# How to interpret Holocene palaeoenvironmental and cultural changes in SW Iberia based on the palynological record from the GeoB23519-01 core (RV METEOR cruise M152)

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# Introduction

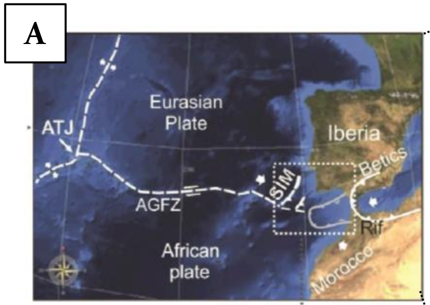
→ **Southwest of the Iberian peninsula**: key territory of major geoarchaeological interest, as well as a reservoir of biodiversity and a wildlife refuge area during the Holocene.

→ **Unstable bioclimatic conditions in the Western Mediterranean**: further studies are still required to understand how climate events and natural hazards impacted societies and environment.

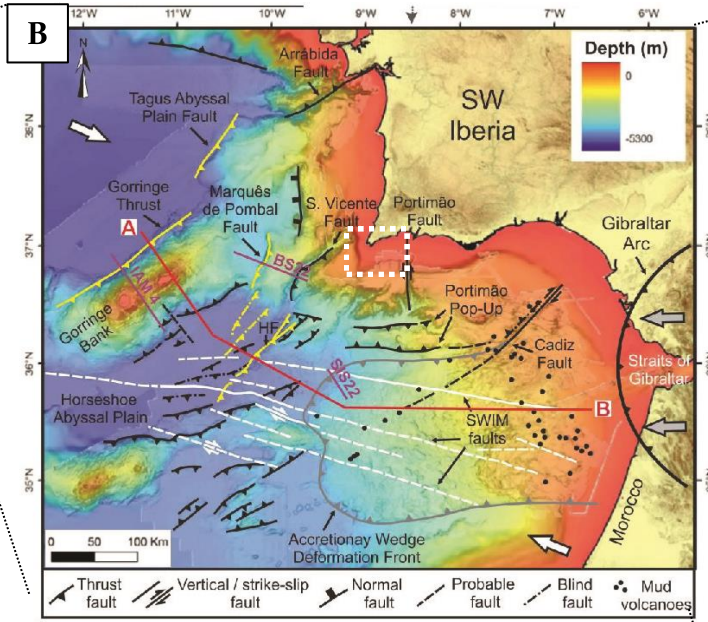
→ The RV Meteor cruise M-152 retrieved 19 vibracores and 4 gravity cores along the Algarve coast. The core **GeoB23519-01** was taken 65 m below present sea level and recovered 365 cm of sediment. Five potential event layers were identified over the last 11 ka cal BP and, at least two of them, are related to tsunami deposits (*ca*. 3700* cal BP and 1779 cal AD).

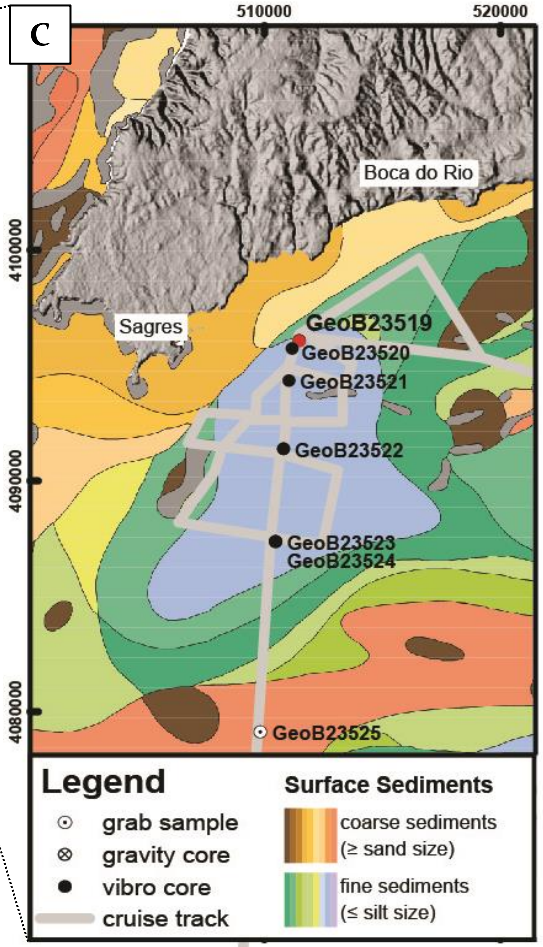
*There is a mistake in the abstract. It is 3700 cal BP instead of 4370 cal BP.

# Study area




**A**: Simplified overview of plate tectonic in the North Atlantic Ocean. AJT: Azores triple junction; AGFZ: Azores-Gibraltar fracture zone. Modified after Duarte et al. (2013).




**B**: Tectonic map of southwest Iberia margin. White line show Africa-Eurasia WNW-ESE convergence, while gray arrows show the Gibraltar westward movement. HF: Horseshoe fault. Modified after Duarte et al. (2013).

**C**: Surface sediments of the Portuguese continental shelf and some stations of expedition M-152. Surface sediments are adapted from Hydrographic Institute Lisbon (1986). Core 19 is pointed in red.

# Material & Methods

**PALYNOLOGY:**

Sampling at 5-10 cm interval.

Treatment: exotic marker + HCl 10% + KOH 10% + SPT 2.0 $cm^3/gr$ + Glycerol.

Optical microscope at 400x and 1000x. Counting up to 200 terrestrial pollen grains.

Identification & counting of pollen grains/spores, fungi, algae, zoo-remains, micro-charcoal.

Diagrams: TiliaGraph – CONISS.

**LITHOLOGY & CHRONOLOGY:**

Stratigraphic units identified by visual description of the sediment.

Magnetic characteristics
(Bartington MS2K, resolution of 2 cm, accuracy of 1.0 SI).

P-wave velocity
(interval of 2.5 cm, PUNDIT LAB).

X-ray fluorescence scans - XRF
(ITRAX core scanner, resolution 2 mm, 20 s exposure time, 30 kV, 55 mA).

$^{14}C$-dated: 5 articulated bivalves (cores GeoB23519-01/02) at the Beta Analytic Inc., USA.

Calibration: CALIB 7.1

**FORAMINIFERAL STUDY:**

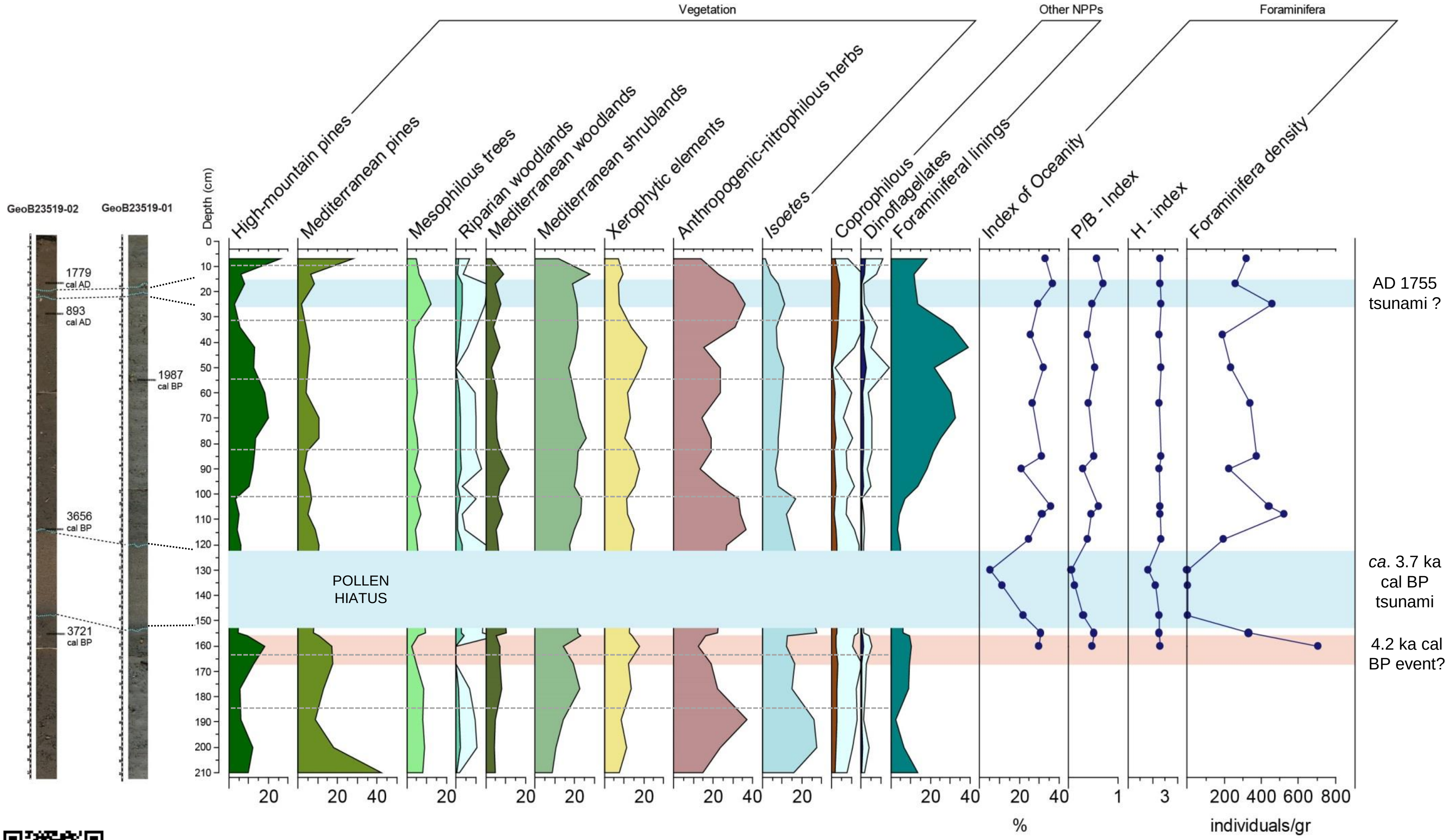
Sampling focused on the energy wave events (EWE) occurrence.

Treatment: drying 20 gr bulk sample + washing + sieving at 0.063 mm.

Samples subdivision (ca 0.01g) to calculate n° individuals/gr.

Planktonic/benthic-Index (P/B-Index), Shannon-Wiener Index (diversity of the assemblage), and Index of Oceanity after Gibson (1989).

# First results




See **Feist et al.** (EGU2020-8504) for more information about cores 01&02

# Discussion

**PALYNOLOGY:**

- *ca.* 160 cm, before the palaeo-tsunami:
  - · Continentalization (↑ high-mountain pines).
  - · Dry conditions (↑ xerophytic elements).
  - · Moisture decrease (↓ mesophilous woodlands; ↓ riparian trees; ↓ *Isoetes*).
  - · Evidence of anthropization decrease (↓ anthropogenic-nitrophilous herbs).

  4.2 ka cal BP event?

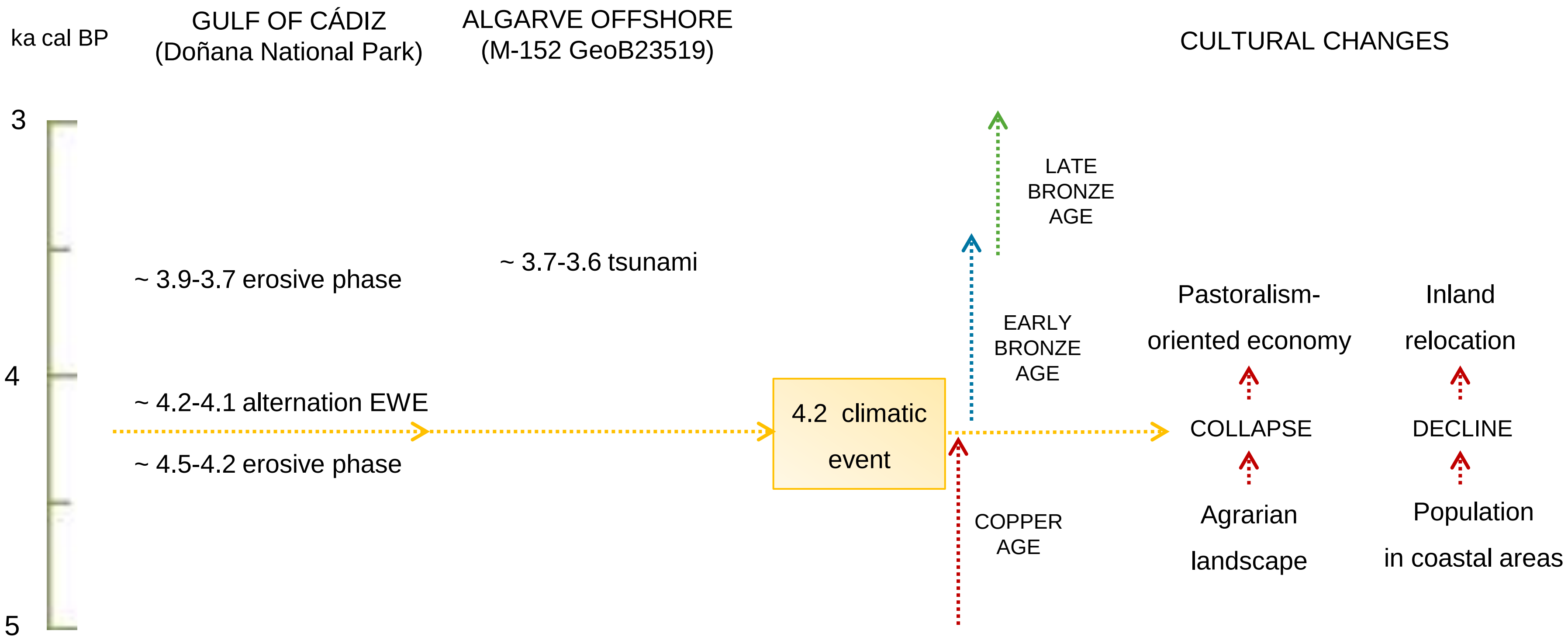
- Pollen hiatus during the *ca.* 3.7 ka cal BP tsunami layer (sterile samples) *vs* no impact of the AD 1755 tsunami in pollen preservation.

**FORAMINIFERAL STUDY:**

- Palaeo-tsunami:
  - · Less diversity and density.
  - · Planktonic foraminifera decreasing from the basis to the top of the event layer.
  - · Transport of shallow water taxa towards deeper areas → tsunami backwash.
  - · Taphonomic features like scratches due to turbidite-like flow towards deeper waters.

- No input of the AD 1755 tsunami backwash.

# Discussion



ka cal BP
GULF OF CÁDIZ
(Doñana National Park)
ALGARVE OFFSHORE
(M-152 GeoB23519)
CULTURAL CHANGES
3
4
5
~ 3.9-3.7 erosive phase
~ 3.7-3.6 tsunami
~ 4.2-4.1 alternation EWE
~ 4.5-4.2 erosive phase
4.2 climatic event
LATE BRONZE AGE
EARLY BRONZE AGE
COPPER AGE
Pastoralism-oriented economy
COLLAPSE
Agrarian landscape
Inland relocation
DECLINE
Population in coastal areas

# Conclusion & Outlook

- Clear impact of the 4.2 ka cal BP climate event on the vegetation and human groups / land use.

- Impact of EWEs:

  · Algarve offshore ~ 3.7-3.6 ka cal BP → unknown → no pollen preservation

  · Doñana National Park ~ 4.2-4 ka cal BP → clear impact / also climate event

  FAST RECOVERY afterwards

- Coastal geomorphology determines the EWEs impact on the landscape and coastal settlements.

- Marine cores do not mirror that impact at the same level than continental cores do.

- Currently working on:

  · Accurate age-depth model to correlate all the dated cores.

  · Palynological analysis of the deepest sections of the core.

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