

## Reviews

Arianna Borelli, *Aspects of the astrolabe, "architectonica ratio" in tenth- and eleventh-century Europe*. Sudhoffs Archiv 57, Wissenschaftsgeschichte. Franz Steiner Verlag, Stuttgart, 2008, 270 pp.

Arianna Borelli's *Aspects of the astrolabe* is an excellent revision, with new interpretations, of all known aspects of the early collection of Latin texts on the astrolabe and other astronomical instruments compiled in Catalonia towards the end of the 10<sup>th</sup> century, which had a clear Arabic origin. It is based on a complete, updated bibliography (see pp. 246-266) and a direct study of the available manuscripts: the two lists of manuscripts dealing with the astrolabe and dated between the 11<sup>th</sup> and the 15<sup>th</sup> centuries, which appear in appendixes 7 and 8 (pp. 226-237), are extremely useful and a good starting point for any future research on the subject.

The book comprises six chapters plus six appendixes, a bibliography and indexes of names and subjects.

Chapters 1 and 2 give a thorough explanation of what an astrolabe is and a survey of stereographic projection which is more or less intuitive and avoids the use of geometry and trigonometry. In this way the author explains how Latin scholars of the late 10<sup>th</sup> and 11<sup>th</sup> c. were able to understand the treatises on the construction of the astrolabe. The book continues with a brief outline of the history of the astrolabe until the 11<sup>th</sup> c. (3.1) followed by an analysis of sources: both actual astrolabes (3.2) and texts including a survey of editions and results obtained in previous research (3.3 and 3.4). In this chapter Borelli also explains something which is essential for the first of the two main theses she presents in her study: the state of the sources makes it extremely difficult to prepare a critical edition of the corpus, as she exemplifies with the different attempts made to establish the text of J (*De utilitatibus astrolabii*). In the same way she also underlines an obvious truth: only two Arabic sources have been identified by Paul Kunitzsch as texts translated into

Latin in the collection (short passages of a treatise by al-Khwārizmī and of an Arabic translation of Ptolemy's *Planisphaerium*).

The first of her two theses is formulated in chapter 4 in which she states that the astrolabe manuscripts of the old collection “are the written traces of a process of transmission and assimilation of knowledge which took place thanks to a combination of written and non-written, verbal and non-verbal strategies of communication” (p. 99). In other words, one should not consider that the extant texts of the early collection are, all of them, translations of Arabic originals or revisions of earlier translations, but rather notes taken during or after (Borelli emphasizes the importance of memory) an oral explanation in which drawings were used: one of the great assets of this book is its careful study of illustrations (see 4.4, pp. 118-129).

I fully support this theory although I believe that one should add actual Arabic artefacts to the drawings. The author underlines (p. 110) the insistence of the texts on the need to memorize the Arabic terms of the parts of the astrolabe and this is, in my opinion, extremely important. When one reads, for example, the *Astrolabii sententiae* or *De utilitatibus astrolabii* one is somewhat puzzled by the use of Arabic terms (in some cases even a full sentence) which are totally unnecessary because they are immediately followed by a Latin

translation. It seems to me that only Arabic astrolabes were available at an early stage (the case of the “Carolingian astrolabe” is unique) and that a minimal knowledge of Arabic was necessary to read the inscriptions (mainly the *abjad* notation, star names etc.) if one had to use an astrolabe. A good example of the kind of instruments used can be found in the bilingual drawings of an Arabic astrolabe made by Khalaf ibn al-Mu'ādh, extant in ms. BnF lat. 7412 and studied by Kunitzsch (2004). Here all the inscriptions of the instrument are copied carefully in Kufic script and are perfectly readable in an 11<sup>th</sup> c. manuscript (see 5.6.1, pp. 203-206). An evolution of this kind of bilingual illustration can be seen in a photograph of the (no longer extant) 12<sup>th</sup> c. ms. Chartres 214 fol. 30r, where we find a clumsy attempt to reproduce the Arabic inscriptions of the instrument which become barely illegible here; a third example, which is even worse, can be found in the ms. London, British Library Old Royal 5 B, fol. 71r, the date of which is doubtful; here the author of the drawing has made an unsuccessful attempt to reproduce the Arabic inscriptions but seems to have tired of the effort, leaving most of the spaces empty. It is obvious that the author of the drawings of the BnF manuscript knew Arabic, but this is not the case of the two others and the successive copies of Arabic inscriptions by illustrators

who did not know the Arabic alphabet became progressively more corrupt and illegible. Illustrations of this kind are referred to in an appendix to the *Astrolabii sententiae* (Millàs, 1931, p. 288) the title of which is “Hec est figura interpretationis verborum arabicorum in latinum que sunt in astrolapsu” (see on this topic J. Samsó, “Els inicis de la introducció de la ciència àrab a Europa a través de Catalunya”, in Joan Vernet & Ramon Parés (dirs.), *La ciència en la història dels Països Catalans. I. Dels àrabs al Renaixement*. València, 2004, pp. 115-159, especially pp. 132-141).

Within chapter 4 two subchapters are particularly interesting: the first (4.5, pp. 129-137; see also 6.3.8, pp. 187-188) emphasizes, quite convincingly, the echoes of the Arabic translation of the *Planisphaerium* in several texts and drawings of the old collection, with a thorough analysis of the construction of the two tropics and the ecliptic. It seems clear that the short text edited by Kunitzsch (1993) is not isolated and that the *Planisphaerium* was read and understood by the Latin scholars. The second subchapter (4.6, pp. 137-157) contains a careful study of the procedures used to divide the projection of the ecliptic into the twelve zodiacal signs both in the different texts and in the drawings of manuscripts Vat. Reg. lat. 598, fol. 120r and BnF lat. 7412 fol. 19v, as well as in the Carolingian astrolabe. In this latter

instrument it seems that the division of the ecliptic into signs corresponds to the original date in which the astrolabe was built and that it agrees with the instructions registered in the texts, while the subdivisions into smaller parts, as well as the inscriptions with the name of the zodiacal signs, are much later and made incompetently.

Other details related to the astrolabe are referred to in chapter 5. Thus in 5.6, when Borelli discusses the perfect drawings of an astrolabe in ms. BnF 7412, she remarks (p. 204) that “neither Western nor Eastern Arabic-Islamic astrolabe artefacts usually had plates for the seven climates”. This may be true but one must bear in mind that, at least the *Astrolabii sententiae* and the *De astrolabii compositione* (see Millàs, 1931, pp. 279 and 309) seem to refer to plates of this kind when they state that an astrolabe is composed by five *rotae*: one of them should correspond to the rete, another to the “mother” (on which the plate for one latitude is engraved) and the other three are three plates, with latitude diagrams on both sides. We have, therefore, seven possible latitudes in which the astrolabe may be used and it is logical to assume that these seven latitudes correspond to the seven climates. Another reference to the climates can be found in 5.3.2 and 5.3.3 in which Borelli collects references in the different manuscripts of J (*De utilitatibus astrolabii*) to the maximum length

of a temporal hour: 18°, 19° and 20° are the values quoted, and it is easy to see that a longest hour of 18° corresponds to a longest day of  $(18 \times 12) / 15 = 14\text{h } 24\text{m}$ , an approximation to 14 h. and 30 m which, in Ptolemy's division of the climates, corresponds to climate IV; similarly a longest hour of 19° corresponds to a longest day of 15 h 12m (15 h in climate V) and 20° to 16 h (climate VI). The values for the longest hour used by the manuscripts are, perhaps, the result of adaptations to the local latitudes of the place in which each manuscript was copied. Finally, also in 5.6 (p. 204), when the author refers to the calendric scale on the back of the astrolabe drawings of ms. BnF 7412, as well as in the Carolingian astrolabe and in several texts of the collection, she believes that this scale is a result of the influence of Latin culture. This is a hypothesis with which I was in full agreement until David King published (*Suhayl* 8, 2008, pp. 93-119) a study of an instrument made by Nasṭūlus in Baghdad ca. 900 in which a diagram of this kind appeared. Nowadays one cannot be so sure.

Chapter 5 begins with the second main thesis of the book in which Borelli investigates why early medieval Latin scholars were interested in the astrolabe. According to her, the instrument was useful as a way to understand and rationalise the structure of the world. This is absolutely correct and there is no doubt that the astrolabe has always been considered as a

practical instrument of particular use for an elementary course on spherical astronomy. On the other hand, it is obvious that the old collection of Latin texts omits any reference to astrology (cf. pp. 173-174). It is also clear that the Latin astrological collection published by David Juste (2007) under the title *Alchandreana*, which seems to have the same origin as the astronomical one, explains divination techniques which are mostly unrelated to astronomy and to astrology proper. Therefore the astrolabe was of little use to the readers of the *Alchandreana*. The Latin texts insist, however, on the utility of the instrument for time reckoning and for other monastic applications. Borelli seems somewhat sceptical about the ability of the instrument to tell the time (pp. 162-163) and refers to the famous passage, already discussed by Poulle (1980), in which Walcher of Malvern states that he has used an astrolabe (a nocturnal, according to Poulle?) to determine the time of a lunar eclipse in 1092. She also refers (pp. 184-187) to the text in which the depth of a body of water is established by measuring the time needed by a loaded sinker to reach the bottom and, then, to reappear again after discharging its load: according to the text an astrolabe is used for this purpose. Borelli believes that other instruments, like sundials (see below), are more reliable for timekeeping. She is probably right but, perhaps, slightly hypercritical in her rejection of the practical

applications of the astrolabe: it is obvious that establishing the time by an observation of the solar altitude has practical difficulties, but the determination of the altitude of a star is perhaps less difficult. On the other hand, the use of the diagram for the hours, in the lower part of each plate, only gives approximations, but a much better result can be obtained by measuring the rotation of the index of the rete between the rise of the star and the moment in which it reaches the observed altitude. In daytime a sundial can be used, although the precision in the measurement of time is in ordinary sundials rather low. During the night, if one does not want to use an astrolabe, the only possibilities are a nocturnal or a clepsydra. A drawing of a nocturnal appears in the lower part of Fig. 25 (p. 194), from ms. BnF 7412, fol. 15r: it depicts a polar sighting tube with a graduated movable disk at the end. Sighting tubes were used by Arab astronomers but there is no evidence of their knowledge of the nocturnal.

Chapter 5 also contains an analysis of the available information on sundials in the old corpus (5.1.4 and 5.1.5, pp. 164-166) and we find most interesting data about equatorial sundials in 5.5 (pp. 197-203), in which I would like to emphasize the importance of the drawing reproduced also in Fig. 27 (p. 198): ms. BnF lat. 7412, fol. 19r, represents an equatorial sundial with curves corresponding to the hours of the five monastic prayer throughout

the solar year. I do not know whether such curves are common in early medieval Latin texts and instruments, but they remind me of the curves for the prayers of *zuhr* and *'aṣr* in Arabic sources. In the same chapter we also find information on other astronomical instruments such as the quadrant which Millàs called *vetustissimus* (5.4.5, pp. 195-197) and, especially, the celestial globe (5.3.5, pp. 181-183) described in “De horologio secundum alkoram id est speram rotundam”: I entirely agree with Borelli’s interpretation that the passage does not deal with a spherical astrolabe, but rather with a celestial sphere, as was established by Richard Lorch in 1980. It is, however, more difficult to accept Marco Zuccato’s interpretation (2005), according to which the Latin text would derive from a treatise by Dunāsh ibn Tamīm, active in the Fatimid court of Mahdiya (Tunis) ca. 925-960, who would have sent a treatise on the sphere to the Jewish Cordovan physician Ḥasdāy b. Shaprūt. The possible connections of Ḥasdāy with Catalonia are easy to justify but the problem is that the treatise sent by Dunāsh to Ḥasdāy did not deal with the celestial globe but was an introduction to astronomy composed of three parts: the science of the structure of the spheres, mathematical astronomy and astrology (see S.M. Stern in the *Festschrift* for Millàs-Vallcrosa, Barcelona, 1956). If one looks for a source of the Latin text, the use of an alidade with two sights

(*foramina*) and other details of the description make me think of the *bayda* described by al-Battānī in his *zīj*, a source that was well known by Maslama al-Majrīfī, whose influence on the old Latin corpus is well established. In fact, the drawing of ms. BnF 7412 fol. 15r (Fig. 25, p. 194) representing a sphere with seven sighting tubes may correspond to the aforementioned celestial sphere in which the illustrator tried to draw seven different positions of the alidade which is probably fixed to a movable ring (*circulus horarum*) which rotates perpendicularly to the horizon.

Chapter 6 (pp. 214-225) contains a summary of the whole book and an analysis of the success the texts of the old collection had, as it was copied until the 15<sup>th</sup> century. The most popular were the late recension made by Hermann of Reichenau on the construction of the astrolabe (text h) and the *Horologia viatorum*, as well as text J (*De utilitatibus*). They remained the standard works of reference on the astrolabe until, in the mid 13<sup>th</sup> century, the two books on the construction and use of the astrolabe by the pseudo-Māshā'allāh appeared.

Julio Samsó

Massimiliano Lisa, Mario Taddei, Edoardo Zanon, *The Book of Secrets in the Results of Ideas. Incredible Machines from*

*1000 Years Ago, Ibn Khalaf al-Murādī*. Leonardo3, Milano, 2008.

This important publication is a luxury product which has been able to see the light thanks to the sponsorship of the emir of Qaṭar. It contains the first complete edition and translation of Ibn Khalaf al-Murādī's *Kitāb al-asrār fī natā'ij al-afkār*, a book which describes five mechanical toys (machines 1-5), 18 clocks moved by water (machines 6-15, 17-20, 27-30), four war machines (machines 21-24), two water-lifting devices (machines 25-26) and a sundial (machine 31, followed by four appendixes, on which see below). Machine 16 is missing in the manuscript.

The work is presented in the form of four fascicles contained in a card box. They are not numbered but I will give them numbers following a logical order:

1) Facsimile reproduction of the Arabic manuscript Florence, Medicea - Laurenziana Library Or 152, fols. 1r-48v. This is the only extant manuscript of al-Murādī's work. The date on which it was copied appears in fol. 48v: the last ten days of May of year 1304 of the Hispanic era (1266 A.D.) = 21 Sha'bān 664 H (28<sup>th</sup> May). Dating according both to the Hispanic era and the Islamic calendar implies, in principle, that the manuscript was copied by a Muslim (or, perhaps, a Jew) living in one of the Christian kingdoms of Spain. The year coincides with the reign of King Alfonso X (1252-

1284), in which there was a serious interest in Islamic scientific culture. The *Kitāb al-asrār* is followed, in the Florence manuscript, by Ibn Mu'ādh's treatise on spherical trigonometry (fols. 49v-70v) and by Ibn Mu'ādh's treatise on the projection of rays (fols. 71r- 80r). This latter work is dated in Toledo between the 10<sup>th</sup> and the 20<sup>th</sup> of March 1303 H.A./1265 A.D. To this, one should add that on fol. 81r of the same manuscript there is a note, in Arabic written in Hebrew script, by Ishāq b. Sīd (one of the two main scientific collaborators of King Alfonso) in which he states that he has read the text and tried to reconstruct its contents: it is not clear whether he refers to the *Kitāb al-asrār* or to the anonymous *Kitāb al-dawālīb wa l-arḥā' wa 'l-dawā'ir al-mutaḥarrīka min tilqā' dhātihā* (on water-lifting devices) extant in the same manuscript in fols. 81v-89v. It is, therefore, clear that the ms. was copied in Toledo in the Alfonsine circle.

2) The second fascicle (191 pp.) contains an edition of the *Kitāb al-asrār* without identification of the name of the editor. As the Florence manuscript is in a very bad state and about a third of its contents have been lost, the editor has tried to reconstruct a certain number of sentences by filling the gaps with hypothetical readings. The criteria for the edition are not clear and the editor has not tried to standardize the Arabic text according to the basic grammatical rules (for example in the spelling of *hamza*).

The edition is preceded by three introductory studies (in Arabic) by Massimiliano Lisa, Edoardo Zanon and Mario Taddei. Together with the text, there are excellent coloured photographs of the drawings of the manuscripts and of the reconstructions of the machines made by the authors of the publication.

3) The third fascicle (191 pp.) contains the same introductory studies (in English) and an English translation of the whole work by Ahmed Ragab, accompanied by photographs similar to those of the edition. Sometimes the illustrations of the reconstructed machines contain peculiar details: the astrolabic dials of machines 15 (pp. 107, 109) and 18 (p. 119) seem to be upside down (the upper part of the illustration corresponds to the part of the astrolabic plate which is below the horizon); another astrolabic dial of machine 28 (p. 164) depicts a rete which is not on top of a standard plate but on some kind of geographical table; the illustration in p. 159 (machine 27) is a mirror image.

Both the edition and the translation add to the heading of each numbered chapter (called *ṣūra* = figure) a subtitle which summarizes, in a few words, the main characteristics of the figure: these subtitles are additions by the editor and/or translator. Each chapter also includes an "interpretation" which, in most cases, is only a summary of the dramatic action implied in the description of the Arabic text. Nowhere do we find a thorough

analysis of the functioning of each machine. A quick comparison of several passages of the Arabic edition with the corresponding translation makes me think that the two texts do not coincide completely: quite often the hypothetical additions introduced by the editor have not been translated. On the other hand, several chapters describe astronomical clocks which, besides telling the time, also indicate the four cusps of the horoscope: the translator seems to have had difficulty in translating the astronomical terminology and his translations are, in some cases, inexact.

4) The fourth fascicle is not a fascicle proper but a DVD in which we find a) a facsimile of the manuscript and b) a reconstruction of each one of the machines where we can see the movement of the actors of each dramatic scene as well as a detail of the machinery used. The rhythm of the motion is extremely fast and it is difficult to establish whether the reconstructed mechanisms agree with the descriptions of the Arabic text.

One of the defects of this publication is that the authors seem to have ignored a good part of the previous research on al-Murādī's work. Here is a list of the missing publications:

A.I. Sabra, "A Note on Codex Medicea-Laurenziana Or. 152", *Journal for the History of Arabic Science* 1 (1977), 276-283 (containing the first complete description of the Florence manuscript).

D.A. King, "Three Sundials from Islamic Andalusia", *JHAS* 2 (1978), 358-392. Reprint in King, *Islamic Astronomical Instruments*, Variorum Reprints, London, 1987 (King edits the text of the first two appendixes to machine 31).

M.V. Villuendas: "A Further Note on a Mechanical Treatise Contained in Codex Medicea Laurenziana Or. 152", *JHAS* 2 (1978), 395-396.

D.R. Hill, *Arabic Water-Clocks*, Institute for the History of Arabic Science, Aleppo, 1981, pp. 33-45.

R. Casals, "Consideraciones sobre algunos mecanismos árabes", *al-Qanṭara* 3 (1982), 333-345.

J. Vernet, "Alfonso X el Sabio: Mecánica y Astronomía", *Commemoración del Centenario de Alfonso X el Sabio*, Madrid, 1984, pp. 23-32. Reprint in J. Vernet, *De 'Abd al-Raḥmān I a Isabel II*, Barcelona, 1989, pp. 341-350.

J. Vernet, "Alfonso el Sabio y la Mecánica", *Boletín de la Real Academia de la Historia* 185 (1988), 29-38. Reprint in J. Vernet, *De 'Abd al-Raḥmān I a Isabel II*, pp. 331-340.

J. Vernet, R. Casals & M.V. Villuendas, "El capítulo primero del *Kitāb al-asrār fī natā'iy al-afkār*", *Awrāq* 5-6 (1982-83), 7-18. Reprint in J. Vernet, *De 'Abd al-Raḥmān I a Isabel II*, pp. 319-330.

D.R. Hill, "Tecnología andalusí", in J. Vernet and J. Samsó (eds.), *El legado científico andalusí*. Catalogue of an Exhibition held in Madrid, at the Museo Arqueológico

Nacional, in 1992. Madrid, 1992, pp. 162-172. Cf. also pp. 304-309.

J. Casulleras, "Descripciones de un cuadrante solar atípico en el Occidente Musulmán", *al-Qanṭara* 14 (1993), 65-87.

J. Casulleras, "El último capítulo del *Kitāb al-asrār fī natā'iy al-afkār*", in J. Casulleras and J. Samsó (eds.), *From Baghdad to Barcelona. Studies in the Islamic Exact Sciences in Honour of Prof. Juan Vernet*. University of Barcelona, Barcelona, 1996. II, pp. 613-653.

Two papers are particularly important in this list: Vernet, Casals and Villuendas (1982-83) and Casulleras (1996). The former contains a detailed study of the first machine of the book. Using it as a basis, Eduard Farré built two copies of the machine. One of them was shown in the Museo Arqueológico Nacional during the exhibition *El legado científico andalusí* (Madrid, 1992, see the catalogue p. 309) and is now in the Museo Nacional de la Ciencia y de la Técnica (Madrid). The second copy is preserved in the museum of the Institut für Geschichte der Arabisch-Islamischen Wissenschaften (Frankfurt). Casulleras's paper (1996) contains an edition, translation and full commentary of al-Murādī's "machine" 31, a most peculiar sundial, which Casulleras interprets as an equatorial dial used as if it were horizontal, together with a most interesting comparison with the sundial described in ms. Lat. Ripoll

225 (beginning of the 11<sup>th</sup> c.). Casulleras's conclusion, with which I fully agree, is that machine 31 has a late Latin origin. Al-Murādī's text asserts that the sundial can be used for any latitude and the translator considers that machine 31 is a "portable sundial" (?).

The problems aroused by machine 31 and by the four appendixes which follow it (a description of another sundial, a chapter on the procedure to determine the meridian line using the technique known as the "Indian circle", a table on the solar altitude for the entrance of the sun in each zodiacal sign, and a chapter on the determination of the *qibla* for Cordova) lead me to consider, here, the problem of the name, epoch and location of Ibn Khalaf al-Murādī. First of all the name: when, in 1977, I saw a microfilm of ms. Medicea Laurenziana 152, for the first time, I remember reading (on fol. 1v) ..*m.d Ibn Khalaf al-Murādī* and I thought the *m.d.* might be the final two letters of either *Aḥmad* or *Muḥammad*. Nowadays these two letters do not appear in the facsimile and one can only read *Ibn Khalaf al-Murādī* with something, in front of *Ibn*, which could be interpreted as a *d* or a *r*. Consequently, one cannot be sure, nowadays, that Ibn Khalaf's first name was *Aḥmad*. As for the location, the authors of the present publication consider that al-Murādī was working in Cordova (fasc. 3, p. 11) and they say so

because of appendixes 3 and 4: the solar altitudes of the table in appendix 3 are calculated for the latitude of Cordova (38;30°); the interpretation of this table in the translation (Fasc. 3, p. 186) is full of errors and absurd values, mainly because the translator is not aware of the existence of a Western *abjad* system in which several letters have different values from those in Eastern *abjad*. This table had already been edited twice, by King (1978) and by Casulleras (1996). On the other hand Cordova is explicitly mentioned in appendix 4. It seems that the authors of this publication do not realize that the four appendixes have nothing in common with the machines described in chapters 1-30 and that at least two of them derive from earlier sources: appendix 1 is attributed to Ibn al-Šaffār and appendix 2 to al-Battānī in the text; appendix 1 is identical to the description in the *Kitāb fī l-hay'a* by Qāsim b. Muṭarrif al-Qaṭṭān as established by Casulleras (1993). To this one should add that Casulleras has established that the maximum rising and setting amplitudes of the sun mentioned in the text is 30°, which corresponds to a latitude of 37;6° and could be that of Cordova. It seems clear that machine 31 and the four appendixes derive from Cordovan sources.

In the rest of the book (machines 1-30) the situation is entirely different: in machines 14, 17, 18, and 27 we find explicit references to

a length of 15 equinoctial hours for the longest day of the year and this value corresponds to a latitude of 40;41° (if we use an obliquity of the ecliptic of 24°) and of 41;17° (for an obliquity of 23;33°). This value does not correspond to Cordova but rather to Toledo and this is why I suggested that al-Murādī was living in Toledo during the period in which the city became the most important scientific centre in al-Andalus (see *Las Ciencias de los Antiguos en al-Andalus*, Madrid, 1992, pp. 249-257). This is a mere hypothesis but it seems to me more acceptable than placing the author in Cordova.

As a conclusion, I would say that this publication is an important advance in the study of an extremely interesting scientific work because it provides us with an excellent facsimile of the manuscript, an edition and a translation which make the text more accessible. It is not, however, a finished product and an accurate interpretation of the machinery described in the 29 extant chapters is still needed. I only hope that the work done by the authors will encourage other scholars to finish the task.

Julio Samsó

Charles Burnett, *Arabic into Latin in the Middle Ages. The Translators and their Intellectual*

*and Social Context.* Ashgate-Variorum, Farnham, Surrey, 2009. VIII + 412 pp.

Charles Burnett is today's leading expert in the history of medieval scientific and philosophical translations from Arabic into Latin (an updated list of his works can be found at <http://warburg.sas.ac.uk/institute/cburnett.htm#top#top>). His editions, in collaboration with M. Yano, and K. Yamamoto, of Arabic astrological works (Abū Ma'shar and al-Qabīṣī), together with the corresponding Latin translations and bilingual glossaries of technical terms, have become a model to be imitated and the only way through which a serious study of the medieval translation phenomenon can be undertaken. This is why the present volume will receive a warm welcome from the community of scholars interested in the subject.

*Arabic into Latin in the Middle Ages* is a collection of nine long papers previously published between 1990 and 2002, followed by a detailed *Addenda et Corrigenda* and indexes of manuscripts and names. The order in which the articles are printed follows the chronology of the topics dealt with, beginning towards the end of the tenth century and ending in the first half of the thirteenth. The series of nine papers closely follow the great steps in the history of the translations from Arabic into Latin and, thus, represent an analysis of crucial problems at each one of the different stages. In five of these

papers (I, V, VI, VII, VIII) the translated sources come from al-Andalus; paper III deals with Adelard of Bath, who used Andalusian sources in spite of the fact that he never came to the Iberian Peninsula, although his probable passage through Antioch raises the possibility of the introduction of sources available there. This idea is reinforced in paper IV on the existence of a connection between Antioch and Pisa, which explains the arrival in Europe of Eastern books that were unknown in al-Andalus. Paper II is concerned with the analysis of a few Arabic-Latin translations related to natural philosophy, the origin of which is not clear, made in southern Italy in the 11<sup>th</sup> c. Finally paper IX is, again, concerned with Antioch through the figure of Theodor, who became the philosopher of Emperor Frederick II.

The opening paper ("King Ptolemy and Alchandreus the Philosopher") deals with the European diffusion of the Latin texts of the "early collection" on the astrolabe and other astronomical instruments, based on Arabic sources of some kind, which seems to have been compiled in Catalonia towards the end of the 10th c. In 1931 Millàs Vallicrosa proposed that Gerbert of Aurillac (ca. 950-1003), the future Pope Sylvester II, was the main transmitter of the corpus. Burnett tends, instead, to emphasize the importance of the monasteries near Orléans (St. Benoît of Fleury and St. Mesmin of

Micy), as well as of the cathedral of Chartres, in the transmission of these texts. The collection probably reached Fleury very early, when Abbo was the abbot of the monastery (988-1004) and Constantine of Fleury was studying there. It was later transmitted to Micy, probably by Constantine himself, who was dean of St. Mesmin (988-996) and abbot of the same monastery (1011-1020). Constantine had connections with Gerbert of Aurillac and asked Ascelin of Augsburg for an explanation of the construction of the astrolabe. The result was Ascelin's *Compositio astrolabii* which Burnett edits, translates and comments in an appendix (pp. 343-358). Ascelin was, probably, the master of Bern de Prün who later became abbot of the monastery of Reichenau (ca. 978-1048) and the teacher of Hermann Contractus (1013-1054), the author of a treatise on the construction of the astrolabe as well as of other texts related to the early collection. As a consequence, Burnett establishes a possible chain of transmission from Fleury to Micy, as well as, later, to Reichenau. To this he adds that two manuscripts of the collection seem to have been copied in Chartres, the exemplar of which derives from Fleury via Micy

With the second paper ("Physics before the *Physics*") Burnett moves to southern Italy in the 11th century through the study of the contents of two 12th century British manuscripts which contain a series of texts (*De elementis*, *De metallis*, *De*

*cibis*, Hippocrates's *Airs, Waters and Places* and pseudo-Galen's *De spermate*) which are Grecizing translations of Arabic texts, similar to those of Constantine the African, although they do not appear in the lists of translations made by the latter author. As a conclusion he states that, in the 11th c., there were translations from Arabic into Latin related to natural science which must have begun before the arrival of Constantine in Salerno, coming from Qayrawān, ca. 1077. In the appendix (pp. 81-109) Burnett edits and translates *De elementis*, *De metallis* and *De cibis*.

The story continues in the British Isles as well as in several places in the Mediterranean in the first half of the 12<sup>th</sup> c. with a most illuminating analysis of the mysterious figure of Adelard of Bath. (III "Adelard of Bath and the Arabs"), one of the most important translators of the period and one of the very few who never went to the Iberian Peninsula, in spite of the fact that his scientific translations show clearly that he is using Andalusian materials. He probably learnt Arabic in Syracuse and Burnett suggests a stay in Antioch (IV, pp. 2-4; V, pp. 228-229 and *Addenda*, p. 4). There are works of his written in elegant Latin and not based in Arabic sources (*De cura accipitrum*, *De eodem et diverso*, *Quaestiones naturales*, an introduction to the abacus): they are dedicated to important persons, such as William, Bishop of Syracuse, in the case of *De eodem et diverso*, and they are intended for the education

of young noblemen and the members of bishops' households. In one case (*De opere astrolapsus*) we have a work sharing the characteristics of the previous group, dedicated to Henry, the king's nephew and the future King Henry II, which is based on previous sources belonging to "the early collection" (*De utilitatibus astrolabii, Geometria incerti auctoris*), which had clearly reached the British Isles by then. A third group of works is the most interesting for our purposes, because it contains a series of translations of Arabic mathematical and astronomical works: Euclid's *Elements*, al-Khwārizmī's *Zīj*, Abū Ma'shar's short introduction to astrology, a series of astrological maxims attributed to Ptolemy, and the *Liber prestigiorum*, an incomplete translation of Thābit b. Qurra's book on the elaboration of talismans. These works are clearly intended for Adelard's students and they are written in a careless Latin and lack dedications. The Arabic sources used are Andalusian in most of the cases (al-Khwārizmī's *zīj*, in the version revised by Maslama al-Majrīṭī is a clear example) and Adelard probably obtained them from Petrus Alfonsi, an Aragonese Jew converted to Christianity in 1106, who was working in Britain in the first half of the 12th c. and was the author of a clumsy adaptation of al-Khwārizmī's *zīj* to the Christian solar calendar. Most interestingly, Burnett suggests that this group of Adelard's translations

might have been a mere Latinization of a previous translation made by Petrus Alfonsi into some kind of common language. This would therefore be an early example of the four-hand translations which became common slightly later.

The fourth paper ("Antioch as a link between Arabic and Latin culture") develops a new idea also studied in another paper published by Burnett in J.P. Hogendijk and A.I. Sabra (eds.), *The Enterprise of Science in Islam: New Perspectives*, Cambridge, Ma., 2003, pp. 23-51: the existence of a channel of transmission of science between Antioch and Pisa in the first half of the twelfth century. I have already mentioned (paper III) Burnett's hypothesis about Adelard of Bath's possible stay in Antioch where he might have found the Arabic original of the *Liber prestigiorum*. In this city, Adelard was a near contemporary of Stephen of Pisa who translated 'Alī b. 'Abbās al-Majūsī's *al-Kitāb al-Malakī (Regalis Dispositio)* and wrote the *Liber Mamonis*, a summary of Ptolemaic astronomy, in which he used an Arabic-Latin translation of the first four books of the *Almagest* made in Antioch by a mysterious 'Abd al-Masīḥ of Winchester and extant in a Dresden manuscript. Both the *Liber Mamonis* and the Dresden *Almagest* use a Latin alphanumerical notation and Hindu-Arabic numerals in their oriental form (see Appendix II, pp. 61-66). These Eastern numerals were also used by Abraham b. 'Ezra who

seems to be another important link in this chain of transmission: he not only compiled the *Tabule Pisane*, based on a lost *zīj* by ‘Abd al-Raḥmān al-Šūfī which, apparently, never reached the Iberian Peninsula, but he also mentions in his *Fundamenta Tabularum* a series of Eastern Arabic astronomical sources entirely unknown in al-Andalus. Appendix I contains critical editions and translations of several prefaces of Stephen’s works.

With papers V (“Magister Johannes Hispalensis et Limiensis” and Qusṭā ibn Lūqā’s *De differentia spiritus et animae*”) and VI (“John of Seville and John of Spain. A *mise au point*”) Burnett brings us back to the Iberian Peninsula and poses the problem of the identification of one or several translators called John of Seville [and Limia], John of Spain and John David of Toledo. Since the publication, in 1954, of a famous paper by Marie Thérèse d’Alverny, it has been clear that John of Seville is not the Jewish translator called Avendauth, but we still have the problem of establishing whether Johannes Hispalensis et Limiensis is also the person called Johannes Hispalensis, without any reference to Limia (Portugal). In paper V (published in 1995), Burnett does not adopt a clear position, but in paper VI (2001) he favours this identification. Johannes Hispalensis [et Limiensis] travelled into “Hispanae partes” in search of Thābit b. Qurra’s book on magical images, partially translated by Adelard of Bath in his *Liber prestigiorum*, of

which a complete translation was made by John (*De imaginibus magicis*, see the edition and translation of the preface in V, pp. 252-255): according to Burnett, this means that he came from outside the Iberian Peninsula and that he probably stayed in Seville: this contradicts the fact that several manuscripts call him “episcopus” and that the archbishop Rodrigo Jiménez de Rada mentions a certain John, bishop of Seville, who fled from Seville in 1148 when the Almohads subjugated the city. John of Seville stayed in Limia (Portugal) where he served Queen Tarasia/Teresa (r. 1112-1128) to whom he dedicated his short version of the *Secret of Secrets* (edition and translation of the preface in V, pp. 255-258). Probably before 1143 he dedicated his translation of Qusṭā b. Lūqā’s *De differentia spiritus et animae* to archbishop Raymond of Toledo (1125-1152). Although there is no evidence that he ever stayed in Toledo, it is clear that this work was known in the city and used by Dominicus Gundissalinus and Avendauth in their translation of Ibn Sīnā’s *De anima* and (outside Toledo) by Hermann of Carinthia in *De essentiis* (see V, pp. 259-267). Other works that bear the subscription “et Limiensis” or indicate that they were translated “in Limia” are al-Farghānī’s *Liber in scientia astrorum* (dated in 1135), Māshā’allāh *De rebus eclipsium* and ‘Umar b. Farrukhān’s *Liber universus*.

All the aforementioned information seems to locate the activity of the translator called Johannes Hispalensis [et Limiensis] ca. 1120-1135. He never mentions a collaborator, which implies that he was fluent in Arabic, and only on one occasion is he called “magister”. As regards Johannes Hispalensis, without any reference to Limia, Burnett establishes that he translated two important astrological works (al-Qabīṣī’s *Liber introductorius* and Abū Ma’shar’s *De magnis coniunctionibus*) as well as other less significant ones (Māshā’allāh’s *De interrogationibus*, Abū Ma’shar’s *Liber experientorum* and *Flores astrologiae* and a text on the construction of the astrolabe).

Johannes Hispanus seems to be a different case and Burnett does not reach any clear conclusion regarding his identification with Johannes Hispalensis [et Limiensis]. First of all he is frequently called “magister” and, at least on one occasion, he worked together with Dominicus Gundissalinus (fl. 1162-1181) with whom most of his extant works have a certain connection. His catalogue is composed by seven works, some of which are original: they include the *Liber Algorismi*, *De differentiis tabularum* and, possibly, the *Liber Mahamelet*. They seem to have been written ca. 1145-1160 and it is possible, therefore, to consider that the two Johns are the same person who worked as a translator in an early stage of his life (ca. 1120-1135) dedicating his main

activity later (ca. 1145-1160) to the compilation of original works. He could, in that case, be identified with the Johannes Astronomicus mentioned (without dates) in the obituary of the Cathedral of Toledo. The adjective Hispanus (most unusual for somebody who lived in Spain) could be the result of copyists’ errors given the fact that some twenty manuscripts of al-Qabīṣī’s *Introductorius* replace *Hispalensis* by *Hispaniensis*. He could also be identified with the John David of Toledo to whom both Plato of Tivoli (fl. 1132-1146) and Rudolph of Bruges, a disciple of Hermann of Carinthia, dedicated books on the use of the astrolabe.

There is, however, another possibility raised by the obvious connections between Johannes Hispanus and Dominicus Gundissalinus: he could have been the Johannes who replaced Gundissalinus as archdeacon of Cuéllar in 1193 and died in 1215. In that case, for chronological reasons, he could not be the same Johannes Hispalensis et Limiensis.

Paper VII (“The Coherence of the Arabic-Latin Translation Program in Toledo in the Twelfth Century”) takes us to Toledo which becomes the main centre of translation from ca. 1150, although we have the earlier (ca. 1130) dedication of John of Seville’s translation of *De differentia* to Archbishop Raymond. Burnett underlines the connections of several translators (Gerard of Cremona, Gundissalinus, Mark of

Toledo and Michael Scott) with the Cathedral of which they became canons or where they had other kinds of jobs. This was probably the way in which the archbishops exerted their patronage of translations. In fact such a connection with the church seems to be a constant in the history of Spanish translations from the late 10<sup>th</sup> c. onwards, when we see Lupitus Barchinonensis/ Seniofredus as archdeacon of the Cathedral of Barcelona; during the first half of the 12<sup>th</sup> c. Hugh of Sanctalla worked for Michael, bishop of Tarazona, and I have always wondered whether the other translators working in the Ebro valley (Hermann of Carinthia, Robert of Ketton) also had some kind of connection with the same bishop. In Toledo, the relation to the Cathedral remained until the second half of the 13<sup>th</sup> c. in which we have the beginning of royal patronage with Alfonso X.

Burnett analyses the Toledan program of translations in relation to the works of Gerard of Cremona, clearly documented in the *Commemoratio librorum*, which contains a list of 71 works translated by Gerard and compiled by his *socii*; in Appendix I (pp. 273-287) Burnett gives a critical edition and annotated translation of this list, together with the *Vita* and the *Eulogium*. It seems clear that this program was determined by the requirements of the new European universities and Burnett shows that Gerard's choice of the works to be

translated is probably the result of his following al-Fārābī's *Classification of the Sciences* (translated by Gerard) and that it comprises a selection of works related to three of the seven liberal arts (Dialectics, Geometry, Astronomy) to which he adds Natural Philosophy and Medicine. One of the apparent anomalies of the list is that it lacks references to Astrology, in spite of the fact that it contains translations of works on other kinds of divination. This can be justified by the existence of an important corpus of astrological translations made by John of Seville and by the fact that, according to Richard Lemay and Burnett himself, Gerard probably revised John's translations of Abū Ma'shar's *Great Introduction* and *Great Conjunctions*. It is also interesting to see, mainly in relation to the transmission of Aristotle, that Gerard is particularly concerned with Greek works and their Arabic commentaries, which suggest a different point of view from that of Dominicus Gundissalinus who translates the works of Ibn Sīnā and seems to be attracted by the mixture of Aristotelian and Neoplatonic elements in Arabic Philosophy.

With papers VIII ("Michael Scott and the transmission of scientific culture") and IX ("Master Theodor, Frederick II's philosopher") we again move to a different location, in the 13<sup>th</sup> c.: that of the Sicily of Frederick II Hohenstaufen (1194-1250) in which we find two important characters who represent two different kinds of input. On the

one side we have the figure of Michael Scott, who represents the connection between Toledo and Sicily. He probably arrived in Toledo ca. 1200 and became the successor to Gundissalinus, Gerard of Cremona and John of Seville, completing his translation of al-Bīṭrūjī's *De motibus caelorum* in 1217 and Aristotle's *De animalibus* in 1220. We know that, in 1215, he accompanied Archbishop Rodrigo Jiménez de Rada to Rome for the 4<sup>th</sup> Lateran Council but he probably returned to Toledo. In 1220 he moved definitively to Italy where he stayed in Rome, Bologna and Pisa and, finally, became the astrologer of Frederick II in Palermo. In this second stage of his life he wrote original works: the *Liber quatuor distinctionum* and the *Liber particularis* (probably written in Palermo). Both books present many parallels with the works of Bartholomew of Parma which raises the question of the intervention of this latter author in the final recension of these works. In any case it is clear that the sources used by Michael Scott for the compilation of his original books are Toledan translations. In an appendix (pp. 121-126) Burnett edits a series of quotations from the third *distinctio* of the *Liber quatuor distinctionum* with identification of its sources.

In the last paper (IX) of the book Burnett studies the figure of Theodor, the Emperor's philosopher, identified with Theodor of Antioch, a Jacobite Christian, who

represents the introduction in Sicily of new Eastern Arabic scientific materials. The Syriac bishop Barhebraeus gives information on his life in his *Mukhtaṣar ta'rīkh al-duwal*: Theodor was the disciple of Kamāl al-Dīn ibn Yūnus in Mosul and, later, studied Medicine in Baghdad. He lived in Armenia and, at least from 1238 onwards he was in Sicily in the service of Frederick II. Burnett remarks that Sicily was a centre in which works of Aristotle, Ibn Sīnā and Ibn Rushd were being translated from Arabic into Latin and Hebrew. Theodor had an active part in this program and translated the *Moamin*, a book on falconry, and, probably, another book on the same subject entitled *Ghatrif*, as well as the *Proemium* of Ibn Rushd's long commentary on Aristotle's *Physics*. In two appendixes (pp. 255-285) Burnett reproduces passages related to Theodor in edited Latin and Arabic sources and edits and translates his letters to Pier della Vigna, a letter of regimen for Frederick II, and the short and long prologues to the *Moamin*.

Julio Samsó

Julio Samsó, *Astronomy and Astrology in al-Andalus and the Maghrib*. Variorum Collected Studies Series CS887. Aldershot &c.: Variorum, 2007. XIV + 366 pp.

This collection of papers by Julio Samsó is a sequel to the volume

*Islamic Astronomy and Medieval Spain*, which appeared in 1994. It contains 16 articles published between 1994 and 2004, and has three main parts:

(1) Seven papers pursuing the theme of the earlier volume; most of them treat of single texts or authors. For example, article VI deals with the al-Bīrūnī tradition in Muslim Spain as an instance of the exchange between East and West, a subject that recurs in most of the articles in this volume.

(2) Six papers on the transmission of the Toledan Ibn al-Zarqālluh's theory and parameters to the Maghrib, mainly in the 13th and 14th centuries, their falsification through local observations, and the subsequent introduction of Eastern material from the late 14th century on.

(3) Three papers tracing the diffusion of Abraham Zacut's *Almanach Perpetuum* (for Salamanca, end of 15th c.) in the Maghrib and in the East, notably Egypt and Yemen. The *Almanach* is based on material from the Alfonsine Tables, which, in this way, had its lifetime extended until the 19th century.

Near the end of the book, some three pages of updates to the 1994 collection testify to the fact that quite a lot of work is being done in this area, not least because of the activity of Samsó and colleagues in the research project "The circulation of astronomical ideas in the

Mediterranean...", well known to the readers of this journal.

These are also clearly the intended readers of the articles in this volume. There is, however, a lot of content that will appeal to general historians, notably the survey article "A social approximation to the history of the exact sciences in al-Andalus", which gives a brief but informative overview of important factors such as religion and patronage. It would be perfect, had some more of the Arabic terms been translated.

The two Variorum volumes and their *de facto* sequel, Samsó's Festschrift *Astrometeorología y astrología medievales* (2008), manage to unite the greater part of Samsó's English papers, and not a few of his Spanish ones. It is a boon to the scholarly community to possess this important collection in such a handy and agreeable form.

Fritz S. Pedersen