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(*b*. Bath. England; *fl*. 1116–1142)

mathematics, *astronomy*.

Among the foremost of medieval English translators and natural philosophers. Adelard of Bath was one of the translators who made the first wholesale conversion of Arabo-Greek learning from Arabic into Latin. He traveled widely, first journeying to France, where he studied at Tours and taught at Laon. After leaving Laon, he journeyed about for seven years. Visiting Salerno, Sicily (before 1116, perhaps before 1109), Cilicia, Syria, and possibly Palestine. It seems probable that he spent time also in Spain, on the evidence of his manifold translations from the Arabic (particularly his translation of the astronomical tables of al-Khwārizmī, from the revised form of the Spanish astronomer Maslama al-Majrīṭī).

It may be, however, that he learned his Arabic in Sicily and received Spanish-Arabic texts from other Arabists who had lived in or visited Spain, for example, Petrus Alphonsus and Johannes Ocreatus. He is found in Bath once more in 1130 when his name is mentioned in the Pipe Roll for 31 Henry I as receiving 4*s*. 6*d*. from the sheriff of Wiltshire. There are several indications in his writings of some association with the royal court. The dedication of his *Astrolabe* to a young Henry (*regis nepos*) seems to indicate a date of composition for that work between 1142 and 1146, and no later date for his activity has been established. F. Bliemetzrieder[1] has attempted to show that Adelard made a later trip to Salerno and Sicily, where he undertook the translation from the Greek of the *Almagest* of Ptolemy (completed about 1160), but a lack of any positive evidence and an improbable chronology militate against acceptance of this theory.

Adelard's modest contributions to medieval philosophy are found in two of his works: *De eodem et diverso* (1), written prior to 1116 and dedicated to William, bishop of Syracuse, and *Quaestiones naturales* (6), certainly written before 1137 and probably much earlier. [The numbers assigned here to the works of Adelard are those used by Haskins[2] The author of this article has divided no. (5) into three parts, (5*a*), (5*b*), and (5*c*), and also has added a no. (15), which may reflect a further possible work.]

In the first work no trace of Arabic influence is evident, and he speaks as a quasi Platonist. From the *Timaeus*, he drew the major theme of *Philosophia* as representing "the same" and *Philocosmia* "the diverse." To the problem of universals, Adelard proposed as a kind of harmonizing of Plato and Aristotle his theory of *respectus*, that is, that the names of individuals, species, and genus are imposed on the same essence but under different aspects. ("Nam si res consideres, eidem essentiae et generis et speciei et individui nomina imposita sunt, sed respectu diverso."[3])

Both in *De eodem et diverso* and *Quaestiones naturales*, Adelard exhibits eclectic tendencies rather than strictly Platonic views. The *Natural Questions*, a dialogue with his unnamed nephew, comprises seventy-six chapters covering such manifold subjects as the nature and growth of plants (with attention to the doctrine of the four elements and four qualities); the nature of animals (including the question of whether animals have souls, which is answered in the affirmative); the nature of man (including his psychology and physiology); and meteorology, physics, and astrology.

Although professedly written to reveal something of his recent Arabic studies, no Arabic author is mentioned by name or quoted directly. Still the work shows traces of Arabic influence. The nephew describes a pipette-like vessel with holes in both ends. Water is prevented from flowing out of the holes in the lower end by covering the holes in the upper end with the thumb; "but with the thumb removed from the upper perforations the water [is] wont to flow immediately through the lower holes."[4] This is not unlike the vessel described in Hero's *Pneumatica* or in Philo of Byzantium's *Pneumatica*, which was translated from the Arabic in the twelfth century. Adelard explains this phenomenon by using a theory of the continuity of elements; no element will leave its place unless another element succeeds it; but with the upper holes covered and a vacuum formed, no air can enter the tube to replace the water. Hence the water cannot fall from the open holes below until the upper holes are uncovered and air can enter and replace it.

While there is some tendency to exaggerate Adelard's use of observation and experiment, it is clear that the *Natural Questions* exhibits a naturalistic trend, a tendency to discuss immediate natural causation rather than explain natural phenomena in terms of the supernatural.[5] This was also to become the practice of later writers such as William of Auvergne and Nicole Oresme. Adelard expressly prefers reason to authority, calling authority a capistrum ("halter") like that used on brutes.[6] He claims in the final chapter of the *Natural Questions* that he will write (7) on pure elements, simple forms, and the like, which lie behind the composite things treated in the *Natural Questions*; but no such work has been found.

There is extant, however, the tract *On Falcons* (8), which harkens back to the *Natural Questions*. According to Haskins, it is the "earliest Latin treatise on falconry so far known."[7] Perhaps also indicative of his interest in natural phenomena is the

enlarged edition of the work on chemical recipes, *Mappae clavicula* (12), which is attributed to him.[8] However, the pristine version of that work is far earlier than Adelard. It is possible that some miscellaneous notes (14) that appear in a manuscript at the British Museum are by Adelard.[9] These are philosophical, astronomical, cosmological, and medical notes that seem to conform to Adelard's wide naturalistic interests, and the lunar cycle therein is that of 1136–1154.

Adelard's chief role in the development of medieval science lay, as has been noted, not so much in his contributions to natural philosophy as in the various translations he made from the Arabic. His translations were of a crucial and seminal nature in several areas.

Adelard gave the Latin Schoolmen their first example of the work of one of the most important Arabic astrologers with his *Ysagoga minor Japharis matematici in astronomicam per Adhelardum bathoniensem ex arabico sumpta* (10), a translation of Abū *Maʿshar's Shorter Introduction to Astronomy*.[10] Consisting of some astrological rules and axioms, it was abridged by Abū Maʿshar from his longer *Introductorium maius*. Adelard's translation may well have served to whet the appetite of the Schoolmen for the longer work, which was twice translated into Latin: by John of Seville in 1135 and five years later by Hermann of Carinthia. Adelard also translated an astrological work of Thābit ibn Qurra on images and horoscopes, *Liber prestigiorum Thebidis (Elbidis) secundum Ptolomeum et Hermetem per Adelardum bathoniensem translatus (11)*.[11]

In astronomy Adelard's most significant achievement was his translation of the *Astronomical Tables* of al-Khwārizmī, *Ezich Elkauresmi per Athelardum bathoniensem ex arabico sumptus* (3). At the end of chapter 4, the Arabic date a.h. 520 Muḥarram 1 is said to be 26 January 1126,[12] and this has usually been taken as the approximate date of translation. However, a manuscript at Cambridge gives examples for 1133 and 1134 and mentions a solar eclipse in 1133, throwing some doubt on the date.[13] These additional examples may, of course, be accretions not present in the original translation. How dependent this translation was on a possible earlier translation of the *Tables* by Petrus Alphonsus cannot definitely be determined from the available evidence. Millás-Vallicrosa has proposed that Petrus composed an earlier translation or adaptation of al-Khwārizmī's work, which Adelard then retranslated in 1126 with the assistance or collaboration of Petrus himself.[14]

At any rate, the *Tables* (comprising some 37 introductory chapters and 116 tables in the edition published by Suter) provided the Latin West with its initial introduction (in a considerably confused form) to the complex of Hellenistic-Indian-Arabic tabular material, including, among others, calendric tables; tables for the determination of the mean and true motions of the sun, moon, and planets; and trigonometric tables. (Tables 58 and 58a were very probably the first sine tables to appear in Latin.) In addition to this basic translation, Adelard also composed a tract on the *Astrolabe* (9),[15] continuing a line of work that began with translations from the Arabic as early as the middle of the tenth century. It is in this work that he cites his *De eodem ei diverso*, his translation of the *Tables* of al-Khwārizmī, and his rendering of the Elements of Euclid.

Adelard's earliest efforts in arithmetic appear in a work entitled Regule abaci (2), which was apparently a work composed prior to his study of Arabic mathematics, for it is quite traditional and has Boethius and Gerbert for its authorities. But another work, the *Liber ysagogarum Alchorismi in artem astronomicam a magistro* A. composites (4), based in part on Arabic sources, might well have been composed by him. Manuscript dates and internal evidence point to a time of composition compatible with the period in which Adelard worked. Hence the "magister A." is usually thought to be Adelard. The first three books of this work are concerned with arithmetic; the remaining two consider geometry, music, and astronomy. The subject of Indian numerals and the fundamental operations performed with them is introduced as follows: "... since no knowledge (*scientia*) goes forth if the doctrine of all the numbers is neglected, our tract begins with them, following the reasoning of the Indians." [16](The section on geometry is, however, based on the Roman-Latin tradition rather than the Arabic-Indian tradition. The astronomical section returns to Arabic and Hebrew sources.) It has been suggested that the first three books on Indian reckoning have been drawn from an early Latin translation of al-Khwārizmī's *De numero Indorum* (not extant in its pristine state) or from a version of that translation revised sometime before 1143, which is preserved in an incomplete state at Cambridge and which has the incipit "Dixit algorizmi laudes deo rectori …"[17] This work has been published three times: in transcription by B. Boncompagni,[18] in transcription and facsimile by K. Vogel,[19] and in facsimile only by A.P. Youschkevitch.[20] without any decisive evidence, that the original Latin translation of the *De numero Indorum* was executed by Adelard.

Adelard of Bath in all likelihood was the first to present a full version, or versions, of the *Elements* of Euclid in Latin and thus to initiate the process that led to Euclid's domination of high and late medieval mathematics. Prior to Adelard's translation (5*a*-5*c*) from the Arabic, the evidence exists that there were only grossly incomplete translations from the Greek, such as that of Boethius. Adelard's name is associated in twelfth-century manuscripts with three quite distinct versions. Version 1(5*a*) is a close translation of the whole work (including the non-Euclidean Books XIV and XV) from the Arabic text, probably that of al-Hajjāj. No single codex contains the whole version, but on the basis of translating techniques and characteristic Arabicisms the text has been pieced together.[23] Only Book IX, the first thirty-five propositions of Book X, and the last three propositions of Book XV are missing.

The second treatment of the *Elements* bearing Adelard's name, Version II (5*b*), is of an entirely different character. Not only are the enunciations differently expressed but the proofs are very often replaced by instructions for proofs or outlines of proofs. It is clear, however, that this version was not merely a paraphrase of Version I but derives at least in part from an Arabic original since it contains a number of Arabicisms not present in Version I. It may be that Version II was the joint work of Adelard and his student Johannes Ocreatus or that Ocreatus revised it in some fashion since some manuscripts of Version II include a statement specifically attributed to "Joh. Ocrea," i.e., Ocreatus.[24] (In another work, addressed "to his master Adelard of Bath," Ocreatus' name is given as "N. Ocreatus.") It was Version II that became the most popular of the various translations

of the *Elements* produced in the twelfth century. Apparently this version was the one most commonly studied in the schools. Certainly its enunciations provided a skeleton for many different commentaries, the most celebrated of which was that of [Campanus of Novara](#), composed in the third quarter of the thirteenth century. Version II also provided the enunciations for Adelard's Version III (5*c*).

Version III does not appear to be a distinct translation but a commentary. Whether or not it is by Adelard, it is attributed to him and distinguished from his translation in a manuscript at the Bibliothèque National in Paris;[25] and judging from a twelfth-century copy at Oxford,[26] it was written prior to 1200. This version enjoyed some popularity and was quoted by [Roger Bacon](#), who spoke of it as Adelard's *editio specialis*. Still another quasi commentary, consisting of a hodgepodge of geometrical problems, is found in a Florence manuscript, *Bachon Alardus in 10 Euclidis* (15).[27] It may be based in some way on a work of Adelard. Incidentally, the set of proofs for the *Elementa de ponderibus*, which were almost certainly composed by Jordanus de Nemore, is assigned in one manuscript to "Alardus."[28] Finally, in the area of geometry, note should be made of a thirteenth-century reference to a commentary on the *Spherica* of Theodosius, *Dicti Theodosii liber de speris, ex commentario Adelardi* (13), in the *Biblionomia* of Richard de Fournival.[29] No such work has been found, and the fact that the *Spherica* was translated only later by [Gerard of Cremona](#) makes it quite unlikely that Adelard did a commentary. The foregoing is an impressive list of geometrical translations and compositions; and, if by any chance, Bliemetzrieder should be proven correct concerning Adelard's role as the translator of the *Almagest* of Ptolemy, then the recently discovered translation from the Greek of the *Elements*[30] would also have to be assigned to Adelard since both translations exhibit identical translating techniques and styles.

The conclusion that must be drawn from the widespread translating activity described above is that Adelard should be considered, along with [Gerard of Cremona](#) and William of Moerbecke, as one of the pivotal figures in the conversion of Greek and Arabic learning into Latin.

NOTES

1. Bliemetzrieder, *Adelhard von Bath*, pp. 149–274,

2. Haskins, *Studies in Medieval Science*, ch. 2.

3. *De eodem*, edit. of Willner. p. 11. II. 20–21

4. *Quaestiones naturales*, edit. of Müller, ch. 58, p. 53.

5. *Ibid*., ch. 4.p. 8.

6. *Ibid*., ch. 6, p. 11,

7. Haskins, p. 28.

8. Brit. Mus., Royal MS 15.C.iv., Table of Contents.

9. Brit. Mus., Old Royal and King's Collections. MS 7.D.xxv

10. Oxford. Bodleian Lib. MS Digby 68, 116r. The opening paragraphs are published in Richard Lemay, *Abu Maʿshar*, p. 355.

11. MS Lyons 328. 70r-74r, is among the extant MSS.

12. Edit. of Suter in Björnbo et al., ch. 4. p. 5.

13. Oxford, [Corpus Christi](#) Coll. MS 283. f. 142r.

14. Millás-Vallicrosa, *Nuevos estudios*, p. 107.

15. Cf. Cambridge. Fitzwilliam Mus., McClean MS 165, ff. 8lr-88r, and Brit. Mus. Arundel MS 377, ff. 69r-74r.

16. *Liber ysagogarum*, edit. of Curtze, p. 18.

17. Cambridge Univ. Lib. MS li.6.5.

18. *Trattati d'aritmetica*, pp. 1–23

19. *Mohammed ibn Musa Alchwarizmi's Algorismus.*

20. "Über ein Werk," pp. 1–63: cf. his earlier paper, in Russian, cited on p. 22. n.2.

21. *Op. cit.*, p. 43.

22. *Op. cit.*, p. 22.

23. Clagett, "The Medieval Latin Translations," p. 18.

24. *Ibid.*, p. 21.

25. Paris, BN MS Lat. 16648, f. 58r.

26. Oxford, Balliol Coll. MS 257.

27. Bibliotheca Nazionate Central Conv. Soppr. J.IX.26. 46r-55r.

28. Oxford, Corpus Christi Coll., MS 251, 10r-12v.

29. Haskins, p. 31.

30. Cf. paris. BN MS Lat. 7377 and Florence, Bibliotheca Nazionale Centrale Conv. Soppr. C.I.448.

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For the texts of Adelard's translations and studies on his activities, see A. Björnbo, R. Besthorn, and H. Suter, *Die astronomischen Tafeln des Muḥammed ibn* Mūsāal-Khwārizmī der Bearbeitung des Maslama ibn Aḥmed al-MadjrutT (Copenhagen, 1914) : F. Bliemetzriedcr, Adel-hard von Bath (Munich, 1935); B. Boncompagni., *Trattati d'aritmetica, I. Algoritmi de numero Indorum* (Rome, 1857). pp. 1–23; M. Clagett, "The Medieval Latin Translations from the Arabic of the *Elements* of Euclid. with Special Emphasis on the Versions of Adelard of Bath," in *Isis*, **44** (1953), 16–42; C. H. Haskins, *Studies in the History of Mediaeval Science*, 2nd ed. (Cambridge, Mass., 1927). pp. 20–42; R. Lemay, *Abu Maʿshar and Latin Aristotelianism in the Twelfth Century* (Beirut, 1962). p. 355; and J.M. Millá-Vallicrosa, "La aportación astronómica de Pedro Alfonso," in *Sefaras*, **3** (1943), 65–105., and *Nuevos estudios sobre historia de la ciencia expaññola* (Barcelona, 1960), pp 105–108; O. Neugebauer, *The Astronomical Tables of al-Khwārizmī. Translation with Commentaries of the Latin Versions edited by H. Suter supplemented by Corpus Christi College MS 283* (Copenhagen, 1962); T. Phillipps, "The *Mappae Clavicula*; a Treatise on the Preparation of Pigments During the Middle Ages," in *Archaeologia*, **32** (1847), 183–244; G. Sarton, *Introduction to the History of Science*, II (Baltimore, 1931). 167–169; L. Thorndike, *A History of Magic and Experimental Science*, II (New York, 1923), 19–49; K. Vogel, *Mohammed ibn Musa Alchwarizmi's Algorismus* (Aalen, 1963); A. P. Youschkevitch, "Über ein Werk des 'Abdallah Muḥammad ibn Mūsā al-Ḫuwārizmī al-Maǧusī zur Arithmetik der Inder," in Beiheft 1964 zur Schriftenreihe Geschichte der Naturwissenschaften, Technik and Medizin,.

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