

New documentary sources regarding the large earthquake (~M7) and its associated tsunami of 8 November 1905 in Mt Athos, Northern Greece

Ioanna Triantafyllou¹, Gerassimos A. Papadopoulos², Efthymios Lekkas¹

(1) National and Kapodistrian University of Athens, Department of Geology and Geoenvironment, Panepistimiopolis Zografou Campus, 15784 Athens, Greece

ioannatriantafyllou@yahoo.gr

(2) International Society for Prevention & Mitigation of Natural Hazards, Athens, Greece, 10681

Abstract

Mt Athos, Northern Greece, is a monastic community with life since ~1000 AD, a UNESCO worldwide cultural heritage site that repeatedly hit by large earthquakes. On 8 November 1905 Mt Athos suffered a lot from an earthquake which shook the Balkan peninsula and had estimated magnitude ranging from 6.8 to 8.3. However, this important event remains little known since only very few documentary sources have been utilized so far. We collected a set of new documentary sources, ignored so far by the seismological community, including contemporary press reports, letters and manuscripts. Based on these sources we reconstructed the earthquake impact field and organized a data base which contains assignment of macroseismic intensity in 42 observation points, at epicentral distances up to ~660 km, and an identification of several sites where a variety of co-seismic ground failures were reported, the most important being landslides and sizable rockfalls. From magnitude-intensity relationships based on data of instrumental Greek earthquakes, macroseismic magnitude of ~7 equivalent to Ms was estimated, which is close to the most recent, reliable instrumental estimates of ~7.2. The examined sources revealed for the first time that earthquake-triggered landslides occurred in the southern tip of Mt Athos producing a local but powerful tsunami of ~3 m run-up. Eleven persons were reportedly killed.

Previous studies

The first scientific material regarding the 1905 earthquake was published in the Annals of the National Observatory of Athens (NOA) (Eginitis, 1910), where it was briefly reported that damage was caused in Iviron Monastery. Several years later, Critikos (1932, 1933) reported that damage was also caused in towns and villages of the area, while the earthquake was felt in the Balkan peninsula as far as Athens (Greece), Sofia and west coast of Black Sea (Bulgaria), Bucharest (Romania), Gulf of Adramition (NW Turkey) and Bari (eastern Italy). The same author, based on the macroseismic information published by Eginitis (1910), estimated that the epicentral (maximum) intensity reached at X degree in the 10-grade Rossi-Forel scale, which in the Mercalli-Modified (MM) scale (Wood and Neumann, 1931) corresponds to degree X-XII (Richter, 1958), which very likely is an exaggeration as one may conclude from a variety of documentary sources collected and analyzed by us. Sieberg (1932) dated the event on 9 November 1905, likely on local time, and reported on it very briefly. He has been, however, the only author that tried to draw isoseismals although based only on very few intensity observation points. Galanopoulos (1955) reported also very briefly on the destruction caused by the earthquake.

A prominent historian (Kadas, 1996) found and published a marginal note written in a religious book. The note, which is already known in the seismological community (e.g. Papazachos and Papazachou, 2003), says that due to the earthquake many people died and several monasteries were damaged greatly.

The 1905 earthquake has been included in several descriptive and/or parametric earthquake catalogues but there is confusion as regards the earthquake origin time. As an instance, Kárnik (1969) listed two large earthquakes occurring on 8th November 1905, one at 21.41 GMT and another at 22.06 GMT. An explanation may come out from the records of the Agamennone-type seismograph installed at Athens station in 1898. This seismograph, which was an instrument of intermediate response period introduced by G. Agamennone, Professor of Seismology in Rome, recorded the first seismic wave arrival of the 1905 earthquake at 23.41.54 local time (21.41.54 GMT). This may explain why many authors adopted origin time at 21.41.

The instrumental sources collected by ISC and used to analyze the 1905 event does not include any observation regarding the event in Kárnik (1969) catalogue at 8 Nov. 1905, 21:41. However, European stations offer plenty of measurements for the event at 22:06 which is very likely the correct origin time of the Athos main shock occurring on 8 November 1905. Then, the local time would be 9 November 1905 at 00:06, which likely justifies the dating by Sieberg (1932).

Various estimates of the 1905 earthquake epicenter are consistent with only small deviations from the most recent one calculated in the ISC-GEM (2018) catalogue. Various catalogues, however, provided widely divergent magnitude estimates ranging between 6.8 and 8.3 depending on the different magnitude scales and estimation methods used. Aiming to contribute in resolving the ambiguity regarding the earthquake magnitude we calculated a macroseismic magnitude.

New documentary sources

To further study the 1905 earthquake and tsunami we collected and evaluated a wealth of new information from a variety of documentary sources which remained unknown to the seismological tradition so far. The sources collected include contemporary press reports, manuscripts from Mt Athos and NOA archives, as well as various letters, articles and books containing descriptions about the earthquake and its associated phenomena and impact. From the documentary sources a data base was organized that documents the earthquake impact in both the built and natural environment. Seismic

intensities were assigned in 42 observation sites.

Contemporary press reports

We collected a set of seven contemporary press reports (CPRs) from newspapers published in Athens as well as in Thessalia Province, Central Greece. The relevant reports have been the closest to the event with publication time ranging from 27 October to 7 November 1905 [O.S.], i.e. from 9 to 20 November 1905 [N.S.]. A short review of some Thessalia Province newspaper reports was published by Papaioannou (2018).

NOA manuscript

After the establishment of the Institute of Geodynamics at NOA as the seismological service of the country in 1892, its scientific staff started the systematic record of earthquakes occurring in Greece from 1892 up to 1915 inclusive. The earthquakes were listed in chronological order in an unpublished manuscript called “Book of Earthquakes”. In “Book of Earthquakes, Vol. 2”, covering the time period from 1899 to 1915, there is a short section about the 1905 Athos earthquake.

Manuscripts from Mt Athos archives

We were able to collect two valuable manuscripts which are archived in Mt Athos monasteries. The first (ATHMS-1), dated 1 [O.S.]/14 [N.S.] November 1905, was written by an eyewitness monk named Avimelech Mikragiannanitis and was published later in a religious book by Bishop Rodostolos Chrysostomos (2004) (BOOK-1). However, the manuscript remained unknown to the seismological community so far. The second document (ATHMS-2) is an unpublished manuscript of the Codex (p.185) of Kafsokalivion monastery written in Mt Athos during 1915. A photograph of the manuscript was kindly provided to us by Father Patapios who currently gets monastic life at that monastery.

Letters

Bishop Chrysostomos Lavriotis (1905), being an eyewitness of the 1905 earthquake, sent a comprehensive letter to the Ecumenical Patriarch Joachim III in Constantinople (Istanbul) narrating the destructive effects of the earthquake in Athos. The letter (LETT-1) dated 3 [O.S.]/16 [N.S.] November 1905 was published in a contemporary religious journal and later reproduced in BOOK-1. Of relevance is also a postscript (LETT-2) dated 4 [O.S.]/17 [N.S.] November 1905 and inserted at the end of LETT-1.

Books and articles

The author of BOOK-1, in addition to publishing the valuable manuscript ATHMS-1, performed also an investigation of personal accounts among survivors of the 1905 catastrophic event. The results are included in BOOK-1 too. Useful information can also be found in a religious book by Kaloutsis (2000) (BOOK-2). Of interest is also an article (ART-1) published in a local journal by an eminent archaeologist (Mylonas, 1995).

Regardless the seismotectonic interpretation of the 1905 earthquake, it remains a key event for better understanding the hazards associated with earthquakes and related phenomena, such as landslides, rockfalls and tsunamis, in an important worldwide cultural heritage site like Mt Athos.

Conclusions

From the examination of the documentary sources regarding the 8th November 1905 large earthquake we concluded that this event caused extensive damage, mainly in the south part of Mt Athos. In addition important ground failures, particularly massive landslides and rockfalls were produced by the earthquake. Part of the landslide mass entered the sea and generated a 3 m high local tsunami. The maximum seismic intensity assigned was as high as IX-X (MM). From the seismic intensity field we calculated earthquake magnitude ~7.

References

- Galanopoulos, A.G., 1955. The seismic geography of Greece, *Ann. Geol. Pays Hellen.* 6, 83–121
- Eginitis, D., 1910. Catalogue des tremblements de Terre observes en Grèce pendant les années 1904-1908, *Ann. de L' Observatoire Nat. d' Athènes* 10, 560-585.
- Critikos, M. N., 1932. Sur la Seismicité de Macédoine, *Ann. de L' Observatoire Nat. d' Athènes* 12, 149-159.
- Critikos, M. N., 1933. Sur la Seismicité de Macédoine, *Gerl. Beitr. zur Geophysik* 40, 371-379.
- Kadas, S. N. 1996. Marginal notes in codex of Dionysiou monastery, Mt Athos, Edition by Dionysiou monastery, Mt Athos, 417 pp. (in Greek).
- Kaloutsis, S.D. 2000. The Virgin Mary of Mirtidiotissa. 4th edition, Kythira, 126 pp. (in Greek).
- Mylonas, P.M., 1995. Nineteenth century representational paintings and photographs of Athos monasteries and their interpretation. *Archaeology*, 54, 6-19 (in Greek with Engl. Abstr.).
- Papaioannou, I., 2018. The seismic activity in Thessalia from 1900 to 1950. *Thessaliko Imerologio*, 73, 289-314 (in Greek).
- Papazachos B.C., Papazachou, C., 2003. The Earthquakes of Greece, Ziti Publications, Thessaloniki, pp. 273 (in Greek).
- Richter, Ch., 1958. *Elementary Seismology*. Freeman, San Francisco, CA, 768 pp.
- Sieberg, A., 1932. Untersuchungen über Erdbeben und Bruchschollenbau im östlichen Mittelmeergebiet: Ergebnisse einer Erdbebenkundlichen Orientreise. *Denkschr. Mediz. Naturwiss. Gesellsch. z. Jena, (Jena)* 8, 3-13, 95.
- Wood, H. O., Neumann, F., 1931. Modified Mercalli Intensity Scale of 1931, *Bull. Seism. Soc. Am.* 21, 277-283.