

Comment on “The 373 B.C. Helike (Gulf of Corinth, Greece) Earthquake and Tsunami, Revisited” by Stiros (2022)

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Abstract

We are writing this comment because the presentation and the conclusions reached by Stiros (2022) regarding the catastrophic Helike earthquake of 373 B.C. neglect significant historical sources and scientific data from longstanding ge archaeological work and excavations in the Helike region and offer an incomplete picture of the knowledge acquired about this famous earthquake of Classical Greece. In particular, the attempted re-examination of ancient sources is incomplete and subjective, serving the author’s *a priori* view that accounts of the 373 B.C. earthquake are later fabrications from Roman times. To this end, Stiros neglects published archaeological data dated from soon after the 373 B.C. catastrophe and wrongly concludes that the area did not experience repeated earthquake phenomena. Furthermore, his proposal that the Helike and Aigion faults are identical is an evident geological error. Instead, the two faults are 5 km apart, and their seismological evolution and tectonic geomorphology are quite different.

Discussion and Conclusions

In his recent article, Stiros (2022) promotes the view that the famous Helike earthquake and tsunami of 373 B.C. did not really occur but is rather a fabrication from Roman times, some 400–500 yr after the event itself. To do so, the author (1) claims that there is no mention of the 373 catastrophe in any near-contemporary ancient sources, (2) makes selective use of archaeological finds from the Helike area to suggest that they either predate or postdate the 373 event, and (3) considers that there was no risk of the city’s loss in this area because of local hazards.

On all three points, the article presents an incomplete picture of the available scientific data and knowledge on this topic. Since 1988, The Helike Project has conducted multidisciplinary research at the site of ancient Helike on the southwestern shore of the Gulf of Corinth, in Achaëa, including an underwater sonar survey, drilling about a hundred bore holes, and conducting extensive geophysical prospection and systematic excavations on land (Katsonopoulou, 1998a, 2002, 2005a, 2010, 2011a,b; Papamarinopoulos *et al.*, 1998; Soter and Katsonopoulou, 1998, 1999, 2011; Soter, 1999; Katsonopoulou *et al.*, 2005, 2016; Soter *et al.*, 2001; Kutrubes *et al.*, 2003; Tsokas *et al.*, 2009; Koutsios and Kontopoulos, 2011; Engel *et al.*, 2016; Katsonopoulou and Koukouvelas, 2019). As a result, the

Project has successfully located the long-sought (wrongly in the sea) ancient site in the coastal plain between the Selinous and Kerynites Rivers, ~7 km southeast of the modern city of Aigion, that is, exactly in the area indicated by ancient sources. Regrettably, Stiros provides no substantial reference to this scientific work of the past 30 yr but instead cites works published in the middle of the past century (p. 4 of the article) and only briefly refers to “views of scientists collaborating with “The Helike Project”” (p. 6).

First, the Helike Project work was based on a thorough re-examination of ancient sources, including several near contemporaries to the event: Herakleides of Pontos (fourth century B.C.), Aristotle (fourth century B.C.) and Theophrastos (fourth century B.C. to the beginning of third century B.C.) followed by Philo of Alexandria (end of first century B.C. to first century A.D.), Eratosthenes (third century B.C.), Poseidippos of Pella (third century B.C.), and Aristophanes Byzantios (second half of third century B.C. to the beginning of second century B.C.) followed by Aelian (second century A.D. to the beginning of third century A.D.), that is, writers who either lived at the time of the earthquake or in the following third century (Guidoboni *et al.*, 1994; Katsonopoulou, 1995; Papadopoulos, 1998; Katsonopoulou, 2005b). This study omitted by Stiros (2022), showed that the catastrophic event was originally recorded by contemporary authors, who were apparently the source of relevant reports by later authors. Especially Aristotle, a contemporary and undoubtedly reliable source, makes three references to this event (1) in *Met.* 1.6.343, in which he mentions the appearance of a comet at the time of the earthquake and sea wave in Achaëa; (2) in *Met.* 2.8.368, in which he describes the simultaneous occurrence of an earthquake and sea wave in Achaëa and explains the association of the winds with the triggering of this phenomenon; and (3) in *Mu.* 396a, in which he clearly mentions the destruction of the Achaean cities Helike and Voura because of the invasion of the sea wave. The explicit mention of the names of both cities in the latter shows that in all

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TABLE 1

Geological Data of Helike and Aigion Active Normal Faults

Name of Fault	Trace Length (km)	Strike	Dip and Rake (°)	Offset (m)	Relief of Scarp (m)	Slip Rate (Min/Max) (mm/yr)
Helike	22	≈270	55/–90	>500	650	0.7/2
Aigion	10	≈270	60/–90	200	100	1.6/4.3

three references, the philosopher refers to the same phenomenon of the combined earthquake and sea wave that destroyed Helike and Voura. The connection of these passages with the 373 B.C. Helike earthquake is generally accepted by scholars studying the region of Achaea (Rizakis, 1995; Katsonopoulou, 2005b).

The report of another contemporary and reliable source, the philosopher Heracleides of Pontos, preserved in Strabo 8.7.2, offers significant information on the event and the region. Here is the correct translation (Loeb, p. 215) of Strabo with emphasis added:

“And Heracleides **says** that the submersion took place **by night in his time**, and, although the city was twelve stadia distant from the sea, this whole district together with the city was hidden from sight; and two thousand men who had been sent by the Achaeans were unable to recover the dead bodies; and they divided the territory of Helice among the neighbours.”

Such detailed and explicit information cannot be discredited as a later imaginative description of Strabo, whose careful presentation of his sources has been thoroughly analyzed in Baladie (1980). Note that Eratosthenes, who visited the site of Helike in the third century B.C., made a clear distinction between what he saw himself and what local witnesses reported to him. Here is the correct translation (Loeb, p. 215) with emphasis added:

“And Eratosthenes **says** that **he himself saw the place**, and that **the ferrymen say** that there was a bronze Poseidon in the strait, standing erect, holding a hippo-campus in his hand, which was perilous for those who fished with nets.”

Stiros attempts to discredit Aristotle by attributing the text mentioning the names of both cities to a later fabrication—pseudo-Aristotle (p. 9 of the article, Table S1)—although the authorship of De Mundo remains a debatable and undecided issue, and to dismiss Strabo’s citation of other sources as inaccurate by misinterpreting the ancient texts (p. 10 of the article, Table S1). This serves the author’s *a priori* conclusion that the 373 B.C. catastrophe is a later Roman fabrication. This is also evident in the supplemental material to the article, Table S1, on the historical sources for 373 B.C., which is incomplete and does not include especially writers of the fourth and third centuries B.C. In addition, the author’s correction of the ancient text of Strabo (Strabo 5 and 6 in Table S1) is arbitrary and his translation wrong.

Second, salvage excavations by the local Ephorate of Antiquities (Kolia, 2011, 2014, 2015) and systematic excavation

work of the Helike Project between 2000 and 2012 have brought to light architectural remains and rich associated finds ranging from the Early Helladic period (third millennium B.C.) to Late Antiquity (Katsonopoulou, 1998a, 2002, 2005a, 2011a,b,c, 2016; Kormann *et al.*, 2015; Katsonopoulou and Katsarou, 2017; Katsonopoulou and Koukouvelas, 2019), including two sites where Classical ruins and destruction layers containing Classical pottery, coins, and other finds dated to the late fifth and first half of the fourth century B.C. have been discovered (Katsonopoulou, 2002, 2016). These published results, neglected by Stiros, contradict his opinion that no archaeological remains from the time of the catastrophe have been found. In addition, while the author cites the recent discovery of an Archaic temple in the area to support his view that all these finds predate the catastrophic event of 373 B.C., he fails to mention the clear statement of the excavator about the destruction of the Archaic temple in 373 B.C.:

“An important piece of evidence for dating the deposit, and thus the destruction of the temple to which the tiles and architectural pieces belonged, is a partially preserved skyphos found in the southwest part of the layer underneath the tiles, at a short distance from the relief head. Sherds of a second skyphos of the same type were found next to the first. Exact parallels for these vases date them to the transition from the first to the second quarter of the 4th century B.C. It is likely, then, that the destruction of the Archaic temple to which the roof tiles and terracottas belonged was caused by the earthquake that devastated Helike in 373/2 B.C.” (Kolia, 2014).

Third, a series of palaeoseismological trenches excavated in the Helike area has enabled us to unravel the complete seismic history of the Helike fault between the Selinous and Kerynites Rivers and to dissociate it from the Aigion fault (Koukouvelas *et al.*, 2001; Pantosti *et al.*, 2004; Pavlides *et al.*, 2004; Kokkalis and Koukouvelas, 2005; Koukouvelas *et al.*, 2005; Zygouri *et al.*, 2008) (Table 1). Both faults are active and interact producing a well-defined stepover zone in the area southeast of Aigion. The disaster of 373 B.C. has long been correlated, since 1960, with tremendous changes in the coastal zone related to coseismic earthquake subsidence and tsunami inundation. New evidence provided by Koukouvelas *et al.* (2020) adds unequivocal data on the contribution of rivers in the Helike 373 catastrophe. Furthermore, the published results of the combined palaeoseismological and archaeological work have brought to light a

number of seismic events that occurred in the region between prehistoric times and late antiquity (Katsonopoulou, 1998a, 2016; Soter, 1998; Koukouvelas *et al.*, 2001, 2005, 2020; Pantosti *et al.*, 2004; Pavlides *et al.*, 2004; Kokkalas and Koukouvelas, 2005; McNeill *et al.*, 2005; Alvarez-Zarikian *et al.*, 2008; Soter and Katsonopoulou, 2011). A much younger event that has been considered analogous to the ancient 373 B.C. event has been recorded in the broader Helike area on 26 December 1861 (Schmidt, 1875; Papadopoulos, 1998). It is, then, clear that the ancient inhabitants of the area experienced repeated earthquake phenomena. For this reason, they particularly worshipped Poseidon, the god of waters and earthquakes (Katsonopoulou, 1998b, 2009, 2013, 2017a,b, 2019; Weir, 2017).

Summing up, the views presented by Stiros (2022) about the absence of evidence for the occurrence of the 373 B.C. earthquake have no scientific grounds because they ignore (1) significant archaeological and geoarchaeological evidence from the area consistent with the literary evidence on this destructive event and (2) geological evidence for repeated earthquakes in the Helike area throughout the Holocene.

Furthermore, in his reply to our comment, Stiros puts forward the unsubstantial argument that the Helike Project publications contradict one another. On the contrary, the results of the long multidisciplinary geoarchaeological research and excavations of the Helike Project, extensively published, are complementary and their continued studies provide further clarifications on the Helike issue. The attempted distortion of these studies by Stiros intends to only support his own misconceptions.

First, in Koukouvelas *et al.* (2020: 1666) the relevant conclusion regarding the occurrence of a tsunami associated with the 373 B.C. earthquake is the following: “If there were a tsunami, it was small, resulting from a submarine landslide, and inundated a 200 m wide coastal parallel zone (Engel *et al.*, 2016). There is no geological evidence to suggest that there was an ‘enormous tsunami’ during the 373 BC earthquake.” Second, in Engel *et al.* (2016: 13), it is concluded:

“The most favored scenario for the disappearance of Helike is inundation by a tsunami and partial submergence of the ruins in a shallow, temporary coastal lake or lagoon, which may have been established as a result of slumping, subsidence, and river avulsion. Sedimentological and microfaunal evidence from this study suggest that the lake or lagoon that submerged Helike in 373 B.C. was shallow and ephemeral. In any case it could not have submerged more elevated parts of the city if these extended onto the Katourla fan (Soter and Katsonopoulou, 1999). Although the historical earthquake and tsunami undoubtedly wrecked Helike, the permanent demise of the city as reported by some ancient sources was apparently exaggerated. Extensive excavations suggest that the area was resettled by late Classical and early Hellenistic times (Katsonopoulou, 2011b).”

Third, Weir (2017: 37, 39) does not doubt the occurrence of the 373 B.C. earthquake but suggests a dating of the Helike

coins about 300 B.C., issued by the revived Helike settlement after the 373 B.C. earthquake:

“Before the earthquake of 373 BC Helike had been the leader of the Achaian Dodekapolis. . . . It is possible that the border of ten cresting waves ringing the obverse (of the Helike coins) may allude to the earthquake and tsunami combination that destroyed Helike in 373 BC.”

Stiros (2022), and also in his reply to our comment, insists in the same line of neglecting (1) significant historical sources reporting the 373 B.C. Helike earthquake and tsunami event and (2) the multidisciplinary results from the Helike Project geoarchaeological and excavation work of the last 30 yr, first introduced in Greece to solve a longstanding problem in Greek archaeology. Neglect and/or distortion of available evidence to serve an *a priori* constrained view disregard scientific practice and mislead the readers. Among his conclusions based on alteration of the Helike Project publications, Stiros suggests “respecting ancient authors”; it would be of importance for his arguments to follow also this very suggestion.

Data and Resources

All data used in this article came from published sources listed in the references.

Declaration of Competing Interests

The authors declare that there are no competing interests.

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