astarte

ASSESSMENTS, STRATEGY AND RISK REDUCTION FOR TSUNAMIS IN EUROPE

The ASTARTE Paleotsunami Deposits data base web-based references for tsunami research in the NEAM region

by ***Paolo Marco De Martini***, Simone Orefice, Alessandra Smedile, Antonio Patera, Raphael Paris, Pedro Terrinha, James Hunt , Gerassimos Papadopoulos, Daniela Pantosti, João Noiva, Ioanna Triantafyllou and Ahmet C. Yalciner

Expert meeting on tsunamigenic sources with potential impact in the Iberian coast, Balearic and Canary Islands - Málaga, 6-7 Nov 2017

The ASTARTE Paleotsunami Deposits data base

This DB was implemented with the purpose to be the future **information repository for tsunami research in the NEAM region**, integrating the existing official scientific reports and peer reviewed papers on these topics.

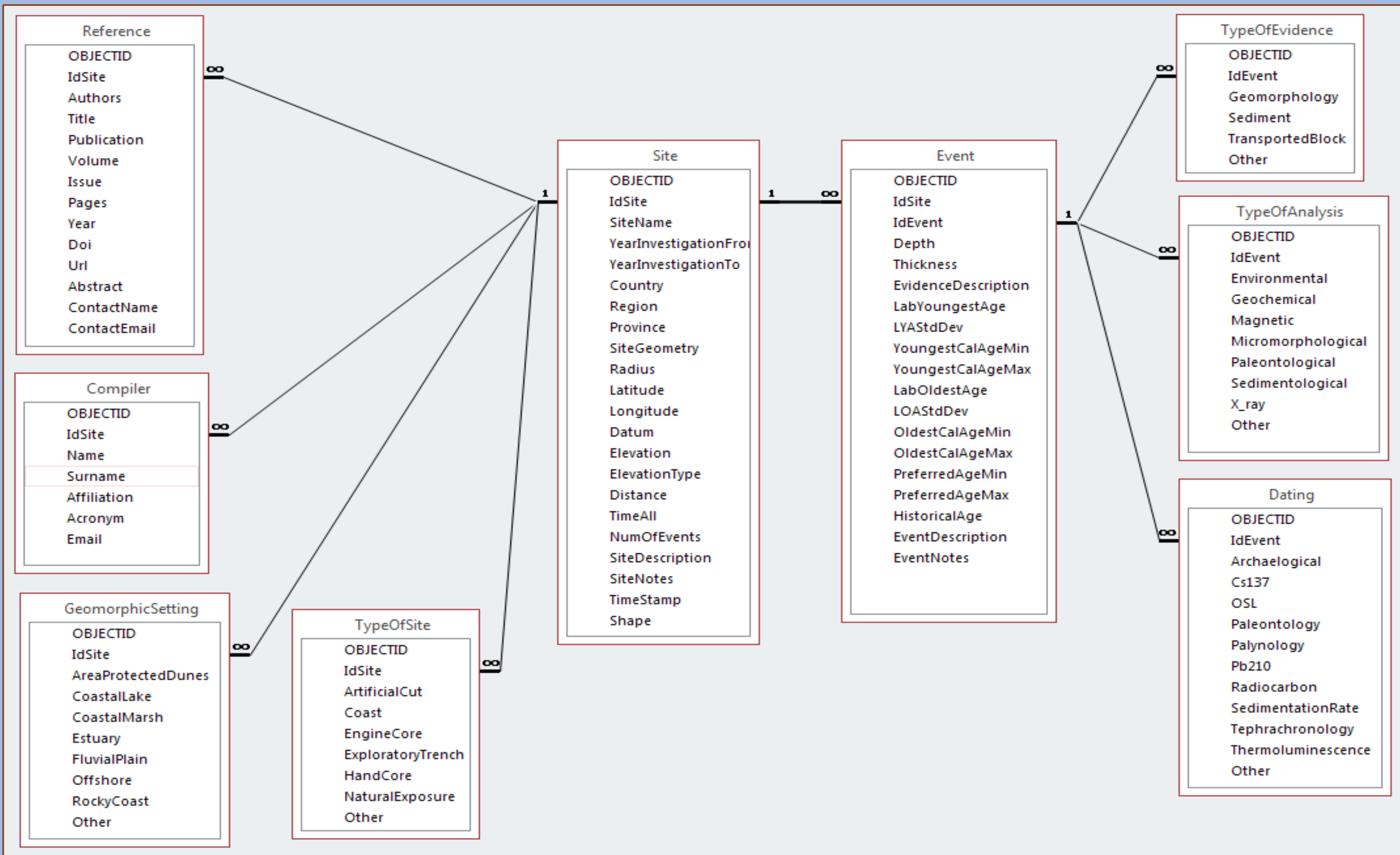
The ASTARTE **Paleotsunami deposits dabase** – NEAM region **is now available online** at the address http://arcg.is/00jWTv

This database version contains **151 sites** and **220 paleotsunami evidences**.

Cite as: The ASTARTE Paleotsunami and Mass Transport Deposits databases – web-based references for tsunami and submarine landslide research around Europe
Paolo Marco De Martini, Antonio Patera, Simone Orefice, Raphael Paris, David Völker, Galderic Lastras, Pedro Terrinha, João Noiva, Alessandra Smedile, Daniela Pantosti, James Hunt, Marc-Andre Gutscher, Sébastien Migeon, Gerassimos Papadopoulos, Ioanna Triantafyllou, and Ahmet C. Yalciner
Geophysical Research Abstracts, Vol. 19, EGU2017-15055, 2017, EGU General Assembly 2017

Paleotsunami deposits DB

THE ARCHITECTURE



Site Information 1

Site Name: Provide name quoted in literature or, if none, provide a reasonable name from a nearby locality

Compiler: *We should consider that only registered persons could act as compilers!!*

Reference: Report the full reference(s) of the published paper or official report following the formats below

Authors; Title
Publication; Volume; Issue; Pages (NºTot.); Year of pub
DOI; URL
Abstract
Contact Name; Contact E-mail

Year of investigation: Provide four digits for year (from; to)

Country:

Region:

Province:


Marine Geology 281 (2011) 1–13

Contents lists available at ScienceDirect

Marine Geology

journal homepage: www.elsevier.com/locate/margeo

ELSEVIER

Possible tsunami signatures from an integrated study in the Augusta Bay offshore (Eastern Sicily—Italy)

A. Smedile [a,*], P.M. De Martini [a], D. Pantosti [a], L. Bellucci [b], P. Del Carlo [c], L. Gasperini [b], C. Pirrotta [d], A. Polonia [b], E. Boschi [a]

Site Information 2

Site Geometry: Choose **Point** if you are reporting results from an individual point (eg. a core, a trench, etc.), **Area** if you are summarizing results from different observational points in an area (e.g., several cores, several boulders, etc). When you select area provide the max width (*radius*) of the area from the center in meters.

Area **Point**

Latitude: Provide Latitude in degrees expressed as a decimal fraction (i.e., 00.0000°); north is positive.

Longitude: Provide Longitude in degrees expressed as a decimal fraction (i.e., 00.0000°); east is positive.

Datum: Select the datum from the list (ED50, ETRF89, Roma40, WGS84)

Elevation: Provide the elevation of the site above(positive)/below(negative) present sea level in meters.

Elevation type: GPS, Topographic map

Distance: Provide the max distance of the tsunami evidence from the present shoreline in meters.

Time all: maximum age of the observed sequence (to be expressed in years before present with reference to year 2000).

N. Events: provide the total number of tsunami deposits found.

Site Information 3

Geomorphic setting: Select the appropriate geomorphic setting (multiple selections allowed)

Area protected by coastal dunes
Coastal lake
Coastal marsh
Estuary
Fluvial plain
Offshore
Rocky coast
Other

Type of site: Select the appropriate type of site (multiple selections allowed)

Artificial cut
Coast
Engine core
Exploratory trench
Hand core
Natural exposure
Other

Site description: Provide a narrative on the site

Site notes: Provide necessary data

Event Information 1

Site Name: Select the appropriate site from the list

Event number:

Type of evidence: Select the appropriate type of evidence

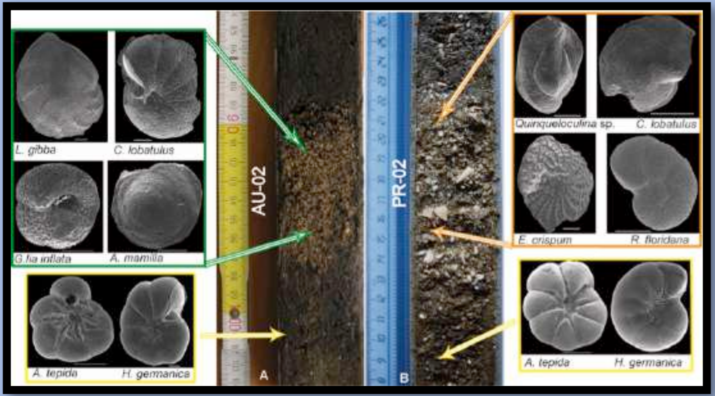
geomorphology
sediment
transported block
other

Depth: Provide the depth of the tsunami in meters with respect to the present ground surface/sea bottom (depth of the layer top)

Tickness (or dimension): Provide the max value in meters (max axis for blocks)

Type of analysis: Select all analyses supporting the interpretation (multiple selections allowed)

Environmental
Geochemical
Magnetic
Micromorphological
Paleontological
Sedimentological
X-Ray
Other



Evidence description: Provide a narrative on the process followed for the recognition of the tsunami

Event Information 2

Dating: Select all the dating methods applied (multiple selections allowed)

- Archaeological
- Cs137
- **OSL** →
- Paleontology
- Palynology
- Pb210
- **Radiocarbon** →
- Sedimentation rate
- Tephrachronology
- Thermoluminescence
- Other

Layer	Core	Fraction	Ø (μm)	Procedure	ED Gy	DR Gy a^{-1}	OSL age (2σ) a BP	Date AD
MOR-T02	S39	CG	90–150	SAR	2.58 ± 0.04	1.57 ± 0.06	1643 ± 132	368 ± 132
MOR-T01	S100	FG	2–11	dSAR	0.38 ± 0.06	3.33 ± 0.11	113 ± 38	1897 ± 38
	S101	FG	2–11	dSAR	0.46 ± 0.06	4.19 ± 0.14	110 ± 32	1901 ± 32
	S102	CG	150–212	SAR	0.20 ± 0.01	1.65 ± 0.09	118 ± 18	1893 ± 18

Sample code	Sample lab	Type	Measured Age BP	δ^{13}C (‰)	Calibrated age ΔR	Calibrated age (preferred)	Probab. Distrib.
S12–69	LTL4282A	*Cerastoderma glaucum*	1989 ± 45	-6.2 ± 0.4	370–680 AD	270–530 AD	1.00
S12–85	LTL4283A	*Cerastoderma glaucum*	1988 ± 40	-5.4 ± 0.3	380–680 AD	280–520 AD	1.00
S12–97	LTL4284A	*Cerastoderma glaucum*	1927 ± 50	-3.8 ± 0.5	420–740 AD	350–600 AD	1.00
S12–312	LTL4285A	*Cerastoderma glaucum*	4081 ± 40	-2.5 ± 0.3	2200–1780 BC	2300–2030 BC	1.00
S39–142	LTL4887A	*Cerastoderma glaucum*	2096 ± 50	-9.3 ± 0.5	240–610 AD	140–410 AD	1.00
S39–415	LTL4888A	*Cerastoderma glaucum*	4746 ± 50	-9.1 ± 0.2	3110–2640 BC	3250–2900 BC	1.00
S51-26	LTL4889A	*Cerastoderma glaucum*	582 ± 45	-3.7 ± 0.5	1710–1950 AD	1640–1880 AD	1.00
S51–284	LTL4903A	*Cerastoderma glaucum*	3207 ± 40	-14.0 ± 0.5	1110–770 BC	1200–930 BC	1.00

Lab. youngest age ± Standard Deviation: Provide numeric value of the youngest laboratory age as yr B.P. (Before Present) **yyyy ± xx**

Youngest calendar age: ([min, max]) Provide youngest age as yr A.D./B.C.; yr AD positive values, yr BC negative values. Report here the dendrochronologically corrected age for Radiocarbon, historical/archaeological estimates etc **yyyy, xxxx**

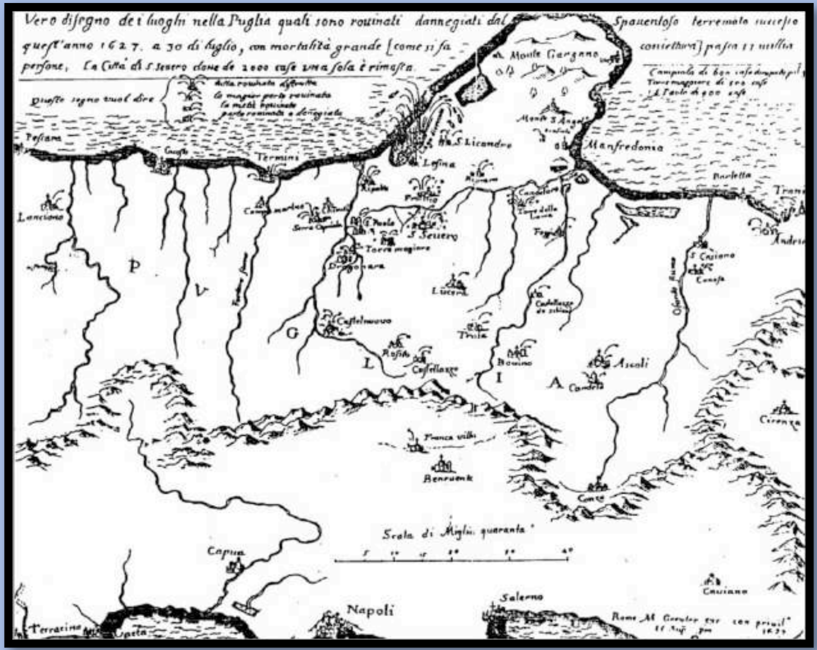
Lab. oldest age ± Standard Deviation: Provide numeric value of the oldest laboratory age as yr B.P. (Before Present) **yyyy ± xx**

Oldest calendar age: ([min, max]) Provide oldest age as yr A.D./B.C.; yr AD positive values, yr BC negative values. Report here the dendrochronologically corrected age for Radiocarbon, historical/archaeological estimates etc **yyyy, xxxx**

Event Information 3

Preferred age: Provide minimum and maximum preferred ages for the tsunami, yr AD positive values, yr BC negative values. **yyyy, xxxx**

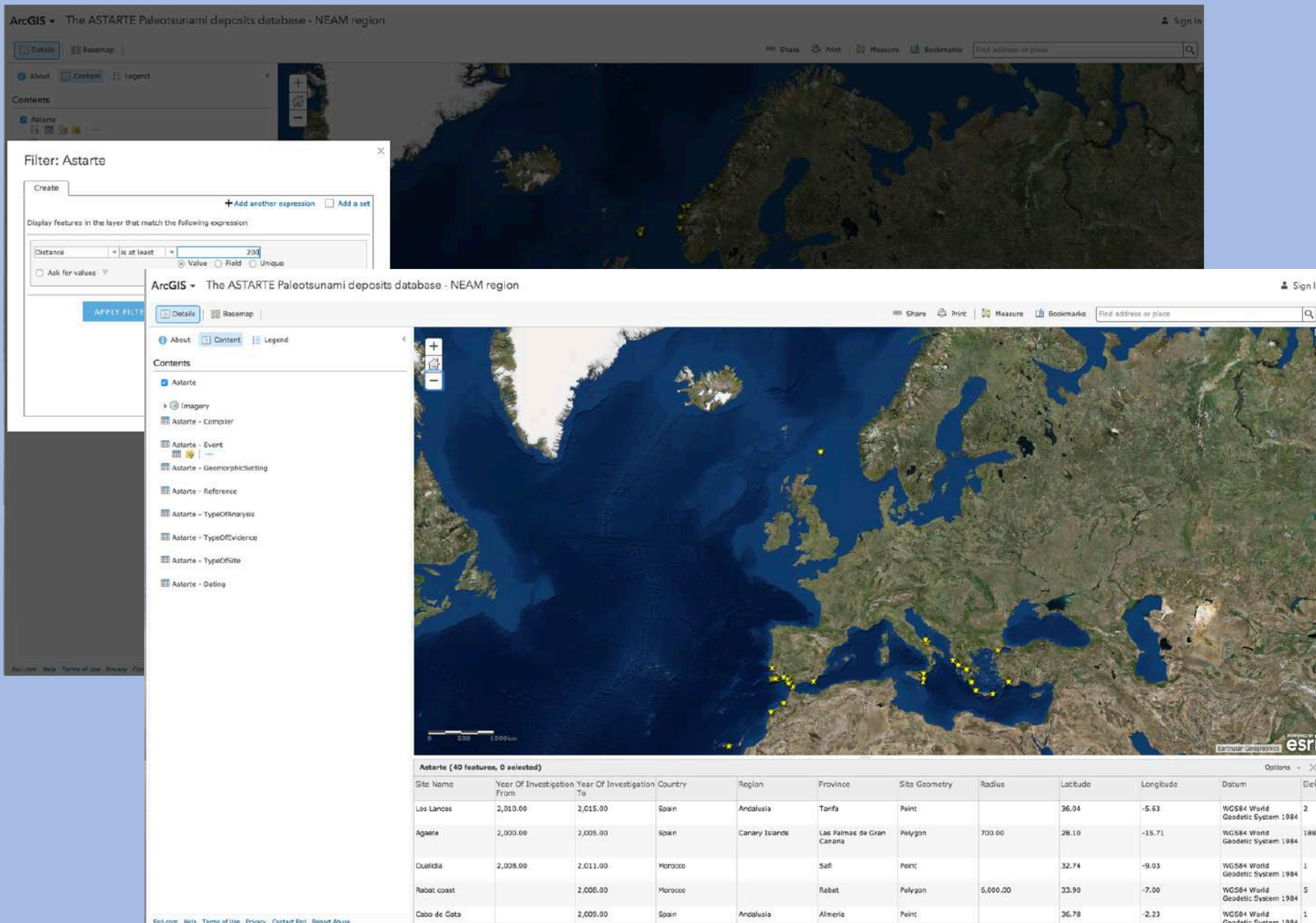
Historical age: Provide year of a potential tsunamigenic earthquake/landslide/eruption occurred within the interval of time defined for the tsunami, yr AD positive values, yr BC negative values. **yyyy**



Event description: Include a short discussion on the type of dated materials (if marine specify ΔR), position with respect to the tsunami deposit to be dated, pertinent problems, explain the reasons for defining the preferred age and correlating the deposit to a historical event (If possible the day, month and year of the event should be indicate). Add any information that can be of relevance.

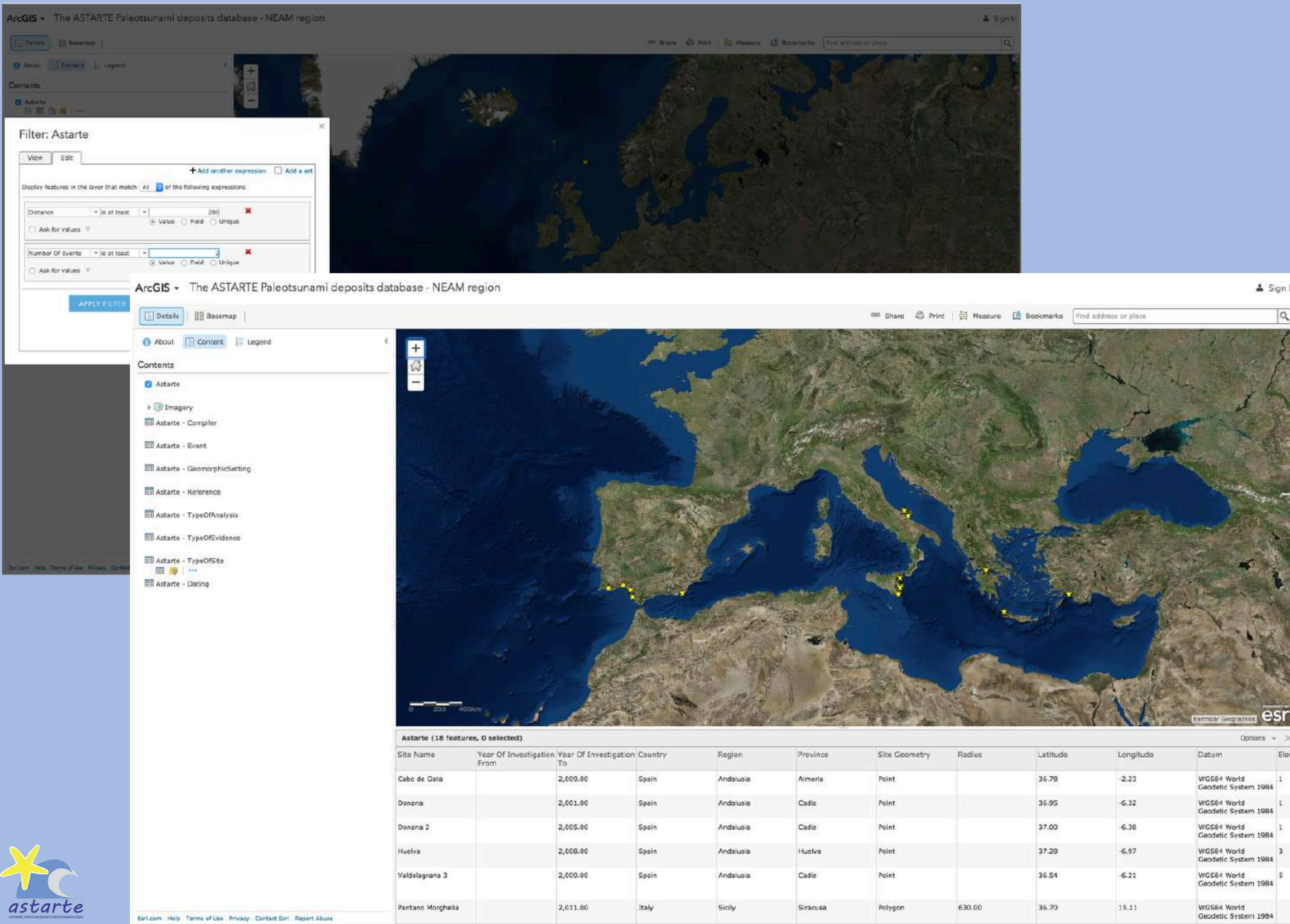
Event notes: Provide necessary data

First level - Query 1: Distance ≥ 200 m

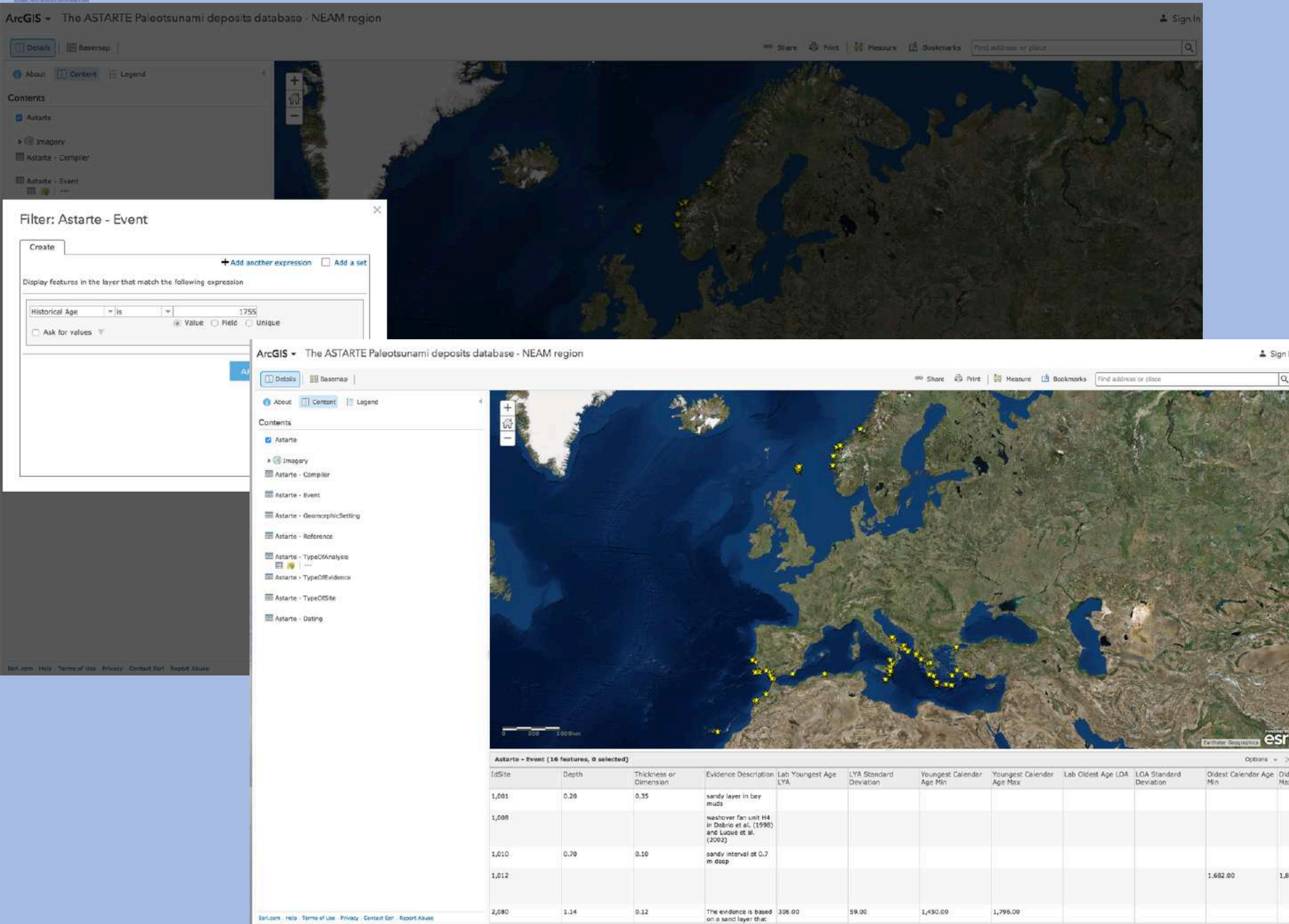


Site Name	Year Of Investigation From	Year Of Investigation To	Country	Region	Province	Site Geometry	Radius	Latitude	Longitude	Datum	Ele
Los Lances	2,010.00	2,015.00	Spain	Andalusia	Tarifa	Point		36.04	-5.63	WGS84 World Geodetic System 1984	2
Agaete	2,000.00	2,005.00	Spain	Canary Islands	Las Palmas de Gran Canaria	Polygon	700.00	28.10	-15.71	WGS84 World Geodetic System 1984	188
Oualidia	2,008.00	2,011.00	Morocco		Safi	Point		32.74	-9.03	WGS84 World Geodetic System 1984	1
Rabat coast		2,006.00	Morocco		Rabat	Polygon	6,000.00	33.90	-7.00	WGS84 World Geodetic System 1984	5
Cabo de Gata		2,009.00	Spain	Andalusia	Almeria	Point		36.78	-2.23	WGS84 World Geodetic System 1984	1

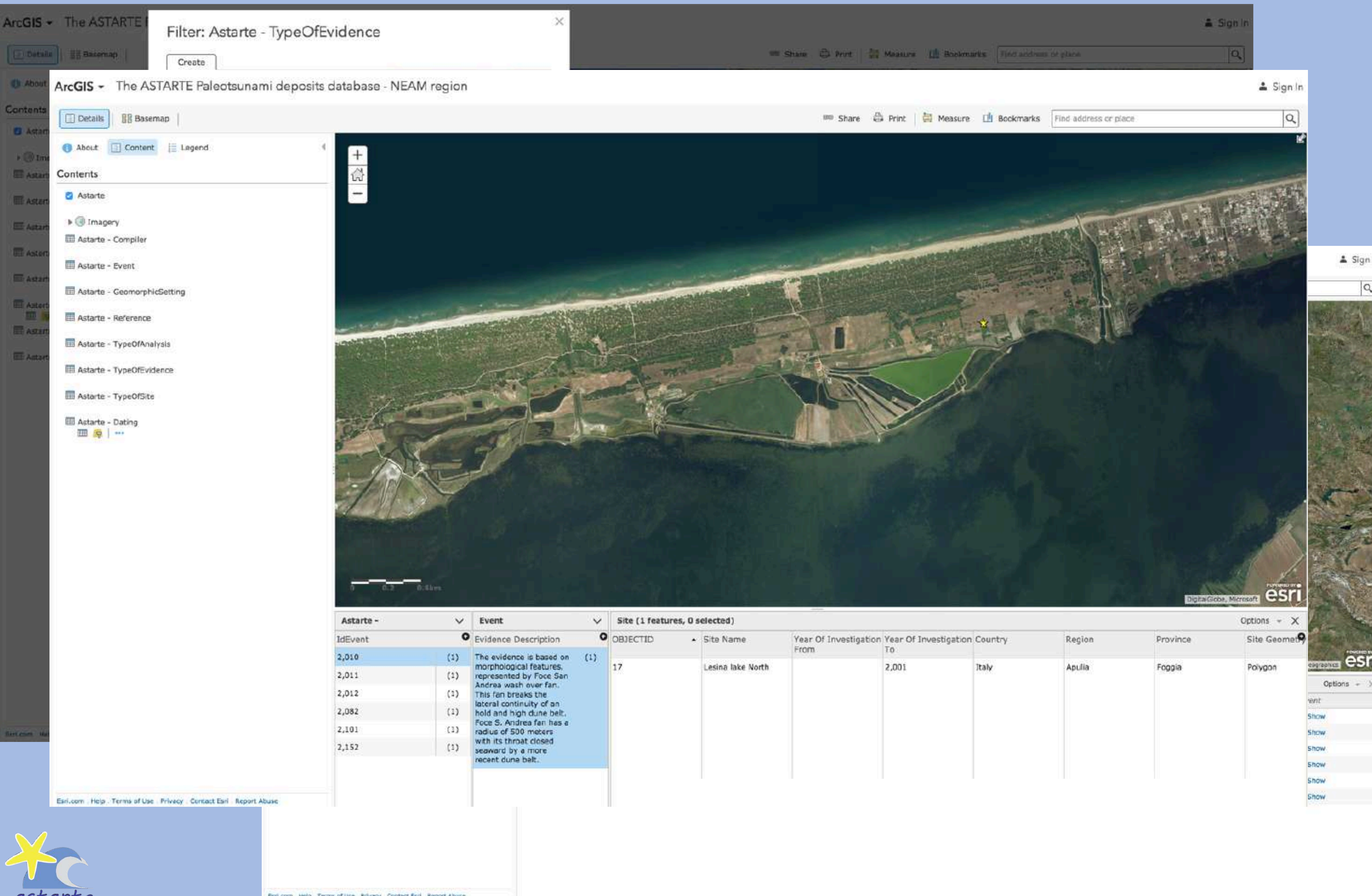
First level - Query 1+Query 2: Dist. ≥ 200 m, N. of events ≥ 2



Second level - Query 3: Historical age = 1755



Second level – Query 4: Type of Evidence Geomorph=Yes - Sediment=No - Boulders=No



An overview of the paleotsunami deposits found so far along the Iberian coast, Balearic and Canary islands

A total of 10 sites with at least one paleotsunami deposit evidence is available in Astarte DB for SPAIN

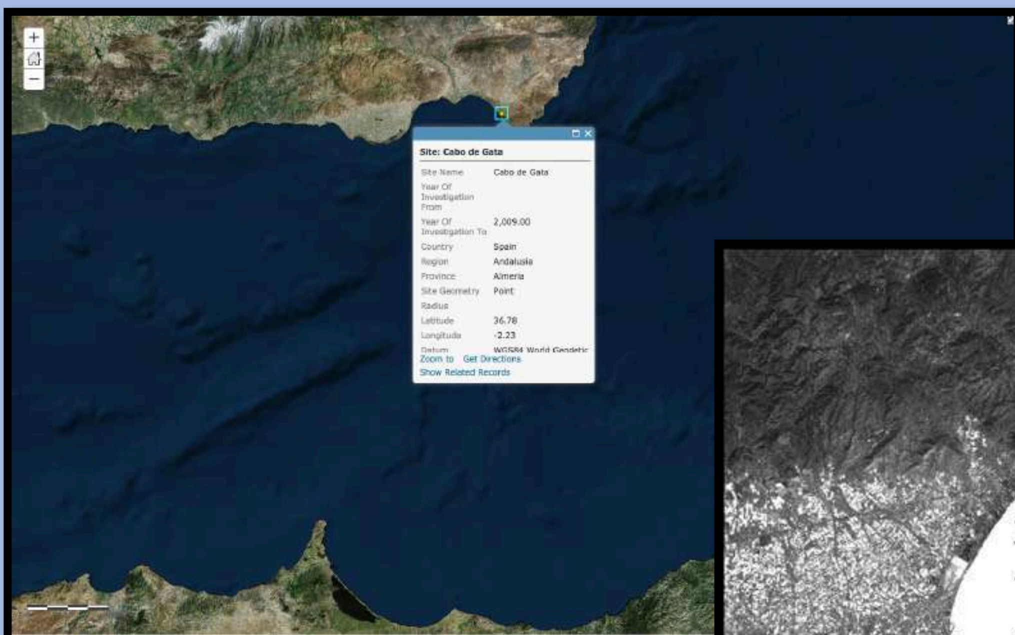
No info for Baleares and most of the data are in Andalusia

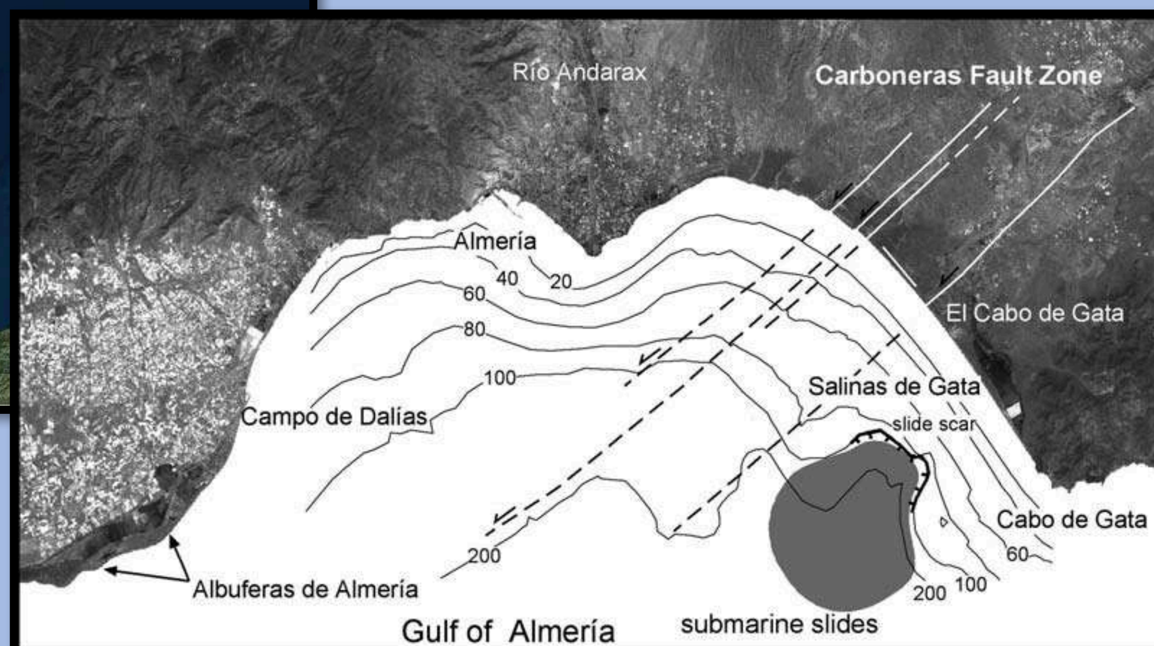
Cabo de Gata site (Andalusia, Almeria)

Reference: Reicherter and Becker-Heidmann (2009), Tsunami deposits in the western Mediterranean: remains of the 1522 Almerı´a earthquake?, The Geological Society, London, Special Publications, 316, 217–235. http://dx.doi.org/10.1144/SP316.14 .

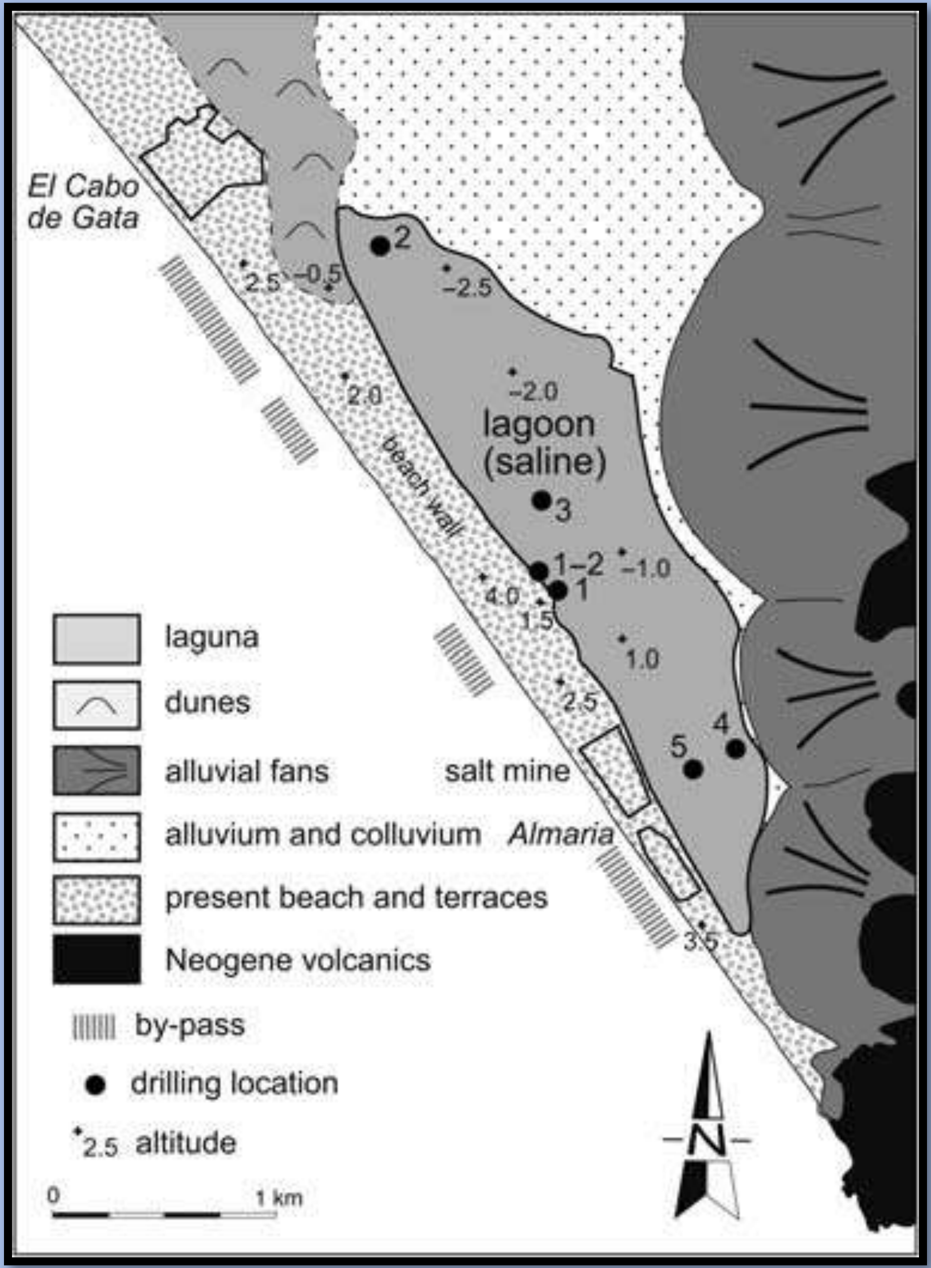
Tsunami 1 < 1270-1390 AD, Historical Eq1522 AD? **Offshore earthquake**? **Carboneras Fault source**?

1270-1390 AD < **Tsunami 2** < 1050-1260 AD, 1013-14 AD? **Offshore earthquake/submarineslide source**?





Cabo de Gata site



INFO

Type of evidence: sediment

Tsunami 1: 10 cm thick, sandy layer;

Tsunami 2: 30 cm thick, sandy layer;

elevation 1 m;

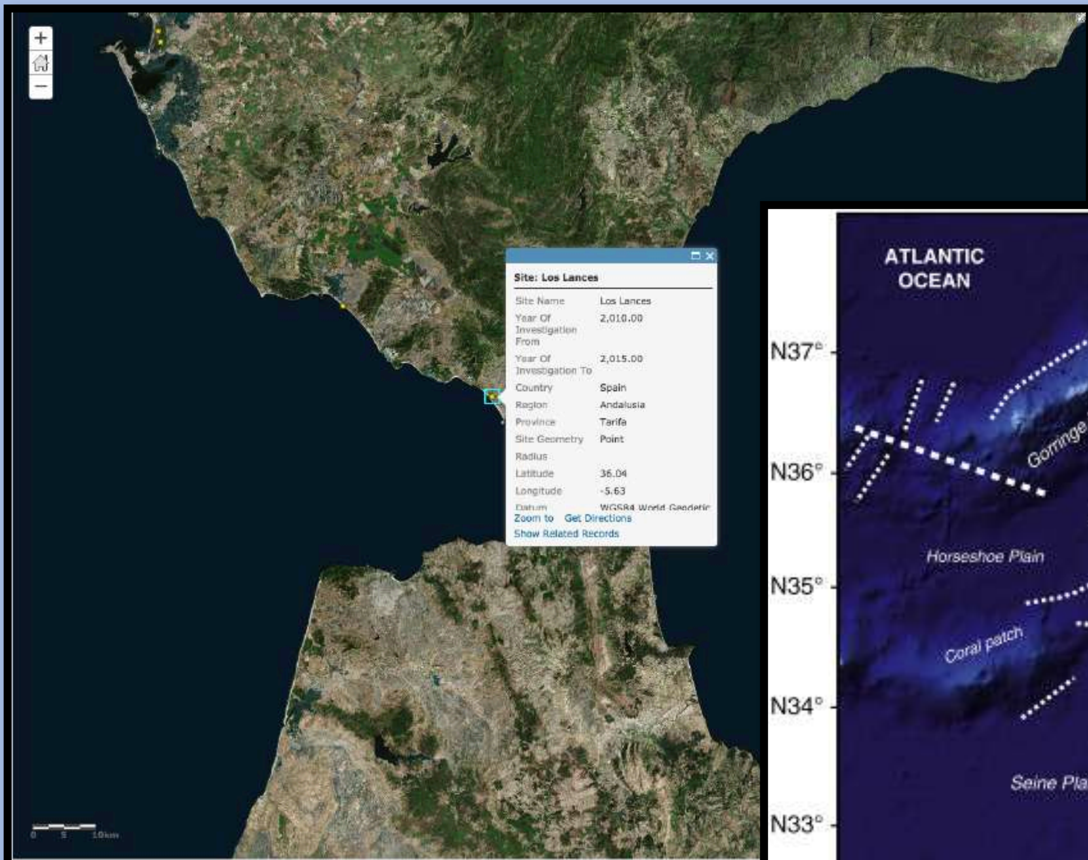
distance 860 m

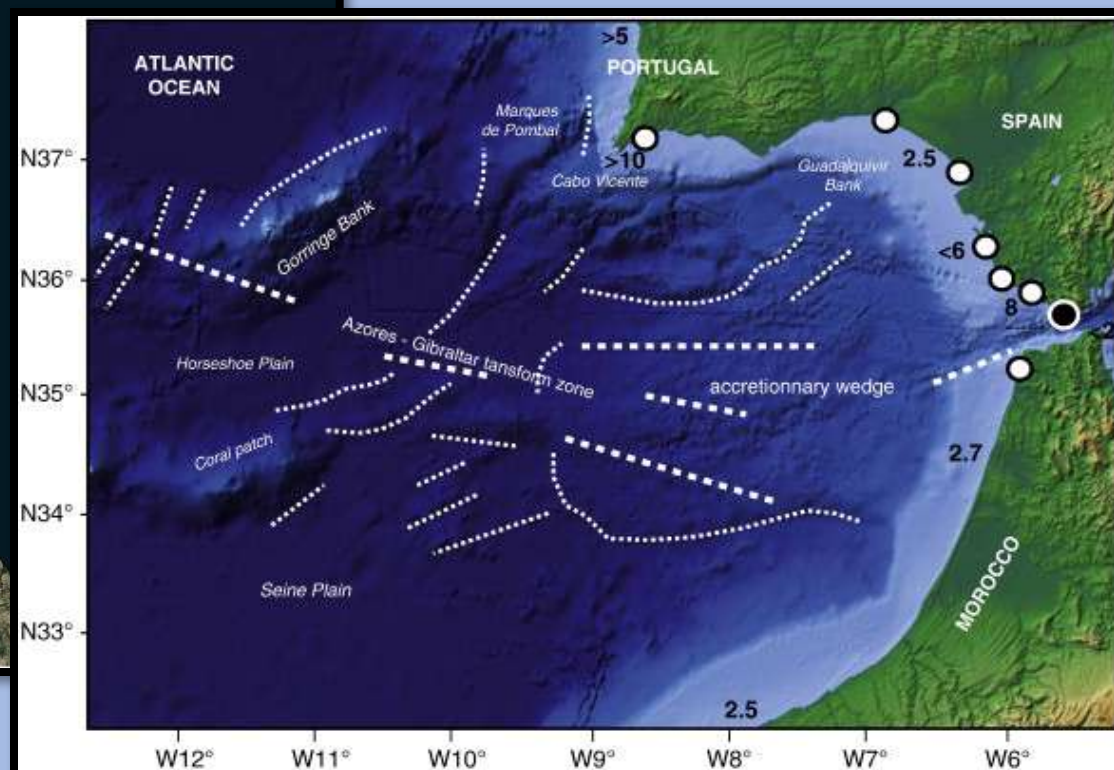
Note that the tectonically risen beach wall and back dune area exceed altitudes of 3 m a.s.l.

Los Lances site (Andalusia, Tarifa)

Reference: Cuven et al., (2013), High-resolution analysis of a tsunami deposit: Case-study from the 1755 Lisbon tsunami in southwestern Spain, Marine Geology, http://dx.doi.org/10.1016/j.margeo.2013.02.002 .

Tsunami 1, Historical Eq 1755 AD? **Offshore earthquake but which source**?



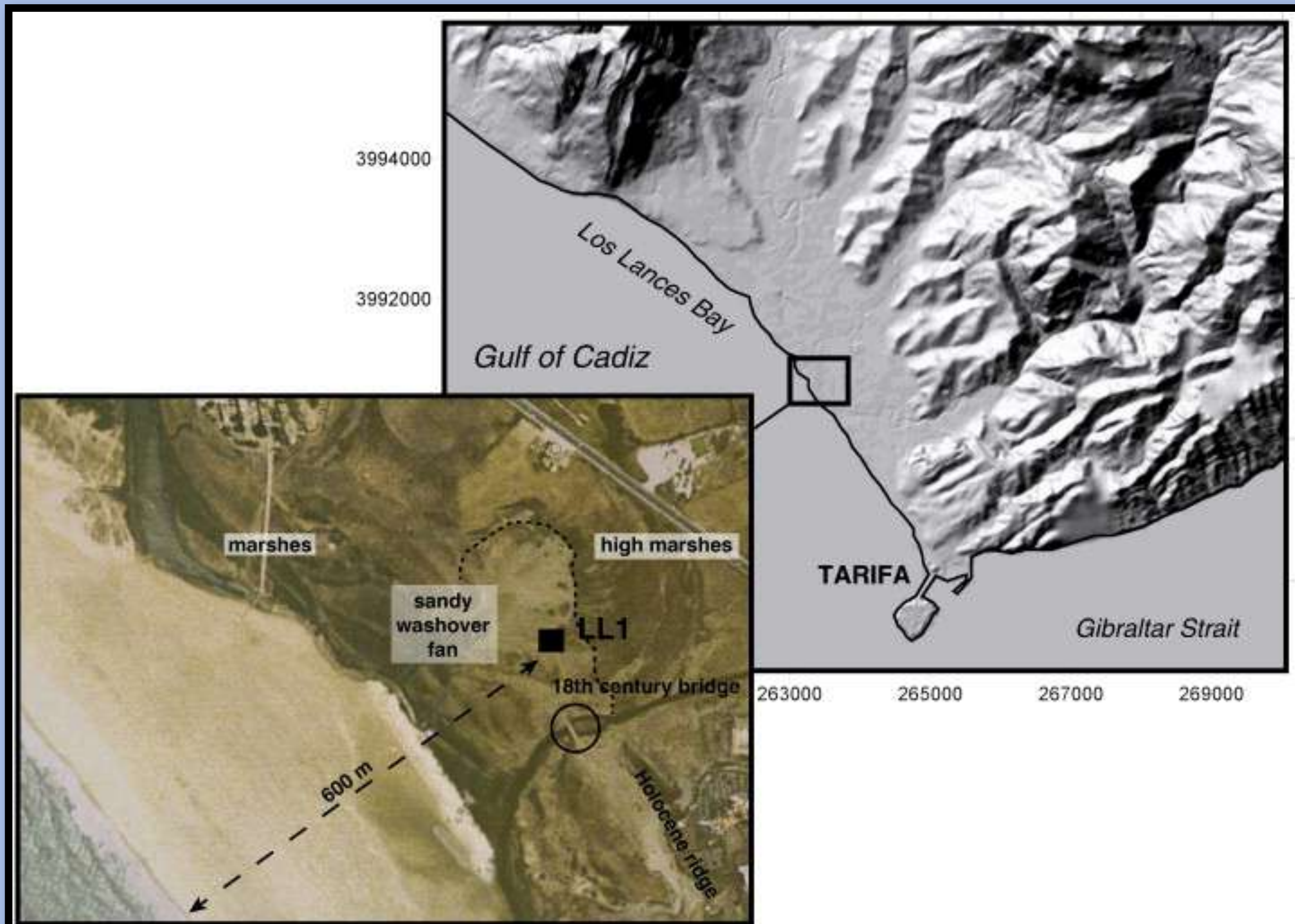


Los Lances site

INFO

Type of evidence: sediment   Tsunami 1: 35 cm thick, sandy layer;

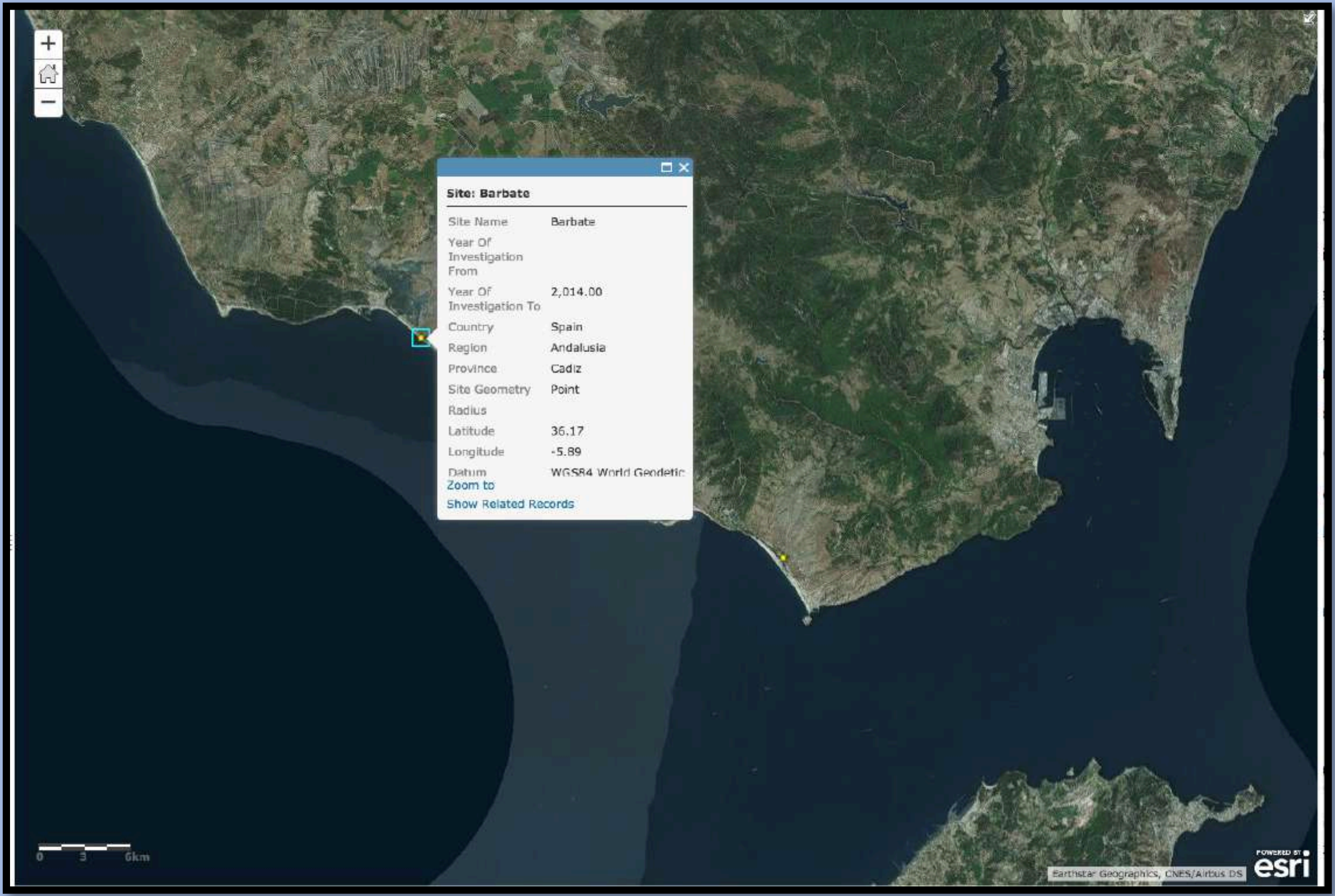
Elevation 2 m;   distance 1500 m



Barbate site (Andalusia, Cadiz)

Reference: Koster, Benjamin, Reicherter, Klaus, (2014), Sedimentological and geophysical properties of a ca. 4000 year old tsunami deposit in southern Spain, *Sedimentary Geology* , doi: 10.1016/j.sedgeo.2014.09.006

5220 BP < **Tsunami 1** < 3320 BP, **unknown source**?

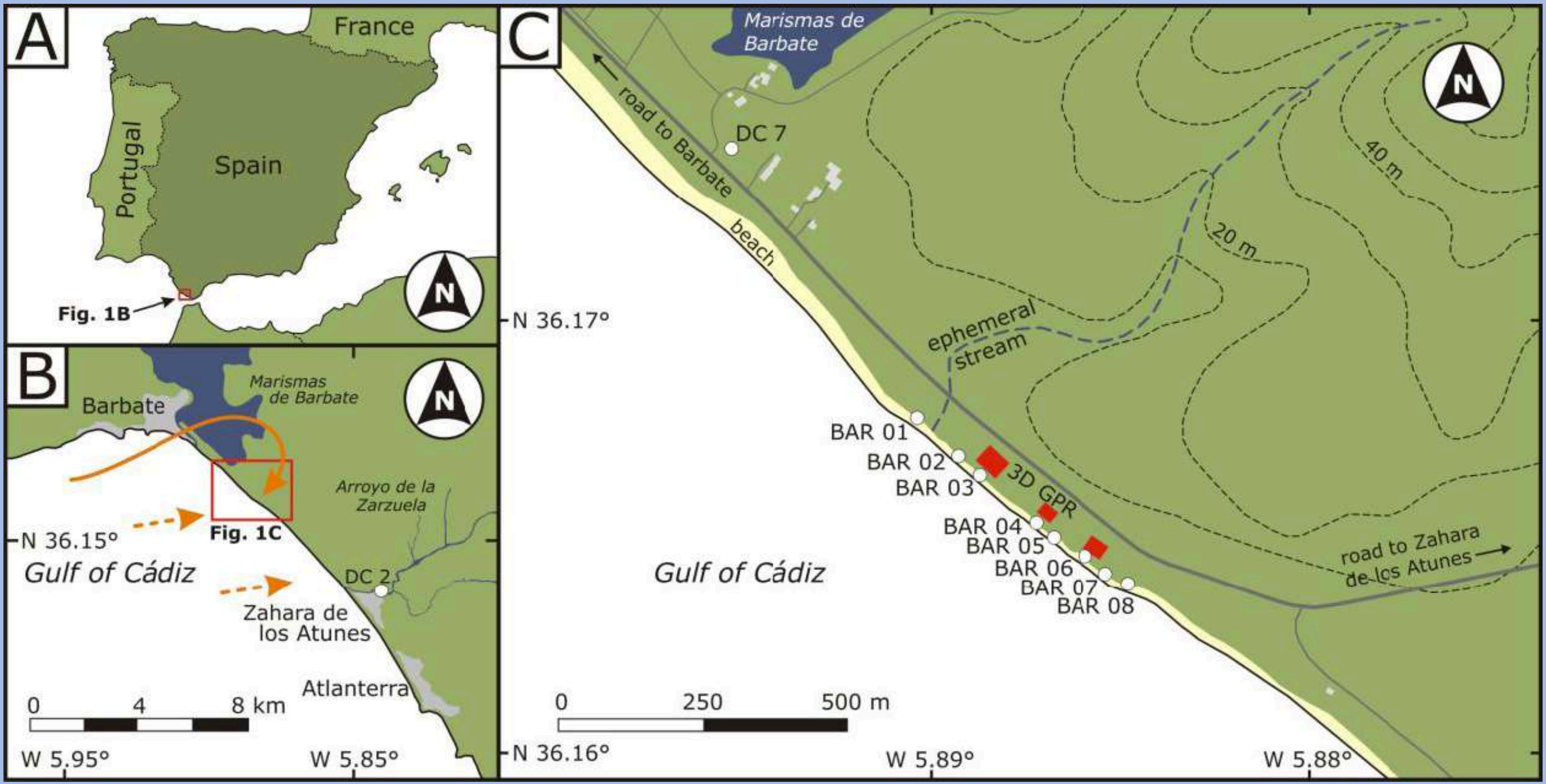


Barbate site

INFO

Type of evidence: sediment **Tsunami 1: 35 cm thick, sandy layer;**

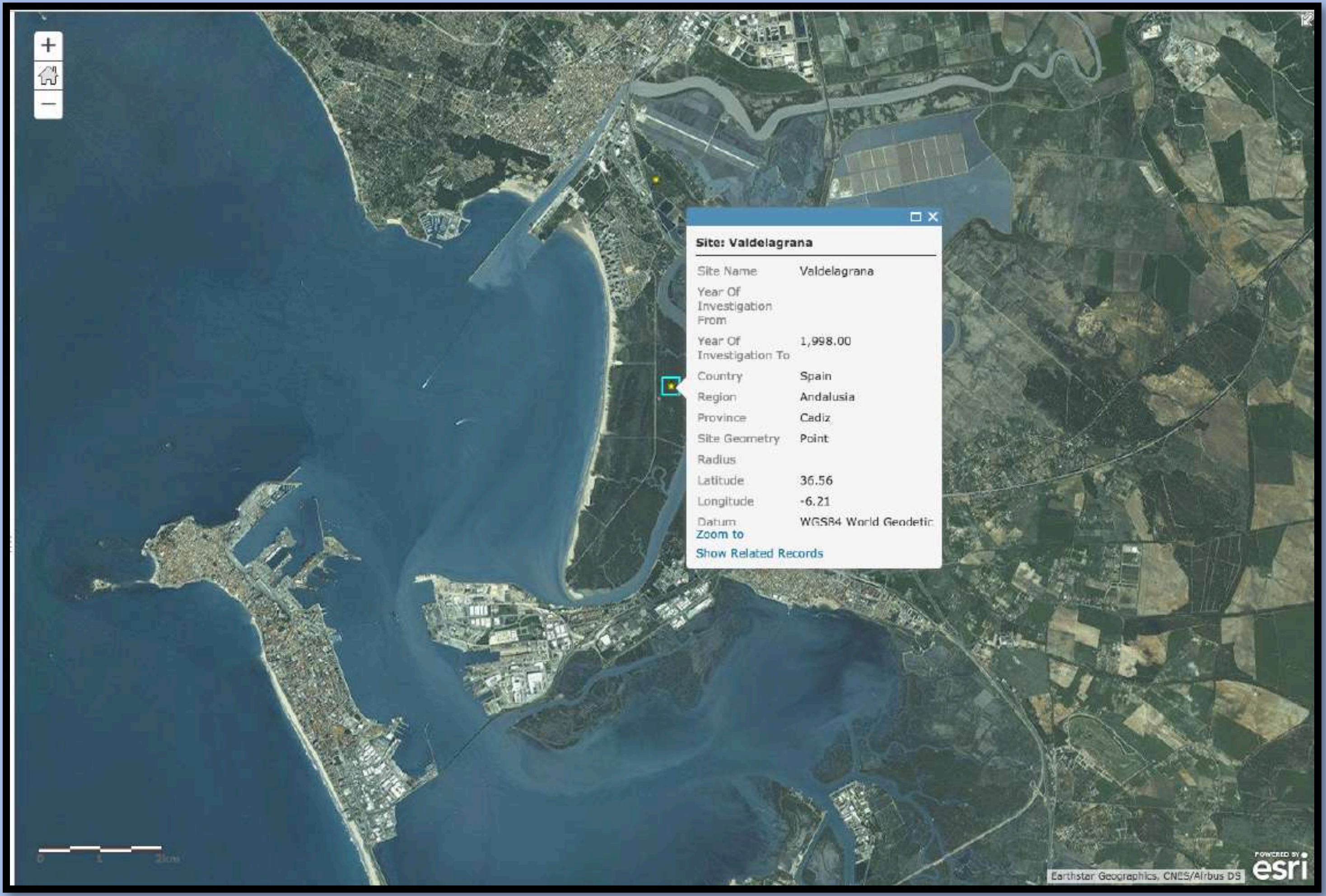
Elevation 2 m; **distance 30 m**



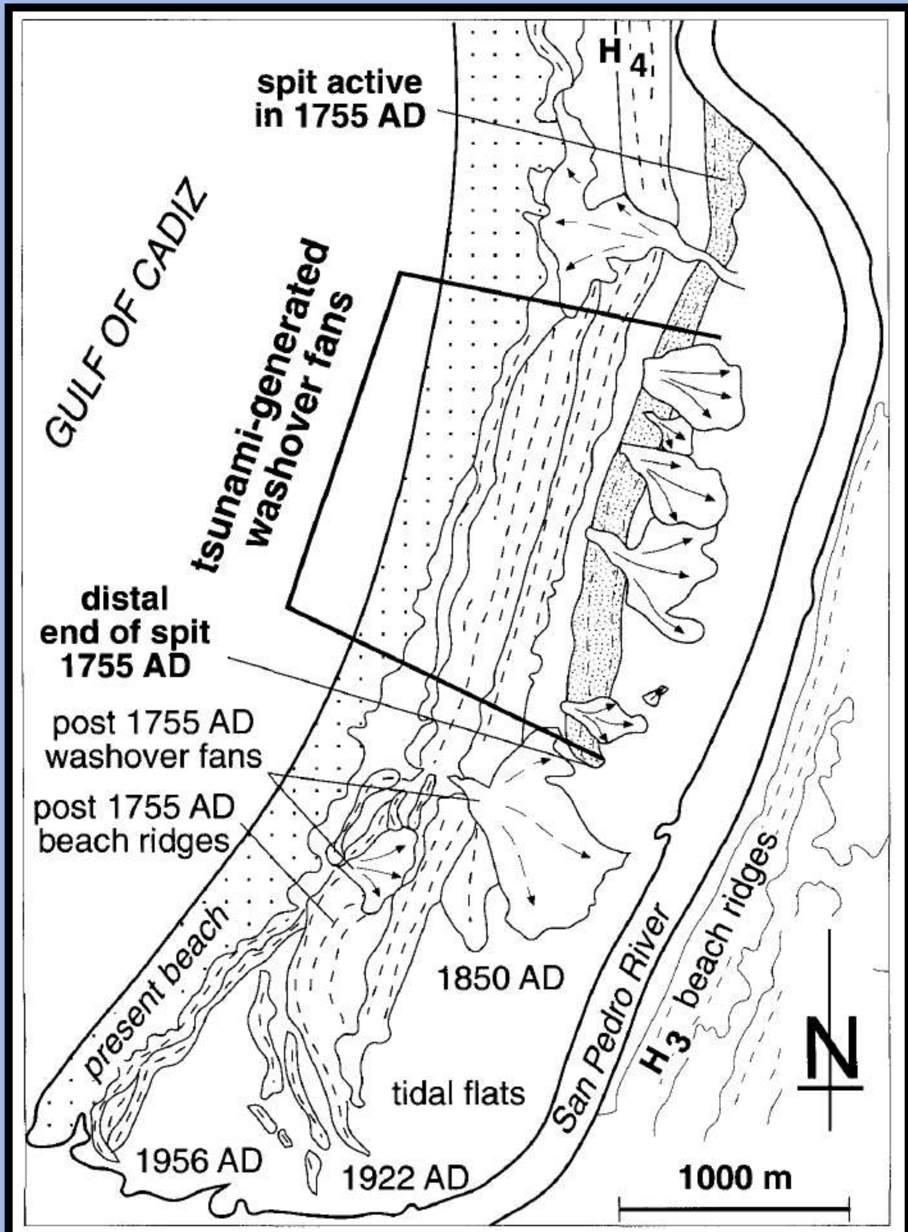
Valdelagrana site (Andalusia, Cadiz)

Reference: Dabrio et al., (1998), The record of the tsunami produced by the 1755 Lisbon earthquake in Valdelagrana spit (Gulf of Cadiz, southern Spain), *Geogaceta*, 23, 31-34, *ISSN: 0213683X*

Tsunami 1, Historical Eq 1755 AD? **Offshore earthquake but which source**?



Valdelagrana site



INFO

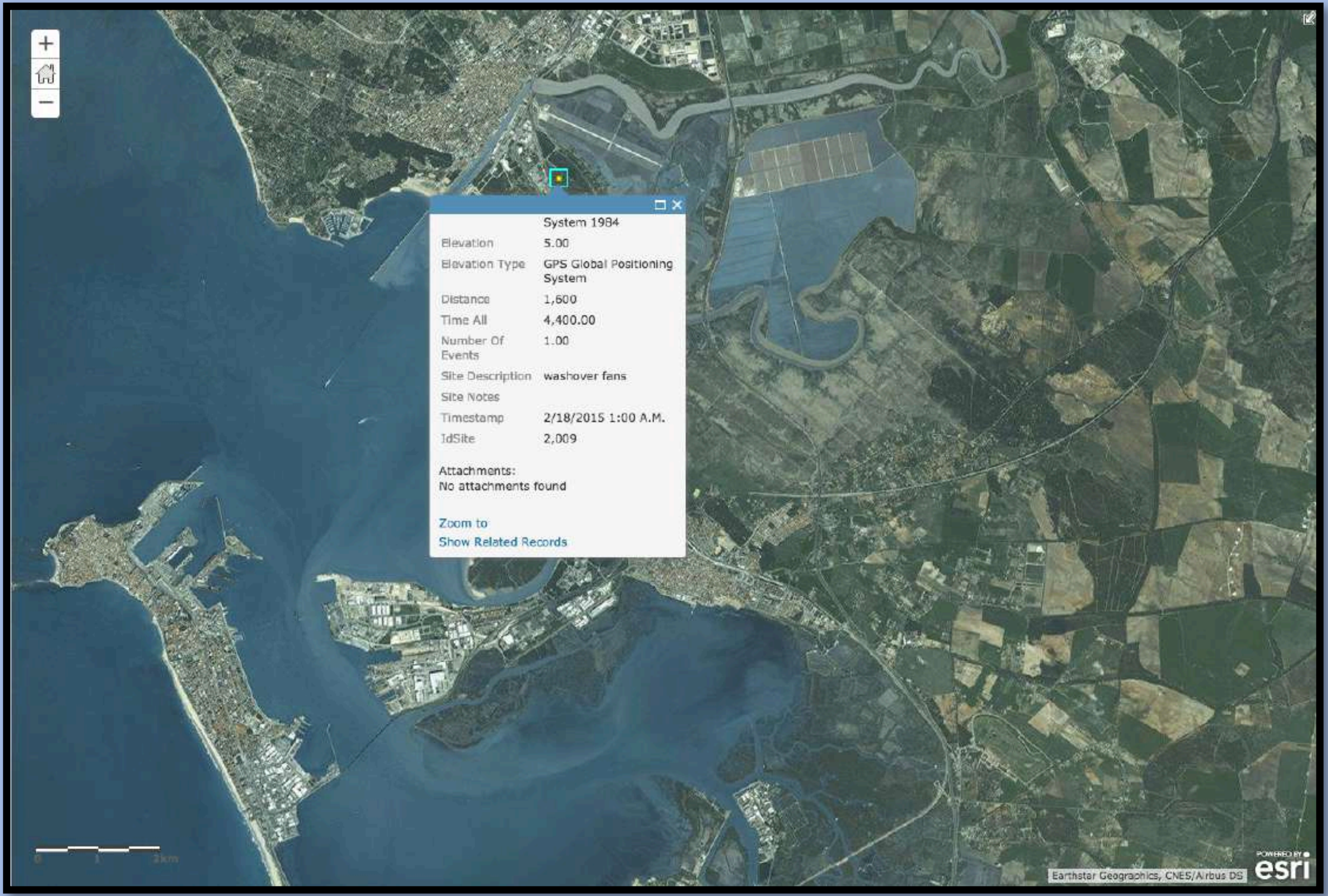
Type of evidence: sediment washover fan unit;

Elevation 4 m; distance 1000 m

Valdelagrana 2 site (Andalusia, Cadiz)

Reference: Luque, L., Lario, J., Civis, J., Silva, P. G., Zazo, C., Goy, J. L. and Dabrio, C. J. 2002. Sedimentary record of a tsunami during Roman times, Bay of Cadiz, Spain. J. Quaternary Sci., **Vol. 17** pp. 623–631. ISSN 0267-8179.

190 BP < **Tsunami 1** < 250 AD, 210-218 BC or 60 BC Roman Tsunami? **Local Eq source**?

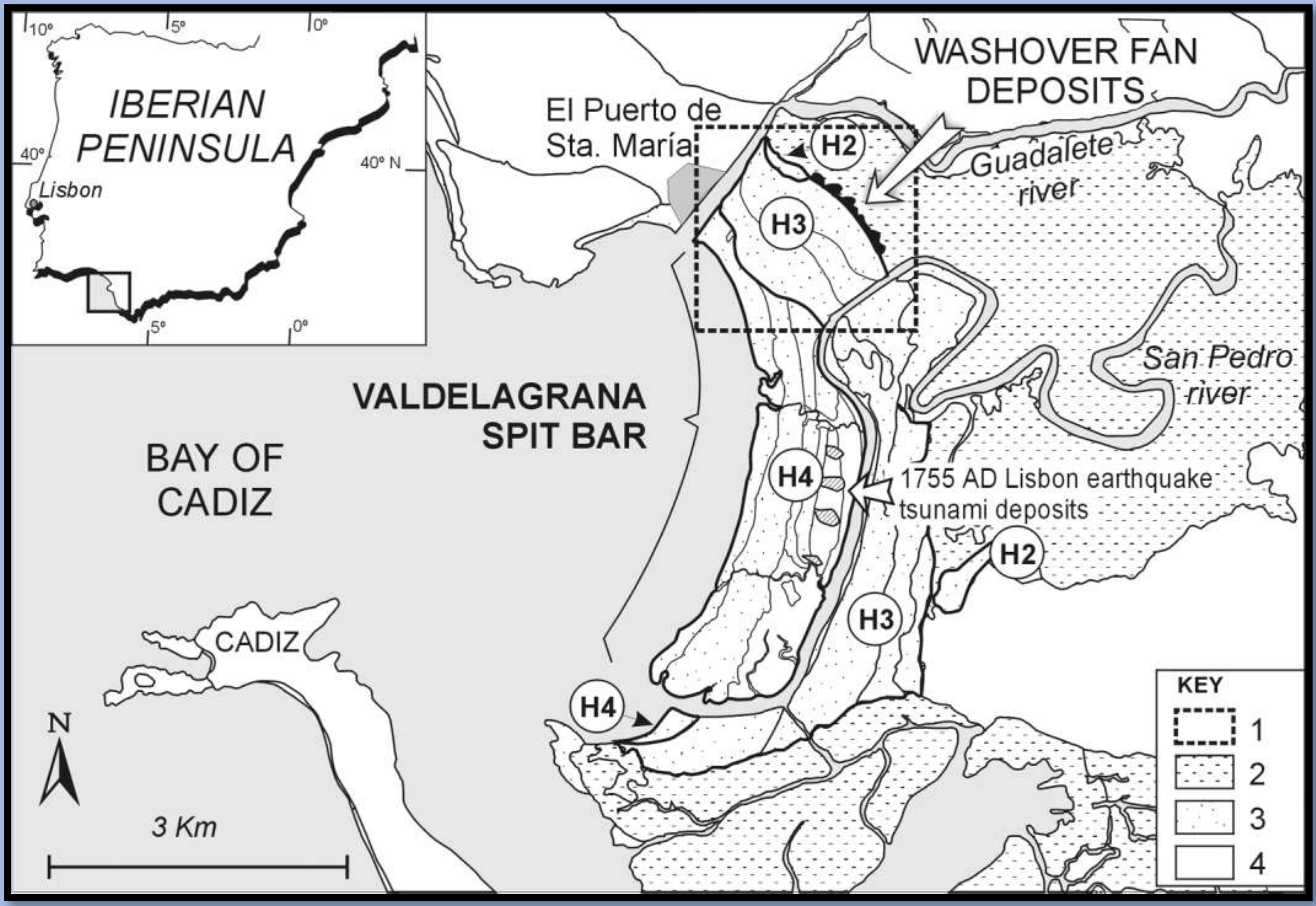


Valdelagrana 2 site

INFO

Type of evidence: sediment washover fan unit 1 m thick;

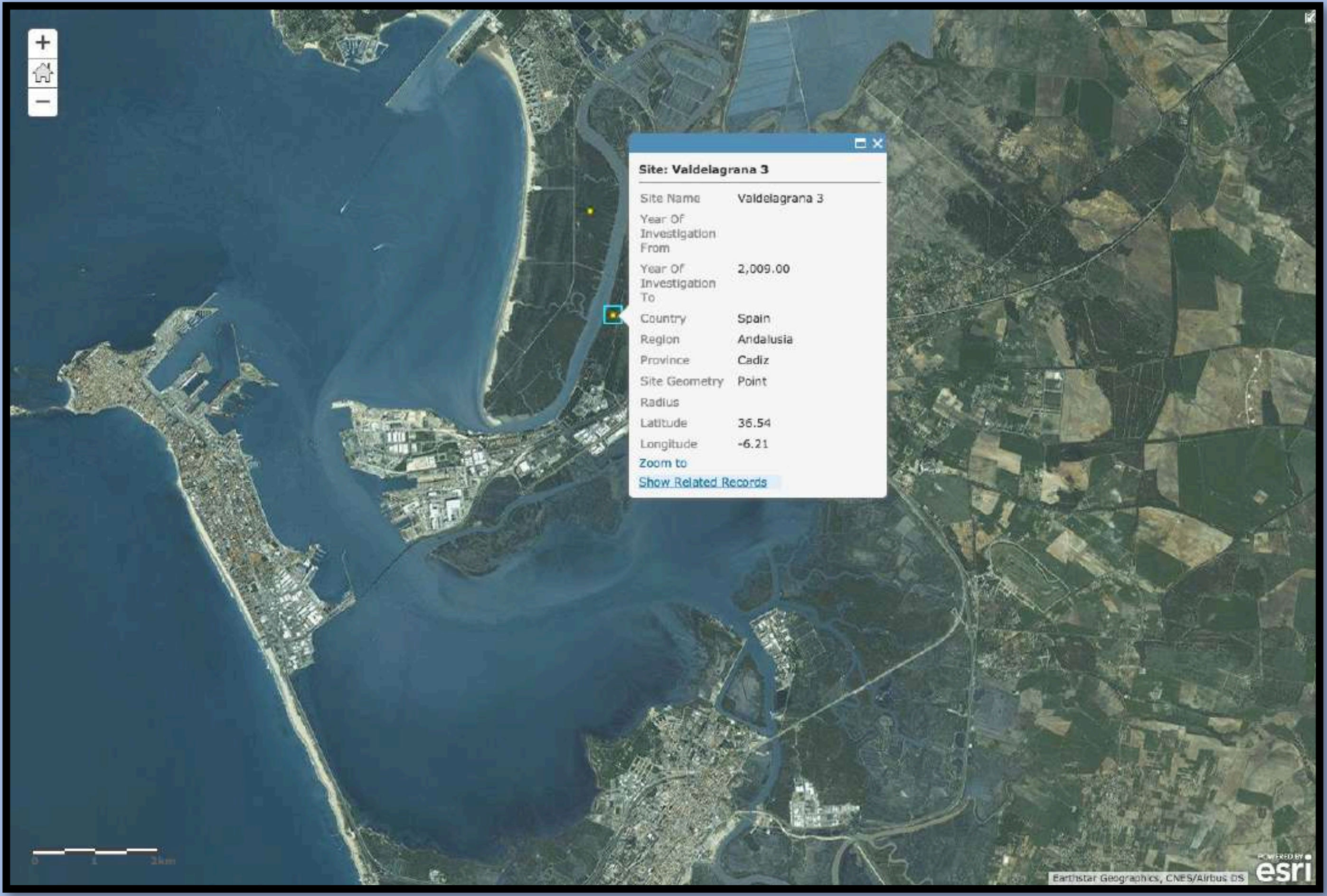
Elevation 5 m; distance 1600 m



Valdelagrana 3 site (Andalusia, Cadiz)

Reference: Gutierrez-Mas et al., (20029). Evidence of high-energy events in shelly layers interbedded in coastal Holocene sands in Cadiz Bay (south-west Spain), *Earth Surf. Process. Landforms* **34**, 810–823, DOI: 10.1002/esp.1770

Tsunami 1 850 ± 20 AD **Historical tsunami 881 AD**? **Tsunami 2** 905 ± 85 AD **Historical tsunami 949 AD**? **Tsunami 3** 1050 ± 105 AD **Historical tsunami 1033 AD**? **Tsunami 4** 1130 ± 90 AD **Hist. tsunami 1033 AD**?

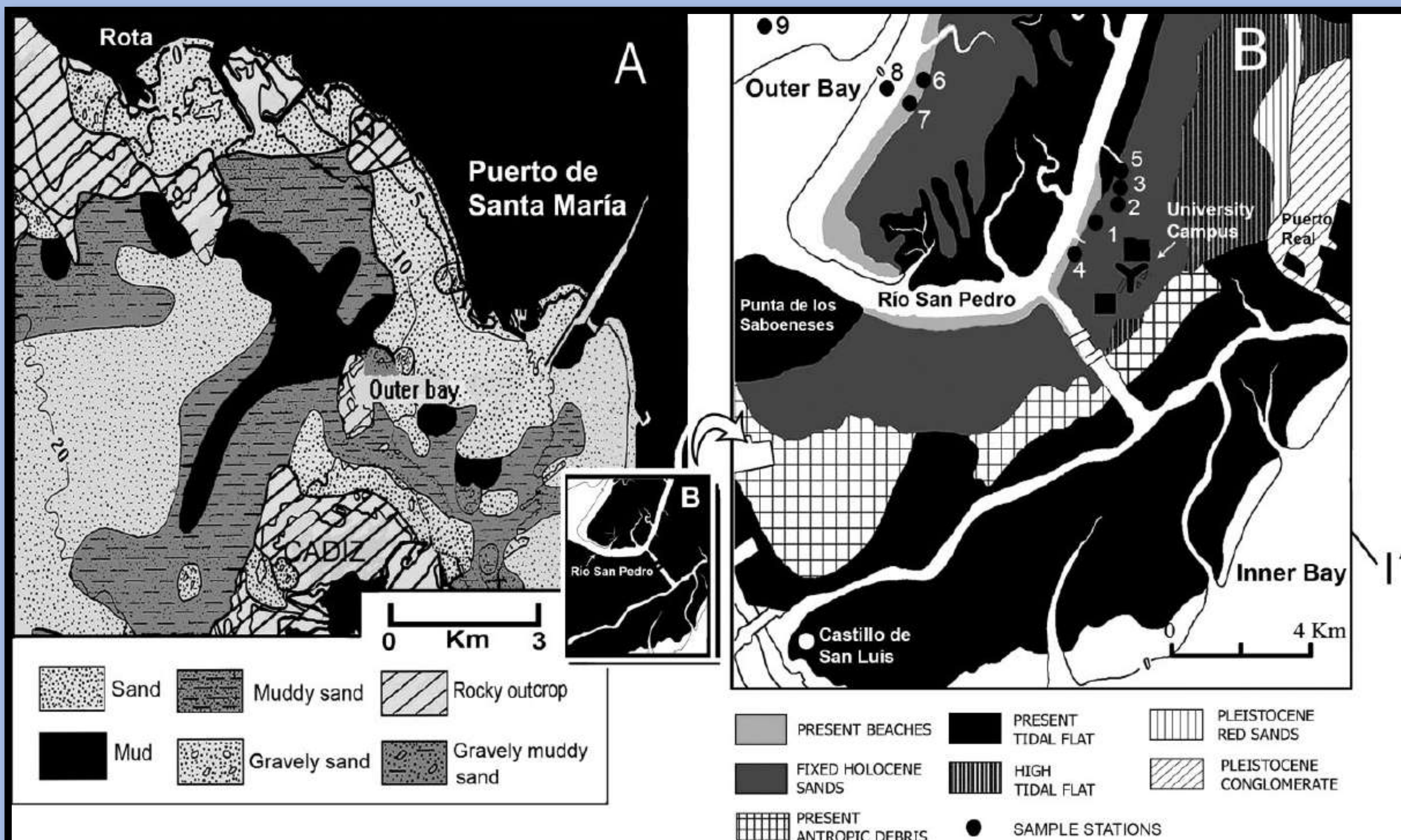


Valdelagrana 3 site

INFO

Type of evidence: sediment   shelly layers about 10 cm thick;

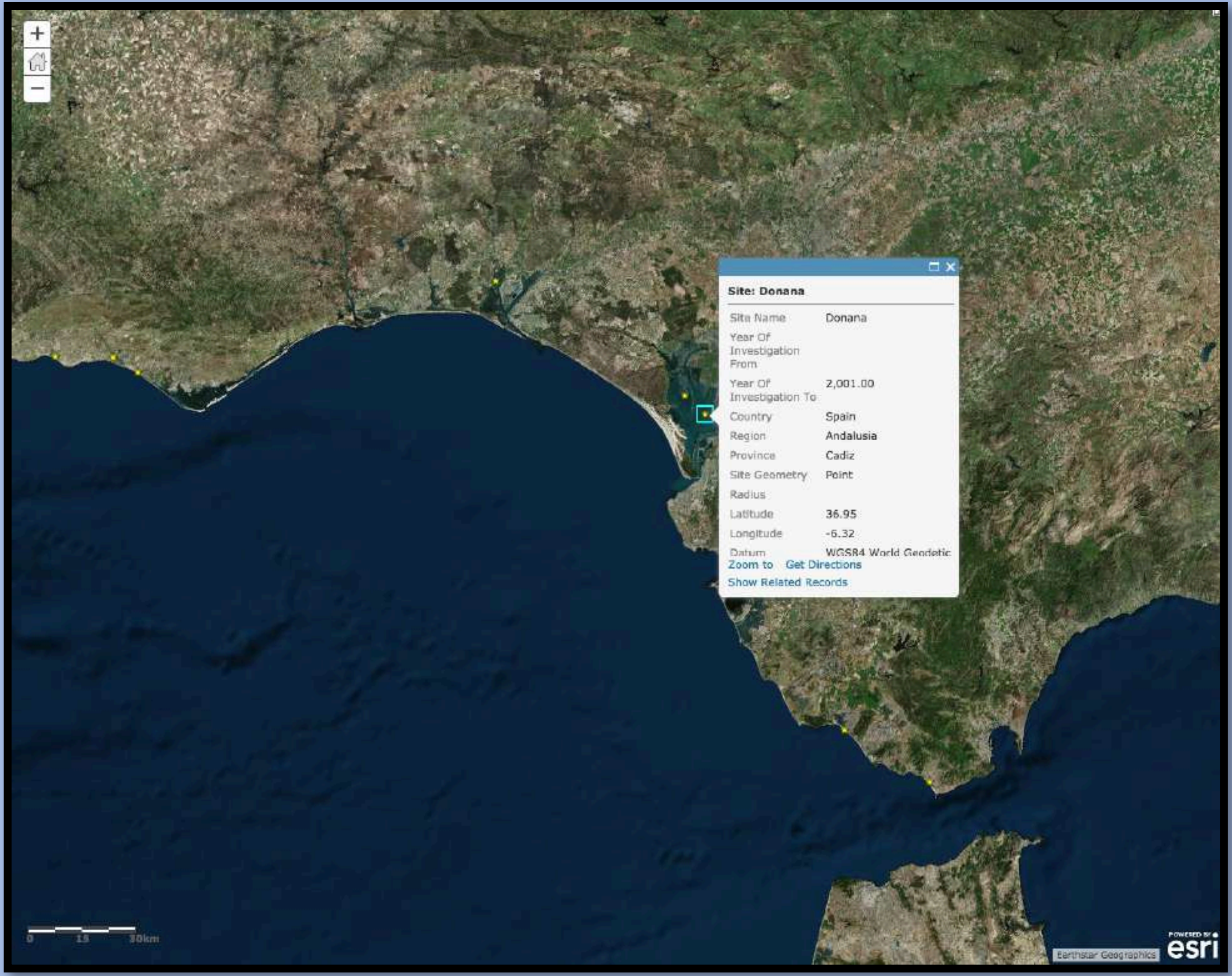
Elevation 5 m;   distance 1870 m



Donana site (Andalusia, Cadiz)

Reference: Luque et al., (2001). Tsunami deposits as paleoseismic indicators: examples from the Spanish coast, *ACTA GEOLOGICA HISPANICA,* **36**, n. 3-4, pp. 197-211

Tsunami 1 Historical tsunami 1755 AD? **Tsunami 2** 2500 BP **Historical tsunami 216-218 BC Roman time**?

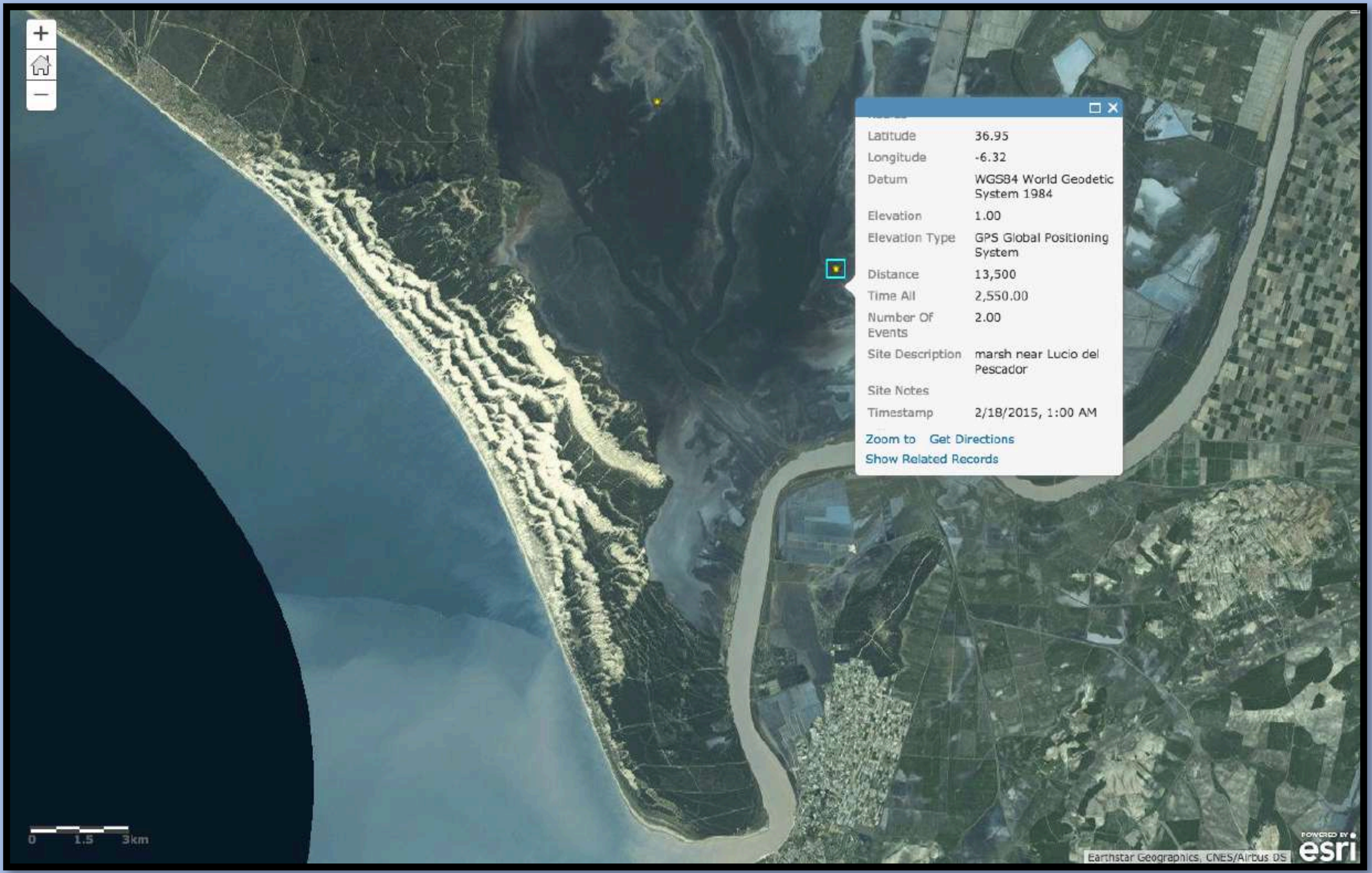


Donana site

INFO

Type of evidence: sediment   sandy layers about 10 cm thick;

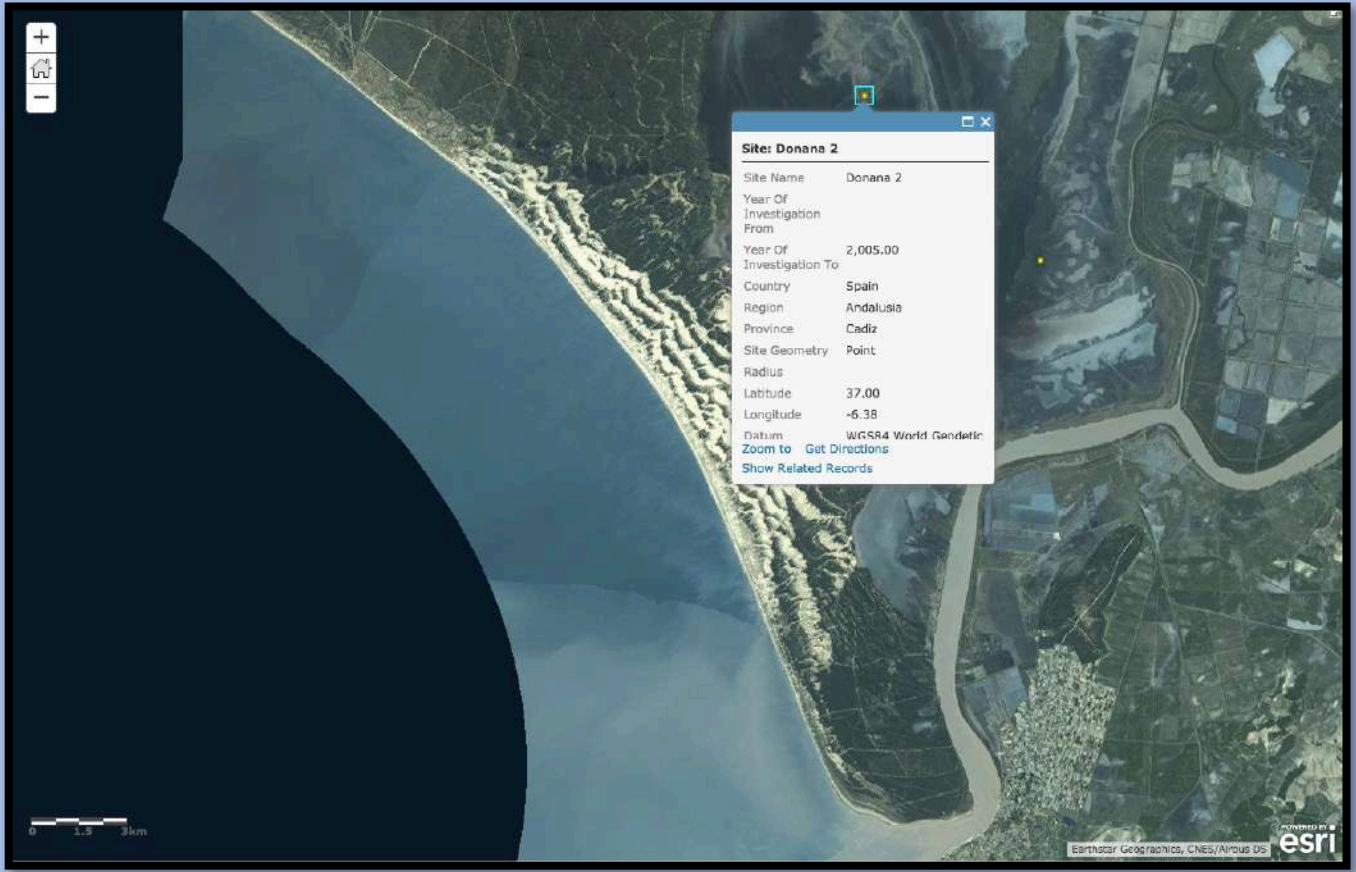
Elevation 1 m;   distance 13500 m



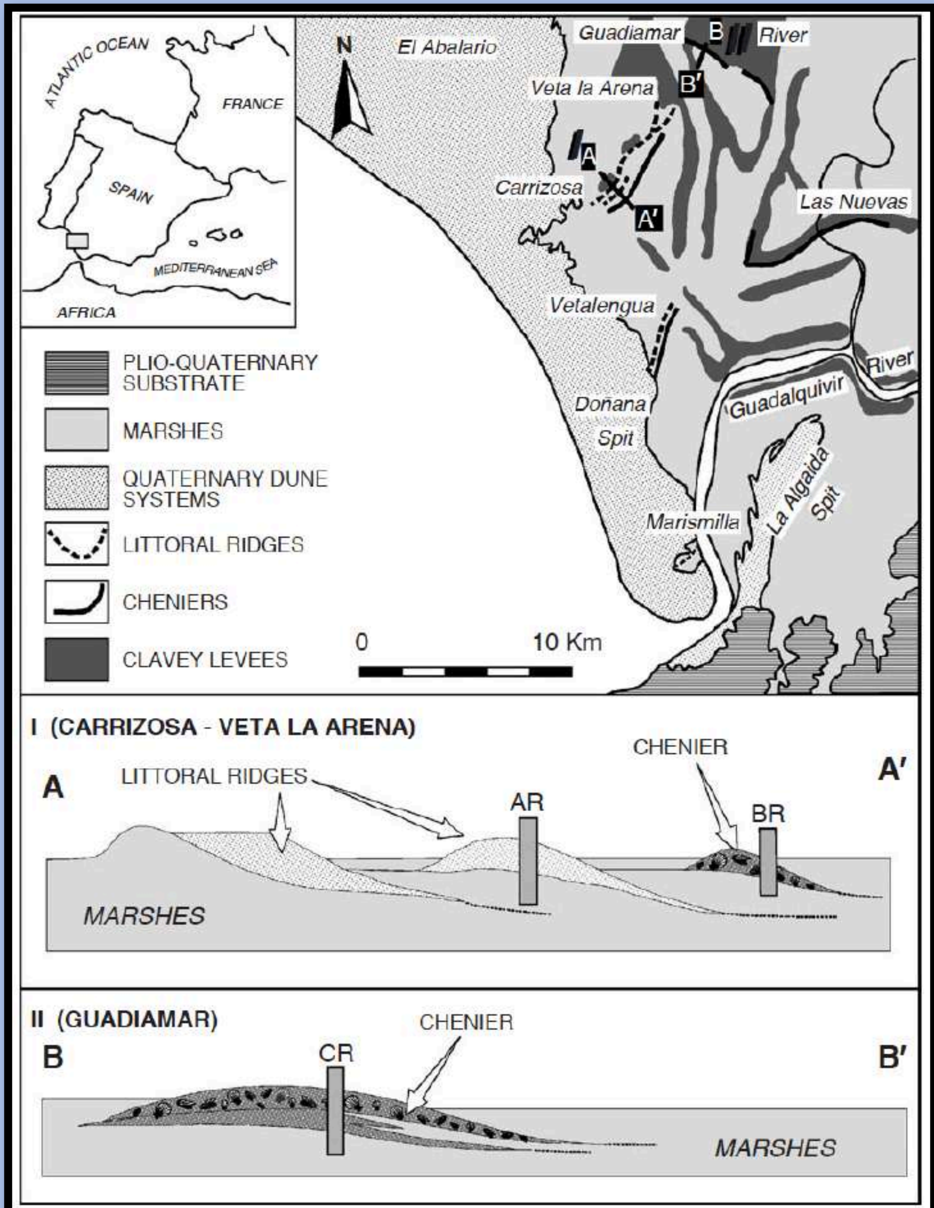
Donana 2 site (Andalusia, Cadiz)

Reference: Ruiz et al., (2005). Evidence of high-energy events in the geological record: Mid-holocene evolution of the southwesternDon˜ana National Park (SW Spain), Palaeogeography, Palaeoclimatology, Palaeoecology 229 (2005) 212–229.

Tsunami 1 4000-3530 BP?
Tsunami 2 4130-3625 BP?
Tsunami 3 4420-3890 BP?
Tsunami 4 5570-5030 BP?



Donana 2 site



INFO

Type of evidence: sediment

detrital shell-enriched layers with variable thickness;

Elevation 1 m;

distance 11000 m

Huelva site (Andalusia, Huelva)

Reference: Morales et al., (2008). Sedimentary record of recent tsunamis in the Huelva Estuary (southwestern Spain), Quatern. Science Reviews 27, 734-746, doi:10.1016/j.quascirev.2007.12.002.

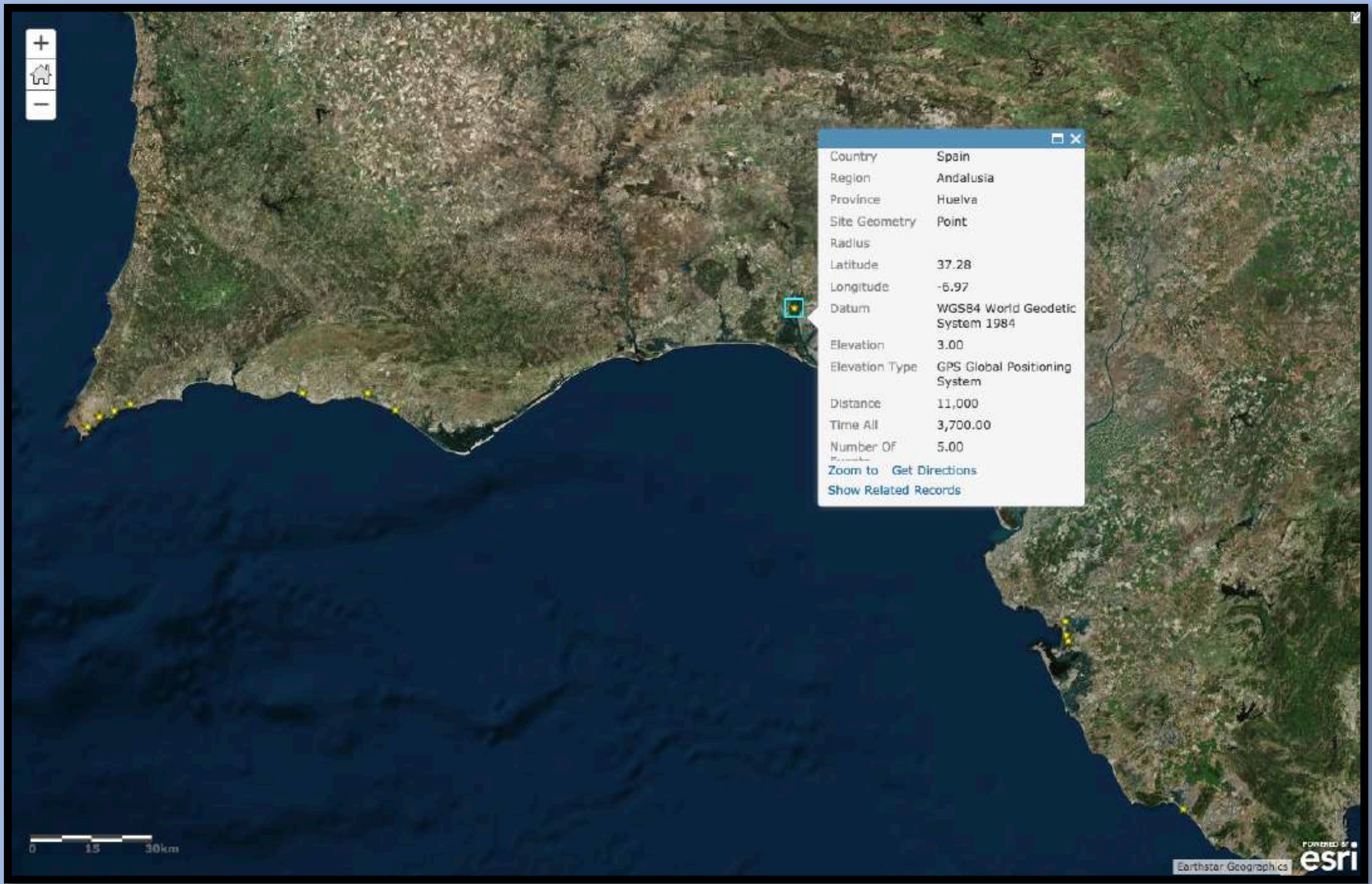
Tsunami 1 1680-1890 AD, **Historical 1755 AD**

Tsunami 2 1480-1630 AD, **Historical 1531 AD**

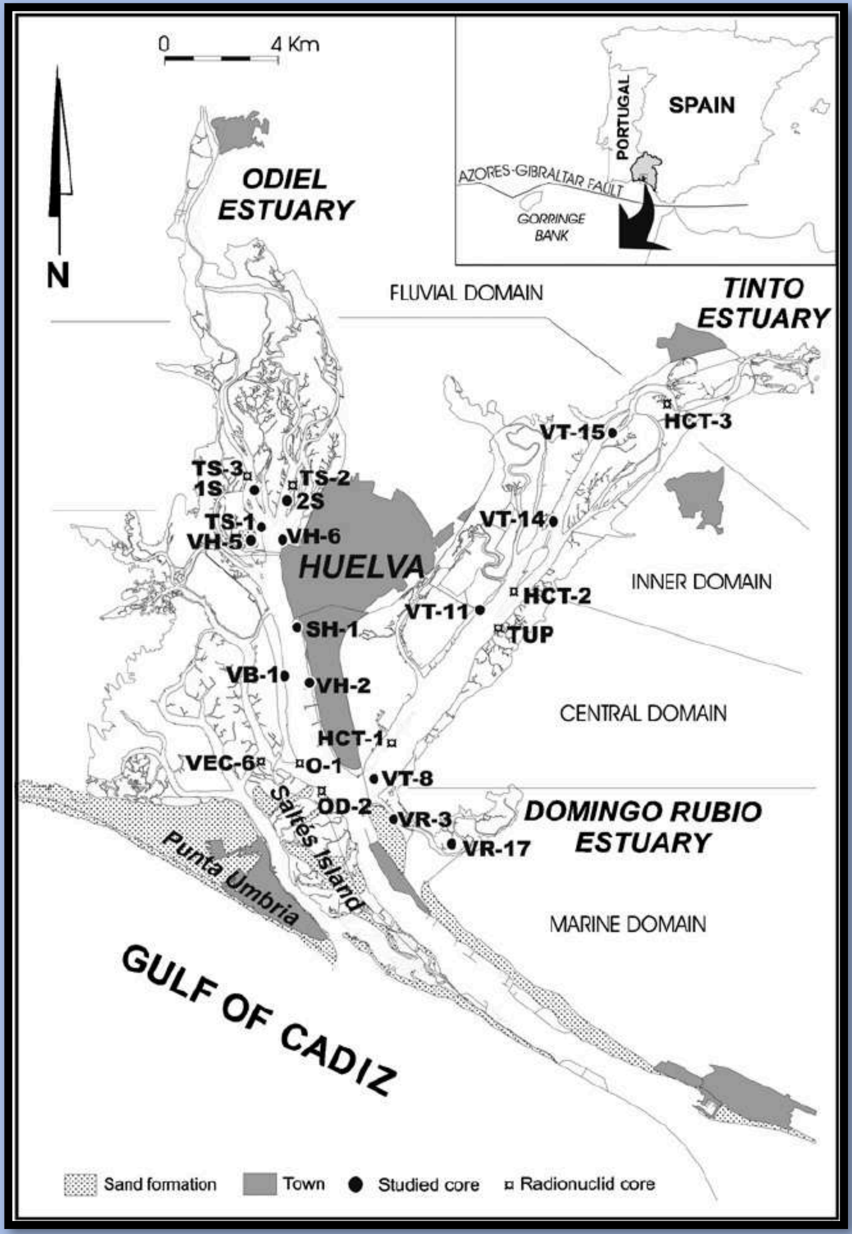
Tsunami 3 920-1120 AD, **Historical 949 (1033) AD?**

Tsunami 4 700-870 AD, **Historical 881 AD**

Tsunami 5 310-410 AD, **Historical 395 (381) AD**



Huelva site



INFO

Type of evidence: sediment

detrital shell-enriched layers with variable thickness;

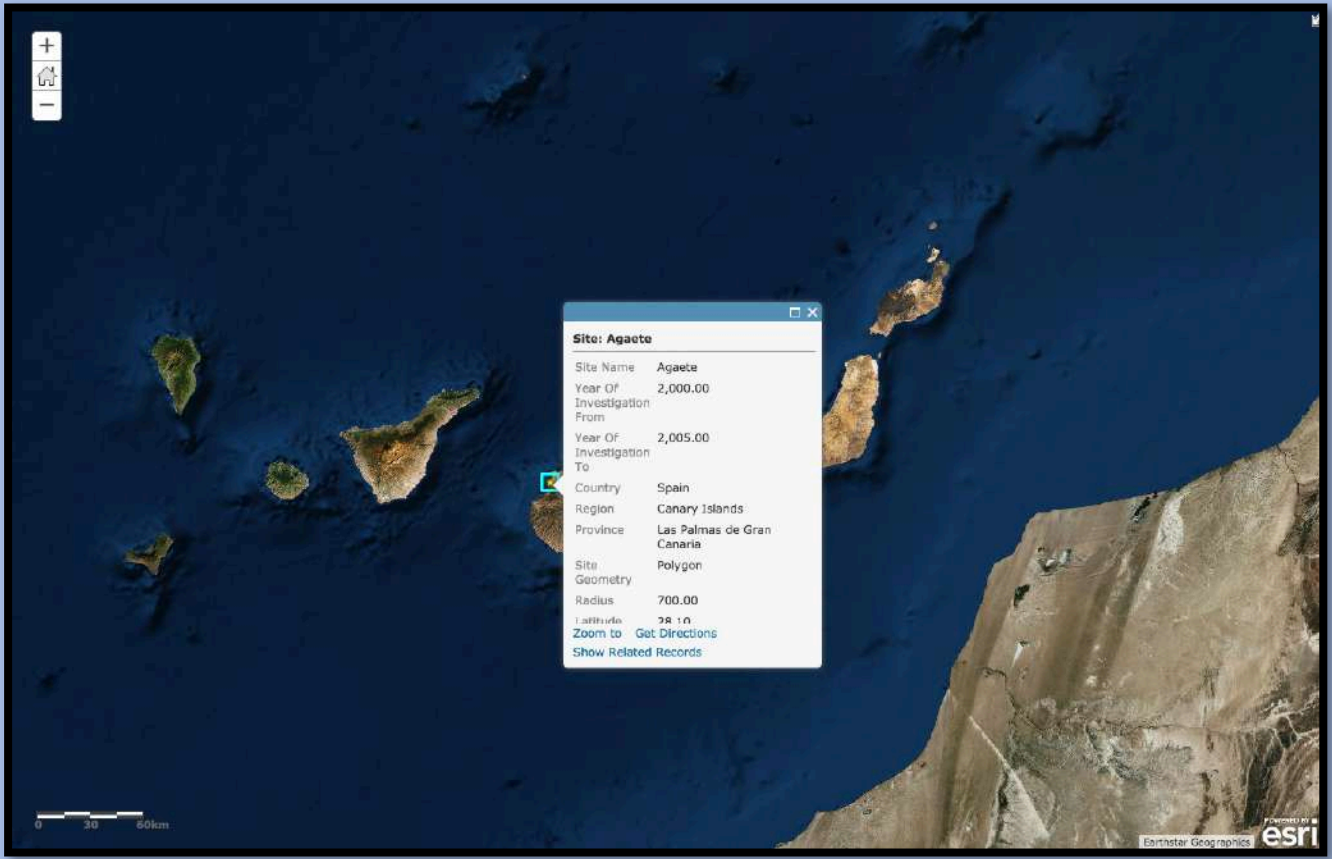
Elevation 3 m;

distance 11000 m

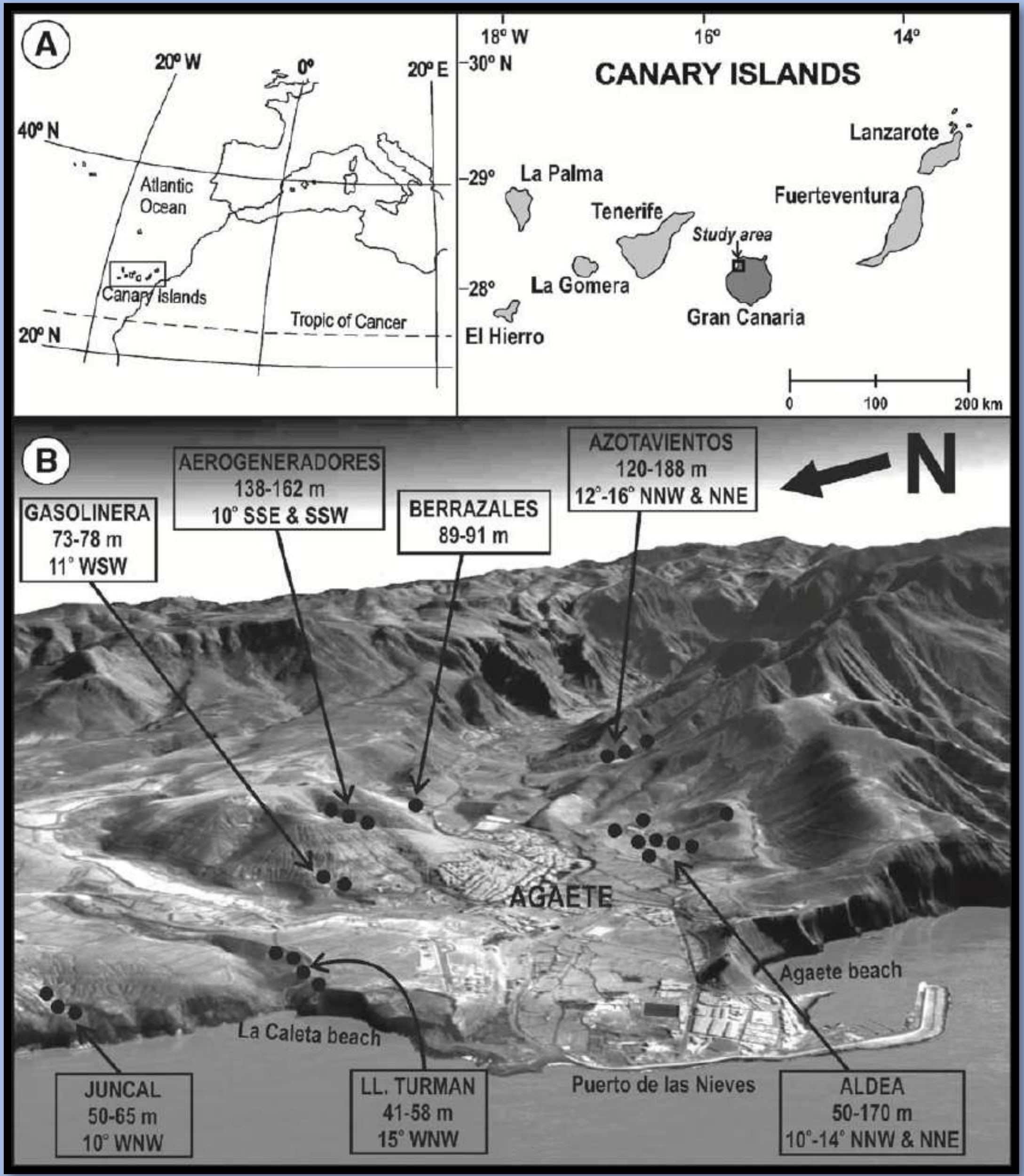
Agaete site (Canary Islands, Las Palmas de Gran Canaria)

Reference: Perez-Torrado et al., (2006). Tsunami deposits related to flank collapse in oceanic volcanoes: The Agaete Valley evidence, Gran Canaria, Canary Islands, Marine Geology 227 (2006) 135– 149, doi:10.1016/j.margeo.2005.11.008

Tsunami 1 33000 -1750000 BP, **Guimar Flank collapse source in Tenerife dated 860-830 ka**?



Agaete site



INFO

Type of evidence: sediment

marine conglomerates with variable thickness;

Elevation 41-188 m;

distance 2600 m

Final considerations

Data from elevation and distance fields (obtained from all NEAM sites) may be considered as **minimum run-up heights and minimum inundation distances** since we know that the Holocene sea level was never higher than today (Fleming et al., 1998).

These minimum values might define **spatial limits of a future tsunami inundation**. More in detail, a possible application of these values could be placed in tsunami simulations in order to have a minimum constraint to be inserted into the inundation models.

This kind of data could be used as a **benchmark** even just to make a comparison between the geological data (heights and distances derived from deposits) and modeled inundations (from tsunami simulations).

Moreover, it is possible to model tsunami deposits using an **inverse sediment transport model** to investigate the spatial and temporal variation of tsunami flow speed, as done for the 11 March 2011 Tohoku-oki tsunami.

Many thanks to you all and now questions……….