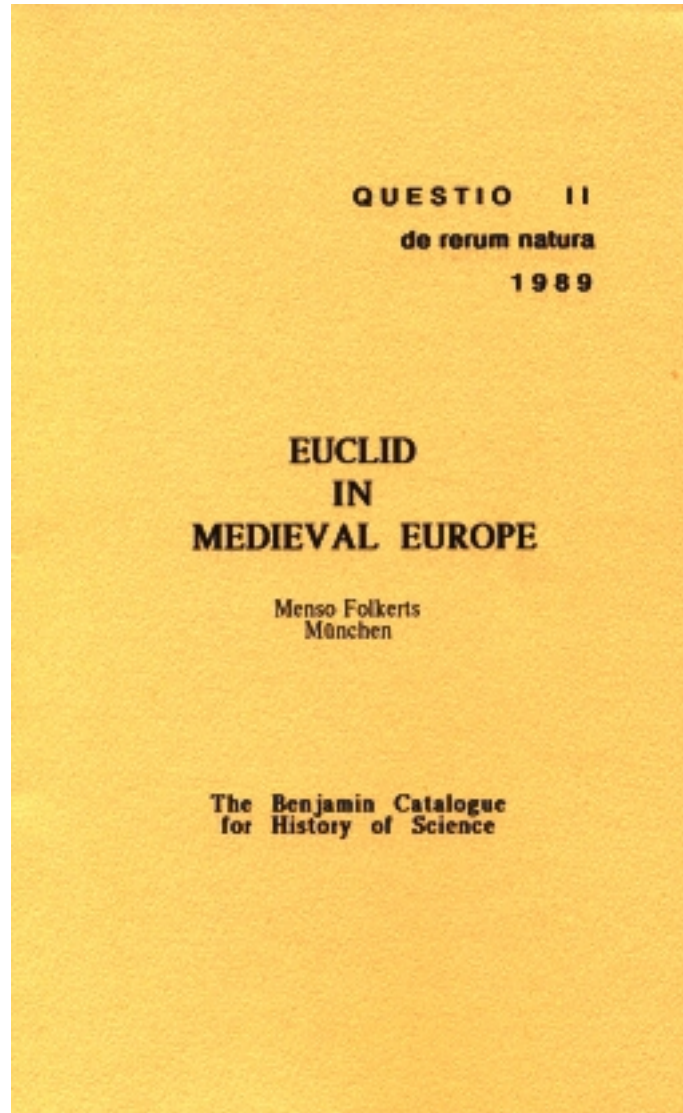

Euclid in Medieval Europe

by Menso Folkerts



Euclid's *Elements* played an important role in the Middle Ages, rivalled in the legacy of Greek science to the period perhaps only by Ptolemy's *Almagest*. This was probably largely due to the emphasis on logic in later medieval education. For a long time, Euclid's text was represented only by the fragments reputed to have originated in a translation by the late Roman philosopher Boethius. And during these early years it is almost certain that its true significance was not appreciated. But in the twelfth century it was introduced in its complete form along with other remnants of Greek science through the medium of translations from the Arabic. There seem to have been a very small number of independent translations, but the first six books of the *Elements* became part of the basic curriculum of that time, and copies spread throughout Europe. Many manuscripts from this period are still to be found among collections today. Most are rather drab productions when compared to the fancier manuscripts of that time, but some have been illuminated and are in places quite beautiful. Almost all include geometrical diagrams - some familiar to us from modern editions, but some in a tradition of their own. Microfilm copies of some are available in a few university collections.

Much of what we know about Euclid's *Elements* and the extant manuscripts from this period is discussed in the following paper by [Dr. Menso Folkerts](#) of the [Institut für Geschichte der Naturwissenschaften](#) of the University of München (Munich, Germany). It has two parts: (1) a general discussion of the medieval Latin texts of Euclid's *Elements*, and (2) a list of all manuscripts of the *Elements* known to Dr. Folkerts at the time he wrote. This paper was originally published in a booklet by the University of Winnipeg in 1989, and based on a presentation made by Dr. Folkerts on October 21, 1986, in the course of a workshop entitled *Summary Catalogues of Medieval Manuscripts - a computer-assisted project*. This publication was of only limited distribution, and we are fortunate that Dr. Folkerts has allowed - even encouraged - us to post it here.

Since that time, Dr. Folkerts tells us, many new results on the medieval Euclid have been found, concerning the Latin as well as the Arabic texts. In particular, the version which is called here "Adelard II" has been edited since that time by Dr. H. L. L. Busard and Dr. Folkerts. Other commentaries and versions have been edited by Dr. Busard, and some will be published soon. Dr. Folkerts' original pamphlet has been updated here to take into account some of these new developments. A list of some recent publications has been included in an appendix.

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No attempt has been made to render Arabic words exactly. To indicate this, they are displayed in blue.

Introduction

A survey of our present knowledge of the medieval translations of Euclid's *Elements* into Latin would clarify the relations of many texts and would distinguish them from later reworkings of the texts. First let us distinguish between translations of Euclid's *Elements* into Latin directly from the Greek and translations from the Arabic (which in turn had come from the Greek).

We begin with the direct translations. The most important was that of Boethius, which has been made in about the year 500. Only parts of this translation are extant in four different fragments dating from the eighth to the eleventh centuries. [Note 1: See M. Folkerts, *The Importance of the Pseudo-Boethian Geometria During the Middle Ages*, in: *Boethius and the Liberal Arts. A Collection of Essays*, edited by Michael Masi (Bern/Frankfurt/Las Vegas: Peter Lang, 1981), pp.187-209.] These fragments are:

- in the so-called "third" recension of Cassiodorus' *Institutiones* [Note 2: Extant are: I def. 1-12.14.13.15-23, post. 1-5, ax. 1.3.2.7; II def. 2; V def. 1-8.11.9.10.13.12.14-16.18.17.]
- in manuscripts of the *Corpus agrimensorum* [Note 3: Extant are: I def. 1-12.14.13.15-23, post. 1-5, ax. 1.3.2.7, prop. 1-3 with proofs.]
- in the so-called *Geometry I* attributed to Boethius [Note 4: Extant are: I def. 1-12.14.13.15-23, post. 1-5, ax. 1.3.2.7; II def. 1.2, prop. 1; III def. 1-6.8-11; IV def. 1.2, prop. 1; III def. 6.8; I prop. 2-4.6-8.(9).10-18.21.23.26-28.31-37.39-41.43.42.44-48; II prop. 1.3-6.9-12.14; III prop. 3.7 beginning. 22 end. 27.30-33; IV prop. 1-4.6.8.12.11; III prop. 7 end. 9.12.10.13.14.16.18.19.24.22 beginning (all propositions without proofs).]
- in the so-called *Geometry II* attributed to Boethius. [Note 5: Extant are: I def. 1-12.14.13.15-23, post. 1-5, ax. 1.3.2.7; II def. 1.2; III def. 1-6.8-11; IV def. 1.2; I prop. 1-8.(9).10-41.43.42.44-48; II prop. 1.3-6.9-12.14; III prop. 3.7 beginning. 22.27.30-33; IV prop. 1-4.6.8.12.11 (all propositions without proofs); further, I prop. 1-3 with proofs.]

The first three texts seem to have originated in Corbie in the eighth century; the fourth text was compiled in Lorraine in the first half of the eleventh century. I have tried to reconstruct the original translation from these fragments. [Note 6: Menso Folkerts, *"Boethius" Geometrie II, ein mathematisches Lehrbuch des Mittelalters* (Wiesbaden: Franz Steiner, 1970), esp. pp.173-217.] In the last few years little that is new has appeared on this subject, except for the discovery of ms Madrid, BN 9088, which contains *Geometry I*. Perhaps one should also mention that the twelfth-

century *Liber Ysagogarum Alchorismi* has been found to contain axioms and enunciations which may belong to the Boethius tradition but are not among the extant Boethius fragments. [Note 7: See the unpublished dissertation of Bruce G. Dickey, *Adelard of Bath: An Examination Based on Heretofore Unexamined Manuscripts* (Ph.D. dissertation, University of Toronto, 1982).]

There are two other anonymous Latin Euclid fragments from the fifth and ninth centuries respectively. The older of them is a palimpsest now in the Biblioteca Capitolare of Verona, ms XL (38). From the original text there are three double folios with parts of Euclid's *Elements*, books XI-XIII. [Note 8: There are parts of the propositions XI 24-25; XII 2-3.8; XIII, 2-3.7. The books XII and XIII are marked as XIII and XV.] Geymonat, who edited the text, [Note 9: *Euclidis Latine facti fragmenta Veronensia*, ed. M. Geymonat (Milano, Varese: Istituto Editoriale Cisalpino, 1964).] thinks that the writing can be dated to the last years of the fifth century and that we have here part of the original Boethius' translation. The second fragment was written at the beginning of the ninth century in a north-east French scriptorium; according to Bernhard Bischoff, it may be connected with the Palatine library of Charlemagne. [Note 10: B. Bischoff, in: *Mittelalterliche Studien*, Bd.3 (Stuttgart: Anton Hiersemann, 1981), pp.14.158.] This fragment, now in the University Library at Munich, [Note 11: Ms. 2^o 757. Besides older editions and comments by M. Curtze and A. A. Björnbo, there is a modern edition by M. Geymonat, *Nuovi frammenti della geometria 'boeziana' in un codice del IX secolo?*, in: *Scriptorium*, XXI (1967) 3-16.] contains Euclid, I 37 to 38 and II, 8 to 9. The translator obviously did not know the mathematical contents nor did he master the Latin grammar: he transliterated the mathematical terms as Greek expressions having similar letters and took Greek letters indicating the endpoints of segments as number symbols. Therefore, it seems very unlikely that this unique fragment has anything to do with the Boethian tradition.

Another direct translation -- this time fully extant -- was made in South Italy or Sicily in the twelfth century. There are translations of the *Almagest*, the minor writings of Euclid (*Data*, *Optics*, *Catoptrics*) and the *Elementatio physica* of Proclus of the same provenance and date. J. E. Murdoch has made a thorough analysis of this translation of the *Elements*, [Note 12: J. E. Murdoch, *Euclides Graeco-Latinus. A Hitherto Unknown Medieval Latin Translation of the Elements Made Directly from the Greek*, in: *Harvard Studies in Classical Philology*, LXXI (1966) pp.249-302.] and H. L. L. Busard has edited the text. [Note 13: H. L. L. Busard, *The Mediaeval Latin Translation of Euclid's Elements Made Directly from the Greek* (Stuttgart: Franz Steiner, 1987).] Unfortunately, we cannot say exactly how the manuscript exemplar used by the translator may be related to the extant Greek manuscripts. It should perhaps be added that, despite Heiberg's analysis of the manuscripts available to him, [Note 14: See the *Prolegomena critica in Euclidis Elementa. Edidit I.L.Heiberg. Vol.V* (Lipsiae: B.G.Teubner, 1888), pp.XXIII-CXIII.] the transmission of the Greek text of the *Elements* is itself unclear. There were of course later translations direct from the Greek by humanist scholars like Zamberto, but these do not concern us now. In any case there has been very little research on them.

Far more interesting than the early translations from the Greek are the twelfth-century translations into Latin from the Arabic. Unfortunately the transmission is extremely complicated

and is still partly unknown -- though in the last few years H. L. L. Busard and others have thrown some light on the situation. In addition, our understanding of the Arabic translations of Euclid by [Hajjaj](#) and [Ishaq-Thabit](#) has been deepened. I should like to make some remarks on some of these results.

The systematic examination of the Arabic-Latin tradition of Euclid's *Elements* began in 1953 with Marshall Clagett's fundamental article. [**Note 15:** [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* XLIV \(1953\) 16-42.](#)] For the first time three different texts were distinguished: version I, "a translation"; version II, "an abridgement"; version III, "an editio". From an examination of the most important manuscripts Clagett was able to characterize these three versions. He also tried to find the relations between the three versions and to decide which were genuine translations from the Arabic and what were the Arabic originals of these translations. He further gave a general description of the other Euclid translations from Arabic, namely those of Gerard of Cremona and Hermann of Carinthia, and also of medieval reworkings of the text. After this article was written it was the accepted theory that there are three Adelard versions of Euclid and a reworking by Campanus. Later, J. E. Murdoch showed that this gives too simple a picture and pointed to a number of "mélanges" and reworkings. [**Note 16:** [J. E. Murdoch, The Medieval Euclid: Salient Aspects of the Translations of the *Elements* by Adelard of Bath and Campanus of Novara, in *XII^e Congrès International d'Histoire des Sciences, Colloques \(= Revue de synthèse, 3^e série, nos 49-52; Paris 1968, pp.67-94.*\] Of all these versions and redactions only the Campanus reworking was in print before 1967 -- and that in the fifteenth and sixteenth centuries. Since this time H. L. L. Busard has published editions of the following translations: Hermann of Carinthia \(1967-1977\), \[**Note 17:** \[H. L. L. Busard, The Translation of the *Elements* of Euclid from the Arabic into Latin by Hermann of Carinthia\\(?\\): books I-VI, *Janus*, LIV \\(1967\\) 1-140, and published separately \\(Leiden: E. J. Brill, 1968\\); books VII-IX, *Janus*, LIX \\(1972\\) 125-187; books VII-XII \\(Amsterdam: Mathematisch Centrum, 1977\\).\]\(#\)\] Gerard of Cremona \(1983\), \[**Note 18:** \[H. L. L. Busard, The Latin translation of the Arabic version of Euclid's *Elements* commonly ascribed to Gerard of Cremona \\(Leiden: New Rhine Publishers, 1983\\).\]\(#\)\] Adelard I \(1983\). \[**Note 19:** \[H. L. L. Busard, The First Latin Translation of Euclid's *Elements* Commonly Ascribed to Adelard of Bath \\(Toronto: Pontifical Institute of Mediaeval Studies, 1983\\).\]\(#\)\] A critical edition of the Adelard II version, which has an important place in the transmission of the text, has been being prepared by Busard and myself. \(H. L. L. Busard, M. Folkerts \(eds.\), *Robert of Chester's \(?\) Redaction of Euclid's *Elements*, the so-called Adelard II Version. 2 vols. Basel / Boston / Berlin: Birkhäuser Verlag, 1992.*\) In the introductions to his editions Busard has collected the available information about the authors and their texts, and in an article he gave information on further, hitherto unknown, reworkings of the text. \[**Note 20:** \[H. L. L. Busard, Some Early Adaptations of Euclid's *Elements* and the Use of its Latin Translations, in: *Mathemata. Festschrift für Helmuth Gericke, ed. M. Folkerts and U. Lindgren \\(Stuttgart: Franz Steiner, 1985\\), pp.129-164.*\\] Yet other results about the connections between the Arabic and Latin versions were published in 1985 by P. Kunitzsch. \\[**Note 21:** \\[Paul Kunitzsch, Findings in Some Texts of Euclid's *Elements* \\\(Mediaeval Transmission, Arabo-Latin\\\), in: *Mathemata. Festschrift für Helmuth Gericke, ed. M. Folkerts and U. Lindgren \\\(Stuttgart: Franz Steiner,*\\]\\(#\\)\]\(#\)](#)

1985), pp.115-128.] These questions were also treated by R. Lorch and M. Folkerts in the Adelard Colloquium held at the Warburg Institute in 1984 and again by C. Burnett, M. Folkerts and R. Lorch in an Addendum published in the proceedings of this conference. [Note 22: R. Lorch, *Some Remarks on the Arabic-Latin Euclid*, in: *Adelard of Bath. An English Scientist and Arabist of the Early Twelfth Century*, ed. by Charles Burnett (London: The Warburg Institute, 1987), pp. 45-54. - M. Folkerts, *Adelard's Versions of Euclid's Elements*, in: *Adelard of Bath ...*, pp.55-65. - Addendum, pp.65-68.]

Questions about the Arabic-Latin translations of Euclid cannot be separated from questions about the state of the Arabic text. Which Arabic versions could the translators have had before them in the twelfth century? It is known that the *Elements* had been translated or reworked by al-Hajjaj, Ishaq b. Hunayn and Thabit b. Qurra. We know far too little about the characteristics of these versions. Only the Hajjaj version is in print and that from an incomplete and contaminated manuscript. [Note 23: Ed. by R. O. Besthorn et al., *Codex Leidensis 399,1. Euclidis Elementa ex interpretatione al-Hadschschadschii cum commentariis al-Narizii* (Copenhagen, 1893-1932).] The study of the Arabic tradition has been scarcely begun. After Klamroth's excellent article (1881) on the Arabic Euclid, [Note 24: M. Klamroth, *Über den arabischen Euklid*, in: *Zeitschrift der Deutschen Morgenländischen Gesellschaft*, XXXV (1881) 270-326, 788.] the only editions of pre-thirteenth century texts are books V and VII-IX of the Ishaq-Thabit version. These editions are Harvard Ph.D. theses by John Engroff and Gregg De Young. [Note 25: J. W. Engroff, *The Arabic Tradition of Euclid's Elements: Book v* (unpublished Ph.D. dissertation: Harvard University, 1980), not seen; G. De Young, *The Arithmetic Books of Euclid's Elements in the Arabic Tradition* (unpublished Ph.D. dissertation: Harvard University, 1981). The results are summarized in G. De Young, *The Arabic Textual Traditions of Euclid's Elements*, in: *Historia Mathematica*, XI (1984) 147-160.]

According to the *Fihrist* of Ibn al-Nadim, Hajjaj translated the *Elements* twice. [Note 26: M. Steinschneider, *Euklid bei den Arabern*, in: *Zeitschrift für Mathematik und Physik, hist.-lit. Abth.*, XXXI (1886) 81-110.] Of the two translations the second "for al-Ma'mun," he says, is better than the first "for Harun." Hajjaj I appears to have been lost. The first six books and a few definitions of book VII of one -- as it seems, the second -- Hajjaj version, together with Nayrizi's commentary, are extant in ms Leiden 399,1 -- and this is the printed version I have just mentioned. It is possible that we also have books XI-XIII in the Hajjaj version, if we can believe the scribe of the Arabic manuscript København 81. The problem here is that the readings in ms København 81 is too close to the corresponding passages in the Ishaq-Thabit manuscripts to represent an independent translation; in fact M. Klamroth in 1881 claimed that there was no more divergence than one would expect from normal manuscript transmission. [Note 27: See note 24.] But we should also note that Kunitzsch's recent investigation revealed sufficient differences to justify the assumption of some kind of independent transmission. [Note 28: See note 21.] There are manuscripts in Leningrad, Teheran and in the El Escorial which probably also carry a text similar to København 81, but they have not yet been investigated.

Another translation is ascribed to Ishaq b. Hunayn. No manuscript of this translation is known.

But **Thabit's** redaction of this text is extant in at least 19 manuscripts. The by far oldest manuscript is Teheran, Malik 3586, which -- according to the subscriptions in books III, VI, and VII -- was written in A.H.343 = A.D.954/55; the missing part at the end of book VII is now Teheran, **Danishgah** 2120. The manuscripts do not all carry the same text. At least two of them are contaminated with **Hajjaj** readings. [**Note 29: El Escorial 907; Leningrad, Akademia Nauk C 2145.**] Further, De Young has identified two recensions, which he calls A and B, in books VII and VIII within the "**Ishaq-Thabit**" tradition. The manuscripts are not constant in their affiliation. P. Kunitzsch attributes one recension to **Hajjaj** and the other to **Ishaq-Thabit**. [**Note 30: See note 21, pp.116-117.**] In the thirteenth century the two texts -- **al-Hajjaj** and **Ishaq b. Hunayn** improved by **Thabit ibn Qurra** -- were available to **Nasir al-Din al-Tusi**. He made several remarks about the differences between them in his *Tahrir*, of which we have several manuscripts. There is another *tahrir*, also attributed to **Nasir al-Din** and printed in Rome in 1594, which gives us other information about the two translations. The thirteenth century redactor tells us that certain theorems were omitted by **Hajjaj** but are included by **Ishaq-Thabit**. [**Note 31: See C. Thaer, Die Euklid-Überlieferung durch al-Tusi, in: Quellen und Studien zur Geschichte der Mathematik, Astronomie und Physik, Abt. B: Studien, III (1936) 116-121. The propositions are: I,45; VI,12; VII,24,25 (in Thabit's numbering; not present in Heiberg's Greek); X,27,28 (in Heiberg; X,21,22 in Thabit).**]

We come now to the four most important twelfth century Latin texts which are assumed to be translations from the Arabic: 1) the one ascribed to Hermann of Carinthia, 2) the one ascribed to Gerard of Cremona, 3) and 4) the two versions ascribed to Adelard of Bath, called Adelard I and Adelard II. The "Hermann" translation contains only books I-XII; it was obviously not much used and is extant only in one manuscript Paris BN Lat. 16646. Recently Busard has found that there is another witness to this translation, a few citations in ms Vat. Lat. 1268; and he thinks that these reflect a more reliable text than the Paris manuscript. [**Note 32: Busard (see note 20), pp.133-134.**] It appears that Hermann followed a **Hajjaj** text, because he leaves out the propositions omitted by **Hajjaj** but retained in **Ishaq-Thabit**, [**Note 33: See note 31.**] but no Arabic manuscript has thus far been found that could have been the one which Hermann translated.

Gerard of Cremona is well known for his extreme literalness in translating Arabic texts. As it stands however, the "Gerard" translation of the *Elements* is not always word for word. It seems indeed that a literal translation -- no doubt originally by Gerard -- has been reworked later giving it a more standardized and uniform wording and a better Latin style which is not so severely "Arabicized" as Gerard's translations normally are -- here I base my conclusions on Kunitzsch's results. [**Note 34: See note 21, pp.119-120.**] The hypothesis that the text has been reworked finds some support in the fact that the earliest manuscript is from the fourteenth century. A comparison of selected passages of the Gerard text with Arabic manuscripts [**Note 35: By R. Lorch; see note 22.**] show that Gerard basically follows the **Ishaq-Thabit** version. The source manuscript for his translation must, however, have included borrowings from the **Hajjaj** version because, inserted in the **Ishaq-Thabit** text translated by Gerard, we find isolated words or formulas or even passages of several words which are recognizably in the **Hajjaj** wording. There

are some alternative proofs "from another book," Gerard says, which may have been taken from [Hajjaj](#).

Now to the text that since Clagett's important article has been called "Adelard I." From this text we have four manuscripts which contain books I - VIII, one for books X.36 - XV.2, one for book X.36-49, but none at all for books IX to X.35. It is quite possible that Adelard himself was the author of Adelard I: Clagett's ascription of the text to Adelard of Bath is based solely on the attribution in ms Oxford, Trinity College 47, which appears to be the oldest. But there are other witnesses for Adelard's authorship: the spelling *el* for the article (normally, Gerard and others used *al*); and the inflecting of an Arabic word according to Latin inflexion -- both being known features of Adelard's work. [Note 36: See [Kunitzsch \(note 21\), p.124.](#)] Adelard I is clearly a translation, not a commentary. It must have been translated from the Arabic, since many of its technical terms are transcriptions from Arabic, some of which are not found in other versions. Curiously, there are yet more Arabic terms in the margins of one -- just one -- manuscript, Bruges 529. Technical terms are not always consistently used. Thus we sometimes find *inconiunctivus* for *equidistans*, *quadratura* for *ductu*, *differens* for *residuum*. Busard supposes that the translator was constantly seeking the right Latin expressions for the various Arabic terms and that Adelard I is more primitive than Adelard II. [Note 37: [Busard \(note 19\), p.17.](#)] Certainly there is no Greek influence in version I -- so *hypotenusa*, *gnomo*, *parallelogrammum*, *ysosceles*, *ortogonaliter*, and so on do not appear, though they are frequent in Adelard II.

Which Arabic translation or mixed version was used in the translation of Adelard I can only be decided after a detailed comparison of Latin against Arabic. Busard has shown that there is an almost literal agreement between Adelard I and the fragment of a Syriac redaction of book I which has come down to us. [Note 38: [Busard \(note 19\), pp.18-19.](#)] Two theorems compared in detail by R. Lorch [Note 39: [See note 22.](#)] reveal, with one uncomfortable exception, affinities with the [Hajjaj](#) phraseology. But further investigations by Kunitzsch [Note 40: [Kunitzsch \(note 21\), p.119.](#)] give quite contrary indications, i.e., that Adelard I depends on [Ishaq-Thabit](#) rather than [Hajjaj](#). Kunitzsch has noted that Adelard I has some sections of a complete literalness against the Arabic, while other sections show a high degree of "literary Latin" transformation. Clearly, the text has been reworked.

Of the three "Adelard" versions (I, II, and III) Adelard II was easily the best known, as the more than 50 extant manuscripts show. Further, Campanus used it as his base text to make what became the standard medieval "Euclid." He and other compilers in the thirteenth and fourteenth centuries took over the enunciations and provided new proofs.

The most striking feature of Adelard II is the form of the proofs: Though some proofs are given in great detail in Adelard II, most are abbreviated. Sometimes only an indication is given of the theorems on which the proof depends. A remarkable characteristic of this text is that the enunciations in the better manuscripts come *after* the proofs.

The principal characteristics of Adelard II and its relationship with the other two "Adelard" versions and with the Campanus text have already been sufficiently treated by Murdoch. [Note 41: See note 16.] I should like to add here some facts which were not known to Murdoch: [Note 42: See Folkerts (note 22).] 1) Some enunciations in Adelard II agree literally with the Boethius excerpts that I have mentioned, but other related enunciations have an "Arabic" formulation. 2) There are some manuscripts of Adelard II which carry an essentially different text. Significant variants of this type occur especially in books VII to IX and XI to XIII where different sets of proofs are given. It must be stated that there was no canonical text for Adelard II in the Middle Ages but that it was at an early stage reworked and commented upon.

Since 1953 when Clagett's article appeared, it was the common opinion that Adelard translated or reworked the *Elements* at least twice and that Adelard I as well as Adelard II were both from Adelard. The main argument was that Adelard is named as author in the Trinity College manuscript of version I and in many manuscripts of version II. Adelard himself said in his treatise on the astrolabe that he has translated the *Elements*, and it seems to be clear that there was a translation by him. But there are doubts that versions Adelard I and Adelard II are both from Adelard: Adelard I and Adelard II have little in common beyond some shared definitions and enunciations, and we should remember here that Hermann and Adelard II also share some definitions and enunciations. Furthermore, the differences are great: different enunciations, different proofs, different Arabisms. There is little ground for believing that they are the work of the same translator or redactor.

My work on Adelard II in collaboration with Dr. H. L. L. Busard has brought new factors to light, and I think we are able to give a better hypothesis about the origin of the Adelard II text. Contrary to what has been assumed, Adelard II appears to have originated as a collection of Euclidean definitions, axioms, postulates, and enunciations; but the proofs came later and piecemeal, influenced by the translations from the Arabic that I have mentioned above. The collection of enunciations appears on so on and not to have been translated from Arabic but to have come from Latin sources. We note in this context that there are only four Arabic expressions in transliteration in this part of the text, [Note 43: [elmuhain](#), [elmunharifa](#), [alkaide](#) and [mutekefia](#).] and all of them can be found in the Hermann or the Adelard I text. Therefore it is not necessary to assume that they were translated from the Arabic for Adelard II.

There are some positive reasons to show that the proofs in Adelard II were probably not original to Euclid. When we look at the earliest manuscripts of the text, we find that several of them contain no proofs at all, or at most very general, short indications how one might prove the proposition. In fact, there are about ten manuscripts written before the end of the twelfth century, but only two of them contain proofs beyond book VI. When proofs are given they are of various lengths and natures. Further, in some manuscripts one finds the proofs before the enunciations, in others they are beside the enunciation; in yet others there is a proof in the regular position but also an indication in the manner just spoken of in the margin.

At this point it is perhaps sensible to mention two particular manuscripts: München CLM 13021,

and Paris BN Lat. 10257. CLM 13021 was written in Prüfening near Regensburg, probably in the sixties of the twelfth century, and contains one of the earliest witnesses to the Adelard II text. The first part of the text in this manuscript is similar to the Greek-Latin tradition associated with Boethius; but from book IV on it is Adelard II. There are no proofs. There is another copy of the same text in ms München CLM 23511, from the end of the twelfth century. The next manuscript mentioned above (Paris BN Lat. 10257) was originally in Chartres and also comes from the twelfth century; it is especially important in our story. [Note 44: See G. D. Goldat, *The Early Medieval Traditions of Euclid's Elements* (unpublished dissertation: University of Wisconsin, 1957).] This manuscript has not only the Boethian excerpts in a contaminated form but also enunciations for all fifteen books. A notable feature of this work is the presence of what appears to be transcriptions of Greek terms for the various irrational quantities in book X. In book I-III the Paris manuscript shows some resemblance to the Munich manuscript and to an Oxford manuscript (Digby 98) which has an incomplete text. In the margin of some manuscripts containing Adelard II there are enunciations of ms Paris BN Lat. 10257 which are referred to by the words *alia translatio*. In the Chartres manuscript now in Paris there are very short indications of proofs in the margin near the figures, and these are only for parts of book I. These excepted, there are eleven other proofs in book I which are somewhat longer. They differ from the corresponding passages in Adelard II, but they are arranged in the same way.

Another manuscript from Chartres is ms 497/498, the *Eptateuchon* written by Thierry of Chartres in about A.D.1140, now unfortunately destroyed. It seems to have contained the oldest witness to Adelard II. It comprised the most modern texts of its time for the seven *liberal arts*, including both a text in the Greek-Latin Boethius tradition, the so-called Geometry II and also originally at least a part of the text of Adelard II. Some folios had been lost, but book VII-IX and the fragment of book XIV-XV contain no proofs, and the text fully confirms what we have deduced above from other manuscripts. The contents of this codex leads us to suppose that perhaps someone or some group from this part of France, maybe even Chartres itself, could have been responsible for making the original collection that later formed what we know as "Adelard II." As we shall see later, it is possible to give some more evidence for this proposal.

Let us make a first conclusion: It seems very likely that the Adelard II text circulated in the beginning without proofs. This is not only confirmed by the early manuscripts Chartres 498 and München CLM 13021, but also by the fact that -- unlike all the other Greek-Latin and Arabic-Latin versions and the Greek and Arabic tradition -- the porisms have been appended to the enunciations. If there had originally been proofs, then we must assume that the porisms would have been at the end of the proofs and not at the end of the enunciations. The enunciations in Adelard II as we have them are a compilation of several texts: of the Boethius tradition - there are some striking identities between the Adelard II and the Boethius text -, of Adelard I which in my opinion was translated by Adelard himself, and of Hermann of Carinthia who seems to have finished his Euclid translation not later than about A.D.1140.

As I said, I think it is possible to give some more details about the compiler of the enunciations and definitions of the text now called Adelard II. There are good reasons to assume that this was

Robert of Chester (Ketton). This Robert lived in Spain about A.D.1141-1147, was archdeacon of Pamplona in 1143, and lived in London about 1147-1150. [Note 45: See C. H. Haskins, *Studies in the History of Mediaeval Science* (Cambridge/Mass., 1924), esp. chapter III and pp.120-123 in chapter VI.] Robert was a friend of Hermann of Carinthia, and we know that Peter the Venerable, abbot of Cluny, found Robert and Hermann in 1141 in the region of the Ebro where they were engaged in astrological studies. In this time Hermann translated the astronomical tables of al-Khwarizmi and the astrological work of Albumasar, and Robert worked with the assistance of Hermann on the first Latin translation of the *Qur'an*. Robert's translation of the algebra of al-Khwarizmi, dated Segovia 1145, may be said to mark the beginning of European algebra. In 1143 Hermann completed the *De essentiis* and the *Planisphere* which he dedicated to his teacher Thierry of Chartres. Besides the striking coincidence of date, there are other indications which lead us to the conclusion that the so-called Adelard II text of the enunciations of Euclid was written by Robert of Chester, Hermann's associate in 1141: - In the preface to his translation of the *Iudicia* of al-Kindi Robert states that he occupied himself with Euclid's *Elements*. [Note 46: *Quamquam post Euclidem, Theodosii cosmometrie libroque proportionum libencius insudarem ...*: Haskins (note 45), p.121.] - As I said, Robert wrote a revision of Adelard's version of the tables of al-Khwarizmi. Its *incipit* is very similar to that of the Adelard II manuscripts [Note 47: *Tables of al-Khwarizmi* (Madrid BN 10016): *Incipit liber Ezeig id est chanonum Alghoarizmi per Adelardum Bathoniensem ex arabico sumptus et per Rodbertum Cestrensem ordine digestus*; Adelard II: *Incipit liber geometrie Euclidis translatus ab Adelardo Bathoniensi de arabico in latinum*.]: only the additional phrase is missing in the Adelard II *incipit*, and we can assume that probably the meaning of the title is that the text is based upon the translation of Adelard, i.e. Adelard I. - In Robert's translation of the *Algebra* of al-Khwarizmi there is an appendix which summarizes the rules for solving the six types of equations. [Note 48: It should be noted that all known manuscripts of this text are from the fifteenth century and that in the appendix these manuscripts have symbols for the powers of the unknown which were used not before the second half of the fifteenth century.] Similarly, we find in book X of Adelard II an introduction where the author gives the definitions of the various irrational quantities and later summarizes the six binomial lines and the six *apotomes*. - Since Hermann was a pupil of Thierry of Chartres and he dedicated his *Planisphere* to him, it is very plausible that Robert, Hermann's friend, sent his work to Thierry, who inserted it in his *Eptateuchon*.

There remains the problem of the proofs in Adelard II. The proofs in the various manuscripts of Adelard II are sometimes very different. Usually the content is the same, but the formulation is sometimes radically different. The proofs often contain interesting Arabic transcriptions and other traces of Arabic origin. There are more Arabic words in the proofs than in the text of the enunciations, but I think these words too can be explained without the assumption that there was a translation from the Arabic other than that by Hermann or Adelard I. The fact that in many cases the proofs are not in agreement with each other and that there are abridged or additional proofs in some manuscripts seems to indicate that the proofs were not written by only one person. I think that originally indications of proofs were given in the margin similar to those in ms Paris BN Lat. 10257 and in the Adelard I manuscripts Bruges 529 and Oxford Trinity College 47. [Note 49: As to the last two manuscripts, see Busard (note 19), p.22, note 10.] In

some of the oldest Adelard II manuscripts [**Note 50: Oxford, Trinity College 47, and London, British Library Royal 15 A 27.**] the proofs are in the margins next to the propositions. Later they were written mostly before the enunciations, but there are differences between the manuscripts, too. In a later state of development the proofs seem to be enlarged by more than one person, and this can explain the differences in the proofs within the manuscripts. Some obscure names, such as *Ocreatus*, *Eggebericus*, *Lincol' Zeob' Rog' Hel'* and *Reginerus*, which are given in some proofs, may indicate that these persons contributed to the text of the proofs or have given additional proofs. But all this must be more rigorously investigated. We may therefore state the following: - No Arabic manuscript has been found from which any of the three Latin translations attributed to Hermann, Gerard, or Adelard I could have been made. - None of these translations, as we have them, presents a pure Euclid text: either the originals were themselves reworked, or the translator took his material from several sources. The transmission of the *Elements* is thus much more complex than that of Archimedes and the *Almagest*. - It appears correct to assume that the Adelard II text, as we have it, is not a translation from the Arabic but a compilation of different texts, among them the Arabic-Latin translations of Hermann and Adelard I, and that the original collection of Adelard II was made from them by Robert of Chester. Therefore there were not four but only three, translations of Euclid's *Elements* in the twelfth century.

The three known translations and the Adelard II compilation were only the beginning of an intensive activity after the Arabic texts had become known. Between the twelfth and fifteenth centuries the text was reworked many times. Of these the most important are:

1) The version called Adelard III by Clagett has the same enunciations as Adelard II, which it cites but different and fuller proofs. Although it contains Arabic terms not in Adelard II, it is in all probability a commentary rather than an independent translation. It was written or compiled probably at the end of the twelfth century; the only manuscript which transmits the complete text, Oxford, Balliol College 257, seems to have been written in the first half of the thirteenth century. One indication of the authorship of Adelard III is the ambiguous ascription by Roger Bacon, *editio specialis Alardi Bathoniensis*.

2) In the middle of the thirteenth century Campanus compiled his well-known reworking of the *Elements*. He took over the enunciations in Adelard II, but the proofs do not correspond. Campanus' method of working has been analyzed by Murdoch. [**Note 51: See note 16.**] Particularly notable is Campanus' habit of including contemporary and near contemporary material in his reworkings. In this material is to be found *Nayrizi's* commentary of the *Elements* and, above all, Jordanus' *Arithmetica* -- the latter is particularly notable in the definitions of books VII and VIII. [**Note 52: Busard (see note 20), p.134. 135.**]

3) Not so well known is a commentary on the *Elements* that exists in five manuscripts. [**Note 53: Wien 5304; Paris BN Lat. 7292; Vat. Regin. lat. 1268, fol.1-69r; Bonn, S 73; see Busard (note 20), pp.131-132.**] This commentary also depends on Adelard II. Busard maintains [**Note 54: Busard (note 20), pp.136-142.**] that the author was acquainted with more than one version II manuscript and perhaps with a version III text. It is particularly interesting that the commentary

ascribed to Albertus Magnus is in turn based on this anonymous commentary. [Note 55: See P. M. J. E. Tummers, *Albertus (Magnus)' commentaar op Euclides' Elementen der geometrie*, Nijmegen 1984.] If Albert is really the author, in this work at least he was not very original.

Busard mentions a number of other reworkings in which contemporary material is mixed with the text. The transmission is made more complicated by the presence in many manuscripts of various translations, commentaries and compilations and of additional proofs.

There is very little scholarly work about the Euclid text in the West during the fifteenth century. It is well-known that in 1482 the Campanus version was printed in Venice -- this was, except of editions of fragments of the Boethian tradition, the first printed Euclid in the West --, that in 1498 Giorgio Valla published books XIV and XV together with commentaries and took over Euclidean material into his encyclopedic *De expetendis et fugiendis rebus* (Venice, 1501), [Note 56: See Paul Lawrence Rose, *The Italian Renaissance of Mathematics. Studies on Humanists and Mathematicians from Petrarch to Galileo*, Genève, 1975, pp.46-50.] and that Bartolomeo Zamberti published a new Latin translation from the Greek in 1505. [Note 57: See Rose (note 56), p.51.] But we know from two Campanus manuscripts [Note 58: Stuttgart HB XI 24, and Vat. Palat. lat. 1352.] that already in 1450 Pope Nicholas V, who was also responsible for the new Archimedes translation made by Jacobus Cremonensis, assembled a Greek Euclid text. [Note 59: On Nicholas' activities in mathematics see Rose (note 56), pp.36-38.] Some years later Regiomontanus tried to reconstruct the original Euclid text with the help of Bessarion's Greek manuscripts. [Note 60: See Rose (note 56), pp.44-46. For Euclid manuscripts in the possession of Regiomontanus see M. Folkerts, *Regiomontans Euklidhandschriften*, in: *Sudhoffs Archiv* LVIII (1974) 149-164. There may be added ms Boston, Medical Library 24, which has the same introduction as Regiomontanus' manuscript Nürnberg Cent. VI.13.] At least the first books of Euclid's *Elements* were taught within the university curriculum of the *artes liberales*. There are some manuscripts of the fifteenth century which seem to be notes or copies of students, but up to now there is no systematical research on them. [Note 61: I have listed some of them in chapter 20 of the enclosed list of manuscripts, but I assume that there are many more texts.]

Therefore it is clear that Clagett's 1953 model is only a simple guide to the reality. It is no surprise that the transmission of such an important and oft-used work as the *Elements* should be so very complicated. Although in the last years many manuscripts have been analyzed and the most important texts have been edited or are to be edited, much more work must be done before we shall have a *Euclid in the Middle Ages*.

Medieval manuscripts containing Euclid's *Elements*

This is a first attempt to list all known Latin manuscripts up to about 1500 containing the text and commentaries on Euclid's *Elements*. A list of Arabic manuscripts of the [Hajjaj](#) and the [Ishaq-Thabit](#) tradition is added, because these texts were used for the translations into Latin in the twelfth century. Manuscripts which I have not seen are marked by +. In 'Printed editions' usually only the latest edition is given which mostly refers to older ones. It was not possible to check all manuscripts in detail, and therefore there will be faults. The 'modern' Euclid texts -- mostly from the fifteenth century -- are listed in a special section at the end without distinguishing the different versions. I have given some information about them, but further research is necessary to obtain certain results.

1. Boethius tradition

1.1 Cassiodorus, *Institutiones*, third recension

Incipit: I def.1: *Punctum est cuius pars nulla est*

Manuscripts:

- +olim Cheltenham, Phillipps MS 16278, s.IX²
- +Glasgow, Hunterian Museum 281, s.X/XI
- +Karlsruhe, Badische Landesbibliothek Augiensis 106, s.X
- München, Bayerische Staatsbibliothek CLM 13084, f.54-54v, s.X (only II def. 2; V def. 1-8.11.9.10.13.12.14-16.18.17)
- +Paris, Bibliothèque Nationale Lat. 12963, s.X¹
- +Valenciennes, Bibliothèque Municipale 195, s.IX

Printed editions of the Euclid excerpts: *Cassiodori Senatoris Institutiones*, ed. R. A. B. Mynors (Oxford, 2nd ed., 1961), pp.169-172. M. Folkerts, *'Boethius' Geometrie II, ein mathematisches Lehrbuch des Mittelalters* (Wiesbaden, 1970), pp.177-185, 189-191 (Ma).

Remarks: Extant are: I def. 1-12.14.13.15-23, post. 1-5, ax. 1.3.2.7; II def. 2; V def. 1-8.11.9.10.13.12.14-16.18.17. See Folkerts (1970), pp.70-82. There may be more manuscripts of the Cassiodorus text. CLM 13084, has not the Cassiodorus text, but only the Euclid excerpts.

1.2 Manuscripts of the *Corpus agrimensorum*

Incipits: I def.1: *Punctum est cuius pars nulla est*

I 1, enunciation: *Super datam rectam lineam terminatam triangulum aequilaterum constituere.*

I 1, proof: *Sit data recta linea terminata AB. Oportet igitur super eam, quae est AB, triangulum*

Manuscripts:

- Bern, Bürgerbibliothek 87, f.16v, A.D.1004 (only I prop. 1-3 with proofs)
- Bruxelles, Bibliothèque Royale 4499-4503, f.4v-5, s.XIIin. (only I def. 19-23)
- Bruxelles, Bibliothèque Royale 10629-10660, s.XII (copy of Vaticano, Palat. lat. 1564)
- Chartres, Bibliothèque de la Ville 498, f.153, s.XII¹ (only I def. 19-23)
- München, Bayerische Staatsbibliothek CLM 13084, f.53v-54, s.X (only I def. 19-23, post. 1-5, ax. 1.3.2.7)
- Napoli, Biblioteca Nazionale V A 13, f.30v-31, s.Xin. (only I prop. 1-3 with proofs)
- Paris, Bibliothèque Nationale Lat. 8679A, f.19-21, s.XVI (copy of Wolfenbüttel, HAB Cod. Guelf. 105 Gud. lat.)
- Vaticano, Ottob. lat. 1862, f.26, s.XII² (only I def. 19-23)
- Vaticano, Palat. lat. 1564, f.79-82, s.IX
- Wolfenbüttel, Herzog August Bibliothek Cod. Guelf. 105 Gud. lat., f.43-45v, s.IX

Printed editions: M. Folkerts, *'Boethius' Geometrie II, ein mathematisches Lehrbuch des Mittelalters* (Wiesbaden, 1970), pp.177-185. 215-217 (Mb). As to older editions, see p.48 and p.174.

Remarks: Extant are: I def. 1-12.14.13.15-23, post. 1-5, ax. 1.3.2.7, prop. 1-3 with proofs. See Folkerts (1970), pp.70-82.

1.3 Pseudo-Boethius, *Geometry I*

Incipits: Text: *Geometria est disciplina magnitudinis immobilis*

I def.1: *Principium mensurae punctum vocatur, cum medium tenet figurae. Punctum est cuius pars nulla est*

I 2, enunciation: *Ad datum punctum datae rectae lineae aequalem rectam lineam collocare*

Manuscripts:

- Bamberg, Staatliche Bibliothek Class. 55 (olim H.J. IV 22), f.1v-16, s.Xin.
- Bern, Bürgerbibliothek 87, f.1v-8v, A.D.1004
- Bern, Bürgerbibliothek 299, f.1-14, s.XI
- Cambridge, Trinity College R.15.14 (939), f.4-43v, s.X
- Cesena, Biblioteca Malatestiana Plut.sin. XXVI.1, f.221-249, ca. A.D.1450-1465
- Chartres, Bibliothèque de la Ville 498, f.141v-143, s.XII¹ (excerpts; no Euclid texts)
- Einsiedeln, Stiftsbibliothek 298, p.1-22, s.X/XI
- Einsiedeln, Stiftsbibliothek 358, p.1-20, 23-37, s.X/XI

- Firenze, Biblioteca Medicea Laurenziana Plut. 29.19, f.1-27, ca. A.D.1250
- London, British Library Addit. 47679, f.74-101v, s.XII
- Madrid, Biblioteca Nacional 9088 (olim Aa 53), f.130-147v, s.XII
- München, Bayerische Staatsbibliothek CLM 560, f.122-149, s.IX
- München, Bayerische Staatsbibliothek CLM 4024^a, f.3-9v, s.XIII (fragmentary)
- Napoli, Biblioteca Nazionale V A 13, f.1-15, s.Xin.
- New York, Columbia University Plimpton 164, f.2-16v, s.XVI (copy of Napoli, BN V A 13)
- Oxford, Bodleian Library Douce 125, p.1-67, s.XI
- Paris, Bibliothèque Nationale Lat. 13020, f.59v-83, s.IX
- Paris, Bibliothèque Nationale Lat. 13955, f.107-123v, s.IX
- Paris, Bibliothèque Nationale Lat. 14080, f.65-72v, 80-87v, 79-79v, 73-77v, s.IX
- Praha, Universitní Knihovna IX.C.6 (= 1717), f.47-63v, s.X
- Rostock, Universitätsbibliothek Phil. 18 (olim IV 111,4), p.1-17, s.XIII
- St. Gallen, Stiftsbibliothek 830, p.283-309, s.XI¹
- Vaticano, Barb. lat. 92, f.19v-22v, 38v-44, ca. A.D.1100
- Vaticano, Ottob. lat. 1862, f.37-44v, s.XII²
- Wien, Österreichische Nationalbibliothek 55, f.1-14v, 22-22v, 15-21v, s.XI
- Wien, Österreichische Nationalbibliothek 2269, f.220-223, s.XIII
- Wroclaw, Biblioteka Uniwersytecka Rehdig. 55, f.2-26, s.XV (copied from Rostock Phil. 18)

Printed editions: Euclid excerpts: M. Folkerts, *'Boethius' Geometrie II, ein mathematisches Lehrbuch des Mittelalters* (Wiesbaden, 1970), pp.176-214 (Mc). As to older editions of the Euclid excerpts, see p.48 and p.174. There is no complete edition of the Geometry I text; the partial editions are listed in M. Folkerts, *Die Altercatio in der Geometrie I des Pseudo-Boethius. Ein Beitrag zur Geometrie im mittelalterlichen Quadrivium*, in: *Fachprosa-Studien. Beiträge zur mittelalterlichen Wissenschafts- und Geistesgeschichte*, ed. by G.Keil (Berlin: Erich Schmidt, 1982), pp.84-114, esp. pp.88-89.

Remarks: The folio numbers concern the beginning and end of the Geometry I text, not of the Euclid excerpts. Extant are the following Euclid parts: I def. 1-12.14.13.15-23, post. 1-5, ax. 1.3.2.7; II def. 1.2, prop. 1; III def. 1-6.8-11; IV def. 1.2, prop. 1; III def. 6.8; I prop. 2-4.6-8. (9).10-18.21.23. 26-28.31-37.39-41.43.42.44-48; II prop. 1.3-6.9-12.14; III prop. 3.7 beginning. 22 end. 27.30-33; IV prop. 1-4.6.8.12.11; III prop. 7 end. 9.12.10.13.14.16.18.19.24. 22 beginning (all propositions without proofs). See Folkerts (1970), pp.70-82.

1.4 Pseudo-Boethius, *Geometry II*

Incipits: text: *Quia vero, mi Patrici, geometrum exercitissime*

I def.1: *Principium autem mensurae punctum vocatur. Punctum est cuius pars nulla est*

I 1, enunciation: *Supra datam rectam lineam terminatam triangulum aequilaterum constituere*

I 1, proof: *Sit data recta linea terminata AB. Oportet igitur super eam, quae est AB, triangulum aequilaterum constituere*

Manuscripts:

- Berlin, Staatsbibliothek Preussischer Kulturbesitz Lat. oct. 162, f.69-70, 71v-76, s.XII¹ (excerpts; no Euclid text)
- Bruxelles, Bibliothèque Royale 4499-4503, f.28-28v, s.XIIin. (excerpts; no Euclid text)
- Cesena, Biblioteca Malatestiana Plut.sin. XXVI.1, f.201-220, ca. A.D.1450-1465
- Chartres, Bibliothèque de la Ville 498, f.155-166, s.XII¹ +olim
- Cheltenham, Phillipps 7017, s.XII. Present location unknown. It seems that this is a Geometry II (not a Geometry I) manuscript
- Erlangen, Universitätsbibliothek 379, f.1v-76, s.XI
- Groningen, Bibliotheek der Rijksuniversiteit 103, f.207v-216, s.XVIin. (excerpts)
- London, British Library Addit. 47679, f.146-147, s.XII (excerpts; no Euclid text)
- London, British Library Arundel 339, f.49-59, s.XIII
- London, British Library Harley 3595, f.57-68, s.XI
- London, British Library Lansdowne 842B, f.51-65v, s.XV
- München, Bayerische Staatsbibliothek CLM 4024^a, f.1v-2v, s.XIII (fragment)
- München, Bayerische Staatsbibliothek CLM 13021, f.194-202, s.XII²
- München, Bayerische Staatsbibliothek CLM 23511, f.30-51v, s.XII/XIII
- New York, Columbia University Plimpton 250, f.98-129, ca. A.D.1500 (copy of Vat. Lat. 3123)
- Paris, Bibliothèque Nationale Lat. 7185, f.62v-80, s.XIIex.
- Paris, Bibliothèque Nationale Lat. 7377C, f.18v-24, 25v-34v, s.XIex.
- Rostock, Universitätsbibliothek Phil. 18 (olim IV 111,4), p.29-30, s.XIII (fragment)
- Vaticano, Lat. 3123, f.65v-84, s.XII
- Vaticano, Barb. lat. 92, f.3-16v, ca. A.D.1100
- Vaticano, Ottob. lat. 1862, f.26v-33v, s.XII²
- Vaticano, Reg. lat. 1071, f.56-58v, s.XII Wrocław, Biblioteka Uniwersytecka Rehdig. 55, f.38-39, s.XV (fragment; copied from Rostock, Phil. 18)

Printed editions: M. Folkerts, *'Boethius' Geometrie II, ein mathematisches Lehrbuch des Mittelalters* (Wiesbaden, 1970), pp.113-135 and 177-211, 215-217 (Md). As to older editions, see pp.41-49 and p.174.

Remarks: The folio numbers concern the beginning and end of the Geometry II text, not of the Euclid excerpts. Extant are the following Euclid parts: I def. 1-12.14.13.15-23, post. 1-5, ax. 1.3.2.7; II def. 1.2; III def. 1-6.8-11; IV def. 1.2; I prop. 1-8.(9.)10-41.43.42.44-48; II prop. 1.3-6.9-12.14; III prop. 3.7 beginning. 22.27.30-33; IV prop. 1-4.6.8.12.11 (all propositions without proofs); further, I prop. 1-3 with proofs. See Folkerts (1970), pp.70-82.

2. Verona palimpsest

Incipit: XI 24, enunciation: *Si solidum parallelis planis circumdatum est*

Manuscript:

- Verona, Biblioteca Capitolare XL (38), f.331v-331, 326v-326, 341-341v, 338-338v, 336-336v, 343-343v, ca. A.D.500

Printed edition: *Euclidis Latine facti fragmenta Veronensia*, ed. M. Geymonat, Milano, Varese (Istituto Editoriale Cisalpino), 1964.

Remarks: Extant are fragments of the following propositions: XI 24-25; XII 2-3.8; XIII, 2-3.7.

3. Munich fragment

Incipit: I 38, enunciation: *Quae triangula quo aequalis grados sunt et autem in ipsis utraque aequales alterutrum sunt*

Manuscript:

- München, Universitätsbibliothek 2^o 757, f.1-2v, s.IXin.

Printed editions: M. Geymonat, Nuovi frammenti della geometria 'boeziana' in un codice del IX secolo?, in: *Scriptorium XXII* (1967) 3-16, with remarks to the older edition by Curtze.

Remarks: Extant are the propositions I 37-38 and II 8-9 (beginning).

4. Greek-Latin translation (twelfth century)

Incipits: I def. 1: *Punctus est cuius pars nulla*

I 1, enunciation: *Super datam rectam terminatam trigonum isopleurum constituere*

I 1, proof: *Esto data recta terminata ab. Oportet ergo super ab rectam trigonum isopleurum constituere*

Manuscripts:

- Paris, Bibliothèque Nationale Lat. 7373, f.2-175v, s.XIII (f.2-2v has definitions, postulates, and common notions of book I in the Campanus version, s.XIV)
- Firenze, Biblioteca Nazionale Centrale Conv.soppr. C I 448, f.1-104v, s.XIV

(incomplete; ends within X 48)

- Venezia, Biblioteca Nazionale Marciana fondo antico 271 (= 1642), f.1-1v, s.XV (I def. 1-20)

Printed edition: H. L. L. Busard, *The Mediaeval Latin Translation of Euclid's Elements Made Directly from the Greek* (Stuttgart: Franz Steiner, 1987).

Remarks: The Paris manuscript has an abbreviated version of books XIV-XV which was known to Leonardo Fibonacci; see Busard (1987), pp.17-20.

5. Liber ysagogarum Alchorismi

Incipit: *Quoniam de quarta introducendis matheseos nos fari disciplinarum praesens tempus ammonuit*

Manuscripts:

- Admont, Stiftsbibliothek, fragment 4, 1f., s.XIV
- Genoa, Biblioteca Universitaria E.III.28, f.231-232v, s.XV
- Milano, Biblioteca Ambrosiana A 3 sup., f.1-20, s.XII (interpolated version)
- München, Bayerische Staatsbibliothek CLM 13021, f.27-31v, s.XII²
- München, Bayerische Staatsbibliothek CLM 18927, f.31-33, s.XIII
- Oxford, Bodleian Library Lyell 52, f.21-34, s.XIV (interpolated version)
- Paris, Bibliothèque Nationale Lat. 16208, f.67-71, s.XII² (interpolated version)
- Wien, Österreichische Nationalbibliothek 275, f.27, A.D.1143 (summary)

Printed editions: Of the arithmetical part there are editions by A. Nagl, *Ueber eine Algorismus-Schrift des XII. Jahrhunderts und über die Verbreitung der indisch-arabischen Rechenkunst und Zahlzeichen im christl. Abendlande*, in: *Zeitschrift für Mathematik und Physik, hist.-lit. Abth.* XXXIV (1889) 129-146, 161-170 (from ms Wien 275), by M. Curtze, *Ueber eine Algorismus-Schrift des XII. Jahrhunderts*, in: *Abhandlungen zur Geschichte der Mathematik VIII* (1898) 1-27 (from München, CLM 13021); and by A. Allard, ++*Muhammad ibn Musa al-Khwarizmi. Le Calcul Indien (Algorismus). Histoire des textes, édition critique, traduction et commentaire des plus anciennes versions latines remaniées du XIIe siècle.* Paris/Namur 1992, pp.23-61. \$\$

Les plus anciennes versions latines du 12e siècle issues de l'arithmétique d'*al-Khwarizmi* (unpublished diss. Université Catholique de Louvain, 1975), pp.92-145.->

The complete text has been edited by Bruce G. Dickey, *Adelard of Bath: An Examination Based on Heretofore Unexamined Manuscripts* (Ph.D. dissertation, University of Toronto, 1982), pp.77-111.

Remarks: The folio numbers concern the beginning and end of the *Liber ysagogarum* text, not of the Euclid excerpts. A work in five books on the four parts of the quadrivium. It contains inter alia parts of Euclid's *Elements* in the Boethian tradition with the following items which are not found in the Boethian excerpts (see 1.1 - 1.4): I ax. 5, I 9, II 13, III 1,3,20,25,35,36; IV 15; VI 2,4,9. The text differs within the manuscripts. See *Adelard of Bath. An English Scientist and Arabist of the Early Twelfth Century*, ed. by Charles Burnett (London: The Warburg Institute, 1987), pp.173-174.

6. Early Arabian Manuscripts

6.1 Hajjaj text

Manuscripts:

- København, Kongelige Biblioteket 81 (XI-XIII) (?)
- Leiden, Bibliotheek der Rijksuniversiteit Or. 399/1 (I - VII beginning)

Printed edition: R. O. Besthorn et al., *Codex Leidensis 399,1. Euclidis Elementa ex interpretatione al-Hadschschadschii cum commentariis al-Narizii* (Copenhagen, 1893-1932).

Remarks: The Leiden manuscript has also the commentary by [Nayrizi](#). Some of the [Ishaq-Thabit](#) manuscripts (see 6.2) seem to be contaminated with a [Hajjaj](#) text, especially mss El Escorial, ar. 907; Leningrad, C 2145; Teheran, Majlis [Shura](#) 200.

6.2 Ishaq-Thabit text

Manuscripts:

- Cambridge, University Library Addit. 1075, 233ff. (I def.19 - XV)
- +Dublin, Chester Beatty Library 3035, A.H. 669, 126ff. (I 39 - XV)
- +Dunedin, Otago Museum a.873 H. El Escorial ar. 907, 184ff., s.7 H. (I-XV)
- +Istanbul, Fatih 3439, f.2r-65v, A.H. 586 (IV 14 - XV)
- +Kabul, [Kitabkhane-i Wizarat-i Ma'arif](#), 297, 241ff.
- +Kastamonu 607, ca. 200 ff., s.8 H. (I-XV) København, Kongelige Biblioteket 81, 214ff. (I-XV)
- +Leningrad, Institut vostokovedenija C 2145, 280ff., A.H. 584
- Oxford, Bodleian Library Huntington 435, 217ff. (I 13 - XV)
- Oxford, Bodleian Library Thurston 11, 212ff., A.H. 635 (I-XV)
- +Paris, Bibliothèque Nationale Arab. 2500, A.H. 806
- +Rabat, al-Malik 1101, ca. 200ff., A.H. 683 (I-XV)

- +Rabat, al-Malik 5317, 63ff., A.H. 1016 (I-VIII)
- +Rampur, Raza Library [Arshi](#) 200, 214ff. (I-XV) Uppsala, Universitetsbibliotek O.Vet. 20, 202ff., A.H. 434 (I-XV)
- Teheran, [Danishgah](#) 2120, 6ff., A.H. 343 = A.D.954/55 (!) (part of VII; part of the same manuscript as Teheran, Malik 3586)
- Teheran, Majlis [Shura](#) 200, 226ff., s.9 H. (I-XV)
- Teheran, Malik 3586, 240ff., A.H. 343 = A.D.954/55 (!) (I-XV; the missing part of book VII is Teheran, [Danishgah](#) 2120)

Printed editions: There are only editions of books V and VII-IX: J. W. Engroff, *The Arabic Tradition of Euclid's Elements: Book v* (unpublished Ph.D. dissertation: Harvard University, 1980); G. De Young, *The Arithmetic Books of Euclid's Elements in the Arabic Tradition* (unpublished Ph.D. dissertation: Harvard University, 1981).

Remarks: See G. De Young, The Arabic Textual Traditions of Euclid's Elements, in: *Historia Mathematica* XI (1984) 147-160. The study of the manuscripts has just begun. Some of them seem to be contaminated with [Hajjaj](#) readings. The very old Teheran manuscript Malik 3586 and [Danishgah](#) 2120 was not used by De Young or somebody else.

7. Adelard I

Incipits: I def. 1: *Punctus est illud cui pars non est*

I 1, enunciation: *Nunc demonstrandum est quomodo superficiem triangulam equalium laterum super lineam rectam assignate quantitatis faciamus*

I 1, proof: *Sit linea assignata ab. Ponaturque centrum supra a occupando spacium quod est inter a et b circulo, supra quem gdb*

Manuscripts:

- Bruges, Stadsbibliotheek 529, f.1-48v, s.XIII (I - VIII 25)
- London, British Library Burney 275, f.302-308, s.XIV (VII 3 - VIII 25)
- Oxford, Bodleian Library D'Orville 70, f.39-71v, s.XIII/XIV (X 36 - XV 2)
- Oxford, Trinity College 47, f.171-180v, 163-170v, 155-162v, 147-154v, 139-146v, s.XII (I - VIII 22)
- Paris, Bibliothèque Nationale Lat. 16201, f.35-82, s.XII (I - VIII 22)
- Vaticano, Reg. lat. 1137, f.73v-74, s.XIII² (X 24, X 17)
- Wien, Österreichische Nationalbibliothek 83, f.64-65v, s.XIV (X 36-49)

Printed edition: H. L. L. Busard, *The First Latin Translation of Euclid's Elements Commonly Ascribed to Adelard of Bath* (Toronto: Pontifical Institute of Mediaeval Studies, 1983).

Remarks: Book IX and X 1-35 are missing, but the enunciations (not the proofs) of X 17 and X

24 are in mss Vaticano, Regin. lat. 1137, f.73v-74; Leipzig, Universitätsbibliothek Rep. I 68c, f.59, and Florence, Biblioteca Riccardiana 2968/2, f.23.

8. Hermann of Carinthia

Incipits: introduction: *Septem sunt omnis discipline fundamenta*

I def. 1: *Punctus est cui pars non est* I 1, enunciation: *Primum igitur equilaterum triangulum supra rectam et definite quantitatis lineam collocamus*

I 1, proof: *Data siquidem linea recta inter a et b puncta, acceptaque punctorum distancia, id est lineae spacio fixo circino supra a centrum fiat circulus bgd*

Manuscripts:

- Paris, Bibliothèque Nationale Lat. 16646, f.2-108, s.XIII (I-XII)
- Oxford, Bodleian Library Digby 174, f.160-160v, s.XIII (XI 1-4, going back to a Hermann version)
- Vaticano, Regin. lat. 1268, f.113r-113v, s.XIVin. (XI 1-4, in agreement with Digby 174)

Printed editions: H. L. L. Busard, *The Translation of the Elements of Euclid from the Arabic into Latin by Hermann of Carinthia (?)*: books I-VI, *Janus LIV* (1967) 1-140, and published separately (Leiden: E. J. Brill, 1968); books VII-IX, *Janus LIX* (1972) 125-187; books VII-XII (Amsterdam: Mathematisch Centrum, 1977).

Remarks: See Busard (1967-1977).

9. Gerard of Gremona

Incipits: introduction: *Ea a quibus procedit scientia*

I def. 1: *Punctum est cui pars non est*

I 1, enunciation: *Super rectam lineam definite quantitatis triangulum equilaterum constituere*

I 1, proof: *Verbi gratia: Ponatur linea recta ab definite quantitatis, et super centrum a secundum quantitatem spatii quod est inter a et b, circumducatur circulus, super quem sunt g, d, b*

Manuscripts:

- Boulogne-sur-Mer, Bibliothèque de la Ville 196, f.1-144 (I-XV), 144-147v (scholia I-XIX), s.XIV
- Bruges, Stadsbibliotheek 521, f.1-109v (I-XV), 109v-113v (scholia I-XVII), s.XIV
- Firenze, Biblioteca Nazionale Centrale Conv.soppr. J V 30, f.55-57v (scholia IV-XVII, XX-XXII), s.XIV
- Madrid, Biblioteca de la Universidad 102 (117-z-6), f.137-196v (I - X 101), s.XIV

- Milano, Biblioteca Ambrosiana D 186 inf., f.1-107v (I - X 109, XIII 11 - XV 5), 107v-112 (scholia I-XVII), s.XV
- Oxford, Bodleian Library Digby 174, f.160v-173v, s.XIII (XI 5 - XIV 1)
- Oxford, Bodleian Library Canon. misc. 145, f.307, s.XV (III def., III 1 porism, III 2-7 enunciations)
- Palermo, Biblioteca Comunale 2 Qq E 98, f.1-83v, s.XIV (I - X 17)
- Paris, Bibliothèque Nationale Lat. 7216, f.1-107v (I-XV), 107v-108 (scholia XVIII-XIX), s.XV
- Paris, Bibliothèque Nationale Lat. 7377B, f.1-9, s.XIV/XV (scholia I-XVII; scholium XVII twice: at the end and after scholium III)
- Paris, Bibliothèque Nationale Lat. 11247, f.78-91v (scholia IV-XVII, XX-XXII), s.XVI
- Roma, Biblioteca Vallicelliana F.86, f.49-54 (I - I 5), s.14
- Vaticano, Lat. 7299, f.1r-136 (I-XV), 136-141 (scholia I-XVII), s.XIV
- Vaticano, Reg. lat. 1268, f.113v-142v (XI 5 - XV), 142v-143 (scholia I-III), s.XIV
- Vaticano, Reg. lat. 1904, f.86-90 (XV 1-5, XIII 16), s.XV/XVI
- Vaticano, Rossiano 579, f.1-126v (I-XV), 126v-130v (scholia I-XVII), s.XIV

Printed editions: H. L. L. Busard, *The Latin translation of the Arabic version of Euclid's Elements commonly ascribed to Gerard of Cremona* (Leiden: New Rhine Publishers, 1983). The *scholia* are edited by H. L. L. Busard, Über einige Euklid-Scholien, die den Elementen von Euklid, übersetzt von Gerard von Cremona, angehängt worden sind, in: *Centaurus XVIII* (1974) 97-128.

Remarks: The *scholia* most of which belonging to books XIII and XIV differ within the manuscripts.

10. "Mélanges" (Boethius tradition, Adelard II)

Incipits: text: *Quia, mi Patricii, geometrum exercitatissime* (Lüneburg)

I def. 1: *Principium mesure punctum vocatur cum medium tenet figure. Punctum vero est cuius pars nulla (nulla pars Oxford) est* (Munich, Oxford, Paris); *Principium autem mesure punctus. Punctus est cuius nulla pars est* (Lüneburg)

I 1, enunciation: *Supra datam rectam lineam terminatam triangulum equilaterum constituere (consistere Oxford)* (Munich, Oxford, Paris), *Supra datam rectam lineam terminatam equilaterum constituere triangulum* (Lüneburg)

Manuscripts Leiden, Bibliotheek der Rijksuniversiteit Voss.lat.qu. 92, f.2-2v, 1-1v, s.XII^{ex}. (fragment: III 34-36 Heiberg = 33-35 Adelard II, IV 14-16 Heiberg = 14-19 Adelard II, with additions from Ps.-Boethius, *Geometry II*) Lüneburg, Ratsbibliothek Misc. D 4^o 48, f.13-17v, ca. A.D.1200 (I-IV) München, Bayerische Staatsbibliothek CLM 13021, f.164-169v, s.XII² (I-III) Oxford, Bodleian Library Digby 98, f.78-85v, s.XII (I - III def.4) Paris, Bibliothèque Nationale Lat. 10257, f.1-88, s.XII (I-XV) (olim) San Juan Capistrano, Honeyman MS 50 (MS Math.1),

Printed editions: The Paris text was edited by G. D. Goldat, *The Early Medieval Traditions of Euclid's Elements* (unpublished dissertation University of Wisconsin, 1957), pp.189-401. The Lüneburg text was edited by M. Folkerts (1971), pp.21-41; there is a facsimile edition: M. Folkerts, *Ein neuer Text des Euclides Latinus. Faksimiledruck der Handschrift Lüneburg D 4^o 48, f.13-17v* (Hildesheim: Dr. H. A. Gerstenberg, 1970). There are no editions of the other texts.

Remarks: There are striking differences within the manuscript texts; see M. Folkerts, *Anonyme lateinische Euklidbearbeitungen aus dem 12. Jahrhundert*, in: *Österreichische Akademie der Wissenschaften, mathematisch-naturwissenschaftliche Klasse. Denkschriften*, 116. Band, 1. Abhandlung (Vienna 1971), pp.1-42. Recent research on the Adelard II manuscripts seems to show that these "mélanges" texts precede the Adelard II text.

11. Adelard II

Incipits: I def. 1: *Punctus est illud cui non est pars*

I 1, enunciation: *Triangulum equilaterum super datam lineam rectam collocare*

I 1, proof: *A duobus terminis date linee ipsam lineam occupando cum circino duos circulos se invicem secantes describe*

Manuscripts:

- Berlin, Staatsbibliothek Preussischer Kulturbesitz Lat. qu. 510, f.1-59v, s.XIII (I-XV)
- Budapest, private possession of Walter Endrei, 1 folio, s.XIIIin. (I 44 end - II 1, II 3 end - II 9 beginning)
- Cambridge, Fitzwilliam Museum McClean 168, f.1-6v, s.XIII² (X 84 - XI def.8, XI 14-31)
- Cambridge, Gonville & Caius College 504/271, f.30v-86, s.XIII (I-XV)
- Cambridge, University Library Dd. XII.61 (= 778), f.2v-124v, s.XIIex. (I-XV)
- Chartres, Bibliothèque de la Ville 498, f.122v-124v, 141-141v, s.XII (VII def.12 - IX end, XIV 6 - XV end)
- Darmstadt, Hessische Landes- und Hochschulbibliothek 739, f.1-39v, s.XIII (I - VI 32)
- Dresden, Sächsische Landesbibliothek Db 86, f.1-48v, s.XIII (I-XV)
- Erfurt, Wissenschaftliche Allgemeinbibliothek Amplon. qu. 23, f.1-70v, s.XIII (I-XV)
- Erfurt, Wissenschaftliche Allgemeinbibliothek Amplon. qu. 352, f.23v-62v, s.XIIIin. (I - VIII 16)
- Exeter, Cathedral Library 3503, f.1-99, s.XIII² (I-XV)
- Firenze, Biblioteca Nazionale Centrale Conv.soppr. J I 18, f.137-160v, s.XIII (I - VI 23)
- Firenze, Biblioteca Nazionale Centrale Conv.soppr. J I 32, f.49-103, s.XIII (I-XV)
- Firenze, Biblioteca Riccardiana 2968/2, f.1-22v, s.XIV (I-XV; proofs only up to I 5)
- Hildesheim, Dombibliothek 744, f.2-108, s.XIII¹ (I - IX 38, X 26 - XV 5)

- København, Kongelige Biblioteket Gl.kgl.S. 277 fol., f.102-113v, s.XIII (I-XV, enunciations only)
- Leipzig, Universitätsbibliothek (formerly Stadtbibliothek) Rep. I,68c, f.1-60, s.XIII (I-XV)
- Lincoln, Cathedral Library 238, f.1-8, s.XIII¹ (VI def.2, VI 1-32; enunciations only)
- London, British Library Addit. 33381, f.186-186v, 187-188v, s.XIVin. (III 36 - IV 4, V 17 - VI 3)
- London, British Library Addit. 34018, f.1-78v, s.XII², XIII¹ (I-XV)
- London, British Library Burney 275, f.293-302, ca. A.D.1300 (I - VII 2)
- London, British Library Royal 10 A VII, f.213, s.XIII (I def., ax., post.)
- London, British Library Royal 15 A XXVII, f.1-47, s.XIIex. (I-XV; proofs only in book I)
- London, British Library Royal 15 B IV, f.154-157v, s.XIII¹ (X 92 - XII 3; proofs only)
- London, British Library Sloane 285, f.14v-65v, s.XIII (VI 5 - XV 5)
- London, British Library Sloane 1044, f.80-80v, s.XIII² (XI 31-36)
- London, Royal Society 28, f.1-74v, s.XIII (I - XV 2)
- München, Bayerische Staatsbibliothek CLM 3523, f.3-21v, s.XIII (I - VI 21)
- München, Bayerische Staatsbibliothek CLM 4377, f.142-142v, s.XIVex. (I def., post., ax.)
- München, Bayerische Staatsbibliothek CLM 13021, f.170-186v, s.XII² (IV-XV; enunciations only)
- München, Bayerische Staatsbibliothek CLM 14111, f.1-4, s.XV (X-XV; enunciations only)
- München, Bayerische Staatsbibliothek CLM 14353, f.78-93v, s.XIII/XIV (I - XI 5)
- München, Bayerische Staatsbibliothek CLM 23511, f.1-29v, ca. A.D.1200 (V-XV; enunciations only)
- München, Bayerische Staatsbibliothek CLM 26889, f.187-187v, s.XIV² (I def., post., ax.)
- Napoli, Biblioteca Nazionale VIII C 22, f.1-44, s.XIII² (I-XV)
- Oxford, Bodleian Library Ashmole 357, f.71-75v, s.XIV (XI def., XI 1-35)
- Oxford, Bodleian Library Auct. F.3.13, f.1-48v, s.XIII² (I-XV)
- Oxford, Bodleian Library Auct. F.5.28, f.ii-xliv, 1-15, s.XIII¹ (I-XV)
- Oxford, Bodleian Library Auct. F.5.29, f.132-158, s.XIIIex. (I - VIII 10)
- Oxford, Bodleian Library D'Orville 70, f.38-38v, s.XIII (introduction to book X)
- Oxford, Corpus Christi College 224, f.114-138, s.XIII (I-XV; enunciations only)
- Oxford, Corpus Christi College 251, f.22-83, s.XIII (I-XV)
- Oxford, Corpus Christi College 283, f.50-65v, ca. A.D.1300 (X - XI 3)
- Oxford, Trinity College 47, f.104v-138, s.XII² (I-XV)
- Paris, Bibliothèque Nationale Lat. 7215, f.4v-105, s.XIIIex. (I-XV)
- Paris, Bibliothèque Nationale Lat. 7292, f.247-267v, s.XV (VII - X 24)
- Paris, Bibliothèque Nationale Lat. 7374, f.1-13v, 109v-111, s.XIII¹ (I - I 46; introduction to book X)
- Paris, Bibliothèque Nationale Lat. 7374A, f.1-57, s.XIIIex. (I - IX 13)

- Paris, Bibliothèque Nationale Lat. 7420A, f.80-85, s.XIII² (I - III 35)
- Paris, Bibliothèque Nationale Lat. 11245, f.1-57v, s.XIII (I - VII 36, X 1-20, X 86-90)
- Paris, Bibliothèque Nationale Lat. 16647, f.3-92, s.XIII¹ (X def. - XV end; f.2r: second proof of X 42 ascribed to Eggebericus)
- Praha, Universitní Knihovna III.H.19 (= 572), f.1-127v, s.XII² (I - XII 4)
- Vaticano, Ottob. lat. 1862, f.1-19, ca. A.D.1200 (I-XV)
- Vaticano, Regin. lat. 1137, f.1-73v, s.XIII² (I-XV)
- Venezia, Biblioteca Nazionale Marciana fondo antico 332 (= 1647), f.86-233, s.XIII² (I-XV, together with Adelard III)
- Wien, Österreichische Nationalbibliothek 83, f.63v-64, s.XIV (introduction to book X)
- Wolfenbüttel, Herzog August Bibliothek Guelf. 51.9 Aug. 4^{to}, f.53-60v, 61-68, s.XIII (I - III 7, V - VIII 5)
- Worcester, Chapter Library Q 89, f.1-3, s.XIV (I - I 20)
- Wrocław, Biblioteka Uniwersytecka Mil. II.10, f.1-115v, s.XIII (I-XV)

Printed edition: H. L. L. Busard, M. Folkerts (eds.), *Robert of Chester's (?) Redaction of Euclid's Elements, the so-called Adelard II Version*. 2 vols. Basel/Boston / Berlin: Birkhäuser Verlag, 1992

12. Texts in the Adelard II tradition

12.1 Adelard III

Incipits: Introduction: *Geometrie sicut et reliquarum facultatum usus suum antecessit artificium*

I def. 1: *Punctus est illud cui pars non est*

I 1, enunciation: *Triangulum equilaterum super datam lineam rectam collocare*

I 1, proof: *Esto exemplum ab linea data. Data dicuntur quibus equalia habitudanter invenire possumus*

Manuscripts:

- Boston, Medical Library 24, post A.D.1466 (introduction only. See Campanus)
- London, British Library Burney 275, f.308-335, s.XIV (IX - XV 3)
- London, British Library Royal 15 B IV, f.158-167v, s.XIII (X 91 - XI 37)
- Oxford, Balliol College 257, f.2-98v, s.XII^{ex} (I - XV 3)
- Oxford, Bodleian Library Digby 174, f.99-132v, s.XII (I-XI), f.139-145 (repetition of 125-132v), f.146-153 (I - V 2), f.154-159v (VI 11 - X)
- Oxford, Bodleian Library D'Orville 70, f.23v-38, s.XIII (VII 7 - X 36)
- Oxford, Bodleian Library Savile 19, f.1-37, s.XIII (I-VI def., the so-called Version IIIB)
- Paris, Bibliothèque Nationale Lat. 16648, f.2-58, s.XIII (X-XV)
- Venezia, Biblioteca Nazionale Marciana fondo antico 332 (= 1647), f.86-233, s.XIII² (I-

XV, together with Adelard II)

- Wien, Österreichische Nationalbibliothek 83, f.53-63v, s.XIV (VII 7 - X 36)

Printed edition: The introduction was edited by M. Clagett, *King Alfred and the Elements of Euclid*, in: *Isis* XLV (1954) 269-277. A critical edition by H. L. L. Busard will appear in 2001.

Remarks: See 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* XLIV (1953) 16-42, esp. pp.23-25. According to recent research by Wilbur R. Knorr, the "usual" version III (named by Clagett 'version IIIA') was written by John ("Bandoun") of Tynemouth and version IIIB by Nicholas le Botiller ("Ocreatus") of Ely; see his article: John of Tynemouth alias John of London: Emerging Portrait of a Singular Medieval Mathematician, in *The British Journal for the History of Science* XXIII (1990) 293-330.

12.2 Thirteenth century commentary

Incipit: I 1, proof: *Sit ab linea data, duo eius capita centra sint circulorum eam occupantium*

Manuscripts:

- Oxford, Bodleian Library D'Orville 70, f.1-23v, s.XIII (I - VII 6)
- Wien, Österreichische Nationalbibliothek 83, f.39-53, s.XIV (I - VII 6)

Remarks: The enunciations are in the form of Adelard II. See H. L. L. Busard, Some Early Adaptations of Euclid's *Elements* and the Use of its Latin Translations, in: *Mathemata. Festschrift für Helmuth Gericke*, ed. M. Folkerts and U. Lindgren (Stuttgart: Franz Steiner, 1985), pp.129-164, esp. p.129.

12.3 Anonymous commentary

Incipit: I def. 1: *Punctus est cui non est pars* I 1, proof: *Ad huius demonstracionem necessaria est tertia peticio et prima et ultima*

Manuscripts:

- Bonn, Universitätsbibliothek S 73, f.1-86, s.XIII (I-XV)
- Paris, Bibliothèque Nationale Lat. 7292, f.188-245v, s.XV (I-VI)
- Pistoia, Biblioteca Fabroniana 315, f.1-48v, s.XIV (I-XV)
- Vaticano, Reg. lat. 1268, f.1-69, s.XIVin. (I-XV)
- Wien, Österreichische Nationalbibliothek 5304, f.1-126v, s.XVI (I 1 - XV)

Printed edition: H. L. L. Busard (ed.), *A Thirteenth-Century Adaptation of Robert of Chester's Version of Euclid's Elements*. 2 vols. München: Institut für Geschichte der Naturwissenschaften, 1996.

Remarks: The enunciations are from Adelard II. The author perhaps used an Adelard III text, too. The text was written before the Albertus Magnus (?) commentary. See H. L. L. Busard, *Some Early Adaptations of Euclid's Elements and the Use of its Latin Translations*, in: *Mathemata. Festschrift für Helmuth Gericke*, ed. M. Folkerts and U. Lindgren (Stuttgart: Franz Steiner, 1985), pp.129-164, esp. pp.131-132 and pp.136-142.

12.4 Campanus of Novara

Incipit: I 1, proof: *Esto data linea recta ab. Volo super ipsam triangulum equilaterum constituere*

Manuscripts:

- Bergamo, Biblioteca Civica A. Mai MA 279 (Delta 4.48), f.33-39v, s.XVI (I def.1 - III 10, enunciations only)
- Berkeley, University of California UCB 79 (olim MAR 35), f.2-165v, s.XV (I - XV)
- Berlin, Staatsbibliothek Preussischer Kulturbesitz Lat. fol. 852, f.85-89v, 90v-92, s.XIV (I I 32, I 41 II 8)
- Berlin, Staatsbibliothek Preussischer Kulturbesitz Lat. qu. 514, f.1-56v, s.XIV (I - VI)
- Berne, Bürgerbibliothek A.50, f.1-168, A.D.1412 (I - XV)
- Boston, Medical Library 24, f.110v-147, post A.D.1466 (I-IX, with introduction from Adelard III; the introduction identical with ms Nürnberg, Cent. VI.13)
- Cambridge, University Library Addit. 6866, f.9-94, s.XIII/XIV (I - XV)
- Cambridge, University Library Gg. I.18 (= 1413), f.1-123, s.XIV (I - XV)
- Cambridge, University Library, Gg. VI.3 (= 1572), f.287v-288, s.XIV (I def., post.)
- Dijon, Bibliothèque Municipale 441 (266), f.1-122v, s.XIV (I-XV)
- Düsseldorf, Universitätsbibliothek F 13, f.21, s.XVIin. (I ax., I 1-6 without proofs)
- Emden, Bibliothek der Grossen Kirche 4^o 14, f.1-229v, A.D.1469 (I - XV)
- Erfurt, Wissenschaftliche Allgemeinbibliothek Amplon. fol. 37, f.1-36, s.XIII/XIV (I - VII)
- Erfurt, Wissenschaftliche Allgemeinbibliothek Amplon. fol. 375, f.18-84v, s.XIV (I - VI)
- Erfurt, Wissenschaftliche Allgemeinbibliothek Amplon. qu. 22, f.3-42v, s.XIV (I - VI 26; the proofs in book I in a different version)
- Erfurt, Wissenschaftliche Allgemeinbibliothek Amplon. qu. 344, f.25-67, s.XIV (I - V 11)
- Erfurt, Wissenschaftliche Allgemeinbibliothek Amplon. qu. 385, f.90-91v, s.XIV (I - I 5)
- Erfurt, Wissenschaftliche Allgemeinbibliothek Amplon. qu. 387, f.9v-23, s.XIV (I - III)
- Firenze, Biblioteca Medicea Laurenziana Plut. 29.27, f.1-7v, s.XVI? (I - II 4,

enunciations only)

- Firenze, Biblioteca Medicea Laurenziana San Marco 212, f.1-132v, s.XV (I - XV)
- Firenze, Biblioteca Medicea Laurenziana Strozzi 62, f.1-60v, s.XIV (I - IX 19)
- Firenze, Biblioteca Medicea Laurenziana Strozzi 71, f.1-187, s.XIV (I - XV)
- Firenze, Biblioteca Nazionale Centrale Conv.soppr. A V 2587, f.1-233, s.XV (I - XV)
- Firenze, Biblioteca Nazionale Centrale Conv.soppr. C VII 2820, f.1-40v, s.XIV (I - V)
- Firenze, Biblioteca Nazionale Centrale Conv.soppr. J I 18, f.1-135v, s.XIV (I - XV)
- Firenze, Biblioteca Nazionale Centrale Conv.soppr. J IV 24, f.1-177v, A.D.1408 (I - XV)
- Firenze, Biblioteca Nazionale Centrale Magliabecch. XI 112, f.1-160, A.D.1259 (I - XV)
- Firenze, Biblioteca Riccardiana MS 129, f.1-179v, s.XIV (I - XV)
- Glasgow, University Library Gen. 1115 (olim BE8-y.18), f.8-172v, A.D.1480 (I - XV)
- Halle, Universitätsbibliothek Za 74, f.175-186v, s.XV (VII 39 - X 64)
- Hildesheim, Dombibliothek 743a, f.55-69v, s.XIV (I - II 12)
- Jena, Universitätsbibliothek El.fol.67, f.1-73v, s.XIV (I - XV)
- København, Kongelige Biblioteket Ny kgl.S. 100 8^o, f.2-86, s.XV (I - XV, enunciations only)
- Krakòw, Biblioteka Jagiellonska 552, f.98-125 (pp.195-249), s.XV (I - III)
- Krakòw, Biblioteka Jagiellonska 567, f.1-127, s.XIV (I - XV)
- Krakòw, Biblioteka Jagiellonska 568, f.5-67v (pp.9-134), A.D.1464/65 (I - XV)
- Krakòw, Biblioteka Jagiellonska 569, f.147-198v (pp.299-402), s.XIV (I - XI 30)
- Krakòw, Biblioteka Jagiellonska 1844, f.41v-82 (pp.82-163), s.XV (I - III)
- Krakòw, Biblioteka Jagiellonska 1859, f.139v-172v (pp.276-342), s.XV (I - III)
- Krakòw, Biblioteka Jagiellonska 1918, f.3-39v (pp.5-78), A.D.1447 (I - III; on f.1v-2v = pp.2-4 commentary to the definitions, axioms, postulates of book I) Krakòw, Biblioteka Jagiellonska 1927, f.20-58 (pp.41-117), s.XV (I - IV 5)
- Kues, Stiftsbibliothek 205, f.134-188v, s.XIV (I-XV)
- Leeuwarden, Prov. Bibliotheek van Friesland, nr. 57 HS, f.1-58v, s.XV (I - XIV 9)
- +Leiden, Bibliotheek der Rijksuniversiteit Perizon. O.47, f.83-96, s.XVIII (I; copied from Leeuwarden, nr. 57 HS)
- Leipzig, Universitätsbibliothek 1461, f.1-79, 80-98, A.D.1440 (I - IX 4, IX 8 - X 36)
- Leipzig, Universitätsbibliothek 1478, f.89-90v, s.XV (I def. - I 21)
- London, British Library Addit. 22783, f.1-102v, s.XV (I - VII 39, VIII 6 - XV)
- London, British Library Arundel 84, f.1-113v, s.XIV (I - XV)
- London, British Library Harley 5266, f.1-126v, s.XIV (I - XV)
- London, British Library Harley 5404, f.1-139v, s.XIV (I - XII)
- Madrid, Biblioteca Nacional 8989, f.1-89v, s.XIII (I - XV)
- Melk, Stiftsbibliothek 781 (181), pp.1-56, s.XV (I)
- Milano, Biblioteca Ambrosiana C 241 inf., f.33-124, A.D.1401 (I - XV) [Ca]
- Milano, Biblioteca Ambrosiana M 28 sup., f.127v-141 (I - III 12), f.143-177v (III-V), s. XIV
- Milano, Biblioteca Nazionale Braidense AF.IX.51, f.63-65v, s.XV (V def.1-16)
- Modena, Biblioteca Estense Lat.567 (= ~~C~~.W.8.12), f.1-179v, A.D.1452 (I-XV)
- Mülhausen, Stadtarchiv 60/2, f.121r-190r, s.XIV/XV (I - XV)

- München, Bayerische Staatsbibliothek CLM 247, f.1-223, s.XV (I-XV)
- München, Bayerische Staatsbibliothek CLM 4377, f.196-200v, s.XV (I - II 4)
- München, Bayerische Staatsbibliothek CLM 11305, f.1-79v, s.XIV (VII-XV)
- München, Bayerische Staatsbibliothek CLM 14111, f.202v-203, s.XV (I - I 1 beginning)
- München, Bayerische Staatsbibliothek CLM 14448, f.70-100, s.XIV (I - VI 32)
- München, Bayerische Staatsbibliothek CLM 28209, f.1-89v, s.XIII/XIV (I - XV)
- Napoli, Biblioteca Nazionale VIII C 20, f.1-17v, 58-67v, 18-57v, 68-80v, s.XV (I - X 1. From book VII on, most proofs are missing)
- Napoli, Biblioteca Nazionale VIII C 21, f.2-106v, s.XV (I - XV)
- Napoli, Biblioteca Nazionale VIII G 86, f.158v-178, 179-220, s.XV (I - III 12, III def.1 - V 34)
- New York, Columbia University Plimpton 156, f.1-164v, ca. A.D.1300 (I - XV)
- New York, Columbia University Plimpton 157, f.1-14v, s.XV (I)
- New York, Columbia University Plimpton 158, f.1-v, s.XIV (II 3 end - II 7 beginning)
- New York, Columbia University Plimpton 159, f.4v-6v, s.XIV (I 1 - III 7, enunciations only)
- New York, Columbia University Plimpton 160, f.1-16v, 17-31v, s.XIV (I - III 29 beginning, III 8 end - V 12)
- New York, Columbia University Plimpton 165, f.29v-140v, s.XIIIex. (I - XV)
- Nürnberg, Stadtbibliothek Cent. VI 13, f.1-162, s.XV (I - XV; the beginning reworked and written by Regiomontanus. See Menso Folkerts, Regiomontanus Euklidhandschriften, in *Sudhoffs Archiv* LVIII (1974) 149-164)
- Oxford, Bodleian Library Arch. Selden. B 13, f.3-65v, s.XIII (I - XV)
- Oxford, Bodleian Library Canon. class. lat. 309, f.1-89v, s.XV (I 2 end - XV)
- Oxford, Bodleian Library Canon. misc. 200, f.37-78v, s.XV (I - V def.1)
- Oxford, Bodleian Library Canon. misc. 554, f.1-73, s.XV (I - VI)
- Oxford, Bodleian Library Digby 191, f.1-66v, s.XIV (I - XV)
- Oxford, Bodleian Library Savile 19, f.37-156, s.XIII (VI 1 - XV)
- Padua, Biblioteca Universitaria Lat.1077, f.1-15v, s.XIV (I - I 38)
- Paris, Bibliothèque Mazarine 3635, f.1-112, s.XIV (I def.2 end - XV; missing are: I 40 end - I 49 beginning, III 35 end - IV 2 beginning, VII 39 end - X 35 beginning, XII 8 end - XIII 12 beginning)
- Paris, Bibliothèque Nationale Lat. 3411, f.92-99v, s.XV (I 1 - 31)
- Paris, Bibliothèque Nationale Lat. 7213, f.1-173, s.XIV (I-XV)
- Paris, Bibliothèque Nationale Lat. 7214, f.1-207, s.XIV (I-XV)
- Paris, Bibliothèque Nationale Lat. 7216A, f.1-190v, s.XV (I-XV)
- Paris, Bibliothèque Nationale Lat. 7366, f.51-84v, s.XIV (I - VI 2)
- Paris, Bibliothèque Nationale Lat. 7373, f.2-2v, s.XIV (I def., ax., post.)
- Paris, Bibliothèque Nationale Lat. 7375, f.1-54, s.XIV (I - V def.16)
- Paris, Bibliothèque Nationale Lat. 14068, f.5-8v, s.XV (I - II 11, enunciations only)
- Paris, Bibliothèque Nationale Lat. 14735, f.1-127v, s.XV (I-XV)
- Paris, Bibliothèque Nationale Lat. 16197, f.2-134v, s.XIII (I-XV)
- Paris, Bibliothèque Nationale Lat. 16198, f.2-73v, s.XIV (I-XV)

- Perugia, Biblioteca Comunale 387 (F.61), f.94(95)-99(100), s.XV (I - I 9)
- Pommersfelden, Graf von Schönbornsche Schlossbibliothek 230 (2852), f.1-149, A. D.1398 (I - XV)
- Praha, Knihovna Metropolitni Kapituli 1459 (M 100), f.53v-60, s.XIV (I - III 29, enunciations only, somewhat different from the usual text)
- Praha, Narodni Museum Nostitz a 4 (151q), f.1-151v, s.XIV/XV (I - XV)
- Praha, Universitni Knihovna IV.D.5 (= 659), f.1-157, s.XIII/XIV (I - XV; I 1 end - 12 beginning and IV 1 - 16 beginning are missing. Reworking of the Campanus text)
- Praha, Universitni Knihovna VIII.G.27 (= 1609), f.135-145v, s.XV (I 1 - VI, enunciations only)
- Princeton, University Library Garrett 104, 160ff., s.XV (I - XV)!!
- Ravenna, Biblioteca Classense 136, 81ff. without foliation, s.XV (I - IX)
- Reims, Bibliothèque Municipale 897, f.66-70, A.D.1451/55 (I def. - I 6)
- Roma, Biblioteca Angelica 127, f.3-5, s.XV (I - I 2 beginning)
- Salamanca, Biblioteca Universitaria 221, f.1-177, s.XIV (I - XV)
- +Salamanca, Biblioteca Universitaria 2624, f.1-94, s.XIII/XIV (I - XV)
- Stuttgart, Württembergische Landesbibliothek HB XI 24, f.2-98v, 107r, A.D.1468-72 (I - VI 32, with special introduction, some additions and commentaries. See Vaticano, Palat. lat. 1352)
- Toledo, Biblioteca Catedral 98-27, f.98-119v, s.XV (I - II 8)
- Vaticano, Archivio S. Pietro H 35, f.1-142v, s.XIVin. (I - XV)
- Vaticano, Lat. 2223, f.1-106v, s.XV (I - XV)
- Vaticano, Lat. 2224, f.1-222, s.XV (I - XV)
- Vaticano, Barb. lat.103, f.1-60, s.XV (X 19 - XV)
- Vaticano, Ottob. lat.1551, f.1-130v, s.XIV (I - XV)
- Vaticano, Palat. lat. 1348, f.1-37v, s.XIV (I - V 28)
- Vaticano, Palat. lat. 1349, f.1-24, s.XIV (I - VII 21, enunciations only, but with proof of V 1 and commentaries to V deff.)
- Vaticano, Palat. lat. 1351, f.1-195v, s.XIV (I 3 end - XV)
- Vaticano, Palat. lat. 1352, f.1-89, s.XV (I - VIII, with special introduction. See Stuttgart, Württembergische Landesbibliothek HB XI 24)
- Vaticano, Palat. lat. 1354, f.98v-99v, 120-120v, ca. A.D.1464 (excerpts from books I, II, III, VII, VIII, X; IX)
- Vaticano, Reg. lat. 1186, f.5-158, s.XV (I - XV; the proofs in book I in a different version)
- Vaticano, Reg. lat. 1261, f.61-197v, s.XIV (I-XV)
- Vaticano, Reg. lat. 1267, f.1-56v, s.XIV (I - VII 3)
- Vaticano, Urb. lat. 506, f.2-159v, s.XV (I - XV) Vaticano, Urb. lat. 507, f.1-143, s.XIV (I - X 3 beg., X-XV)
- Venezia, Biblioteca Nazionale Marciana fondo antico 329 (= 1843), f.12-34, s.XV (I-XV, enunciations only)
- Venezia, Biblioteca Nazionale Marciana Lat. VIII 39 (= 3271), f.1-135, s.XIV (I - XV)
- Venezia, Biblioteca Nazionale Marciana Lat. VIII 77 (= 3223), f.20-98, s.XV (I 24 end -

VII 30 beg.; X 20 end - XV)

- Wien, Österreichische Nationalbibliothek 2367, f.198-247v, s.XIV (I-VI)
- Wien, Österreichische Nationalbibliothek 2465, f.1-142, s.XIVin. (I - XV)
- Wien, Österreichische Nationalbibliothek 4770, f.45-50v. s.XIV (I - I 37. The text of the first proofs differs from the usual Campanus text)
- Wien, Österreichische Nationalbibliothek 4953, f.126-143v, s.XV (I)
- Wien, Österreichische Nationalbibliothek 5304, f.127 (XV 7-13, enunciations only)
- Wien, Österreichische Nationalbibliothek 5417, f.56-74v, s.XIV/XV (I - II 12)
- Wien, Österreichische Nationalbibliothek 5507, f.1-82, A.D.1457 (I-XV)
- Wolfenbüttel, Herzog August Bibliothek Guelf. 65. Aug. fol., f.9-75v, s.XV (I - VI)

Printed editions: First edited by E. Ratdolt (Venice, 1482). Later editions by Henricus Stephanus (Paris, 1516); J. Hervagius (Basel, 1537, 1546, 1558) and others.

Remarks: The enunciations are in the form of Adelard II. Campanus has enlarged the text using, besides others, the [Nayrizi](#) commentary and Jordanus de Nemore, *De arithmetica*. - The numeration of the enunciations is according to the *editio princeps*. - In manuscripts having enunciations only and ending before book V it is difficult or impossible to decide whether they present a Campanus or an Adelard II text. If these manuscripts are from the 14th or 15th centuries, they are listed here. - Reworkings of the Campanus text are to be found in section 20: Translations, reworkings and commentaries mostly from the fifteenth century; not identified texts.

12.5 Reworking Paris, BN Lat. 7374

Incipit: I 47, proof: *Sit triangulus abc, itaque quadratum huius lateris sit tanquam quadrata aliorum duorum laterum. Dico ergo quod iste angulus bac sit rectus*

Manuscript:

- Paris, Bibliothèque Nationale Lat. 7374, f.13v-109v, s.XIII¹: I 47 - IX 38

Remarks: Uses definitions, postulates, axioms, enunciations from Adelard II, but has different proofs which seem to be connected with Adelard I. See 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* XLIV (1953) 16-42, esp. p.29 note 31(2)), and H. L. L. Busard, *Some Early Adaptations of Euclid's Elements and the Use of its Latin Translations*, in: *Mathemata. Festschrift für Helmuth Gericke*, ed. M. Folkerts and U. Lindgren (Stuttgart: Franz Steiner, 1985), pp.129-164, esp. p.136.

12.6 Reworking London, Sloane 285

Incipit: I 1, proof: *Facta dispositione figure per secundam petitionem bis sumptam, 'a puncto et cetera,' per primam conceptionem constat propositum, quia 'que uni et eidem et cetera.'*

Manuscript:

- London, British Library Sloane 285, f.1-14v, s.XIII (I - VI 4)

Remarks: Uses definitions, postulates, axioms, enunciations from Adelard II, but has different proofs which are abridged in the manner of Adelard II. See 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* XLIV (1953) 16-42, esp. p.29 note 31(1).

13. Reworking Vat. Reg. lat. 1268

Incipit: *Executus euclides in superioribus libris quasdam linearum et angularium circulariumque figurarum naturas*

Manuscript:

- Vaticano, Reg. lat. 1268, f.72-91v (V-VI), f.92-112v, 113-113v (X, XI def. - XI 4), s. XIVin.

Printed edition: Some propositions are edited by H. L. L. Busard, *The First Latin Translation of Euclid's Elements Commonly Ascribed to Adelard of Bath* (Toronto: Pontifical Institute of Mediaeval Studies, 1983), *Addendum 3* (pp.400-413).

Remarks: On f.72-91v there is an unknown version of books V and VI; the author used Adelard II, Adelard III, Gerard and Hermann. In book X the author has used Adelard II, Gerard and Hermann, whereas the definitions of book XI and the propositions XI 1-4 very likely go back to a Hermann version. See H. L. L. Busard, *Some Early Adaptations of Euclid's Elements and the Use of its Latin Translations*, in: *Mathemata. Festschrift für Helmuth Gericke*, ed. M. Folkerts and U. Lindgren (Stuttgart: Franz Steiner, 1985), pp.129-164, esp. pp.133-134.

14. an-Nayrizi's commentary on books I-X

Incipits: I def. 1: *Dixit Euclides: Punctum est quod partem non habet*
I 1: *In primo theoremate sunt quinque figure, una Euclidis et 4 Irini*

Manuscripts:

- Krakòw, Biblioteka Jagiellonska 569, f.1-23 (pp.7-51), s.XIV
- Madrid, Biblioteca Nacional 10010, f.13v-36v, 49v-50, s.XIII/XIV
- Oxford, Bodleian Library Digby 168, f.124-125, s.XIV (abridgement)
- Vaticano, Reg. lat. 1268, f.144-183v, 206r-207v, s.XIVin.

Printed editions: M. Curtze, Anaritii in decem libros priores Elementorum Euclidis commentarii, in: *Euclidis Opera Omnia*, ed. I.L. Heiberg et H. Menge, *Supplementum* (Leipzig, 1899), pp.1-252. Edition of book I by P. M. J. E. Tummers, *Albertus (Magnus)' commentaar of Euclides' Elementen der geometrie*, deel II (Nijmegen, 1984), pp.121-190. Edition of books I-IV by P. M. J. E. Tummers, *Anaritius' commentary on Euclid. The Latin translation, I-IV*. Nijmegen: Ingenium Publishers, 1994.

Remarks: Commentary of [an-Nayrizi](#) on Euclid I-X in the translation of Gerard of Cremona.

15. Muhammad ibn `Abd al-Baqi, Commentary on book X

Incipit: *Cum quantitates ad invicem comparantur, alie earum sunt communicantes, alie incommunicantes*

Manuscripts:

- Cambridge, University Library Mm. 2.18, f.49v-65, s.XIV
- Krakòw, Biblioteka Jagiellonska 569, f.23-37v (pp.51-80, s.XIV)
- Madrid, Biblioteca Nacional 10010, f.36v-49v, s.XIII/XIV
- Paris, Bibliothèque Nationale Lat. 9335, f.92v-110v, s.XIII
- Paris, Bibliothèque Nationale Lat. 7377A, f.1-33v, s.XIV

Printed editions: M. Curtze, Anaritii in decem libros priores Elementorum Euclidis commentarii, in: *Euclidis Opera Omnia*, ed. I. L. Heiberg et H. Menge, *Supplementum* (Leipzig, 1899), pp.252-384. and more recently: H. L. L. Busard, A Latin Translation of an Arabic Commentary on Book X of Euclid's *Elements*, in: *Mediaeval Studies* LIX (1997) 19-110.

Remarks: Commentary of [Muhammad ibn `Abd al-Baqi](#) on Euclid X in the translation of Gerard of Cremona. See 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* XLIV (1953) 16-42, esp. p.29 note 29.

16. Commentary on book X by Pappus

Incipit: *Intentio in tractatu decimo libri Euclidis in radicibus est inquisitio de magnitudinibus communicantibus et seiunctis et rationalibus et surdis*

Manuscript:

- Paris, Bibliothèque Nationale Lat. 7377A, f.68-70v, s.XIII (fragment)

Printed edition: G. Junge, Das Fragment der lateinischen Übersetzung des Pappus-Kommentars zum 10. Buche Euklids. (Nr. 7377A, Fol. 68-70 der Bibliothèque Nationale zu Paris), in: *Quellen und Studien zur Geschichte der Mathematik, Astronomie und Physik*, Abt. B,3, Studien (1936), 1-17 edition: pp.7-17.

Remarks: The text is the beginning of Pappus' commentary on Euclid, book X. The Pappus text was translated into Arabic by [Abu Uthman al-Dimishqi](#) and from Arabic into Latin, as it seems, by Gerard of Cremona. See H. Suter, in: *Bibliotheca Mathematica*, 3.Folge IV (1903) 25, and Junge, op. cit., (1936).

17. Commentary of Albertus Magnus (?)

Incipits: introduction: *Sicut triplex est phylosophia ut dicit aristoteles in sexto philosophie prime*
I def. 1: *Punctum est cui pars non est*

I 1, enunciation: *Supra datam rectam lineam equilaterum triangulum constituere*

I 1, proof: *Sit enim data recta linea ab. Per tertiam autem petitionem pono pedem circini immobilem in a*

Manuscript:

- Wien, Dominikanerkloster 80/45, f.105-145, s.XIV (I-IV)

Printed edition: Edition of book I by P. M. J. E. Tummers, *Albertus (Magnus)' commentaar of Euclides' Elementen der geometrie*, deel II (Nijmegen, 1984), pp.1-102.

Remarks: The text is connected with the anonymous commentary (12.3.). See J. E. Hofmann, Über eine Euklid-Bearbeitung, die dem Albertus Magnus zugeschrieben wird, in: *Proceedings of the International Congress of Mathematicians, 14-21 Aug. 1958*, ed. J. A. Todd (Cambridge, 1960), pp.554-566. - Tummers (1984), deel 1, and: The Commentary of Albert on Euclid's Elements of Geometry, in: *Albertus Magnus and the Sciences. Commemorative Essays 1980*, ed. by J. A. Weisheipl (Toronto, 1980), pp.479-499.

18. Commentary ascribed to Roger Bacon

Incipit: *Nulla linea nisi tantum una residuo coniungi potest ut sint ambe sub termino et specie earum que erant ante separationem scilicet quando factum erat residuo et hoc potest patere*

Manuscript:

- Firenze, Biblioteca Nazionale Centrale Conv.soppr. J IX 26, f.46-55, s.XV

Printed edition: H. L. L. Busard, Ein mittelalterlicher Euklid-Kommentar, der Roger Bacon zugeschrieben werden kann, in: *Archives Internationales d'Histoire des Sciences XXIV* (1974) 199-218; edition on pp.204-217.

Remarks: See Busard (1974).

19. Nicole Oresme, Quaestiones super geometriam Euclidis

Incipit: *Circa librum Euclidis queritur primo circa quoddam dictum Campani dicens quod magnitudo decrescit in infinitum*

Manuscripts:

- Seville, Biblioteca Colombina 7-7-13, f.102v-112, s.XIV
- Vaticano, Lat. 2225, f.90-98v, s.XV
- Vaticano, Chigi F IV 66, f.22v-40, s.XIV

Printed edition: H. L. L. Busard, *Quaestiones super geometriam Euclidis* (Leiden: E. J. Brill, 1961).

Remarks: See Busard (1961).

20. Translations, reworkings and commentaries from the fifteenth century; texts not identified

Manuscripts:

- Admont, Stiftsbibliothek 442, f.1-5, s.XIII/XIV: definitions principally taken from Euclid I (f.1-1v), Euclid I - II 13 (Adelard II or Campanus), enunciations only (f.1v-4), proofs of Euclid I 32 and of "secondary propositions" (f.4-5). See P. M. J. E. Tuumers, Geometry and Theology in the XIIIth century, in: *Vivarium XVIII* (1980) 112-142
- Cambridge, University Library li. I.13 (= 1705), f.55v-56v, s.XIV (V 1-34. Commentary to book V, as it seems, by Walter of Evesham. The enunciations are from Campanus. The

author gives numerical examples)

- Erfurt, Wissenschaftliche Allgemeinbibliothek Amplon. qu. 344, f.68-87v, s.XIV (Quaestiones about Euclid, book I)
- Firenze, Biblioteca Medicea Laurenziana Ashburnham 1234, f.9-15v, s.XIV (reworking and commentary)
- Jena, Universitätsbibliothek El.fol.73, f.25v-30v, s.XV/XVI (mathematical texts among which some excerpts from Euclid in the Campanus tradition. The excerpts seem to be from a university lecture)
- Jena, Universitätsbibliothek Prov.oct.254, f.11-240v, s.XV/XVI (I-XIV. Special commented version, as it seems, a university lecture. See Kassel, Math. 8° 8)
- Kassel, Murhardsche Bibliothek Math. 8° 8, f.2-105, s.XV (I-IX. Special commented version, as it seems, a university lecture. See Jena, Prov.oct.254)
- Kraków, Biblioteka Jagiellonska 569, f.37v-47, (pp.80-99), s.XIV (XI-XV, reworking of the Campanus text. The enunciations and some addenda are identical with the Campanus text)
- Leipzig, Universitätsbibliothek 1478, f.80r-88v, s.XV (I def. - V def.1, with commentary, as it seems, from a university lecture)
- London, British Library Addit. 24071, f.70-71v, s.XV (I 2 - XIII 10, enunciations only, in the Campanus version. Only those enunciations are given which are necessary for the proofs in the treatise *De sinibus et cordis ac eorum arcubus*. See Wien, 5268)
- London, British Library Sloane 1478, f.8-42, s.XVII (I-VI, enunciations only with some notes. The text is based upon Campanus version, but not a pure Campanus text)
- +Lübeck, Bibliothek der Hansestadt Math.1, f.1-44v, s.XV (I - VII 12, Campanus ?). Destroyed during World War II
- +Lübeck, Bibliothek der Hansestadt Math.12, f.1-103, s.XVI ("Euclides, Elementa, cum commentario Theonis"). Destroyed during World War II
- +Lübeck, Bibliothek der Hansestadt Math.13, f.1-2, s.XVI (fragment of book XI). Destroyed during World War II +Mostyn Hall 82, s.XV (sold by Sotheby 13 July 1920. Present location unknown)
- München, Bayerische Staatsbibliothek CLM 6, f.1-438v, A.D.1539 (Zamberti, with his translation of the commentary by Proclus)
- München, Bayerische Staatsbibliothek CLM 657, f.82-95v, s.XV (I-VI, diagrams only)
- München, Bayerische Staatsbibliothek CLM 18800, f.121-123, s.XIV/XV (excerpts from Euclid, mostly book I, and texts concerning latitudines formarum)
- New York, Columbia University Plimpton 214, f.2-153, s.XVI (I-III, Zamberti)
- Oxford, Bodleian Library Digby 98, f.130v-131v, s.XV (I 1-6: reworking of the Campanus text; enunciations in the Campanus tradition. On f.131v diagrams of I 7-47)
- Oxford, Bodleian Library Digby 178, f.88-107, s.XIV (I-XV. Enunciations in the Campanus version. There are only some shortened proofs which are based on the Campanus text)
- Oxford, Corpus Christi College 234, f.1-94, 95v-96v, 98-170, s.XV (I-XV. Enunciations in the Campanus version. The author of the proofs which differ from the Campanus text used different manuscripts, among them Campanus, Adelard II and the text in Paris, BN

Lat. 10267)

- Paris, Bibliothèque Nationale Lat. 7219, f.1-26v, s.XV (I - VI, diagrams only)
- +Perugia, Biblioteca Comunale 322, s.XV (Brani d'... Euclide)
- Piacenza, Biblioteca Comunale Pallastrelli 211, f.1-32v, s.XVex. (XIV - XV, G. Valla, with dedication letter to Petrus Barocius)
- Praha, Knihovna Metropolitni Kapituli 1459 (M 100), f.21-48, s.XIV (Quaestiones about Euclid, book I. On f.49v-50, 52v-53 there are notes, commentaries and small extracts from Euclid)
- Praha, Knihovna Metropolitni Kapituli 1585 (O 1), f.166-174v, 176-178, s.XV (Commentary to I-VI, as it seems, from the university lecture)
- Torino, Biblioteca Nazionale H.VII.46, f.1-134v, s.XVI (I-VIII, Zamberti. Enunciations only)
- Vaticano, Lat. 2114, f.257v-258, s.XIV
- Vaticano, Barb. lat. 3, p.1-355, s.XVI (I-VI, Campanus and Zamberti texts)
- Vaticano, Barb. lat. 304, s.XVI: Annotationes in 7. Euclidis
- Vaticano, Ottob. lat. 2273, f.1-49v, s.XVI (XIV-XV, G. Valla with dedication letter to princeps Albertus pius Carpensis)
- Vaticano, Regin. lat. 1208, f.1-32, s.XVI (Michael Stifel, commentary to book X)
- Wien, Österreichische Nationalbibliothek 5268, f.98-98v, s.XV (I 2 - XIII 10, enunciations only, in the Campanus version. Only those enunciations are given which are necessary for the proofs in the treatise *De sinibus et cordis ac eorum arcibus*. See London, Add. 24071)

Appendix by Dr.Folkerts - a list of recent publications

The most important books and articles in this field published since the time of the original publication are (in order of date published):

- H. L. L. Busard, M. Folkerts (eds.), *Robert of Chester's (?) Redaction of Euclid's Elements, the so-called Adelard II Version*. 2 vols. Basel / Boston / Berlin: Birkhäuser Verlag, 1992.
- Sonja Brentjes, Textzeugen und Hypothesen zum arabischen Euklid in der Überlieferung von [al-Haggag b. Yusuf b. Matar](#) (zwischen 786 und 833), in: *Archive for History of Exact Sciences* XLVII (1994) 53-92.
- P. M. J. E. Tuumers (ed.), *Anaritius' commentary on Euclid. The Latin translation, I-IV*. Nijmegen: Ingenium Publishers, 1994.

- Sonja Brentjes, The Relevance of Non-Primary Sources for the Recovery of the Primary Transmission of Euclid's *Elements* into Arabic, in: *Tradition, Transmission, Transformation. Proceedings of Two Conferences on Pre-modern Science held at the University of Oklahoma*. Edited by F. J. Ragep and S. R. Ragep with St. Livesey. Leiden: E. J. Brill, 1996, pp.201-225.
- H. L. L. Busard (ed.), *A Thirteenth-Century Adaptation of Robert of Chester's Version of Euclid's Elements*. 2 vols. München: Institut für Geschichte der Naturwissenschaften, 1996.
- H. L. L. Busard, A Latin Translation of an Arabic Commentary on Book X of Euclid's *Elements*, in: *Mediaeval Studies* LIX (1997) 19-110.
- Sonja Brentjes, Additions to Book I in the Arabic Traditions of Euclid's *Elements*, in *Studies in History of Medicine & Science* XV, no. 1-2, New Series (1997/98) 55-117.