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# When the waters recede: the economic impact of tsunamis in the Graeco-Roman world[1]

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Most people remember the Indian Ocean tsunami (December 26th, 2004) which killed over 230,000 people and, more recently, the earthquake and tsunami which hit the Pacific coast of Japan (March, 11th 2011) killing over 25,000 people. In both cases profound devastation was also caused. As has been often observed, the economic effects of such catastrophes on the remaining survivors, at least for the short-term, seem to have been less damaging than what one might expect. For instance, according to some preliminary analysis, 'in the case of the recent earthquake/tsunami in Sendai, recent data do not suggest that in terms of the initial mortality and destruction it caused even such a catastrophic natural disaster will have any significant adverse impact on the national economy of a rich country like Japan'[4]. That said, the aim of this paper is to focus on the economic consequences, if any, of the tidal waves on certain regions and periods of the classical world. Most interesting is the tsunami that hit Alexandria and some other locations on the South-Eastern Mediterranean on July 21, AD 365. As a matter of fact, the study of natural disasters has been a popular topic for modern scholarship of Antiquity[5]. Along the Mediterranean basin, ancient tsunamis usually devastated regions with high levels of seismic activity, such as the Balkans, the South-East, the Levant or the central and eastern islands. Most of the archaeological evidence from tsunamis and earthquakes, however, has been mixed up by a

(1) This article has its roots in a paper delivered at the conference *Land & Natural Resources in the Roman World – Roman Society Research Centre (Ghent-Brussels-Kent)*, Brussels, 26-28th May 2011. This research has been supported by the research project, *HAR2010-19185/Hist*, funded by the Spanish Ministry of Science, and by the research project 2009SGR 18, funded by the Catalan Research Agency (AGAUR). We also want to thank Aneurin Ellis-Evans, Daniel Gómez-Castro, Annalisa Marzano, Eduardo Ferrer-Albelda, Roger Riera Vargas and Koenraad Verboven for their help, along with the very helpful comments from an anonymous referee. Any mistakes remaining in the text are exclusively ours.
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(4) NOY, 2011, p. 1-6, esp. p. 4. As to the 2004 events and their effects on the tourist industry, see MEPRASERT, 2006.
(5) SORDI, 1989; GUIDOBONI, 1989; OLSHAUSEN and SONNABEND, 1998; GUNN, 2008.

combination of geological and human activity, making it difficult to single out which is which. Tsunamis were less frequent than earthquakes but their impact on human communities and their available natural resources could have been more catastrophic, at least in the short-term. The unexpected nature of such tidal waves surely produced considerable unrest within the affected population, who might have been familiar with the devastating effects of earthquakes but most probably were unaware of such a rare natural phenomenon(6). Our main goal, however, is to ascertain the economic impact of ancient tsunamis on the 'longue-durée'.

## 1. The aftermath of historically and geologically recorded tsunamis up until July AD 365

With the exception of the events of July AD 365, the evidence on damage caused by tidal waves in inhabited areas of the Classical Antiquity period is usually very scarce. For instance, geologists have recently identified several tsunami impacts on the Bay of Aghios Nikolaos, south of the Ambrakian Gulf, NW Greece, in a period between 395 and 247 BC, although there is no historical source attesting such disasters(7). Certainly, the Graeco-Roman literature describes, in some cases with remarkable accuracy, the basic functioning of what geologists know as tsunamis. A series of earthquakes and tidal waves hit Euboea, parts of Boeotia and the Maliakos gulf in 426 BC. Only a few years after the outbreak of the Peloponnesian War, Thucydides reports a tsunami hitting Orobia and the island of Atalante, where it destroyed an Athenian fort occupied since 431 BC (3.89.2-4). Then, Peparathos suffered great damage after a strike of tidal waves which Thucydides explains as a cause-effect phenomenon in direct relation to a previous earthquake. Demetrius of Callatis, the Hellenistic seismologist, gives further details on the immediate damage caused by the waves (Str.1.3.20), but not a single clue as to the long-term consequences of the disaster(8). In Antiquity, as well as today, volcanic eruptions and earthquakes were relatively frequent on the Italian peninsula and the eastern Mediterranean, the cradle of the classical culture. For the collective subconscious imagery of the Classical World, tsunamis seemed to have played a destructive role, perhaps even more severe than earthquakes and volcanoes. In the classical narrative, tsunamis have been usually identified with disasters of devastating effects and thus only the ones which deserve such qualification have been highlighted. One or more cities, or even an entire civilization, may have perished after the impact of a series of tidal waves. Similarly, Pliny the Elder attributes to the same phenomenon the sinking of Pyrrha on the island of Lesbos(9). But, all this is hardly comparable to what probably happened around the isle of Thera in

(6) For reconstruction after earthquakes and the political measures undertaken by the authorities see: PALUMBO, 1989, p. 124-127; CONTI, 2008, p. 374-386, esp. p. 383 ff.; HIGGINS, 2009, p. 12 ff.

(7) VÖTT e.a., 2008, p. 105-122, esp. p. 119-120.

(8) GUIDOBONI, 1989, p. 637-639; ANTONOPOULOS, 1992, p. 83-93; MOSLEY, 1998, p. 67-77, esp. p. 68; MORENO, 2007, p. 131-132.

(9) Plin. *Nat.* 5.39: *ex his Pyrrha hausta est mari, Arisbe terrarum motu subversa*, but there is no timing indication in Pliny's report. As to Strabo (13.2.4), his narration



c.1500 BC. According to the literary, archaeological and geological evidence, a tsunami, perhaps caused directly or in conjunction with the violent eruption of a volcano that destroyed the city of Akrotiri and most of Thera, might have contributed to the ending of the entire Bronze Age Minoan culture on Crete(10). The ancient narrative also reports tsunamis in close connection with sea warfare, particularly when tidal waves surprised the naval forces on the verge of a battle, such as in Salamina (480 BC, Hdt. 8.64.1-2) and Potidea (479 BC, Hdt. 8.129.1-2). According to Herodotus, the tsunami caused no trouble to both parties in the first case, but disrupted the Persian strategy in the latter(11). Furthermore, geologists have found evidence of a massive tsunami hitting the SW coast of Spain late in the third century BC, which coincided with certain operations of the Second Punic War. Geologically, we know that a considerable change on the actual shore line was produced, with an immediate effect on the already existing lagoon over the Guadalquivir estuary (*Lacus Ligustinus*), where only two centuries later some intensive Roman salt working has been attested. The original tsunami probably caused serious damage over a nearby pre-Roman settlement, Monte Algaida, a Punic sanctuary, which was abandoned roughly at the same time. Although the ancient texts offer abundant data on this region during this period, no record of such a disaster has been preserved(12).

It is thus clear that the ancient literature describes the uniqueness of tsunamis, along with their oddity, but it hardly focuses on the consequences of such catastrophes for the survivors, although there is still much to be learnt from the literature. For instance, several texts describe how the Achaean cities of Helikè and Bura, located in the Gulf of Corinth, were wiped out in 373 BC. A tsunami seems to have been the most likely explanation for Helike's sinking into the sea, whilst an earthquake, probably associated with the same event, eventually destroyed Bura, although perhaps not entirely(13). We need hardly emphasize that, according to the classical sources, politics lies behind some of the traditional explanations for such disasters we find in Antiquity. Bura and particularly Helikè (the latter retaining the main cult centre for Poseidon in Achaea) opposed the re-founding of the Pan-Ionian sacrifice altar in some other location, despite the specific request made by some Ionian delegates in remembrance of an old sanctuary in honour of the Heliconian Poseidon; this sanctuary had been erected by the Ionians themselves before

only confirms that Pyrra had been wiped out in the past, stating that the town was again inhabited in his own time.

(10) MARINATOS, 1939, p. 425-439; GUIDOBONI, 1989, p. 625-631; PARARAS-CARAYANNIS, 1992, p. 115-123; MONAGHAN e.a., 1994, p. 217-228; POLINGER E.A., 1996, p. 1-14; DOMINEY-HOWES, 2004, p. 107-112.

(11) See SMID, 1970, p. 100-104, esp. p. 102-103; GUIDOBONI, 1989, p. 634-635.

(12) RODRÍGUEZ-VIDAL e.a., 2011, p. 1-12. On Lacus Ligustinus in Antiquity, see: FEAR, 2003, p. 43; FERRER ALBELDA e.a., 2008, 217-146, esp. p. 220-222.

(13) *RE* XII, col. 2855-2862; *RE* IV, col. 1059-1060; GUIDOBONI, 1989, p. 642-644, listing and commenting on the abundant literary record on the topic, and in particular Plb. 2.41.7 (pointing out, along with Paus. 7.25.9, that Bura survived all these events despite suffering great damage); Strabo 8.7.2; Paus. 7.24.5-6. On the physical description of the events, see STOTHERS, 2004, p. 101-108, esp. p. 101-102; GOUKOWSKY, 2006, p. 73-117, esp. p. 76-78. On the archaeological remains, see SOTER and KATSONOPOULOU, 1999, p. 531-563, esp. p. 557-561.

their expulsion from Achaia centuries ago (Paus.7.24.5; Hdt. 1.145). All this inevitably contributed towards raising the political tension in the region spreading a general hatred against both towns (Diod.15.49), which also explains why some ancient traditions interpreted the tsunami of 373 as divine revenge for the towns' obstruction (Sen. *Nat.Quaest.* 6.26.2-3 [3])(14).

As soon as the news from the disaster reached inland, the Achaean league took immediate action. According to Strabo, following Heracleides of Pontus's description of the post-catastrophe scenario, two-thousand people were immediately sent to the shore by the Achaean league but there were too many dead bodies for these people to cope with. That is a clear indication of the vast tragedy provoked by the tsunami. In the long-run, the Achaean koinon was responsible for framing new settlement patterns after the loss of such a troublesome town. Later on, Strabo reports that Helikè's territory was partitioned amongst its Achaean neighbors, probably some time after the disaster (Str. 8.7.2., C.385)(15). Although more specific data are limited to one additional literary passage, all our evidence seems to indicate that Helikè's devastated landscape was repopulated by the neighbouring peoples and, according to Pausanias, also those from Aigion (Paus. 7.25.4). If this last text is to be trusted, once there was full confirmation of the complete destruction of Helikè then the sanctuary of Zeus Homarios, located near Aigion, assumed its new role as the centre cult for Poseidon on behalf of the Achaens(16). According to E. Mackil, the archaeological record from the area where Helikè once stood has produced some evidence of a temple from the Hellenistic age. All this shows that the area was at least partially repopulated, although there is no doubt that the polis of Helikè ceased to exist in 373 BC, unlike Boura, which a century later was a fully functional city(17). Moreover, D. Katsonopouou points out that, despite Pausanias' indications, the representations of a trident (Poseidon's symbol) on the federal coins of Keryneia seem to indicate that it was the latter which replaced Helike's central position in Achaean religion and politics after 373 BC(18). The truth is that discerning which town held Poseidon's sanctuary, as soon as the waters receded, is not essential to this matter. More important to us is to understand the overall geopolitical changes when any Achaean town other than Helikè assumed regional control. Therefore, despite the scanty evidence we have, the historical impact of the 373 tsunami on the Achaean political landscape, in particular on the neighbouring towns, need hardly to be stressed.

(14) PRANDI, 1989, p. 43-59.

(15) Str. 8.7.2 (lin. 29-30): δισχιλίους δὲ παρὰ τῶν Ἀχαιῶν πεμφθέντας ἀνελέσθαι μὲν τοὺς νεκροὺς μὴ δύνασθαι; Str. 8.7.2 (τοῖς δ' ὁμόροις νεῖμαι τὴν χώραν).

(16) Paus. 7.25.4.5: Ἑλικαέων δὲ οὐκέτι ὄντων νέμονται τὴν χώραν οἱ Αἰγιεῖς. PRANDI, 1989, p. 57-58; MORGAN and HALL, 2004 , p. 472-488, esp. p. 482.

(17) MACKIL, 2004, p. 493-516, esp. p. 498 and n.29, and p. 499, and p. 511, n.104.

(18) KATSONOPOUOU, 2002, p. 175-182, esp. p. 178. According to Seneca, Aigion suffered destruction from an earthquake exactly when Helikè and Bura were wiped out: *Illa vasta concussio quae duas suppressit urbes, Helicem et Burin, circa Aegium constitit* (*Nat.Quaest.* 6.25.4). Therefore, Keryneia might have effectively claimed such a central role in Achaean politics and religion. RIZAKIS, 1995, p. 285-286, esp. n.476 (*La destruction d'Aigion par un tremblement de terre*); RIZAKIS, 2008, p. 213 and p. 335, n.19.



Already in the Hellenistic period Polybius and some other sources attest to the severe consequences suffered by Caria, Lycia and in particular the isle of Rhodes after an earthquake shook the region, probably between 228 and 226 BC(19). Polybius (5.88-90.4) reports the call for help of the Rhodians to their neighbours, in order to cope with the financial costs of rebuilding the town and some monuments after the disaster. According to this passage, several Hellenistic towns and kingdoms responded to such a desperate call, probably for reasons directly related to the commercial and financial role Rhodes played in the area, pouring many resources into the Rhodian treasure. In his twentieth book Polybius narrates such events from late in the 190s BC, but in one passage from the same book he claims that, earlier in the past, a naval expedition to Caria, conducted by King Antigonos Doson of Macedonia (229-221 BC), was delayed on the bay of Larymna, in Boeotia, after a sudden low tide made his fleet run aground (Plb. 20.5.7)(20). Dating this episode (most likely a tsunami caused by a previous earthquake) is a controversial matter. In the first place, to single out a clear connection between the historical events described by the texts and a particular natural disaster, such as an earthquake or a tsunami, has become increasingly difficult to establish for a region with high seismic activity. Secondly, it is worth noting that the Polybian passage provides no clear chronological indication for the king's expedition, neither is the rest of the historical evidence more conclusive (Iust. *Prol.* 28)(21).

It may be noted that in 1988 J. Bousquet published an inscription from Xanthos in Lycia (206-205 BC), in which some legates from the Dorian town of Kytenion carried a petition of financial assistance on a tour of several Greek towns. The Kytenians provide detail of the financial support they were eventually able to collect, in compliance with the common practice in Hellenistic times of offering assistance to towns which had suffered from natural disasters(22). The walls of Kytenion had been severely damaged by

(19) Diod. 26.4.8; Paus. 2.7.1; Str. 14.2.5; Oros. 4.13.13; Plin. *Nat.* 34.41; Iust. 30.4.3. For the complete list of literary and epigraphic evidence on the earthquake see GUIDOBONI, 1989, p. 648-651; and on the impact of the earthquake see also BERTHOLD, 1984, p. 92-93; ASHTON, 1986, p. 1-18, esp. p. 14-15; CATAUDELLA, 1998, p. 190-197; TRAINA, 2002, p. 747-757, esp. p. 750-751.

(20) Ἀντίγονος μετὰ τὸν Δημητρίου θάνατον ἐπιτροπεύσας Φιλίππου, πλέων ἐπί τινας ῥάξεις πρὸς τὰς ἐσχατιὰς τῆς Βοιωτίας πρὸς Λάρυμναν, παραδόξου γενομένης μπώτεως ἐκάθισαν εἰς τὸ ξηρὸν αἱ νῆες αὐτοῦ. WALBANK, 1979, p. 69-70. According to FOSSEY, 1990, p. 169 (Str. 9.2.13 C 405), geographically this region belonged to Boeotia and Lokris.

(21) On the date of Antigonos Doson's expedition to Caria, see CATAUDELLA, 1998, p. 190-191, esp. n.4, summarising the previous literature. Iust. *Prol.* 28: *Antigonus, qui Thessaliam et in Asia Cariam subiecit.*

(22) Apart from the Rhodian example, a well-known inscription from Iasos (*c.*196-5 BC) contains a letter sent by Laodike, wife of Antiochos III, offering benefaction to the city after having suffered from 'unexpected natural disasters' (συμπτώμασιν περιπεσοῦσαν ἀπροσδοκήτοις) Iasos 4, lin. 7-8), according to the translation made by CROWTHER, 1985, p. 91-136, esp. p. 113, and normally related to an earthquake of 199-8 BC. See also REAGER, 2003, p. 331-351, esp. p. 344; RAMSEY, 2011, p. 510-527, esp. p. 512-514. In earlier periods such petitions were not uncommon, as in 399 BC when, according to Xenophon, the Eleans sent embassies to all the Spartan enemies in order to help them recover from a recent earthquake (X. *Hell.* 3.2.24).

an earthquake a few years before and Antigonos Doson's military advance to Phocis and the Dorian region (lin. 93-96) caused even more damage to the defenseless town. According to Bousquet's interpretation, the earthquake responsible for the tsunami at Larymna ought to have been the one mentioned by the Kytenians. There has been much discussion on the exact dates of the Kytenion's invasion since Bousquet chose a date later on in Antigonos' reign (222 BC), which meant that it could hardly be associated with the Rhodian earthquake. His theory, however, has been convincingly argued by F. Walbank and others and an early date such as 228 BC seems now more plausible(23).

Without entering here on the detailed chronological discussion, it is certain that the inscription from Xanthos only refers to the damage caused to Kytenion's walls (*seismós*, lin.95)(24) by an earthquake and not, at least explicitly, by tidal waves. Regardless of the fact that the lethal chain of events concerning the Kytenians was probably triggered by a different natural phenomenon than the one described in Plb.20.5.7, it should be stressed that normal affairs of ancient communities were easily disrupted by sudden disasters that had unexpected consequences for the history of the affected region. But, to this general picture we should also add that it is impossible to recover the full significance of this Polybian passage. It seems reasonable to think that along with Antigonos' ships, seriously affected by the tidal waves at Larymna in the midst of the Carian expedition, some coastal towns from Boeotia, close to Lokris, might also have been damaged by the tsunami, and may have eventually produced an economic impact, at least for a few years. Nevertheless, if we take a broad look at the historical evidence we actually have, neither the archaeological nor the epigraphical record from coastal towns such as Larymna (modern Kastrí or Lárymna) or Anthedon (modern Loukísia), which held successful fishing and commercial industries in their harbours during that period, seem to attest to any clear sign of economic or even political decline which, if it had been detected for the last decades of the third century BC, might have been attributed to the Polybian tsunami. Therefore, if such a natural catastrophe eventually had an impact on coastal Boeotia, we must conclude that the recovery from the sudden 'low tide' was so quick that any possible damaging effects on the long-term economic life of both seaside towns is imperceptible(25).

According to a passage from Plutarch, in 58 BC Cicero was voyaging to Dyrrachium in order to spend the last part of his exile in Illyria, when his ship encountered an earthquake and a tidal wave: σπασμὸν ἅμα γενέσθαι

(23) BOUSQUET, 1988, p. 12-53, esp. p. 42-43 for a date in 222 BC; GUIDOBONI, 1989, p. 648. *Contra*. WALBANK, 1989, p. 184-192, who believes in an earlier date such as 228 BC, supported by MACKIL, 2004, p. 502-503.

(24) BOUSQUET, 1988, p. 16.

(25) 'Anthedon must however have remained in use as a trading and fishing port during the centuries that followed; it seems to have been fairly prosperous at the time of Herakleides (late 3rd century BC) and her harbour could have a military significance': SCHLAEGER e.a., 1968, p. 21-102, esp. p. 91. See also: WALLACE, 1979, p. 57-59, p. 73-76; KNOEPFLER, 1986, vol.2, p. 579-630, esp. p. 596-597; FOSSEY, 1988, vol.1, p. 252-257; FOSSEY, 1990, p. 22-26; FARINETTI, 2011, p. 204-205.



τῆς θαλάσσης (Plut. *Cic*. 32.4)(26). No more evidence on the exact nature of that disaster or its impact on the terrain is provided by any other literary source, but we know that the bill which decreed his exile was passed on the 20th March of 58. Thereafter, Cicero sought to flee from Italy almost immediately, writing a letter to his wife, Terentia, from Brundisium on the 29th April, where he had been stuck for thirteen days (Cic. *Fam*. 14.4.2), and then spending six months at Thessalonika before reaching Dyrrachium(27). Therefore, if Plutarch's narration is to be believed, the tsunami probably took place a few days before the 29th November 58 BC, because we have another Ciceronian letter which was begun in Thessalonika and only finished in Dyrrachium on that precise date (Cic. *Fam*.14.1). As a result, Cicero's mere presence at the Illyrian town just after the 'catastrophe', as well as the fact that he did not mention anything uncommon concerning disasters in his letter, clearly indicate that the seismic activity described in Plutarch, if it ever occurred, hardly had any consequence for the economic life of Dyrrachium or of its generally busy port. The active role of Roman businessmen within the region, and more specifically at Dyrrachium's port, before and during the Civil Wars, clearly shows that the alleged tsunami hardly had any impact on the Illyrian economy and finances, beyond the fact of a more direct Roman intervention in the affairs of a *civitas libera*(28).

A well-known passage from Dio reveals that, in AD 68, a tsunami seriously affected Lycia, in Southern Asia Minor, when the waters retreated from Egypt (63.26.5) and, according to some verses from the Sibylline Oracles, the tidal waves hit the Lycian towns of Myra and Patara (4.109-113)(29). At this stage, any eventual change in the daily life at coastal Lycia, a rough terrain for agriculture but with highly important harbour facilities, may help us to establish a connection, at least indirectly, with the events recorded in the literary sources. The archaeological and epigraphic record from Patara and Myra's port, Andriake, may help us to connect firstly the rebuilding of baths and some aqueduct sections roughly after AD 68, secondly some substantial donations provided by the Emperor and, finally a catastrophe normally linked to an earthquake but perhaps related to the literary attested

(26) λέγεται δὲ καὶ καταπλεύσαντος εἰς Δυρράχιον αὐτοῦ καὶ μέλλοντος ἀποβαίνειν, σεισμόν τε τῆς γῆς καὶ σπασμὸν ἅμα γενέσθαι τῆς θαλάσσης. ἀφ' ὧν συνέβαλον οἱ μαντικοὶ μὴ μόνιμον αὐτῷ τὴν φυγὴν ἔσεσθαι· μεταβολῆς γὰρ εἶναι ταῦτα σημεῖα. GUIDOBONI, 1989, p. 655.

(27) Cic. *Fam*. 14.1.7: *Dyrrachium veni, quod et libera civitas est, et in me officiosa et proxima Italiae*. See most recently: TEMPEST, 2011, p. 121-123, and also: CABANES, 1995, p. 42-43; WILKES, 2004, p. 383-389, esp. p. 384.

(28) DENIAUX, 1993, p. 263-270, esp. p. 264, p. 267-268; CABANES, 2001, p. 121-136, esp. p. 133-134; DENIAUX, 2007, p. 71-79.

(29) Dio 63.26.5: οὐδ' ὅτι ἐκ τῆς Αἰγύπτου ὑπαναχωρήσασα ἐπὶ πολὺ ἡ θάλασσα μέρος μέγα τῆς Λυκίας κατέλαβεν·. Orac. Sibyl. 4.109-113: ὦ Λυκίης Μύρα καλά, σὲ δ' οὔποτε βρασσομένη χθών στηρίξει· πρηνὴς δὲ κάτω πίπτουσ' ἐπὶ γαίης εἰς ἑτέρην εὔξῃ προφυγεῖν χθόνα, οἷα μέτοικος, ἠνίκα δὴ Πατάρων *ὅμαδόν ποτε δυσσεβίῃσιν βρονταῖς καὶ σεισμοῖσιν ἀλὸς πετάσει μέλαν ὕδωρ. NEWBOLD, 1973, p. 211-213, esp. p.211; GUIDOBONI, 1989, p. 664-665; DUGGAN, 2004, p. 123-162, esp. p. 128.

tsunami as well[30]. A similar phenomenon may be also observed after the c. AD 139-144 earthquake, whose epigraphical record provides even more specific data on the imperial benevolence towards the devastated Lycian cities[31]. But, we should add that all the evidence seems to point out that any temporary disruption suffered by the harbour facilities in Patara and Myra-Andriake in the aftermath of the AD 68 tidal wave hardly had any impact on the general trend of their economies, or even on the general economic development of a region such as Lycia, often struck by similar seismic disasters. Thereafter, the tsunami might have destroyed a lighthouse attached to the harbour of Patara. However, the rebuilding of the lighthouse by Nero, according to the most common reading of an inscription, along with some geological projections of the extension of the tidal waves, makes it difficult to accept such a chronological succession of events[32]. These brief considerations bring us inevitably to the conclusion that by itself the AD 68 tsunami had less damaging consequences in the long-run than for example the more spectacular Antonine disaster along with others which have been attested in Lycia for the classical period[33].

From several passages from Cassius Dio, Eusebius, Orosius and others it is clear enough that probably late in December AD 115, during the emperor Trajan's visit to Antioch, a terrible earthquake struck a vast area of the Levant coast[34]. The catastrophic magnitude of these events is shown by the relatively lengthy and accurate descriptions depicted in the chronicles we have and, also, by the efforts made by the imperial administration to restore normal life in the region after the disaster. Nonetheless, it is important to stress that if the AD 115 earthquake deserves full attention now it is because some recent studies on the harbour of Caesarea Maritima (Israel), conducted by geologists

(30) MAGIE, 1950, vol.1, p. 530; vol.2, p. 1388, n.52; SAMS, 1975, p. 202-205, esp. p. 203-204; in Patara, the first phase of the so-called 'Baths of Vespasian' may be dated shortly after the tsunami/earthquake impact in AD 68-68, dated thanks to an inscription: FARRINGTON, 1995, p. 156-157, n.38 in the catalogue. On the aqueduct from Patara, built under Claudius, and seriously damaged by this same earthquake: SAHIN, 2007, p. 99-109, esp. p. 104-106, p. 108-109.

(31) IGR 3.379; MAGIE,1950, vol.1, p. 536, p. 631-632, and vol.2, p. 1395 n.71, p. 1491-1942 n.6; MITCHELL, 1987, p. 333-365, esp. p. 351-352; GUIDOBONI, 1989, p. 669; HORDEN and PURCELL, 2000, p. 306-307; DELRIEUX, 2008, p. 220-222.

(32) FATIH GÜLSEN, 2007, p. 223-238, esp. p. 234-235 n.88; JONES, 2008, p. 153-154. It is worth noting that the tsunami model recently simulated by geologists seem to calculate that the tidal waves did not probably reach the area where the lighthouse from Patara was located: YALCINER e.a., 2010, p. 1-9, esp. p.8 (fig.7); GIARDINA, 2010, p. 71-72 (num.71 of the catalogue).

(33) BEAN, 1978, p. 82-91 (Patara), and on the harbour facilities: esp. p. 85-86 and p. 89; p. 120-130 (Myra), and on the harbour: esp. p. 121 and p. 129-130, and see also more recently: *NP*, 9, 2006, p. 411-412 (Myra) and *NP*, 10, p. 594-595 (Patara); ISIK, 2006, p. 263-277; in both Patara and Andriake's ports large magazines (*horrea*) have been confirmed at least from the first half of the second century AD: CAVALIER, 2007, p. 51-64, esp. p. 64. See also: CEVIK and PIMOUGUET-PEDARROS, 2011, p. 303-319, esp. p. 304, p. 308.

(34) Dio 68.24-25, with a very detailed narration of the destruction caused by the earthquake in Antioch and, particularly, how the Emperor escaped whilst others from his entourage, such as the consul Pedo, did not survive their injuries; Eus. *Hieron. Chron.* 196c; Oros. 7.12.5; Evag. 2.12; Mal. 275, see GUIDOBONI, 1989, p. 667-668.



and geoarchaeologists, have presented hard evidence for a tsunami strike in Caesarea exactly at the same time as the Antioch earthquake. It is worth noting that the only literary sources mentioning tidal waves in connection with a disaster in Caesarea are those from the Talmud, but not the classical tradition[35].

This is a relevant topic which cannot be pursued with much detail here, because it has already been fully dealt with recently. Indeed, we note that Dey and Goodman-Tchernov's article has definitively shed new light on the true implications of a series of tsunamis striking the harbor of Caesarea for the economic history of one of the most relevant ports within the Levant. First of all, the geoarchaeological record confirms that Caesarea's harbour was effectively damaged by the strike of the AD 115 and AD 551 tsunamis[36], also well attested by our literary sources. Secondly, other tsunamis (AD 365, 502) not so well documented by the archaeology and the geological surveys in Caesarea, may have exacerbate the situation of the port facilities. And last but not least, the economic decay of the city, principally after the tsunami strikes at AD 115 and 551, may well be attributed to the poor state of its port, but without taking into consideration other macroeconomic, political and military issues, this hardly allows us to conclude that these two tsunamis were the main cause for such decay[37].

Finally, according to the classical sources at least two tsunamis have been identified before the big disaster narrated by Ammianus for AD 365, although there is hardly any evidence to prove their effects over the damaged regions suggested by those texts. In AD 262, against a general background of war and political unrest in Rome under the consulate of Gallienus and Faustinianus, several earthquakes struck Lybia, Asia Minor and Rome itself. In this passage a phenomenon which may be easily attributed to a tsunami is explicitly mentioned: *maria etiam multas urbes occuparunt* (SHA, *Gal.* 5.2.5). After rejecting old theories, such as the ones which had connected a disaster in Ephesus around this period with some mysterious Gothic invasions, a natural disaster has arisen as a more likely explanation. Only recently signs of destruction and rebuilding, attested by the archaeological record, have been directly attributed to the AD 262 earthquake, although it is also true that there is no evidence for any tidal wave hitting the city or any other coastal landscape[38]. Then, according to Malalas, a Byzantine author, we know of a tsunami normally dated in AD 342 striking Salamis in Cyprus although

(35) REINHARDT e.a., 2006, p. 1061-1064; DEY and GOODMAN-TCHERNOV, 2010, p. 265-284, and p. 270, n.17 for the Talmudic texts.

(36) GUIDOBONI, 1989, p. 699-700. Specifically, recent studies have shown the key role played by the AD 551 earthquake and tsunami to explain Beirut's decline. Located not far from Caesarea, the rebuilding of the city and its harbour facilities never brought back her old splendour: MIKATI and PERING, 2006, p. 42-55, esp. 49, 52; MARRINER e.a., 2008, p. 2495-2516, esp. p. 2512-2513.

(37) RABAN, 2009, p. 205-206; DEY and GOODMAN-TCHERNOV, 2010, p. 276-282.

(38) GUIDOBONI, 1989, p. 605, p. 671-672; TRAINA, 2002, p. 748-749, and n.7. The AD 262 earthquake has been attested archaeologically for instance in Ephesus: LADSTÄTTER and PÜLZ, 2007, p. 391-433, esp. p. 394-397. As to Lybia, the lack of geoarchaeological evidence connected with a tsunami is even worse: see STIROS and PAPAGEORGIOU, 2001, p. 381-397, esp. p. 385, p. 391.

the archaeological record can only confirm, for that period, relevant seismic activity in the island seriously affecting some buildings from Salamis(39). As to the impact of these events on the general economic trends within Cyprus, all authors emphasize that a period of decline may be observed from the second half of the fourth century AD. It becomes increasingly difficult to attribute such economic decline solely to the AD 342 tsunami, although it surely caused serious damage on harbour installations, fishing industries and seafaring trade. Despite news of rebuilding immediately after such events, there is evidence of a series of earthquakes regularly striking the cities, their harbours, road systems and the water supply all along the island, as well as the Eastern Mediterranean during this period. On this basis, it is likely that adverse conditions upset the Cyprian economy for some time, regardless of the quick recovery one might have expected if only a tidal wave had hit the coast line and the lower lands(40).

## 2. The earthquake of AD 365. Sources and geological evidence

According to a vivid description of a tsunami in a well-known passage from Ammianus Marcellinus, who is the main source on this subject, a 'big wave', consequence of an earthquake whose epicenter has been geologically located near Crete, swept away the shores of the eastern and central Mediterranean on July 21st AD 365:

> While this usurper [Procopius] yet lived, whose various deeds and whose death I have described, on 21 July in the year in which Valentinian was consul for the first time with his brother [A.D. 365], fearsome terrors suddenly strode through the whole circle of the world, the like of which neither legends nor truthful ancient histories tell us. 16. Slightly after daybreak, and heralded by a thick succession of fiercely shaken thunderbolts, the solidity of the whole earth was made to shake and shudder, and the sea was driven away, its waves were rolled back, and it disappeared, so that the abyss of the depths was uncovered and many-shaped varieties of sea-creatures were seen stuck in the slime; the great wastes of those valleys and mountains, which the very creation had dismissed beneath the vast whirlpools, at that moment, as it was given to be believed, looked up at the sun's rays. 17. Many ships, then, were stranded as if on dry land, and people wandered at will about the paltry remains of the waters to collect fish and the like in their hands; then the roaring sea as if insulted by its repulse rises back in turn, and through the teeming shoals dashed itself violently on islands and extensive tracts of the mainland, and flattened innumerable buildings in towns or wherever they were found. Thus in the raging conflict of the elements, the face of the earth was changed to reveal wondrous sights. 18. For the mass of waters returning when least expected killed many thousands by drowning, and with the tides whipped up to a height as they rushed back, some ships, after the anger of the watery element had grown old, were seen to have sunk, and the bodies of people killed in shipwrecks lay there, faces up or down. I9. Other huge ships, thrust out by the mad blasts, perched on the roofs of houses, as happened at Alexandria, and others were hurled nearly two miles from the shore, like the Laconian vessel near the town of Methone which I saw when I passed by, yawning apart from long decay. (Amm. 26.10.15-19)(41).

In a recent article, G. Kelly has focused principally on Ammianus' specific approach to his narrative of the tsunami as a Late Roman historian. In fact, Kelly's article is particularly concerned with the analysis of Ammianus' sources and with any contemporary political and symbolic reading which may lie behind his detailed description of the events(42). But, some issues that were not central to Kelly's arguments, such as the immediate casualty

(39) Mal. 48. 313; Teoph. 1.37.14-15; KARAGEORGHIS, 1970, p. 201 and p. 226, albeit not mentioning at all the impact of tsunamis, he points out that the earthquakes striking the island in AD 332 and 342 severely damaged the daily life of most of the Cyprian towns, such as may be observed in the water supply from Salamis and Kourion, as well as in the gymnasium, palestra and baths from Salamis. Actually, these last buildings were rebuilt soon after the catastrophe, as stated in an inscription, normally dated c. AD 346, commemorating the restoration of the baths by Constantius II and Constans: MITFORD and NIKOLAU, 1974, num. 41, p. 64-67, esp. p. 66; WATKIN, 1988, p. 331 (restoration of the gymnasium). Imperial benefaction over Salamis not only meant the remission of some taxes for four years but also the complete rebirth of the town, now called Constantia, MITFORD, 1980, p. 1285-1384, esp. p. 1376; KARAGEORGHIS, 1982, p. 189; GUIDOBONI, 1989, p. 674.

(40) KARAGEORGHIS 1970, p. 201-202; FLEMMING, 1974, p. 163-173, esp. p. 170-172, pointing out that the port was submerged in AD 342 but perhaps not by a tidal wave; MICHAELIDES, 1996, p. 139-149; LEONARD, 2005, p. 145-147 (port of Salamis and AD 342 tsunami), p. 251-252 (road system seriously affected by the same earthquake), and p. 971 ff. on the economy of the island after the earthquake and its rebuilding.



(41) Transl. KELLY, 2004, p. 141-167, esp. p. 141. *Hoc novatore adhuc superstite, cuius actus multiplices docuimus et interitum, diem duodecimum Kalendas Augustas, consule Valentiniano primum cum fratre, horrendi terrores per omnem orbis ambitum grassati sunt subito, qualis nec fabulae nec veridicae nobis antiquitates exponunt. Paulo enim post lucis exortum densitate praevia fulgurum acrius vibratorum tremefacta concutitur omnis terreni stabilitas ponderis, mareque dispulsum retro fluctibus evolutis abscessit, ut retecta voragine profundorum, species natantium multiformes limo cernerentur haerentes, valliumque vastitates et montium tunc, ut opinari dabatur, suspicerent radios solis, quos primigenia rerum sub inmensis gurgitibus amendavit. Multis igitur navibus velut arida humo conexis, et licenter per exiguas undarum reliquias palantibus plurimis, ut pisces manibus colligerent et similia: marini fremitus velut gravati repulsam versa vice consurgunt perque vada ferventia insulis et continentis terrae porrectis spatiis violenter inlisi, innumera quaedam in civitatibus et ubi reperta sunt aedificia, conplanarunt: proinde ut elementorum furente discordia involuta facies mundi miraculorum species ostendebat. Relapsa enim aequorum magnitudo cum minime speraretur, milia multa necavit hominum et submersit recurrentiumque aestuum incitata vertigine, quaedam naves, postquam umentis substantiae consenuit tumor, pessum datae visae sunt exanimataque naufragiis corpora supina iacebant aut prona. Ingentes aliae naves extrusae rabidis flatibus culminibus insedere tectorum, ut Alexandriae contigit: et ad secundum lapidem fere procul a litore contortae sunt aliquae, ut Laconicam prope Mothonen oppidum nos transeundo conspeximus diuturna carie fatiscentem.*

(42) KELLY, 2004, p. 166: 'To the reader who has not sought safety in flight, I suggest that the combination of autopsy, allusiveness and the universalising elements of the description invites a metaphorical interpretation, and that the tsunami mirrors Ammianus' grand narrative of the Roman Empire: it is linked to his portrayal of Julian and portends the barbarian invasion and the end of the *Res Gestae* – and helps in turn to link the two'. See also: KELLY, 2008, p. 88-101.

record or any data on infrastructure damage as well as the eventual recovery policies carried out by the authorities, merit further investigation. As far as we know, this tsunami carried its destructive effects not only to Alexandria and the rest of Egypt's delta, North Africa, mainland Greece and the Levant, but it also reached the Adriatic coast of Italy and Sicily. It is likely that the invading waters engendered an immediate destructive effect on crops and pasture lands, water technology such as draining systems and dams, fishing and commercial boats, and other productive activities(43).

As is obvious, the starting point is to go through the available literary evidence, to verify the impact of the whole event, as perceived by contemporary and later authors. Ammianus' account offers various elements of interest to help us understand the scale of this huge natural event. His precise description of the phases of the tsunami offers support for the trustworthiness of his reconstruction of the phenomenon. For instance, he first tells us how the waters receded from the coastline, resulting in ships "stranded as if on dry land" (*Multis igitur navibus velut arida humo conexis*) and people collecting fish with their bare hands. But soon after a big wave of water hit the city, drowning thousands of people who clearly had not understood the nature of the tsunami and were still wandering near the coastline. The power of this big wave can easily be derived from what Ammianus says in the last lines of his account: *Ingentes aliae naves extrusae rabidis flatibus culminibus insedere tectorum, ut Alexandriae contigit: et ad secundum lapidem fere procul a litore contortae sunt aliquae, ut Laconicam prope Mothonen oppidum nos transeundo conspeximus diuturna carie fatiscentem*. Huge ships were thrown inland, even two miles away from their original location. Ammianus' account is very much focused on the very day of the tsunami and does not say anything about the effects it had on the life of Alexandria, or generally on the Empire. His focus is only the actual disaster, not its aftermath.

A similar approach to the events is shared by the other authors dealing with the same subject. Most of them are Christian writers, so their accounts are also biased by moralistic approaches.(44) Among them, are the more reliable texts of Sozomen and Malalas:

> "From what I have heard, I conjecture that it was during the reign of this emperor, or, at least, when he occupied the second place in the government, that a great calamity occurred near Alexandria in Egypt, when the sea receded and again passed beyond its boundaries from the reflux waves, and deluged a great deal of the land, so that on the retreat of the waters, the sea-skiffs were found lodged on the roofs of the houses. The anniversary of this inundation, which they call the birthday of an earthquake, is still commemorated at Alexandria by a yearly festival".(45)

(43) GOODCHILD, 1976, p. 229-238; DI VITA, 1980, p. 303-307; REBUFFAT, 1980, p. 309-328; LEPELLEY, 1984, p. 463-491; HENRY, 1985, p. 36-61; GUIDOBONI, 1989, p. 678-680; TRAINA, 1989, p. 449-451; LEPELLEY, 1990-1991, p. 359-371; DI VITA, 1995, p. 971-975; STIROS and PAPAGEORGIOU, 2001, p. 381-397; YANGAKI, 2005, p. 253-267.

(44) There is no need here to go through all the sources. For a focussed analysis of the Christian sources and their bias, see JACQUES and BOUSQUET, 1984, p. 423-461; HENRY, 2012, p. 175-196.

(45) Sozomen, HE, 6.3.



> "In his reign the island of Crete suffered through the wrath of God, 'the island of a hundred cities in the midst of the sea' (…). In Crete the public bath built by the Caesar Julius in the metropolis of Gortyn collapsed. (…) The emperor Theodosius restored six of these [chambers], (…). He provided large sums for the city and countryside for building purpose."(46)

While Sozomen adds a few more pieces of information on what happened in Egypt, Malalas' account also makes clear that Crete was hit by the tsunami, providing us with an interesting piece of evidence. This attests that the earthquake and the tsunami were not a local phenomenon limited to Egypt, but a much wider disaster. In fact, it has long been known by the scholars that the earthquake of 365 hit vast areas of the Mediterranean Sea. This also led archaeologists to connect every sign of damage in the fourth century AD to the earthquake, even in places very far from its epicenter such as Spain, depicting the earthquake of AD 365 as an "End of the World disaster", echoing the descriptions of the ancient Christian sources.(47)

Yet, over the years, far more accurate analyses have proved such an interpretation to be incorrect.(48) The epicenter of the earthquake was in the Mediterranean Sea, just south-west of Crete.(49) Recent geological analyses have proved that the tsunami of 365 was a natural disaster containing as its main component a severe earthquake triggering a tsunami which should at least have struck the complete basin of the Eastern Mediterranean, especially Crete, Cyprus, Lybia, Egypt and Palestine.(50) The search for a geological testimony led to a connection with what geologists call the Early Byzantine Time Paroxysm (EBTP) which lifted up South-western Crete almost eight meters high and should have happened approximately at the same time. The probable cause of such this phenomenon might well be an earthquake with a magnitude of Mw = 8.0 at that site, which triggered a mega-tsunami flooding all the coast of the Eastern Mediterranean. The disaster can be seen as a compilation of events of different times and locations where the EBTP may have been one part of those phenomena.(51)

(46) Malalas 14, 359-360.

(47) KELLY, 2004, p. 143.

(48) See, for instance, LEPELLEY, 1984, p. 463-491; DI VITA, 1990, p. 466-74.

(49) See HAMOUDA, 2010, p. 698.

(50) Nevertheless, recently HENRY, 2012, 175-196 tried to go against such accepted reconstruction, suggesting both a relocation of the epicentre of the earthquake (relocated to the Adriatic Sea), and the area of impact of the tidal waves (excluding, for example, the Levant). Henry's argument is mainly based on literary evidence along with some geological data. At the time of writing of this work, it seems to the authors that the interpretation of the epicentre being located in Crete relies on much more solid and complete evidence and is still therefore preferable.

(51) HAMOUDA, 2010, p. 688: "The AD 365 event was probably responsible also for reported or observed destruction in ancient towns of west Cyprus and Libya. This earthquake is most likely to be identified with a Hellenic Arc subduction-zone event of 'great' (M > 8) magnitude, as testified by up to 9 m uplift in western Crete dated back by previous geological studies to around this time. Historical and archaeological data also support the hypothesis that the fourth to the sixth centuries AD were a period of abnormally high seismicity in the Eastern Mediterranean region." See also PANTOSTI e.a., 2011, p. 159-162.

### 3. The earthquake & tsunami of AD 365. Archaeological evidence

After the overview of the previous part of this work, which aimed to define the nature of the event, we still have to assess the impact of it on the Roman Empire and the policies displayed by the Empire in order to cope with the disaster. In this regard, very useful information is provided by the archaeological excavations carried on in various sites of the Mediterranean, over the last few decades. The sites on which we will focus are Sabratha in Libya and Alexandria in Egypt. With regard to the first site we know it was severely hit by the earthquake. Ammianus reports raids, made by a dangerous tribe of camel-riding barbarians called Austurians, occurring around 363 AD in the area.(52) His account led several scholars to believe that the evidence of disruption found in the excavations at Sabratha, datable at the same period, might be connected to the raids of the Austurians. Nevertheless, further analyses carried on recently tended to discard such a hypothesis: the impact of the barbarian tribes could not have been so strong to cause the disruption recorded in the city, such as the destruction of buildings and roads.(53)

The evidence of disruption is certainly more consistent with the aftermath of the great earthquake/tsunami of AD 365. The analysis of some inscriptions found in the newly reconstructed town allows us to have a rather precise idea of the timing of the reconstruction. Two inscriptions, IRT 57 and 58, dated to AD 375-77 celebrate the reconstruction of the curia.

> *Iustitia pariter ac / pietate caelesti adq(ue)/ Romanae felicitatis perpetuo fundatori / d(omino) n(ostro) Valentiniano vic-/ toriossimo ac totius / orbis Aug(usto) Antonius/ Dracontius u(ir) c(larissimus) agens / uicem praefectorum prae-/ torio per Africanas pro-/ uincias numini et / maiestati eius semper / dicatissimus*
> "To one who is in justice and sense of duty alike heavenly, and perpetual founder of Roman good fortune, our lord Valentinian, most victorious, and Augustus of the whole world; Antonius Dracontius, outstanding man (i.e. member of the Roman Senate), deputy for the praetorian prefects throughout the African provinces, always most devoted to his divine power and majesty."(54)
> *Iustitia pariter ac pieta-/ te caelesti adq(ue) Romaną [e]/ felicitatis perpetuo/ fundatori d(omino) n(ostro) / Valenti uictori-/ osissimo ac totius or-/ bis Augusto/ Antonius Dracon-/ tius u(ir) c(larissimus) agens uicem / praefectorum prae-/ torio per Africanas / prouincias numini e[t] / maiestati eius semper diç [a]-/ tissimus*
> "To one who is in justice and sense of duty alike heavenly, and perpetual founder of Roman good fortune, our lord Valens, most victorious, and Augustus of the whole world; Antonius Dracontius, outstanding man (i.e. member of the Roman Senate), deputy for the praetorian prefects throughout the African provinces, always most devoted to his divine power and majesty."(55)

(52) Amm. 18.6.1-30.
(53) DI VITA, 1995, p. 971-976.
(54) IRT 57.
(55) IRT 58.



These two inscriptions testify that within ten or twelve years after the catastrophe the Roman state had already reconstructed the curia of the town. Yet, the reconstruction works did not finish in those years but carried on for some time. The inscription IRT 103, dated to the 28th June 378 reports the reconstruction of the baths, of which it is clearly said they were destroyed by some sort of disaster (*ruina*):

> *[Fl(aui) Viui Benedicti u(iri)] p.(erfectissimi) / totius integritatis modera-/ tionis iustitiae prouisionis / fidei benignitatis fortitudinis / ac beneficentiae uiro Fl(auio) Viuio / Benedicto u(iro) p(erfectissimo) praesidi prou(inciae) Tripol(itanae) / inter cetera beneficia sua quibus / omnem prouinciam conpendiis re-/ mediis et uirtutibus fouit suble/ uabit erexit etiam ob ea quae sibi / specialiter conlata sunt ciuitas / Sabrathensis exsultans* ***quod po/st ruinam et abnegatum therma-/ rum*** *populo exercitium citra ullius / dispendium ornamentis patriae / reuocauit ordo populusque / concinentibus omnibus uo-/tis statuam patrono pr(a)estan-/tissimo gratanti studio/ conlocauit*
> "[In honour of Flavius Vivius Benedictus,] excellent [man] (i.e. of equestrian status). To a man of complete integrity, moderation, justice, foresight, good faith, generosity, courage and beneficence, Flavius Vivus Benedictus, excellent man(i.e. of equestrian status), governor of the province of Tripolitania; among the other generous acts by which he cherished, assisted and improved the whole province, the city of Sabratha honours him also on account of those specifically conferred on itself; they are delighted that, when the Baths had fallen down so that the people could not use them he restored them without expense to anyone, and they are now among the ornaments of the country. The city-council and people, voting unanimously, set up the statue to an outstanding patron with enthusiastic gratitude."(56)

The completion of the restoration works at Sabratha is finally attested by IRT 111, dated to AD 383-88, in which the local community offers its gratitude to Lucius Aemilius Quintus, perpetual flamen, for having taken his people's troubles to the 'sacred' ears of the emperor. An interesting hint in the text refers to the common condition of the whole province affected by the catastrophe (*miseriae communes*):

> *L(uci) Aemili Quinti fl(aminis) p(er)p(etui) / quod laborem continu<u>m / pro prouinciae suae / necessitate sustinuit / et quod* ***miserias com-/munes*** *sacris aurib(us) / intimabit et remedium / meruit ordo et popul(us) / splendidae col(oniae) Sabrat(hensis) / secundum decreta totius / prouinc(iae) dedic(auerunt) cur(ante) / Fl(auio) Venantio*
> "(In honour) of Lucius Aemilius Quintus, perpetual flamen, because he made continual effort to meet the needs of his province and because he brought its shared misfortunes to the sacred (i.e. imperial) ears and obtained a remedy; the city council and the people of the splendid colony of Sabratha, in accordance with the decrees of the whole

(56) IRT 103.

province, dedicated (this); Flavius Venantius took charge (of the work)."[57]

Summing up, the evidence from Sabratha shows a precise pattern of reconstruction. First of all, the imperial authority aimed to restore the *curia*, which was the cardinal point of local political life and the basis for the restoration of the normal life of the town. This phase was completed within ten or twelve years. Then, slightly later, in thirteen years, came the restoration of the baths. Again a public building played a central role in the everyday life of the Roman towns, also playing a crucial role in securing the minimum of hygiene and the harmony of the community. The last inscription attests finally that within a time frame of 23 years (but possibly fewer) the full process of reconstruction of the town was completed.

The dataset of inscriptions from Sabratha is the most complete among those available. Still, traces of disruption are available for this period all over North Africa[58]. If we compare the dates provided by the dataset of Sabratha with the ones from the other cities of northern Africa, we find a very similar situation. As various works have shown, the building and restoration activities in the cities of Africa Proconsularis, Byzacena, Tripolitania, and Mauretania increase notably after 364 AD, towards the years 375-383[59], a timeframe certainly coherent with the reconstruction period in Sabratha. This allows us to put forward the possibility that, in dealing with such a disaster, the Roman Empire displayed some sort of unified recovery policy, that the central imperial power developed a plan to help all the regions after the earthquake and that this plan was carried on according to a precise schedule, which was homogeneously applied to all the regions struck by the events. If such a scheme could be further proved, it would provide interesting evidence of the existence of a regular plan to cope with natural disasters. Also, the existence of such a plan would shed some light on questions regarding the existence of a wider unified policy or proactive plans in the Ancient World.

A second aspect that is still left to discuss is the short and long term economic impact of the tsunami on the Roman economy. In this respect, the main focus of our analysis must be relocated to the area of Alexandria and the Egyptian delta, because the province of Egypt provides a dataset of economic data not comparable to any other region of the Empire. First of all, like Ammianus attests, we can safely say that the tsunami struck Alexandria and Egypt with violence. Apart from Ammianus' account, we can make use of geological analyses carried out on the region. Such analyses have proved that in terms of the tidal wave, the area of Alexandria and the Delta were the worst affected by the tsunami, with waves of more than 8 metres[60]. This caused great devastation to the western area of the city. Recent excavations

(57) IRT 111.

(58) See recently the city found in the sea in Cyrenaica, available at www.regione.sicilia.it/beniculturali/archeologiasottomarina/sez_news/news_09.htm

(59) See the data collected in LEPELLEY, 1979, p. 74-79.

(60) HAMOUDA, 2010, p. 698-99.



have found out that the area of the 'regia', the imperial quarters, was submerged under water in this period.[61]

Finally, we can say something on the impact that the tidal wave had at least on agricultural production (cereals and wine, mainly) and on farming activities. It is safely accepted that agricultural production in Egypt was of paramount importance not only for the economy of the region, but also for the whole Empire. Yet, as recently remembered by A. Bowman, to gauge the actual level of production in any given area and/or time frame, is still something behind our possibilities; also, the documentary evidence, although relatively abundant for Egypt, is quite scarce for the area of the Delta[62]. Nevertheless, some scholars ventured in trying to calculate at least the surface of the arable land in Egypt, giving a figure between 20,000 and 25,000 kmq overall[63]. Of this, roughly 16,000 kmq would have been in the Delta[64].

Despite the extremely rough nature of such figures, we can easily understand the relative importance of the Delta in the overall agricultural production of Egypt, and how the tidal wave should (in principle) have had a disastrous impact on such production. To add to this picture, we can also speculate that the Delta was used for fishfarming activities[65], once more a business which should have suffered greatly for the disruption brought by the tsunami.

We cannot know exactly how much of the arable land was affected by the tidal wave, but we know for sure the effect of salt on arable lands. This might be influenced by the nature of soil and of the crops, some being more resistant than others. Still, given the high concentration of salt in marine water, the effect of salt pollution in the Delta would have been devastating. The salt would stick in the area of the roots of the crops, preventing them from being properly watered. The only solution to cope with such problem was to set up an efficient system of drainage to reclaim the saline soil. Drainage consists in watering the soil deeply till the level of root zone, so that salt can progressively leach below the root zone, therefore allowing the plants to be properly watered again[66]. Such practice requires a good knowledge of irrigation procedures, a feature typical of the Egyptian area. This would allow us to think that the Roman Empire was in the position to cope with the disruption caused by the tsunami fairly quickly.

And in fact analysis of the available data, mainly from papyrological and other documentary evidence, seem to demonstrate that there is no evidence of an economic crisis following the year of the earthquake/tsunami[67]. This would lead us to two possible conclusions. The first one, that the impact of the tsunami on Egypt was limited, and therefore its economic consequences

(61) LALLEMAND, 1963, p. 224-228; KISS, 2007, p. 193-95; ALSTON, 1998, p. 168-202; STANLEY, 2007, p. 256.

(62) BOWMAN, 2009, p. 179-83.

(63) SCHEIDEL, 2001, p. 220; VAN MINNEN, 1997, p. 29; BOWMAN, 1996, p. 13.

(64) BUTZER, 1976, p. 83.

(65) We do not have positive evidence for such detail. We know for sure that fishfarming was a normal activity at some point of the economic history of Egypt (see KELLY, 2011, p. 54-55, although the evidence is for first century AD).

(66) HORNECK e.a., 2007, p. 7-9.

(67) VAN MINNEN, 2000, p. 204.

hardly noticeable. Yet, this possibility is clearly ruled out by what we have seen so far. The tsunami did hit Egypt possibly stronger than any other region of the Empire so, if there was any economic consequence of the tsunami in the Roman World, it must be visible there. The second option is that, simply, despite the impact in the short term, the tsunami was not able to affect the Roman economy in the medium or long term, not even on a regional scale. Such an assumption leads us to some final considerations. First of all, we can assume that the overall economic performance of the Roman Empire in this period was solid, able to absorb the consequences of such a disaster without major difficulty. Secondly, we can add that such a solid economy was certainly backed up by a well organized system of reaction to natural disasters, as shown by the evidence of the north African cities. Experience from all the evidence we have collected for the Antiquity has shown that tsunamis, along with other natural disasters of similar magnitude, may have had a negative impact on the current situation of the towns or the region directly hit by the tidal waves, particularly concerning the infrastructures related to production or trade, but their damaging effects –safe for some few exceptions of complete devastation of entire cities or civilizations- normally lasted for a short period, causing little or hardly any relevant economic impact on the 'longue-durée'. As far as our evidence is concerned with Antiquity, long periods of economic decay can hardly be attributed only to the consequences of eventual tsunami strikes. Nonetheless, our data also seem to indicate that such disasters, caused by natural phenomena usually described as extremely odd by the ancient literature, may have contributed to exacerbate the economic conditions or even the stamina of societies already in decay.

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## ABSTRACT

This article investigates the impact of ancient tsunamis on the ancient World. Nowadays, the effects of such events on contemporary economic is easy to assess and investigate, thanks to the amount of information available. More complicated is the picture for pre-modern societies.

The aim of this paper is precisely to focus on the economic consequences, if any, of tidal waves on certain regions and periods of the classical world.

As a matter of fact, the study of natural disasters has been a popular topic for modern scholarship of the Antiquity. Along the Mediterranean basin, ancient tsunamis usually devastated regions with high levels of seismic activity, such as the Balkans, the South-East, the Levant or the central and eastern islands. Most of the archaeological evidence from tsunamis and earthquakes, however, has been mixed up by a combination of geological and human activity, making it difficult to single out which is which. Tsunamis were less frequent than earthquakes but their impact on human communities and their available natural resources could have been more catastrophic, at least in the short-term. The unexpected nature of such tidal waves surely produced considerable unrest within the affected population, who might have been familiar with the devastating effects of earthquakes but most probably were unaware of such a rare natural phenomenon. Our main goal, however, is to ascertain the economic impact of ancient tsunamis on the 'longue-durée'.

The article is composed of two main parts. In the first one, we examine the evidence for tsunamis occurred in the Mediterranean basins from fifth century BC till the fourth AD, before the great tsunami of AD 365. It is possible to recognize how the Graeco-Roman literature describes, in some cases with remarkable accuracy, the basic functioning of what geologists know as tsunamis, but generally fails to provide any information on the economic impact of them on the ancient societies.

In the second part, we focus on the tsunami of AD 365, for which we have more information, provided by both literary and documentary evidence, allowing us to use it as an interesting case study with a particular relevance in the ancient history.

The final conclusion is that tsunamis in antiquity, as far as it is possible to infer from the status of our sources, despite having probably a huge damaging effect on the economy on the short term, usually did not affect it on the 'longue-durée', given, most likely, to efficient policies devised by ancient civilizations, to cope with such events.



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Elke bijdrage vermeldt de naam van de auteur. Deze alleen is voor de in zijn studie uiteengezette opvattingen en verdedigde zienswijzen verantwoordelijk. Het *Tijdschrift* aanvaardt slechts één repliek op een artikel of een recensie. De schrijver ervan mag op de ingezonden repliek antwoorden. Van verdere polemiek wordt beslist afgezien.

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