



UNIVERSITÀ DEGLI STUDI DI MILANO



Documenting the diversity of human responses to Quaternary environmental changes when the stratigraphic record is gone. The experience of the SPHeritage Project



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Abstract



Archaeological sequences and landscapes preserve evidence of the complex relationship between human communities and climatic/environmental changes occurred in the Quaternary. In this perspective, archaeological sediments and landscapes are proxy data for past ecosystems evolution, as much as for changes in land use, exploitation of natural resources, and human behavior. Most of the latter can be detected and explored with a geoarchaeological approach, using the tools and methods offered by Earth Sciences. For that reason, accurate sampling during the excavation of archaeological sites allows to increase the number and quality information useful to reconstruct the formation of an archaeological sequence, its preservation, and human activities. What can we do when archaeological excavations were carried out before the application of methods from the Earth Sciences? How can we gather information from residual strips or archaeological sediments? The SPHeritage Project (MUR grant: FIRS2019_00040, P.I.: M. Pappalardo) is coping with this challenging task reinvestigating the Balzi Rossi archaeological area (Western Liguria, Northern Italy). This area represents a key site for the reconstruction of how human populations have responded to Pleistocene environmental changes and sea-level variations since the Middle Pleistocene. Local anthropogenic cave sequences have been excavated since the half of the XIX century; unfortunately, the geological processes in charge of the formation of such deposits have been only occasionally considered. As most of the local archaeological sequences were removed, we are combining the analyses of the remnants of strips of anthropogenic sediments still preserved inside local rock shelters as much as sediment samples preserved in museums. Moreover, our geomorphological survey identified new sedimentary sequences preserving information on relative sea level changes, better constraining the time and steps of climate change, sea-level oscillations, and human settlements. Our results confirm that this approach is an effective tool to reconstruct the formative processes of anthropogenic sequences excavated in the past, thus expanding our possibility of understanding the climateenvironment-human nexus.



The Balzi Rossi archaeological area



The Balzi Rossi archaeological area

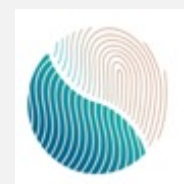
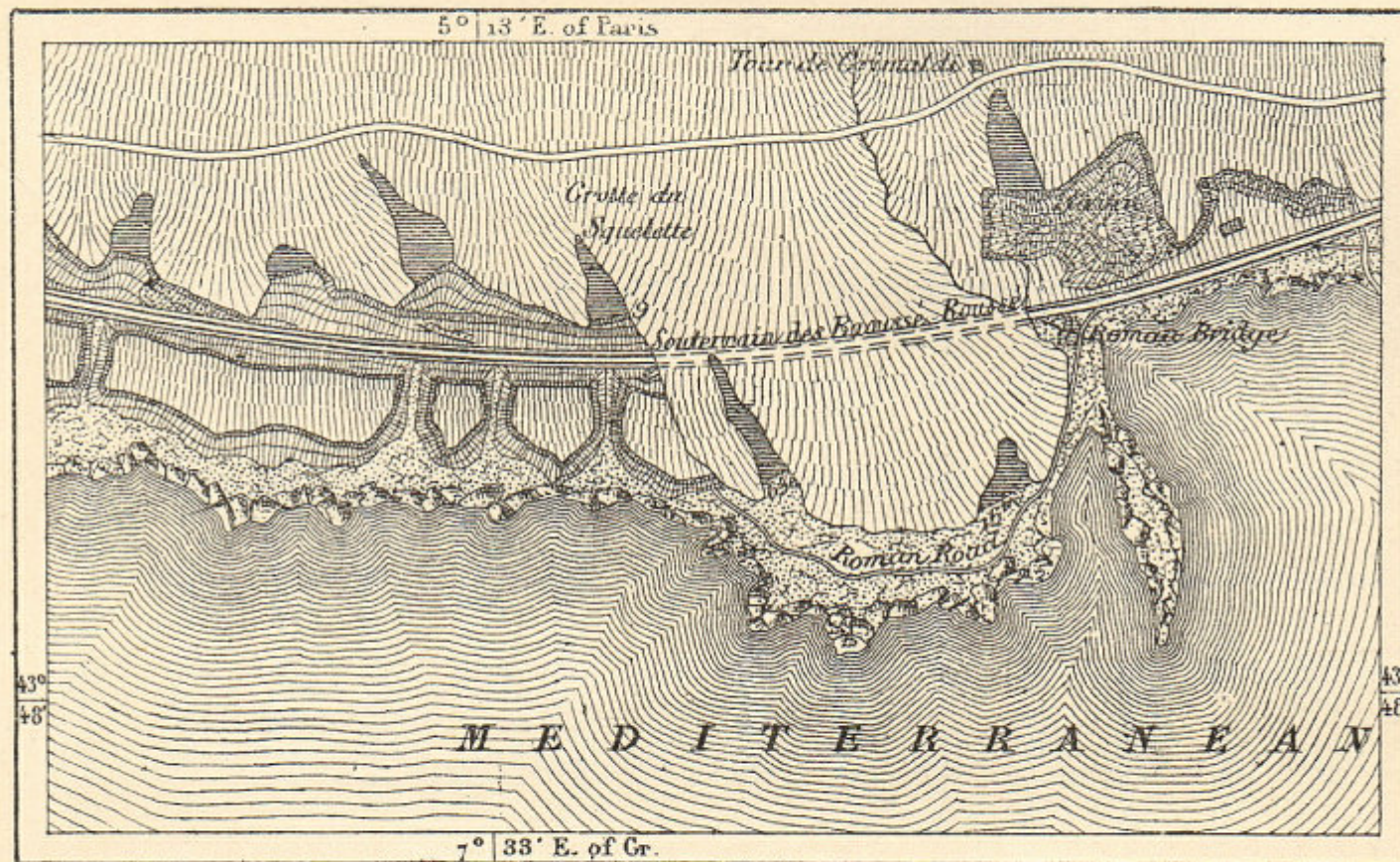


Fig. 102.—BAOUSSÉ-ROUSSÉ.

According to M. Rivière. Scale 1 : 3,000.



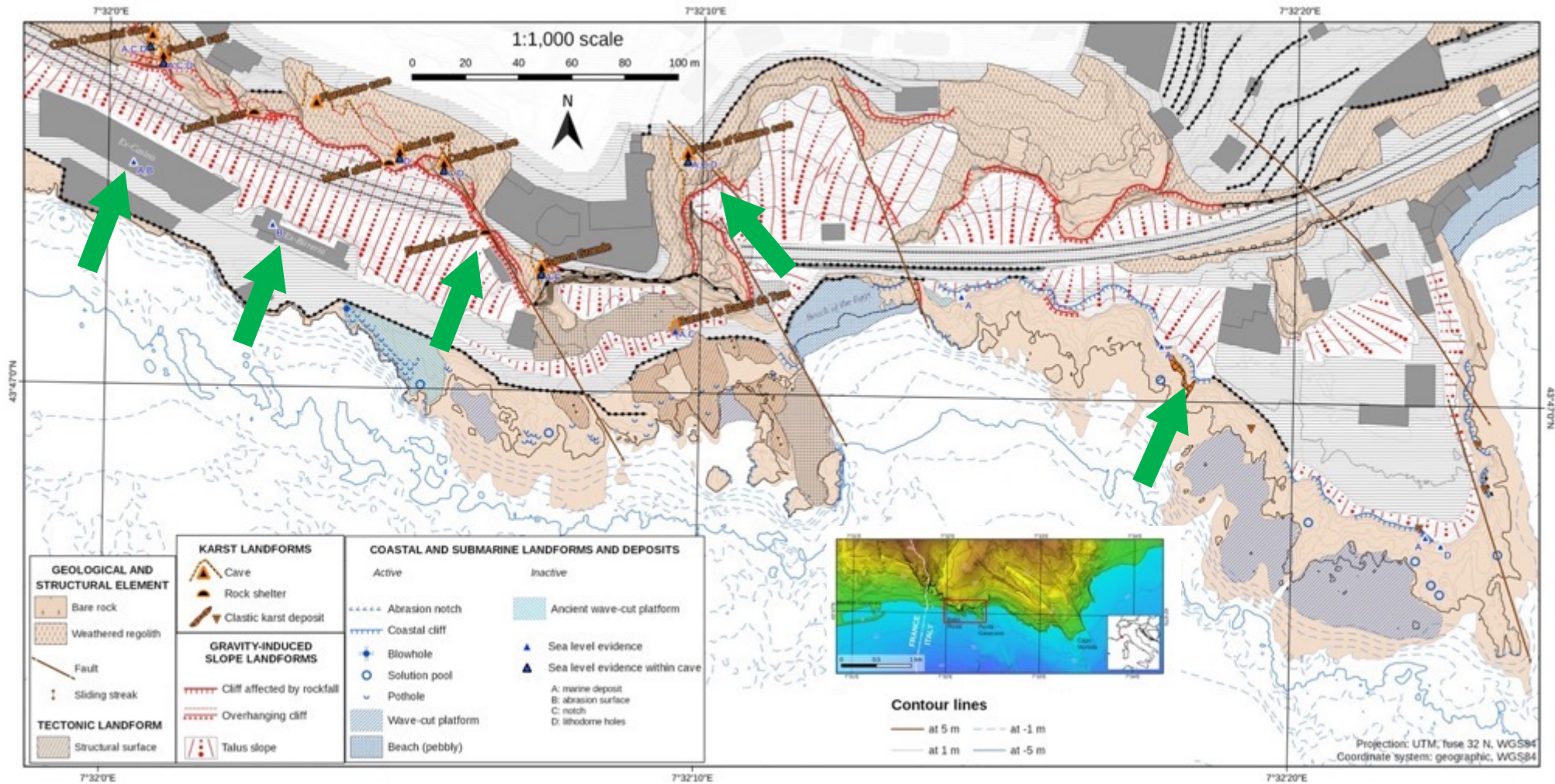
- | | | |
|---------------|--------------|---------------------|
| Earth | Rocky Slopes | Hearths |
| Earthy Slopes | Caverns | Railroad |
| Rocks | Bone Breccia | Base of grand Rocks |

100 Yards.

We investigate an already excavated area to collect fresh data on geochronology and forming processes using museum samples, sampling residual strips of archaeological sediments and coring unexcavated anthropogenic sediments.



Geomorphology and geoarchaeology



To compare the distribution of natural and anthropogenic sequences of the area.
To understand forming processes.
To establish a fresh chronological framework.



The ex-Birreria and ex-Casinò sequences

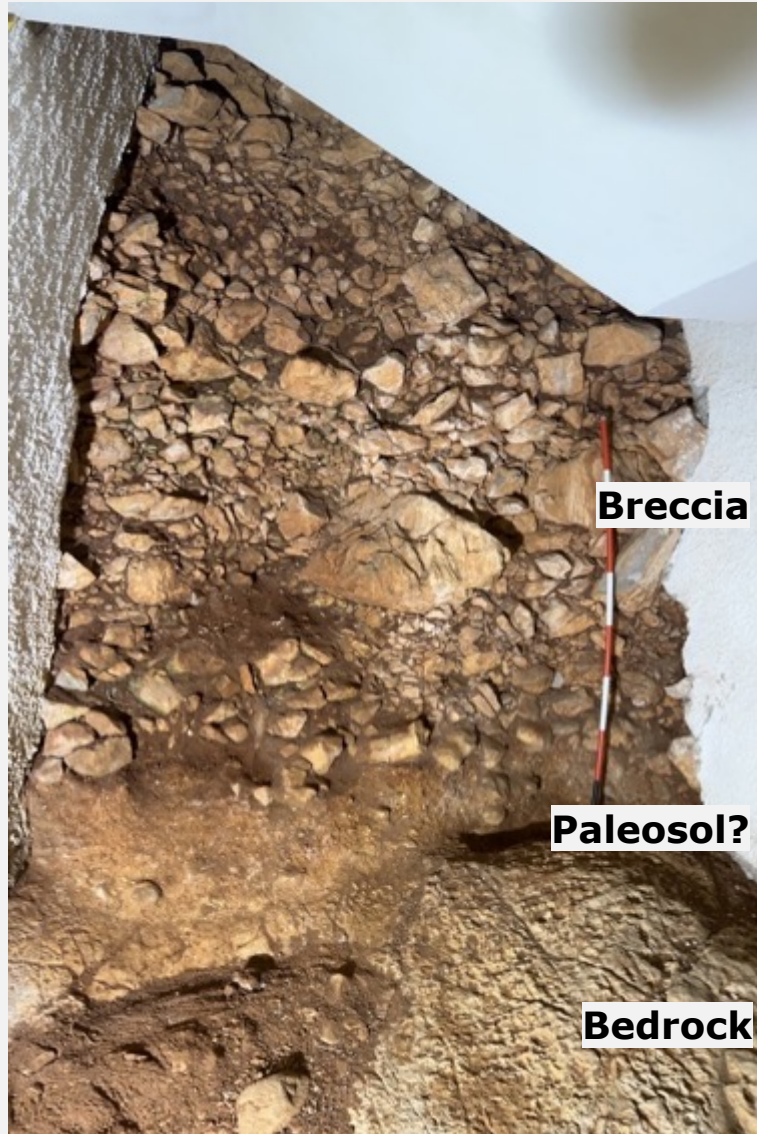
These are two companion sequences, preserved along the foot of the rock cliff.

Investigated in the past, but not radiometrically dated.

A few micromorphological data (Cremaschi; Angelucci and Zambaldi) available for the ex-Birreria section (the one preserved at the Museum); no dating.



The ex-Birreria and ex-Casinò sequences



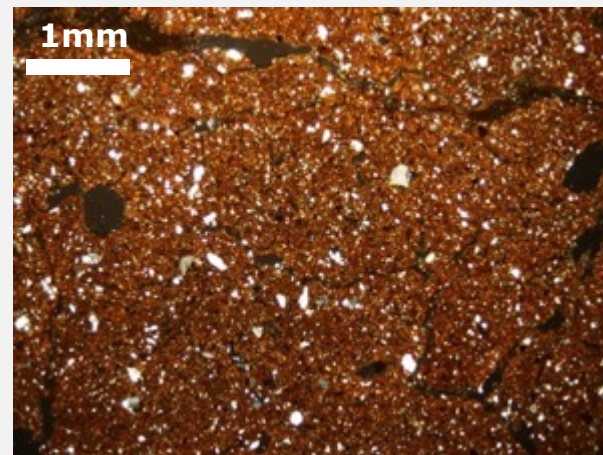
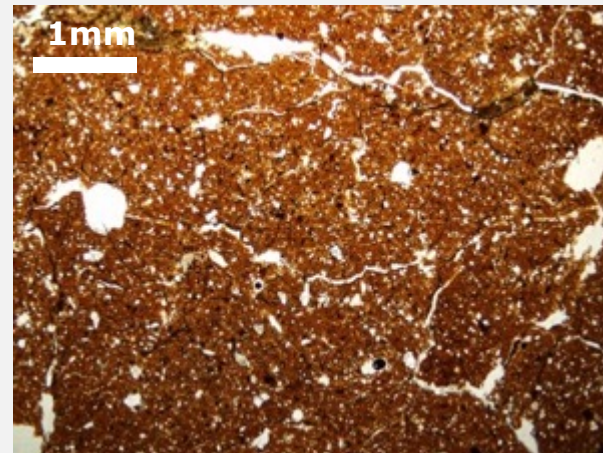
A thick breccia unit covers a rubified paleosol weathered into the abrasion platform.

New sampling for thin sections micromorphology, OSL dating, criptotephra.



The ex-Birreria and ex-Casinò sequences

A thin section from the ex-Casinò display several pedofeatures related to colluvial soil, rather than an in situ redefined paleosol. But the stratigraphy is more complicated because at the top of the abrasion platform we found a discontinuous layer of (weathered?) rounded pebbles.



Breccia

Colluvial
paleosol

Beach deposit
(weathered?)

Bedrock



The ex-Birreria and ex-Casinò sequences

Along the Punta Garavano area, we found a residual strip of sediments consisting of a beach deposit.



The ex-Birreria and ex-Casinò sequences

The beach deposit, weathered into a reddish soil and truncated, laying upon the abrasion platform. The very top of this unit is strongly cemented (includes lithics) and buried by a colluvial red paleosol. A breccia close the sequence.



The Riparo Bombrini

At Riparo Bombrini the archaeological excavation ended in 2023 and it is not possible to further go deep with the investigation due to stability reasons.



The Riparo Bombrini – coring beyond excavation!

After performing a geophysical survey, we extracted two (>5m depth) cores from the Riparo Bombrini area.



The Riparo Bombrini – coring beyond excavation!

After performing a geophysical survey, we extracted two (>5m depth) cores from the Riparo Bombrini area. We found chert fragments and sherds related to cryptotephra (found also in the archaeological layers)

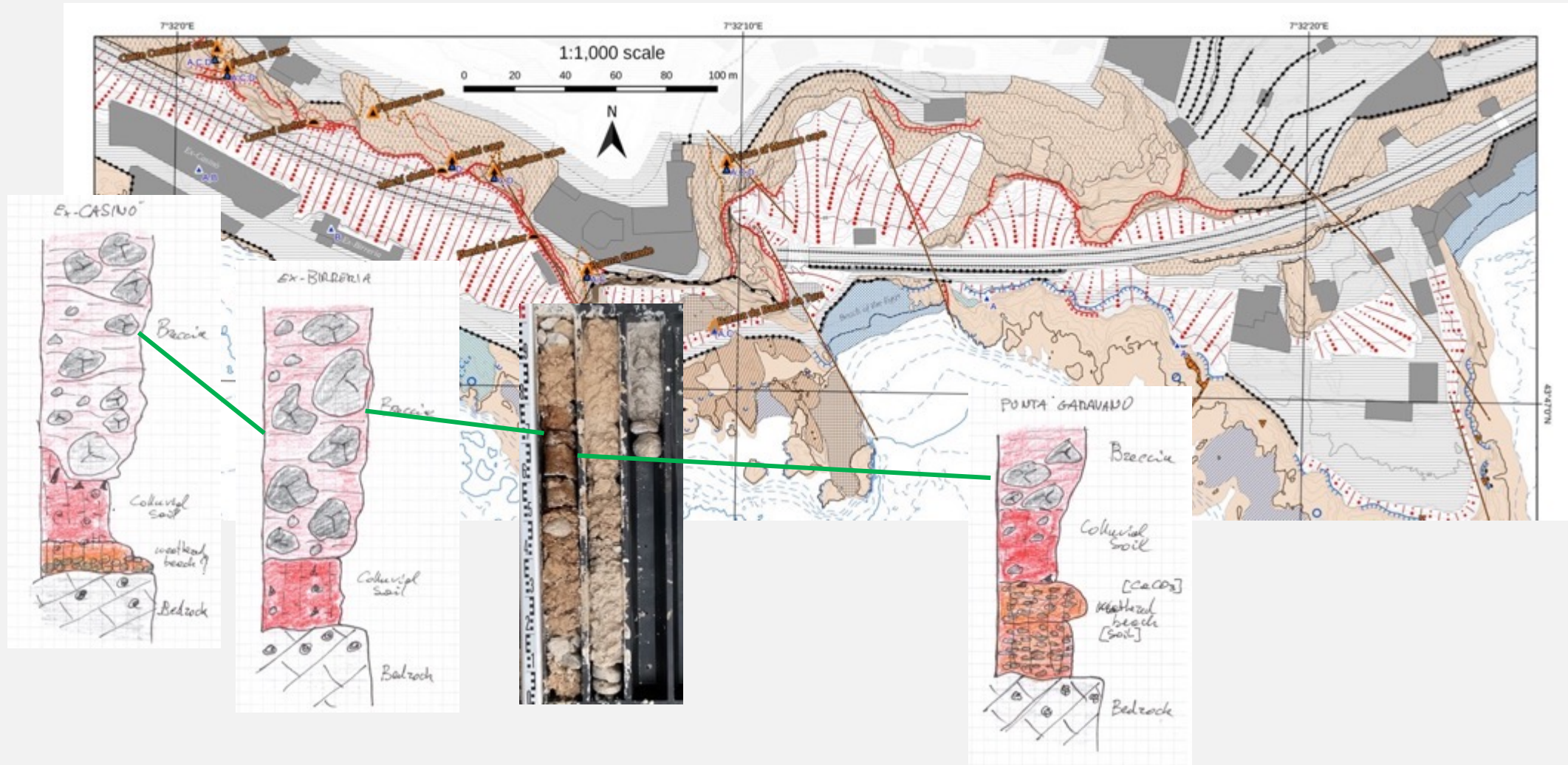


The Riparo Bombrini – coring beyond excavation!

After performing a geophysical survey, we extracted two (>5m depth) cores from the Riparo Bombrini area. Below the archaeological layers, the stratigraphy is similar to the one found elsewhere in the archaeological area...



Is a lateral correlation possible?



The Prince of Monaco Cave



This is a key sequence for the project as much as for the European archaeology

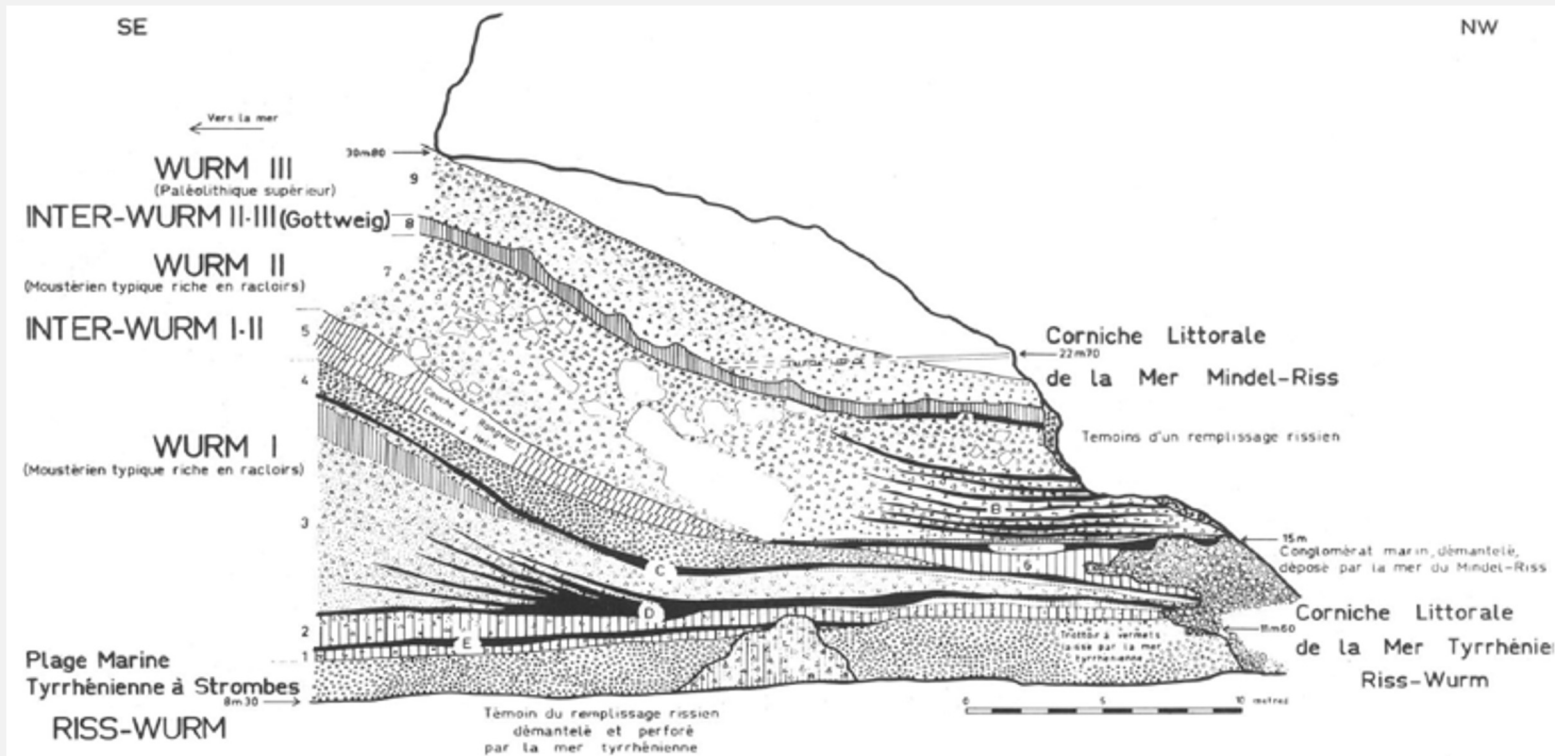


FIG. 44 : Grotte du Prince. Coupe schématique selon le grand axe. Un foyer moustérien (E) recouvrait la plage à strombes et contenait une faune ancienne (*Elephas antiquus*, *Rhinoceros mercki*, *Hippopotamus major*) datée de l'extrême début du Wurm. Les niveaux du Wurmien I, argileux et rougeâtre (couches 1 à 4 et foyers E à C) correspondent à un climat encore peu froid mais très humide où les animaux de forêt (cerfs) dominent sur les animaux de prairie (chevaux). Le bouquetin est encore peu abondant; le renne est absent. Les niveaux du Wurmien II, sableux et jaunâtres (couche 7 et foyers B et A) correspondent à un climat beaucoup plus rigoureux. Les animaux de prairie (chevaux) sont beaucoup plus nombreux que les animaux de forêt (cerfs). Le bouquetin est devenu abondant. Le renne et la marmotte ont fait leur apparition. Un épais plancher stalagmitique (couche 8) s'est déposé, comme dans beaucoup d'autres grottes pendant l'Inter-Wurm II-III qui a été tempéré et très humide.

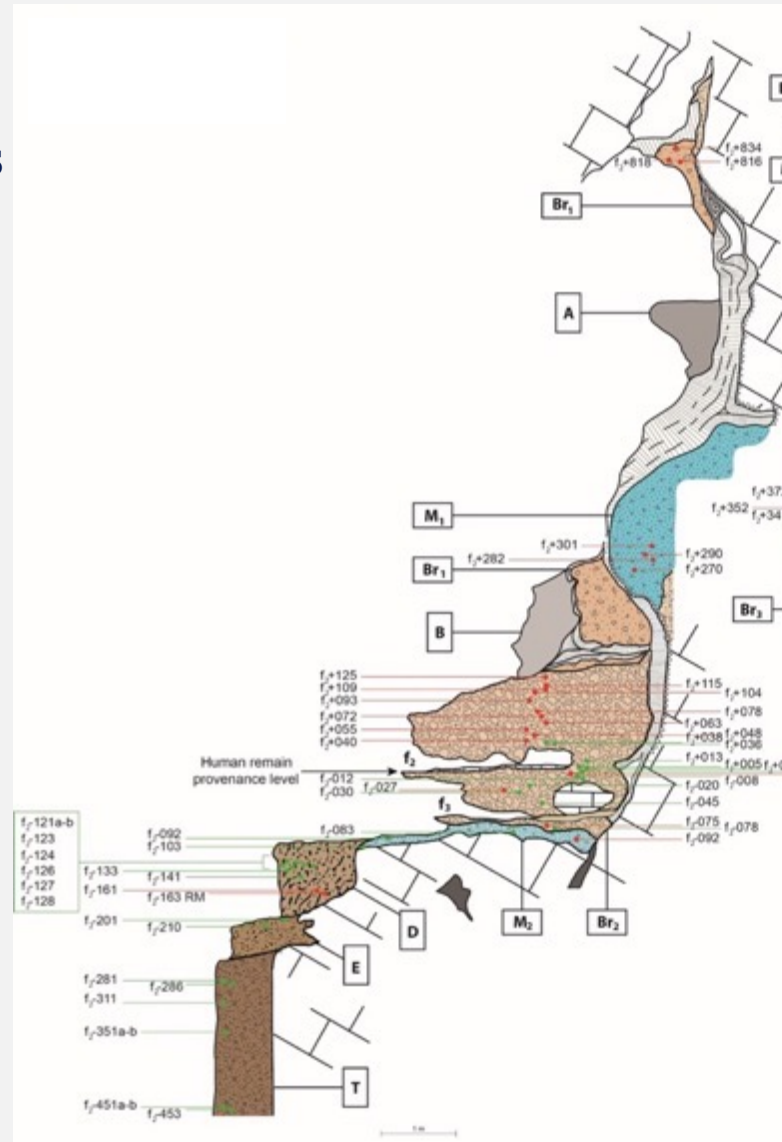


The Cave of the Prince of Monaco: the sequence



Previous interpretation reports on marine sediments (*M units*) alternated to continental breccias (*Br units*) and flowstones; *f units* interpreted as wash-out of deposit during sea high stand.

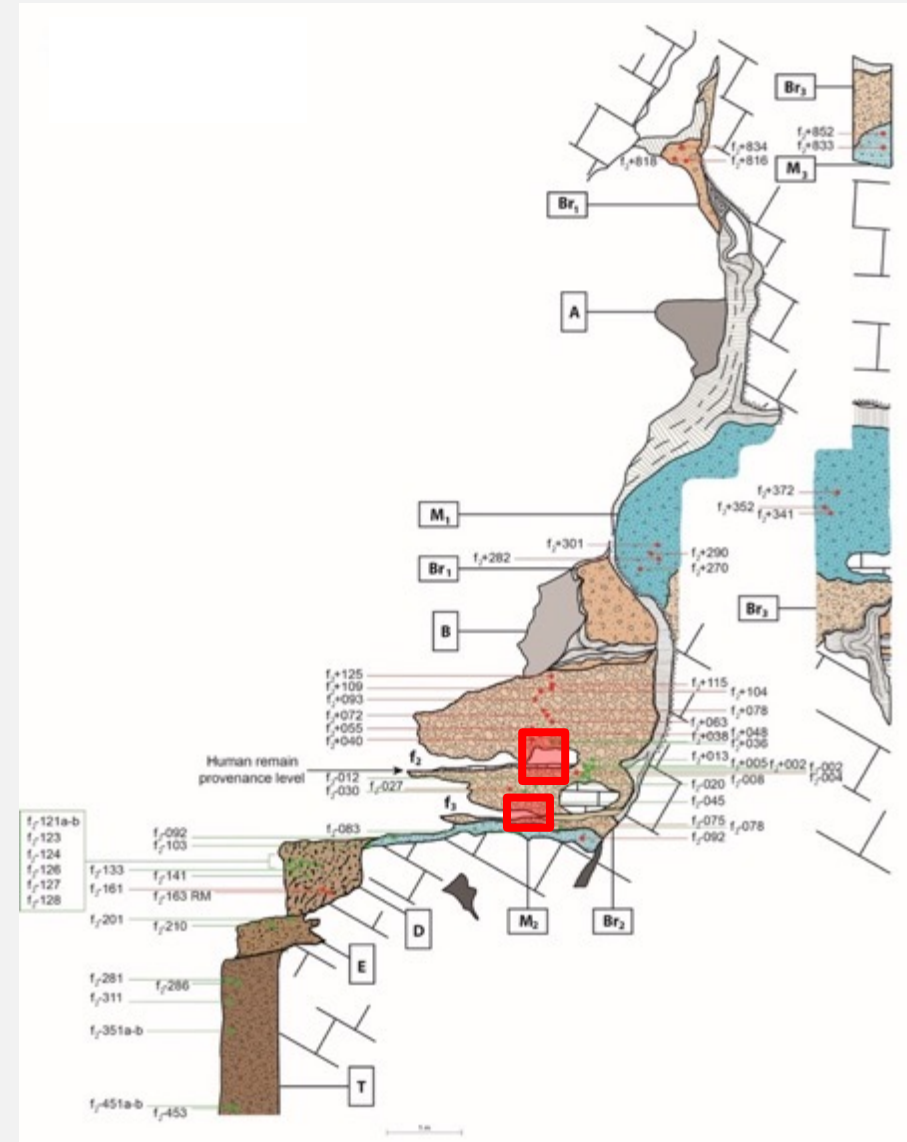
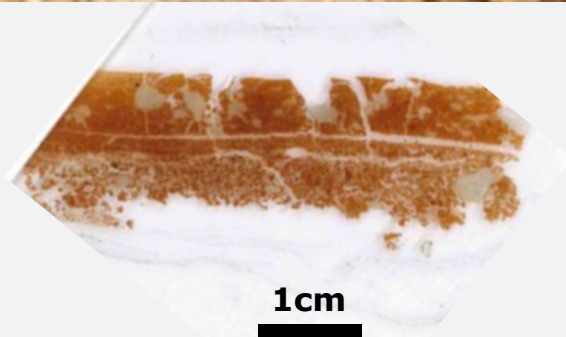
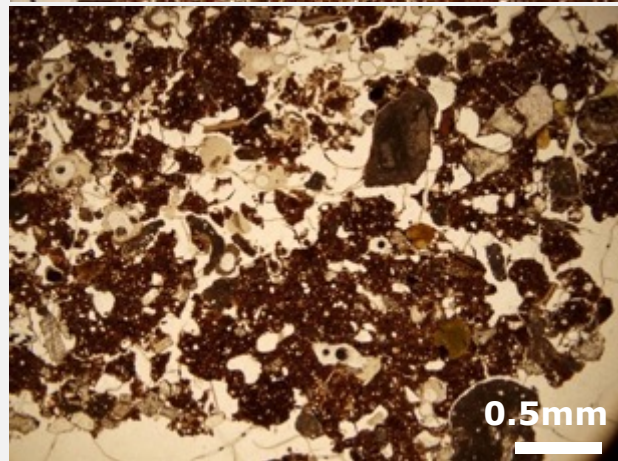
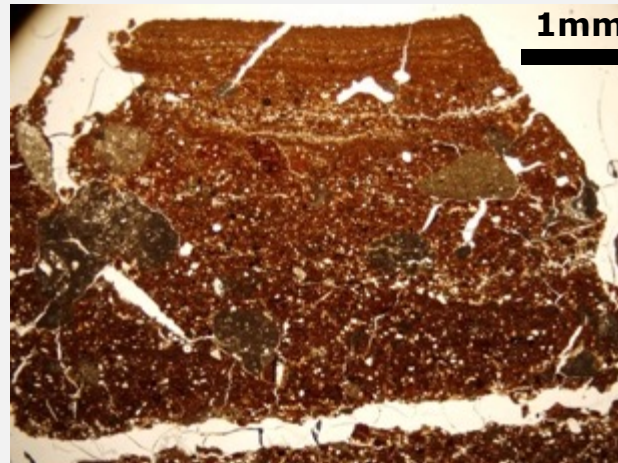
- Samples collected for:
- U/Th dating (ongoing)
 - Paleomag (inversion detected)
 - C,O stable isotopes (ongoing)
 - Thin sections micromorphology



The Cave of the Prince of Monaco: *unit f*



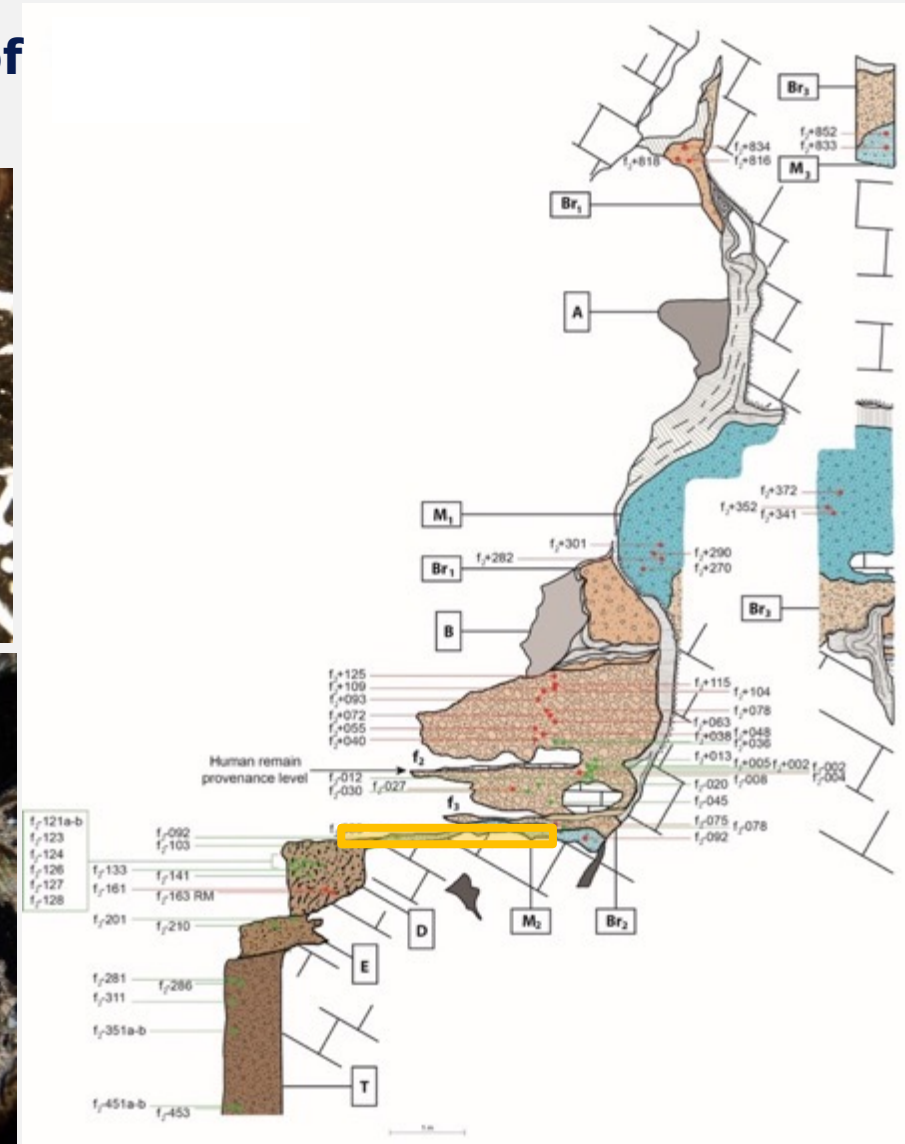
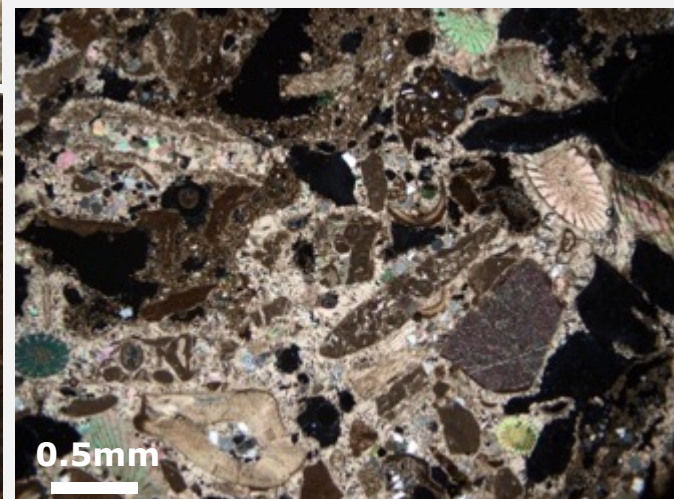
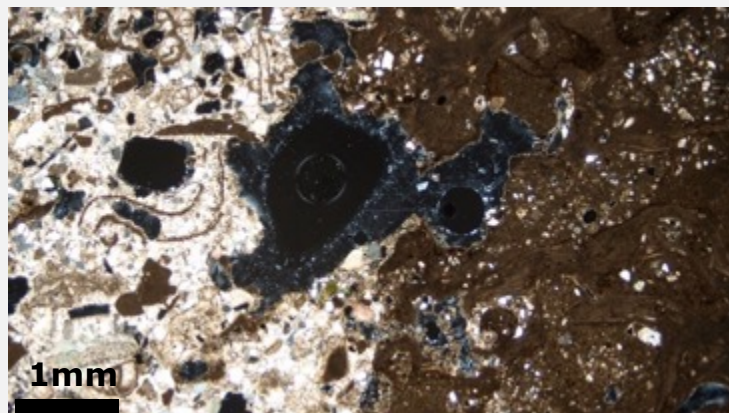
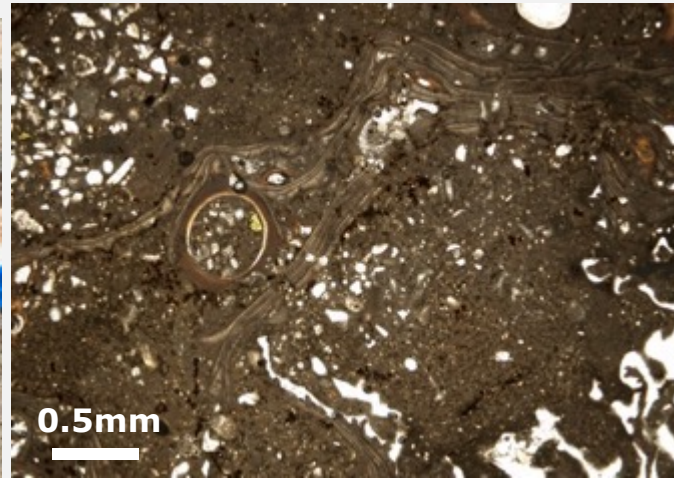
The infilling of the **f1-3** fissures corresponds to clastic cave sediments, constituted by reddish soil material reworked along the karst network; likely, fissures are related to karst dissolution.





The Cave of the Prince of Monaco: *unit M*

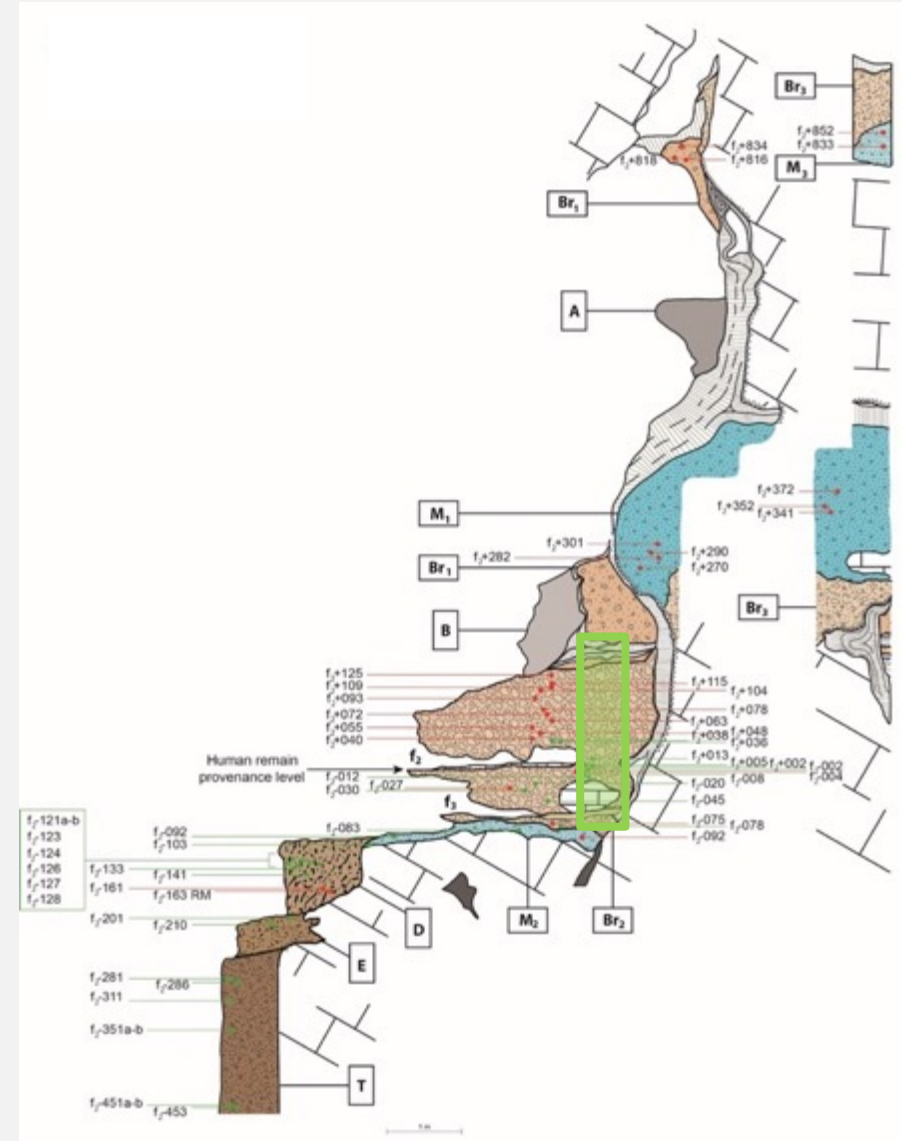
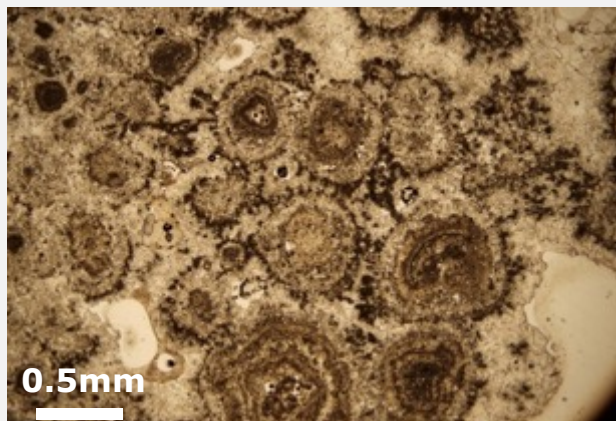
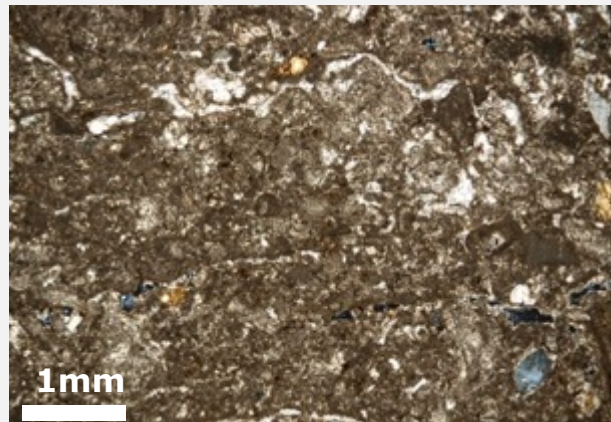
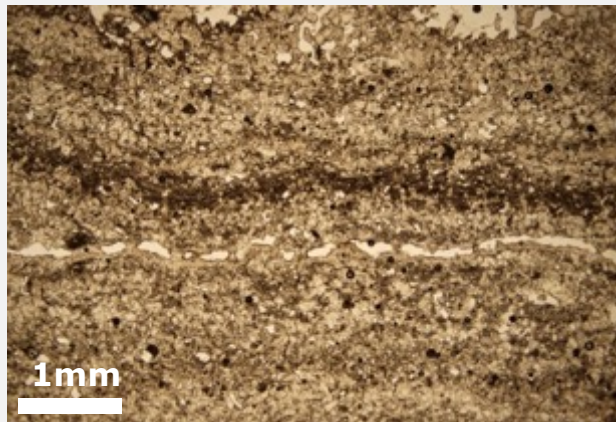
The **M2** units (marine sediments) correspond to littoral calcarenites formed after the precipitation of CaCO_3 from freshwater spring. Different facies.



The Cave of the Prince of Monaco: *unit Br*



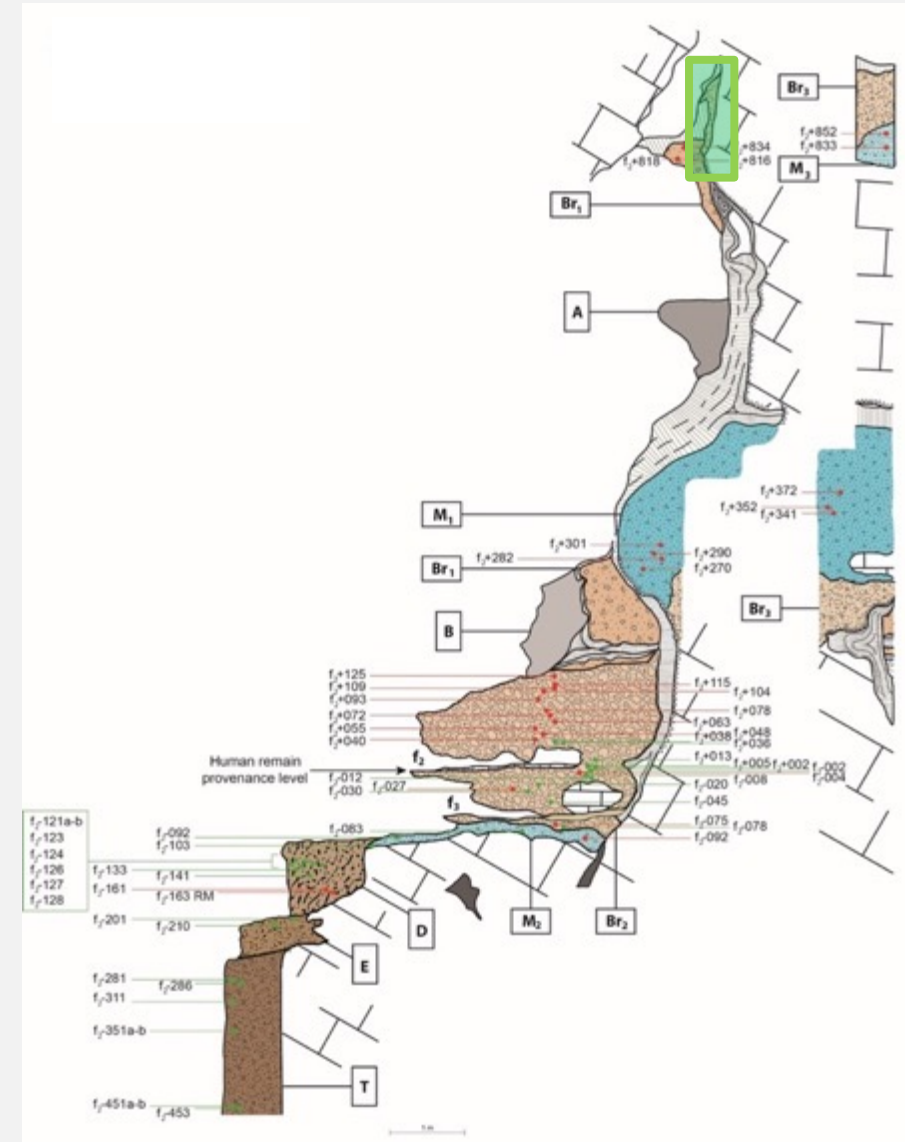
Br units are not breccias but calcareous tufa that formed for a long time, fed by the saturated spring water of a spring. Rock fragments from the rockshelter vault were occasionally incorporated in the tufa. The same spring also formed flowstone (same depositional environment, different facies).



The Cave of the Prince of Monaco: *unit Br1*



One of the oldest **units (Br1)** is a terrigenous yellowish-brown sediments, rich in manganese nodules and clasts.



The Cave of the Prince of Monaco: *unit Br1*



Correlating clastic deposits along Punta Garavano?



BTW: implications for the sourcing of archaeological ochres



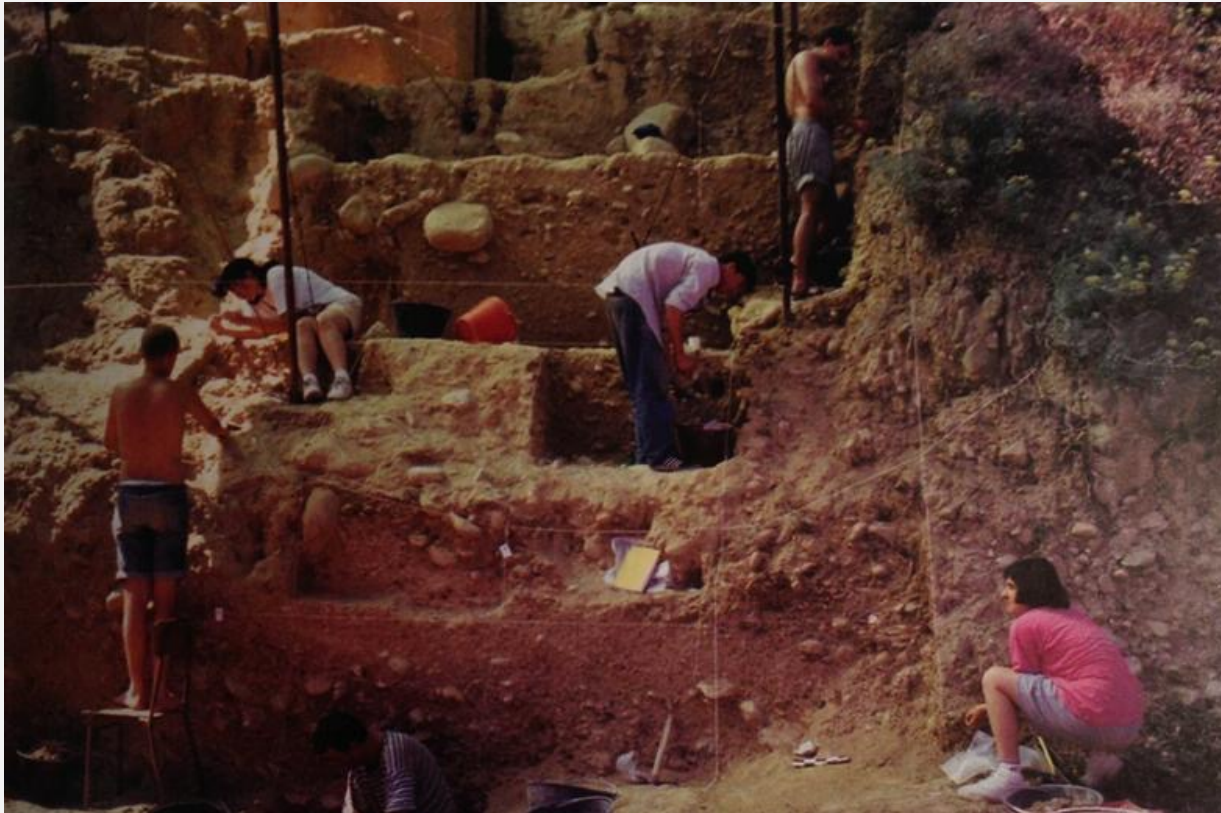
Beyond the Balzi Rossi – Madonna dell'Arma

The Madonna dell'Arma site includes a thick stratigraphy, still preserved, but difficult to excavate. We plan to collect samples to investigate the sedimentary processes.



Beyond the Balzi Rossi – Madonna dell'Arma

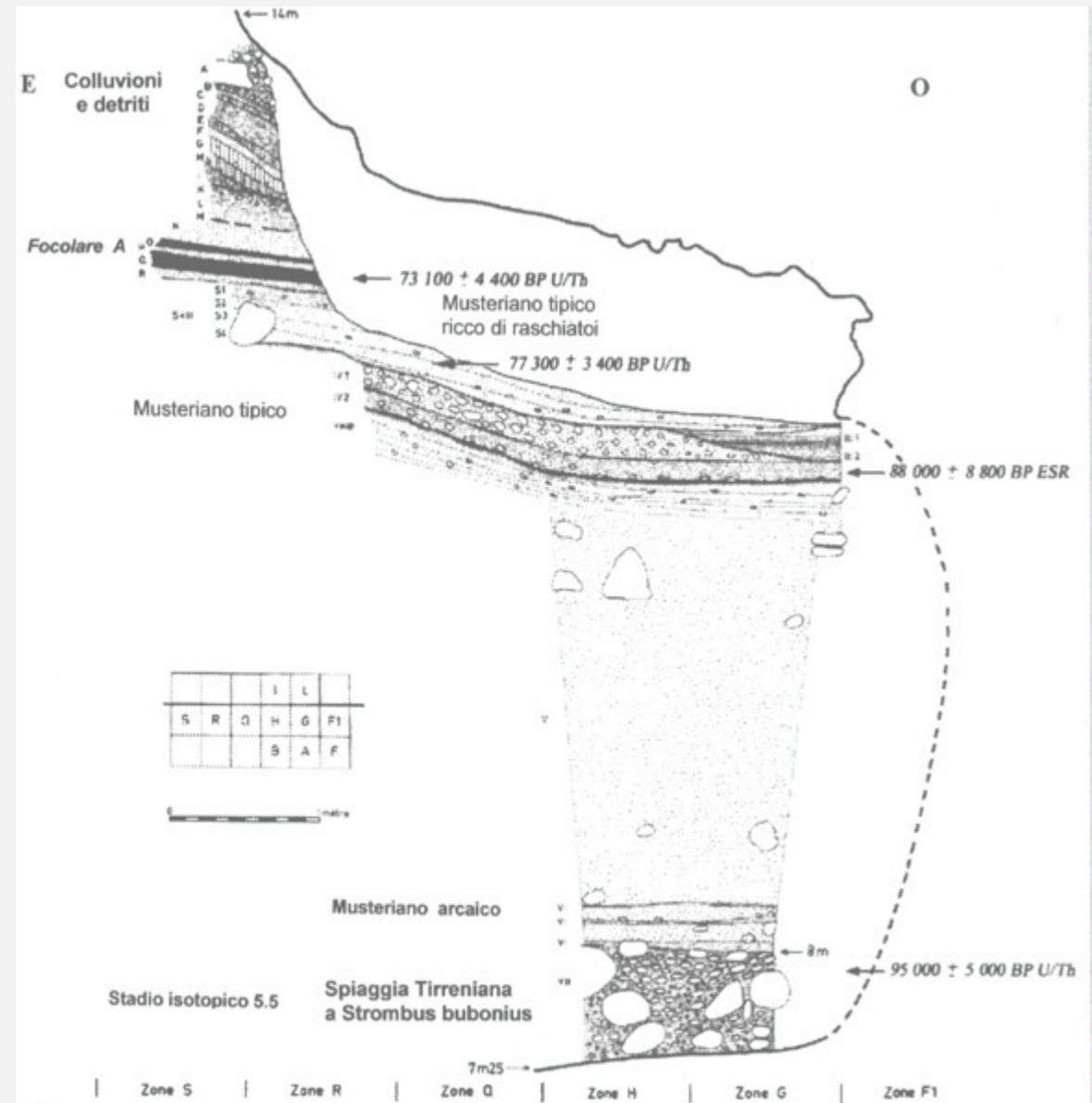
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Beyond the Balzi Rossi – Madonna dell'Arma

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In the 1960s, the Isetti excavation preserved several strips of archaeological sediments still preserved at the Museum of Sanremo



Beyond the Balzi Rossi – Madonna dell'Arma

Museum samples include several Mousterian hearths!

Preliminary 3D scanning will be followed by micro-sampling for dating and other analyses.



Thank you!

