

*Emperor of Culture*  
**Robert I. Burns, S.J.**

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**Chapter Five**  
*Jewish Collaborators in Alfonso's Scientific Work*  
**Norman Roth**

[59] Just as in the Middle Ages, when it was imagined that there was an international "congress" of Muslim, Jewish, and Christian scientists, so popular modern mythology has assumed that a "school" of translators existed at Toledo, already under the patronage of the twelfth-century archbishop and then later in the reign of Alfonso X. Less romantic consideration shows that no such school actually existed and that translation activity was taking place all over Spain and was by no means centralized in Toledo.<sup>(1)</sup>

What is remarkable about the Jewish translators whose work was sponsored by Alfonso, following an already old tradition of Jewish translation activity, was their concentration almost exclusively on scientific literature and their significant contribution to the development of the Spanish language. While Jewish scholars, with the exception of the pioneer Moritz Steinschneider, have totally ignored this aspect,<sup>(2)</sup> Spanish scholars have demonstrated an increasing awareness of the importance of Alfonso's Jewish "collaborators" in the scientific corpus. Thus, José Muñoz Sendino has remarked: 'The Hebrew element was the group of the greatest scientific value because of its great intellectual discipline [and its] mastery of both languages--Arabic and Spanish--[which] guaranteed a faithful reflection of the original thought' of the works translated.<sup>(3)</sup> This view of the fidelity of the translation, fully substantiated by the careful analysis of J. M. Millas Vallicrosa,<sup>(4)</sup> invalidates the claim of earlier scholars like Gonzalo Menéndez Pidal, who conjectured that a second translation into Latin from Spanish was necessary because Jewish translators rendering Arabic texts into Spanish used "a very peculiar and archaic dialect, which was barbarous to Castilian ears."<sup>(5)</sup>

Américo Castro also has commented on the significance of Alfonso's choice of Castilian rather than Latin for the writings he sponsored-- historical, legal, and scientific. (This Castilian form is the reason why some of the works were retranslated into Latin for use in other European countries [60], of course, and not because of any barbarism which supposedly exists in the medieval Spanish versions.) "This interest the Jews, above all, would feel," Castro wrote. "The innovation of writing historical and scientific books in Romance appeared to be sponsored by a monarch compared by the Jews with Alexander and Caesar, and who recompensed with splendid favors their services and praises."<sup>(6)</sup> Of particular importance are the remarks of Alfonso's nephew Juan Manuel; after mentioning Alfonso's translation of *toda la secta de los moros* (which may refer to all or part of the Qu'ran), he wrote,

Furthermore he ordered translated the whole law of the Jews, and even their Talmud, and other knowledge which is called *qabbalah* and which the Jews keep closely secret. And he did this so it might be manifest through their own Law that it is all a [mere] representation of that Law which we Christians have; and that they, like the Moors, are in grave error and in peril of losing their souls.<sup>(7)</sup>

In spite of the concluding dogmatic piety, which need not be taken too seriously in light of both Alfonso's and Juan Manuel's personal friendship with Jews, it is significant that Alfonso apparently

arranged for the translation of the entire Talmud and certain cabalistic works. There is no trace of the existence of such translations, but this testimony is certainly reliable.

The reign of Alfonso X was an extremely productive and generally beneficial period for the Jews, marred only occasionally by some restrictive actions (the laws, such as the *Siete partidas*, were entirely of a theoretical nature). There was great independent literary, scientific, and philosophical activity among the Jews of Spain at this time, and it is significant that a very large percentage of the work of "Jewish collaborators" in the Alfonsine scientific corpus consists, in fact, of original writings and not just translations from the Arabic.

The first of the translated works, which together with the literary work *Calila e Digna* was done when Alfonso was still infante, was the book on gems and stones called the *Lapidario* by an unknown author identified only as "Abolays."<sup>(8)</sup> The translation was done sometime between the conquest of Murcia in 1243<sup>(9)</sup> and the conquest of Seville in 1250, according to the prologue:

He [Alfonso] obtained it from a Jew who held it hidden, who neither wished to make use of it himself nor that any other should profit therefrom. And when [61] he [Alfonso] had this book in his possession, he caused another Jew, who was his physician, to read it, and he was called Yhuda Mosca *el menor* and he was learned in the art of astrology and understood well both Arabic and Latin. And when through this Jew his physician he understood the value and great profit which was in the book, he commanded him to translate it from Arabic into the Castilian language.<sup>(10)</sup>

From this prologue, it is clear that Yehudah was the physician to Alfonso while the latter was not yet king. It is not entirely clear whether the title *alfaquim* which appears after his name in all of the other translations he did (except in the *Tabla astronómicas* and the *Libro de las estrellas fixas*) meant literally that he was a physician, or was merely an honorary title.<sup>(11)</sup> He was "helped" in the translation of *Lapidario* by a priest named Garcí Pérez.

José Amador de los Ríos refers to Yehudah as Yehudah ha-Qaton ("the small" in Hebrew), which is perhaps the explanation of the appellation *el menor* found only in the prologue of *Lapidario*.<sup>(12)</sup> The term is not satisfactorily explained, however, either by the previous attempts mentioned by Gerold Hilty or by his own suggestion of "junior, younger," which would only make sense if his father's name had also been Yehudah (instead of Moshe). If the title has any significance at all, and is correctly assumed to correspond to the Hebrew suggested by Amador, then the meaning is most probably "insignificant," a term used by the poet and philosopher Solomon Ibn Gabirol, among others.

There is, however, another possibility. Hilty has convincingly argued that Yehudah b. Moses ha-Kohen and Yehudah Mosca are one and the same, and that Mosca is not a corruption of Moses (Moshe), but rather a family name identical to that of the astronomer Yehudah b. Solomon Ibn Mosca.<sup>(13)</sup> If this is correct, then *el menor* in the sense of "the lesser, the other" could have served to distinguish him from his relative who lived at the same period of time. This suggestion would not invalidate, but rather strengthen, Hilty's surmise as to why the title is found only in the first work translated by Yehudah. As his fame increased, Hilty argues, it was no longer necessary to distinguish him from the other Yehudah; the latter by 1247 was already in Italy, where he engaged in scientific discussion with Frederick II. Furthermore, if Yehudah in fact was related to that Yehudah b. Solomon, then he was a member of the famous Ibn Susan family, members of which were officials of Alfonso.<sup>(14)</sup> This might explain how such a young man came to the attention of the then infante and became his physician.

Even before the *Lapidario*, however, Yehudah made a Latin translation of the *Azafeha* (*Safiha*) of Azarquiel (the correct form of this name is noted [62] below) together with Guillelmus Anglicus,

between 1225 and 1231. The prologue refers to him as "Iuda filius Mosse Alchoen, professione t\_\_, ex mérito sciencie astronomus dictus." Hilty suggests *tabib* for the missing word (Arabic *tabīb*, or "doctor"). If so, Yehudah was a physician even at this early period; that is not impossible, but the peculiarity of an Arabic word in an otherwise Latin text needs explanation. [\(15\)](#)

Hilty accepts the theory proposed by Millas Vallicrosa that the discrepancy between the Biblioteca Nacional manuscript, which ascribes the translation of the *Azafeha* to Yehudah, and the two European manuscripts, which ascribe it to Guillelmus, is to be explained by Yehudah's making the original adaptation which was then put into polished Latin by Guillelmus. The final resolution of this problem will depend on detailed analysis of the translation and on comparison with other known translations by Yehudah, for such elements as terminology. Yet it is clear that the reference to six years spent in study of the work, and the professions of "doctor" (?) and astronomer, which are attributed to *both* Yehudah and Guillelmus in the manuscripts respectively, must refer originally to Yehudah alone. This leads to the speculation that European copyists merely substituted the name of the better known Guillelmus for the Spanish Jew.

Hilty considers as unproven the suggestion of George Sarton and Millas Vallicrosa that Yehudah was also the translator of Ptolemy's *Tetrabiblon* (*Quatripartito*). Muñoz Sendino, however, accepts this suggestion as definite. [\(16\)](#) This discrepancy also could profit from detailed textual/comparative analysis.

The *Libro conplido en los iudizios de las estrellas*, [\(17\)](#) begun on 12 March 1254, is a translation of Abu'l-Hasan 'Alī b. al-Rijāl, *Kitāb al-bāri' fī ahkām al-mujūm*. Here Yehudah is described as "su alfaquim e su mercet," which means that he was granted a privileged status or received special favors from Alfonso.

The *Libro del saber de astrologia* (as Anthony Cárdenas has shown, this is the correct title) was composed approximately during the years 1256 to 1280 in the final redaction. Altogether there are sixteen treatises that make up the *Libro del saber*. [\(18\)](#) Table 5-1 shows the treatises that were either written by Jews or translated solely by a Jewish translator, with the correct title of each book in the order of its appearance, together with the corresponding pages of Rico's edition.

The *XLVIII figuras de la VIII espera*, or *Libro de la ochava sphaera* for short (which Hilty insists on calling *Libro de las estrellas fixas*), is based on a work by Abu'l-Husayn 'Abd al-Rahman b. 'Umar al-Sufi, [\(19\)](#) but greatly **[63]** revised and with additions by Yehudah. [\(20\)](#) The translation was begun in 1256, and the final redaction completed in 1276. Abraham Zacut, the fifteenth-century Jewish astronomer of Spain whose tables were used by Columbus, mentions this translation by Yehudah in his chronicle (where he also refers to the "wondrous" historical composition of Alfonso). [\(21\)](#)

**Table 5-1: Treatises Written by Jews or Translated Solely by a Jewish Translator**

Yehudah b. Mosheh and Samuel ha-Levi	<i>XLVIII figuras de las VIII espera</i>	Rico I, 1-145
(Yehudah b. Moshe?)	<i>Espera redonda (Alcora)</i>	I, 153-206
Xosse (Mosse?)	<i>Cuemo se deuen fazer las armillas del atacyr</i>	I, 113-222
Çag (author)	<i>Astrolabio redondo</i>	II, 206-8
Çag (?)	<i>Astrolabio llano</i>	II, 225-92
Çag	<i>Libro dell actçir</i>	II, 295-309
Çag	<i>Lamina universal</i>	III, 1-135
Yehudah b. Mosheh	<i>Azafeha</i>	III, 135-237

Çag (author)	<i>Libro de las armellas</i>	II, 1-79
?	<i>Laminas de cada una de las siete planetas</i>	III, 241-84
Çag (author)	<i>Libro del quadrante</i>	III, 287-316
?	<i>Relogio de la piedra</i>	IV, 3-118
Çag (author)	<i>Relogio de agua</i>	IV, 3-118
Çag (author)	<i>Relogio del argent vivo</i>	IV, 3-118
Samuel ha-Levi (author)	<i>Relogio de la candela</i>	IV, 3-118
Çag (author)	<i>Palacio de las horas</i>	IV, 3-118
Çag (author)	<i>Cuomo se debe fazer... atarçir</i>	II, 295-309

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Great caution is needed in referring to the direct participation of Alfonso himself in these astronomical works, as well as in all of the works composed during his reign. Hilty himself, who discusses this direct participation, seems too naive in accepting it at face value and in assuming that the entire group of translators at Toledo followed the king from Burgos to Victoria, and that the king had the time on these journeys to concern himself with the translation of this book. Alfonso certainly had more important things on his mind in 1276. [\(22\)](#)

The *Alcora* [\(23\)](#) is a translation by Yehudah of a work by Qusta Ibn Lûqâ. [\(24\)](#) The prologue states: "And he made this book in Arabic, and later the king don Alfonso ordered it translated from Arabic into the Castilian [64] language ... by Master Johan Daspa his cleric and Hyuda el Cohem his *alfaquim*." The translators (Yehudah was probably among them) added four introductory chapters not found in the original, on the making and use of the "*espera*." There is an additional problematic chapter (fol. 38r) on making the *armillas* of the sphere, by "don Xosse nuestro alfaquim." Anthony Cárdenas, who corrected the text to "Mosse," claiming that Manuel Rico y Sinobas erred in reading "Xosse," dismissed the chapter as a later interpolation. [\(25\)](#) Never doubting its authenticity, Hilty argues that the author is the same as Yehudah b. Moses. [\(26\)](#) He holds that the calculations in the chapter reflect the period of astronomical observations between 1263 and 1272, which would seem to prove the authenticity of the chapter (Cárdenas does not disagree on this but still denies the authenticity).

Tentatively, it seems to me arbitrary to challenge the authenticity of the chapter and to consider it a later interpolation. The identification of "Xosse" (as all who have read the text have cited it) or "Mosse" with Yehudah b. Moses ha-Kohen is also problematic. It fails to explain why Yehudah's name is given correctly in the prologue and indeed in all the other works that bear his name, whereas only his father's name is given here in a chapter in the same book. If only one name were used to identify him, why not his own name (Yehudah) instead of that of his father?

Baer conjectured that "Xosse" is the same as the "Yuçaf" (actually Juçef in the text), *su alfaqui* (of Alfonso), mentioned in a document of grants of land by Alfonso to various Jews in Seville in 1253. [\(27\)](#) This is etymologically impossible, however, since in medieval Castilian *x* always represents either *s* or *sh*. The most plausible identification for our "Xosse," therefore, seems to me don Ziza *su alfaquim* in the very same document. This is none other than Ziza Ibn Susan mentioned above. In any case, it is quite clear that he is completely distinct from Yehudah b. Moses ha-Kohen. The grant to Xosse was a substantial one, too, not likely to have been made to the young Yehudah b. Moses. That same document of grants of land, as well as an earlier such charter, also mentions other well-known Jewish officials of Alfonso: don Çuleman [Solomon Ibn Sadoq], don Todros [Abulafia], and Çag el Maestro. [\(28\)](#) Note

also that the list uses only first names.

The *Libro lie las cruces* by one "Oueydalla," whom Sarton identifies as Ab Sa'id 'Ubayd-Allah, an identification which is problematic, (29) was the next work translated by Yehudah, in 1259. This work affords a better insight into the work of the "collaborators" in Yehudah's translation; the prologue states that it was translated from Arabic into Castilian by Yehudah-- "Hyuhda fy de Mosse alChoen Mosca"-- and that "Maestra Johan"[65] (Daspa) arranged it in chapters, since the original work was not so arranged. (30) Certainly in this case, at least, the work of the Christian "collaborator" was obviously minimal.

It is possible also that Yehudah took part in the translation of the *Liber picatrix*. The Spanish manuscript is mutilated, as A. G. Solalinde indicates, but the Latin manuscripts should be examined for possible evidence of Yehudah's participation.

Very valuable is Hilty's conclusion that Yehudah did *not* orally translate the works but rather wrote them out. (31) Hilty calls attention to the marginal notes in the manuscript of *Libro conplido* which prove the collaboration, in that work at least, of a group of translators and an *emendador* (corrector, or editor). In spite of his interesting conjectures about the meaning of this latter term, scholars are still in no position to decide with any certainty what his exact function was, or to determine whether Yehudah wrote the prologues himself (I am inclined to doubt this), or to be certain what parts of any given work come directly from his pen and what from that of others.

Hilty claims that since the Latin translation of the *Azafeha* was done between 1225 and 1231, and since it was the first of Yehudah's works, he must have been born before 1205. (32) This is a faulty conclusion, based on the arbitrary assumption that he must have been at least twenty years old at the time he began his work. The usual age for having completed one's studies (including science and medicine) among Muslims and Jews in Spain was much earlier, however, at least by age eighteen. On the other hand, the fact that Yehudah was still actively working in 1276 renders suspect such an early date (1205) for his birth. It would seem more likely that he was born *after* 1205 than before. Possibly the fact that a second translation of the *Azafeha* was ordered by Alfonso in 1277, and was made by Abraham rather than Yehudah, as discussed below, indicates that Yehudah was either dead or retired from his work in that year. Hilty is probably correct in saying that Yehudah was a resident of Toledo, but his attempt to identify Yehudah's father as the "Rabbi Moses ha-Kohn" of various documents remains unconvincing--not only because of the chronological problems which he himself recognized, but because both the names Moses and ha-Kohen were very common among Jews. (33)

Finally, Hilty's table showing Yehudah's work is reproduced here as Table 5-2.

The famous *Tablas alfonsies* (34) were composed by--not translated but the original work of--Yehudah and the Rabbi Çag who appears below. [66]

**Table 5-2 :Yehudah's Work\***

Date	Title	Author/Translator	Collaborator
1225-1231	<i>Azafeha</i> (Latin tr.)	Iuda filius Mosse Alchoen, professione t_____, ex merito science Astronomusdictus	Guillelmus Anglicus
1243-1250	<i>Lapidario</i>	otro su judio que era su fisico Yhuda Mosca el menor	Garci Perez, un su clerigo
1254	<i>Libro conplido</i>	Yhuda fi de Mosse Alcohen, su	Other translators and



		alfaquim e su mercet	emendador
1256	<i>Libro de la ochaba sphaera</i>	Yhuda el Cohen, so alhaquim	Guillen Arremon Daspa, so clerigo
1259	<i>Libro de las cruces</i>	Hyuda fy de Mosse Alchoen Mosca, su alfaquim e su merced	Maestre Johan
1263-1272	<i>Tablas [astronomiacas]</i>	Yhuda fi de Mose Mosca	Rabiçag
1276	<i>Libro de las estrellas fixas</i> (final redaction)	Yhuda sobredicho	Maestre Joan de Mesina, Maestre Joan de Cremona, Samuel

\* Revised from Hilty

The prologue of the Spanish manuscript gives their names as "Yhuda fi de Moses fi de Mosca, e Rabiçag Aben Cayut." (35) Noting that the manuscript is a late fourteenth- or early fifteenth-century copy, Hilty is convinced that an error has been made in both names. The first should be simply Yhuda fi de Moses Mosca, he proposes; the second, Cayut, he correctly assumes is Arabic Sîd and should therefore probable be Cayd. These suggestions appear acceptable.

The exact date of the composition of the *Tablas* is conjectural; Hilty [67] dates it between 1263 and 1272. (36) In fact, those are the dates of the astronomical observations, not necessarily the dates of the composition of the work. The year 1272 is suggested by both Sarton and Millas. (37) In addition to the Spanish manuscript, there is at least one other manuscript of the Latin version, and an extant Hebrew translation which has never been examined. The whole work definitely needs a new edition, taking these problems and findings into consideration. (38)

Many of the tables are dependent upon those of Azarquiel (the correct form of that name apparently should be al-Zarqâllah, not al-Zarkâlî). (39) The tables appear to have had an influence also on later Jewish astronomy, and this should be a subject for further research. (40)

About Rabiçag, the author of at least seven of the treatises in the *Libro del saber* collection and the translator of another, we know almost nothing. In the prologue to the *Libro del cuadrante* (see below), he is also called Rabiçag Aben Cayut; this raises some doubt as to whether this form of the name in the *Tablas* is, as Hilty thought, erroneous. (41)

Isaac Israeli, a student of Rabbi Asher b. Yehiel of Toledo, composed an astronomical treatise in 1310 in which he briefly mentions Çag. "I examined [calculations of] three eclipses, which Rabbi *Isaac hazzan* b. Sîd prepared and arranged in the city of Toledo at the command of the king don Alfonso, according to what was available to me, [saw] how he prepared them, and [saw them] in his own handwriting." There follows a detailed description of three lunar eclipses of 1266 and 1267, and also a solar eclipse of 1263. (42)

More information is reported by Abraham Zacut in his Hebrew chronicle:

Then [in the reign of Alfonso] the scholar Rabbi Isaac b. Sîd, *hazzan* of Toledo, prepared tables of the host of the heavens with great precision at the [command] of the king, and their like had not been in precision in the tables and books of astronomy, for Rabbi Isaac Israeli and Rabbi Levi b. Gerson [Gersonides] and all who came after them found in him no fault with them . . . and they are called zîj [Arabic for "tables"] *Alfonso*, and from the east to the west, Germany, France, England, all Italy, and Spain, they broke all the former tables and kept these tables to this day. (43)I

In the first version of this study, I mistakenly suggested that Zacut may be the don Çag referred to in a letter of Alfonso dated 15 July 1278. I have since discovered that this is not so and that the reference there was to Çag de la Maleha. [\(44\)](#)

[68] Table 5-3 shows the works written and/or translated by Isaac b. Sîd. Unfortunately, dates cannot be definitely assigned to any of these, except 1277 for the *Libro del cuadrante*.

The prologue of the *Libro del astrolabio redondo* (fol. 40r to fol. 66r) reads:

And since there are facts in the aforesaid science, and since we do not have a book in which is told how [an astrolabe] is made, therefore I, the king don Alfonso, order Rabbi Çag to make this, well and clearly done. [\(45\)](#)

The book is divided into three parts: the making of an astrolabe, the nature of the "firmament" of the heavens and its movements, and the use of the astrolabe. Each part is composed of several chapters. This is a major scientific treatise, which deserves careful analysis of topics such as sources utilized and influence on later works. [\(46\)](#)

An interesting feature in the *Libro del astrolabio llano* (fol. 66r) is the use of the letters "a, b, g, d" to locate points on a circle. This betrays the Jewish origin of the author, for this series is explicable at this time and place only in terms of the Hebrew alphabet (and not, of course, the Latin or Arabic). Note also his reference to the custom of some Christians (*algunos délos cristianos*) in the marking of their astrolabes (fol. 73v). In the *Libro de lamina universal*, he has already corrected the system of lettering to "a, b, c, d." [\(47\)](#)

The *Libro de lamina universal* (fol. 80r) consists of two sections. The first, written by Çag, is the theoretical portion. The second (fol. 83v) is on the use of the *lamina*, as translated by Çag. [\(48\)](#) The prologue reads:

We wish to speak of how to make the universal table which was done in Toledo, where the table [*acafeha*] of al-Zarqallah was produced. . . . Therefore I, don Alfonso, order my learned Rabbi Çag of Toledo to make this.

The part on the use of the instrument was written by "Aly el fijo de halaf," whom earlier authorities erroneously identified as Abu'l-Hasan 'Alî b. Khalaf Jâlib al-Ansârî. [\(49\)](#) José Sánchez Pérez even attributed it to Azar-quiêl. [\(50\)](#) Cárdenas conjectures that the author may have been Abu'l-Qasim Khalaf b. Husayn b. Marwân Ibn Hayyân (such is the correct spelling); but the name 'Alî is missing here altogether. In fact, the author was Abu'l-Hasan 'Alî b. Khalaf b. Ahmad, astronomer of the Banû Dhu'l-Nûn of Toledo, as Millas had already observed. [\(51\)](#)

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### Table 5-3. Works Written and/or Translated by Isaac b. Sîd

1. *Tablas alfonsies [astronómicas]* with Yehudah b. Moshe
2. *Astrolabio redonda*\*
3. *Astrolábio llano*\*
4. *Lamina universal* (translated)\*
5. *Libro del cuadrante*\*
6. *Libro de las armellas*\*
7. *Libro dei ataçir*\*
8. *Relogo de la piedra* (?)\*

9. *Relogo del agua*\*
10. *Relogo del argent vivo*\*
11. *Palácio de las boras*\*
12. *Libro (del) quadrante sennero*
13. *Cânones* of al-Batānī (? translated)
14. Tables of Almanach of "Azarquiel" (translated)

\*Asterisks indicate inclusions in the *Libro del saber*. Question marks indicate uncertainty.

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The *Libro del quadrante con que rectificar* consists of two parts, one on the construction of the quadrant and the other on its use. (52) (Cárdenas [69] suggests *rectifican* in the title, but Millas and others read *rectificar*.) To divide the treatise into two such parts seems to have been the established pattern of Çag's works. The *Libro de fazer las armillas* (or *armillas*) (53) is on the construction and use of an instrument of Ptolemy called *dett alhalac* (Arabic *dat al-halaq*, "sphere of rings") or *armillas* in "Latin"--that is, Romance, perhaps betraying the Arabic and Jewish use of *latino* to mean "Romance." (54)

The *Libro del ataçir* is unfortunately missing several folios at its beginning, including the prologue--the text begins at the end of chapter one. It is impossible to be sure, therefore, but the attribution of the work to Çag is probable. (55) The same is true of the *Relogio de la piedra*, which lacks the first three folios. (56) I am unaware of anyone else who has attributed this work to Çag; and I would hesitate to be so bold as to suggest it, except that it comes in order in the manuscript with other works by him and all of the other treatises on clocks except one are by him. Perhaps here as well, careful linguistic analysis and comparison would solve the problem. The other treatises on clocks by Çag are the *Relógio del agua*, the *Relogio del argent vivo*, and the *Palacio de las horas*. The last is in many ways the most interesting, being a sun clock with twelve windows, one for each daylight hour. (57)

Because of the insight and diligent research of Millas Vallicrosa, without [70] whom our knowledge of the Jewish culture of medieval Spain would be considerably diminished, we now know of Çag's composition of the *Libro que es de saber como puede omne rectificar el quadrante sennero*, or *Book for knowing how a man can verify the solitary quadrant*. (58) The same manuscript contains the translation of the *Canones* of al-Battānī (the authenticity of its attribution is now in doubt), and Çag's translation of the astronomical tables of Azarquiel. (59) Neither of these important manuscripts has yet been edited. David Romano has challenged the attribution of the translation of al-Battānī, perhaps on good grounds, though he does not mention Millás's study cited here. Romano's claim that Isaac did not know Arabic at all, however, has absolutely no merit.

The least-known of the Jewish collaborators in the *Libro del saber* is Samuel ha-Levi. Steinschneider, usually a reliable source of information even when all others fail, seems in this case to be the cause of the erroneous name Abulafia for Samuel, which is still repeated by scholars. (60) There was one and only one eminent Abulafia family in Spain, which numbered among its ranks several ministers and officials of Alfonso, as well as rabbis and the great poet Todros. (61) There is no evidence for a Samuel in this family, however, and it is incorrect to assume that every Jew named ha-Levi, an extremely common name, was automatically Abulafia. We may conjecture--but it is only that and hardly worth serious consideration--that our Samuel was an ancestor of the famous Samuel ha-Levi of Toledo, *tesorero mayor* of Pedro I and patron of the famous synagogue of Toledo. (62) Samuel translated, with Yehudah b. Moses ha-Kohen, the *Libro de la ochava sphaera* discussed earlier under Yehudah. In addition, he composed--not translated as Steinschneider said, followed by Sarton--the *Relógio de la candela*. (63) There he is called simply "Samuel el levi de Toledo nuestro iudio."



We come finally to Abraham, *alfaquim* (physician, in this case) of Alfonso. Once again, Steinschneider has caused confusion, by identifying him with Abraham Judaeus Tortuosensis (actually Abraham b. Shem Tov b. Isaac of Tortosa, active around 1254-1264), who translated Abu'l-Qâsim Khalaf b. 'Abbâs "al-Zahrawi" (for Ibn Sarâbî), the court physician of al-Hakam II of Córdoba. (64) The most probable identification of our Abraham, almost certainly correct, was made by Evelyn Procter, who conjectured that he is identical with "don Abraham físico," later the court physician also of Alfonso's son Sancho IV. (65) (Romano erroneously identifies him as Abraham b. Susan.) He is therefore Abraham Ibn Waqar, member of another eminent family of Jewish diplomats, courtiers, physicians, and [71] officials, whose activities extended over a long period of time in the courts of Spain. He was not only physician to both Alfonso and his son Sancho but also a close personal friend of the latter. Together with his brother "don Zag" (Isaac), he was present at the deathbed of Sancho and received the king's last will and testament. The scene is movingly described by Alfonso's nephew Juan Manuel. (66) Baer claims that Abraham was captured and held hostage by the rebels in the struggle between Sancho and his father, but he cites no source for this, and I have not been able to verify it. (67)

The most famous work for which Abraham was responsible, although the original is unfortunately lost, preserved now only in Latin and French translations from his Spanish, is the translation of al-Mî râj (based on Sura 70 of the Qu'rân) called *Escala de Mahoma*, done in 1263, (68) His second known work, produced sometime after 1270 at the order of Alfonso, is a cosmography (*Kitâb fi hay'at al-'alam*) by Ibn al-Haytham. (69) Finally, in 1277 at the command again of Alfonso, Abraham made a new translation of the *Azafeha* of Azarquiel, revising and correcting the translation by the Christian Fernando of Toledo; it appears in the *Libro del saber*. (70) There is no justification, incidentally, for the claim of Castro that Fernando was a *converso*. Nor is it necessarily true that, merely because Alfonso was in Burgos when he commissioned the translation by Abraham, we should conclude that Abraham was born in Burgos, as Procter has claimed. (71)

Millás has concluded that Abraham's translation of the *Azafeha* is more faithful to the original Arabic text than either the Hebrew translation done by Profiat (Judah b. Makhir) Ibn Tibbon or the Latin one by Guillelmus Anglicus and that it is "absolutely in harmony with the Arabic source." (72) This judgment coincides generally with Millás's positive view of all the Alfonsine translations made by the Jewish translators.

It is good to end this brief summary of the contributions of Jewish scientific translators and authors to the Alfonsine corpus on such a positive tone. The influence of both the translations and the original compositions upon later Jewish and non-Jewish scientific treatises, the significance of the Jewish contribution to the development of the Spanish language, and the relationship of these translators and authors to the broader picture of Jewish translation and literary activity prior to and during the period of Alfonso el Sabio remain to be considered in more detail.

#### Notes for Chapter Five

This chapter, as its new title indites, represents a considerable revision of the original version in *Alfonso, Emperor*.

1. For the "congress" see Steinschneider, *Die hebraeischen Übersetzungm des Mittelalters und die Juden als Dolmetscher* (Berlin: Kommissionsverlag des bibliographischen Bureaus, 1893; repr. Graz: Akademische Druck, 1956), 561-62. A popular account focusing on early translation at Toledo, and scarcely mentioning the Jews, is Alfonso Gamir, "Toledo School of Translators," *Journal of the Pakistan Historical Society* 14 (1966): 85-92. Similarly popular though not without merit is Juan Vernet, though he deals more with early scientific developments in Islamic Spain than with translation as such: "Les traductions scientifiques dans l'Espagne du Xe siècle," *Les cahiers de Tunisie* 18 (1970):

47-59. L. P. Harvey's essay is merely an expression of indignation at the lack of appreciation of Islam found in the *Primera crónica*-, and it has absolutely nothing to do with his title: "The Alfonsine School of Translators: Translations from Arabic into Castilian Produced under the Patronage of Alfonso the Wise of Castile (1221-1252-1284)," *Journal of the Royal Asiatic Society* (1977-1978): 107--17. It is incredible that Jacob L. Teicher could have written that the existence of a "school" of Hebrew translators "has not even been suspected hitherto," in light of the splendid work of Steinschneider and the admirable summaries of Sarton. See Teicher, "The Latin-Hebrew School of Translators in Spain in the Twelfth Century," *Homenaje á J. M. Mulas Vallicrosa*, 2 vols. (Barcelona: Consejo Superior de Investigaciones Científicas, 1956), 2: 403-4; and George Sarton, *Introduction to the History of Science*, 3 vols. (Baltimore: Carnegie Institution, 1927-1931), e.g., vol. 2, pt. 1: 349 and pt. 2: 721. When the less developed version of this study was published (see preface above), it was impossible to obtain a copy of José Gil's doctoral thesis. It has now appeared in a revised form and contains some, but by no means all, of the information here. See his "The Jews in the Toledo School of Translators" (Ph.D. diss., Catholic University of America, 1974), revised and translated as *La escuela de traductores y sus colaboradores judíos* (Toledo: Instituto Provincial de Investigaciones y Estudios Toledanos, 1985). The same judgment applies to David Romano, "Le opere scientifiche di Alfonso X e l'intervento degli ebrei," *Oriente e occidente nel medioevo: filosofia e scienze, in the Atti dei convegni* 13 (Rome: Accademia Nazionale dei Lincei, 1971), 677-710. A good summary of the translators and their activity can also be found in Muñoz Sendino's edition of *La escala* (see note 3 below), 163-72. Pilar León Tello has a section on Jewish translators and authors, but it is based on outdated and largely incorrect secondary literature: *Los judíos de Toledo*, 2 vols. (Madrid: Consejo Superior de Investigaciones Científicas, 1979) 51: 65-75. The 1985 Berkeley symposium *De astronomía Alphonsi regis*, ed. Mercé Comes, Roser Puig, and Julio Samsó (Barcelona: University of Barcelona, 1987), contains no reference at all to the subject, or any awareness of the 1981 UCLA conference.

2. Even the late historian of the Jews in Christian Spain, Yitzhak (Fritz) Baer, virtually ignored the translators and Jewish scientists; see his *A History of the Jews in Christian Spain*, 2 vols. (Philadelphia: Jewish Publication Society of America, 1966).

3. In *La escala de Mahoma*, ed. José Muñoz Sendino (Madrid: Ministerio de Asuntos Exteriores, 1949), 15.

4. "El literalismo de los traductores de la corte de Alfonso el Sabio," *Al-Andalus* I (1933): 155-87. This great scholar, fluent in both Hebrew and Arabic and an accomplished scientific historian, was fully qualified to make such a judgment. Cf. also Gil's criticism of Claudio Sánchez Albornoz for attempting to deny the value of Jews as translators, arguing that there were more Christians than Jews in Spain! To this Gil replies: "Certainly, but what was the work of these Christians? Where are their translations? If one compares the effort realized by the Jews with that of the Christians, that of the latter was minimal. Furthermore, the Christians were collaborators with the Jews and not the opposite" (Gil, *Escuela de traductores*, 57, n. 3).

5. Menéndez Pidal, "Cómo trabajaron las escuelas alfonsíes," *NRFH* 5 (1951): 367. Although he wrote this after Muñoz had published his edition of the *Escala*, where he made the remarks cited in note 4, in general, Menéndez's conclusions should be carefully checked in light of Gerold Hilty's analysis in his edition of *El libro conplido en los judizios de las estrellas por Aly aben Ragel, or 'All ibn Abl al-Rijal* (Madrid: Real Academia Española, 1954).

6. *España en su historia; cristianos, moros y judíos* (Buenos Aires: Editorial Losada, 1948), 494; cf. the note on 495-96 on the scientific vocabulary created by Jewish translators. Herbert Van Scoy's dissertation noted there has since been published; see his *Old Spanish Terms*, above in ch. 3, n. 4.

7. Juan Manuel, *Libro de la caza*, ed. J. Gutiérrez de la Vega in his *Biblioteca venatoria*, 5 vols.

(Madrid: M. Tello, 1877-1899), 3:4; also ed. J. M. Castro y Calvo (Barcelona: Consejo Superior de Investigaciones Científicas, 1947), 2: "Otrosí fizo tras-lador toda le ley de los judíos et aun el su *Talmud* et otra sciencia que han los judies muy escondida, a que llaman *Cabala*. Et esto fizo porque parezca manifestamente por la su ley que toda ella es figura de esta ley que los cristianos habernos; et que también ellos como los moros están en gran error et en estado de perder las almas."

8. *Lapidario*, ed. José Fernández Montaña (Madrid: Imprenta de la Iberia, J. Blasco, 1881). On the author and his possible identity see George Darby, "The Mysterious Abolays," *Osiris* I (1936): 151--59, and his "Ibn Wahshlyia in Medieval Spanish Literature," *Isis* 33 (1941): 433-38. In the latter, *Chaldean* on 433 almost always means Syriac. *El libro de Calila e Digna: edición crítica*, ed. John E. Keller and A. White Linker (Madrid: Consejo Superior de Investigaciones Científicas, 1979).

9. José Amador de los Ríos erroneously has 1241 in his *Historia crítica de la literatura española*, 7 vols. (Madrid: J. Rodríguez, et al., 1861-1865), 3: 630. He describes the *Lapidario* on 630-31.

10. Translation by Evelyn Procter, "The Scientific Works of the Court of Alfonso X of Castile: The King and His Collaborators," *MLR* 40 (1945): 12-29. On her explanation of the word *indio* there, which should actually be *iudio*, see Yaakov Malkiel and Maria Rosa Lida-Malkiel, "The Jew and the Indian: Traces of a Confusion in the Hispanic Tradition," in *For Max Weinreich on His Seventieth Birthday, Studies in Jewish Languages, Literature and Society* (The Hague: Mouton, 1964), 203-8. Cf. also *Mishlei Sendebār, the Tales of Sendebār*, ed. and trans. Morris Epstein (Philadelphia: Jewish Publication Society, 1967), 388, n. 2; and King Alfonso's *El libro de los engaños*, ed. John E. Keller (Chapel Hill: University of North Carolina Press, 1953; rev. edn. 1959); also ed. Emilio Vuolo (Naples: Liguori, 1980), I. If the *Lapidario* was translated from a Hebrew, not Arabic, version (which is entirely possible), then the confusion of "India-ludia" is understandable; whereas the Arabic word for India is *Hind*.

11. See the discussion by Gerold Hilty, "El Libro conplido en los judizios de las estrellas," *Al-Andalus* 20 (1955): 6 (with notes 2, 3) and 30-1. His claim (8, n. 2) that the title of *alfaquim* (*alfaqi*) was given only to Jews is not correct, as Muslims also had this title (Romano, "Intervento degli ebrei," 688, n. 61, also makes this mistake). As far as I can determine, the study of this promised there by Hilty was never written. Details on this title will be in my book on relations between Jews, Christians, and Muslims in Spain.

12. On the confusion this has caused various writers, see Hilty, "El Libro conplido": n. 3.

13. *Ibid.*, 22. Baer had already suggested the identity but wrongly assumed that Mosca was the same as Moses; see his *Die Juden im christlichen Spanien: Urkunden und Regesten*, 2 vols. (Berlin: Akademie für die Wissenschaft des Judenthums, 1929-- 1936), 2:59-60; see also his *Jews in Christian Spain*, 1: 120. Yehudah certainly was not a "rabbi of the Toledo synagogue," as Gil claims in his "Escuela de traductores," 6a. There is an edition of the astronomical treatise by Yehudah b. Solomon (whose family name apparently should be read Ibn Mosca, not Motqa), *Mishpatei kokavim, otot ha-shamayim* (Warsaw: 1886), extremely rare. This has been overlooked by bibliographers; a copy is in the National Library at Jerusalem. Maimonides knew this family and refers to the "aged" Ibn Mosca, perhaps the father of our Yehudah, and also seems to indicate that Ibn Mosca was related to the famous Ibn al-Fakhkhar family of Granada (letter to Ibn Tibbon in *Qoves teshuvot ha-Rambam ve-iggrotav*, ed. A. Lichtenberg [Leipzig: 1859], 2: 27a).

14. Yehudah b. Solomon states that his grandfather was "Zira" Ibn Susan, which is a printer's error for Ziza (*Mishpatei kokavim*, 16). On Ziza see Heinrich Brody, "'Al shushan 'edut" (Hebrew), in *Siyyonim, qoves le-zikhrono shel Y.N. Sim-honi* (Berlin: Eschkol, 1929), 48 n. Yehudah b. Solomon was born in 1219 and was a student of Meir Abulafia.

15. Millas Vallicrosa suggested *tabulae or traductor* in *Las traducciones orientales en los manuscritos de la- Biblioteca- central de Toledo* (Madrid: Consejo Superior de Investigaciones Científicas, 1942), 182. Cf. his *Estudios sobre Azarquiel* (Madrid and Granada: Consejo Superior de Investigaciones Científicas, 1943-1950), 452.
16. Hilty, *Libro conplido*, 47-48 n., and on the Millas Vallicrosa theory, p. 17. Cf. Sarton, *Science*, 2: pt. 2, 842 and Millas, *Traducciones*, 158-59. The Spanish manuscript of the translation is not extant, but see the *Escala*, 92ff., on a manuscript of a Latin translation which the editor thought was copied from the Spanish.
17. In addition to Hilty's article and edition, see the important observations on this work in the *Escala*, 85ff., and by Steinschneider, *Hebraeischen Übersetzungen*, 585.
18. "A Study and Edition of the Royal Scriptorium of *El libro del saber de astrologia* by Alfonso X, el Sabio," 4 vols. (Ph.D. diss., University of Wisconsin, 1974), I: xxvi, cf. xxiii-iv. This edition is cited here throughout, as obviously superior to *Libros del saber de astronomía*, ed. Manuel Rico y Sinobas, 5 vols. (Madrid: E. Aguado, 1863-1867). Francisco Vera gives the number of treatises as twenty-four, but he counts parts of books as whole separate books. However, he is almost correct in saying that seventy-five percent of the *Libro del saber* was composed and/or translated by Jews; the exact figure is somewhat higher. See his *Los judíos españoles y su contribución a las ciencias exactas* (Buenos Aires: El Ateneo, 1948), 156.
19. On him, and with reference to Yehudah's translation, see Steinschneider, "Zur Geschichte der Uebersetzungen aus dem Indischen in's Arabische .. ." *Zeit-schrift der deutschen morgenlandischen Gesellschaft* 24 (1870): 349-50.
20. Cf. O. J. Tallgren, "Sur l'astronomie espagnole d'Alphonse X," *Studia orientalia* 1(1925): 344.
21. Abraham Zacut, *Sefer yuhasin ha-shalem*, ed. Herschell Filipowski (London: 1857, repr. Jerusalem: 1963), 222. Hilty also cites a manuscript of Zacut's astronomical tables and translates the passage ("*El Libro conplido*": 26). The work he cites is not currently available to me, but Hüty certainly seems correct in saying that Zacut erred there and referred actually to the *Libro de la ochava spbera* and to the *Libro conplido* (Libro conplido edn., introduction, lxi). This is all the more surprising since in the chronicle Zacut clearly mentions the author of the work, as well as Yehudah as the translator, so it is obvious that he is referring to the *Libro de la ochava sphaera*. Incidentally, Hilty's reference may be the source of Gil's confusion (*Escuela de traductores*, 65) that Ibn al-Rijál was called "Zacuto"!
22. Cf. Antonio Ballesteros Beretta, "Burgos y la rebelión del infante don Sancho," *BRAH* 11 9 (1946): especially 119-21.
23. *Libro del saber*, Cárdenas edn., 2:185 (fbl. 24).
24. See Sarton, *Science*, 2, pt. 2, 836. Cf. also the description of the work in José Soriano Viguera, *Contribución al conocimiento de los trabajos astronómicos desarrollados en la escuela de Alfonso X el Sabio* (Madrid: A. Fontana, 1926), 41-50. There is, however, no justification for the claim that Alfonso himself wrote the prologue, which clearly was written in each case by the translators.
25. *El libro del saber*, Cárdenas edn., I: xxxvii-xl
26. *El libro conplido*, Hilty edn., 39-40
27. Baer, *Die juden*, 2: 51. The document was first edited in *MHE*, I: 13ff. and then by Julio González, *Repartimiento de Sevilla* (in ch. 2 above, n. n), 2:113, 118, 233, and passim.
28. On these see Norman Roth, "Two Jewish Courtiers of Alfonso X Called Zag (Isaac)," *Sefarad* 43 (1983): 75--85. For conditions of the Jewish community of Toledo in general during this period, see his

"New Light on the Jews of Mozarabic Toledo," *AJS Review* (Association for Jewish Studies) II (1986): 189-220.

29. Sarton, *Science*, I: 370; 2: pt. I, 442. J. A. Sánchez Pérez points out that chapter three of the book gives a date corresponding to 1066-1067 of the Common Era, whereas Abû Sa'îd died in 1058. See the "Nota preliminar" to King Alfonso's "El libro de las cruces," edited by Sánchez Pérez in *insis* (below in ch. 7, n. 91), p. x. And see most recently on this work Julio Samsó, "La primitiva versión árabe del Libro de las cruces," in *Nuevos estudios sobre astronomía española en el siglo de Alfonso X*, ed. Juan Vernet (Barcelona: Consejo Superior de Investigaciones Científicas, 1983), 149-61.

30. *El libro de las cruces*, ed. Lloyd A. Kasten and Lawrence B. Kiddle (Madrid: Consejo Superior de Investigaciones Científicas, 1961), I, col. b. The *explicit*, on the other hand, states: "e fue su [Yehudah] companero en esta translación Maestre Johan Daspa" (168). Undoubtedly Hilty is correct (*contra* Menéndez Pidal, "Escuelas alfonsies," 369, 371) in seeing that "Maestre Johan" of the prologue is the same as "Maestre Johan Daspa" of the *explicit*. We need not, however, make too much out of the term "*companero*" here. On the possibility of ch. 59 (Sánchez Pérez edn., 124; Kasten and Kiddle edn., 160) being an interpolation, composed entirely by Yehudah, see Samsó, "Primitiva versión": 150.

31. *El libro conplido*, 55-60.

32. *Ibid.*, 46. Regarding what Hilty wrote on 47, it should be mentioned that, while it is true that there is a tendency to call almost every medieval Jew "rabbi," there is nothing in the fact that Yehudah was a doctor which precludes his also having been, or had the title of, a rabbi. The argument ought rather to be that none of the treatises in which his name appears refers to him as such.

33. *Ibid.*, n. 3, drawing from the documents in Angel González Falencia, *Los mozárabes de Toledo en los siglos de Toledo en los siglos XII y XIII*, 3 vol. (Madrid: Instituto de Valencia de Don Juan, 1926-1930). Hilty's table is on p. 15. Muñoz Sendino considered "Judá ben Moisés [*sic*] ha-Cohen" and "Judá ben Moisés ben Mosca" two different people (perhaps including even a third!) in his edition of *Escala.*, 172.

34. See Sarton, *Science*, 2: pt. 2, 837 and the list of editions of the Latin translations on 840, with a bibliography of studies on 841.

35. *BNM*, 3306, fols. 34v-35.

36. *Libro conplido*: 42.

37. Hilty, *ibid.* Sarton, *Science*, 2: pt. 2, 837. Millas, *Traducciones*, 227-30.

38. Cf. Millas, *ibid.*, and his *Azarquiel*, 407-15.

39. Millas, *Azarquiel*, 15ff. The peculiarities of Arabic pronunciation in al-Andalus, however, do not affect the spelling of the name.

40. Madrid, Real Academia de la Historia, MS Heb. 7, fols. 27-28 and 30-39, described by Francisco Cantera Burgos in *Sefarad* 19 (1959): 12. This is not, of course, the Hebrew manuscript of the translation of the tables mentioned above. This *RAH* manuscript is obviously at least fifteenth century, not fourteenth as Cantera suggested (10,13).

41. Amador de los Ríos in his *Historia social, política y religiosa de los judíos de España y Portugal* (Madrid: T. Fortanet, 1875) erroneously referred to him as "Rabbi Isahak Aben Zagut Metolitoláh" (i: 448-49)!

42. Isaac Israeli, *Yesod 'olam*, 2 vols. in I, ed. Baer Goldberg and Loeb Rosen-kranz (Berlin: 1777 and 1847; latter as repr. Jerusalem: 1970), fols. 11b and 12a. In the 1777 edition, fol. 70b, the first section quoted here is lacking altogether and the section on the solar eclipse gives his name as "Isaac ben Sir";



but see the corrections following p. 48 of the 1847 edition. On the other hand, the earlier edition gives the date of the solar eclipse as 1266, which seems to me more correct than 1263. The title *hazzan* does not mean "precentor" in medieval Spain, as Sarton says (*Science*, 2: pt. 2, 843), but rather a teacher and/or reader of the Scriptures in the synagogue. Thus, his Spanish title "rabi" (rabbi) is correct. Isaac Israeli again cites investigations of Isaac b. Sîd on the solstice of the Hebrew month of Tishrei, 1265 (fol. 30a, or fol. 82b of the 1777 edition). At the end of Rico's edition of *Libros del saber* (2: 222) appear certain calculations for Seville, which led Ballesteros (*Alfonso X*, 308-9) to conjecture that Isaac lived in that city, but this is not necessarily so.

43. Zacut, *Sefer*, 221-22.

44. Roth, "Zag," 81, n. 29 for details.

45. *Astrolabio* in Alfonso's *Libro del saber*, 2: 270--384.

46. Cf. Soriano Viguera's *Contribución*, 52--74.

47. In *Libro del saber*, 2: 384, 422, 461.

48. In *Libro del saber*, 2: 459 and 471.

49. A. Wegener, "Die astronomischen Werke Alfons X," *Bibliotheca mathematica*, series 3, 6 (1905): 150. Heinrich Suter, *Die Mathematiker und Astronomen der Araber und ihre Werke* (Leipzig: B. G. Teubner, 1900), 124; the usually reliable Suter was incorrect here.

50. *La ciencia árabe en la edad media* (Madrid: Instituto de Estudios Africanos, 1954), 69. He confused the *Lamina universal* with the *Laminas de cada una de las siete planetas*, which is by al-Zarqâllah.

51. *Libro del saber*, Cárdenas edn., 1, cl, n. 9; Millas, "Un ejemplar de azafea árabe de Azarquiel," *Al-Andalus* 9 (1944): 112.

52. In *Libro del saber*, IV: 892 (fol. 166v). See Millas Vailicosz, *Estudios sobre la historia de la ciencia española* (Barcelona: Consejo Superior de Investigaciones Científicas, 1949), 66-67 and plate at 80.

53. Both forms appear in the text, but *armellas* with more frequency.

54. In *Libro del saber*, 3: 743 to 847 (fols. 132v to 152v).

55. In *Libro del saber*, IV: 1000 (fol. 198). This work is the strange "Fabrica y usos del instrumento del levamento que en Árábigo se llama atazin" ("The construction and use of the instrument of elevation called in Arabic *atazin*") to which Sarton refers as being in an Italian translation in a Vatican manuscript (*Science*, 2: pt. 2, 843). He attributed it either to Samuel ha-Levi or to Isaac b. Sîd. Given the strange title he had for the work, it is not surprising that he was unable to find it in the *Libro del saber*. See most recently on the Ataçir Mercé Viladrich and Ramón Martí in Vernet, *Nuevos estudios*, 75-100.

56. In *Libro del saber*, IV, 913 (fol. 172).

57. *Ibid.*, respectively 988 (fol. 177), 966 (fol. 185), and 988 (fol. 195). On the water clocks of "Azarquiel" in Toledo, see the interesting story in Millas, *Azarquiel*, 7ff. The *Libro de las armellas* was an extremely important work, and was utilized as late as the fifteenth century by the German astronomer Johann Miiller Regiomontanus ("of Königsberg") for the construction of his astronomical instruments (Vera, *Judíos*, 132).

58. Millas, "Una nueva obra astronómica alfonsí: el tratado de cuadrant 'sennero,'" *Al-Andalus* 21 (1956): 77-92.

59. Respectively in fols. 1-93 and 94-135; see Millas, "Obra": 59-61, 63.
60. Steinschneider, *Hebraeischen Übersetzungen*, 986.
61. See index to Baer, *Jews in Christian Spain*, s.v. "Abulafia," and his Hebrew article on "The Life and Times of Todros Abulafia," *Zion* 2 (1936): 19-55.
62. Baer, *Jews in Christian Spain*, I: 362-63. The literature on the synagogue, now a national monument in Spain, is vast. See generally Francisco Cantera Burgos, *Sinagogas de Toledo, Segoviay Córdoba* (Madrid: Consejo Superior de Investigaciones Científicas, 1973), and Don A. Halperin, *The Ancient Synagogues of the Iberian Peninsula* (Gainesville: University of Florida Press, 1969), 49-55; both works have photographs.
63. In *Libro del saber*, 976 (fol. 189).
64. Steinschneider, *Catalogus Itbrorum hebraeorum in bibliotheca bodleiana* (Berlin: A. Friedlaender, 1852-1860 and various reprint editions), col. 2747 (no. 7406.2); cf. also Steinschneider, *Hebraeischen Übersetzungen*, 657, 737, 740, 972. On Shem Tov see Sarton, *Science*, 2: pt. 2, 1085 and 1096, and on our Abraham 844.
65. Procter, "Scientific Works," 23. Procter was not correct in saying that Steinschneider and Sarton have no basis for calling him Abraham of Toledo, however, for Abraham Ibn Waqar in fact lived in Toledo. Procter did not know, apparently, of the Ibn Waqar name or realize that this was our Abraham.
66. Juan Manuel, "Tratado sobre las armas," in *Biblioteca de autores españoles* (Madrid: M. Rivadeneyra, 1846-1880), series I, vol. 51: 262. Edited also from the manuscript by Antonio Giménez Soler in his *Don Juan Manuel, biografía y estudio crítico* (Zaragoza: 1932), 688.
67. *Jews in Christian Spain*, r. 126.
68. This work was first mentioned by Steinschneider, *Catalogus*, col. 2747. The manuscript of an "Astrolabio" by one "Habraham magister" discussed by the editor Muñoz (*Escala*, 22) is possibly a work by Abraham Ibn Ezra.
69. *Escala*, 18 and n. 2, where the prologue is cited; cf. Procter, "Scientific Works," 15, 18 (prologue), 22; Sarton, *Science*, 2: pt. 2, 844.
70. Sarton, *ibid.*, is somewhat misleading; it is the translation by Fernando, not the one by Abraham, which is included in the *Libro del saber*, 2: 601 (fol. 106v).
71. Procter, *Alfonso, Patron*, 125. See Castro, *España*, 497.
72. Millas, *Ciencia española*, 104-5; cf. his *Azarquiel*, 462ff.