Critical Revision of Earthquakes in the Iberian Peninsula before Year 1000

Introduction

The study of historical earthquakes is based on written sources or archeological evidences. The most reliable historical sources are naturally those of contemporary authors or of authors who quote contemporary sources that are not preserved. In absence of contemporary accounts of the events we may find reliable information in later historians who may have had access to sources nearer to the events, although they may not give their explicit reference. More problematic is, for example, the information about events in antiquity given in works of historians or chroniclers of the 16th or 17th century. This is often the only sources we have for many earthquakes in the Iberian Peninsula. On these sources are based the lists or catalogs of earthquakes, the first compiled in late 17th century, which acquire modern form in the 19th and 20th centuries. These catalogs depend on one another and it is important to find the first catalog where a particular earthquake is found.

Earthquakes in the Iberian Peninsula can be found in global catalogs and specific catalogs or lists of earthquakes for the region, beginning in the end of 17th century (Munoz and Udias, 1982). The catalog of Martinez-Solares and Mezcua (2002) (MSM) is the most recent one for earthquakes of the Iberian Peninsula before 1900 and is reproduced in the official catalogue of the Instituto Geografico Nacional (Madrid, Spain) (www.ign.es/ign/layoutin/sismoFormularioCatalogo.do)
This catalog (MSM) includes 29 earthquakes before the year 1000 and they are the subject of the present analysis. These earthquakes can be found in earlier catalogs, global and regional or specific for the Iberian Peninsula which in chronological order are. Global Catalogs: Bonito (1691) (MB), Zahn (1696) (JZ), Moreira de Mendoza (1758) (MM), Von Hoff (1840) (VH). Iberian Peninsula Catalogs: Perrey (1847) (AP), Sanchez Navarro-Neumann (1917, 1921) (NN), Steikhardt (1932) (ST) (reproduced in Sieberg, 1932), Galbis Rodriguez (1932, 1934) (GR), Munuera (1963) (JM) and Mezcua and Martinez-Solares (1983) (MMS). In the global catalogs for this period (before year 1000) for the Iberian Peninsula, MB includes three earthquakes and JZ none. MM includes 11 earthquakes and VH only four. Particular catalogs for the Iberian Peninsula begin with AP and followed by NN and GR. AP begins at 1009. Before year 1000 NN includes 10 and GR 25 earthquakes. ST list of earthquakes of the Iberian Peninsula includes only four earthquakes before year 1000. More recent catalogs are all based on GR. JM introduces the geographical coordinates and magnitudes for each earthquake. Coordinates correspond to the localities where the earthquake was felt or its damage was greatest, so they cannot be considered as epicentral coordinates. Magnitudes are supposed to be based on maximum intensities assigned to each earthquake and them through an algebraic relation converted into magnitudes. This is a very questionable method, especially for earthquakes of this time with so little information. These coordinates and magnitudes cannot be considered representative. Some modern catalogs follow this practice and give very precise values of these parameters for historical earthquakes with insufficient evidence, ignoring the great uncertainties present (Ambraseys *et al*., 1983). Coordinates and magnitudes are maintained in MMS, but not in MSM, where coordinates are only given for nine events before year

1000. Intensities are given in some cases by NN but not by MMS and only in one case by MSM.

For the study of earthquakes in the Iberian Peninsula before year 1000, the most important point is the analysis of the historical sources on which the information used in these catalogs is based. Here I will analyze these sources and how they have been used in the different catalogs. The period covers some 2000 years beginning in year 1000 B.C., approximate date for the founding of the city of Gadir (old name for Cadiz), one of the oldest cities of Spain. It can be divided into four periods: Pre-Roman (Phoenician, Greek and Carthaginian settlements) till 205 B.C.; Roman 205 B.C. to 520 A.D.; Visigothic 520-712; Arabic 712-1000. Information about earthquakes in the Iberian Peninsula for the pre-Roman and Roman period from contemporary sources should be found in Greek and Roman historians. However, not a single reference has been found in these historians about the occurrence of any large earthquake in the then Roman province of Hispania. Guidoboni (1989) in the thorough study of Greek and Roman sources about earthquakes in the Mediterranean region does not mention any reference to any earthquake in the Iberian Peninsula. No contemporary historical sources either have been found for earthquakes in the Visigothic epoch. Saint Isidore, Bishop of Seville, in his history of the Goths written about 620 A.D., makes only a short referent about earthquakes during the war against the Huns (about 450): "During this time there were many prodigious signs in the heavens and in the earth which were significant of such a cruel war. There were frequent earthquakes, the moon darkened, …" (Rodríguez Alonso, 1975). This relationship between extraordinary events and earthquakes can often be found in later historians. It must be seen as a literary genre and not necessarily as reference to actual events. Therefore, for these three periods the oldest sources we have about the occurrence of earthquakes in the Iberian Peninsula are from historians of the 16th and 17th centuries. For the Arabic period, however, we do have information about earthquakes in Arabian historians of the eighth to thirteenth centuries, practically contemporary with the events. The earthquakes of this late period are, then, the first we have reliable information.

Earthquakes before year 1000

This study of the earthquakes in the Iberian Peninsula before year 1000 follows the list of events according to MSM. MM followed by GR, begins with the first earthquake of which there is notice in 1030 B.C., but MM himself considers it very doubtful. It is not included in MSM and will not be considered here.

880 B. C. MM is the oldest reference for this earthquake which he locates at the Pyrenees Mountains. He is based on the work of the Spanish historian Esteban de Garibay (1533-1599) (Garibay, 1571). However, in this place (Garibay, 1571, vol. 1, book 5, chap. 3) Garibay does not refer to an earthquake in 880 B.C., but to one in 500 B.C., which is also included by MM. Garibay uses in this and other cases the history of Florián de Ocampo (1499-1558), a chronicler of Charles V, author of one of the first histories of Spain from antiquity to the 15th century (Ocampo, 1543). However, for reports about antiquity in the Iberian Peninsula, Ocampo is not considered to be very reliable by modern historians (Caballero, 2002). Ocampo and Garibay write about some large fires that took place in the Pyrenees about the year 890 B.C., which melted the metals, especially silver, which were

buried in the earth. Ocampo considers that the fires were originated by men burning trees and then the fires extended through the whole mountains. He says that these large fires gave origin to the name Pyrenees (from *pyr* Greek for fire) (Ocampo, 1543, book 2, chap. 5). Moreira reasons that the origin of the fires could not have been caused by men, but by the occurrence of a large earthquake that broke through the underground fires, produced the metal melting and brought them to the surface. In his words:

> As a fire on the surface of the earth (as reported by Ocampo) could not penetrate the silver mines, enclosed in the mountains, it is more probable that this was the effect of some earthquake which broke the underground fire inside those mountains and melted the enclosed metals.
>
> *Como o fogo à superficie da terra não podia penetrar as minas de prata, que encerravão os montes, he mais provavel, que por effeito de algum Terremoto rompeu o fogo subterraneo aquellos montes e liquidou o metal que enceravão* .

Thus, MM assigned an earthquake in 880 BC as the cause of the fires in the Pyrenees. Neither NN nor JM include it. GR does include it quoting MM and locates it at the Pyrenees Mountains. MMS follow GR and locate the earthquake at Olot (Gerona), giving its coordinates. This is also given in MSM. There is no historical basis for this earthquake since the original story by Ocampo about the melting of metals is completely legendary. Ocampo uses it to explain the coming to Spain of Carthaginians merchants looking for silver. Moreira's explanation of the fires in terms of the occurrence of an earthquake has no historical basis at all.

500 B.C. This earthquake is found in all catalogs. The original source is in the history of Ocampo, (Ocampo, 1543, book 2, chap 40):

> In particular the following years after all this, that is in the year 500 after the birth of our Lord God, besides the already mentioned misfortunes, there were large earthquakes in the whole sea shore where they are usually more often, as it is declared by natural philosophers. These earthquakes were so horrible that many houses and town walls came down and many rivers changed their course. Some mountains and hills of certain high were moved to different places by the force of the motion that moved them from their original place. Large cracks were opened in the earth and near the sea shore. In some of them, new fountains and streams sprung up with many waters and oils never seen before. Among them there was an opening near that part where in the past centuries there were the fires in the Pyrenees Mountains, about which we talked in the fifth chapter of this book. This was when by the force of the fire there were abundant streams of molten silver and metals (here a description follows of what happened in 880 B.C. where there is no mention of earthquakes)…But in the present year the earthquakes were so strong and continuous that some of those mountains were open and removed the surface cover large amounts of silver appeared. This happened in the mountains of Denia and Muxacra which many cosmographers and chroniclers call Pyrenees where there are many metal mines... More to the interior in Andalusia we think that this did not occur.

Particularmente los años posteriores de todo esto, que fueron quinientos cabales antes del nacimiento de Nuestro Señor Dios, en que las adversidades arriba dichas hubo grandes terremotos en toda la costa de mar, donde suelen ser más continuos que por otras partes, como lo declaran los filósofos naturales. Y fueron tan espantosos aquellos temblores que muchas casas y cercas de pueblos cayeron, muchos ríos corrieron por otras partes diversas de las que solían. Algunos montes y collados bien crecidos se mudaron a diversos lugares con la fuerza del movimiento que los arrojaba fuera del primer sitio. Abriéronse grandes hendiduras por la tierra y por cerca de la marina, y en algunas de ellas salieron nuevas fuentes y arroyos de betunes y muchas aguas nunca vistas. Entre las cuales fue grandemente notada una boca que se hizo cerca de la parte donde los siglos pasados acontecieron los encendimientos famosos del monte Pyrineo, de quien ya hablamos en el quinto capítulo deste libro, cuando con la fuerza del fuego corrieron los grandes regueros de plata y metales en abundancia sobrada …. Mas como los terremotos del año presente fueron, como dije, terribles y continuos abriose con ellos una parte de las tales cumbres y quitadas afuera, luego aparecieron los montones grandísimos de plata … Esto parece que debió suceder contra las montañas de Denia o de Muxacra, que muchos cosmógrafos y coronistas llaman Pyrineos y sabemos ser muy venosos de metales….Porque metidos en las tierras más adelante sobre vuelta de Andalucía no pensamos que tal aconteciese.

Garibay also talks about this earthquake but he seems to be based on Ocampo, although he does not quote him. (Garibay, 1571, vol. 1, book. 5, chap. 5):

When these things happened in the year five hundred before the Birth (of the Lord), there was a great famine in Andalusia and large earthquakes on its sea shore, so that they changed the course of some rivers and moved some hills from one place to another. In the part of the Pyrenees of Creus Cape there were large openings of the earth and metals, which were hidden underground since the fire of the Pyrenees, came to the surface. The merchants from Marseille took great part of these metals from Spain in the journeys they made with their ships.

Durante estas cosas, venido el año centésimo de quinientos antes del Nacimiento, hubo grande hambre en Andalucía y fuertes temblores en sus marinas hasta mudar madres algunos ríos y ciertos collados transportarse de una parte a otra y hacer grandes aberturas las tierras por la parte de los Pirineos de Cabo Creus y pareciéndose metales, de los que debajo de tierra estaban ocultos, desde el incendio de los Pirineos que mucho fue lo que los Marsellanos llevaron de España en diversos viajes que con sus navíos hacían.

Ocampo and Garibay refer to two different events: occurrence of earthquakes and the appearance of metals in the Pyrenees. Ocampo refers to earthquakes on the sea shore without specifying where and later speaks of earthquakes in the Pyrenees, where they are the cause of the appearances of the metal mines. Garibay places the earthquakes in Andalusia and Pyrenees. The appearance of metals in the Pyrenees due to ground breaks during this earthquake is related by both Ocampo and Garibay to the fires of 880 B.C. in these mountains. This was the motive for MM to put the occurrence of an earthquake in

880 B.C besides that of 500 B.C. MM describes the earthquake of 500 B.C. following Garibay:

> There were many large earthquakes in Andalusia and Spanish sea shore. Mountains were moved and in the Pyrenees there were large ground breaks where precious metals appeared which the previous fires had melted.
>
> *Houve grandes terremotos em Andaluzia e partes marítimas de Hespanha. Mudárão-se montes, e fez a terra grandes aberturas nos Pyrineos descrubindo os precios metâes, que o incêndio antecedente havia derretido .*

Ocampo, however, denies that there were earthquakes in Andalusia and only talks of those of the Pyrenees. He uses the appearance of metals, to explain the coming of Carthaginians to Spain searching for silver. NN and GR places the earthquakes of 500 B.C. in Andalusia and the Pyrenees, but JM does not include them. ST says: "Destructive earthquake in the sea shore of Andalusia with fracture of rocks" (*Zerstörendes Erdbeben an der Küste Andalusiens mit Felsstürzen)*; nothing about the Pyrenees and no references. MMS have for this year two earthquakes one in St. Vincent Cape and the other in Olot (Gerona), giving their coordinates, with no evidence for it, corresponding to those of Andalusia and Pyrenees mentioned by Garibay. MSM place them in Andalusia and Pyrenees, but without coordinates. It is difficult to assess the historical evidence, if any, for these earthquakes. The oldest reference of Ocampo talks only of earthquakes in the Pyrenees, but it may be just a literary figure to relate them with the finding of silver and metals, the stories of the fires of 881 B.C. and the coming of the Carthaginians to Spain. They may be considered as legendary.

MM lists an earthquake in 399 B.C., citing Juan de Mariana (1536-1624), Jesuit author of a history of Spain from antiquity to the death of King Ferdinand, the Catholic (1516). The text by Mariana is: (Mariana, 1601, book 2, chap. 4):

> The following year there were large earthquakes and many cities near the shore of the Mediterranean Sea suffered great damage. Sagunto among them suffered so greater a damage as it was above all the other cities of Spain in size, beauty and wealth.
>
> *Luego al año siguiente hubo grandes temblores de tierra con que muchas ciudades a la ribera del mar Mediterráneo quedaron por esta causa maltratadas y entre las demás Sagunto recibió tanto mayor daño cuanto ella sobrepujaba en grandeza, hermosura y riquezas a las demás ciudades de España.*

Mariana was talking about the year 398 of the founding of Rome (753 B.C.), that is 355 B.C., the following year was then the 354 B.C. Moreira has confused the years after the founding of Rome with B.C. years. This earthquake would be the same that Ocampo places in 348 B.C., as we will see below, since Mariana follows Ocampo, this year must be preferred instead of 354 B.C. (Ocampo, 1543, book 3, chap. 25).

377 B.C. This earthquake is listed first in GR citing ST "Around Lisbon the earth shaked". ST says "A heavy earthquake around the present Lisbon" (*Schweres Erdbeben in der Gegend des heutigen Lissabon*), no references given. It is not in MM who has better information about earthquakes in Lisbon. It is listed in MMS and in MSM with the coordinates of Lisbon. We do not know on what evidence ST is based, but if MM, who used all available Portuguese sources, did not include it, it should not be considered as historically based.

370 B.C. This earthquake at Lisbon is listed only in MMS and MSM citing GR, but it is not there. It is a mistake for that of 377 B.C.

348 B.C. The first to list this earthquake is NN who places it in 349 B.C. and cites Ocampo. Ocampo's text is: (Ocampo, 1543, book 3, chap. 25):

> Until the end of the year 351 before the coming of Our Lord God…. The same happened the following year …. The other following three years were more notable in the Spanish chronicles. .. The second year most of the places near to the coast of our Mediterranean Sea suffered terrible earthquakes (this is three years after 351). In these places by nature are the earthquakes more continuous than in other parts of Spain. Especially the town of Sagunto or Montvedre suffered great danger. The damage was considered to be greater there than in other places of the sea shore for this town was at that time the greatest, most powerful and richest."
>
> *Hasta fenecer el año trescientos y cincuenta y uno antes del advenimiento de Nuestro Señor Dios…. Lo mismo fue también el año siguiente…Los otros tres años adelante son algo más notables en las crónicas españolas…. El año segundo padecieron terribles terremotos los más de los lugares vecinos a la costa de nuestro mar Mediterráneo, donde suelen aquellos temblores de su natural venir más continuos que por otra parte de España. Señaladamente padeció gran peligro de ellos la ciudad de Sagunto o Montvedre que por ser aquellos tiempos más grande y más poderosa y más rica que ninguna de la marina, qualquier daño que le viniese fue mayor que lo de los otros.*

According to Ocampo the correct year is 348 B.C. (351 minus three) and he talks about several earthquakes that caused damage in several towns the most important Sagunto, a port in east Spain, 20 km north of Valencia. This seems to be the same event that Mariana places in 354 B.C. (Mariana, 1601, book 2, chap.4). and MM in 399 B.C., as explained above. Mariana seems to have added three years to 351 instead of subtracting them. Since MM depends on Mariana and Mariana on Ocampo, the year given by Ocampo 348 B.C. must be the correct one. GR and JM place it on 349 B.C no reason given. MMS do not list it, but list one in 346 B.C. in Lisbon and another in 343 B.C. in SE Spain (they could be the same and refer to the one in 348 B.C., but the reference to Lisbon is a mistake). MSM list this earthquake in Sagunto in 348 B.C. giving its coordinates. There is a certain confusion of dates, but it seems that about 348 B.C. one or several large earthquakes occurred in south-east Spain which caused the destruction of the then important city of Sagunto.

343 B.C. This earthquake is listed by GRII with reference to Díaz Cassou (1887) in a work about the Murcia Valley (south-east Spain) where there are mentions to earthquakes in antiquity based on Ocampo, Garibay and Mariana, but these authors only talk about the earthquake of 348 B.C. So this may be a mistake of years for that of 348 B.C. MSM list it located in SE Spain. It is probably an error.

GRII lists also and earthquake in 337 B.C. following Díaz Cassou (1887). This may be also a mistake and both years 343 B.C. and 337 B.C. may refer to the event of 348 B.C. which destroyed the city of Sagunto.

246 (241-242) B.C. MM lists this earthquake in 245 B.C. citing Mariana (book 2, chap. 6):

> This year was very unfortunate for Spain due to the draught and lack of water and the many earthquakes, in which, as it is said, part of the island of Cadiz broke and sank in the sea.
>
> *Fue este año desgraciado para España por la seca que padeció y falta de agua y por los ordinarios temblores de tierra, con que una parte de la isla de Cádiz dicen se abrió y se hundió en el mar*.

Mariana places these earthquakes 22 years after the beginning of the war between Romans and Carthaginians in the Iberian Peninsula which he assigns to the year 490 before the founding of Rome. This will place the earthquakes in the year 241 B.C. Mariana gives also the date of the beginning of the war as the first year of the 129th Olympiad and the earthquakes will, then, be in 242 B.C. NN lists them in 245 B.C.: "Epicenter in the Gulf of Cadiz. Sinking of an island" (*Epicentro en el golfo de Cádiz. Submersión de una isla)*. GR follows MM. JM lists an earthquake in 245 B.C. in Cadiz. He is followed by MMS. MSM places it in 246 in the Gulf of Cadiz. Since the oldest reference is Mariana the year must be 241 or 242 B.C. It could have been a large earthquake in the Gulf of Cadiz followed by a tsunami (sinking of Cadiz), but the evidence, based only on Mariana's testimony, is very weak.

237 B.C. It is only in GRII who cites Ibáñez García (1931): "It is most likely that in these years (500, 399, 346, 237 and 218 B.C.) there were earthquakes that shook the Spanish ground, mainly in the south sea shore and the Valley of Murcia.*" (Es más que probable que en estos años (500, 399, 346, 237 y 218 a. C.) hubo terremotos que conmovieron el suelo español y principalmente el litoral del mediodía y el valle de Murcia).* MMS and MSM follow GRII and lists the 237 B.C. earthquake in SE Spain. Ibáñez García does not give any reference for these earthquakes. We have seen that those of 500, 399 and 346 (348) B.C. are also given by other authors. Then there is no basis for an earthquake in 237 B.C. on the only reference in the book about Murcia by Ibañez García.

218 (217, 216) B.C. This earthquake is listed by MM in 216 B.C. who cites Mariana (book 2, chap. 10):

> In this year in Spain there were abundant resources, but lack of health. There were sicknesses and plague, earthquakes, storms in the sea and in the sky appearances of armies shown with great noise of clouds

Fue este año en España abundante de mantenimientos, pero falto de salud. Hubo enfermedades y peste, temblores de tierra, ordinarias tormentas en el mar, en el cielo apariencias de ejércitos que se mostraban con gran ruido de nubes.

Mariana at this point is talking about the year 536 of the founding of Rome, that is 217 B.C., the year of the capture of Sagunto (city allied with Rome) by the Carthaginians. Navarro-Neumann lists the earthquake in 216 B.C. and cites Ocampo (book 4, chap. 45) saying : "Large earthquakes which destroyed many buildings, killed people and made very terrible damage. The sea flooded large places" (*Grandes terremotos que derrocaron edificios, mataron gentes e hicieron daños terribles. La mar anegó grandes lugares).* GR lists two earthquakes, one in 218 B.C. and another in 216 B.C. For the earthquake of 218 B.C. he cites Ocampo (book 4, chap. 44). The complete text of Ocampo is:

The Island of Cadiz and all the sea shore of Andalusia suffered large earthquakes which destroyed buildings, kill people and caused terrible damage: the sea flooded many places which were first uncovered, throwing out a multitude of fish, some common and known other never seen before (this part is the quotation by Galbis, Ocampo's text continues). In the air there were appearances of armed people without knowing its cause, all signs and predictions of the confusion and great evils which happened around here, with the wars and cruelties which were then beginning.

*La isla de Cádiz y toda la marina frontera del Andalucía padeció grandes terremotos o temblores que derrocaron edificios, mataron gentes y causaron daños terribles: la mar anegó muchos lugares que primero fueron descubiertos, lanzando fuera de sí multitud de pescados de ellos comunes y conocidos y de ellos nunca vistos (*this part is the quotation by Galbis, Ocampo's text continues*). Oyéronse muestras en el aire de gentes armadas sin saber quien los hiciese, que fueron señales todas y pronósticos de la turbación y mucho mal que después redundó también por acá, con guerras y crueldades que por allá comenzaban.*

To find the correct year, in the beginning of chapter 40 Ocampo says "As it arrived the beginning of the following year that was the year 216 before Our Lord Jesus Christ" (*Llegado el principio del año siguiente que fue 216 antes de N.S. Jesucristo).* In chapter 45 he says "four months after he moved from Cartagena", therefore the events related in chapter 44 are in the same year 216 B.C. not two years before in 218 B.C. NN gives for the earthquake of 216 B.C. the reference Ocampo, book 4, chap. 45. This is an error, there is nothing about earthquakes there and he must be referring to chapter 44. JM lists an earthquake in 218 B.C. and another in 216 B.C. both in Cadiz following GR. MMS list only that of 218 in the Gulf of Cadiz, the same as MSM who locates it at SW Cape St. Vincent. The most probable date is 216 B.C. and it may refer to a large earthquake at the Gulf of Cadiz or off-shore Cape St. Vincent followed by a tsunami according to the description of the forward and backward motion of the sea. However, the historical reference is weak. Ocampo and Mariana talk about large earthquakes together with other prodigious signs with predicted the future disasters that affected Spain caused by the war between the Roman and Carthaginians; the mention of earthquakes may be only a literary tool with no factual evidence.

211, 210 or 209 B.C. These earthquakes are not in MM. NN lists one in 209 B.C. in Cadiz, citing Ocampo (book 5, chap 50), but this is a mistake, book 5 only has 46 chapters. GR lists two earthquakes in 211 B.C. and 210 B.C. citing for the one in 211 Ocampo (book 5, chap. 29):

> The common people in the army talked about ghosts and signs which they said had appeared in the air of armed people… There were also earthquakes and changes in Africa, great motions in heaven and storms and fury in the sea of ways and forms never seen nor known before.
>
> *La gente común del ejército platicaban de fantasmas y señales que decían haber parecido por el aire de personas armadas…Publicábanse también terremotos y mudanzas en África, grandes movimientos en el cielo, tempestades y bravezas en el mar de formas y maneras nunca vistas no conocidas.*

To fix the year we consider the beginning of chapter 28 which says "The following year was 211 before the birth of Our Lord Jesus Christ" (*El año siguiente fue 211 primero que N. S. Jesucristo naciese)*. If the events in chap. 29 are the same year this should be the correct year. GR lists an event on 210 B.C. citing Ocampo (book 5, chap. 39): "The neighbors of Cadiz suffered some earthquakes and the sea was rough with fury and large currents so that it passed ahead of what it used" (*Los vecinos de Cádiz padecieron algunos terremotos y la mar anduvo muchos días tan gruesa con braveza y corrientes excesivas que pasó harto delante de donde solía)*. The complete text of Ocampo is:

> The natural resources were prosperous, harvests were abundant and livestock and people enjoyed good health. However, the people of Cadiz suffered some earthquakes and the sea was rough with fury and large currents, so that it came forward beyond what it used. There were signs in the air no less terrible than those of other years. Firing comets appeared on the western turns of heavens. There were dangerous lightning in populated places.
>
> *La sustancia del temporal sabemos haber sido próspera, crió la tierra mantenimiento en abundancia, tuvieron salud ganados y gentes, sino cuanto los vecinos de Cádiz padecieron algunos terremotos, y la mar anduvo muchos días tan gruesa con braveza y corrientes excesivas, que pasó harto más delante de donde solía. Hubo señales en el aire no menos terribles que los otros años. Mostrándose cometas ardientes contra las vueltas occidentales del cielo. Cayeron rayos peligrosos en lugares poblados.*

There is no mention of the years from that given in chapter 28 (211 B.C.). Therefore there is no form of knowing if the events of chapter 39 correspond to the same year as those of chapter 29 or to other years after. The sentence "no less terrible than those of other years" (*no menos terribles que los otros años*) may indicate other year, but we do not know which one. Nothing really points to the year 210 B.C. JM lists two earthquakes in Cadiz one in 209 B.C. and another in 210 B.C. MMS list only one in 210 B.C. located at SW Cape St. Vincent and the same MSM, but they locate it at the Gulf of Cadiz. It may be probable that

the correct year for the earthquakes was 211 B.C. and the repetition by Ocampo refers to the same events. The reference to other signs in the air and heavens may indicate that the earthquakes are just a literary genre and may not indicate any real events. There is no sufficient historical basis, then, for this earthquake.

196 B.C. NN, GR and MSM list this earthquake citing MM, but this is a mistake, it is not there.

60 B.C. MM lists an earthquake for this year:

> In those years a horrible earthquake happened at the sea shore of Portugal and Galicia which caused the ruin of many buildings and complete villages. The sea went forward from its ordinary limits and flooded many lands and uncovered others when the water moved away. People went to live in the fields and mountains.
>
> *Por estes annos suecedeu na Costas de Portugal e Galiza hum Terremoto horrivel que arruinou muitos edificios e lugares inteiros. O mar excedendo os seus ordinários limites cobriu muitas terras, descobrindo também outras o retiro das suas agoas. A gente se retirou a habitar nos campos e montanhas*."

MM cites here the History of Portugal (first editon 1628) by Manuel de Faria y Sousa (1590-1649), Portuguese historian. In the edition of 1730 (original in Spanish) the quotation is (Faria y Sousa, 1730, part 1, cap. 9, p. 70):

> After the war an earthquake occurred at the coast of Portugal which caused the ruin of many buildings, villages and mountains. The sea went forward from it limits flooded the fields and uncovered them in other parts. There were several signs and omens.
>
> *Sucedió a la guerra, por la costa de Portugal un terremoto con que padecieron ruina muchas fábricas y poblaciones y montes. El mar excediendo sus límites ganó campos, descubriéndolos también en otras partes. Hubo varios prodigios y agüeros".*

At the margin there is the year between 61 B.C. and 60 B.C. In the text there is no mentioned of Galicia. It may be that MM is using a different edition. The earthquake is listed by ST, JM (Miño River), Mezcua and Martínez Solares (SW. Cape S. Vincent) and Martínez-Solares and Mezcua (North of Portugal). The oldest source is Faria who locates it at the coast of Portugal. Ocampo and Mariana do not mention it when they talk on those years about Caesar's campaign against the followers of Pompey in Spain. The earthquake is based only on the testimony of Faria and we do not know his source. I may be considered doubtful.

33 A.D. This earthquake is not in Moreira**.** NN is the first to list it. He says: "Felt in the whole world. Terrific in Portugal" (*Sentido en todo el orbe. Formidable en Portugal*). He may be citing the global catalog by JZ "Universal earthquake that happened in the whole world" (*Terremotus universalis per totum terrarum orbem contigit)*. JZ refers to the earthquake in the Gospel of St. Mathew at the death of Christ. JZ adds, citing ecclesiastic

authors, that the earthquake destroyed eleven towns in Thrace and was felt in other towns in the Middle East. To give it more importance he adds "felt in the whole world". NN adds "terrific in Portugal", I do not know on what basis. GR cites NN but he lists the earthquake in 33 B.C. (a mistake). JM follows GR, but with the correct year 33 A.D. and localizes it in Portugal. MMS follow JM but locate it at the Cape St. Vincent and MSM, simply in Portugal. It is clear that this is not a historical event and less felt in the whole world including the Iberian Peninsula.

MM lists an earthquake in 263:

> The earthquake of this year was one of the largest that the world has experienced. It began in Asia, spread out for the whole coast of the Mediterranean, and was felt in the whole of Europe and Africa where it caused great damage. Many cities disappeared, sunk in the openings of the earth and lakes of salt water appeared.
>
> *O terremoto deste anno foi hum dos mayors que tem experimentado o mundo. Começou na Asia e extendeu-se por toda a costa do mar Mediterrãneo comunicando-se a toda Europa e Africa, onde occassionou grandes estragos. Deapparecerão muitas ciudades subvertidas nas aberturas da terra e apparecêrao lagoas de agoas salgadas*.

The description is obviously exaggerated. This earthquake is not listed in any of the following catalogs.

MM lists also an earthquake in 309**: "**On 22 February before dawn a horrible earthquake occurred in Portugal and in the whole of Europe" (*A 22 de Fevereiro antes de amanhecer houve hum espantoso Terremoto em Portugal e em toda a Europa*) (S. Maria, Ann. Histor. tom. 1, 22 Feb., n. 2). This earthquake is listed by NN (1921) but not in NN (1917). It is listed in GR, and JM, who give the date 22 February, but neither by MSM nor by MSM. It is not clear why this earthquake has been dropped out from these two more recent catalogs when they usually follow GR.

346. This earthquake is listed by MSM in Portugal although it is not in MM, NN, GR, JM, and MSM. MSM cite GRII, but in that place there is only a reference to earthquakes between 346 a 395 in GRI, listed by numbers 16, 17 y 18, that is , the earthquakes of 309, 365 y 382. Therefore this is an error.

The earthquake of 365 in GR and listed also by JM with date 21 July, is a well known earthquake in Greece followed by a tsunami that has been placed by GR erroneously in Malaga (Udías, 1983).

382. This earthquake is first listed by MM: "This year there was an earthquake in the whole world. The sea shores of Portugal suffered a great deal. Some islands were submerged of which there is still some rests in front of Cape St. Vincent" (*Neste anno houve hum terremoto por cuasi todo o Orbe, no cual padecerão muito as terras maritimas de Portugal. Subverterão-se ilhas de que ainda ao presente apparecem algumas eminencias defronte do Cabo de S. Vicente*). It is listed by NN who says: "disappearance of islands in

front of Cape St. Vincent" (*Desaparición de islas frente al cabo S. Vicente*). The same is repeated by GR "disappearance and appearance of islands" (*aparecieron y desaparecieron islas*). It is listed by JM, MMS and MSM (SW Cape St. Vincent). MM, the first to list this earthquake, cites Laymundo according to Brito. Bernardo de Brito (1569-1617) is the author of the history *Monarquia Lusitana*. The fictional Laymundo (a character made up by Brito) is supposed to have been the chaplain of the last Visigoth King Don Rodrigo. His attributed account is a well-known fable invented by Brito, so it does not have any historical value. There is, then, no serious basis for this earthquake.

GR lists an earthquake in 536 saying: "Spain was afflicted by several sicknesses, plague, earthquakes and storms" (*Afligieron a España varias enfermedades, pestes, temblores y tormentas*) and cites Mariana, vol. 1, book 2, chap. 10, but there Mariana is talking about the earthquake of 217 B.C. This is a mistake.

Nifo y Cagigal (1755) lists an earthquake in 528: "large rocks fell off in the Pyrenees" (*Se desprendieron unos crecidísimos peñascos de los Pirineos*). There si no further information and the earthquake is not listed in any other catalog. It may be an error for the events of 586 referred by Morales (1574) (see below)

565. This earthquake is listed first in GRII: "There were earthquakes in Andalucia, with information that they were felt in Andujar, Cordoba and Granada" (*Ocurrieron terremotos en Andalucía, teniéndose noticia de que se sintieron en Andujar, Córdoba y Granada*). There is a reference to Museo Español, tom. 4, p. 338 and Sahibarolo, p. 129-130. The earthquake is listed only by MMS and by MSM. The references have not been found. It is very doubtful.

580, 585 or 586. According to NN between 580 and 585 there were large earthquakes in France that were also felt in Spain. He gives intensity IX (Forell-Mercalli), and gives reference to Ambrosio Morales (1513-1591), a chronicler of King Philip II who continued the historical work of Ocampo (Morales, 1574, vol. 5, book 11, chap.71). The text of Morales is:

> In Andalucia there was extreme heat and in Castille cold. The Archbishop of Tours writes about this and also that there were large earthquakes in France that were felt in Spain where large rocks broke off in the Pyrenees with great damage to people and cattle …this happened in the year of Our Lord Saviour 586.
>
> *En Andalucía la causa el gran calor y en Castilla el mucho frío. El Arzobispo Turonense cuenta esto y también grandes terremotos que hubo en Francia y llegaron hasta España donde cayeron de los Pirineos grandes peñascos haciendo harto destrozo en hombres y ganados… fue en el año de Nuestro Redentor quinientos ochenta y seis.*

Roche (1756) lists these events in 580 in his answer to Cevallos (1756). Milne (1911) gives the years 579-580 and locates the earthquake in France, Bordeaux and Pyrenees with intensity X (Forell-Mercalli). GR reproduces the quotation by Morales (1574) and NN. It

is included in JM, MMS and MSM (Central Pyrenees, intensity V -VI) in 580. The year remains doubtful between 580 and 586.

718. This earthquake is first found in GR. This event is related with the battle of Covadonga between the invading Moorish army and a group of Christians led by Don Pelayo in the mountains of Asturias, (North Spain) (modern historians dates the battle in 722). Galbis quotes the historian Celio A. Curión (reference has not been found) that there was an earthquakes that caused a landslide that buried the Moorish soldiers and gave the victory to Don Pelayo. Galbis adds that "the accuracy of the event has not been confirmed" (*No está comprobada la exactitud del hecho*). Munuera lists it and locates it at the Deva River (Asturias, North Spain). MMS and MSM place it in Asturias. The oldest story of the battle (*Chronicon Albendense*, about 881) does not mention any earthquake or landslide. Mariana (Mariana, 1601, lib. 7, cap. 2) in his history of the battle writes only about a landslide with no reference to an earthquake:

> There was another miracle and this was that near a place called Causegadía, I think because of this event, part of a nearby mountain and all those who were on it fell to the river and caused the death of a great number of those barbarians.
>
> *Allí sucedió otro milagro y fue que cerca de una heredad, que de este suceso como yo pienso se llamó Causegadía, una parte de un monte cercano con todos los que en él estaban se cayó en el río y fue causa que gran número de aquellos bárbaros pereciesen.*

There is no historical base for the occurrence of an earthquake. Besides, no earthquakes have ever occurred in that region.

Nifo y Cagigal (1755) lists an earthquake in 753 in South Spain: "Near Cordova there were many openings in the earth where sand and stones were thrown out some stones of more of four pounds in weight were thrown at a league distance" (*En las cercanías de Córdoba se abrió en muchas bocas la tierra y arrojó arena y guijarros de más de cuatro libras de peso a distancia de una legua*). This earthquake is not found in any other source.

881, 26 May. This earthquake is first listed by MM who quotes Mariana (Mariana, 1601, lib. 7, cap. 19): "Only in the year 881 there were earthquakes in the whole of Spain with damage and destruction of many buildings" (*Solo el año 881 en toda España hubo temblores de tierra con daño y destrozo de muchos edificios*). NN gives the date 10 of June and quotes the history of José Antonio Conde y García based on Spanish-Arabic authors (Conde y Garcia, 1820, vol. 1, cap. 55, p. 251):

> In the year 267 the date 22 of the *xawal* (*Chawwâl*) moon, the earth shook with such a great noise and tremor that many castles and magnificent buildings fell down and other were seriously damaged, mountains foundered, rocks opened and the earth sunk and swallowed villages and hills. The sea withdrew from the coast and islands and reefs disappeared. People abandoned the villages and fled to the countryside, birds went out of their nests and wild animals frightened left their caves and dens with great confusion and disruption. Never before men have seen or heard something

similar. Many villages of the southern and western coast of Spain were ruined. All this so influenced the spirits of people and especially of the ignorant that Almondhir could convince them that these were natural things although not frequent .. In the same manner shakes the earth for Muslins and for Christians.

En el año 267, día jueves 22 de la luna xawal (Chawwâl) tembló la tierra con tan espantoso ruido y estremecimiento que cayeron muchos alcázares y magníficos edificios y otros quedaron muy quebrantados, se hundieron montes, se abrieron peñascos y la tierra se hundió y tragó pueblos y alturas. El mar se retrajo y apartó de las costas y desaparecieron islas y escollos en el mar. Las gentes abandonaban los pueblos y huían a los campos, las aves salían de sus nidos y las fieras espantadas dejaban sus grutas y madrigueras con general turbación y trastorno. Nunca los hombres vieron ni oyeron cosa semejante: se arruinaron muchos pueblos de la costa meridional y occidental de España. Todas estas cosas influyeron tanto en los ánimos de los hombres y especialmente en la ignorante multitud, que pudo Almondhir persuadirles que eran cosas naturales aunque poco frecuentes… que lo mismo tiembla la tierra para los muslimes que para los cristianos.

All conversions of dates of Hegira to Gregorian calendar, for uniformity, have been done using: municion.org/conversio/calendari.htm . In this case 22 Chawwâl 267 corresponds to 26 May 881. This is the first earthquake in the Iberian Peninsula for which there is an accurate date. NN assigns it an intensity of X or XI (Forell-Mercalli). GR cites MM and NN and adds a reference to the Arabic work "Al-Bayano'l-Mogrib" by Ibn Adhari, a Moroccan author of the 13th century, (French edition by E. Fagnan (1904), vol. II, p.171-172):

Among the phenomena which mark this year (267 Hegira = 881) is that related by Razi and others. A violent earthquake happened in Cordova and the wind which arose at the *magreb* (evening) prayer time brought black clouds loaded with lightning and thunder. …This earthquake demolished palaces and mountains, people left their houses to the countryside and made humble prayers to the Almighty. According to the general opinion this earthquake was felt from the Syrian Sea to the most far northern lands and up to the end of the countries inhabited by Christians.

Parmi les phénoménes qui marquèrent cette année (267 Hégira = 881) figure ce que racontent Ràzi et d'autres. Il y eut à Cordove un violent tremblement de terre, et le vent qui s'évela au moment de la prière du maghreb amena des nuages noirs chargés de tonnerre et d'éclairs; … Ce tremblement de terre ébranla les palais et les montagnes, et les habitants se précipitèrent des maisons dans les champs en adressant d'humbles prières au Tout-Puissant. De l'aveu général, ce phénomène se fit sentir de la mer de Syrie jusqu'aux pays septentrionaux les plus éloignés et jusqu'à l'extrémité des pays habités par les chrétiens.

GRII cites also *Roudh et Kartas,* or *Rawd al-Qirtas,* by Ibn Abi Zar, Moroccan autor of the 14th century, (Spanish edition, A. Huici, 1964, vol. I, p. 185-186):

The year 267, Thursday 22 of the Chawwal (26 May 881), a large earthquake happened, men have heard nothing equal; castles were ruined, mountains and rocks opened, people fled the towns because of the terrible shaking of the earth and the fall of roofs, walls and houses, birds abandoned their nests and offspring and flew about the air for some time until the earthquake ceased. This earthquake was general in all *al-Magrib* (north-west Africa) from Tremecen to Tangiers and in all *al-Andalus* (Southern Spain), in their beaches and mountains, from the Mediterranean Sea to the western end; however, nobody died because of the goodness of God with His creatures.

El año 267, el jueves 22 de Chawwal (26 de Mayo del 881) hubo un terremoto grande cual no oyeron los hombres de otro igual; se arruinaron con el los castillos, se abrieron las peñas y montañas y huyó la gente de la ciudad al campo por causa de la terrible conmoción de la tierra y de la caída de techos, muros y casas; abandonaron los pájaros sus nidos y sus crías y vagaron por el aire algún tiempo, hasta que cesó el terremoto. Fue general este temblor en el al-Magrib desde Tremecén hasta Tanger y en todo el país de al-Andalus, en sus playas y en sus montañas, desde el mar Mediterráneo hasta el extremo occidente; solo que de él no murió nadie por la bondad de Dios con sus criaturas.

JM, MMS and MSM list this earthquake with the date 26 May. JM locates it at South of Portugal (37.5N, 8W) and MMS at the Gulf of Cadiz (36N, 8W). MSM at Gulf of Cadiz without coordinates. Poirier and Taher (1980) date it on 27 May and place it in Andalusia, Morocco and Algeria with intensity X. Bretón González and Espinar Moreno (1996) list an earthquake in 880 different from that of 881 and use the reference of Ibn Adhari. This does not seem to be correct since Ibn Abi Zar does not mention any earthquake in 880 and only that of 881.

944, 3 July. Neither MM nor NN lists this earthquake. GR lists it based on Ibn Adhari, (French edition by Fagnan, 1904, vol. II, pp. 349-350):

A violent earthquake was felt at Cordova the night of the Sunday to Monday 9 *dhoû'l-ka'da* (Hegira 332) (15 July 944). So violent shaking has never been felt neither one has ever heard of it. It happened after the last prayer of the evening and lasted during one hour. People very frighten took refuge in the mosques, making ardent prayers asking for the end of this ordeal and the prayers were finally heard.

Un violent tremblement de terre se fit sentir à Cordove dans la nuit du dimanche au lundi 9 dhoû'l-ka'da (Hegira 332) (15 July 944); jamais on n'avait ressenti d'aussi vives secousses non plus qu'on n'en avait ouï parler. Elles aurent lieu après la dernière prière du soir et durèrent une heure. La population, excessivement effrayée, se réfugia dans les mosquées, adressant au ciel de bruyantes invocations pour lui demander la fin de cette épreuve et le prières finirent par être exaucées.

The problem here is about the Arabic date: 9 *dhoû'l-ka'da* (*Dhul-Qa'da*) which GR interprets following Fagnan corresponding to 15 July. He is followed by JM and MMS; Poirer and Taher (1980) date the earthquake on 9 July in Cordova, with intensity VIII; Bretón González and Espinar Moreno (1996) date it on 3 July; MSM on 2 July in Cordova (with coordinates). According to the conversion used here, the corresponding date is: 9 Dhul-Qa'da 332 = 3 July 944. This should be the correct date. Bretón González and Espinar Moreno (1996) propose that probably there were several shocks between 3 and 9 July. However, the text of Ibn Adhari, on which all are based, is clear with the reference to a single earthquake which happened on 9 of Dhul-Qa'da.

949. This earthquake is listed by GR as doubtful. He bases it on the historian Urcisino Álvarez Martínez (1889) who uses the Annals of the Compostelan Monk (*Anales del Monje Compostelano*) in which there is the story about the change of the course of the river Valderabuey, a tributary of the Duero River. This prodigious event is explained in different ways by a volcanic eruption or a large earthquake that fractured the earth and destroyed villages. There is no sufficient historical evidence. It is listed by JM (in Valderabuey), MMS and MSM (in western Iberian Peninsula). It is not found in MM or NN. It is very doubtful.

955. 29 Agosto y **2 Septiembre**. Lo trae GR, based on Ibn Adhari (Fagnan, 1904, vol. II, p. 365):

> On 7 *djomada* (*Jumâda al-Awwal*) (29 August), a violent and thunderous earthquake was felt in Cordova. A similar shock took place on Saturday 11 of the same month about noontime.
>
> *Le 7 djomâda (Jumâda al-Awwal) (29 août) un violent et bruyant tremblement de terre se fit sentir à Cordove; une autre secousse analogue eut lieu le samedi 11 du même mois, vers l'heure de midi.*

Ibn Adhari is talking about the year 344 Hégira or 955. Neither MM nor NN list this earthquake. JM is the first after GR to do it and he is followed by MMS (located in Cordova). MSM list also the second earthquake on 2 September. Poirier and Taher (1980) locate both earthquakes in Cordova, but on different dates, the first on 30 August, intensity VIII, and the second on 4 September. Bretón González and Espinar Moreno (1996) propose a seismic sequence of several earthquakes between 28 August and 4 September, but the Arabic text talks only of two shocks. (Date conversion: 7 Jumâda al-Awwal 344 = 29 Agust 955; 11 Jumâda al-Awwal 344 = 2 September 955). MSM locate them in Cordova with coordinates

957. NN lists this earthquake with reference to Conde y Garcia (1820,1821) giving the year 346 Hégira (957) saying that the sea moved off and uncovered "islands and reefs never seen" (*el mar se retiró descubriendo "islas y escollos nunca vistos*"). Conde y García, (1820) p. 446:

> Ben Alathir (Ali ibn al-Athir, 1160-1233, Arabic historian) a very diligent writer of prodigious events, relates that in the year 346 the sea decline in eighty fathoms

(*brazas*), showing many islands, mountains and reefs never seen nor known in past time. In the same year a fountain and ornaments were finished in the courtyard of the Aljama of Cordova...

Cuenta ben Alathir (Ali ibn al-Athir, 1160-1233, Arabic historian) escritor muy diligente de sucesos prodigiosos, que en este año 346 el mar menguó ochenta brazas, descubriéndose islas, montes y escollos nunca vistos ni conocidos en los pasados tiempos. Así mismo en este año se acabaron de labrar una fuente y ornatos del patio de Aljama de Cordoba.."

Ibn Adhari does not mention any earthquakes for the years 345 to 348 Hegira, so it may be an error of ben Alathir. GR list this earthquake and cites Conde y Garcia (1820,1821) and NN. MSM and Bretón González and Espinar Moreno (1996) also list it, it is not in JM and MMS. MSM locate it in the Gulf of Cadiz. Ibn Abi Zar between the years 339 and 350 Hégira (950 – 961) narrates about drought, hail, strong winds, thunders and lighting and plague in *Al Andalus* and *al-Magrib* (south Iberia and north west Africa), but nothing about earthquakes. Conde y García, following ben Alathir, does not explicitly talks about an earthquake, but only about changes in the sea level so it may refers to strong tides. So it is doubtful.

971. **19 o 18 Diciembre**. NN, GR, JM and MMS do not list this earthquake. The first to do it is Bretón Gonzalez and Espinar Moreno (1996) and it is included in MSM located at Cordova with coordinates. The source is the contemporary account by Isa ibn Ahmad al Razi (s. X), chronicler of the Caliph al-Hakam II, (Spanish translation García,1967, n. 39, p. 89): "Wenesday 26 of *Safar* of this year (361 Hegira) the earth shook at the beginning of the fourth hour, but it became quiet fast" (*El miércoles (38 r) día 26 de safar de este año (361) tembló la tierra a comienzos de la hora cuarta, pero se aquietó rápidamente*) (date conversion: 26 Safar 361 = 18 Dicember 971). It may have been a small shock.

973. **20 Mayo**. As in the previous (971) case the first to list this earthquake is Bretón Gonzalez and Espinar Moreno (1996). The source is also Isa ibn Ahmad al Razi, (García, 1967, n. 115, p. 137-138):

About these days of *sa'ban* (*Cha'ban*) of this year (Hegira 362), coinciding with the last ten days of the solar month of May, there was in Cordova a fine rain swept by very strong winds and bright lightening and some years later abundant rain. The earth shook in Cordova and surroundings on the night of the day 14 sa'ban (20 May) at the ninth hour.

Por esas fechas de mediados de sa'ban (Cha'ban) de este año (Hégira 362), coincidentes con la última decena del mes solar de mayo, cayó en Cordoba y sus contornos una llovizna fina arrastrada por vientos recios y ofuscadores relámpagos a la que siguieron al cabo de unos días lluvias abundantes. La tierra tembló en Córdoba y sus contornos la noche del día 14 sa'ban (20 de mayo) a la hora nona.

(Date conversión 14 Cha'ban 362 = 20 Mayo 973). MSM locates it at Cordova with coordinates.

974. **9 Noviembre**. This earthquake is similar to that of 971 and 973 (Bretón Gonzalez and Espinar Moreno, 1996). The source is also the chronicle by Isa ibn Ahmad al Razi (García, 1967 n. 205, p. 243):

> On Monday 20 of *safar* at the end of the midday prayer a perceptible earthquake of short duration was felt in Cordova and its neighborhood. The same happened at the same time in great part of the *coras* of Al-Andalus. Sahib al Surta Ya'la ibn Ahmad ibn Ya'la, general in the north, wrote about this event from the town of Coria on the same date and fixed exactly the mentioned hour.
>
> *El lunes día 20 de safar al acabar la oración de mediodía se sintió en Córdoba y sus contornos un perceptible temblor de tierra de corta duración . Otro tanto ocurrió a la misma hora en la mayor parte de las coras de al-Andalus. El sahib al Surta Ya'la ibn Ahmad ibn Ya'la, general en el Norte, escribió hablando de él desde la ciudad de Coria, esa misma fecha y fijó exactamente la hora mencionada*.

(Date conversion: 20 Safar 364 = 9 Noviembre 974). MSM locate it at Western Andalusia.

The earthquakes of 971, 973 and 974 are only based on al Razi's account. They were felt in Cordova, but this does not mean that their epicenters were there, so assigning Cordova coordinates to the 944, 955, 971 and 973 earthquakes by MSM may not be justified. They may have been small earthquakes felt in Cordova where Al Razi wrote at that time. Neither Ibn Adhari nor Ibn Abi Zar mentions them. Ibn Abi Zar writing about the events between 950 and 990 talks about floods, winds and plagues, but not about earthquakes (Huici, 1964, 191-195).

Conclusion.

The earthquakes in the Iberian Peninsula during the pre-Roman and Roman period which figure in the catalogs are not based in any contemporary documents. They are listed for the first time by MM catalog of 1758 and based on Spanish and Portuguese historians of the sixteenth to eighteenth centuries, such as, Ocampo (1543), Garibay (1571), Morales (1574), Mariana (1601) and Faria y Sousa (1730). The first author to mention some of these earthquakes is Ocampo (1543) who does not give the sources on which he is based and Garibay, Morales and Mariana follow him. Regarding events in antiquity Ocampo is not considered reliable (Caballero, 2002). The earliest earthquakes of 881 B.C. and 500 B.C. do not have any historical basis. They are used by Ocampo in his legendary story about the melting of rivers of silver in the Pyrenees and the origin of this name. The destruction of the city of Sagunto by an earthquake about 348 B.C., according to Ocampo and Mariana, may have some grounds, but the year may be only approximate. The offshore region near Cape St. Vincent and the Gulf of Cadiz has been the place of large earthquakes followed by tsunamis, the best documented those of 1755 (Lisbon earthquake) and 1969. It is clear that this type of earthquakes must have also happened in the past in the period we are considering. Stories about flooding by the sea and sinking of parts of the city of Cadiz (founded about 1000 B.C.) and about appearance and disappearance of islands may have this origin. The events dated about 241-245 B.C., or about 216 B.C. may have corresponded to one of such a type of events. But all we can say is that in the third century

B.C. there may have been one or several large earthquakes offshore Cape St. Vincent followed by tsunamis that affected Cadiz. For the following centuries there is also very little information. The earthquake of year 33 is clearly not a historical event and had no relation with the Iberian Peninsula. The same can be said of other earthquakes of this period, such as, that of 718 which is totally legendary. During this long period of time there may have been earthquakes in the offshore region of Cape St. Vincent and other regions of south Iberian Peninsula, but there is not reliable information about them. The only mention of the occurrence of earthquakes for this period by historians of the sixteenth and seventeenth centuries it is not enough to assign them to particular years.

The situation changes with the accounts about earthquakes by Arabic historians writing in the north of Africa and south of Spain in the tenth to fourteenth centuries, such as, Ibn Adhari, Ibn Abi Zar and Ibn Ahmad al Razi. The earthquake of 26 May 881 is the first we have an accurate date and it may have been a large shock offshore St. Vincent Cape followed by a tsunami. The earthquakes of 944 and 955 seem to be well grounded on accounts by Arabic historian and the same can be said of those 971, 973 and 974 only felt in Cordova.

Catalogs in chronological order.

Bonito, M. (1691). *Terra tremante o vero continuatione de terremoto*. Naples: A. Parrino e M. L. Mutti.

Zahn, J. (1696). *Specula physico mathematica*. Scrutinium IV Geocosmicum. Cap. XIII, Chronicon. Nurenberg: Johannis Christopher Lochner.

Moreira de Mendonça, J. J. (1758), *Historia Universal dos terremotos*. Lisbon: A.V. da Silva.

Von Hoff, K. A. (1840). *Chronik der Erdbeben und Vulkan-Ausbrüche*. Gotha: Justus Perthes.

Perrey, A. (1847). Sur le tremblement de terre de la péninsule Ibérique. *Annales des Sciences physiques et Naturelles d'Agriculture et d'Industrie,* Tome X. Lyon: Barret.

Sánchez Navarro-Neumann, J.M. (1917), Ensayo sobre la sismicidad del suelo español. *Bol. Real Sociedad de Historia Natural,* 87-108

Sánchez Navarro-Neumann, J.M. (1921), Bosquejo sísmico de la península Ibérica (Lista de los terremotos destructores sentidos en la península Ibérica). In *La estación sismológica y Observatorio Astronómico de Cartuja*. Granada: Observatorio de Cartuja.

Steikhardt, L. (1931). *Die Erdbebentätigkeit am Westrand des Mittelmeeres und ihre Geologische Bedeutung*. Doktor Dissertation, Thüringischer Landuniversität Jena.

Sieberg, A (1932). Erdbebengeographie (Wichtigere Erdbeben der Iberischen Halbinsel, 739-740). In B. Gutenberg *Handbuch der Geophysik*. Berlin: Gebrüder Borntraeger.

Galbis Rodriguez, J (1932). *Catálogo sísmico de la zona comprendida entre los meridianos 5º E y 20º W de Greenwich y los paralelos 45º y 25 N.* vol. I. Madrid: Instituto Geográfico Catastral y Estadístico.

Galbis Rodriguez, J (1934). *Catálogo sísmico de la zona comprendida entre los meridianos 5º E y 20º W de Greenwich y los paralelos 45º y 25 N.* vol. II. Madrid: Instituto Geográfico Catastral y Estadístico.

Munuera, J.M. (1963). *Datos básicos para un estudio de la sismicidad en el área de la península Ibérica (Seismic Data),* Memoria 32. Madrid: Instituto Geográfico y Catastral.

Mezcua, J. and J. M. Mártinez-Solares (1983), *Sismicidad del área Ibero Mogrebí*. Publicación 203. Madrid: Instituto Geográfico Nacional.

Martinez-Solares, J. M. and J. Mezcua (2002), *Catálogo sísmico de la península Ibérica (880 a.C. – 1900)*. Monografía 18, Madrid: Instituto Geográfico Nacional.

References

Álvarez Martínez, U. (1889) *Historia general, civil y eclesiástica de la provincia de Zamora.* Zamora: La Seña Bermeja.

Ambrasseys, N. et al. (1983) Notes on historical seismicity. *Bull. Seism. Soc. Am*., 73, 1917-1920.

Breton González, M. y Espinar Moreno, M. (1996) Fenómenos sísmicos que afectaron a las tierras andaluzas en los siglos IX al XII según las crónicas musulmanas. In *Homenaje en honor del profesor Fernando de Miguel Martinez.* Granada: Universidad de Granada, 47-76.

Caballero, J. A. (2002). Mito e historia en la Crónica General de España de Florián de Ocampo. *AISO-Actas VI*, 397-405.

Cevallos, J. (1756). Censura. In B. Feijoo y Montenegro, *Nuevo systhema sobre la causa physica de los terremotos, explicado por los phenómenos eléctricos y adaptado al que padeció España en primero de Noviembre del año antecedente de 1755*. Puerto de Santa María: Casa Real de las Cadenas.

Conde y García, J. A. (1820,1821), *Historia de la dominación de los árabes en España.* (3 vols.) Edición de 1844, Barcelona: Imp. y Lib. Española.

Díaz Cassou, P. (1887), *La huerta de Murcia*. Madrid

Faria y Sousa, M. de (1730) *Historia del Reino de Portugal* (Nueva Edición). Brussels: Francisco Foppens

Garibay, E. de (1571), *Los quarenta libros del Compendio Historial de las crónicas y universal historia de todos los reynos de España*. Barcelona: Sebastian de Cornelles (2. ed. 1628).

Guidoboni, E. (ed.) (1989). *I terremoto prima del mille in Italia e nell'area Mediterranea.* Bologna: Storia-Geofisica-Ambiente.

Ibáñez García, J. M. (1931), *Crónica de la Ciudad de Murcia.* Murcia.

Ibn Abi Zar (s. XIV) *Rawd al-Qirtas*. Traducido y anotado por Ambrosio Huici Miranda (Textos medievales 12 y 13). Valencia: Anubar Ediciones (Huici, 1964)

Ibn al' Adhari (s. XII), *Histoire de l'Afrique et de l'Espagne intitulée Al-Bayano'l-Mogrib*; Traduite et annotée par E. Fagnan. Argel: Pierre Fontana (Fagnan, 1904)

Isa ibn Ahmad al Razi (971-975) *Anales palatinos del Califa de Cordoba Al-Hakam II*. Traducción de Emilio García Gómez, Madrid: Sociedad de Estudios y Publicaciones (García, 1967).

Mariana, J. de (1601), *Historia General de España*. Biblioteca de Autores Españoles vols. 30 and 31. Madrid: Rivadeneira (1854).

Milne, J. (1911). *Catalogue of destructive earthquakes* AD 7 to AD 1899. Londres: Burlington House.

Morales, A. (1574) *Crónica General de España*. (continuación de Ocampo, lib. 6-12). Madrid: Benito Cano (1791)

Muñoz, D. and A. Udías, 1982. Historical development of Spain´s Catalogs of Earthquakes. *Bull. Seism. Soc. Am*. 72, 1039-1042.

Nifo y Cagigal, F. M. (1755). *Explicación physica y moral de las causas, señales, diferencia y efectos de los terremotos*. Madrid: Herederos de A. Gordejuela

Ocampo, F. de (4 libros, 1543; 5 libros 1578) *Crónica General de España*. Madrid: Benito Cano (1791).

Poirier, J. P. and M. A. Taher (1980), Historical seismicity in the near and middle east, north Africa and Spain from Arabic documents (VIIth-XVIIIth century). *Bull. Seism. Soc. Am*. 70, 2185-2201.

Roche, J. L. (1756). *Relación y observaciones physico mathemáticas y morales sobre el general terremoto y la irrupción del mar del día primero de noviembre de este año de 1755*. Puerto de Santa María: Casa Real de las Cadenas.

Rodriguez Alonso, C. (1975), *Las historias de los godos, vándalos y suevos de Isidoro de Sevilla*. *Estudio, edición crítica y traducción*. León: Centro de Estudios e Investigación San Isidoro.

Udías, A. (1983). El terremoto del 21 de Julio 365, erróneamente atribuido a la costa de Málaga. *Sismicidad Histórica de la Región de la península Ibérica*. Madrid: Asociación Española de Ingeniería Sísmica, 53-55.

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