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In copertina: "Morpho-Bathymetry of the Mediterranean Sea", CIESM, Ifremer Special Publication, France. 1/3.000000 scale map.

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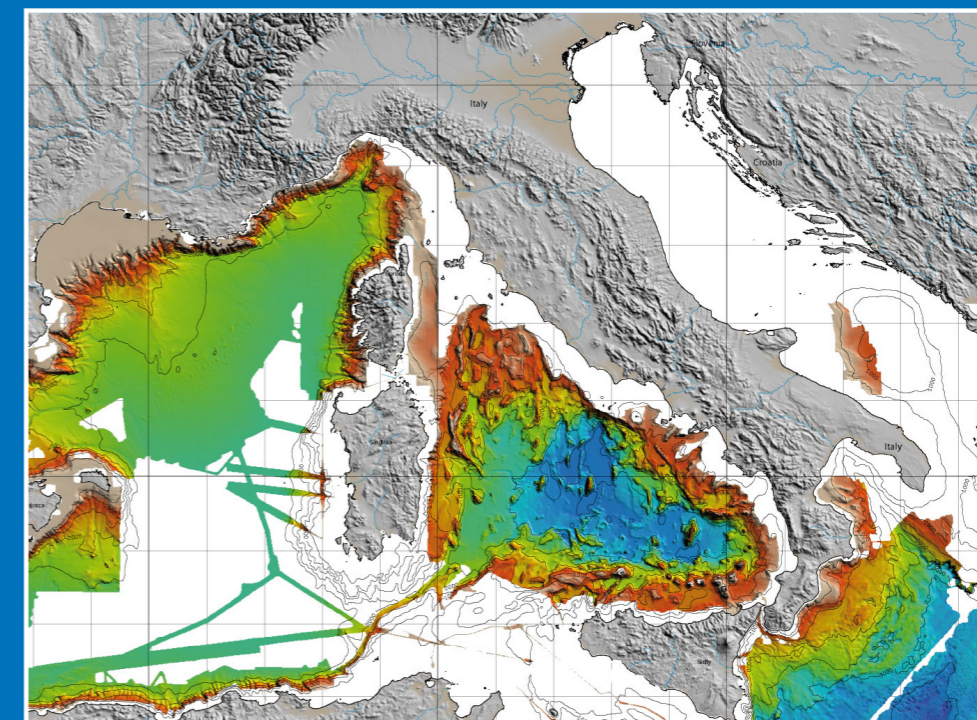
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NOTE BREVI E RIASSUNTI

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Pozzo Cucù cave (Castellana-Grotte, Apulia): karst researches and considerations on the karst disturbance

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Key words: *karst, speleology, cave deposits, disturbance, Apulia.*

INTRODUCTION

The karst system of Pozzo Cucù, located in the Low Murge sub-karst sector of Apulia, is one of the most valuable caves of the region. Identified with the number PU 1200 in the regional register of natural caves, managed by the Apulian Speleological Federation (FSP, website <http://www.fspuglia.it/>) it is only 1,5 km distant from the Castellana show cave (PU 8), the longest and most famous cave of Apulia (PARISE, 2011a). Pozzo Cucù cave was discovered in late 1980, during the foundation works for a building at the northern outskirts of town: the works brought to light a small shaft, 7-m deep, that initially seemed to show no further continuation. However, in the course of the first days of exploration, a passage was identified, thanks to air current, and it was thus possible to enter the real cave system, after another jump through a 8-m deep shaft. At depth of about 20 m from the ground surface, a cave with mostly sub-horizontal development was explored. It soon appeared as one of the longest caves in Apulia, with over 1 km of development.

In the area nearby Pozzo Cucù cave, several other subsurface karst features are present: the most important is Grotta della Jena (PU 7), where many palaeontological remains were found (DELL'ERBA, 1881), including a hyaena skull. Then, Grave Gentile (PU 11) is a 35-m deep vertical shaft, whilst the Inghiottoio of Chiancofreddo (PU 806) is no more accessible since it was object of man-made infilling several years ago.

POZZO CUCU' KARST SYSTEM

The karst system of Pozzo Cucù consists of two main branches, respectively directed toward the SE and the NW. In

addition, other rooms and passages (named Cavern of the Great Column), are present only a few meters from the main cave. No direct connection has been found so far between the two parts of the system. The SE branch, that is the longest, is characterized by large caverns, which size mostly derives from frequent instability phenomena, as shown by the widespread breakdown deposits marking the cave floors. These deposits mask for most of the development the real pavement of the cave, located some meters below. The terminal part of the SE branch is characterized, before the very final sectors consisting of low and narrow conduits, by one of the largest cavern in the system, the Bones Hall.

The NW branch, on the other hand, presents several low passages, corresponding to past phreatic conduits developed along the sub-horizontal bedding of the limestones (Fig. 1), with intervening wider rooms. At the terminal north-western part of



Fig. 1 – View of one of the low passages that characterize the NW branch (photo courtesy of V. Martimucci).

the system, landslide deposits stop any further continuation, at some tens of meters from the site of Grotta della Jena.

Besides being accounted in the first-rank group of caves in Apulia due to its length, Pozzo Cucù system presents a great variety of underground karst features. Further, the cave has great importance also as concerns paleontological remains, mineralogy, biospeleology, and cave sediments.

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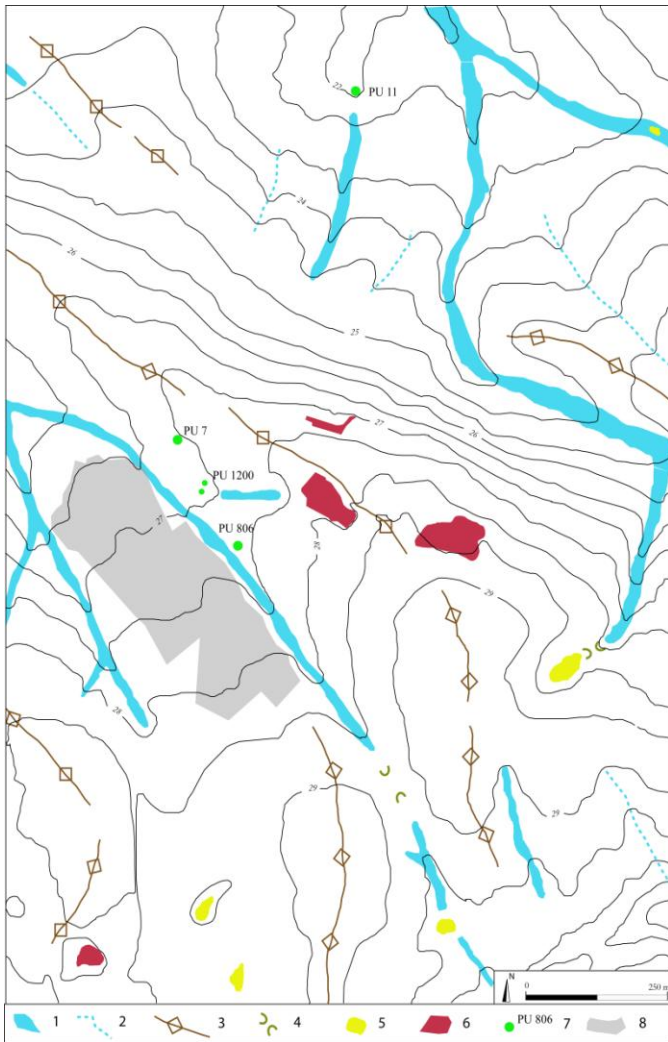


Fig. 2 – Geomorphological map of the Pozzo Cucù area, showing also the other caves mentioned in the text. Key: 1) karst valleys (*lame*); 2) temporary water lines; 3) ridge; 4) morphologic saddle; 5) doline; 6) quarry; 7) cave entrance; 8) urban area.

At Pozzo Cucù, several features have been identified as possibly relating some parts of the karst system to hypogene caves (PARISE, 2011b): ceiling pockets, locally developed along fractures, and cupola-form solution pockets at the ceiling.

The Pozzo Cucù karst system is located in a sector of Low Murge showing many surface karst features (Fig. 2), including dolines and slight karst valleys (locally called *lame*, see PARISE *et alii*, 2003). These latter become interested by surface runoff on the occasion of the main rainfall events, remaining otherwise dry for the rest of the time. As in the rest of Apulia, an almost entirely karst region characterized by outcrops of carbonate rocks, water infiltrates underground at the many swallow holes and dolines, as well as through the network of discontinuities in the carbonate rock mass.

This sector of Low Murge is very rich in paleontological remains, both found in caves and at surface excavations. At this regard, the Pozzo Cucù karst system shows several interesting

sites, among which the most remarkable is the debris cone in the Bones Hall, at the terminal part of the SE branch. At this point, a natural access to the cave had to be located, that was later on closed by arrival of large amount of rock debris, including many bones and paleontological remains. Most of these are now covered by calcite deposits and flowstones, but still recognizable within the debris cone. Other paleontological remains are distributed in other sites of the karst system, and in particular close to the main entrance. In the first sector of the SE branch, as a matter of fact, a complete skeleton has been found, identified as a wild cat (MONTENEGRO *et alii*, 2005). The paleontological remains at Pozzo Cucù, together with those from Grotta della Jena, as well as from other sites in the Low Murge, represent a good piece of data for performing a reconstruction of the palaeoclimate of this sector of Apulia in the last epochs.

At this regard, further elements of interest derive from analysis of speleothems and deposits contained within the cave. In particular, at many points of the SE branch it is possible to observe black sediments (Fig. 3) covered by an alabaster crust. The first studies carried out by FORTI *et alii* (1985), and more recently confirmed by MONTENEGRO *et alii* (2002), have shown by means of chemical and mineralogical analyses on the two levels under the crust the presence of clay minerals (caolinite, illite, and muscovite), and oxides of iron, manganese and titanium.



Fig. 3 – Close-up view of the pockets within the carbonate strata, containing the black sediments in the SE branch of the Pozzo Cucù karst system.

The main phases of cave development have been inferred from these mineralogical analyses, integrated by observations on the underground morphologies of the cave (FORTI *et alii*, 1985): after formation of the cave, when circulation of aggressive water led to enlargement of the system, waters infiltrating from the surface were capable to mobilize Fe and Mn from the soil; once in the cave environment, they lost their aggressiveness allowing the deposition of Fe and Mn hydroxides. Then, formation of the crust above the clay deposits was related to alkaline waters, followed by infilling of the cave by clays and silts. Later on, a partial emptying of the cave system by flowing rivers occurred, that favored also the development of the second, deeper level of

cave formation, consisting of narrow and decorated passages separated by breakdown deposits (Fig. 4).



Fig. 4 – SE branch of the system, showing in the foreground breakdown deposits (see also the shape left by the rock failures on the cave ceiling).

BIOSPELEOLOGY

Since discovery of the system, the first scientific researches performed at Pozzo Cucù concerned biospeleology. The presence of several species, including the Orthoptera *Troglophilus andreinii* and some Coleoptera as *Italodytes stammeri* and *Batrisodes oculatus* (DE MARZO & VIT, 1982; DE MARZO, 1989) was soon proved. Due to these discoveries, the cave was declared in 1995 a Site of Interest for the European Community (SIC, site code IT9120010). It has to be noted that, following the intense phase of biospeleological research in the years after discovery of the cave, very few further efforts in this field have been carried out later on.

ENVIRONMENTAL CONSIDERATIONS

As typical of the karst settings, where a direct link exists between the surface and the subsurface environments, any action performed at the surface may have serious environmental consequences for the underground karst ecosystem. At Pozzo Cucù, over the last decades many negative episodes were registered, even though the site is included in the list of protected sites of the European Community, as before recalled.

Implementation of the recently proposed Karst Disturbance Index (VAN BEYNEN & TOWNSEND, 2005) at the Castellana-Grotte area resulted in values of 0.57 (CALÒ & PARISE, 2006), corresponding to the upper range of the “Disturbed” class. This is also in accordance with more general data about Apulia, which shows a level of “Significant disturbance” to the karst environment, according to revision of the first version of

classification by NORTH *et alii*, (2009). These outcomes are mostly due to absence of real enforcement of the existing laws and regulations in the region, combined with lack of an environmental awareness, which have brought to an overall very low degree of protection of the karst settings, and the consequent high levels of disturbance exerted by man on the natural landscape.

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