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THE FRONTE CANDIDATE SECTION FOR THE UPPER PLEISTOCENE GSSP: A SHORT REPORT

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ABSTRACT: We report new data regarding the environmental history of the Taranto Area since MIS 11, which possibly led to the peculiar sediment preservation characterizing the Fronte Section. This section is a very promising candidate for the Upper Pleistocene GSSP. Some preliminary results achieved after the multiple core drilling at the Fronte locality (Taranto, Italy) are reported as well.

Keywords: Upper Pleistocene, GSSP, Morphostratigraphic reconstruction, Paleomagnetism, Taranto

1. INTRODUCTION

The Taranto area is located in the Apulian platform (Southern Italy) where a near 6 km-thick succession of Mesozoic neritic limestones (*Calcari delle Murge*) is unconformably overlain by the marine Pliocene to Pleistocene Gravina Calcarenite, the marine Pliocene to Middle Pleistocene Subapennine Clay or Blue Clay (*Argille Subappennine*), and marine terrace deposits of Middle to Late Pleistocene age. The marine terrace deposits generally show a characteristic unconformable contact with the underlying Blue Clay. Among them, those showing the presence of rhodalgal biocalcarenites containing warm-water "Senegalese" fauna (with the most known *Persististrombus latus*), and reefal build-ups bio-constructed by *Cladocora caespitosa* (Hearty & Dai Pra, 1992; Belluomini et al., 2002; Peirano et al., 2009 and references therein) date to the Last Interglacial Period. In particular, the outcrop at the Fronte locality has attracted the curiosity of several authors (Dai Pra & Stearns, 1977; Belluomini et al., 2002), providing excellent exposure of an exceptionally preserved thick fine-grained sedimentary succession lying above the calcarenites and reefal build-ups pertaining to the MIS 5.e, studied in detail by Antonioli et al., 2008, Amorosi et al., 2014 and Negri et al., 2015.

The outcrop is located about 7 km east of Taranto (Fig. 1), along the coastal cliff surrounding the Mar Piccolo (Fig. 1) close to the 65° *Deposito Territoriale* of the *Aeronautica Militare*, Taranto, Italy (40°28'32.57'' N, 17° 18'48.07'' E). The section is easily accessible by land and sea, because of the proximity to the harbour, and the km-sized outcrop guarantees easy sampling for comparison. Moreover, the conservation of the outcrop site is assured by a protocol under formalization between Bari and Taranto Universities and the Administra-

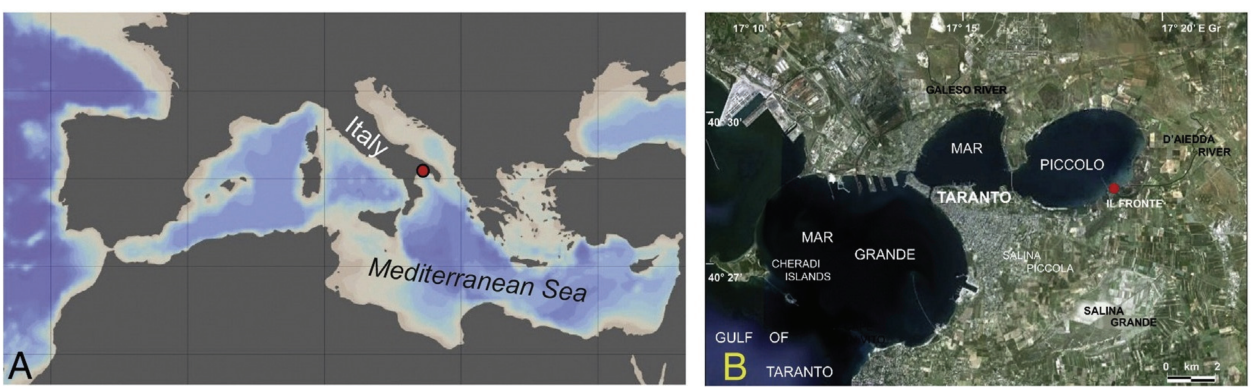

Fig. 1 - Location map of the Fronte Section Taranto, Italy (red dot).

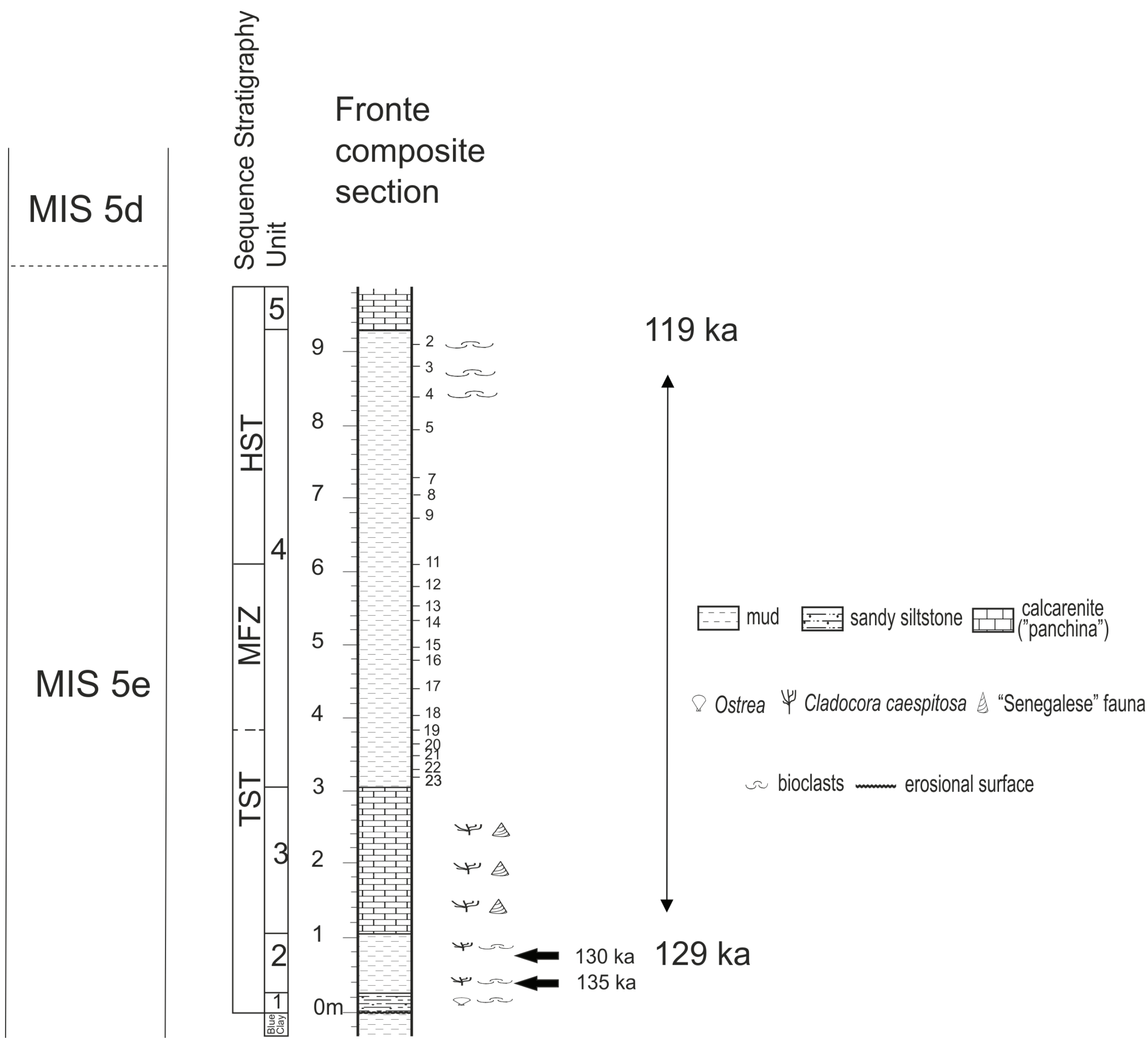

Fig. 2 - The Fronte Section stratigraphic log.

tion of the Italian Air Force, owner of the Fronte site. Finally, this site has been appointed as Special Geosite - Natural Monument CGP432 by the Puglia Region Administration who recognized its geological importance (Mastronuzzi et al., 2015).

The stratigraphic section consists of 5 lithologic units described in Amorosi et al. (2014) and Negri et al. (2015) (Fig. 2). According to Negri et al. (2015), above a regional unconformity the MIS 5.e, these deposits are continuously sedimented showing an overall deepening-upward trend, from nearshore to inner-shelf (*Cladocora*-rich) and then middle to outer-shelf deposits. Above the *Cladocora*-rich units, the open-marine clays include the maximum flooding zone and show a continuous succession of marly clays, 6.25 m thick (unit 4) in which stable isotopic, foraminiferal and palynological data, coupled with the U-Th dates, indicate that the whole MIS 5.e plateau (sensu Shackleton et al., 2003), up to the onset of the following sea-level fall, occurs in this section.

Based on our previous studies, the present paper aims to 1) attempt the reconstruction of the evolution which led to the preservation of the Fronte Cliff and its peculiar sedimentary succession 2) provide a short report regarding the activities ongoing on the Fronte site, where a composite core was drilled in February 2015, on top of the outcropping section.

2. INFERRED EVOLUTION OF THE TARANTO AREA SINCE MIS 11

An attempt to reconstruct the geological history leading to the preservation of a fine sedimentary succession above the calcarenites is based on the presence of two quasi-flat surfaces whose inner margins occur re-

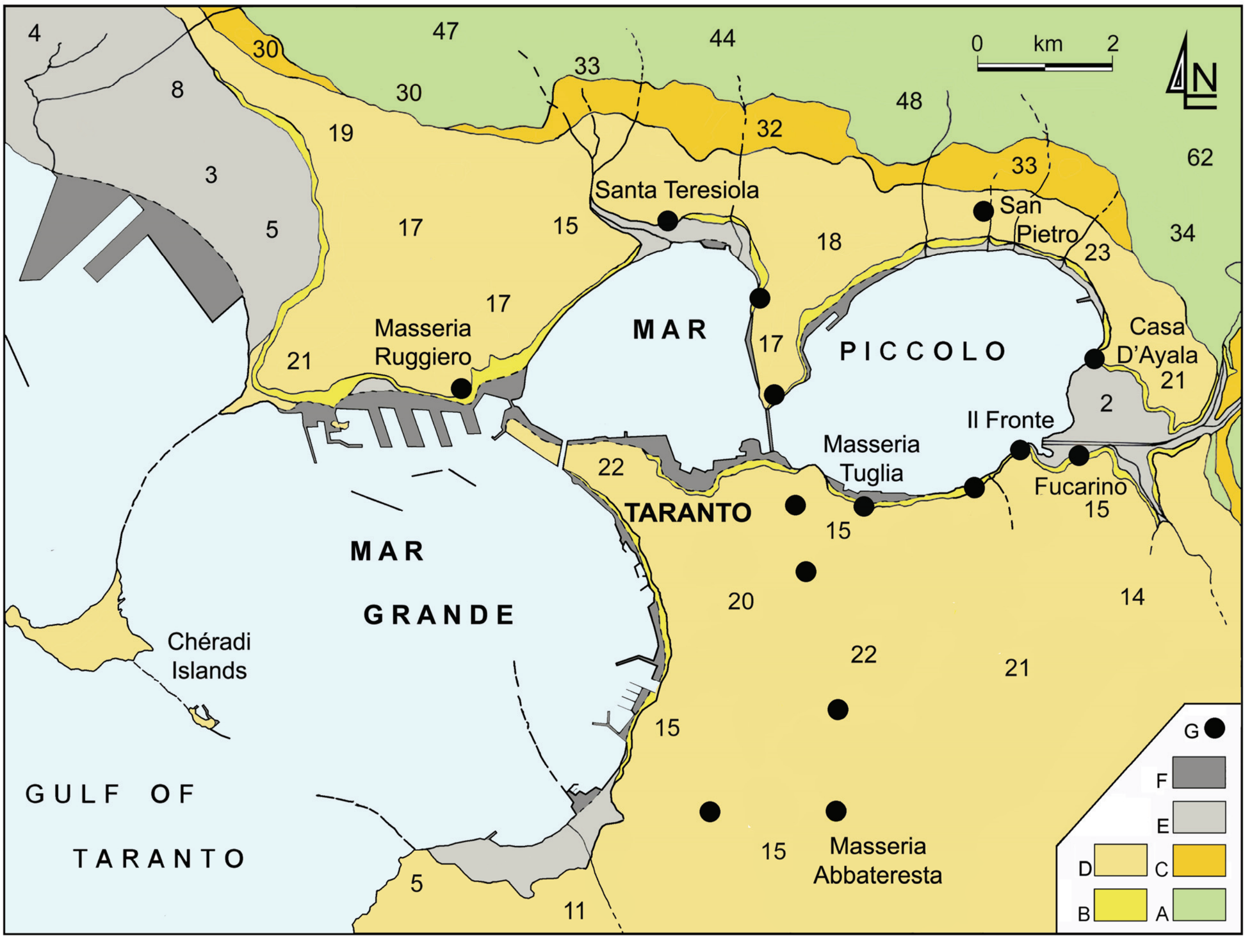

Fig. 3 - Geologic geomorphologic map showing interpretative reconstruction of the MIS 5 (D) and MIS 11? (C) marine terraces and related coastlines in the Taranto area (modified after Dai Pra & Stearns, 1977; Mastronuzzi, 2001; Belluomini et al., 2002, Amorosi et al., 2014). A, pre-Middle Pleistocene calcareous substratum; B, Lower to Middle Pleistocene pelagic sediments (*Blue Clay*); C, Middle Pleistocene calcareous marine deposits (MIS 11?); D, Upper Pleistocene marine deposits (MIS 5); E, Holocene alluvial and beach deposits; F, Reclaimed areas (19th and 20th centuries); G, Black dots: outcrops with "Senegalese" fauna. Numbers indicate elevation above sea level. Note that according to Dai Pra & Stearns (1977), the boundary between A and C is a paleo coastline older than 300 ka.

spectively at 28-35 and 35-55 m above sea level, as reported by Dai Pra & Stearns, 1977. They reported the higher and more landward as older than 300 ka (based on four U-Th dates yielding ages ranging from 250 to 350 ka). Such an age is consistent with Marine Isotope Stage (MIS) 9 or 11, the last being the longest (423,000-362,000 ka) and warmest interglacial of the entire Quaternary Period, attaining the highest-known sea-level so far (Roberts et al., 2012). These features therefore suggest a low uplift rate at least during the last 125 ka, but possibly extended up to the last 400 ka, which is consistent with the hypothesis of a large bay ("*the Taranto paleobay*") submerging a wide area around the present Mar Grande and Mar Piccolo during the last two major highstand peaks (MIS 5.e and MIS 11), (Fig. 3 based on the original drawings of Dai Pra & Stearns, 1977).

In addition, the possibly MIS 11 to MIS 7 aged "*Panchina*" (calcarenites) terraces outcropping around the locality Masseria San Pietro (C in Fig. 3) were probably formed by alternate processes of marine abrasion and fluvial incision for some tens of meters during the quite long and relatively stable MIS 11 or MIS 9 to MIS 5 time interval. The ensuing steep-walled *Taranto palaeovalley* was carved mostly through the Blue Clay (*Argille Azzurre*) substratum which developed mainly under control of a regional tectonic-related karst springs net, which is still active (Fonte Galeso). The rapid rise of MIS 5.e sea level submerged not only the MIS 6 emerged Taranto palaeovalley but probably also most of the Masseria S. Pietro MIS 11 terrace. In this view, depressed areas, such as Salina Grande (Fig. 3), accommodated a mainly pelitic sedimentation (similar to unit 4 at the Fronte section in Amorosi et al., 2014 and Negri et al., 2015) whereas the most elevated areas were places of nearly continuous carbonate sedimentation (*Panchina* with *Persististrombus latus* and small colonies of *Cladocora caespitosa*).

This morphostratigraphic interpretation permits us to attribute the Fronte cliff outcrop to the infill of MIS 5 sediment on the southernmost side of the "*Taranto pale-*

ovalley", depressed enough to be submerged early during Termination II, and protected seaward by sandy shoals and islands.

In this way, above the unconformity bounding the upper part of the Blue Clay (*Argille Subappennine* Fm), the continuous coastal to marine succession (including most of MIS 5.e) was preserved from the subsequent low-stand dissection and erosion. After MIS 5, sea-level drop caused the palaeovalley's distal segment to be reincised during MIS 4 to MIS 2 and later filled by the Holocene clayey deposits cored in the Mar Piccolo basin floor, creating the present morphology. Based on the detailed section reported in Dai Pra & Stearns (1977) and Belluomini et al. (2002) we infer that only a few areas (the Fronte locality and the Salina Grande segment) became morphologically fossilized because they were protected from retrogressive erosion by the hard *Panchina* beds and, probably, some differential vertical movements. But this inferred evolution shows that the combination of low uplift rate with dissected palaeomorphology provides, in this case, a particularly favourable host for sedimentation articulated in different facies and variable thicknesses, resulting in a unique candidate area for the Upper Pleistocene GSSP.

3. NEW CORES AND INVESTIGATIONS

In this view of great potential to host a GSSP, a further improvement in the study of the section started from the preliminary paleomagnetic results published by Negri et al. (2015), suggesting the suitability of sediments for a complete paleomagnetic study. This idea led us to drill multiple cores at the Fronte locality. The drilling was done on February 2015 at the top of the cliff

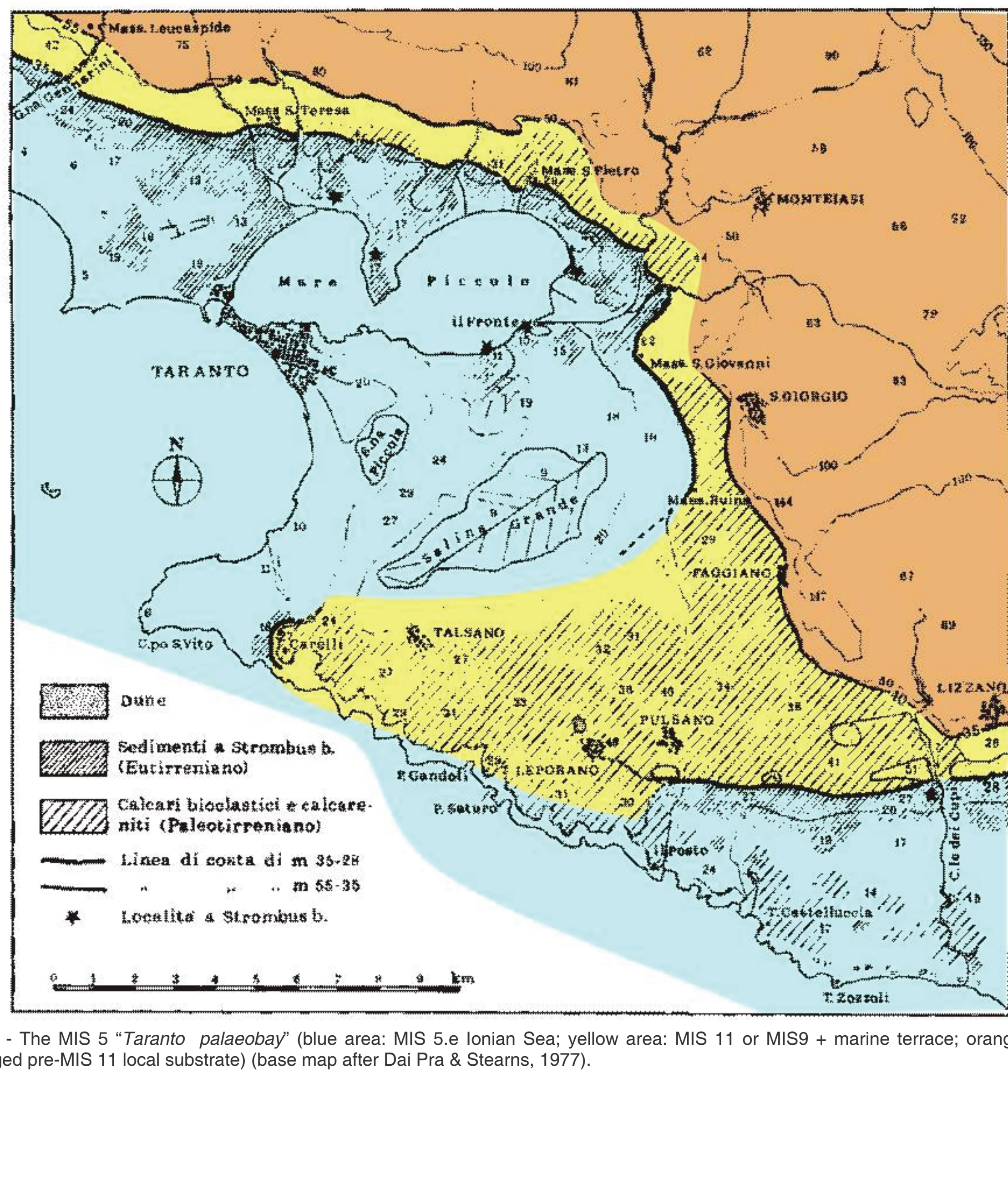

Fig. 4 - The MIS 5 "*Taranto palaeobay*" (blue area: MIS 5.e Ionian Sea; yellow area: MIS 11 or MIS9 + marine terrace; orange area: emerged pre-MIS 11 local substrate) (base map after Dai Pra & Stearns, 1977).

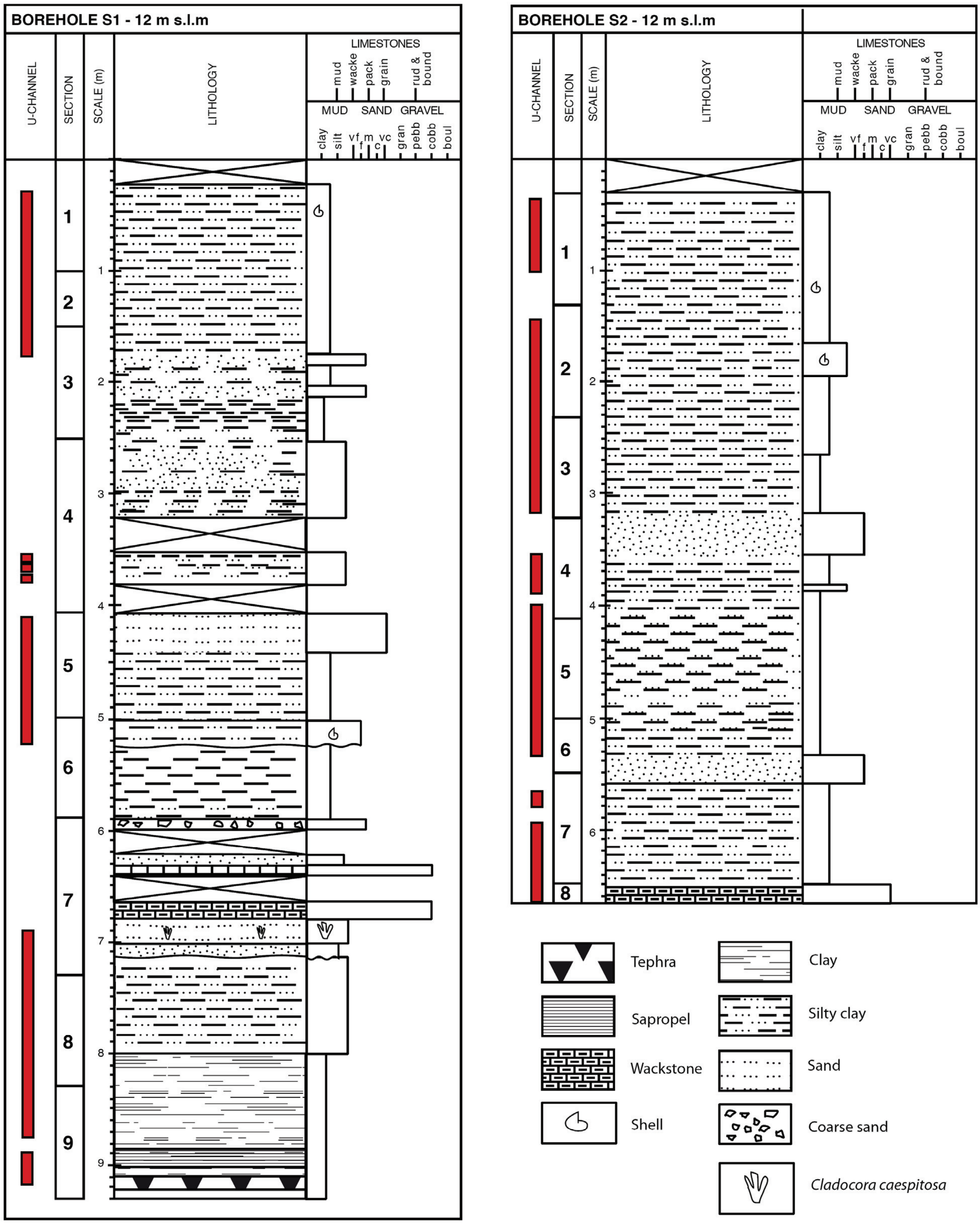

Fig. 5 - The Fronte Cores Stratigraphic logs.

where the section crops out, and yielded two cores (Fig. 5), showing the same lithological succession sampled in the field.

We then sampled the cores (red bars in Fig. 5) using u-channels (1 m in length) and standard ~8 cm^3 plastic cubes made up of non-magnetic material, and investigated the geomagnetic palaeosecular variation and relative palaeointensity recorded in these sediments.

Stepwise alternating-field treatment resulted in good demagnetization behaviour, with most samples showing a clear, major origin-directed magnetization component. The average inclination of around 57° is close to the geocentric axial dipole inclination of 60° for the sampling site, with the difference attributable to typical inclination shallowing effects. The record contains several brief excursions of shallowed inclination. The most significant of these reaches inclinations of below 10°, and we tentatively correlate it with the Blake event. Relative palaeointensity exhibits a similarly dynamic behaviour across this interval. Integration of our palaeomagnetic record with ongoing biostratigraphic work, and with other regional palaeomagnetic data, will provide a more thorough characterization of Late Pleistocene palaeosecular variation in southern Europe.

4. CONCLUSION

In conclusion, we are intensifying the study of this section, but also we plan to go well beyond. In fact, although this section has to date received considerable attention from a multidisciplinary team, with basic information now available in the literature, further comprehensive activity is required to evaluate its correlation with coeval continuous marine successions, thus permitting comparison with north-western European continental records. This work is a necessary prerequisite for any proposal for this section as a GSSP candidate. We intend to fill the current gap in the correlation of the Fronte section with coeval marine Mediterranean successions and with the Continental North Western Europe sections, using all the available proxies, thereby building a reliable framework for the detection of the Upper Pleistocene GSSP.

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