lore and attributed to legendary wisdom from the ancient East.[22] These works were part of William of Malmesbury's frame of reference, as will be discussed in Chapter II.

Any discussion of Roman influence on the early medieval Latin West must also include the work of Boethius (d. 524). Boethius was a late Roman statesman employed by Theodoric the Great, who later imprisoned and executed him in 524 on charges of conspiracy. While jailed, Boethius composed his *Consolation of Philosophy.* His commentaries on Aristotle were of essential importance to knowledge of Aristotle well into the twelfth century and remained important into the later Middle Ages.[23] His work on arithmetic, *De arithmetica,* was an adapted translation of the *Introductionis arithmeticae* by Nicomachus of Gerasa (c. 160 – c. 220 A.D.), as was his work on music, *De musica* (c. 510). These works formed the basis of the early and high medieval *quadrivium.* Mathematical ratio and proportion formed the foundation for the four parts of the *quadrivium*: mathematics, music, geometry, and astronomy. Though descriptions of the *quadrivium* and subcategories vary in this period*,* these elements remain constant.[24] This

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[20] Arato de Soles, *Phaenomena*, in Douglas Kidd, ed. (Cambridge: Cambridge University Press, 1997).
[21] Milan Dimitrijević and Aleksandra Bajić, 'Mythological Origin of Constellations and their Description: Aratus, Pseudo-Eratosthenes, Hyginus', in L.Č. Popović, V.A. Srećković, M.S. Dimitrijević, and A. Kovačević, eds., *Proceedings of the XII Serbian-Bulgarian Astronomical Conference*, *Serbia, Sept, 25–29 2020* (Publications of the Astronomical Society 'Rudjer Boskovic', 2020): pp. 129–138; see also Emma Gee, *Aratus and the Astronomical Tradition* (New York: Oxford University Press, 2014).
[22] Firmicus Maternus, *Matheseos Libri VIII*, in Jean Rhys Bram, trans., *Ancient Astrology: Theory and Practice: Matheseos Libri VIII* (Park Ridge, NJ: Noyes Press, 1975).
[23] Sten Ebbesen, 'Boethius on Aristotle', in Sten Ebbesen, ed., *Greek-Latin Philosophical Interaction: Collected Essays of Sten Ebbesen* (Aldershot: Ashgate, 2008): pp. 107–113; Sten Ebbesen, 'Boethius as an Aristotelian Commentator', in Richard Sorabji, ed., *Aristotle Transformed: The Ancient Commentators and Their Influence* (Ithaca, NY: Cornell University Press, 1990): pp. 373–391; James Shiel, 'Boethius' Commentaries on Aristotle', in Sorabji, ed., *Aristotle Transformed*: pp. 349–372.
[24] The study of music as part of the *quadrivium* and its links to astronomy is important in this period. However, because it does not surface in a significant way in the works and texts of William of Malmesbury, Walcher of Great Malvern, or John of Worcester, it will not be discussed in full in this thesis. Further reading, however, should include Anthony Santamaria, 'In Pursuit of Happiness: The Platonic and Aristotelian Harmony in 'The Consolation of Philosophy'', *Carmina Philosophiae* 16 (2007): pp. 71–99; Férdia J. Stone-Davis, 'The Consolation of Philosophy and the 'Gentle' Remedy of Music', in Katherine Butler and Samantha Bassler, eds., *Music, Myth and Story in Medieval and Early Modern Culture* (Woodbridge: Boydell Press, 2019): pp. 32–45, consolidated bibliography at pp. 277–

philosophy and practice was more fully developed in Gerbert and passed on to the Severn Valley scholars, possibly via Robert. In its' most simplistic form, Boethian philosophy was expressed in the *Rithmomachia,* a board game using ratios and equations, which had entered the Severn Valley manuscript corpus by the early twelfth century.[25]

The practice of astronomy and mathematics was linked clearly to the needs of the church, such as liturgical timekeeping and the ecclesiastical calendar. The work of scholars, monastic, and ecclesiastical leaders was focused on the needs of the monastic community, both horological and calendrical. This effort and their contributions kept astronomy, including observational astronomy, alive as a useful science. Providing institutional endorsement for these early efforts were several early monastic leaders. The desert hermit John Cassian (d. 435) had prescribed in his *Institutes* that the monks maintain a strict and regular schedule of prayer throughout the day and into the night. Their last prayer was at Vespers or Compline at bedtime. Then the monks rose at Lauds (or Matins) in the small hours of the morning. To keep up with the schedule, the position of the sun was monitored during the day, and the stars were monitored during the night. Cassian had recommended that one monk (preferably the dean) be appointed to track the time and wake the Abbot and the monks at the appropriate time.[26] St. Benedict's Rule also underscored this need, saying that it was the explicit responsibility of the abbot to wake the

304; John Crossley, 'The Writings of Boethius and the Cogitations of Jacobus de Ispania on Musical Proportions', *Early Music History* 36 (2017): pp. 1–30; Cecilia Panti, 'Boethius and Ptolemy on Harmony, Harmonics and Human Music', *Micrologus: Nature, Sciences and Medieval Societies* 25 (2017): pp. 3–35; Margot Fassler, 'The Office of the Cantor in Early Western Monastic Rules and Customaries: A Preliminary Investigation', *Early Music History* 5 (1985): pp. 29–51; Susan Rankin, 'On the Treatment of Pitch in Early Music Writing', *Early Music History* 30 (2011): pp. 105–175; Leo Treitler, 'The Early History of Music Writing in the West', *Journal of the American Musicological Society* 35, no. 2 (1982): pp. 237–279; Leo Treitler, 'Reading and Singing: On the Genesis of Occidental Music-Writing', *Early Music History* 4 (1984): pp. 135–208.

[25] Anne Moyer, *The Philosophers' Game: Rithmomachia in Medieval and Renaissance Europe* (Ann Arbor: University of Michigan Press, 2001); Arno Borst, *Das mittelalterliche Zahlenkampfspiel* (Heidelberg: Winter, 1986); Charles Burnett, 'The Instruments That Are the Proper Delights of the Quadrivium: Rhythmomachy and Chess in the teaching of Arithmetic in Twelfth Century England', *Viator* 28 (1997): pp. 175–202; Evans, 'Rithmomachia': pp. 257–273; Of interest to this thesis, the *Rithmomachia* is to be found in Hereford MS, O.I.6, from Cirencester, Oxford, BL, Auct .F.1.9, and Avranches 235.

[26] Stephen McCluskey, 'Cosmology and Culture', in J.A. Rubiño-Martín, J.A. Belmonte, F. Prada, and A. Aberdi, eds., *ASO Conference Series* (2009); John Cassian, *De institutis coenobiorum*, in Jean Claude Guy, ed., II (Paris: Éditions du Cerf, 1965): pp. 1–4.

monks.[27] In time, the responsibility for this particular role fell to the sacristy and, as will be discussed below, to the cantor.[28]

The *De cursu stellarum* of Gregory, bishop of Tours (d. 594), represents, in many ways, a handbook on how to keep this commitment. The *De cursu* was divided into two parts. First is a general astronomical description of fourteen constellations. Next is a discussion of Gregory's primary concern: how the course of the stars can be used to regulate nocturnal prayer throughout the year. He describes the stars in the most practical terms: where they are in the night sky, when they first appear on the horizon, and how to recognise them. Gregory's chart and descriptions of the stellar movement show actual observation on his part in the night sky in northern Gaul. McCluskey has verified this by timing the chants between astronomical events.[29] Gregory's work, therefore, was not a copy of ancient tropes but a manual based on actual observation. The importance of lunar observation to track the hours of prayer emerges strongly in later texts, too, such as the late ninth century *Expositio regulae sancti Benedicti* of Hildmar of Corbie (d. 845).[30] Tools such as the horologium, and the clepsydra, or water clock, were used. It is not surprising, then, that monastic communities would continue to be receptive to newer astronomical tools such as the astrolabe when they did become available.[31]

It can be argued that Walcher of Great Malvern was, much later, still a part of a long-standing tradition of lunar observation within church communities. In addition to the horological needs, the calendrical needs of the church communities were met by the complex studies of the computists. Each of the Severn Valley scholars in this case study had computistical training or advanced interests.

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[27] Timothy Fry, ed. and trans., *Regula Benedicti* 45.1, 11.12–13, *The Rule of St. Benedict* (Collegeville, MN: Liturgical Press, 1981): pp. 206–207.
[28] See Chapter II.
[29] McCluskey, 'Gregory of Tours': pp. 8–22.
[30] See McCluskey, 'Gregory of Tours': pp. 19–20; see also 'The Hildemar Project', http://hildemar.org (accessed 14/01/2020).
[31] McCluskey, *Astronomies*.

1.2 THE EASTER TABLES AND THE EARLY *COMPUTI*

As indicated above, a major astronomical concern of monastic and other ecclesiastical communities was that of the calendar. This subject has received a good deal of recent scholarly attention.[32] Computistical study has, at its heart, the calculation of the date of Easter. The concerns involved in this calculation were understandably different in the early Christian period than in the early twelfth century. Up to the seventh century, the primary concern was when Easter should be celebrated in any given year. By the eleventh century, this concern had largely shifted to the historical date of the *first* Easter and, hence, the accuracy of the dating of the Christian Era. The computists of the early period used mathematics and astronomy to determine the date of Easter and provide continuing Easter tables.[33]

The calculation of Easter involved the reconciliation of the records of the gospels to the Hebrew lunar calendar. The gospels indicate that the crucifixion occurred on a Friday, about the time of the Passover. This presented two problems. The first was that the crucifixion took place on a specific day in the solar calendar, Friday, March 25, but that this event was to be determined and calculated by an event in a lunar calendar, the Passover. The difficulties involved in this calculation were both ecclesiastical and mathematical. The second, which was to become

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[32] Nothaft, ed., *Walcher*; in Faith Wallis, ed. and trans., *Bede: The Reckoning of Time* (Liverpool: Liverpool University Press, 1999); C. Philipp Nothaft, *Scandalous Error: Calendar Reform and Calendrical Astronomy in Medieval Europe* (Oxford: Oxford University Press, 2018); Immo Warntjes, 'The Continuation of the Alexandrian Easter Table in Seventh-Century Iberia and its Transmission to Ninth-Century Francia', *Revue d'histoire des textes* n. s. 13 (2018): pp. 185–194; Immo Warntjes, 'Introduction: State of Research on Late Antique and Early Medieval Computus', in Immo Warntjes and Dáibhí Ó. Cróinín, eds., *Late Antique Calendrical Thought and its Reception in the Early Middle Ages. Proceedings of the 3rd International Conference on the Science of Computus in Ireland and Europe* (Turnhout: Brepols, 2017): pp. 1–42; Immo Warntjes, 'The *Argumenta* of Dionysius Exiguus and their Early Recensions', in Immo Warntjes and Dáibhí Ó. Cróinín, eds., *Computus and its Cultural Context in the Latin West, AD 300–1200. Proceedings of the 1st International Conference on the Science of Computus in Ireland and Europe* (Turnhout: Brepols, 2010): pp. 40–111; Faith Wallis, 'Albums of Science in Twelfth-Century England', *Peritia* 28 (2017): pp. 195–224; Lawrence-Mathers, 'Computus and Chronology'.

[33] For more classic material see Charles W. Jones, ed., *Opera de temporibus* (Cambridge, MA: Medieval Academy of America, 1943), 'Introduction': pp. 3–172; other useful summaries are to be found in Reginald L. Poole, *Chronicles and Annals: A Brief Outline of Their Origin and Growth* (Oxford: Clarendon Press, 1926): pp. 1–26 and Wilhelm Levison, 'Bede as Historian', in Alexander H. Thompson, ed., *Bede: His Life, Times, and Writings: Essays in Commemoration of the Twelfth Centenary of His Death* (Oxford: Clarendon Press, 1935): pp. 111–151.

particularly important by the late eleventh century, concerned the exact historical relation of the crucifixion to the Passover. According to the Synoptic Gospels, Matthew, Mark, and Luke, the crucifixion took place the morning after the Passover. According to John, it took place the morning before. The difference in interpretation involved a shift in the calculation of the historical death of Christ by at least eight years.

The Passover occurs on the fourteenth day of the lunar month, Nisan. The majority of the gospels agreed that the Resurrection had occurred on the Sunday after Passover (Nisan 14), and very early, it was decided that Easter should always be celebrated on a Sunday.[34] The question disputed until the seventh century was the relation Nisan 14 should have to that Sunday. All but the 'Quartodecimans' (and later in the Irish church) had decided that Easter should never be celebrated on a Sunday that fell *on* Nisan 14.[35] The Alexandrian church prescribed Nisan 15 as the earliest date, while the Roman church, for many years, prescribed Nisan 16. Advocates of the Alexandrian limits in Rome included Paschasinus, bishop of Lilybaeum (c. fl. 444), Proterius, bishop of Alexandria (c. fl. 454), and Dionysius Exiguus (c. fl. 525). The Alexandrian limits eventually came to be accepted, but not without an extensive controversy that reached resolution by the time of the Council of Whitby in 664.[36] The letters of these earlier writers were employed both by those involved in and those studying this particular controversy.

Even with agreement on the date of the first Easter, the calculation of future Easters involved mathematical and astronomical problems. Twelve lunar months of 29.5 days make a total of 354 days per year, in contrast to the solar calendar of 364.25 days. To calculate the date of Easter, a table providing a concordance of at least these two cycles was necessary. It was also preferable that these tables could be used for an extended period of time. This would ensure that for any given year in the future (or in the past), one simply had to look at the table to know the date of Easter for the desired year. It was the job of the computists to develop and calculate a single repeatable cycle in which the lunar, solar, and weekly calendars would be in harmony.

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[34] This decision did not come about without controversy, but according to Jones, Sunday observance had become custom by the second century, Jones, , ed., *DTR* (1943), 'Introduction': pp. 10–11.
[35] The term 'Quartodeciman' refers broadly to any group that advocates keeping Easter on the same day as Passover, Nisan 14.
[36] Richard Abels, 'The Council of Whitby: A Study in Early Anglo-Saxon Politics', *Journal of British Studies* 23 (1983): pp. 1–25; Miranda Wilcox, 'Confessing the Faith in Anglo-Saxon England', *The Journal of English and Germanic Philology* 113, no. 3 (2014): pp. 308–341.

Because it was desirable that all Christians should celebrate Easter at the same time, Easter tables were drawn up and circulated in the major bishoprics.

The number of Easter tables developed is a witness to the difficulty in trying to construct an eternal cycle. Among the most influential calendars were the 100-year cycle of Theophilus[37] and the 95-year cycle of Cyril of Alexandria. Around 297 B.C., an 84-year cycle was developed. Though this table required the inter-calculation, or addition, of a few days at the end of the cycle, it continued to be popular because it required only eighty-four entries to be complete. But the most accurate version was the 'Great Cycle' of 532 years developed by Victorius of Aquitaine in c. 457.[38] The most practical table and cycle was the 19-year cycle also developed by Theophilus.

Within these Easter tables, a concordance of dating systems was provided as well. Every year listed in an Easter table was identified according to the myriad ways of describing it within different cycles.[39] The year of the solar, lunar, and indictional cycles was given, as were the concurrents and the Dominical letters. Therefore, every annual entry was provided with a concordance of most dating systems so that, no matter what system was in use, the day of Easter for that year would be known. As will be discussed more fully in Chapter II, the concordances in these Easter tables may also have helped historians such as William of Malmesbury and John of Worcester, who were using documents with a variety of dating systems to determine the actual year indicated. The development of a generally accepted era helped lessen the need for such concordances.[40]

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[37] Theophilus also developed the 19-year lunar cycle. He calculated that it took 19 solar years for the lunar cycle to be complete. This 19-year lunar cycle was included in most Easter tables.

[38] The solar cycle is complete in 4 years; the weekly cycle in 7 days. A cycle that takes these and the lunar cycle into account would be 532 years long (4x7x19=532).

[39] Faith Wallis, 'What a Medieval Diagram Shows: A Case Study of 'Computus'', *Studies in Iconography* 36 (2015): pp. 1–40; a useful description is also to be found in Moreton, 'Before Grosseteste': pp. 562–586; useful and clear discussions of the various methods of dating can be found in Christopher R. Cheney, *Handbook of Dates for Students of English History* (London: Offices of the Royal Historical Society, 1945) and Reginald L. Poole, *Medieval Reckonings of Time* (London: Society for Promoting Christian Knowledge, 1935); still useful is Arthur Giry, *Manuel de diplomatique; diplômes et chartes, chronologie technique, éléments critiques, et parties constitutives de la teneur des chartes, les chancelleries, les actes privés*, Book II, New Edition (Paris: F. Alcan, 1925).

[40] James Palmer, 'Calculating Time and the End of Time in the Carolingian World, c. 740–820', *EHR* 126, no. 523 (2011): pp. 1307–1331; Rosamond McKitterick, 'Constructing the Past in the Early Middle Ages: The Case of the Royal Frankish Annals', *Transactions of the Royal Historical Society* 7 (1997): pp. 101–129.

Hand in hand with the development of the Easter cycles went the revision of the notion of the 'era'. An era is a method of dating that is continuous from a specific historical moment rather than cyclical. Before the development of the Christian Era, a number of other eras were in use: the year of Rome's foundation, dating from about 753 B.C.; the Olympic Era, dating from the first Olympic games; and the Diocletianic Era, dating from the reign of Diocletian, c. 284. A Christian Era was first used by Prosper of Aquitaine in his Chronicle (c. 433) and was adopted by Victorius of Aquitaine in his Great Cycle (c. 457).[41] Victorius' era was dated from the Passion. His 532-year cycle began with the year 29, that is, the then-supposed age of Christ when he died. It was a Scythian monk named Dionysius Exiguus who, in 525, first reckoned an era from the *birth* of Christ: the Era of the Incarnation. Dionysius had used this era in his continuation of the 95-year cycle of Cyril of Alexandria.[42]

The construction of an Easter table required mathematical and astronomical knowledge. From their early origins, Easter tables were accompanied by the scientific works needed for this study, the *computi*. Victorius of Aquitaine's *Calculus* is an early example.[43] The same principles can be seen in Bede's corpus, which included the *De natura rerum*, the *De temporibus*, and the *De temporum ratione*.[44] The *De temporum ratione* was his most important computistical work. The first section of this work is a manual of mathematical, astronomical, and technical chronology. The second and last sections of the *De temporum ratione* are a chronicle of the world based on Jerome's translation of Eusebius.[45] Bede's *De temporum ratione* became his most widely known work. His computistical studies were continued on the continent in the

[41] See Poole, *Chronicles and Annals*, pp. 7–26; Victorius' table is printed in full by Krusch, *Studien* II: pp. 27–52.
[42] Dionysius defended his theories in two letters to Petronius and Boniface. Both are printed by Migne, *PL,* 67: pp. 19–28; also Krusch, ed., *Studien* II: pp. 63–68 and pp. 82–86. Dionysius' tables are reproduced by Krusch, *Studien* II: pp. 69–74.
[43] For editions of this work, see Charles W. Jones, ed., *Bedae Pseudepigrapha: Scientific Writings Falsely Attributed to Bede* (Ithaca, NY: Cornell University Press, 1939): p. 53.
[44] Relevant editions of Bede's scientific works are as follows *De natura rerum, De temporibus,* and the *De temporum ratione* in *Bedae opera didascalica,* in C.W. Jones, ed., 3 vols., *Corpus christianorum series latina* (Turnhout: Brepols, 1975-80); the *De temporum ratione* is also edited with an Introduction by C.W. Jones in *Bedae opera de temporibus* (Cambridge Mass; Mediaeval Academy of American, 1943); the *De temporum ratione* was translated by Wallis, ed., *The Reckoning of Time*, including the translations of *Epistola ad Wicthedum* and *Epistola ad Pleguinam* which are often included in computistical manuscripts of the twelfth century.
[45] Wallis, trans., *The Reckoning of Time,* 'Introduction': pp. lxvii-lxxi.

Carolingian period by such scholars as Hrabanus Maurus, Dungal, who wrote on the nature of eclipses, and Helperic of Auxerre (c. 900), who calculated the lunar phases.[46] The chronicle at the end of the *De temporum ratione* formed the basis for a number of annals, including that of Marianus Scotus (d. c. 1082), who will be discussed in more detail below.[47]

Further impetus was given to computistical study at the turn of the tenth century by Gerbert of Aurillac (d. 1003), later Pope Silvester II.[48] Gerbert had travelled to Iberia, where he acquired a familiarity with Arabic astronomy and gained knowledge of the armillary sphere and abacus. He wrote various tracts on the use of these instruments.[49] The abacus was an invaluable tool for mathematical calculation; the armillary sphere would prove equally useful for astronomical studies. With Gerbert and an introduction of more accurate tools, the studies of the *computi* started to be undertaken with goals beyond those of the calendrical needs of the church. His influence on the computists and, in turn, their influence on the Severn Valley scholars will be discussed below in Chapter II. This was an important, but not the only, influence Gerbert would have on the Severn Valley scholars.

1.3 GERBERT OF AURILLAC, INSTRUCTION, AND ASTRONOMICAL INSTRUMENTATION

Gerbert and his work had a strong impact, direct and indirect, on Severn Valley scholarship. His focus on instrumentation, including the abacus, the armillary sphere, and the

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[46] All of Hrabanus Maurus' works are printed by Migne, *PL* 107–112, the *Liber de Computo*, Migne, *PL* 107: pp. 669–727; Bruce Eastwood, *The Revival of Planetary Astronomy in Carolingian and Post-Carolingian Europe* (Aldershot; Burlington, VT: Ashgate, 2002); Dungal's letter on eclipses is printed by Migne, *PL* 105: pp. 447–453; see Emanuel Grosu, 'Dungal, Epistola de Duplici solis eclipsi...An Analysis', *Philologica Jassyensia* 30, no. 2 (2019): pp. 203–222; Ludwig Traube, 'Computus Helperici', in *Vorlesungen und Abhandlungen*, vol. 3 (Munich: C.H. Beck, 1920): pp. 128–152, originally printed in *Neues Archiv der Gesellschaft für Ältere Deutsche Geschichtskunde zur Beförderung einer Gesamtausgabe der Quellenschriften Deutscher Geschichten des Mittelalters* 18 (1893): pp. 71–105.

[47] Marianus, *Chronicon*: pp. 481–568.

[48] Thorndike, *History of Magic,* vol. 1: pp. 697–718.

[49] Most of Gerbert's works and those erroneously ascribed to him in the Middle Ages are available in Nicolaus Bubnov, ed., *Opera Mathematica (972–1003): Accedunt aliorum opera ad Gerberti libellos aestimandos intelligendosque necessaria per septem appendices distributa* (Berolini: R. Friedländer and Sohn, 1899; reprinted Hildesheim: Georg Olms Verlagsbuchhandlung, 1963).

astrolabe, was followed by Robert of Losinga, Walcher of Great Malvern, and, as late as the mid-twelfth century, Adelard of Bath. All three of these scholars were raised within Gerbert's instructional home in the cathedral schools of the Lorraine, and their work, in turn, had an instructional focus. His employment by German emperors and his training of young nobility bolstered the understanding that nobility should be educated and surrounded by scholars. The expectation of patronage by the nobility was to become part of the courts of the Norman leaders in England after the conquest. Perhaps most notably, Gerbert was a pioneer in bringing scientific material from Iberia into the Latin West.

A rich body of material on Gerbert survives, including an impressive number of his letters.[50] These have left an important testament to his relationships with other scholars, both in

[50] A concise summary and bibliography for Gerbert can be found in Carlo Bianchini and Luca Senatore 'Gerbert of Aurillac (c. 940–1003)', in Michela Cigola, ed*., Distinguished Figures in Descriptive Geometry and Its Applications for Mechanism Science: From the Middle Ages to the 17th Century* (Cham: Springer, 2016): pp. 33–51; included here are works that informed this thesis, Paul Basted, 'Le Millénaire de Gerbert', *Revue Politique Et Parlementaire* 45, no. 525 (1938); Jindřich Bečvář, 'Gerbert of Aurillac (Sylvester II)', in *Matematika ve středověké Evropě,* ed. (Prague: Prometheus, 2001): pp. 185–229; A.N. Bogolyubov, 'Khwārizmī and Gerbert', in S. Sirazhdinov, ed., *Iz Istorii srednevekovoĭ vostochnoĭ Matematiki i Astronomii* (Tashkent: Izd-vo 'Fan' Uzbekskoĭ SSR, 1983): pp. 23–37; Philippe Carbonne, Jean Cassinet, and Guy Beaujouan, eds., *Huit siècles de mathématiques en Occitanie: de Gerbert et des Arabes à Fermat : actes du Colloque international tenu du 10 au 13 décembre 1992 à Toulouse et à Beaumont de Lomagne* (Cressé: Éd. des Régionalismes, 2014); Oscar G. Darlington, 'Gerbert, 'obscuro Loco Natus'', *Speculum* 11, no. 4 (1936): pp. 509–520; Oscar G. Darlington, 'Gerbert, the Teacher', *The American Historical Review* 52, no. 3 (1947): pp. 456–476; Courtney DeMayo, 'The Students of Gerbert of Aurillac's Cathedral School at Reims: An Intellectual Genealogy', *Medieval Prosopography* 27 (2012): pp. 97–117; Gillian Evans, 'The Saltus Gerberti: The Problem of the 'Leap'', *Janus* 67, no. 4 (1980): pp. 261–268; Gerbert, *The Letters of Gerbert: With His Papal Privileges as Sylvester II*, in Harriet Pratt Lattin, trans. (New York: Columbia University Press, 1961); Olivier Guyotjeannin and Emmanuel Poulle, eds., *Autour de Gerbert d'Aurillac: le pape de l'an mil* (Paris: École des Chartes, 1996); William P. Kitchin, 'A Pope-Philosopher of the Tenth Century: Sylvester II (Gerbert of Aurillac)', *The Catholic Historical Review* 8, no. 1 (1922): pp. 42–54; Ferdinand Lot, 'Étude sur le recueil des lettres de Gerbert', *Bibliothèque De L'École Des Chartes* 100, no. 1 (1939): pp. 8–62; Marina Passalacqua, 'Lupo di Ferrières, Gerberto di Aurillac e Il de Oratore', *Materiali e Discussioni per l'analisi dei Testi Classici* 36 (1996): pp. 225–228; Osmo Pekonen, 'Gerbert of Aurillac: Mathematician and Pope', *The Mathematical Intelligencer* 22, no. 4 (2000): pp. 67–70; Osmo Pekonen, 'Gerberto de Aurillac: Matemático y Papa', *La Gaceta de la Real Sociedad Matemática Española* 4, no. 2 (2001): pp. 399–408; Emmanuel Poulle, 'L'astronomie de Gerbert', in Michele Tosi, ed., *Gerberto, Scienza, Storia e Mito: Atti del Gerberti Symposium, Bobbio 25–27 Luglio 1983* (Bobbio (Piacenza), Italy: Archivi storici bobiensi, 1985): pp. 597–617; Pierre Riché, *Gerbert d'Aurillac, le Pape de l'an mil* (Paris: Fayard, 1987); Elly R. Truitt, 'Celestial Divination and Arabic Science in Twelfth-Century England: The History of Gerbert of Aurillac's Talking Head', *Journal of the History of Ideas* 73, no. 2 (2012): pp. 201–222; Marco Zuccato, 'Gerbert of Aurillac and a Tenth-Century Jewish Channel for the Transmission of Arabic Science to the West', *Speculum* 80, no. 3 (2005): pp. 742–763.

Catalonia and the Lorraine, and to his teaching approach. Gerbert's works and those attributed to him were very popular and were copied or emulated for some time after.[51] Some of these scientific works were circulated in the Severn Valley and were part of the corpus of materials that included the texts of the new sciences. As will be discussed in Chapter II, William of Malmesbury may also have had access to Gerbert's letters or derivatives of them. It was Gerbert's teaching career that had a direct influence on Robert of Losinga and, therefore, on the Severn Valley culture. Gerbert's use of instrumentation as a teaching tool helped to popularise the new sciences.[52]

Gerbert was raised and educated under the tutelage of Raymond at St. Gerald, in Aurillac. He received a traditional education in Latin grammar.[53] As recounted by Gerbert's student and biographer, Richer, in 967, Burrell, the Count of Barcelona, visited Gerbert's monastery and received permission for Gerbert to return with him to Iberia.[54] Gerbert remained in Iberia for three years under the care of Atto, the Bishop of Vic, in Catalonia, seventy kilometres from Barcelona. At the time of Gerbert's arrival, Iberia was roughly divided between the north and south. The northern region was, in turn, divided into multiple and ever-changing boundaries of Christian kingdoms, including Catalonia, Astoria, Castile, Aragon, and Galicia. The southern and by far the largest region of Iberia, Andalusia, was under Muslim rule.[55] Catalonia in the northeast was more culturally and politically aligned with southern France than with Andalusian Iberia.[56]

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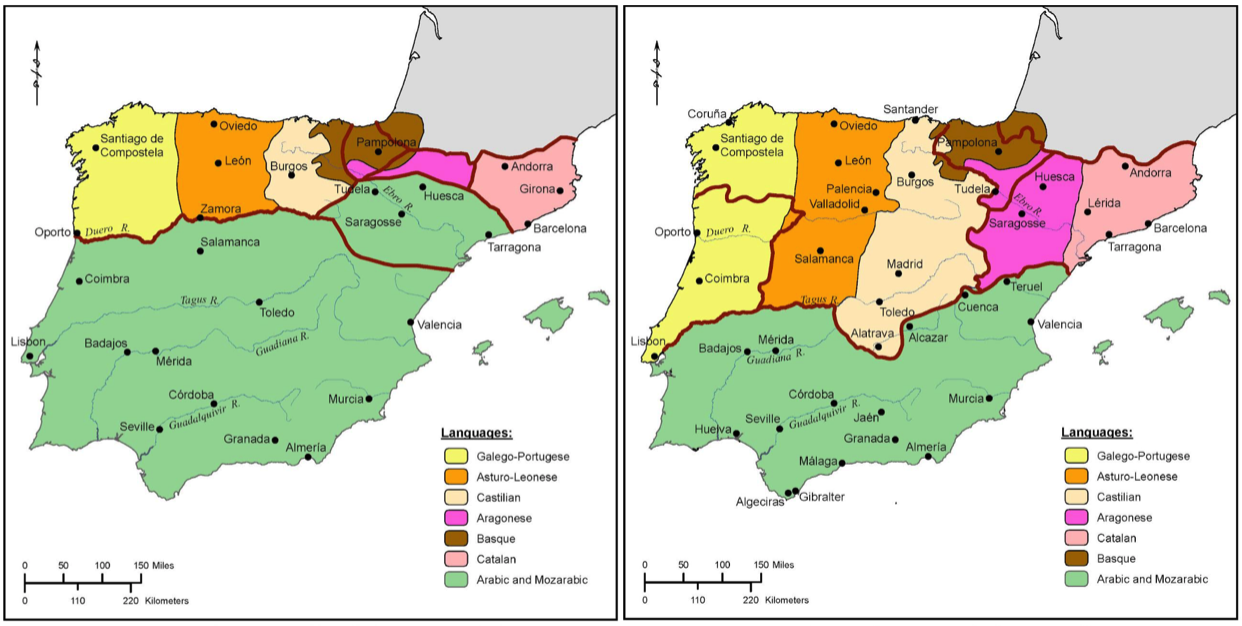
[51] Many were edited by Bubnov in his *Opera Mathematica* (1899), and there has been a good deal of work on the definition and attribution of these texts since then (see note above).
[52] Truitt, 'Celestial Divination': pp. 201–222; Elly R. Truitt, *Medieval Robots: Mechanism, Magic, Nature and Art* (Philadelphia: University of Pennsylvania Press, 2015).
[53] Darlington, 'Gerbert, the Teacher': pp. 457–460.
[54] Richer, *Histoire de France [Historia Francorum] 888-995 Vol II*, ed. and trans. by Robert Latouche in *Les Classiques de l'Histoire de France au Moyen Age,* Vol. 17 (Paris, 1937)*:* Book III.43: pp. 50–51: 'Qui a loci abbate humanissime exceptus, post sermones quotlibet an in artibus perfecti in Hispaniis habeantur sciscitatur. Quod cum promptissime assereret, ei mox ab abbate persuasum est ut suorum aliquem susciperet, secumque in artibus docendum duceret. Dux itaque non abunens, petenti liberaliter favit, ac fratrum consensu Gerbertum assumptum duxit, atque Hattoni...episcopo intruendum commisit. Apud quem etiam in mathesi plurimum et efficaciter studuit'; Zuccato, 'Gerbert': pp. 742–763. See also http://thelatinlibrary.com/richerus3.html (accessed 11/04/2022)
[55] In the year 756, the last branch of the Arab Umayyad royal family took flight to Iberia, establishing themselves in the lower part of the country known as Andalusia. Described further in Chapter III.
[56] Thomas Bisson, *The Medieval Crown of Aragon: A Short History* (Oxford: Clarendon Press, 1986).

Gerbert maintained correspondence throughout his life with the acquaintances he made there, often asking for new scientific material.[57]



Map #5: Maps depicting the expansion of Aragon and Castile in the period 900–1150. The line indicates the rough division between Christian and Muslim rule.

There has been much scholarly speculation and disagreement on what scientific materials Gerbert had access to in Iberia and what he learned.[58] The speculation on access to new learning revolves around the understanding that Christian Catalonia was not a region of Iberia where the science of the stars was particularly advanced. The bishopric of Vic does not appear to have had the kind of library to support Gerbert's training, and while Santa Maria de Ripoll was better equipped, it was also not as great a centre of learning as Cordoba or Seville.[59] Vic was 250 kilometres north of the Ebro Delta, the then March between Christians and Arabs. It has been argued that Gerbert must have travelled to Cordoba or Toledo in Andalusia to have gained the

[57] Lattin, *Letters*, nos. 25, 32, 33, 77, and 79.
[58] Emmanuel Poulle, 'L'astronomie de Gerbert': p. 613: Emmanuel Poulle went as far to suggest 'Gerbert no doubt learned some very interesting things on that side of the Pyrenees, but not Arabic astronomy.' 'Gerbert a sans doute appris outre-Pyrénées des choses très intéressantes, mais pas l'astronomie arabe'.
[59] Lattin, *Letters*, 'Introduction': p. 3; Rudolf Beer, *Die Handschriften des Klosters Santa Maria De Ripoll* (Vienna: 1907); Zuccato, 'Gerbert': pp. 742–763.

knowledge he is purported to have had when he returned to Italy and the Lorraine.[60] This perception is largely based on the statement by Adémar of Chabannes (d. 1034), Gerbert's contemporary, that the young Gerbert, thirsty for knowledge, travelled to Catalonia and al-Andalus, going all the way to Cordoba:

> Gerbert, of Aquitanian origin, was a monk from Aurillac, of the Monastery of St. Gerald. With the purpose of learning, he traversed first France and then to Cordoba. He was acknowledged by the Emperor and was appointed archbishop of Ravenna.[61]

Adémar of Chabannes' statement that he had travelled to Muslim Iberia may have been the catalyst for Gerbert's reputation to be associated with the dark arts, a perception that later captured the imagination of William of Malmesbury. However, there is nothing else to corroborate a trip to Cordoba, and it is entirely possible that, in fact, he never left Catalonia at all. Marco Zuccato postulates that Gerbert did not have to travel out of Catalonia to acquire the knowledge with which he returned.[62] Zuccato also indicates that Gerbert probably studied the texts, later referred to as the *Alchandreana,* while at St. Maria de Ripoll. This collection was either brought back with him from Iberia or later shipped to Gerbert from Iberia. It contained prognosticative material as well as that related to the use and construction of such astronomical instruments as the astrolabe and the armillary sphere. On his return to the Lorraine, Gerbert continued to write to his new colleagues in Iberia, asking for more works to be sent to him.[63] After his return, Gerbert began a distinguished and influential career as an instructor and advisor to kings and the popular instructor at the Cathedral School at Reims as Archbishop of Ravenna, and finally, as Pope Silvester II (999–1003). There is evidence that Gerbert used some of the tools mentioned above in his teaching and works. He used at least four different versions of the

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[60] Darlington, 'Gerbert, the Teacher', see esp. n. 28.

[61] This testimony appears in the third book of the *Historia Francorum* written by Adémar of Chabannes, in George Pertz, ed., *MGH SS* 4 (Hannover: MGH, 1841): p. 130: 'Gerbertus vero natione Aquitanus, monacus Aureliacensis sancti Geraldi ecclesiae, causa sophiae primo Franciam, deinde Cordobam lustrans, cognitus ab imperatore, archiepiscopatu Ravennae donatus est' (Bader translation).

[62] Zuccato, 'Gerbert': pp. 742–763, Zuccato suggests that Gerbert's teaching approach and his use of tools such as the armillary sphere were derived from the text of Dunāsh ibn Tamim al-Qarawî, a Jewish philosopher associated with the Fatimid court in Tunisia. Dunāsh's text was brought to Catalonia by Abù Yusef Hasdäy ben Ishaq ben Shaprùt, the Andalusian Jewish scholar whom Gerbert later referred to as Joseph the Wise. This transmission route via Jewish scholars to Catalonia is compelling; see also Gerbert's letters to Joseph in Lattin, *Letters*, nos. 25 and 33.

[63] Lattin, *Letters*, nos. 25, 32, 33, 77, and 79; see also Juste, *Les 'Alchandreana' primitifs*.

armillary sphere in his classroom to explore the night sky. He knew of the astrolabe and was familiar with its functions, at least in theory, if not in practice. [64]

In the *Gesta regum,* William of Malmesbury recounts his own version of Gerbert of Aurillac's travels to Iberia and what he learned there:

> Here [Gerbert] surpassed Ptolemy in the science of the astrolabe, Julius Firmicus in the science of fate, Alchandreum in the science of planetary distances. Here he learned what the singing and flights of birds predicted; here he learned to summon ghostly presences from hell; here, at last his human curiosity absorbed any knowledge, whether noxious or salubrious. There is no necessity to speak of his progress in the lawful sciences of arithmetic and astronomy, music and geometry, which he imbibed so thoroughly as to show they were beneath his talents, and which with great perseverance, he revived in Gaul, where they had a long time been wholly obsolete.[65]

This passage, which will be analysed in some detail in Chapter II, is illustrative of the importance of Gerbert to the Severn Valley scholars. Gerbert's influence reached the Severn Valley by multiple routes. His student Fulbert of Chartres was, in turn, the teacher of Lanfranc, who was instrumental in the English church reform promoted by Wulfstan.[66] Both Robert of Losinga and Walcher of Great Malvern were raised in the educational tradition that Gerbert had 'with great perseverance, revived in Gaul'. They were trained in the 'lawful sciences of arithmetic and astronomy' and benefited from Gerbert's early emphasis on instrumentation. Walcher, for instance, was an expert in both the abacus and the astrolabe.

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[64] Bianchini and Senatore, 'Gerbert', in Cigola, ed*., Distinguished Figures*: pp. 33–51.

[65] William, *GR*, II.167: pp. 280–281: 'Ad hos igitur, ut dixi, Gerbertus pervuniens desiderio satisfecit. Ibi uicit scientia Ptholomeum in astrolabio, Alhandreum in astrorum interstitio, Iulium Firmicum in fato. Ibi quid cantus et uolatus auium portendat didicit, ibi excire tenues ex inferno figuras, ibi postremo quicquid uel noxium uel salubre curiositas humana deprehendit; nam de lictis artibus, arithmetica musica et astronomia et geometria, nichil attinet dicere, quas ita ebibit ut inferiores ingenio suo ostenderet, et magna industria reuocaret in Galliam omnino ibi iam pridem obsoletas'.

[66] DeMayo, 'The Students of Gerbert': pp. 97–117, has constructed a genealogy of Gerbert's students, using the evidence of individuals' residencies at Reims during his tenure there, Gerbert's letters, and (more cautiously) testimonials from Richer and others. His students included members of the royal families of Germany and France, and people prominent within Lotharingian monasteries, including Constantine of Fleury and Remi of Trier. DeMayo concludes, 'the education these men received from Gerbert composed a significant factor in allowing their promotion into prominent positions.' A tradition or an expectation was established that those in power would be familiar with the *quadrivium* and hire educated men into their administration. This sensibility was to be carried over via the Norman conquest into England.

A particularly potent and influential part of Gerbert's teaching was astronomy. Astronomy was, as noted above, regularly identified as one of the important arts of the *quadrivium*, with geometry, arithmetic, and music defined as skills in its service. Gerbert's letters are particularly articulate on this topic. Gerbert's great legacy was the astronomical learning and instrumentation he used or knew about. In approximately 978 A.D., Gerbert wrote to his student Constantine of Fleury describing the construction and use of the armillary sphere:

> In response to your query about the sphere for demonstrating the celestial circles and constellations, my brother, it is made completely round, divided equally through the middle by the circumference, which has been divided into sixty parts.

He describes how to create the hemispheric and horizontal rings and divide up the circumference based on Hyginus' translation of Aratus' *Phaenomena* (d. 67 A.D.).[67] He is specific in telling Constantine how to use it:

> When our pole star can be observed, place the hemisphere which we have described under the open sky in such a way that, [looking] through the tubes at the extremities, you may perceive the pole star itself in an unobstructed view. If you doubt that it is the pole star, station the tube in such a position that it does not move during the night and look toward that star which you perceive to be the pole star. If it is the pole star, you will be able to see it the whole of the night; if it is another star, it will soon not be visible through the tube because it will have changed position.[68]

This remarkable record of hands-on teaching is not to be matched until much later in the work of Walcher of Great Malvern.

Gerbert's influence spread also, and particularly, throughout the Lorraine and the cathedral schools. His influence was immediate, and a new wave of scholarship appears after his return and well into the next century. In this period, we see an increased and more sophisticated use of the abacus and texts based on Gerbert's work. This included Heriger of Lobbes (d. 1007), Marianus Scotus, Bernelius, and Hermann of Reichenau (d. 1154), all of whom wrote on the

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[67] Learned by Gerbert in the Iberian Peninsula according to Zuccato, 'Gerbert'.

[68] Lattin, *Letters*, no. 2; Bubnov, ed., *Opera*: pp. 24–28: 'Sphaera, mi frater, de qua quaeris, ad coelestes circulos vel signa ostenda componitur ex omni parte rotunda, quam dividit circumducta linea mediam aequaliter in LX partibus divisa...Notato itaque nostro borneo polo, descriptum hemisphaerium taliter pone sub divo, ut per utrasque fistulas, quas diximuss extremas, ipsum boreum polum libero intuitu cernas. Si autem de polo dubitas, unam fistulam tali loco constitue, ut non moveatur tota nocte, et per eam stellam suspice, quam credis esse polum, et si polus est, eam tota nocte poteris suspicere, sin alia, mutando loca non occurrit visui paulo post per fistulam'.

abacus and were influential computists.[69] Educated in the cathedral schools in the Lorraine, and a part of this later computistical tradition, Robert of Losinga and Walcher of Great Malvern were the heirs of Gerbert's influence; John of Worcester was an enthusiastic member of their audience.

1.4 A NEW APPROACH FOR THE COMPUTISTS

Of particular import to the Severn Valley scholars was how the increased skills and interest in mathematics represented by Gerbert impacted the study of the Paschal question. The work of later computists, Abbo of Fleury, Marianus Scotus, and Gerland of Besançon, did not focus primarily on which Sunday to celebrate Easter, nor did they contest the accuracy of the 532-year cycle. Rather, these computists were concerned with the date of the *original* Easter and how that would affect the numeration of the historical or Christian Era. Known by the twelfth century as *computus naturalis*, Hermann of Reichenau and Gerland also began to study the courses of the sun and moon in their own right, with no expressed utility of this work to ecclesiastical functions.[70] These new intellectual sensibilities, the controversy over the dating, and the study of the natural course of the sun and moon were to have a profound effect on the Severn Valley scholars via Robert of Losinga and Walcher of Great Malvern.

Abbo of Fleury, also Abbot of Ramsey, suggested that Dionysius had miscalculated the historical date for the death (and therefore for the birth) of Christ. The date given by Dionysius did not, according to Abbo, agree with the astronomical evidence of the Passion. Christ was

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[69] For Hériger de Lobbes, see Pierre Riché, 'Le millénarisme autour de l'an mille', *Revue Française d'Histoire des Idées Politiques* 10 (1999): pp. 247–258; Alfred Cordoliani, 'Abbon de Fleury, Hériger de Lobbes et Gerland de Besançon sur l'ère de l'incarnation de Denys le Petit', *Revue d'histoire ecclésiastique* 44 (1949): pp. 462–487, esp. pp. 471–474; Mavek Otisk, 'Descriptions and Images of the Early Medieval Latin Abacus', *Średniowiecze Polskie I Powszechne* 7 (2015): pp. 13–35, identifies Hériger and Bernelius as possible students of Gerbert, as does Nothaft, ed., *Walcher*: p. 15; on Hermann of Reichenau see C. Stephen Jaeger, 'Men and Women in the Life of the Schools: In the Classroom of Hermann of Reichenau', in Micol Long, Tjamke Snijders, and Steven Vanderputten, eds., *Horizontal Learning in the High Middle Ages: Peer-to-Peer Knowledge Transfer in Religious Communities* (Amsterdam: Amsterdam University Press, 2019): pp. 163–184; Irene Caiazzo, 'Sur l'astrolabe et le comput au XIIe siècle: Nouveaux textes inédits', *Sudhoffs Archiv* 96, no. 1 (2012): pp. 28–38.
[70] Nothaft, ed., *Walcher,* pp. 11–24.

reputed to have died in the 34th year of his life in a year when the 14th, 15th, 16th, and 17th days of the month, Nisan, fell on the 24th, 25th, 26th, and 27th day of March. The only year in which this occurred was in the 13th year of the great cycle of 532 years. This would mean that the year assigned to the death of Christ was twenty-one years too late (34-13=21). Abbo, therefore, constructed his lunar tables with dates that were twenty-one years earlier than those used by Dionysius.

A discrepancy in the calculation of the historical date of the first Easter and, hence, a shift in the dating of the era would have been of some interest to historical writers. It is not surprising, therefore, that Abbo's ideas were taken up some time later by a chronicler from Mainz named Marianus Scotus.[71] Marianus, however, calculated that the amount of error was twenty-two years. The argument is that Bede had begun his great cycle of 532 years in the year 532. This would mean that the first year of the previous cycle did not begin in the first year of the Era of the Incarnation, according to Dionysius, but in the year before. While Abbo was correct in assigning the proper astronomical evidence to the thirteenth year of the Cycle, this year would, in fact, be the twelfth of the Dionysian Era. The era was, therefore, twenty-two years too late (34-12=22). Marianus used this dating system in his chronicle.

Gerland of Besançon, writing at the same time as Marianus, was another critic of the era according to Dionysius.[72] But instead of placing the date of the death of Christ twenty-two years earlier than had Dionysius, Gerland placed it eight years later. The reason for this was that Gerland supported the view that Christ was crucified on the day before the Passover rather than the day after. The Resurrection, therefore, took place on 25th rather than 27th March. The chronological data thus shifted the dating of the event eight years forward, according to Gerland's calculations.

It is interesting that while Abbo, Marianus, and Gerland were all critical of Dionysius, they were not openly critical of Bede. Dionysius' critics argued that Bede had not agreed with Dionysius on the historical date of the birth of Christ, and Bede had only reluctantly used

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[71] Cordoliani, 'Abbon': pp. 470–471; the preface to Marianus' *Chronicle*, in which he explains his calculations and summarises those of others, has been edited by Anna-Dorothee v. den Brincken, 'Marianus Scottus unter besonderer Berücksichtigung der nicht veröffentlichen Teile seiner Chronik', *Deutsches Archiv für Erforschung des Mittelalters*, 17 (1961): pp. 191–238.
[72] On Gerland, see Cordoliani, 'Abbon'; see also Haskins, *Studies*: pp. 85–86.

Dionysius' era calculation in the *Historia ecclesiastica*. There are two reasons for this. The first is that in the *Chronica maiora,* Bede placed the incarnation in the 751st year of Rome, while Dionysius had placed it in the 754th year.[73] This discrepancy was noted by Marianus in his chronicle (though Marianus calculated the difference to be four rather than three years).[74]

The second is that Bede's defence of Dionysius' calculation of the date of the Passion in *De temporum ratione* was obtuse enough to cause some confusion.[75] Also, in Chapter LXI, Bede states that those who place the Resurrection on 25th March rather than 27th would find the cyclical data pointing to the year forty-two rather than the year thirty-four. Bede, however, refrains from making a positive conclusion.[76] Marianus Scotus again noted this problem in the preface to his chronicle and took it to mean that Bede favoured a date for the Passion that was eight years later than that of Dionysius.[77] Marianus did not give this calculation much consideration, for he was more concerned with illustrating his own calculations. Gerland, however, used this discrepancy as a basis for his work. Despite the disagreements on Bede's calculations, Bede's scientific works remained the basis of computistical study. Later, in the twelfth century, William of Malmesbury, like Bede, had some serious questions about the Dionysian Era, but he, like Bede, chose to use that era regardless. It is possible that Bede's lack of clarity stemmed from the tension between what he perceived to be a more accurate calculation and his fear that he might be excommunicated for his views.

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[73] Bede, *The Reckoning of Time,* trans. Faith Wallis: p. 157.

[74] Marianus, *Chronicon*: p. 501. Marianus places the incarnation *iuxta cronicas Eusebii vel Bedae* in his year 19 (or 4 B.C.), the birth of Christ and the first year of the Great Cycle in the year 22 (1 B.C.), and Incarnation *secundum Dionisium* in the year 23 (1 A.D.). Marianus notes, *Chronicon*: p. 505, that for the date of the Passion Bede's chronicle and Dionysius' calculations differ by five years. Bede had placed Christ's death at 33 years of age, while Dionysius had placed it at 34.

[75] For Jones commentary on this see Jones, ed., *DTR* (1943), 'Introduction': p. 70; For Bede's text see, Bede, *DTR*, Ch 47: pp. 427-433; Bede, *DTR* (1943), Ch. 47: pp. 265–268; Wallis, trans., *Reckoning of Time*, Ch 47: pp. 126–129.

[76] Bede, *DTR*, Ch 56: pp. 445-446; Bede, *DTR* (1943), Ch. 56: pp. 281–283; Wallis, trans., *Reckoning of Time*: Ch. 56: pp. 145–147; for Jones commentary on this see Jones, ed., *DTR* (1943), 'Introduction': p. 389, n. 57; see also Lawrence-Mathers, 'William of Malmesbury', in Thomson, Dolmans, and Winkler, eds., *Discovering William of Malmesbury*: pp. 93–106.

[77] Marianus states that the year nine 'incarnationis secundum eundem Dionisium, qui est annus nativitatis dominice secundum Bedam', Marianus, 'Praefatio': p. 227. Marianus seems to be unconcerned with the fact that his interpretations of Bede's chronicle and of Bede's *De Temporum Ratione* would indicate that Bede advocated two different dates for the Passion, thirteen years apart.

1.5 COMPUTISTICAL STUDY IN ENGLAND PRIOR TO THE APPOINTMENT OF ROBERT OF LOSINGA

The computistical collections prior to the late eleventh century and Robert's appointment tended to contain a cross-section of works on the Paschal question and the peripheral subjects.[78] Any such collection almost always contained the letters of Dionysius Exiguus to Patronius and Boniface explaining his era and an Easter table. The scientific works in these collections included those of the Venerable Bede. Also included were sections of Isidore of Seville's *De natura rerum* or the *Etymologies*, Helperic of Auxerre's *Computus*, and the works of Abbo himself.[79] Though the make-up and organisation of these manuscripts varied, most of these works can generally be found in manuscripts influenced by Abbo and the Fleury school.[80] These works are representative of traditional computistical study and the newly acquired mathematical skills of the late tenth century. The era controversy did not reach England until almost one hundred years later.

There is evidence that Abbo's appointment as Abbot of Ramsey (985–987) stimulated continued scientific study in the Ramsey area.[81] His student Byrhtferth (d. 1020) followed in

[78] For several centuries after his death, Bede's *De temporibus* and *De temporum ratione* appeared to have enjoyed popularity on the continent. The English computistical collections were influenced by this tradition as well as by Anglo-Saxon and Irish sources. See Charles W. Jones, 'Bede's Place in Medieval Schools', in Wesley M. Stevens, ed., *Bede, the Schools and the Computus* (Aldershot: Variorum, 1994): pp. 261–285; Wallis, trans., *Bede*: pp. lxxxvi-xcii; Dorothy Whitlock, *After Bede* (Jarrow: Parish Jarrow, 1960); Immo Warntjes, 'Seventh-Century Ireland: The Cradle of Medieval Science?', in Mary Kelly and Charles Doherty, eds., *Music and the Stars. Mathematics in Medieval Ireland* (Dublin: Four Courts Press, 2013), pp. 44–72.

[79] See Patrick McGurk, '*Computus Helperici*: Its Transmission in England in the Eleventh and Twelfth Centuries', *Medium Aevum* 43, no. 1 (1974): pp. 1–5; on Abbo, see Peter Verbist, *Duelling with the Past: Medieval Authors and the Problem of the Christian Era, c. 990–1135* (Turnhout: Brepols, 2010): pp. 35–84.

[80] A description of the influence of the Fleury school on English manuscripts is given by Harry Bober, 'An Illustrated Medieval School-Book of Bede's 'De Natura Rerum'', *The Journal of the Walters Art Gallery* 19/20 (1956): pp. 64–97; Wallis, 'What a Medieval Diagram Shows': pp. 1–40.

[81] Cousin, *Abbon*: pp. 60–74; Abbo found a disciple in Byrhtferth of Ramsey. The presence of later, high-quality manuscripts from this area testifies to the continued interest in, or at least respect for, the tradition begun by Abbo. See Cyril Hart, 'The Ramsey Computus', *EHR* 85, no. 334 (1970): pp. 29–44; see also Evans, 'Schools and Scholars': p. 73.

Abbo's footsteps.[82] Manuscript British Library Cotton Caligula A.XV contains the earliest copy of Byrhtferth's computistical work; it should be noted that portions of this manuscript were developed in the eleventh century at Worcester.[83] The twelfth-century document, Oxford St. John's College 17 from Thorney Abbey, is a testament to the beauty and breadth of the computistical collections.[84] Because of Abbo's close connections with the Severn Valley during his stay in England, the germs of scientific interest in this area may have been partially due to his influence.[85] Prior to Robert's arrival, we have a few glimpses of that interest. John Bale, for instance, credited Eilmer of Malmesbury (d. 1069), a scientific enthusiast we will discuss in Chapter II, with three astronomical treatises.[86] But the evidence for this activity is scanty. Computistical works reflective of the continental influence were not popular or widely copied. It was not until the late eleventh and early twelfth centuries that the scientific works brought over a century earlier by Abbo were widely circulated.

1.6 ROBERT OF LOSINGA: THE ABACUS, THE ERA CONTROVERSY, AND THE SEVERN VALLEY

Another period of continental scientific influence occurred, not surprisingly, after the conquest, with a direct impact on Severn Valley scholarship. The early Severn Valley connections to Ireland and indications of Irish computistical texts in the area pre-conquest

[82] Cyril Hart, 'Byrhtferth and his Manual', *Medium Aevum* 41 (1972): pp. 95–109; Peter Baker, 'Byrhtferth's 'Enchiridion' and the Computus in Oxford, St John's College 17', *Anglo-Saxon England* 10 (1982): pp. 123–142.
[83] Cotton MS Caligula A XIV, http://www.bl.uk/manuscripts/FullDisplay.aspx?ref=Cotton_MS_Caligula_A_XIV (accessed 08/04/2022)
[84] Faith Wallis, 'Oxford St. John's College. MS 17', *The Calendar and the Cloister*: Oxford, St. John's College MS 17, http://digital.library.mcgill.ca/ms-17/ (accessed 08/04/2022).
[85] Ramsey had been founded by Oswald Bishop of Worcester six years prior to Abbo's visit. Ramsey retained close connections with Worcester. James Westfall Thompson, *The Medieval Library* (Chicago: University of Chicago Press, 1939): p. 122, suggests that Abbo sent a number of manuscripts back to Fleury from the Worcester area.
[86] They are: *Astrologorum dogmata*, *De planetarum signis*, and *De geomantia*. John Bale, *Scriptorum illustrium Brytanniae quam nunc Angliam et Scotiam vocant catalogus* (Basel, 1557): p. 163; see Lynn White, 'Eilmer of Malmesbury, an Eleventh Century Aviator: A Case Study of Technological Innovation, its Context and Tradition', *Technology and Culture* 2, no. 2 (1961): pp. 97–111.

provided an already fertile ground for further mathematical study.[87] Renewed continental influence can once again be traced to Robert of Losinga. Robert brought into England both the still heated controversy of the date of the Christian Era and the relatively new instruments that had been introduced into the Latin West by Gerbert.

As we have seen, Gerbert's educational model was widely adopted in the Lorraine, including Liège. Beginning with Notger in the second half of the tenth century, the curriculum in the school was expanded to include a strong focus on mathematics and astronomy.[88] The roster of mathematically inclined scholars associated with Liège in this early period is long. It included Hériger de Lobbes, who wrote about the abacus, and Franco of Liège (*De quadratura circuli*), who put forward a theory of irrational square roots. The emphasis of the school appears to have been on practical mathematics, in the Gerbertian tradition, rather than rhetoric and dialectic. It was within this tradition that Robert of Losinga was educated.

It may be important to return to the utilitarian nature of Robert's appointment and how a mathematician and astronomer might have been considered useful to William the Conqueror.[89] Robert's mathematical skills and skills with the abacus proved critical to the financial and administrative reform of the see of Hereford. Robert was instrumental in the second Domesday survey, possibly as the commissioner for the southwest circuit, according to Julia Barrow.[90] In fact, the most frequently quoted description of the Domesday survey was possibly written by Robert himself in his introduction to his summary work on the dating of the incarnation.

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[87] See most particularly Immo Warntjes, 'The Munich Computus and the 84 (14)-Year Easter Reckoning', *Proceedings of the Royal Irish Academy* 107 C (2007): pp. 31–85; and Moreton, 'Before Grosseteste'.

[88] Christine Renardy, 'Les écoles liégeoises du IXe au XIIe siècle: grandes lignes de leur évolution', *Revue belge de philologie et d'histoire* 57, no. 2 (1979): pp. 309–328; Jaeger, *The Envy of Angels*, pp. 55–56 and pp. 93–95.

[89] See Barrow, 'A Lotharingian in Hereford'; Julia Barrow, ed., *Hereford, 1079–1234*, English Episcopal Acta 7 (Oxford: Oxford University Press, 1993): pp. xxxi–xxxvi, l–lv, lxiii–lxiv, 1–3; W.H. Stevenson, 'A Contemporary Description of the Domesday Survey', *EHR* 22, no. 85 (1907): pp. 72–84; Alfred Cordoliani, 'L'activité computistique de Robert, évêque de Hereford', in Pierre Gallais and Yves-François Rion, eds., *Mélanges offerts à René Crozet à l'occasion de son 70e anniversaire par ses amis, ses collégues, ses élèves et les membres du C.E.S.C.M.*, vol. 1 (Société d'études médiévales, 1966): pp. 333–340; Evans, 'Schools and Scholars': pp. 71–89; William, *GP*, IV.164: pp. 458–461; John, *Chronicle*, III: pp. 68–71 and pp. 86–87; Gleb Schmidt, 'A Saint Petersburg Manuscript of the *Excerptio Roberti Herefordensis de chronica Mariani Scotti*', in Cleaver and Worm, eds., *Writing History*: pp. 69–92.

[90] Barrow, 'Robert the Lotharingian (*d.* 1095)'.

> This was the twentieth year of William, king of England, who ordered that a record be made of all possessions of the whole of England, the fields of every single county, possessions of every single vassal, their fields, manors, men, serfs as well as freemen, those who live in huts as well as those who possess houses and fields, wagons, horses and other animals, services and payment which could be rendered from the whole land. Other investigators followed the first and were sent to counties that they did not know, and where they themselves were unknown, to check the first description and to denounce any wrongdoers to the king. And the land was vexed with much violence proceeding from the collection of king's money.[91]

Robert helped regularise the collection of the King's revenues in the area and the revenues of the see of Hereford.[92] He was able to reorganise the cathedral's relationship with various churches, standardise clerical appointments by adopting practices from the Lorraine, and also regulate the relationship of the cathedral to the city. Under Robert of Losinga, the cathedral itself was rebuilt and was designed in the likeness of the Cathedral of Aachen, according to William of Malmesbury.[93] With Robert of Losinga's administration, Hereford prospered.

Looking forward, it appears that those scholars with mathematical skills, so useful to administration, continued to be sought after by those in power. Walcher of Great Malvern's appointment to the important priory of Great Malvern may have been a royal one, and his skill with the abacus and the astrolabe was held in high regard.[94] Later, and without recognisable connection to the Severn Valley, the abacist Turcilus (writing in 1115) is associated with the court of Henry I.[95] Also, slightly later, Adelard of Bath was to use his abacus and mathematical skills in his position with the Exchequer.[96]

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[91] Stevenson, 'A Contemporary Description': p. 74: 'Hic est annus vicesimus Wuillelmi, Regis Anglorum, quo iubente hoc anno totius Angliae facta est descriptio in agris singularum provinciarum, in possessionibus singulorum procerum, in agris eorum, in mansionibus, in hominibus, tam servis quam liberis, tam in tuguria tantum habitantibus, quam in domos et agros possidentibus, in carrucis, in equis, et ceteris animalibus, in servitio et censu totius terrae omnium. Alii inquisitores post alios, et ignoti ad ignotas mittebantur provincias, ut alii aliorum descriptionem reprehenderent et regi reos constituerent. Et vexata est terra multis cladibus ex congregatione regalis pecuniae procedentibus'; see also the discussion by Schmidt, 'A Saint Petersburg Manuscript', in Cleaver and Worm, eds., *Writing History*: pp. 69–92.
[92] Barrow, 'A Lotharingian in Hereford': pp. 29–49.
[93] William, *GP*, IV.164: p. 459.
[94] Lawrence-Mathers, *The True History of Merlin*: p. 126 draws attention to the interest of Henry I in scholars with medical and astronomical training and to the royal connections possibly related to Walcher's appointment.
[95] Evans, 'Abacus': pp. 114–131.
[96] Cochrane, *Adelard*: pp. 22–31.

As cited earlier, William of Malmesbury praised Robert of Losinga as 'highly learned in all the liberal arts, but had particularly studied the use of the abacus, lunar calculations, [and] the celestial course of the stars'.[97] Robert has been credited with the introduction of the abacus into England. Gillian Evans, however, has indicated that it is much more likely that the abacus came across the channel years earlier with Abbo in the late tenth century.[98] While this is probably so, it is also likely that Robert's mathematical pursuits helped to popularise the use of the abacus. In the period following Robert's appointment, the works on the abacus became increasingly commonplace.[99]

Robert was also responsible for bringing Marianus Scotus' *Chronicle* to England and, with it, Marianus' new era. Robert wrote a summary of Marianus' theories in which he delineated the mathematical and astronomical reasons why the Dionysian Era was twenty-two years late. As a meticulous church administrator, Robert wrote that he was offended that the dating systems did not add up: 'When the anniversary day of a single martyr or confessor or virgin is written and honoured in the books of the Church, but [the anniversary day of] the creator and of the redemption of man is doubted, who does not burn with rage because of this, making it a less reliable source?'[100] His introduction and advertisement of Marianus' dating system were meant to correct these liturgical errors.

A review of Robert's documents reveals the localised influence of his work.[101] The manuscripts of Robert's *Excerptio* are summarised here:

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[97] William, *GP*, IV.164: pp. 458–459: 'Omnium liberalium artium peritissimus, abacum precipue et lunarem compotum et caelestium cursum astrorum rimatus*'*.

[98] See Charles Johnson, trans., *De necessariis observantiis scaccarii dialogus qui vulgo dicitur Dialogus de Scaccario, The Course of the Exchequer* (London: Nelson, 1950), 'Introduction': p. xxxvii; and Charles Homer Haskins, 'The Abacus and the King's Curia', *EHR* 27, no. 105 (1912): pp. 101–106, for the more traditional view of Robert's role in the introduction of the abacus into England. For Evans' convincing arguments, see 'Abacus': pp. 114–131.

[99] The work *De abaco* of Gerlandus Computos (d. 1102) also found a home in the Severn Valley in the late eleventh century. It has been proposed by Lambert De Rijk that Gerlandus was in England briefly under the service of Harold I: Lambert De Rijk, *Dialectica: First Edition of the Manuscripts, with an Introduction on the Life and Works of the Author and on the Contents of the Present Work* (Assen: Van Gorcum & Co., 1959).

[100] Oxford, Bodleian Library, Auct. F.1.9, f. 17r. (translation done with assistance from the Hunter 100 working group, Durham University).

[101] In 1904, W.H. Stevenson had identified the piece in two manuscripts, Oxford, Bodleian Auct. F.5.19. and Oxford, Bodleian Library, Auct. F.3.14, belonging to William of Malmesbury, Stevenson, 'A

- Durham, Cathedral Library, MS Hunter 100, fols. 17r–22v (Durham)
- Glasgow, University Library, MS Hunter 85, fols. 98v–100r (Durham)
- London, British Library, Egerton MS 3088, fols. 85va–99ra (Dore)
- Cotton MS Tiberius E.IV, fols. 162ra–176ra (Winchcombe)
- Oxford, Bodleian Library, MS Auct. F.1.9, fols. 2v–12r (Worcester)
- Oxford, Bodleian Library, MS Auct. F.3.14, fols. 134r–148v (Malmesbury)
- Oxford, Bodleian Library, MS Auct. F. 5.19, fols.1r–22v (Worcester)
- Oxford, Bodleian Library, MS Digby 56, fols. 194v–195v (England, Unknown, Winchester hand)
- Cambridge, St. John's College, MS I 15, fols. 338–341 (England)
- Trinity College, MS O. 7. 41, fols. 37v–54v (Colchester?)
- Saint Petersburg, National Library of Russia MS Lat. O. IV. 1, fols. 74r–102v. (France)

Of note is that most of Robert's manuscripts are from the Severn Valley, or areas of some connection to Worcester, such as Durham and Ramsey. Gleb Schmidt has suggested that the Petersburg manuscript was brought to France from Worcester by Orderic Vitalis, thus further cementing that connection.[102]

While Robert has long been praised for his initiative in bringing the influential Marianus Scotus Chronicle to England, his role as a computistical expert has been neglected.[103] The restriction of his influence to his own region was not, in truth, a significant limitation. Robert's work formed the basis upon which Severn Valley mathematical interests were built. In circulation in the Severn Valley, thanks partially to Robert's influence, were at least three of the different theories of the timing of Christ's death: that of Dionysius Exiguus, espoused by Bede, that of Marianus, which had a twenty-two-year differential, and that put forward by Gerland of

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Contemporary Description': pp. 72–84; in 1976, Rodney Thomson added Auct. F.1.9, belonging to John of Worcester, in Thomson, 'The Reading of William': pp. 362–402, at p. 394; in 1983, the following were added: B.L., Cotton Tiberius E.IV. from Winchcombe; B.L., Egerton 3088 from Dore, and two manuscripts from Durham, Durham Cathedral Library, Hunter 100, and Glasgow, Hunterian Library 85, see Katharine Bader, 'The Relation of Computistical to Historical Study in the Severn Valley Renaissance of the Twelfth Century' (M.A. Thesis, University of North Carolina at Chapel Hill, 1985); Recently, Gleb Schmidt has added the Petersburg manuscript, and provided a preliminary analysis. See Schmidt, 'A Saint Petersburg Manuscript', in Cleaver and Worm, eds., *Writing History*.

[102] Schmidt, 'A Saint Petersburg Manuscript', in Cleaver, and Worm, eds., *Writing History*: pp. 69–92.

[103] Julia Barrow has devoted effort to studying Robert's skills with the abacus and his administrative acumen (see Barrow, 'Robert the Lotharingian', and Barrow, 'A Lotharingian in Hereford'). While Schmidt has reviewed the manuscript tradition, Robert's *Excerptio* remains unedited.

an eight-year differential.[104] The number and breadth of mathematical, computistical, and astronomical manuscripts in the Severn Valley expanded dramatically in this period and immediately after.[105] The corpus reflected a new era in computistical and mathematical studies. Hermannus Contractus, Bernelius, and Gerland all began to be represented. It is not unreasonable to suppose that they were brought into the Severn Valley partially as a result of Robert's interests and influence.

Robert's influence was facilitated by his close friendship with Wulfstan of Worcester. Wulfstan may have had a role in Robert's appointment. As the last Anglo-Saxon bishop remaining after the conquest, Wulfstan was a powerful and influential man. He carried great intellectual weight in the church reforms under Lanfranc, and was a powerful local leader, defending Worcester from marauding armies on several occasions. He was also a strong moral force in the area, credited, for instance, with slowing the slave trade out of Bristol.[106] He appreciated Robert's interests and, as we shall see, commissioned a continuation of the Marianus Scotus *Chronicle* by one of his monks, John of Worcester. Together, Robert and Wulfstan formed a powerful intellectual alliance in the Severn Valley.

Independent to the continental works brought in after Robert's appointment, there were several other interesting calendrical traditions represented in the Severn Valley. Jennifer Moreton has pointed out that both Irish Christian and Jewish calendrical traditions were circulating in the

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[104] See section (1.4) above and summaries of the computistical tradition in Nothaft, ed., *Walcher*: pp. 18–31, and particularly, Wallis, trans., *The Reckoning of Time*, 'Introduction': lx-xliii.
[105] Evans, 'Schools and Scholars': pp. 71–89; Wallis, 'Oxford St. John's College, MS 17', *The Calendar and the Cloister*, http://digital.library.mcgill.ca/ms-17/ (accessed 11/04/2022).
[106] See Fontaine, 'Early Medieval Slave-Trading'; David Pelteret, *Slavery in Early Medieval England: From the Reign of Alfred until the Twelfth Century* (Woodbridge: Boydell Press, 1995): pp. 76–78 and pp. 224–225 and 'Slave Trading and the Slave Trade in Early England', *Anglo-Saxon England* (1981): pp. 99–114; see also Michael Toch, 'Was There a Jewish Slave Trade (or Commercial Monopoly) in the Early Middle Ages?', in Stefan Hanß, Juliane Schiel, and Claudia Schmid, eds., *Mediterranean Slavery Revisited (500–1800)* (Zürich: Chronos, 2014): pp. 421–444; see also William of Malmesbury, *Vita Wulfstan,* in Michael Winterbottom and Rodney Thomson, eds., *William of Malmesbury: Saints' Lives* (Oxford: Clarendon Press, 2002), n. 4: pp. 100–101. It is important to note that the slave trade may not have entirely disappeared with this movement. Pelteret, in *Slavery,* points out the contradictions, including that Wulfstan himself (or the Worcester Cathedral) owned hundreds of slaves. While manumission was encouraged as a Christian virtue, slavery still persisted. Specifically, what was outlawed was the sale overseas of slaves.

area by the twelfth century.[107] The work of Constabulus is a computistical piece reflecting the Irish traditions which had been rejected at the council of Whitby in 664. The Bristol slave trade meant that Ireland and the Severn Valley area shared close and frequent contact. Another interesting influence was that of the Jewish calendrical traditions and lunar tables. The *Ysagogarum alchorismi*, available since the eleventh century in the western part of England, contains a Jewish calendar.[108] The Jewish influence in the area, the first and largest after London, will be discussed more in subsequent chapters. This document is, perhaps, one breadcrumb in that trail.

1.7 CONCLUSION

In summary, the Severn Valley intellectual world benefited from its importance as a political and ecclesiastical centre of interest. On the Welsh border, the Severn Valley was a place of interest to the Conqueror. When a key appointment was to be made, Robert of Losinga was selected, a Lotharingian trained in the Cathedral schools. The maturity of the Gerbertian tradition, astronomical tools, and the recent computistical controversies came with him. The activity of Bristol around the world meant that other influences, Irish and Hebrew, were present in the area. The church affiliations between Worcester, Durham, and Ramsey facilitated the sharing of key computistical and mathematical texts, with Worcester as a possible hub. This was a place where the science of the stars and mathematics were urgent and relevant topics.

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[107] Moreton, 'Before Grosseteste': pp. 562–586. See also Warntjes, 'Computus as Scientific Thought': pp. 158–178.

[108] Charles Burnett, 'The Writings of Adelard of Bath and Closely Associated Works, Together with the Manuscripts in Which They Occur', in Charles Burnett, ed., *Adelard of Bath: An English Scientist and Arabist of the Early Twelfth Century* (London: Warburg Institute, 1987): pp. 163–196, on pp. 173–174, he describes the *Liber ysagogarum alchorismi*, attributed in one manuscript to 'magister A'. This manuscript contains a Jewish calendar that is evidently not included in Muhammad ibn Mūsā Khwārizmī, *Le calcul indien (Algorismus): histoire des textes, édition critique, traduction et commentaire des plus anciennes versions latines remaniées du XIIe siècle*, Andre Allard, ed. and trans., (A. Blanchard, 1992): pp. xlv–lii and pp. 23–61.

CHAPTER II

A Matter of Interest: Three Severn Valley Scholars and the Quadrivium

> ***1117, 39, [1095]****: Wulfstan the venerable bishop of the holy church of Worcester . . . passed away in the night of Saturday, the eighteenth of January, about the middle of the seventh hour, and in the year 5299 from the beginning of the world, according to the undoubted reckoning of the holy scripture, in the 529th year of the 9th Great cycle or the 476th of the ninth from the beginning of the world; in the 1084th from the passion of our Lord according to the Gospel, but the 1066th according to Bede's chronicle, and the 1061st according to Dionysius; in the 745th from the arrival of the Angles in Britain; in the 498th from the arrival of St. Augustine; in the 103rd from the death of St. Oswald, the Archbishop, in the 32nd of the 11th Great Paschal Cycle, and in the 510th in the tenth cycle from the beginning of the world, in the 4th of the second solar cycle, in the 3rd of the leap-year cycle, in the 13th of the second cycle of nineteen years, in the 10th of the second lunar cycle, in the 5th endecade, in the 3rd of the Indictional cycle, in the 18th lustre of his own age, and in the 3rd year of the seventh lustrum of his episcopate.*
>
> - John of Worcester, *Chronicle*[1]

The death of Wulfstan, bishop of Worcester, in January 1095, was described by the chronicler John of Worcester in a rather unusual fashion. This remarkable passage is replete with computistical information and poses a number of questions as to why, for example, John gave three numbers for the annual entry and different dates for the Passion. An analysis of this passage will be provided in section 2.4 below. It is provided here as an illustration of the computistical enthusiasm represented by Severn Valley scholars in the early twelfth century.

[1] Oxford Corpus Christi 157: p. 359; John, *Chronicle*, III s.a. 1095: pp. 74–75: 'Vir venerabilis et valde admirabilis uite, Wulstanus, episcopus sancte Wigornensis ecclesiae… die mensis Januarii octavo decimo noctis septimi Sabbati, hora mediante septima, migravit e seculo, anno a primo seculi die, certa scriptrae ratione divinae v.cc.xcix., noni magni anni quingentesimo vigesimo nono, noni vero magni anni ab initio seculi quadringentisimo septuagesimo sexto, a passione Domini secundum Evangelium millesimo octogesimo quarto, juxta chronicam Bedae millesimo sexagesimo sexto, secundum Dionysium millesimo sexagesimo primo, ab adventu Anglorum in Brytanniam septingentesimo quadragesimo quinto, ab adventu S. Augustini quadringentesimo nonagesimo octavo, a transitu S. Oswaldi archipraesulis centesimo tertio, undecimi magni paschalis cycli tricesimo secundo, decimi vero a capite mundi quingentesimo decimo, secundi solaris cycli quarto, bissextilis cycli tertio, secundi decennovenalis cycli decimo tertio, secundi lunaris cycli decimo, endecadis quinto, indictionalis cycli tertio, lustro suae aetatis octavo decimo, sui vero pontificatus septimi lustri anno tertio'.

John's interest in computistical and astronomical learning was shared by two of his near contemporaries, Walcher of Great Malvern and William of Malmesbury, and, in the case of Walcher, his near geographic neighbour. The present discussion will establish the ground and grammar of their interest in the years before the arrival of, and their acquaintance with, new learning from Latin translations of Arabic texts on these subjects. Where William of Malmesbury consistently represents pre-translation movement astronomical knowledge, both Walcher and John were heavily influenced by the new learning in their encounters, personally and textually, with Petrus Alfonsi and Adelard of Bath. In light of this bifurcation in their experience of astronomical learning, the present discussion in this chapter is confined, in the case of Walcher and John, to the period before their exposure to the new sources. The period afterwards and the effect of the new learning will be considered in Chapters IV and V. Chronologically, then, the focus for what follows is the period before the 1120s. Thematically, since none of the three authors had encountered the new learning by this point, comparisons between them are more stable and meaningful. What these scholars knew, what materials they were aware of prior to the arrival of the Arabic texts, and how they used them in their works are key questions to be addressed.

As a part of this analysis, it will be important to review how the positions these scholars had in their respective monasteries may have influenced their interest in astronomy. Both William of Malmesbury, as cantor, and Walcher of Great Malvern, as prior, had positions in their communities that required them to maintain accurate time keeping and calendrical rotations within their monasteries.[2] In this regard, their interests and skills in the science of the stars were entirely appropriate to their position. In addition, William and John also acted as historians or chroniclers and librarians for their monasteries.[3] As historians, they became deeply invested in

[2] Lawrence-Mathers, 'William of Malmesbury': pp. 93–106; Paul Hayward, 'William of Malmesbury as a Cantor-Historian', in Katie Ann-Marie Bugyis, A.B. Kraebel, and Margot E. Fassler, eds., *Medieval Cantors and Their Craft: Music, Liturgy and the Shaping of History, 800–1500* (Woodbridge: Suffolk York Medieval Press, 2017): pp. 222–239; Fassler, 'The Office of the Cantor': pp. 29–51.

[3] The most relevant works on this topic are, for William of Malmesbury, Thomson, 'William of Malmesbury as Historian', pp. 387–413; and for John of Worcester, see Martin Brett, 'John of Worcester and His Contemporaries', in R.H.C. Davis and J.M. Wallace-Hadrill, eds., *The Writing of History in the Middle Ages: Essays Presented to Richard William Southern* (Oxford: Oxford University Press, 1981): pp. 101–126; Valerie Flint, 'The Date of the Chronicle of 'Florence' of Worcester', *Revue Bénédictine* 86 (1976): pp. 115–119; John of Worcester, *The Chronicle of John of Worcester,* vol. II, Patrick McGurk, ed. and trans., (Oxford: Clarendon Press, 1998): pp. xv–xlviii; Paul Hayward, ed. and trans., *The*

the era discussion previously embraced by Abbo of Fleury, Marianus Scotus, and Robert of Losinga and the relation of computistical studies to the writing of history that forms part of the focus of the present discussion. As historians, John and William, like Bede and Marianus Scotus, were obliged to be up to date on computistical studies. While their perceptions of the accuracy of the current theories were, to some degree, shared, William and John differed in their adoption of the era in their actual histories. Their astronomical interests were also broadened by their awareness of the channel opened by Gerbert to the *Alchandreana* and other texts, as will be discussed below. In this, their perception that the science of the stars was related to prognostication, including astrology, is germane. William of Malmesbury, as we have seen in his own description of Gerbert, was fascinated by both the 'noxious and the salubrious' uses of astronomy.

Within discussion of post-conquest learning and the development and reception of new scholarly frameworks, the activity that has most often earned the Severn Valley a place in studies of the twelfth century was the historical writing produced there.[4] The *Chronicle* of John of Worcester served as a catalyst for historical writing throughout England, used as a source in the writings of Symeon of Durham (d. post-1129) and Henry of Huntingdon (d. 1157).[5] The contemporary fame of William of Malmesbury's historical writings is well-established.[6] Moreover, as recent studies have continued to emphasise, historical writing was far from the only learned pursuit in the area. Severn Valley scholarship went well beyond the classics and the *trivium*. The sciences, as represented by the *quadrivium*, had a special home in this valley.

Winchcombe and Coventry Chronicles: Hitherto Unnoticed Witnesses to the Work of John of Worcester (Tempe, AZ: Arizona Center for Medieval and Renaissance Studies, 2010): pp. 3–98; Lawrence-Mathers, 'John of Worcester'.

[4] See particularly, Haskins, *Studies*; Southern, *Robert Grosseteste.*

[5] See Charles C. Rozier, 'Durham Cathedral Priory and Its Library of History, c. 1090–c. 1150', in Cleaver and Worm, eds., *Writing History*: pp. 133–148; Charles C. Rozier, *Writing History in the Community of St Cuthbert, c. 700–1130: From Bede to Symeon of Durham* (Cambridge: Cambridge University Press, 2020); Symeon of Durham, *Historia ecclesiae Dunelmensis*, in Thomas Arnold, ed., *Symeonis Monachi Opera Omnia: Volume 1* (Cambridge: Cambridge University Press, 2012); Henry of Huntingdon, *Historia Anglorum*, in Diana Greenway, ed., *Historia Anglorum: History of the English People* (Oxford: Oxford University Press, 1996).

[6] See most recently the collection by Thomson, Dolmans, and Winkler, eds., *Discovering William of Malmesbury*.

William of Malmesbury, Walcher of Great Malvern, and John of Worcester all feature as persons of interest in the history of twelfth-century science.

Each of these scholar-monks lived in Benedictine houses in close or relatively close geographical proximity to each other: Great Malvern and Worcester were one days' ride apart, and while Malmesbury to Worcester was a three-day ride, the path was well-trodden, with Cirencester and Tewkesbury offering comfortable accommodation.[7] They all lived long lives to roughly the same period, dying within eight years of each other, c. 1135–1143. William and John were, in all probability, raised in the Severn Valley area and spent their lives in their respective monasteries. While William and John both travelled, they appear to have done so only within England.[8] Walcher had travelled further afield, though still within Latin Christendom, in Germany, France, and Italy, before coming to England by 1092 to be eventually appointed as Prior of Great Malvern.

The intellectual and textual connections between the monasteries in the Severn Valley were further developed under the leadership of Wulfstan and Robert of Losinga. Document sharing and individuals travelling between monasteries appear to have been encouraged, as were the scholarly connections to other centres of learning in England and beyond. As will be shown throughout this thesis, Worcester and Hereford had strong relationships with Ramsey, Glastonbury, Winchester, and Durham. Manuscript provenances and records of travellers, such as Orderic Vitalis, reveal additional hints of the Severn Valley monasteries' connection to other areas of Europe.[9] These connections, which will be demonstrated in the upcoming chapters, include Mont Saint Michel, Fulda, Chartres, Rouen, and possibly Monte Cassino. Moreover, Walcher of Great Malvern, John of Worcester, and William of Malmesbury had inherited an already lively enthusiasm for the science of the stars from Robert of Losinga and others; an enthusiasm that they carried forward and which, in particular, was a prerequisite for their reception of the new learning.

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[7] Route confirmed in personal correspondence with Professor Julia Barrow, who suggested that such a trip would go Malmesbury–Cirencester (via Fosse Way)–Cheltenham–Tewkesbury and then up the main road on the eastern side of the Severn to Worcester.
[8] Rodney Thomson, 'The Rediscovery of William of Malmesbury', in Thomson, Dolmans, and Winkler, eds., *Discovering William of Malmesbury*: pp. 219–224 suggests he may have been to Normandy.
[9] Orderic Vitalis, *Ecclesiastical History*, in Chibnall, III.ii.161: pp. 188–189, Orderic says of John of Worcester, 'Unum eorum Wigornae vidi in Anglia'.

Map 1 - Severn and Wye Valleys in the 12th Century

Map #6: The Severn Valley Basin, including Worcester, Malvern, Bath, and Malmesbury

2.1 WALCHER OF GREAT MALVERN BEFORE PETRUS: MONASTIC TIME KEEPING, INSTRUCTION, AND *COMPUTI*

Oxford, BL, Auct. F.1.9, fol. 88r: Walcher's diagram of an astrolabe in *De lunationibus.* The text cited above is a translation of the Latin describing this diagram.

> *It will not be easy for you to draw this diagram correctly, unless you are thoroughly acquainted with the rules for constructing an astrolabe. For the three circles are here drawn in proportion in the same way as [in the astrolabe. And] just as [on the*

astrolabe] the first almucantar is put down in accordance with the latitude of a given province, so it is the case here with the red line representing the border between day and night. The difference, hereafter, [between the two] is as follows: in the astrolabe further almucantars follow upon the first one; here, on the other hand, whatever portion of the circles the red line has on either of its sides is divided into twelve, and dots are impressed [on them], through which curved hour lines are drawn. Both here and [in the astrolabe], however, the left side of this division remains completely the same, whereas the other one does not.

Walcher of Great Malvern*, De lunationibus 3.2*[10]

Walcher of Great Malvern is the first person in the Latin West known to have used the astrolabe and recorded his findings. In the section above in *De lunationibus*, Walcher was giving instructions for the use of an astrolabe. It is highly reminiscent of Gerbert's language of instruction, demonstrated in Chapter I. Walcher's journey also reveals the story of the introduction of the new sciences in a personal, autobiographical manner. Walcher's self-portrait in *De lunationibus* revealed a scholar well trained in the learning traditions of the cathedral schools. According to William of Malmesbury, Walcher had spent some time at Fulda, and there is reason to believe that he was educated in Liège, where Robert of Losinga received his education in the *quadrivium*.[11] From Walcher himself, we know that he was in Italy, thirty miles east of Rome, in October of 1092. Nothaft has suggested that he may have been travelling from Monte Cassino to Rome at the time.[12] This theory has some attraction, especially in light of possible connections in the Severn Valley to Monte Cassino. Walcher was appointed Prior of Great Malvern in approximately 1120.

[10] Walcher*, DL*, 3.2, pp. 102–103: 'Componere hanc figuram recte non leviter poteris nisi regulas de compositione astrolabii perfecte noveris. Sicut enim ibi componuntur tres circuli proportionaliter, ita et hic. Quemadmodum ibi iuxta cuiuslibet provincie latitudinem primum imponitur almuncantaraz, ita et hic rubens linea confinium tenens diei et noctis. Postea sit differentia talis: in astrolabio post primum almuncantaraz secuntur cetera, hic autem quantum in qualibet sui parte omnium circulorum rubens habet linea, tantum in XII dividitur punctique imprimuntur per quos oblique linee horarum ducuntur. Ibi autem et hic, sinistra pars huius divisionis prorsus eadem est, altera vero ibi non est.'
[11] William, *GP,* II.292.I, p. 526, 'Sed quia Fuldense cenobium nominaui, dicam quod ibidem accidisse uir renerendus michi naravit, Walkerius prior Maluerni, cuius uerbis qui non credit iniuriam religioni'.
[12] Nothaft, ed., *Walcher*, p. 93.

Walcher has been described by McCluskey as having distinguished himself for his questioning mind and careful, observational approach.[13] As characterised by McCluskey, Walcher's *De lunationibus* drew on two medieval astronomical traditions, timekeeping and *computus*, but with decidedly new purpose and precision.[14] Like Gregory of Tours, he was concerned with timekeeping, a critical skill for a man of his position as prior of a monastery. Like Gerbert, he had a particular interest in the tools at his disposal: the astrolabe, the horologium, and the abacus. He presented *De lunationibus* as a teaching tool, possibly for his own community. Walcher was a master in the computistical arena as well. He was aware of both the ecclesiastical and *computus naturalis,* moving his arguments between the theories of Bede, Hermann of Reichenau, and Gerlandus with ease.[15] Walcher also showed himself to be a scholar willing to go beyond the specialisation of mathematical and computistical investigation into a more observational method of inquiry. Specifically, he was fascinated by the rotation of the moon.

His work, *De lunationibus,* on lunar phenomenon, was written before he was aware of the new sciences, or in approximately 1108; the *De dracone* was written ten years later, after he had met Petrus Alfonsi, one of the great scientific influencers of this period. This chapter section will focus on Walcher's life and his science *prior* to his meeting with Petrus, beginning with a description of *De lunationibus*. This document adds much to Walcher's biography and self-discovery. An analysis of *De lunationibus* presents themes that are important to a study of the scientific tradition in the Severn Valley. A more thorough analysis of Walcher's life and encounter with Petrus Alfonsi will be undertaken in Chapter IV.

2.2 *DE LUNATIONIBUS*

In *De lunationibus*, Walcher expressed dissatisfaction with the computistical tables, which seemed inadequate for guiding other human activities, such as medical prognostication or

[13] McCluskey, *Astronomies*: pp. 180–182.
[14] The best summary of Walcher's work (*DL*) is found in McCluskey, *Astronomies*: pp. 180–186.
[15] Nothaft, ed., *Walcher*: pp. 11–45.

weather forecasting. He stated one of his purposes in writing his work, 'If the change in the Moon's waxing and waning has certain effects on human action or medical practice, as wise men know from experience, it is necessary that the hour of the Moon's kindling—and, thereafter, the dimension of its whole circuit—is always discerned with exactitude'.[16] Walcher wanted to find a way to predict the exact time of each new moon and proposed that finding and predicting the timing of lunar eclipses would give him that metric.

De lunationibus is divided into six books. The first and second books discuss the length of the lunar month. Walcher proposed that the most accurate method is to start with eclipse events, either the conjunction or opposition of the sun and moon. In Book 3, he explained how to convert from equinoctial hours into temporal hours. He also explained why these two calculations differ and what tools to use. Here, the use of the astrolabe is described in detail, along with a diagram (above). Book 4 provides the nexus of the work and includes his lunar tables based on 19-year cycles grouped into 76 years. These groupings would traditionally advance computistical calculations of the Easter cycle, but Walcher disassociated his work from ecclesiastical needs beyond timekeeping and was able, as he himself states, to create a more precise format. In Book 5, Walcher began with the sun's zodiacal path and then focused on the moon's journey through the zodiac, describing it in precise mathematical terms. In Book 6, Walcher described the test of all his work and came to the remarkable conclusion that he had done something wrong, that he had made a mistake. While this section provides the perfect segue to his encounter with Petrus, Nothaft has convincingly argued that it was written after his meeting with Petrus. The material in that section will be treated in Chapter IV of this thesis.

Walcher's *De lunationibus,* in many ways, fits into the tradition of Gerbert, using known tools, such as the astrolabe, and methods of calculation, such as dividing the rotations into degrees of 365.5 (rather than the 360-degree measurement used only a few years later). But amidst a dense layer of computational language, Walcher painted a rare autobiographical portrait. It is a portrait of a scientist who knows there is something else to be learned. Walcher's account of the development of his ideas about the moon is one of the most compelling accounts

[16] Walcher, *DL*, 2.1: pp. 94–95: 'Si in humanis actibus velut in exercitationibus medicine aliquos habet effectus lunaris incrementi sive detrimenti varietas, sicut sapientes experti senserunt, necesse est ut accensionis lune dies et hora semper ac deinde totius discursus eius dimensio ad purum dinoscatur'.

of this period. It is both vivid and self-revealing. In *De lunationibus,* Walcher tells of how he had observed a lunar eclipse in Italy in an undocumented location east of Rome.

> In the year of the Lord's incarnation 1091 according to Dionysius, I happened to be in Italy, one and a half day's journey east of the city of Rome, where on 30 October I saw an eclipse of the Moon on its 14th [day], which took place towards the west before the break of dawn; but neither did I then have a time-measuring device [with me], by which I could have determined the hour of the full moon, nor did the Moon itself appear clearly because of the concentrated fog that stood in the way. I remember seeing it horned like a V, but as the fog grew even thicker I could not see when it began to be eclipsed or when it had regained the fullness of its light. And so, upon returning to England, when I asked certain people if any one of them had seen the eclipse at that time, a certain brother told me this: he had spent the whole day that preceded the night in question going about his daily business and did not get home until most of the night had already passed. Afterwards he had supper, after the meal he sat a while, and then a servant, who had gone out, came back stupefied and said that a horrible sign was showing itself in the Moon. When he himself went out, he saw it and recognised that it was still long before midnight. For the Moon still had a long way to go before it was in the south, which the full moon always occupies at midnight.[17]

He went on to describe that this observation indicated that the eclipse occurred at different times depending on the observer's geographic location, 'And thus I perceived there to be a considerable distance in hours between Italy and this our island of England, since there it was eclipsed shortly before dawn, when it was already turning towards its setting-place, but here long before midnight, when it was still ascending from its rising place'. Walcher described himself as frustrated that in his quest for an accurate calculation, he had 'no starting point—whether for this or that country—for the cycle I wanted to create, I was very depressed and remained in a searching state'.[18]

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[17] Walcher, *DL*, 4.1: pp. 114–115: *'*Anno ab incarnatione domini iuxta Dionisium MXCI contigit me esse in Italia in parte orientali ab urbe Romana itinere diei et dimidii, ubi defectum lune XIIII vidi III kal. Novembris ad occidentalem plagam ante aurore exortum. Sed nec horologium tunc habui, quo plenilunii horam deprehenderem, nec ipsa luna conspicue densis obstantibus nebulis apparebat. Memini me vidisse eam corniculatam in modum V, sed quando deficere incepit, vel quando rursus plenitudinem sui luminis recuperavit vehementius densatis nebulis videre non potui. Reversus itaque in Angliam, cum quesissem a quibusdam si quis eo tempore videsset eclipsim narravit mihi frater quidam ea die tota que noctem illam precesserat diurno tractande cause negocio se occupatum, plurima iam noctis parte transacta domum venisse, postea cenasse, post cenam parumper sedisse et quendam de familia egressum attonitum regredi, dicentem horribile prodigium in luna monstrari , quod ipse dum exisset videt et agnovit diu ante mediam noctem. Multum enim adhuc a plaga meridiana distabat, quam semper luna plena nocte tenet media'.

[18] Walcher, *DL,* 4.1: pp. 114–115: 'Iamque inter Italiam et hanc nostram Anglie insulam non modicam horarum animadvertebam distantiam, cum illic paulo ante auroram defecerit, iam vergens ad occasum, hic vero diu ante mediam noctem adhuc ab ortu ascendens. Sed cum nil certum haberem, neque de illa

Walcher waited for the next opportunity, the night of October 18, 1092, this time armed with his astrolabe:

> And behold, as if to cheer me up by helping my studies, it underwent another eclipse in the following year during the lunation of the same month, and its darkening on 18 October brought me light, because it dispelled the lightless gloom of my ignorance. For as soon as I seized my astrolabe I made a careful observation of the time when the murky blackness had swallowed up the whole Moon and the eleventh hour of the night was then spent, the third point having passed.[19]

Walcher used his observations to develop a method to recalculate lunar event tables, which form the material presented in Book 4. The abacus mathematics describing his new process is impressive, and at this point in his studies, all the data he had at his disposal lined up with his findings.

Throughout *De lunationibus,* we find themes illustrative of what may be called the culture of inquiry that developed in the Severn Valley. First, Walcher is explicitly not attempting to provide new or critical insight into the calculation of Easter. He uses Bede to provide backup for the idea that observation will not line up with the agreed-on Easter cycle. He alludes to Bede's *De temporum ratione*:

> It is of course true that the computation commonly in use, to which the 19-year cycle corresponds, was by the authority of the holy fathers reasonably and usefully devised for finding the boundary-dates of Easter and the other [movable feasts], but it cannot be completely equated to the natural course.... We have inserted this from the writings of the blessed Bede so that nobody will be bewildered when he discovers that the natural calculation, which we are here to elucidate, anticipates the common calculation by two or perhaps more days. [20]

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neque de hac terra, unde quod in voluntate habebam cyclum texere inciperem, grave ferebam et in instantia querendi permanebam.'

[19] Walcher, *DL*, 4.1: pp. 114–115: 'Et ecce, anno sequenti eiusdem mensis lunatio, tamquam meis occurens studiis ut me reficeret, iterum defecit et XV kal. Novembris obscurata me illuminavit, quia ignorantie mee tenebras ipsa lumina privata depulit. Mox enim ego apprehenso astrolapsu horam qua totam nigredo caliginosa lunam absorbuerat diligenter inspexi et undecima noctis agebatur hora, tertio puncto peracto'.

[20] Walcher, *DL*, 2.1: pp. 94–95: 'Vulgaris quippe supputatio, qua constat cyclus decennovenalis, sanctorum patrum auctoritate rationabiliter et utiliter pashalibus terminis et ceteris inveniendis est prefixa sed naturali discursui coequari non potest per omina...Hec iccirico ex scriptis beati Bede interseruimus, ne quisquam miretur cum naturalem supputationem, cui dilucidande servimus, biduo vel fortasse plus interdum vulgate supputationi antecedere deprehenderit'; for the Bede text see Bede, *DTR* (1980): pp. 412–418; Bede, *DTR* (1943), Ch 43: pp. 257-260); Wallis, trans., *Reckoning of Time,* Ch. 43: pp. 115–

While Walcher here gave notice that his observations will conflict with that of the *computus ecclesiasticus*, he self-identified as a *computus naturalis*. Walcher was a trained and skilled computist, though he used these skills for a different purpose. The themes presented in *De lunationibus* suggest Walcher's purpose partially reflected those of the traditions of Gregory of Tours and Gerbert of calculating the hours of prayer and teaching.

Walcher spends some time in this work instructing his reader on how to convert the equinoctial hours into the horological hours for the appropriate latitude and time of year.

> *On the twofold distinction between hours*. Although it may perhaps seem that you already have a complete grasp of the lunar kindlings, you still lack a noble and useful part of the work, which concerns the measurements of hours. As is obvious, the measurement that is carried out with sundials always splits one day into twelve hours, whatever its length may be, [whereas] the hours we have discussed must all be equinoctial and equally distributed. Because of this, you will often err in this investigation and accept what is false for the truth, unless you know how to translate any number of horological hours of any given day or night into equinoctial ones and equinoctial into horological ones.[21]

This is reminiscent of Gregory of Tours and his discussion of the proper way to calculate hours:

> This reckoning of the sun, how or how many hours it shines in a single month; and although in each season twelve hours are reckoned, [the hour] does not have equal measure; if in reality you wish them to hold equal measure, there will be, as we have said, 15 hour long days. [22]

Gregory, like Walcher, then spent some time outlining the number of hours of daylight and moonlight each month and providing stellar indicators for the changes.

119; for commentary see Wallis, trans., *Reckoning of Time*: pp. 328–332 and Jones, , ed., *DTR* (1943), 'Introduction': pp. 378–379.

[21] Walcher, *DL*, 3.1: pp. 100–101: '*De bipertita discretione horarum.* Quamvis iam fortasse ad plenum tibi lunarium accensionum cautelam habere videaris, deest adhuc pulchra pars laboris in horarum dimensionibus et utilis. Horologica quippe dimensio omni tempore unum diem cuiuscumque sit magnitudinis in XII horas findit et hore de quibus tractavimus omnes equinoctialiter debent et equaliter distribui. Quapropter, nisi quotlibet horas cuiuscumque diei sive noctis horologicas equinoctialibus et equinoctiales horologicis redere noveris, sepe in hac inquisitione errabis et falsum pro vero tenebis'.

[22] Gregory of Tours, *De cursu stellarum ratio,* in Bruno Krusch ed., *MGH SS Rer. Merov.* I.2 (Hannover: MGH, 1885), XVII: pp. 413: 'Solis autem haec ratio, qualiter aut quantis horis in singulis luceat mensibus; et quamquam omni tempore horae duodicem conputentur, non tamen aequalem habet mensuram; si vero aequalem vis tenere mensuram, erunt, ut diximus, in diebus longis horae 15'. Translation by Bader.

It cannot be ignored that Walcher wrote that the reason the study of the moon is important is that it 'has certain effects on human action or medical practice.' Astronomy and astrology (with medicine very much connected to the latter) were never far apart in this period. Nothaft's discussion of the possible 'astro-medical impetus' of Walcher's text is insightful, especially in terms of the possible influences Walcher had on his work. It is tempting to see *De lunationibus* in the light of Anglo-Saxon and early Norman lunaries. These texts prescribed which days of the lunar cycle were beneficial to which activity, including travel, marriage, blood-letting, or planting. At first glance, Walcher's careful calculations of lunar events might appear to fall within this tradition. Nothaft points out that Walcher's methods do not, however, easily lend themselves to this prognostic methodology. Rather, Nothaft proposes that Walcher's zodiacal focus on the moon's rotation is more closely reflective of the work of Constantine the African. His exposure to Constantine's works is tenuous but certainly feasible. Nothaft reflects back on Walcher's travels in Italy, which may have brought him to Monte Cassino and thus within reach of Constantine's influence. In keeping with this, evidence of a manuscript trail from Monte Cassino to Worcester and to William of Malmesbury will be discussed below.

It is also important to note that this text was primarily a teaching tool and was perceived as such by Walcher's contemporaries. His language is directed at the student: 'if it pleases you' and 'but if you ask why'.[23] This is the language of instruction. To illustrate his points around the discussion of horological hours, Walcher uses a diagram illustration in the text, his own direction on how to use an astrolabe, and the instruction of another teaching treatise, *De utilitate astrolabii* by Hermann of Reichenau [see image above]. *De lunationibus* achieved some popularity, particularly in England, and was most often bound with other teaching texts. The collections that included Walcher's work often focused on the era or the Paschal question, such as relevant sections of Bede and the Dionysius Exiguus letters, Abbo of Fleury, Helperic of Auxerre, and sometimes, Gerland. It was also often bound with Robert of Losinga's excerpt on the era calculation. This is the case for five out of the seven known copies of the *De lunationibus*.[24]

[23] Walcher, *DL*, c. 1.3, 1.2, and 2.7, as examples.
[24] Wallis, 'Albums of Science': pp. 195–224.

2.3 THE SEVERN VALLEY HISTORICAL WRITING AND COMPUTISTICAL STUDIES

As noted by Faith Wallis, computistical texts were often bound with other works that might seem unrelated to that topic.[25] Beyond the now obvious connections to astronomy, these texts were often bound with musical and medical texts, as in St. John's MS 17 and Durham Cathedral MS Hunter 100.[26] Often, these texts were also bound with or related to historical texts or annals. The Winchcombe annals in Cotton Tiberius E.IV, for instance, are bound with astronomical and computistical works.[27] In keeping with Wallis' challenge to review the body of the entire text from the perspective of those who put it together, the argument that astrological and computistical works were bound in the same manuscripts with histories because the historians and scribes themselves considered these topics to be related should be considered. Another subtle factor for the Severn Valley historians may have been the levels of contact between these scholars in the late eleventh and early twelfth centuries, which perhaps allowed the surges of interest in both historical writing and astronomical inquiry to become of mutual interest and support.[28]

Two of the most important historians in this respect are William of Malmesbury and John of Worcester. In style and approach, they were very different from each other, with the former

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[25] Wallis, 'Albums of Science'.

[26] Jay Diehl, 'The Saint, the Voice, and the Author: Imagining Textual Authority and Personal Presence at Durham Priory, ca. 1080–1150', *Viator* 47, no. 3 (2016): pp. 101–128; A.N. Doane and D. Rollason, '123. Durham Cathedral Library, Hunter 100', *Anglo-Saxon Manuscripts in Microfiche Facsimile Vol. 14: Manuscripts of Durham, Ripon, and York* (Tempe, AZ: Medieval and Renaissance Texts and Studies, 2007): pp. 111–122; Neil R. Ker, *Catalogue of Manuscripts Containing Anglo-Saxon* (Oxford: Clarendon, 1957), no. 110; M. Lapidge and P.S. Baker, 'More Acrostic Verse by Abbo of Fleury', *Journal of Medieval Latin* 7 (1997): pp. 1–27; Anne Lawrence-Mathers, *Manuscripts in Northumbria in the Eleventh and Twelfth Centuries* (Woodbridge, Suffolk: D.S. Brewer, 2003); R.A.B Mynors, *Durham Cathedral Manuscripts to the End of the Twelfth Century* (Oxford: 1939); Charles C. Rozier, 'Contextualizing the Past at Durham Cathedral Priory, c. 1090–1130: Uses of History in the Annals of Durham, Dean and Chapter Library, MS Hunter 100', *Haskins Society Journal* 25 (2013): pp. 107–123; F. Wormald, *English Benedictine Kalendars after A.D. 1100,* vol. 2 (London: Harrison, 1939).

[27] Oxford, Cotton Tiberius E.IV is now available in digital form, http://www.bl.uk/manuscripts/Viewer.aspx?ref=cotton_ms_tiberius_e_iv_f013v (accessed 08/04/2022); Manuscript descriptions are available in Wallis, *The Calendar and the Cloister*, https://digital.library.mcgill.ca/ms-17/apparatus.php?page=related_manuscripts#sec06 (accessed 08/04/2022) and Nothaft, ed., *Walcher*: pp. 78–81; see Hayward, ed. and trans., *The Winchcombe and Coventry Chronicles.*

[28] Wallis, 'Albums of Science': pp. 195–224.

modelling himself after Bede and the latter continuing the chronicle of Marianus Scotus and following his more annalistic style. As writers of history, both were concerned with maintaining an accurate chronology. Both were students of the era controversy. Both owned computistical collections, knew a good deal about computistical studies, and were fascinated by the science of the stars. The two scholars appear to have reacted very differently to the new sciences, as will be explored in the upcoming chapters. John was already clearly a computistical enthusiast and revolutionary of sorts before the 1120s and the arrival of the new sciences. The upcoming section will focus on John's knowledge and use of the computists in his role as a clerical historian *before* he put together his great scientific manuscript, Oxford, Bodleian Library, Auct. F.1.9.

2.4 JOHN OF WORCESTER AND CHRONOLOGY

John, a monk of Worcester Cathedral Priory (d. 1041), was appointed by Bishop Wulfstan of Worcester to edit and bring up to date the chronicle of Marianus Scotus.[29] As described in Chapter I, this chronicle was brought to England by Robert of Losinga. The *Chronicle of Chronicles*, as it is known, runs from the beginning of the world to 1140, Marianus' portion having ended in 1082. For a number of years, the extended chronicle was attributed to Florence of Worcester (d. 1118), who is mentioned by John himself as a skilled contributor to the work.[30] Recent scholarship has clearly shown through stylistic comparisons and the evidence of John's handwriting that John was the primary author throughout. John's chronicle used the Marianus Scotus chronicle as its base but drew from other historical sources such as the Anglo-Saxon Chronicle, Bede, and Eadmer. John's history went through many iterations and, thanks to the critical edition of Darlington and McGurk, a good deal about its growth can be ascertained. In outline, the first 'edition' was completed by 1131 and the last by 1140. As will be reviewed further in Chapter V, the timing of the two editions are critical to our understanding of the growth of John's knowledge of the science of the stars. In this chapter, the focus will be on the

[29] For references for John of Worcester, see Chapter II, [2.0].
[30] John, *Chronicle,* III, s.a. 1118: pp. 142–143: 'Huius subtili scientia et studiosi laboris industria preeminet cunctis hec chronicarum chronica'.

computistical matters he had already absorbed in the early phases of his work, prior to his awareness of the new sciences.

John, like William, consciously followed in the historical tradition of Bede. In his entry for Bede's death, he clearly designated Bede as the master of historical writing and designated himself as Bede's successor. Bede, he states,

> recorded many of the deeds of his own people down to that time in a splendid work, and ended at the one and the same time his earthly life and his history. With God's inspiration we have thought it fitting that, from the happy end of Bede's life, as we have found events in the text of the English chronicles and in trustworthy accounts of faithful men, and those things beyond doubt that we ourselves have heard, and some that we have seen with our own eyes, should henceforth remain faithfully recorded for the memory of our successors.[31]

Here, John has outlined his historical methodology. His chronicle put mention to practice.

Besides the Anglo-Saxon Chronicle, the other 'credible accounts of trustworthy persons' that John used in his work are Bede's *Historia ecclesiastica*, Asser's *Life of King Alfred*, Eadmer's works, and William of Malmesbury's *Gesta regum* and *Gesta pontificum*. John has been considered a conscientious historian by including documents within his writing, at times quoted in full, such as, for example, the record church councils held in London in the years 1125 and 1127.[32]

John also followed Bede in his interest in computistical study. Here, however, the greater influence belongs to Marianus, whose chronology John read, understood, and imitated. Marianus had explained his era calculations and refuted those of others in the introduction to his chronicle. In the process, Marianus provided a summary of traditional computistical study, including the

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[31] John, *Chronicle*, II, s.a 734: pp. 184–185: 'Hic sue gentis quamplurima gesta hucusque luculento descripsit sermone unumque temporalis uite modumque terminauit hystorie. Nos uero, Deo aspirante, ab ejus uite felici exitu, prout Anglicarum cronicarum repperimus textu, fideliumque uirorum credibili relatu, uel que nos ipsi indubitata audiuimus, vel quedam que oculis aspeximus amodo fideliter notata, fidelium successorum relinquenda dignum duximus memoriae'.

[32] The first is a record of the canons outlined in a synod held in London, the second a record of the statutes of a legatine council. See John, *Chronicle*, III, s.a. 1125: pp. 160–165; John, *Chronicle*, III, s.a. 1127: pp. 168–173. Both the synod and the council are discussed with John as a primary source in Dorothy Whitlock, Martin Brett, Frederick Powicke, Christopher Cheney, and David Brook, eds, *Councils and Synods: With Other documents Relating to the English Church*, ii (Oxford: Clarendon Press: 1981): pp. 733–741 and pp. 743–749 respectively.

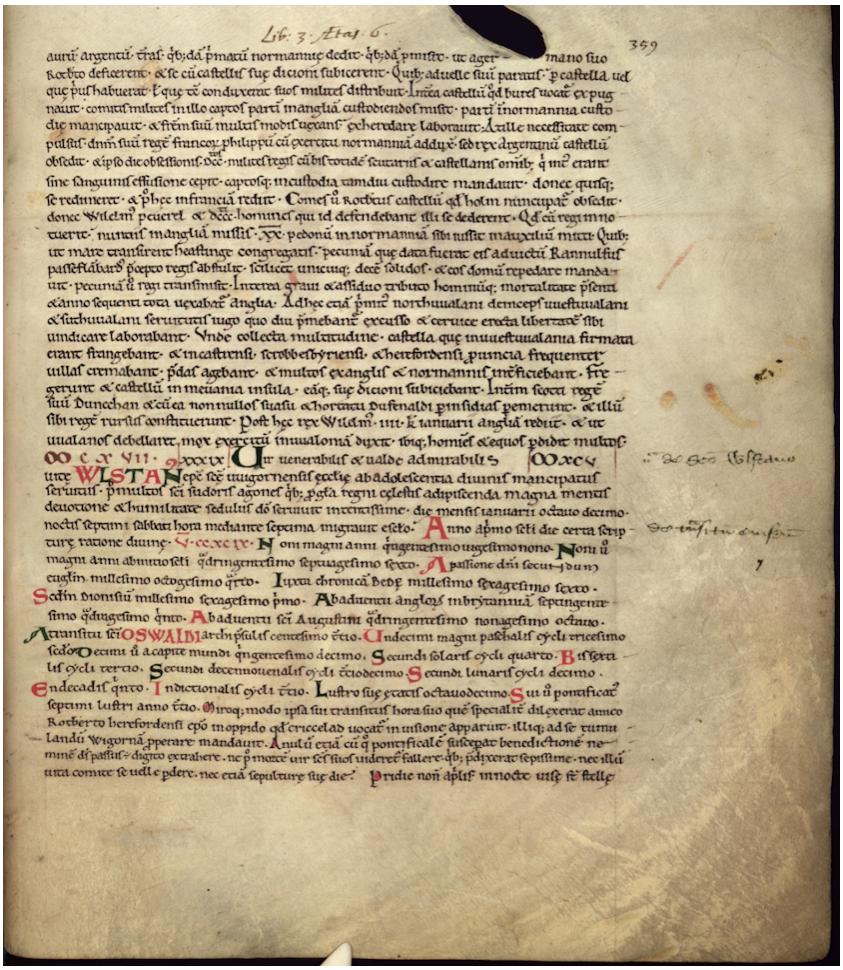
work of Theophilus, Dionysius, and Bede, and provided an Easter table based on his era calculation. Since this also formed the introduction for John's work, it can be assumed that he had read it. John's *Chronicle* reveals that this is the case; it continued the chronological system adopted by Marianus. In annual entries, the year listed first was the year of the Incarnation according to Marianus, then John would enter the regnal year of the German Emperor, and finally, the year of the Incarnation according to Dionysius. John, like Marianus, was very conscious of chronological material. His concordances for years often read as though he was reading from an elaborate Easter table. The year for 1128, for instance, reads, 'Henry, King of England, in the 28th year of his reign on the Octave of Easter which was the 3rd Kalends of May [29th April], on the 7th Indiction, when the concurrent was 7, in a leap year, when the epact was 25'.[33] These entries reveal John's familiarity with the Great Cycle and the lunar and solar cycles, 'in the thirteenth year of the fourth nineteen-year cycle, in the fourteenth year of the third solar cycle, and the first year of the sixth leap-year cycle'.[34] John was also familiar with other eras. Another concordance for the year 1128 reads, 'in the second year of the 470th Olympiad, seventh indiction, on the twenty-fifth moon, on Saturday, the 6th ides of December [8th December]'.[35] All of these entries reveal an easy fluency with both traditional computistical language and that which was passed on to him by Marianus.

In the entry for the year 1095, however, John outdoes himself. The year of Wulfstan's death was particularly important to a monk of Worcester, and John dressed it up as he best knew how (this passage is repeated from above for the reader's convenience):

> *Wulfstan the venerable bishop of the holy church of Worcester . . . passed away in the night of Saturday, the eighteenth of January, about the middle of the seventh hour, and in the year 5299 from the beginning of the world, according to the undoubted reckoning of the holy scripture, in the 529th year of the 9th Great cycle or the 476th of the ninth from the beginning of the world; in the 1084th from the passion of our Lord according to the Gospel, but the 1066th according to Bede's chronicle, and the 1061st according to Dionysius; in the 745th from the arrival of the Angles in Britain; in the 498th from the*

[33] John, *Chronicle*, III, s.a. 1128: pp. 176–177: 'Rex Anglorum Heinricus anno regni sui xxviii, in octavis Pasce quod erat iii kal. Maii, indictione vii, concurrentibus vii, bissextilibus, epactis xxv' [translation modified slightly].
[34] John, *Chronicle*, III, s.a. 1131: pp. 202–203: 'Annus cycli decennovenalis iiii xiiii, cycli solaris iii xiiii, bissextilis vi, annus i'.
[35] John, *Chronicle*, III, s.a. 1128: pp. 182–183: 'Olimpiadis cccclxx anno ii, indictione vii, luna xxv existente, vi idus Decembris, sabbato' [translation modified slightly].

arrival of St. Augustine; in the 103rd from the death of St. Oswald, the Archbishop, in the 32nd of the 11th Great Paschal Cycle, and in the 510th in the tenth cycle from the beginning of the world, in the 4th of the second solar cycle, in the 3rd of the leap-year cycle, in the 13th of the second lunar cycle, in the 5th endecade, in the 3rd of the Indictional cycle, in the 18th lustre of his own age, and in the 3rd year of the seventh lustrum of his episcopate.[36]



CC157, 359r, indicated are the three sets of years presented in the margins. This date refers to Wulfstan's death.

Several things must be noted about this passage. The first and most obvious is that John not only had a fluency with computistical language, but he also enjoyed it. He was also comfortable with the traditional computistical terminology and charts and with the theories of

[36] Oxford Corpus Christi 157: p. 359; John, *Chronicle*, III, s.a. 1095: pp. 74–75 (Latin provided above).

Marianus. The computistical data given in this passage reveal a heavy reliance on Marianus. John gave a number of different calculations for the beginning of the world and for the Passion. This passage is, in many ways, a brief summary of Marianus' introduction to his chronicle. John used Marianus' calculation of 4204 for the beginning of the world and used his calculation for the Passion.[37] He also follows Marianus by indicating the differences in the date of the Passion according to Bede's continuation of Eusebius' chronicle and that of Dionysius. As indicated earlier, Marianus' *Chronicle* placed the Eusebius/Bede calculation for the passion in A.D. 29, and Dionysius' calculation in the year 34. John gave the same five-year difference in the concordance above.

John's knowledge of computistical study up to the year 1131 seems to have been limited to traditional computistical study and the knowledge imparted to him by Marianus Scotus. This is not to belittle that knowledge. Marianus' theories were very avant-garde for the early twelfth century. John, by his fluency with the computistical calculations, showed that he had mastered the techniques and was eager to learn. John's work will be revisited in some detail in Chapter V, for he is key to a description of the reception of the new texts.

2.5 WILLIAM OF MALMESBURY

Although William of Malmesbury is one of the more renowned scholars of the early twelfth century, we know very little about his life.[38] He was born around 1090, perhaps in the Malmesbury area.[39] He was of mixed Anglo-Saxon and Norman parentage and went to the monastery at Malmesbury at an early age.[40] William remained there until his death in 1143,

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[37] 4204+1095=5299; 1095+22 (Marianus' difference from Dionysius) -34 (Christ's then accepted age at death) = 1083.

[38] A good analysis of William's life is William Stubbs' preface to his edition of *Willelmi Malmesbiriensis monachi De gestis regum Anglorum,* vol. 1 (London: Her Majesty's Stationery Office, 1887): pp. ix–cxlviii; Reginald R. Darlington, *Anglo-Norman Historians: an Inaugural Lecture Delivered on 20 May 1947* (London: Birkbeck College, University of London, 1947); Rodney Thomson, *William of Malmesbury* (Woodbridge: Boydell Press, 1987).

[39] William says he is a 'compatriota' of Dunstan, who was from Somerset, Stubbs, *Willelmi*: p. xii.

[40] William, *GR*, III.1: p. 424–425: 'De Willelmo rege scripserunt, diuersis incitati causis, et Normanni et Angli . . . Ego autem, quia utriusque gentis sanguinem traho, dicendi tale temperamentum seruabo'; of interest is Robert Stein, 'Making English History: Cultural Identity and Historical Explanation in William

having served the monastery for most of his life as cantor and librarian. William's life as librarian was concerned, not surprisingly, with literary works; he both collected and composed them.

The Malmesbury library collection, perhaps begun by Aldhelm (d. 709), was, according to William, increased with renewed vigour under the abbacy of Godfrey of Jumieges (a. c. 1082-1105).[41] In his time, 'some books were copied, or rather a start was made on building up a library'.[42] William also considered his library of primary importance and followed Godfrey in expanding the collection.

> Indeed (if I can say this without boasting) I have easily surpassed them all. May there be someone to look after the present stock! I have collected much material for reading, approaching the prowess of my excellent predecessor at least in this respect; I have followed up his laudable start as best I could.[43]

William's official role in Malmesbury monastery was that of cantor. Recent work on the changing role of the cantor in the late eleventh and twelfth centuries argues that the cantor would have had a large role in interpreting the liturgical calendar.[44] With respect to William, it is clear that his role would have involved organising the daily and annual liturgical calendar. He would have been responsible, as Walcher had been responsible, for understanding when prayers were to take place. As noted by Anne Lawrence-Mathers, 'William of Malmesbury's appreciation of the ramifications of daily time-calculation is apparent in his remarks on both ecclesiastical institutions and learned individuals'.[45] An example of his awareness and attentiveness is an account in the *Gesta pontificum* of two churches, the New Minister at Hyde and Winchester, disturbing each other's prayers by sounding the bells for a service at different times. As cantor,

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of Malmesbury and Laȝamon's *Brut*', in Sylvia Tomasch and Sealy Gilles, eds., *Text and Territory: Geographical Imagination in the European Middle Ages* (Philadelphia: University of Pennsylvania Press, 1998): pp. 97–115.

[41] David Knowles, Christopher N.L. Brooke, and Vera C. M. London, *The Heads of Religious Houses: England and Wales, 940–1216*, vol. 1 (Cambridge: Cambridge University Press, 1972): p. 55.

[42] William, *GP*, V.271: p. 644–45: 'Libri conscripti nonnulli, vel potius bibliothecae primitiae libatae'.

[43] William, *GP*, V.271: p. 644: 'immo, nisi quod dico iactantia sit, cunctos facile supergressus sim. Sit qui modo parta conseruet: ego ad legendum multa congessi, probitatem praedicandi viri in hoc duntaxat emulatus. Ipsius ergo laudabili cepto pro uirili portione non defui. Vutinam sit qui labores nostros foueat'.

[44] Fassler, 'The Office of the Cantor': pp. 47–51; Hayward, 'William of Malmesbury': pp. 222–239.

[45] Lawrence-Mathers, 'William of Malmesbury', in Thomson, Dolmans, and Winkler, eds., *Discovering William of Malmesbury*: pp. 93–106.

William's horological and calendrical sensibilities were already heightened, and he was clearly interested in works that would help him in that effort. William's computistical manuscript, Oxford, BL, Auct. F.3.14, analysed in detail below, is instructive in this regard. The importance he placed on this collection is reflected in the effort he took in collecting it, his notes and personal additions to it, and the use he clearly made of it in his works. William's role as historian (self-appointed or not), carried an even deeper connection for him to the work of the computists. He shared this connection with his neighbour and contemporary, John of Worcester.

In his early years, 'history seemed a delightful and amusing thing' to William.[46] The historical writer who delighted William the most was the Venerable Bede. Since the time of Bede, he states, 'you will not easily, I think, find anyone who has devoted himself to writing English history in Latin'.[47] William then offered that 'if was therefore my design, in part moved by love of my country and in part encouraged by influential friends [Queen Matilda] to mend the broken chain of our history, and give a Roman polish to the rough annals of our native speech'.[48] His first attempts to fill that chasm were major and valuable efforts – the *Gesta pontificum* and the *Gesta regum.* As Bede's self-appointed successor, William modestly wished that his work should earn him 'praise for my style, [or] at least tribute for my industry'.[49] William critically used all of the sources available to him: past historical works, charters, oral history, and even archaeological evidence.[50] William's use of visual history in his works is particularly interesting.

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[46] William of Malmesbury, *Commentary on the Lamentations of Jeremiah:* 'Olim enim cum historias lusi, viridioribus annis rerumque laetitae congruebat rerum jocunditas, this line is printed by J.A. Giles, trans., *William of Malmesbury's Chronicle of the Kings of England: From the Earliest Period to the Reign of King Stephen* (1857; repr., London: George Bell and Sons, 1904): p.vi. Translation in William of Malmesbury, *On Lamentations,* in Michael Winterbottom, trans. (Turnhout: Brepols, 2013): p. 9; Latin in *Willelmi Meldunensis monachi Liber super Explanationem Lamentationum Ieremi prophetae*, Michael Winterbottom and Rodney Thomson, eds. (Turnhout: Brepols, 2011).

[47] William, *GR*, I.Prol.: pp. 14–15: 'post eum non facile, ut arbitror, reperies qui historiis illius gentis Latina oratione texendis animum dederit'.

[48] William, *GR*, I.Prol.: pp. 14–15: *'*Vnde michi cum propter patriae caritatem, tum propter adhortantium auctoritatem uoluntati fuit interruptam temporum seriem sarcire et exarata barbarice Romano sale condire'.

[49] William, *GR*, I.Prol.: pp. 16–17: 'si non eloquentiae titulum, saltem industriae testimonium*'* (translation altered slightly).

[50] William Wells Newell, 'William of Malmesbury and the Antiquity of Glastonbury', *PMLA* 18, no. 4 (1903): pp. 459–512; Thomson, *William of Malmesbury*: p. 20; Sarah Foot, 'Glastonbury's Early Abbots', in Lesley Abrams and James Carley, eds., *The Archaeology and History of Glastonbury Abbey: Essays in Honour of the Ninetieth Birthday of C.A. Ralegh Radford* (Woodbridge: Boydell Press, 1991): pp. 163–189.

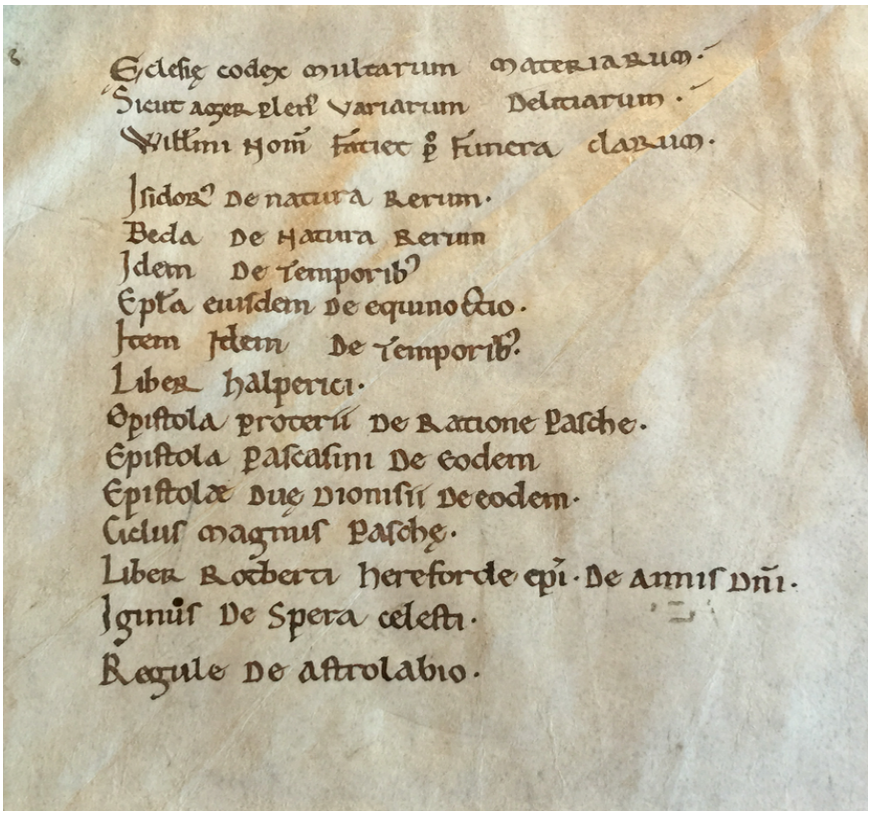
He had travelled England extensively in search of books and historical material, and his works, especially the *Gesta pontificum*, are full of descriptions of landscapes and buildings.[51] William not only followed Bede in his devotion to historical writing but in his interest in computistical study as well. This analysis will rely upon the computistical manuscript William owned and upon what he says about the computists in *Gesta pontificum, Gesta regum, Polyhistor,* and *Abbreviatio amalarii*.[52]

2.6 WILLIAM AND THE *COMPUTI*

Six manuscripts survive that have been found to contain the handwriting of William of Malmesbury.[53] The computistical collection, Oxford, BL, Auct. F.3.14, is one amongst them.[54] This manuscript was not only owned by William; he made heavy use of it. His additions and corrections are all through the text; in parts, he acted as scribe and, apparently, composed a short poem to preface the collection. William also seems to have had an active hand in the compilation of this manuscript. It was copied by a multitude of scribes, from a number of different exemplars, some perhaps coming as far as Monte Cassino.[55] Because of the number of scribes (at

[51] See Antonia Gransden, *Historical Writing in England, c. 550 to c. 1307*, vol. 1 (London: Routledge and Kegan Paul, 1974): pp. 174–175; William describes Athelney church in *GP*, II.92: pp. 312–313, Rochester in *GP*, I.17: pp. 215–221, and Worcester in *GP*, IV.149: pp. 438–439.
[52] Richard Pfaff, 'The 'Abbreviatio Amalarii' of William of Malmesbury', *Recherches de Théologie ancienne et médiévale* 47 (1980): pp. 77–113; Pfaff edited the text in 'The 'Abbreviatio Amalarii' of William of Malmesbury', *Recherches de Théologie ancienne et médiévale* 48 (1981): pp. 128–171.
[53] Neil R. Ker, 'William of Malmesbury's Handwriting', *EHR* 59, no. 235 (1944): pp. 371–376 at p. 371, had found William's hand 'certainly or very probably' in Oxford, Magdalen Coll., William's signature copy of the *Gesta Pontificum*, Lambeth Palace, 224 (Oxford: Bodleian Library, lat. 172) and Arch. Selden B.16 and Auct. F.3.14. (Oxford: Lincoln College, lat. 100). Farmer, 'William': p. 49 located another (Cambridge: Corpus Christi College 330); see also Thomson's discussion in 'William's 'Scriptorium', *William of Malmesbury* (1987, 2002): pp. 76–96.
[54] Falconer Madan and H.H.E. Craster, *A Summary Catalogue of Western Manuscripts in the Bodleian Library at Oxford Which Have Not Hitherto Been Catalogued in the Quarto Series*, Vol. II, pt. 1 (Oxford: Clarendon Press, 1922, 1937): pp. 332–333.
[55] Rodney Thomson has counted fourteen scribes at work on this manuscript, 'The 'Scriptorium' of William of Malmesbury', in Malcolm B. Parkes and Andrew G. Watson, eds., *Medieval Manuscripts and Libraries: Essays Presented to N.R. Ker* (London: Scolar Press, 1978): pp. 117–142 at p. 127.

least fourteen) and the sloppiness of some of the scripts, Thomson speculated that much of this document was hastily copied while William was travelling.[56]


Ecclesię codex multarum materiarum.
Sicut ager plenus variarum Deliciarum.
Willelmi nomen faciet post funera clarum.

Jsidorus De natura Rerum.
Beda De Natura Rerum
Idem De temporibus
Epta eiusdem De equinoctio.
Item Idem De temporibus.
Liber halpherici.
Epistola proterii De Ratione Pasche.
Epistola Paschalini De eodem
Epistolæ Due Dionisii De eodem.
Ciclus magnus Paschę.
Liber Rotberti Herefordie epi. De Amiss Dñi.
Iginus De Spera celesti.
Regule De astrolabio.

Oxford, Bodleian Library, Auct. F. 3.14 title page and full table of contents in William's hand.

William's compilation is preceded by a verse and a table of contents, both in William's hand.[57] The collection is then prefaced by a work listed in the *Summary Catalogue* as *De numero vel computo*, attributed by Rodney Thomson to William (an assignation that will be discussed

[56] Thomson, 'The 'Scriptorium''; see also R. Thomson, 'More Manuscripts from the 'Scriptorium' of William of Malmesbury', *Scriptorium* 35 (1981): pp. 48–54.

[57] The verse reads:

> Eclesiae [sic] codex multarum materiarum Sicut ager plenus variarum
> delitiarum Willellmi nomen faciet post funera clarum. (f. 0).

more below).[58] As noted in William's own table of contents, the collection begins with Isidore's *De natura rerum.*[59] The works by Bede begin on fol. 20r.[60]

Bede's *De natura rerum* is followed by *De temporibus,* and *De temporum ratione, Epistola ad Wicthedum* and *Epistola ad Pleguinam* on the equinox.[61] Fol. 102 begins Helperic's *De computo*. William also included four letters – two from Dionysius to Petronius and Boniface, one from Proterius of Alexandria (c. 454),[62] and one from Paschasinus, Bishop of Lilybaeum (c. 444).[63] The last two letters were written to Pope Leo the Great in support of the Alexandrian limits of the Easter celebration. The letters are followed by extended Paschal tables with added notes on historical events. Next is the treatise by Robert of Losinga on Marianus' calculations of the Incarnation. Of critical note is that the Paschal tables are those of Marianus.

The last items in the manuscript were listed in the Bodleian catalogue as additions of c. 1200.[64] As Thomson has pointed out, however, this cannot be the case since they are mentioned in the table of contents in William's hand.[65] These works were later partially emulated by John of Worcester, whose avant-garde taste in computistical reading material also sheds light on this section of the collection. The works include Hyginus' *De spera celesti*[66] and a collection of

[58] Madan and Craster, *A Summary Catalogue*, vol. II, pt. 1: p. 332; Thomson, 'Addenda': p. 330.
[59] Isidore of Seville, *De natura rerum*, in Jacques Fontaine, ed., *Traité de la Nature* (Bordeaux: Féret, 1960).
[60] BL, Auct. F.3.14 fol. 20r; this manuscript is not yet available in digital form.
[61] See Abbreviation List for editions of Bede's work. As noted there, Wallis, ed., *Reckoning of Time*, includes translations of *Epistola ad Wicthedum* and *Epistola ad Pleguinam*.
[62] Jones, , ed., *DTR* (1943), 'Introduction' :p. 58 and n. 1, and is printed by Krusch, *Studien* I: pp. 266–278. Also printed in Migne, *PL* 67: col. 507–514.
[63] Jones, , ed., *DTR* (1943), 'Introduction': pp. 55-56; printed in Krusch, *Studien* I: pp. 245–250.
[64] Madan and Craster, *Summary Catalogue*, vol. II, pt. 1: p. 333.
[65] Thomson, 'Addenda': p. 331.
[66] This work is most often referred to as *Excerptum de astrologica Arati*, printed in Ernst Maass, *Commentariorum in Aratum reliquiae* (Berlin: Apud Weidmannos, 1958): pp. 307–312; see Lynn Thorndike and Pearl Kibre, *Incipits of Mediaeval Scientific Writings in Latin* (Cambridge, MA: The Medieval Academy of America, 1963): p. 474, Incipit, 'Duo sunt extremi vertices mundi', identifies this as *either* Aratus or Hyginus, and the two were often confused. See Dimitrijević and Bajic, 'Mythological Origin of Constellations': pp. 129–138; see Emma Gee, *Aratus.*

works summarised by William as *Regulae de astrolabio.*[67] The last items are of particular interest and will be discussed further below.

William's computistical collection dates to the first decades of the twelfth century. W.H. Stevenson observed in 1907 that William used the same spelling for Marianus – Marimanus – in the *Gesta pontificum* that is found in Robert of Losinga's work in Auct. F.3.14.[68] Rodney Thomson concludes from this that the computistical collection must predate the *Gesta pontificum*, written in 1125. He also concludes that because of the 'lack of skill and organisation' reflected in the manuscript, he would 'give this book as early a date as possible'.[69] In contrast to this statement, while not arguing with the dating, Anne Lawrence-Mathers has underscored the purposeful nature of this collection.[70] Its intentionality and importance to William are reflected throughout the document. In the first lines of the document, William suggested that it is for *this* collection that he will be remembered (granted, he had not yet written the *Gesta regum* or the *Gesta pontificum).* The short poem reflects his personal association with this manuscript: 'This, the church's book of many materials, is like a field full of various delights, and will bring renown to William's name after his death'.[71] He then follows this with a table of contents in his own hand. The works are organised historically and had been carefully selected. His handwriting exists throughout the document, editing it, and commenting on it.

William's manuscript provides an interesting cross-section of computistical study. It represents well the status and intellectual frameworks for the science of the stars by the 1120s. The more traditional computistical works up to and including Abbo of Fleury's influence are well represented. Also represented are the work of Robert of Losinga and the tables of Marianus Scotus. The last works of the manuscript reflect the revived interest in early Latin and Arabic astronomy represented in the Gerbertian tradition. Rather than reflecting a lack of intentionality, the patch-work quality of this manuscript suggests that William actively sought out the works he

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[67] These works were misidentified by Bubnov as 'a work on the astrolabe without author or title listed, but now associated with Gerbert, and an Arabic work in translation called *De Horologio*'; see Bubnov, ed., *Opera*: pp. 109–147; see further discussion in Chapter II, [2.8].
[68] Stevenson, 'A Contemporary Description': pp. 83–84.
[69] Thomson, 'The 'Scriptorium'': p. 128.
[70] Lawrence-Mathers, 'William of Malmesbury'.
[71] Auct. F. 3.14, title page: 'Ecclesiae codex multarum materiarum/Sicut ager plenus variarum delitiarum / Willelmi nomine faciet post funera clarum'.

wanted and compiled the manuscript carefully. It also tells us that because he did seek out these works, he must have wanted them very badly. His familiarity with all the works included in the collection can be assumed, and the contents show that his knowledge was widespread and diverse for the early decades of the twelfth century.

Of note and special discussion is the preface to the collection, which immediately proceeds Isidore's *De natura rerum* on fol. 2r. This work has been tentatively ascribed to William.[72] It is an excellent introduction to the study of time [it is printed and translated here as it is otherwise not available in print]:

> First we ought to ask whence first this art which is called number or computation began. Then after this we ought to know from what root of wisdom number proceeds. For we know that all wisdom, whether divine or human, is called philosophy, and that philosophy is divided into three parts. The part of philosophy that is called physics seems divided into four parts. Ethics, the second part of philosophy, has four divisions. The third, logic, [has] two [divisions]. This art of number proceeds from these four divisions. This is necessary to be demonstrated. For it is appropriate to know who first discovered number among the Hebrews, Chaldeans, Egyptians, among the Greeks and Latins. Then it ought to be investigated in what way number is called in the principle languages, that is among the Hebrews, Chaldeans, Persians, Egyptians, Macedonians, Greeks, Latins and if that name that is called number is simple or composite, primitive or derivative, and it is appropriate for us to know how it is defined. About this we ought to ask how numbers are counted among the Greeks from one to a thousand and ten thousand and which signs signify those numbers among the Greeks. For we ought to know which signs signify numbers from one to a thousand and ten thousand among the Latins. Then it is appropriate that we ought to ask what are the divisions of time and in what way those larger divisions arise from the smaller ones.[73]

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[72] Thomson, 'Addenda': p. 331; Lawrence-Mathers, 'William of Malmesbury': p. 99.

[73] Bader translation, Auct. F.3.14, fol. 2r: 'Primum nobis interrogandum est unde primum haec ars quae numerus vel compotus [sic] dicitur incepit. Deinde postea scire debemus ex qua radice sapientiae numerus processit. Scimus enim quod omnis sapientia sive divina sive humana philosophia nuncupatur et illa philosophia in iii partes dividitur. Pars autem philosophiae quae dicitur phisica in quattuor partes divisa videtur; ethica autem secunda pars philosophiae iiii divisiones habet. Tercia autem lo[g]ica duas. Ex quattuor divisionibus haec ars numeri procedit. Quas demonstrari necesse est. Scire etiam convenit quis primus invenit numerum apud hebreos, caldeos, egiptios, apud grecos, et latinos. Deinde investigari oportet quomodo numerus in linguis principalibus nuncupatur hoc est apud hebreos, caldeos, persas, egiptios, macedones, grecos, latinos, et illud nomen quod dicitur numerus si simplex est aut compositum si primitivum aut dirivativum et quomodo diffinitur scire nos convenit. De hinc interrogare debemus quomodo numeri numerantur apud grecos ab uno usque ad mille et miliades* et quae notae significant illos numeros apud grecos. Scire nos etiam oportet quae notae significant numeros ab uno usque ad mille et miliades apud latinos. Deinde etiam oportune interrogandum est quot sunt divisiones temporis et quomodo illae divisiones maiores crescunt de minoribus'.

Though it seems to be reflective of William's sentiments and purpose in putting the document together, unfortunately, this work *cannot* be ascribed to William as an original composition. It is taken from a work ascribed to the pseudo-St. Augustine (possibly wrongly by the nineteenth-century cataloguer), which discusses the value of numerology and the calendar with his disciple Isidore. This work appeared in the late eleventh century in a Monte Cassino manuscript, MC 230. Some difficulty in associating it with this document has stemmed from the fact that William's copy begins on the second line, that it only included a portion of the text, and because it only exists in this Monte Cassino document and three other texts, one of which postdates William's. According to Francis Newton, 'I have re-dated this [Monte Cassino] MS to the early Desiderian period (ca. 1058–1075) in my big book, *Scriptorium and Library at Monte Cassino* (1999), pp. 89–95 and attributed it (with confidence) to the master scribe Grimoaldus'.[74] That the presence of this document may indicate an early connection to Monte Cassino is interesting and would match a similar interest in medical material from the abbey of Le Bec in Normandy.[75]

2.7 THE EVIDENCE FROM WILLIAM'S WRITTEN WORK

Other evidence for William's knowledge of computistical study, apart from his computistical manuscript, comes from his own writing. In contrast to Hugh Farmer's statement that William 'had little acquaintance with science', a quick perusal of the *Gesta pontificum* and the *Gesta regum* is enough to show that William, in fact, knew a good deal about scientists and their work.[76] As suggested above, his computistical collection reveals that he was familiar with the works brought into England and the Severn Valley in the tenth, late eleventh, and early twelfth centuries. His own written works also reveal that he had studied and absorbed the major trends and problems in computistical study up to his time: the computistical controversies over the Easter limits, the historical date of the first Easter, and quickly advancing mathematical and

[74] Personal correspondence with Francis Newton dated May 25th, 2019.
[75] Giles Gasper and Faith Wallis, 'Anselm and the Articella', *Traditio* 59 (2004): pp. 129–174.
[76] Farmer, 'William': p. 39.

astronomical subjects. In fact, a history of computistical study up to the first years of the twelfth century can be derived from the writings of William of Malmesbury.

William was well versed in the controversies of both the earlier and the more recent computists. In the *Gesta pontificum*, William gives a detailed description of the council at Whitby and the Easter dispute (including taking Bede to task for passing over Aldhelm's contributions to the 'conversion' of the North to the Roman norms agreed at the council).[77] William was aware that the dispute at Whitby centred on the Irish church's advocacy of Nisan 14 as the earliest date for Easter. His inclusion in his computistical manuscript of the earlier work of Dionysius Exiguus, Proterius, and Paschasinus, all of whom advocated Nisan 15, shows that he was also aware of the longer history of the dispute.

The more recent era controversy also caught William's attention. He was familiar with the letters of Dionysius Exiguus, in which he explains his Christian Era and uses Dionysius' dating system in his work. William was also familiar with the work of Dionysius' most adamant critic, Marianus Scotus. Marianus' achievements are discussed by William in both the *Gesta pontificum* and the *Gesta regum*. Although William did not use Marianus' chronology in his histories, he had most certainly studied it. The Paschal tables in William's computistical work were copied directly from the preface to Marianus' *Chronicle*.[78]

William also understood and admired Marianus' theories of the dating of the Incarnation. He summarises them accurately:

> It was at that time that Marianus, a monk of Mainz, during his long solitude, carefully studied the works of the chronographers. He was the first to discover that Dionysius' cycle disagreed with the record of the Evangelists. Reckoning from the beginning of the era, he added twenty-two years to Dionysius' cycle, and included this in his great and extended chronicle.[79]

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[77] See esp. William, *GP*, I.72.8: p. 135 and William, *GP*, III.100.1–13: pp. 328–333; on Aldhelm, *GP*, V.prol.2, p. 498: 'Adeo, preter illud quod de illo Beda in Gestis Anglorum tangit, semper infra meritum iacuit, semper, desidia ciuium agente, inhonorus latuit'.

[78] Stevenson, 'A Contemporary Description': pp. 79–80.

[79] William, *GP*, IV.164.1–2: p. 458: 'Erat tunc temporis Marinianus monachus apud Magontiam inclusus, qui longo solitudinis otio chronographos scrutatus, dissonantiam ciclorum Dionisii Exigui contra euangelicam ueritatem uel primus uel solus animaduertit. Itaque, ab initio seculi annos sigulos recensens, uiginti duos annos, qui circulis predictis deerant, superaddidit, magnam et diffusissimam cronicam facere adortus'.

In the *Gesta regum*, William gives Marianus even more direct praise:

> But he [Marianus] had few or no followers of his theories. And it often makes me wonder how, in our time, such misfortune could fall on scholars when they are in such great numbers and have grown pale from studying at night, that scarcely any of them should receive recognition.[80]

A number of scholars have pointed out that William appears to be in agreement with Marianus' calculation of the Incarnation.[81] His statement that Dionysius Exiguus was '*contra evangelicam veritatem*' would seem to substantiate this.[82] Lawrence-Mathers has recently written convincingly of William's take on and usage of the Marianus dating system. She concludes that William thoroughly understood the dating issue and the dilemma, and that he seems to have thought, in fact, that Marianus was correct. His notes throughout BL, Auct. F.3.14 also indicate that Marianus' dating was on his mind. In a few places, he pens in 'according to the apostles'.[83] He was also appreciative of Robert of Losinga's more digestible version of Marianus' work. William evidently admired Marianus, but it must be remembered that he does not use Marianus' calculations. William dates *his* historical work in the same manner that Bede did in the *Historia ecclesiastica gentis Anglorum*, according to the calculations of Dionysius Exiguus. It seems clear that he did this mindfully and for many of the same reasons that Bede did, including fear of reprisal, since he takes pains to point out that he felt compelled to continue to follow current custom, indicating that a wide acceptance of Marianus' work would not be forthcoming without support from his patrons,

> So much does the ancient custom please, and so little encouragement, though deserved, is given to new discoveries, however consistent with the truth. All are anxious to grovel in the old track and everything modern is condemned; and therefore, as patronage alone can

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[80] William, *GR*, III.292: pp. 526–527: 'Sed paucos aut nullos sententiae suae sectatores habuit. Quare sepe mirari soleo cur nostri temporis doctos hoc respergat infortunium, ut in tanto numero discentium, in tam tristi pallore lucubrantium, uix aliquis plenam scientiae laudem referat'.
[81] Stevenson, 'A Contemporary Description': p. 73, n. 3; Gransden, *Historical Writing*, vol. 1: pp. 145–146; Lawrence-Mathers, 'William of Malmesbury': pp. 93–106, esp. p. 101.
[82] William of Malmesbury, *GP,* IV.164.1: pp. 458–459.
[83] For example Auct. F.3.14, fol. 132r, 'the correct year, according to the gospels' and on fol. 120v, 'according to Dionysius and not according to the gospels'; see Lawrence-Mathers for the first notation in 'William of Malmesbury': p. 101.

foster genius, when that is withheld, every exertion languishes.[84]

William expresses particular appreciation for Robert of Losinga. Robert, he states, wrote a valuable summation of Marianus' work, a comment extended to an assessment of the dense nature of Marianus' material. This might, perhaps, imply an understanding on William's part that Marianus, and perhaps John by extension, were historians of a somewhat lower calibre than himself. Nevertheless, it is also from William, and it should be recalled, that Robert receives praise for being an abacist and astronomer of note. The Fulda reference may indirectly place Walcher as a source of some credibility for information about Marianus.

We know from their partial inclusion in Auct. F.3.14 that William had read at least some of the scientific works of Bede. In his preface to the *Abbreviatio amalarii*, William shows that he knew Bede's *De temporibus*. In an invective directed against the Carolingian scholar Hrabanus Maurus, William exclaims, 'What is there in his *De natura rerum* that is not already in Isidore's Etymologies? What is in his *De computo* that is not in Bede's *De temporibus*?'[85] Bede's *De temporibus* was, for William, the standard against which computistical work must be measured, just as Bede's *Historia ecclesiastica gentis Anglorum* was the standard for historical writing.

William's interests went beyond the computists. In particular, he relates the exploits of a number of scientists, including those in his own backyard. These include the exploits of Eilmer of Malmesbury, a mechanical enthusiast and a stargazer. Eilmer is known for constructing a flying machine and sailing off the Malmesbury tower. According to William:

> He was a man of good learning for those times; of mature age and in his early youth had hazarded an attempt of singular temerity: he had by some contrivance fastened to his hands and feet in order that he might fly as Daedalus, and collecting the air, on the summit of a tower, had flown for a distance of a furlong (200m); but agitated by the violence of the wind and a current of air, as well as the consciousness of his rash attempt,

[84]William, *GR*, III.292.1: pp. 526–527: 'Quare sepe mirari soleo cur nostri temporis doctos hoc respergat infortunium, ut in tanto numero discentium, in tam tristi pallore lucubrantium, uix aliquis plenam scientiae laudem referat: adeo inueteratus usus placet, adeo fere nullus nouis, licet probabiliter inuentis, serenitatem assensus pro merito indulget. Totis conatibus in sententiam ueterum reptatur, omne recens sordet; ita, quia solus fauor alit ingenia, cessante fauore obtorpuerunt omnia' (Stubbs translation chosen); Also see Lawrence-Mathers, 'William of Malmesbury': pp. 96–97.

[85] Thomson, 'William of Malmesbury as Historian': p. 390; William, 'Abbreviatio': p. 129: 'In libro porro De natura rerum quid dicit aliud quam Isidorus Ethimologiarum; vel in illo De compoto, quid nisi quod Bede De temporibus preter quedam allegoriam commenta?'.

> he fell and broke both his legs, and was lame ever after. He used to relate as the cause of the failure that he had forgotten to provide himself with a tail.[86]

William also indicates that Eilmer is William's source for the timing of Haley's comet in 1066, possibly indicating some early observational astronomy practised at Malmesbury.[87]

William displays within his computistical work a wide and impressive knowledge of computistical writers, including chronographers, mathematicians, and astronomers. How much he was interested in all of their efforts is, at times, unclear, particularly the abacists. He either speaks of them with a certain awe, as he does of Robert, or with boredom, as when he calls them the 'sweating abacists'.[88] While he did not pursue mathematics or astronomy himself, William gleaned enough from the works of others for his own purposes as cantor and historian.

2.8 OTHER TEXTUAL EVIDENCE FOR WILLIAM'S KNOWLEDGE OF THE SCIENCE OF THE STARS

As discussed above, the contents of Auct. F.3.14 and his own works provide a window into what William knew of the new sciences. Similarly, the last two works in Auct. F.3.14, as well as the stories of Gerbert and others, open insight into William's knowledge of the first wave of Alchandrean influence that had been introduced in the early eleventh century. In his telling of the escapades of Gerbert, for instance, William told of two scientific works associated with Gerbert and his disciples:

> When Gerbert returned to Gaul, he joined the public schools and learned to teach. As co-philosophers and colleagues, he had Constantine, Abbot of the monastery of St. Maximin, near Orleans, to whom he addressed the Rules of the Abacus, and Ethelbald, who they

[86] Eilmer attached an apparatus to his feet and hands and leapt from the Malmesbury church tower. He flew about 600 feet before crashing, and afterwards lamented that he had not attached a tail. See White, 'Eilmer of Malmesbury': p. 98; William, *GR*, II.225.6: pp. 412–416: 'nam pennas manibus et pedibus haud scio qua innexuerat arte, ut Dedali more volaret, fabulam pro vero amplexus, collectaque e summo turris aura, spatio stadii et plus volavit. Sed venti et turbinis violentia, simul et temerarii facti conscientia, tremulus cecidit, perpetuo post haec debilis et crura effractus. Ipse ferebat causam ruinae quod caudam in posteriori parte oblitus fuerit.'

[87] White, 'Eilmer of Malmesbury'; Maxwell Woosnam, *Eilmer, 11th Century Monk of Malmesbury: The Flight and the Comet: A Recent Investigation* (Malmesbury: Friends of Malmesbury Abbey, 1986). Eilmer may have witnessed *two* sightings of Haley's Comet.

[88] William, *GR*, II.167.3: pp. 280–281: 'sudantibus abacistis'.

> say was bishop of Wittenberg, and who revealed his talent in a letter which he wrote to Gerbert, on a question concerning the diameter of the circle in Macrobius, and on some other points.[89]

The first work mentioned above is Gerbert's work on the abacus dedicated to Constantine.[90] The second may have been a letter written to Gerbert on the measurement of the circle by Adelbold, bishop of Utrecht, probably before 999.[91] There was a fairly wide circulation of these works in the twelfth century, and William's precise description suggests that he was familiar with them.

In describing a figure who stepped over the line in the dark arts, William reveals another source. Gerald, Bishop of Hereford (1096–1100) and Archbishop of York (1100–1108), was 'not without knowledge of literature' and was also said to be a student of the black arts. This was based (according to William) on his practice of reading Julius Firmicus in private every afternoon. He died with a 'book of curious arts' (*curiosarum artium codicem*)[92] underneath his pillow. The canons at York refused to bury him in the minster and 'would hardly suffer a lowly clod of earth to be thrown on the body outside the gates'.[93] Gerald apparently did not meet William's standard of using new knowledge for good.

Of note here is that this is the second time in the *Gesta regum* that Julius Firmicus has appeared. It seems likely that William was familiar with the work (it will be noted below that in his *Polyhistor*, William quotes from Firmicus, though the quote is unattributed). As noted above, William describes Gerbert as having a level of learning that 'surpassed Ptolemy in his knowledge of the astrolabe, Alchandreus in that of the relative positions of the stars, and Julius Firmicus in judicial astrology'.[94] Of the two, the Alchandrean texts were perhaps the least known in England.

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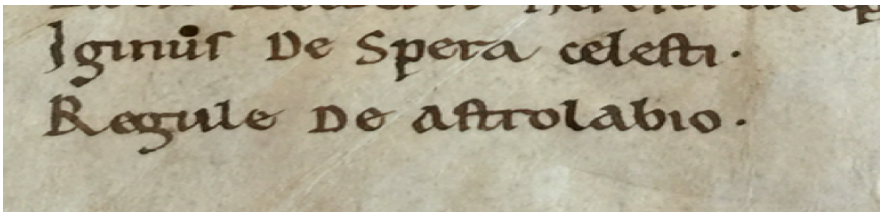
[89] William, *GR*, II.168: pp. 282–284: 'Gerbertus Galliam repatrians, publicasque scolas professus, arcem magisterii attigit. Habebat conphilosophos et studiorum sotios Constantinum abbatem monasterii santi Maximini, quod est juxta Aurelianis, ad quem edidit Regulas de Abaco; Adelboldum episcopum, ut dicunt, Winziburgensem, qui et ipse ingenii monimenta dedit in epistola quam facit ad Gerbertum de quaestione diametri super Macrobium, et in nonnullis aliis'.
[90] Bubnov, ed., *Opera*, 'Regulae de numerorum abaci rationibus': pp. 1–22.
[91] Bubnov, ed., *Opera*, 'Epistola Adelboldi ad Silvestrum II papam': pp. 300–309, see also pp. 485–487.
[92] William, *GP,* III.118.2–3: pp. 392–395: 'Litterarum non nescius, in eloquentia diffusus ceterum, uel rei ueritate uel rumorum licentia parum diffinio, multorum criminum reus et maxime libidini obnoxius erat. Qui etiam malefaciis dicitur inseruisse, quod Iulium Firmicum secreto et postmeridianis horis lectitaret'.
[93] William, *GP*, III, 118.3: pp. 394–395: 'Certe canonici Eboracenses, ne in aecclesia sepeliretur, pertinacissime restitere, uix ignobilem cespitem cadaueri pre foribus inici passi'.
[94] William, *GR*, II.167.2: pp. 280–281: 'Ibi uicit scientia Ptholomeum in astrolabio, Alhandreum in astrorum interstitio, Iulium Firmicum in fato'; both Stubbs and Thorndike identified William's familiarity

William's own hand-written table of contents describes these works as Hyginus' *De spera celesti* followed by *'Regule de astrolabio'*, the last condensing several texts into one. These will be discussed below; they are often associated with Alchandrean texts.



Oxford, Bodleian Library, Auct. F.3.14 Fol. 0, a detail on the last two lines of William's table of contents

As outlined in Chapter I, in relation to Gerbert, who bore the responsibility for conveying these early translations of texts into the Latin West, the 'person' of 'Alhandreus' is a collection of texts on the zodiac, astral measurement, and astrological divination known as the *Alchandreana*. These works include short treatises of texts of Arabic material or influence, including some Jewish texts. Millás Vallicrosa and, more recently, David Juste have suggested that the term *Alchandreana* is a corruption of al-Kindī, who wrote on astrology.[95] The Latin translations of these texts were earliest known at the Monastery of St. Ripoll.

Lynn Thorndike, in 1923, cited William's passage and commented, 'It is rather remarkable that a work ascribed to Alhandreus or Alcandrus, 'supreme astrologer', should be found in two [other] manuscripts of the eleventh century, in both of which occurs the work on the astrolabe which is perhaps by Gerbert, while in one is also found the *Mathesis* of Julius Firmicus Maternus'.[96] Thorndike was referring to two manuscripts, BL, Add. 17808[97] and CLM 560, respectively, with CLM 560 having a possible provenance of Fleury. The remarkable nature

with these texts as remarkable, with the former suggesting Walcher of Malvern as a source: Thorndike, *History of Magic*, vol. 1: p. 710; Stubbs' preface to his edition of *Willelmi*, vol. I: p. lxx.

[95] See Juste, *Les 'Alchandreana' primitifs*: pp. 52–54; see also H. Darrel Rutkin, 'Review', *Early Science and Medicine* 13 (2008): pp. 511–513 of Juste, *Les 'Alchandreana' primitifs*; José María Millás Vallicrosa, *Assaig d'historia de Les Idees Físiques i Matemàtiques a La Catalunya Medieval* (Barcelona: Edicions Cientifiques Catalanes, 1931).

[96] Thorndike, *History of Magic,* vol. 1: p. 710.

[97] BL, Add. 17808, accessible online here: http://www.bl.uk/manuscripts/FullDisplay.aspx?ref=Add_MS_17808

of this 'coincidence' can only be appreciated, however, when we compare the contents of CLM 560 with William's computistical manuscript, Auct. F.3.14.

CLM 560 contains sections of the Alchandrean corpus and includes parts of Julius Firmicus' *Mathesis*, as well as a work known as the *Epistola Ergaphalau* (or *Ut testatur Ergaphalau*), an astrological treatise that will feature later in this analysis.[98] The last entries of William's computistical manuscript, Auct. F.3.14 are also found in CLM 560. These are *De utilitatibus astrolabii*, a work whose attribution has wavered radically even in recent scholarship, though it is most likely the work of Hermannus Contractus, and *De horologio secundum Alkora (Alchoram),* also often misattributed. That these last two works are in the same order as in the CLM manuscript is interesting. But there are other connections between William's statement about Gerbert and the two manuscripts in question.

The first is that the work on the astrolabe was often ascribed to Ptolemy in the first part of the twelfth century.[99] The second was that William was quite familiar with the *text* of the *Mathesis* of Julius Firmicus. In the *Polyhistor*, William quotes a very long description of the death of Plotinus from that work.[100] William copied this segment from the first book of the *Mathesis*. The CLM manuscript contained the first three books of this same work. While a suggestion that William copied part of his manuscript from CLM 560 may go too far, William might have seen a manuscript with a similar collection. David Juste has recently supported this theory:

> Dans la chronique de Guillaume de Malmesbury (vers 1120), on lit que Gerbert s'était initié à l'astrologie et aux sciences arabes en Espagne, au point se surpasser Ptolémée en matière d'astrolabe, Alchandreus *in astrorum intersititio,* et Firmicus Maternus *in fato.* Bien entendu, se témoignage doit être considéré avec prudence car on connaît le récit par ailleurs rocambolesque auquel nous convie Guillaume à propose de Gerbert. Cependant,

[98] Kristen Lippincott, The Saxl Project has a description of this manuscript along with other information here: https://www.thesaxlproject.com/assets/Uploads/MSS-DESCRIPTIONS-Revised-Aratus-latinus-Munich-30-Sept-2011.pdf (accessed 08/04/2022); Karl Halm and Georg von Laubmann, eds., *Catalogus Codicum Latinorum Bibliothecae Regiae Monacensis*, vol. 1, pt. 1(Munich, 1892): pp. 154–155; Bubnov, ed., *Opera*: p. xli.
[99] Francis Carmody, *Arabic Astronomical and Astrological Sciences in Latin Translation: A Critical Bibliography* (Berkeley and Los Angeles: University of California Press, 1956): p. 19.
[100] William of Malmesbury, *Polyhistor: A Critical Edition*, in Helen Testroet Ouellette, ed. (Binghamton, NY: Center for Medieval & Early Renaissance Studies, 1982): p. 104; quoted from Firmicus Maternus, *Matheseos Libri VIII*, in Jean Rhys Bram, trans., I.vii: pp. 22–24.

> sur ce point précis, ce témoignage n'est pas fantaisiste et il est même d'une remarquable précision car l'association des traités sur l'astrolabe (dont certaines portions sont bien attribuées à Ptolémée), du *Liber Alchandrei* et de Firmicus Maternus correspond exactement en contenu d'un a nos manuscrits les plus anciens: [CLM 560]. D'autre part, que Gerbert ait été initié chez les Arabes est aussi l'avis d'Adémar de Chabannes.[101]

Other twelfth-century manuscripts have similarities to William's manuscript. Avranches 235 from Mont Saint Michel and BL, Add. 17808 (of unknown provenance) share *De utilitatibus astrolabii, De horologio secundum Alkoram,* as well as a work known as *Compositio astrolapus* with William's document.[102] It is important that these texts have all three of William's texts in the same order. Thomson and Millás Vallicrosa speculate that these two may have had the same exemplar from a Reims document.[103] In other words, these texts and William's model probably come from exemplars in the Lorraine. It may also be that connections of the Norman royal court and Robert of Gloucester to Avranches facilitated this exchange. Like CLM 560, BL, Add. 17808 and Avranches 235 also contain significant Alchandrean texts.

Below is a comparison of the last section of Auct. F.3.14 with CLM 360, Avranches Bibl. Municipal 235, and British Library, Add. 17808. This is a summary comparison:

[101]See Chapter I on Adémar of Chabannes; Juste, *Les 'Alchandreana' primitifs*: p. 254.

[102] On the Avranches document, see Louis Callebat and Olivier Desbordes, eds., *Science antique, science médiévale: autour d'Avranches 235: actes du colloque international, Mont-Saint-Michel, 4–7 septembre 199*8 (Hildesheim (Allemagne); Zürich; New York: Olms-Weidmann, 2000); Avranches BM 235 can also be accessed here: https://www.unicaen.fr/bvmsm/ead.html?id=FR_UCBN_MSM_mss_av&c=FR_UCBN_MSM_mss_av_Avranches_BM_56_w6&qid=sdx_q39 (accessed 08/04/2022).

[103] Thomson, *William of Malmesbury*: p. 197 (further notes on p. 202 from Thomson, *ibid.,* include some inaccuracies, including that the document continues past its actual last folio of f.157v to 164v); Vallicrosa, *Assaig d'historia*: pp. 288–290 and pp. 322–324.

TEXT	Auct. F. 3.14	CLM 560	BL, 17808	Avranches 235	Getty Ludwig XII.5
Liber [H]igni philosophi de spera celesti *(also known as Aratus' Excerptum de astrologia)* *Auct.Incipit: 'Duo sunt extremi verticos mundi'*	ff148-153				ff.103v-107r
De utilitatibus astrolabii (Hermannus Contractus) *Auct.Incipit: 'Quicumque astronomice peritiam discipline'*	ff153r-154r	ff1v-14v	ff73-79	ff58r-66r	ff101r-103r
De horologio secundum Alkoram *Auct.Incipit: 'In primis de horis de horis diei'*	ff156r-157r	ff14v-16r	ff79r-80r	ff66r-68r	
Compositio astrolapsus secundum Ptolomaeum *Auct.Incipit: 'Iubet ptolomeus rex bene politam'*	ff157r-157v		ff80r-81r	ff68r-69v	
Matheseos libri *CLM Incipit: 'Olim tibi hos libellos Mavorti'*		ff20r-60v			
Epistola Ergaphalau *CLM Incipit: 'Regi macedonum alexandro astrologo'*		ff77r-84v	97r-99r		
Misc Alchandreana (per Juste)		X	X	X	X

This Table compares Oxford, BL, Auct. 3.14 (Malmesbury) with CLM 560 (Fleury), BL, Add. 17808 (unknown), Avranches 235 (Mont Saint Michel), and Ludwig XII.5 (Worcester?). CLM and Avranches documents as indicated.

A document that requires further attention and may expand the landscape of this thesis is a relatively unstudied document in the Getty Library, J. Paul Getty Museum, Ludwig XII.5. The first 151 folios date from the early twelfth century. The document is of English provenance and has been recently identified as possibly a Worcester text by David Juste.[104] It includes computistical works, including extracts from Bede, Isidore, Macrobius, Martianus Capella, Pliny, and Abbo of Fleury. Of particular interest are the medical/astronomical diagrams in the first few folios. It also includes Aratus' *Excertum de astrologia.* This document includes *Alchandreana,* which is not present in the Malmesbury text, including sections on lunar eclipses and Jewish

[104] Juste, *Les Alchandreana primitifs*: p. 264.

astrology. (As will be discussed in Chapter V, this text carries earlier references to the astronomical parlance of the 'Dragon'). This text, if from Worcester, would add to the richness of the Severn Valley intellectual landscape.

2.9 PROGNOSTICATION AND THE SCIENCE OF THE STARS

The final part of this analysis will address astrology. William and John, to a lesser extent, attached knowledge of the stars to powers of prognostication. In this connection, both also mention Robert of Losinga's skills as an astronomer; his skills in the science of the stars made him a figure of astrological ability as well to his peers and followers. It may have made him, like many astronomers who followed, useful to those in power, who were nervous about the future. And there was a good deal to be nervous about under William Rufus, Henry I, and in the troubled reign of Stephen. In this period, the common ancient and medieval conceptual framework implied that astronomy and astrology were entwined, and the science of the stars was rarely separated from the purposes of prediction, with the strongest connections in medical prediction or prognostication and weather forecasting (for example, when to sail your fleet).

Robert, like Gerbert before him and Adelard of Bath afterwards, who read royal horoscopes, was perceived by those who wrote directly about him to have the gift of foresight, granted by his astronomical abilities.[105] William of Malmesbury says that Robert 'had studied the course of the stars'.[106] In proof of his skills, William mentions in the *Gesta pontificum* that Robert was the only bishop invited to Lincoln who refused to go because by 'certain inspection of the stars', he had foreseen that the dedication would not be performed. Both William and John also relate the story of how the spirit of Robert's friend, Bishop Wulfstan of Worcester, appeared to Robert when Wulfstan was on his death bed in 1095.[107] The apparition told Robert to hurry to his side if he wanted to see him alive. Robert made haste too slowly and arrived too late. Later

[105] John D. North, 'Some Norman Horoscopes', in Burnett, ed., *Adelard of Bath*: pp. 147–161; Cochrane, *Adelard*: p. 93; Roger French, 'Foretelling the Future: Arabic Astrology and English Medicine in the Late Twelfth Century', *Isis* 87 (1996): pp. 453–480.
[106] William, *GP,* IV.165: pp. 458–459: 'Omnium liberalium artium peritissimus, abacum precipue et lunarem compotum et caelestium cursum astrorum rimatus.'
[107] William, *GP*, IV.165.2: pp. 458–459; John, *Chronicle*, III, s.a. 1095: pp. 76–77.

Wulfstan's ghost once more appeared to his friend and told Robert to prepare to join him in heaven. The portent was more accurate this time, for Robert died in June of that same year. The association of Robert to powers of prediction appears to be directly related to his interactions with things astronomical. Again, looking forward, the scholars in this period continue to associate astronomy with astrology. When Petrus Alfonsi, who may have been responsible for bringing in Arabic texts and theories in the early twelfth century, advertised his skills in astronomy, he emphasised the utility of astronomy to medical diagnosis, as did his Severn Valley protégé, Walcher of Great Malvern.[108]

Exploring William's attitude towards the science of the stars and prognostication necessitates reconnecting with Gerbert of Aurillac. In William's descriptions of Gerbert, he reveals much about his sources and about astronomical and astrological texts. But William also revealed a conflicting set of reactions to Gerbert's life and work. William, on the one hand, saw Gerbert as an erudite explorer who rescued Europe by bringing back this new knowledge of the stars and related fields such as mathematics. He was as impressed with Gerbert's use of instrumentation, such as the abacus and the astrolabe, as he was with that of Gerbert's more modern followers, including Robert of Losinga. However, William was also titillated and shocked by the stories he had heard about Gerbert's exploits in necromancy and the dark arts. William did not, as a whole, look unfavourably at using the stars judiciously as tools to predict the future. In fact, he found it an admirable and necessary skill; his stories are filled with caution about the abuse of this knowledge. His anecdotes, therefore, explored concepts of the legitimate and illegitimate in the new world of Jewish/Arabic influence, or as he put it, of the 'salubrious and the noxious'.

As outlined in Chapter I, Gerbert was educated in the liberal arts in France and had travelled to Christian Iberia. He returned to the continent with a heightened knowledge of the sciences at play in the wider Christian/Jewish/Muslim Spanish culture. He returned to Europe and developed his career as a teacher of note and influence, a mentor to kings, and finally, as Pope. Gerbert's reputation as a creative and influential scientific thinker changed, however, within fifty years of his death. It quickly took on a mythology of sorcery and the dark arts. In his

[108] For Petrus Alfonsi, *Epistola*: p. 166 (Latin) and p. 174 (English); on Walcher see Nothaft, ed., *Walcher*: pp. 55–61 for discussion.

own life-time, as we have seen, there was speculation that Gerbert travelled beyond Catalonia to Muslim Iberia. Adémar of Chabannes (d. c. 1030) wrote that Gerbert must have studied in Cordoba, a notion followed until recently in modern scholarship. As discussed in Chapter I, Atto and other Catalan diplomats had promoted an active intellectual exchange between Barcelona and Cordoba. It may be that the rumour of Gerbert's travels to Muslim Iberia had persisted because Gerbert and the texts he brought back had Jewish and Arabic connections. It may also be that the imagined journey to Cordoba conveyed more mystery, more 'otherness', and offered more potential for his actions to be nefarious.[109]

The most serious and lasting impetus for Gerbert's reputational decline was Beno (d. 1030?) of Santi Silvestro e Martino ai Monti. Beno was an imperialist in the Investiture Controversy, and his aim was to discredit the reformer Hildebrand, or Pope Gregory VII. [110] Hildebrand was Gerbert's student, and Beno circulated stories that both of them were practitioners of the dark arts. In one account, repeated later by William of Malmesbury, Beno recounted that Gerbert created a mechanical head that could predict the future, with simple answers of 'yes' and 'no'. According to the story, Gerbert asked the head if he would live to pray in Jerusalem. The head answered 'no'. Gerbert was determined to avoid death and cancelled his trip to Jerusalem. He forgot, however, that a church in Rome was called Jerusalem. He realised his error too late, as he was kneeling in the church. 'Immediately after, he died a horrid and miserable death, and in between those dying breaths, he begged his hands and tongue to be cut to pieces, by which having sacrificed them to demons he had dishonoured God'.[111] This story was repeated in a number of different venues over the next century, including Sigebert of Gembloux

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[109] On the Anglo-Norman view of Iberia as the frontier between Islam and Christianity and the portrayal of Islam as a diabolical version of Christianity, see Richard William Southern, *Western Views of Islam in the Middle Ages* (Cambridge, MA: Harvard University Press, 1980); Debra Strickland, *Saracens, Demons and Jews: Making Monsters in Medieval Art*. (Princeton: Princeton University Press, 2003).

[110] Johannes Joseph Ignaz von Döllinger, *Die Pabst-Fabeln des Mittelalters: Ein Beitrag zur Kirchengeschichte* (Munich: J. G. Cotta, 1863): pp. 151–159.

[111] Beno, 'Benonis aliorumque cardialium schismaticorum contra Gregorium VII et Urbanum II', in Kuno Francke, ed., *MGH Libelli de lite imperatorum et pontificum saeculis XI et XII conxcripti* II (Hannover, 1892): pp. 366–422 at p. 377: 'Hac ambage, hac nominis equivocatione delusus, dum civitatem Ierusalem sibi predictam credit, Romae in aecclesia, quae vocatur Ierusalem, missam faciens in die stacionis, ibidem miserabili et horrida morte preventus, inter ipsas mortis angustias supplicat manus et linguam sibi abscidi, per quas sacrificando demonibus Deum inhonoravit'; Truitt, 'Celestial Divination': pp. 201–222; Truitt, *Medieval Robots*, 'Chapter 3: Talking Heads: Astral Science Divination, and Legends of Medieval Philosophers'.

(c. 1035–1112), a Benedictine monk who was, like Beno, an imperial advocate of the Investiture Contest.[112] Sigebert's *Chronicon* was widely distributed throughout the Middle Ages and may have been William of Malmesbury's source for at least a few of his more outrageous stories about Gerbert. Sigebert recounts:

> Regarding Gerbert or Silvester ... he shone even among those who were the most illuminated by the wisdom of the sciences . . . yet it is said that Silvester did not enter by this door [of proper study], as one might expect of one who is still accused of necromancy; also, there is something crooked about his death; truthfully, it is said that he died from a violent beating at the hands of the Devil; but we leave off these things in the middle, [and] he is seen to be excluded from the number of popes.[113]

William, in turn, devoted a very large section of the *Gesta regum* to the necromantic or noxious exploits of Gerbert. In relating Gerbert's reasons for going to Iberia, William conveyed different motives than those told by Gerbert's biographer, Richer (see Chapter I). William states that Gerbert, 'either disgusted at monastic life or seized by lust of glory, fled by night into Spain, chiefly designing to learn astrology and other sciences of that description from the Saracens'. He describes even the Christians in Iberia as 'practising divinations and incantations, after the usual mode of that nation'. William's often-quoted description of the value of Gerbert's learning, should be fully expanded to include a more balanced view of William's attraction to Gerbert and William's worries.

> There he learned to interpret the song and flight of birds, to summon ghostly forms from the nether regions, everything in short whether harmful or healthful, that has been discovered by human curiosity; for of the permitted [lawful] arts, arithmetic, music, astronomy and geometry, I need say nothing – by the way he absorbed them he made them look beneath the level of his intelligence, and re-established in Gaul through his untiring efforts subjects that had long been completely lost. He was the first to seize the abacus from the Saracens, and he handed down the rules which calculators [computists] for all their efforts hardly understand. He lodged in the house of a philosopher who was of their region, whose esteem he earned first by lavish spending and later also by promises. And the Saracen played his part; he sold his knowledge, often sat with him discussing topics sometimes serious, sometimes trivial, and provided him with books to copy. There was, however, one volume to which he had committed all his art and which Gerbert could by no means get out of him. On his side he was passionately anxious to

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[112] Jutta Beumann, *Sigebert von Gembloux und der Traktat de investiture episcoporum* (Sigmaringen: Thorbecke, 1976): pp. 7–14; Mireille Chazan, *L'Empire et l'histoire universelle de Sigebert de Gembloux à Jean Saint-Victor* (Paris: Champion, 1999); Truitt, 'Celestial Divination': pp. 201–222.
[113] Sigebert of Gembloux, *Chronologium,* Migne, *PL* 160: pp. 196–197.

> make the book somehow serve his turn. 'We ever strive towards what is forbidden', and set a higher value on what we are not allowed to have. Turning to entreaties therefore, he begged the man in God's name and in the name of their friendship; he made him handsome offers and still more handsome promises. Making no progress, one night he tried a stratagem. With the connivance of the man's daughter, intimacy with whom he had won by constant attentions, he plied him with wine, seized the book, which was kept under his pillow, and made himself scarce. The Saracen awoke with a start and, guided by the stars – for he was the expert in the art – pursued the fugitive. Gerbert, looking behind him as he ran and by the same expert knowledge perceiving his danger, hid himself under a wooden bridge that was close by, and hung there, grasping the structure so he touched neither water nor earth. Thus all his pursuer's zeal was frustrated, and he returned home. Gerbert speedily resumed his journey, and reached the coast. There he called up the Devil with incantations, and covenanted to pay him perpetual homage if he would protect him from the Saracen, who had resumed the pursuit, and convey him overseas. And so it happened.[114]

William also retells the story first known to have been told by Beno, with more details about the Talking Head. He relates that Gerbert 'after close inspection of heavenly bodies (at a time, that is when all the planets were proposing to begin their course afresh) he cast for himself the head of a statue which could speak, though only if spoken to, but would utter the truth in the form of either a Yes or No'.[115] He related the story of his boondoggle around his death being

[114] William, *GR*, II.167.3–167.4: pp. 280–283: 'Ibi quid cantus et uolatus auium portendat didicit, ibi excire tenues ex inferno figuras, ibi postremo quicquid uel noxium uel salubre curiositas humana deprehendit; nam de licitis artibus, arithmetica musica et astronomia et geometria, nichil attinet dicere, quas ita ebibit ut inferiores ingenio suo ostenderet, et magna industria reuocaret in Galliam omnino ibi iam pridem obsoletas. Abacum certe primus a Saracenis rapiens, regulas dedit quae a sudantibus abacistis uix intelliguntur. Hospitabatur apud quendam sectae illius philosophum, quem multis primo expensis, post etiam promissis demerebatur. Nec deerat Saracenus quin scientiam uenditaret; assidere frequenter, nunc de seriis nunc de nugis colloqui, libros ad scribendum prebere. Vnus erat codex totius artis conscius quem nullo modo elicere poterat. Ardebat contra Gerbertus librum quoquo modo ancillari. Semper enim in uetitum nitimur, et quicquid negatur pretiosius putatur. Ad preces ergo conuersus orare per Deum, per amicitiam; multa offerre, plura polliceri. Vbi id parum procedit, nocturnas insidias tentat. Ita hominem, coniuente etiam filia, cum qua assiduitas familiaritatem parauerat, uino inuadens uolumen sub ceruicali positum arripuit et fugit. Ille somno excussus indicio stellarum, qua peritus erat arte, insequitur fugitantem. Profugus quoque respitiens eademque scientia periculum comperiens sub ponte ligneo qui proximus se occulit, pendulus et pontem amplectens ut nec aquam nec terram tangeret. Ita querentis auiditas frustrata, domum reuertit. Tum Gerbertus uiam celerans deuenit ad mare. Ibi per incantationes diabolo accersito, perpetuum paciscitur hominium si se ab illo qui denuo insequebatur defensatum ultra pelagus eueheret. Et factum est'.

[115] William, *GR*, II.172: pp. 292–295: 'fudisse sibi statuae caput certa inspectione siderum, cum uidelicet omnes planetae exordia cursus sui meditarentur, quod non nisi interrogatum loqueretur, sed uerum uel affirmatiue uel negatiue pronunciaret'.

associated with prayer in Jerusalem and realised too late it referred to the church in Rome. He related Gerbert's painful death, coloured by madness.

David Rollo and Elly Truitt caution that these stories should not be viewed through a modern lens.[116] Some historians have either ignored these passages because they do not match up with our vision of William as an erudite scholar or indicated that while William has put them in his history, he does not believe them. Rollo has argued that the stories usually contain a poetic point, an instruction for the reader. Truitt has read these sections as evidence of the educated and knowledgeable twelfth-century scholar's struggle with the new knowledge of the Arabs. She argues, convincingly, that while William is extremely cautious of the potential for illicit use of these arts. In the end, he advocates for predictive tools enhanced by a knowledge of the stars.

Despite the dark nature of these stories, William challenges the view that all science, even predictive science, is dangerous. He notes that some may 'regard all of this as fiction, because the vulgar are used to undermining the fame of scholars, saying that the man who excels in any admirable science converses with the devil'. Not so, William goes on. Boethius had also been accused of practising 'detestable arts'. In response, according to William, Boethius pointed out 'it is hardly likely that I, whom you dress up with such excellence as to almost make me a God, should catch at the protection of the vilest of spirits, but it is in *this point that we approach nearest to a connection to them, in that we are instructed in your learning, and educated in your customs*. So far, Boethius'.[117]

Another story illuminates both Gerbert's skill in using his astronomical knowledge and William's worry that Gerbert takes it too far into the dark arts. It involves a statue in the field of Mars near Rome. The statue is pointing, and on it are the words 'Strike Here', which, for reasons he did not explain, indicated to the population that there was a treasure within or directly under

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[116] David Rollo, *Glamorous Sorcery: Magic and Literacy in the High Middle Ages* (Minneapolis: University of Minnesota Press, 2000); Truitt, 'Celestial Divination': pp. 201–222.

[117] William, *GR*, II.168.5–6: pp. 282–283: 'Sed haec uulgariter ficta crediderit aliquis, quod soleat populus litteratorum famam ledere, dicens illum loqui cum demone quem in aliquo uiderint excellentem opere. Boetius in libro de Consolatione Philosophiae queritur se propter studium sapientiae de talibus notatum, quasi conscientiam suam sacrilegio polluisset ob ambitum dignitatis. 'Non conueniebat' inquit 'uilissimorum me spirituum presidia captare, quem tu in hanc excellentiam componebas ut consimilem deo faceres. Atqui hoc ipso uidemur affines malefitio, quod tuis imbuti disciplinis, tuis instituti moribus sumus.' Haec Boetius'.

the statue. Gerbert solved the problem by marking where the shadow of the finger fell at noon, 'when the sun was on the meridian'. He and his assistant dug and found a palace, a treasure, and magical figures defending it. He and his servant escaped only through Gerbert's quick thinking.

However, William goes on to elaborate on the story. He states that it is generally accepted that Gerbert performed in the story using 'unlawful devices'. His next point is very telling:

> *Yet, however, if anyone diligently investigates the truth,* he will see that even Solomon, to whom God himself had given wisdom, was not ignorant of these arts: for, as Josephus relates, he in conjunction with his father, buried vast treasures in coffers, which were hidden, as he says, in a necromantic manner, underground.[118]

By pointing out that God himself gave Solomon 'power over demons', William defends, in a particular sense, the use of astrological and even necromantic skills. As Rollo points out in *Glamorous Sorcery*, 'by citing the precedent of Solomon, William aligns Gerbert with a tradition not of sorcery, but of preeminent wisdom'.[119]

William saw Gerbert as a positive source for the spread of the new knowledge. He described Gerbert's return from Iberia and his influence as a teacher before the dark arts took hold:

> Gerbert, returning to Gaul, became a public professor in the schools, and had as brother philosophers and companions of his studies, Constantine, Abbot of the monastery of St. Maxime, near Orleans, to whom he addressed the Rule of the Abacus; and Ethelbald bishop, as they say, of Wintenburg, who himself gave proof of ability, in a letter which he wrote to Gerbert, on a question concerning the diameter in Macrobius and in some other points. He has as his pupils, of exquisite talents and noble origin, Robert, son of Hugh Capet, and Otto, son of the Emperor. Robert, afterwards king of France, made a suitable return to his master, and appointed him archbishop of Reims. In that church, still extant, as proof of his science, a clock constructed on mechanical principles: and an hydraulic organ.[120]

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[118] William, *GR*, II.169: pp. 284–289: 'Veruntamen, si quis uerum diligenter exsculpat, uidebit nec Salomonem, cui Deus ipse dederit sapientiam, huiusce inscium commenti fuisse (ut enim Iosephus auctor est, thesauros multos cum patre defodit in loculis qui erant, inquit, mechanico modo reconditi sub terra)'.
[119] Rollo, *Glamorous Sorcery*: p. 8.
[120]William, *GR*, II.168: pp. 282–285: 'Gerbertus Galliam repatrians, publicasque scolas professus, arcem magisterii attigit. Habebat conphilosophos et studiorum sotios Constantinum abbatem monasterii sancti Maximini, quod est iuxta Aurelianis, ad quem edidit Regulas de Abaco; Adelboldum episcopum, ut dicunt, Winziburgensem, qui et ipse ingenii monimenta dedit in epistola quam facit ad Gerbertum de

It could be argued, along with Truitt, that while William was cautious about the new sciences, he found them to be of great value. He separated the uses of the new sciences between the legal and the illegal. Studying the stars for purposes of forecasting, such as that done by Robert of Losinga, is 'legal'. Using necromantic arts to summon the devil to change the future is 'illegal'. He used the story of Gerbert himself to underscore the advantages of the new knowledge and its tools and to illustrate where scholars can cross the line.

2.10 CONCLUSION

Prior to the arrival of the new wave of scientific texts after the 1120s, the Severn Valley scholars already exhibited a keen interest in an up-to-date knowledge of the science of the stars and its related field of computistical studies. These scholars' efforts were fuelled by a culture already sympathetic to the *quadrivium* and invigorated by Robert of Losinga, Bishop of Hereford and Wulfstan, Bishop of Worcester. Walcher, William, and John had roles within their institutions, abbot, cantor, and historian, that benefited from horological and calendrical skills. They were also in an area known since before the conquest for book production and diverse scriptoria. The connection of Worcester to Ramsey, including the influence of Abbo, was of importance here. According to J.W. Thomson, documents headed to Ramsey from Fleury often made a first stop for copying at the Worcester scriptorium.[121] The enthusiasm of William, Walcher, and John for these sciences was reflected in their own collections of scientific documents and in their own works. We can tell that they read them, absorbed them, and to some extent, adopted the new theories.

From these scholars, a sense can be gained of some of the challenges and ambiguities that had already been presented by the new sciences, even before the wave of twelfth-century Arabic

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questione diametri super Macrobium, et in nonnullis aliis. Habuit discipulos predicandae indolis et prosapiae nobilis, Rotbertum filium Hugonis cognomento Capet, Ottonem filium imperatoris Ottonis. Rotbertus postea rex Frantiae magistro uicem reddidit et archiepiscopum Remensem fecit. Extant apud illam aecclesiam doctrinae ipsius documenta, horologium arte mechanica compositum, organa hidraulica ubi mirum in modum per aquae calefactae uiolentiam uentus emergens implet concauitatem barbiti, et per multiforatiles tractus aereae fistulae modulatos clamores emittunt'.

[121] James Westfall Thomson, *The Medieval Library* (Chicago: The University of Chicago Press, 1939): p. 122.

texts hit the shore. Walcher, as an observer of the stars and the course of the moon, was armed with tools such as the astrolabe and knew how to use them. His observations of the moon and the horological divisions went beyond his predecessors, and he asked new questions of his data. He was eager for answers and ready to hear new theories by the time he met Petrus. John and William, as historians, were challenged by calendrical inconsistencies. They were both completely up to date on computistical studies and the era controversy and were challenged to adopt a new, more accurate calendrical view. John, with the backing of his Bishop, embraced the new calculations. William appreciated them but did not feel their adoption was a politically astute move. In William's writing, we see in full and high drama the dilemma presented by the predictive promise of stellar observation. William struggles early in the century with themes that will become more complicated and pressing as the century progresses, as more and more tools, textual and otherwise, become available for those interested in the stars.

The intellectual climate of the Severn Valley by the second quarter of the twelfth century can be appropriately characterised as a culture of inquiry. Inquiry must also be fuelled by opportunity. In the next chapter, the circumstances that facilitated the arrival of the translators and the texts into the Severn Valley will be examined.

CHAPTER III

Practitioners, Patrons, and the Introduction of the New Sciences

> *When it comes to the Moon, however, given that an eclipse of the Sun and Moon follows upon its kindling or full moon, we cannot say anything better at present than what has been said above, where we have discussed its natural kindling, even though we may not be able to arrive at its certain hour because of its varying motions. We both discerned this variety ourselves in this treatise and had it confirmed through the testimony of Petrus Alfonsi, who said that [the Moon] has three motions, as we said above. But he said that the Moon traverses 13 degrees and 10 points and 24 fractions and 52 fractions of fractions in a day, whereas in our rules it is found that it has 1/3 and 1/36 and 1/144 after 13 degrees. The reason it is so much more is that we divide the zodiac into 365 degrees and a quadrant, whereas he finishes all of it in 360 degrees.*
>
> Walcher of Great Malvern, *De dracone*[1]

In the *De dracone,* Walcher of Great Malvern's second treatise written over a decade after the *De lunationibus,* he speaks of the many things he says he learned from his new teacher, Petrus Alfonsi. This includes the sexagesimal system of stellar measurement and the varying motions of the sun and moon indicated in the citation above. It is here, then, in approximately 1120, that some of the first evidence, the first traces, of the new astronomical knowledge and texts coming into England is to be found.[2] Petrus Alfonsi arrived in the Severn Valley Basin via France, bringing knowledge of the science of the stars he had developed within the

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[1] Walcher, *DD,* c. 3.2: pp. 204–205: 'De luna vero, quia accensionem eius et plenilunium sequitur solis eclipsis et lune, nil melius ad presens dicere possumus quam supra dictum est, ubi de naturali accensione eius tractavimus, quavis ad certam illius horam propter diversos eius motus pervenire non valeamus. Quam diversitatem et nos in ipso tractatu deprehendimus et testimonio Petri Anfulsi confirmatum est, dicentis eum habere tres motus, ut supra diximus. Quod autem ipse dicit lunam in die XIII gradus et X punctos et XXI-III minutias et LII minutias minutiarum pergere, in nostris regulis invenitur post XIII gradus trientum et duellam et emisesclam habere, multo videlicet plus ideo fit quia nos per CCCLXV gradus et quadrantem zodiacum dividimus, ille autem totum in CCCLX gradibus concludit.'

[2] The bibliography for the introduction of Arabic Science into England is copious; much of it will be cited as this chapter proceeds. The origins of this study are most sensibly to be found in Charles Homer Haskins, 'The Reception of Arabic Science in England', *EHR* 30 (1915): pp. 56–69; the most helpful modern summaries remain Burnett's *The Introduction of Arabic Learning*, his *Arabic into Latin in the Middle Ages: The Translators and their Intellectual and Social Context* (Aldershot: Ashgate, 2009), and, as editor, a collection of important articles in Burnett, ed., *Adelard of Bath.*

Judaic/Muslim traditions of Iberia.[3] In roughly the same period, Adelard of Bath, who had been raised in the Bath area and had travelled to southern Italy, Sicily, and Antioch (all under Norman rulership), returned with his new awareness of Arabic learning. What follows explores the careers of Petrus and Adelard and the possible reasons for their presence in the Severn Valley region. It is possible, for instance, that political patronage offered by Henry I and his immediate court played a part in this process and the positive reception of their work. So too was there already well-developed appetite for the science of the stars, as shown in the enthusiasms of Walcher, William of Malmesbury, and John of Worcester.

3.1 THE ARABIC INFLUENCE ON THE SCIENCE OF THE STARS

As outlined earlier, several different and important traditions would have informed the astronomical portfolio of Severn Valley scholars. Available to them were the classical and early medieval encyclopaedic and cosmographical treatises: Plato's *Timaeus*, Cicero's *The Dream of Scipio,* Isidore of Seville's *Etymologies*, Macrobius' *Commentarii in somnium Scipionis*, and Martianus Capella's *De nuptiis Philologiae et Mercurii.* This material, alongside medical, computistical, and other related texts, was in circulation well before the twelfth century within the wider Severn Valley.[4] An emphasis on material deriving from Gerbert of Aurillac can be

[3] The normally provided date for Petrus' entry into England is 1116. However, Dickey, 'Adelard of Bath': pp. 54–56 has argued that Petrus stayed in France until 1120. This theory is borne out by Walcher's writings and reflected in the progression of John and William's awareness of astronomical studies – e.g. we see no evidence of his influence prior to 1120. The bibliography on Petrus Alfonsi (or Alphonsi) should include Tolan, *Petrus Alfonsi*; Petrus Alfonsi, *Dialogue against the Jews*, in Irven Michael Resnick, trans., (Washington: Catholic University of America Press, 2006); Nina Caputo, 'The Voice of a Jew? Petrus Alfonsi's Dialogi Contra Iudaeos and the Question of True Conversion', in Nina Caputo and Mitchell Hart, eds., *On the Word of a Jew: Religion, Reliability, and the Dynamics of Trust* (Bloomington: Indiana University Press, 2019): pp. 181–200; Charles Burnett, 'The Works of Petrus Alfonsi: Questions of Authenticity', *Medium Aevum* 66 (1997): pp. 42–79; Charles Burnett, 'Petrus Alfonsi and Adelard of Bath Revisited', in Carmen Cardelle de Hartmann and Philipp Roelli, eds., *Petrus Alfonsi and his Dialogus: Background, Context, and Reception* (Firenze: SISMEL – Edizioni del Galluzzo, 2014): pp. 77–92; Anna Sapir Abulafia, 'Moyses in Service of Petrus in Petrus Alfonsi's *Dialogus*', in Hartmann and Roelli, eds., *Petrus Alfonsi and his Dialogus*: pp. 111–128; also appreciated are the works cited below of Dorothee Metlitzki, *The Matter of Araby in Medieval England* (New Haven: Yale University Press, 1977) and Maria Menocal, *The Ornament of the World: How Muslims, Jews, and Christians Created a Culture of Tolerance in Medieval Spain* (New York: Back Bay Books, 2012).

[4] For an important list of manuscripts, see Faith Wallis, *The Calendar and the Cloister*, https://digital.library.mcgill.ca/ms-17/apparatus.php?page=related_manuscripts#sec06 (accessed

attributed, at least in part, to the appearance in the area of Robert of Losinga.[5] These materials pertain particularly to instrumentation and observation.

Petrus, and to a different extent, Adelard, brought to England the products of a different inheritance, namely that of the Islamicate and its long engagement with Hellenic science. This tradition was pre-eminently but not exclusively in astronomy, flourishing from the eighth and ninth centuries onwards. It also included the translation of the works of Aristotle, Ptolemy, and Euclid and their commentaries, imitations, and criticisms, and, in the case of astronomy, observational as well as theoretical criticism.

The House of Wisdom of Baghdad, the creation of Abbasid Caliph Hārūn al-Rashīd (r. 786–809 CE) and his son al-Ma'mun (r. 813–833 CE), was the centrepiece of this movement.[6] It started as a library and a centre of translation and quickly became an intellectual centre where much original and groundbreaking thought developed in the fields of medicine, alchemy, mathematics, and astronomy. Of particular note in the context of the arguments explored here was the activity of al-Khwārizmī (780–850 CE), whose work and influence were of central importance to the new developments in the twelfth-century Severn Valley. While he is noted for inventing algebra and algorithms and for introducing, via his texts, Arabic numerals into the West, it was the translation of his astronomical tables, or *zij*, that represented the first sign of the arrival of Arabic astronomical learning in England. Al-Khwārizmī's *Zīj al-Sindhind* is a work consisting of approximately 37 chapters on calendrical and astronomical calculations and related tables.[7] The *zij* is reminiscent in form and structure of Ptolemy's *Handy Tables.* These

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08/04/2022); Moreton, 'Before Grosseteste': pp. 562–586. For a wider consideration of legacies in computistical literature, see Warntjes, 'The Continuation': pp. 185–194; Warntjes, 'Seventh-Century Ireland': pp. 44–72.

[5] See Chapter I, [1.5] above; it is also possible that this reception can be linked to Lanfranc as incoming Archbishop of Canterbury in 1170, see Priscilla Watkins, 'Lanfranc at Caen: Teaching by Example', in Sally N. Vaughn and Jay Rubenstein, eds., *Teaching and Learning in Northern Europe: 1000–1200* (Turnhout: Brepols, 2006): pp. 70–97.

[6] Richard Lorch, *Arabic Mathematical Sciences: Instruments, Texts, Transmission* (Aldershot: Variorum, 1995); George Saliba, *A History of Arabic Astronomy: Planetary Theories during the Golden Age of Islam* (New York: New York University Press, 1994); Jonathan Lyons, *The House of Wisdom: How the Arabs Transformed Western Civilization* (New York: Bloomsbury, 2009).

[7] Heinrich Suter, ed., *Die astronomischen Tafeln des Muhammad ibn Mūsā al-Khwārizmī in der Bearbeitung des Maslama ibn Ahmed al-Madjriti und der latein. Übersetzung des Athelard von Bath auf Grund der Vorarbeiten von A. Bjornbo und R. Besthorn herausgegeben und kommentiert* (D. Kgl. Danske Vidensk. Selskap, Skrifter 7. Raekke, Historisk og filosofisk Afd. III. 1. Copenhagen, 1914).

astronomical tables were the practical expression of Ptolemy's cosmology in the *Almagest* and were popular throughout the Middle Ages.[8] The *zij* went well beyond the translation or geographic adaption of Ptolemy's tables by introducing mathematical elements, which allowed for the calculation of mean motions and the syzygies between the sun and the moon.[9] The work marked a turning point in Arabic astronomy, based on observation rather than translated authorities.[10] The *zij* had a complex transmission, including iterations in Arabic, Hebrew, and Latin. Its principles were adopted for many regions and meridians, such as Cordoba, by al-Majrītī (d. 1107). And it is this version by al-Majrītī that was later used by both Petrus and Adelard of Bath. As will be discussed in Chapter V, the oldest known copy of Adelard's version of the *zij* was used by John of Worcester.

3.2 THE IBERIAN PENINSULA, PETRUS ALFONSI, AND THE SCIENCE OF THE STARS

Petrus Alfonsi, born in Huesca as Moses Sephardi, was a converted Aragonese Jew and the product of the rich al-Andalusi intellectual heritage. Trained and schooled in the Jewish and Arabic traditions of the science of the stars, his astronomical knowledge, while sometimes considered shallow by al-Andalusi standards, far exceeded that of the northern European intellectual community.[11] After his conversion, the trajectory of his career eventually seems to have brought him to England and probably to the wider court of Henry I. From there, he came within the sphere of the Severn Valley scholars under scrutiny here on whom his influence was

[8] Alexander Jones, 'Ptolemy's *Handy Tables:* Essay Review', *Journal for the History of Astronomy* 48, no. 2 (2017): pp. 238–241; Anne Tihon, ed., *Le 'Grand commentaire' de Théon d'Alexandrie aux tables faciles de Ptolomée* (Città del Vaticano: Biblioteca Apostolica Vaticana, 1985); William Stahlman, *Ptolemy's Handy Tables* (New York: Routledge, 2000).
[9] Nothaft, 'Roman vs. Arabic Computistics': pp. 187–208, see p. 188.
[10] C. Philipp Nothaft, 'Ptolemaic Orbs in Twelfth-Century England: A Study and Edition of the Anonymous Liber de motibus planetarum', *Mediterranea. International Journal on the Transfer of Knowledge* 3 (2018): pp. 145–210; David A. King, *In Synchrony with the Heavens: Studies in Astronomical Timekeeping and Instrumentation in Medieval Islamic Civilization,* vol. 1 (Leiden: Brill, 2004): pp. 1–191; Raymond Mercier, 'Astronomical Tables in the Twelfth Century', in Burnett, ed., *Adelard of Bath*: pp. 87–118; McCluskey, *Astronomies*: pp. 165–208.
[11] Tolan, *Petrus Alfonsi*: p. 3.

both immediate and lasting.[12] Petrus' works included his defence of Christianity over Judaism, *Dialogi contra Iudaeos*, his own translation of the al-Khwārizmī tables, and a short but important letter outlining a new programme of study which favoured the practical arts of mathematics and astronomy.

The al-Andalusi scientific scholarship in the tenth and eleventh centuries that Petrus had access to included both translation and interpretive works. An important example is that of Maslama al-Majrītī (950–1007), who founded a school of astronomy and mathematics in Cordoba. Writing at the heyday of the caliphate, he was an accomplished (al)chemist and astronomer who translated Ptolemy's *Planisphaerium* and *Almagest* and, as noted above, set the al-Khwārizmī tables to the meridian of Cordoba from the original meridian of Arin (Arin is a corruption of Ujjain, a city in India).[13] These tables were later directly used by Petrus Alfonsi and Adelard. Among al-Majrītī's students was his own daughter, Fátima of Madrid, an astronomer of obscure note, and Ibn-ad Saffār (d. 1135), who collaborated with al-Majrītī on the al-Khwārizmī tables and also wrote a work on the abacus which in translation was popular for many years in the Latin West.[14]

Much has been written recently about the lasting influence of this multi-cultural society and its lively intellectual culture, which survived the breakup of the caliphate and the establishment of the successor *taifa* or party kingdoms.[15] By 1100, however, two forces

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[12] Tolan, *Petrus Alfonsi*; Burnett, 'The Works of Petrus Alfonsi': pp. 42–79; Caputo, 'The Voice of a Jew?': pp. 181–200; Vallicrosa, 'La aportación astronomica': pp. 65–105.

[13] E.S. Kennedy, 'A Survey of Islamic Astronomical Tables', *Transactions of the American Philosophical Society* 46 (1956): pp. 123–177.

[14] Gabriella Bernardi, 'Fátima of Madrid (Tenth Century)', in Gabriella Bernardi, ed., *The Unforgotten Sisters: Female Astronomers and Scientists before Caroline Herschel* (Cham: Springer International Publishing, 2016), pp. 45–48; Qanbarali Roudgar, 'Ibn Saffār and the Development of Islamic Astronomy in Andalusia: Finding Qibla Direction in Kitāb al-'amal bi-l-asṭurlāb and Balāta Sundial (at the Cordova Museum)', *The Journal of Islamic History and Civilisation* 16, no. 31 (2020): pp. 141–174; José Chabás and Bernard R. Goldstein, 'Ibn al-Kammād's 'Muqtabis' zij and the Astronomical Tradition of Indian Origins in the Iberian Peninsula', *Archive for History of Exact Sciences* 69, no. 6 (November, 2015): pp. 577–650.

[15] David Wasserstein, *The Caliphate in the West: An Islamic Political Institution in the Iberian Peninsula* (Oxford: Clarendon Press, 2010); Menocal, *The Ornament of the World*; Lyons, *The House of Wisdom*. It should be noted that the scholarly Andalusian culture has been mythologised to some extent. It is clear that Jews, Muslims, and Christians did not universally live in total and equal harmony. Jews, for instance, under Muslim rule were often not able to hold official office and there were episodic flare ups of persecution, such as forced conversion or the violent anti-Jewish riots in Muslim Granada in 1066, see Menocal, *The*

threatened this eclectic society: first, the more aggressive expansion from the Christian kingdoms to their southern frontiers, and second, the aggressive expansion of the Almoravids from the Atlas region and Morocco into al-Andalus. The result was a heightening of persecution and increased segregation of Jewish communities, especially under the stricter rule of the Almoravids.[16] This more hostile environment for the Jews in Andalusia led to the migration of Jewish scholars to Northern Europe in search of employment and patronage.[17] Petrus Alfonsi (though a convert to Christianity) and Ibn Ezra are important examples of these scholarly migrations.[18]

Petrus Alfonsi was active right at the cusp of these developments. His career foreshadows what would become a more prevalent scholarly movement only a few years later. His education and career are reflective of both the environment in which he was raised, as well as the drastic changes in regional authority. The intellectual framework in which Petrus was raised is nicely described by Sâ`id al-Andalusîi in praise of the Iberian Jew Abūu al-Faḍl Ḥaṣdāī ibn Yūṣuf ibn Ḥaṣdāī (1046–1100) before he converted to Islam:[19]

Ornament of the World, cited above, and Jane Gerber, *The Jews of Spain: A History of the Sephardic Experience* (New York: Free Press, 1992).

[16] Carlos de Ayala, 'On the Origins of Crusading in the Peninsula: The Reign of Alfonso VI (1065–1109)', *Imago temporis. Medium Aevum* 7 (2013): pp. 225–269; Bernard Reilly, *The Contest of Christian and Muslim Spain: 1031–1157* (Oxford: Blackwell, 1995); Shahnaz Husain, *The Muslim Conquest of Spain and the Legacy of Al-Andalus* (London: Taha, 2004); Salma Khadra Jayyusi, ed., *The Legacy of Muslim Spain* (Leiden: Brill, 1994); Simon Doubleday and David Coleman, eds., *In the Light of Medieval Spain: Islam, the West, and the Relevance of the Past* (New York: Palgrave Macmillan, 2008); Bisson, *The Medieval Crown of Aragon.*

[17] On the Jewish migration see Michael Toch, 'Migrations, Settlement, Population', *The Encyclopedia of Global Human Migration* (The Hebrew University of Jerusalem, 2013).

[18] Ibn Ezra says of his travels to Provence: 'I resided in that place as a stranger, wrote books, and revealed the secrets of knowledge', from his poem the *Nedod Hesir Oni*, quoted in Richard Gottheil and Wilhelm Bacher, 'Ibn Ezra, Abraham Ben Meïr (Aben Ezra)', *Jewish Encyclopedia*, vol. 6 (New York: Funk and Wagnalls Company, 1901); Other immigrants/travellers included Joseph Kimchi (d. 1170) and Judah ben Saul ibn Tibbon (d. c. 1190), see Gerber, *Jews of Spain,* pp. 91–114, esp. p. 96–97; also of note is Abraham bar Ḥiyya ha-Nasi, who travelled to Provence; also see Raymond Mercier, 'Astronomical Table of Abraham bar Hiyya', in Sacha Stern and Charles Burnett, eds., *Time, Astronomy and Calendars in the Jewish Tradition* (Leiden: Brill, 2014), pp. 115–207; and Martin Levey, 'Abraham bar Hiyya Ha-Nasi', *Dictionary of Scientific Biography* (New York: Charles Scribner's Sons, 1970): pp. 22–23.

[19] Sâ`id al-Andalusī was born in 1029 in Almería in southern Al-Andalusian Iberia and wrote one of the earliest histories of science, the *Ṭabaqāt al-'Umam*. For a summary of the work and life of Sâ`id Al-Andalusî see M.S. Khan, 'Qāḍī Ṣā'id al-andalusī's Ṭabaqāt al-Umam: The First World History of Science', *Islamic Studies* 30, no. 4 (1991): pp. 517–540.

> Among our contemporaries we note Abu'lFadl Hasdai b. Yûsuf ibn Hasdai who lives in Saragossa and belongs to an illustrious family of Jews, an al-Andalus descended from the Prophet Moses, peace upon him. This wise man studied the sciences according to a rational order, and acquired great erudition in various branches of knowledge according to the best methods. He has proficiency in the Arabic language and a good knowledge of Arabic rhetoric and poetry, he is remarkable in arithmetic, geometry and astronomy. He understands the theory of music and its application. Finally, he has a consummate grasp of logic, and also the practical science of research and observation. He subsequently advanced to the study of the sciences of nature. He began with the study of the *Physics* of Aristotle, which he finally mastered. He afterwards began the study of *De caelo et mundo.* When I left him in 1065, he was penetrating the mysteries of this book. If he lives long enough, and his zeal is sustained, he will certainly know to perfection philosophy, and the various parts of this science will be no secret to him.[20]

Clearly, Aristotle's *Physics* was being studied in Iberia over 100 years before its arrival in Paris. This was the educational context for Petrus.

Almost all we know of Petrus Alfonsi's life, we know from his work, the *Dialogi contra Iudaeos*. This work is styled as an argument between his current Christian self as Petrus and his previous Jewish self as Moses. It is a cutting polemic against conservative Jewish thought, but it also contains much autobiographical information. In this work, Petrus tells Moses:

> I know that you used to excel in knowledge of the writings of the prophets and the words of our doctors; and from boyhood you were more zealous of the law than all your peers. And if there were an adversary, you opposed him with a shield of defence. You preached to the Jews in the synagogues, so that you might not lapse even a little in their faith; you taught your peers, and the learned you provoked to be even better.[21]

As John Tolan points out, this self-praise indicates that he received a religious education in a town with a school.[22] Petrus later tells us himself that he was schooled in both Hebrew and Arabic, 'You were always educated and always talking with [the Saracens], you read their books,

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[20]Referenced by Tolan, *Petrus Alfonsi*: p. 5*,* translated in Norman Roth, 'Some Aspects of Muslim-Jewish Relations in Spain', in María del Carmen Carlé, Hilda Grassotti, and Germán Orduna, eds., *Estudios en homenaje a Don Claudio Sánchez Albornoz en sus 90 años*, vol. 2 (Buenos Aires: Universidad, Instituto de Historia de España, 1983): pp. 179–214 esp. p. 196.

[21] Petrus Alfonsi, *Dialogus Iudicus (DI)*, Migne, *PL* 157, ch. 1: pp. 538–539, in Resnick, trans., *Dialogue Against the Jews*: p. 43: 'Novi enim bene olim to valere in scriptis prophetarum, et verbis nostrorum doctorum a pueritia quoque super omnes coaequaevos tuos legis relatorem fuisse, et si quis adversarius esset, te illi defensionis clypeum opposuisse; Judeis in synagogis ne a sua unquam fide recederent praedicasse, conscios docuisse, doctos in majus orovexisse'.

[22] Tolan, *Petrus Alfonsi*: p. 9.

you understood their language'.[23] As will be further discussed below, he would have known the astronomical tradition of al-Majrītī and would have been schooled in all parts of the *quadrivium* and related instrumentation, such as the abacus and astrolabe.

It is not entirely clear what the circumstances of or rationale for Moses Sephardi's conversion were. It is possible that he sought career advancement under the increasing strength of Christian rule. He tells us that in 1106, he was baptised by Alphonso I of Aragon and took on his name.[24] The presence of Alphonso I at the conversion ceremony may have been a reflection of Petrus' importance. It is also possible that this was a mass conversion, which in itself would have warranted Alphonso I's patronage.[25] Regardless, the fact that Petrus took Alphonso's name indicates his commitment to and association with the king. Petrus' connection to Alphonso I holds some clues about his eventual progress to England. Petrus served in his court, possibly as his physician, after his conversion.[26] Alphonso I 'the Battler' was referred to by Petrus as the 'Glorious Emperor of Hispania', king of Aragon and aspiring to the throne of Castile. Alphonso I played a major role in the Aragonese conquests, taking Huesca in 1096, Tudela in 1116, and Zaragoza in 1118.[27] Of note is that in 1115, he signed an agreement with the Jews of Tudela on the Ebro river outlining the conditions of his protection.[28] Alphonso I's motivations for his support of the Jews may have been primarily an act of Christian evangelism; the nature of the

[23] Petrus Alfonsi, *DI*, ch. 5: p. 597; Resnick, trans., *Dialogue Against the Jews*: p. 146: 'Semper enim ut dixi cum eis conversatus et enutritus es, libros legisti, linguam intelligis'.
[24]Petrus Alfonsi, *DI*, Preface, pp: 537–538; Resnick, trans., *Dialogue Against the Jews*: p. 40: 'baptizatus in sede Oscensis civitatis, in nomine Patris, et Filii, et Spiritus sancti, purificatus manibus Stephani gloriosi et legitimi ejusdem civitatis episcopi...Hoc autem factum est anno a nativitate Domini millesimo centesimo sexto, aetatis meae anno quadragesimo quarto, mense Julio, die natalis apostolorum Petri et Pauli. Unde mihi ob venerationem et memoriam ejusdem apostoli, nomen quod est Petrus, imposui. Fuit autem pater meus spiritualis Alfunsus, gloriosus Hispaniae imperator, qui me de sacro fonte suscepit, quare nomen eijus praefato nomini meo apponens, Petrus Alfunsi mihi nomen imposui'.
[25] Dickey, 'Adelard of Bath': p. 48; Caputo, 'The Voice of a Jew?': pp. 181–200.
[26] Tolan, *Petrus Alfonsi*: pp. 10–11.
[27] See Bisson, *The Medieval Crown of Aragon*; Luis Garcia-Guijarro, 'Reconquest and the Second Crusade in Eastern Iberia: The Christian Expansion in the Lower Ebro Valley', in Jason Roche and Janus Jensen, eds., *The Second Crusade: Holy War on the Periphery of Latin Christendom* (Turnhout: Brepols, 2015): pp. 219–255; De Ayala, 'On the Origins of Crusading': pp. 225–269.
[28]Metlitzki, *The Matter of Araby*: pp. 19–20; Yiṣḥāq Fritz Baer, *A History of the Jews in Christian Spain*, in Louis Schoffman, trans., Second Edition, vol. 2 (Philadelphia: Jewish Publ. Soc. of America, 1992): p. 52; 'Tudela (ancient Tutela)', *The Jewish Encyclopedia.*

Iberian acts of protection for the Jewish populations did not mirror that of Northern Europe, where the motivations for protecting the Jews were largely financial.[29]

By 1110, Petrus had left Aragon, and we are not sure of the timing of his eventual arrival in England until approximately 1120, when he met Walcher of Great Malvern.[30] The exact reasons and circumstances for his departure remain opaque, but he tells us himself that he has sought employment in France as an instructor in the new sciences. In his introduction to the al-Khwārizmī tables, now entitled *Epistola ad peripateticos,* Petrus writes to 'the peripatetics and others nourished with this philosophical milk, those in all parts of France most diligently engaged in teaching knowledge'. He suggests that they may want to learn of something new and:

> that anyone who might have anything rare, precious and useful which is unknown to others should impart it generously to others, so that in this way everyone's knowledge may both grow and be extended in time: we then, wishing to observe this law, have been zealous to investigate diligently if we had anything of this sort, which we might present to you.[31]

Upon literary self-examination, Petrus does indeed find he has something to offer and states that it is his wish to 'impart to the Latins that with which great labour and profound study I have gathered from the Arabs, Persians and Egyptians'.[32] What he had to offer was lessons in

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[29] Baer, *A History of the Jews*; Robert Chazan, *European Jewry and the First Crusade* (Berkeley: University of California Press, 1996); Gerber, *Jews of Spain*; Norman Golb, *The Jews in Medieval Normandy* (Cambridge: Cambridge University Press, 1998); Robin Mundill, *The King's Jews: Money, Massacre and Exodus in Medieval England* (London: Continuum, 2010).

[30] Tolan, *Petrus Alfonsi*: pp. 3–11; Nothaft, ed., *Walcher*: pp. 46–55*;* Metlitzki, *The Matter of Araby*: p. 23.

[31] Petrus, *Epistola*: pp. 164–165 (Latin) and pp. 172–173 (English): 'Uniuersis sancte matris ecclesie omnibus, uidelicet perypateticis ac per hoc aliis philosophico lacte nutritis, ubique per Franciam quamuis scientie doctrina diligentius exercitatis, Petrus Anidefunfus seruus Ihesu Christi, frater eorum et condiscipulus: salus uobis et benedictio ab eo cuius est salutem et benedictionem conferre. Quoniam omnes quocumque philosophico nectare potatos? Alterutrum se diligere, et si rarum quicquam preciosum et utile ceteris autem incognitum quis habeat, iustum est honestum begigne aliis impartire, ut sic cuiusque scientia et crescat et amplificetur in horas. Nos quippe legem hanc seruare uolentes diligenter inuestigare studuimus si quid huiusmodi haberemus quod ut dulce ac deliciosum uobis experientibus presentare possemus'; the epistola is also printed by Vallicrosa, 'La aportación astronómica', pp. 97–105.

[32]This was transcribed by Haskins, *Studies*: pp. 117–118, from Petrus' introduction to the al-Khwārizmī Tables in Corpus Christi 283 fol. 142v: 'Hoc autem opus magno labore desudatum et summon ab Arabicis Persicis Egipciacis translatum Latinus benigne impertiri volui, et quia volo ut hic liber predictis omnibus clareat, ideo sub eorumdem numero intitulavi et prout in ordine in eorum lingua repperi sic seriatim in latinam linguam digessi'; partially referenced by Metlitzki, *The Matter of Araby*: p. 25; see also Otto Neugebauer, *The Astronomical Tables of al-Khwārizmī: Translation with Commentaries of the*

astronomy, a subject both important to itself and 'necessary to medicine and indeed to other things', such as weather forecasting.

> Since I have discovered that almost all Latins are devoid of knowledge of this art of astronomy, though I have practised it and I have learned a small part of it, I have decided, if it pleases you, to share it with you and to present it – with diligence and kindness – as something rare, sweet and delicious.[33]

No need, he said, to travel abroad and 'traverse to distant places' to gain this knowledge because 'that which they prepare to seek in remote places is close at hand, unless they have some doubt that I am somewhat gifted in this art'.[34] Petrus made a point to say that he was in demand as a teacher: 'Everyday messengers come to us from surrounding regions, those who send them promise that as soon as I begin my lectures, they will come to listen'.[35] It is not known who listened to Petrus' lectures in France, but Walcher of Great Malvern certainly did so in the Severn Valley around 1120. There is also some evidence that Adelard of Bath collaborated with Petrus, a point that will be explored in the sections ahead.[36]

Petrus' career trajectory was one being taken by a number of Iberian scholars. The destabilisation period of the conquests of Christian Navarre and Aragon, coupled with the less lenient Almoravid rule of Yûsuf ibn Tashufin (1061–1106), beginning in the 1080s in al-Andalus, may have inspired a northern migration of Jewish scholars.[37] Attacks on Iberian Jewish communities were recorded in Granada in 1090, and in 1108 many Jews were massacred

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Latin Version Edited by H. Suter, Supplemented by Corpus Christi College MS 283 (Copenhagen: Ejnar Munksgaard, 1962) for notations by or about Petrus in the document (see index of the work).

[33] Petrus, *Epistola*: pp. 166–167 (Latin) and pp. 174–175 (English): 'Quia igitur fere omnes latinos artis huius astronomie uidelicet expertes inueni, ego autem in ea me diutius exercui, et partem inde nonnullam animo mandaui, uobis si placet impartire et quasi quiddan rarum, preciosum, dulce ac deliciosum diligenter ac benigne disposui presentare'.

[34] Petrus, *Epistola*: pp. 166–167 (Latin) and p. 175 (English): 'Ad nostras enim aures peruenit quod quidam ex eis qui sapientiam inuesigant, secundum quod potest per similitudinem comprehendi, longinquas parant peragrare prouincias et in remotas secedere regiones, ut ad artis astronomice pleniorem possint peruenire notitiam. Quibus utique incunctanter ego respondeo quia uerum est quod uidere desiderant, presto habent quod uolunt et prope est quod remotius parant inquirere, nisi forte eis ueniat in dubium quod in hac arte quippiam ualeamus'.

[35] Petrus, *Epistola*: p. 168 (Latin) and p. 177 (English): 'Singulis sane diebus ex finitimis circumquaque regionibus ad nos legati conueniunt ex persona mittentium promittentes quoniam statim postquam inceperimus ad audiendam nostram conuenient lectionem ad effectum'.

[36] Dickey, 'Adelard of Bath'; Burnett, 'The Works of Petrus Alfonsi': pp. 42–79.

[37] See Toch, 'Migrations'.

following the Muslim victory at the battle of Uclés in Castile. Yûsuf, in 1105, had ordered all Jews in his realm to convert to Islam. He was later dissuaded from this directive by an Islam judge (qûdî) from Cordoba. Nevertheless, Jews were removed from high office, and the communities were at risk. This event was one of many signs that the 'golden age' of Jewish-Muslim relations was officially at an end.[38] Iberian Jewish intellectuals sought refuge in other areas of the Mediterranean, such as Sicily and Italy, as well as travelling to Northern Europe and England. It is also possible that the relatively new and vital intellectual tenor of the schools developing in places like Chartres and Paris made northern France seem an attractive destination to these scholars.

Petrus was perhaps in an unusual position as a convert to Christianity from Judaism, but his message and path are reflective of Jewish scholars who left Iberia in this period. The analysis by Metlitzki is germane:

> It is clear that Petrus Alphonsi left Spain soon after his conversion and it may well have been that he could not bear the opprobrium of the Jewish community of his native land of which he must have been a distinguished member and which his baptism and his *Dialogues* outraged. But the manner in which he carried his knowledge of Spanish-Arabian science to the heart of the Latin world reminds one of the most distinguished Jewish scholars. Abraham bar Hiyya of Barcelona and Abraham ibn Ezra of Tudela considered it their mission to spread the new learning among the Jews of France and England for whom they made Hebrew translations of Arabic mathematical and astronomical treatises. While critical of Petrus' arguments against Judaism, Hiyya, also explains he is prompted by the feeling that the ignorant have to be educated in Arabic science, and explains that he is called upon to spread the knowledge of Arabic science among Hebrew readers in France.'[39]

While Petrus' travels are not clearly outlined, it is likely that he, like a number of scholars of Jewish origin in this period, decided his learning could reach a market in Northern Europe. As noted by Metlitzki, Petrus' later migration to England also foreshadowed the trail of Jewish scholars, such as Ibn Ezra (1089–1167) and Hiyya of Barcelona (d. 1145), who sought new intellectual markets and found the rising anti-Jewish sentiment in the continent in the wake of the crusades to be less secure.

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[38] Bat Ye'or, *The Dhimmi, Jews and Christians Under Islam*, in David Maisel, Paul Fenton, and David Littman, trans. (London: Associated University Presses, 1985): pp. 70–71.
[39] Metlitzki, *The Matter of Araby*: p. 23.

The role that Jewish scholars played in the transmission and translation of the new learning is evocatively portrayed by Abraham ibn Ezra himself in his introduction to his Hebrew translation of Ibn-Muthannā's commentary on the astronomical table of al-Khwārizmī where he places a Jew in the key role of the early transmission of the al-Khwārizmī tables to the Arab world in the eighth century:

> There arose a great King of the Arabs whose name was al-Saffāh. He heard that in India there were many sciences and so he ordered that a wise man be sought, fluent in both Arabic and the Language of India, who might translate one of the books of their wisdom for him. He thought that some mishap might befall the translator because profane sciences were still known in Islam. They had only the Qur'an and wise traditions which they received from Muhammed… [al-Saffāh] fasted in the hope that the angel of dreams might appear and permit the book to be translated for him into Arabic. Then in a dream he saw what he hoped for. So he sent for a Jew who knew both languages and ordered him to translate this book, for he feared that if an Arab were to translate the book, he might die. When he saw how wonderful the book was… he yearned for more knowledge of the sciences of India. He gave great wealth to the Jew…so that he might travel to the city of Arin [in India]. thinking that 'perhaps he will succeed in bringing one of their wise men to the king.' So the Jew went and indulged in many subterfuges after which, for a large sum, one of the wise men of Arin agreed to go to the king. Then from this scholar, with the Jew as an Arabic Indian interpreter, a scholar named Ya'qūb ibn Tāriq translated a book containing the tables of seven planets, the arrangement of the astrological houses, knowledge of the fixed stars, and eclipses of the luminaries.[40]

The actual progress of this transmission and translation did not initially involve a Jew insofar as this can be ascertained. There was a delegation from India to Baghdad that included scholars that brought Indian astronomy to the Muslims in the late eighth century. Ya'qūb ibn Tāriq, in the same period, did produce a set of astronomical tables on which the al-Khwārizmī tables were based, with Arin as the Meridian. Either Ibn Ezra assumed in error that a Jew must have been involved, or this element was inserted into the account. In either case, the role of the Jewish intermediary was established as inherently plausible.

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[40] Bernard Goldstein, *Ibn al-Muthannâ's Commentary on the Astronomical Tables of al-Khwârizmî: Two Hebrew Versions, Edited and Translated, with an Astronomical Commentary* (New Haven: Yale University Press, 1967): pp. 147–148; Bernard Goldstein, 'Astronomy as a 'Neutral Zone': Interreligious Cooperation in Medieval Spain', *Medieval Encounters,* 15 (2009): pp. 159–174; Ross Brann, 'The Moors?', in Ivy A. Corfis, ed., *Al-Andalus, Sepharad and Medieval Iberia: Cultural Contact and Diffusion* (Leiden: Brill, 2009): pp. 151–162 at p. 161, reprinted from *Medieval Encounters* 15, no. 2–4 (2009), pp. 307–318.

In his *Dialogus*, considered one of his earlier works, Petrus used scientific and astronomical arguments to illustrate how much better-suited Christian thought was to the new sciences than the conservative Jewish thinking was.[41] In this work, his theories around the new sciences are presented in a somewhat scattered form. Within this context, however, a practical, logical approach to astronomy emerges. For instance, he derided the literal-mindedness of the Jewish scholars ('vestry doctors') who take the biblical text to mean that God's abode is in the West. Peter (the Christian) explained that 'East' and 'West' are not absolutes; they are not the same to all men. He used the example of the location of Arin, the Arabic exemplar noted above, which is featured in the text of the al-Khwārizmī tables. Also, in this work, Petrus supported a recurring argument that astronomy forms the basis and illuminates all other sciences, including medicine.[42]

In the *Epistola*, the introduction to his translation of the al-Khwārizmī tables, Petrus more formally outlined the pivotal role of astronomy within the context of the liberal arts.[43] Describing the arts, he states upfront that grammar is not one of them. Of the others, he states that they are all in some measure dependent on astronomy. The dependency of medicine on astronomy, in particular, is emphasised. Living bodies are impacted not just by major events such as the rotation of the equinoxes but by the unique revolutions of the stars and the moon. These influences subject the living to forces that produce decay, bile, and phlegm.[44] Astronomy is also helpful in predicting the weather, which is important to sailing. Astronomers, whose business it is to observe these influences are, therefore, he emphasises, of great utility. 'In sum it is proven by experimental argument, and we can affirm a true thing, that the sun, the moon, and the other planets exercise their powers in earthly things and many things are affected by them'.[45]

Petrus' description of astronomy includes several areas, notably medical practice and meteorological prognostication, that would have made his knowledge marketable to royal patrons. It seems clear that is what Petrus was attempting to convey. Given his emphasis on

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[41] Tolan, *Petrus Alfonsi*: pp. 95–158.
[42] Tolan, *Petrus Alfonsi*: pp. 49–54.
[43] Petrus, *Epistola*: pp. 163–180.
[44] Petrus, *Epistola*: pp. 170–171 (Latin) and pp. 178–179 (English).
[45] Petrus, *Epistola*: pp. 171 (Latin) and 179 (English): 'Probatum est igitur argumento experimatali, et re uera possumus affirmare, solem et lunam aliosque planetas in terrenis uires suas exercere ac secundum ipsos multa contingere'.

medicine and astronomy in his works, it should also be no surprise that he was to be remembered, perhaps wrongly, as one of Henry I's legion of personal physicians.[46] Regardless of his position related to a specific court, his expertise proved to be of interest among the Severn Valley scholars. In many ways, more is known about Petrus' actual astronomical skill indirectly from Walcher, Prior of Great Malvern, as the next chapter will explore. Petrus' possible relationship to another of the Severn Valley thinkers, Adelard of Bath, is equally worth consideration. The potential connections between these two scholars are of import to the development of astronomical thinking and awareness in the Latin West and the connections to royal patronage. To establish the framework for that discussion, it will be important to review the early career of Adelard.

3.3 ADELARD OF BATH AND HIS EARLY TRAVELS

Adelard of Bath (1080–1152) was Petrus Alfonsi's contemporary and, while there is debate over whether they met or collaborated, they had many parallel interests.[47] Adelard, after a period where he explored the new learning in the East, used a similar strategy as Petrus to market his knowledge. Nevertheless, Adelard and Petrus are, in some ways, strange bedfellows. It is possible that Petrus contributed to Adelard's later education and, if this is the case, the student exceeded the master. First, something should be said about Adelard's early background, travels, and works.[48] In this chapter, only Adelard's early biography will be addressed. His life and work after his return to England in the 1120 will be discussed in Chapter IV.

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[46] Edward Kealey, *Medieval Medicus*, *A Social History of Anglo-Norman Medicine* (Baltimore: Johns Hopkins University Press, 1981), Chapter II: pp. 30–31. Kealey's work should be treated with some caution, though all but Petrus are confirmed in Charles Hugh Talbot, and Eugene Ashby Hammond. *The Medical Practitioners in Medieval England: A Biographical Register* (Wellcome Historical Medical Library, 1965); see Tolan, *Petrus Alfonsi*: pp. 213–214, n. 17.

[47] Dickey, 'Adelard of Bath'; Burnett, 'Petrus Alfonsi and Adelard of Bath Revisited'; Burnett, 'Questions of Authenticity'; see also M.T. d'Alverny, 'Pseudo-Aristotle, *De elementis*', in J. Kraye, W.F. Ryan, and C.B. Schmitt, eds., *Pseudo-Aristotle in the Middle Ages: The Theology and Other Texts* (London: Warburg Institute, 1986): pp. 63–84.

[48] The best sources for Adelard are Charles Burnett, ed. and trans., *Adelard of Bath, Conversations with his Nephew: On the Same and the Different, Questions on Natural Science, and On Birds* (Cambridge: Cambridge University Press, 1998): pp. 20–42; Thorndike, *History of Magic,* vol. 2: pp. 19–49, esp. pp. 14–19; Brian Lawn, *The Salernitan Questions: An Introduction to the History of Medieval and*

Adelard, in all likelihood, came from Bath, which he identified as his place of origin.[49] There is also supporting, although individually non-conclusive, evidence for this from the Pipe Rolls and various cartularies from Bath.[50] These indicate that his father, named Fastradi, may well have been one of the principal tenants of Giso, Bishop of Bath. Bishop John Villula (1088-1122), successor to Giso and appointed by Henry I, was known to have made a practice of sending promising students to the cathedral schools of the continent for study.[51] It was first to Tours and then Laon that Adelard was sent. At Tours, Adelard studied with a 'certain man' who encouraged him to think for himself about the science of the stars. It is unclear who this 'certain man' was, but Burnett has suggested Hildebert of Lavardin.[52] Laon had a reputation for advanced study of the *quadrivium*, as well as theology, and it is likely that Adelard learned there the practical mathematics and a facility with the abacus, which would have been relevant to his later association with the English Exchequer.[53]

In the *De eodem,* Adelard describes to his nephew (a literary device much like Petrus' conversation with his former self in the *Dialogus*) 'the reason for my troublesome journey' to the East and the influence of the 'certain man' indicated above.

> One night, when he had explained to me the positions of the constellations, the qualities of the planets and the distances of their orbs, he said: 'it is for you to consider in your mind whether I have described things correctly: I shall take myself home'. At this point I, struck as much by the dignity of the subject as the advice of the old man, prepared to go over in my mind what I had heard.'[54]

Renaissance Problem Literature (Oxford: Clarendon Press, 1963): pp. 20–31; contributions in Burnett, ed., *Adelard of Bath*: *An English Scientist and Arabist* o*f the Early Twelfth Century* (London: Warburg Institute, 1987); Southern, *Robert Grosseteste*: pp. xiv–xvii and pp. 85–88; Cochrane, *Adelard*. For an in-depth study of the relationship of Adelard and Petrus' scholarly relationship, see, Dickey, 'Adelard of Bath'; see also, Franz Bliemetzrieder, *Adelhard von Bath Blätter aus dem Leben eines englischen Naturphilosophen des 12. Jahrhunderts und Bahnbrechers einer Wiedererweckung der griechischen Antike; eine kulturgeschichtliche Studie* (Munich: Hueber, 1935).

[49] Adelard, *QN*: p. 150: 'non Stoicum me set Bathoniensem dico'.

[50] William Hunt, ed., *Two Chartularies of the Priory of St Peter at Bath: I. The Chartulary in MS. No. cxi., in the Library of Corpus Christi College, Cambridge. II. Calendar of the MS. register in the Library of the Hon. Society of Lincoln's Inn* (London: Harrison and Sons, 1893), nos. 34, 41, 53, 54.

[51] Julia Barrow, 'Giso (d. 1088), Bishop of Wells', *ODNB*.

[52] Burnett, ed. and trans., '*Conversations,* 'Introduction': pp. xlii, xviii–xix; arguing against this is Victoria Goddard, 'The Poetry and Philosophy of Boethius and Dante' (PhD Dissertation, University of Toronto, 2011): pp. 206–207.

[53] Burnett, ed. and trans., *Conversations,* 'Introduction': pp. xiii–xvi.

[54] Adelard, *De eodem*: pp. 4–5: 'Cumque semel michi situs siderum, qualitates planetarum, distantas orbium, nocturnus exposuisset. 'Tu', inquit, 'utrum recte executus sim tecum expende: ego me domum

Adelard's search for new astronomical knowledge took him not to the Iberian Peninsula but to Norman Italy and Sicily and Antioch.

As he describes it himself, Adelard's departure also was a result of dissatisfaction with the approach of scholars within his orbit. Much like Petrus, Adelard speaks with disdain for those who put an 'irrational' reverence for ancient authority over experience or logic:

> Daily in our midst new Platos and Aristotles, [are those] who promise what they do not know as boldly as what they do know, without batting an eyelid. They place their greatest confidence in the greatest torrent of words. Can anything be more similar to scurrilous impudence than their pretence of being sensible? For they say that the sense provides no proof, and one should believe neither eyes nor the ears, nor the other senses. If they are deprived of the use of the senses, they will change their minds! Would they be not all made blind and deaf! And deservedly. For they follow (they say) reason as a leader, than which nothing is more blind, since they tell the lie that they see that which is nothing in reality.[55]

Instead, Adelard insists that he has '…learned from my Arab master to take reason as my guide'.[56] He elaborates in his letter to his nephew that those who study the encyclopaedic works of the ancients are stuck in a state of unknowing. The new sciences of the Arabs, based on observation and reason, lead to a new understanding. This is strikingly reminiscent of Petrus Alfonsi's rhetoric in the *Epistola* to the scholars in Paris on the subject of astronomy.

When Adelard left Laon, he tells us he travelled to Sicily and Antioch, following the lines of Norman influence in the Mediterranean with Roger II in Sicily and Tancred in Antioch. While his sojourn in Sicily has been accepted in modern scholarship, the visit to Antioch has been

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recipiam. Hic ego, tum tractatus dignitate cum senis ammonitione occupatus, ad audita relegenda animo accingor'.

[55] Adelard, *De eodem*: pp. 10–11: 'Et assidue quidem etiam nunc cotidie Platones, Aristotles novi nobis nascuntur, qui eque ea que nesciant ut at ea que sciant sine frontis iactura promittant. Estque in summa verbositate summa eorum fiducia. Quid enim scurrili impudentie simulius quam quod ipsi se sentire simulant? Aiunt enim nullam esse certificationem sensuum, nec oculis nec auribus ceterisque credendum esse. Quo munere si priventur ipsi, aliter sentiant! Utinamque omnes ceci surdique effciantur! Ac merito. Sequuntur enim, ut dicunt, rationem ducem, qua nichil cecius est, cum id quod nichil in actu rerum est se videre menciantur'.

[56] Stefano Corboni, *Venice and the Islamic World, 828–1797* (New Haven: Yale University Press, 2007): p. 157; see also Edoardo D'Angelo, 'A Latin School in the Norman Principality of Antioch', in Edoardo D'Angelo, David Bates, and Elisabeth Houts, eds., *People, Texts and Artefacts: Cultural Transmission in the Medieval Norman Worlds* (London: Institute of Historical Research, 2018): pp. 78–88.

treated a little more sceptically, for instance, by Brian Lawn.[57] Part of this scepticism stems from the fact that Adelard seemed to return with surprisingly little Arabic, though he was adept enough in the language later in his career to translate Euclid. All of that said, as Dickey suggests, there is no particular reason not to take Adelard at his word and that scholarly expectations of such a trip might do better to do so.[58] Indeed, the visit to Antioch is referenced within the *Quaestiones naturales,* where Adelard has his nephew state, 'once, when you were crossing the bridge of the city of Mamistra in the region of Antioch, that bridge together with the whole of that region trembled with an earthquake'.[59] Exactly what Adelard came away with from this portion of his journey, apart from an experience of natural phenomena on a different scale to Bath, is, however, more difficult to assess.

Adelard's exposure to Sicilian culture may have been the more formative of the experiences. Norman Sicily, in many ways, resembled al-Andalus in cultural plurality and intellectual fortitude. Adelard would have arrived at the time of the ascension of Roger II, at that time as count of Sicily and before formally being made king in 1130. Under Roger's influence, Sicily rose to its Golden Age. Greek, Arab, and Iberian intellectuals gravitated to his court and were well supported. A later description by Ibn Jubayr, an al-Andalusi scholar of the court of William I of Sicily, reveals the practice and tone of royal patronage earlier established by Roger II:

> King William is admirable for his just conduct, and the use he makes of the industry of the Muslims....He has much confidence in Muslims, relying on them for his affairs, and the most important matters...He pays much attention to his [Muslim] physicians and astrologers by taking great care of them. When told that a physician or astrologer is passing through his land, he will even order his detainment, and then provide him with means of living so that he will forget his native land… [Last but not least], one of the remarkable things told of him is that he reads and writes Arabic.[60]

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[57] Haskins, *Studies,* p. 39; Lawn, *The Salernitan Questions*: pp. 21–24.
[58] Dickey, 'Adelard of Bath': p. 65.
[59] Adelard, *QN*: pp. 184–185: 'Quia cum semel in partibus Antiochenis pontem civitatis Mamistre transires, ipsum pontem simul etiam totam illiam regionem terre motu contremuisse'; see also Haskins, *Studies*: p. 39; Cochrane, *Adelard*: pp. 32–35; Dickey, 'Adelard of Bath': pp. 66–68.
[60] Sarah Davis-Secord, *Where Three Worlds Met: Sicily in the Early Medieval Mediterranean* (Ithaca, NY: Cornell University Press, 2017) and Hubert Houben, *Roger II of Sicily: A Ruler Between East and West* (Cambridge: Cambridge University Press, 2002); R.J.C Broadhurst and Robert Irwin, eds., *The Travels of Ibn Jubayr: A Medieval Journey from Cordoba to Jerusalem* (London: I.B. Tauris, 2019).

Elements of Roger's royal style were taken from the Fatimid court. Aspects mimicked Byzantium and others the administrative practices of the Norman rulers of England. Roger had a large and active fleet, connecting him to the Mediterranean civilisations as well as to Iberia, Normandy, and England and an active trade policy with the eastern and western Mediterranean.[61] It is not unreasonable to suppose that these maritime connections facilitated the travel of scholars in the wide region of his influence.

While in Sicily, Adelard was possibly connected to William, the Bishop of Syracuse, whom he praised as 'learned in all the mathematical arts', and to whom he dedicated his *De eodem et diverso*. Here, Adelard learned the full value of astronomy, which he described as:

> this maiden [who] sketches the shape of the world, as contained in her teaching, the number and size of the circles, the distances of the orbs, the courses of the planets, the positions of the signs of the zodiac; she paints in the parallels and colures, she divides the zodiac into twelve parts with thoughtful reason, she is aware of the size of the stars, the opposite position of the two poles, the axis stretching between them. If anyone could make her his own, he would be confident in declaring not only the present condition of lower things, *but also their past and future conditions*. For those higher and divine animate beings are the principle and causes of the lower natures.[62]

By approximately 1122 Adelard had returned to England, determined to provide instruction in what he learned, including, as he indicates above, the telling of fortunes.[63] He, like Petrus, seems to have made learning his livelihood and probably as a secular scholar. Patrons were therefore essential. Adelard's later work and his impact on the Severn Valley scholars will be discussed in the next chapter, as will Petrus'.

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[61] His wife was from Iberia; Jeremy Johns, *Arabic Administration in Norman Sicily: the Royal Dīwān* (Cambridge: Cambridge University Press, 2007).

[62] Adelard, *De eodem:* pp. 68–69: 'Hec enim sua disciplina comprehensam mundi formam, numerum quantitatemque circulorum, distantias orbium, cursus planetarum, situs signorum describit; paralellos colurosque depingit, zodiacum in duodecim partes rata ratione disertit, stellarum magnitudinem, polorum oppositionem, axium extesionem non ignorat. Hanc si quis sibi privatam facere posset, non modo presentem rerum inferiorem statum, verum etiam preteritum vel futurum non diffiteretur. Superiora quippe illa divinaque animalia inferiorum naturarum et principium et cause sunt'. My emphasis to indicate the use of astronomy in forecasting.

[63] Burnett, ed. and trans, *Conversations*: p. xvi.

3.4 ASTRONOMY, PATRONAGE, AND THE ROYAL COURT

Royal or noble patronage is an important and recurring theme in the analysis of the lives of the scholars involved in the transmission of Arabic science. As discussed, Petrus Alfonsi began his career under the wing of Alphonso I and then sought, probably, noble or royal patronage as he moved into Northern Europe and England. Adelard of Bath, before first leaving England, was sponsored initially by John Villula, the Bishop of Bath, himself under the royal patronage of Henry I. As we have seen, Adelard may have been sponsored by Bishop William of Syracuse, with potential links to the court of Roger II of Sicily and his large and distinguished circle of scholars and artists. Henry I of England, similarly to Roger II, styled himself as a learned ruler.

Henry was sometimes referred to as 'Beauclerc' in reference to his relatively high level of learning. Henry's reign was anything but peaceful, but nonetheless, Henry's sensibilities and policies had a strong cultural impact. In several aspects, these sensitivities were suited to the exchange of ideas and of the new sciences. Anne Lawrence-Mathers paints an image of Henry as a king who may have been eager to present himself in particular ways.[64] Part of this exercise was to appear to be educated, achieved to some extent by being surrounded by educated men. The household of Henry 'Beauclerc' has been described as the 'first patronising court'.[65] C. Warren Hollister described the court as one where education was valued.[66] The sons of Henry's advisor Robert Meulan were educated by Faricius, an Italian physician and Abbot of Abingdon who extended the scientific collection of his house, as will be described below. According to William of Malmesbury, these two had presented an argument before the Pope that convinced him that the court of Henry represented a more 'flourishing literary culture than they had ever heard of'.[67]

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[64] Lawrence-Mathers, *The True History of Merlin*.
[65] Karl Julius Holzknecht, *Literary Patronage in the Middle Ages* (Philadelphia: University of Pennsylvania, 1923): p. 218; see also M.D. Legge, 'L'influence littéraire de la cour d'Henri Beauclerc', in Fred Dethier, ed., *Melanges offerts à Rita Lejeune, Professeur à l'université de Liège I* (Gembloux: Duculot, 1969): pp. 679–687, and James Westfall Thompson, *The Literacy of the Laity (*Berkeley: University of California Press, 1939): p. 170.
[66] Hollister, *Henry I*: pp. 293–297.
[67] William, *GR,* V.406: pp. 736–737: 'florere litterarum peritia quam ipsi audissent'.

Other examples put forward by Hollister include several of Henry's administrative retinue. Roger, the Bishop of Salisbury and Robert of Béthune, for instance, had ties to or were educated at the school of Laon.

Henry I surrounded himself with people and things that piqued his varied interests. Henry appeared to be interested in both the pragmatic and the exotic. But in both these areas, the element of novelty existed. The most colourful example of his interest in the exotic was his menagerie at Woodstock, his favourite English domicile. According to William of Malmesbury, Henry was:

> extremely fond of the wonders of distant countries, begging with great delight, as I have observed, from foreign Kings, lions, leopards, lynxes or camels – animals which England does not produce. He had a park called Woodstock which he used to place favourites of this kind.[68]

Henry also collected scholars and administrators, often for pragmatic and administrative reasons. Those who were trained in the use of the abacus and mathematics, such as Adelard of Bath and Walcher of Great Malvern, were probably useful in a court where the Exchequer was the central institution of account. A similar situation might be posited for medicine, whose expert practitioners were sponsored by Henry I and his queens and who might have included Petrus, though the evidence is thin.[69] The only mention of Petrus as *medicus* to Henry I occurs in the margins of a thirteenth-century copy of *Disicplina clericalis*.[70] No other contemporary texts refer to Petrus as having the role of 'physician'. Perhaps in the blurred line between *medicos, physica,* and astronomy, Petrus' role became somewhat apocryphal. It is plausible, however, that both Petrus and Adelard were scholars who would have been of interest to Henry I.

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[68] William, *GR,* V.409.2: pp. 740–741: 'Nam et ille prona uoluptate exterarum terrarum miracula inhiabat, leones, leopardos, linces, camelos, quorum fetus Anglia est inops, grandi, ut dixi, iocunditate a regibus alienis expostulans; habebatque consetum quod Wdstoche dicitur, in quo delitas taliumrerum confouebat'; 'Woodstock in Oxfordshire Housed UK's First Zoo', *BBC*, June 10, 2010. http://news.bbc.co.uk/local/oxford/hi/people_and_places/history/newsid_8717000/8717819.stm (accessed 17/04/2020).

[69] A clerk of Henry and his Queen, Adeliza, and not, it appears, related to Serlo, the Abbot of Gloucester who had ties to Avranches, or Serlo the Abbot of Cirencester.

[70] Tolan, *Petrus Alfonsi*: pp. 10–11, notation Cambridge University Library Ms. Ii. VI. II. fo. 95: 'Dixit Petrus Amphulsus servus Jhesu Christi Henrici primi regis anglorum medicus compositor huius libri'. See also Haskins, 'Reception': p. 60 and Thorndike, *History of Magic*, vol. 2: p. 69.

A particular note must also be taken of important local patrons, such as Miles of Gloucester, who became the first Earl of Hereford, and Robert of Gloucester. Both (after some vacillation) supported Matilda's claim and led campaigns against Stephen. Both were involved in maintaining the Welsh border. Both were active patrons, supporting the new construction of churches, monasteries, and other buildings with high levels of artistry. This was no provincial effort. The work of Malcolm Thurlby and Jonathan Turnock has underscored the importance and wider significance of the architectural patronage of these two figures.[71]

These more permanent markers of patronage are further supported by the evidence of Robert of Gloucester's literary patronage. A survey of his charters shows attendance at a number of significant centres of learning for the late Anglo-Norman realm: Mont Saint Michel, Chartres, and Bec are of interest (see Map #2 above in the Introduction). More significant still is his relationship to William of Malmesbury and Geoffrey of Monmouth. William dedicates or addresses at least three works to Robert: the *Abbreviatio amalarii* (there is some doubt on the dedication here), the *Gesta regum Anglorum,* and the *Historia novella.* Robert Patterson argues convincingly that this last work was written as an apologia for Robert of Gloucester's actions against Stephen and that Robert may have commissioned the work himself.[72] Patterson also suggests that Robert's patronage may have extended into the new sciences, though the evidence for that is only indirect and will be discussed in Chapter IV [4.2]. In the *Gesta regum Anglorum*, William of Malmesbury suggests that Robert, like his father, was a highly educated man: 'To literature you are so devoted that, burdened as you are, you yet snatch a few hours to yourself in which to read'.[73] Geoffrey of Monmouth also noted the importance of Robert's patronage and

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[71] Malcom Thurlby and Bruce Coplestone-Crow, *The Herefordshire School of Romanesque Sculpture,* 2nd ed. (Almeley: Logaston, 2013); Jonathan Andrew Turnock, 'Reconsidering the Reign of King Stephen: A Contextual Study of Sculpture Created in Gloucestershire between 1135 and 1154' (MA Thesis, Durham University, 2015); Brian Golding, 'Trans-Border Transactions: Patterns of Patronage in Anglo-Norman Wales', *Haskins Society Journal* 16 (2006): pp. 27–46.

[72] Robert Patterson, 'William of Malmesbury's Robert of Gloucester: A Re-Evaluation of the *Historia Novella*', *The American Historical Review* 70, no. 4 (1965): pp. 983–997; see also Joe W. Leedom, 'William of Malmesbury and Robert of Gloucester Reconsidered', *Albion: A Quarterly Journal Concerned with British Studies* 6, no. 3 (1974): pp. 251–265; James Turner, 'Illegitimacy and Power: 12th Century Anglo-Norman and Angevin Illegitimate Family Members within Aristocratic Society', (PhD Dissertation, Durham University, 2020).

[73] William, *GR,* V.447: pp. 798–799: 'Litteras ita fouetis ut, cum sitis tantarum occupationum mole districti, horas tamen aliquas uobis surripiatis, quibus aut ipsi legere aut legentes possitis audire'.

interest in his *Historia regum Britanniae*.[74] Even at the local level, with Robert of Gloucester, there is evidence (albeit faint) of how the presence of important political figures may have offered patronage opportunities for scholars in this period.

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[74] Geoffrey of Monmouth, *Historia Regum Britanniae*, ed. Jacob Hammer (Cambridge, MA: Medieval Academy of America, 1951), p. 22: 'Opusculo igitur meo, Roberte, Claudiocestriae dux, faveas, ut sic, te doctore, te monitore, corrigatur quod non ex Gaufridi Monemutensis fonticulo censeatur exortum, sed sale Minervae tuae conditum, illius dicatur editio, quem Henricus, illustris rex Anglorum, genuit, quem philosophia liberalibus artibus erudivit', in Michael A. Faletra, trans., *The History of the Kings of Britain* (Peterborough, Ontario: Broadview Editions, 2008): 'You too, Earl Robert of Gloucester, who are the pillar of our realm, should lend your effort to my task, so that this work will benefit marvelously from the guidance you both provide. Because you too are sprung from that illustrious King Henry, Mother Philosophy has welcomed you to her bosom and has instructed you in the subtleties of her various arts'.

CHAPTER IV

Walcher of Great Malvern, Petrus Alfonsi, Adelard of Bath, and the Use of the New Astronomical Sciences

> ***The doctrine of Peter the Hebrew, surnamed Alfonsus, concerning the Dragon, which Dom Walcher, Prior of the Church of Malvern, translated into the Latin Language***
>
> *Among the seven planets that go around the zodiac, the Dragon roams as well, but with a contrary motion, because whereas the path of all the planets is carried from Aries to Taurus, from Taurus to Gemini, and so on, only the Dragon is held to go from Aries to Pisces, from Pisces to Aquarius, and so on…An understanding of this circuit is so essential to foreknowing an eclipse of the Sun or the Moon that without it there is no way of predicting it.*
>
> Walcher of Great Malvern*, De dracone*[1]

So Walcher began his *De dracone,* which has drawn scholarly attention since Charles Haskins printed part of it in 1915.[2] *De dracone* holds a place of some significance in the history of science.[3] It is one of the first pieces of evidence we have of the introduction of the new sciences from the Iberian Peninsula and the Islamicate world into the Latin West. It is the only contemporary reference we have besides Petrus himself to his teaching, travels, and other

[1] Walcher, *DD*, c. 1.1: pp. 194–195: 'Sententia Petri Ebrei, cognomento Anphus, de Dracone, quam dominus Walcerus prior Malvernenis ecclesie in Latinam transtulit linguam.
Inter septem planetas per zodiacum circumeuntes discurrit etiam Draco, sed contrario motu, quia cum omnium planetarum cursus ab Ariete in Taurum, a Tauro in Geminos, et sic in cetera, feratur, solus Draco ab Ariete in Pisces, a Piscibus in in Aquarium, et sic in cetera, ferri perhibetur. Est autem tante magnitudinis, ut in quocumque signo vel gradu caput eius habeatur, eius oppositum signum vel gradum cauda eius semper obtineat. Huius autem circumitionis cognitio ad prenoscendam solis eclipsim sive lune sic est necessaria ut sine hac nullo modo presciri valeat, quia numquam fit solis eclipsis, nisi sol et luna sum capite sive cauda Draconis huius in uno gradu cuiuslibet signi convenerint, neque lune eclipis, nisi sol in capite eius et luna in cauda, vel sol in cauda et luna in capite eius, sibi opposite fuerint'. [note, entire section printed here for reader, and partially repeated below.]

[2] Haskins, 'The Reception of Arabic Science': pp. 56–69; the edition of Walcher's work and commentary are found in Nothaft, ed., *Walcher.*

[3] The most useful summaries of Walcher's influence are to be found in Nothaft's edition of Walcher's works, *Walcher,* (noted above) and in McCluskey's *Astronomies*: pp. 180–187.

activities. It also marks a trail of progress in Walcher's own thinking, with themes later echoed by his neighbour John of Worcester.

The intellectual progression of Walcher of Great Malvern and John of Worcester in the early twelfth century provides a vivid image of the impact of the arrival of the new sciences. Any analysis of Walcher and of John also requires further attention to the works of Petrus Alfonsi and Adelard of Bath, the intellectual explorers described in Chapter III, who were largely responsible for the introduction of the new learning. In order to elaborate on their direct or indirect relationships to Walcher of Great Malvern and John, the focus will be redirected to their respective careers as they arrived in England in the first half of the twelfth century. To this end, this chapter will focus on Walcher of Great Malvern and his encounter with Petrus Alfonsi, look forward to the arrival of Adelard of Bath, and include reflections on the promise of patronage which may have drawn them to the area.

4.1 HOW WALCHER CAME TO THE SEVERN VALLEY

Walcher's role as Prior of Great Malvern and his Lotharingian background are important for a fuller consideration of his intellectual interests and development. As described in Chapter II, scholarly consensus interprets *De lunationibus*, written before his introduction to Petrus and the new sciences, as coherent with the traditions of Gerbert of Aurillac and, indeed, moving beyond them.[4] Written for the priory and in his role as the community leader, it focused on timekeeping, both calendrical and horological. It may also be considered compatible, as discussed earlier, with the lunaries' tradition of prognostication, which was popular in the monastic tradition. His observational skills with the horologium and the astrolabe followed the example of Gregory of Tours and others who contributed to the tool-box of monastic timekeeping. However, Walcher took that interest further than most priors or cantors. We have seen from *De lunationibus* that he had more than a passing interest in astronomy, more than

[4] McCluskey, *Astronomies*: pp. 180–187; George Sarton, *Introduction to the History of Science.* vol. 2, pt. 2 (Baltimore: Published for the Carnegie Institution of Washington by the Williams & Wilkins Company, 1931), p. 210 calls him 'one of the first Englishmen to make astronomical observations'.

passing skills in the related tools (the abacus and the astrolabe), and that his knowledge of medicine may have included an awareness of the work of Constantine the African. Perhaps the most revealing are his self-reflective comments about where his research would go from that point. Walcher was obviously frustrated with his results. He ended his *De lunationibus* with the stated intention to continue his studies and find the solutions which had so far eluded him. Around 1120, he found some of the answers he sought through personal mentoring by Petrus Alfonsi.

What is known of Walcher comes from his own writings, from William of Malmesbury, and from John of Worcester.[5] There are also scattered traces in a more disparate documentary tradition. From William, we know that he was educated at Fulda, Saxony, a monastery within the sphere of the Gerbertian educational sensibilities concerning the importance of the *quadrivium*.[6] From Walcher himself, we know he was near Rome on October 30th 1091 and recorded in some detail an eclipse he saw there. He was in England in time to see the eclipse of October 18th 1092. He states that he had 'returned' to England, but this is the only indication we have of a previous visit or residence.[7] Walcher's role immediately on his return is uncertain, and the timing of his appointment as Prior of Great Malvern is also unclear. William of Malmesbury suggests that Walcher was a member of the Great Malvern community before 1120, the time of his writing of the *Gesta regum*. The first solid evidence concerning his appointment as prior comes from John of Worcester, who notes that *prior etiam Malvernensis domnus Walcerus* attended the consecration of a new Abbot of Tewkesbury in Worcester Cathedral on May 23rd 1125.[8]

The priory itself was a recent establishment. While the history and rationale for the establishment are somewhat opaque, it most likely began as an offshoot of the monastery of Malvern Chase, established in 1085. William of Malmesbury wrote that thirty monks formed a

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[5]John, *Chronicle*, III, s.a.1125: pp. 160–161, mentions that he is Prior of Great Malvern ('Prior etiam Maluernensis domnus Walcerus') and therefore gives us a *terminus ante quem* for his appointment; William of Malmesbury is cited below. The main biographical discussions of Walcher of Great Malvern are Nothaft, ed., *Walcher*: pp. 1–2 and Charles Burnett, 'Malvern, Walcher of (*d.* 1135), Prior of Great Malvern and Astronomer', *ODNB*; McCluskey, *Astronomies*: pp. 180–187; William, *GR*, 293: pp. 526–539.

[6] For Gerbert's relationship to Fulda, see Boyd Hill, *Medieval Monarchy in Action: The German Empire from Henry I to Henry IV* (London: Allen and Unwin, 1971), 'The Reign of Otto III (983–1002)'.

[7] Walcher, *DL*, c. 4.1: pp. 114–115: 'Reversus itaque in Angliam'.

[8] John, *Chronicle*, III, s.a. 1125: pp. 160–161.

group led by Aldwyn on land owned by Westminster Abbey.[9] By William's time, it had been recognised as a priory under Westminster's direction.[10] It is unclear whether the priory had been established before Walcher's arrival or return(?) in 1092. Still, as Richard Sharpe puts it, 'since he had travelled to Italy in that year, it seems very unlikely that he was living as a hermit in the woods of Malvern'.[11] The architectural evidence indicates that the building effort had commenced by the 1090s. By 1120 the church was an impressive building, according to William of Malmesbury.[12] The patronage for this construction is unclear, though the stylistic similarities to Tewkesbury and Gloucester make it tempting to suggest a connection to William Rufus and later construction to Robert of Gloucester.[13] A royal connection is also plausible since the Priory fell under the jurisdiction of Westminster Abbey.

The Westminster administrative connection makes it likely that Walcher's appointment was known to Henry I.[14] Walcher's profile fits that of Norman ecclesiastical appointments. Like Robert of Lorraine, Walcher had the skills and education that seemed to have been sought after by the Norman kings. In a daughter house to Westminster, his connections to the royal see and household would have been maintained. Henry I's itinerary shows that Great Malvern was of interest to him. In 1127 and 1128, for instance, Henry and Matilda witnessed charters for the 'church of Malvern'.[15] Walcher would have been prior at this time.

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[9] William, *GP,* IV, 145: pp. 434-435.

[10] Richard Sharpe, 'Great Malvern Priory'*, The Charters of William II and Henry I* (2013): https://actswilliam2henry1.files.wordpress.com/2013/10/h1-great-malvern-2013-1.pdf (accessed 09/04/2022); J. W. Willis-Bund and William Page, eds., *A History of the County of Worcester: Volume 2* (London: Victoria County History, 1971), 'Houses of Benedictine Monks: Priory of Great Malvern': pp. 136–143 also available online: https://www.british-history.ac.uk/vch/worcs/vol2/pp136-143#anchorn96 (accessed 19/05/2021); Anthony C. Deane, *A Short Account of Great Malvern Priory Church, a History of the Monastery, and Description of the Fabric* (London: G. Bell and Sons, Ltd., 1914).

[11] Richard Sharpe, 'Great Malvern Priory'.

[12] The Malvern Church was built between 1089–1120 with more compelling arguments placing construction closer to the 1120s. Nikolaus Pevsner, *Worcestershire* (Harmondsworth: Penguin Books, 1968): pp. 158–159 places it around 1120, and C. Wilson, 'Serlo's Church at Gloucester, 1089–1100', in S. Heslop and V. Sekules, eds., *Medieval Art and Architecture at Gloucester and Tewkesbury* (London: British Archaeological Association, 1985): pp. 52–83, estimates an earlier date of 1095–1100.

[13] See Malcolm Thurlby, 'Observations on Romanesque Architecture and Sculpture in the Diocese of Monmouth', *Monmouthshire Antiquary*, 34 (2018): pp. 17–44.

[14] See discussion on the appointment of Walcher and the springs of Malvern, Lawrence-Mathers, *The True History of Merlin*: pp. 126–127.

[15] Farrer, *An Outline Itinerary*, nos. 524 and 543; the authenticity of these charters (524 and 543) is questioned by Sharpe, 'Great Malvern', though he acknowledges a royal connection.

Nevertheless, as a person and a scholar, we have a few testimonials for Walcher. Of note is William of Malmesbury's professed friendship and admiration. William recounted a story told to him by Walcher about the monastery of Fulda. William concluded this narrative in this way: 'I learned this [story] from the reverend figure Walcher prior of Malvern; for anyone who does not believe what he says affronts the religious life'.[16] Walcher's skills in these arts persisted in local lore. In 1711, an epitaph was discovered buried on the grounds of the abbey, which can now be seen in St. Anne's Chapel in the church:

> Here lies in a cyst, Walcher the teacher, a worthy philosopher, a good astronomer, a Lorrainer, a pious man and humble monk, the prior of this sheepfold, a geometer and abacist. The people mourn, the clergy grieve on all sides. The first day of October brought death to this elderly man. May each believer pray that he may live in heaven.'[17]

Great Malvern, UK, tomb of Walcher of Great Malvern

Despite Walcher's training in the *quadrivium* and his skills with the abacus, at the time of

[16] William, *GR*, II.293: pp. 526–527: 'Sed quia Fuldense cenobium nominaui, dicam quod ibidem accidisse uir reuerendus michi narrauit, Walkerius prior Maluerni, cuius verbis qui non credit iniuriam religioni facit'.

[17] Burnett, 'Walcher', *ODNB*; Deane, *A Short Account*: p. 71; Inscription:
'Philosophus dignus, bonus astrologus, Lotheringus,
Vir pius ac humilis, nionachus, prior huius ovilis.
Hic jacet in cista, geometricus ac abacista,
Doctor Walcherus: flet plebs, dolet undique clerus;
Huic Iux prima mori dedit Octobris seniori:
Vivat ut in coelis exoret quisque fidelis. MCXXV'

writing *De lunationibus,* he was not able to explain or time lunar eclipses in a way that he found satisfactory. As was discussed in Chapter II, Walcher had prepared himself for the October 1092 eclipse, armed himself with an astrolabe, and then was frustrated that his calculations were off. He wondered aloud in writing how he could educate himself on these matters and noted, 'I was very annoyed and pressed on with my research'.[18] His musings also serve to set up what was to come next in his life – a teacher with answers to his questions.

4.2 WALCHER AND PETRUS?

Walcher states quite clearly that he met Petrus Alfonsi.[19] The timing of this meeting is not specified, although it was after Walcher wrote *De lunationibus* (approx. 1108) and before the generally recognised date of his second work, *De dracone* (approx. 1120).[20] Nor is it possible to ascertain for sure where this meeting took place, although we can make an informed guess that it was in England.[21] To be clear, there is no certain proof that Petrus was in England at any time or for this meeting. As a well-travelled man, Walcher may have returned to France or Italy for a visit and met Petrus there. What is certain is that Walcher spent some time with Petrus before 1120. He records that Petrus provided detailed guidance on astronomical topics but says he could not provide full answers since he had 'left his books… across the sea'.[22] This might imply that Petrus had crossed the channel to England at some point, although there is perhaps an argument to be made that he was referring to his journey from his original home in Aragon.

There are other reasons to believe that Petrus had gone to England. It was a plausible location for seeking employment and patronage as a scholar at court. A thirteenth-century notation in MS Cambridge, University Library, Ii.VI.11, to the side of Petrus' translation of the al-Khwārizmī tables, identifies Petrus as one of the physicians of Henry I, 'Henrici primi regis

[18] Walcher, *DL*, c. 4.1: pp. 114–115: 'grave ferebam et in instantia querendi permanebam*'.*
[19] Walcher, *DD,* cc. 1.2 and 2.2: pp. 194–199.
[20] See Nothaft, ed., *Walcher*: pp. 9–71 for the dating of these two documents and their relationship to Petrus' influence.
[21] Nothaft, ed., *Walcher*: pp. 46–55; Tolan, *Petrus Alfonsi*: pp. 9–11.
[22] Walcher, *DD*: c. 2.2: 'Habet et ipsa motum mairorum et minorum, quorum diversitatem ad plurum in promptu se non habere dicebat et codices suos in quibus de his et de aliis pluribus ominia certa habebat se trans mare tunc temporis reliquisse'.

Anglorum medicus'.[23] The distance in time between this notation and Petrus' time in England has rightly led it to be questioned as hard evidence. However, it is an indicator that the author of that note found it plausible that a man of Petrus' talents and background would seek employment with Henry I. As already noted, Henry I's court did include scholars and particularly those experts in the medical arts, with as many as nine physicians on record. At least one of these, Faricius, Abbot of Abingdon, was interested in wider scientific matters.[24] Petrus and many other astronomers at the time, including Adelard, advertised their skills as being useful to medical prognosis.[25] Henry was also very interested in the new, the unusual, and the exotic, as evidenced by his zoo (see Chapter III [3.4]) and the vitality of his court. He may also have been aware of the larger intellectual and cultural horizons of the courts of Norman Sicily. Finally, since he may have spent some time in the Severn Valley, it is also possible that Petrus was associated with Robert of Gloucester's court rather than Henry's. While not much is known about Robert's court, he was an active patron in the wider Severn Valley. William of Malmesbury and Geoffrey of Monmouth dedicated their works to him; Adelard of Bath dedicated his *Quaestiones naturales* to Robert's son, Richard, the Bishop of Bayeux.[26] It is not unreasonable to suppose that the circle around Henry, as well as that of his sons and grandsons, created an atmosphere more open than might at first be assumed for the new learning.

Petrus' presence in England may not be demonstrable from a physical standpoint, but the manuscript tradition and literary influence do seem to indicate a presence there. The manuscript tradition of Petrus' documents is particularly strong in England, including his translation of the al-Khwārizmī tables.[27] Petrus' other works, the *Dialogus contra Iudaeos,* had a strong literary influence in England and the Severn Valley, with a certain audience of Gilbert Foliot and possible influence on William of Malmesbury's *Miracles of the Virgin*, which also has a strong

[23] Cambridge University Library MS Ii.VI.11, fol. 95r.
[24] Peregrine Holden, 'Faricius (d. 1117)', *ODNB*; see also Chapter III, [3.4].
[25] See Burnett, 'Petrus Alfonsi and Adelard of Bath Revisited': pp. 77–92.
[26] Patterson, *The Earl, the Kings, and the Chronicler*: pp. 178–179; Dickey, 'Adelard of Bath': pp. 67–69; Haskins, *Studies*: pp. 26–27; because there were two bishops of Bayeux named Richard, serving sequentially, it is unclear which Adelard is referring too, though Haskins prefers Robert of Gloucester's son, Richard, who served 1135–1142.
[27] Burnett, 'Petrus Alfonsi and Adelard of Bath Revisited': p. 79; Neugebauer, *The Astronomical Tables*: pp. 217–218.

anti-Semitic bent.[28] Therefore, all caveats being borne in mind, an operating suggestion that Petrus met Walcher in England and was in the sphere of the courts of those with political influence, such as Henry I and Robert of Gloucester, can be sustained, the tentative nature of this suggestion notwithstanding.

4.3 *DE DRACONE:* WALCHER AS AN OBSERVATIONAL ASTRONOMER

The question of the nature of the relationship between Petrus Alfonsi and Walcher turns on the authorship of *De dracone*. For many years, Walcher's description of the book as a translation of the *De dracone* was taken literally, that he had translated a work given to him or authored by Petrus. Charles Homer Haskins dispelled that myth in 1915; he promoted the theory that the relationship between Walcher and Petrus was one of student and pupil, with Walcher as the author of *De dracone*.[29] In this work, Walcher attempts to describe and use the teaching of his master. Haskins transcribed portions of both the *De lunationibus* and the *De dracone*.[30] Recently the work of McCluskey, Burnett, and Nothaft has placed Walcher more firmly in this tradition. McCluskey was one of the first scholars to underscore the importance of Walcher's work and his apparent reliance on observations rather than theory. Nothaft, in 2016, provided a critical edition and commentary of both works, using the seven known copies of *De lunationibus* and the two known copies of *De dracone.* He sets Walcher's work within the context of the progressive thinking of the *computus naturalis,* represented by Gerland and Herman of Reichenau, and the current state of the new sciences.[31]

As reviewed in Chapter II, in *De lunationibus,* Walcher had revealed his skill with astronomical tools and his extraordinary facility with the abacus. Walcher's lunar calendars were focused on the calculation of each new moon and predicting eclipses in a shorter, 19-year cycle. With a more precise focus, Walcher had begun to notice discrepancies that had not been

[28] Katie Ihnat, 'William of Malmesbury and the Jews', in Thomson, Dolmans, and Winkler, eds., *Discovering William of Malmesbury*: pp. 49–63.
[29] Haskins, 'The Reception of Arabic Science': pp. 56–69.
[30] Footnoted at the beginning of this chapter, Chapter IV, [4.0].
[31] Nothaft, ed., *Walcher*: esp. pp. 65–70; see also McCluskey, *Astronomies*: pp. 180–187; Burnett, *The Introduction of Arabic Learning*.

of immediate concern to those fixing a point for Easter. Walcher's last book of *De lunationibus*, in all probability written after his encounter with Petrus, challenges one of the core assumptions that undergirded his entire approach to calculating lunar phases and ecliptical positions, that is, the absolute equality of the moon (and the sun's) motion.[32] Two accounts were given to him by others on the eclipses that contradicted his predictions based on the methods outlined in earlier books of *De lunationibus*. The solar eclipse on September 23rd, 1093, revealed an eleven-hour difference between actual observation and his calculations. Similarly, the total lunar eclipse on January 11th, 1107, was a day later than Walcher's tables would indicate. Walcher's own observation of the partial lunar eclipse on December 31st, 1107, indicated a difference of sixteen hours between observation by Walcher and his tables. This eclipse event was also counter to calculations based on the January 11th event by ten hours. In other words, the Sun or the Moon, or both, were varying in their speeds. This was not something that Walcher had understood before. In this postscript, Walcher establishes the perfect introduction to his encounter with Petrus. Here, he wrote that the moon:

> underwent an eclipse [that] turned out to neither agree with the order of the cycle nor stay in relation to the eclipse of the Moon that happened in the same month in the previous year… But seeing how it was delayed for a whole day and waited until the beginning of the night that drew near, it is proved clearly that during its twelve lunations, [the Moon] deceitfully usurped the span of ten hours.'[33]

By 1120, the accepted date of *De dracone*, Walcher had come to know, or possibly actively sought out, Petrus Alfonsi. Walcher refers to Petrus as *magister noster*[34] and found in him the astronomical expertise he needed. In the *De dracone*, Walcher now used the sexagesimal system of degrees, saying, 'while we divide the zodiac into 365 degrees and a quadrant, he [Petrus] finishes all of it in 360 degrees'.[35] Walcher also documented the phenomena of the sun moving at different speeds depending on its place in its complete

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[32] Nothaft, ed., *Walcher*: p. 213.

[33] Walcher, *DL*, c. 6, pp: 188–191: 'deficiens monstravit nec ordinationi se circuli concordare nec illi lune defectui, qui eodem mense in anno precedenti contigit regulariter respondere…Cum autem per totem diem retardata propinquantis expectaverit noctis exortum in suis XII mensibus decem horarum spatium falliciter sibi usurpasse convincitur.'

[34] Walcher, *DD*, c. 1.2: pp. 194–195.

[35] Walcher, *DD*, c. 4.1: pp. 204–205: 'Quia nos per CCCLXV gradus et quadrantem zodiacum dividimus, ille autem totum in CCCLX gradibus concludit*'*.

zodiacal sweep of 900 years. The moon's rotation, he wrote, also has a greater or lesser motion, whose difference [Petrus] says 'he did not exactly know off-hand'.[36] Walcher's relationship with Petrus was clearly personal and worth his while to advertise.

4.4 WALCHER'S INFLUENCE

It is important to review why Walcher wrote he was initially interested in the study of the stars and to reflect on whether his perception had changed over time. As noted earlier, interest in the science of the stars was not at all unusual in a monastic context, not least in the calculation of Easter and time-reckoning. Cantors and monastic historians (sometimes the same person) may also have developed an interest in the stars to bolster their historical narrative. They would be interested in works that established a chronological framework, such as the 19 or 532-year cycles or the establishment of a recognised era.[37] William of Malmesbury and John of Worcester fall into this category. In addition, star lore was important for the purposes of prognostication, especially in medical contexts. William of Malmesbury, for example, was tantalised by the predictive possibilities of astronomy even before the new sciences arrived.

Walcher's interest in astronomy seems to have been as much for its own sake as for its usefulness, and he addressed his interest both directly and indirectly. He, like Gerbert, was fascinated by the tools of the trade – an important part of his narrative is telling the audience how he measured the eclipses, what tools he had at the time, and what limitations. He wrote specifically about his calculations. He also discussed what went wrong and what he perceived as his investigative needs.

> For if it had agreed with the cycle, which notes its kindling for 16 December, the 14th hour, the second point—so that by counting forward 14 days and 18 hours and 2 points one arrives at the 3rd point of the 8th hour of the night on the 31st of December—, then the eclipse of this lunation, which came about at the beginning of the following night, should

[36] Walcher, *DD*, c. 2.2: pp. 198–199: 'Habet et ipsa motum maiorem et minorem, quorum diversitatem ad plurum in promptu se non habere dicebat et codices suos in quibus de his et de aliis pluribus omnia certa habebat se trans mare tunc temporis reliquisse'.
[37] See Chapter I.

> have occurred at the third point of this 8th hour. It hence differed from the order of the cycle by more than 16 hours.[38]

These are reflections that a modern reader might recognise as those of an observational astronomer.

Walcher's *De dracone* had a limited distribution path, and as Nothaft points out, his work was outdistanced within decades of writing it. There are only two extant copies of the *De dracone* to be found, both from England. The first and exemplar is in BL, Auct. F.1.9, a manuscript that will be reviewed in some detail shortly. The second is an incomplete thirteenth-century document that is partially in an English hand.[39] While Walcher's legacy was apparently not lasting, his work was studied in the immediate area of the Severn. He was held in high regard, for instance, in the later twelfth century by Roger of Hereford. Roger was an astronomer and computist of note who, among other things, expanded on Walcher's observation of the inequality of the lunar motions.[40] Walcher's local fame aside, as Petrus' only known student, he is an important witness to, and representative of, the early reception of the new sciences. Moreover, Walcher's interests may have paved the way for the more lasting influence of Adelard of Bath.

4.5 ADELARD OF BATH AND THE SEVERN VALLEY

> *When I recently returned to England during the reign of the English Henry, son of William, since I had absented myself from my native land for a long time for the sake of study, meeting friends was both delightful and helpful for me. So when on our first meeting… the fact impressed itself on my mind that I should get to know the character of our own people.*

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[38] Walcher, *DL*, c. 6: pp. 188–189: 'Si enim cyclo concordaret, cum accensio euis XVII Kal. Ianuarii, hora XIIII, puncto secondo notetur et hinc usque ad tertium punctum octave hoer huius lunationibus occurreret eclipsis, que subsequentis initio noctis evenit. Plus ego quam XVI horis ab ordine cycli discordavit'.

[39] Erfurt, Universitäts- und Forschungsbibliothek, CA 4o 351, described in Nothaft, ed., *Walcher*: p. 74..

[40] On the continued Severn Valley computistical tradition of Roger of Hereford, Constabularius, and Grosseteste, see Moreton, 'Before Grosseteste': pp. 562–586.

Adelard of Bath*, 'Ricardo Baiocensi Episcopo Adelardus Bathoniensis Salutem,' Quaestiones naturales*[41]

By the 1120s, Adelard had returned from the East with texts, ideas, and perhaps some functional Arabic. He described his return and the intellectual milieu in England, which, in his view, desperately needed a man of his talents. Adelard came back to find employment and at first found, 'the princes barbarous, the bishops bibulous, judges bribeable, patrons unreliable, clients sycophants, promisers liars, friends envious, and almost everyone full of ambition'.[42] Despite his excoriation of English society, Adelard had found, within a decade, patrons in the Severn Valley who were more reliable. He also had knowledgeable collaborators, an appreciative audience, and students to carry on his work. His work in this period was important and innovative. It included a translation of the al-Khwārizmī tables, perhaps in collaboration with Petrus Alfonsi, translations of astronomical texts such as the *Centiloquium*, a translation of Abū Ma'šar's *Ysagoge minor,* and, moving more firmly into the realm of prognostication, the *Liber prestigiorum,* a work on talismans.[43] Later in his career and still in the Severn Valley, he undertook the important task of translating Euclid's *Elements*.[44] Adelard's work was transformative and lasting, and it was in the Severn Valley that he found his first known audience. In his works, nearly every reference to 'place' in England is a locale in the wider Severn Valley area. Bath is used as an example for calculating differences in latitude in several places in the *De opera astrolapsus* and, in the same

[41] Adelard, *QN*: pp. 82–83: 'Cum Angliam nuper redierim, Henrico Willelmi Anglis imperante, quoniam a patria causa studii diu me exceperam, occursus amicorum et iocundus michi fuit et commodus. Cum itaque in conventu nostro primo, ut fit, multum de nostra et amicorum salute quesitum esset, id quidem animo meo consequenter innotuit, ut gentis nostre mores agnoscerem'.

[42] Adelard, *QN*: pp. 82–83: 'Id igitur querens, violentos principes, vinolentos presules, mercennarios iudices, patronos inconstantes, privatos adulators, mendaces promissores, invidiosos amicos, ambitiosos fere omnes cum acceperim, nichil inquam michi inaccessius esse quam huic miserie meam intentionem subdere'.

[43] Deborah Houlding, trans., *Centiloquium of Hermes Trismegistus*, (2006), http://www.skyscript.co.uk/centiloquium2.html (accessed 09/04/2022); Charles Burnett's edition of the *Liber pretigiorum* is not yet available; for the *Ysagoge minor* see Burnett, Yamamoto, and Yano, eds. and trans., *The Abbreviation of the Introduction to Astrology.*

[44] H.L.L. Busard, ed., *The First Latin Translation of Euclid's* Elements *Commonly Ascribed to Adelard of Bath* (Toronto: Pontifical Institute of Medieval Studies, 1983); see also Marshall Clagett, 'The Medieval Latin Translations from the Arabic of the Elements of Euclid, with Special Emphasis on the Versions of Adelard of Bath', *Isis* 44, no. 1/2 (1953): pp. 16–52; Menso Folkerts, 'Adelard's Versions of Euclid's *Elements*', in Burnett, ed., *Adelard of Bath*: pp. 55–68. A later edition focuses specifically on the Adelard II version of the text, and claims it was actually done by Robert of Chester, not Adelard, see Busard and Folkerts, eds., *Robert of Chester's (?) Redaction*.

work, as the location for a discussion of the power of talismans in the successful driving out of scorpions from the city.[45] John of Worcester was among Adelard's first admirers.

Because Adelard's later biography is tied to the Severn Valley scholars, it will receive some focus here. His translation work was largely done in the area: his early manuscripts have the stamp of the Severn Valley scriptoriums, and he may have encountered his patrons in Bath and Bristol. What follows will explore the patronage and support that Adelard was able to find by dividing his marketable skills into three broad categories: his administrative skills bolstered by his mathematical training, his abilities as a teacher and translator, and finally, his skills as court astrologer, a role that leveraged his appeal as a well-travelled man with astronomical expertise. In each of these roles, Adelard would have been a person of interest to the royal court and its entourage.

There are perils, however, in categorising Adelard and his work. He was a man of many faces and skills, and any categorisations will carry ambiguities, omissions, and overlap. There has been much debate around the authorship of texts related to him as well as the timing of his travels and periods of writing or translating.[46] There is also some debate over his abilities in the Arabic language. Nevertheless, although Adelard may have returned to England with more eagerness than skill, what is indicated by his literary output is that he continued to develop his language, mathematical, and astronomical skills and became a prestigious scholar by the end of his career.

4.6 ADELARD AS ADMINISTRATOR

On his return to England, Adelard found employment in the Royal Exchequer at Bath, deploying the skills he had begun to develop in his studies in France. Dickey places his return to

[45] Adelard, *De opera astrolapsus,* ed., Dickey, 'Adelard of Bath': pp. 112–229, p. 166, l. 10 and p. 197, l. 12; scorpions being driven out of Bath in the *Liber prestigiorum,* cited in Charles Burnett, 'Talismans: Magic as Science? Necromancy Among the Seven Liberal Arts', in Burnett, ed., *Magic and Divination*, pp. 1–15 at p. 10.

[46] Relevant scholarship includes Haskins, *Studies*, pp. 20–42; Clagett, 'The Medieval Latin Translations'; Bliemetzrieder, *Adelhard von Bath*; Lawn, *The Salernitan Questions*; Dickey, 'Adelard of Bath'; Burnett, *Conversations*: pp. xi–xix; Cochrane, *Adelard*: pp. 2–8; Southern, *Robert Grosseteste*: pp. xiv–xvii and pp. 85–88; see also Reinhold Rieger, 'Adelard of Bath', *Religion Past and Present* (Leiden: Brill, 2011).

England between 1113 and 1125 based on the evidence of his texts.[47] He was associated with the Exchequer by the 1120s, and the Pipe Rolls indicate he was excused for murder in 1126, a form of pardon according to Poole reserved for those under royal employment.[48] Adelard was an accomplished scholar with knowledge of mathematics and the abacus he had gained in Laon. Adelard's skill with the abacus, like Robert of Losinga's and Walcher's, made his an equally useful appointment for episcopal and royal administrations.[49] His Exchequer role would also have given him a position close to those in power, for example, to Bishops John (d. 1112) and Godfrey of Bath (d. 1135), and it is possible to indicate how a supportive network might have functioned. John of Bath had been physician to William I before his episcopal appointment, and Godfrey, John's successor, had been the personal chaplain of Adeliza, Henry I's second queen.[50] As has been discussed above, Adeliza was a patron of the arts and continued Queen Matilda's interest in the medical arts and administration. The cross-section of royal needs and interests with Adelard's skill is to be noted.

4.7 ADELARD AS TEACHER

Adelard, like Petrus, suggested he had something to offer the English audience. In the context of his return, he states that his nephew 'urged me to put forward some new items of the studies of the Arabs. As the others agreed with him, I undertook the following treatise, which I know will be useful to its auditors, but whether it is pleasant I do not know, for the present generation suffers from this ingrained fault, that it thinks that nothing should be accepted which

[47] Dickey, 'Adelard of Bath': pp. 70–73.
[48] Reginald L. Poole, *The Exchequer in the XIIth Century, the 'Ford Lectures' Delivered in the University of Oxford Michaelmas Term, 1911* (Oxford: Clarendon Press, 1912): pp. 51–57; Burnett, *Conversations*: p. xvi.
[49] See Chapter I.
[50] For Adeliza as promoter of the arts see Thomas O'Donnell, Matthew Townend, and Elizabeth Tyler, 'European Literature and Eleventh-Century England', in Clare Lees, ed., *The Cambridge History of Early Medieval English Literature* (Cambridge: Cambridge University Press, 2012): pp. 607–636, esp. pp. 627–628.

is discovered by the 'moderns''.[51] Adelard's advertisement is to the provincial English, from one who has travelled well and embraced the new learning.

The following dialogue also indicates that Adelard saw himself as a teacher and as someone who had something marketable to teach:

> *Adelard:* You remember, dear nephew, that, seven years ago, when I dismissed you (still a boy) with my other students in French studies at Laon, we agreed amongst ourselves that I would investigate the studies of the Arabs according to my ability, but you became no less proficient in the insecurity of the French.
> *Nephew:* …. I took note of you when often you explained the opinions of the Saracens, and quite a few of them appeared quite useless, I shall for a brief while refuse to be patient and shall take you up as you expound these opinions…. For you both extol the Arabs shamelessly and invidiously accuse our people of ignorance in a disparaging way.
> *Adelard:* No one should think that when I am putting forward unknown ideas, I am doing this out of my own head, but I am giving the views of the Arabs…. therefore, I shall defend the cause of the Arabs, not my own.'[52]

Adelard advertises himself, as did Petrus, as a teacher of the science of the stars. To this end, Adelard's original works appear to have teaching as a primary goal. These include:

- *De eodem et diverso* (dedicated to William Bishop of Syracuse)
- *Quaestiones naturales* (dedicated to Richard, Bishop of Bayeux and son of Robert of Gloucester)
- *De avibus tractatus*[53]
- *De opera astrolapsus* (dedicated to young prince Henry Plantagenet)[54]
- *Regule abaci (*dedicated to 'H. suo' – perhaps Ocreatus)[55]

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[51]Adelard, *QN*: pp. 82–83: 'aliquid Arabicorum studiorum novum me proponere exhortatus est. Cui cum assentirent ceteri, ego tractatum subscriptum recepi, quem quidem auditoribus suis utilem fore scio, locundum nescio. Habet enim hec generation ingenitum vitium, ut nichil quod modernis reperiatur putet esse recipiendum'.

[52]Adelard, *QN*: pp. 90–91: 'Adelardus: meministi, nepos, septennio iam transacto, cum te in Gallicis studiis pene puerum iuxta Lauisdunum una cum ceteris auditoribus meis dimiserim, id inter nos convenisse, ut Arabum studia ego pro posse meo scrutarer, tu vero Gallicarum sententiarum inconstantiam non minus adquireres.
Nepos: ...quia cum Sarracenorum sententias te sepe exponentem auditor tantum notaverim, earumque non pauce satis futiles michi videantur, patientiam mean paulisper abrumpam, teque eas edisserente, ego sicubi michi videbitur obviabo. Quippe et illos impudice extollis, et nostros detractionis modo inscitia invidiose arguis.
Adelardus: Ne quis me ignota proferentem ex mea id sententia facere, verum Arabicorum stuiorum sensa putet propnere...Quare causam Arabum, non meam, agam.'

[53] *De eodem, Quaestiones,* and *De avibus* are edited in Burnett, ed. and trans., *Conversations.*

[54]Adelard, *De opera astrolapsus*, in Dickey, ed., 'Adelard of Bath': pp. 212–229.

[55]Adelard, *Regule abaci,* in B. Boncompagni, ed., 'Intorno ad uno scritto inedito di Adelardo di Bath intitolato 'Regule abaci'', *Bullettino di Bibliografia di Storia delle scienze Matematiche e Fisiche* IV (1881): pp. 1–134; see Evans, 'Schools and Scholars', and 'Abacus to Algorism'; see 'Ocreatus' note below.

The documented evidence of Adelard's students is slim. However, as noted above, it is possible that he taught while in Laon. After Adelard arrived in England, he had relationships as both a master and colleague. A possible student of Adelard's was a mathematician associated with the Bath and Tewkesbury area named Ocreatus.[56] A somewhat elusive figure, Burnett places him as a member of an influential family in Bath. He is thought to have made one of the translations of Euclid's *Elements* as well as a work known as the *Helcep Saracenicum* /*Saracen Calculation*. In the latter, Ocreatus refers to Adelard as 'a friend but also a master and a teacher'.[57] As another indication of Adelard's role as teacher, Burnett characterises Adelard's translations as reading like the 'chalk-dust (or rather the wax tablets or scrapers) of the school room'.[58] Among other scientists, it is likely that Adelard had collegial relationships (though it is unclear how close), such as that with Petrus Alfonsi. Also related to his translation of the al-Khwārizmī table, it has been suggested that Robert of Chester was a student of Adelard's.[59]

Finally, there is some weight to be given to the notion that he was tutor to the young Henry II. Matilda had used Bristol as her home base, and it may have been here or in one of the Norman courts that Adelard encountered Henry Plantagenet.[60] To Henry, he dedicated his treatise on the astrolabe, *De opera astrolapsus*. Here again, Adelard outlined his calling and his purpose. He wrote,

> You [young Henry] not only read carefully and with understanding those things the writings of the Latins contain, but you also dare to wish to understand the opinions of the

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[56] Charles Burnett, 'Ocreatus', in Menso Folkerts and Jan P. Hogendijk, eds., *Vestigia Mathematica: Studies in Medieval and Early Modern Mathematics in Honour of H.L.L. Busard* (Amsterdam: Rodopi, 1993): pp. 69–77.

[57] See Charles Homer Haskins, *Studies in the History of Medieval Science* (New York: Frederick Ungar, 1960): p. 35: 'ab amico, immo a domino et magistro'; see the translation of *Helcep Saracenicum* in Charles Burnett, '*Algorismi vel helcep decentior est diligentia*: The Arithmetic of Adelard of Bath and his Circle', in *Mathematische Probleme im Mittelalter: Der lateinische und arabische Sprachbereich*, in M. Folkerts, ed. (Wiesbaden, 1996): pp. 221–331; see also Burnett, ed., *Numerals and Arithmetic*: pp. 222 and 233; also see Charles Burnett, 'Adelard of Bath and the Arabs', in J. Hamesse and M. Fattori, eds., *Rencontres de cultures dans la philosophie médiévale* (Louvain-la-Neuve and Cassino, 1990): pp. 89–107.

[58] Charles Burnett, 'Adelard of Bath and the Arabs': p. 95.

[59] Charles Burnett, 'Adelard of Bath', *ODNB*; Busard and Folkerts, eds., *Robert of Chester's Redaction,* vol. 1: pp. 1–31.

[60] Charles Homer Haskins, 'Adelard of Bath and Henry Plantagenet', *EHR* 28, no. 111 (1913): pp. 515–516; Dickey, 'Adelard of Bath': pp. 8–22; McCluskey, *Astronomies*: pp. 186–187.

> Arabs concerning the sphere, and the circles and the movements of the planets…. Having been asked by you frequently to do this, although I am not confident in my own strength, never the less so that I may join philosophy to nobility in an example from our own age, I will attempt to fulfil your demand as far as I am able. Therefore, I shall write in Latin what I learnt in Arabic about the world and its parts.[61]

Of note here is that Adelard was close enough to the court to know what Henry had been studying. Later, he used his astrological prowess to provide Henry with a personal horoscope, as shall be discussed below.

There are numerous indications of Adelard's continued association with the courts of Henry I and Henry II, most in reference to his astronomical and prognosticative reputation. Apart from his work on the astrolabe referenced above, Adelard's translations of several astronomical and predictive works would solidify his reputation as an astronomer and astrologer and make him a useful addition at court. It is uncertain whether he was directly connected to the court before the late 1140s, but he was certainly within its sphere. And if Adelard's abacus and mathematical skills made him useful to the court, this situation was likely to have been enhanced by his newly developed astronomical knowledge and related skills in prognostication.

4.8 ADELARD AS ASTROLOGER

[61] The whole introduction is reproduced here since it is only transcribed in full in an unpublished dissertation, Adelard, *De opera astrolapsus*, in Dickey, ed., 'Adelard of Bath': pp. 147–148: 'Quod regalis generis nobilitas artium liberalium studie se applicat, ualde assentior. Quod rerum gubernandarum occupatio ab eodem animum non distrahit, non minus ammiror. Intelligo itaque te, Henrice, cum sis regis nepos, a philosophia id plana animi percepisse nota. Ait enim beatas esse res publicas si aut philosophis regende tradantur aut earum rectores philosophie adhibeantur. Huius rationis odore ut infantia tua semel inbuta est in longum seruat, quantoque grauius exterioribus honeratur, tanto ab eisdem diliguentius se subtrahit. Inde fit ut non solum ea que latinorum scripta continent intelligendo perlegas, sed et arabum sententias super spera et circulis stellarumque motibus intelligere uelle presumas. Dicis enim ut in domo habitans quilibet, si materiam eius et compositionem, quantitatem et qualitatem, situm et distinctionem ignoret, tali hospitio dingus non est. Sic qui in aula mundi natus atque educates est, si tam mirande pulcritudinis rationem scire negligat post discretionis annos, ea indignus atque, si fieri posset, eiciendus est.
His a te frequenter ammonitus, licet meis non confidam uiribus, tamen ut nobiliati philosophiam uno nostre etatis exemplo coniungam, postulationi tue pro posse meo dabo operam. De mundo igitur iusque distinctione quod arabice didici latine subscribam, hoc prestricto nodo, ut cum mundus nec quadratus nec longilaterus nec alterius figure quam spericus sit, quicquid de spera dixero de mundi dici intelligatur'.

If Adelard's original work reflects his assumed role as instructor, many of his translations indicate a strong bent for the astrological. Both skills would make him a useful person in court. The translation works associated with Adelard are the:

- *Centiloquium*
- *Liber prestigiorum*
- Abū Ma'šar (Iafar), *Ysagoge minor* [62]
- Al-Khwārizmī, *Astronomical Tables*[63]
- Euclid's *Elements*

All the works above, with the exception of the *Elements,* can be seen as works either directly related to prognostication or astrology or descriptive tools in service of those efforts. Even the al-Khwārizmī tables, often seen as the first indicator of an advanced scientific view, were tools for determining planetary motions and were useful to the astrologer. Adelard himself says clearly in *Liber prestigiorum* that the study of the stars is intended primarily for forecasting, and its most perfect form is the study of talismans.[64] As will be discussed further below, in looking at the collections that may have influenced John of Worcester, Adelard's early work was often bound with works on judicial astrology. They were seen, therefore, by his near contemporaries as tools for fortune-telling.

Adelard's translation of the *Liber prestigiorum,* a work on talismans, seems to have been intended to add to his toolkit as court astrologer. The *Liber* is Adelard's version or translation of the ninth-century astronomer Thabit b. Qurra's *De imaginibus*.[65] Adelard gives some detail here on the benefits and methods of fortune-telling, including the most frequently asked questions such as how to gain the love of the king and how to protect a place against misfortune. While he details the process to tell fortunes in this method, there is, strictly speaking, no actual evidence that Adelard used talismans to tell fortunes or that he did so for members of the noble courts. But there is evidence that he told fortunes using horoscopes.

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[62] Dickey, 'Adelard of Bath': p. I–II argues that Adelard did not translate the *Ysagoga minor*.
[63] Muḥammad ibn-Mūsā al-Khwārizmī, *Astronomical Tables*, trans. by Neugebauer, *The Astronomical Tables of al-Khwārizmī*; the Latin is in Heinrich Suter, ed., *Die astronomischen Tafeln des Muhammad ibn Mūsā al-Khwārizmī.*
[64] Patricia Aakhus, 'Astral Magic and Adelard of Bath's *Liber prestigiorum*; or Why Werewolves Change at the Full Moon', *Culture and Cosmos* 16, nos. 1 and 2 (2012): pp. 151–161.
[65] See Francis Carmody, 'Notes on the Astronomical Works of Thabit b. Qurra'. *Isis* 46 (1955): pp. 235–242; John Michael Greer, trans., *Astral High Magic: De Imaginibus of Thabit Ibn Qurra* (Lulu, 2011).

John North has identified ten twelfth-century royal horoscopes, nine of which he believes to have been done by Adelard.[66] The subject of these horoscopes appears to be the accession of Stephen, with speculation on a few of them of the channel crossing of a person of importance. North suggests that whoever did the horoscopes was sympathetic to the future Henry II. Adelard stands out as an almost certain candidate. North postulates that 'it seems likely that Adelard taught Henry while he resided at Bristol, that he looked on him as a future English hope, and that this proven court connection, not to mention a rare expertise that would have enabled him to cast nine of the ten horoscopes, he is our strongest candidate for their authorship'.[67] Of interest in North's analysis is that he speculates that in this work Adelard was using al-Majrītī's tables of the houses based on the Cordoban meridian. To derive the specifications he needed for the horoscopes, he used the al-Khwārizmī tables he translated himself and was bolstered by his work on the astrolabe, *De opera astrolapsus*. Adelard's extended presence at court is further indicated by the proposal that he was responsible for several horoscopes for someone in the English royal household.[68] It is unclear how early Adelard's association with the royal court began, but it would appear that Adelard, in the 1120s and 1130s, was building a career that would put him in that sphere.

The association of Adelard and Petrus has been a topic of great speculation.[69] There is evidence that they both may have been in the Severn Valley region at the same time. They both made translations of the al-Khwārizmī tables at roughly the same period and both based them on al-Majrītī's tables from Cordoba. Both Dickey and Burnett have speculated on the relationship between Petrus and Adelard. Dickey concluded that they worked separately on these texts, with Petrus' version of the al-Khwārizmī tables done in 1116 and Adelard's done in 1126. He also noted that they shared certain new cosmographical ideas that pointed to a shared Arabic

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[66] North, 'Some Norman Horoscopes': pp. 147–161; see also John D. North, *Stars, Minds, and Fate: Essays in Ancient and Medieval Cosmology* (London: Hambledon Press, 1989).
[67] North, 'Some Norman Horoscopes': p. 160.
[68] North, 'Some Norman Horoscopes': p. 160; also in Adelard, *De eodem*: pp. 52–53, Adelard indicates that he had played a cithara for a queen in France (possibly Queen Matilda in Normandy): 'tu ipse, si recolligis, cum preterito anno in eadem musica Gallicis studiis totus sudares adessetque in serotino tempore magister artis una cum discipulis, cum eorum Regineque rogatu citharam tangeres'.
[69] The most compelling scholarship on their relationship is Dickey, 'Adelard of Bath': pp. 46–76, and Burnett, 'The Works of Petrus Alfonsi': pp. 42–79.

influence.[70] At one time, Burnett and Raymond Mercier suggested that Adelard and Petrus were working from the same exemplar and that it was possible that they met and were working together or that it was perhaps Petrus who tutored Adelard in Arabic.[71] It should be noted that Burnett later changed his mind, arguing that their texts and theories were sufficiently different to argue against a mentor/mentee relationship.[72]

While it should be noted that there is scholarly disagreement over their relationship or where it took place, there are two venues that may have facilitated the meeting of Petrus and Adelard. First, both are associated with the royal court, though Petrus is more clearly associated with Henry I and Adelard with Matilda and Henry II. If both were connected to the court, even loosely, they may have found each other. There also may have been other non-royal patrons or opportunities to teach that brought them together. Walcher was Petrus' student; he may also be considered a possible patron. The evidence of Ocreatus shows that Adelard also had non-royal students or patrons in the area. These are some of the breadcrumbs indicating that Petrus and Adelard both spent some time in the Severn Valley, had students and position opportunities there, and it is there that their manuscripts first appeared. The fact that the first appearance of Adelard's al-Khwārizmī tables and Walcher and Petrus' *De dracone* appeared in the same document, BL, Auct. F.1.9, speaks to some simultaneity. This returns the argument to John of Worcester.

[70] Dickey, 'Adelard of Bath': p. 72 summarises his thesis.
[71] Burnett, 'The Works of Petrus Alfonsi'; see also Mercier, 'Astronomical Tables': pp. 87–118.
[72] Burnett, 'Petrus Alfonsi and Adelard of Bath Revisited'.

CHAPTER V

John of Worcester and the Use of the New Astronomical Sciences

Oxford, Corpus Christi 157, p. 380, Digital Bodleian, https://digital.bodleian.ox.ac.uk/objects/93b83416-7972-40d7-9789-18f54e17ae25/

In the third year of Lothar, emperor of the Romans, the twenty-eighth year of King Henry of the English, in the second year of the 470th Olympiad, eleventh indiction, twenty fifth moon, on Saturday, 8 December, there appeared from the morning right up to the

evening two black spheres against the sun. The first was in the upper part and large, the second in the lower and small, and each was directly opposite the other as this diagram shows.

John of Worcester, *Chronicle*[1]

As this text, and very probably image, illustrate, John of Worcester described and drew a sunspot in what may well have been a global first. Sunspots are not normally visible to the human eye, but the astronomical event of 1138 was large enough to have been described in several contemporary accounts, the *Chronicle* of John of Worcester, and several chronicles in China and Korea.[2] John's fame in identifying and drawing this astronomical event extends beyond those who study the medieval history of science and intellectual history to modern astronomers interested in tracking the history of astronomical events. His observations, for instance, are the subject of an article on the NASA website and feature F.R. Stephenson's investigations into the longer record of solar activity.[3] John of Worcester's modern astronomical celebrity is the product of his interest in the new sciences of the first third of the twelfth century and the intellectual milieu of the Severn Valley. He was a member of the early audience for the new sciences and, as such, directly embodies an important moment in the history of scientific scholarship.

John's enthusiasm for computistical studies, as described and analysed in Chapter II, formed an important and complex background to his astronomical interests. As previously discussed, in the late 1120s, John was up to date on all things computistical, but his writings up to then revealed little or no knowledge of the new sciences. By the late 1130s, however, John had become familiar with the new astronomical sciences; he had collected and studied texts in this area and included evidence of his new knowledge in his own works. By the end of his career, he

[1] John, *Chronicle*, III, s.a. 1128: pp. 182–183: 'Anno regni iii Leodergarii Romanorum imperatoris, regis uero, Anglorum Heinrici xxviii, olimpiadis cccclxx anno ii, indictione vii, luna xxv existente, vi Idus Decembris, sabbato, a mane usque ad uersperam apparuerunt quasi due nigre pile infra solis orbitam, una in superiori parte et erat maior, altera in inferiori et fuit minor; eratque utraque directa contra alteram ad huiusmodi figuram'. Image from Oxford Corpus Christi 15, fol. 380v.
[2] D.M. Willis and F.R. Stephenson, 'The Earliest Drawing of Sunspots', *Annales Geophysicae* 40 (1999): pp. 21–22; D.M. Willis and F.R. Stephenson, 'Solar and Auroral Evidence for an Intense Recurrent Geomagnetic Storm during December in AD 1128', *Annales Geophysicae* 19 (2001): pp. 289–302.
[3] F.R. Stephenson, 'First Sunspot Drawing', *Technology Through Time* 35 (NASA, 2005) https://sunearthday.nasa.gov/2006/locations/firstdrawing.php (accessed 18/06/2021).

had also begun to record astronomical events with eager assiduousness. How such familiarity arose and how, precisely, it was reflected in his works will be important questions to address.

What is clear is that his awareness of the new sciences was in large part due to Walcher of Great Malvern. Walcher's works had been directly impacted by his relationship to Petrus, as was argued in Chapter IV, and were known to John. By the time of his encounter with Petrus, Walcher had already developed the habits and stance of an observational astronomer. These skills were enhanced by the new tools given to him by Petrus. Walcher's new awareness directly impacted John, who owned an important copy of *De lunationibus* and *De dracone*, possibly as gifts from Walcher himself. While it is likely that Walcher and Petrus were the first sources of John's new astronomical awareness, the sources for John's awareness of other scientific works are harder to pinpoint and will need to rely on textual and circumstantial evidence. At some point in the 1130s, John became aware of the work of Adelard of Bath: John had acquired the first known copy we have of Adelard's translation of the al-Khwārizmī tables. How he came across Adelard's work and what may have been the possible connections that drew him into Adelard's sphere have not yet been fully explored.

John of Worcester has been described here as a type of 'miners' canary' for the introduction of the new sciences into England. His scientific document, now Oxford, BL, Auct. F.1.9, is where Walcher's *De dracone* and Adelard's translation of the al-Khwārizmī tables may have first appeared. And it is his chronicle that provides the first evidence of secondary or audience reference to these works. Nevertheless, the descriptor of the 'canary' for John gives an incorrectly passive impression of John's engagement with the new sciences. He, like William of Malmesbury, sought out documents reflecting the new sciences and is revealed in his later career as an observational astronomer and a collector of accounts of atmospheric events. Like William and Walcher, John shows himself to be part of an active audience for the new sciences in the Severn Valley region, in good part because scholars like John, Petrus Alfonsi, and Adelard of Bath found a home for their work. What John knew of the new sciences and how, when, and where he came to know them are explored in what follows.

5.1 JOHN OF WORCESTER AND OXFORD, BODLEIAN LIBRARY, AUCT. F.1.9

John's signature document of his *Chronicle* is Oxford Corpus Christi 157. John's work saw roughly two drafts or writing periods. The first major draft was written before 1131, and the second, made in several iterations, was taken up in the late 1130s or after 1136, according to Martin Brett.[4] Already, before the early 1130s, John had been fascinated by mathematical and computistical studies and appreciated multiple dating systems. He had fully embraced the new era calculation of Marianus Scotus, incorporating it into his history without fear, it seems, of reprisal or political backlash as had William of Malmesbury. After 1136 however, when later drafts were made, John showed a new awareness. A brief comparison of his exposition before the pre-1131 and post-1136 drafts illustrate a change in his sensibilities.

In the 1095 entry, made before 1131, John elaborately detailed the date of the death of Wulfstan in every conceivable way to calculate a date, as shown in Chapter II above.[5] In its way, the extended passage summed up all the known computistical studies available to John up to that time. In the 1138 entry, however, John has an updated and very different computistical take:

> The year of our Lord 1138 began according to the Arabs on 16 September, and this was the first day of the first Arab month Muharram, on Friday at the sixth hour, the dominical letter being B.[6]

Here, John was revealing a different sensibility and an exposure to the Arabic dating system. In the parts of his works postdating 1136, he revealed knowledge of *De dracone* and the al-Khwārizmī tables. John's exposure to these works is reflected in the Worcester manuscript, Oxford, Bodleian Library, Auct. F.1.9.

Oxford, Bodleian Library, Auct. F.1.9 has received a great deal of scholarly attention,

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[4] Flint, 'The Date of the Chronicle', pp. 115–119; Hayward, ed. and trans., *The Winchcombe and Coventry Chronicles*; Brett, 'John of Worcester', pp. 101–126; Lawrence-Mathers, 'John of Worcester', pp. 255–274. The 1131 date has meaning because several copies of the chronicle were made at this point (or going up to this date), including an Abingdon copy, London Lambeth Palace Library 42. These copies do not include the revisions and the astronomical editions discussed here.

[5] Chapter II, [2.0].

[6] John, *Chronicle,* III, s.a. 1138: pp. 260–261: 'Annus ab Incarnatione Domini MCXXXVIII^{us}, secundum Arabes hoc anno incepit xvi^{o} kal . Octob. et fuit prima dies Almuharran primi mensis Arabici, feria vi^{a}, hora diei vi^{a}, dominicali littera B existente'.

especially from Burnett.[7] The texts in this manuscript include computistical and mathematical works available in the second quarter of the twelfth century, as well as those representing the new sciences. The discussion of this document will involve two parts, what is in Auct. F.1.9 and how John may have come upon the texts in this document. First, a survey of the document itself. The manuscript includes:

- *De rithmomachia* (shared with Hereford O.1.6)[8] [fol. 1r-v]
- Robert of Losinga*, Excerptio episcopi de chronica Mariani* (shared with William of Malmesbury text Auct. F.3.14) [fols. 2v-12v]
- Gerland, *Compotus Garlandi Bedam imitantis* [fols. 12v-26r]
- Commentaries on Gerbert's *Regulas de numerorum abaci rationibus* [fols. 33v-65v]
- First three books of Bernelius, *Liber abaci* (shared with Hereford O.I.6) [fols. 66r-75r]
- *De utilitatibus astrolabii* (portions of inserted text are shared with William of Malmesbury text Auct. F.3.14) [fols. 75r-78r]
- *De horologio secundum alchoram*, an Arabic work in translation (shared with William of Malmesbury's collection Auct. F.3.14) [fol. 79r-v]
- *De horis diei* [fol.79v]
- Ascelinus of Augsburg, *Compositio astrolabii* [fols. 80v-84r]
- *De lunationibus, De dracone*, Walcher of Great Malvern [fols. 86r-99r]
- Adelard of Bath, translation of the *al-Khwārizmī tables* [fols. 99v-159v]
- Compilation of Martianus Capella, *De nuptiis Philologiae et Mercurii,* Pliny's *Naturalis historia,* and Bede's *De temporum ratione, book XXIX* [fols. 160r-163r]
- Macrobius, *Commentarii in somnium Scipionis* [fol. 163r-164r]

This manuscript was compiled fifteen or twenty years later than Auct. F.3.14, owned by William of Malmesbury and described in Chapter II. While the two manuscripts have some similarities, a comparison shows that within a brief period, there were very different mathematical and astronomical documents in circulation.

BL, Auct. F.1.9 begins with a mathematical teaching aid known as the *Rithmomachia*.[9] The work of Robert of Losinga is included (John's copy of this work contains a chapter not

[7] Numerous citations of this document began with Haskins, 'The Reception of Arabic Science': pp. 56–69; Charles Burnett, 'The Introduction of Scientific Texts into Britain, c. 1100–1250', in Nigel J. Morgan and Rodney M. Thomson, eds., *The Cambridge History of the Book in Britain* (Cambridge: Cambridge University Press, 2008): pp. 446–453; Burnett, *The Introduction of Arabic Learning*; Nothaft, ed. *Walcher* provides a partial list of contents: pp. 125–131.
[8] R.A.B. Mynors and Rodney Thomson, eds., *Catalogue of the Manuscripts of Hereford Cathedral Library* (Cambridge: D.S. Brewer, 1993): pp. 7–8.
[9] Evans, 'Rithmomachia': pp. 257–273.

found in the Malmesbury copy).[10] Robert's bête-noire of the era controversy is here complicated and expanded to include the work of Gerland. Gerland's *Computus* is followed by two fraction tables.[11] These are followed by two commentaries on Gerbert's *Regulae de numerorum abaci rationibus*.[12] Next is Bernelius' treatise on the abacus.[13] Fols. 75r-85v contain works of Alchandrean influence that share synergies with William's computistical manuscript, including the *Horologio secundum alchoram* and the work of Ascelinus of Augsburg. As will be seen in the upcoming sections, these texts are of interest because they were often associated or bound with the work of Adelard of Bath. The works of Walcher of Great Malvern begin on fol. 86r: *De lunationibus* and the only complete copy of *De dracone* extant. Following this is a stunning version of Adelard of Bath's translation of the al-Khwārizmī Tables. The texts of the document also include book eight of Martianus Capella's *De nuptiis Philologiae et Mercurii,* into which chapter XXIX of Bede's *De temporum ratione* was inserted.[14]

Represented here are a variety of traditions or themes: works reflecting the local mathematical tradition of the Severn Valley; works that are critical of Dionysius and which present the arguments of the *computus naturalis*; and works that reveal the influx of the new translations from Arabic. Of interest is that Bede is not present except in the form of excerpts. Neither did John include any of the traditional computistical works associated with Abbo of Fleury. Auct. F.1.9, which does not provide, as does the Malmesbury manuscript, a historical cross-section of computistical study. On the other hand, in some ways, this text is more reminiscent of William's document than it is of other computistical collections of the period. It will be recalled that William's text only included mathematical and computistical texts and did not, for instance, have medical or overtly prognosticative texts. Likewise, Auct. F.1.9 has no medical texts, and the texts have little in the way of prognosticative elements (those that are

[10] Thomas D. Hardy, *Descriptive Catalogue of Materials Relating to the History of Great Britain and Ireland: To the End of the Reign of Henry VII*, vol. 2 (London: Longman, Green, Longman, and Roberts, 1865): p. 75; Schmidt, 'A Saint Petersburg Manuscript', in Cleaver and Worm, eds., *Writing History*; also see Chapter I, [1.6].
[11] Alfred Lohr, ed., *Der Computus Gerlandi: Edition, Übersetzung und Erläuterungen* (Stuttgart: Steiner, 2013).
[12] Bubnov, ed., *Opera*: p. 252 and p. 246.
[13] See Chapter I, [1.6].
[14] This compilation has been found in Auct. F.1.9., Rawlinson G.40.; Cambridge, McClean 185; Haskins, *Studies*: p. 89.

shared with Auct. F.3.14 will be discussed below). In contrast, many computistical texts of the period, such as St. John's College 17, included medical and prognosticative texts, revealing the more full-bodied interests of a monastic community.[15]

That is not to say that this document was made without the Worcester community in mind. The practical nature of this study is indicated by the preponderance of 'how to' works. The manuscript begins with the *Rithmomachia*, a mathematical game designed to teach the contestant the art of multiplication and division.[16] The practical works advance to a higher level in the works on the abacus, which William had found so frustrating, and the astrolabe. Walcher and Adelard's work can be categorised as practical as well, for the charts and tables they provide were designed for the interpretation of data collected by such instruments as the astrolabe. Auct. F.1.9's organisation appears to be that of a teaching tool and one specifically devoted to *computus* and astronomy.

Auct. F.1.9 has received attention from scholars for the important evidence it brings to the history of medieval science.[17] That its owner was one of the most influential historians of the early twelfth century has been overlooked until recently.[18] Otto Pächt has suggested that it seems to be also drafted as a companion volume to Oxford Corpus Christi 157.[19] It is the same size and laid out similarly. John wrote in the margins of both documents. And in developing the edition of John's *Chronicle*, his editor, Patrick McGurk, drew from Auct. F.1.9 for text and comment. For instance, when John made the notation about Henry I's dream (described in section 5.4 below), comparing it to that of Nebuchadnezzar, he made it in the margins of Gerland's *Computus* in Auct. F.1.9.[20] Of note is that John copied the entirety of the Gerland manuscript in his own hand. It also points to the synergies between John's manuscript Corpus Christi 157, his signature history, and Auct. F.1.9. He made them as companion volumes and used them together. Auct.

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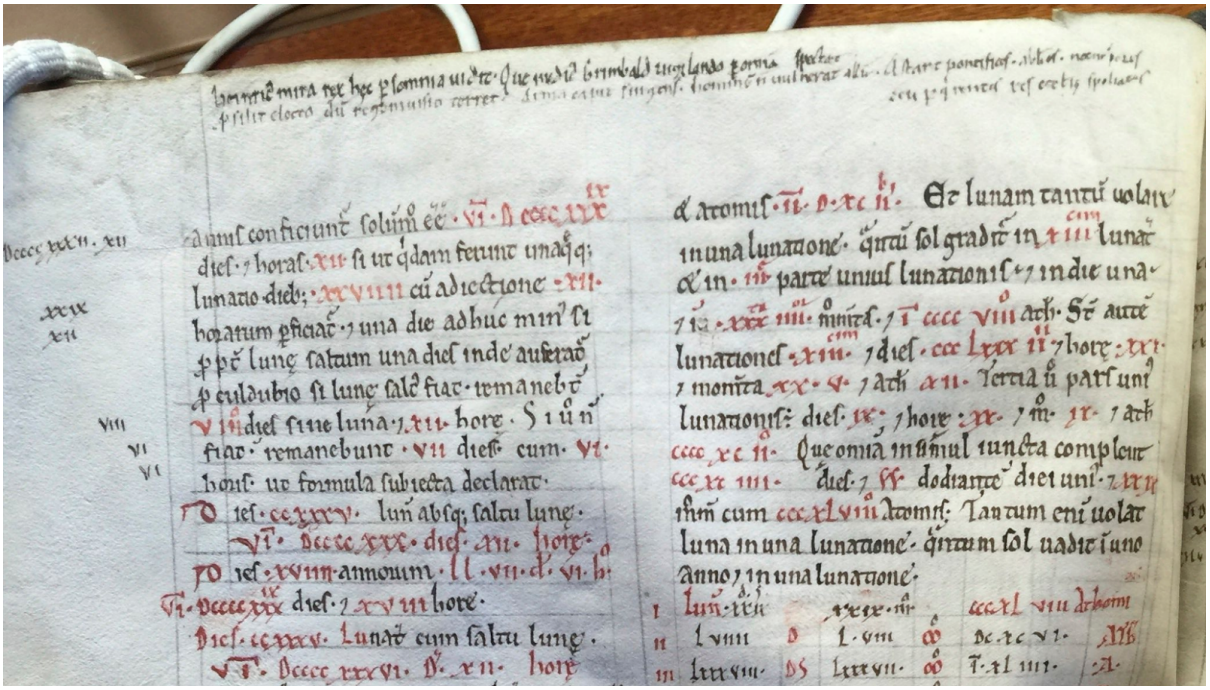
[15] Wallis, 'Albums of Science': pp. 195–224; also Wallis, *The Calendar and the Cloister*, https://digital.library.mcgill.ca/ms-17/ (accessed 11/04/2022).
[16] Evans, 'Rithmomachia': pp. 257–273.
[17] Haskins, *Studies*, see esp.: pp. 22–23 and pp. 114–117; Thorndike, *History of Magic*, vol. 1: p. 68; Evans, 'Rithmomachia': p. 272; Evans, 'Schools and Scholars': pp. 71–89.
[18] Lawrence-Mathers, 'John of Worcester'.
[19] Otto Pächt and J.J.G. Alexander, eds., *Illuminated Manuscripts in the Bodleian Library, Oxford*, vol. III (Oxford: Clarendon Press, 1973): p. 15, n. 126.
[20] John, *Chronicle,* III, s.a. 1130: p. 198 and p. 200.

F.1.9 was of personal importance to John. It also appears that John, like William, travelled to collect the material in his document, actively collecting and compiling these documents in the time period between his first and second drafts or between 1131 and 1136.



Oxford, Bodleian Library, Auct. F.1.9, fol. 20v, 'Henricus mira rex hec per somnia uidit medicus Grimbald uigilando per ominia spectat. Prosilit e lecto dum regem uisio terret. Arma capit surgens hominem non uulnerat ullum. Astant pontifices, abbates, necne priores, ceu perquientes res ecclesie spoliatas'.

5.2 JOHN AS COLLECTOR

What seems evident from the language of John's history is that he did not have many of the new astronomical documents before 1131. He did not, in his summary of the death of Wulfstan, have exposure to Adelard or the al-Khwārizmī tables. By the time of his later historical editions, however, John had collected the documents of Walcher and Adelard. It is certainly possible that John put together part of his collection from Worcester without having to

travel. As has been described in previous chapters, Worcester and its library was already an intellectual waystation. William of Malmesbury, Orderic Vitalis, John of Salisbury and others frequented its collections and, in doing so, must have encountered John. Worcester is also only a day's journey from Great Malvern; John could have had access to Walcher's documents directly from Walcher himself without significant travel. The Adelard of Bath documents could have been introduced via Walcher's relationship with Petrus. That rendezvous could also have happened later, in the period when Petrus and Adelard may have been collaborating.

All of that said, it is apparent that John did travel, and the implications with respect to his sources are intriguing. He was at Winchcombe abbey in the mid-to-late 1130s, and it was here that John was told of Henry's dreams by Grimbald, the physician of Henry I. The story of these dreams and the related illustrations in Corpus Christi 157 are John's most widely known historical contributions and will be discussed below. John's encounter with Grimbald can be placed chronologically with some accuracy. Under the year 1134, John tells of the torture and death of Christians by Saracens in Apulia and says, 'I heard these things from the reverent Abbot of St. Valery [visiting the Abbey] while I was in exile [exulans] at Winchcombe, and I took care to insert them in our chronicle'.[21] Then, in relating the dreams of Henry I, John says Grimbald also 'related these stories to Godfrey, Abbot of that same monastery'.[22] Godfrey was Abbot of Winchcombe from 1122–1137, which would place John's visit between 1134–1137.[23] John's visit there was a source of other information for his *Chronicle*. Because he described his stay as 'exulans', John may have stayed at Winchcombe for some time. John's encounter with Grimbald offers a tantalising glimpse of the wider networks which were open to John and the wider range of possibilities he had for access to knowledge.

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[21] John, *Chronicle*, III, s.a. 1134: pp. 214–215: 'Hec olim exulans Wincelcumbe, ab ore doctissimi uiri abbatis de Sancto Walarico audivi, et huic chronicae nostrae inserere curavi'; the narrative was printed in G.H. Pertz, ed., *MGH SS* 22 (Hannover: MGH, 1872): p. 133 who noted that Lambert was Abbot of St. Valéry 1106–1140.

[22] John, *Chronicle*, III, s.a. 1131: pp. 200–201: 'Erat itaque iste medicinae artis peritus, Grimbaldus nomine, qui apud Wincelcumb, me presente et audiente, narravit haec omnia domno Godefrido eiusdem aecclesiae abbati'.

[23] Gordon Haigh, *The History of Winchcombe Abbey* (London: Skeffington, 1950): p. 207; Knowles, *Heads of Religious Houses*: p. 79; see also Hayward, ed. and trans., *The Winchcombe and Coventry Chronicles.*

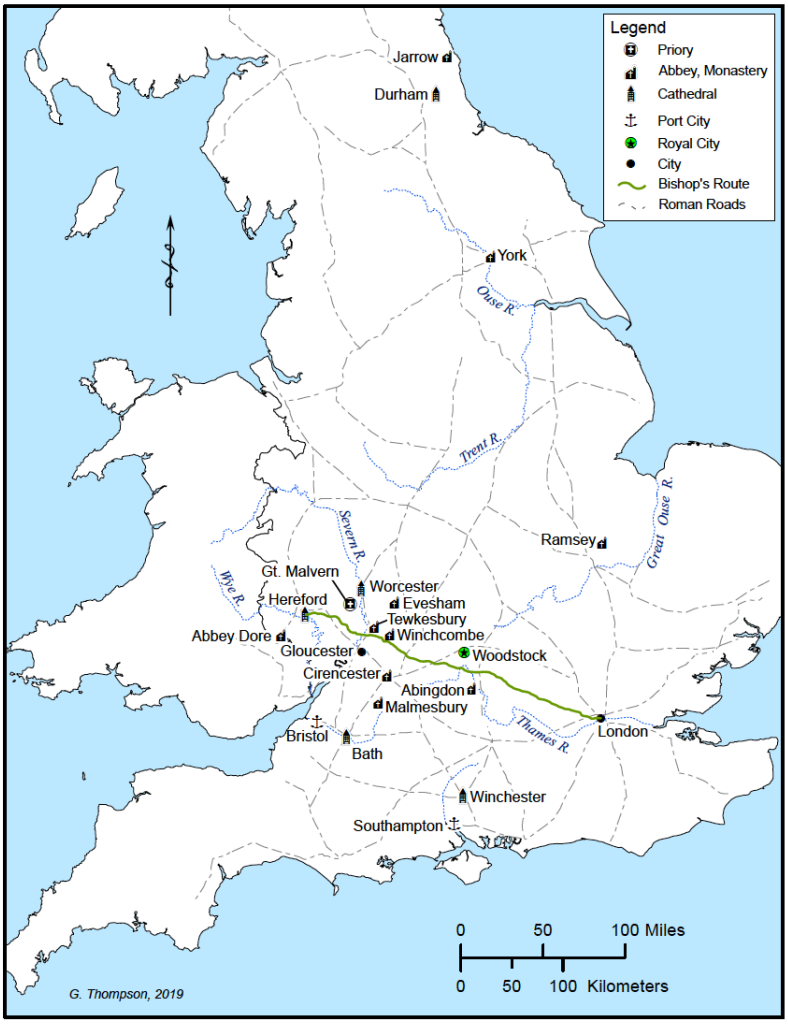
5.3 WINCHCOMBE ABBEY AND ITS IMPORTANCE TO JOHN OF WORCESTER

John states himself that he was at Winchcombe and his connections were probably strong – he gave a copy of his *Chronicle* to the community. It is not surprising that Winchcombe would have been a destination for John. It has been noted in previous chapters that Winchcombe was a part of the network of monasteries in the Severn Valley that were known for book copying. The Winchcombe library and scriptorium were of some distinction. Winchcombe also had an existing relationship with Worcester, as will be discussed below, which makes a monk of Worcester spending a period of time there less unusual. John's visit took place during the period of his most influential writing and when he was collecting the astronomical documents in Auct. F.1.9.

Winchcombe Abbey was established in the late 700s with the support of Ceonwulf, King of Mercia 796–826. It is believed that St. Kenelm (c. 786–811) was buried there, and it became a major centre for his cult. Winchcombe also had a relationship with Cluny, beginning with the appointment of Cluniac priors and abbots in the area by William Rufus.[24] In the Benedictine revival of the late eleventh century, Winchcombe came under the influence of Worcester and Ramsey and, together with Evesham, was instrumental in the reestablishment of Benedictine monasticism in the northeast, including the Cathedral priory in Durham.[25] The Abbey flourished, becoming one of the most well-endowed monasteries in the area, second only to Gloucester.[26] Geographically, Winchcombe lay on one of the principal routes through the Cotswolds, linking the west and places such as Hereford or Worcester to London.[27] Other routes from Worcester to London via Woodstock would have passed by Winchcombe. As Barrow suggests, members of the royal court and senior church members would have stayed in places like Winchcombe, which were slightly off the main route and welcomed distinguished visitors. Below is a map of the

[24] Haigh, *History*: p. 36 and Knowles, *Heads of Religious Houses*: pp. 78–79; see also Hayward, ed. and trans., *The Winchcombe and Coventry Chronicles*.
[25] Haigh, *History*: pp. 28–29; David Rollason, *Anglo-Norman Durham, 1093–1193: [based on Papers Read to a Conference Held in Durham on 13–18 September 1993]* (Woodbridge: Boydell Press, 1998).
[26] Haigh, *History*: p. 31.
[27] Julia Barrow, 'Way-Stations on English Episcopal Itineraries, 700–1300', *EHR* 127, no. 526 (2012): pp. 549–565.

possible travel route from Hereford and Worcester to London, passing immediately by Winchcombe, based on the data in Barrow's article.



Map 2 - Bishop's Route and Roman Roads for Severn-Wye Valleys in the 12th Century

Map #7: This is a diagram of a typical route for bishops between Hereford and London, as indicated by Barrow, 'Way-Stations on English Episcopal Itineraries' pp. 549–565. It shows that Winchcombe was a convenient waystation on the route.

Politically, the Winchcombe area was also one of military and social importance, as evidenced by the number of fortifications, residences, and new monasteries established in the

area in the 1130s and 1140s.[28] This included the rebuilding of Tewkesbury Abbey, ten miles away, sponsored by Robert of Gloucester.[29] After the death of Henry I in 1135, this area was to become one of the frontiers in the struggle between Stephen and Matilda. Winchcombe had become an important staging post for Matilda, where she had built a residence also with the support of Robert of Gloucester.[30] That Winchcombe was a focal point for those connected to the courts of Henry I, Matilda, and Robert of Gloucester makes it possible that in his sojourn at Winchcombe, John would have met people associated with the court. Besides Grimbald, it is possible that he met others who knew something about the new sciences and that he learned more during his stay than the story of Henry I's dreams.

5.4 GRIMBALD AS PHYSICIAN AND ASTROLOGER

Grimbald was part of Henry I's trusted circle in court. He is listed on no less than eleven known charters and confirmations, many in the Severn Valley and some in Normandy (Rouen).[31]

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[28] See David Walker, 'Gloucestershire Castles', *Transactions of the Bristol and Gloucestershire Archaeological Society* 109 (1991): pp. 5–23 at p. 15 notes the construction of these fortifications during the struggle between Matilda and Stephen.

[29] William Page, 'Houses of Benedictine Monks: The Abbey of Tewkesbury', in William Page, ed., *A History of the County of Gloucester*, vol. 2 (London: Victoria County History, 1907): pp. 61–66; Karen Stöber, 'Female Patrons of Late Medieval English Monasteries', *Medieval Prosopography* 31 (2016): pp. 115–136; 'The Misericords and History of Tewkesbury Abbey', *Misericords*, http://www.misericords.co.uk/tewkesbury.html (accessed 20/01/2021); Winchcombe was of sufficient import and distinction to have the nephew of King Stephen appointed as Abbot in 1138.

[30] A motte and bailey castle may have been built for her there in the 1140s by Roger, Earl of Hereford (and supported by Robert of Gloucester), see Walker, 'Gloucester Castles': pp. 5–23; *Gesta Stephani*, s.a. 1144–1145: pp. 174–175: English: 'the king [Stephan] … arrived unexpectedly at Winchcombe, where Roger, the new Earl of Hereford, had built a castle against his adherents'. Latin: 'His rex...sub festimatione ab illis locis dimota, ad Winchelcomam, ubi Rogerius, nouus ille Herefordensis comes, castellum aduersus sibi consentientes eruerat'.

[31] Farrer, *An Outline Itinerary*, nos. 28, 39, 114, 116, 135, 144, 258, 280, 281, 292, 294, 349, 358, 430, 436, 439, 440, and 519. (He is also mentioned on p. 154, but not as part of a charter); the charters: Charles Johnson and H.A. Cronne, eds., *Regesta Henrici Primi, 1100–1135*, vol. 2, Regesta regum Anglo-Normannorum, 1066–1154 (Oxford: Clarendon Press, 1956), nos. 528a, 544, 550 (a chronicler attributes the seeking of this grant to Grimbald and another), 567, 654, 683, 734, 758, 804, 812, 833, 943, 961, 972, 980, 988, 1015, 1015a, 1017, 1037, 1089, 1245, 1296, 1299, 1317, 1363, 1369, and 1439.

Other physicians of Henry I, such as Faricius, used that position to further their careers.[32] As we have seen, William of Malmesbury vilified John of Villula for using his position to move up the ladder in the church and develop Bath as a healing centre.[33] Grimbald did not move on; he stayed with Henry. As recounted by John, Grimbald slept in Henry's room during his nightmares and may have been at his side when he died.[34] It was Grimbald who warned Henry I not to eat the eels which were the cause of his death in 1135. In this position, he was able to develop a large personal fortune. Even after his death, his daughter's dowry received royal attention.[35]

The royal court that Grimbald was a part of was active and diverse. Henry I's title 'Beauclerc', while probably exaggerated, reflects an appreciation of learning on the part of the king and his court. Henry seems to have patronised men of scientific interests such as Faricius of Abingdon and possibly Adelard, who devoted works to at least two of Henry I's grandsons.[36] It may not, therefore, be illogical to assume that someone with Grimbald's skills and his direct connections to the court would have known, or known of Adelard. The appeal of the prognostic implications of Adelard's work and those like him would be irresistible to a physician like Grimbald. While Grimbald's encounter with John does not directly indicate that they discussed things astronomical, there are, as will be indicated, astrological elements presented in his story.

John's encounter with Grimbald deserves some attention. The account of Henry's dreams is to be found in Corpus Christi 157 and was prefaced by John's description of an unusual astral event over Hereford and the Brecon Beacons (which will receive more attention in due course). John says that he got the stories about Henry's dreams directly from Grimbald, who, as his physician, had been asleep in Henry's bedchamber. The king had three dreams, as described by Grimbald. In the first dream, angry peasants confronted him and 'demand[ed] from him dues

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[32] William of Malmesbury on Faricius, Abingdon Abbot, *GP,* II.88.4–88.5: pp. 300–305; Kealy, *Medieval Medicus*: pp. 41–44.
[33] William, *GR*, IV, 340: pp. 588–591.
[34] Henry of Huntingdon, *Historia,* VII.43: pp. 490–491*,* states that in 1135 near St. Denis, Henry ate lampreys despite the advice of his physician, and died, 'Cum autem medicus hoc comedi prohiberet, non adquieuit rex salubri consilio'. This is assumed by Farrer, *An Outline Itinerary*, no. 522, p. 154, to be Grimbald, but there is no hard evidence for this. Grimbald had accompanied Henry to France on several other occasions.
[35] R.R. James, 'Grimbald the Physician', *The British Medical Journal* 1, (1926): pp. 298–299.
[36] He dedicated his work on the astrolabe to Henry Plantagenet Chapter IV, [4.7], and the *Quaestiones naturales,* to Robert of Gloucester's son, Chapter IV, [4.2].

which I am unable to describe'.[37] Henry, waking in terror, leaped out of bed to protect himself from his imaginary foes. In the second dream, knights appeared to Henry, threatening to kill him, and in the third, Bishops appeared, also to reprimand him, searching for their despoiled churches. 'One man secreted in a hidden corner of the royal chamber under the cover of the total silence of the night saw all these marvellous things'.[38] Grimbald recounts to John that he had interpreted the dreams to mean that Henry had to do alms, but, like Nebuchadnezzar ignoring his astronomers and astrologers, Henry disregarded Grimbald and continued on his path. Henry ignored Grimbald's warnings at his peril, for Henry was later nearly killed at sea and, as a result, vowed to rule justly going forward. The dreams and the misadventure at sea are depicted in some of the most compelling manuscript illustrations of the time.[39] Of interest is that Grimbald is pictured in the margins in all three of the dream sequences.

Grimbald's self-proclaimed role in these stories and John's illustrations of him are important. In the first two images, Grimbald's medical qualifications are displayed. In the first image, he is holding up a urine flask, one of the most often depicted medical instruments in manuscripts of the period. In the second, he is holding up what might be an ointment container, but which could also very easily be a bleeding device. In both of these images, Grimbald is pictured in roughly the same garb and hat. Of particular interest is the figure in the third diagram. It is usually assumed that that is also Grimbald. In this drawing, the figure is wearing a very different hat and seems to be holding and referring to a document rather than a medical device. The headwear appears to be a Phrygian hat. In reference to the document he is holding, the image may be referring to the more literary nature of the physician's profession and connections to Salerno.[40] Images of Phrygian hats, such as the one the figure is wearing, had only just begun to be introduced into the Latin West as an artistic device. In other images of the period, both

[37] John, *Chronicle*, III, s.a. 1131: pp. 200–201: 'Omnes in illum diuersis modis seuire, dentibus frendere, et nescio quod ab eo debitum exigere'.
[38]John, *Chronicle*, III, s.a. 1131: pp. 200–201: 'Hec mira uideos uidit quidam in regie aule secreto angulo latens, scilicit sub nocturno tempore omnia tegit silentio'.
[39] Lawrence-Mathers, 'John of Worcester'; Oxford Corpus Christi 157 is digitised; here is the link for this specific page, https://digital.bodleian.ox.ac.uk/objects/93b83416-7972-40d7-9789-18f54e17ae25/surfaces/b429fdfb-9d79-4aeb-8d38-7d41d1159176/ (accessed 11/04/2022); Robert Maxwell, 'Visual Argument and the Interpretations of Dreams in the Chronicle of John of Worcester', in Erik Kooper and Sjoerd Levelt, eds., *The Medieval Chronicle IX* (Leiden: Brill, 2015): pp. 233–269.
[40] Suggested by Michael McVaugh in private correspondence.

illustrations and sculpture, the hat is associated with astronomy.[41] The iconography of these drawings associates the physicians' craft with that of prognostication and astrology. Grimbald had, in effect, 'put on his other hat' and is portrayed in this image as interpreting Henry's dream and, like Nebuchadnezzar's astronomers, is using the stars to give him counsel. John, if we are to judge from his stories and drawings, associated Grimbald with the prognostic sciences, and it should be emphasised their encounter was within the time frame in which John absorbed more and distinctive astronomical learning and came into possession of the al-Khwārizmī tables.

Grimbald #1 With Urine Flask, Oxford, Corpus Christi 157, p. 382

[41] Images of Perseus depicted with a Phrygian hat can be found in Ludwig XII.5, fol. 2v and Durham Hunter 100 fol. 62v (Los Angeles: J. Paul Getty Museum) and then the sculptures near Hereford and Durham as documented by Turnock, 'Reconsidering the Reign of King Stephen'. The iconographic usage of the Phrygian hat is non-specific; it appears to have been connected early on to Mithraic themes, and is often in diagrams of Perseus or Sagittarius. Of further note is that the images of this hat seem associated with the Severn Valley or the Durham area (culturally connected, as we have pointed out). Discussions of the Phrygian hat can be found in Hilda Amphlett, *Hats: A History of Fashion in Headwear* (Chalfont St. Giles: Sadler, 1974): pp. 18–19; Naomi Lubrich, 'The Wandering Hat: Iterations of the Medieval Jewish Pointed Cap', *Jewish History* 29, no. 3 (2015): pp. 203–244, especially pp. 220–225; Sara Lipton, *Dark Mirror: The Medieval Origins of Anti-Jewish Iconography* (New York: Metropolitan Books, 2014).

Grimbald #2 With Bleeding Cup, Oxford, Corpus Christi 157, p. 382

Grimbald #3 With Possible Star Table, Oxford, Corpus Christi 157, p. 383

5.5 WINCHCOMBE AND COTTON TIBERIUS E.IV

Cotton Tiberius E.IV suggests further evidence of John's document sharing while in Winchcombe. The manuscript belonged to Winchcombe abbey, and though badly burned in the

Cotton Library fire of 1731, it remains a critical testament to both historical study and computistical texts.[42] It includes both the annals for the abbey as well as works that will now sound familiar: Bede's *De temporum ratione,* Dionysius Exiguus, Abbo of Fleury's *Ephemerida* and *Astronomica*, as well as Helperic of Auxerre's *De computo*, Robert of Losinga, and Walcher's *De lunationibus.* The Winchcombe annals drew extensively from John of Worcester's chronicle. They are not, however, a complete transcription of the Worcester chronicle.[43] Rather, they contain excerpts, with entries relating to Winchcombe added. While it is not a complete copy, the manuscript is an important testimony. As noted, John was in Winchcombe between 1134 and 1137. It is probable that portions of the annals in Cotton Tiberius E.IV also date from his stay there.

5.6 FURTHER EVIDENCE OF JOHN AS COLLECTOR

So far, this chapter has focused on John's connections to Winchcombe as a possible venue for developing his collection of Auct. F.1.9. This was important because it is the only evidence of John travelling. It reveals evidence of document sharing and it ties him to figures like Grimbald, who was connected to the world of the court. But to lay further groundwork for the reception of the new sciences, it is worth exploring some of the other evidence to be found in Auct. F.1.9. The body of this manuscript and the nature of its compilation reveal relationships to other manuscripts, monasteries, and collectors. The composition of Auct. F.1.9 also provides textual links to other works of Adelard.

John's document Auct. F.1.9, probably collected after the mid-1130s, shares similarities with several different manuscripts in the area. Those of particular interest are Hereford O.1.6 (from Cirencester), Auct. F.3.14, owned by William of Malmesbury, the Winchcombe document Cotton Tiberius E.IV already mentioned, as well as Ludwig XII.5, also possibly from Worcester

[42] Joseph Planta, ed., *A Catalogue of the Manuscripts in the Cottonian Library Deposited in the British Museum* (London: Luke Hansard, 1802): p. 40 lists this MSS as useless due to damage, and does not give a description. A modern edition is provided in Hayward, ed. and trans., *The Winchcombe and Coventry Chronicles.*

[43] Reginald R. Darlington, ed., 'Winchcombe Annals 1049–1181', in Patricia Barnes and C.F. Slade, eds., *A Medieval Miscellany for Doris May Stenton* (London: Pipe Roll Society, 1962): pp. 111–137.

and discussed in Chapter II.[44] Of continued note will be the relationship of Severn Valley area manuscripts to what we believe to be manuscripts of French and German origin, namely Avranches 235, from Mont Saint Michel, Munich CLM 560, and BL, Additional 17808.[45] As will be described below, these documents have texts that are often associated with Adelard's works.

Below is a graph of the manuscripts from the area, their place of origin, and contents. This graph is meant to be representative rather than exhaustive.

[44] MS Ludwig XII.5 (Los Angeles; Malibu, California: J. Paul Getty Museum); see Chapter II, [2.8].
[45] Juste, 'MS Avranches, Bibliothèque Municipale, 235', *Ptolemaeus Arabus et Latinus. Manuscripts*, in Callebat and Desbordes, eds., *Science antique* CLM 560 (Munich), https://www.thesaxlproject.com/assets/Uploads/MSS-DESCRIPTIONS-Revised-Aratus-latinus-Munich-30-Sept-2011.pdf (accessed 11/04/2022); BL, Add. MS. 17808, http://www.bl.uk/manuscripts/FullDisplay.aspx?ref=Add_MS_17808 (accessed 11/04/2022).

TEXT	BL Auct F.1.9 Worcester	BL Auct F.3.14 Malmesbury	Hereford O.I.6 Cirencester	Ludwig XII.5 Worcester	Munich CLM 560 Germany	Add 17808 Chartres/ Fleury ?	Avranches 235 Mt St Michel
De numero divisio		x					
Rithmomacia	x		x				x
Robert of Losinga, *Excerptio de Chronica Mariani*	x	x	x				
Walcher of Great Malvern, *De lunationibus*	x						
Walcher of Great Malvern, *De dracone*	x						
Isidore of Seville, *De natura rerum*		x		x			
Gerland, *Computus*	x						
Gerland, *De abaco*			x				
Verses on Arabic numerals			x				
Incertus de minutiis	x						
Gerbert, *Regulas de numerorum abaci rationibus*	x		x				
Gerbert, *Letter to Constantine*				x			
Bernelinus, *Liber abaci*	x			x		x	x
De utilitatibus astrolabii	x	x		x	x	x	x
Horologio secundum alchoram	x	x			x	x	x
Compositio astrolapsus secundum Ptolomaeum		x				x	x
De mensura astrolabii	x				x		
Ascelinus of Augsburg, *Compositio astrolabii*	x				x	x	x
Helperic, *De computo*		x					
Abbo of Fleury, *De ratione spere*				x			
Bede, *De temporum ratione, varia*		x					x
Epistola ad Wicthedum		x					
Dionysius Exiguus		x					
Hyginus (*Excerptum Arati*)		x		x	x		x
Aratus Latinus					x		
Pliny	x			x			x
Firmicus Maternus					x		
Alchandrean texts				x	x	x	x
Macrobius, *Dream of Scipio*	x			x	x		x
Capella				x			x
Epistola Ergaphalau					x	x	
Musical texts of Guido De Arezzo				x		x	
Adelard, *Ysogoge minor*							x
Adelard, *Liber prestigiorum*							x
Centiloqium							

This chart is a comparison of select texts in several of the manuscripts under discussion. This includes Oxford, Bodleian Library, Auct. F.1.9, Oxford, Bodleian Library, Auct. F.3.14, Hereford O.I.6, Getty Museum Ludwig XII.5, Munich CLM 560, British Library Additional 17808, and Avranches, Bibliothèque Municipal 235.

John's relationship with William of Malmesbury and the textual similarities between their documents is of interest. That William was known to John is suggested by the fact that he used

William's work in his own history.[46] John's collection postdates 1126 at the least (the date *post quem* for Adelard's translation of the al-Khwārizmī tables), and, as argued above, John became familiar with most of the works in this collection during the mid to late 1130s. Because William's collection predates 1125, it is possible that John copied some of these texts from William. William was in Worcester between 1113 and 1124 and had the opportunity to meet John.[47] However, the date of John's manuscript may point to a later interchange. While it is certainly possible that William visited Worcester again between 1136 and 1140, it may also be possible that John encountered William during his *exulans* and John may have travelled to other monasteries in the area besides Winchcombe.[48]

While the most compelling textual evidence comes from the Alchandrean texts and connections to Mont Saint Michel and Rouen, this section will first examine synergies between the *Rithmomachia* and Robert of Losinga's and Walcher's work, for they set the groundwork of document sharing. John's text shared the *Rithmomachia* with several texts produced in the area. The *Rithmomachia* was included, for instance, in Hereford O.I.6 from Cirencester, a Severn Valley Augustinian monastery. It is also included in Avranches 235, from Mont Saint Michel.[49] Robert's *Excerptio* is well represented in the area, included in Hereford O.I.6, Auct. F.3.14, and Cotton Tiberius E.IV. The *Excerptio* has received some attention from Schmidt.[50] His analysis to date, as indicated in Chapter II, shows that John's version of the *Excerptio* was a later critical edition than the others and that he revised Robert's text with other materials he had at his disposal. Robert's document is also included in Glasgow Hunter 85 and Durham Cathedral Library Hunter 100, both from Durham, which underscores the relationship between Worcester and Durham. The Walcher document's origins are elusive. One might assume that John's copies are the originals, given John's proximity to Walcher. John's copy of *De dracone* is the only full

[46] Rodney Thomson, 'The Reading of William': pp. 362–402 at pp. 395–396, particularly notes Cambridge University Library, MS. Kk.4.6. (written in part in John's hand), which contains the *Breviarium Alaricum*, known to William. See recent notation of this and the Liber Pontificalis, Thomas Langley, 'Englishing the Papacy: The Liber Pontificalis and MS. Kk.4.6.' (Cambridge University Library Special Collections, May 21, 2018), https://specialcollections-blog.lib.cam.ac.uk/?p=16120 (accessed 11/04/2022).
[47] Reginald R. Darlington, ed., *The Vita Wulfstani of William of Malmesbury* (London: Offices of the Society, 1928): p. ix; see also Thomson, *William of Malmesbury*: p. 5.
[48] Thomson, *William of Malmesbury*: p. 8.
[49] Callebat and Desbordes, eds., *Science antique*.
[50] Schmidt, 'A Saint Petersburg Manuscript', in Cleaver and Worm, eds., *Writing History*.

text we have. According to Nothaft, however, John's copy of *De lunationibus* has some missing text, so in his critical edition, other texts were considered, including Glasgow Hunter 85.[51] The Cotton Tiberius E.IV version of *De lunationibus* was probably directly related to these two manuscripts (again illustrating the connections between Durham and the Severn Valley). This tells us that while John may have the *best copies* we have, he may not have had the *earliest copies.* This again points to a later date for the collection of Auct. F.1.9.

The texts circulating in the Severn Valley reveal farther-reaching connections. William's document, it will be recalled, shared texts with Avranches 235 from Mont Saint Michel, Munich, CLM 560, from Germany, and BL, Add. 17808, most likely from Fleury. John's text also shared these texts, namely the *Horologio secundum alchoram* and *De utilitatibus astrolabii,* but has further similarities with BL, Add. 17808 and Avranches 235.[52] This includes Ascelinus' *De compositio astrolabii* and Bernelius' *Liber abaci*.[53] These synergies are important because the documents noted above also contained Alchandreana and, in the case of Avranches 235, Adelard's works on judicial astrology and talismans. That John (and earlier, William) were exposed to similar collections makes it all the more likely that John would have access to other, more advanced collections as they arrived.[54]

The works described above were part of a corpus of works that establish evidence of early transmission of the Arabic sciences via the Iberian Peninsula. This includes the Alchandrean texts, anonymous or unidentified texts on the astrolabe, and, occasionally, a curious

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[51] Nothaft, ed., *Walcher*: p. 75.

[52] Paul Kunitzsch, 'A Note on Ascelinus' Table of Astrolabe Stars', *Annals of Science* 57, no. 2 (2000): pp. 181–185; Charles Burnett, 'King Ptolemy and Alchandreus the Philosopher: The Earliest Texts on the Astrolabe and Arabic Astrology at Fleury, Micy and Chartres', *Annals of Science* 55, no. 4 (1998): pp. 329–368.

[53] Otisk, Mavek, 'Descriptions and Images of the Early Medieval Latin Abacus', *Średniowiecze Polskie I Powszechne* 7 (2015): pp. 13–35; Bernelin, élève de Gerbert d'Aurillac: *Libre d'Abaque*. Ed. B. Bakhouche. Pau 1999.

[54] In the area and not directly related to John, there is other evidence of the introduction as use of the new sciences. For instance, MS. London, British Library, Cotton Cleopatra A.VII, from Tewkesbury, contains an intriguing text recently edited by C. Philipp Nothaft. See Nothaft, 'Roman vs. Arabic Computistics': pp. 187–208. The text, *Collatio Compoti Romani et Arabici*, discusses the relative merit of the Arabic calendar and the Christian calendar, referencing either the al-Khwārizmī tables of Adelard or that of Petrus Alfonsi. Tewkesbury, a recently founded monastery by Robert of Gloucester, was directly adjacent to Winchcombe. (In his article 'Roman vs. Arabic Computistics', Nothaft also points out that Adelard's student Ocreatus is mentioned in a local document.)

text, the *Ut testatur Ergaphalau* (a work on the liberal arts reflective of Jewish influence).[55] As discussed earlier in the Introduction and Chapter II, the path of these documents to England is somewhat elusive, but they indicate connections in the Latin West to Mont Saint Michel and other learning centres in France, including Chartres and Fleury. These documents reveal a grounding in the classical tradition and also an awareness of the Jewish and Arab traditions of Alchandrean Iberia. They are important as early evidence of the arrival of this material and also because they were later often grouped with Adelard's prognosticative translations. As Burnett suggests: 'Adelard or an early follower may have supplemented pre-existing works on judicial astrology with Adelard's new translations and used the *Ut testatur Ergaphalau* [for example] as a preface to that collection'.[56] In other words, Adelard's work was originally seen as a part of this corpus, so their presence is a marker for the new sciences. John's document is therefore revealing. The presence of a scattering of these texts reflects back to William's earlier collection, underscoring connections to French and German centres of learning, and most importantly, to the works of Adelard. In all, the manuscript sharing, revealed using a few key documents, shows that the Severn Valley region had an important manuscript sharing tradition that facilitated the reception of the new sciences.

5.7 THE NEW SCIENCES AS REFLECTED IN THE WORKS OF JOHN OF WORCESTER

John not only collected these texts, but he also copied them himself, wrote in the margins, read them, and changed his intellectual path as a result of this activity. John's writing after the mid-1130s reflects not just an awareness of the new sciences, but like Walcher's, it reveals an observational astronomer. Two areas of evidence are key to this. First, the direct reflections of the new sciences which are found in John's *Chronicle*. Second, John's development into a scholar keenly aware of atmospheric and astronomical events.

As described in Chapter II, John was already a computistical expert before he learned of the new sciences from Walcher and Adelard of Bath. His summary of Wulfstan's death was a

[55] Burnett, 'Adelard, Ergaphalau and the Science of the Stars': pp. 133–145.
[56] Burnett, 'Adelard, Ergaphalau and the Science of the Stars': p. 142.

nearly complete outline of known calculations for time and the eras before 1120. Sometime after John collected the works in Auct. F.1.9, not only did his knowledge base change, his approach to his own work also changed. Of note are John's descriptions of astronomical events. It is not uncommon in medieval chronicles for there to be a number of references to eclipses of the sun and the moon. Robert Newton has put together an analysis of astronomical activity in the Middle Ages based on these entries.[57] Often the eclipses are recorded as portents of the future. The 1135 entry of the Anglo-Saxon Chronicle, for example, reads:

> The day drew dark over the lands and the sun became as if it were a 3-night old moon, and the people were astonished and terrified and said something important would happen – and so it did, that same year, the king died.[58]

Eclipses were also very often placed within a precise chronological framework, perhaps because of their importance to the calculation of calendrical and horological time: 'On the 9th calends October [23rd Sept.] on the 6th feria, from the 3rd to the 8th hour, on the 28th moon, Indiction 1, epact 1, there was an eclipse of the sun'.[59] Or they are mentioned for their literary effect, as by William of Malmesbury:

> On the 4th feria, the elements accompanied with their sorrow the crossing of such a prince [Henry I]. On that very day, at the 6th hour, the sun covered his bright head with gloomy rust as the poets are accustomed to say, frightening peoples' minds by his eclipse.[60]

Up until his later editions, John described astronomical events with relatively little enthusiasm. In the year 729, for example, he wrote, 'two comets appeared near the sun and remained for about two weeks'. As pointed out by Lawrence-Mathers, he was even 'omitting all the details provided by Bede as to exact locations, time of appearance, and possible

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[57] Robert R. Newton, *Medieval Chronicles and the Rotation of the Earth* (Baltimore: Johns Hopkins University, 1972).
[58] Newton, *Medieval Chronicles*: p. 160.
[59] Newton, *Medieval Chronicles*: p. 241; D.L. Bethmann, ed., 'Annales Blandinienses', *MGH SS* 5, in George Pertz, ed. (Hanover: MGH, 1844): pp. 20–34. Newton says this annalist must be 'a fanatic on chronology.'
[60] William, *Historia*, I.10: 'feria quarta prosecuta sunt elementa dolore suo extremum tanti principis transitum. Nam et sol ipsa die, hora sexta, tera ferrugine, ut poetae solent dicere, nitidum caput obtexit, mentes hominum defectione sua terrens'; see Newton, *Medieval Chronicles*: p. 161.

significance'.[61] Similarly, the comet of 975 is noted only as 'a comet was seen'.[62] Again, John ignored the prophetic flourish associated with this event by the Anglo-Saxon Chronicle, a source to which he deferred regularly.[63] Eclipses are ignored or not noticed at all.

By the mid-1130s, his writing was peppered with new language and includes highly developed astronomical observations. These accounts are described in detail, interpreted as best he could with his new knowledge. John's entry for the year 1133, for example, reads:

> The king and his attendants and many others walked about in great wonder, and raising their eyes to the heavens saw that the sun shone like a new moon. But it did not hold one shape for long – it was sometimes broader, sometimes narrower, sometimes more curved, sometimes upright, now steady as usual and then moving like quicksilver. Some say the sun was eclipsed.[64]

The detailed physical description of the eclipse will be described further below, but John also gives his description another quality not found in any other account of this period. 'If this be so', he muses,

> Then the sun was *in the head of the dragon and the moon in its tail*, or the sun in the tail and the moon in the head, in the fifth sign of the Zodiac, the lion, and in the seventeenth

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[61] Lawrence-Mathers, 'John of Worcester': pp. 255–274 at p. 269.
[62] John, *Chronicle*, II, s.a. 975: pp. 444–445, 'Cometa uisa est'.
[63] *Anglo-Saxon Chronicle*, Medieval and Classical Library, s.a. 975, http://mcllibrary.org/Anglo/part3.html (accessed 11/04/2022),
'high in the heavens,
the star on his station,
that far and wide
wise men call --
lovers of truth
and heav'nly lore --
"cometa" by name.
Widely was spread
God's vengeance then
throughout the land,
and famine scour'd the hills'.
[64] John, *Chronicle*, III, s.a. 1133: pp. 209–211: 'Unde rex latusque regium ambientes et alii complures mirantes, et in caelum oculos levantes, solem ad instar novae lunae lucere conspexerunt, qui tamen non diu se uno modo habebat. Nam aliquando latior, aliquandiu subtilior, quandoque incurvior, quandoque erectior, nunc silito modo firmus, modo movens, et ad instar vivi argenti motus et liquidius videbatur. Asserunt quidam eclypsim solis factam fuisse'.

> degree of that sign. The moon was in her 27th day. At that same day and hour, many stars appeared.[65]

And again, in 1140, John described the eclipse in terms of the dragon sign, 'the sun was eclipsed while the moon was in the tail of the dragon, but it illuminated the head'.[66]

Eclipses occur when the sun and moon are in the nodes of their position.[67] The sun and moon travel on different ecliptics around the earth from an observational standpoint. These ecliptics are off by 5 degrees but cross at two opposite points, known as the nodes. When the sun and moon are at the same end of a node, it is a solar eclipse, and at opposite ends, a lunar eclipse. As several historians have pointed out, John has his node crossing description confused since the sun and moon would have been in the same node for a solar eclipse.[68] (A diagram of the nodes is provided below). But John's observed connection of nodes of the ecliptic of the sun and moon to eclipses is accurate, and his reference to the dragon is important.

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[65]John, *Chronicle*, III, s.a. 1133: pp. 210–211: 'Quod si verum est, tunc sol erat in capite draconis, et luna in cauda, vel sol in cauda et luna in capite, in v°. signo leonis, in xvii°. gradu ipsius signi. Erat autem tunc luna xxvii^a^. Eodem etiam die et eadem hora, stelle quamplurime apparuere'.

[66]John, *Chronicle*, III, s.a. 1140: pp. 284–285: 'Eclypsis solis dum caudam luna draconis occupat est facta, caput ipso luce premente'.

[67]A node is 'the intersection of the orbital plane of some celestial body such as the moon, a planet, or comet, with the plane of the ecliptic (the apparent path of the sun among the stars) and projected on the celestial sphere. The ascending node is the one where the body crosses from the south to the north side of the ecliptic, the opposite being the descending node', *Encyclopedia Britannica*, 15th ed., vol. 17 (1979): p. 374. The dragon's head refers to an ascending node, the dragon's tail to a descending node.

[68] McGurk, ed., *Chronicle,* III: p. 210, n. 2 cites correspondence with Charles Burnett; see also Nothaft, ed., *Walcher*: p. 219.

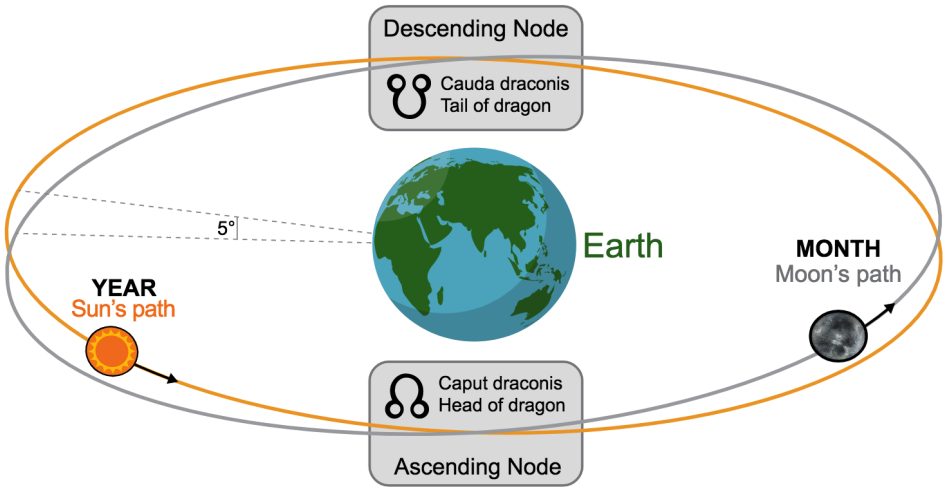

Diagram of eclipses shown with geocentric aspect. The ecliptics of the sun and moon are off by 5 degrees but cross at two opposite points, known as the nodes. When the sun and moon are at the same end of a node, it is a solar eclipse, and at opposite ends, a lunar eclipse. Terms used by Walcher and John are indicated. The ascending lunar node is referred to as the *Caput draconis* and the descending node, as the *Cauda draconis.*

Before the arrival of Petrus, it was not unheard of for the term 'dragon' to be used in relation to an eclipse, but it was rarely done so with any astronomical accuracy. For instance, the 1093 Hildesheim entry reads, 'there was an eclipse of the sun in the third hour of the day, and a dragon was seen'.[69] It is possible that the connection between a 'dragon' and an eclipse could be misunderstood in a period when Arabic astronomical terms had preceded theoretical knowledge.[70] The Alchandrean texts had arrived in the tenth century, as noted above. These texts brought a vocabulary before the science was understood.[71] In contrast, John of Worcester may be

[69] Newton, *Medieval Chronicles*: pp. 407–408: 'Eclypsis solis facta est 3. hor diei et draco visus est'.
[70] Haskins, *Studies*: p. 9 and p. 115.
[71] On the arrival of the Alchandrian texts see Juste, *Les Alchandreana primitifs*; Paul Getty Ludwig XII fol. 11v, is a text identified by Nothaft, ed., *Walcher*: p. 217 as containing an eclipse and dragon reference. It may not surprise us that this text is from Worcester.

the only historian of the period who understood and applied the theoretical meaning of the astronomical term 'dragon'.

John's new awareness may have come from one of two sources, both of which indicate a connection to Petrus Alfonsi, most likely via Walcher. First, the terminology of eclipse nodes as the 'dragon' is not surprising when we consider that he owned a copy of Walcher of Great Malvern's *De dracone*. In this work, Walcher states:

> For a solar eclipse never happens unless the Sun and Moon meet with the head or tail of this Dragon in one degree of a given sign, nor is there a lunar eclipse unless the Sun is in its head and the Moon in the tail opposite it – or the Sun in the tail and the Moon in its head. There you see how essential it is to know, if we want to predict anything about an eclipse, in whatever signs or degrees of signs, the Sun and the Moon would at all times be crossing each other in the head and tail of the dragon.[72]

Walcher explained here how to measure the position of the moon and sun according to the zodiacal sign and the gradation of that sign. That the wording of John's statement so closely resembles Walcher's indicates a high likelihood that he got his knowledge from this work.[73] Nothaft's edition and comparison of this section of the texts highlight this hypothesis.[74] A second possibility that has been proposed by Burnett is that John is referencing the text of Petrus Alfonsi's translation of the al-Khwārizmī tables.[75]

John's familiarity with the al-Khwārizmī tables, as translated by Adelard of Bath, has already been established in this paper. As noted, John of Worcester's copy is one of the earliest copies of this work, and it is recognised as the exemplar. John of Worcester's handwriting is found throughout his copy of this work, thus revealing a high level of interest in its contents. Just

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[72] Walcher, *DD*: pp. 194–195, (translation modified slightly): 'quia numquam fit solis eclipsis, nisi sol et luna cum capite sive cauda Draconis huius in uno gradu cuiuslibet signi convenerint, neque lune eclipsis, nisi sol in capite eius et luna in cauda, vel sol in cauda et luna in capite eius, sibi oppositi fuerint. Ecce vides si de eclipsi aliquid volumus prescire quam sit necessarium scire in quibus signis vel signorum gradibus inveniri vel sibi opponi debeant sol et luna, caput et cauda draconis omni tempore'; see also Haskins, *Studies*: pp. 116–117; Haskins, 'The Reception of Arabic Science': pp. 56–69 at pp. 58–59.
[73] Bader, 'The Relation of Computistical to Historical Study'.
[74] Nothaft, ed., *Walcher*: p. 218.
[75] Burnett, 'Petrus Alfonsi and Adelard of Bath Revisited'.

as interesting is that his chronicle shows that he put it to use in his history. Under the year 1138, John described this work:

> I set down here the first month of the Arabic year and the day and hour with which it began so that the work in which in Arabic is call 'Ezich' and which the learned al-Khwārizmī wrote most carefully on the course of the seven planets is not consigned to oblivion [rescued 'presumably by its translator Adelard of Bath'].[76]

Previously, when John gave a full concordance for a year, it appeared as though he was reading from an Easter table. In 1138, John described a concordance of a very different nature:

> I wished to know when, on what day, or what hour of the day, the first month of the Arabic year began. Take the year of our Lord's Incarnation 1138. According to the Arabs, this year began on the 16th Kal. October [16th Sept.] which was the first day of the first Arabic month Almoharan, on the 6th feria, in the 7th hour of the day, when the dominical letter was B. I would say that this Arabic year was the 537th of the collected Arabic years, and the 22nd of the single Arabic years.[77]

John was now at home in Arabic chronology, every bit as much as he had been with that of Marianus.

5.8 JOHN AS AN OBSERVATIONAL ASTRONOMER

> *Some say that on the Monday of the following week, that is on 7 August, when the moon was three days old, she appeared as she normally does at that age, and then, a little later*

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[76] John, *Chronicle*, III, s.a 1138: pp. 258–59: 'Ne igitur opus quod Arabica lingua dicitur Ezich quodque uir subtilissimae scientiae, Elkaurezmus vocabulo, de cursu viiem planetarum subtilissime composuit et seriatim digessit, oblivioni tradatur, Arabici anni primus mensis ubi et qua die uel qua hora diei incepit notare disposui'.

[77] John, *Chronicle,* III, s.a. 1138: pp. 260–261: 'Arabici anni primus mensis ubi et qua die vel qua hora diei incepit notare disposui. Annus ab Incarnatione Domini MCXXXVIIIus, secundum Arabes hoc anno incepit xvio kal . Octob. et fuit prima dies Almuharran primi mensis Arabici, feria via, hora diei via, dominicali littera B existente, annus autem Arabicorum ex quo inceptus est Arabicorum dico collectorum dxxxviius, plavorm vero xxiius'; the Arabic years are grouped into collected years, which are thirty years long. The plain years are the intervening years from one to thirty. The collected year for 1138 was 510, the plain year 23. I believe the collected year dxxxvii above should read dxxxii. If John's 22-year difference was subtracted from this, we would then have a collected year of 510 and a plain year that is only one year off; see Sherrard Burnaby, *Elements of the Jewish and Muhammadan Calendars with Rules and Tables and Explanatory Notes on the Julian and Gregorian Calendars* (London: G. Bell & Sons, 1901): pp. 637–708; see also Sacha Stern and Charles Burnett, eds., *Time Astronomy, and Calendars in the Jewish Tradition* (Leiden: Brill, 2013).

in the same evening she appeared full like a round and very brilliant shield. Many also say that on the same night two moons were also seen, about a spear's length apart.

John of Worcester*, Chronicle*[78]

While it is not clear that John was an observer of the phenomenon above, the atmospheric detail John provided is enough for a scientific experiment in refraction to explain what his sources had seen – a three-day-old moon that appeared for a time as a full moon and then as two moons. This experiment will be illustrated below. This passage has been cited here to show one example of what will be described as John of Worcester's newfound enthusiasm for astronomy and atmospheric events. Comparison to modern scientific discussion of the same phenomena illustrates that John's atmospheric observations, or collection of observations of others, are within the realm of possibility and should not be taken as purely imaginary or literary constructs.

Historians of art and science have in recent years noted a change in John's descriptions of his world. As argued above, John was clearly influenced by the astronomical works he owned. His incorporation of new language into his own works is established. It can also be inferred that he, like Walcher, took his astronomical interests further than some of the texts he was reading. As an example, it will be useful to return to the description of the solar eclipse of August 2nd, 1133. John told us that the position of the moon during the eclipse was 'in the fifth sign of the Zodiac, the lion, and in seventeenth degree of that sign'. According to Nothaft, this positional notation is not in agreement with Walcher's tables but is in agreement with that of *De utilitatibus astrolabii,* which John also owned and, as we have seen, was included in Auct. F.1.9.[79] It is logical to suggest that John was using another one of his astronomical texts to make this assessment. It may also be that he could have come to this conclusion by observation, in other words, by looking up.

[78] John, *Chronicle,* III, s.a. 1133: pp. 210–211: 'Fuerunt etiam qui dicerent se in subsequenti eptomada, feria .ii., sexto uidelicet idus mensis euisdem, cum luna foret .iii., ipsam uidisse primam qualis in tali etate esse solet, paruoque interuallo uespere eiusdem se ipsam uidisse magnam, ad modum scuti rotundi, ualdeque rutilantis. Dicebant quoque plures se ipsa nocte uidisse duas lunas inter se quasi longitudine haste unius distantes'. Note, the translation by McGurk is adjusted here – the correct date is August 7th.
[79] Nothaft, ed., *Walcher*: p. 219.

There is evidence that John was indeed noting the night sky or gathering detailed observational impressions from others. In the 1130 entry, in the lead up to describing the dreams of Henry I, John had erased what he previously wrote in his signature manuscript, Corpus Christi 157, and inked in in great detail an atmospheric event:

> Shortly after the middle of the night, on 17 February, that is on 13 Kalends of March, as they were coming out of Lauds, two priests and two clerks at Hereford saw an unusual bright light, about one perch in length, in that part of the heavens where the sun is to be found toward the end of the tenth hour, when it is setting at the summer solstice. The object from which the bright light came was covered with a white cloud. For a short period, it would often emerge from the cloud as though it was moving upwards, and then after a short interval it would re-enter the cloud to the fear and amazement of the observers. Its colour was a blend of those of the full moon and of bright flames. In shape and size, it was like a small pyramid, broad at the bottom, and narrow at the top. The observers called out so that there could be more witnesses to this matter, they declared that a fairly small plank, stretching upwards a long way was seen to stand on the cloud in which that brilliant object had been — which object had at first shed light on the cloud and had in the end covered with a dim light for the most part from below the northerly parts next to it, a light less bright than the spot in which it stood. Whilst these things were happening, some persons who had been called arrived and as soon as they had come, all that light was completely blotted out except the faintest trace which could barely be seen on its north side. The person who had seen the earlier light also saw at the beginning of the spectacle two lines seemingly filled with the light of dawn and stretching from the equinoctial sun's rising to its equinoctial setting. However, he was able to establish neither how long the two aforesaid lines lasted nor exactly when they vanished because he felt such fear of the sight and because he was concentrating wholly on the other vision which had been described. This was seen by the clerks of St. Guthlac in Hereford Castle. It was also seen by the watchmen in Brecon castle as well as in Herefordshire by the shepherds watching their flocks that same night. I have written down what I have heard. May Christ's mercy save us! [80]

[80] John, *Chronicle,* III, s.a. 1130: pp. 198–199: '1130/1152 Mense Februario xvii die mensis id est xiii kal. Martii, paulo post noctis medium, uisus est a duobus presbyteris et totidem clericis apud Herefordian a laudibus nocturnis exeuntibus splendor insolitus ad mesuram unius pertice porrectus, in illa celestis spere parte qua sol esse solet circa finem X hore, cum in estiuo solstitio uergit ad occasum. Erat autem corpus illud unde splendor exibat ille alba tectum nube, et per breuia temporis interualla sepius a nube prefata quasi exiliens ad superior emergebatur, et post breuem moram iterum nubi immergebatur, quod non sine metu ac stupore cernebatur. Color quoque eius erat quasi de coloribus plene lune flame esset confectus. Forma uero et quantitas eius sicut breuis piramis, in inferioribus lata, et in superioribus angusta. Cunque qui hec uiderunt inclamassent, ut plures in hac re testes habere possent, tabula mediocris in longum erecta stare uisa est super nubem in qua splendidum corpus illud fuerat, quod super ipsam nubem lumen ab initio sparserat, et in fine proximas sibi aquilonis partes inferius magna ex parte tenui luce repleuerat, minus lucida quam locus in quo stabat. Inter hec uenere quidam qui inclamati fuerant, et mox in eorum aduentu omnis lux illa penitus est extincta, nisi paucissima ipsus uestigia que uix in parte aquilonis tenuiter poterant uideri. Qui autem prius prefatam lucem uidit, duas etiam in initio uisionis lineas quasi aurorali luce plena ab equinoctiali solis ortu usque ad equinoctialem eius occasum porrectas aspexit, sed pro pauore quem inde incurrit et pro altera de qua dictum est uisione cui totus intendit neque

As the passage shows, John described this event in detail, using precise terms: he noted the exact date and time ('after the middle of the night, on 17 February, that is on 13 Kalends of March, as they were coming out of Lauds'); he described exactly where it was in the sky in astronomical terms ('the sun is to be found toward the end of the tenth hour, when it is setting at the summer solstice'); he placed the event in familiar directional terms, using the equinox and the summer solstice to guide the reader; he measured the size with what he considers to be a precise measurement (using the standard of the 'one perch', or approximately 5 1/2 yards);[81] he described in detail how it changed; and, he described the sight from various vantage points to gain insight.

This description is, in fact, reminiscent of Walcher's text. John pinpointed the position and then described the event. Compare this to Walcher, who said the eclipse:

> took place towards the west before the break of dawn; but neither did I then have a time-measuring device [with me], by which I could have determined the hour of the full moon, nor did the Moon itself appear clearly because of the concentrated fog that stood in the way. I remember seeing it horned like a V, but as the fog grew even thicker I could not see when it began to be eclipsed or when it had regained the fullness of its light.[82]

Walcher, as described above, was more interested in the event itself than discussing it in relation to the date of Easter or even as a prognostic event. John's description is similar in that regard. While John presented astronomical events, it seems, in the vicinity of major historical events, he rarely ascribes a providential connection. As Lawrence-Mathers has suggested, he gave the facts and left their wider significance for the reader to decide.[83]

Intriguing, is that John's detailed description of this event indicates a viewing of the northern lights, certainly possible at that latitude and with the nighttime visibility afforded in an

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quantum ille prefate due linee durauere, neque quando discessere potuit agnoscere. Via sunt ista in castello Herefordensi a clericus Santi Guthlaci. Visa sunt etiam a uigilibus Brecenaeunensis castelli; insuper in pago Herefordensi a pastoribus in ipsa nocte super gregem suum uigilantibus. Que didici scripsi, salute nos gratia Christi'.

[81] 'Measurements', University of Nottingham Manuscripts and Special Collections, https://www.nottingham.ac.uk/manuscriptsandspecialcollections/researchguidance/weightsandmeasures/measurements.aspx (accessed 22/01/2021).

[82] See Chapter II, [2.2].

[83] Lawrence-Mathers, 'John of Worcester': p. 273.

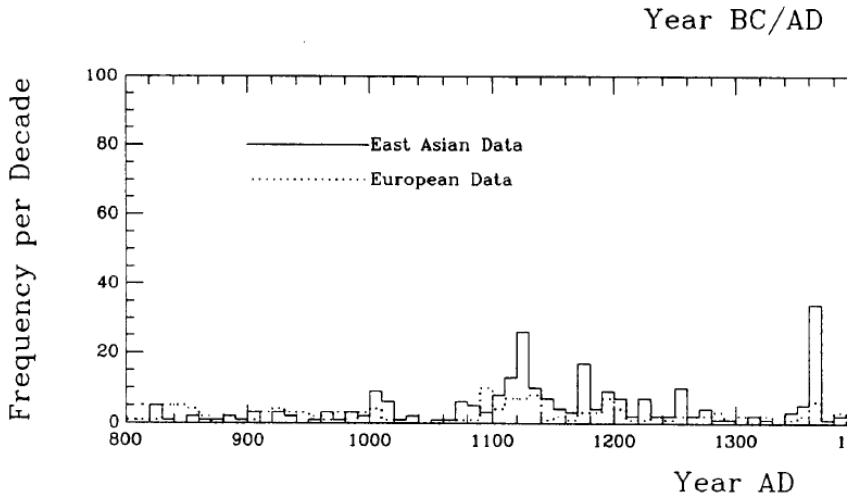
era of little to no ambient light. John's description is in keeping with the visual effect of wide range, high latitude aurorae.[84] Note below the sample photos capturing the effects similar to those described by John. From top left to right are pictured two pyramid shapes, one taken from Ireland ('In shape and size, it was like a small pyramid, broad at the bottom, and narrow at the top'); also pictured are broad bands of light moving across the horizon ('the spectacle [of] two lines seemingly filled with the light of dawn'), as well as the pillar effect he described ('a fairly small plank, stretching upwards a long way was seen to stand on the cloud in which that brilliant object had been'):

Representative images of aurorae with similar aspects to those in John's description. Top left to right, 1) https://www.thephotoargus.com/gorgeous-pictures-of-the-northern-lights/ ;2) https://www.youtube.com/watch?v=dL-GnWfJTh0 (note this photo was taken in Ireland); 3) https://www.youtube.com/watch?v=QH8u8Vf1uI4; 4) https://fineartamerica.com/featured/aurora-pillars-james-anderson.html

While an aurora in the Hereford area is rare, there is evidence that this was a period of heightened solar and geomagnetic activity. Kevin Yau's analysis of historical astrological events

[84] Correspondence on aurorae with Brian Tanner, Emeritus Professor of Physics Durham University.

shows that there was high geomagnetic activity in this period, creating the possibility for multiple and frequent auroral events.[85] While Yau's research largely focused on Asian chronicles and other records, he compared his results with European records and found similar results. Yau's comparison with Asian and European data is shown here with the dotted lines indicating European auroral reports:



European vs Asian aurora reports, according to Yau[86]

These data indicate that the 1130s saw heightened auroral activity. John's description of the 1130 event as seen in Hereford, therefore, may indeed have been an auroral event.

Another auroral description was more briefly included in John's *Chronicle* for the year 1138. Here John states:

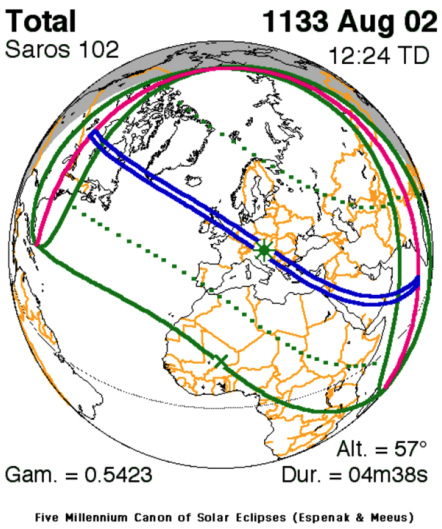
[85] Kevin Kam Ching Yau, 'An Investigation of Some Contemporary Problems in Astronomy and Astrophysics by Way of Early Astronomical Records' (PhD Thesis, Durham University, 1988); of note is that the October 2021 solar activity was followed by aurora citings around the world. An example is provided here: 'Astonishing aurora awed skywatchers Wednesday night', *Washingtonpost.com* (The Washington Post, November 4, 2021), https://www.washingtonpost.com/weather/2021/11/04/aurora-northern-lights-november2021-photos/ (accessed 11/04/2022).
[86] Yau, 'Early Astronomical Records': p. 165.

> On the seventh day of October, on the twenty-ninth moon, at dusk, on the sixth night of the week, the whole firmament to the north appeared red, and many rays of various colours were seen, blending and disappearing.[87]

Again, John's description is in keeping with a true auroral event. In an aurora, energy particles emitted by the sun (as in a sunspot event) get channelled by the earth's magnetic field into regions around the poles. 'There, they interact with oxygen and nitrogen particles in the upper atmosphere, releasing photons to create swaths of light that snake across the sky'.[88] The colour of the event is determined by its height and relative oxygen level. The yellow-green colour noted by John in the 1129 event is consistent with a lower altitude event; the red colour described in the 1138 event is consistent with a higher altitude aurora. That the first was seen in Hereford and the second in Wark, southeast of Edinburgh, is therefore also consistent.

Again, it will be useful to return with a different purpose to the entry of 1133, in which John described a total eclipse of the sun. The path of this eclipse took it across England and down through Germany into Greece.[89] The path of this major eclipse is pictured below in a graphic from the NASA website:

[87] John, *Chronicle*, III, s.a. 1138: pp. 256–257: 'Septimo die mensis Octobris, luna existente .xxviiii, in crepusculo noctis sexte sabbati, uersus aquilonales partes uisum est firmamentum totum rubicundum. Radii etiam diuersi coloris uisi sunt, mixtim apparentes et euanescentes'.
[88] Lina Tran, 'NASA's THEMIS Sees Auroras Move to the Rhythm of Earth's Magnetic Field' (NASA, 2016), https://www.nasa.gov/feature/goddard/2016/nasa-s-themis-sees-auroras-move-to-the-rhythm-of-earth-s-magnetic-field (accessed 11/04/2022).
[89] Norma Reis, 'Famous Eclipses of the Middle Ages – Part Two', Astronomy Today, http://www.astronomytoday.com/eclipses/middleages-part2.html (accessed 22/01/2021).



The path of the 1133 solar eclipse, according to NASA[90]

As will be recalled, the August 2nd, 1133 solar eclipse had been described by other historians and chroniclers. William of Malmesbury used poetic flourish – 'the sun covered his bright head with gloomy rust as the poets are accustomed to say, frightening peoples' minds by his eclipse'.[91] Again, the Anglo-Saxon Chronicle gave it a prophetic turn, 'In this year King Henry went over sea at Lammas, and the second day as he lay and slept on the ship the day darkened over all lands; and the Sun became as it were a three-night-old Moon, and the stars about it at mid-day. Men were greatly wonder-stricken and were affrighted, and said that a great thing should come thereafter. So it did, for the same year the king died on the following day after St. Andrew's Mass-day, Dec 2 in Normandy'. While John may not have been an eyewitness, he described it in detail. Here, it is useful to consider the entire passage:

> In the thirty-third year of the reign of Henry, king of England, on Wednesday, the same day in the course of the year on which his brother and predecessor, king William Rufus,

[90] Fred Espenak, 'Solar Eclipses of Historical Interest', NASA, September 28, 2009; https://eclipse.gsfc.nasa.gov/SEhistory/SEhistory.html#1133 (accessed 11/04/2022); https://moonblink.info/Eclipse/eclipse/1133_08_02 (accessed 11/04/2022).
[91] William, *Historia*, I.10: 'Nam et sol ipsa die hora sexta tetra ferrugine, ut poetae solent dicere, nitidum caput obtextit, mentes hominum eclipsi sua concutiens'.

> was slain, and on which king Henry himself assumed the government at the commencement of his reign, it is stated that the following appearance occurred. While the king, having gone to the coast for the purpose of crossing the sea, delayed his departure, although the wind was often fair for the voyage, at last, on the day mentioned, he went down to the shore about noon to take his passage, surrounded by his guards, as is the custom of kings. Then suddenly a cloud was seen in the air, which was visible throughout England, though not of the same size; for in some places the day only appeared gloomy, while in others the darkness was such that men required the light of candles for whatever they had to do. The king and his attendants, and many others, walked about in great wonder; and, raising their eyes to the heavens, observed that the sun had the appearance of shining like a new moon. But it did not long preserve the same shape; for sometimes it was broader, sometimes narrower, sometimes more curved, sometimes more upright, now steady as usual, and then moving, and quivering and liquid like quicksilver. Some say that the sun was eclipsed. If this be true, the sun was then in the head of the dragon, and the moon in its tail, or the sun in the tail, and the moon in the head, in the fifth sign, and the seventeenth degree of that sign. The moon was then in her twenty-seventh day. On the same day, and at the same hour, many stars appeared.

An actual solar eclipse is accompanied by several of the visual components John describes. John described the partially eclipsed sun as resembling a new moon [*solen ad instar noue lune lucere*]. He also noted that the effect differed depending on where the observer was, 'in some places [it] only appeared gloomy, while in others the darkness was such that men required the light of candles'. This is reminiscent of Walcher's description of the variation he observed between Italy and England. John also described the varying and 'quicksilver' description of the eclipsed sun. This effect rings true and is known to modern science as Bailey's Beads. Of note again is that John seemed overall more concerned with the physical and scientific description than he was of its portentous effect.

This passage in John's *Chronicle* is followed immediately by the description of the two moons with which this chapter section began [5.8], reprinted here for ease of reference:

> *Some say that on the Monday of the following week, that is on 8 August, when the moon was three days old, she appeared as she normally does at that age, and then, a little later in the same evening she appeared full like a round and very brilliant shield. Many also say that on the same night two moons were also seen, about a spear's length apart.*

This illusion of the two moons appeared shortly after an earthquake off the coast of York, which had shaken ships in their moorings to an alarming extent. Several days later, the three-day-old moon appeared first as a luminous shield and then as two moons. It is possible that the

earthquake had the effect of causing uneven atmospheric humidity, producing an optical illusion such as that which John described. Atmospheric changes before and after earthquakes have been recently documented. [92] An easy experiment can diagram how this illusion could have occurred. A glass filled with water held before the image of the moon shows the refracted image of either a full moon or two moons, depending upon the angle presented. This experiment is illustrated below:

[92] Laurie Schmidt, 'Squeezing Water from Rock', NASA, https://earthobservatory.nasa.gov/features/Earthquake (accessed 18/08/2021); see also Bernard Pinty et al., 'Observing Earthquake-Related Dewatering using MISR/Terra Satellite Data', *EOS, Transactions American Geophysical Union* 84, no. 5 (2003): pp. 37–48; M.P. Tuttle, J. Hengesh, K.B. Tucker, W. Lettis, S.L. Deaton, and J.D. Frost, 'Observations and Comparisons of Liquefaction Features and Related Effects Induced by the Bhuj Earthquake', *Earthquake Spectra* 18 (2002): pp. 79–100; Irfran Mahmood, et al., 'Investigation of Atmospheric Anomalies Associated with Kashmir and Awaran Earthquakes', *Journal of Atmospheric and Solar-Terrestrial Physics* 154 (2017): pp. 75–85.

A photo of a three-day-old moon; a glass of water held in front of the image, creating the effect of a full moon; a glass of water moved slightly to create the effect of two moons at a 'spears' length from each other.[93]

John's description once again focuses on exact observational details that can be explained by what we now know about atmospheric optics and that can be reproduced.

To circle back to the beginning of this chapter, John's sunspot diagram and description can be reconsidered in light of the discussion above. In the late 1130s, John erased what he had written before about 1128 to account for his new learning. John began this new description by marking the exact date, as only he could: 'In the third year of Lothar, emperor of the Romans, the twenty-eighth year of King Henry of the English, the second year of the 470th Olympiad, eleventh indiction, twenty fifth moon, on Saturday, 8 December', then John proceeded to describe an astronomical event that has made him renowned in the world of astronomy even to today, repeated from above,

> There appeared from the morning right up to the evening two black spheres against the sun. The first was in the upper part and large, the second lower and small and each was directly opposite the others as the diagram shows.

As noted, this was an actual astronomical event. In this instance, John not only describes the sunspot event, but also draws it. It is thought by Patrick McGurk that he may have drawn this particular diagram himself.[94]

As indicated at the beginning of this chapter, the late-1128 to early-1129 sunspot event continues to be of interest to the astronomical scientific community. As described by D.M. Willis and F.R. Stephenson, this eruption event was of the size that it had wide-ranging atmospheric implications, and it was visible during at least three solar cycles. The December 13th entry of *Korya-sa*, a Korean chronicle of the time, described an aurora, which is considered to be an aftereffect of the sunspot eruptions. Also, in the next two solar cycles, reports of sunspots were

[93] Experiment described in personal correspondence with Brain Tanner.
[94] Patrick McGurk, 'Illustrations in the *Chronicle* of John of Worcester', *Source Notes in the History of Art* 33, no. 3/4 (2014): pp. 28–33; Michael Camille, 'Seeing and Reading: Some Visual Implications of Medieval Literacy and Illiteracy', *Art History* 8, no. 1 (1985): pp. 26–49 at p. 27.

recorded by several Chinese chronicles.[95] Willis and Stephenson indicate that John's description of the sunspot and his drawing are in keeping with a large sunspot event and with how it would present itself. 'The angular diameters of the two sunspots are at least about 3 arcmin and 2 arcmin [a unit of angular measurement equal to 1/60 of one degree] in the northern and southern hemispheres [of the sun], respectively. Similarly, the heliographic latitudes of both sunspots are within the approximate range of 25-35 degrees'.[96] At least six different aurora events were recorded across the world in the immediate period before and after John's sighting. This is in keeping with modern understanding of the geomagnetic storms associated with an event of this magnitude. John of Worcester is, in all probability, unique in having attempted to draw it. It is shown again below for reference:

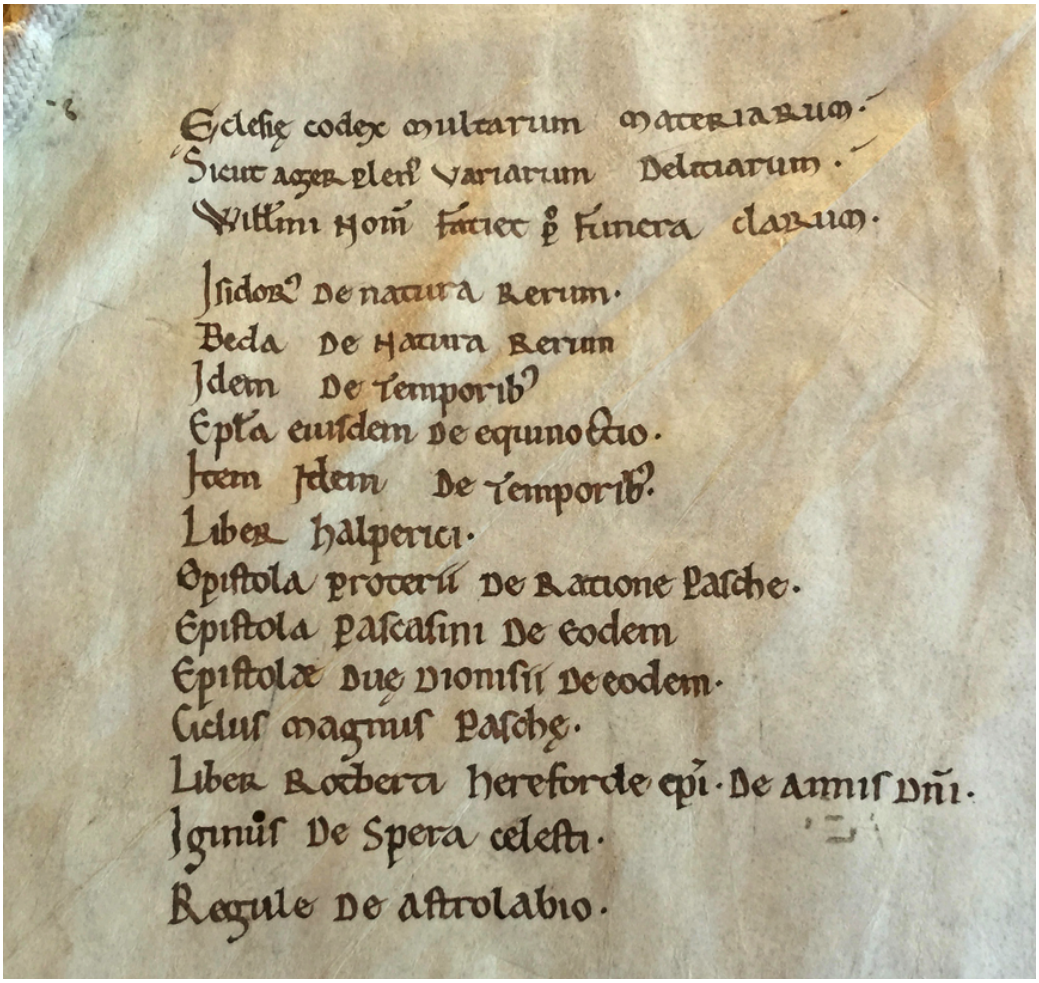
Oxford, Corpus Christi 157, p. 380 Digital Bodleian, https://digital.bodleian.ox.ac.uk/objects/93b83416-7972-40d7-9789-18f54e17ae25/

[95] Willis and Stephenson, 'Solar and Auroral Evidence': p. 289.
[96] Willis and Stephenson, 'Solar and Auroral Evidence': p. 289.

When taken as a whole, the evolution of John of Worcester's awareness of astronomical and meteorological events from the late 1120s to the late 1130s is stunning. It coincides with other progress he had made as a reporter of his world. As noted above, his descriptions of the dreams of Henry I and other historical details of the period have made him a key resource for the period. His two manuscripts, Auct. F.1.9 and CC 157, reveal him to have been on the cultural forefront in other important ways. As Lawrence-Mathers and Judith Collard have pointed out, his autograph document CC 157 may be considered a rare form of illustrated history in this period.[97] The sunspot drawing is as important an artefact to art historians as it is to historians of science and, as with Stephenson, those charting historical astronomical events. John's documents portray a personal engagement with the new knowledge and, together with his relationship with Walcher of Great Malvern, illustrate the dynamics of reception in this period in ways that would be difficult to match.

[97] Lawrence-Mathers, '*John of Worcester*'; Judith Collard, 'Henry I's Dream in John of Worcester's *Chronicle* (Oxford: Corpus Christi College, MS 157) and the Illustration of the Twelfth-Century English Chronicles', *Journal of Medieval History* 36 (2010): pp. 105–125.

CONCLUDING REFLECTIONS



'This book of many varied materials, is like a field full of various delights, and will bring renown to William's name after his death'.

William of Malmesbury, BL, Auct. F.3.14[1]

In the concluding reflections, it is not unfitting to return to William of Malmesbury's statement that his personal collection of computistical and astronomical texts would bring him

[1] Auct. F.3.14 (Oxford: Bodleian Library) title page and full table of contents in William's hand.

fame. He was proud, evidently, of his knowledge of these topics. His interest did not end with this collection. His works, including the *Gesta regum Anglorum*, the *Gesta pontificum Anglorum,* and the *Abbreviatio amalarii*, all reveal a profound interest in and knowledge of the new sciences.

This thesis has sought to explore whether there was an interest in or appetite for the new sciences in the Severn Valley region in the early twelfth century and how that interest expressed itself in the careers and works of three scholars: William of Malmesbury, Walcher of Great Malvern, and John of Worcester. The evidence presented here demonstrates that these three scholars had already developed an appetite for the sciences by the early twelfth century, that these scholars welcomed or actively sought out the new sciences as these texts arrived in England in this period, and that their own work was impacted by the new knowledge.

An approach with a focus on regional reception is one that has not been undertaken previously. The approach taken to illustrate and analyse the reception and reactions of the three scholars hinged on developing a 'before and after picture' of their life and works, most clearly illustrated in the examples of John of Worcester and Walcher of Great Malvern. It also sought to review the context of their varying reactions to the new sciences within an interdisciplinary framework. The central evidence presented has been the specific manuscripts owned by these scholars and the evidence of their own writing. The evidence of the relationship of related texts and references has also been presented, some with new and intriguing implications. Also, testing the argument that this region had developed into one of a 'culture of inquiry', it has explored the evolving intellectual heritage of the region, as well as the increased political and economic importance of the area. It explored the interactions between those elements, most primarily within the context of patronage, by proposing that the presence of the royal court was a draw for the translators, Petrus Alfonsi and Adelard of Bath. The cultural vitality of the area in the early twelfth century and the presence of these translators facilitated the availability of critical texts, documents, and awareness for William of Malmesbury, Walcher of Great Malvern, and John of Worcester.

To build the framework for discussion of the individual case studies, relevant history, intellectual themes, and trends were established. This background included a topographical review of the area and its growing economic and political importance, as well as a discussion of the perceived imperative to contain the Welsh border, which brought royalty to the area with regularity. These opportunities and pressures may have motivated the establishment of key political appointments, including that of Robert and Miles of Gloucester, and important ecclesiastical appointments, including Robert of Losinga, Walcher of Great Malvern, as well as Faricius of Abingdon and John of Villula, Bishop of Wells and Bath (and patron of Adelard). This background also included discussion of textual transmission in England in this period, and the comparative strength of the Severn Valley ecclesiastical and monastic libraries. While these libraries were important during both the Anglo-Saxon and early Norman period, it must be concluded that the survival of relevant documents for the three scholars in question is the most critical factor in being able to conduct this study. Finally, this background also included a discussion of the influence of Gerbert of Aurillac, a mathematical and astronomical scholar of profound influence on the Severn Valley scholars under discussion, and whose impact was amplified with the appointment of Robert of Losinga. In turn, Robert brought to the Severn area the complex but important discussion of the era controversy, of interest to all three of the scholars, William of Malmesbury, Walcher of Great Malvern, and John of Worcester.

The examination of the reception of the new sciences by the three scholars in the case studies reveal that all had an already developed interest in the related science of computistical studies prior to the arrival of new or more advanced texts. This thesis argues that the intellectual 'pump' was already primed for the new knowledge. The evidence presented reveals varying reactions to the new material by the three scholars. The range of reaction and usage is instructive and evocative of the range or diversity of reactions to the new sciences to be witnessed decades and indeed centuries after this period. It will be useful to review what has been gleaned from these authors own works and from an analysis of the texts to which they were exposed or actively collected. It will also be useful to highlight what has been offered up as a new approach and new insights presented in this thesis to the question of the reception of the new sciences.

William of Malmesbury, as we have seen, was proud of his computistical document, Oxford, BL, Auct. F.3.14. He was active in collecting it, and his computistical knowledge and enthusiasm has been pointed out by several scholars, most recently, Anne Lawrence-Mathers, who argued William understood and had been open to the new dating structure of the Christian Era represented by Marianus and Robert of Losinga, though William was reluctant to pursue or endorse that line of thinking for fear, perhaps, of disapproval.[2]

This thesis has gone further than previous studies in analysing other scientific areas that held the interest of William of Malmesbury, beyond his computistical interests. William's well-developed familiarity with the astronomical sciences is demonstrated through a detailed analysis of the last folios of his Auct. F.3.14 document (fols. 153r and beyond), a comparison of these sections to advanced texts in circulation in the second quarter of the twelfth century, and the evidence of his own writings. The evidence presented here reveals a wide net for William's knowledge base. A text within Auct. F.3.14 has been heretofore misidentified until this thesis, or misidentified as his own work. This little-known document has only one exemplar prior to William's document and that is a tenth century Monte Cassino text (Chapter II,[2.6]). An analysis of fols. 153r to 157 show connections to other advanced continental manuscripts including Avranches 235 from Mont St Michel, CLM 560 from Germany, British Library, Additional 17808, possibly from Fleury, as well as Cambridge, Corpus Christi 283, later housed at Canterbury, but portions of which were copied in a western hand (i.e., it may be that this document originated in the Severn Valley vicinity and its contents were available to William). The manuscript comparisons done in this thesis suggest, though cannot definitively prove, that William may have been exposed to such authors as Julius Firmicus Maternus, as well as the author of the elusive Jewish text the *Ut testatur Ergaphalau,* and, possibly, the prognosticative texts of Adelard of Bath (Chapter II [2.8], Chapter V [5.6]). While the connections of William's document and writing have been used as examples to support the transmission of texts, no other analysis has so fully pursued this from William's perspective, the perspective of audience.

[2] Lawrence-Mathers, 'William of Malmesbury'.

While it is likely that William was exposed to a wider array of scientific texts than otherwise thought, William's opinions on the topic of science were mixed. Using the evidence, most particularly that of his discussions of Gerbert, this thesis has argued that William admired but was cautious of the science of the stars. His admiration for their prognosticative powers as expressed in Robert of Losinga's abilities was tempered by the cautionary tale of Gerbert, who had clearly moved into the dark arts. His narrative indicates that William viewed intention to have been the most salient point in whether astronomy was used for good or ill. William's caution on the uses of prognostication may explain, to some extent, his apparent loss of interest in these topics as his scholarly career advanced.

If William had at one time been impressed by the prognosticative uses of astronomy, the evidence presented in this thesis suggests that Walcher of Malvern was not. While Walcher states that astronomy may be used for medical prognosis, the placement of that statement, and that it is not mentioned again in either of his works, suggests a different motive for the statement. In the salient section of *De lunationibus*, Walcher made a point of distancing himself from any ecclesiastical implications of his work.[3] He then suggested immediately that there may be other reasons to study the moon rather than to calculate Easter – that it may be important to study the moon phases for medical purposes. This would be entirely consistent with intellectual sensibilities of the time, but that Walcher does not mention medical usage again in his works implies that he is, instead, looking for a way to deflect attention from the hazardous terrain of ecclesiastical non-conformity and to understate his real motives. Those, it can also be derived from the evidence presented, were the pure scientific interests he had in lunar eclipses and the measurement and prediction of lunar and solar rotation. In Walcher's dedication to observational astronomy, as suggested in Chapter IV, Walcher exceeds his teacher, Petrus Alfonsi. The work of Walcher of Great Malvern presents one of the first examples of the shift from theoretical and mathematical astronomy to practical and observational astronomy.

The evidence presented from the work of John of Worcester also reveals a shift in scientific sensibilities, and a shift from the theoretical to the actionable. While John's newly

[3] See Chapter II, [2.2]

expressed sensibilities do not reflect the scientific discipline of Walcher's, they are perhaps the most revealing and innovative portions of these case studies. As described, after exposure to the new sciences John's interests and stance shift quickly from standard computistical studies to those which reflect the new terminology he has gleaned from both the texts of Walcher of Great Malvern and those of Adelard of Bath. This thesis has also demonstrated an alternative and novel narrative to explain how John may have acquired some of the texts he collected in his famous document Oxford, BL, Auct. F.1.9. Here it is proposed that John may have been exposed to the texts or knowledge of Adelard when he met Grimbald, Henry I's physician. The illustration of Grimbald in John's signature manuscript, Oxford, Corpus Christi 157, suggests an association with Grimbald and astronomical expertise, comparing him to Nebuchadnezzar's astronomical advisors. Grimbald's connections to the Royal court and Henry I's army of intellectuals may have boosted John's pursuits of things astronomical.

The detailed and comprehensive study presented by this thesis on the atmospheric observations made by John has not previously been undertaken. After John's exposure to the work of Walcher, Petrus, and Adelard, John's language regarding dating changes. The incorporation of Arabic terminology regarding calendric measurements within the framework of computistical inclinations was first commented on in 1983, and has received attention since that period.[4] However, John's accurate astronomical observations (often reported to him by others) have merited attention. In this thesis, these observations have been tested for accuracy and reviewed within the context of current scientific knowledge. John's observations have proved to be consistent with what is known of the solar activity in this period: visible sunspots, increased auroral activity, earthquakes, and distortions in visibility of lunar events. That John's observations can be mapped in detail to known scientific phenomenon is a testament to his skill as an observer and reporter of events. John's first observable shift from advanced computistical calendric notations to similar notations using new terminology and measurements can be framed within the context of what he already knows and how he chooses to describe his world. The move to atmospheric descriptions using precise detail are reminiscent of Walcher's lunar descriptions. The evidence presented in this thesis reveals a remarkable change in how John used his scientific knowledge. He was, like Walcher, relatively unconcerned with prognostication.

[4] Bader, 'The Relation of Computistical to Historical Study'.

John's narrative presents us with one of the first examples of a shift in the apparent use of astronomical knowledge. Specifically, astronomical calculations have moved away from the practical utility of determining the date of Easter, and in fact have moved beyond the use of more advanced mathematical astronomical calculations in the service of prognostication. For Walcher and John, astronomy had taken on an interest of its own.

The preceding discussion has focused on the complexity of the intellectual relationships in the twelfth century and the variety of circumstances, including happenstance, that can impact change. Its primary focus has been on the case studies of William of Malmesbury, Walcher of Great Malvern, and John of Worcester, as a means to explore the reception and use of the new sciences at the first point of their arrival in England in the early part of the twelfth century. These scholars were the heirs to intellectual, economic, and political traditions within the region that made the reception of these works not only possible but perhaps more likely. The Severn Basin bracketed an area with a rich heritage from the Anglo-Saxon era. This included the intellectual vigour of the area's Benedictine monasteries and the dynamics of ecclesiastical leadership under Wulfstan. This tradition was bolstered by propitious appointments within the church, including Robert of Losinga and Walcher of Great Malvern, who brought with them the new authority of the studies of the *quadrivium* of the cathedral schools on the continent. It was further bolstered by the unifying influence of Robert of Gloucester and royal interest and presence in the area. Indeed, patronage in the area occurred on overlapping levels, including monastic, ecclesiastical, and noble. In these concluding reflections, however, it will be important to distinguish between what can be illustrated and what can be explained.

As discussed in the Introduction, an exercise in causation in this period, especially one that implies exclusivity, is hazardous. Southern's attempt to explain the progress of Robert Grosseteste within the context of a provincial education in the Hereford area proved to be simultaneously groundbreaking and unworkable. It was groundbreaking in that it suggested that a relatively regional culture may have been as important to intellectual history as that of the major centres such as Paris and Chartres and in that he suggested its importance lay in the strength of its provincial traditions. However, the argument is unworkable, particularly in that its insistence that the unique intellectual characteristics of this area and continuity of intellectual

traditions at Hereford across the whole twelfth century, culminating in Grosseteste's experiences, is difficult to prove.

It is also difficult to demonstrate exclusivity in the early twelfth century, and the discussion above has attempted to steer away from both this and causation with respect to the Severn Valley region. All of that said, the Severn Valley nevertheless stands out as an area where the textual evidence at hand indicates that it was one of the first areas where the new scientific ideas and texts such as the al-Khwārizmī tables found a home and a positive and traceable reception. As suggested in the Introduction, the fact that this evidence exists in the personal reflections and texts of three scholars, William of Malmesbury, Walcher of Great Malvern, and John of Worcester, may be serendipitous, but this also may be an inadequate explanation. The personal scientific collections of two scholars from the region, William and John, show the contents of the new scientific texts reflected in their own work. To this can be added the record of Walcher of Great Malvern, reflected in his own text and copied most prolifically in areas in or connected to the Severn Valley area. The existence and survival of this evocative textual testimonial are what sets this area apart. While it is possible that this same set of circumstances occurred in other areas of England and that the historical record has been entirely lost, this is intrinsically unlikely. Durham, York, and Canterbury would be among the most obvious candidates in this respect, but in all cases, the documentary traditions are sufficiently strong that the fact that the new learning is not mentioned in the same way implies that this is because it had not met with the same level of audience reception and absorption.

Serendipity notwithstanding, the textual evidence for William, Walcher, and John does exist, and the cultural collage it projects is compelling. William writes with both enthusiasm and caution about the era controversy on the first wave of Alchandrean texts from Iberia and reflects on the use of the science of the stars for prognostication; Walcher's account of his encounter with Petrus Alfonsi shows him to have become arguably the first observational astronomer in England, and; while John has, at times, been seen as a somewhat naïve scholar, his astronomical document reveals a keen understanding and appreciation of the new sciences, and his later work shows he was deeply impacted by these studies. The depth of the record in the Severn Valley and

the collective observations of these scholars may indeed be unique to this period and have formed the basis of Chapters II–V.

As stated above, in the Introduction and Chapter I, it was important to develop the cultural prerequisites for what has been described here as an eager reception of the new sciences in the early twelfth century. First, the Severn Valley area already had a rich intellectual foundation that was inclusive of Anglo-Saxon, Irish, and even Jewish intellectual traditions. It was also a region that required the nearly constant presence and attention of those in power or their representatives (both lay and ecclesiastical). As such, it provided a profile of patronage that would have been attractive to the translators, such as Petrus Alfonsi and Adelard of Bath. The often elusive topic of patronage is important to stress. William, Walcher, and John were supported in their efforts by their monastic superiors to collect manuscripts and develop material. In all three cases, their scientific texts appear to have served as teaching aids to their own communities. Also, in their collection of texts, William, Walcher, and John can be seen as patrons themselves. As William indicates, the process was not without cost. Walcher was the only known student of Petrus Alfonsi, though it is unknown if Petrus received any compensation. Most particular note must be given, however, to the royal, noble, and ecclesiastical patrons who may have supported the lay translators, Petrus and Adelard. This is an area where a more focused future study presents itself. While this patronage is implied, there is no direct proof.

Evidence for the reception of the new sciences in the Severn Valley is clearest in the examples of Walcher of Great Malvern and John of Worcester and brings together the themes discussed above. These men were close neighbours; their communities were a day's journey from each other. On record, they were among the first audiences for the new sciences. They were also among the first students to engage with this material. They inhabited a region that had a long and active tradition in the *quadrivium*, promoted by Robert of Losinga and reflected in the work of Walcher of Great Malvern. This region was also one where there was a strong royal presence in response. Of particular interest in our period was the stabilising role of Robert of Gloucester. Petrus and Adelard may very well have been drawn to the area in search of patronage, both ecclesiastical and noble. Whatever the case, these were the circumstances and conceptual framework in which Walcher and John came to know of Petrus and Adelard and to support their

work. In many ways, Walcher and John's works reflect more observational scientific sensibility than that of their models. As mathematical astronomers, translators, and transmitters of the sciences from the East, Petrus and Adelard were the door that opened up the new scientific movement. Their students, Walcher of Great Malvern and John of Worcester, passed through that door, recording astronomical events in ways that reveal an interest in the atmospheric and astronomical events themselves. The new scientific learning had taken hold.

BIBLIOGRAPHY

Primary Sources:

Adelard, 'Ysagoge minor', in Charles Burnett, Keiji Yamamoto, and Michio Yano, eds. and trans., *The Abbreviation of the Introduction to Astrology Together with the Medieval Latin Translation of Adelard of Bath* (Leiden: Brill, 1994).

Adelard, 'Regule abaci', in B. Boncompagni, ed., 'Intorno ad uno scritto inedito di Adelardo di Bath intitolato 'Regule abaci'', *Bullettino di Bibliografia di Storia delle scienze Matematiche e Fisiche* IV (1881): pp. 1–134.

Adémar of Chabannes, *Historia Francorum*, in George Pertz, ed., *MGH SS* 4 (Hannover: MGH, 1841).

Arato de Soles, *Phaenomena,* in Douglas Kidd, ed. (Cambridge: Cambridge University Press, 1997).

Bede, 'Historia ecclesiastica gentis Anglorum', in Bertram Colgrave and R.A.B. Mynors, eds. and trans., *Bede's Ecclesiastical History of the English People* (Oxford: Clarendon Press, 1991).

Beno, 'Benonis aliorumque cardialium schismaticorum contra Gregorium VII et Urbanum II', in Kuno Francke, ed., MGH *Libelli de lite imperatorum et pontificum saeculis XI et XII conscripti* II (Hannover, 1892): pp. 366–422.

Bethmann, D.L., ed., 'Annales Blandinienses', in George Pertz, ed., *MGH SS* 5 (Hanover: MGH, 1844): pp. 20–34.

Borst, Arno, *Das mittelalterliche Zahlenkampfspiel* (Heidelberg: Winter, 1986).

Burnett, Charles and Jacquart, Danielle. eds., *Constantine the African and 'Alī Ibn al-'Abbās al-Maǧūsī: The* Pantegni *and Related Texts* (Leiden: Brill, 1994).

Burnett, Charles, Yamamoto, Keiji and Yano, Michio., eds. and trans., *The Abbreviation of the Introduction to Astrology Together with the Medieval Latin Translation of Adelard of Bath* (Leiden: Brill, 1994).

Burnett, Charles., ed. and trans., *Conversations with his Nephew: On the Same and the Different, Questions on Natural Science, and On Birds* (Cambridge: Cambridge University Press, 2006).

Busard, H.L.L. and Folkerts, Menso, eds., *Robert of Chester's (?) Redaction of Euclid's* Elements*, the So-Called Adelard II Version.* Vol. 1 (Basel: Birkhäuser, 1992).

Busard, H.L.L., ed., *The First Latin Translation of Euclid's* Elements *Commonly Ascribed to Adelard of Bath* (Toronto: Pontifical Institute of Medieval Studies, 1983).

Cassian, John, *De institutis coenobiorum*, in Jean Claude Guy, ed., II (Paris: Éditions du Cerf, 1965): pp. 1–4.

Darlington, Reginald R., ed., *The Vita Wulfstani of William of Malmesbury* (London: Offices of the Society, 1928).

Darlington, Reginald and McGurk, Patrick., eds., McGurk, Patrick and Bray, Jennifer., trans., *The Chronicle of John of Worcester: Vol. II: The Annals from 450–1066* (Oxford: Clarendon Press, 1995).

Faletra, Michael A., trans., *The History of the Kings of Britain* (Peterborough, Ontario; Broadview Editions, 2008).

Geoffrey of Monmouth, *Historia Regum Britanniae*, in Jacob Hammer, ed. (Cambridge, MA: Medieval Academy of America, 1951).
Gerald of Wales, *Opera*. Vol. 1. in John Sherren Brewer, ed. (London: Longman, Green, Longman, and Roberts, 1861).
Gesta Stephani, in K.R. Potter, ed. and trans., with introduction and notes by R.H.C. Davis (Oxford: Clarendon Press, 1976).
Giles, J.A., trans., *William of Malmesbury's Chronicle of the Kings of England: From the Earliest Period to the Reign of King Stephen* (1857; repr., London: George Bell and Sons, 1904).
Giles, J.A. ed., *Venerabilis Bedae Opera quae supersunt omnia, nunc primum in Anglia, ope codicum manuscriptorum, editionumque optimarum.* Vol. 6 (London: Whittaker, 1843).
Greer, John Michael, trans., *Astral High Magic: De Imaginibus of Thabit Ibn Qurra* (Lulu, 2011).
Gregory of Tours, *De cursu stellarum ratio*, in Bruno Krusch, ed., *MGH SS* Rer. Merov. I.2 (Hannover: MGH, 1885).
Hayward, Paul, ed. and trans., *The Winchcombe and Coventry Chronicles: Hitherto Unnoticed Witnesses to the Work of John of Worcester* (Tempe, AZ: Arizona Center for Medieval and Renaissance Studies, 2010).
Helmold, *Chronica Slavorum*, in George Pertz, ed., *MGH SS* 21 (Hannover: MGH, 1869).
Henry of Huntingdon, 'Historia Anglorum', in Diana Greenway, ed. and trans., *Historia Anglorum: History of the English People* (Oxford: Oxford University Press, 1996).
Historia Compostelana, in Emma Falque, ed. and trans. (Torrejón de Ardoz, Madrid: Akal, D.L., 1994).
Houlding, Deborah, trans., *Centiloquium of Hermes Trismegistus* (2006), http://www.skyscript.co.uk/centiloquium2.html (accessed 09/04/2022).
Hunt, William, ed., *Two Chartularies of the Priory of St Peter at Bath: I. The Chartulary in MS. No. cxi., in the Library of Corpus Christi College, Cambridge. II. Calendar of the MS. register in the Library of the Hon. Society of Lincoln's Inn* (London: Harrison and Sons, 1893).
Isidore of Seville, *De natura rerum*, in Jacques Fontaine, ed., *Traité de la Nature* (Bordeaux: Féret, 1960).
John of Hexham, *Historia XXV annorum*, in Thomas Arnold, ed., *Symeonis monachi opera* 2 (London: Longmans & Co., 1885).
Johnson, Charles and Cronne, H.A., eds., *Regesta Henrici Primi, 1100–1135.* Vol. 2. Regesta regum Anglo-Normannorum, 1066–1154 (Oxford: Clarendon Press, 1956).
Johnson, Charles, trans., *De necessariis observantiis scaccarii dialogus qui vulgo dicitur Dialogus de Scaccario, The Course of the Exchequer* (London: Nelson, 1950).
Jones, Charles W., ed., *Bedae Pseudepigrapha: Scientific Writings Falsely Attributed to Bede* (Ithaca, NY: Cornell University Press, 1939).
Kendall, Calvin B. and Wallis, Faith., eds. and trans., *Bede: On the Nature of Things and On Times* (Liverpool: Liverpool University Press, 2010).
Khwārizmī, Muhammad ibn Mūsā, *Le calcul indien (Algorismus): histoire des textes, édition critique, traduction et commentaire des plus anciennes versions latines remaniées du\ XIIe siècle*, in Andre Allard, ed. and trans., (A. Blanchard, 1992).
Lattin, Harriet Pratt, trans, *The Letters of Gerbert, with his Papal Privileges as Sylvester II*

(New York, NY: Columbia University Press, 1961).
Lohr, Alfred, ed., *Der Computus Gerlandi: Edition, Übersetzung und Erläuterungen* (Stuttgart: Steiner, 2013).
Maternus, Firmicus, 'Matheseos Libri VIII', in Jean Rhys Bram, trans., *Ancient Astrology: Theory and Practice: Matheseos Libri VIII* (Park Ridge, NJ: Noyes Press, 1975).
McGurk, Patrick, ed. and trans., *The Chronicle of John of Worcester: vol. III: The Annals from 1067 to 1140 with the Gloucester Interpolations and the Continuation to 1141* (Oxford: Clarendon Press, 1998).
Nothaft, C. Philipp, ed. and trans., *Walcher of Malvern, De lunationibus and De dracone: Study, Edition, Translation, and Commentary* (Turnhout: Brepols, 2017).
Orderic Vitalis, *The Ecclesiastical History of Orderic Vitalis*, in Marjorie Chibnall, ed. and trans. (Oxford: Clarendon Press, 1969, reprinted 2002).
Patterson, Robert., ed., *Earldom of Gloucester Charters: The Charters and Scribes of the Earls and Countesses of Gloucester to A.D. 1217* (Oxford: Clarendon Press, 1973).
Petrus Alfonsi, *Dialogue against the Jews*, in Irven Michael Resnick, trans. (Washington: Catholic University of America Press, 2006).
Pingree, D., ed., *Preceptum canonis Ptolomei* (Louvain-la-Neuve: Academia Bruylant, 1997).
Richer, *Historiae*, ed., Hartmut Hoffmann. *MGH SS* 38 (Hannover: MGH, 2000).
Richer, *Histoire de France 888–995 Vol II*, in Robert Latouche, ed. and trans., *Les Classiques de l'Histoire de France au Moyen Age.* Vol. 17 (Paris, 1937).
Robert of Torigni, 'Gesta Normannorum ducum', in Elisabeth M.C. van Houts, ed. and trans., *The Gesta Normannorum ducum of William of Jumieges, Orderic Vitalis and Robert of Torigni* (Oxford: Clarendon Press, 1992).
Scotus, Marianus, *Chronicon*, in George Waitz, ed., *MGH SS* 5 (Hannover: MGH, 1844): pp. 481–568.
Stevenson, Joseph, ed., *Chronicon Monasterii de Abingdon: From the Norman Conquest until the Accession of Richard the First*, Vol. 2 (London: Longman, 1858).
Stubbs, William, ed., *Willelmi Malmesbiriensis monachi De gestis regum Anglorum*, Vol. 1 (London: Her Majesty's Stationery Office, 1887).
Suter, Heinrich, ed., *Die astronomischen Tafeln des Muhammad ibn Mūsā al-Khwārizmī in der Bearbeitung des Maslama ibn Ahmed al-Madjrītī und der latein. Übersetzung des Athelard von Bath auf Grund der Vorarbeiten von A. Bjornbo und R. Besthorn herausgegeben und kommentiert* (D. Kgl. Danske Vidensk. Selskap, Skrifter 7. Raekke, Historisk og filosofisk Afd. III. 1., Copenhagen: 1914).
Symeon of Durham, 'Historia ecclesiae Dunelmensis', in Thomas Arnold, ed., *Symeonis Monachi Opera Omnia: Volume 1* (Cambridge: Cambridge University Press, 2012).
Thorn, Frank and Thorn, Caroline, eds., *Domesday Book 17: Herefordshire* (Chichester: Phillimore, 1983).
Tihon, Anne, ed., *Le 'Grand commentaire' de Théon d'Alexandrie aux tables faciles de Ptolomée* (Città del Vaticano: Biblioteca Apostolica Vaticana, 1985).
Wallis, Faith, trans., *Bede: The Reckoning of Time* (Liverpool: Liverpool University Press, 1999).
William of Malmesbury, *Gesta pontificum Anglorum*, in Michael Winterbottom, ed. and trans., (Oxford: Clarendon Press 2007).
William of Malmesbury, *Gesta Regum Anglorum*, in R.A.B. Mynors, ed. and trans., completed by R.M. Thomson and Michael Winterbottom (Oxford: Clarendon Press, 1998).

William of Malmesbury, *Historia Novella*, in Edmund King, ed., K.R. Potter, trans. (Oxford: Clarendon Press, 1998).
William of Malmesbury, *On Lamentations,* in Michael Winterbottom, trans. (Turnhout: Brepols, 2013).
William of Malmesbury, *Polyhistor: A Critical Edition*, in Helen Testroet Ouellette, ed. (Binghamton, NY: Center for Medieval & Early Renaissance Studies, 1982).
William of Malmesbury, *Willelmi Meldunensis monachi Liber super Explanationem Lamentationum Ieremi prophetae*, in Michael Winterbottom and Rodney Thomson, eds. (Turnhout: Brepols, 2011).
Winterbottom, Michael and Thomson, Rodney, eds. and trans., *William of Malmesbury: Saints' Lives* (Oxford: Clarendon Press, 2002).

Secondary Sources:

Aakhus, Patricia, 'Astral Magic and Adelard of Bath's *Liber prestigiorum*; or Why Werewolves Change at the Full Moon', *Culture and Cosmos* 16, nos. 1 and 2 (2012): pp. 151–161.
Abels, Richard, 'The Council of Whitby: A Study in Early Anglo-Saxon Politics', *Journal of British Studies* 23 (1983): pp. 1–25.
Abrams, Lesley and Carley, James, eds., *The Archaeology and History of Glastonbury Abbey: Essays in Honour of the Ninetieth Birthday of C.A. Ralegh Radford* (Woodbridge: Boydell Press, 1991).
Abulafia, Anna Sapir, 'Moyses in Service of Petrus in Petrus Alfonsi's *Dialogus*'. In *Petrus Alfonsi and his* Dialogus*: Background, Context, and Reception*, in Carmen Cardelle de Hartmann and Philipp Roelli, eds. (Firenze: SISMEL – Edizioni del Galluzzo, 2014): pp. 111–128.
Adamson, Peter, 'Vision, Light and Color in al-Kindi, Ptolemy and the Ancient Commentators', *Arabic Sciences and Philosophy* 16 (2006): pp. 207–236.
Adler, Michael, 'The Jews of Bristol in Pre-Expulsion Days', *Transactions (Jewish Historical Society of England)* 12 (1928–1931): pp. 117–186.
Adler, Michael, *Jews of Medieval England* (London: E. Goldston, 1939).
Aird, William, *Robert 'Curthose', Duke of Normandy (c. 1050–1134)* (Woodbridge: Boydell Press, 2008).
Allen, Martin, *Mints and Money in Medieval England* (Cambridge: Cambridge University Press, 2012).
Allen, Rosamund, ed., *Eastward Bound: Travel and Travellers 1050–1550* (Manchester: Manchester University Press, 2004).
Amphlett, Hilda, *Hats: A History of Fashion in Headwear* (Chalfont St. Giles: Sadler, 1974).
Applebaum, Shimon, 'Were There Jews in Roman Britain?', *Transactions (Jewish Historical Society of England)* 17 (1951–1952): pp. 189–205.
Bader, Katherine, 'The Relation of Computistical to Historical Study in the Severn Valley Renaissance of the Twelfth Century' (M.A. Thesis, University of North Carolina, Chapel Hill, 1985).

Baer, Yiṣḥāq Fritz, *A History of the Jews in Christian Spain.* in Louis Schoffman, trans., Second Edition, Vol. 2 (Philadelphia: Jewish Publ. Soc. of America, 1992).
Baker, Peter, 'Byrhtferth's 'Enchiridion' and the Computus in Oxford, St John's College 17', *Anglo-Saxon England* 10 (1982): pp. 123–142.
Bale, John, *Scriptorum illustrium Brytanniae quam nunc Angliam et Scotiam vocant catalogus* (Basel, 1557).
Banham, D., 'Medicine at Bury in the Time of Abbot Baldwin', in T. Licence, ed., *Bury St Edmunds and the Norman Conquest* (Woodbridge: Boydell Press, 2014), pp. 226–246.
Barlow, Frank, *The English Church, 1066–1154: A History of the Anglo-Norman Church* (London: Longman, 1979).
Barlow, Frank, *William Rufus* (New Haven: Yale University Press, 2000).
Barnes, Patricia and Slade, C.F., eds., *A Medieval Miscellany for Doris May Stenton* (London: Pipe Roll Society, 1962).
Barrow, Julia and Brooks, Nicholas, eds., *St Wulfstan and His World* (Aldershot: Ashgate, 2005).
Barrow, Julia, 'A Lotharingian in Hereford: Bishop Robert's Reorganisation of the Church of Hereford, 1079–1095', in David Whitehead, ed., *Medieval Art, Architecture and Archaeology at Hereford* (Leeds: British Archaeological Association, 1995): pp. 29–49.
Barrow, Julia, 'Way-Stations on English Episcopal Itineraries, 700–1300', *EHR* 127, no. 526 (2012): pp. 549–565.
Barrow, Julia, ed., *Hereford, 1079–1234*, English Episcopal Acta 7 (Oxford: Oxford University Press, 1993).
Basted, Paul, 'Le Millénaire de Gerbert', *Revue Politique Et Parlementaire* 45, no. 525 (1938).
Bečvář, Jindřich, 'Gerbert of Aurillac (Sylvester II)', *Matematika ve středověké Evropě* (Prague: Prometheus, 2001): pp. 185–229.
Beer, Rudolf, *Die Handschriften des Klosters Santa Maria De Ripoll* (Vienna, 1907).
Bernardi, Gabriella. 'Fátima of Madrid (Tenth Century)', in Gabriella Bernardi, ed., *The Unforgotten Sisters: Female Astronomers and Scientists before Caroline Herschel* (Cham: Springer International Publishing, 2016): pp. 45–48.
Bernardi, Gabriella, ed., *The Unforgotten Sisters: Female Astronomers and Scientists before Caroline Herschel* (Cham: Springer International Publishing, 2016).
Beumann, Jutta, *Sigebert von Gembloux und der Traktat de investiture episcoporum* (Sigmaringen: Thorbecke, 1976).
Bianchini, Carlo and Senatore, Luca, 'Gerbert of Aurillac (c. 940–1003)', in Michela Cigola, ed., *Distinguished Figures in Descriptive Geometry and Its Applications for Mechanism Science: From the Middle Ages to the 17th Century* (Cham: Springer, 2016): pp. 33–51.
Bisson, Thomas, *The Medieval Crown of Aragon: A Short History* (Oxford: Clarendon Press, 1986).
Blair, John and Ramsay, Nigel., eds., *English Medieval Industries* (London: Hambledon, 1991).
Bliemetzrieder, Franz, *Adelhard von Bath Blätter aus dem Leben eines englischen Naturphilosophen des 12. Jahrhunderts und Bahnbrechers einer Wiedererweckung der griechischen Antike; eine kulturgeschichtliche Studie* (Munich: Hueber, 1935).
Bober, Harry, 'An Illustrated Medieval School-Book of Bede's 'De Natura Rerum'', *The Journal of the Walters Art Gallery* 19/20 (1956): pp. 64–97.
Bogolyubov, A.N., 'Khwārizmī and Gerbert', in S. Sirazhdinov, ed., *Iz Istorii srednevekovoĭ vostochnoĭ Matematiki i Astronomii* (Tashkent: Izd-vo 'Fan' Uzbekskoĭ SSR, 1983): pp. 23–37.

Brann, Ross, 'The Moors?', in Ivy A. Corfis, ed., *Al-Andalus, Sepharad and Medieval Iberia: Cultural Contact and Diffusion* (Leiden: Brill, 2009): pp. 151–162. Reprinted from *Medieval Encounters* 15, no. 2–4 (2009): pp. 307–318.
Brett, Martin, 'John of Worcester and His Contemporaries', in R.H.C. Davis and J.M. Wallace-Hadrill, eds., *The Writing of History in the Middle Ages: Essays Presented to Richard William Southern* (Oxford: Oxford University Press, 1981): pp. 101–126.
Broadhurst, R.J.C. and Irwin, Robert, eds., *The Travels of Ibn Jubayr: A Medieval Journey from Cordoba to Jerusalem* (London: I.B. Tauris, 2019).
Brooks, Nicholas and Cubitt, Catherine, eds., *St. Oswald of Worcester: Life and Influence* (London; New York: Leicester University Press, 1996).
Bryan, Elizabeth, 'Astronomy Translated: *Caput Draconis* and the Pendragon Star in Geoffrey of Monmouth, Wace, and Laȝamon', *Arthuriana* 26, no. 1 (2016): pp. 141–163.
Bubnov, Nicolaus, ed., *Opera mathematica (972–1003): Accedunt aliorum opera ad Gerberti libellos aestimandos intelligendosque necessaria per septem appendices distributa* (Berolini: R. Friedländer and Sohn, 1899; reprinted Hildesheim: Georg Olms Verlagsbuchhandlung, 1963).
Bugyis, Katie Ann-Marie, Kraebel, A.B., and Fassler, Margot E., eds., *Medieval Cantors and Their Craft: Music, Liturgy and the Shaping of History, 800–1500* (Woodbridge, Suffolk: York Medieval Press, 2017).
Burnaby, Sherrard, *Elements of the Jewish and Muhammadan Calendars with Rules and Tables and Explanatory Notes on the Julian and Gregorian Calendars* (London: G. Bell & Sons, 1901).
Burnett, Charles, 'The Abacus at Echternach in ca. 1000 A.D.', *Sciamus* 3 (2002): pp. 91–108.
Burnett, Charles, ed., *Adelard of Bath: An English Scientist and Arabist of the Early Twelfth Century* (London: Warburg Institute, 1987).
Burnett, Charles, 'Adelard of Bath and the Arabs', in J. Hamesse and M. Fattori, eds., *Rencontres de cultures dans la philosophie médiévale*, (Louvain-la-Neuve and Cassino, 1990): pp. 89–107.
Burnett, Charles, 'Adelard, Ergaphalau and the Science of the Stars', in Charles Burnett, ed., *Magic and Divination in the Middle Ages: Texts and Techniques in the Islamic and Christian Worlds* (Aldershot: Variorum, 1996): pp. 133–145.
Burnett, Charles, '*Algorismi vel helcep decentior est diligentia*: The Arithmetic of Adelard of Bath and his Circle', in Charles Burnett, ed., *Numerals and Arithmetic in the Middle Ages* (Farnham: Ashgate Variorum, 2011).
Burnett, Charles, *Arabic into Latin in the Middle Ages: The Translators and Their Intellectual and Social Context* (Aldershot: Ashgate, 2009).
Burnett, Charles, 'Avranches, B.M. 235 et Oxford, Corpus Christi College 283', in L. Callebat and O. Desbordes, eds., *Science antique, science médiévale (Autour d'Avranches 235), Actes du colloque international (Mont-Saint-Michel, 4–7 Septembre 1998)* (Hildesheim; Zürich; New York: Olms-Weidmann, 2000): pp. 63–70.
Burnett, Charles, *The Introduction of Arabic Learning into England* (London: British Library, 1996).
Burnett, Charles, 'The Introduction of Scientific Texts into Britain, c. 1100–1250', in Nigel J. Morgan and Rodney M. Thomson, eds., *The Cambridge History of the Book in Britain* (Cambridge: Cambridge University Press, 2008): pp. 446–453.
Burnett, Charles, 'The Instruments That Are the Proper Delights of the Quadrivium:

Rhythmomachy and Chess in the Teaching of Arithmetic in Twelfth Century England', *Viator,* 28 (1997): pp. 175–202.
Burnett, Charles, 'King Ptolemy and Alchandreus the Philosopher: The Earliest Texts on the Astrolabe and Arabic Astrology at Fleury, Micy and Chartres', *Annals of Science* 55, no. 4 (1998): pp. 329–368.
Burnett, Charles, ed., *Magic and Divination in the Middle Ages: Texts and Techniques in the Islamic and Christian Worlds* (Aldershot: Variorum, 1996).
Burnett, Charles, 'Mathematics and Astronomy in Hereford and its Region in the Twelfth Century', in David Whitehead, ed., *Medieval Art, Architecture and Archaeology at Hereford* (Leeds: British Archaeological Association, 1995).
Burnett, Charles, 'Music and the Stars in Cashel, Bolton Library, MS 1', in Mary Kelly and Charles Doherty, eds., *Music and the Stars: Mathematics in Medieval Ireland* (Dublin: Four Courts Press, 2013): pp. 142–158.
Burnett, Charles, ed., *Numerals and Arithmetic in the Middle Ages* (Farnham: Ashgate Variorum, 2011).
Burnett, Charles, 'Ocreatus', in Menso Folkerts and Jan P. Hogendijk, eds., *Vestigia Mathematica: Studies in Medieval and Early Modern Mathematics in Honour of H.L.L. Busard* (Amsterdam: Rodopi, 1993): pp. 69–77.
Burnett, Charles, 'Petrus Alfonsi and Adelard of Bath Revisited', in Carmen Cardelle de Hartmann and Philipp Roelli, eds., *Petrus Alfonsi and his* Dialogus*: Background, Context, and Reception* (Firenze: SISMEL – Edizioni del Galluzzo, 2014): pp. 77–92.
Burnett, Charles, 'Talismans: Magic as Science? Necromancy Among the Seven Liberal Arts', in Charles Burnett, ed., *Magic and Divination in the Middle Ages: Texts and Techniques in the Islamic and Christian Worlds* (Aldershot: Variorum, 1996): pp. 1–15.
Burnett, Charles, 'The Works of Petrus Alfonsi: Questions of Authenticity', *Medium Aevum* 66 (1997): pp. 42–79.
Burnett, Charles, 'The Writings of Adelard of Bath and Closely Associated Works, Together with the Manuscripts in Which They Occur', in Charles Burnett, ed., *Adelard of Bath: An English Scientist and Arabist of the Early Twelfth Century* (London: Warburg Institute, 1987): pp. 163–196.
Butler, Katherine and Bassler, Samantha, eds., *Music, Myth and Story in Medieval and Early Modern Culture* (Woodbridge: Boydell Press, 2019).
Caiazzo, Irene, 'Sur l'astrolabe et le comput au XIIe siècle: Nouveaux textes inédits', *Sudhoffs Archiv* 96, no. 1 (2012): pp. 28–38.
Callebat, Louis and Desbordes, Olivier, eds., *Science antique, science médiévale: autour d'Avranches 235: actes du colloque international, Mont-Saint-Michel, 4–7 septembre 1998* (Hildesheim; Zürich; New York: Olms-Weidmann, 2000).
Camille, Michael, 'Seeing and Reading: Some Visual Implications of Medieval Literacy and Illiteracy', *Art History* 8, no. 1 (1985): pp. 26–49.
Caputo, Nina and Hart, Mitchell, eds., *On the Word of a Jew: Religion, Reliability, and the Dynamics of Trust* (Bloomington: Indiana University Press, 2019).
Caputo, Nina, 'The Voice of a Jew? Petrus Alfonsi's *Dialogi Contra Iudaeos* and the Question of True Conversion', in Nina Caputo and Mitchell Hart, eds., *On the Word of a Jew: Religion, Reliability, and the Dynamics of Trust* (Bloomington: Indiana University Press, 2019): pp. 181–200.
Carbonne, Philippe, Cassinet, Jean, and Beaujouan, Guy, eds., *Huit siècles de mathématiques en*

Occitanie: de Gerbert et des Arabes à Fermat : actes du Colloque international tenu du 10 au 13 décembre 1992 à Toulouse et à Beaumont de Lomagne (Cressé: Éd. des Régionalismes, 2014).
Carlé, María del Carmen, Grassotti, Hilda, and Orduna, Germán, eds., *Estudios en homenaje a Don Claudio Sánchez Albornoz en sus 90 años*, Vol. 2 (Buenos Aires: Universidad, Instituto de Historia de España, 1983).
Carmody, Francis, 'Notes on the Astronomical Works of Thabit b. Qurra', *Isis* 46 (1955): pp. 235–242.
Carmody, Francis, *Arabic Astronomical and Astrological Sciences in Latin Translation: A Critical Bibliography* (Berkeley and Los Angeles: University of California Press, 1956).
Chabás, José and Goldstein, Bernard R, 'Ibn al-Kammād's 'Muqtabis' zij and the Astronomical Tradition of Indian Origins in the Iberian Peninsula', *Archive for History of Exact Sciences* 69, no. 6 (2015): pp. 577–650.
Chaloner, William and Richardson, Roger C, *British Economic and Social History: A Bibliographical Guide* (Manchester: Manchester University Press, 1976).
Chardonnens, László Sándor, *Anglo-Saxon Prognostics, 900–1100: Study and Texts* (Leiden: Brill, 2007).
Chazan, Mireille, *L'Empire et l'histoire universelle de Sigebert de Gembloux à Jean Saint-Victor* (Paris: Champion, 1999).
Chazan, Robert, *European Jewry and the First Crusade* (Berkeley: University of California Press, 1996).
Chazan, Robert, *In the Year 1096: The First Crusade and the Jews* (Dulles: Jewish Publication Society, 1997).
Cheney, Christopher R., *Handbook of Dates for Students of English History* (London: Offices of the Royal Historical Society, 1945).
Childs, Wendy R., *Anglo-Castilian Trade in the Later Middle Ages* (Manchester: Manchester University Press, 1978).
Childs, Wendy R., *Trade and Shipping in the Medieval West. Portugal, Castile and England* (Turnhout: Brepols, 2013).
Christelow, Stephanie Mooers, 'A Movable Feast? Itineration and the Centralization of Government under Henry I', *Albion: A Quarterly Journal Concerned with British Studies* 28, no. 2 (1996): pp. 187–228.
Cigola, Michela, ed., *Distinguished Figures in Descriptive Geometry and Its Applications for Mechanism Science: From the Middle Ages to the 17th Century* (Cham: Springer, 2016).
Clagett, Marshall, 'The Medieval Latin Translations from the Arabic of the Elements of Euclid, with Special Emphasis on the Versions of Adelard of Bath', *Isis* 44, no. 1/2 (1953): pp. 16–52.
Clarke, Peter and James, Sarah, eds., *Pastoral Care in Medieval England: Interdisciplinary Approaches* (Abingdon, Oxon.: Routledge, 2019).
Cochrane, Louise, *Adelard of Bath: The First English Scientist* (London: British Museum Press, 1994).
Collard, Judith, 'Henry I's Dream in John of Worcester's *Chronicle* (Oxford, Corpus Christi College, MS 157) and the Illustration of the Twelfth-Century English Chronicles', *Journal of Medieval History* 36 (2010): pp. 105–125.
Corboni, Stefano, *Venice and the Islamic World, 828–1797* (New Haven: Yale University Press, 2007).

Cordoliani, Alfred, 'L'activité computistique de Robert, évêque de Hereford', in Pierre Gallais and Yves-François Rion, eds., *Mélanges offerts à René Crozet à l'occasion de son 70e anniversaire par ses amis, ses collégues, ses élèves et les membres du C.E.S.C.M.* Vol. 1, (Société d'études médiévales, 1966): pp. 333–340.
Cordoliani, Alfred, 'Abbon de Fleury, Hériger de Lobbes et Gerland de Besançon sur l'ère de l'incarnation de Denys le Petit', *Revue d'histoire ecclésiastique* 44 (1949): pp. 462–487.
Corfis, Ivy A., ed., *Al-Andalus, Sepharad and Medieval Iberia: Cultural Contact and Diffusion* (Leiden: Brill, 2009).
Cousin, Patrice, *Abbon de Fleury-sur-Loire: Un savant, un pasteur, un martyr à la fin du Xe siècle* (Paris: P. Lethielleux, 1954).
Crossley, John, 'The Writings of Boethius and the Cogitations of Jacobus de Ispania on Musical Proportions', *Early Music History* 36 (2017): pp. 1–30.
D'Alverny, M.T., 'Pseudo-Aristotle, *De elementis*', in J. Kraye, W.F. Ryan, and C.B. Schmitt, eds., *Pseudo-Aristotle in the Middle Ages: the Theology and Other Texts* (London: Warburg Institute, 1986): pp. 63–84.
D'Angelo, Edoardo, Bates, David, and Houts, Elisabeth, eds., *People, Texts and Artefacts: Cultural Transmission in the Medieval Norman Worlds* (London: Institute of Historical Research, 2018).
D'Angelo, Edoardo, 'A Latin School in the Norman Principality of Antioch', in Edoardo D'Angelo, David Bates, and Elisabeth Houts, eds., *People, Texts and Artefacts: Cultural Transmission in the Medieval Norman Worlds* (London: Institute of Historical Research, 2018): pp. 78–88.
Dachowski, Elizabeth, *First among Abbots: The Career of Abbo of Fleury* (Washington, DC: Catholic University of America, 2008).
Darlington, Oscar G., 'Gerbert, 'obscuro Loco Natus'', *Speculum* 11, no. 4 (1936): pp. 509–520.
Darlington, Oscar G., 'Gerbert, the Teacher', *The American Historical Review* 52, no. 3 (1947): pp. 456–476.
Darlington, Reginald R., *Anglo-Norman Historians: an Inaugural Lecture Delivered on 20 May 1947* (London: Birkbeck College, University of London, 1947).
Darlington, Reginald R., ed., 'Winchcombe Annals 1049–1181', in Patricia Barnes and C.F. Slade, eds., *A Medieval Miscellany for Doris May Stenton* (London: Pipe Roll Society, 1962): pp. 111–137.
David, Charles Wendell, 'The Authorship of the *De expugnatione Lyxbonensi*'. *Speculum* 7, no. 1 (1932): pp. 50–57.
David, Charles Wendell, *De expugnatione Lyxbonensi: The Conquest of Lisbon* (New York: Columbia University Press, 2001).
Davies, R.R., 'Henry I and Wales', in Henry Mayr-Harting and R.I. Moore, eds., *Studies in Medieval History Presented to R.H.C. Davis* (London: Hambledon Press, 1985): pp. 133–148.
Davis-Secord, Sarah, *Where Three Worlds Met: Sicily in the Early Medieval Mediterranean* (Ithaca, NY: Cornell University Press, 2017).
Davis, R.H.C., and Wallace-Hadrill, J.M., eds., *The Writing of History in the Middle Ages: Essays Presented to Richard William Southern* (Oxford: Oxford University Press, 1981).
De Ayala, Carlos, 'On the Origins of Crusading in the Peninsula: the Reign of Alfonso VI (1065–1109)', *Imago temporis. Medium Aevum* 7 (2013): pp. 225–269.
De Rijk, Lambert, *Dialectica: First Edition of the Manuscripts, with an Introduction on the Life*

and Works of the Author and on the Contents of the Present Work (Assen: Van Gorcum & Co., 1959).
Deane, Anthony C., *A Short Account of Great Malvern Priory Church, a History of the Monastery, and Description of the Fabric* (London: G. Bell and Sons, Ltd., 1914).
DeMayo, Courtney, 'The Students of Gerbert of Aurillac's Cathedral School at Reims: An Intellectual Genealogy', *Medieval Prosopography* 27 (2012): pp. 97–117.
Dethier, Fred, ed., *Melanges offerts à Rita Lejeune, Professeur à l'université de Liège I* (Gembloux: Duculot, 1969).
Dickey, Bruce, 'Adelard of Bath: An Examination Based on Heretofore Unexamined Manuscripts' (PhD Dissertation, University of Toronto, 1983).
Diehl, Jay, 'Origen's Story: Heresy, Book Production, and Monastic Reform at Saint-Laurent de Liège', *Speculum* 95, no. 4 (2020): pp. 1051–1086.
Diehl, Jay, 'The Saint, the Voice, and the Author: Imagining Textual Authority and Personal Presence at Durham Priory, ca. 1080–1150', *Viator* 47.3 (2016): pp. 101–128.
Dimitrijević, Milan and Bajić, Aleksandra, 'Mythological Origin of Constellations and their Description: Aratus, Pseudo-Eratosthenes, Hyginus', in L.Č . Popović, V.A. Srećković, M.S. Dimitrijević, and A. Kovačević, eds., *Proceedings of the XII Serbian-Bulgarian Astronomical Conference*, *Serbia, Sept., 25–29 2020* (Publications of the Astronomical Society 'Rudjer Boskovic', 2020): pp. 129–138.
Doane, A.N. and Rollason, D., '123. Durham Cathedral Library, Hunter 100', *Anglo-Saxon Manuscripts in Microfiche Facsimile Vol. 14: Manuscripts of Durham, Ripon, and York* (Tempe, AZ: Medieval and Renaissance Texts and Studies, 2007): pp. 111–122.
Dobson, R.R., *The Jews of Medieval York and the Massacre of 1190* (York: Borthwick Institute, 2002).
Doubleday, Simon and Coleman, David, eds., *In the Light of Medieval Spain: Islam, the West, and the Relevance of the Past* (New York: Palgrave Macmillan, 2008).
Dubler, C.E., 'Los caminos a Compostela en la obra de Idrisi', *Al-Andalus* 14 (1949): pp. 59–122.
Eastwood, Bruce, '*Robert Grosseteste: The Growth of an English Mind in Medieval Europe* by R.W. Southern', Review in *Speculum*, 63 (1988): pp. 233–237.
Eastwood, Bruce, *The Revival of Planetary Astronomy in Carolingian and Post-Carolingian Europe* (Aldershot; Burlington, VT: Ashgate, 2002).
Ebbesen, Sten, 'Boethius as an Aristotelian Commentator', in Richard Sorabji, ed., *Aristotle Transformed: The Ancient Commentators and Their Influence* (Ithaca, NY: Cornell University Press, 1990): pp. 373–391.
Ebbesen, Sten, 'Boethius on Aristotle', in Sten Ebbesen, ed., *Greek-Latin Philosophical Interaction: Collected Essays of Sten Ebbesen* (Aldershot: Ashgate, 2008): pp. 107–113.
Ebbesen, Sten, ed., *Greek-Latin Philosophical Interaction: Collected Essays of Sten Ebbesen* (Aldershot: Ashgate, 2008).
Espenak, Fred, 'Solar Eclipses of Historical Interest', NASA, September 28, 2009. https://eclipse.gsfc.nasa.gov/SEhistory/SEhistory.html#1133 (accessed 02/05/2022).
Evans, Gillian, 'From Abacus to Algorism: Theory and Practice in Medieval Arithmetic', *The British Journal for the History of Science* 10 (1977): pp. 114–131.
Evans, Gillian, 'Schools and Scholars: The Study of the Abacus in English Schools, c. 980–c. 1150', *EHR* 94, no. 370 (1979): pp. 71–89.
Evans, Gillian, 'The Rithmomachia: A Medieval Mathematical Teaching Aid?', *Janus* 63

(1976): pp. 257–273.
Evans, Gillian, 'The Saltus Gerberti: The Problem of the 'Leap'', *Janus* 67, no. 4 (1980): pp. 261–268.
Farmer, Hugh, 'William of Malmesbury's Life and Works', *Journal of Ecclesiastical History* 13, no. 1 (1962): pp. 39–54.
Farrer, William, *An Outline Itinerary of King Henry the First* (Oxford: Printed by Frederick Hall, 1919).
Fassler, Margot, 'The Office of the Cantor in Early Western Monastic Rules and Customaries: A Preliminary Investigation', *Early Music History* 5 (1985): pp. 29–51.
Flechner, Roy and Meeder, Sven, eds., *The Irish in Early Medieval Europe: Identity, Culture and Religion* (London: Palgrave, 2016).
Flint, Valerie, 'The Date of the Chronicle of 'Florence' of Worcester', *Revue Bénédictine* 86 (1976): pp. 115–119.
Folkerts, Menso, and Hogendijk, Jan P., eds., *Vestigia Mathematica: Studies in Medieval and Early Modern Mathematics in Honour of H.L.L. Busard* (Amsterdam: Rodopi, 1993).
Folkerts, Menso, 'Adelard's Versions of Euclid's *Elements*', in Charles Burnett, ed., *Adelard of Bath: An English Scientist and Arabist of the Early Twelfth Century* (London: Warburg Institute, 1987): pp. 55–68.
Fontaine, Janel, 'Early Medieval Slave-Trading in the Archaeological Record: Comparative Methodologies', *Early Medieval Europe* 25, no. 4 (2017): pp. 466–488.
Foot, Sarah, 'Glastonbury's Early Abbots', in Lesley Abrams and James Carley, eds., *The Archaeology and History of Glastonbury Abbey: Essays in Honour of the Ninetieth Birthday of C.A. Ralegh Radford*, Woodbridge: Boydell Press, 1991): pp. 163–189.
Forbes, Helen Foxhall, 'Making Books for Pastoral Care in Late Eleventh-Century Worcester: Oxford, Bodleian Library, Junius 121 and Hatton 113 + 114', in Peter Clarke and Sarah James, eds., *Pastoral Care in Medieval England: Interdisciplinary Approaches* (Abingdon, Oxon.: Routledge, 2019): pp. 29–66.
French, Roger, 'Foretelling the Future: Arabic Astrology and English Medicine in the Late Twelfth Century', *Isis* 87 (1996): pp. 453–480.
Fry, Timothy, ed. and trans., *Regula Benedicti* 45.1, 11.12–13, *The Rule of St. Benedict* (Collegeville, MN: Liturgical Press, 1981): pp. 206–207.
Gallais, Pierre and Rion, Yves-François, eds., *Mélanges offerts à René Crozet à l'occasion de son 70e anniversaire par ses amis, ses collégues, ses élèves et les membres du C.E.S.C.M.* Vol. 1 (Société d'études médiévales, 1966).
Gameson, Richard, 'Book Production and Decoration at Worcester in the Tenth and Eleventh Centuries', in Nicholas Brooks and Catherine Cubitt, eds., *St. Oswald of Worcester: Life and Influence* (London; New York: Leicester University Press, 1996): pp. 194–243.
Gameson Richard, ed., *The Cambridge History of the Book in Britain: Volume I c. 400–1100* (Cambridge: Cambridge University Press, 2011).
Gameson, Richard, 'The Circulation of Books between England and the Continent, c. 871 – c. 1100', in Richard Gameson, ed., *The Cambridge History of the Book in Britain: Volume I c. 400–1100* (Cambridge: Cambridge University Press 2011).
Gameson, Richard, *The Manuscripts of Early Norman England (c. 1066–1130)* (Oxford: Oxford University Press, 1999).

Gameson, Richard, 'From Vindolanda to Domesday', in Richard Gameson, ed., *The Cambridge History of the Book in Britain: Volume I c. 400–1100* (Cambridge: Cambridge University Press, 2011): pp. 1–9.
Gameson, Richard, 'St Wulfstan, the Library of Worcester and the Spirituality of the Medieval Book', in Julia Barrow and Nicholas Brooks, eds., *St Wulfstan and His World* (Aldershot: Ashgate, 2005).
Garcia-Guijarro, Luis, 'Reconquest and the Second Crusade in Eastern Iberia: The Christian Expansion in the Lower Ebro Valley', in Jason Roche and Janus Jensen, eds., *The Second Crusade: Holy War on the Periphery of Latin Christendom*, Studies in the Crusades and Latin East 2 (Turnhout: Brepols, 2015): pp. 219–255.
Gasper, Giles, '*On the Liberal Arts* and its Historical Context', in Giles Gasper, Cecilia Panti, Tom McLeish, and Hannah Smithson, eds., *The Scientific Works of Robert Grosseteste. Volume 1, Knowing and Speaking: Robert Grosseteste's* De artibus liberalibus 'On the liberal arts' *and* De generatione sonorum 'On the generation of sounds' (Oxford: Oxford University Press, 2019): pp. 9–35.
Gasper, Giles and Wallis, Faith, 'Anselm and the Articella', *Traditio* 59 (2004): pp. 129–174.
Gasper, Giles E.M., Sønnesyn, Sigbjørn Olsen, Pollani, Nicola, Lewis, Neil, and Cunningham, Jack, 'The Liberal Arts: Inheritances and Conceptual Frameworks', in Giles Gasper, Cecilia Panti, Tom McLeish, and Hannah Smithson, eds., *The Scientific Works of Robert Grosseteste. Volume 1, Knowing and Speaking: Robert Grosseteste's* De artibus liberalibus 'On the liberal arts' *and* De generatione sonorum 'On the generation of sounds' (Oxford: Oxford University Press, 2019): pp. 36–50.
Gasper, Giles E.M. and Wallis, Faith, 'Salsamenta pictavensium: Gastronomy and Medicine in Twelfth-Century England', *English Historical Review,* 131 (2016): pp. 1353–1385.
Gasper, Giles, Panti, Cecilia, McLeish, Tom, and Smithson, Hannah, eds., *The Scientific Works of Robert Grosseteste. Volume 1, Knowing and Speaking: Robert Grosseteste's* De artibus liberalibus 'On the liberal arts' *and* De generatione sonorum 'On the generation of sounds' (Oxford: Oxford University Press, 2019).
Geddes, Jane, 'Iron', in John Blair and Nigel Ramsay, eds., *English Medieval Industries* (London: Hambledon, 1991): pp. 167–188.
Gee, Emma, *Aratus and the Astronomical Tradition* (New York: Oxford University Press, 2014).
Gerber, Jane, *The Jews of Spain: A History of the Sephardic Experience* (New York: Free Press, 1992).
Giry, Arthur, *Manuel de diplomatique; diplômes et chartes, chronologie technique, éléments critiques, et parties constitutives de la teneur des chartes, les chancelleries, les actes privés*, New Edition (Paris: F. Alcan, 1925).
Goddard, Victoria, 'The Poetry and Philosophy of Boethius and Dante' (PhD Dissertation, University of Toronto, 2011).
Golb, Norman, *The Jews in Medieval Normandy* (Cambridge: Cambridge University Press, 1998).
Golding, Brian, 'Trans-Border Transactions: Patterns of Patronage in Anglo-Norman Wales', *Haskins Society Journal* 16 (2006): pp. 27–46.
Goldstein, Bernard, 'Astronomy as a 'Neutral Zone': Interreligious Cooperation in Medieval Spain', *Medieval Encounters,* 15 (2009): pp. 159–174.
Goldstein, Bernard, *Ibn al-Muthannâ's Commentary on the Astronomical Tables of al-Khwârizmî: Two Hebrew Versions, Edited and Translated, with an Astronomical*

Commentary (New Haven: Yale University Press, 1967).
Gorski, Richard, ed., *Roles of the Sea in Medieval England* (Suffolk: Boydell Press, 2012).
Gottheil, Richard and Bacher, Wilhelm, 'Ibn Ezra, Abraham Ben Meïr (Aben Ezra)', *Jewish Encyclopedia,* Vol. 6 (New York: Funk and Wagnalls Company, 1901).
Gransden, Antonia, *Historical Writing in England, c. 550 to c. 1307*, Vol. 1 (London: Routledge and Kegan Paul, 1974).
Green, Judith, *Henry I: King of England and Duke of Normandy* (Cambridge: Cambridge University Press, 2009).
Green, Monica, 'In and Beyond the Beneventan Zone: The Transformation of Latin Medicine in the Eleventh Century', to appear in Andrew J. Irving and Richard Gyug, eds., *Brill Companion to the Beneventan Zone* (Leiden: Brill, forthcoming).
Green, Monica H., 'Medicine in France and England in the Long Twelfth Century: Inheritors and Creators of European Medicine', in Charlotte Denoël and Francesco Siri, eds., *France et Angleterre: manuscrits médiévaux entre 700 et 1200*, *Bibliologia* 57 (Turnhout: Brepols, 2020), pp. 363–388.
Grosu, Emanuel, 'Dungal, Epistola de Duplici solis eclipsi...An Analysis', *Philologica Jassyensia* 30, no. 2 (2019): pp. 203–222.
Guyotjeannin, Olivier and Poulle, Emmanuel, eds., *Autour de Gerbert d'Aurillac: le pape de l'an mil* (Paris: Ecole des Chartes, 1996).
Gwara, Scott, 'Anglo-Saxon Schoolbooks', in Richard Gameson, ed., *The Cambridge History of the Book in Britain: Volume I c. 400–1100* (Cambridge: Cambridge University Press, 2011): pp. 507–524.
Haigh, Gordon, *The History of Winchcombe Abbey* (London: Skeffington, 1950).
Halm, Karl and von Laubmann, Georg, ed., *Catalogus Codicum Latinorum Bibliothecae Regiae Monacensis*, Vol. 1, pt. 1 (Monachii, 1892).
Hamesse, J. and Fattori, M., eds., *Rencontres de cultures dans la philosophie médiévale* (Louvain-la-Neuve and Cassino, 1990).
Hanß, Stefan, Schiel, Juliane, and Schmid, Claudia, eds., *Mediterranean Slavery Revisited (500–1800)* (Zürich: Chronos, 2014).
Hardy, Thomas D., *Descriptive Catalogue of Materials Relating to the History of Great Britain and Ireland: To the End of the Reign of Henry VII,* Vol. 2 (London: Longman, Green, Longman, and Roberts, 1865).
Harper-Bill, Christopher and Vincent, Nicholas, eds., *Henry II: New Interpretations* (Woodbridge: Boydell, 2007).
Hart, Cyril, 'Byrhtferth and his Manual', *Medium Aevum* 41 (1972): pp. 95–109.
Hart, Cyril, 'The Ramsey Computus', *EHR* 85, no. 334 (1970): pp. 29–44.
Hartmann, Carmen Cardelle de and Roelli, Philipp, eds, *Petrus Alfonsi and his* Dialogus*: Background, Context, and Reception* (Firenze: SISMEL – Edizioni del Galluzzo, 2014).
Haskins, Charles Homer, 'Adelard of Bath and Henry Plantagenet', *EHR* 28, no. 111 (1913): pp. 515–516.
Haskins, Charles Homer, 'The Abacus and the King's Curia', *EHR* 27, no. 105 (1912): pp. 101–106.
Haskins, Charles Homer, 'The Reception of Arabic Science in England', *EHR*, 30 (1915): pp. 56–69.
Haskins, Charles Homer, *Studies in the History of Medieval Science* (Cambridge, MA: Harvard University Press, 1924).

Haskins, Charles Homer, *Studies in the History of Medieval Science*, Second Edition (New York: Frederick Ungar, 1960).
Hayward, Paul, 'William of Malmesbury as a Cantor-Historian', in Katie Ann-Marie Bugyis, A.B. Kraebel, and Margot E. Fassler, eds., *Medieval Cantors and Their Craft: Music, Liturgy and the Shaping of History, 800–1500* (Woodbridge, Suffolk: York Medieval Press, 2017): pp. 222–239.
Heslop, S. and Sekules, V., eds., *Medieval Art and Architecture at Gloucester and Tewkesbury* (London: British Archaeological Association, 1985).
'The Hildemar Project', http://hildemar.org (accessed 14/01/2020).
Hill, Boyd, *Medieval Monarchy in Action: The German Empire from Henry I to Henry IV* (London: Allen and Unwin, 1971).
Hillaby, Joe, 'The London Jewry: William I to John', *Jewish Historical Studies* 33 (1992): pp. 1–44.
Hillaby, Joe, 'Hereford Gold: Irish Welsh and English Land, Part 2 – The Jewish Community at Hereford and Its Clients 1179–1253: Four Case Studies', *Transactions of the Woolhope Naturalists' Field Club* 45, no. 1 (1985): pp. 193–270.
Hillaby, Joe, *The Palgrave Dictionary of Medieval Anglo-Jewish History* (Basingstoke: Springer, 2013).
Hirshman, Elizabeth and Yates, Donald, *The Early Jews and Muslims of England and Wales* (North Carolina: McFarland & Co., 2014).
Hollister, C. Warren, *Henry I,* ed. and completed by Amanda Clark Frost (New Haven: Yale University Press, 2001).
Holzknecht, Karl Julius, *Literary Patronage in the Middle Ages* (Philadelphia: University of Pennsylvania, 1923).
Houben, Hubert, *Roger II of Sicily: A Ruler Between East and West* (Cambridge: Cambridge University Press, 2002).
Huneycutt, Lois L, *Matilda of Scotland: A Study in Medieval Queenship* (Woodbridge: Boydell Press, 2003).
Husain, Shahnaz, *The Muslim Conquest of Spain and the Legacy of Al-Andalus* (London: Taha, 2004).
Ihnat, Katie, 'William of Malmesbury and the Jews', in Rodney Thomson, Emily Dolmans, and Emily Winkler, eds., *Discovering William of Malmesbury* (Woodbridge: Boydell Press, 2017): pp. 49–63.
Jacoby, David, *Medieval Trade in the Eastern Mediterranean and Beyond* (London: Routledge, 2018).
Jaeger, C. Stephen, 'Men and Women in the Life of the Schools: In the Classroom of Hermann of Reichenau', in Micol Long, Tjamke Snijders, and Steven Vanderputten, eds., *Horizontal Learning in the High Middle Ages: Peer-to-Peer Knowledge Transfer in Religious Communities* (Amsterdam: Amsterdam University Press, 2019): pp. 163–184.
Jaeger, C. Stephen, *The Envy of Angels: Cathedral Schools and Social Ideas in Medieval Europe, 950–1200* (Philadelphia: University of Pennsylvania Press, 1994).
James, M.R., *Two Ancient English Scholars: St. Aldhelm and William of Malmesbury* (Glasgow: Jackson, Wylie & Co., 1931).
James, R.R., 'Early Charters Witnessed by Medical Men', *The British Medical Journal* 2, no. 3378 (1925): p. 571.
James, R.R., 'Grimbald the Physician', *The British Medical Journal* 1, no. 3398 (1926): pp. 298–

299.
Jayyusi, Salma Khadra, ed., *The Legacy of Muslim Spain* (Leiden: Brill, 1994).
Johns, Jeremy, *Arabic Administration in Norman Sicily the Royal Dīwān* (Cambridge: Cambridge University Press, 2007).
Jones, Alexander, 'Ptolemy's *Handy Tables:* Essay Review', *Journal for the History of Astronomy* 48, no. 2 (2017): pp. 238–241.
Jones, Charles W., 'Bede as Early Medieval Historian', *Medievalia et Humanistica* 4 (1946): pp. 26–36.
Jones, Charles W., 'Bede's Place in Medieval Schools', in Wesley M. Stevens, ed., *Bede, the Schools and the Computus* (Aldershot: Variorum, 1994): pp. 261–285.
Jones, Charles W., *Saint's Lives and Chronicles in Early England* (Ithaca, NY: Cornell University Press, 1947).
Jones, Owain Wyn, 'Brut y Tywysogion: The History of the Princes and Twelfth-Century Cambro-Latin Historical Writing', *Haskins Society Journal* 26 (2014): pp. 209–228.
Juste, David, *Les Alchandreana primitifs: étude sur les plus anciens traités astrologiques latins d'origine arabe, Xe siècle* (Leiden; Boston: Brill, 2007).
Kealey, Edward, *Medieval Medicus: A Social History of Anglo-Norman Medicine* (Baltimore: Johns Hopkins University Press, 1981).
Kelly, Mary and Doherty, Charles., eds., *Music and the Stars. Mathematics in Medieval Ireland* (Dublin: Four Courts Press, 2013).
Kennedy, E.S., 'A Survey of Islamic Astronomical Tables', *Transactions of the American Philosophical Society* 46 (1956): pp. 123–177.
Ker, Neil R., *Catalogue of Manuscripts Containing Anglo-Saxon* (Oxford: Clarendon Press, 1957).
Ker, Neil R, *English Manuscripts in the Century after the Norman Conquest* (Oxford: Clarendon Press, 1960).
Ker, Neil R., 'William of Malmesbury's Handwriting', *EHR* 59, no. 235 (1944): pp. 371–376.
Khan, M.S., 'Qāḍī Ṣā'id al-Andalusī's Ṭabaqāt al-Umam: The First World History of Science'. *Islamic Studies* 30, no. 4 (1991): pp. 517–540.
King, David A., *In Synchrony with the Heavens: Studies in Astronomical Timekeeping and Instrumentation in Medieval Islamic Civilization,* Vol. 1 (Studies I–IX) (Leiden: Brill, 2004).
Kitchin, William, 'A Pope-Philosopher of the Tenth Century: Sylvester II (Gerbert of Aurillac)', *The Catholic Historical Review* 8, no. 1 (1922): pp. 42–54.
Knowles, David, Brooke, Christopher N.L., and London, Vera C.M., *The Heads of Religious Houses: England and Wales, 940–1216*, Vol. 1 (Cambridge: Cambridge University Press, 1972).
Knowles, David, *The Religious Orders in England* (Cambridge: Cambridge University Press, 1979).
Kooper, Erik and Levelt, Sjoerd, eds., *The Medieval Chronicle IX* (Leiden: Brill, 2015).
Kraye, J., Ryan, W.F., and Schmitt, C.B., eds., *Pseudo-Aristotle in the Middle Ages: the Theology and Other Texts* (London: Warburg Institute, 1986).
Krueger, Hilmar C. and Duby, Georges, *The Early Growth of the European Economy: Warriors and Peasants from the Seventh to the Twelfth Century.* in Howard B. Clarke, trans., (Ithaca, NY: Cornell University Press, 1974).
Krusch, Bruno, *Studien zur Christlich-mittelalterlichen Chronologie: Die Entstehung unserer*

heutigen Zeitrechnung; I. Victorius; Ersatz der fehlerhaften Ausgabe Mommsens in den M.G.; II. Dionysius Exiguus, der Begründer der christlichen Ära (Berlin: De Gruyter, 1938).
Krusch, Bruno, *Studien zur Christlich-mittelalterlichen chronologie. Der 84jährige ostercyclus und seine quellen* (Leipzig: Veit & comp., 1880).
Kunitzsch, Paul, 'A Note on Ascelinus' Table of Astrolabe Stars', *Annals of Science* 57, no. 2 (2000): pp. 181–185.
Langley, Thomas, 'Englishing the Papacy: The Liber Pontificalis and MS. Kk.4.6.', Cambridge University Library Special Collections. May 21, 2018.
Lapidge, Michael, *The Anglo-Saxon Library* (Oxford: Oxford University Press, 2005).
Lapidge, Michael, 'The Library of Byrhtferth', in Richard Gameson, ed., *The Cambridge History of the Book in Britain: Volume I c. 400–1100* (Cambridge: Cambridge University Press, 2011): pp. 685–693.
Lapidge, M. and Baker, P.S., 'More Acrostic Verse by Abbo of Fleury', *Journal of Medieval Latin* 7 (1997): pp. 1–27.
Lawn, Brian, *The Salernitan Questions: An Introduction to the History of Medieval and Renaissance Problem Literature* (Oxford: Clarendon Press, 1963).
Lawrence-Mathers, Anne, 'Computus and Chronology in Anglo-Norman England', in Laura Cleaver and Andrea Worm, eds., *Writing History in the Anglo-Norman World: Manuscripts, Makers and Readers, c. 1066–c. 1250* (Woodbridge: Boydell, 2018): pp. 53–68.
Lawrence-Mathers, Anne, 'John of Worcester and the Science of History', *Journal of Medieval History* 39, no. 3 (2013): pp. 255–274.
Lawrence-Mathers, Anne, *Manuscripts in Northumbria in the Eleventh and Twelfth Centuries* (Woodbridge, Suffolk: D.S. Brewer, 2003).
Lawrence-Mathers, Anne, 'William of Malmesbury and the Chronological Controversy', in Rodney Thomson, Emily Dolmans, and Emily Winkler, eds., *Discovering William of Malmesbury* (Woodbridge: Boydell Press, 2017): pp. 93–106.
Lawrence-Mathers, Anne, *The True History of Merlin the Magician* (New Haven: Yale University Press, 2012).
Leedom, Joe W., 'William of Malmesbury and Robert of Gloucester Reconsidered', *Albion: A Quarterly Journal Concerned with British Studies* 6, no. 3 (1974): pp. 251–265.
Legge, M.D., 'L'influence littéraire de la cour d'Henri Beauclerc', in Fred Dethier, ed., *Melanges offerts à Rita Lejeune, Professeur à l'université de Liège I* (Gembloux: Duculot, 1969): pp. 679–687.
Levey, Martin, 'Abraham bar Hiyya Ha-Nasi', *Dictionary of Scientific Biography* (New York: Charles Scribner's Sons, 1970): pp. 22–23.
Levison, Wilhelm, 'Bede as Historian', in Alexander H. Thompson, ed., *Bede: His Life, Times, and Writings: Essays in Commemoration of the Twelfth Centenary of His Death* (Oxford: Clarendon Press, 1935): pp. 111–151.
Lewis, Chris, ed., *Anglo-Norman Studies, XXI: Proceedings of the Battle Conference 2008* (Woodbridge: Boydell Press, 2009).
Lindberg, David, *Science in the Middle Ages* (Chicago: University of Chicago Press, 1978).
Lindberg, David, *Theories of Vision from al-Kindi to Kepler* (Chicago: University of Chicago Press, 1996).
Lipton, Sara, *Dark Mirror: The Medieval Origins of Anti-Jewish Iconography* (New York:

Metropolitan Books, 2014).
Lohr, Alfred and Obrist, Barbara, eds., *Abbonis Floriacensis Miscellanea De Computo, De Astronomia et De Cosmographia: Secundum Codicem Berolinensem Phill. 1833* (Turnhout: Brepols Publishers, 2019).
Long, Micol, Snijders, Tjamke, and Vanderputten, Steven, eds., *Horizontal Learning in the High Middle Ages: Peer-to-Peer Knowledge Transfer in Religious Communities* (Amsterdam: Amsterdam University Press, 2019).
Lorch, Richard, *Arabic Mathematical Sciences: Instruments, Texts, Transmission* (Aldershot: Variorum, 1995).
Lot, Ferdinand, 'L'Étude sur le recueil des lettres de Gerbert', *Bibliothèque de L'École des Chartres* 100, no. 1 (1939): pp. 8–62.
Lubrich, Naomi, 'The Wandering Hat: Iterations of the Medieval Jewish Pointed Cap', *Jewish History* 29, no. 3 (2015): pp. 203–244.
Lyons, Jonathan, *The House of Wisdom: How the Arabs Transformed Western Civilization* (New York: Bloomsbury, 2009).
Maass, Ernst, *Commentariorum in Aratum reliquiae* (Berlin: Apud Weidmannos, 1958).
Madan, Falconer and Craster, H.H.E., *A Summary Catalogue of Western Manuscripts in the Bodleian Library at Oxford Which Have Not Hitherto Been Catalogued in the Quarto Series,* Vol. II, pt. 1 (Oxford: Clarendon Press, 1922, 1937).
Mahmood, Irfran et al., 'Investigation of Atmospheric Anomalies Associated with Kashmir and Awaran Earthquakes', *Journal of Atmospheric and Solar-Terrestrial Physics* 154 (2017): pp. 75–85.
Marchandisse, Alain, ed., *L'obituaire de la Cathédrale Saint-Lambert de Liège (XIe–XVe siècles)* (Bruxelles: Palais des académies, 1991).
Mason, Emma, 'William Rufus: Myth and Reality', *Journal of Medieval History* 3, no. 1 (1977): pp. 1–20.
Mason, Emma, *Saint Wulfstan of Worcester, c. 1008–1095*, (Oxford, UK; Cambridge, MA, USA: B. Blackwell, 1990).
Maxwell, Robert, 'Visual Argument and the Interpretations of Dreams in the Chronicle of John of Worcester', in Erik Kooper and Sjoerd Levelt, eds., *The Medieval Chronicle IX* (Leiden: Brill, 2015): pp. 233–269.
Mayr-Harting, Henry and Moore, R.I., eds., *Studies in Medieval History Presented to R.H.C. Davis* (London: Hambledon Press, 1985).
McCluskey, Stephen, 'Gregory of Tours, Monastic Timekeeping, and Early Christian Attitudes to Astronomy', *Isis* 81, no. 1 (1990): pp. 8–22.
McCluskey, Stephen, *Astronomies and Cultures in Early Medieval Europe* (Cambridge: Cambridge University Press, 1998).
McCluskey, Stephen, 'Cosmology and Culture', in J.A. Rubiño-Martín, J.A. Belmonte, F. Prada, and A. Aberdi, eds., *ASO Conference Series* (2009).
McGurk, Patrick, '*Computus Helperici*: Its Transmission in England in the Eleventh and Twelfth Centuries', *Medium Aevum* 43, no. 1 (1974): pp. 1–5.
McGurk, Patrick, 'Illustrations in the *Chronicle* of John of Worcester', *Source Notes in the History of Art* 33, no. 3/4 (2014): pp. 28–33.
McKitterick, Rosamond, 'Constructing the Past in the Early Middle Ages: The Case of the Royal Frankish Annals', *Transactions of the Royal Historical Society* 7 (1997): pp. 101–129.
Menocal, Maria, *The Ornament of the World: How Muslims, Jews, and Christians Created a*

Culture of Tolerance in Medieval Spain (New York: Back Bay Books, 2012).
Mercier, Raymond, 'Astronomical Table of Abraham bar Hiyya', in Sacha Stern and Charles Burnett, eds., *Time, Astronomy and Calendars in the Jewish Tradition* (Leiden: Brill, 2014): pp. 115–207.
Mercier, Raymond. 'Astronomical Tables in the Twelfth Century', in Charles Burnett, ed., *Adelard of Bath: An English Scientist and Arabist of the Early Twelfth Century* (London: Warburg Institute, 1987), pp. 87–118.
Metlitzki, Dorothee, *The Matter of Araby in Medieval England* (New Haven: Yale University Press, 1977).
'The Misericords and History of Tewkesbury Abbey', *Misericords*, http://www.misericords.co.uk/tewkesbury.html (accessed 20/01/2021).
Mitchell, Sarah, 'Kings, Constitution and Crisis: 'Robert of Gloucester' and the Anglo-Saxon Remedy', in Donald Scragg and Carole Weinberg, eds., *Literary Appropriations of the Anglo-Saxons from the Thirteenth to the Twentieth Century* (Cambridge: Cambridge University Press, 2000): pp. 39–56.
Moore, John S., 'Trade, Money, and Power in Medieval England – By Pamela Nightingale', *The Economic History Review* 62 (2009): pp. 205–206.
Moreton, Jennifer, 'Before Grosseteste: Roger of Hereford and Calendar Reform in Eleventh- and Twelfth-Century England', *Isis* 86, no. 4 (1995): pp. 562–586.
Morgan, Nigel J. and Thomson, Rodney M., eds., *The Cambridge History of the Book in Britain* (Cambridge: Cambridge University Press, 2008).
Moyer, Anne, *The Philosophers' Game: Rithmomachia in Medieval and Renaissance Europe* (Ann Arbor: University of Michigan Press, 2001).
Mundill, Robin, *The King's Jews: Money, Massacre and Exodus in Medieval England* (London: Continuum, 2010).
Mynors, R.A.B. and Thomson, Rodney M., eds., *Catalogue of the Manuscripts of Hereford Cathedral Library* (Cambridge: D.S. Brewer, 1993).
Mynors, R.A.B., *Durham Cathedral Manuscripts to the End of the Twelfth Century* (Oxford, 1939).
Neugebauer, Otto, *The Astronomical Tables of al-Khwārizmī: Translation with Commentaries of the Latin Version Edited by H. Suter, Supplemented by Corpus Christi College MS 283* (Copenhagen: Ejnar Munksgaard, 1962).
Newell, William Wells, 'William of Malmesbury and the Antiquity of Glastonbury', *PMLA* 18, no. 4 (1903): pp. 459–512.
Newton, Robert R., *Medieval Chronicles and the Rotation of the Earth* (Baltimore: Johns Hopkins University, 1972).
Nightingale, Pamela, 'The London Pepperers' Guild and Some Twelfth-Century English Trading Links with Spain', in Pamela Nightingale, ed., *Trade, Money, and Power in Medieval England* (Aldershot: Ashgate, 2007), pp. 123–132. Reprinted from *Bulletin for the Institute for Historical Research* 58, no. 138 (1985): pp. 123–132.
Nightingale, Pamela, ed., *Trade, Money, and Power in Medieval England* (Aldershot: Ashgate, 2007).
North, John D., *Stars, Minds, and Fate: Essays in Ancient and Medieval Cosmology* (London: Hambledon Press, 1989).

North, John D., ‘Some Norman Horoscopes’, in Charles Burnett, ed., *Adelard of Bath: An English Scientist and Arabist of the Early Twelfth Century* (London: Warburg Institute, 1987): pp. 147–161.
Nothaft, C. Philipp, ‘Bede’s Horologium: Observational Astronomy and the Problem of the Equinoxes in Early Medieval Europe (c.700–1100)’, *EHR* 130, no. 546 (2015): pp. 1079–1101.
Nothaft, C. Philipp, ‘Ptolemaic Orbs in Twelfth-Century England: A Study and Edition of the Anonymous Liber de motibus planetarum’, *Mediterranea. International Journal on the Transfer of Knowledge* 3 (2018): pp. 145–210.
Nothaft, C. Philipp, ‘Roman vs. Arabic Computistics in Twelfth-Century England: A Newly Discovered Source (*Collatio Compoti Romani et Arabici)*’, *Early Science and Medicine* 20, no. 2 (2015): pp. 187–208.
Nothaft, C. Philipp, *Scandalous Error: Calendar Reform and Calendrical Astronomy in Medieval Europe* (Oxford: Oxford University Press, 2018).
O’Donnell, Thomas, Townend, Matthew and Tyler, Elizabeth, ‘European Literature and Eleventh-Century England’, in Clare Lees, ed., *The Cambridge History of Early Medieval English Literature* (Cambridge: Cambridge University Press, 2012): pp. 607–636.
Ogilby, John, *Britannia, Volume the First* (London, 1695).
O’Mara, Tim, ‘Constantine the African in Worcester Cathedral Library’, Worcester Cathedral Library and Archive Blog, April 25, 2018, https://worcestercathedrallibrary.wordpress.com/2018/04/25/constantine-the-african-in-worcester-cathedral-library/ (accessed 11/04/2022).
Orchard, Andy, ‘Aldhelm’s Library’, in Richard Gameson, ed., *Cambridge History of the Book, Volume I c. 400–1100* (Cambridge: Cambridge University Press, 2011): pp. 591–605.
Orchard, Andy, ‘The Library of Wulfstan of York’, in Richard Gameson, ed., *The Cambridge History of the Book in Britain: Volume I c. 400–1100* (Cambridge: Cambridge University Press, 2011): pp. 694–700.
Otisk, Mavek, ‘Descriptions and Images of the Early Medieval Latin Abacus’, *Średniowiecze Polskie I Powszechne* 7 (2015): pp. 13–35.
Oxford Dictionary of National Biography (Oxford: Oxford University Press, 2004).
Pächt, Otto and Alexander, J.J.G., eds., *Illuminated Manuscripts in the Bodleian Library, Oxford* (Oxford: Clarendon Press, 1973).
Page, William, ‘Houses of Benedictine Monks: The Abbey of Tewkesbury’, in William Page, ed., *A History of the County of Gloucester*, Vol. 2 (London: Victoria County History, 1907): pp. 61–66.
Page, William, ed., *A History of the County of Gloucester,* Vol. 2 (London: Victoria County History, 1907).
Palmer, James, ‘Calculating Time and the End of Time in the Carolingian World, c. 740–820’, *EHR* 126, no. 523 (2011): pp. 1307–1331.
Panti, Cecilia, ‘Boethius and Ptolemy on Harmony, Harmonics and Human Music’, *Micrologus: Nature, Sciences and Medieval Societies* 25 (2017): pp. 3–35.
Parkes, Malcolm B. and Watson, Andrew G. eds. *Medieval Manuscripts and Libraries: Essays Presented to N.R. Ker* (London: Scolar Press, 1978).
Passalacqua, Marina, ‘Lupo di Ferrières, Gerberto di Aurillac e Il de Oratore’, *Materiali e Discussioni per l’analisi dei Testi Classici* 36 (1996): pp. 225–228.

Patterson, Robert, 'William of Malmesbury's Robert of Gloucester: A Re-Evaluation of the *Historia Novella*', *The American Historical Review* 70, no. 4 (1965): pp. 983–997.
Patterson, Robert, *The Earl, the Kings, and the Chronicler: Robert Earl of Gloucester and the Reigns of Henry I and Stephen* (Oxford: Oxford University Press, 2019).
Peden, A.M., *Abbo of Fleury and Ramsey: Commentary on the Calculus of Victorius of Aquitaine* (Oxford: Oxford University Press, 2003).
Pedersen, F.S., *The Toledan Tables. A Review of the Manuscripts and the Textual Versions with an Edition* (København, 2002).
Pekonen, Osmo, 'Gerbert of Aurillac: Mathematician and Pope', *The Mathematical Intelligencer* 22, no. 4 (2000): pp. 67–70.
Pekonen, Osmo, 'Gerberto de Aurillac: Matemático y Papa', *La Gaceta de la Real Sociedad Matemática Española* 4, no. 2 (2001): pp. 399–408.
Pelteret, David, 'Slave Trading and the Slave Trade in Early England', *Anglo-Saxon England* (1981): pp. 99–114.
Pelteret, David, *Slavery in Early Medieval England: From the Reign of Alfred until the Twelfth Century* (Woodbridge: Boydell Press, 1995).
Perkins, Clarence, 'The Knights Templars in the British Isles', *EHR* 25, no. 98 (1910): pp. 209–230.
Pevsner, Nikolaus, *Worcestershire* (Harmondsworth: Penguin Books, 1968).
Pfaff, Richard, 'The 'Abbreviatio Amalarii' of William of Malmesbury', *Recherches de Théologie ancienne et médiévale* 48 (1981): pp. 128–171.
Phillips, Jonathan, *The Second Crusade: Extending the Frontiers of Christendom* (New Haven: Yale University Press, 2008).
Pinty, Bernard, et al., 'Observing Earthquake-Related Dewatering using MISR/Terra Satellite Data', *EOS, Transactions American Geophysical Union* 84, no. 5 (2003): pp. 37–48.
Pirenne, Henri, *Medieval Cities: Their Origins and the Revival of Trade* (Princeton: Princeton University Press, 1925).
Planta, Joseph, ed., *A Catalogue of the Manuscripts in the Cottonian Library Deposited in the British Museum* (London: Luke Hansard, 1802).
Poole, Reginald L., *Chronicles and Annals: A Brief Outline of Their Origin and Growth* (Oxford: Clarendon Press, 1926).
Poole, Reginald L., *The Exchequer in the XIIth Century, the 'Ford Lectures' Delivered in the University of Oxford Michaelmas Term, 1911* (Oxford: Clarendon Press, 1912).
Poole, Reginald L., *Medieval Reckonings of Time* (London: Society for Promoting Christian Knowledge, 1935).
Popović, L.Č., Srećković, V.A., Dimitrijević, M.S., and Kovačević, A., eds., *Proceedings of the XII Serbian-Bulgarian Astronomical Conference*, *Serbia, Sept., 25–29 2020* (Publications of the Astronomical Society 'Rudjer Boskovic', 2020).
Postan, M.M. *Medieval Trade and Finance* (Cambridge: Cambridge University Press, 1973).
Poulle, Emmanuel, 'L'astronomie de Gerbert', in Michele Tosi, ed., *Gerberto, Scienza, Storia e Mito: Atti del Gerberti Symposium, Bobbio 25–27 Luglio 1983*, (Bobbio (Piacenza) Italy: Archivi storici bobiensi, 1985): pp. 597–617.
Pound, N.J.G., *An Economic History of Medieval Europe* (London: Longman, 1974).
Pryce, Huw, 'British or Welsh? National Identity in Twelfth-Century Wales', *EHR* 116, no. 468 (2001): pp. 775–801.
Rankin, Susan, 'On the Treatment of Pitch in Early Music Writing', *Early Music History* 30

(2011): pp. 105–175.
Reilly, Bernard, *The Contest of Christian and Muslim Spain: 1031–1157* (Oxford: Blackwell, 1995).
Reis, Norma, 'Famous Eclipses of the Middle Ages – Part Two', Astronomy Today, http://www.astronomytoday.com/eclipses/middleages-part2.html (accessed 22/01/2021).
Renardy, Christine, 'Les écoles liégeoises du IXe au XIIe siècle: grandes lignes de leur évolution', *Revue belge de philologie et d'histoire* 57, no. 2 (1979): pp. 309–328.
Riché, Pierre, 'Le millénarisme autour de l'an mille', *Revue Française d'Histoire des Idées Politiques* 10 (1999): pp. 247–258.
Riché, Pierre, *Gerbert d'Aurillac, le Pape de l'an mil* (Paris: Fayard, 1987).
Rieger, Reinhold, 'Adelard of Bath', *Religion Past and Present* (Leiden: Brill, 2011).
Roche, Jason and Jensen, Janus, eds., *The Second Crusade: Holy War on the Periphery of Latin Christendom*, Studies in the Crusades and Latin East 2 (Turnhout: Brepols, 2015).
Rollason, David, *Anglo-Norman Durham, 1093–1193: [based on Papers Read to a Conference Held in Durham on 13–18 September 1993]* (Woodbridge: Boydell Press, 1998).
Rollo, David, *Glamorous Sorcery: Magic and Literacy in the High Middle Ages* (Minneapolis: University of Minnesota Press, 2000).
Romain, Jonathan, 'River Jews: Medieval Jews along the Thames as a Microcosm of Anglo-Jewry', *Jewish Historical Studies* 43 (2011): pp. 21–42.
Rose, Susan, *The Wine Trade in Medieval Europe* (London: Bloomsbury, 2011).
Roth, Norman, 'Some Aspects of Muslim-Jewish Relations in Spain', in María del Carmen Carlé, Hilda Grassotti, and Germán Orduna, eds., *Estudios en homenaje a Don Claudio Sánchez Albornoz en sus 90 años*, Vol. 2 (Buenos Aires: Universidad, Instituto de Historia de España, 1983): pp. 179–214.
Roth, Cecil, *A History of the Jews in England* (London: John Trotter, 1978).
Roudgar, Qanbarali, 'Ibn Saffār and the Development of Islamic Astronomy in Andalusia: Finding Qibla Direction in Kitāb al-'amal bi-l-asṭurlāb and Balāta Sundial (at the Cordova Museum)', *The Journal of Islamic History and Civilisation* 16, no. 31 (2020): pp. 141–174.
Rozier, Charles C., *Writing History in the Community of St Cuthbert, c. 700–1130: From Bede to Symeon of Durham* (Cambridge: Cambridge University Press, 2020).
Rozier, Charles. C., 'Durham Cathedral Priory and Its Library of History, c. 1090–c. 1150', in Laura Cleaver and Andrea Worm, eds., *Writing History in the Anglo-Norman World: Manuscripts, Makers and Readers, c. 1066–c. 1250* (Woodbridge: Boydell, 2018): pp. 133–148.
Rozier, Charles C., 'Contextualizing the Past at Durham Cathedral Priory, c. 1090–1130: Uses of History in the Annals of Durham, Dean and Chapter Library, MS Hunter 100', *Haskins Society Journal* 25 (2013): pp. 107–123.
Rutkin, H. Darrel, 'Review Of Juste, David', *Les 'Alchandreana' primitifs: Études sur les plus anciens traités astrologiques latins d'origine arabe (Xe siècle),* in *Early Science and Medicine,* Vol. 13 (2008): pp. 511–513.
Saliba, George, *A History of Arabic Astronomy: Planetary Theories during the Golden Age of Islam* (New York: New York University Press, 1994).
Santamaria, Anthony, 'In Pursuit of Happiness: The Platonic and Aristotelian Harmony in 'The Consolation of Philosophy'', *Carmina Philosophiae* 16 (2007): pp. 71–99.
Sarton, George, *Introduction to the History of Science,* Vol. 2, pt. 2 (Baltimore: Published for the

Carnegie Institution of Washington by the Williams & Wilkins Company, 1931).
Schmidt, Gleb, 'A Saint Petersburg Manuscript of the *Excerptio Roberti Herefordensis de chronica Mariani Scotti*', in Laura Cleaver and Andrea Worm, eds., *Writing History in the Anglo-Norman World: Manuscripts, Makers and Readers, c. 1066–c. 1250* (Woodbridge: Boydell, 2018): pp. 69–92.
Schmidt, Laurie, 'Squeezing Water from Rock', NASA, https://earthobservatory.nasa.gov/features/Earthquake (accessed 18/08//2021).
Scragg, Donald and Weinberg, Carole, eds., *Literary Appropriations of the Anglo-Saxons from the Thirteenth to the Twentieth Century* (Cambridge: Cambridge University Press, 2000).
Sharpe, Richard, 'Great Malvern Priory', *The Charters of William II and Henry I* (2013), https://actswilliam2henry1.files.wordpress.com/2013/10/h1-great-malvern-2013-1.pdf (accessed 15/03/2020).
Shiel, James, 'Boethius' Commentaries on Aristotle', in Richard Sorabji, ed., *Aristotle Transformed: The Ancient Commentators and Their Influence* (Ithaca, NY: Cornell University Press, 1990): pp. 349–372.
Short, Ian, 'Literary Culture at the Court of Henry II', in Christopher Harper-Bill and Nicholas Vincent, eds., *Henry II: New Interpretations*, (Woodbridge: Boydell, 2007): pp. 335–361.
Sirazhdinov, S., ed., *Iz Istorii srednevekovoĭ vostochnoĭ Matematiki i Astronomii* (Tashkent: Izd-vo 'Fan' Uzbekskoĭ SSR, 1983).
Sivier, David, *Anglo-Saxon & Norman Bristol* (Stroud, Gloucester: Tempus, 2002).
Smith, Brian and Ralph, Elizabeth, *A History of Bristol and Gloucestershire* (Chichester, West Sussex: Phillimore, 1996).
Sorabji, Richard, ed., *Aristotle Transformed: The Ancient Commentators and Their Influence* (Ithaca, NY: Cornell University Press, 1990).
Southern, Richard W., *Medieval Humanism and Other Studies* (Blackwell: Oxford, 1970).
Southern, Richard W., *Robert Grosseteste: The Growth of an English Mind in Medieval Europe* (Oxford: Clarendon Press, 1986).
Southern, Richard W., *Western Views of Islam in the Middle Ages* (Cambridge, MA: Harvard University Press, 1980).
Stahlman, William, *Ptolemy's Handy Tables* (New York: Routledge, 2000).
Stein, Robert, 'Making English History: Cultural Identity and Historical Explanation in William of Malmesbury and Laȝamon's *Brut*', in Sylvia Tomasch and Sealy Gilles, eds., *Text and Territory: Geographical Imagination in the European Middle Ages* (Philadelphia: University of Pennsylvania Press, 1998): pp. 97–115.
Steinová, Evina, ed., 'London, British Library, Cotton Caligula A xv', in 'Innovating Knowledge' (Huygens Institute, Amsterdam, 2021), online at https://db.innovatingknowledge.nl/#detail/M0171 (accessed 28/01/2022).
Stephenson, F.R., 'First Sunspot Drawing', *Technology Through Time* 35, NASA, 2005, https://sunearthday.nasa.gov/2006/locations/firstdrawing.php (accessed 18/06/2021).
Stern, Sacha and Burnett, Charles, eds., *Time Astronomy, and Calendars in the Jewish Tradition* (Leiden: Brill, 2013).
Stern, Sacha and Burnett, Charles, eds., *Time, Astronomy and Calendars in the Jewish Tradition* (Leiden: Brill, 2014).
Stevens, Wesley M., ed., *Bede, the Schools and the Computus* (Aldershot: Variorum, 1994).
Stevenson, W.H., 'A Contemporary Description of the Domesday Survey', *EHR* 22, no. 85 (1907): pp. 72–84.

Stöber, Karen, 'Female Patrons of Late Medieval English Monasteries', *Medieval Prosopography* 31 (2016): pp. 115–136.
Stone-Davis, Férdia J., 'The Consolation of Philosophy and the 'Gentle' Remedy of Music', in Katherine Butler and Samantha Bassler, eds., *Music, Myth and Story in Medieval and Early Modern Culture* (Woodbridge: Boydell Press, 2019): pp. 32–45.
Storrs, Constance Mary and Tate, Robert Brain, *Jacobean Pilgrims from England to St. James of Compostela: From the Early Twelfth to the Late Fifteenth Century* (Santiago de Compostela: Xunta de Galicia, 1994).
Sugden, Keith F., 'A History of the Abacus', *The Accounting Historians Journal* 8 (1981): pp. 1–22.
Susser, Bernard, *The Jews of South-West England* (Exeter: University of Exeter Press, 1993).
Strickland, Deborah, *Saracens, Demons and Jews: Making Monsters in Medieval Art*, (Princeton: Princeton University Press, 2003).
Tabuteau, Emily, *Transfers of Property in Eleventh-Century Norman Law* (Chapel Hill: University of North Carolina Press, 1988).
Talbot, Charles Hugh and Hammond, Eugene Ashby, *The Medical Practitioners in Medieval England: A Biographical Register* (Wellcome Historical Medical Library, 1965).
Thompson, Alexander H., ed., *Bede: His Life, Times, and Writings: Essays in Commemoration of the Twelfth Centenary of His Death* (Oxford: Clarendon Press, 1935).
Thompson, James Westfall, 'The Introduction of Arabic Science into Lorraine in the Tenth Century', *Isis* 12, no. 2 (1929): pp. 184–193.
Thompson, James Westfall, *The Literacy of the Laity (*Berkeley: University of California Press, 1939).
Thompson, James Westfall, *The Medieval Library* (Chicago: University of Chicago Press, 1939).
Thompson, Kathleen, 'Affairs of State: The Illegitimate Children of Henry I', *Journal of Medieval History* 29 (2003): pp. 129–151.
Thomson, Rodney, *Books and Learning in Twelfth-Century England: The Ending of 'alter orbis': The Lyell Lectures 2000–2001* (Walkern, Herts.: Red Gull Press, 2006).
Thomson, Rodney, ed., *A Descriptive Catalogue of the Medieval Manuscripts in the Library of Corpus Christi College Oxford* (Woodbridge, Suffolk: D.S. Brewer, 2011).
Thomson, Rodney and Gullick, Michael, eds., *A Descriptive Catalogue of the Medieval Manuscripts in Worcester Cathedral Library* (Cambridge: Published on behalf of the dean and chapter of Worcester Cathedral by D.S. Brewer, 2001).
Thomson, Rodney, Dolmans, Emily, and Winkler, Emily, eds., *Discovering William of Malmesbury* (Woodbridge: Boydell Press, 2017).
Thomson, Rodney, 'The Library of Bury St. Edmunds Abbey in the Eleventh and Twelfth Centuries', *Speculum* 47.4 (1972): pp. 617–645.
Thomson, Rodney, 'More Manuscripts from the 'Scriptorium' of William of Malmesbury', *Scriptorium* 35 (1981): pp. 48–54.
Thomson, Rodney, 'The 'Scriptorium' of William of Malmesbury', in Malcolm B. Parkes and Andrew G. Watson, eds., *Medieval Manuscripts and Libraries: Essays Presented to N.R. Ker* (London: Scolar Press, 1978): pp. 117–142.
Thomson, Rodney, 'The Reading of William of Malmesbury', *Revue Bénédictine* 85, nos. 3–4 (1975): pp. 362–402.
Thomson, Rodney. 'The Reading of William of Malmesbury: Addenda et Corrigenda', *Revue*

Bénédictine 86, nos. 3–4 (1976): pp. 327–335.
Thomson, Rodney, 'The Reading of William of Malmesbury: Further Additions and Reflections', *Revue Bénédictine* 89, no. 3–4 (1979): pp. 312–324.
Thomson, Rodney, 'The Rediscovery of William of Malmesbury', in Rodney Thomson, Emily Dolmans, and Emily Winkler, eds., *Discovering William of Malmesbury* (Woodbridge: Boydell Press, 2017): pp. 219–224.
Thomson, Rodney, 'William of Malmesbury and the Latin Classics Revisited', *Proceedings of the British Academy* 129 (2005): pp. 383–393.
Thomson, Rodney, 'William of Malmesbury as Historian and Man of Letters', *Journal of Ecclesiastical History* 29, no. 4 (1978): pp. 387–413.
Thomson, Rodney, *William of Malmesbury* (Woodbridge: Boydell Press, 1987).
Thorndike, Lynn and Kibre, Pearl, *Incipits of Mediaeval Scientific Writings in Latin* (Cambridge, MA: The Medieval Academy of America, 1963).
Thorndike, Lynn, *A History of Magic and Experimental Science during the First Thirteen Centuries of Our Era*, 2 vols. (New York: Macmillan Company, 1923).
Thurlby, Malcom, 'Observations on Romanesque Architecture and Sculpture in the Diocese of Monmouth', *Monmouthshire Antiquary* 34 (2018): pp. 17–44.
Thurlby, Malcom and Coplestone-Crow, Bruce, *The Herefordshire School of Romanesque Sculpture.* Second Edition (Almeley: Logaston, 2013).
Toch, Michael, 'Migrations, Settlement, Population', *The Encyclopedia of Global Human Migration* (The Hebrew University of Jerusalem, 2013).
Toch, Michael, 'Was There a Jewish Slave Trade (or Commercial Monopoly) in the Early Middle Ages?', in Stefan Hanß, Juliane Schiel, and Claudia Schmid, eds., *Mediterranean Slavery Revisited (500–1800)* (Zürich: Chronos, 2014): pp. 421–444.
Tolan, John, *Petrus Alfonsi and his Medieval Readers* (Gainesville: University Press of Florida, 1993).
Tomasch, Sylvia and Gilles, Sealy, eds, *Text and Territory: Geographical Imagination in the European Middle Ages* (Philadelphia: University of Pennsylvania Press, 1998).
Tosi, Michele, ed, *Gerberto, Scienza, Storia e Mito: Atti Del Gerberti Symposium, Bobbio 25–27 Luglio 1983* (Bobbio (Piacenza) Italy: Archivi storici bobiensi, 1985).
Tran, Lina, 'NASA's THEMIS Sees Auroras Move to the Rhythm of Earth's Magnetic Field', NASA, September 12, 2016. https://www.nasa.gov/feature/goddard/2016/nasa-s-themis-sees-auroras-move-to-the-rhythm-of-earth-s-magnetic-field (accessed 11/05/2022).
Traube, Ludwig, 'Computus Helperici', *Vorlesungen und Abhandlungen*, Vol. 3 (Munich: C.H. Beck, 1920): pp. 128–152, originally printed in *Neues Archiv der Gesellschaft für Ältere Deutsche Geschichtskunde zur Beförderung einer Gesamtausgabe der Quellenschriften Deutscher Geschichten des Mittelalters* 18 (1893): pp. 71–105.
Treitler, Leo, 'Reading and Singing: On the Genesis of Occidental Music-Writing', *Early Music History* 4 (1984): pp. 135–208.
Treitler, Leo, 'The Early History of Music Writing in the West', *Journal of the American Musicological Society* 35, no. 2 (1982): pp. 237–279.
Truitt, Elly R., 'Celestial Divination and Arabic Science in Twelfth-Century England: The History of Gerbert of Aurillac's Talking Head', *Journal of the History of Ideas* 73, no. 2 (2012): pp. 201–222.
Truitt, Elly R., *Medieval Robots: Mechanism, Magic, Nature and Art* (Philadelphia: University of Pennsylvania Press, 2015).

Turnock, Jonathan Andrew, 'Reconsidering the Reign of King Stephen: a Contextual Study of Sculpture Created in Gloucestershire between 1135 and 1154' (MA Thesis, Durham University, 2015).
Tuttle, M.P., Hengesh, J., Tucker, K.B., Lettis, W., Deaton, S.L., and Frost, J.D., 'Observations and Comparisons of Liquefaction Features and Related Effects Induced by the Bhuj Earthquake', *Earthquake Spectra* 18 (2002): pp. 79–100.
Tyerman, C.J., *England and the Crusades 1095–1588* (Chicago and London: University of Chicago Press, 1988).
Unger, Richard, *The Ship in the Medieval Economy, 600–1600* (Aldershot: Ashgate, 1997).
Vallicrosa, José María Millás, 'La aportación astronómica de Pedro Alfonso', *Sefarad* 3 (1943): pp. 65–105.
Vallicrosa, José María Millás, *Assaig d'història de Les Idees Físiques i Matemàtiques a La Catalunya Medieval* (Barcelona, 1931).
Van der Vijver, A., 'Les oeuvres inédites d'Abbon de Fleury', *Revue Bénedictine* 47 (1935): pp. 125–169.
Vanderputten, Steven, Snijders, Tjamke, and Diehl, Jay., eds., *Medieval Liège at the Crossroads of Europe: Monastic Society and Culture, 1000–1300* (Turnhout: Brepols, 2017).
Vaughn, Sally N. and Rubenstein, Jay, eds., *Teaching and Learning in Northern Europe: 1000–1200* (Turnhout: Brepols, 2006).
Vaughn, Sally, 'Robert of Meulan and Raison d'Etat in the Anglo-Norman State, 1093–1118', *Albion* 10 (1978): pp. 352–373.
Verbist, Peter, *Duelling with the Past: Medieval Authors and the Problem of the Christian Era, c. 990–1135* (Turnhout: Brepols, 2010).
Villegas-Aristizábal, Lucas, 'Revisiting the Anglo-Norman Crusaders' Failed Attempt to conquer Lisbon c. 1142'. *Portuguese Studies* 29 (2013): pp. 7–20.
Von den Brincken, Anna-Dorothee, 'Marianus Scottus unter besonderer Berücksichtigung der nicht veröffentlichen Teile seiner Chronik', *Deutsches Archiv für Erforschung des Mittelalters* 17 (1961): pp. 191–238.
Von Döllinger, Johannes Joseph Ignaz, *Die Pabst-Fabeln des Mittelalters: Ein Beitrag zur Kirchengeschichte* (Munich: J.G. Cotta, 1863).
Walker, David, 'Gloucestershire Castles', *Transactions of the Bristol and Gloucestershire Archaeological Society* 109 (1991): pp. 5–23.
Wallis, Faith, 'Albums of Science in Twelfth-Century England', *Peritia* 28 (2017): pp. 195–224.
Wallis, Faith, 'Oxford St. John's College, MS 17', *The Calendar and the Cloister* (Oxford: St. John's College), http://digital.library.mcgill.ca/ms-17/ (accessed 05/05/2019)
Wallis, Faith, 'What a Medieval Diagram Shows: A Case Study of 'Computus'', *Studies in Iconography* 36 (2015): pp. 1–40.
Warntjes, Immo and Cróinín, Dáibhí Ó., eds., *Computus and its Cultural Context in the Latin West, AD 300–1200. Proceedings of the 1st International Conference on the Science of Computus in Ireland and Europe* (Turnhout: Brepols, 2010).
Warntjes, Immo and Cróinín, Dáibhí Ó., eds., *Late Antique Calendrical Thought and its Reception in the Early Middle Ages. Proceedings of the 3rd International Conference on the Science of Computus in Ireland and Europe* (Turnhout: Brepols, 2017).
Warntjes, Immo, 'Computus as Scientific Thought in Ireland and the Early Medieval West', in Roy Flechner and Sven Meeder, eds., *The Irish in Early Medieval Europe: Identity, Culture and Religion* (London: Palgrave, 2016): pp. 158–178.

Warntjes, Immo, 'Introduction: State of Research on Late Antique and Early Medieval Computus', in Immo Warntjes and Dáibhí Ó. Cróinín, eds., *Late Antique Calendrical Thought and its Reception in the Early Middle Ages. Proceedings of the 3rd International Conference on the Science of Computus in Ireland and Europe* (Turnhout: Brepols, 2017): pp. 1–42.
Warntjes, Immo, 'Seventh-Century Ireland: The Cradle of Medieval Science?', in Mary Kelly and Charles Doherty, eds., *Music and the Stars. Mathematics in Medieval Ireland* (Dublin: Four Courts Press, 2013): pp. 44–72.
Warntjes, Immo, 'The *Argumenta* of Dionysius Exiguus and Their Early Recensions', in Immo Warntjes and Dáibhí Ó. Cróinín, eds., *Computus and its Cultural Context in the Latin West, AD 300–1200. Proceedings of the 1st International Conference on the Science of Computus in Ireland and Europe* (Turnhout: Brepols, 2010): pp. 40–111.
Warntjes, Immo, 'The Continuation of the Alexandrian Easter Table in Seventh-Century Iberia and its Transmission to Ninth-Century Francia', *Revue d'histoire des textes* n. s. 13 (2018): pp. 185–194.
Warntjes, Immo, 'The Munich Computus and the 84 (14)-Year Easter Reckoning'. *Proceedings of the Royal Irish Academy* 107 C (2007): pp. 31–85.
Wasserstein, David, *The Caliphate in the West: An Islamic Political Institution in the Iberian Peninsula* (Oxford: Clarendon Press, 2010).
Watkins, Priscilla, 'Lanfranc at Caen: Teaching by Example', in Sally N. Vaughn and Jay Rubenstein, eds., *Teaching and Learning in Northern Europe: 1000–1200* (Turnhout: Brepols, 2006): pp. 70–97.
Webber, Teresa, 'Books and Their Use across the Conquest', in T. Licence, ed., *Bury St Edmunds and the Norman Conquest* (Woodbridge: Boydell Press, 2014): pp. 160–189.
Webber, Teresa, *Scribes and Scholars at Salisbury Cathedral, c. 1075-1125 (Oxford: Clarendon Press, 2002).*
Weiler, Bjorn, 'William of Malmesbury, King Henry I, and the *Gesta regum Anglorum*', in Chris Lewis, ed., *Anglo-Norman Studies, XXI: Proceedings of the Battle Conference 2008* (Woodbridge: Boydell Press, 2009): pp. 157–176.
Welborn, Mary Catherine, 'Lotharingia as a Center of Arabic and Scientific Influence in the Eleventh Century', *Isis* 16, no. 2 (1931): pp. 188–199.
White, Lynn, 'Eilmer of Malmesbury, an Eleventh Century Aviator: A Case Study of Technological Innovation, its Context and Tradition', *Technology and Culture* 2, no. 2 (1961): pp. 97–111.
Whitehead, David, ed., *Medieval Art, Architecture and Archaeology at Hereford* (Leeds: British Archaeological Association, 1995).
Whitlock, Dorothy, Brett, Martin, Powicke, Frederick, Cheney, Christopher, and Brook, David, eds, *Councils and Synods: With Other Documents Relating to the English Church*, ii (Clarendon Press: 1981).
Whitlock, Dorothy, *After Bede* (Jarrow: Parish Jarrow, 1960).
Wilcox, Miranda, 'Confessing the Faith in Anglo-Saxon England', *The Journal of English and Germanic Philology* 113, no. 3 (2014): pp. 308–341.
Williams, Henry, *The Great Astronomers* (New York: Simon and Schuster, 1930).
Willis-Bund, J.W. and Page, William, eds., *A History of the County of Worcester: Volume 2* (London: Victoria County History, 1971).
Willis, D.M. and Stephenson, F.R., 'Solar and Auroral Evidence for an Intense Recurrent

Geomagnetic Storm during December in AD 1128', *Annales Geophysicae* 19 (2001): pp. 289–302.
Willis, D.M. and Stephenson, F.R., 'The Earliest Drawing of Sunspots', *Annales Geophysicae* 40 (1999): pp. 21–22.
Wilson, C., 'Serlo's Church at Gloucester, 1089–1100', in S. Heslop and V. Sekules, eds., *Medieval Art and Architecture at Gloucester and Tewkesbury* (London: British Archaeological Association, 1985): pp. 52–83.
Wilson, Jonathon, 'Enigma of the De expugnatione Lyxbonensi', *Journal of Medieval Iberian Studies*, 9 (2017).
Woosnam, Maxwell, *Eilmer, 11th Century Monk of Malmesbury: The Flight and the Comet: A Recent Investigation* (Malmesbury: Friends of Malmesbury Abbey, 1986).
Wormald, F., *English Benedictine Kalendars after A.D. 1100*, Vol. 2, (London: Henry Bradshaw Society, 1939).
Wright, Neil, ''Industriae Testimonium': William of Malmesbury and Latin Poetry Revisited', *Revue Bénédictine* 103 (1993): pp. 482–531.
Wright, Neil, 'William of Malmesbury and Latin Poetry: Further Evidence for a Benedictine's Reading', *Revue Bénédictine* 101 (1991): pp. 122–153.
Yau, Kevin Kam Ching, 'An Investigation of Some Contemporary Problems in Astronomy and Astrophysics by Way of Early Astronomical Records' (PhD Thesis, Durham University, 1988).
Ye'or, Bat, *The Dhimmi, Jews and Christians Under Islam,* in David Maisel, Paul Fenton, and David Littman, trans., (London, Associated University Presses, 1985).
Zuccato, Marco, 'Gerbert of Aurillac and a Tenth-Century Jewish Channel for the Transmission of Arabic Science to the West', *Speculum* 80, no. 3 (2005): pp. 742–763.