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ORIGINAL ARTICLE

Roman literary and epigraphic sources for the study of historical seismicity in Algeria circa 42–420 AD

Sabah Ferdi · Assia Harbi

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Abstract The seismicity of Algeria since the nineteenth century is relatively well documented. However, compared with the numerous damaging earthquakes that are documented since 1850, fewer than a dozen reports of earthquakes are listed for the pre-1850 AD period, suggesting that the historical record is missing a substantial number of earthquakes. This paper examines the use of literary and epigraphic sources relevant to the investigation of seismicity in Algeria during Roman times. We provide examples where the meager written literary record may be supplemented with appropriate archaeological and epigraphic data describing damage to ancient Roman sites. The examples show that collaboration between earth scientists and archeologists is of utility in improving the seismic record and highlights the need for further study of data sources and repositories located both inside and outside of Algeria.

Keywords Algeria · Historical seismicity · Terrae motus · Antiquity · Archeological data · Epigraphy

1 Introduction

The purpose of this article is to examine the historical and archaeological records of earthquakes during ancient times in Algeria. It is generally acknowledged that history is helpful not only to browse the past but also to read the future. As an example before the Mw 6.8 Zemmouri-Boumerdes earthquake of 21 May 2003 (Ayadi et al. 2003), the Boumerdes-Dellys area was believed to be free from damaging earthquakes because of its recent record of modest microseismicity (Mokrane et al. 1994; Benouar 1994; Yelles et al. 2002). However, a brief review of literary sources led us to discover that Dellys, the Roman *Rusucurru*, was previously damaged by a destructive earthquake in about 42 AD (Harbi et al. 2007). In fact, the literary sources describing the seismic character of the central Maghreb (the area of Algeria and part of Morocco) including Numidia province (the eastern part of Algeria, Fig. 1) since ancient times, are quite numerous. Earthquakes were relatively frequent in the first century in the region, and seismic phenomena were well known by its inhabitants as attested by the famous scientist Apulée (125–170 AD) who discussed earthquakes and tsunami in chapters XVII–XVIII of his cosmographic book "De mundo" (Beaujeu 1973).

Although, literary sources now available to us mention only some earthquakes by date and location and degree of severity, epigraphic monuments can be used to provide additional and sometimes more reliable information on the seismicity of sites during antiquity.

At present, there is no critical study of the historical seismicity of Algeria during ancient times. Thus, the present research work provides us with the opportunity to review our knowledge on the subject. Ancient earthquakes in Algeria remain poorly known because literary sources are sparse and give no details enabling us to characterize the intensity of an earthquake or to estimate its effects on people, construction, and the environment.

S. Ferdi
Centre National de Recherche en Archéologie,
Dar El Hamra, 2 rue M. Bouras, Algiers, Algeria

A. Harbi (✉)
Centre de Recherche en Astronomie,
Astrophysique et Géophysique,
BP 63, Bouzaréah, 16340 Algiers, Algeria
e-mail: harbi.assia@gmail.com

Fig. 1 Geographical situation of Numidia, re-drawn from Leppeley (1981)

In addition, the archaeoseismological investigations of past earthquakes are only in their infancy in Algeria. The purpose of this paper is: (1) to show that earthquakes have damaged or destroyed early settlements in Algeria; (2) to underline how far it is important to critically combine the literary and archaeological information; (3) to draw the attention of archaeologists and earthquake scientists in Algeria to the necessity to interact to distinguish between earthquake damage and damage from other causes; and (4) to infer from the retrieved information, the sites which should be the subject of critical and urgent geoarchaelogical studies.

2 Problems of historical earthquake research in Algeria and the main objective of the present study

Rewriting the seismic history of Algeria is a rather difficult task because of the lack of records of past

earthquakes. The different existing compilations of earthquake catalogues of Algeria (Perrey 1847; Chesneau 1892; Sieberg 1932; Galbis 1932; Rothé 1950; Hée 1950; Mezcua and Martinez 1983; Benhallou 1985, Ambraseys and Vogt 1988; Vogt and Ambraseys 1991; Mokrane et al. 1994; Harbi et al. 2010) both local and regional, do not include seismic events (or very few) of the different periods the country experienced (Harbi et al. 2010) as shown in Fig. 2. For the pre-French periods, we are obliged to start from the scratch. The survey of documented material sources we conducted previously in the framework of the revision of historical seismicity of Algeria was inconclusive concerning the antique, middle age, Spanish, and Ottoman periods. This is why a partnership is being formed between seismologists, geologists, historians, and archaeologists to compensate for the lack of sources and to fill the gaps in the earthquake catalog of Algeria.

The earthquake catalog of Algeria is short compared with that of other Mediterranean countries due to historical circumstances. Written sources, such as diaries, chronicles, poems, and even books undeniably existed. Moreover, each prince of the middle age and Ottoman periods had his own historiographer documenting all the phenomena that occurred during his reign: earthquakes, inundations, diseases, drought, invasion of locusts, etc. (Al Djillali 1995). As mentioned above, the famous scientist Apulée (125–170 AD) summarizes knowledge of earthquakes and tsunami in the first century AD, in his cosmographic book "De mundo" (Beaujeu 1973), although he reports no seismic events that specifically occurred in Algeria. Tlili (2000) informs us that libraries existed in ancient Algeria at Timgad and Hippone (*Bibliotheca Ecclesiae Hipponensis* of Augustine). Very likely, the original sources available to early writers have been lost or destroyed as no written trace has been preserved, and most of the literary sources that remain are derivative. Although these original sources may possibly be discovered in the archives of former occupying powers (Spain, Turkey, and France), epigraphic documentations, described here, provides a local source of information on historical earthquakes.

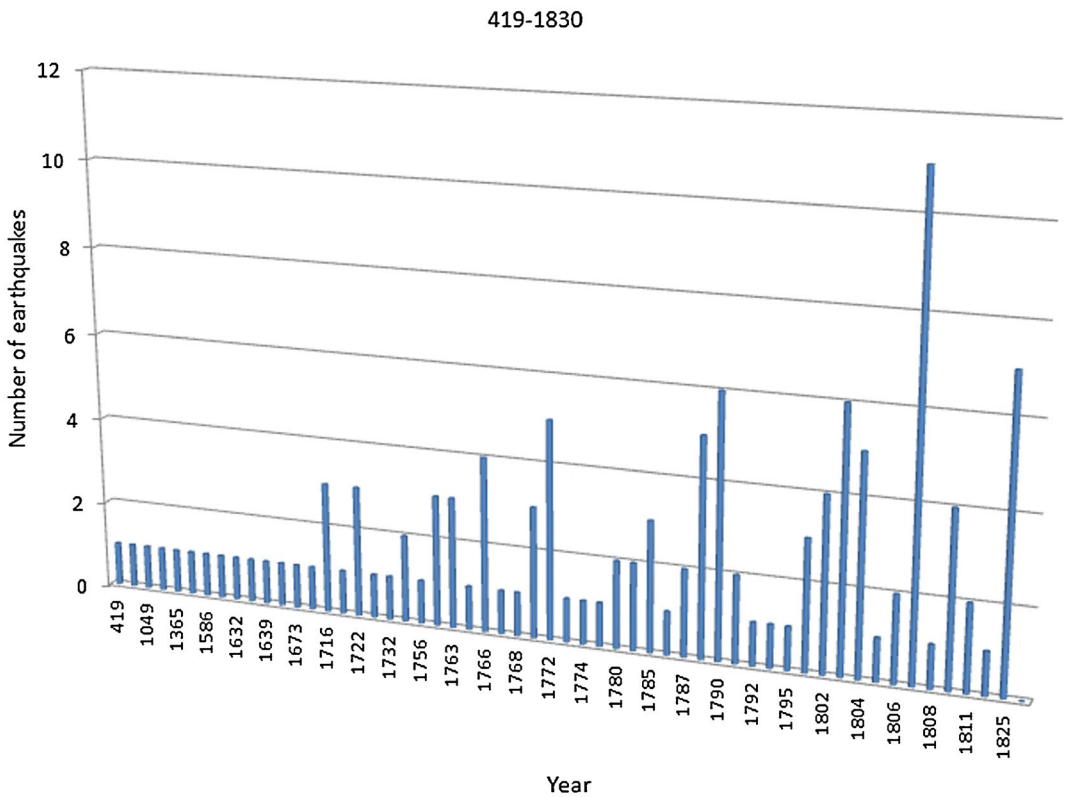

Fig. 2 Histogram of the number of earthquakes versus time during the pre-French period (the data are from Harbi et al. 2010 and CRAAG data file)

On the basis of what we already know on the damaging and destructive earthquakes that struck Algeria and aiming at expanding our knowledge on that topic, the question to which we seek to answer is the following: is there any material relating to earthquakes of Algeria in antiquity and how reliable are these sources? This issue is critical. In the following study, we have adhered to two important tenets: (1) report all the earthquakes retrieved in the literature as having occurred during ancient times in Algeria and/or the information on damage to monuments caused (or interpreted by authors as likely caused) by earthquakes and (2) attempt to qualify the reliability of the retrieved information. This approach is dictated by the need to exercise caution to prevent the introduction of the seismic events into the historical catalogue of questionable reliability that would otherwise prove detrimental to the assessment of seismic hazards in Algeria.

3 The source materials

3.1 The epigraphic documentation and original literary sources

Epigraphy is a historical and archaeological science aiming at studying, indexing, and decrypting ancient engraved inscriptions (Cagnat 1890). The first earthquake we discuss is located at *Nigrenses Maiores* in Numidia (now Henchir Besseriani, Fig. 3). Two Latin inscriptions on arches were found about 300 m to the north and to the west of the "porte du camp antique" (door of the ancient camp), respectively. These inscriptions drew the attention of several archaeologists who examined them and suggested restorations as widely described and discussed by Laporte and Dupuis (2009, pp. 59, 73, 82–84). The first inscription (Corpus Inscriptionum Latinorum (CIL) 1881, VIII, 2480) is a dedication engraved on the northern arch from the time of Carus, Carin and Numérien (283). The second inscription (Corpus Inscriptionum Latinorum (CIL) 1881, VIII, 2481) is a dedication on the western arch dated 286–287. These two passages evoke an earthquake (*terrae motus*) that occurred during the night when the inhabitants where sleeping. According to Laporte and Dupuis (2009): "in 267 (under the consulship of Paternus and Arcesilaus), an earthquake damaged the city. At that time it was governed by two *duumvirs*, Pomponius Macianus and Clodius Victor, who promised the construction (or the reconstruction, there is no knowing) of two arches at their own expenses and *ob honorem*, that means because of their promotion to the "duumvir position." But construction was delayed 20 years later, around 286–287, the Governor of Numidia Flavius Flavianus inaugurated these constructions." Hereafter, the last version of these inscriptions completed by Laporte and Dupuis (2009) and where the word *terrae motus* is highlighted:

> "Pro salute dd(ominorum) nn(ostrorum) (Diocletiani et Maximiani Augg(ustorum)…ar(cum in ho(c municipio Nigrensium/quem Clodius Victo(r et Pomponius ob honorem duumui(ratus promiserant an<te>? terrae mo/tum quod patriae, Paterno e(t Arcesilao co(n)s(ulibus)…)ESSIS (ou: ESSOLIS) contigit, dedi(c)ante u(iro)

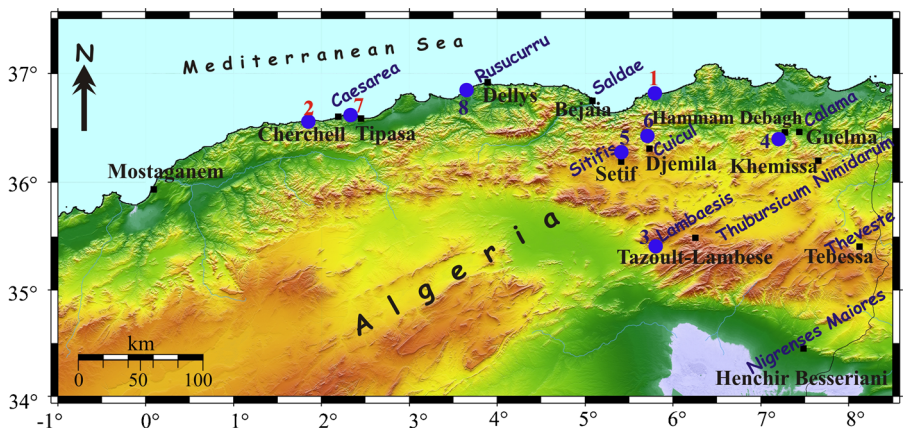

Fig. 3 Algerian cities cited as having experienced earthquakes in ancient times. The name in *blue* corresponds to the Roman name of the respective city. *Squares*, city; *circles*, epicenter; *numbers 1, 2, 3, etc.* correspond to the event listed in Table 2

p(erfectissimo) Flavio Flaviano p(raeside) N(umidiae), Clodius Victor, fl(amen) p(er)p(etuus) ?, et T(itus) ? Flavius Paulinianus…tr(ibuno), c(uratore reip(ublicae) ".

The date of the Nigrenses Maiores earthquake remains equivocal since it is inferred from the epigraphic inscriptions (2480 and 2481+17970) by several authors (see Leppeley 1981; 1984), even if most of them agreed on this date (see Laporte and Dupuis 2009, p. 86).

The second seismic event (circa 419), that is believed to have occurred in Numidia, is mentioned in a sermon by Saint Augustin (Aug. Serm. 19.6) delivered at Carthage in 419 (Mohammedi et al. 1991; Guidoboni 1994; Harbi et al. 2003a). In this sermon (Aug., Serm. 19.6), the famous bishop refers to a "very serious" earthquake which shook Sitifis (Setif now, Fig. 3) and constrained the population of Sitifis to stay in the country and open space during probably 5 days, this event would have led 2,000 persons to baptism. Here is the corresponding text:

"Sitifensis etiam civitas gravissimo terrae motu concussa est, ut omnes forte quinque diebus in agris manerent, et ibi baptizata dicuntur fere duo milia hominum".

The reference to the occurrence of an earthquake is clearly established for the two dated events, cited above, and by the mention *terrae motus*.

Although these written sources provide us with ambiguous data, the archaeological data provide additional data on the seismicity of at least one site. In fact, several well-dated inscriptions give evidence of restoration and reparations work, and even reconstructions of monument without specifying to the best the cause of destruction. Thus, the 267 earthquake may be related to the ruins attested by an inscription of Tazoult-Lambèse of the same time (Corpus Inscriptionum Latinorum (CIL) 1881, VIII, 2571):

"[Im]p(erator) [C]aesar P(ublius) Licinius Egnatius Ga[llien]us Pius [Felix Invictus Aug(ustus) pont(ifex) max(imus) tri]b(unicia) pot(estate) XVI co(n)s(ul) VII/[pater] patriae proco(n)s(ul) gromam Te[rtiis] Augustani[s 3 restituit] Ten[a]gino Prob[us]/pra[eses] prov(inciae) Nu[midiae dedicavit].
[Im]p[p(eratoribus) C]aess(aribus) C(aio) Aurelio Valerio Dioclet[ia]n[o] e[t M(arco) Aure]lio Valeri[o Maximiano Invictis Augg(ustis)]/[pater] patriae proco(n)s(ul) gromam Te[rtiis] Augustani[s 3 restituit] Ten[a]gino Prob[us]/pra[eses] prov(inciae) Nu[midiae dedicavit]".

This last example highlights the importance of epigraphy. Gsell (1901) reported the earthquake of *Lambaesis* (Tazoult) referring to a fragment of an inscription dated 267. Based on this fragment, he assumed that the earthquake occurred in 237 while other authors suggest 267 as the year of the occurrence of the earthquake (see above). Here is the text of Gsell (1901), translated from French: "One concludes, with some probability, that the undertakings carried out in 238 were aimed at repairing the damage caused, the year before, by a tremendous earthquake."

Another earthquake occurred probably at Thubursicu Numidarum (Khemissa now, Fig. 3) (possible before 355 AD, Lepelley 1984) where several inscriptions attest to the deteriorations of statues and monuments and their transfer to another place. That is, the inscription ILAlg, 1, 1229 evokes a transfer, to the forum novum, of a statue taken from a place in ruins by the Legate Theodotus (see Leppeley 1981). The inscriptions (ILAlg 1247 and ILAlg 1276) inform us about the removal of imperial statues (of Trajan and Constantin) from their initial location, which was ruined, and their transfer to the *forum novum* of the city (see Lepelley 1984). The inscription (ILAlg 1276) evokes considerable work in the new city's forum and moving columns and statues from the old place (*platea vetus*). This archaeological documentation which insists on the transfer of vestiges from a ruined place towards another, permits speculation that it followed the occurrence of a natural disaster (an earthquake?) even if the available epigraphic sources do not clearly mention it.

Referring to an epigraph (Corpus Inscriptionum Latinorum (CIL) 1881, VIII, 8935, see below) reported in Burnand (1983), Fareh (2008) mentions the probable occurrence of earthquakes which could have caused the collapse of equestrian statues in the forum of Saldae (Bejaïa now, Fig. 3) while the inscription refers to the decrepitude (by the word "vetustate" meaning old age) as the cause of the damage. However, there is neither indication on the date nor a clear mention of the earthquake occurrence:

"Sex(tus) Cornelius L(uci) f(ilius) Arn(ensi) Dexter Maximus/eq(ues) R(omanus) omnib(us) patriae honoribus functus et/Sex(tus) Cornelius

> Sex(ti) f(ilius) Arn(ensi) Dexter Petronianus/ statuas equestres pro patrui sui vetustate conla <p=B>sas/e foro ad ornandum templum permissu ordinis/transtulerunt ac sua pecunia restitue/ runt dedicaveruntque".

The 365 Crete "universal" earthquake (M 8.5), which triggered a destructive tsunami that have affected the coasts of Egypt and widespread seismic destructions in Crete, Sicily, and Libya (see Shaw et al. 2008; Stiros 2010 and references therein), is a matter of debate among archaeologists of Ancient Algeria (Rebuffat 1980; Blanchard-Lemée 1983; Lepelley 1984; Jacques and Bousquet 1984). For Rebuffat (1980), the public works conducted during the years 364–367 in Numidia, where the governor Publilius Caeionius Caecina Albinius inaugurated 15 "workmanships," could have as their objective to remove the ruins caused by the 365 earthquake at Cuicul. According to this author, the various destructions, pointed out by Allais (1971) and which affected the western district are probably due to different factors among which the occurrence of the 365 earthquake. Rebuffat supports his assertion by an inscription dated 367 at the latest (published by Albertini 1943) and commemorating the construction of the basilica that replaced the Frugifer temple and where we are told that the basilica was build: "after having cleared the ruins that rise higher than the ridges of the buildings themselves":

> "pro beatitudine ac felicitate temporum dd nn valentiniani et valentis semper augg basilicam dignam coloniae cuiculitanae egestis ruderibus quae ipsis iam altiora essent culminibus civiltatis a fundamentis construxit exornavit dedicavitque publilius ceionus caecina albinus vc consularis sexfacalis provinciae numidiae curantibus p f cecilio patricio fl(amine) p(erpetuo) tulio prestantio fl(amine) p(erpetuo) pomponio pudetiano f(lamine) p(erpetuo) dom(itio) rustico g.s.s faustiniano".

For Rebuffat "the collapse of the Frugifer temple and other monuments, collapse caused by the earthquake would have certainly created these enormous piles of ruins, quite high so as to top the buildings ridges still standing."

Blanchard-Lemée (1983), Lepelley (1984), and Jacques and Bousquet (1984) also examine this issue. By carefully examining the archaeological data, previously used by Rebuffat (1980) and on which he based his demonstration, Blanchard-Lemée (1983) attempted to refute the reasoning of this author that led him to attribute to 365 a number of epigraphic and archaeological data. Taking into consideration historical and social factors, she concludes that the archaeological data remains silent on the causes and dates of the observed destructions at Cuicul. Lepelley (1984) questions the effects of the 365 earthquake at Cuicul early in the title of his contribution: "North Africa and the *alleged* earthquake of 21 July 365", arguing that it is impossible, from geological point of view, to have an earthquake, with offshore epicenter in Eastern Mediterranean, causing destructions at 1,800-km distance. A careful examination and synthesis of the inscriptions found in North Africa led him to contest the interpretation of previous authors because "the evocation of earthquakes on inscription is not a taboo in North Africa as reported for Ad Maiores earthquake" (see above). A painstaking study of all the sources related to the 365 is also conducted by Jacques and Bousquet (1984) who confronted all the sources and analyzed them by taking into account the historical and geographical contexts. That research led them to refute the "universal" character attributed by ancient authors to the 365 seismic event and its destructive effects at Cuicul.

3.2 Non original sources

Secondary materials reproduced and repeated in history books and periodicals frequently emphasize the seismic character of Algeria, mentioning cities that experienced earthquakes during historical times. The beginning of the French colonization in Algeria (and even few years before) has seen an unprecedented production of books describing Algerian cities and their history. We present in an Appendix some examples derived from literary sources about the cities of Guelma, Cherchell, Mostaganem, and Tebessa, where seismic events are believed to have occurred in antiquity (see locations on Fig. 3). The problem with these non contemporaneous sources is that their authors do not quote their sources. The inability to verify stated conclusions in these secondary accounts means that they may contain serious errors through inaccurate repetition, exaggeration, and the omission of precise date information (see Appendix for more details).

Table 1 List of the earthquakes that occurred in Algeria during the ancient times

Date	Longitude (°E)	Latitude (°N)	Site	Observations	Kind of sources	References
42	3.89	36.92	Rusucurru	Destructive	Secondary	Robert (1891)
267 ?	7.48	34.45	Nigrenses Maiores	Terrae motus, damaging	Primary	Corpus Inscriptionum Latinorum (CIL) (1881, VIII, 2480, 2481, 17970)
267 ?	6.26	35.49	Lambaesis	Destruction caused probably by an earthquake	Primary	Corpus Inscriptionum Latinorum (CIL) (1881, VIII, 2571)
355 ?	7.65	36.2	Thubursicu Numidarum	Deterioration of statues and monuments caused probably by an earthquake	Primary	ILAlG1 (1229, 1247, 1276)
365 ?	5.73	36.31	Cuicul	Collapse of a temple and monuments caused probably by an earthquake. The date is controversial.	Primary	Epigraphy in Albertini (1943)
365 ?	0.09	35.93	Mostaganem		Secondary	Rozet and Carette (1850)
419	5.41	36.19	Sitifis	Terrae motus, damaging	Primary	Augustin Sermon 19.6
Ancient time	5.08	36.75	Saldae	Collapse of statues interpreted by an ancient author as probably caused by an earthquake and not due to decrepitude as reported on the inscription	Primary	Corpus Inscriptionum Latinorum (CIL) (1881, VIII, 8935)
Ancient time	2.19	36.61	Caesarea	Destructive	Secondary	Boutin (no date), Raynal (1826), Shaw (1830), Salle (1832), Nouvelles annales des voyages (1840), Marmier (1847), Rozet and Carette (1850), Barbier (1855), Revue de l'Orient (1848), Berthet (1884), and Cagnat (1913)
Ancient time	7.43	36.47	Calama	Destructive	Secondary	Barbier (1855)
Ancient time	8.12	35.41	Theveste	Damage to the statue of the Emperor Caracalla, probably caused by an earthquake	Secondary	Recueil des notices et mémoires de la société archéologique de la province de Constantine (1863)

4 Discussion and conclusions

Investigation of available documentary sources has allowed us to incrementally improve our knowledge on Algeria seismicity. Our main findings are as follows. Two original sources explicitly mention, by the Latin word "terrae motus," the occurrence of earthquakes. The first one, an epigraphy, reports an earthquake that occurred at Nigrenses Maiores in 267; and the second one, a literary source, refers to the 419 Sitifis earthquake (Table 1). Other inscriptions report damage, destruction or restoration whose origin could be earthquakes or other causes: the epigraphic inscriptions found in Tazoult-Lambèse (267 ?) and Khamissa (circa 355 ?) where restoration of the sites were conducted following a probable earthquake according to ancient authors. The collapse of equestrian statues in the forum of Saldae is ascribed to an earthquake instead of the decay as reported in the inscription (Fareh 2008). The Crete 365 earthquake raised a controversial debate among archaeologists between those who believe in the effects it could have produced at Cuicul and those who refute that assertion. Less reliable secondary literary sources inform us that Cherchell, Tebessa, Mostaganem, Guelma, and Tazoult-Lambèse experienced damaging to destructive earthquakes but fail to report the sources of their data. The results obtained in this study raise many questions, among which the following ones: (1) when the origin of the destruction or restoration is not clearly established in the inscriptions, how it is possible to affirm that it is caused by an earthquake? Why it is undoubtedly mentioned for Nigrenses-Maiores and not for Thubursicu Numidarum or Saldae ? (2) The information we retrieved does not allow us to define a clear and accurate dating of the seismic events which would have occurred in ancient time. (3) According to the interpretation of the epigraphic inscriptions, two earthquakes occurred in Numidia in the year 267 at Nigrenses-Maiores and Lambaesis at 120 km to the North-West; could it be the same earthquake or different seismic events that occurred within a short lapse of time? Indeed, a destructive earthquake at Nigrenses-Maiores could produce damaging effects at Lambaesis and vice versa but details are lacking.

Clearly, there were several earthquakes near the time of the Crete 365 earthquake as pointed out by Stiros (2010). Moreover, the recent seismicity of Djemila (formerly Cuicul) (Table 2) makes plausible the assumption that it was previously hit by an earthquake, not necessarily in 365 but probably in ancient times. The only way to clarify the precise date of the inferred 365 seismic event at Cuicul, is to conduct a detailed geoarchaelogical study of the site.

The seismicity of Algeria in the 19th and 20th centuries shows that the majority of the cited sites (Table 1) experienced destructive and/or damaging earthquakes (Table 2; Fig. 3). Therefore, it is not surprising to find out that they were affected by seismic events in ancient times. The seismotectonics of Numidia was already underlined in previous studies (see for example Fig. 5 in Harbi et al. 2003b). However, attention has to be paid to some regions as Henchir Besseriani where no damaging earthquake has occurred recently.

In conclusion, we remark that the epigraphic and primary literary sources provide us with some indications on the seismicity of Algeria during the Roman

Table 2 List of the most destructive or damaging earthquakes that affected the cities (or their surroundings) mentioned as having experienced earthquakes in ancient times (see epicenters in Fig. 3)

No.	Date (y.m.d)	Longitude (°E)	Latitude (°N)	Intensity (EMS°	Site	Remark	Reference
1	1856.8.22	5.79	36.82	IX	Djidjelli	VII-VIII at the ancient Saldae	Harbi et al. (2011)
2	1891.1.15	1.85	36.56	IX	Gouraya	VII at the ancient Caesarea	Maouche et al. (2008)
3	1924.3.16	5.80	35.40	VIII	Mac Mahon	Damaging at the ancient Lambaesis	Benouar (1994)
4	1937.2.10	7.20	36.40	VIII	Guelma		Benouar (1994)
5	1957.11.13	5.41	36.28	VI–VII	Sétif		Harbi and Maouche (2009)
6	1977.4.14	5.71	36.43	VI–VII	Djemila		Harbi and Maouche (2009)
7	1989.10.29	2.33	36.62	VIII	Tipasa	VII at the ancient Caesarea	Benouar (1994)
8	2003.5.21	3.65	36.85	X	Zemmouri	X at the ancient Ruscurru	Ayadi et al. (2003)

period. The secondary sources should indeed be taken with great caution especially as they are often based on assumptions not easily verifiable. We also note the existence of several epigraphic mentions indicating an activity of reconstruction and restoration of public buildings since the severe period at the end of the fifth century in ancient Algeria (Jouffroy 1986) but none of them evokes a natural disaster with precision. However, only an in situ examination of the main monuments could provide us with answers for better knowledge of historical seismicity of ancient Algeria with greater reliability. This is corroborated by preliminary investigations conducted in one of the Roman quarries in Hammam Debagh (Maouche et al. 2013) and around Tipasa (Maouche et al. 2009), respectively. Additional studies, based on fieldworks, must be performed on the sites reported in Table 1.

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Appendix: The seismic character of the Algerian cities in the literary sources

We present hereafter some examples (not an exhaustive list) derived from literary sources about some cities where seismic events seem to have occurred during the antiquity:

(a) *Cherchell* (formerly Caesarea)*:* This is the most cited city for having experienced earthquakes during the Roman periods. Several authors (Boutin (no date); Raynal 1826; Shaw 1830; Salle 1832; Nouvelles annales des voyages 1840; Marmier 1847; Rozet et Carette 1850; Barbier 1855; Revue de l'Orient, 1848; Berthet 1884, Cagnat 1913); some notes here below:

> "The small city of Cherchel located at 22 miles to the west of Algiers, is build on the ruins of an immense city, whose vestiges are still visible […] Its port is overgrown of debris of the old city which one thinks was destroyed by an earthquake" (Boutin, no date, p. 156).
>
> "There is an ancient tradition relating that the entire city of Cherchell was destroyed by an earthquake, and its harbor, very big at that time and very convenient, was overturned and overgrown by the arsenal and several other buildings thrown down there following an extraordinary shaking. The "Cothon" which communicated with the western part of the port confirms this tradition because when the tide is low and calm, which often happens after the south and east winds, one see that the bottom of the basin is scattered with large columns and fragments of walls, which certainly have been carried by a tremendous earthquake" (Shaw 1830).
>
> "… while Julia Caesarea, which was a first-class city with a good harbor and a "cothon" viz. an artificial basin where all the city was overturned by an earthquake; Julia Caesarea was located at 20 miles to the east of the present Cherchell" (De Salle 1832).

(b) *Guelma:* Referring to the book of Victor Bérard, Barbier (1855) informs us that "Guelma, was founded by the Romans by the name of *Calama*, in order to command the Numidian city *Suthul*, Salluste talks about, and which was located on the other side of the *Seybousse* river, running from west to east. Calama, mentioned by Paul Orose and Saint Augustin, was overturned by an earthquake in early times and was no longer inhabited since then" (Barbier 1855, p. 185).

(c) *Lambèse*: "… regarding Lambèse, the report demonstrates that the praetorium rebuilt at the end of the third century after it had overturned by an earthquake, was cleared …" (Bulletin de la Société archéologique du Midi de la France of 19 January 1901).

(d) *Tebessa (formerly Theveste)*. In the periodical "Recueil des notices et mémoires de la société archéologique de la province de Constantine (1863)", we may read the following text: "a detailed notice of the engineer officer Captain Hinstine accounts for the works carried out around the triumphal arch. The report informs us that a marble torso was found at the top of the arch. According to the specialists, this torso is unhesitatingly attributed to the emperor Caracalla whose statue was to decorate the

tetrastyle shaken by an earthquake so much as to require its reconstruction."

(e) *Mostaganem* "is located at a half mile from the sea and six miles south of the Chellif River, on the edge of a ravine within which the Aïn Sofra stream runs. […] On the seaside, there is only the port management, two or three stores and a jetty at the mouth of Aïn Sofra. The town is built on a sandy limestone rock, at eighty-five meters above sea level. Some people noticed the cut aspect of this coast and attributed the age of the Mostaganem shoreline to the period during which terrible earthquakes struck northern Africa, towards the mid-third century AD." (Rozet et Carette 1850).

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