

# The making of a mathematician: al-Qalaṣādī (d. 891/1486) and his *Riḥla*

Manuela Marín

In his autobiography, the well-known Moroccan scholar Muḥammad Dā'ūd gives a detailed account of his education during the second decade of the 20th century. Among many other subjects, he says he took lessons on mathematics (*ḥisāb*) with his father, who taught him “the book of al-Qalaṣādī”.<sup>1</sup> This is not surprising, as al-Qalaṣādī's work, specially his *Kaṣḥf al-asrār 'an 'ilm ḥurūf al-ghubār* has been, for centuries, the handbook of mathematicians in Arab-speaking countries.<sup>2</sup> The comment by M. Dā'ūd confirms that it was also the standard text for training young scholars in the science of calculation, usually connected with the study of distributing shares in estates (*farā'id*). This is a pattern easily identified in many scholarly careers and, as it will be shown later, the same that can be recognised in the training of al-Qalaṣādī himself as a mathematician.

It their account of scientific developments during the Naṣrid period in al-Andalus, J. Vernet and J. Samsó state that mathematics were not specially flourishing in the kingdom of Granada. They also claim that the tradition of studying mathematics was probably kept in scholarly circles; otherwise it is difficult to explain the emergence of a figure such as al-

<sup>1</sup> Muḥammad Dā'ūd, *Alā ra's al-arba'in. Mudhakkirāt*, ed. H. Dā'ūd, Tetuan, 2001, p. 60 and 68.

<sup>2</sup> See M. Souissi, “Un mathématicien tuniso-andalou : al-Qalaṣādī”, *Actas del II Coloquio Hispano-Tunecino de Estudios Históricos*, Madrid, 1973, p.147-169. Travelling in the Sūs in 1897 the Scottish writer R. B. Cunningham Graham found traces of al-Qalaṣādī's fame among the local population: “Our local guide, a long, thin, scrofulous-looking Berber, dressed in a single garment like a night-gown, but most intelligent, said that close to where we sat, two hundred years ago lived El Kalsadi, a writer of arithmetic; and casting about the corners of my recollection I recalled having seen the name in Quaritch's Catalogue of Arab books.” (R. B. Cunningham Graham, *Mogreb-el-acksa*, London, 1898, reprinted in 1988, p. 137).

Qalaṣādī.<sup>3</sup> In what follows, I do not intend to examine or appraise the scientific production of al-Qalaṣādī, but to analyse how he became a mathematician, and the scholarly circles to which he attached himself in order to complete his formation as such. For this purpose, I shall rely on al-Qalaṣādī's *Rihla*, a very interesting document on his intellectual development and scholarly training. In this paper, an abstract of the itinerary followed by al-Qalaṣādī will be given first. In the second part, I shall examine the formative period of the author both in al-Andalus and in the Maghreb. Finally, some conclusions will be offered.

### Travelling to the southern shores of the Mediterranean

The *Rihla fī ṭalab al-ilm* is a well-known feature of Arabic biographical dictionaries, and most specially in al-Andalus, where a rich literature developed historically around it.<sup>4</sup> In Naṣrid times, the *rihla* genre was cultivated by Khālīd al-Balawī (d. after 767/1365) and by al-Qalaṣādī.<sup>5</sup>

The *Rihla* of al-Qalaṣādī is the last of its genre written in al-Andalus. It is primarily an account of the author's masters and the books he studied with them. In this sense, the book pertains to the bio-bibliographical literature (*fahāris*, *barāmij*). However, in contrast with the strictly academic dryness of the *fahāris*, glimpses of urban and rural landscapes, as well as personal portraits are scattered through this *Rihla*, giving to the text a distinct character, and allowing the reader to get a nuanced picture

<sup>3</sup> J. Vernet and J. Samsó "El saber científico y técnico", *El reino nazarí de Granada. Historia de España Menéndez Pidal*, VIII-3, coord. M. J. Viguera, Madrid, 2000, p. 293. See the biography of al-Qalaṣādī in *E.I. 2*, s.v. "Al-Qalaṣādī" (article by M. Souissi), and José A. Sánchez Pérez, *Biografías de matemáticos árabes que florecieron en España*, Madrid, 1921 (reprint. Granada, 1995), n. 55.

<sup>4</sup> See S. L. Gellens, "The Search for Knowledge in Medieval Muslim Societies: A Comparative Approach," *Muslim Travellers: Pilgrimage, Migration, and the Religious Imagination*, eds. D. F. Eickelman and J. Piscatori, London, 1990, 50-65. A recent study on early Andalusī travelling scholars is that of M. L. Ávila, "The Search for Knowledge: Andalusī Scholars and their Travels to the Islamic East", *Medieval Prosopography* 23 (2002), 125-139.

<sup>5</sup> On al-Balawī, see J. Lirola Delgado, "Al-Balawī, Jālid", *Enciclopedia de al-Andalus. Diccionario de Autores y Obras Andaluzes*, I, p. 104-6. M. J. Viguera has emphasized the richness of data found in al-Qalaṣādī's *Rihla* and the need to exploit it; see M. J. Viguera, "La cultura nazarí y sus registros históricos, biobibliográficos y geográficos", *Estudios nazaríes*, ed. C. Castillo Castillo, Granada, 1997, p. 186, and "Historiografía", *El reino nazarí de Granada. Historia de España Menéndez Pidal*, VIII-3, coord. M. J. Viguera, Madrid, 2000, p. 28.



of the learned elites in al-Andalus, Tlemcen, Tunis and Cairo in the last quarter of the 8th/15th century. Al-Qalaṣādī's description of his stay in the sacred places of the Ḥijāz is obviously of more interest for the historian of religions than it is for our purposes here.

Writers of *riḥlas* were usually very careful in registering the dates of departure and arrival to any place, thus attesting chronologically their connections to masters encountered during their travels. Al-Qalaṣādī is no exception to this rule, followed also by his predecessors al-Balawī and the anonymous narrator of Abū Marwān al-Bāḥī's travel to the East.<sup>6</sup> These are the places visited by al-Qalaṣādī in his journey, with the duration of every stage:

- 840/July 1436-July 1437: departure from Almuñécar and arrival to Tlemcen
- 848/April 1444: departure from Tlemcen and arrival to Oran
- rajab of 848/October 1444: departure from Oran. After 12 days of travel by sea, arrival to Tunis
- 14 rabī' I 851/ May 30, 1447: departure from Tunis, by sea
- 21 rabī' I 851/June 6, 1447: arrival to the island of Jerba
- 24 rabī' I 851/June 9, 1447: departure from Jerba
- 25 rabī' I 851/June 10, 1447: arrival to Tripoli
- 8 jumādā I 851/July 22, 1447: departure from Tripoli, by sea
- beginnings of jumādā II 851/August 14, 1447: arrival to Alexandria
- 8 jumādā II 851/August 21, 1447: departure from Alexandria, by the Nile
- 16 jumādā II 851/August 29, 1447: arrival to Būlāq and Cairo
- 26 rajab 851/October 7, 1447: departure from Cairo
- 8 sha'bān 851/October 19, 1447: arrival to al-Ṭūr<sup>7</sup>
- 16 sha'bān 851/October 27, 1447: departure from al-Ṭūr, by sea
- 7 ramaḍān 851/November 16, 1447: arrival to al-Yanbū'
- 25 ramaḍān 851/December 4, 1447: arrival to Judda
- 28 ramaḍān 851/December 7, 1447: departure from Judda
- 29 ramaḍān 851/December 8, 1447: arrival to Mecca

<sup>6</sup> On the itinerary followed by al-Balawī, see J. Lirola, "Al-Balawī, Jālid", p. 105-106. The route of Abū Marwān al-Bāḥī, in M. Marín, "El viaje a Oriente de Abū Marwān al-Bāḥī (m. 635/1237)", *Estudios Onomástico-Biográficos de al-Andalus*, VI, Madrid, 1994, p. 273-304.

<sup>7</sup> From the middle of the 8th/14th century, al-Ṭūr, situated in the south of the Sinai Peninsula, had recovered its role as the harbour for Mecca, lost to 'Aydhāb in the 5th/11th century (E. Honigsmann and C.E. Bosworth, "al-Ṭūr", *E.I.* 2).

- 29 dhū l-ḥijja 851/March 6, 1448: departure from al-Yanbū', by sea
- 17 muḥarram 852/ March 23, 1448: arrival to 'Aqabat Īliyā
- 23 muḥarram 852/March 29, 1448: arrival to Cairo
- 6 rabī' I 853/April 29, 1449: departure from Būlāq, by the Nile
- 17 rabī' I 853/May 10, 1449: arrival to Alexandria
- 24 rabī' I 853/May 17, 1449: departure from Alexandria, by sea [2 rabī' II 853/May 25, 1449]: arrival to Barqa
- 20 rabī' II 853/June 12, 1449: arrival to Tripoli
- 9 jumādā II 853/July 30, 1449: departure from Tripoli, by sea
- 19 jumādā II 853/August 9, 1449: arrival to Tunis
- 19 jumādā II 854/July 30, 1450: departure from Tunis, by sea
- 10 sha'bān 854/September 18, 1450: arrival to Oran
- 19 rabī' I 855/April 21, 1451: departure from Oran, towards Tlemcen
- 21 rabī' I 855/April 23, 1451: arrival to Oran, coming from Tlemcen; departure from Oran, by sea
- 23 rabī' I 855/April 25, 1451: arrival to Almería

Some interesting facts emerge from this chronological display of al-Qalaṣādī's *Riḥla*. Although not uncommon among Andalusī scholars, a stay of 15 years outside al-Andalus was certainly a long one.<sup>8</sup> Al-Qalaṣādī, born in 815/1412, was 24 at the time he abandoned his country, and 39 when he came back. He therefore spent his youth and mature age in "foreign" lands, and returned to al-Andalus as a man of well established learning. It is also noticeable that most of this period of absence was not only devoted to travel, as al-Qalaṣādī remained eight years in Tlemcen (from 840/1436-47 to 848/1444) and three in Tunis (from 848/1444 to 851/1447). He also stayed for a year (852-853/1448-1449) in Cairo, in his way to al-Andalus after accomplishing the pilgrimage to Mecca. These three cities, and more specially the first two, appear as the places where he established himself with the aim of improving his knowledge; in regard to mathematics, it is clear from the text of the *Riḥla* that his early formation in Baza –more about that later– was complemented mostly in Tlemcen. However, no explanation is given for other reasons of such a long stay in this last city.

<sup>8</sup> Cases of scholars spending 12, 15 and even 20 years in their travels are recorded by M. L. Ávila, but the average scholar would stay in the Muslim East from four to seven years (see Ávila's article quoted in note 4).



From the total amount of 15 years, al-Qalaṣādī spent 12 years in long term residences, in different cities. The remaining three years correspond to his actual travelling and, interestingly enough, this was the amount of time that Andalusī jurists considered sufficient, for married men, to be away from al-Andalus, when they left their country in order to perform the pilgrimage to Mecca.<sup>9</sup> The duration of sea travels, as recorded by al-Qalaṣādī, may contribute to the knowledge of seafaring in the southern shore of the Mediterranean, adding to what is already known for other historical periods.<sup>10</sup> In contrast to the route taken by Abū Marwān al-Bāḡī in the 13th century, al-Qalaṣādī never left the North African coast, and proceeded from Oran to Tunis, a trip of 12 days. The following stops were Jerba, Tripoli and Alexandria, and, in the way back, Alexandria, Barqa, Tripoli, Tunis and Oran. From Oran to Almería, the passage took only two days. Transport between Alexandria and Cairo was also on boat, this time along the Nile. A pattern of communications by sea routes, avoiding as far as possible travelling by land, appears constantly in the travelogue of al-Qalaṣādī. When his ship arrived to Barqa, in rabī' II 853/May 1449, he was obliged to stop there for eight days, due to contrary winds. Some passengers proposed to stay in the city awaiting for the autumn, while others wanted to go back to Alexandria. Finally, a change in the wind's direction allowed the ship to leave the harbour and continue her way westwards. Nobody seems to have suggested a trip by land.<sup>11</sup>

A comparison between the sea-travels of al-Qalaṣādī and his predecessor Khālid al-Balawī (8th/14th century) is now possible through the study by J. Lirola on al-Balawī's voyage.<sup>12</sup> The most striking difference between both routes is the land itinerary followed by al-Balawī from Ḥunayn –the harbour for Tlemcen– to Tunis, a distance covered by sea by al-Qalaṣādī. It is also important to note that al-Qalaṣādī does not mention Ḥunayn, but Oran, as the starting point of his travel eastwards once he left Tlemcen, and also as the place where he stops, on his way

<sup>9</sup> See M. Marín, *Mujeres en al-Ándalus*, Madrid, 2000, p. 461-465.

<sup>10</sup> See A. L. Udovith, "Time, the sea and society: duration of commercial voyages on the southern shores of the Mediterranean during the High Middle Ages," *La navigazione mediterranea nell'alto medioevo*, Spoleto, 1978, p. 503-563.

<sup>11</sup> Al-Qalaṣādī, *Rihla*, ed. Muḥammad Abū I-Ajḡān, Tunis, 1978, p. 159.

<sup>12</sup> Jorge Lirola Delgado, "Travesías náuticas en la *Rihla* del almeriense Jālid al-Balawī (siglo XIV)", *Actas del II Congreso de Historia de Andalucía*, I, Córdoba, 1994, 85-92.

back to al-Andalus, to make a short visit to Tlemcen.<sup>13</sup> The rest of the trip is very similar in both cases, land routes between Tunis and Egypt being traditionally avoided in this part of the trip, as it has just been noticed in al-Qalaṣādī's *Rihla*. Both travellers' ships used the harbour of al-Barqa, *marsā l-Imāra*, when faced against contrary winds; al-Balawī and the other passengers were obliged to return to Alexandria and spent the winter in the city, awaiting there for better weather conditions.

### **Baza and its learned elites: how to become a scholar and a mathematician in late Naṣrid al-Andalus**

When al-Qalaṣādī left al-Andalus in 840/1436, he intended to improve his level of knowledge, but he was not by any means an uneducated person. In fact, he already had an excellent training in matters such as the Qur'ān, *ḥadīth*, Arabic grammar and literature, Islamic law –with an special interest in the study of distributing shares in estates–, and arithmetic. The list of the works he studied in Baza with different masters, covering all these subjects, contains titles as basic as the *Risāla* of Ibn Abī Zayd (d. 386/996) or the *Alfīya* of Ibn Mālik (d. 672/1274), both standard texts for teaching islamic law and Arabic grammar. Al-Qalaṣādī also studied in Baza the classical works of Ibn Qutayba (d. 276/889), *Adab al-kātib*, and of Tha'lab (d. 291/904), *al-Faṣīḥ*. Through these and other similar texts, al-Qalaṣādī acquired a general but competent knowledge on the essential subjects of Arabic-Islamic culture. What marks a peculiarity in his formative period is his interest in arithmetic, very seldom found in the academic records of Andalusī scholars, the *fahāris*.<sup>14</sup>

As was the costum in al-Andalus, al-Qalaṣādī began his scientific training studying the Qur'ān, under the direction of Abū l-Ḥasan 'Alī b. 'Azīz, from whom nothing else is known. Al-Qalaṣādī describes him as a man of ascetic tendencies, completely devoted to the study and recitation

<sup>13</sup> The end of the 15th century witnessed the economic decline of Tlemcen and the growing threat of Spanish intervention in this region; see M. Bouayed, "Le port de Hunayn, trait d'union entre le Maghreb central et l'Espagne au Moyen-Age", *Relaciones de la Península Ibérica con el Magreb (Siglos XIII-XVI)*, ed. M. García-Arenal y M. J. Viguera, Madrid, 1988, 325-359.

<sup>14</sup> The longest and more detailed work of this genre is that of Ibn Khayr (d. 575/1180), where there is no section on arithmetics, mathematics and other "rational" sciences. See J. M. Vizcaino Plaza, *La fahrasa de Ibn Jayr*, Madrid, 2002 (*Estudios Onomástico-Biográficos de al-Andalus*, XII).



of the sacred text.<sup>15</sup> After this first stage in learning, his second master played a crucial role in the subsequent career of al-Qalaṣādī, as it was him who introduced the young man to the works of the famed Maghribian mathematician Ibn al-Bannā’.

This second master was Abū ‘Abd Allāh Muḥammad al-Qusṭurī,<sup>16</sup> with whom al-Qalaṣādī continued to study the Qur’ān, as well as “some *maqālas*” on arithmetic by Ibn al-Bannā’. The same texts by Ibn al-Bannā’, together with his *Talkhīṣ*, were taught to al-Qalaṣādī by another scholar from Baza, Abū Aḥmad Ja’far b. Abī Yaḥyā.<sup>17</sup> According to his disciple, Ibn Abī Yaḥyā, born and educated in Shūjar, a small town near Baza in the frontier with Christian territory,<sup>18</sup> was an expert on legal methodology (*furū’*), distribution of shares in estates and arithmetics (*‘ilm al-‘adad*), being also interested in *ḥadīth*, qur’ānic readings and Arabic. Such a description could also apply to al-Qalaṣādī himself, who appears to have been deeply influenced by Ibn Abī Ja’far, with whom he studied continuously until the time of this departure from al-Andalus.

Al-Qusṭurī and Ibn Abī Ja’far introduced al-Qalaṣādī to the legacy of Ibn al-Bannā’ (654-721/1256-1321), a distinguished scholar in mathematics, astronomy and astrology.<sup>19</sup> His mathematical work soon

<sup>15</sup> Al-Qalaṣādī, *Riḥla*, p. 83. ‘Alī b. ‘Azīz died during the plague of 844/1440-41.

<sup>16</sup> *Idem*, p. 84. Al-Qusṭurī died also in the plague of 844/1440-41.

<sup>17</sup> *Idem*, p. 86. Later biographies of Ja’far b. Abī Yaḥyā reproduce the information given here by al-Qalaṣādī (see Aḥmad Bābā al-Tunbuktī, *Kitāb Nayl al-ibtihāj bi-taṭrīz al-dībāj*, on the margins of Ibn Farḥūn, *Al-Dībāj al-mudhhab*, Beirut, n.d., p. 103 and al-Qalaṣādī, *Riḥla*, p. 86, note 31).

<sup>18</sup> Nowadays Zújar, northwest of Baza. In the *Nubdhat al-‘aṣr*, ed. and transl. by A. Bustani and C. Quirós (Larache, 1940) p. 25 of the Arabic text, this place-name appears as ḥiṣn Mūjar. Zújar was a stronghold conquered by the Castilian army in rajab of 894 (May 1489), at the beginning of the campaign that ended with the conquest of Baza in December of 1489 (see F. Vidal, “Historia política”, *El reino nazari de Granada. Historia de España Menéndez Pidal*, VIII-3, p. 204-5).

<sup>19</sup> Recent Spanish research has specially focused on Ibn al-Bannā’ as astronomer. See R. Puig, “El *Taqbīl alā risālat al-ṣafiḥa al-zarqāliyya* de Ibn al-Bannā’ de Marrākus”, *Al-Qanṭara* VIII (1987) 45-64; J. Samsó, “Azarquiel e Ibn al-Bannā’”, *Relaciones de la Península Ibérica con el Magreb (siglos XIII-XVI)*, ed. M. García-Arenal y M. J. Viguera, Madrid, 1988, p. 361-72; the same and E. Millás, “The computation of planetary longitudes in the *zīj* of Ibn al-Bannā’”, *Arabic Sciences and Philosophy* 8 (1998), 259-86; J. Vernet, *Contribución al estudio de la labor astronómica de Ibn al-Bannā’*, Tetuán, 1951; the same, “La supervivencia de la astronomía de Ibn al-Bannā’”, *Al-Qanṭara* I (1980), 447-51. On another subject, see M. Forcadá Nogués, “Les sources andalouses du Calendrier d’Ibn al-Bannā’”, *Actas del II Coloquio Hispano-Marroquí de Ciencias Históricas*, Madrid, 1992,

became very popular in the Islamic West and it is not surprising to verify that it was the basis of al-Qalaṣādī's training in this field. The *Talkhīṣ* of Ibn al-Bannā' was equally studied by al-Qalaṣādī during his stay in Tlemcen, as can be seen below.<sup>20</sup> However, it has to be noted that commonly, the interest for arithmetic and mathematics was related to the specialization in distributing shares in estates, a task demanding a good knowledge of calculation. During his early years in Baza, al-Qalaṣādī studied several books on this matter: the *Farā'id* of 'Abd al-Ghāfir<sup>21</sup> and *al-Mawāriṭh* of al-Qāḍī 'Abd al-Wahhāb b. 'Alī (d. 422/1031),<sup>22</sup> both under the direction of Ibn Abī Yaḥyā. This was also the case with the study of other works on the same subject, such as *al-Tilimsāniya*, written in *rajaz* by Abū Ishāq Ibrāhīm b. Abī Bakr al-Anṣārī al-Tilimsānī (d. 690/1291 or 699/1300).<sup>23</sup> Finally, it was with Ibn Abī Yaḥyā that al-Qalaṣādī began his long-term acquaintance with the Andalusī author al-Ḥawfī (d. 588/1192), whose books on *farā'id* were greatly estimated in scholarly circles.<sup>24</sup>

Al-Qalaṣādī was the disciple of three other scholars from Baza, in subjects such as Islamic law, Arabic grammar and language, qur'ānic readings, etc. Their names are preserved in the *Riḥla*, a precious text for the knowledge of the scholarly ambiance in the city: Abū Bakr al-Bayyāz, Abū 'Abd Allāh Muḥammad al-Bayyānī (d. 876/1472) and Abū l-Ḥasan 'Alī b. Mūsā b. 'Ubayd Allāh al-Lakhmī, usually called "al-Qarabāqī" (d.

p.183-196). The most recent and comprehensive study on Ibn al-Bannā' is that of Aḥmad Jabbār and Muḥammad Aballāgh, *Ḥayāt wa-mu'allafāt Ibn al-Bannā' al-Marrākushī ma'a nuṣūṣ ghayr manshūra*, Rabat, 2001 (I owe this reference to Julio Samsó).

<sup>20</sup> On the editions of Ibn al-Bannā's mathematical work, see E. Calvo, "La *Risālat al-ṣafiḥa al-muṣṭaraka 'alā al-Ṣakkāziyya* de Ibn al-Bannā' de Marrākūš", *Al-Qanṭara* X (1989), 21-50, note 1, and the work of A. Jabbār and M. Aballāgh quoted in note 19.

<sup>21</sup> Unidentified.

<sup>22</sup> He was also the author of a famous treatise on mālikite law, *al-Talqīn*, also studied by al-Qalaṣādī in Baza. See A. Ramos, "Estudio de la transmisión de las obras de *fiqh* contenidas en el *Barnāmay* de at-Tuḥṭībī", *Al-Qanṭara* VII (1986), p. 107-134, esp. p. 115-16.

<sup>23</sup> Ibn Farḥūn, *Dībāj*, p. 90-91. The editor of al-Qalaṣādī's *Riḥla* (p. 86, note 33) signals two commentaries by al-Qalaṣādī to *al-Tilimsāniya*, whose manuscripts are kept in the National Library, Tunis. See *E.I.* 2, s.v. "Al-Tilimsānī".

<sup>24</sup> Aḥmad b. Muḥammad b. Khalaf al-Ḥawfī, born in Seville, where he was a judge, was of Egyptian origins. See the references to his biographies in M. Penelas and J. Zanón, "Nómima de ulemas andalusíes de época almohade", n° 344, in *Biografías almohades (EOBA, IX)*, ed. M. Fierro and M. L. Ávila, Madrid-Granada, 1999, p. 11-222.



in the plague of 844/1440-41).<sup>25</sup> Nothing is known of the first, save what al-Qalaṣādī himself notes in his *Riḥla*: he was a pious man who died in Granada, in an unknown date. Far more interesting are the other two scholars. Among the disciples of al-Bayyānī was another famed son of Baza, the poet ‘Abd al-Karīm al-Qaysī al-Basṭī, whose *dīwān* is an important source of data on the city and its inhabitants.<sup>26</sup> Al-Bayyānī appears in this *dīwān* in several occasions, and al-Qaysī devoted to him a poem of biographical character, emphasizing his wide knowledge of Islamic law, *ḥadīth*, Arabic language, logic, arithmetics and algebra. In another poem, al-Qaysī mentions that al-Bayyānī, who had mystic tendencies, was appointed judge of Baza against his wishes.<sup>27</sup> Curiously enough, although al-Qaysī mentions among al-Bayyānī’s fields of knowledge, arithmetics and algebra, al-Qalaṣādī limits himself, in his *Riḥla*, to a general reference on having learnt, under al-Bayyānī’s direction, “many books on law, Arabic language and other subjects”, the only titles specifically recorded being the *Risāla* of Ibn Abī Zayd, the *Alfiya* of Ibn Mālik and the *Īdāḥ* of al-Fārisī (d. 377/987).<sup>28</sup> But al-Bayyānī’s name has to be added, in any case, to the list of scholars in Baza having a good level of knowledge in the science of mathematics.

Al-Qarabāqī, on his part, taught al-Qalaṣādī the same books that al-Bayyānī and his other masters, adding some other relevant titles, like *al-Tafrīr* by Ibn al-Jallāb (d. 378/988),<sup>29</sup> the grammatical treatise of Sībawayh, and al-Qarabāqī’s own composition on versification, *al-Tabṣira al-kāfiya fī ‘ilmay al-‘arūd wa-l-kāfiya*.<sup>30</sup> Remarkably, al-Qarabāqī’s expertise in astronomy is not mentioned by al-Qalaṣādī, but other sources refer to his leading role in the discussions related to the *qibla*’s right

<sup>25</sup> Al-Qalaṣādī, *Riḥla*, p. 84-91.

<sup>26</sup> The most comprehensive study on al-Qaysī is due to Muḥammad Ibn Sharīfa, *Al-Basṭī, akhīr shu‘arā’ al-Andalus*, Beirut, 1985. Several articles by C. Castillo Castillo offer Spanish translations of some of al-Qaysī’s poems, like “Más elegías de al-Qaysī por pérdidas granadinas”, *Homenaje al profesor José María Fórneas Besteiro*, Granada, 1995, I, p. 111-115 and “‘Abd al-Karīm al-Qaysī y su *dīwān*”, *Estudios nazaries*, ed. C. Castillo Castillo, Granada, 1997, p. 259-81.

<sup>27</sup> Ibn Sharīfa, *Al-Basṭī*, p. 22-24.

<sup>28</sup> Al-Qalaṣādī, *Riḥla*, p. 85.

<sup>29</sup> A short summary of Ibn al-Jallāb’s life and work on legal methodology, in S. Abboud-Haggar, *El tratado jurídico de al-Tafrīr de Ibn al-Ġallāb. Manuscrito aljamiado de Almonacid de la Sierra*, Zaragoza, 1999, I, p. 17-22.

<sup>30</sup> Al-Qalaṣādī, *Riḥla*, p. 87.

orientation in Andalusí mosques. As happens with the relationship between mathematics and *farā'id*, there are important religious and legal implications in the astronomical expertise of this particular subject, over which developed a rich literature recently analyzed by M. Rius.<sup>31</sup> Again, the silence of al-Qalaṣādī on this respect does not mean that he could not profit of his master's expertise, as was probably the case with the algebraic knowledge of al-Bayyānī.

While the information given by al-Qalaṣādī about his masters is normally restricted to academic and scholarly activities, his portrait of al-Qarabāqī covers other and important biographical data. Moreover, it is clear from the text of the *Rihla* that the relationship between the two men was very friendly. While these aspects are not highly relevant for the subject of this article, it may be interesting to deal with them, however briefly. The fact that al-Qarabāqī's family and properties are well documented in the preserved archives from Naṣrid Granada gives an added value to his figure, emerging from all these different sources as a representative of the well-off urban elites, a social group joining its position as landowners and professional men to the prestige derived from their dedication to scholarship. Al-Qalaṣādī describes his master, al-Qarabāqī, as an excellent and pious scholar, of great eloquence and exemplary behaviour. After being a Qur'ānic reader in Almería as his brother was in Guadix, al-Qarabāqī established himself in Baza. By reasons not clearly stated, he had to flee the city, forced to do that by a "tyrant", and he took refuge in Purchena, in 838/1435. Ten months later he was able to go back to Baza, where he lived until his death in 844/1440-41.<sup>32</sup> As was to be expected, nothing is found in al-Qalaṣādī's *Rihla* about the economic position of his master or, even less, about his family. We are fortunate in having pieces of information concerning these two sides of al-Qarabāqī's life, contained in the archive documents still preserved from the last times of Naṣrid Granada. Thanks to these records, it is possible to trace some of the lands owned by al-Qarabāqī near Baza<sup>33</sup> and to know the

<sup>31</sup> See her *La alquibla en al-Andalus y al-Magrib al-Aqsà*, Barcelona, 2000. The discussion between al-Qarabāqī, who was a supporter of practising *ijtihād* in this regard, and his contemporary from Granada, Ibn Sirāj, is examined in p. 173-4. The relevant Arab texts are preserved in the legal collection of al-Wansharīṣī.

<sup>32</sup> Al-Qalaṣādī, *Rihla*, p. 90-91.

<sup>33</sup> L. Seco de Lucena, *Documentos árabe-granadinos*, Madrid, 1961, p. 5, n° 2 (date: 15 ramadān 836/May 7, 1433); p. 9, n° 5 (date: 20 sha'bān 842/February 5, 1439); p. 10, n° 6 (date: 25 sha'bān 842/February 10, 1439). The surname "al-Qarabāqī" appears in other



terms of the marriage contract of his daughter Fāḥima to Abū Ishāq Ibrāhīm b. Aḥmad al-Ḥakīm.<sup>34</sup> Another daughter of al-Qarabāqī, Umm al-Faḥ, was married to a trader. Her son, Abū l-Ḥajjāj Yūsuf, sold her a land in Bajjān, near Baza, in 26 shawwāl 888/November 27, 1483.<sup>35</sup> A last testimony about the properties of Umm al-Faḥ is found in a document dividing the shares of her estate –a vineyard near Baza.<sup>36</sup> No detailed examination of all these documents is possible here, but their existence bear witness to the social position of al-Qarabāqī and his immediate family (there is also mention of a brother of him, Yūsuf b. Mūsā b. ‘Ubayd Allāh al-Qarabāqī), and his standing in the community, no doubt enhanced by his scholarly prestige as well as by his integration into the urban network of family ties and economic interests.

The last comments made by al-Qalaṣādī in his biography of al-Qarabāqī deserve to be quoted literally:

“In that period sciences were flourishing in Baza, as well as in the neighbouring fortresses, where all the imams were men of learning, so that people in every place used to compete among them on which one should be their imam. I have seen that and have been a witness to that in the fortresses of Shūjar and that of Qanālish”.<sup>37</sup>

It is tempting to interpret these enthusiastic sentences as a proof of al-Qalaṣādī’s love for his birth-place and discard them accordingly. But the very text of the *Riḥla*, as we have just seen, attests to the presence in the city of a notable group of scholars from whom al-Qalaṣādī received a wide education. It is noteworthy that some of them shared an interest in arithmetic and astronomy, integrated in the mainstream current of transmission of knowledge. Moreover, other documents confirm al-Qalaṣādī’s assertion on the high level of education in the region. The legal compilation of al-Wansharīsī contains a rich collection of *fatāwā* related to religious bequests (*aḥbās*) in Baza and its surrounding area, established

documents about lands situated near Granada, but they may refer to other members of his family (*idem*, p. 71, n° 35 and p. 139, n° 86).

<sup>34</sup> *Idem*, p. 7-8, n° 4.

<sup>35</sup> *Idem*, p. 96, n° 48.

<sup>36</sup> *Idem*, p. 97, n° 49 (date: 4 muḥarram 890/January 21, 1485).

<sup>37</sup> Al-Qalaṣādī, *Riḥla*, p. 91. Qanālish is the Arabic name for nowadays Caniles, located to the southeast of Baza. See M. C. Jiménez Mata, *La Granada islámica: contribución a su estudio geográfico-político-administrativo a través de la toponimia*, Granada, 1990, p. 235. On Shūjar, see *supra*, note 18.

with the aim of supporting poor students.<sup>38</sup> Famed scholars from Granada were asked whether students who had a trade or profession, such as a teacher, had the right of benefit from the bequests. Independently of the actual discussion on the students' rights, these texts suggest the imbrications of scholarly activity in the social structure of Baza and its region –another fortress, Qashtāl, is mentioned in this respect in one of these texts.

### Al-Qalaṣādī in Tlemcen

By the time al-Qalaṣādī began his travels, in the middle of the 9th/15th century, the 'Abd al-Wādid kingdom of Tlemcen was still able to maintain its independence against its two rival powers, to the East (the Ḥafṣids of Tunis) and to the West (the Marīnīds of Fez).<sup>39</sup> In this period, many scholars from al-Andalus chose the capital city of Tlemcen as a place of residence, seeking refuge from the advancing Christian armies in the Iberian Peninsula. This Andalusī presence has been interpreted by some, as the crucial element for the “de-bedouinization” of the Berber population of Tlemcen,<sup>40</sup> following the now outdated vision of an opposition between Arabs –and specially Andalusīs– and Berbers, the former as representatives of an urban and therefore superior culture, and the latter of a peasant and inferior one. In fact, and whatever was the influence of Andalusī scholars in Tlemcen, when al-Qalaṣādī arrived to the city he met learned men of local stock (some of them bear names of Berber origin), and he could expand his knowledge in many fields, among them mathematics and other rational sciences.<sup>41</sup> His long stay in the city allowed him to establish deep ties of discipleship with some of the most renowned masters of Tlemcen, and to begin his own career as an author on his own

<sup>38</sup> A careful analysis (with an Spanish translation) of these *fatāwā* has been recently published by M. I. Calero Secall, “Afectación de las rentas de los habices de las mezquitas en fetuas nazaríes del siglo XV. El caso del poeta-alfaquí al-Baṣṭī”, *En el epílogo del islam andalusí: la Granada del siglo XV*, ed. C. del Moral, Granada, 2002, p. 157-183.

<sup>39</sup> See *E.I.* 2, s.v. “‘Abd al-Wādidis” [G. Marçais] and G. Marçais, *La Berbérie musulmane et l'orient au moyen age*, Paris, 1946.

<sup>40</sup> G. Marçais, *La Berbérie musulmane*, p. 299 and R. Arié, “Relations entre Grénade et la Berbérie au XIVe siècle”, *Etudes sur la civilisation de l'Espagne musulmane*, Leiden, 1990, 22-33.

<sup>41</sup> See Abū I-Qāsim Sa'd Allāh, *Ta'rīkh al-Jazā'ir al-thaqāfī min al-qarn al-'āshir ilā l-rābi' 'ashar*, Alger, 1981, I, p. 105-113.



right. According to al-Qalaṣādī's biographer, al-Sakhāwī, it was in Tlemcen where he wrote *al-Tabṣira fī l-ghubār* and several commentaries on works on *farā'id* that he had already studied in al-Andalus, the *Tilimsānya* and the book by al-Ḥawfī. To this he added a commentary on the didactic poem on the same subject by al-Sharrān.<sup>42</sup>

The *Riḥla* of al-Qalaṣādī gives a detailed account of his masters in Tlemcen. The first of them was Abū 'Abd Allāh Muḥammad b. Aḥmad b. Muḥammad b. Marzūq al-'Ajīsī (d. 842/1439), a member of the illustrious family of the Banū Marzūq.<sup>43</sup> Al-Qalaṣādī studied many texts with this scholar, among them his own work on *farā'id*.<sup>44</sup> This field of knowledge, so prominent in the education of al-Qalaṣādī, was also decisive in his choice of a second master, Abū Maḥdī 'Isā al-Rutaymī (known as Amziam), with whom he studied the text of al-Ḥawfī extensively, "in different ways and according to the two systems, the complete and the fractional."<sup>45</sup>

But al-Qalaṣādī also looked in Tlemcen for masters who were specialized in mathematics and other "rational" sciences, although he does not always mention that he had studied works of this kind with them. This is the case of Abū 'Abd Allāh Muḥammad al-Sharīf (d. 847/1443-44),<sup>46</sup> of Abū 'Abd Allāh Muḥammad Ibn al-Najjār (d. 846/1442-43),<sup>47</sup> and of al-Ḥasan b. Makhluḥ al-Rāshidī, known as Aburkān (m. 857/1453).<sup>48</sup> Far more important for al-Qalaṣādī's training as a mathematician were his

<sup>42</sup> Al-Sakhāwī, *Al-Daw' al-lāmi' li-ahl al-qarn al-tāsi'*, Beirut, n.d., VI, p. 15. On al-Sharrān and his poem, see C. Castillo Castillo, "Un poeta granadino poco conocido: Muḥammad al-Šarrān (s. XV)", *En el epilogo del islam andalusí: la Granada del siglo XV*, ed. C. del Moral, Granada, 2002, 187-200.

<sup>43</sup> He was a grandson of the author of *al-Musnad al-ṣaḥīḥ*. In her study and translation of this work (Madrid, 1977), M. J. Viguera gives a biographical notice of al-Qalaṣādī's master; see p. 67-69.

<sup>44</sup> Al-Qalaṣādī, *Riḥla*, p. 97. The biographical text of al-Qalaṣādī on Ibn Marzūq was reproduced by Ibn Maryam, *El Bostan ou jardin des biographies des saints et savants de Tlemcen*, French translation by F. Provençal, Alger, 1910, p. 238-9.

<sup>45</sup> Al-Qalaṣādī, *Riḥla*, p. 99. The father of al-Rutaymī was also a good expert on al-Ḥawfī; see Ibn Maryam, *Bostan*, p. 92.

<sup>46</sup> Al-Qalaṣādī, *Riḥla*, p. 99-100.

<sup>47</sup> Al-Qalaṣādī, *Riḥla*, p. 102.

<sup>48</sup> Al-Qalaṣādī, *Riḥla*, p. 108. Ibn Maryam gives a very long biography of this mystic and miracle-doer who was also an expert in law, *farā'id* and mathematics (*Bostan*, p. 78ss.)

contacts with other scholars of Tlemcen, al-Zaydūrī, Ibn Zāghū and al-'Uqbānī.

With Abū l-Ḥajjāj Yūsuf b. Ismā'īl, known as al-Zaydūrī (d. 845/1441-42), al-Qalaṣādī extended his knowledge of Ibn al-Bannā's production. He read again with al-Zaydūrī, and more than once, the *Talkhīṣ* of Ibn al-Bannā, a work he already knew. But thanks to al-Zaydūrī, al-Qalaṣādī read other texts of Ibn al-Bannā not mentioned before in the *Riḥla*, namely, *al-Uṣūl wa-l-muqaddimāt fī l-jabr* and the *Raf' al-ḥijāb*, a commentary on the *Talkhīṣ* by Ibn al-Bannā himself.<sup>49</sup> Al-Zaydūrī's portrait in the *Riḥla* is that of man completely devoted to his studies, uninterested in worldly affairs and a great specialist in exact sciences (*riyāḍiyyāt*).

Abū l-'Abbās Aḥmad b. Muḥammad b. 'Abd al-Raḥmān al-Maghrāwī al-Khazarī, better known as Ibn Zāghū (d. 845/1441-42),<sup>50</sup> was probably the most important master of al-Qalaṣādī in Tlemcen.<sup>51</sup> In the *Riḥla*, Ibn Zāghū appears as a man of many intellectual interests and a great master whose fame attracted numerous disciples. He was a pious ṣūfī, and stood out as a great expert in qur'ānic exegesis. Al-Qalaṣādī attached himself to Ibn Zāghū, reaching a point when the master considered him as a son and lodged him in the house of one of his friends. When Ibn Zāghū died, al-Qalaṣādī compared his own feelings of loss to those of the wet-nurse who is separated from the child she has fed.<sup>52</sup>

The list of works studied by al-Qalaṣādī with Ibn Zāghū is impressive, and it covers mainly subjects such as qur'ānic exegesis, *ḥadīth* and law. It was also with Ibn Zāghū that al-Qalaṣādī was introduced to the work of al-Gazālī. There is no title of mathematics in this list, but al-Qalaṣādī, recording Ibn Zāghū's system of teaching, explains how the master gave lessons in the *madrasa* al-Ya'qūbīya, dividing the subjects according to seasonal changes. Thus he would teach "qur'ānic exegesis, *ḥadīth* and law

<sup>49</sup> Al-Qalaṣādī, *Riḥla*, p. 101. Al-Qalaṣādī mentions another title, *al-Muqābala*, which may be another name for *al-Uṣūl*. See the titles of works by Ibn al-Bannā, as recorded in his biographies, in H. P. J. Renaud, "Ibn al-Bannā' de Marrakech, ṣūfī et mathématicien (XIIIe-XIVe s. J.C.)", *Hespéris* XXV (1938), p. 13-42, especially 39-42, and A. Jabbār and Muḥammad Aballāgh, *Ḥayāt wa-mu'allafāt Ibn al-Bannā' al-Marrākushī*, p. 52-63.

<sup>50</sup> Both Ibn Zāghū and al-Zaydūrī died during the plague of this year.

<sup>51</sup> Aḥmad b. 'Alī al-Balawī al-Wādī Āshī (d. 938/1532), a disciple of al-Qalaṣādī, puts Ibn Zāghū at the top in the list of his master's masters. See al-Wādī Āshī, *Thabat*, ed. 'A. al-'Imrānī, Beirut, 1983, p. 105.

<sup>52</sup> Al-Qalaṣādī, *Riḥla*, p. 106. See Ibn Maryam, *Bostan*, p. 45-47.



in winter, and fundamentals of law (*uṣūl*), rethorics, arithmetic, *farā'id* and geometry in summer. All throughout the year, Thursdays and Fridays were dedicated to the reading of ṣūfī works and the correction of Ibn Zāghū's writings."<sup>53</sup>

After the death of Ibn Zāghū, al-Qalaṣādī chose another master, Abū l-Faḍl Qāsim al-'Uqbānī (d. 854/1450-51), whose father, Sa'īd, had been the author of a commentary on the book on *farā'id* by al-Ḥawfī and was considered a great expert in geometry and calculation.<sup>54</sup> With al-'Uqbānī, al-Qalaṣādī studied again the book of al-Ḥawfī on *farā'id*, and other texts about specific questions in this complex subject.

Through his own account in the *Rihla* it appears that it was in Tlemcen where al-Qalaṣādī expanded his mathematical knowledge and where he began to write his own works on this subject. After leaving the city, he stayed in Tunis and, later on, in Cairo. In both places he attended the lessons of the most important masters of the day, but he never again refers to specific texts on scientific subjects, with the exception of the *urjūza* of Ibn al-Raqqām on the astrolabe, which he studied in Tunis.<sup>55</sup>

## Conclusions

Al-Qalaṣādī's interest in mathematics was not exceptional in his own time. As a young student in his home-town, he had access to the works of Ibn al-Bannā' and could benefit from the expertise in arithmetic and *farā'id* of the masters then living in Baza. For most of these scholars, a good knowledge of calculation was an essential part of their education, which included many other subjects. The distinction between "rational" and "transmitted" sciences (*al-'ulūm al-ma'qūla wa-l-'ulūm al-manqūla*) did not act as a barrier separating isolated worlds of knowledge. Because of the accent put on the techniques related to distributing shares in estates, a narrow relationship developed between mathematics and Islamic law, opening ways for the advancing of calculation theory and practice. This also explains why in a small provincial city like Baza, transmission of mathematical knowledge was an accepted part of scholarly training. By a

<sup>53</sup> Al-Qalaṣādī, *Rihla*, p. 104.

<sup>54</sup> See Yaḥyā b. Muḥammad Ibn Khaldūn, *Bughyat al-ruwwād*, ed. and transl. by A. Bel, Argel, 1903, n° 86. Other members of this scholarly family are Aḥmad and Ibrāhīm, sons of Qāsim, and his grand-son Muḥammad (Ibn Maryam, *Bostan*, p. 55, 61 and 257).

<sup>55</sup> Al-Qalaṣādī, *Rihla*, p. 117. With the same master, Muḥammad al-Dahhān, al-Qalaṣādī studied two medical texts by Ibn Sīnā and al-Rāzī.

happy concurrence of historical circumstances, we can now resort to a wide range of sources (biographical, juridical, legal, and even poetic) to reconstruct this particular moment in the scientific life of Baza, at the end of its Islamic history. All the documentary evidence points to the permanence of a tradition of learning for which basic texts of mathematics were as essential as those pertaining to religious subjects.<sup>56</sup>

The crucial figure in this tradition is, of course, Ibn al-Bannā'. Like other scholars met by al-Qalaṣādī during his stay in Tlemcen, Ibn al-Bannā' had ṣūfī tendencies.<sup>57</sup> This connection between the mystical experience and the most rational of sciences, mathematics, opens a different perspective for the understanding of the world of learning in the period under consideration. As mystics, scholars like Ibn al-Bannā' and the above mentioned Aburkān<sup>58</sup> were held in high esteem by their contemporaries, who admired their pious behavior as well as their learning. Science and religion were inextricably united in the lives and works of these scholars, and it is not by a mere rhetorical resort that al-Qalaṣādī points out consistently to the personal virtues of the masters he had in al-Andalus and in Tlemcen.

The text of al-Qalaṣādī's *Rihla* is a testimony of a personal adventure in acquiring knowledge and this article does not pretend, by any means, to exhaust its potential as a source of information. By concentrating on his early years in Baza and Tlemcen, I have only tried to show the main currents in the scientific training and education of a man of his time, and to underline the intellectual ties bonding learned elites in al-Andalus and in North Africa.

<sup>56</sup> See a recent and discerning account on the relationship between Islam and science in J. Samsó, "La ciencia árabe-islámica y su papel", *Revista de Libros* 75 (2003), 12-16.

<sup>57</sup> In their appraisal of Ibn al-Bannā''s biography, A. Jabbār and M. Aballāgh discuss the implication of Ibn al-Bannā' in the mystic activities of two of his masters, Abū 'Abd Allāh and Abū Zayd al-Hazmīrī, founders of the *zāwiya hazmīriya*. Jabbār and Aballāgh are trying —successfully— to disentangle the scientific achievements of Ibn al-Bannā' from his popular fame as a mystic and even a miracle-maker, but their own arguments make also evident that Ibn al-Bannā' was strongly involved in the religiously oriented circles of his time. Moreover, Abū Zayd al-Hazmīrī (d. 706/1306) was himself a good mathematician, as Jabbār and Aballāgh acknowledge (see their *Ḥayāt wa-mu'allafāt Ibn al-Bannā' al-Marrākushī*, p. 39-43).

<sup>58</sup> See his biography in Ibn Maryam, *Bostan*, p. 78-100, with many pages devoted to the description of his miracles.