

The enigmatic orientation of the Great Mosque of Córdoba

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ABSTRACT: The Great Mosque at Córdoba does not face Mecca as we moderns think it should. This is also true of many other medieval mosques. However, now that we have some control over the medieval textual sources relating to the Ka‘ba and to the *qibla*, we can see that in the first two centuries of Islam, and occasionally also long thereafter, astronomical horizon phenomena were used to face the Ka‘ba, itself astronomically aligned. From the 9th century onwards, mainly directions based on geographical data and mathematical procedures were used to align mosques towards Mecca. Nevertheless some of the earliest mosques, as in Jerusalem and Damascus, were aligned with pre-Islamic religious edifices or complexes. In the case of the Great Mosque of Córdoba, it was a suburban Roman street-plan, revealed by excavations only some 20 years ago, which defined the *qibla*-axis of the Mosque, and this happened to be one of the several *qibla*-directions favoured in al-Andalus. So in medieval terms the Mosque could indeed have been thought to be facing the Ka‘ba.

KEYWORDS: Islam, Mecca, Makkah, Ka‘ba, Kaaba, Islamic architecture, Al-Andalus, Qurtuba, Córdoba, Cordova, Cordoue, Great Mosque, Aljama, Roman cardo system, orthogonal street-plan, solar solstitial alignments, *qibla*, astronomical horizon phenomena, archaeoastronomy.

SUMMARY

In Muslim practice mosques should face the *qibla*, that is, the sacred direction toward the sacred Ka‘ba in Mecca. Why is it then that the Great Mosque of Córdoba, established in the 780s, faces the deserts of Algeria rather than the deserts

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of Arabia? Much effort has been expended in attempts to explain this situation by historians of Islamic architecture, notoriously ill-informed on the subject of orientations; by historians of Islamic science, with access to medieval Arabic texts on the *qibla* in medieval al-Andalus; and by tourist guides and internet surfers, always ready to provide what the Egyptians call *ayyi kalām*. Most of the vast amount of speculation in printed or virtual form on the orientation of the Great Mosque and the reason for it is without any merit, ignoring as it does the actual orientation of the Great Mosque, as well as the archaeological finds in the city during recent years, and being innocent of any knowledge of relevant medieval texts on the *qibla* in general or the *qibla* in al-Andalus in particular. It also tends to deal with the Mosque in isolation, when we know of many other mosques in al-Andalus and the Maghrib with the same orientation, and numerous other Muslim cities with similarly diffuse mosque orientations.

We are dealing with a very complicated subject, which we only recently have begun to understand, and the situation with regard to the *qibla* in al-Andalus is to be viewed as one of many such situations all over the medieval Islamic world. Also timing is of the essence. Medieval Arabic texts dealing with the *qibla* in Qurtuba were identified only about 40 years ago, and the street plan of Roman Corduba has only been reconstructed by excavations over the past 20 years. The time is perhaps ripe for a new investigation, necessarily interdisciplinary.

The reason why the Qurtuba Mosque faces the way it does is that it is in the same direction as the orthogonal street plan of the suburb Colonia Patricia of the Roman city of Corduba. This street plan is inclined to that of the city centre, which is cardinally aligned, at an angle of about 30°, and it is thus aligned with summer sunrise and winter sunset; furthermore it slopes, fairly and squarely, gently down to the River Guadalquivir. The Mosque was built on top of another edifice — a Roman temple to Janus (?) or a church to San Vicente (?) or both (?) — and a portion of the tiled floor of that earlier building can still be seen some 4 m under the floor of the earliest part of the Mosque. The alignment of that tiled floor is clearly cardinal, which means that the Mosque was built skew to that earlier building, in line with the solstitial Roman street plan of Colonia Patricia.

To understand why this orientation was considered acceptable as the *qibla* over several centuries, and why the orientation was never changed, we also have to consider how the Andalusīs viewed the *qibla*, and how they justified different directions, and for this we have some medieval Arabic texts. (Most writers on Andalusī mosques have ignored these, but the same is true from al-Andalus to Central Asia).

Much misunderstanding, repeated even in the current official tourist guide brochure to Córdoba, seems to go back to early-20th-century pronouncements that the Mosque faces due south. It does not. This error conveniently links it to the Umayyad Mosque in Damascus (which does face south, the direction that was taken as the *qibla* for Syria), whence the first Andalusīs came. Two internet sites even claim that the Mosque in Qurṭuba deliberately faces Damascus. Scholars and amateurs have all contributed to this nonsense. With investigations of relevant medieval Arabic texts (King, Samsó and Rius) and measurements of mosques (Jiménez), we are on safer ground.

This new interpretation of the orientation of the Great Mosque has profited from information that was previously not generally available. For a start, the correctness of the orientation of a medieval mosque is not for us to judge. Rather, we should investigate what directions were considered appropriate for the *qibla* at the time the mosque was built. And the *qibla* is the direction of the Ka‘ba, not of Mecca —there is a subtle difference, subtle indeed, but extremely important. The fact that the rectangular base of the Ka‘ba is astronomically aligned (see below) has been known to a small group of scholars for over 30 years but it cannot be said that this is widely appreciated. In addition, these existed in medieval Islamic society the notion of a sacred geography centred on the Ka‘ba, with the *qiblas* in the surrounding regions of the world astronomically defined. Further, as far as Córdoba is concerned, the street-plans of the two main parts of the ancient Roman city have only some 20 years ago become identifiable through archaeological excavations. We shall use the street-plan of the principal Roman suburb to show why the Mosque is oriented the way it is, and we shall use various schemes of sacred geography to show how that orientation can be justified in medieval Islamic terms.

It was only when it became obvious that the orientation of the Mosque was the same as that of the *cardo* of the Colonia Patricia that I realized how relevant to the situation in Córdoba was the earlier research of my late colleague Michael Bonine in the Maghrib. Michael had investigated mosque orientations in Morocco and Tunisia, and there, in spite of medieval texts on the *qibla*, the mosque orientations are in accordance with the former Roman cities. And in many of these, the main axis is perpendicular to the axis defined by the solstices —summer sunrise and winter sunset— exactly as in the case of the Colonia Patricia. Michael’s research immediately explains why the orientation of the Great Mosque in Córdoba and those of mosques in Tunisia are more or less the same. It is primarily because they are all aligned with solstitial axes of Roman cities, less than they are “parallel” to the axis of the Ka‘ba. But in several schemes of sacred ge-

ography the *qibla* of al-Andalus is stated or implied to be in the direction that is parallel to the major axis of the Ka'ba. This could be used to justify the orientation of the Great Mosque of Córdoba.

Thus the answer to the Córdoba question lies firstly in Roman Corduba with the suburban street plan. Then the cardinally-aligned rectangular foundation of the Umayyad Mosque in Damascus, as well perhaps as the Prophet's Mosque in Medina (long destroyed in its original form), may have been in some way relevant. But more important is the orientation of the rectangular base of the Ka'ba in Mecca. It is far more complicated than the rough designations applied to the corners —Syrian, 'Irāqī, Yemeni, and “Western”— would suggest. The Ka'ba —once a simple enclosure the height of a man— is aligned with the rising-point of Canopus in one direction and the sun at the solstices —summer sunrise to winter sunset— in the perpendicular direction. Canopus, the brightest star in the Southern sky, is an indicator of South in Arabia; it is not visible at the latitude of Córdoba, but, happily, the sun is not lacking in the “cazuela de España”. How to face a distant edifice that is astronomically aligned? Astronomical alignments are the answer.

Only in the early 9th century did Muslims in Iraq, Syria and Iran became familiar with mathematical geography (latitudes and longitudes), mathematical methods (trigonometric formulae), and mathematical astronomy (observations and theories and tables). Before that, but already in that century, elements of a sacred geography associated segments of the perimeter of the Ka'ba with the corresponding sectors of the surrounding world; the *qiblas* in those regions were then derived by standing in front of the appropriate segment of the perimeter of the edifice, thereby facing significant astronomical directions. Various later medieval Andalusī astronomers, using mathematics, and on the other side the legal scholars, using sacred geography and astronomical risings and settings, proposed several different procedures for finding the *qibla* in Córdoba. Nevertheless, we have only one Andalusī treatise describing a mathematically correct procedure for finding the *qibla*, and no evidence of any Andalusī astronomer calculating the *qibla* accurately for any locality (a situation vastly different from that in the Islamic East).

Some of the schemes of sacred geography associate al-Andalus with the NW Wall of the Ka'ba, which means that the *qibla* would be in line with the major axis of the Ka'ba. Of particular interest is the statement of the 9th-century Qurṭubī legal scholar Abū 'Ubayda al-Laythī, nicknamed *Sāhib al-qibla*, “the man who knows all about the *qibla*”. He is reported to have said, whilst standing in front of

the NW Wall of the Ka'ba, facing the rising of Canopus: “this is the *qibla* of al-Andalus”. This is perhaps the ultimate justification for the orientation of the Córdoba Mosque, appropriately toward the Ka'ba, not toward the town of Mecca.

Thus a solstitially aligned orthogonal street plan laid out by the Romans and the astronomically aligned layout of the Ka'ba provided the basis of and the justification for the *qibla* of the Great Mosque of Córdoba. Each time the Mosque was enlarged the *qibla* was deemed acceptable, in spite of opposition from the astronomers, and so it was never changed. Indeed, it was copied in mosques all over al-Andalus and the Maghrib, as had been the Roman street plans centuries before.

The idea that a pre-existing religious edifice or a street plan or even a canal could inspire the *qibla* orientation of a mosque in an age before scientific methods became available for finding the *qibla* is not unique to Córdoba. We find the same situation in Jerusalem, Damascus, Cairo, and various places further east, but also in Morocco, Algeria and Tunisia.

In 1992 the American historian of Islamic art and architecture Jerrilyn Dodds edited a splendid volume of studies entitled *Al-Andalus: the Art of Islamic Spain*. She had the foresight and good taste to include a chapter on some Andalusī astronomical instruments —after all, ‘we’ owe perhaps more to Andalusī science than to Andalusī art, and besides the Andalusī instruments were scientific works of art— and in her own chapter on the Great Mosque she wisely omitted any reference to its orientation. In 2007 two colleagues of the next generation, Glaire Anderson and Mariam Rosser-Owen, have edited another volume entitled *Revisiting Al-Andalus – Perspectives on the material culture of Islamic Iberia and beyond*. The purpose of the volume is to show the state of art history in al-Andalus “15 años después” / “15 years later”. So there is not a word on either Andalusī astronomical instruments or on orientations.

At least “hace 25 años” / “25 years ago” Alfonso Jiménez published the orientations of all mosques in the Iberian peninsula. In 2000 Mònica Rius published her book on the *qibla* and mosque orientations in al-Andalus and the Maghrib. In 2016 the historian of Islamic art and science Azucena Hernández published descriptions of almost 50 astrolabes from al-Andalus and the Spain of the “Reinos cristianos”. Historians of Islamic science and civilization are contributing to the history of Islamic art and architecture.

A NEW INTERPRETATION

1. *The pearl of Qurṭuba*

We [God] see thee [Man] turning thy face toward the heavens. Now We shall make the face a *qibla* that will please thee. Turn then thy face toward the Sacred Mosque: wherever ye [all Mankind] are, turn your faces toward it. —*Qur’ān* II.144.

The Ka‘ba is the *qibla* for the Sacred Mosque; the Sacred Mosque is the *qibla* for the sacred precincts (of Mecca and its environs); and the sacred precincts are the *qibla* for the inhabitants of the whole world, from where the sun rises to where it sets. —Ibn al-Qāṣṣ (*ca. 975*), *Kitāb Dalā'il al-qibla*, cited in KING, *World-Maps for finding the direction of Mecca*, p. 47. [Nevertheless Muslims over the centuries faced the distant Ka‘ba from all over the Muslim world by a variety of different and often ingenious methods].

Every mosque in the world is a segment of a circle whose centre is the Kaaba. **The most significant characteristic of the mosque is the direction that it faces.** Hence it is the building’s abstract orientation and not its most visible elements —dome, minaret, mihrab, etc.— that determines its identity. —H. MASUD TAJ, “Facing the city: the influence of *qibla* on street-line orientation in Islamic cities” (1999), p. 173. [This is a message from a Muslim architect for all those who write on Islamic architecture. The emphasis is mine].

The (Cordova) mosque does not face Mecca, but the reason is not clear. —CHING & JARZOMBEK & PRAKASH, *A Global History of Architecture* (2017), p. 316. [This was the case in 1995, when the book first was published, before the medieval Arabic texts on the *qibla* in al-Andalus were published and before the recent excavations of the Roman city].

He aquí un libro que hacía falta. Y hacía falta porque hasta ahora, como en su página 97 se señala de forma clara y explícita, casi acusadora, “los historiadores del arte y arqueólogos, en general, no han prestado mucha atención a la *qibla*. De este modo, los planos levantados de las mezquitas carecen, a menudo, de indicación alguna sobre la orientación del edificio. Otras veces, se alude a ella sin demasiada precisión”. Así nos ha ido. El asunto tampoco se había abordado mejor ni más ampliamente desde otras disciplinas, y así nos seguía yendo. Resulta que en cualquier manual de arte islámico, incluso en libros especializados, la alquibla y lo relativo a ella suele “despacharse” en

unas frases, cuando más en unas líneas. / Now here is a book that there needed to be. It was necessary because up till now... “historians of art and archaeology have, in general, not paid much attention to the *qibla*...”. —The late Juan A. Souto, review of MÒNICA RIUS, *La Alquibla en al-Andalus y al-Magrib al-Aqsà* (2000), p. 177, my emphasis. [One could add that in many studies of Islamic religious architecture the *qibla* is not mentioned at all, but perhaps this is a good thing].

The pearl of the fabulous city of Islamic قرطبة Qurṭuba¹ was the *Jāmi'* or Congregational or Great Mosque. Now the Mosque is oriented at some **60° S of E**, that is, toward the deserts of Algeria rather than the deserts of Arabia. We may well ask: why?

In general we do better to consult relevant medieval texts than to consult our colleagues in the history of Islamic architecture, who have an unfortunate reputation when it comes to orientations. From graduate students to university chairs, they would rather devote a page to a portal or a section to a hypostyle hall or a chapter to a minaret than consider the orientation of any mosque within its urban setting or within the context of the various extant medieval writings on the *qibla* in that region.² In 1979 a splendid volume edited by George Michell gave a reliable overview of many aspects of Islamic architecture, religious and secular, and was appropriately arranged chronologically according to region, with numerous illustrations and not a few serious plans.³ As far as orientations are concerned, things have not progressed in the history of Islamic architecture since then. In Paris in 1980 there was an entire conference on the *mihrāb*; the *qibla* was not mentioned in the proceedings.⁴ In 1992 Martin Frishman & Hassan-Uddin Khan edited a richly-illustrated volume entitled *The Mosque - History, architectural*

1. I use Corduba for the Roman city, Qurṭuba for the Islamic city, and Córdoba for the city thereafter. In my 1987 study on orientations in Qurṭuba I used the English Cordova, which, like French Cordoue, should be suppressed. The Arabic adjective *jāmi'* means ‘congregational’ and in English is rendered Great’. The adjective is in Spanish rendered as *Aljama*. There is much to be said for the Turkish *Ulu Cami*. Nevertheless I shall stick to ‘Great Mosque’.

2. For example, Rabbat, *Staging the City - Or How Mamluk Architecture Coopted the Streets of Cairo*, also earlier discussions by Kessler and al-Sayyad and Behrens-Abouseif which ignored actual orientations. See further Section 15.

3. Michell, *Architecture of the Islamic world*.

4. Papadopoulou (ed.), *Le Mihrāb*. The scholar who knew most about the *mihrāb*, Robert B. Serjeant, was not invited.

development & regional diversity, with numerous chapters on every aspect of mosques except their orientations.⁵ A recent introduction to Islamic archaeology makes no mention of the *qibla* or orientations.⁶ A recent article on structural configurations (meaning?) in early Islamic architecture has nothing of consequence on the *qibla*.⁷ Detailed studies of certain individual mosques in which the orientation is the key to understanding the edifice often ignore the orientation altogether.⁸ A 2017 *Companion to Islamic Art and Architecture* edited by Finbarr Barry Flood and Gülrü Necipoğlu mentions the word *qibla* dozens of times, mainly in the context of ‘*qibla wall*’, continuously defining it, but ignores the topic of orientations (almost) altogether.⁹

Various historians of Islamic architecture, mainly but not exclusively in the English tradition, have believed that the Great Mosque in Córdoba faces due south. This false belief has had a shelf-life of close to a century.¹⁰

Already K. Archibald C. Creswell (1879-1974), the past doyen of the history of Islamic architecture, at least in the UK, whom everyone in the field still venerates and quotes, stated the following in his monumental work *Early Muslim Architecture*:¹¹

(The Mosque) is set, as nearly as can be measured, exactly north and south, although the direction of Mecca from Cordova is $10^{\circ}14'$ S. of E.

5. Frishman & Khan (eds.), *The Mosque – History, architectural development & regional diversity*, but no discussion of the orientation of mosques!

6. See Milwright, *An introduction to Islamic archaeology*, 2010, with one exception: some uninspired remarks on pp. 52 and 108 about the Mosque at Wāsit.

7. Kaptan, “Early Islamic architecture and structural configurations”.

8. For example, Bloom, “The Mosque of al-Hākim in Cairo”, where the *qibla* of the Mosque, derived by mathematics by al-Hākim’s astronomer Ibn Yūnus, is 10° off the orientation of the orthogonal street-plan of the Fatimid city, which is aligned —by happy coincidence— with the *qibla* of the Companions of the Prophet.

9. Flood & Necipoğlu (eds.), *A Companion to Islamic Art and Architecture*. The exception is Mark Horton writing on mosques in East Africa (II, p. 261).

10. Alfonso Jiménez also makes a tirade against various authors after Creswell, mainly Spanish but also French, who repeated the error of a southern orientation and wallowed in the mythical Syrian connection: see his “*Qibla extraviada*”, cols. 191b-192a. I have not cited all of those references here.

11. Creswell, *Early Muslim Architecture* (1940), II, pp. 145-146, repeated in *idem, A short account of early Muslim architecture* (1958), p. 216.

It is clear that Creswell or his source never actually measured the orientation, for no compass could give such a faulty reading. The modern value of the *qibla*, here correctly stated, is, as already noted, irrelevant to any discussion of medieval architecture, although over 75 years later few historians of Islamic architecture are aware of this and people continue to quote this modern value as though it was somehow relevant to the history of the Great Mosque.

The misinformation provided by Creswell gave rise to the further fallacy that the Córdoba Mosque (actually at **30° E of S**) was oriented in the same way as the Umayyad Mosque in Damascus, which is within a few degrees and for all practical purposes in the cardinal directions, with the *qibla*-wall to the south.

Yet another fallacy often propounded is that the *qibla* in Damascus (and Jerusalem) is due south. In fact, for Damascus the *qibla* based on medieval coordinates is about 30° E of S and for Jerusalem it is about 45° E of S. The actual orientation of the Córdoba Mosque and the medieval *qibla* at Damascus are the same, but this is pure coincidence.

The present doyen of the history of Islamic architecture in the UK, Robert Hillenbrand, wrote in a 1992 article on Córdoba:¹²

Most striking of all, though, is the choice of a *qibla* direction facing due south — a direction which at Damascus was accurate but which at Cordoba pointed at Ghana rather than Mecca. Furthermore, this grossly erroneous *qibla* was maintained without change in all the subsequent enlargements of the mosque, even though each such enlargement offered another opportunity to correct it. This *qibla* therefore functioned as a continuous reminder of the Syrian heritage. Yet by the time of the final enlargement of the mosque in the late 4th/10th century these multiple references to the Damascus mosque were old-fashioned; mosque design had moved on.

Now these remarks are individually and collectively unfortunate, for each one is incorrect:

- (1) The Umayyad Mosque may face due south, but this direction can hardly be described as “accurate”. It was taken by many to be the *qibla* of Damascus, but it is not the only *qibla* that was used.

12. Hillenbrand, “The Great Mosque of Córdoba”, in “‘The Ornament of the Worl’. Medieval Cordoba as a Cultural Centre”, pp. 130–131.

- (2) The Great Mosque does not face south, nor does it face Ghana.
- (3) Its orientation as a mosque is not at all “grossly erroneous” (and if one does not know how it was derived, it is unwise and presumptuous to judge it). The at first sight enigmatic orientation of many medieval mosques presents a challenge to us moderns to learn something about the way medieval Muslims thought about the *qibla*.
- (4) In fact, it faces the Ka‘ba, but in a way no historian of Islamic architecture could ever have been able to understand.
- (5) Its orientation could never have functioned “as a continuous reminder of the Syrian heritage” because it does not face due south.
- (6) The “grossly erroneous” *qibla* of the Great Mosque was not changed during “subsequent enlargements” because it was considered acceptable by the legal scholars since it had been laid out by trustworthy predecessors.

In a general essay on the mosque the same author does not mention the *qibla* of any mosque other than to say:¹³

In a properly oriented mosque the entire wall that faces the Ka‘ba, the holy Black Stone at Mecca —the so-called *qibla* wall— serves as a directional indicator. It thereby makes the mihrab superfluous.

The Black Stone is not the Ka‘ba, and the *qibla* wall is not “so-called”: it is the wall indicating the *qibla*. A *mihrāb* is as superfluous in a mosque as a trunk on an elephant.

According to Nicolle Samadi of the Institut européen en sciences des religions at Paris, writing about the Mosque in 2012,¹⁴ during the extensions of al-Hakam II (961-971) the Mosque was extended toward the south and

le nouveau *mihrāb* est tourné vers Damas. // The new *mihrāb* is turned towards Damascus.

Of course no source is mentioned, and nor is the orientation of the Mosque itself.

13. Hillenbrand, “The mosque in the medieval Islamic world”, unpaginated.

14. Nicolle Samadi, “La Mosquée de Courdoue”.

A series of Spanish historians of Islamic architecture have also maintained the double fiction that the Córdoba Mosque faces south in order to be in line with mosques in Syria. The distinguished restorer of the Mosque during the years 1923–36, Leopoldo Torres Balbás, published a plan showing a substantial deviation east of south, some 20° instead of the more appropriate 30° , but wrote that the Mosque was facing “mediodía”, midday, which means, more or less south in Spanish. In any case, that is unfortunately what has been understood by many writers since his time. What he actually wrote in his history of art in al-Andalus was:¹⁵

En la mezquita mayor de Córdoba el muro de la quibla, y, por tanto, el mihrab, estaban orientados hacia el mediodía, al repetir lo acostumbradoen las mezquitas sirias, para las que la Meca está al sur. / In the Grand Mosque in Córdoba the *qibla* wall and also the mihrab were oriented toward the south, to be in accordance with what is usual in Syrian mosques, for which Mecca is to the south.



FIGURE 1. The Great Mosque, seen here from the south east, is situated close to the River Guadalquivir with its *qibla*-wall parallel to the River. The Mosque is at the foot of a slope which runs from the old Roman city down to the River. The Roman bridge veers off slightly to the east as it crosses the River.

15. For example, Torres Balbás, *Arte hispanomusulmán hasta la caída del califato de Córdoba* (1973), I, p. 346. See also the plan on p. 344.

On the other hand, Basilio Pavón Maldonado's imposing volume in Spanish on the architecture of mosques in al-Andalus (2009) devoted much space to the topics of the *qibla* and orientations without, however, mentioning any directions.¹⁶

In 1977 the two London-based Islamicists Patricia Crone and Michael Cook in their attempt to rewrite the early history of Islam totally misinterpreted the enigmatic *qiblas* of the earliest mosques in Egypt and al-‘Irāq and were able to convince themselves and most of their readers that those mosques were not intended to face Mecca at all.¹⁷ Their views are still held by many ‘revisionists’ who know nothing about the history of the *qibla* and who believe that Islam started somewhere other than Mecca.¹⁸

In 1998 one of the leading historians of early Islam, Fred Donner,¹⁹ with considerable mathematical naïveté, compared Crone & Cook’s interpretation of early mosque orientations and my own interpretation —they maintained that these mosques did not face Mecca; I maintained they faced the astronomically-aligned Ka‘ba using (specific, measurable) astronomical horizon phenomena—and concluded that “more often than not, the historical outlook of the interpreter determines his or her evaluation of the archaeological evidence, rather than vice-versa”. We can hardly expect any understanding of the situation from such colleagues. We are talking about medieval orientations, which we can measure, and we have medieval texts on folk astronomy and on mathematical astronomy which can help us interpret them. Let me repeat: I did not maintain that those early mosques ‘face’ Mecca (as we moderns tend to think they should), I said they face the astronomically-oriented Ka‘ba using astronomical horizon phenomena —winter sunrise in Egypt and winter sunset in al-‘Irāq— and that was actually not such a bad idea.

16. Pavón Maldonado, *Tratado de arquitectura hispanomusulmana*, iv, cols. 72b-85a.

17. See Cook & Crone, *Hagarism*, pp. 23-24. I demolished their main thesis in 1995: see “On the orientation of medieval Islamic religious architecture”, p. 253. I mention it again in “From Petra back to Mecca”.

18. We shall mention Dan Gibson later. He accepts nothing that has been written about the *qibla* in the modern scholarly literature and has convinced himself that dozens of early mosques face Petra, which is news for Islamic Studies and for Nabataean Studies

19. Donner, *Narratives of Islamic origins*, p. 3 and n. 4. Donner quotes my 1982 “Astronomical Alignments in Medieval Islamic Religious Architecture” paper. As far as I know, not one critic of Crone & Cook has mentioned their false interpretation of early mosque orientations. This is all the more regrettable because it has allowed even crazier interpretations by such amateurs as Dan Gibson (on whom see below).

The *qibla* is otherwise barely ever mentioned in historical writing about Islam, except when it comes to legal issues in Safavid Iran in the early 15th century or Fez between the 12th and 17th centuries.²⁰

It is therefore important to have new studies like that of Susana Calvo Capilla (2016) on the first mosques of al-Andalus,²¹ and that of Carmen González Gutiérrez (2016) on the mosques of Córdoba, using medieval texts, architectural plans and showing respect for orientations.²² But the general lack of interest in orientations is apparently not the only reason the discipline of the history of Islamic art and architecture is in crisis.²³ Perhaps the present study will serve as a kind of wake-up call.

The answer to the question of the orientation of the Great Mosque is to be found through the archaeological investigation of Córdoba's ancient and medieval past and the study of relevant Arabic historical documents. Apparently, the answer emerges now for the first time. When I was invited to write this study I initially proposed to simply survey the available Arabic texts on the *qibla* in al-Andalus and on Islamic sacred geography, materials mainly unknown to historians of Islamic architecture. But it did not take long before I started to wade into a vast sea of studies of ancient and medieval Córdoba by Spanish archaeologists and Arabist historians, all knowing more about their subjects than I did, but, fortunately for me, most of them ignored the thorny topic of orientations. Part of my task was to show how the particular orientation of the Mosque might have been justified by, or to, the Qurṭubīs. Thanks to previous research by my colleagues in the history of Islamic science at the University of Barcelona, I was able to find a Qurṭubī of some renown who showed how the orientation of the Mosque was not just acceptable but, in his opinion, optimal.

My first naïve pronouncement on the Great Mosque was that the medieval text which said that it was at **60° S of E** must be wrong because K. A. C. Creswell, the doyen of the history of Islamic architecture, said the Mosque faced due south.²⁴ If we few historians of Islamic science have misinterpreted the medieval Arabic texts, this is nothing compared to the way our colleagues in the history of Islamic

20. See, respectively, the sources cited in King, *World-maps*, pp. 134–138 (“the al-Karakī affair”); and Dallal, *Islamic science and the challenge of history*, pp. 3–9, and *idem*, “Science and religion in the history of Islam”, pp. 25–28 (on al-Tajūrī and others on the problems of the *qibla* in Fez).

21. Calvo Capilla, “Las primeras mezquitas de al-Andalus a través de las fuentes árabes”.

22. González Gutiérrez, *Las mezquitas de la Córdoba islámica*.

23. See Madrid 2017 Islamic Art History and Archaeology Conference in the bibliography.

24. King, “Some medieval values of the *qibla* at Cordova”, pp. 370, 372 and 374. A correction is appended to the 1987 Variorum reprint of my 1978 article (page before indexes).

architecture have elaborated and waxed eloquent on their false understandings of orientations that they have never actually measured. Yet worse are the claims of those who are innocent of any knowledge of the notion of the *qibla* in historical times and who clutter the internet with more rubbish about the Great Mosque. These unfortunate utterances were originally collected in an appendix to this paper but have been deemed by the editor and by the author to be not worthy of space in this journal.

2. The street plans of Roman Corduba

The Great Mosque was supposedly built on the site(s) of earlier sacred edifice(s)—a Roman temple dedicated to Janus (?) replaced by a church dedicated to San Vicente (?)—by the River Guadalquivir at some distance from the main part of the city. It is better that I not write too much on the temple and the church, for at least the latter has recently been eloquently declared an “obstinación historiográfica” (of which I can think of quite a few more examples).²⁵ The orientation of the Mosque is clearly more or less perpendicular to the direction of the River at that location. Now the second Roman street plan for the suburb of Colonia Patricia, adjacent but inclined to the primary cardinally-aligned street plan for the city centre, has the same orientation as the later Mosque.²⁶ Also that street plan slopes downwards to the River. Was topography behind the orientation of the secondary *cardo* system and hence also of the original edifices?

25. Ocaña Jiménez, “Precisiones sobre la historia de la mezquita de Córdoba”, pp. 276-278; and, most recently, Arce-Sainz, “La supuesta basílica de San Vicente en Córdoba: de mito histórico a obstinación historiográfica”.

26. See the mutually inconsistent plans of the Roman city in Anonymous, “Córdoba romana”, and Anonymous, “Roman walls of Córdoba”. On such city plans see César González-García & Magli, “Roman city planning and spatial organisation”.

The orientations of Roman towns in Hispania do seem to follow an astronomical pattern. Furthermore, “if the city had similar political structures as those of Rome and was populated by soldiers who were Roman citizens, it was commonly called a *colonia* (colony). If the foundation was otherwise and people from other areas of Italy populated the city, it was commonly called a *municipium*”. González-García & Rodríguez-Antón & Belmonte, “The orientation of Roman towns in Hispania”, p. 110.

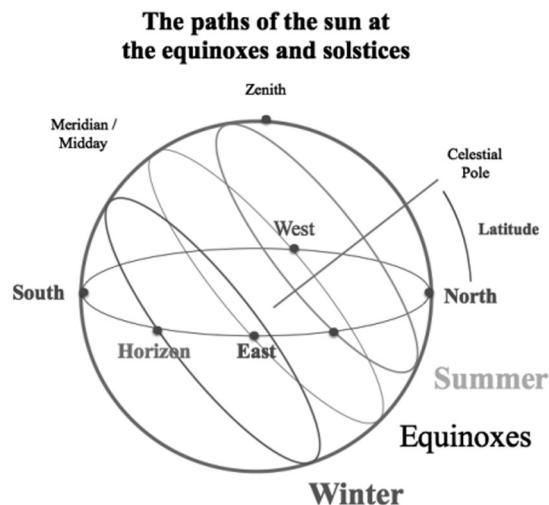


FIGURE 2a. The diagram shows the daily motion of the sun throughout the year, featuring the ‘day-circles’ at the equinoxes and solstices.

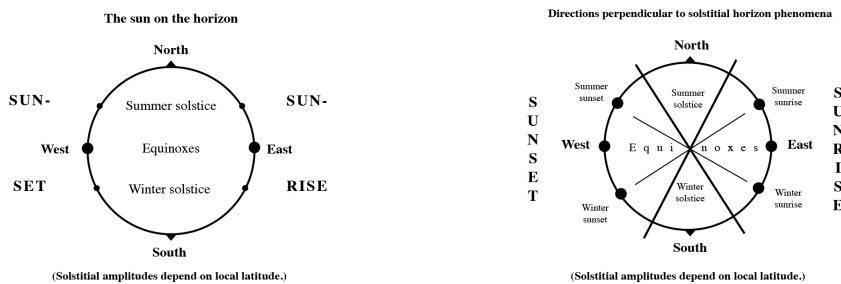


FIGURE 2b. The sun on the horizon. The sun rises in the east between winter sunrise around east south-east and summer sunrise around east north-east. It sets in the west between winter sunset around west south-west and summer sunset around west north-west. The rising and setting amplitude of the sun —the distance of sunrise from the east point and that of sunset from the west point— is called the solar rising or ortive amplitude, and varies as a function of terrestrial latitude.

FIGURE 2c. In this study we shall be referring to the solstitial axes —joining winter sunrise to summer sunset, and summer sunrise to winter sunset— and the axes perpendicular to each. This diagram explains what we shall find relevant to the rectangular Ka‘ba and to the rectangular Grand Mosque. In both the major axis is perpendicular to the axis joining summer sunrise and winter sunset, that is, around 30° E of S.

Now Michael Bonine has shown that many of the major mosques in Tunisia are oriented in accordance with the local Roman *cardo*.²⁷ And these are “parallel” to the axis of the Córdoba Mosque. The reason is that the Romans favoured city-plans in these regions that were aligned so that the minor axes were solstitially aligned (summer sunrise to winter sunset).²⁸

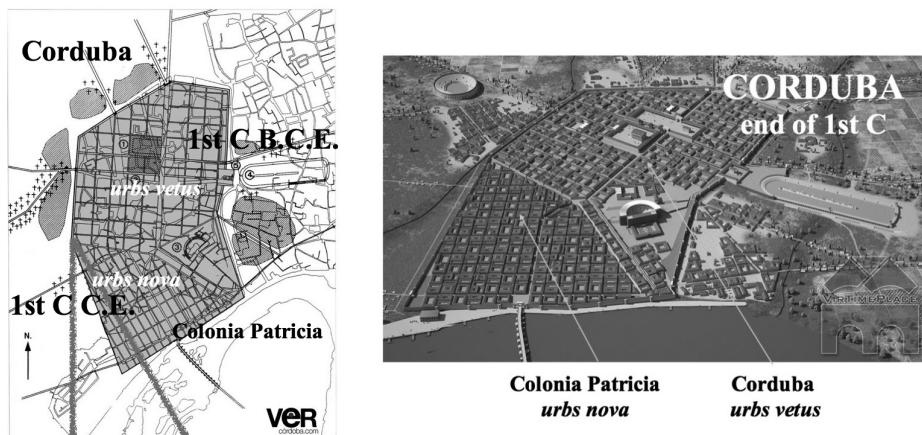


FIGURE. 3a-b. Two representations of Roman Corduba (*urbs vetus*) from the 1st century BCE and the Colonia Patricia (*urbs nova*) from the 1st century CE.

It is beyond the scope of the present paper to discuss the pre-history of the Córdoba Mosque. I can only hope to touch the surface of the vast amount of literature, mainly by Spanish researchers, on the archaeology of Roman Corduba, and on the archaeology of Islamic Qurtuba. However, the effect of several centuries of neglect between the two city structures is well described by the expression “desarticulación del callejero hispanorromano...” / “the ‘disarticulation’ of the Hispano-Roman road-system” used by Manuel Ruiz Bueno

27. Michael Bonine, “Romans, astronomy and the *qibla*: urban form and orientation of Islamic cities of Tunisia” (2008), and *idem*, “The sacred direction and city structure: A preliminary analysis of the Islamic cities of Morocco” (1990).

28. See González-García & Rodríguez-Antón & Belmonte, “The orientation of Roman towns in Hispania: Preliminary results” (2014), and González-García & Magli, “Roman city planning and spatial organisation” (2015).

in a 2018 article.²⁹ Alas, ‘disarticulation’ is not quite the right English translation here.

As far as the Mosque is concerned, it has the same orientation as the Roman street plan of the suburb of Colonia Patricia. The alignment was not changed whilst Qurtuba was under Muslim hegemony, and remains in its original direction today. The alignment of the new Mosque was deemed appropriate for a *qibla* alignment at the outset as well as in the course of various enlargements. Any opposition would have resulted from people who supported other *qibla* directions for al-Andalus in general and Qurtuba in particular. All of these *qiblas* will be discussed in this paper.

It was perfectly reasonable for the first Muslims in Córdoba to build their congregational mosque in this way. The first Muslims in Syria had built their main mosque out of a Byzantine church which itself was built over a Roman temple, both cardinally aligned in accordance with streets “called Straight”. Somebody surely voiced the idea that a south-facing *qibla*-wall would be “facing”, in the sense of *istiqbāl*, the Syrian Corner of the Ka’ba, which is indeed roughly facing north. One thing is certain: there have not been dozens of moderns pronouncing that the Umayyad Mosque is not facing Mecca. In fact, the orientation of the Mosque is some 30° off the mathematically-computed *qibla* for Damascus, with medieval or modern coordinates. We shall return to this in Section 15.

Much has been written, a lot of it fanciful, about the relationship between the Umayyad Mosque in Damascus and the new Mosque in Qurtuba built by Syrians from Damascus. Here we shall limit the discussion to the Damascus Mosque being laid out on the foundations of previously-existent religious edifices that were cardinally aligned, and the Qurtuba Mosque being laid out on the foundations of a previously-existent edifices in accordance with the previously-existent solstitially-aligned street plan.³⁰

We are fortunate to have several recent serious and well-illustrated studies of urban history of Córdoba in Roman times, particularly of the suburb called Colonia Patricia. By the 1st century BCE the Roman city of Corduba, the *urbs vetus*, had a cardinally-aligned orthogonal street-plan centred on the Forum. By the end

29. Ruiz Bueno, “La desarticulación del callejero hispanorromano: cambios en la infraestructura viaria y de saneamiento entre los siglos II y VII d.C”.

30. In both cases, the mosques were about 30° off the *qibla* that later astronomers either computed or claimed for Damascus and Qurtuba.

of the 1st century CE, to the south-west of this, and down to the river, there had been built the *urbs nova*, the suburb called Colonia Patricia. This too had an orthogonal street-plan, but distinctly inclined at 30° to the first. The second street-plan followed the downward slope of the new suburb down to the river, which was perpendicular to the slope.³¹

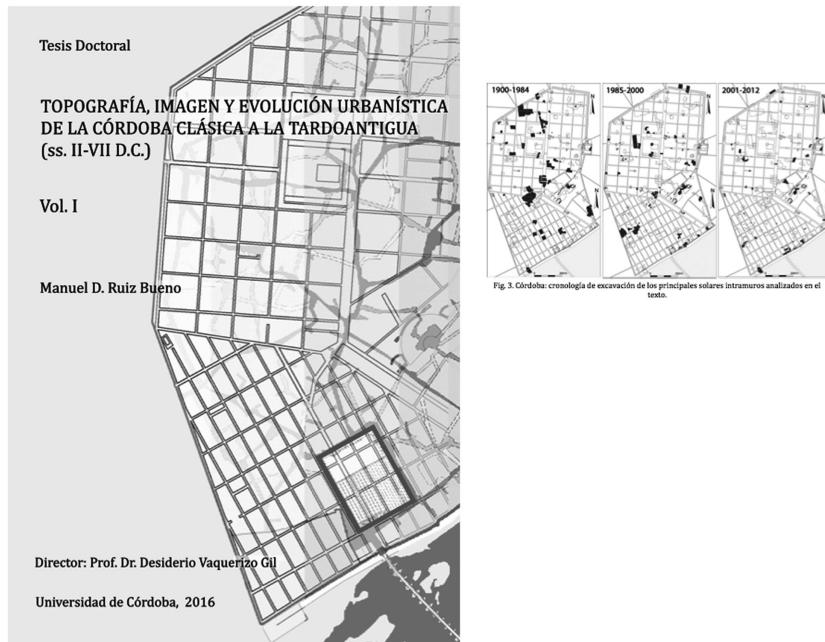


FIGURE. 4a. The plans of the central city of Corduba (upper right) and the later suburb of Colonia Patricia, as illustrated on the cover of the 2016 doctoral thesis of Manuel D. Ruiz Bueno, a work particularly rich in maps and plans. The outline of the Great Mosque, here added in red, is featured lightly in Ruiz Bueno's thesis.

FIGURE 4b. The three smaller plans indicate the places where excavations were conducted in order to locate the two *cardo*-systems. The *cardo* of the central city is cardinally aligned, that of the suburb is solstitially aligned in the sense that its minor axis joins summer sunrise and winter sunset. (Courtesy Dr. Manuel D. Ruiz Bueno).

³¹ See the various plans in Ruiz Bueno, *Topografía, imagen y evolución urbanística de la Córdoba clásica a la Tardoantigua*. Some earlier literature is less helpful: Murillo *et al.* (eds.), *Córdoba: 300-1236 D.C. – un milenio de transformaciones urbanas* (1997), contains not a single diagram.

3. From Corduba to Qurtuba

In 1992 my colleague Julio Samsó suggested that one possibility for the orientation of the Mosque might be that it was a consequence of “*las calles de la primitiva ciudad romano-visigoda*”, “the streets of the early Romano-Visigothic city”.³² The archaeological excavations that have revealed the double city plan are, of course, more recent.

Only in November, 2017, when preparing the final version of this study did I find out that the Córdoba archaeologist Pedro Marfil had already suggested that the Mosque was laid out in accordance with the Roman street plan. An anonymous article in the newspaper *ABC* on 22.08.2001, reported this, but hardly as an earth-shaking discovery, and not giving many details, to the point of omitting any reference to the *Colonia Patricia*.³³ The article’s title summarizes the report:

La Mezquita de Córdoba está orientada al sureste [sic] y no a La Meca [sic], porque se adaptó a los límites urbanísticos de época tardorromana // The Mosque of Córdoba is oriented towards the south east [sic] and not towards Mecca [sic] because it was adapted to the urban limits [= city layout] of the late Roman period.

In fact, the Mosque is laid out south south-east and is oriented towards the Ka’ba, but this was achieved because both the Mosque and the Ka’ba are aligned in the same direction, namely, perpendicular to the solstitial axis joining summer sunrise and winter sunset. The Ka’ba was built by Arabs and the *Colonia Patricia* was built by the Romans.

On the other hand, Marfil’s publication “*Urbanismo cordobés*” (2001) contains no mention of this discovery, and his brief guide to the Mosque (2009)³⁴ offers only a passing comment, for which I provide a rough translation:

32. Samsó, *Las ciencias de los antiguos en Al-Andalus*, p. 65. In his most recent study of the *qibla* in al-Andalus this possibility is not mentioned, but the work is not yet submitted for publication and I hope my dear colleague will use the materials in the present study ‘*alā kayfū*’.

33. Anonymous, “La Mezquita de Córdoba está orientada al sureste y no a La Meca, porque se adaptó a los límites urbanísticos de época tardorromana”, *ABC | Cultura*, 22.08.2001.

34. Marfil, “Recorrido por la gran mezquita omeya de Córdoba // Tour of Córdoba’s Great Omeya Mosque”, p. 164.

Ha de destacarse un dato al respecto, el muro este de la mezquita apoyaba directamente sobre la fachada de las construcciones romanas, respetando como espacio público la anchura ocupada por los antiguos pórticos y la calzada. Esta es la razón que justifica la orientación heterodoxa de la mezquita de Córdoba, desviada con respecto a La Meca, el emir prefirió respetar el trazado urbano y orientarla de forma similar a las mezquitas sirias. // It is obvious that the eastern wall of the Mosque rested directly on the facade of Roman constructions, respecting as a public space the breadth occupied by the ancient porticos and the road. This is the reason which justifies the heterodox orientation of the Mosque of Córdoba, deviating away from Mecca: the Emir preferred to respect the city plan and to orient them in the same way as the Syrian mosques [no!].

What is correct here is the connection between the orientation of the Mosque and the city plan, but only the plan of the suburb of Colonia Patricia, facing south south-east, which Marfil does not mention. This in no way relates to the situation to Damascus, where the Umayyad Mosque faces south. The connection between both mosques —Córdoba and Damascus— is that both were oriented according Roman city-plans. The difference, as we shall see, is that the *cardo* in Damascus was cardinally aligned and the *cardo* in Colonia Patricia is solstitially aligned. Elsewhere Marfil summarizes his findings in one sentence,³⁵ which ‘says it all’:

Se planifica la mezquita siguiendo las trazas de los módulos y orientaciones preexistentes, adaptando su planta al urbanismo preislámico. / The Mosque was laid out following the traces of pre-existing buildings (?) and orientations, its plan being adapted to the pre-Islamic urbanism.

Another such explanation is provided by the archaeologist Juan F. Murillo Redondo,³⁶ stating almost nonchalantly that two lateral cardines formed the western and eastern fronts of the subsequent Umayyad Great Mosque.

Henceforth I shall pursue the lead of Julio Samsó, and now also of Pedro Marfil and Juan Redondo, by looking at the double city-plan that archaeologists have uncovered.

35. Marfil, “La Gran Mezquita, edificio emblemático de al-Andalus”, p. 163.

36. Murillo Redondo, “Caliphal Qurtuba” (2013), p. 73

For the time being, it is not my intention of discussing the details of how the Roman city developed during Visigothic times and how the Islamic city evolved.³⁷ Rather, I must concentrate on orientations. Rosa López Guerrero & Ana Valdivieso Ramos published in 2001 an overview of the Spanish studies that had been conducted on neighbourhood mosques (*mezquitas de barrio*) in Córdoba.³⁸ One of their new lines of investigation (*nuevas líneas de investigación*) was appropriately the question of orientations (represented by Jiménez, Rius and Samsó). Particularly noteworthy from this point of view was the remains of a mosque that was being built in the wall of a new bus station, oriented in the same direction as the Great Mosque. The existence of medieval Arabic texts was, however, barely mentioned. Already in 2016 Carmen González Gutiérrez published an update to the 2001 paper of López & Valdivieso on ways to approach Córdoba mosques, with further remarks on orientations.³⁹

González Gutiérrez devoted her 2015 doctoral thesis to the mosques of Córdoba, paying considerable attention to orientations and the works of Jiménez and Rius.⁴⁰ Her discussion was entitled: “*La orientación de las mezquitas cordobesas: un parámetro en revisión*”. She could not know that a few of us —disciples of Prof. Ted Kennedy, the leading scholar in the history of Islamic astronomy in the second half of the 20th century— love parameters —I here refer to the parameters which underly astronomical tables,⁴¹ and at least this particular writer loves the parameters, that is, orientations, that underly medieval mosques.⁴²

37. See Murillo Redondo, “Qurṭuba califal” (2013); Blanco Guzmán, “El inicio de la Córdoba islámica” (2014); Blanco Guzmán, review of González Gutiérrez, *Las mezquitas de barrio de Madīnat Qurṭuba* (2013); Vaquerizo & Murillo, “The suburbs of Cordoba” (2016); as well as the overview in García Sanjuán, “Arqueología de la Córdoba” (2013).

38. López Guerrero & Valdivieso Ramos, “Las mezquitas de barrio en Córdoba: estado de la cuestión y nuevas líneas de investigación”.

39. González Gutiérrez, “Las mezquitas de barrio de *Madīnat Qurṭuba* 15 años después”, pp. 279-280.

40. González Gutiérrez, *Las mezquitas de la Córdoba islámica*, pp. 454-469.

41. King & Samsó & Goldstein, “Astronomical handbooks and tables from the Islamic world (750-1900)” (2001), is an interim report presaging the *magnum opus* of Benno van Dalen. Parameters are nice because, as numbers, they do not lie.

42. See King, “From Petra back to Mecca”, in which I discuss the orientations of several dozen early mosques, including the Great Mosque of Qurtuba.

4. Previous studies of the *qibla* in Qurtuba

Many previous pronouncements on the *qibla* in Qurtuba and the orientation of the Grand Mosque are of no value because they do not know what the *qibla* there was or because they do not know in which direction the Mosque is oriented. I have referred to some of them in Section 1. My purpose now is first to revive information about the *qibla* in Qurtuba presented by myself in 1978⁴³ and by my colleague Julio Samsó in 1992,⁴⁴ based on a few medieval Andalusí sources. In the meantime I have been able to consult a splendid 1991 study of mosque orientations in al-Andalus by Alfonso Jiménez.⁴⁵ And in particular, I wish to draw attention again to the ground-breaking book of Mònica Rius, published in 2000, analysing various medieval Maghribī textual sources on the *qibla* in both the Maghrib and al-Andalus and using them to investigate actual mosque orientations provided by Jiménez.⁴⁶

The interested reader must consult the writings of my three Spanish colleagues, particularly the substantial amount of data presented by Jiménez and the enormous amount of information recorded by Rius. Her study, rich with new in-

43. King, "Some medieval values of the *qibla* at Cordova". In this study I shall not cite all the medieval geographical data underlying the medieval *qibla* values, and shall round the latter to the nearest degree where necessary. For more details see the works of King, Samsó and Rius.

44. Samsó, *Las ciencias de los antiguos en al-Andalus*, pp. 60–67, with additions on pp. 460–461, essential reading for an overview of the *qibla* and mosque orientations in al-Andalus. More information is contained in Prof. Samsó's forthcoming book entitled *On Both Sides of the Straits of Gibraltar – Studies in the History of Medieval Astronomy in the Iberian Peninsula and the Maghrib*. I have deliberately not used new materials from this book, of which I have copies of relevant chapters, so readers interested in this subject will have to consult this new book, as well as the writings of Alfonso Jiménez and Mònica Rius.

45. Jiménez, "La *qibla* extraviada". This is a remarkable study which is most welcome and highly significant addition to the literature on Islamic architecture in al-Andalus. It is still welcome in the sense that most historians of Andalusí architecture seem unaware of its existence. Not only does Prof. Jiménez survey the *qibla* problem generally, but he then concentrates on the *qibla* in al-Andalus. He appreciates that it is the Muslim scientists and legal scholars who are an invaluable source on orientations and that the Ka'ba itself is highly important for our understanding thereof. He is rightly sceptical that the Córdoba Mosque was actually built so as to be parallel to the axis of the Ka'ba, but can accept that it is indeed aligned in this way. The most valuable part of his study for posterity is the list of orientations of all surviving mosques in the Iberian peninsula. See further Section 13.

46. Rius, *La Alquibla en al-Andalus y el-Magrib*, based on the author's doctoral dissertation, a ground-breaking study that deserves to be better known.

formation about the *qibla* in al-Andalus and the Maghrib, has, like all our writings on the orientations of Islamic architecture based on medieval texts, been consistently ignored by our colleagues who deal with these monuments on a more lofty level, but without reference to any orientations or any relevant texts.⁴⁷

In the summer of 2017, before the Córdoba Conference, I was in the fortunate position of being able to consult Julio Samsó's splendid forthcoming overview of the history of astronomy in al-Andalus and the Maghrib.⁴⁸ The interested reader should consult the section of that work when it becomes generally available, for it deals in depth with the *qibla* in al-Andalus and the Maghrib. It is quite different in presentation and focus from the present study, and much better informed on the historical background. In the sequel I shall not use most of the material relating to Córdoba orientations of which I was unaware and which will appear in Samsó's new book.

In addition, I shall not venture outside Córdoba for the present study. For orientations in other places in the Iberian Peninsula the reader should consult the writings of Jiménez, Samsó and Rius.

At the outset I should stress that the study of orientations of religious architecture in al-Andalus is just one chapter in a much vaster subject covering historical religious architecture throughout the *Muslim world* from al-Andalus to China and from the Yemen to Central Asia.⁴⁹ The following are the main authors who have published on orientations in the Islamic world:

Al-Andalus - King 1978 (medieval text), Jiménez 1991 (mosques), Samsó 1992 (medieval texts), Rius 2000 (medieval texts).

Maghrib - Bonine 1990 & 2008 (mosques, no texts), Rius 1996 & 2000 (mosques, medieval texts), Dallal 2010 (legal texts).

Egypt - Kessler 1967-84 (monuments, no orientations), King 1983 (medieval texts & street plan & mosques).

Greater Syria? Iraq? Arabia? Yemen? Africa?

47. Hillenbrand, "Studying Islamic architecture", p. 7, bemoans the lack of medieval texts on medieval architecture (for the pre-Ottoman period). Ironically, the only texts that are available deal with the *qibla*, sometimes with the orientation of specific religious edifices. They are particularly useful for Mecca, Kairouan, Cordova, Fez, Sus, Cairo and Samarkand, which is not bad for a start.

48. Samsó, *Studies in the history of medieval astronomy*, esp. Section 2.5 on the *qibla*.

49. King, "Astronomical alignments in medieval Islamic religious architecture", and "The orientation of medieval Islamic religious architecture and cities".

Iran - Bonine 1979 (city plans, no texts), King 1999 (medieval texts on *qibla*, tables of *qibla*-values, maps for finding the *qibla*).

Turkey - Yilmaz 2012 (mosques).

Central Asia - King 1983/86 (medieval text on situation in Samarkand).

India & beyond?

In each of these regions problems have been identified, inevitably of a different nature. This is an exciting field demanding further research of one kind or another. Field-work is not becoming easier. The first attempt to use satellite images to this end, by Dan Gibson, has proved a resounding failure because he thought the data proved that the earliest mosques face Petra rather than Mecca — see further below.

Did those who built the first Mosque really think that they were aligning it with the *qibla*? They certainly did, if we can believe the historical accounts discussed in the next section, even if they were actually aligning the Mosque with the street-plan of the Colonia Patricia, which is inevitably not stated. But here coincidence played a role, since the major axis of the Ka'ba just happens to be “parallel” to that street-plan.⁵⁰ But at the latitude of Mecca the axis defined by the rising of Canopus just happens to be perpendicular to the axis defined by the summer sunrise / winter sunset direction. And indeed most of our research has progressed thanks to a series of coincidences. Around 1980, we had just the Mosque and the newly-discovered text of Ibn al-Nattāh (King). In the 1980s we had recently discovered the orientation of the Ka'ba (Hawkins & King).⁵¹ Also in the 1980s the most important schemes of sacred geography were being discovered (King). At this time the excavations were in progress that would reveal the double *cardo*-plan of the Roman city (several Spanish archaeologists). In particular, the *cardo* of Colonia Patricia is solstitially aligned, the minor axis being parallel to the line between summer sunrise and winter sunset. Now we have the Mosque, in the context of the Colonia Patricia, one mosque amongst dozens in al-Andalus whose orientations have now been classified (Jiménez & Rius), and the astro-

50. This coincidence is mentioned in Vergara-Muñoz & Martínez-Monedero, “Las mezquitas de Arcila (Marruecos): mihrabs y quiblas” (2018), p. 242.

51. At the Conference on Ethnoastronomy and Archaeoastronomy in the (American) Tropics at the New York Academy of Sciences in 1981, I mentioned the Yemeni texts on the orientation of the Ka'ba to Prof. Anthony Aveni and he told me Gerald Hawkins had discovered the same thing using satellite images. The two of us got together and published a joint paper.

nomically-aligned Ka‘ba, as the focus of a complicated tradition of sacred folk geography involving solar and stellar horizon phenomena. We also have a whole spectrum of Maghribī mosques and cities which are aligned with the orthogonal plans of former Roman cities (thanks to Michael Bonine).⁵²

5. Some historical sources on the Mosque in Qurṭuba

The medieval historical texts relating to the Qurṭuba Mosque are well-known, but I repeat them here nevertheless. More information is to be found in the writings of Susana Calvo Capilla.⁵³

The only written account of the foundation of the Great Mosque by the first Muslims to arrive in al-Andalus from Syria is recorded by the early-17th-century Maghribī historian al-Maqqarī, quoting the 12th-century historian from Qurṭuba, Ibn Bashkuwāl.⁵⁴ He writes about the future ‘Abd al-Rahmān I:

In the book of Ibn Bashkuwāl (we find mention) that he entered al-Andalus with 28 second-generation Muslims and they laid out (جسّوا assasū) the *qibla* of the *Jāmi‘* Mosque of Qurṭuba.

Now in these few lines we surely have as much fantasy as history recorded. It would be pleasing if we could find written evidence of what they thought they were doing, for all we have is the Mosque, with its curious *qibla*.

The problems related to the orientation of mosques in Qurṭuba continued during the reign of Caliph al-Hakam II (961-976), the son of ‘Abd al-Rahmān III (912-961), when the growth of the population in the city created the need for the

52. One more happy coincidence is that Michael Bonine and I used to chat together at the annual meetings of the North American Middle East Studies Association in the early 1980s, at a time when we were, I think, the only non-Muslim academics who realized the historical importance of the *qibla* and mosque orientations. Alas, Michael (1942-2011) did not live to learn of my research confirming his own research in the Maghrib and offering an Andalusī parallel to it. See the obituary by Anne H. Betteridge, “Michael E. Bonine: Professor of Geography and of Near Eastern Studies” (2013), available online.

53. Calvo Capilla, “Las primeras mezquitas de al-Andalus a través de las fuentes árabes”, esp. pp. 166-177, and *eadem*, “Les grandes mosquées de Damas et Cordoue”, pp. 286-287.

54. Quoted from Rius, *La Alquibla*, p. 179.

enlargement of the Great Mosque. Julio Samsó has translated al-Maqqarī's text in which he explains the situation and the problems involved:⁵⁵

(Al-Ḥakam II) asked the advice of the experts (*al-‘ulamā’*) on the question of changing the orientation of the *qibla* towards the East, in agreement with what had been done by his father ('Abd al-Rahmān III) al-Nāṣir with the *qibla* of the Great Mosque of (*Madīnat*) al-Zahrā', because astronomers (*ahl al-ta‘dīl*) said that the old *qibla* of the mosque was deviated towards the West [meaning: it needed to be oriented more towards the East!]. The faqīh Abū Ibrāhīm told him: "Prince of the Believers, the best people of this community, including the imāms who were your ancestors and the righteous Muslims and scholars, have prayed facing this *qibla* since the conquest of al-Andalus until this moment, in agreement with the principles of those who, for the first time, established it, who were Muslims belonging to the second generation (after the Prophet) (*tābi‘ūn*) like Mūsā ibn Nuṣayr, Ḥanash al-Ṣan‘ānī and others... (God) favours those who prefer to follow traditions (*al-itibā'*) and dislikes those who allow them to be destroyed by innovations (*al-ibtidā'*)". The Caliph, then, adopted his point of view and said: "You have spoken well and our belief is that we should follow tradition".

The 15th-century legal scholar Aḥmad ibn Yahyā al-Wansharīsī presents a slightly different version:⁵⁶

When al-Ḥakam (II), son of 'Abd al-Rahmān (III), wanted to change the *qibla* of the Great Mosque of Qurṭuba —the astronomers (*ahl al-ḥisāb*) who advised him, among whom there were leading figures deserving to be followed, having agreed on the fact that it was strongly deviated toward the West— he had to give up the idea as a result of the strong opposition of all the people ('āmmat al-nās) who did not want to deviate from the custom of their ancestors.

Thus the orientation of the Mosque was never changed. Those moderns who suggest that it should have been, perhaps underestimate the challenge of realigning a large edifice.

It is worth noting that one of the persons of first and second generation of companions of the Prophet who were involved in laying out the new Mosque was

55. Samsó, *Studies in the history of medieval astronomy*, Section 2.5.

56. Rius, *La Alquibla*, p. 35; Samsó, *Studies in the history of medieval astronomy*.

named Ḥanash al-Ṣan‘ānī. I have wondered whether he might have passed through Mecca at some stage and seen the Ka‘ba for himself.⁵⁷ Although Manuela Marín in her study of the earliest Muslims in al-Andalus identifies al-Ṣan‘ānī as coming from a place called Ṣan‘ā near Damascus,⁵⁸ Ḥanash is a Yemeni name and so our man is undoubtedly from Ṣan‘ā in Arabia Felix.

Alas we have no serious account of any exchange between the legal scholars and the astronomers if it ever came to a consideration of changing the orientation of the mosque. One of the arguments of legal scholars —traditionalists of the Mālikī legal school, predominant in al-Andalus— might have been that the Mosque was aligned “similarly” toward the south like the Mosque of the Prophet in Medina. A problem here is that we have no reliable information on the original orientation of that Mosque in Medina; surely it was roughly toward the south, but so is the Mosque in Qurtuba, *ya‘nī*.

6. The Ka‘ba and its astronomical orientation

The Arabs even long before the time of the Prophet had a detailed astronomical folklore, dealing with the seasons; day and night and their divisions; the sun, moon and planets, and the stars, their risings and settings; and the winds and the rains.⁵⁹

Their most sacred shrine, the Ka‘ba in Mecca, at first a simple rectangular enclosure with walls the height of a man, situated amidst houses, was built up before the beginning of the 7th century.⁶⁰ Now its major axis points toward the rising of Canopus, the brightest star in the southern sky, and the setting of the Pleiades in the north. The minor axis is solstitially aligned toward the summer

57. Rius, *La Alquibla*, pp. 184-189. On Ḥanash and his grave at the *Bāb al-qibla*, “Qibla Gate” in Saragossa see Fierro, “Holy places in Umayyad al-Andalus”, p. 127.

58. Marín, “Ṣahāba et tābi‘ūn dans al-Andalus”, pp. 25-36, esp. p. 25

59. For overviews of this aspect of Islamic astronomy see Schmidl, “Islamic folk astronomy”, and Varisco, “Islamic folk astronomy”. The articles “Anwā’ (the setting of an asterism of one of the lunar mansions in the west at dawn and simultaneous rising of another opposite it in the east)” and “Manāzil (lunar mansions)” in *EI*₂ are still useful, as is the article “Ibn Qutaybah” by Paul Kunitzsch in *DSB*.

60. Creswell, “The Ka‘ba in AD 608”; Rubin, “The Kaaba ...”, and Shalem, “The four faces of the Kaaba”.

sunrise and winter sunset.⁶¹ For the latitude of Mecca these directions are conveniently perpendicular. Whether this layout was planned from the beginning is not clear, but this author is of the opinion that it was never changed over the centuries. As we shall see, in some Arabic folk astronomical texts dealing with the *qibla*, the layout of the Ka‘ba plays an essential role.

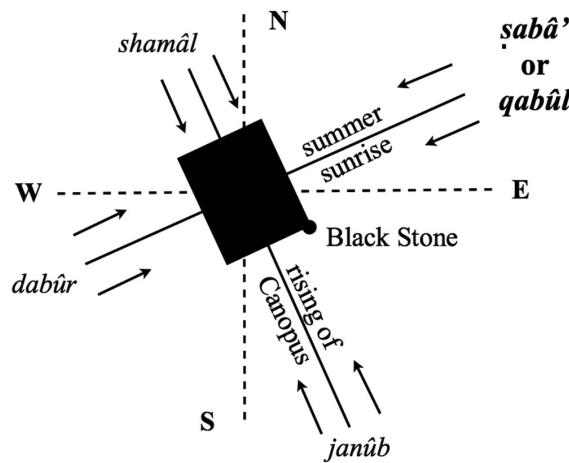


FIGURE 5. The astronomical orientation of the Ka‘ba and its association with the winds in pre-Islamic Arabian folk-lore. The details of the orientation were found in a 13th-century Yemeni treatise on folk astronomy and confirmed by satellite images: see Hawkins & King, “On the orientation of the Ka‘ba”.

It should be noted that this feature of the Ka‘ba was discovered in modern times only in the 1980s, by Gerald Hawkins in Washington, D.C., using satellite images, and by myself, researching medieval Arabic treatises on folk astronomy. Our conclusions coincided, so we published a joint paper which has been mainly ignored by all those who have written on the Ka‘ba since or simply plagiarized.

61. Hawkins & King, “On the orientation of the Ka‘ba”. The orientations mentioned in medieval texts on folk astronomy were confirmed by analysis of satellite images. On the implications of this for our understanding of the Ka‘ba see King, “Astronomical alignments in medieval Islamic religious architecture”, and “Faces of the Kaaba”. On one of the texts dealing with the orientation of the Ka‘ba see, more recently, Schmidl, *Volkstümliche Astronomie*, I, pp. 342–345.

The orientation of the Ka‘ba is fundamental to the tradition of sacred geography in Islam and also to the orientation of mosques. It is the Ka‘ba that Muslims should be facing in prayer, not the city of Mecca. There is a very subtle difference, which affects everything.

Before moving on, I should point out that Robert Hoyland has written extensively on the earliest *qiblas* and mosque orientations in the central lands of the new Islamic world. He does not believe a word of what I have written on the Ka‘ba, stating that it is all derived from late texts.⁶² Also, he reminds us that the Ka‘ba has been demolished and rebuilt several times over the centuries, and he thinks the fundaments could have been reoriented. I personally think that the last thing any Muslim would ever have done would be to re-erect the Ka‘ba from scratch because the orientation is as sacred as the edifice itself.⁶³ Since my ‘late’ texts on the *qibla* are the best I have at my disposal, and since Hoyland has (fortunately) not dealt with the *qibla* in al-Andalus, I will press on.

7. Finding the qibla as a problem of folk geography and folk astronomy

The Arabs of the peninsula before Islam had a complicated system of folk astronomy, defined as being not based on scientific observation or mathematics. This folk astronomy is well documented in the modern literature, mainly by Charles Pellat, Paul Kunitzsch, Petra Schmidl and Daniel Varisco.⁶⁴ I have tried

62. Hoyland, *Seeing Islam as others saw it*, pp. 560-573.

63. Certain revisionists several decades ago have argued that the *hijr* or low semi-circular wall spanning the NW wall of the Ka‘ba was originally the apse of a pre-Islamic church that was the original function of the edifice. Anybody re-orienting the Ka‘ba in the past would have to re-orient the *hijr* as well, turning it away from Jerusalem. A voice of reason is Shalem, “The four faces of the Kaaba”, pp. 141-142, with extensive bibliographical references on the history of the edifice.

64. See already n. 59.

Readers should be aware that the *revisionistas*, those who now rewrite early Islamic history, do not believe any early sources in Arabic and so do not use them. They see a monumental conspiracy of fabrication of texts and manipulation thereof in early Muslim society, right, left and centre.

Fortunately, one area of Arab and early Muslim activity that they have not yet attacked is the corpus of Arabic texts purporting to document the astronomical traditions of the Arabs before Islam. None of the earlier Western scholars who have confronted this corpus has found any problem with its authenticity.

to document the use of folk astronomy for those aspects of Islamic ritual —calendar, prayer-times, *qibla*— involving astronomy,⁶⁵ an endeavour continued for al-Andalus and the Maghrib by Julio Samsó, Miguel Forcada and Emilia Calvo,⁶⁶ and by Petra Schmidl for the Yemen, the one region where mathematical and folk astronomy flourished simultaneously.⁶⁷

The earliest *qibla* determinations were achieved with reference to astronomical risings and settings. These directions are mentioned occasionally in medieval texts on folk astronomy or, in rare cases, on local history. Muslim legal scholars and specialists on folk astronomy later developed a sacred geography in which the world was divided into sectors around the Ka‘ba, each associated with a segment of the perimeter of the edifice, with a *qibla* for each sector defined in terms of the rising and setting of the sun or chosen *qibla* stars.⁶⁸ The information given is for non-numerates, for whereas a single number would suffice to identify the *qibla* in any given place, a series of risings and settings of the sun or various *qibla* stars is provided instead, together with directions in terms of winds relative to body parts, and often this information is mutually inconsistent. Not the least problem is the fact that the indicators appear to have been established in front of the Ka‘ba, so that they are not actually appropriate for distant locations. In addition, sometimes three sectors are assigned to the Yemen, and sometimes Syria is divided into three sectors, which leaves just six sectors for the rest of the world in a 12-sector scheme.

Some 20 different schemes of sacred geography have been identified in about 30 medieval manuscripts, though none from al-Andalus. In the very earliest schemes it is the direction from the Ka‘ba to the locality that is associated with a region and a segment of the perimeter. In the earliest schemes, al-Andalus is not even mentioned, and in the schemes from the 16th century onwards, al-Andalus features less and less frequently. We are therefore forced to take information on

65. King, “Folk astronomy in the service of religion: The case of Islam” (1994).

66. For example, Samsó, “Lunar mansions and timekeeping in Western Islam”; Forcada, “Astrology and folk astronomy”; and Calvo, “Two treatises on *mīqāt* from the Maghrib (14th and 15th centuries)”.

67. Schmidl, *Volkstümliche Astronomie*, which provides an analysis of three most promising sources —Ibn Rahīq, al-Asbahī and Muḥammad ibn Abī Bakr al-Fārisī— identified in King, *Mathematical astronomy in the Yemen*.

68. See the article “Makka as centre of the world” (also “Maṭla” and “Maṭāli”) in *EI*₂, and King, “The sacred geography of Islam”.

this particular folk tradition of the *qibla* in the sector for al-Andalus from Eastern Islamic sources, bearing in mind that even the early ones were not necessarily known in al-Andalus.⁶⁹

This folk astronomy, well established before Islam, later flourished alongside the sophisticated tradition of mathematical astronomy for which Islamic civilisation is appropriately famous.⁷⁰

8. Finding the qibla as a problem of mathematical geography and mathematical astronomy

In the first 150 years of Islam there was, as far as we know, nobody who could calculate the direction of one locality from another using the appropriate geographical data by a proper mathematical method. This situation changed in Baghdad in the early 9th century. Not only did Ptolemy's geographical coordinates become available, but procedures were developed for deriving the *qibla* that were either simple approximate geometrical ones or complicated exact mathematical ones.⁷¹ The former variety were not intended to serve localities far from the meridian of Mecca: for Córdoba, for example, with the available medieval coordinates the standard approximation yielded a *qibla* in error by about 10°. For al-Andalus, exact procedures were necessary, but apparently seldom used.

69. The closest are the 16th-century schemes by the Tunisian 'Alī al-Sharafī al-Ṣafāqusī, on which see now Herrera Casais, "Geografía sagrada islámica en dos atlas náuticos tunecinos del siglo xvi". In these schemes the *qibla* for al-Andalus is due East.

70. For a general overview see King, "Islamic astronomy".

71. King, "The earliest Islamic mathematical methods and tables for finding the direction of Mecca", esp. pp. 103-107, and "The sacred geography of Islam", pp. 166-169, on the procedure associated with al-Battānī (but proposed at least a century before his time).

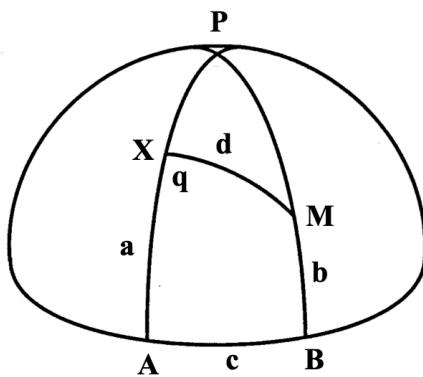


FIGURE 6. It is required to find the direction of any locality to Mecca and also the distance to Mecca. Here X is any locality and M represents Mecca. P is the North Pole and PXA and PMB are the meridians (north-south lines) of X and M , where A and B are on the celestial equator. The latitude at X is measured by arc $XA = a$ (variable) and the latitude at M is measured by arc $MB = b$ (fixed). The longitude difference between X and M is measured by arc $AB = c$ (variable) on the equator. The direction to Mecca, that is, the qibla, is represented by angle $MXA = q$ and the distance to Mecca, measured by the arc $XM = d$. Then the modern formulae for the qibla q (measured from the local meridian) and the distance d to Mecca are:

$$\begin{aligned} q(a,c) &= \text{arc cot } \{ [\sin a \cos c - \cos a \tan b] / \sin c \} \\ \& \quad \& d(a,c) = \text{arc sin } \{ \sin c \cos b / \sin q \}. \end{aligned}$$

In medieval times equivalent formulae to these were used seriously only in the Islamic East.

In al-Andalus it seems that a simple geometric procedure, associated with al-Battānī (Raqqa, ca. 910), was popular, and with this the *qibla* at Qurṭuba could be derived as about **23° S of E**. But this procedure is so simple that the Andalusīs would not have needed to have waited until al-Battānī's significant astronomical handbook arrived in al-Andalus to know of it; besides, it was known in Baghdad a century before al-Battānī's time. The formula does not work so well for large longitude differences from Mecca, and the *qibla* for Qurṭuba that can be derived using the same medieval geographical data and any of the (equivalent) exact formulae that were available (at least in Baghdad) was **11° S of E**. It so happens that the modern *qibla* for Córdoba is about **10° S of E**, but this is a coincidence since the two values are based on different formulae and different coordinates.

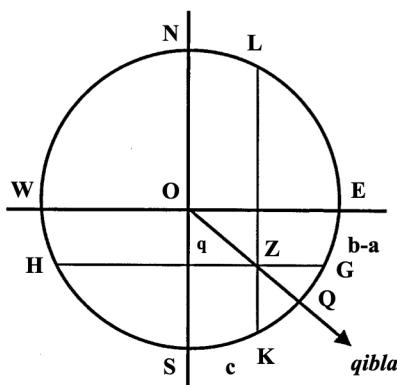


FIGURE 7. The approximate *qibla* method associated with al-Battānī. First lay out the cardinal directions NESW on a circle around point *O*. Then mark point *G* on arc *ES* so that arc *EG* measures the latitude difference *a-b* on arc *ES* and point *K* on arc *SE* so that arc *SK* measures the longitude difference *c* on arc *SE*. Draw *GH* parallel to *EW* and *KL* parallel to *SN* to meet at *Z*. The segment *OQ* defines the *qibla*, measured from the meridian by the arc *SQ* (*q*). To compute *q* use the formula:

$$q = \text{arc tan} \{ \sin(c) / \sin(a-b) \}.$$

Simple enough, but the procedure does not work adequately for large longitude differences, as in al-Andalus.

Even the medieval exact value of 11° S of E is irrelevant to our study, for, as we shall see, exact *qibla* determinations were not the forte of Andalusī astronomers. I know of only one, Ibn Mu‘ādh from 11th-century al-Jayyān (Jaén), who proposed an exact theoretical procedure for finding the *qibla*, and he refrained from actually using the procedure to derive the *qibla* anywhere.⁷² For this reason I shall not discuss the exact procedures, which are well documented elsewhere.

In the Islamic East spectacular tables were available displaying the *qibla* for each degree of longitude and latitude in the *Muslim world*, as well as imposing lists of *qibla*-values for hundreds of localities.⁷³ No such tables or lists are known from the Islamic West.

72. Samsó & Mielgo, “Ibn Ishāq al-Tūnisi and Ibn Mu‘ādh al-Jayyānī on the *qibla*”.

73. King, *World-Maps for finding the direction and distance to Mecca*, pp. 71–89 and 149–163, and various tables edited on pp. 456–638.

9. Medieval Andalusī folk astronomical texts on the *qibla* in Qurṭuba

At the risk of dealing only with Qurṭuba when the subject demands an investigation of the entire region of al-Andalus and the Maghrib, such as has been conducted by Mònica Rius and Julio Samsó, we proceed with caution. We ignore late Eastern Islamic materials on folk astronomy and sacred geography and the like because they would not have influenced early mosque orientation in al-Andalus.

Our earliest source is the early-9th-century Qurṭubī scholar Ibn Ḥabīb, in his treatise on folk astronomy.⁷⁴ He stated:

Our *qibla* in Qurṭuba is the direction of the rising of (the star) *qalb al-‘aqrab*, because it comes out of the corner of the Black Stone.

Now the star in question is Antares (alpha Scorpionis), a bright star which is close to the winter solstice on the ecliptic (this can be clearly seen on the upper right of an astrolabe rete). In other words, the *qibla* proposed is winter sunrise. Now the corner of the Ka‘ba in which the Black Stone is fixed is the Eastern one, and we may suppose that one can see Antares rising over that Corner if one is facing the Western Corner from an appropriate distance. Further away one is in al-Andalus. This is a simple, but by no means unreasonable means of finding the *qibla*.

In the scheme of the early-10th-century legal scholar Ibn al-Qāṣṣ, al-Andalus is associated with the Western Wall; alas, he gives no *qibla* directions.⁷⁵

The late-10th-century Andalusī scholar Ibn ‘Āsim, in his *Kitāb al-Anwā’*, proposed a different rule:⁷⁶

If you put the (North) Pole at your left shoulder and you have South in front of you, you will be facing the *qibla*.

74. Renaud, “Astronomie et astrologie marocaines”, p. 58; Hawkins & King, “The astronomical orientation of the Kaaba”, p. 106; King, “Astronomy and architecture”, p. 122; Samsó, *Las ciencias de los antiguos en al-Andalus*, p. 62; and Rius, *La Alquibla*, pp. 176 and 182.

75. From my unpublished notes on sacred geography, taken from MSS Cairo DM 1201 and Istanbul Velyeddin 2453.2. On Ibn al-Qāṣṣ — Sezgin, GAS, i, 496-497, and King, *Cairo Survey*, no. C26 — see now Ducène, *Le Kitāb dalā’il al-qibla d’Ibn al-Qāṣṣ*, and various publications by the same author.

76. Samsó, *Las ciencias de los antiguos en al-Andalus*, p. 62 and 461, referring to a study by Miguel Forcada.

This must mean having the Pole behind one's left shoulder, for the statement "South in front of you" is unambiguous. But such instructions could only lead to confusion. Two centuries thereafter, the late-12th-century author of a treatise on folk astronomy Abū 'Alī al-Hasan ibn 'Alī ibn Khalaf al-Umawī al-Qurṭubī stated that one should stand with the celestial pole (meaning the Pole Star) behind one's left shoulder and face "South".⁷⁷ If he had meant by "South" due South, he could have written "behind the nape of the neck", an expression standard in our texts. One could hope that what he meant was "somewhat East of South", and this could be taken as a non-explicit but rather clumsy support for the *qibla* of the Great Mosque in Qurṭuba.

10. Non-Andalusī non-scientific sources for the qibla in al-Andalus

All of the materials mentioned in this section —part of 20 schemes in 30 manuscripts— are documented in my unpublished study *The Sacred Geography of Islam*. A survey of the sources is in my 2019 article "Finding the qibla by the sun and stars".

The 8-sector scheme of sacred geography recorded in the *Kitāb al-Masālik wa-'l-mamālik* of the 9th-century Iraqi scholar Ibn Khurradādhbih is so early that al-Andalus is not mentioned, and again so early that **the qibla is the direction one faces when standing with one's back toward a particular segment of the perimeter of the Ka'ba**.⁷⁸ The text proposes:

Sector 8 - The *qibla* for the inhabitants of the Maghrib, Ifrīqiya, Egypt, Syria and al-Jazīra is from due west [to the North Pole]. They pray [from the Western corner (?)] to the Syrian corner...

In other words, the *qibla* is to the East in the Maghrib and to the South in al-Jazīra (N. E. Iraq).

77. King, "Medieval values of the *qibla* at Cordova", p. 370; Samsó, *Las ciencias de los antiguos en al-Andalus*, p. 62; Rius, *La Alquibla*, p. 181.

78. King, article "Makka as centre of the world", p. 183; and Schmidl & Herrera, "The earliest known schemes of Islamic sacred geography", pp. 277-284.

Another 8-sector scheme proposed in one copy of the *Ahsan al-taqāṣīm fi ma'rifat al-aqālīm* by the 10th-century Jerusalem geographer al-Muqaddisī⁷⁹ likewise has no mention of al-Andalus, and it is obviously very early. Its reference to the Maghrib is particularly remarkable and unlike any other:

Sector 1 - This is the *qibla* for al-Jār (the port of Medina on the Red Sea) as far as Walīla (the Roman city of Volubilis near Meknes) and Tangiers: (The *qibla* stars are) Altair and Vega. Face the Ka'ba in between them when they both rise. (This is) correct.

The east north-east direction defined by the rising of the two *qibla* stars is problematic, and it seems that we should interpret the information in the text as referring to the east south-east direction defined by turning one's back on the setting of the two stars. The associated segment of the perimeter of the Ka'ba would be the North West Wall, even though when standing in front of it one is facing south south-east. There is mention of Canopus here, but Sector 6 is labelled "the *qibla* of the Prophet", that is, when he was in Medina, and there "Canopus rises at your right eye and Altair rises at your left eye".

The Yemeni legal scholar Ibn Surāqa, who worked in Basra *ca.* 1000, compiled three schemes of sacred geography which were later more influential than other schemes, at least in Egypt, Syria and the Yemen.⁸⁰ These were presented in text form, although in later centuries the information was recorded in diagrammatic form, with eight or eleven or twelve sectors about the Ka'ba illustrated at the centre. For specific segments of the edifice, the various regions in each sector are named, and the *qibla* is given in terms of astronomical risings and settings or the directions associated with the cardinal winds. The winds are in all probability the winds associated with the four walls of the Ka'ba (they are not the cardinal winds we think of today). Ibn Surāqa proposes:

Sector 7/8 and Sector 10/11 —al-Andalus, Maghrib, Ifrīqiya, Ethiopia— (On the SW wall) 7 cubits from the Western Corner to the Corner itself: Pleiades rising in front;

79. Schmidl & Herrera, "The earliest known schemes of Islamic sacred geography", pp. 284-299.

80. See my *EI*, article "Makka as centre of the world", pp. 183-184 (where the both 8- and 11-sector schemes are displayed); Schmidl, *Volkstümliche Astronomie im islamischen Mittelalter*, i, pp. 419-420.

Sirius rising at right eye; Capella setting behind the nape of the neck (only in 10/11); East wind in front; West wind behind; North wind at left shoulder; South wind at right shoulder.

If one tries to unravel this information one soon comes unstuck. One could hope that it was not used for laying out any mosques. Canopus occurs in these schemes only twice, namely, in Sector 1/8 & 1/11, for Medina and Palestine, associated with the Water-Spout at the middle of the North-Western wall, and to indicate the *qibla* there, Canopus is rising in front. In Sector 6/8 and 7/11, for Yemen and Hadramawt, associated with the segment of the perimeter of the Ka‘ba from the *Muṣallā* of the Prophet to the Yemeni Corner, the *qibla* is the rising of Canopus at the right ear and its setting behind the left ear. There were good reasons why these indications (*dala‘ il*) using *qibla*-stars and wind-directions were dropped in most later schemes of sacred geography.

An anonymous 8-sector scheme of sacred geography found in an Ottoman Egyptian manuscript shows every sign of being many centuries older than the date of copying.⁸¹ The relevant text reads:

(The eighth sector). The *qibla* of Egypt. This is the sector of Egypt (from) Aswan (to) Alexandria, and (westwards) as far as Kairouan and al-Andalus. Their *qibla* is (found) by the stars (by standing so that) [the Banāt Na‘sh set directly behind] and the Pleiades rise at the left eye. The section of the Ka‘ba which they face is (the part) **from the Western Corner to the Waterspout.**

The Banāt Na‘sh are the stars of Ursa minor and at the latitude of Mecca they rise and set. Indeed, their setting defined the northern direction of the major axis of the Ka‘ba, whereas the rising of Canopus defined the southern direction of the axis.

81. MS Cairo Tal’at *majāmī* 811,7, fol. 60r. On these diagrams see already King, “Astronomical alignments in medieval Islamic religious architecture”, pp. 305 and 308; and *idem*, “Astronomy and architecture”, p. 121.

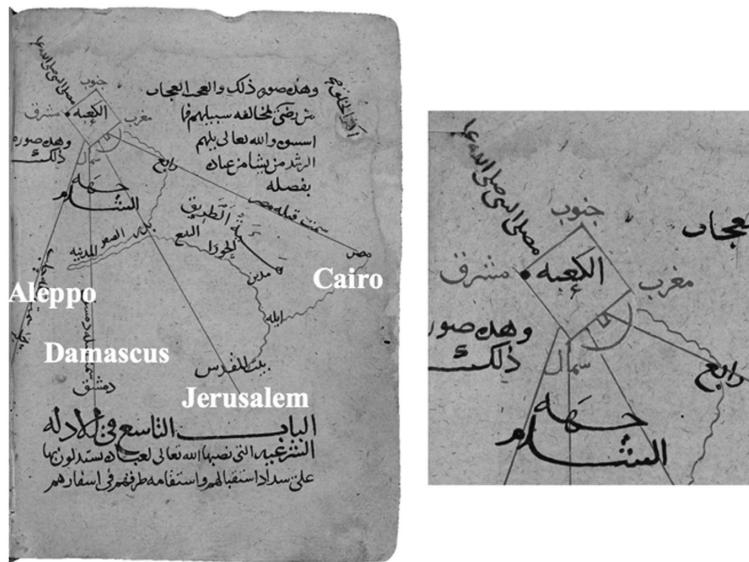


FIGURE 8. The situation of various Mamluk cities relative to the Ka'ba, as illustrated in the single most serious and informed treatise on the *qibla* by a medieval Muslim legal scholar, Zayn (?) al-Dīn al-Dimyātī. The diagram is remarkable for its accuracy and for its correct depiction of the Ka'ba, with its corners named after the cardinal directions but appropriately slightly inclined to them. Notice the *mizāb*, the waterspout on the roof of the Ka'ba shown at the middle of the NW Wall and the *hijr*, the lower semi-circular wall spanning the NW Wall. This text is extant in the apparently unique copy MS Oxford Bodleian Marsh 592 (fol. 88v is shown here), shown here courtesy of the Bodleian Library.

A 12th-century Egyptian legal scholar al-Dimyātī, the author of the most sophisticated legal treatise on the *qibla* that has survived for us, had the following to say in his 13-sector scheme,⁸² which is illustrated as well as outlined as text:

Facing the part of the NW wall **between the Western Corner and the Waterspout (in the middle of the NW wall)**: this is the *qibla*-sector of Egypt and the northern part of Upper Egypt and their coasts from Alexandria, Damietta, and Tinnis to Barqa and Tripoli, and the coasts of the Maghrib and Sicily and al-Andalus, as far as al-Sūs al-aqṣā.

82. Oxford Bodleian Marsh 592, fol. 97v-101v & 26r-27r. See King, "Astronomy and architecture", pp. 123-126, and *idem*, "Architecture and astronomy", pp. 115, 123 and 125-126, on this text and a shorter version in MS Damascus Zāhiriyah 5579.

This is an extremely important testimonial because it justifies taking the *qibla* in al-Andalus as the direction one faces when one stands in front of the NW wall of the Ka‘ba, in other words, facing the rising of Canopus.

Ibn al-Ajdābī was a philologist from al-Ajdāb in Libya who lived in the early 13th century.⁸³ In his treatise on folk astronomy, *Kitāb al-Āzmina wa-‘l-anwār*, he presents an 8-sector scheme in words, which is distinguished by the fact that it imposes solstitial alignments on each of the four sides of the edifice. However, in the single copy (MS Paris BnF ar. 2186, fol. 44r) of the very popular *Kharīdat al-‘ajā’ib* of the 15th-century Syrian Ibn al-Wardī, the scheme is illustrated, with the rectangular Ka‘ba at the centre. Adjacent to the *hijr*, the low wall that spans the N. W. Wall, we read:

al-hijr – al-mīzāb – qibla of al-Madīna, Jerusalem, Egypt, Tripoli (Libya), Ifrīqiyya (= Tunisia), al-Andalus, Sicily – al-hijr.

Here al-Andalus is clearly associated with the *mīzāb* and the N. W. Wall.

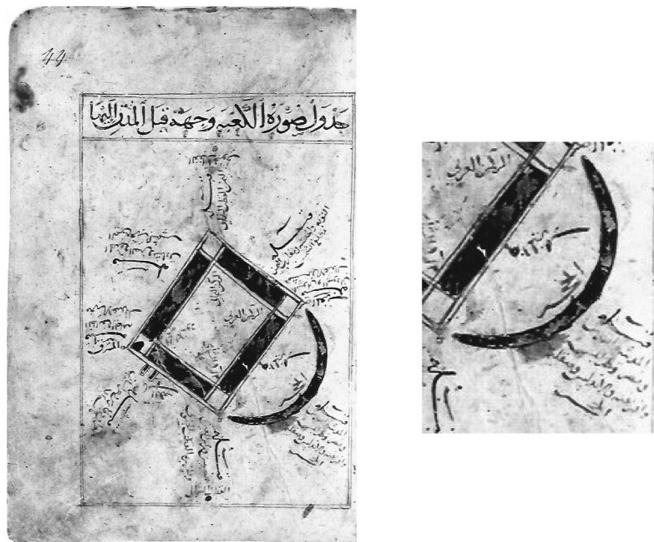


FIGURE 9. A diagram of an 8-sector scheme of Islamic sacred geography in which the sector of the world including al-Andalus is shown facing the *hijr* and the *mīzāb*, the principal features of the N-W Wall of the Ka‘ba. From MS Paris BnF ar. 2186, fol. 44r, courtesy of the Bibliothèque nationale de France.

83. On this author see the article “Ibn al-Adjābī” by Charles Pellat in *EJ* 2.

The early-15th-century Egyptian encyclopaedist al-Qalqashandī⁸⁴ presents a description of the Ka‘ba outlining 12 segments of its perimeter and the associated regions of the world, without referring to the associated *qiblas*. The following extract concerns al-Andalus:

The third (segment of the perimeter of the Ka‘ba) is **from the middle of the (NW) Wall at the Water-Spout and the parts on either side of it as far as the Western Corner**. This is the part of the Ka‘ba for the whole of Egypt from Aswan to Damietta and Alexandria, Barqa, and also Tripoli and Sicily, as well as the coast of the Maghrib and **al-Andalus**, and places in the same direction.

Here again we have essentially the same information as that given by al-Dimyātī.

I refrain from presenting any more information from such sources because they are not relevant to Andalusī orientations.

Since at the latitude of Qurtuba Canopus is not visible and the Pleiades do not rise or set,⁸⁵ if one wanted to relate the Mosque in Qurtuba to the Ka‘ba in Mecca, one would necessarily have to ensure that the *qibla* wall of the Mosque be “parallel” to the NW wall of the Ka‘ba, which, in fact, it is. In Qurtuba if one were standing so that the winter sunrise was on the left or summer sunset was on the right, one would be facing **60° S of E**, which is the orientation of the Great Mosque. Alternatively one could stand so that the Pole Star was behind one’s left shoulder and be facing roughly in that same direction.

11. Some more specific qibla values for Qurtuba

In the calendar of the 10th-century Andalusī scholar Ahmad ibn Fāris, contained in his *Mukhtasar min al-anwā’*,⁸⁶ we find a statement that:

84. al-Qalqashandī, *Šubḥ al-a‘shā*, IV, pp. 251–255.

85. Compare Samsó, *Las ciencias de los antiguos en al-Andalus*, p. 461, and Forcada, “A new Andalusian astronomical source from the 14th century”, p. 777.

86. Kunitzsch, “Über eine anwā’-Tradition mit bisher unbekannten Sternnamen”, pp. 19–20 (I was reminded of this reference by Sepp Rothwangl, Vienna), and Forcada, “Astrology and folk astronomy: the *Mukhtasar min al-anwā’* of Ahmad b. Fāris”, p. 130.

The rising of the sun on the 16th day of (December) is called the *qibla* in Qurṭuba.

This direction is **sunrise at mid-winter**.

The early-12th-century Maghribī legal scholar Abū ‘Alī al-Mattījī in his book *Dalā’il al-qibla* offers a wealth of information on the *qibla* in the Muslim West.⁸⁷ On al-Andalus he states that he has read in a treatise on the astrolabe by an unidentified author that the *qibla* at Qurṭuba is **24° S of E**. He disagrees and says it is **30° S of E**, which, he says, is the same as the *qibla* in Kairouan derived by Saḥnūn, referring to the famous Tunisian *faqīh* who died in 854.⁸⁸ He says that some treatises on the quadrant have the *qibla* in Qurṭuba at **45° S of E**. This observation is curious because no known Andalusī treatises on the quadrant include this information.

The treatise on the use of the astrolabe by the early-11th-century Qurṭubī astronomer Abu ’l-Qāsim Ahmad Ibn al-Šaffār contains a remark to the effect that the *qibla* at Qurṭuba is **30° S of E**.⁸⁹ Ibn al-Naṭṭāh (see next paragraph) quotes Ibn al-Šaffār as stating that the *qibla* is **23° S of E**, clearly derived from al-Battānī’s simple construction (see Section 8).

The remarkable treatise on mechanical devices by the Andalusī scholar Ibn Khalaf al-Murādī, possibly from the 11th or 12th century, implies that the *qibla* there is toward **winter sunrise**.⁹⁰ These two definitions by Ibn al-Šaffār and al-Murādī are the same for the latitude of Qurṭuba. Likewise, the late-11th-century Andalusī astronomer Ibn al-Zarqalluh mentions this same direction in his treatises on the universal astrolabic plate.⁹¹ It boggles the mind of someone who knows what Muslims in the East achieved regarding the mathematical determination of the *qibla* to learn that one of the most celebrated astronomers of al-Anda-

87. Rius, “La orientación de las mezquitas según el *Kitāb dalā’il al-qibla*”, pp. 818-820.

88. Article “Saḥnūn” in *EI*, by M. Talbi, also Rius, *La alquibla*, pp. 284-285.

89. Rius, article “Ibn al-Šaffār” in *BEA*.

90. King, “Medieval mechanical devices” (1975), pp. 288-289, announcing the discovery of the spectacular treatise in the Florence manuscript; also *idem*, “Medieval values of the *qibla* at Cordova”, pp. 371, 388-389; and Samsó, *Las ciencias de los antiguos en al-Andalus*, p. 62. The Florence manuscript of al-Murādī’s treatise is now published in an extravagant Milan facsimile by the study centre Leonardo3, with English and Italian translations.

91. Samsó & Mielgo, “Ibn Ishāq al-Tūnī and Ibn Mu‘ādh al-Jayyānī on the *qibla*”, p. 4, and the text editions cited (correct 30° E of S to **30° S of E**).

lus would propose an “approximate” or “inaccurate” or “folksy” and “irrelevant” *qibla* corresponding to winter sunrise.

Similarly, the early-14th-century legal scholar of Granada Ibn Juzayy in his *Kitāb al-Qawānīn* mentioned that the astronomers (*al-mu‘addilūn*) stated that the *qibla* at Qurtuba was at **30° S of E**; alas, he did not mention the Grand Mosque.⁹²

12. The testimony of Ibn al-Naṭṭāḥ

We are fortunate to have more information on the *qibla* in Qurtuba in a treatise on the astrolabe by an Andalusī astronomer called Ibn al-Naṭṭāḥ. Alas, we have no other biographical information on him than that he apparently lived in the 12th century,⁹³ for the unique British Library manuscript (9602,1, fols. 1v-24v) can be dated *ca.* 1200. It bears a note stating that the best treatises on the astrolabe are those of Ibn al-Samḥ and Ibn al-Naṭṭāḥ; only the former has received any attention in modern times (and it hardly needs be said that several treatises from the Islamic East are considerably of greater consequence than these two). The uncritical presentation of his material on the various *qibla* values for Qurtuba (fols. 18v-19r) does Ibn al-Naṭṭāḥ little credit but serves us well. Likewise, his description of the use of the back of an astrolabe to find any of these values is somewhat naïve. We divide the text into three main parts:

Chapter on finding the *qibla*. If you want to find the *qibla* with (an astrolabe), measure the altitude of the sun and place the sun (on the rete) over its altitude (on the latitude plate) and find its azimuth. Then determine from (this) the four (cardinal) directions as I explained in the chapter preceding this one. If you have found (the four directions) leave the astrolabe as it is and do not move it from its position, then turn the alidade, without moving the astrolabe, to thirty degrees on the altitude circle. The direction opposite the marker will be the *qibla* at Qurtuba and (places) near it.

The *qibla* of **30° S of E** is here presented with no justification. We know that it is the *qibla* of winter sunrise, which is **30° S of E**.

92. Aguiar Aguilar, “La *Qibla* en el *Kitāb al-Qawānīn* de Ibn Juzayy”, p. 224.

93. See King, “Some medieval values of the *qibla* at Cordova”, pp. 371-374, 387, with the Arabic text. See also Samsó, *Las ciencias de los antiguos en al-Andalus*, pp. 64-65.

There follows a strange remark:

This is the *qibla* at Qurṭuba at forty-five degrees (??).

Our author next seems to associate 45° (S of E?) with the *qibla* at Qurṭuba, but this is an error of interpretation on our part. He does not mean that 45° (S of E) is another accepted *qibla*. It seems that this remark of his has jumped out of the following sentence, for at least there it makes sense. On the other hand, we know from other sources, such as a sundial from Granada, that the *qibla* in al-Andalus (and in the Maghrib as far as Tunis) was sometimes taken as **45° S of E**.⁹⁴ We also know that several Andalusī mosques face roughly south-east (see below). Our text continues:

I found in some notes on the authority of Abu ‘l-Qāsim [al-Zubayrī, text has al-Şnyry] (that) the alidade should be placed on **twenty-three degrees** if the latitude of the city is $38;30^\circ$ [LACUNA: and its latitude is $21;40^\circ$ and the longitude difference to Mecca is 45°]. This is what I mentioned (?), and it is the opinion of the astronomers (*ahl ḥisnā’ at al-ta’ dīl*). The legal scholars think that the whole (south-eastern) quadrant is the *qibla*.

al-Zubayrī has not been identified, but his name is confirmed by a later source.⁹⁵ He clearly favoured al-Battānī’s approximate method, for **23° S of E** is the *qibla* that can be derived using that procedure, if the latitude of Qurṭuba is correctly $38;30^\circ$, with Mecca at $21;40^\circ$, and the longitude difference to Mecca is 44° (easily mistaken from 45° in alphanumerical —*abjad*— notation).⁹⁶ For latitude difference $16;50^\circ$ and longitude difference 45° , the *qibla* is actually 22° S of E.

I am confident that al-Şnyry was not Abu ‘l-Qāsim Aḥmad ibn al-Şaffār, the prominent astronomer of early-11th-century Qurṭuba whom we have already mentioned and whose treatise on the astrolabe was highly influential. In that treatise Ibn al-Şaffār states that the *qibla* is **30° S of E** (see above).⁹⁷

94. King, “Three sundials from Islamic Andalusia”, p. 365, and pls. 4-5, and *idem*, “A fourteenth-century Tunisian sundial”, pp. 190-191.

95. Rius, *La Alquibla*, p. 183.

96. King, “Some medieval values of the *qibla* at Cordova”, pp. 373-374.

97. See n. 89.

The legal scholars were rather sensible in accepting that the entire south-east quadrant was the *qibla*. We have a detailed explanation of this phenomenon in, for example, a 12th-century Egyptian treatise on the *qibla* by al-Dimyātī, as well as various later Maghribi sources.⁹⁸

Ibn al-Nattāh concludes:

The *Jāmi'* Mosque is at **sixty degrees**. Most of the mosques in Qurṭuba are (laid out at **twenty-three degrees**) according to the opinion of al-Battānī - may God have mercy upon him. There are some at **thirty (degrees)**. If you want to know the *qibla* at night, determine the four (cardinal) directions as previously (explained), and then turn the alidade on the quadrant of the degrees of altitude to whichever you wish of the numbers I mentioned for the *qibla* at Qurṭuba. Understand (this).

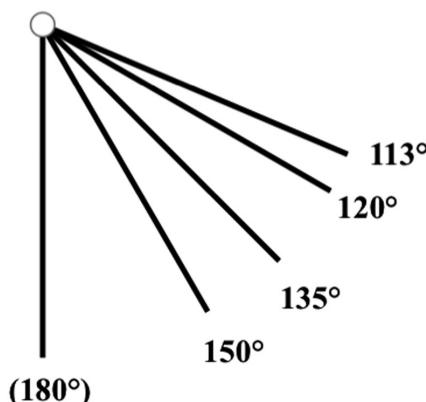


FIGURE 10. According to a 12th-century Andalusī treatise on the astrolabe by Ibn al-Nattāh, mosques in Qurṭuba were oriented in these different directions: **113°**, the *qibla* computed by the standard approximate formula (which works reasonably well in localities on the central regions of the Islamic world, but not in al-Andalus (or Central Asia and India), where the error is more than 10°; **120°**, winter sunrise; **135°**, a compromise between due east and due south; **150°**, the direction of the Great Mosque; and **180°**, due south (not specifically mentioned). Notice that Ibn al-Nattāh does not mention **101°**, the direction that would be computed using an exact trigonometrical formula and medieval geographical data.

98. See King, "Architecture and astronomy", pp. 126; and Rius, *La Alquibla*, pp. 174-175.

al-Mattījī mentions that an author of a treatise on the astrolabe, probably Ibn al-Nattāḥ, whom he cites by name elsewhere, had stated that the Great Mosque is at **66° S of E**.⁹⁹ In Arabic alphanumerical notation the numbers 60 (s) and 66 (s-w) are easily confused, although 60 is written out as *sittīn* in the London manuscript (though normally 60 would be written as *sād* in Western *abjad*). The Great Mosque is actually oriented at 62° S of E. Clearly, Ibn al-Nattāḥ or one of his sources actually measured the orientation.

(In the 1950s the Spanish historian of Islamic art L. Torres Balbás showed an orientation of between **65°-70° S of E** in the *Historia de España*.¹⁰⁰ It is a great pity that K. A. C. Creswell and his followers, as well as R. Hillenbrand, did not have access to such information.)

Particularly interesting is Ibn al-Nattāḥ's next comment that "most of the mosques in Qurṭuba" face **23° S of E**, and that there are some at **30° S of E**. We can check this against the surviving religious architecture.

13. Actual mosque orientations

Ibn al-Nattāḥ's assertion about mosque orientations in Córdoba is **not** confirmed by the orientations of mosques in, say, Córdoba, Seville and Granada (C-S-G below).

From the original data (to base 400°) for mosques all over Spain assembled by Alfonso Jiménez, adapted to a standard system (base 360°) and used by Mònica Rius in an attempt to classify them in the light of the relevant medieval texts,¹⁰¹ we extract the following values:

99. Rius, *La Alquibla*, p. 184.

100. Samsó, *Las ciencias de los antiguos en al-Andalus*, p. 61, n. 59.

101. Jiménez, "La qibla extraviada", pp. 194-195; and Rius, *La Alquibla*, p. 110-113, esp. 110, n. 259.

I think it is unfortunate that Prof. Jiménez presented orientations according to a bizarre system with a circle of 400 units, which he calls "decimal". The system assures that anyone who uses his data without realising this will, as I did, interpret it wrongly at first. Fortunately the sexagesimal system is superior to the decimal system and that it is why it was favoured in Antiquity. Also, I would have preferred that the author had not listed the "errors" in each of the mosque orientations, since they are basically of interest for medieval architecture (because the modern *qibla* is irrelevant).

Mònica Rius in her book has rearranged the data to clearly show the orientations, ignoring the "errors".

"Eastern" orientation:

C - Sta. Clara	X	35° S of E
C - Medina Azara	X	19

South-East:

C - S. Juan	IX	49
S - Sta. Catalina	IX	51
G - Albaicín	XIII	44
G - S. Sebastian	XIII	49
G - Madrasa	XIV	48
G - Masjid al-Sultān, Alhambra	XIV	40
G - Parcal, Alhambra	XIV	39

South-South-East:

C - Aljama	VIII	62
S - Aljama de Carmona	X	58
S - Huevar, Leirena	X	65
G - San José	XI	64
S - Sanlúcar la Major	XII	65
S - Cuatrovitas	XIII	66

South:

S - El Salvador	IX	84
S - Alcalá de Guadaira	XII	84
S - Aljama	XII	84
G - San Juan	XIII	79

Slightly West of South:

C - Santiago	IX	7° W of S
S - Aljama de Aznalcázar	X	11
S - Miraflores	XI	7

From the more extensive data collected by Jiménez for the whole of the Iberian Peninsula and by Rius for the Maghrib it is evident that the "Qurṭubī *qibla*"

Inevitably we find people nowadays repeating Prof. Jiménez' value for the orientation of the Grand Mosque as if it were in degrees.

of ca. **60° S of E** was generally favoured, and this in spite of the claim of Ibn al-Naṭṭāḥ that mosques in Qurtuba had a more easterly orientation. Yet not a single Andalusī scientific text refers to this as a value of the *qibla*. This is indeed a “*qibla extraviada*” (after the title of Alfonso Jiménez’ splendid study).

In addition to the orientation of mosques we should consider also the orientation of the dead in cemeteries. This, according to the archaeologist Alberto Léon Muñoz, is mainly with the head towards SW and the feet toward NE, thus facing the *qibla*.¹⁰² But which *qibla*?

14. The orientation of the Great Mosque and its justification

What we are missing is a medieval source that somehow refers specifically to the fact of the “parallelism” of the Great Mosque in Qurtuba and the major axis of the Ka‘ba. Whilst we have several sources mentioning a *qibla* for Qurtuba toward winter sunrise, this is not relevant here. We are looking for a *qibla* that is perpendicular to the line between summer sunrise and winter sunset.

Can it be that we are dealing with some sort of coincidence with this parallelism? Can it be that this coincidence has misled one or two historians of Islamic science? In 1982 I proposed the parallel theory,¹⁰³ which was accepted by Julio Samsó.¹⁰⁴ Clearly, the Mosque was not laid out using Canopus, since that star is not visible in Córdoba. Mònica Rius rightly commented:

El problema de esta teoría es que no explica cómo se orientaba la aljama / the problem of this theory is that it does not explain how the Mosque was oriented;

she then proposed that the builders might have been content to concentrate on the solstitial alignment of the minor axis, which would indeed have been a sensible way.¹⁰⁵ The major Canopus axis of the Ka‘ba is perpendicular to the solstitial minor axis, for the latitude of Mecca. For the latitude of Córdoba the major “Canopus” axis of the Great Mosque can still be defined by the perpendicular solstitial minor axis. Alas we do not have any textual evidence for that procedure either.

102. León Muñoz, “El mundo funerario islámico en Córdoba (siglos VIII-XIII)”, p. 43.

103. Hawkins & King, “On the orientation of the Ka‘ba”, p. 106 and esp. n. 10 on p. 109.

104. Samsó, *Las ciencias de los antiguos en al-Andalus*, pp. 63-64.

105. Rius, *La Alquibla*, pp. 175-176.

But all these proposals took place before the street pattern of Colonia Patricia was investigated. Before we admit that we have no relevant texts, we do have a text of sorts, in the form of two anecdotes, which inevitably post-date the construction of the Great Mosque.

First, the 11th-century historian of science Ṣā'id al-Andalusī, whilst mentioning the legal scholar and astronomer Abū 'Ubayda al-Laythī (d. 907), known by the enviable name *Ṣāhib al-qibla*, roughly, “the *qibla* expert”,¹⁰⁶ records that, in addition to visiting Mecca, *kāna yusharriqu fī salātih*, which can mean “he used to turn toward the East in his prayers” or “he used to turn more to the East in his prayers (than the *qibla* of the mosque)”.¹⁰⁷

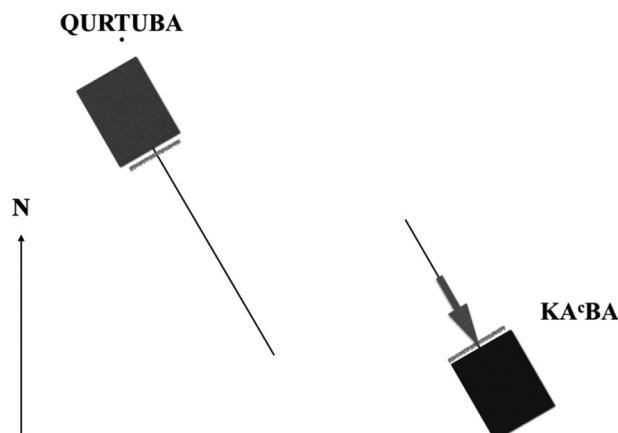


FIGURE 11. The 9th-century Qurṭubī legal scholar Abū 'Ubayda al-Laythī, known as *Ṣāhib al-qibla*, when standing in front of the middle of the NW wall of the Ka'ba, said: “This is the *qibla* (of al-Andalus)”.

Next, the 10th-century biographer al-Jushānī reports that Abū 'Ubayda instructed a certain Ibn Jumayr in front of the Water-Spout of the Ka'ba how to determine the *qibla* (no locality mentioned). However, upon Ibn Jumayr's return to al-Andalus he was not able to fulfil the procedures he had learned from Abū 'Ubayda for fear of upsetting the community.¹⁰⁸ What this means is first that he

¹⁰⁶. See the article “al-Laythī, Abū 'Ubayda” by Mònica Rius.

¹⁰⁷. Samsó, *Las ciencias de los antiguos en al-Andalus*, pp. 60–61.

¹⁰⁸. Rius, *La Alquibla*, pp. 172–173.

thought the Water-Spout (*mīzāb*) and perhaps also an unspecified section of the NW Wall was the segment of the perimeter of the Ka‘ba corresponding to al-Andalus, and that he was standing at the middle of the NW Wall of the edifice, facing the direction of the major axis of the Ka‘ba, toward the rising point of Canopus, or with summer sunrise on his left and winter sunset on his right. This is very nice, because it provides additional justification for the adoption and the retention of the orientation of the Great Mosque.

We have found various early schemes of sacred geography in which al-Andalus is associated with the Water-Spout or the section of the North-Western Wall from the Water-Spout to the Western Corner. For these situations the *qibla* in al-Andalus could be thought of as “parallel” to the major axis of the Ka‘ba.

Curiously enough, the article “*Kibla* (legal aspects)” in the first edition of the *Encyclopaedia of Islam* (1913–36)¹⁰⁹ defined the *qibla* as

the direction of Mecca (to be exact of the Ka‘ba or the place between the water-spout (*mīzāb*) and the western corner), which has to be observed during the *salāt*.

As a general definition this is, of course, an error, but it becomes slightly less serious when one has an idea where it comes from. It is, in fact, part of a statement taken from some regional Islamic legal text identifying a particular segment of the perimeter of the Ka‘ba that is to be associated with that particular region. Alas we cannot know whether the statement itself or the world-scheme from which it was taken was of Egyptian, Maghribī or Andalusī origin. Several recent works on Islamic architecture by renowned Western scholars assert incorrectly that the *qibla* is towards the Black Stone (see Section A1).

In any case, we are left with a situation in which the original orientation of the Great Mosque appears to have followed the Roman street plan for Colonia Patria. Either at that time or later on, it was noticed that the Mosque was aligned “parallel” to the axis of the Ka‘ba, which also served as a *qibla* for Qurtuba. This direction, although not specifically mentioned as a *qibla* in the texts we have presented, also influenced the orientation of other mosques in both al-Andalus and the Maghrib. In subsequent extensions to the Córdoba Mosque the orientation was never changed.

¹⁰⁹. Article “*Kibla*” in *EI*, by A. J. Wensinck (legal aspects) and Karl Schoy (astronomical aspects).

The internal geometry of the Mosque in its various stages has been investigated by Antonio Fernández-Puertas in 2000. Needless to say, his inquiry was fruitful and the results were interesting and important.¹¹⁰ His writings on the *qibla* of the mosque are less convincing because he thinks like many others, that Arabic “*qibla*” means “south” and that the Qurtuba Mosque faces south.¹¹¹

Some final comments in this regard. The street plans and significant edifices of several pre-Islamic cities dictated the layout of the subsequent Islamic cities and mosques that replaced them. Islamic Córdoba is yet another, with its principal religious edifice built in line with the second Roman solstitial *cardo* system of Colonia Patricia. Later astronomers preferred a *qibla* inclined at 30° to that, towards winter sunrise, but they seem to have lost out.

But now we are ahead: a 2017 joint paper in Spanish by my two colleagues, Manuel D. Ruiz Bueno and Carmen González Gutiérrez, each deeply involved in the history of Roman Corduba and of Islamic Qurtuba, respectively, shows the plan of the Grand Mosque happily superposed on the plan of the Roman Colonia Patricia, just as it was in the late 8th century.¹¹² This alone makes me feel that my 2017 lecture in Córdoba was worthwhile, and perhaps this English overview of the situation will bring these discoveries to a wider audience. However, dismantling the misinformation currently circulating about the Great Mosque will not be easy.

15. Some remarks on orientations in Damascus, Jerusalem, Cairo, and Wāsiṭ

In light of the controversy currently raging about the orientations of most the earliest mosques, the following information may be useful.

¹¹⁰ Fernández-Puertas, “I. Mezquita de Córdoba. Trazado proporcional de su planta general (siglos VIII-X)” (2002), and “II. Mezquita de Córdoba: La ‘qibla’ y el ‘mihrab’ del siglo VIII” (2008), esp. p. 346.

¹¹¹ I think that in Arabic dialects at least from the Maghrib to Syria *qiblī* or *'iblī* means the general direction of South” and/or the wind from the South. Surely this will be documented somewhere.

¹¹² Ruiz-Bueno & González-Gutiérrez, “De ‘iglesia’ tardoantigua a mezquita califal”, esp. fig. 1.

(a) Damascus

The Umayyad Mosque in Damascus, completed in 715, was erected on foundations that were more or less cardinally aligned, so its *qibla* wall faces more or less due south. I am not aware of any medieval (or modern) discussions that the *qibla* in Damascus is not what most people thought it was or think it is.¹¹³ Dan Gibson has convinced himself, if not others, that the Mosque faces “between Petra and Mecca”;¹¹⁴ whereas the actual orientation of the Mosque has nothing to do with either location. A 2012 study of Syrian mosques from Damascus University does not mention the *qibla* at all.¹¹⁵

The *qibla* in Damascus based on medieval coordinates is close to 29° E of S, say about 30° E of S. (modern value 16°). On a Syrian astrolabe that has just come to light, made by one Ma‘ālī ibn al-‘Arrāb al-Iskandarī for the Ayyubid Sultan al-Mu‘azzam in 622 Hijra (1225/26), the *qibla* at Damascus is shown as 27° E or S. Values of the *qibla* for each degree of latitude and each degree of longitude difference from Mecca were calculated by the mid-14th-century Dama-scene astronomer Shams al-Dīn al-Khalīlī, the scholar who concerned himself more than any other with the calculation of the *qibla*. His universal table contains close to 3,000 entries accurately computed to degrees and minutes.¹¹⁶ In addition he presented a list of *qibla* values for numerous localities in Syria and Palestine, with 29;4° E of S for Damascus.¹¹⁷

It is an interesting fact, not previously noted, that the Mosque in Córdoba, which everybody thinks is incorrectly oriented, is at 30° to the south of the most common medieval *qibla* for Córdoba; the Umayyad Mosque in Damascus, which everybody thinks is correctly oriented, is at 30° to the west of the medieval *qibla*. It took several centuries for folk in Syria to abandon the southern *qibla* for one that was mathematically correct (within the limits of medieval parameters).

¹¹³ A new study of the large-scale building of new mosques in medieval Syria is Talmon-Heller, *Islamic Piety in Medieval Syria*. See also Flood, *The Great Mosque of Damascus*.

¹¹⁴ Gibson, *Early Islamic qiblas*, pp. 49–50.

¹¹⁵ Garsivaz-Gazi & Mikhail & Estamboli, “The position of mosques in Islamic cities”.

¹¹⁶ King, “al-Khalīlī’s *qibla* table”.

¹¹⁷ King, *In Synchrony with the Heavens*, 1, pp. 386–390.

(b) Jerusalem

The situation in medieval Jerusalem is also complicated. The *qibla* of the Dome of the Rock and the al-Aqsā Mosque is barely mentioned in the modern literature, not least because it is “obviously” due south.¹¹⁸ In fact, the al-Aqsā Mosque faces about **10° E of S**. The orientation of the Temple Complex and of the al-Aqsā Mosque certainly has nothing to do with the direction of Petra.¹¹⁹ South is not, however, the only *qibla* for Jerusalem.¹²⁰

The *qibla* at Jerusalem based on medieval coordinates used by al-Khalīlī is about 44° E of S; an earlier value based on different coordinates is about 41° E of S (modern value, 23°).¹²¹ The direction **45° E of S or 45° S of E** can be derived using al-Battānī’s approximate method. (This is a result of the fact that in some medieval sources the latitude difference from Mecca and the longitude difference from Mecca are both 10° ; in reality, the former is about twice the latter). Mosque orientations in Jerusalem tend to be dictated by the street pattern, and reliable information is scarce. Some medieval architecture in Jerusalem investigated in the 1970s falls in the range **50°-75° E of S**.¹²²

The White Mosque at Ramla dating from *ca.* 715 faces due south;¹²³ centuries later al-Khalīlī computed the *qibla* at Ramla as **$42^{\circ}56'$ E of S**.¹²⁴

Dan Gibson has convinced himself that the al-Aqsā Mosque was intended to face Petra, a thesis easily demolished because the Mosque was aligned with the Temple Complex, which is roughly in the cardinal directions.¹²⁵

118. On the Mosque see Grabar, “The Umayyad Dome of the Rock in Jerusalem”, and other studies reprinted in the volume *Jerusalem*; Baer, “The Mihrab in the Cave of the Dome of the Rock” (pointing to the difficulty of dating that mihrab); Burgoyne, *Mamluk Jerusalem* (not consulted); and Elad, *Medieval Jerusalem and Islamic worship*; Luz, *The Mamluk City in the Middle East*.

119. Contra Gibson, *Early Islamic qiblas*, pp. 47-48.

120. See Di Cesari, “A *qibla musharriqa* for the first al-Aqsā Mosque?”, represents the first serious attempt by a historian of Islamic architecture to take orientations seriously.

121. King, *In Synchrony with the Heavens*, 1, pp. 350-351 and 386-390.

122. King & Walls, “The sundial of the Madrasa of Sultan Qaytbay in Jerusalem”, p. 21. This seems to be the only study of the *qibla* in Jerusalem.

123. Rosen-Ayalon, “The White Mosque of Ramla”.

124. King, *In Synchrony with the Heavens*, 1, p. 392.

125. Gibson, *Early Islamic qiblas*, pp. 47-48. See also King, “From Petra back to Mecca”.

A recent study of the orientation which compares it with the modern *qibla* could not be expected to achieve a great deal.¹²⁶ Now in 2017 we have a new study by Michelina di Cesari which looks seriously at the orientation of the al-Aqsā Mosque in the light of what we know about the Ka'ba and early determinations of the *qibla*.¹²⁷

(c) Cairo-Fustāṭ

Cairo-Fustāṭ is another example, but the situation there is far more subtle. The Mosque of 'Amr in Fustāṭ, the first mosque in Egypt, appears to have been originally built facing east and then demolished and rebuilt facing winter sunrise, 27° **S of E**, a direction later generally referred to the *qibla* of the *Šahāba*. The Fatimid city was with a roughly orthogonal street-plan built alongside the Pharaonic / Roman Red Sea Canal, fortuitously aligned at 27° **E of N**, perpendicular to winter sunrise. The Mamluks preferred a mathematically-derived *qibla*, as proposed by the Caliph al-Hākim's astronomer Ibn Yūnus, at 37° **S of E**. For this reason the Mosque of al-Hākim and the Azhar Mosque are inclined at 10° to the Fatimid city-plan, and numerous Mamluk religious edifices along the main thoroughfare of the Fatimid city are inclined with the *qibla* of the *Šahāba* on the outside and the *qibla* of the astronomers on the inside. The 10° difference between the orientation of the inner and outer walls can be seen at the windows. I published all this in 1983.¹²⁸

The historian of Islamic art and architecture Christel Kessler was the first to realize the importance of the *qibla* for understanding Mamluk Cairo.¹²⁹ However, she could not be convinced —I did try, since we were both living in Cairo at the same time— that the various *qibla* directions mentioned in medieval texts were sometimes more important than the edifices themselves when attempting to understand the orientations. So she did not recognize the importance of the *qiblat al-Šahāba* and she did not measure any orientations. Since the time of Kessler, entire books have been written on the layout of medieval Cairo, all

126. Wizard, "The Farthest Mosque or the alleged Temple".

127. Di Cesari, "A *qibla mushariqa* for the first al-Aqsā Mosque".

128. King, "Architecture and astronomy".

129. Kessler, "Mecca-oriented architecture and urban growth of Cairo" (1967), and other papers listed in the bibliography.

ignoring orientations.¹³⁰ The only historian of Islamic architecture to have realised the importance of recent studies of the *qibla* for understanding that architecture is Jonathan Bloom. In his 2007 study of Fatimid architecture in Cairo, he acknowledged that the *qibla* of the Al-Azhar Mosque (as that of the Al-Hākim Mosque) was that computed by Ibn Yūnus. And he even mentioned the orientation of the Pharaonic / Roman Red Sea Canal, alongside which the new Fatimid city of al-Qāhirah with its orthogonal *qibla*-oriented street plan was built.¹³¹

In Damascus, Jerusalem and Cairo, as in Córdoba, major mosques and even city complexes were aligned with pre-Islamic edifices of consequence. In each case, the new edifices or complexes were *qibla* oriented, sometimes by coincidentally, but occasionally, as in Córdoba and Cairo, with a little help from a gentle slope.

(d) The earliest mosques at Wāsiṭ

Much has been written about the mosques in Wāsiṭ in al-‘Irāq but their orientations have never been explained. The first one was built in 706 and was later pulled down and replaced with another one, between 1009 and 1155. The striking plan prepared in by F. Safar, the Iraqi archaeologist who conducted the 1936-42 excavations, shows this clearly. Nobody in modern times has ever realized that the first mosque was erected towards summer sunrise. Why did the early Muslims erect this mosque in this way? Because they thought that was a good idea. They had no knowledge of geography or mathematics, but it is not unreasonable to suppose that they knew that the NE wall of the Ka‘ba faced summer sunrise. In the 9th century Muslims came into contact with mathematics and geography, and one of their first concerns was to determine the *qibla* ‘properly’, meaning, according to the definition of their scholars familiar with mathematics and geography (which happens to be the most prevalent modern definition). We have no 9th-century texts stating that the *qibla* at Wāsiṭ was found to be so many degrees and minutes, but we do have the geographical data they would have used and we know how they

¹³⁰ Al-Sayyad, *Streets of Islamic Cairo: a configuration of urban themes and patterns* (1981); Behrens, *Cairo of the Mamluks* (2007); Rabbat, *Staging the City – Or How Mamluk architecture coopted the streets of Cairo* (2014).

¹³¹ Bloom, “Ceremonial and Sacred Space in Early Fatimid Cairo”, pp. 99-100 and 105.

would have used it. It is not surprising that they came up with the *qibla* that they used for the second mosque.

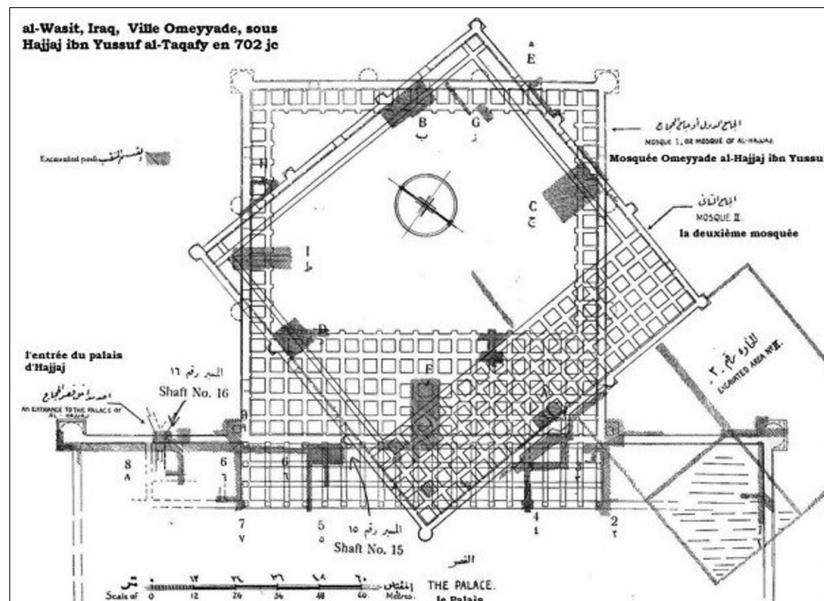


FIGURE 12. This diagram says all that we need to understand about early mosque orientations. The first mosque at Wāṣiṭ was erected in 706 towards winter sunset because it seemed like a good idea at the time. Obviously the Ka 'ba was more or less in that direction, and its NE Wall also faced winter sunset. A few centuries later a replacement mosque was built on the same site in the direction that was computed for the local *qibla* using a mathematical formula and the available data. The modern *qibla* for Wāṣiṭ is irrelevant to any discussion of this situation, which is about 'them', not 'us'.

Those who built those two mosques could never have imagined that 1400 years later people would come along and pronounce that neither of these mosques were facing Mecca at all. Even such a respected scholar of Islamic art and archaeology as Jeremy Johns apparently accepts the absurd and false conclusions of Cook & Crone, based on data that they did not understand.¹³² Johns, like his predecessors, is happy to consider the two mosques at Wāṣiṭ, for example, without discussing the orientations of either (the first is towards winter sunset and the

¹³² Johns, "Archaeology and the history of Early Islam" (2003), pp. 411-415.

second is mathematically computed using the available geographical data). Cook & Crone, and Johns, are innocent of what the early Muslims took as the *qibla* in different parts of the Islamic world, and why.

All this would be of no great concern had such considerations not led to the amateur archaeologist Dan Gibson pronouncing that all of several dozen of the earliest mosques are accurately oriented towards Petra rather than Mecca. Gibson sees the orientation of the Great Mosque in Córdoba as being “parallel” to the axis between Petra and Mecca.¹³³ These claims are easily dismissed using his own data, namely, the orientations themselves. He also thinks that the advanced methods of finding the “pibla” to Petra that were available to the Arabs in Petra in the early 7th century — astrolabes, spherical trigonometry, and more — were derived from navigation, which is all new to the history of science.

16. Concluding remarks

This is the second time I have tried to draw attention to the *qibla* in Qurtuba. The first time (1978) my findings largely fell on deaf ears, except for Prof. Julio Samso, Alfonso Jiménez and Mònica Rius. Mònica addressed the *qibla* problem in the whole of al-Andalus and the Maghrib but her work, first welcomed, then cited, then soon forgotten, has also been mainly ignored by historians of Islamic architecture. The same holds for two articles that I published with fairly explicit titles: “Astronomical alignments in medieval Islamic religious architecture” (1982) and “The orientation of medieval Islamic religious architecture and cities” (1995), which have been barely cited by anyone other than archaeoastronomers.

This would have been of little consequence had it not been for the appearance of Dan Gibson, who thinks he has proven that the earliest mosques face Petra, rather than Mecca.¹³⁴ His absurd theory is easily demolished, but only if one knows the ways Muslims actually used to find the *qibla* in past centuries, which Gibson does not. However, he is part of a network opposed to the religion of Islam that has easy access to the multiple ways of publishing articles and videos on the internet, as googling “Petra *qibla*” or “Mecca Petra” will reveal.

¹³³. See Gibson, *Early Islamic qiblas*, pp. 96–97, and King, “From Petra back to Mecca” and “The Petra fallacy”.

¹³⁴. Gibson, *Early Islamic qiblas*. See my review “From Petra back to Makka” and “The Petra fallacy”.

In conclusion I cite an eloquent plea¹³⁵ by the German mathematician, linguist and polymath, Hermann Grassmann, who in 1844, aged 35, published his monumental work *Die lineale Ausdehnungslehre – Ein neuer Zweig der Mathematik*, literally, on “a new branch of mathematics”. In the second edition of 1862 he expressed his feeling that the first edition had not had the response it should have had amongst his colleagues:

I remain completely confident that the labour I have expended on the science presented here and which has demanded a significant part of my life as well as the most strenuous application of my powers, will not be lost. It is true that I am aware that the form which I have given the science is imperfect and must be imperfect. But I know and feel obliged to state (though I run the risk of seeming arrogant) that even if this work should again remain unused for another seventeen years or even longer, without entering into the actual development of science, still that time will come when it will be brought forth from the dust of oblivion and when ideas now dormant will bring forth fruit. I know that if I also fail to gather around me (as I have until now desired in vain) a circle of scholars, whom I could fructify with these ideas, and whom I could stimulate to develop and enrich them further, yet there will come a time when these ideas, perhaps in a new form, will arise anew and will enter into a living communication with contemporary developments. For truth is eternal and divine.

In 1874 Grassmann’s publisher wrote to him:

Your book *Die Ausdehnungslehre* has been out of print for some time. Since your work hardly sold at all, roughly 600 copies were used in 1864 as waste paper and the remaining few odd copies have now been sold out, with the exception of the one copy in our library.

Today Grassmann’s mathematics is the fundamental of ‘Supersymmetry’ in Quantum Mechanics described as “the most abstract construction of all of physics” and used, for example, at the CERN particle accelerator.¹³⁶

135. I owe these references to Hermann Grassmann to the kindness of Malcolm Cameron, author of *Mathematics the Truth* (available free on iBooks, Amazon, etc.), which includes the information about Grassmann.

136. Grassmann subsequently turned to historical linguistics and the study of Sanskrit. Along with compiling a Sanskrit dictionary he translated the *Rigveda*, an ancient Indian collection of

Nothing gets lost in mathematics. Likewise, the *qibla* is never *extraviada*, “lost”, even though in many places it might seem so. For no mosque from al-Andalus to China and from Central Asia to Yemen was ever built without consideration of the sacred direction. And no historical mosque should be investigated without consideration of its orientation. After all, the *qibla*, for Muslims, guides the believer towards the divine.

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