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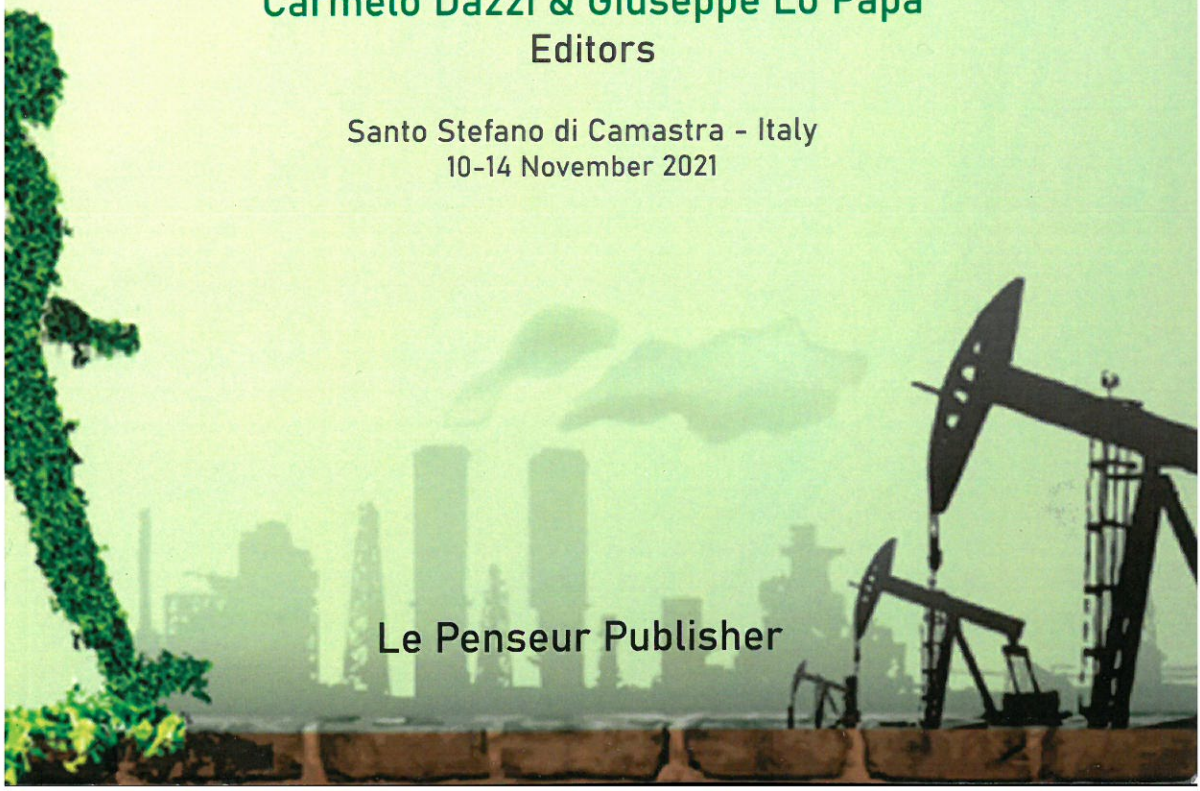

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2nd stop: The Palaeolithic site of San Teodoro

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The San Teodoro Cave (ST) is located in north eastern Sicily, about one km from the village of Acquedolci, near Messina, about 1.2 km from the coastline, at about 140 m a.s.l. (Figure 1) The cave formed into the Jurassic limestone of the Longi-Taormina geological Unit, which is mainly affected by normal faults and cover the Palaeozoic metapelite. In the surroundings other geological formations occur, such as the Numidic and the Monte Soro Flysch, prevalently formed by quarzarenite (Lentini et al., 2000 and personal observations). The longer axis of the ST site follows the NNW-SSE fault-system orientation, suggesting that karstic processes along a fault line led to the formation of the cave. The shape of the cave is that of a large, about 1200 m2, tunnel-like chamber that slightly narrows towards the inside. The cave entrance is about 5 m high and 15 m wide; maximum height of the inside is 20 m.

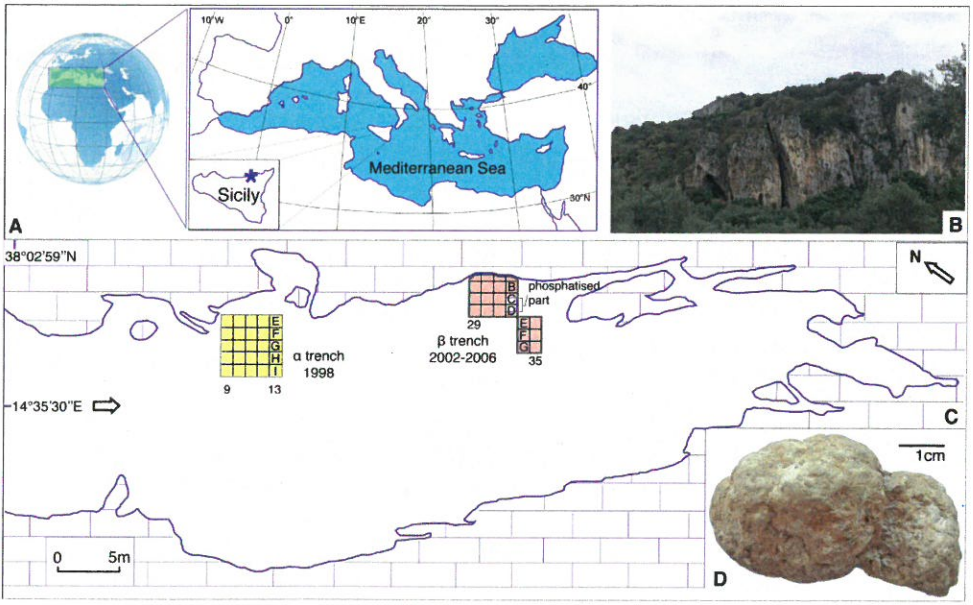

Figure 1. A) General location of the study site, the San Teodoro Cave (Acquedolci, Messina, NE Sicily). B) The study site from the outside. C) Plan of the Cave with location of α and β trenches and the phosphatized part. D) One of the phosphate nodules detected from the β trench.

The Cave and the surrounding area are at present site of very important paleontological and palaeoanthropological assemblages. The geography and geomorpho-

logy of the area were markedly different from today as eustatism and tectonics deeply modified the landscape, especially during the Pleistocene. At the time of the late Palaeolithic attendance there was a low stand of about -90 m (Lea et al., 2002), and the nearest shore would therefore have been about six kilometres distant from the site.

The importance of the ST site within the Mediterranean Palaeolithic is due to the finding of seven Epigravettian human individuals (Maviglia, 1941; Graziosi, 1947; D'Amore et al., 2009). According to Graziosi (1947), one of the individuals (ST5) was found in a more recent stratigraphic unit (Figure 2). ST5 was attributed to a different humanity by D'Amore et al. (2010).

The international resonance of the site is also related to the astonishing Pleistocene large-mammal remains found outside and inside the cave. These faunal assemblages testify of a great biodiversity in the area and of the clear transition from a warm Middle-Upper Plesitocene Faunal assemblage, to a temperate Late Upper Pleistocene one. (Anca, 1860; Vaufrey, 1928; Bonfiglio et al., 2001, 2008; Mangano and Bonfiglio, 2012).

The cave deposits consists of two main stratigraphical units (Figure 2):

- the older unit B of Bonfiglio *et al.* (2001), near the cave entrance corresponding to the layers F-E of Graziosi (1947), with vertebrate faunal complex and several human burials;
- the younger unit A of Bonfiglio et al. (2001), corresponding to the layers D-A of Graziosi (1947) and the layer PAL of Garilli et al (2020a), with lithics, human food remains (mostly bones) and charcoal.

Both units occur at the α trench, excavated by Laura Bonfiglio in 1998 near the cave entrance; at the β trench, excavated eight years later by Laura Bonfiglio in the inner part of the cave, only the unit B occurs. At the α trench a red ochre layer (the layer β of Graziosi, 1947), lain down by Epigravettian humans for ritual purpose, marked the stratigraphic boundary between units B and A (Figure 2).
Chronostratigraphy of the cave deposits is based on radiometric dating: at the β trench (unit B) an 230Th/234U analysis of carbonate concretion and an AMS 14C analysis of an European wild ass bone provided ages of 32 and 21-23 kyr, respectively (Antonioli *et al.*, 2014); at the α trench AMS 14C analyses provided an age of about 15 kyr BP for one of the human individuals buried in the unit B (Mannino *et al.*, 2011) and for an aurochs tooth from the base of the unit A (Garilli et al., 2020a).
The skeleton remains of six human individuals (ST1-4 and ST6-7) were found during excavations conducted by Carlo Maviglia and Paolo Graziosi from 1938 to 1947 near the cave entrance. ST1-4, possibly also ST6 and 7, were buried within the oldest layer formed in the cave, the unit B of Bonfiglio et al. (2001). This people presumably represent among the earliest Epigravettians of Sicily (D'Amore et

al., 2009; Modi et al., 2021). Recent studies on "ancient DNA" extracted from the individual number 2 (ST2) indicate a common mithochondrial haplotype (U2#--) for the western Mediterranean hunter-gatherers.

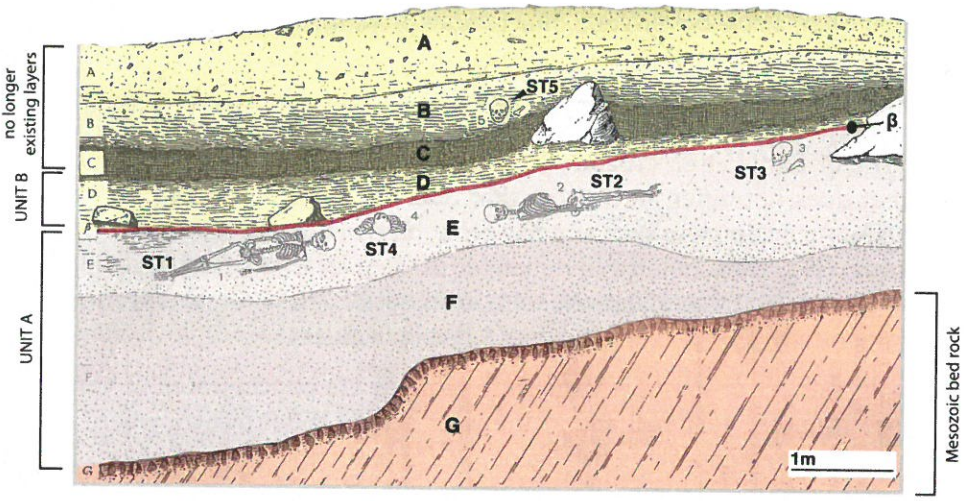

Figure 2 – Section of the San Teodoro Cave deposits (NE Sicily) at the time of the early 1940s excavation (from Figure 1 of Graziosi, 1947, modified), showing stratigraphy and the position of four of the seven human individuals found: ST1-4, buried and covered by the red ochre carpet (β); ST5, found in a younger layer. Units A and B are from Bonfiglio *et al.* (2001).

The burial-layer consists of prevalently clayey sediments with a Late Pleistocene fauna (Pianetti Faunal Assemblages) with Bison priscus siciliae, Bos primigenius siciliae, Cervus elaphus siciliae, Crocuta crocuta spelaea, Equus hydruntinus, Palaeoloxodon sp, Sus scofa, Vulpes vulpes (Bonfiglio *et al.*, 2001, 2008; Herridge, 2010; Mangano and Bonfiglio, 2012). Among the six human individuals, ST1 was the most intact, whereas some other individuals were possibly damaged by grave-robbers (Graziosi, 1947). At least three of these individuals showed bone remains stained by red ochre (Graziosi, 1947 and Carotenuto *et al.*, 2013), possibly as a consequence of the contact with an above red ochre layer (Graziosi, 1947). This red layer, with an average thickness of 5 cm, covered without interruption the entire burial ground homogenously, with a few exceptions (Graziosi, 1947), and was possibly strewn on a surface of about 16 square metres (see Graziosi, 1947, figure 2), very few decimetres above the ST corpses (Maviglia, 1941; Graziosi, 1947). This red layer was no longer detected after the excavations by Maviglia and Graziosi in the early 20th century, until the rediscovery of a small, relict portion (Garilli *et al.* 2020b).

Chemical and palaeobiological analyses showed that the ST ochre represents the earliest case of archaeological use of ferrous pigment produced by iron-oxidising bacteria (FeOB), the first identified in a European Upper Palaeolithic site. The

same analyses suggested that the ST hunter-gatherers identified several possible water sources (springs) rich of pigment used for covering a multiple burial. The red layer represents a stratigraphic and an anthropological marker bed separating two different moments of the Epigravettian attendance of the ST site: one strictly linked to burials; a subsequent one, much more prolonged, with intense production of lithics (Vigliardi, 1968) and fireplace remains, and remarkable slaughter of late glacial fauna (Garilli *et al.*, 2020a). The memory of this second phase is embodied in the layers D-A of Graziosi (1947), the Unit A of Bonfoglio *et al.* (2001) and the layer PAL of Garilli *et al.* (2020a), whose base was dated at about 15 kyr BP, an age that does not differ much from that obtained on ST1 skeleton (Mannino *et al.*, 2011). An incomplete skull and few other human bones belonging to a further individual (ST5) were found in a no longer existing layer (B of Graziosi, 1947, see Figure 2), with no trace of intentional human burial. These remains are therefore stratigraphically younger than those of ST1-4 individuals.

In the inner part of the cave vertebrate remains are concentrated at very close distance from the east wall and at the west side of the β trench, where a huge amount of Hyena coprolites (Mangano, 2011) and fresh water molluscs (Esu *et al.*, 2007) were also found. The remaining part of the same trench underwent phosphatizing processes resulting in the formation of abundant phosphate nodules with a diameter maximum of about 8 cm. Vita *et al.* (2021) showed that phosphatizing was produced by the reaction of bat guano with clayey sediments, forming an acidic soil environment and consequently causing the dissolution of fossil bones and carbonates.

The oldest deposit with large vertebrates was excavated outside the cave by Laura Bonfiglio in years 1982-1987. It mainly bears a huge amount of hippo remains (the endemic, small sized Hippopotamus pentlandi) and large rounded boulders locally with a muddy matrix. Hippo bones are rarely in partial connection and with long bones often oriented, suggesting reworking. The vertebrate association also includes elephant and other vertebrates (Bonfiglio, 1992, 1995). The age of 200 +/- 40 kyr, attributed to the hippo deposit on the basis of an amino acid racemization dating (Bada et al., 1991), needs confirmation based on more exhaustive methods.

Steps at the San Teodoro site

Step 1. The excavations outside the ST cave

Trenches excavated by L. Bonfiglio in 1982-1987 discovered very abundant bones belonging to the small sized, endemic Hippopotamus pentlandi and few elephant remains, the oldest vertebrate palaeofauna in the ST site. Bones are rarely in connection and often not fragmented, suggesting short distance reworking. Large rounded boulders occur locally with muddy sediment. The radiometric age of 200 +/- 40 kyr, based on amino acid racemization (Bada *et al.*, 1991), needs confirmation.

Step 2. Inside the ST cave, near the entrance: the α trench

Excavated by L. Bonfiglio in 1998, the trench shows complete site stratigraphy:

- the older unit B in the lower part of the trench, mainly bearing hyena, elephant, red dear, aurochs, wild boar and ass, where Epigravettians buried their companions about 15 kyr ago;
- the younger, anthropozoic layer PAL (Unit A) in the upper part, with lithics, charcoal and food remains mainly consisting of fragmented bones; the base of this layer has been dated at about 15 kyr BP.

The relict of the red ochre used for funerary rituals occurs very locally between layers B and PAL.

Step 3. Inside the cave: the β trench

Excavated by L. Bonfiglio in 2002-2006 in the innermost part of the cave, the trench shows layers of the unit B, bearing the same fauna as in the α trench plus fresh water molluscs at the west side, indicating that a spring occurred in the cave. Two carbonate concretions occur: the older, overlaying sediments with fresh water molluscs has been 230Th/234U dated at 32 kyr; the younger, which formed after the deposition of the layer B, incorporated a wild ass bone dated at 21-23 kyr by a AMS 14C analysis. The east side of the trench is mostly sterile due to the taphonomical processes involving the reaction between bat guano and clays. This reaction formed an acidic environment, causing bone dissolution and the production of abundant phosphate whitish-yellowish nodules.

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