NEPTUNE TALKS

a series of online scientific lectures

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Ecole Pratique des Hautes Etudes, FR

Aix-Marseille University – CEREGE, FR

Geoarchaeology of coastal hazards

Earth-shaping catastrophic events have long focused the attention of geosciences, and captured the public imagination. During the past 40 years, neocatastrophism has emerged as a key paradigm that reflects widespread changes involving cultural, scientific, political and technological spheres. Nonetheless, chronology and origin of this trend are equivocal. Google Ngram was used to quantitatively explore the recent development of catastrophism. We elucidate a discernable rise in neocatastrophic thinking during the last quarter of the twenty-first century that can be linked to the environmental awakening of the 1960s. It is suggested that these discourses of 'shock' and 'fear' partly correspond to a media-driven dramatization of natural hazards, exploited by scientists to attract wider readership. We will explore during this lecture the problems of sea-level and tsunami obsession in archaeological context.

From 2000 to 2015, tsunamis and storms killed more than 430,000 people worldwide and affected a further 530 million, with total damages exceeding US$970 billion. These alarming trends, underscored by the tragic events of the 2004 Indian Ocean catastrophe, have fueled increased worldwide demands for assessments of past, present and future coastal risks. Nonetheless, despite its importance for hazard mitigation, discriminating between storm and tsunami deposits in the geological record is one of the most challenging topics in coastal geoarchaeology. To probe this knowledge gap, we present a 4500-year reconstruction of "tsunami" variability from the Mediterranean based on stratigraphic archives and assess it in relation to climate records and reconstructions of storminess. We elucidate evidence for previously unrecognized "tsunami megacycles" with three peaks centered on the Little Ice Age, 1600, and 3100 cal. yr B.P. These ~1500-year cycles, strongly correlated with climate deterioration in the Mediterranean/North Atlantic, challenge up to 90% of the original tsunami attributions and suggest, by contrast, that most events are better ascribed to periods of heightened storminess. This finding is crucial in providing appropriately tailored assessments of coastal hazard risk in the Mediterranean and beyond.

28 April, 4:00 pm UTC+1

Scan the QR code or click the following link to JOIN THE LECTURE:

https://teams.microsoft.com/l/meetup-join/19%3ameeting_Yzk2ODVjNmUtYTZhNy00MDY5LWEwMWYtZmM5MjhkYmE5Yjg4%40thread.v2/0?context=%7b%22Tid%22%3a%22017e16ae-f415-4f8d-9af0-a21b57cd448e%22%2c%22Oid%22%3a%22a1017122-4a58-499e-bc56-57e9c3eaf038%22%7d

NEPTUNE

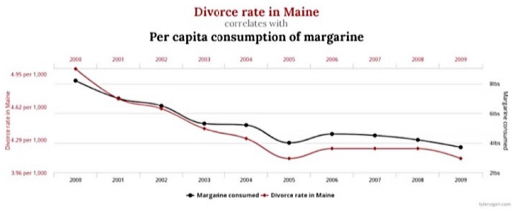
Preliminary conclusions

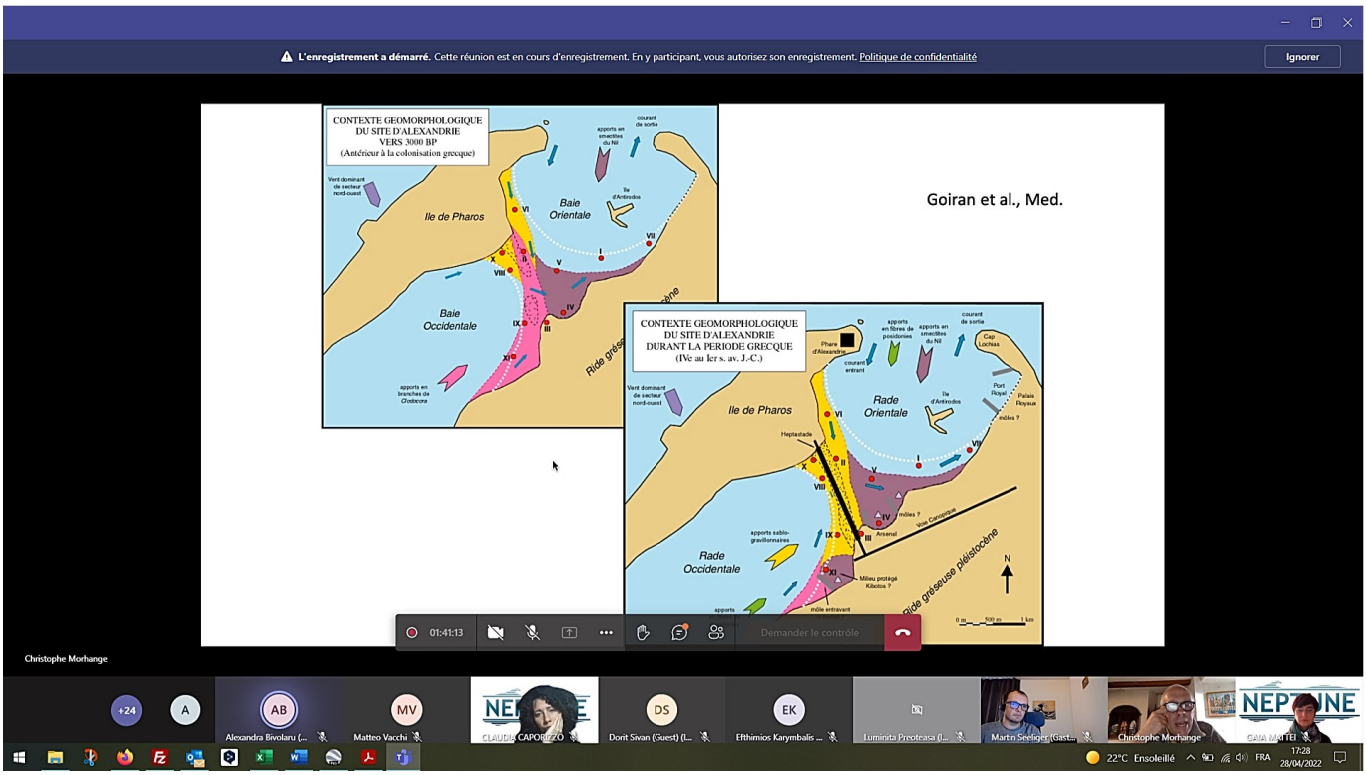
- « **The absence of proof is not a proof of absence** ».
- Objective : minimize identification errors, chronological imprecisions…
- **Confusion between causality and statistical correlations** in many publications.
- **Terminology** : « high energy event », « extreme event »
- Importance of using **multiple streams of evidence** to make inferences about the distant past.
- Tsunami and societies, *une liaison dangereuse*, **a dangerous liaison ?**

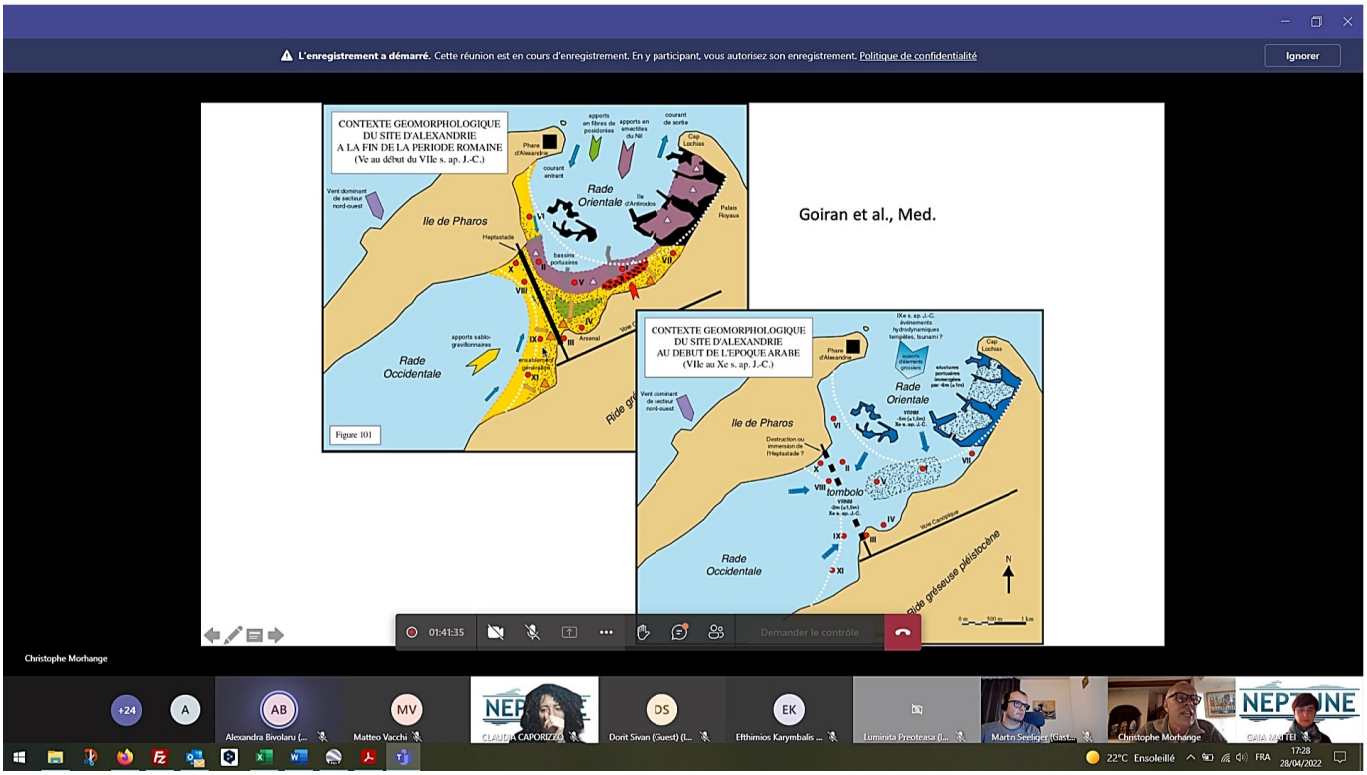
PALEO-TSUNAMI OR FACTOID?

Causality or correlation ?

Alexandria (PhD Goiran), Tipasa (PhD Maouche), Constantinople (PhD Bony)




L'enregistrement a démarré. Cette réunion est en cours d'enregistrement. En y participant, vous autorisez son enregistrement. Politique de confidentialité
Ignorer
CONTEXTE GEOMORPHOLOGIQUE DU SITE D'ALEXANDRIE VERS 3000 BP (Antérieur à la colonisation grecque)
Goiran et al., Med.
CONTEXTE GEOMORPHOLOGIQUE DU SITE D'ALEXANDRIE DURANT LA PERIODE GRECQUE (IVe au Ier s. av. J.-C.)
Ile de Pharos
Baie Orientale
Baie Occidentale
Rade Orientale
Rade Occidentale
Ride gréseuse pléistocène
Christophe Morhange
01:41:13
Demander le contrôle
Alexandra Bivolaru (...
Matteo Vacchi
CLAUDIA CAPORIZZO
Dorit Sivan (Guest) (L...
Efthimios Karymbalis ...
Luminita Preoteasa (I...
Martin Seeliger (Gast...
Christophe Morhange
GAIA MATTEI
22°C Ensoleillé
FRA
17:28
28/04/2022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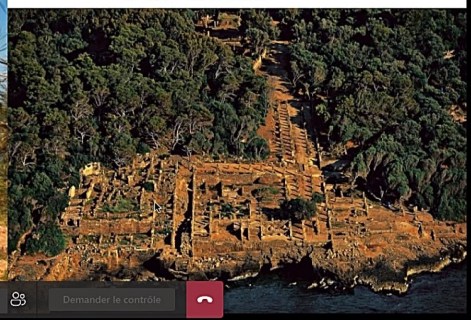
Ignorer
CONTEXTE GEOMORPHOLOGIQUE DU SITE D'ALEXANDRIE A LA FIN DE LA PERIODE ROMAINE (Ve au début du VIIe s. ap. J.-C.)
Goiran et al., Med.
CONTEXTE GEOMORPHOLOGIQUE DU SITE D'ALEXANDRIE AU DEBUT DE L'EPOQUE ARABE (VIIe au Xe s. ap. J.-C.)
Ile de Pharos
Rade Orientale
Rade Occidentale
Ride gréseuse pléistocène
tombolo
Figure 101
Christophe Morhange
01:41:35
Demander le contrôle
Alexandra Bivolaru (...
Matteo Vacchi
CLAUDIA CAPORIZZO
Dorit Sivan (Guest) (L...
Efthimios Karymbalis ...
Luminita Preoteasa (I...
Martin Seeliger (Gast...
Christophe Morhange
GAIA MATTEI
22°C Ensoleillé
FRA
17:28
28/04/2022

Tipasa (Algeria), punic foundation V° BC

tsunami ? (PhD Maouche)
ca. AD 400–600
AD 1700



Maouche, Meghraoui

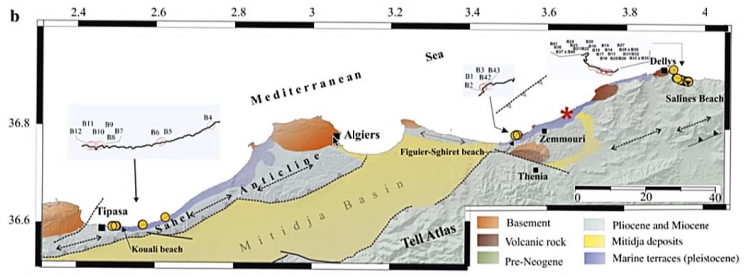
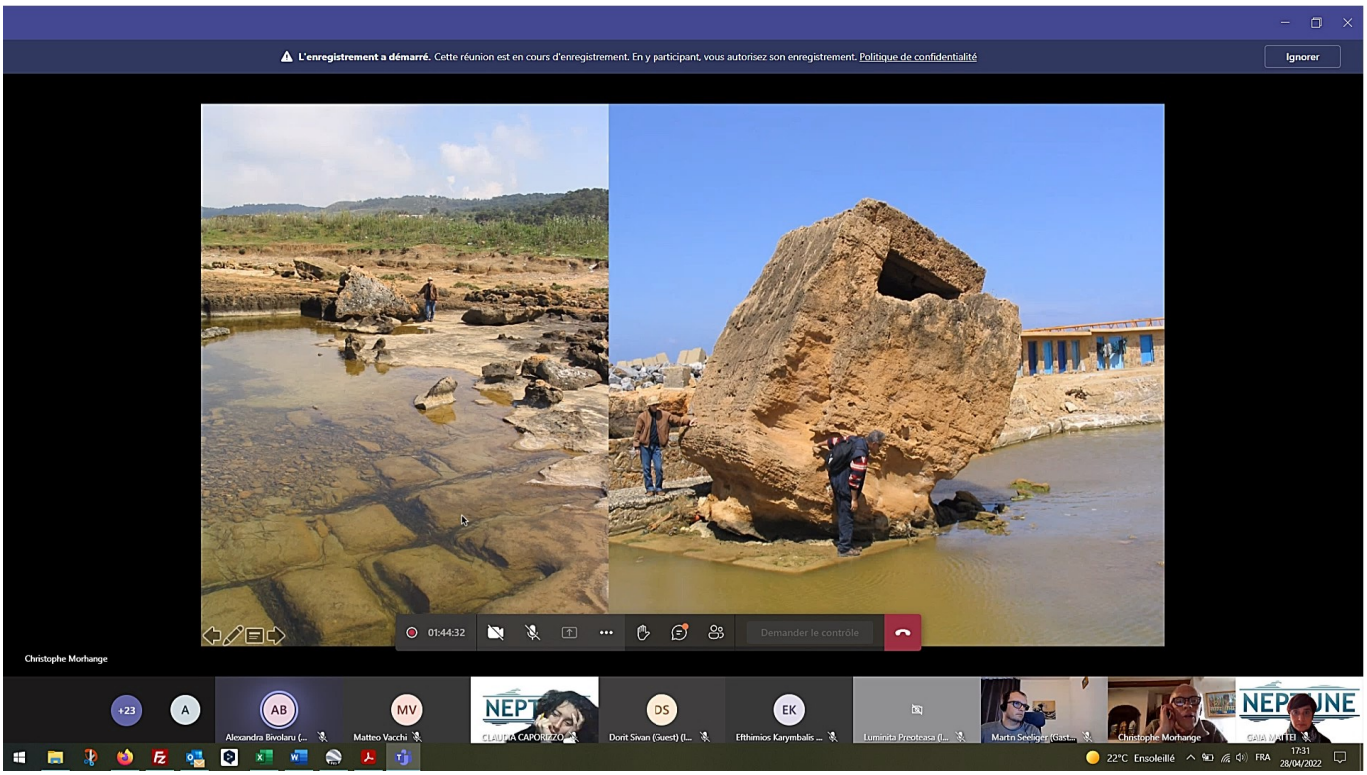


Fig. 1. a - Major tsunami earthquakes along the North Africa coastline and western Mediterranean Sea (data are from the European Tsunami Catalogue and recent publications: Soloviev et al., 2000; Tinti et al., 2004; Alasset et al., 2006; Harbi et al., 2007a,b). b - location of the studied sites (circles) along the coastal region of Algiers with simplified geology and geomorphology. The epicenter of the 2003 Zemmouri earthquake (Mw 6.8, Bounif et al., 2004) is on the coastline NE of Zemmouri.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01:44:32
Demander le contrôle
Christophe Morhange
Alexandra Bivolaru (...
Matteo Vacchi
CLAUDIA CAPORIZZO
Dorit Sivan (Guest) (I...
Efthimios Karymbalis ...
Luminita Preoteasca (I...
Martin Seeliger (Gast...
Christophe Morhange
GAIA MATTEI
22°C Ensoleillé
FRA
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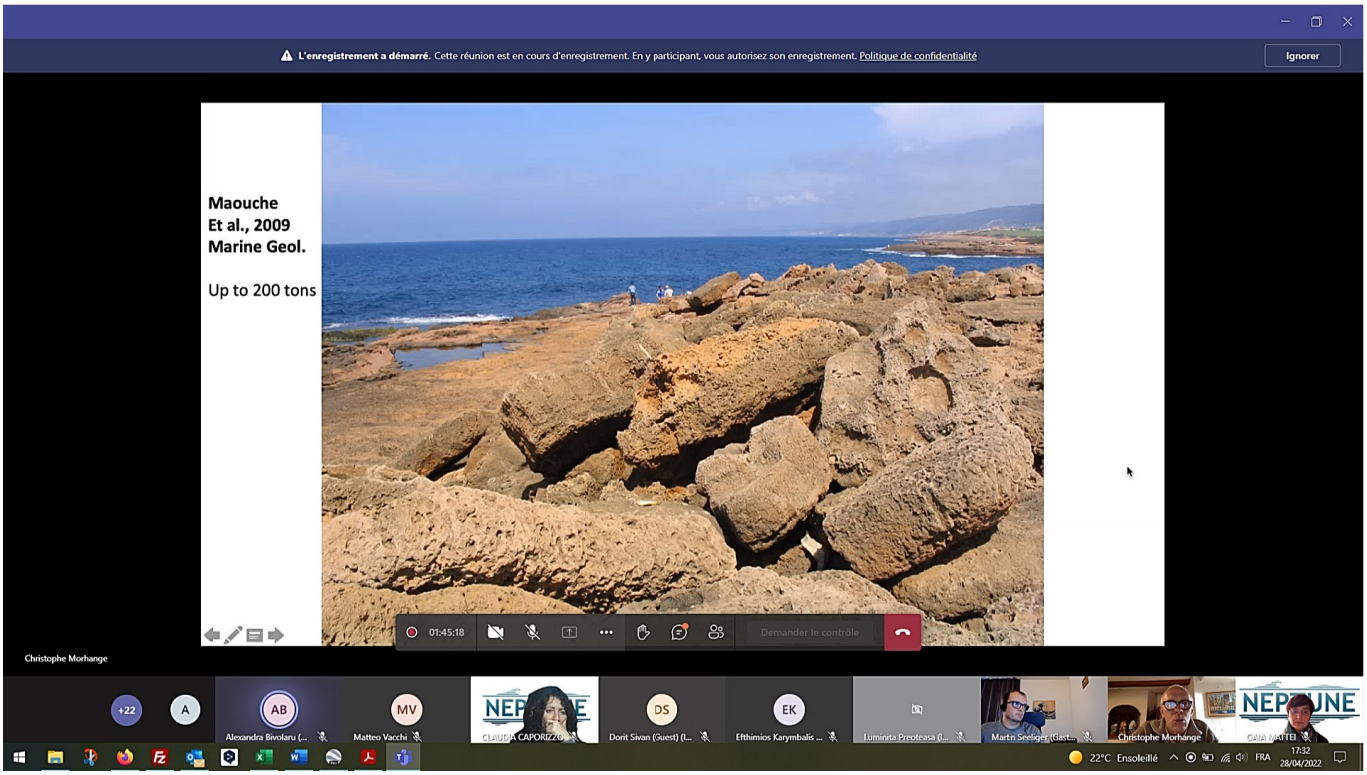
28/04/2022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Ignorer
Maouche
Et al., 2009
Marine Geol.
Up to 200 tons
01:45:18
Demander le contrôle
Christophe Morhange
Alexandra Bivolaru (...
Matteo Vacchi
CLAUDIA CAPORIZZO
Dorit Sivan (Guest) (I...
Efthimios Karymbalis ...
Luminita Preoteasca (I...
Martin Seeliger (Gast...
Christophe Morhange
GAIA MATTEI
22°C Ensoleillé
FRA
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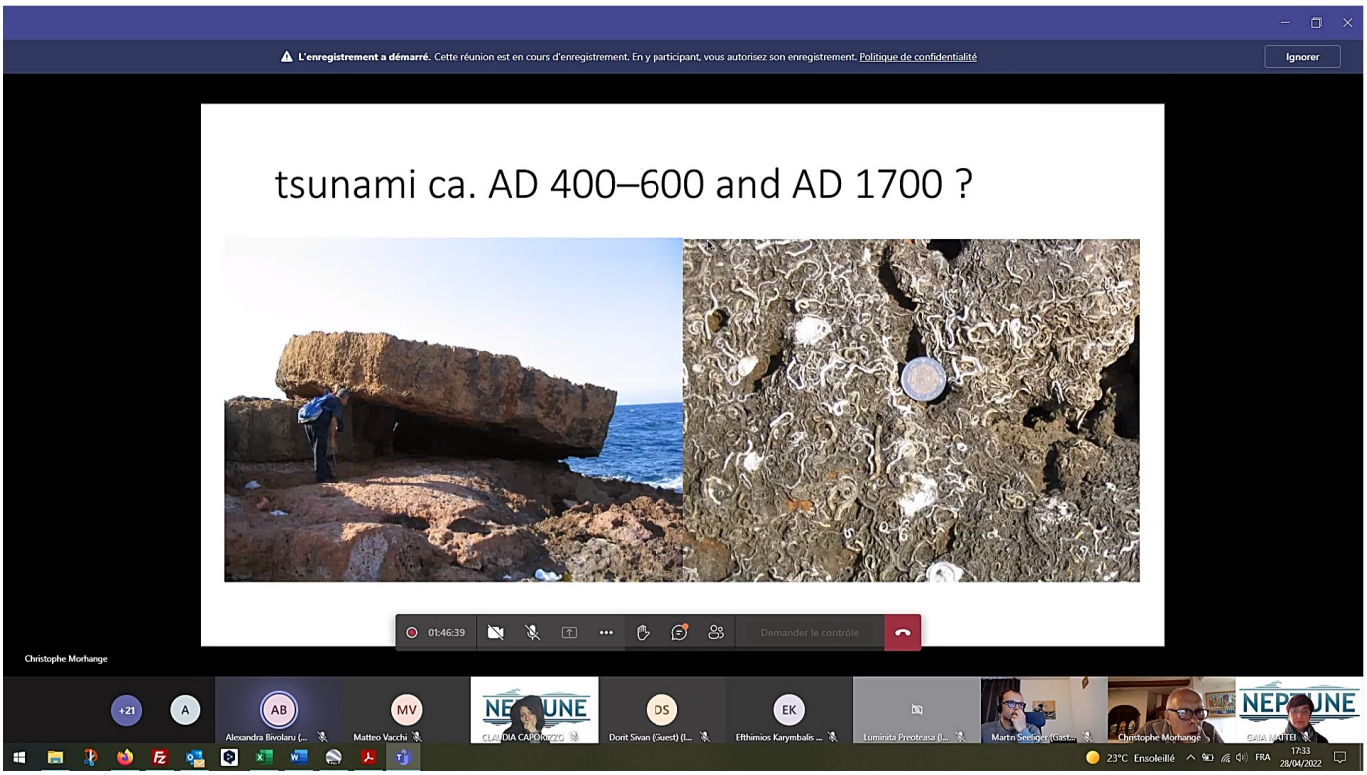
28/04/2022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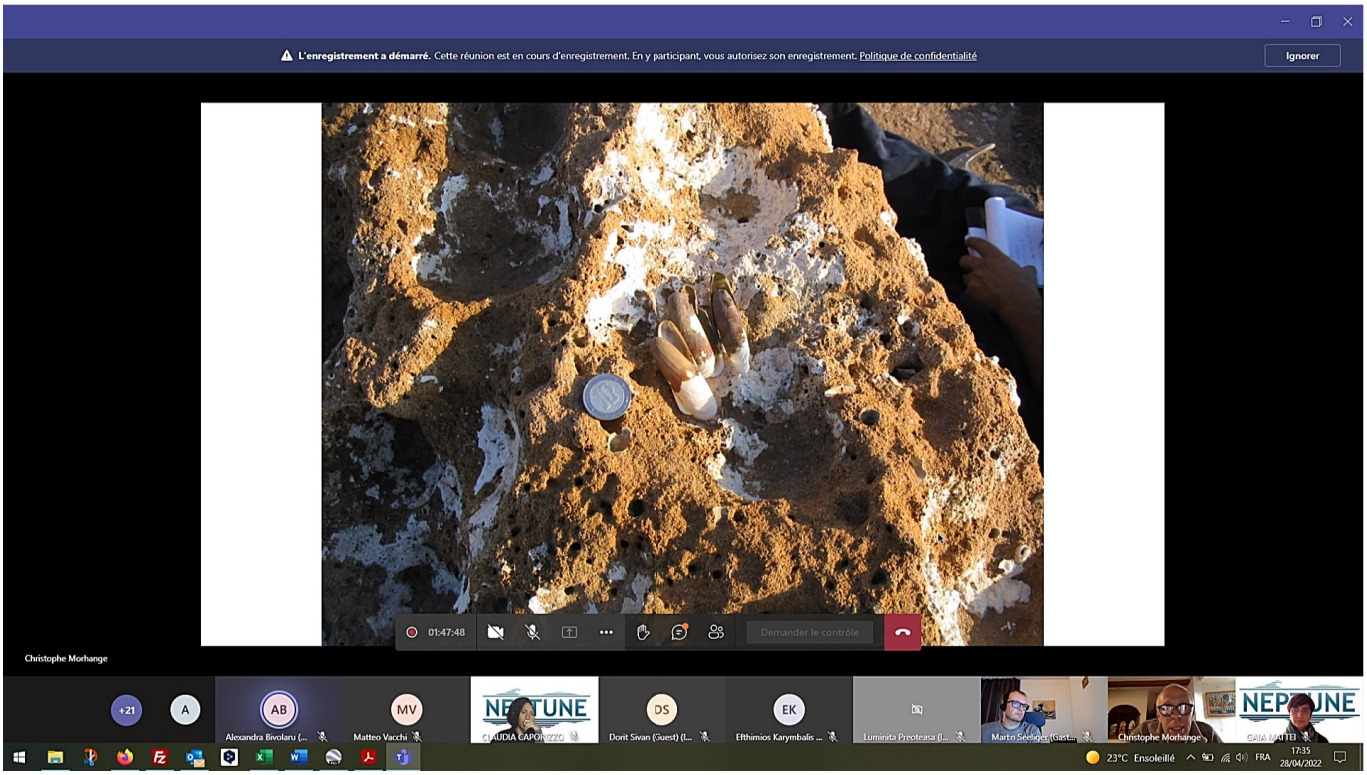
Ignorer
tsunami ca. AD 400–600 and AD 1700 ?
01:46:39
Demander le contrôle
Christophe Morhange
Alexandra Bivolaru (...
Matteo Vacchi
CLAUDIA CAPORIZZO
Dorit Sivan (Guest) (L...
Efthimios Karymbalis ...
Luminita Preoteasa (I...
Martin Seeliger (Gast...
Christophe Morhange
GAIA MATTEI
23°C Ensoleillé
FRA
17:33
28/04/2022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Demander le contrôle
Christophe Morhange
Alexandra Bivolaru (...
Matteo Vacchi
CLAUDIA CAPORIZZO
Dorit Sivan (Guest) (L...
Efthimios Karymbalis ...
Luminita Preoteasa (I...
Martin Seeliger (Gast...
Christophe Morhange
GAIA MATTEI
23°C Ensoleillé
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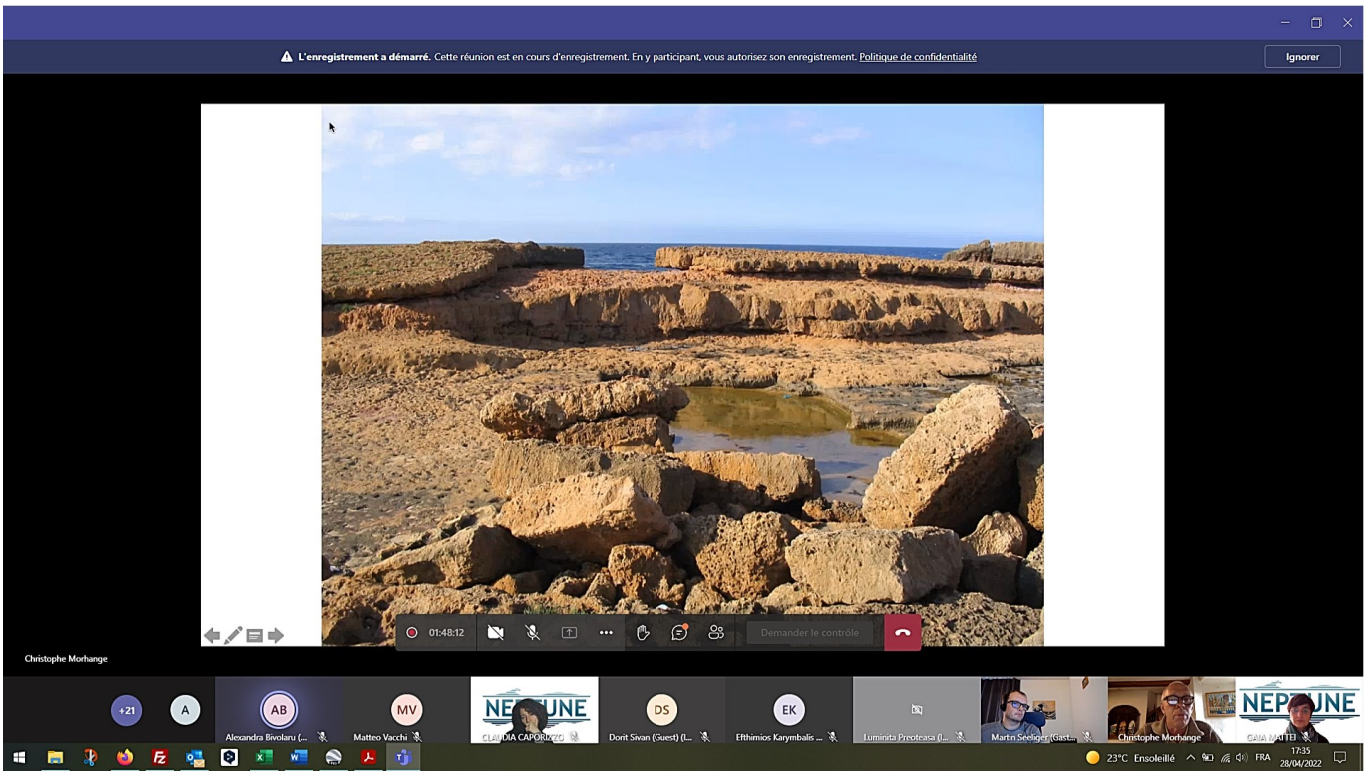
28/04/2022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Christophe Morhange
Alexandra Bivolaru (...
Matteo Vacchi
CLAUDIA CAPORIZZO
Dorit Sivan (Guest) (L...
Efthimios Karymbalis ...
Luminita Preoteasa (I...
Martin Seeliger (Gast...
Christophe Morhange
GAIA MATTEI
23°C Ensoleillé
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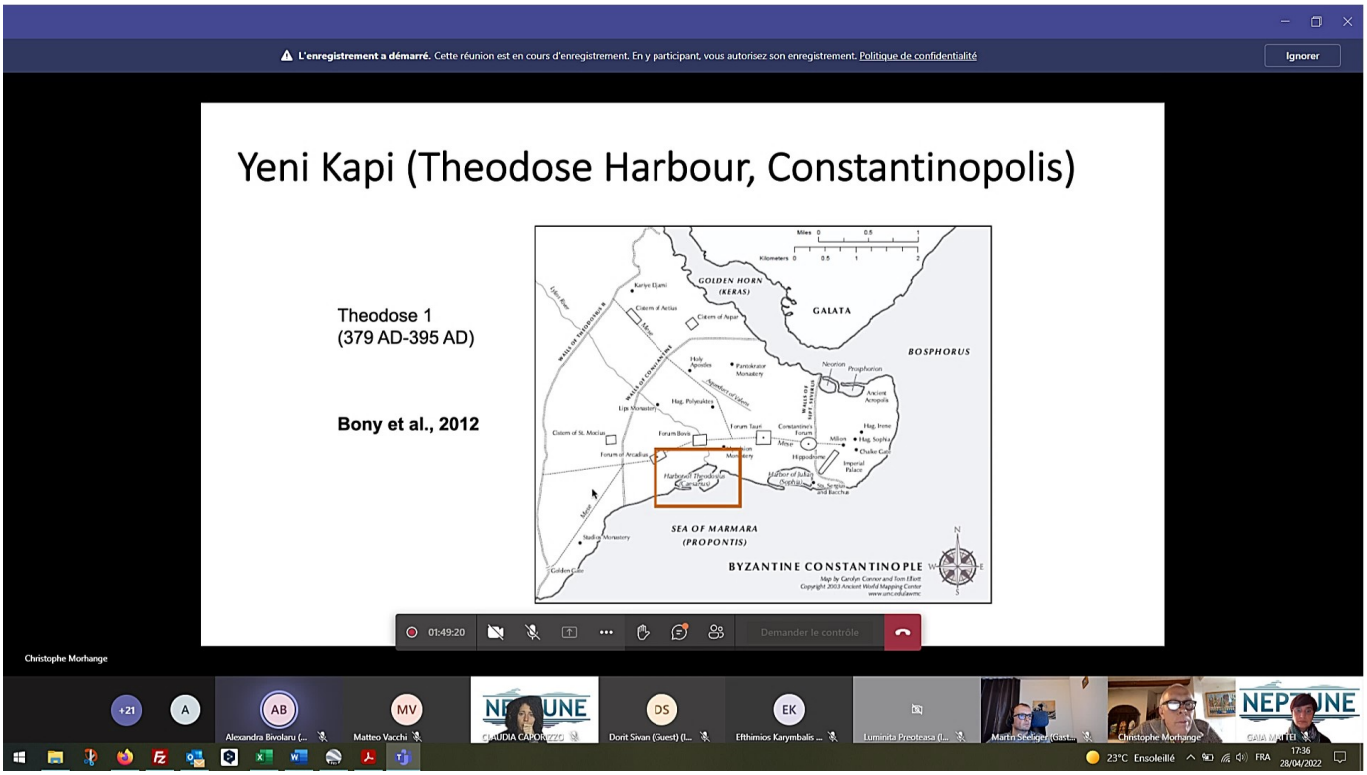
28/04/2022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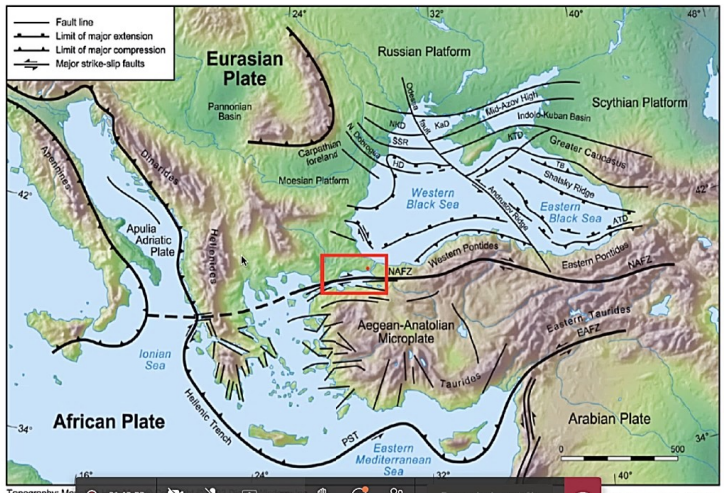
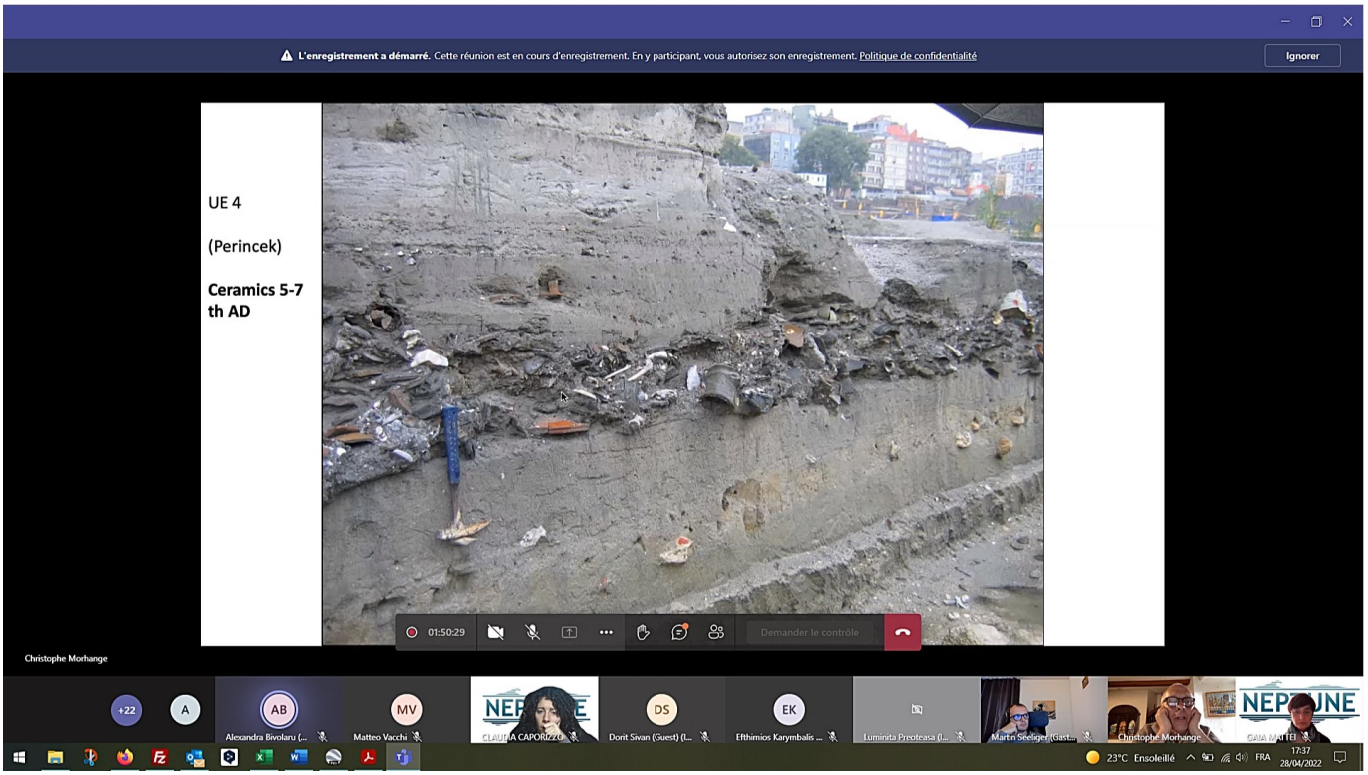
Ignorer
Yeni Kapi (Theodose Harbour, Constantinopolis)
Theodose 1
(379 AD-395 AD)
Bony et al., 2012
GOLDEN HORN
(KERAS)
GALATA
BOSPHORUS
SEA OF MARMARA
(PROPONTIS)
BYZANTINE CONSTANTINOPLE
01:49:20
Demander le contrôle
Christophe Morhange
Alexandra Bivolaru (...
Matteo Vacchi
CLAUDIA CAPORIZZO
Dorit Sivan (Guest) (L...
Efthimios Karymbalis ...
Luminita Preoteasa (I...
Martin Seeliger (Gast...
Christophe Morhange
GAIA MATTEI
23°C Ensoleillé
FRA
17:36
28/04/2022



Brückner *et al.*, 2010

Christophe Morhange



Christophe Morhange

UE 4

D. Perincek

Table 1
Radiocarbon dates performed by the Poznan Radiocarbon Laboratory at Poznan.

Sample code	Sample name	Material	pMC	Err.	Age 14C (BP)	Err.	d13C	Err.	Calibrated age −95.4%
Poz-25849	Yenikapi U4 795 wood	Wood	82.34	0.3	1560	29	−27.3	0.5	424–565 cal. AD
Poz-25827	Yenikapi U4 795	Tellinidae	78.09	0.3	1985	30	−0.5	0.5	424–565 cal. AD
Poz-25824	Yenikapi U2 798	Vermetus sp.	44.53	0.23	6498	41	−3.9	0.5	5216–4791 cal. BC
Poz-25825	Yenikapi U2A 801	Vermetus sp.	43.43	0.24	6699	44	0.4	0.6	5469–5021 cal. BC

R(marine reservoir age) = 1560 − 1985 = 425 years σ = √(30 × 30 + 30 × 30) = 42 years Calibrate with Calib. Rev 6.0.1 with IntCal09 (Reimer et al., 2009).

Ceramics 5-7 th AD

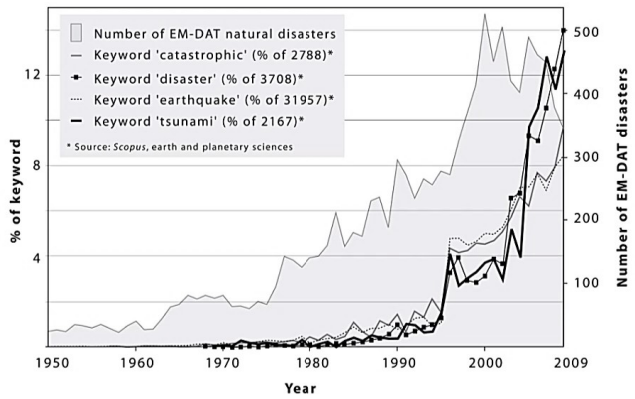
- 447 AD (Guidiboni et al., 1994; Antonopoulos 1979, Ambraseys 1962)
- 477/480 AD (Altinok et al., 2001)
- 553 AD (inundation 2000 m; Altinok et al., 2001)
- 557-558 AD (inundation 3000 m; Altinok et al., 2001)

- Many unsolved questions…
  - 2100 BC - 1900 AD: ca. 30 tsunami (Yalçiner *et al.*, 2002)
  - 120 AD - 1999 AD : ca. 40 tsunami in Marmara sea (Altinok *et al.*, 2001)

Most important tsu in Istanbul
- 447 AD (Guidoboni et al., 1994; Antonopoulos 1979, Ambraseys 1962)
- 477/480 AD (Altinok *et al.*, 2001)
- 553 AD (inundation 2000 m, Altinok *et al.*, 2001)
- **557 AD** (inundation 3000 m, Altinok *et al.*, 2001)
- 1509 AD (wave 6 m, Antonopoulos 1979, Ambraseys 1962)
- 1894 AD (inundation 200m, Hébert et al., 2005, Antonopoulos 1979; Ambraseys 1962)

Problem of scientific demonstration (tsunami versus storm, stratigraphical record versus dredging, comparison with catalogues…)

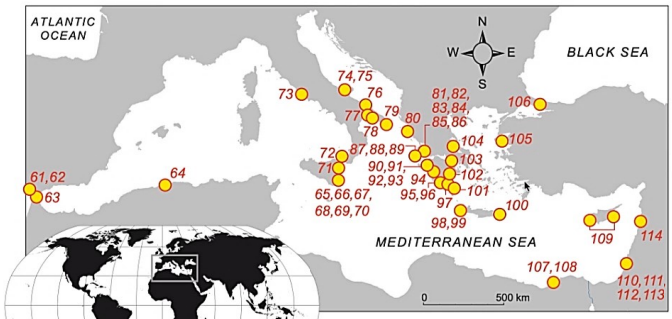
H_{moy} waves : 1.5 m to 2.5 m



Marriner N., Morhange C., Skrimshire S. (2010). Geoscience meets the four horsemen? Tracking the rise of neocatastrophism. *Global and Planetary Change*.

SITES IN THE STUDY

135 tsunami events

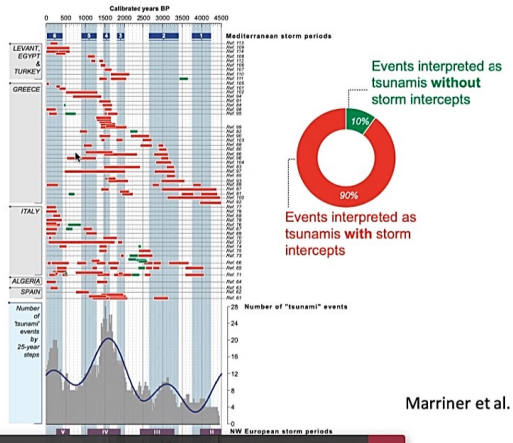


▲ Location of sites and references used in this study.

Marriner et al.

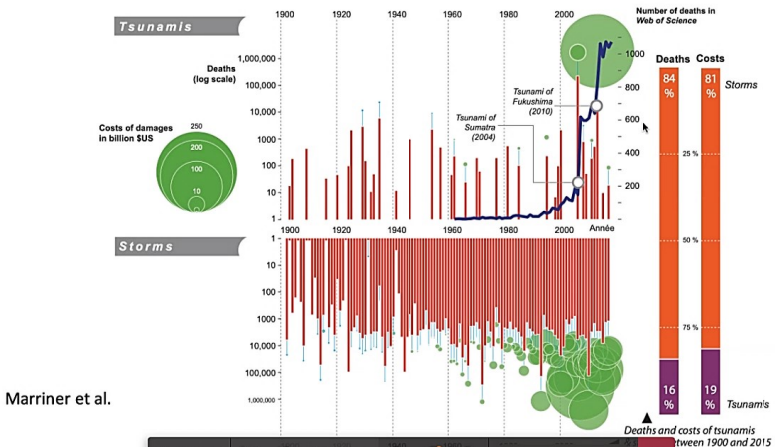
TSUNAMIS OR STORMS?

Temporal distribution of high-energy events interpreted as tsunamis, grouped geographically from the Eastern to Western Mediterranean. The lower histogram plots tsunami frequency at regular 25-year intervals. The blue line denotes the 1500-year sinusoidal filter fitted to these data (phase = Free; r = 0.839). The list of references and their locations is provided in Materials and Methods. Mediterranean (21) and NW European (49) storm periods are also indicated.



Marriner et al.

TSUNAMIS: A DISCOURSE OF FEAR?



frontiers in Marine Science

SYSTEMATIC REVIEW

Systematic Review Shows That Work Done by Storm Waves Can Be Misinterpreted as Tsunami-Related Because Commonly Used Hydrodynamic Equations Are Flawed

Rónadh Cox[1,2*], Fabrice Ardhuin[3], Frédéric Dias[1,4], Ronan Autret[4], Nicole Beisiegel[1,2], Claire S. Earlie[4], James G. Herterich[1,4], Andrew Kennedy[5], Raphaël Paris[6], Alison Raby[7], Pál Schmitt[10] and Robert Weiss[11,12]

Earth-Science Reviews 208 (2020) 103268

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ELSEVIER

Palaeotsunami deposits at the Tiber River mouth (Ostia Antica, Italy): Do they really exist?

Hugo Delile[a,b,*], Ferréol Salomon[c]

scientific reports

OPEN

Discovery of a tsunami deposit from the Bronze Age Santorini eruption at Malia (Crete): impact, chronology, extension

Laurent Lespez[1,2,3*], Séverine Lescure[1], Ségolène Saulnier-Copard[1], Arthur Glais[1], Jean-François Berger[4], Franc... Sylvie Müller Celka[4] & Maia F...

« Therefore, the maximum run-up of the tsunami was probably less than 10 m above the Late Minoan sea level, and the wave height at the coastline would have been much less.
In the flat area of the Malia marsh, the inundation distance was probably up to 500 m,
but also with only modest geomorphological consequences. «