

**Data from investigation on seismic Sea waves events
in the Eastern Mediterranean from 500 to 1000 A.D.**

Part 2

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1. INTRODUCTION

Tsunamis from 500 to 1000 A.D. in the Eastern Mediterranean between 31-44 N and 18-36 E excluding Black Sea and the Italian coasts of the Adriatic Sea is the object of the present paper.

2. DESCRIPTION OF EVENTS.

1. 542 Winter. Sea of Marmara. Thracian Coasts and Gulf of Edremit (iv). 4 (P. 374d, 375b), 5 (P. 269c), 8 (p. 189), 10 (P. 64), 7 (xviii, P. 224), 2a (ii, 22.1, 24.8-12, iv, 31,4.17), 2b (iv, 1, vi, 22, xviii, 44), 11 (19), 12 (iv, 29), 20.

From Cedrinus (p. 375b) we learn that in the reign of Justinianus the sea flooded the coasts of Thrace and that the cities of Odessa (Varna), Dionysioupolis, Aphrodesion and other towns in

the gulf of Adramyttium were inundated. The sea in many places advanced four miles (1) inland and after drowning many people and causing heavy damage to the land « retired to its habitual places ». The same event we find in Glycas (p. 269 c) who refers this to the time when the pestilence was wasting Constantinople. The inundation should have occurred therefore between September 542 and probably January 543 (2).

Neither Cedrinus (3) nor Glycas imply in any way that the inundation of the Thracian coasts was the result of an earthquake. We notice, however, that Theophanes (p. 189) and Cedrinus (p. 374 d) mention in this period an earthquake which devastated Kyzicos (Banderma) and damaged Constantinople. This earthquake can be easily placed in the beginning of September 542 AD (4).

This inundation of the Thracian and Aegean coasts shows quite clearly the characteristics of a seismic sea-wave. It does not seem improbable, therefore, that the cause of this wave was in fact the earthquake at Kyzicos (Banderma). When, in particular, these two events happen to be so closely spaced together.

From the narrations of the writers in the *Corpus Scriptorum Historiae Byzantinae* on earthquake events of this period, one feels inclined to go even further and suggest, with some justification, that the earthquake at Constantinople of 542 (5), that of Kyzikos and the seismic sea-wave that followed belong, if not to the same earthquake, but to the activation of the Marmara region.

(1) According to Glycas (p. 269b) « three miles ».

(2) Cf. Procopius (bel. Goth., lib. ii, § 22.1 ff, § 24.8-12; lib. vi, § 3.1, § 4.17-18); Procopius (Anecdota, lib. iv, § 1; lib. vi, § 22; lib. xviii, § 44); Jornandes Get. (§ 19); Evagrius (lib. iv, § 29); Malalas (lib. xviii, p. 224); Theophanes (p. 188c).

(3) Cedrinus places this event in the 18th Justinian.

(4) Cf. Anastasios (Eccles. Hist., p. 64); Cedrinus (p. 374d, 375b); Theophanes (p. 188, 189); Calvisius (p. 579); Schmidt (1879, p. 151).

(5) Cf. Theophanes (p. 188).

2. *551 Ad. Spring. Malian Gulf. Achinos, Tarphe (iv-). 2a (viii, 25.20), 2c (iv, 23), 12 (iv, 23).*

In the middle of the fourth century AD, disasterous earthquakes occurred throughout Greece and in Asia Minor. One of these earthquakes took place on the northern coast of the Gulf of Corinth. The towns of Chaeronia, Patrae, Naupactus, Coronae and most probably the city of Corinth as well, were severly damaged and thousands of people perished, Procopius (Bel. Goth., lib. viii, § 25.17).

From a contemporary narration of Procopius it appears that during this earthquake some fault break must have occurred which extended to the surface of the ground, for he says:

« ...the ground was rent asunder in many places and formed chasms. Some of these openings came together again so that the earth presented the same form and appearance as before, but in other places they remained open and formed steps, with the consequence that the people in such places are not able to intermingle with each other except by making use of many detours ». (Bel. Goth., lib. viii, § 25.18).

Without excluding the possibility that to what Procopius (1) refers, it might have been some intense « lurching », this description to our mind is the earliest refering to such a phenomenon after an earthquake.

Procopius also mentions that at the same time the region of the Maliacos Gulf (2) was shaken by an earthquake which was accompanied by a devastating seismic sea-wave:

« ...in the gulf between Thessaly and Boeotia there was a sudden influx of the sea at the city called Echinus (Achi-

(1) Evagrius (Eccles. Hist., lib. iv, § 23) refers to the same deformation of the surface of the ground.

(2) This is the very area where the 426 BC inundation took place.

nos) and Scarpea (Tarphe) in Boeotia. And advancing far over the land it deluged the towns there and levelled them immediately. And for a long time the sea thus visited the mainland, so men on foot for a considerable period it was possible to walk to the islands which are inside this gulf, since the water of the sea, obviously, had abandoned its proper place, and, strange to say, spread over the land as far as the mountains which rise there. But when the sea returned to its proper place, fish were left on the ground... » (Bel. Goth., lib. viii, § 25.20).

From Procopius's statements it is very difficult to distinguish whether these two events, the one in the gulf of Corinth and the other forty miles northeastwards in the Maliacos Gulf, were caused by the same earthquake. Sieberg (1932) considers both events caused by the same earthquake, while Galanopoulos (1955) enters these two events in his catalogue separately. To our mind, there is no reasonable justification in considering the two events connected to the same earthquake. If this were the case, in order to justify the heavy damage on towns in the gulf of Corinth and at the same time justify the collapse of the walls at Thermopylae (Procopius, Edif., lib. iv, § 23) the magnitude of the earthquake shock should have been colossal. It would most certainly required heavy damage of many large cities, in particular of those between the two shaken regions, a fact which is absent in Procopius's narrations. Also, geotectonically, there is no connection between these two regions to justify a seismic to this extent. We may, therefore, with some justification, consider that the seismic sea-wave in the Maliacos Gulf was produced by a local earthquake, most probably the very same shock which destroyed Thermopylae.

From Procopius we learn that this event took place while Narses was marching against the Goths. This fixes the time of the earthquake in the spring of 551 AD.

The description of this event makes it rather difficult to distinguish the origin of the sea-wave. It appears that in a confined region such as that of the Maliacos Gulf, for the wave to

flood all of a sudden with such impetuous the surrounding coasts it should have had its seat within the gulf. Should this had been the case, the origin of the sea-wave seems more likely to had been connected with submarine landslides, rather than with fault movements since the shock itself does not seem to had been of considerable magnitude. The floor of the gulf is thickly alluviated, and, although there is no indication of steep sloper, the shock may well have triggered slides, as a result of which a sea-wave was generated. Moreover, once the stability of the slopes was disturbed by the slides produced by the earthquake, additional slides and slumping of the coasts may have continued for some time after the earthquake. This would account for the extraordinary behaviour of the sea after the earthquake which is described by Procopius.

It is of interest to note that in 551 AD earthquakes occurred also in other parts of Greece, as well as in the Middle East and Asia Minor (1). At Botrys in Palestine part of the face of the mountain Lithoprosopos slid into the sea and created a natural harbour for the town of Botrys. The sea at this place retired one mile it returned destroying many ships (lib. xviii, 0.230). The exact b). According to Malalas, however, the sea after it retired one mile it returned destroying many ships (lib. xviii, 0.230). The exact place where this event took place seems to be the promontory of Euprosopon between Byblos and Botrys (2).

It is of interest to notice that Nasir-i-Khusrau in his «Diary» says that all along the coasts of Syria people prefer to build towns where there is an elevation, but not a precipice, being in terror of an encroachment of the waves of the sea which so often caused devastations (MSS, British Mus. Ad. 18418, Or. 1991).

3. 551 July 9. Syrian coasts. Votrys near Jubeil (Byblos) (iii+), Tarabulus (Tripolis), Beirut (iii-), 4 (P. 376b), 7 (xviii, 0.230), 13a (P. 81), 21, 24 (p. 191).

(1) Cedrinus (p. 376); Theophanes (p. 192); Malalas (p. 376b); Lycosthenes Calvisius (p. 582); Sigonius (p. 725); Frystchius (p.).

(2) Chilmeadi (1831).

4. 554 AD. August 15. Southwest Coasts of Asia Minor, Mandalya Bay, Island of Kos, Sporades Isls. (iv-). 4 (P. 384d), 26 (ii, P. 51.16), 5 (P. 269d), 7 (xviii, 0.231), 8 (P. 194), 29 (xx, 31), 25.

Three years later another earthquake occurred in the south coasts of Asia Minor which was most destructive at Tralles (Aidin) and in the island of Cos. It is said that his shock damaged also the cities of Nicomedia (Izmid) and Antiochia (Antakije) and that it was felt as far as Constantinople and the Middle East.

This earthquake was accompanied by a seismic sea-wave which in many places flooded the south coasts of Asia Minor and advanced over one mile inland carrying ships and marine animals, Matalas (xviii, 231), Theophanes (P. 194a), Cedrinus (P. 384d).

From Agathias, who visited the island of Cos shortly after this earthquake, we learn that the seismic sea-wave was exceptionally strong at this island. What remained standing in the city of Cos after the earthquake perished under the ensuing sea-wave (ii. p. 53).

From the narrations of the writers in the *Corpus Scriptorum Historiae Byzantinae* it appears that during the year 554 AD earthquakes shook Palestine, Mesopotamia, Arabia and Asia Minor, and that cities distant apart such as Alexandria, Beirout and Constantinople were severely damaged. From the vast area which was affected it does not seem probable that this seismic activity was the result of only one earthquake. We are rather inclined to think that this was the accumulative effect of many different earthquakes, one of which was responsible for the damage at Tralles (Aidin) and Cos, as well as for the sea-wave which followed.

The date of this earthquake, the epicentre of which we may tentatively place somewhere on the Meander graben, seems to be August 554 (1) (Clinton p. 802-3).

(1) Sigonius (p. 745) dates this event in 555 or 556. Huot (1837, p. 109).

5. 740 AD. October 26. *Sea of Marmara, Izmit, Iznik Lake, Thracian Coasts of Marmara (iii)*. 9 (ii; xv, P. 105), 8 (P. 345), 4 (P. 458), 10 (P. 137), 20 (p. 628), 17.

Fourteen years after the eruption of the volcano of Thera (Cedrinus. p. 454b) a disastrous earthquake occurred in Constantinople. The walls and many public buildings collapsed and over one thousand people perished. Many towns in Thrace were also destroyed among which Nicea (Iznik) (1), Nicomedia (Izmit) and Praenetos. The sea retired in many places and returning soon after inundated many towns (Theophanes, p. 345; Cedrinus, p. 458).

The date of this event is 26 October 740 AD, to which all writers concerned agree (Zonaras, *Annales* II, lib. xv, p. 105; Anastasios, p. 137; Baronios, vol. ix, p. 132; Sigonius, vol. ii, p. 182; Mathias, *Theatr. Hist.*, p. 457; Calvisius, p. 628).

No description of the seismic sea-wave was found.

6. 746 AD. January 18. *Syrian and Egyptian Coasts (iii—)*. 15a (i, 17).

Jirgis El-Macin in this « *Historia Saracenicæ* » mentions a great earthquake which:

« ...in the night of the 21st day of Tuba in the year 120 AH destroyed many cities and their inhabitants perished in the ruins. Six hundred cities in the east perished that night and many ships were sunk at sea. They say that this earthquake was universally felt over all regions to the extreme east... » (lib. i, § 17).

Taking into consideration that the Mohamedan day begins after sunset, the date of this event corresponds to the 15th day of January 738 AD. In his « *Historia Mohametana* » the same event El-Macin dates in the 460th year of Diocletianus, which corresponds to 743 AD. It is very strange that this author gives the

(1) From the waves in the lake.

wrong date in two places of an event which we know that it occurred in January 18, 746 AD (1); should the year in El-Macín's « *Historia Saracenicæ* » was 128 AH instead of 120 AH, an error which could be easily attributed to Erpenius, then the date becomes exactly the same with that given by other chronographers.

From the description of this earthquake (2) it seems that the shock was exceptionally severe in Syria and eastwards of the Jordan in Palestine and Transjordan. Although a severe disturbance of the sea in the Syrian coasts is described, which has many characteristics of a seismic sea-wave, from Ebn-Aïas's description of the events which followed this earthquake, it seems probable that it might have been a heavy tempest at sea.

We were unable to distinguish the nature of this phenomenon.

7. 792. *Gulf of Venice, coasts of Istria and Jugoslavian coasts of the Adriatic sea (iv), 30, 28.*

8. 803 AD. December 19. *Gulf of Iskenderun, Massisa Coast (iii), 18b, (f. 20a).*

As-Soyuti in his « *Kashf as-salsalah 'an wasf az-zalzalah* » mentions an earthquake and an inundation at Massisah (Mop-sueste) on the river Kjaihan, on 187 AH.

We were unable to find other references to this event, which should have occurred in the period 30 December 802 to 19 December 803 AD. In his latter work on the « *History of the Caliphs* » As-Soyuti does not mention this event.

It is quite clear, however, that As-Soyuti in his MS refers to a seismic sea-wave which he attributes to an earthquake felt at Massisah.

(1) From the waves in the lake.

(2) Abul-Feda (*Annales Moslem*, p. 136, § 2); Aboulmahasen (MS 663, fol. 60); Ebn-Aïas (fol. 115, § 7); Anastasios (p. 143); Theophanes (p. 354); Cedrinus (p. 452); Sigonius (vol. ii, p. 190); Baronius (p. 184); Calvisius (p. 630); Bonito (p. 365).

9. 859 AD. November. Syrian Coasts near Samandag (iii). 15a (ii, 11), 15b (ii, 31), 18a (P. 364), 18b (ii, 31), 13b (P. 261), 17.

A study of Arab and Syrian MSS (1) shows that in the year 245 AH, which corresponds to the period 8 April 859 to 27 March 860 AD, a large number of earthquakes prevailed in the East. During this Mohammadan year, places such as Bagdad, Emessa, Harrana, Balisum, Antiochia, Akka, Uti, Rasulaicum, Adana, Buka, Marissa, Madatinum, in Syria, Asia Minor, Armenia, Palestine, Arabia, and Egypt were shaken from time to time with great damage to property and loss of life.

In many earthquake catalogues these individual events are treated collectively and are referred to the same earthquake, which some authors even date precisely on the 8 April 859 (2).

There is little doubt that in this case, as in many other cases, the effects of more than one earthquake have been treated by modern writers collectively, with the result to overestimate the magnitude and destructiveness of old earthquakes.

During one of the earthquakes of 245 AH, most probably in the month of Shaban (1 to 30 November 859 AD), a strong earthquake shook the Syrian coasts from Antiochia to Akka. As-Soyuti says that this earthquake shattered a mountain near Antiochia which fell into the sea together with 1005 houses and 90 villages. El-Macin, Abul-Faragi and Tabar add that the mountain was called Acraus or Rock and that it was closer to Akka rather than to Antiochia. All writers agree that when the mountain collapsed into the sea, the water retired and then returning surged he shores (3).

(1) As-Soyuti (Kashf as-salsalah MS p. 77), (Chaliphs, Al-Mutawakkil Ala'l'lah, p. 364); El-Macin (Hist. Sarac. MS. lib. 2 § 11), (Hist. Moham. MS, lib. 2, § 31); Abul-Faragi (Chronography, MS, p. 158), Hist. Dynast. MS, p. 261); Tabar in El-Macin r° § 31); Cedrinus p. 552A.

(2) This date is given by Sieberg (1932, p. 199) but is merely the date of the first day of the Muslim year 245 All.

(3) This event is very similar to that which happened between Byblos and Botrys in 551 AD.

10. 811*. *Coasts of Israel and Egypt, from Acre to Alexandria.*

Sieberg (1932, p. 193) on the authority of Willis (1928) gives an earthquake and a seismic sea-wave at Akka for the year 881 AD. Willis's authority for this event is Tholozan (1879) who, on page 1063, says that during the period 881-882 AD (268 AH) a severe earthquake set up waves in the Nile, on the coasts of Alexandria and on the Syrian coasts, in particular near Akka where much damage was caused.

Tholozan's description of the event is identical to that given by many Arab chronographers for the 702 AH earthquake in Egypt (1).

The fact that in spite of our thorough search in many authorities we were unable to find any justification for this event (2) and also the identity of Tholozan's description with that for the 702 AH earthquake in Egypt, to our mind, indicates that Tholozan and hence Sieberg refer to a non-existent event.

11. 957 AD. *Caspian Sea (iii). 18a (P. 419), 14 (ii, P. 467), 13a (P. 183), 16 (P. 167).*

Many Arab and Syrian chronographers (3) mention for 346 AH a catastrophic earthquake in Iraq-al'Adjan. The shocks lasted 40 days and then discontinued for sometime, but they again returned destroying 150 villages in the Djabal area together with the towns of Rayy, Talikan and Hulwan.

From the narrations of many chroniclers, it appears that the

(1) Taki-Eddin-Ahmed-Nakrizi (Hist. Mamlucana, MS Melik-Naser-Mohammed ben-Kelaoun, p. 581-583); Descript. Egypt. MS 798, fol. 239, v^o); Abou'LMahâsen (MS. 663, fol. 61. r^o); Ebn-Aïas Hist. Egypt. fol. 126, r^o and v^o) and others.

(2) The only chronographer who refers to an earthquake in 268 AH is As-Soyuti, who in his Kashf as-salsalah gives an earthquake at Bagdad which was followed by torrents of rain and thunderstorm.

(3) As-Soyuti (Kashft as-salsalah), (Hist. Chaliphae, p. 419); Ibn ul Jauzi (MS 56 v^o); Abul-Feda (Annales Muslem., F. 2, p. 467); Abul-Farag (Chronographiae, p. 183); Miskawaihi (Abbasid Chaliph., p. 167); also Ibn-el-Athir; Hatji Chalifa; el-Macin and others.

paroxysm of this Iraqi earthquake should have been very severe. As-Soyuti (Histor. Chaliphae, p. 419) says:

« ...at Rayy a mountain sunk and an enormous chasm opened from which water and smoke gushed out. Talikan sunk into the ground, and there escaped of its inhabitants only about 30 persons; something similar happened at Hulwan. This town was practically engulfed and the earth vomited up the bones of the dead and water burst forth. At Rayy a mountain was cleft asunder and a village with its inhabitants was swallowed up in a mighty chasm and fetid waters came forth from it and volumes of smoke... ».

As-Soyuti, Abul-Feda, and Abul-Farag mention in addition that at the same time (1) the « Great Sea » sunk eight fathoms and retired about 500 yards from its coast; many rocks and islands were laid bare which had not been known before. Miskawaihi adds that this change in the coasts perplexed many sailors. Abou' Imahāsen (MS 342, fol. 2) says that when the islands appeared the sea was in a state of « convulsion ».

The events of 346 AH (i.e. 4 April 957 - 24 March 958 AD) seem to indicate that this Iraqi earthquake was followed by extensive faulting and most probably by some permanent crustal deformation which resulted in elevating the coasts of the « Great sea ». It seems most probable that this crustal movement was followed by a seismic sea-wave. In spite of our search we were unable to locate the « Great sea ». Reiske (1789) and Budge (1932) suggested the Persian Gulf while Mallet (1858) the Caspian Sea. To our mind, with the data available, it is impossible to locate this sea. From Abou'Imahāsen and Miskawaihi, however, one than to any other sea or lake in the neighbourhood of Djabal.

Here, we would like to point out that Arab writers very often mention in their narrations seismic sea-waves which occur-

(1) It is somewhat doubtful whether this elevation of the coast of the « Great Sea » was the result of the seismic activity in the Djabal area. Although it occurred in 346 AH(it is not clear from the MSS whether this event took place in the Irac-al-'Adjam area.

red in the Persian Gulf. Abul-Farag in his *Chronographiae* (p. 204) and As-Soyuti (*Kashf as-salsalah*) mention, for instance, the sea-wave which accompanied the Dinawar earthquake of 1008 AD (Shaban 398).

12. 975. *October 26. Constantinople and Thracian coasts (iii). 6 (P. 109), 17, 22 (p. 132, 186).*

13. 991* AD. *April 5. Coasts of Syria. 182a (p. 199).*

From El-Macin (*Historia Moham.*, lib. iii, § xlvi) and (*Historia Sarac.*, lib. iii, § v) we learn that on the 17th Muharram of 381 AH (5th April 991) a great earthquake occurred at Damascus where 1000 houses fell and many perished under the ruins; the village of Beglabec was engulfed. The shocks continued till the 14th of Safar of the same year (3rd May 991 AD) (1).

For April 5, 991 AD, Sieberg (1932) gives an earthquake at Damascus and also a seismic sea-wave which, he says, inundated the Syrian coasts; no authority is given.

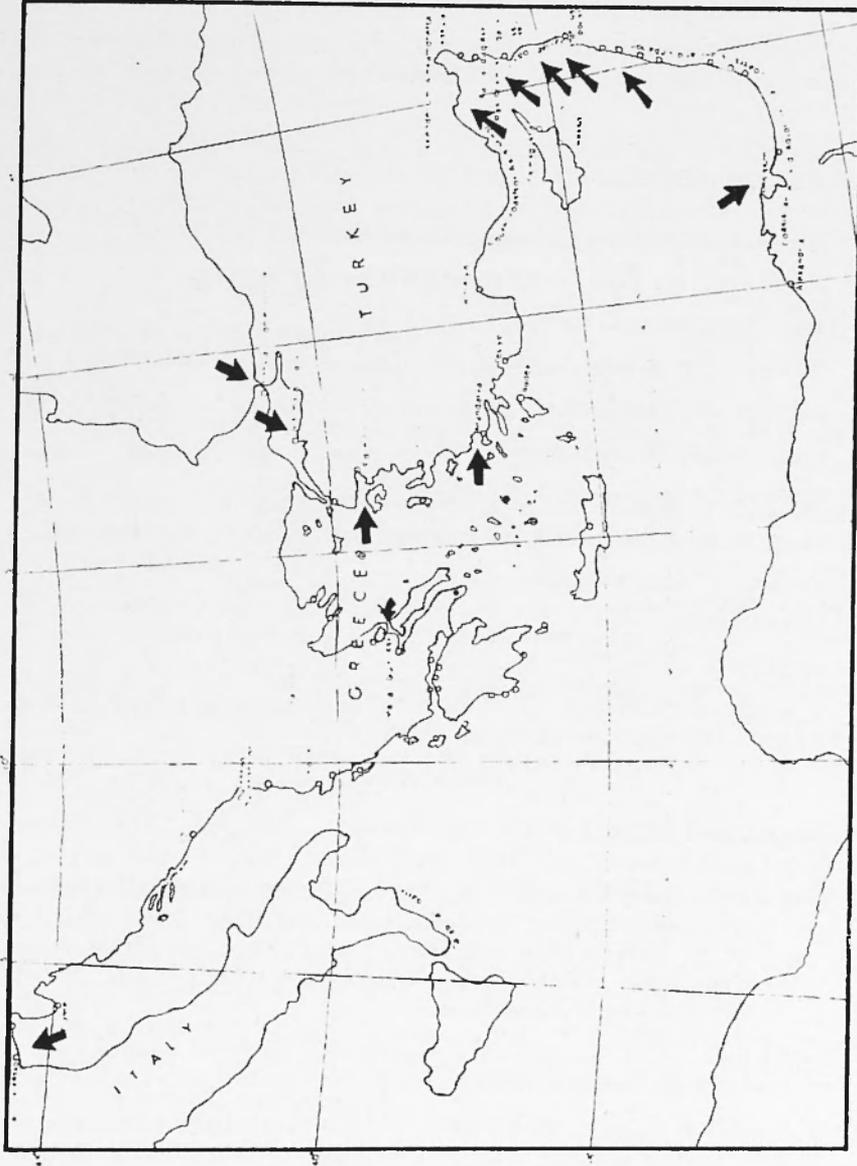
Apart from Sieberg's statement, in the literature and MSS which we consulted for the 991 events, we were unable to find any other reference to a seismic sea-wave. Neither Vattier (1652) nor Bonito (1691), whose works refer to that period, mention such a phenomenon connected with the 991 earthquake.

ACKNOWLEDGEMENTS

I have been much assisted by Professor N. Ambraseys of the Imperial College — University of London — to whom I am indebted.

Without his invaluable help this work could not have been carried out.

(1) On the authority of Vattier's French edition of El-Macin, Mallet (1852) quotes this earthquake as occurring in August 992 AD, but we can find no mention of an earthquake in August 992 AD in that author.



o - Main Regions in which the tsunami was felt. Seismic sea-waves in Eastern Mediterranean from 500 to 1000 A.D.

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