

# CAVE Project – Karstic caves of Central Portugal as palaeoenvironmental archives: speleogenesis and present-day dynamics

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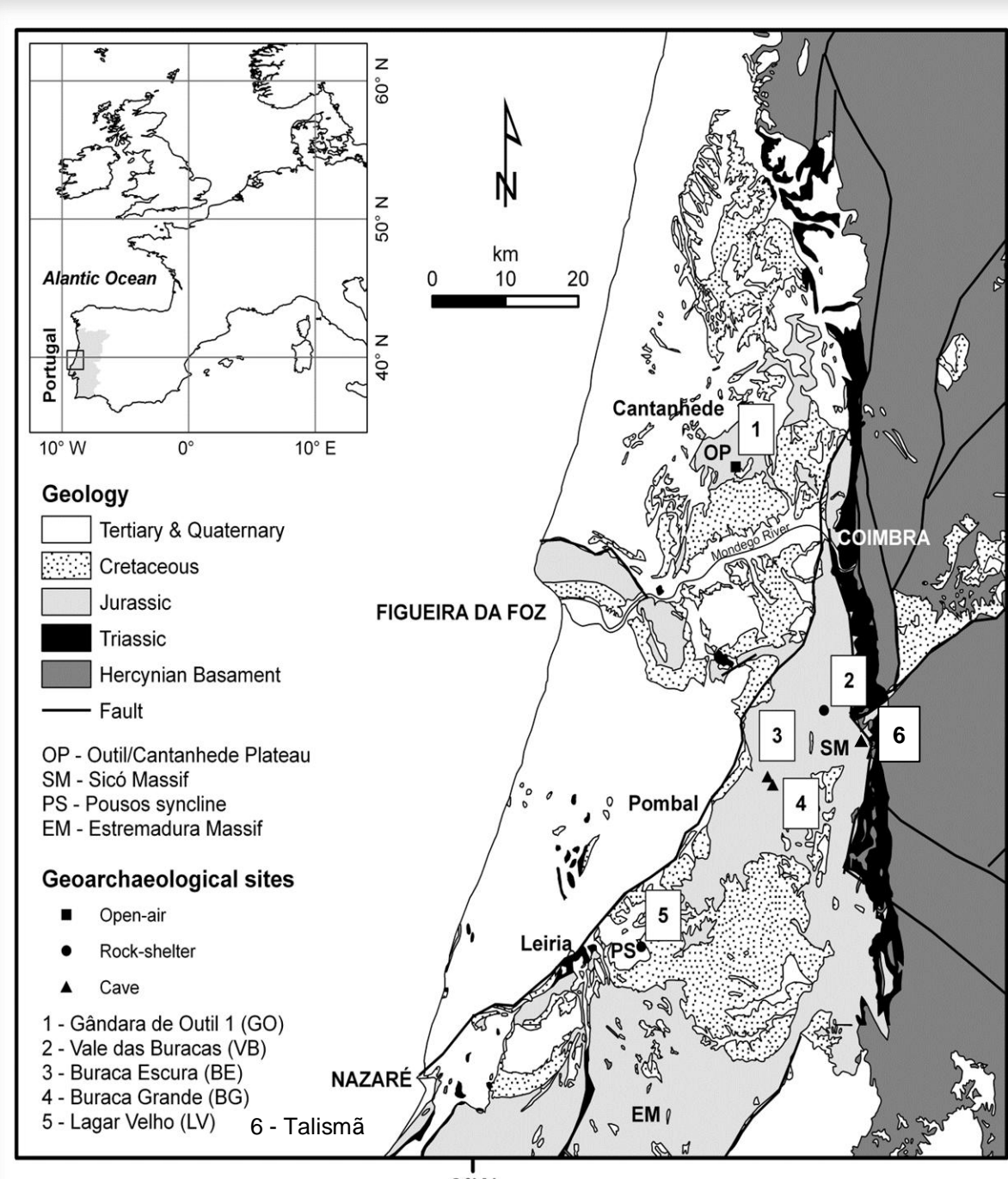
## Talismã Cave – Sicó Massif

The cave (also named *Soprador do Carvalho*) developed predominantly horizontally into the Middle Jurassic carbonate rocks and is located ca. 30 km south of Coimbra city (Central Portugal). It is part of a complex karst system (*i.e.* Dueça Karst System), one of the largest and most important in Portugal. It has at least three distinguishable levels of galleries accessible to the visitors. The lower level show a subterranean river in vadose and epiphreatic hydrological regimes. The cave show approximately 4.5 Km of total extension but just in the first 2 km we are details topographic and geomorphological survey. Actually, its visits are limited essentially to the speleological community.

## Aim of the Project

The CAVE project proposes an integrated approach based on an analysis of the various palaeoclimatic archives from caves and karst deposits. Of these, the most important are the stable isotope analyses and absolute dating in speleothems, as well as sedimentological characteristics of fluvialite, lacustrine and other cave sediments. Most of the above deposits contain information relevant to the palaeoclimate evolution at local and regional scales and, sometimes, show evidence of archaeological materials correlated with human occupation.

The combination of data from various features (speleothems, clastic cave sediments, cave animals remains and archaeological evidences) within the same karstic environment, allow for the ability to overcome the limitations of some absolute dating methods, to combine different climate records into a composite one, to carry on time-series analyses taking into account local, regional and/or global climate records and to identify the regional constraints of climate oscillations.

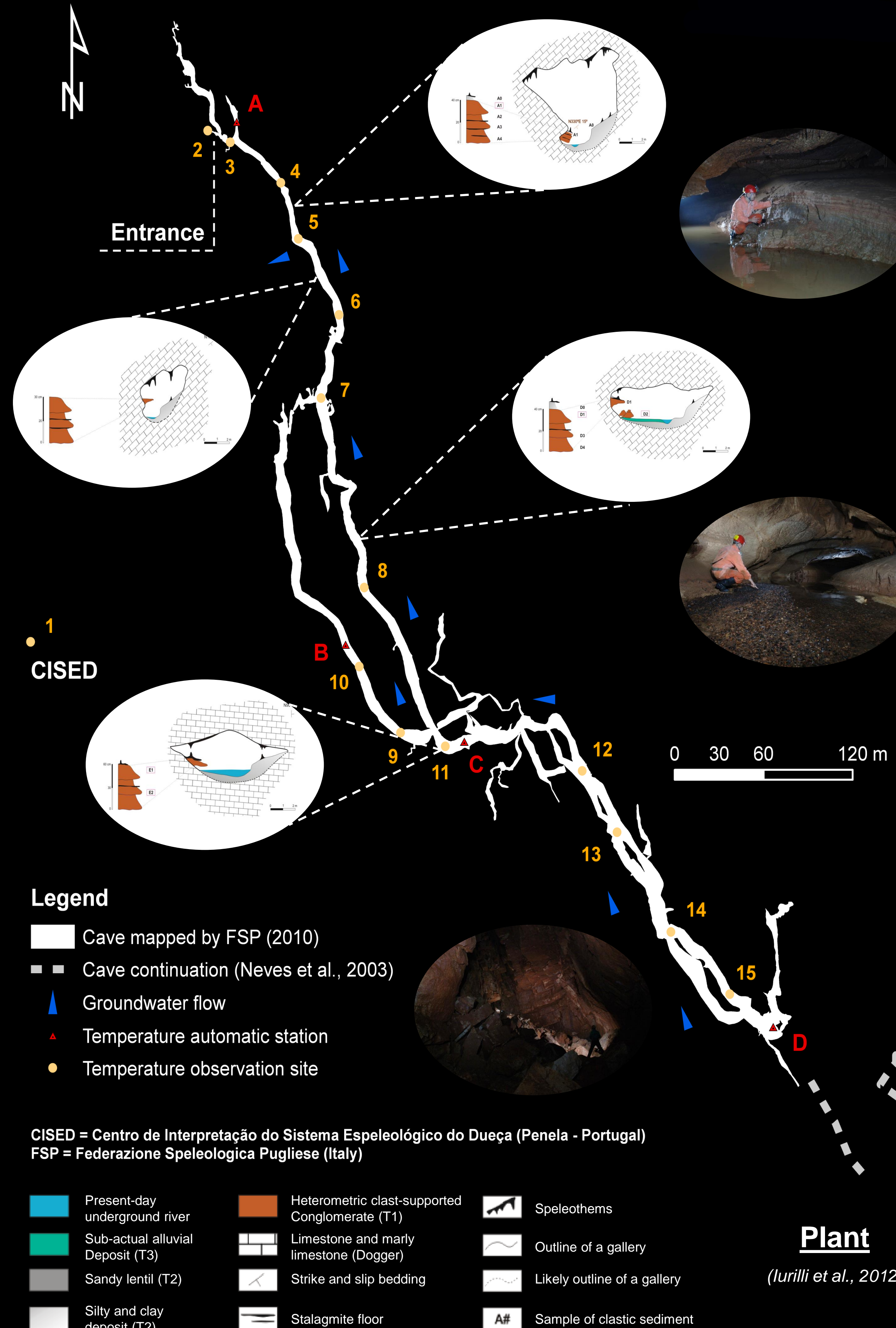


Regional geological setting and location of studied caves

The proposed research will focus on the main karstic massifs of Central Portugal (Outil/Cantanhede Massif, Sicó Massif and Estremadura Massif) and has the following aims:

- creation of an evolutionary model of caves based on structural, morphological, sedimentological and geochronological analyses; this model will further be integrated with known geological and geomorphological regional evolutionary models;
- understanding of contemporary cave activity and groundwater dynamics as well as their vulnerability to human activities;
- transfer of the project results and conclusions to public and private institutions with territorial planning and conservation responsibilities in karstic areas.

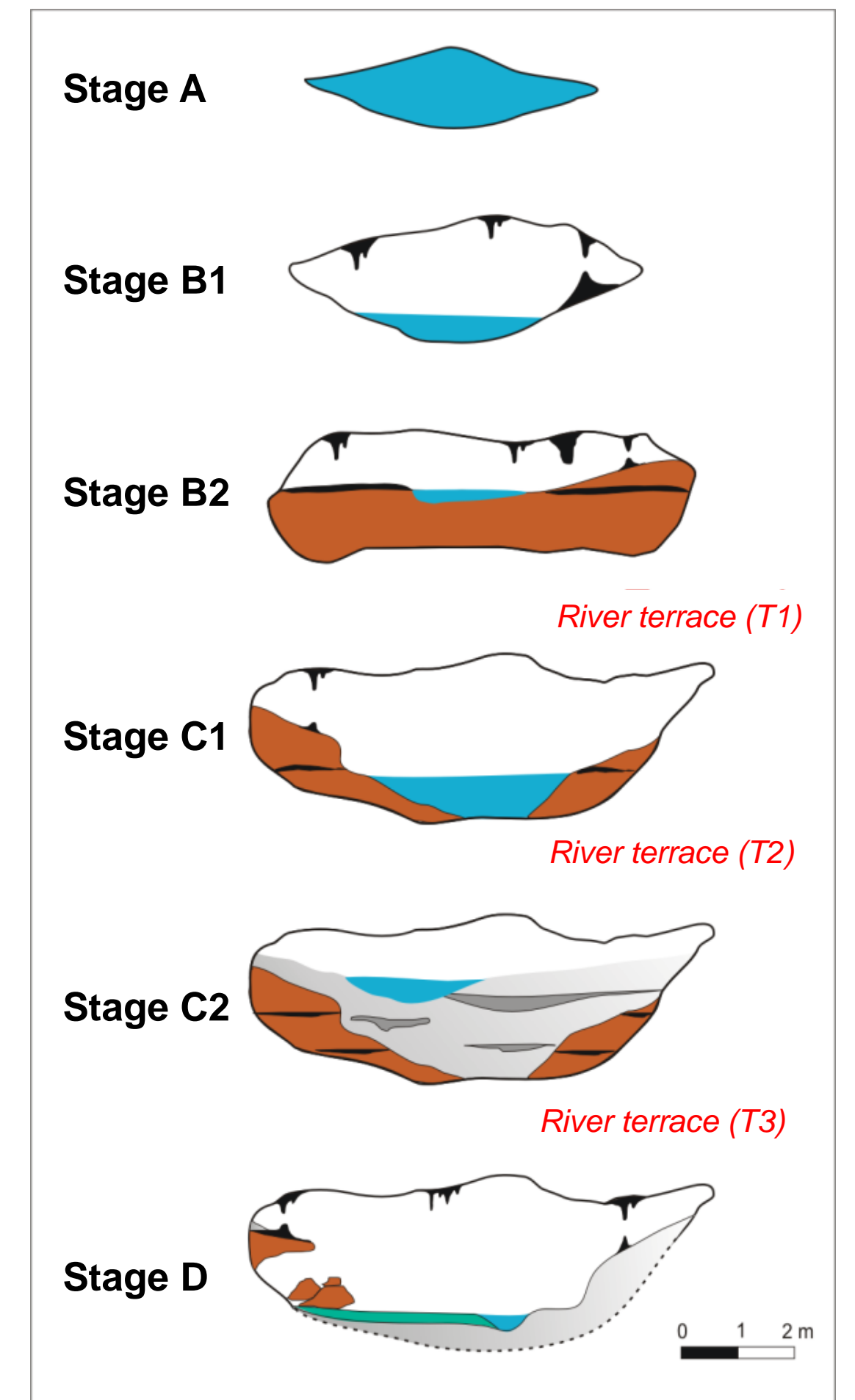
In this communication we will present just the preliminary results obtained for two caves (Talismã and Buraca Escura) in the Central Portugal area (Sicó Massif).



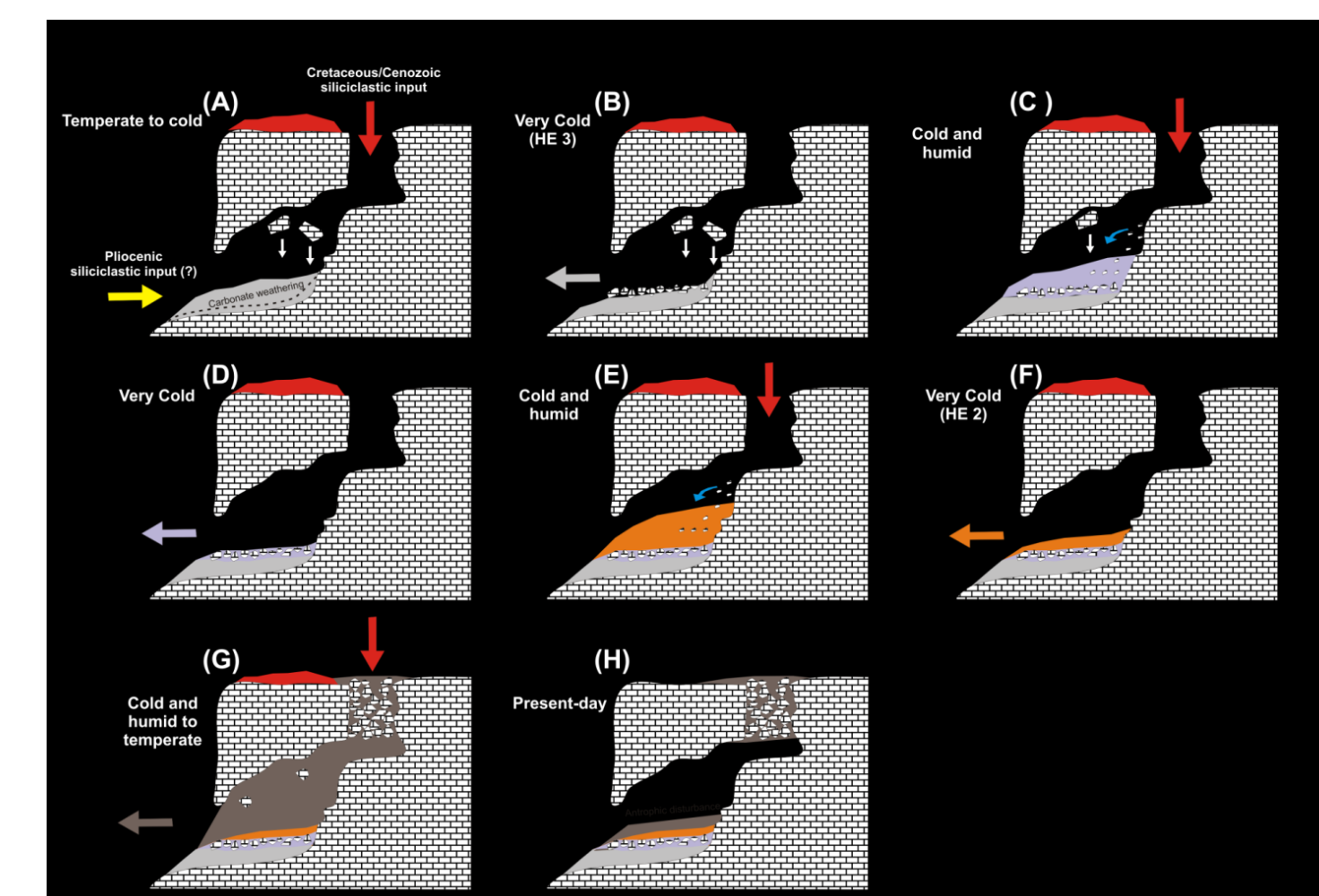
CISED = Centro de Interpretação do Sistema Espeleológico do Dueça (Penela - Portugal)  
 FSP = Federazione Speleologica Pugliese (Italy)

Plant (Iurilli et al., 2012)

## Preliminary results and interpretations



Preliminary speleogenetic model of the Talismã Cave (Cunha & Dimuccio, 2008).



Preliminary speleogenetic model of the Buraca Escura Cave (Dimuccio et al., 2011).

## Future working

- Field observation:**
- Elaboration of a precise and actualised geodatabase in which a large number of caves and springs will be available for study;
  - Per site, and surroundings area, improve the characterization of geomorphological and geological (e.g. tectonic) settings;
  - More details lithostratigraphic and chronostratigraphic description of exposed cross-sections and profiles;
  - Sedimentary, pedogenetic and anthropogenic characterizations of the deposits;
- Continue laboratory analyses:**
- Grain-size, morphoscopy and mineralogical characterizations of the siliclastic deposits (into the caves and outside) and relative clay assemblages;
  - Stable oxygen and carbon isotopic ( $^{18}O/^{16}O$  and  $^{13}C/^{12}C$ ) analyses of speleothems for palaeotemperature interpretations;
  - Dating speleothems by  $^{230}Th/^{234}U$ , Thermoluminescence (TL) and Electron Spin Resonance (ESR) methods;
  - Dating clastic sediments by Optically Stimulated Luminescence (OSL) method;
  - Dating archaeological remains by the  $^{14}C$  method.
- Expected results:**
- Per site, characterization of the sedimentary circulation: provenance, accumulation *locus* and evacuation routes of the continental sedimentary record;
  - Speleogenetic models for each of the selected caves;
  - Characterisation of human and animal Upper Pleistocene and Holocene occupations in caves and establishment of their chronological frameworks;
  - A more precise chronological framework of seasonal to long-term records of natural and anthropogenic events in the selected caves (palaeoclimatic interpretations);
  - Construction of a conceptual regional speleogenetic model for Central Portugal endokarst;
  - Definition of the strategies to adopt for the implementation of an endokarst-integrated management model focused on caves as ecosystems.

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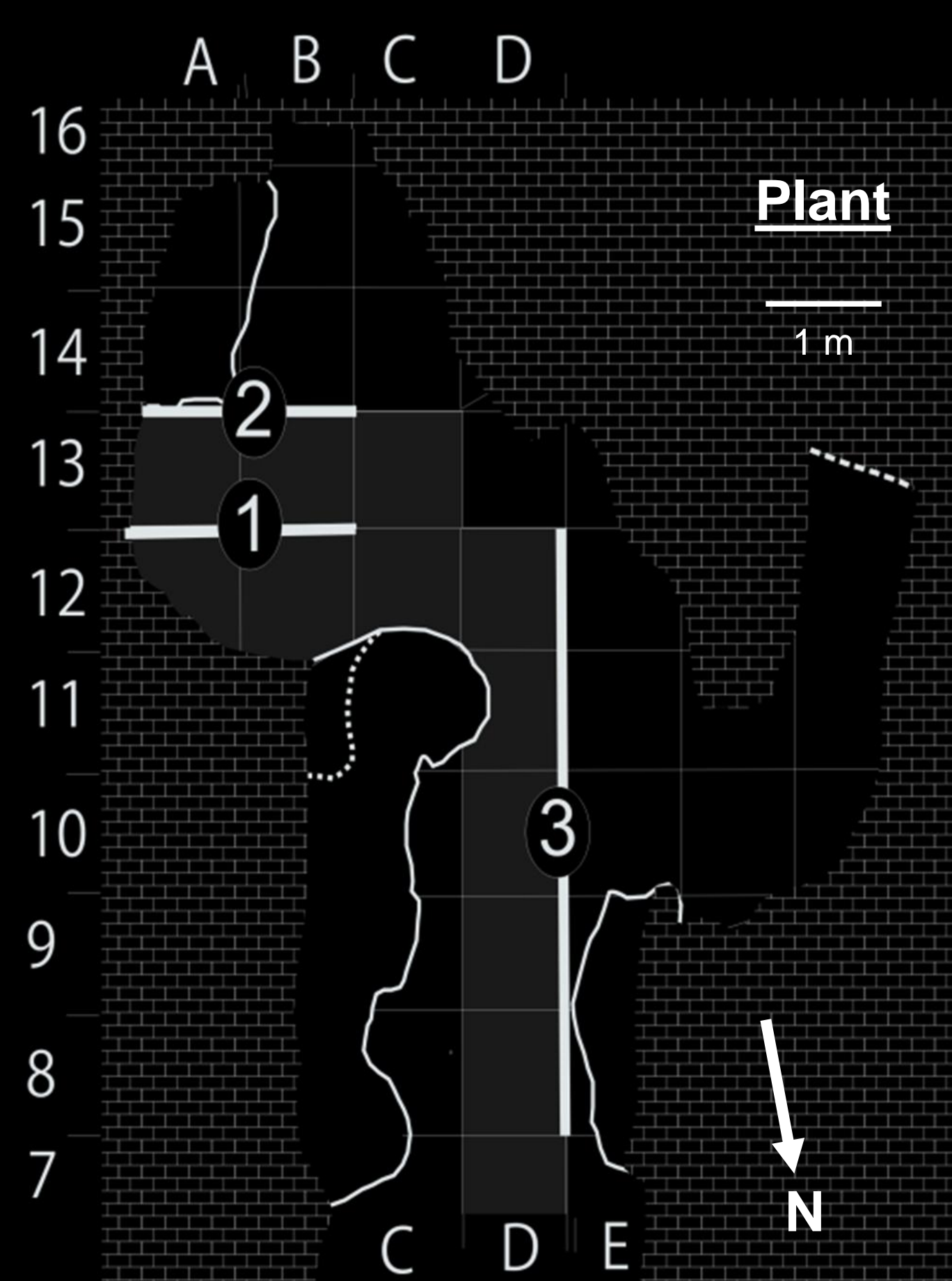
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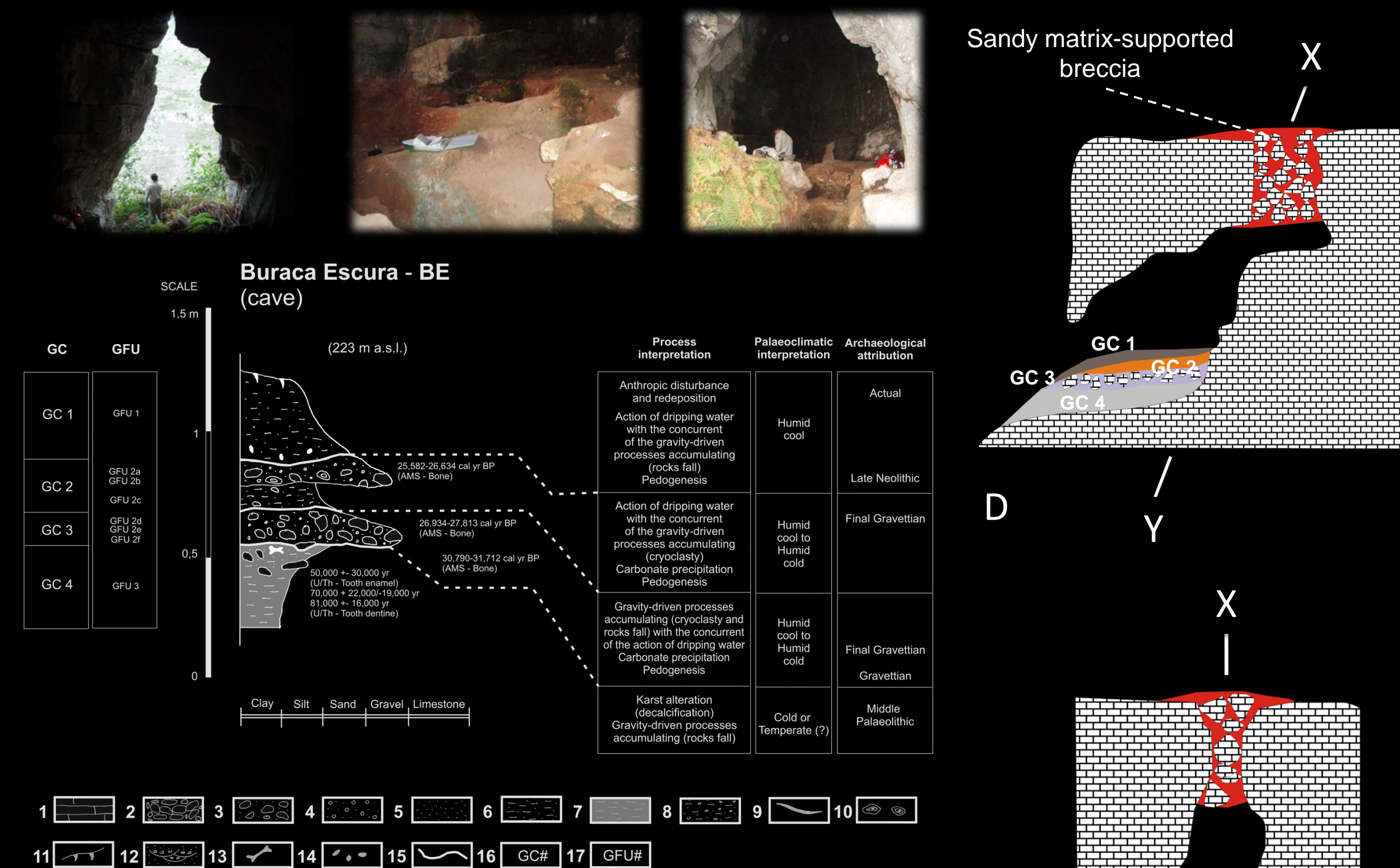
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## Buraca Escura Cave – Sicó Massif

The cave was discovered during systematic archaeological survey and excavated between 1991 and 2002. It is located at an altitude of 223 m, on the southern slope of a deeply incised fluvio-karst valley cut in Middle Jurassic carbonate rocks. The valley, named *Poio Novo*, follows a structurally controlled E-W orientation, which is almost perpendicular to the major fault zone that constitutes the western border of the Sicó Massif of Central Portugal. Actually, its visits are limited essentially to the archaeological community.



Plant of the Buraca Escura Cave with indication of the studied geochronological exposed cross-sections (*i.e.* 1, 2 and 3) (Aubry et al., 2001).



Synthetic log showing archaeostratigraphic interpreted sequence (Aubry et al., 2011). 1 = Limestone, 2 = Clast-supported conglomerate bearing limestone fragments with low sphericity, angular to sub angular, 3 = Sandy matrix-supported conglomerate, 4 = Polymodal sand bearing quartz and quartzite clasts with high sphericity, sub-rounded to sub-angular, 5 = Unimodal sand, 6 = Silt, 7 = Clay, 8 = Sandy clay loam, 9 = Fe and/or Mn oxides, 10 = Carbonate nodules and concretions, 11 = Bioturbation, 12 = Trough cross-bedding, 13 = Bones, 14 = Charcoal fragments, 15 = Disconformity (erosive unconformity), 16 = Geochronological Complex, 17 = Geochronological Field Unit.