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On the orientation of pre-islamic temples of north Africa: a re-appraisal (new data in Africa proconsularis)

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Abstract

Since the late 1990s, our research group has embarked on a systematic archaeoastronomical study of archaeological sites in the Maghreb. Earlier campaigns were devoted to Tunisia, Morocco and Libya (see e.g. Belmonte et al. 1998, 1999 and 2002). In this short report, we will present part of the data obtained in a field campaign carried out in winter 2002, analysing the results yielded on nearly 50 ancient sacred structures (temples, churches, earlier mosques and mausoleums) of an extended area in Northern Tunisia (ancient Africa Proconsularis). These data were not discussed in previous reports on similar structures (e.g. Esteban et al. 2001), although, in a previous paper (Belmonte et al. 2003), we reported our results on the contemporary measured megalithic monuments. This paper will present the data of more than 30 temples and mausoleums of Roman era, 10 pre-Islamic Christian churches and a few earlier mosques. These new data will be discussed together with those obtained in previous campaigns in an attempt to shed some light on the possibility of astronomical alignments within this extended set of monuments (more than a hundred). Our results show that some astronomical patterns could be identified. Several structures were oriented towards declinations close to the equinoctial and could be interpreted as solar ones. Interestingly, this solar tendency was continued by Christian churches until the arrival of Islam. This is a common feature to other regions of early Christianity (see e.g. Romano, 1992). Other curious patterns, including the planning of important cities, could presumably be associated to the brightest stars of the sky, Sirius and Canopus. Finally, we will analyse how this astronomical tendencies managed to survive within the first Islamic orienting traditions.

Keywords: *archaeoastronomy, orientations, Roman temples, early Christian churches, Muslim mosques.*

Introduction

In his books of history, the Greek historian Herodotus (IV, 401) tells us that the Sun and the Moon were the only gods to whom all the Libyans made sacrifices. These Libyans were the ancestors of present day Berbers and have been the aboriginal people of the northwest of Africa, from the Nile to the Canary Islands and from the Mediterranean to the Great Saharan Desert, since the beginning of history (Camps 1992, Hachid 2001).

These people founded powerful kingdoms that strongly influenced the history of the ancient world (see e.g. Coltelloni-Trannoy 1997). Mauretania, in present day Morocco and western Algeria, and Numidia, in eastern Algeria and parts of Tunisia and Libya, were the most important. The most famous of all the Numidian kings, Massinisa, is known for his invocation to "the powerful Sun and all the divinities of heaven" when defending his friend, Scipio the African, in one of Cicero_s stories. Their culture was profoundly influenced by Punic and Roman colonizers between 1000 BC and the end of Antiquity (Lancel 1994), but it only started to severely loose its peculiarities, first with the wide extension of Christianity in the region, and specially with the Arabic invasion and the general adoption of Islamic religion from the 7th century onwards. Only in the Canary Islands, part of the original culture (astral cults in particular, see e.g. Tejera Gaspar et al. 2006) were kept, in splendid isolation, until the Castillian conquest and colonization of the islands during the 15th century.

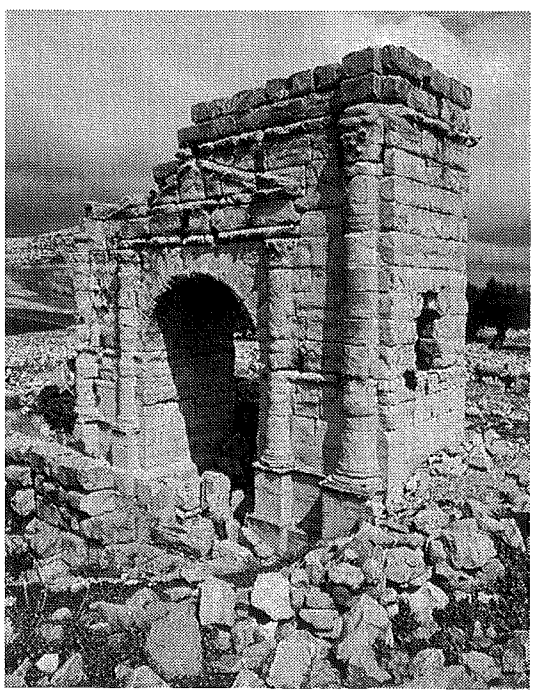

Fig. 1: *The triumphal arch of the Roman city of Thigibba, currently Hamman Zouakra. Tunisia is covered by splendid archaeological sites all around the country. Photograph by Juan A. Belmonte.*

Taking all these facts into account, a team integrated by Canarian astronomers and archaeologists started more than a decade ago a search for astronomical aspects in the culture of these populations and how these interrelate with Punic or Roman traditions. This research is based on the study of the bibliographical sources, like ancient stories or chroniclers, and the impressive archaeological remains that can be found well scattered around the area (see Figure 1). Several field campaigns have been carried out in the islands and in the continent, as already mentioned, studying the potential astronomical references in rock art and monumental remains.

Discussion

In this paper, we will discuss part of the data obtained in a second visit to the ancient Roman province of Africa Proconsularis, in what today is Tunisia, in March 2002. Figure 2 shows the places visited in that campaign. We were able to measure more than a hundred megalithic monuments and a few dozens of other relevant buildings during fieldwork. The data on the dolmens and the rock-carved tombs known as hawanat were already presented in Belmonte et al. (2003). However, here, we are presenting the data obtained in temples and monumental tombs (mausoleums) of Roman era, and ruined Christian churches, at sites not visited in earlier campaigns, or monuments recently excavated, identified or reassigned in already studied sites. Besides, a few historically relevant early mosques are included.

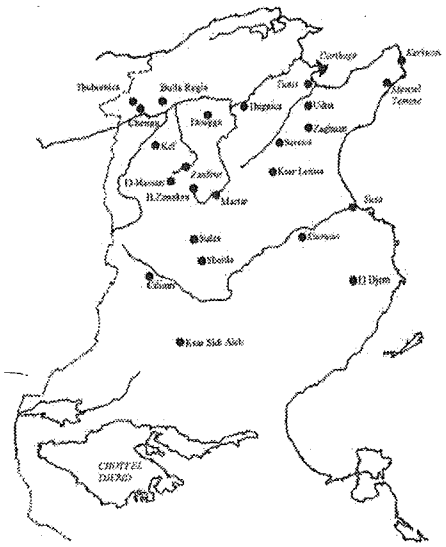

Fig. 2: *Map of Northern Tunisia, showing the location of the localities discussed in the paper, either ruined cities of pre-Islamic era or modern towns.*

Table 1 lists these data.

In Figure 3, relevant orientation diagrams are presented. Panel (a) shows the diagram of all the temples we have so far measured in the North-west of Africa. Previous data, published in earlier works (Esteban et al. 2001) is presented in continuous line while the new data is plotted in dashed line. One interesting outcome is that we have temples orientated in every quarter of the horizon. However, the sensation, already noticed before, of a substantial concentration at azimuths between summer solstice sunrise and due south is indeed reinforced with the incorporation of the new data.

A few new mausoleums were measured in 2002, including the Flavii at Cillium and the impressive couple at El Qsur, near the small village of Sidi Aich (see, Figure 4). These are plotted in Panel (b) together with the rest of mausoleums measured so far in the region. A similar pattern to those of the temples, and to earlier megalithic monuments (see, for example, Belmonte and Hoskin 2002 or Hoskin 2001), could be identified. Finally, Panel (c) is most relevant from the astronomical point of view. It shows the orientation of Christian churches in the region and, with a couple of exceptions at Sbeitla

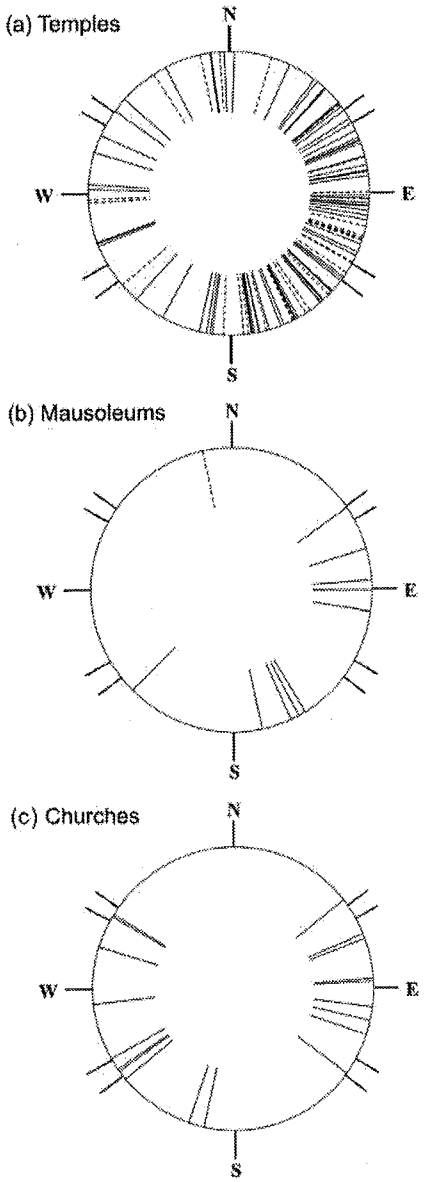

Fig. 3: *Orientation diagrams of the three sets of data discussed in the text: pre-Islamic pagan temples and mausoleums (a & b, respectively) and early Christian churches (c). Data come from Table 1 (dot-dashed line in panel a) and from earlier publications (Esteban et al. 2001 and Belmonte et al. 2002). The lines in the border of the circles indicate the extreme average positions of rising and setting sun (inner ones) and moon (outer ones), respectively. Notice the characteristic concentration for pagan monuments, in a wide range of azimuths between summer solstice rising and south, approximately, and the lunisolar pattern for Christian churches.*

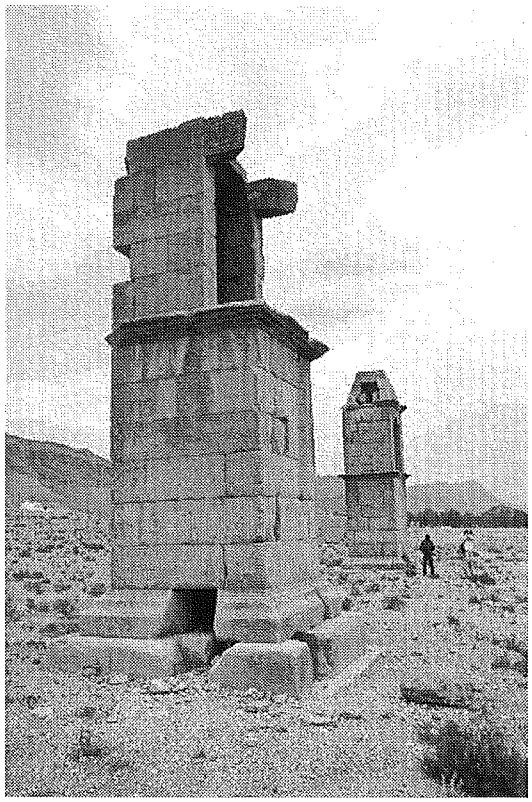

Fig. 4: *Malik (in the foreground) and Malika, the two Roman mausoleums, or Qsur, located in the vicinity of the village of Sidi Aich, near the limits of the cultivated land. They are orientated close to the SE as several contemporaneous monuments in the region. Photograph by Juan A. Belmonte.*

(ancient Sufetula), all of them follow a clear lunisolar custom. Since these are some of the earliest Christian churches ever erected in the Mediterranean region, they perhaps represent the first attempts of including solar aspects in the Christian liturgy.

In earlier works, our team concluded that there was not an established custom in the orientation of temples in the North-west African coast regions. Esteban et al (2001), for example, were deterred by an orientation diagram showing no preferential orientations. However, our new data (see Panel a) might support a different view. This is why we have produced the declination histogram shown in Figure 5, containing the data of orientation of more than one hundred pre-Islamic temples in the region, from the Atlantic Ocean to the Saharan borders of Tripolitania.

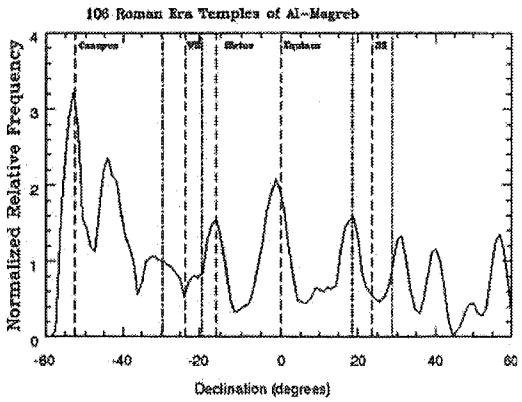

Fig. 5: *Declination histogram of more than a hundred pre-Islamic pagan temples of the north of Africa, from Volubilis, in ancient Mauretania Tingitana, to Golaia, at the desert borders of Tripolitania. The plot has been obtained with the data presented in Table 1 and those data already published in Esteban et al. (2001). Several peaks can be identified in the distribution, including those presumably associated with a near equinoctial custom and with the two brightest stars of the sky, Canopus and Sirius. However, the second most significant peak at about -44 could indirectly be associated to the summer solstice. See the text for further discussions.*

The histogram shows several peaks above the average associated with relevant values of astronomical declinations. There is one relevant peak almost centred at 0°. This we associate with a large number of temples devoted to the sun, or deities of solar character, spread throughout the region. This is beautifully illustrated in Figure 6, where the equinoctial rising sun can be seen along the axis of the Apollo temple in Mactar. Actually, this result could be interpreted as a subgroup of a much widespread "equinoctial", or simply solar, custom identified in many monuments of ancient Western Mediterranean cultures, such as the Garamantians, ancient Iberians or the pre-Hispanic inhabitants of the Canary Islands, as demonstrated in Belmonte et al (2002), Belmonte and Hoskin (2002), Esteban (2003) or Esteban and Delgado (2005). Indeed, we speculate with the possibility that this tradition could have had a remote origin in the orientation practices of the Neolithic cultures of the Sahara (Gauthier and Gauthier 1999).

There is another important peak at a declination of nearly –44°. In principle, there would not be any

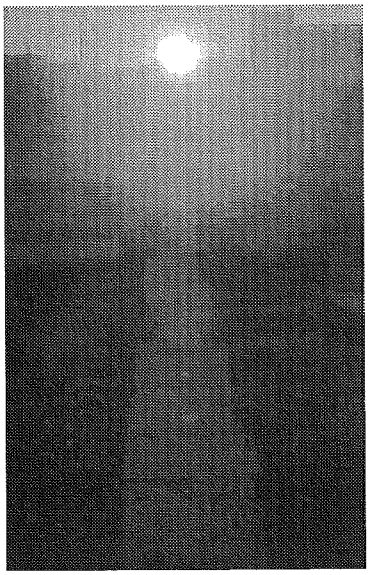

Fig. 6. *The equinoctial rising sun of March 21st 2002 following the axis of symmetry of the sun (Apollo in Roman times) temple of Mactar. The phenomenon is observable close to a knock in a distant mountain which could have been used as a close-equinoctial marker. Photograph by Juan A. Belmonte.*

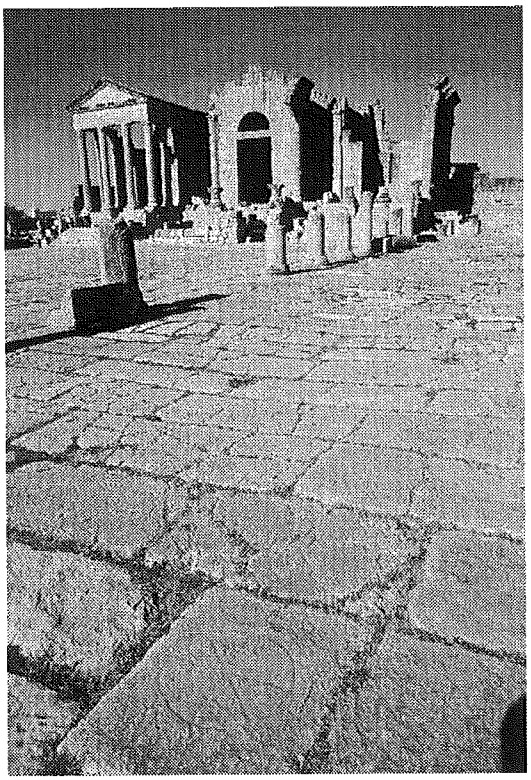

Fig. 7: *One of the mundus engraved at the floor of the Roman forum of the splendid ruins of Sbeitla (ancient Sufetula). It perfectly fits the axes (cardus and decumanus) of the city that could have been orientated (singularly the cardus) to the rising of Sirius, the brightest star of the sky, at the moment of the foundation of the city. Another one shows the cardinal directions. The beautifully preserved local Capitol can be seen in the foreground. Photograph by Juan A. Belmonte.*

astronomical justification for such a peak in the epoch of our interest (nearly from the 2nd Century BC to the 4th Century AD). However, one possible solution appears when we take into account the way in which the Roman cities were planned. Using the groma, the Roman topographers established a squared grid-plan where just one of the fundamental directions of the square ought to be deliberately chosen. For the average latitude of Africa Proconsularis, the declination of –44° corresponds to an azimuth of nearly 150°. The perpendicular to this is 60° and, inverting the problem, this corresponds to a declination of nearly 24°. So, one possible solution to the challenge is that those temples with orientations within this group would have been actually included in a more general grid-plan (as in the case of the ancient city of Seressi, see Table 1) where the direction of one of the sides of the square would have been astronomically fixed by the rising sun of the summer solstice; indeed a very important astronomical landmark.

The square plan was for sure used in the planning of the important Roman city of Sufetula. However, here, the grid-plan followed a different approach. Figure 7 shows the Forum of this beautifully preserved ancient city. There, in the forum, there are a couple of similar engravings in the floor of the precinct. Both are radiated circles divided into eight sections (see Fig. 7) which are supposed to represent the ancient mundus of the city. But, they have completely different orientation patterns. One is orientated according to the cardinal points, thus indicating that the topographers knew the position of these important directions in the surrounding landscape. The second, however, follows precisely the network plan of the city as dictated by the cardus, crossing the

TABLE 1. *For each location, preferably identified by its ancient name (in italics), the table presents the latitude, the nature of the monument under discussion, its azimuth and angular elevation of the horizon and the corresponding declination. In a few cases, a relevant comment is added.*

Place	Latitude	Monument	a°	h°	d°	Comments
Afsa el Hasam	35° 49'	Ruined temple	92½	½	-2	Not yet excavated
Bulla Regia	36° 35'	Small church	235½	1½	-26°1/4	
		Large church	234½	2 1/4	-26 3/4	
Cillium	35° 9'	Forum temple	135½	1	-35 1/4	
		Byzantine church	240	0	-24	6th Century
		Flavii Mausoleum	225½	7	-30	
Mactar	35° 50'	Forum temple	183	0	-54½	
Qairuan	35° 41'	Sidi Oqba mosque	146 1/4	0B	-43 1/4	Main axis
		Sidi Oqba mosque	148½	0B	-44½	*Qibla* wall
		Three gate mosque	149½	B	-45	9th Century
		Barber mosque	149	0	-44 3/4	
Shimitu	36° 30'	Forum temple	356	3½	56½	
		Caelestis temple	174½	2	-54½	
		Dii Mauri temple	147½	2	-41 1/4	
		Ceremonial stair	75½	15½	20 3/4	Way to Saturn temple
Sidi Aich	34° 44'	East mausoleum	152	0	-47	Known locally as *Malek*
		West mausoleum	149	0	-45 1/4	Known locally as *Malika*
Sufes	35° 33'	Sidi Oqba mosque	165	½	-51 3/4	On earlier Roman temple
Sufetula	35° 15'	Minerva temple	109½	0	-16 1/4	
		Jupiter temple	109	0	-15 3/4	
		Juno Temple	108½	0	-15 1/4	
		Anonymous	230	1	-31 1/4	
		Roman temple	107½	½	-14 1/4	Transformed into Servus church
		Three*				
		Saint Church	301	0	24½	*Gervasius, Protasius & Tryphon
		Servus church	287½	0	14	Donatist cathedral
		Forum church	109	0	-15 3/4	Above a Roman structure
		Bellator church	192	b	-53½	Catholic cathedral.
		Vitalis church	199	b	-51	
		Baptisterium	109	0	-15 3/4	
Seressi	36° 9'	Capitol temple 1	151	1½	-44	⊥ at 90° > δ ~23 1/4°
		Capitol temple 2	153	1	-45½	
		Anonymous temple	153½	1	-45 3/4	
Susa	35° 49'	Great mosque	162½	B	-51 1/4	Above the Roman forum
		Mosque of the Ribat	169½	B	-53½	
Thignica	36° 31'	Asclepius temple	266½	2½	-1½	
		Saturn temple	103½	0	-11 1/4	
Thugga	36° 26'	Sun temple	267 3/4	2 1/4	-0 3/4	
		Old Saturn temple	119	1	-22 3/4	
		Venus temple	172½	0	-54	Transformed into a mosque
		Massinissa temple	348	6½	58½	
		Theatre temple	124	½	-27	
		Southern temple	89½	0	0	Near Ateban mausoleum
		Northern mausoleum	99	1/4	-7½	
		Wall bacina	155½	b	-48	
		Christian basilica	97½	1	-5 3/4	Under excavation
Uthina	36° 36'	Capitolium	145½	2½	-39 3/4	
		Unidentified temple	51½	½	30	
Ziqua	36° 24'	Ninfeum	327 3/4	½	41 1/4	Today Zaghuan
Assuras	35° 58'	Extant temple	119½	½	-23½	

forum in a WNW-ESE direction, and the decumanus, perpendicular to this. Thus, from these engravings, we might infer that this grid-plan was deliberately chosen. Moreover, according to this pattern, the cardus, either by chance or by design, is orientated to the rising position of the brightest star of the sky, Sirius, most relevant for several Mediterranean cultures. Curiously, there is another singular peak in the declination histogram at a value of nearly –16° (see Fig. 5) which might be connected to Sirius. Actually, the first author had already proposed that part of the street plan of the city of Sabratha, in ancient Tripolitania, was oriented according to this star (Belmonte and Hoskin 2002) but he did not strongly support this idea because it was a unique case at that moment. Now we might have, at least, two examples of this conspicuous orienting custom.

Exceptionally, other secondary peaks in the histogram could be connected to the moon or even to Arcturus (31°) or Vega (38°), the following bright stars (apart from Canopus, discussed below) in the north African skies, but these are not so relevant and are not supported by other sources, or by the fantastic example of Sufetula, as in the case of Sirius.

Finally, we will discuss the largest and most significant peak of the histogram at a declination of nearly –53°. Considering the latitudes we are dealing with (between 34° and 37°), this could be easily interpreted as the southern accumulation point for orientations close to due south. However, there is another striking possibility, the peak might be associated to the second bright star of north African skies at the turn of the Christian era, Canopus (-52¾° at 1 AD). At our present state of knowledge, we are not able to favour any of these two possibilities.

However, one thing is true and relevant to the discussion, when the Muslims arrived to *Ifriqiya* (the name they gave to Africa Proconsularis) at the end of the 7th Century AD, the converted several ancient buildings into mosques and various of them had an orientation close to a declination of –52_ (see Table 1). There was one spectacular case. Figure 8 shows an image of the oldest mosque in Tunisia, now in ruins. It was erected on an ancient Roman building (probably a temple or basilica) in the city of Sufes (today Sbiba) by the first Arab conqueror of Roman Africa, Oqba Ibn Nafi, as the first monument of Islamic cult in the region. Curiously, either by chance or by design, it was adequately orientated to the rising of Canopus.

David King (1995) has shown that the first Arab expansion across the ancient world, including the Mediterranean shores, brought an unexpected problem to the expanding Muslim armies, the question of establishing a correct *qibla*, i.e. the direction of the Qa'aba in Mecca, for the daily praying. Thus, two groups of opinion, in conflict with each other, were generated. One defended a correct, although approximate, orientation of the *qibla* towards Qa'aba. Another defended that, if a perfect qibla could not be found, it would be preferably to orientate the mosque like Qa'aba, such that the southern wall of the new building (i.e. the *qibla*) would be orientated to the rising of Canopus (as the southern wall of the Qa'aba does). Apparently, this was the solution chosen in the first stages of the conquest of Ifriqiya. So, some ancient monuments, like the temple of Venus in Thugga, were apparently chosen as appropriate buildings to be converted into a mosque because they were orientated close to the rising point of Canopus. However, we are unable to confirm if this astronomical orientation was the original intention of the primeval Libyan, Punic or Roman builders of the monument or not.

Surprisingly, a few years after selecting that particular building at Sufes to be converted into a mosque, Oqba founded a new capital city at Qairuan which, indeed, needed a brand new mosque. As King has stressed, legend tells us that the opinions of the army were divided between those supporting an orientation of the new building to sunrise at winter solstice (near to the correct *qibla* of the place by a few degrees and thus, a "towards Qa'aba" team) and those supporting an orientation to the rising of Canopus (a "like Qa'aba" team). Both groups were severely confronted. Then, Oqba woke up one morning and said that he had got a vision and that the

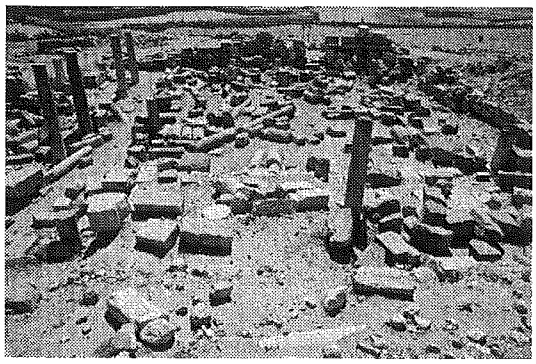

Fig. 8: *Ruins of the mosque of Sidi Oqba at Sufes. The Muslim conqueror chose an appropriately orientated early Roman building to establish the first Islamic cult place of Africa Proconsularis. The building was not properly orientated to Mecca but was accurately orientated like Qa'aba to the rising of the bright star Canopus. Photograph by Juan A. Belmonte.*

qibla for the new mosque in Qairuan would be a certain one. When one features the orientation of Qairuan, it is easy to check that its azimuth is exactly in the middle of those of the winter solstice sunrise and the rising of Canopus, precisely. We can not avoid to be amazed by Oqba's intelligence to give up further conflicts. The debate between "towards Qa'aba" and "like Qa'aba" supporters would continue for centuries being relevant for other important Muslim building such as the big mosque in Cordoba or the famous Qutubiya of Marrakech. However, this is another story.

Acknowledgements

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