



The continental shelf as an offshore archive for tsunami deposits

- an example from southwest Iberia (RV METEOR cruise M152) -



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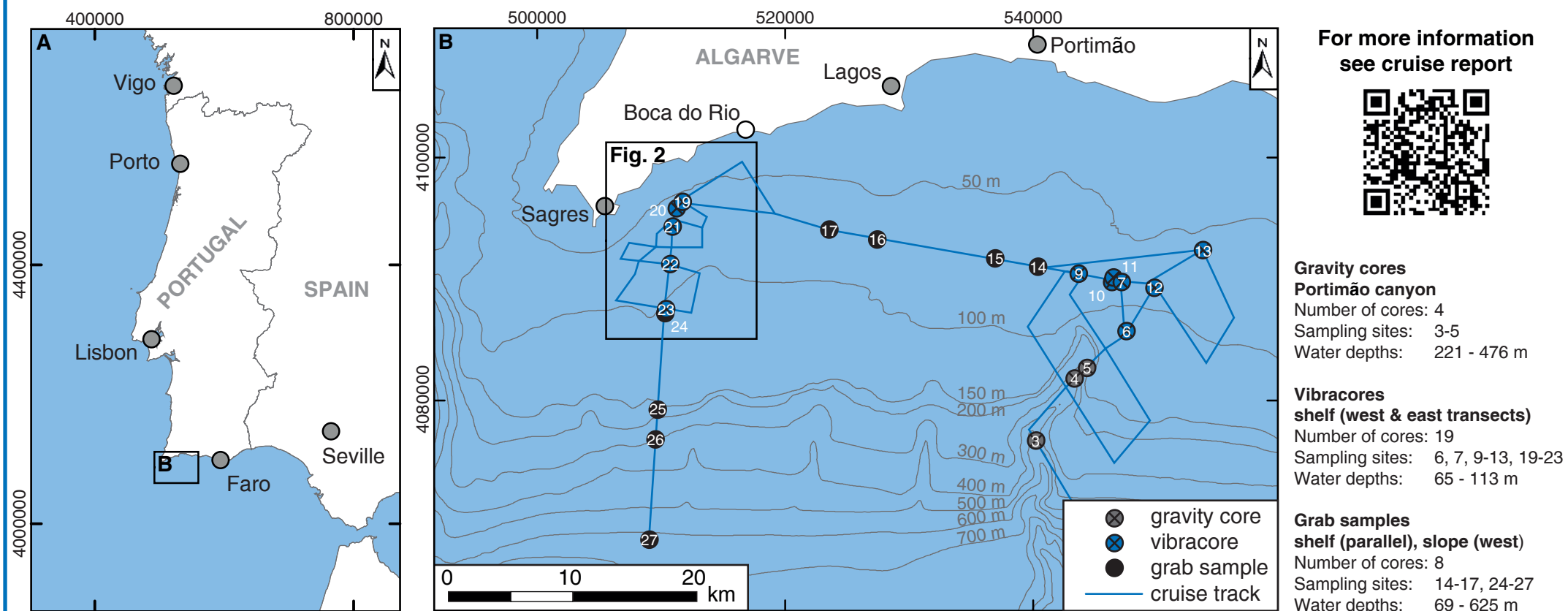
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This work is part of project





Introduction: In AD 1755 a strong earthquake-generated tsunami destroyed large parts of the southwest Iberian coastline. Since the hydrodynamics of tsunami backwash currents are as yet poorly understood, data for the study of the sedimentological characteristics and palaeo-ecological effects of the backwash of this well-known AD 1755 Lisbon tsunami and possible preceding events on the Algarve continental shelf were obtained during RV METEOR cruise M152 in November 2018. Along the Algarve coast, prominent AD 1755 Lisbon tsunami deposits have been detected onshore for quite some time (e.g., at Boca do Rio).

Figure 1: **A** Location of the study area offshore of southwestern Portugal. **B** Cruise track and sampling sites (gravity coring, vibracoring, grab sampling) of RV METEOR cruise M152 with bathymetry.

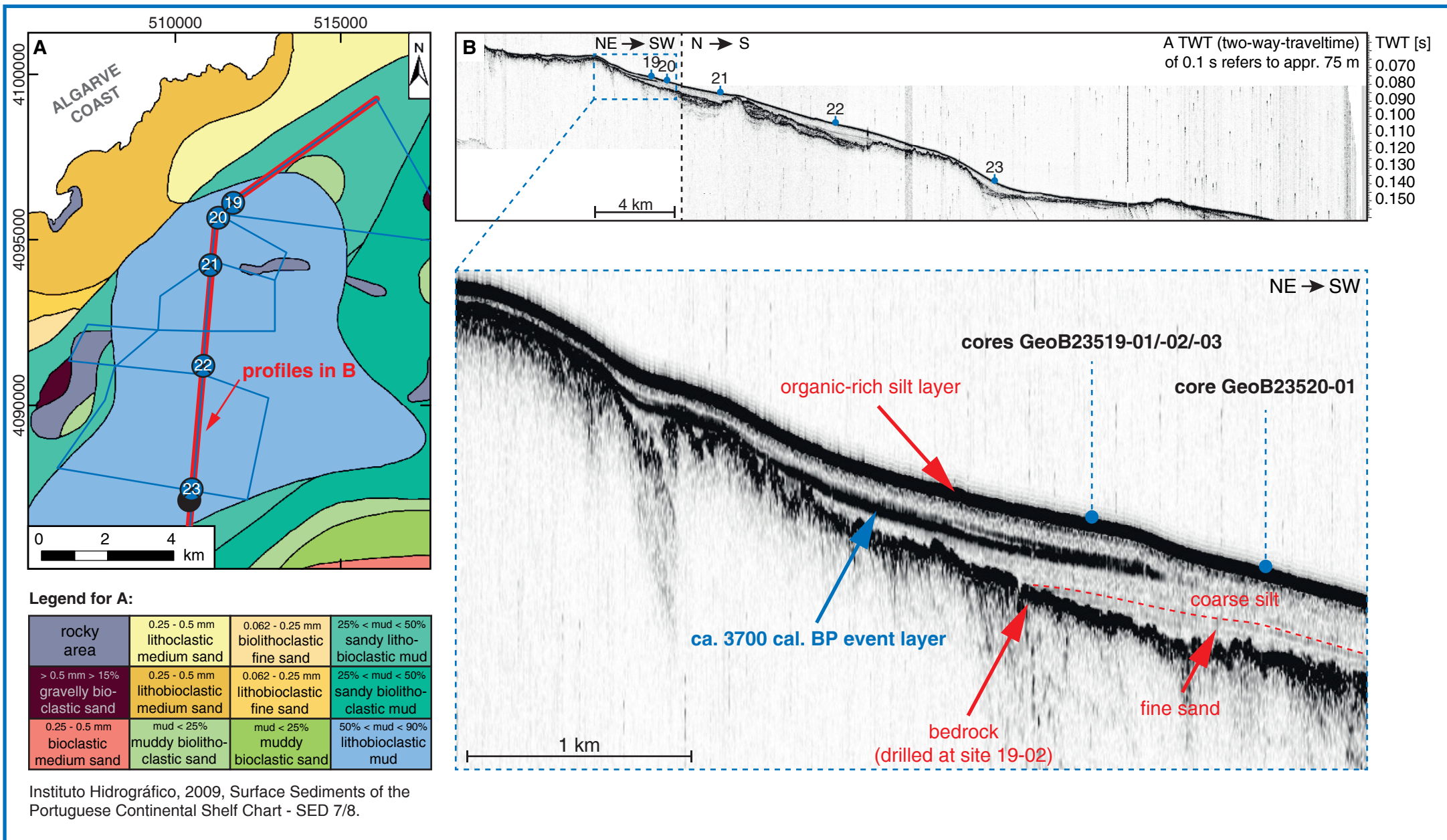


Figure 2: **A** Surface sediments in the area of the western transect (adapted from Instituto Hidrográfico, 2009). **B** Sub-bottom profiles (obtained by an Atlas Parasound P70 system) of the western transect with interpretation based on reflectors and stratigraphy of the retrieved vibracores.

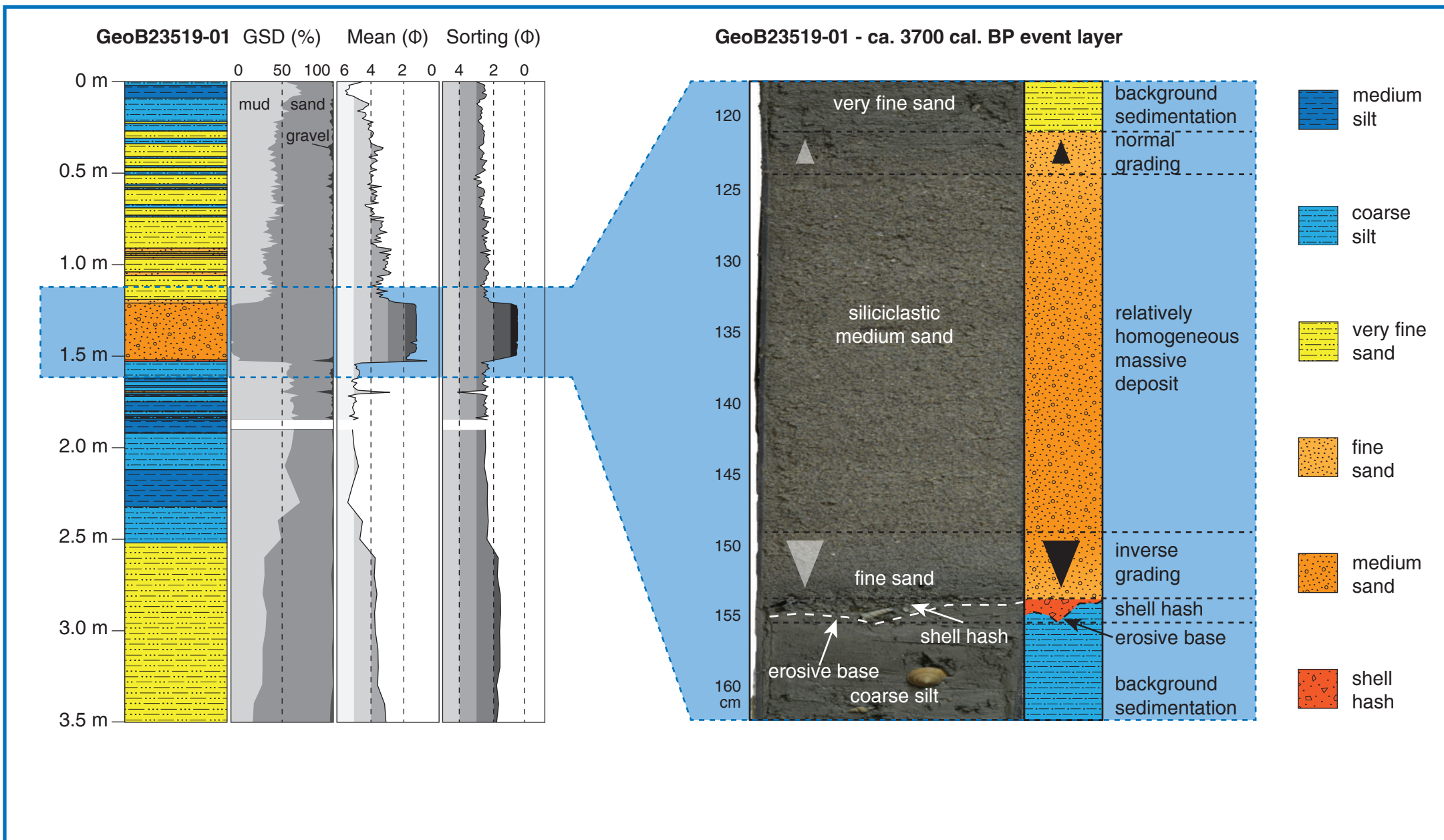


Figure 3: Stratigraphy, grain size distribution (GDS, in %), mean grain size (in Φ) and sorting (in Φ) of core GeoB23519-01 (from 65 m water depth). Photo and sub-units of a ca. 3700 cal. BP event layer (1.21-1.55 m core depth) are shown in a close-up.

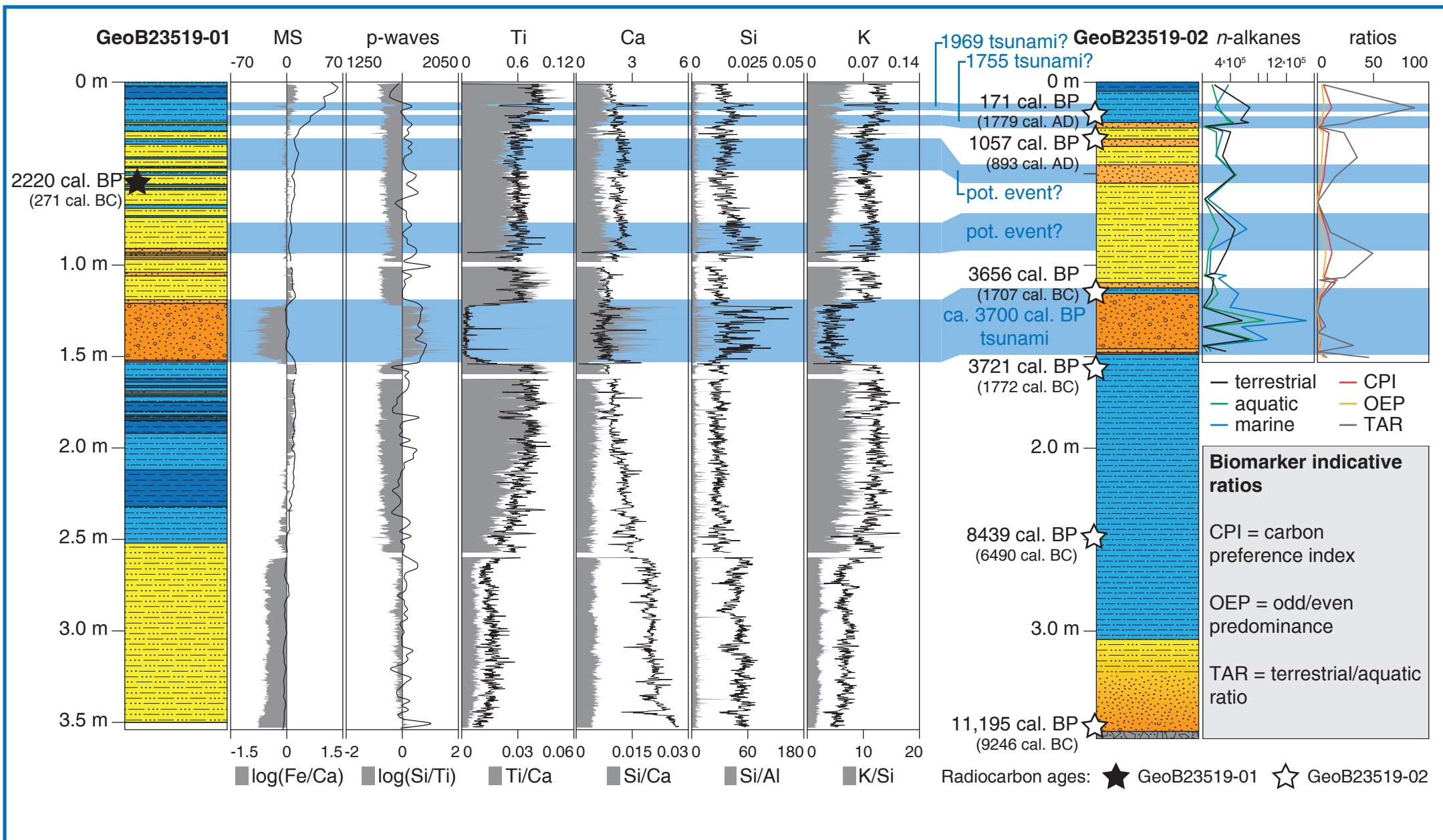


Figure 4: Stratigraphy, magnetic susceptibility (MS, 10^{-5} SI), p-wave velocities (m/s), XRF results (cps/kcps and (log-) ratios), n -alkanes (ng/g_{TOC}) and biomarker indicative ratios of GeoB23519-01. Potential event layers are marked, ultimate assignments to specific event types and correlations to confirmed events can as yet not be made - work in progress.

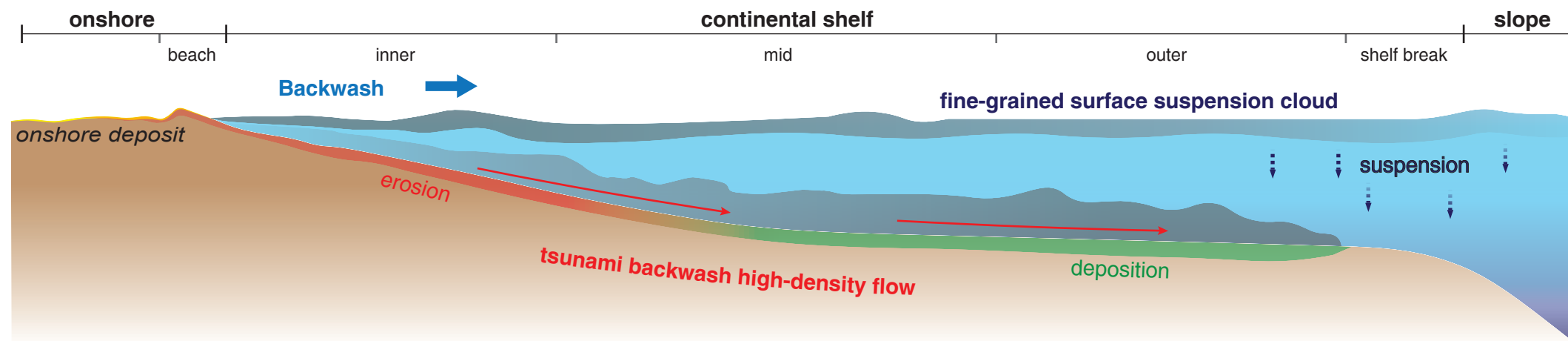
Interpretation

A tsunami backwash scenario can be assigned as most suitable for the generation of the ca. 3700 cal. BP event deposit, based on internal structure (traction carpet, massive deposit), coastal provenance of the deposited sediments (based on XRF and biomarker), broad lateral distribution and likely correlation to Spanish tsunami records along the Gulf of Cádiz. Dry conditions related to the 4.2 ka climate event (see Val-Péon et al., EGU2020-13902) may have favoured sand availability both onshore and nearshore, thus generating increased sediment supply for the event deposit.

See Val-Péon et al. (EGU2020-13902) for foraminifera & pollen results



Conceptual model



The continental shelf as an offshore archive?

- (a) Tsunami event deposit preservation is possible on the continental shelves below the storm-wave base
- (b) Pre-historic event deposits may also be preserved considering the lower sea-levels

Offshore sedimentary shelf archives show the potential to extend the understanding of the regional tsunami history, especially when coastal records are incomplete or sparse. However, offshore tsunami research is as yet limited (e.g., lateral distribution, access etc.) and focuses on specific locations along the shelf, such as depositional areas in morphological sinks or channel structures, wherefore observed characteristics are strongly site-specific. Furthermore, tsunami records of continental shelves face limitations due to, e.g., post-depositional bioturbation and current-induced sediment transport.

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