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WHERE HISTORY MEETS FUTURE



Edited by
Michal Filippi
Pavel Bosák

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Czech Republic, Brno

July 21–28, 2013

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Cover photos (some photos were adjusted/cropped)

Top left – José Bidegain, on his way for the recovery Marcel Loubens' body. Author unknown. For details see the paper by A.A. Cigna.

Top right – "Walking Mammoth" – a prehistoric drawing from the Kapova Cave, Russia. Photo by O. Minnikov. For details see the paper by Y. Lyakhnitsky et al.

Bottom left – "Astronaut" David Saint-Jacques (CSA) collecting microbiological samples for the scientific programme of the ESA CAVES course. Photo by V. Crobu. For details see the paper by Bessone et al.

Bottom right – The long-legged cave centipede *Thereuopoda longicornis* – a typical species of Lao caves. Photo by H. Steiner. For details see the paper by H. Steiner.

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THE ALBURNI MASSIF, THE MOST IMPORTANT KARST AREA OF SOUTHERN ITALY: HISTORY OF CAVE EXPLORATION AND RECENT DEVELOPMENTS

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The Alburni Massif (Campania, southern Italy) is a karst mountain extremely rich in caves and other karst landforms, situated between the valleys of the rivers Calore and Tanagro. After some initial activities at the turn between the 19th and 20th centuries, systematic speleological explorations were carried out in the early 50s by the Commissione Grotte “Eugenio Boegan”. During the following decades, the push toward further explorations reduced, until, in the late ‘80s the will to explore together gave life to AIRES, an association joining cavers from many different grottos. The main outcome of this co-operation was a book, entirely dedicated to the Alburni caves, which is still today the most important reference to study the area. In the 90’s, the activities went on, even though not within the framework of a co-operated action. Nevertheless, several important exploration results were obtained. Recently, it was again decided to make a joint effort in order to better plan and carry out research in the Alburni; thus, the Alburni Exploration Team was born, and since 2009 all the activities in the area are duly coordinated, and the news about any discovery is shared with all the interested cavers in real time, also by means of a dedicated website. The present article describes briefly the history of explorations in the Alburni Massif, following the main phases of research, and then focusing on the activities carried out in the last years. Aims of the paper are to present to an international audience the potentials of this karst area, to attract the interest of other cavers, and disseminate the information about karst and caves of Alburni to the local population, as a fundamental step toward protection and safeguarding of this precious natural environment.

1. Introduction

The Alburni Massif (Fig. 1) is located in the Apennine Chain of Italy (Campania region), and represents the most significant karst area of Southern Italy. The name Alburni takes its root from a word meaning white, due to the main color characterizing the area, related to exposure of the carbonate rocks. The massif has been the object of several cave expeditions, due to a great variety of karst landforms, including some hundreds of caves. After a period of relative still in the exploring activities, in recent years a new phase was started, thanks to the re-established co-operation among the main grottos working in the area.

This article describes the history of the main phases of caving research and exploration in the Alburni Massif, aimed at highlighting the importance of this karst area,

and to show the many potentialities it has for further developments; following a geological and morphological introduction to the area, the main activities carried out during the years will be described, and the new (still ongoing) research mentioned, before concluding the article with future perspectives for caving activity in the area.

2. Geological and morphological setting

The Alburni Massif is in the heart of the Cilento and Vallo di Diano National Park, between the valleys of the rivers Calore and Tanagro, and represents a karst ridge extremely rich in dolines, ponors, caves, and swallow holes. The karst nature of the area is illustrated by the presence of over 400 caves explored so far (Table 1). Among these, the most



Figure 1. The Alburni Massif seen from NW (photo: F. Maurano).

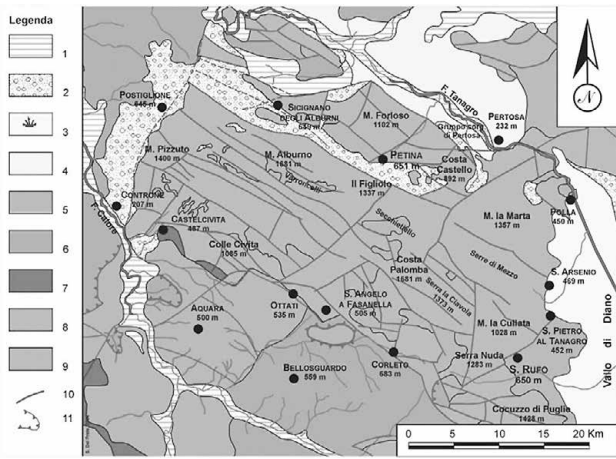


Figure 2. Geological sketch of the study area. Key: 1) alluvial deposits; 2) debris; 3) lacustrine deposits; 4) conglomerates (Pliocene); 5) marly limestones and quartz sandstones; 6) varicoloured clays; 7) limestones and marls; 8) Mesozoic limestones; 9) dolostones and dolomitic limestones (Upper Triassic – Jurassic); 10) fault; 11) overthrust.

famous are represented by the show caves of Castelcivita, the longest in Southern Italy with a total length of 5.4 km, and of Pertosa, about 3 km long (Parise 2011). Covering a total area of about 280 square kilometers, the massif is one of the many carbonate ridges of Southern Italy, mostly consisting of limestones and dolomitic limestones of Mesozoic age, originated in carbonate platform environments. Karst features are mostly concentrated within the Cretaceous sequence, with overall thickness over one thousand meters. Apart from the Mesozoic deposits, more recent, Miocene terrigenous formations can be found laterally to the limestones along the sides of the massif, and as filling materials within structural basins developed at the highplain.

Table 1. Main caves in the Alburni Massif. The star in the last column indicates spatial development of the cave.

Cadastral no.	Name (m)	Depth (m)	Development (m)
Cp 94	Fumo	443	1,590
Cp 255	Gentili	437	2,036 *
Cp 472	Piani S. Maria III	422	1,850
Cp 1406	Campo	403	1,542 *
Cp 244	Gatti I	402	657
Cp 253	Vitelli	385	1,800
Cp 487	Ossa	291	250
Cp 92	Madonna del Monte	288	435
Cp 671	Confine II	266	461
Cp 93	Melicupolo	259	154
Cp 86	Piani S. Maria I	253	755

As concerns the geomorphological setting, the Alburni Massif can be described as a monoclinical structure gently dipping to the SW; delimited by fault scarps (main systems N 030°, N 070°, and N 120°), the massif shows a summit plateau, developed in elevation between 1,000 and 1,500 m a.s.l., where many closed basins of karst origin can be identified. A great variety of surface and subterranean karst landforms has developed in the area, and represents the main character of this mountain.

Basal springs are distributed at the SW and NE sides, with mean discharges ranging from 3 to 7 m³/sec (Celico 1979).

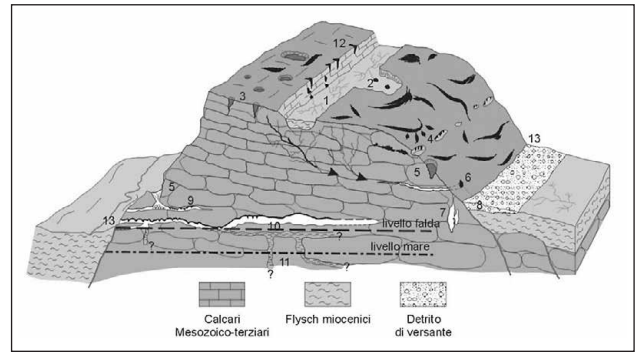


Figure 3. Morphological sketch of the Alburni Massif (after Santangelo and Santo, 1997). Key: 1) swallow holes along fault walls; 2) swallow holes in valleys; 3) surface solution shaft; 4) intrastratal caves; 5) collapse sinkhole; 6) spring; 7) inverse erosion shaft; 8) cave due to lateral spreading; 9) fossil hanging phreatic conduits; 10) phreatic conduits related to the present water table; 11) water table karst conduits; 12) vertical shaft along fracture; 13) basal spring.

Location of these springs between elevation from 260 to 70 m a.s.l. shows that the overall thickness of potentially karstifiable limestones exceeds one thousand meters (Santangelo and Santo 1997).

In addition to classical karst caves in the Mesozoic limestones, it has to be pointed out that different types of caves can be observed, which also include those produced by landslides in the slope breccias deposits (“lateral spreading caves” according to Santangelo and Santo 1997).

Several caves open in correspondence of swallow holes, as described by Santangelo and Santo (1997): vertical inputs from perforated overlying beds, and lateral inputs from adjacent impervious rocks (contact ponors), represented by the clays of the Miocene flysch formations. As concerns the morphological position of the swallow holes, these are mostly located along fault scarps or at the lowest points of endorheic valleys and basins.

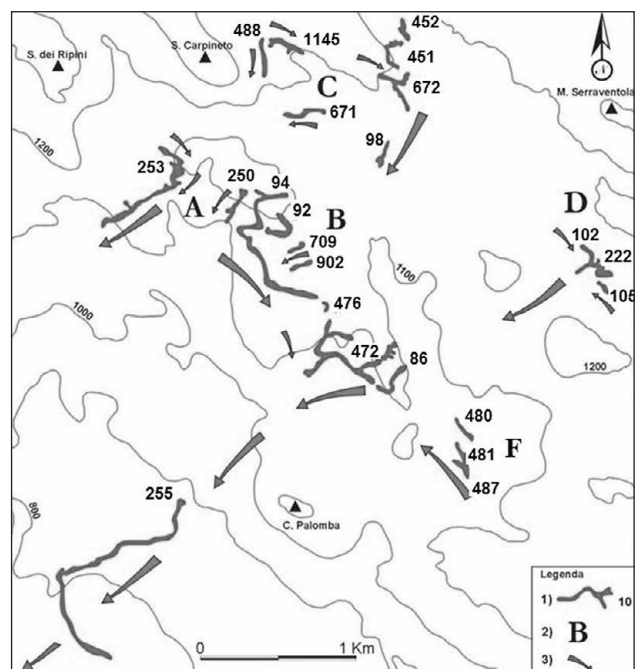


Figure 4. Network of the main karst systems in the central sector of Alburni. Key to symbols: 1) caves (numbers indicate the entry in the Campania register); 2) main endorheic basins (see Table 2); 3) underground flow direction, by cave explorations and tracing tests.

Progressive development of erosional processes in many cases caused the downward migration of the input sites, which resulted in the presence of both inactive (the oldest and highest) and active (the youngest and topographically lowest) ponors. There is an overall dependence of the size of ponors (and the related subterranean karst systems as well) with that of the feeding catchments: the dimensions of the inactive ponors are larger than those of the active ones, which should derive from wider areas collecting water and transporting it toward the input points.

entered 300 m into the cave. They were not able to find their way out, and were rescued only eight days later. One of the brothers died soon after, and the other went insane.

The Castelcivita karst system became a show cave in 1930, and two years later also at Pertosa the cave was opened to the public. At this latter site, however, the first lighting system was installed only 30 years later, due to a dispute between the municipalities of Pertosa and Auletta (Russo et al. 2005; Parise 2011).

Table 2. List of the main caves in the central sector of Alburni Massif (shown in Figure 4), and their main characteristics. In the last column, the first letter indicates position of the cave access at the valley bottom (v) or along a faults scarp (f), and the second (in upper case) the endorheic basins, as shown in Figure 4.

Cave no.	Cave	Length (m)	Depth (m)	Catchment basin (km ²)	Activity	Location (see Fig. 4)
Cp 253	Vitelli	1,800	385	-	inactive	f in A
Cp 92	Madonna del Monte	435	288	0.12	active	f in A
Cp 250	Fra' Gentile	335	232	-	inactive	f in A
Cp 94	Fumo	1,590	443	1.14	active	f in A
Cp 709	R. Lombardi	108	147	-	inactive	f in A
Cp 86	Piani S. Maria I	755	253	0.25	active	f in B
Cp 472	Piani S. Maria III	1,850	422	0.81	active	f in B
Cp 476	Gravaccine	54	51	0.37	inactive	f in B
Cp 902	Stretta	235	113	-	inactive	f in B
Cp 451	La Pila I	700	122	0.34	active	v in C
Cp 452	La Pila II	265	153	0.37	active	v in C
Cp 672	Inverno	1,420	201	-	inactive	f in C
Cp 488	S. Carpineto	500	117	0.23	active	f in C
Cp 1145	Cavaggione	300	226	-	inactive	f in C
Cp 98	Confine I	240	216	0.44	active	f in C
Cp 671	Confine II	461	266	-	inactive	f in C
Cp 102	Parchitiello I	565	205	0.25	active	v in D
Cp 222	Parchitiello II	4	7	-	inactive	v in D
Cp 105	T. Aresta	144	116	-	inactive	v in D
Cp 480	Varroncelli I	160	118	0.27	active	f in F
Cp 481	Varroncelli	100	127	-	inactive	f in F
Cp 487	Ossa	250	291	-	inactive	f in F
Cp 255	Gentili	2,036	437	1.03	active	

Karst appears to be controlled by a combination of lithological and structural features, starting from the local structural setting and the relationship between bedding and water flow direction (Fig. 4).

3. History of explorations

3.1. Man and the caves in the Alburni Massif

Even though with less remains than those found in many other caves located near the coasts of Campania, some Alburni caves testify to the frequentation by man since Paleolithic times (Pellegrini and Piperno 2005). This in particular occurred for the most accessible sites, located at the foothills of the massif, and/or close to water sources.

Apart from the prehistoric frequentations, as concerns the main topic of this article, that is caving explorations, the pioneering activity actually began during the 19th century, and had a tragic end (Boegan and Anelli 1930): in 1889, two brothers from a nearby town entered the Castelcivita cave using oil lamps to explore the system, still unknown at that time. Carbon dioxide from a lateral branch of the cave system extinguished the lamps after the two had

3.2. Beginning of the caving activities

At the beginning of the 1920's, the Commissione Grotte "Eugenio Boegan" from Trieste, the oldest grotto in Italy, began its caving activity in the Alburni Massif. Since that time, with an increasing pace in the 50's and 70's, the explorations were carried out systematically, producing remarkable results in terms of numbers of explored caves. The surveys were published in several articles. These provided the first documents showing the remarkable features of the Alburni Massif, and the exploration potentials of the area (Vianello 1965). Thus, many other cavers from different parts of Italy became to be interested to cover this area in their activities.

In 1950, the Gruppo Speleologico CAI Napoli began to work in the area, especially carrying out scuba diving explorations. The above mentioned grottos were followed later on by Circolo Speleologico Meridionale and, in the years 1960–70s, by other grottos from Latium: namely, Circolo Speleologico Romano and Speleo Club Roma. In the late '80s, after some years of minor activity, the change to new exploration techniques led to abandonment of cable ladders. Nylon ropes and new, more reliable and lightweight

gear allowed to carry out better explorations within the abysses of the Alburni Massif.

Three grottos (Gruppo Speleologico Martinese, Gruppo Speleologico Dauno and Gruppo Speleologico CAI Napoli) were the most active at that time and began to co-operate during the explorations. At the same time, they also produced a survey register, where all the informations about the outcomes of each survey were recorded. Toward the end of the '80s, to stress the joint will to explore together, AIRES was born, as an association covering different grottos and aimed at obtaining the best from joint explorations and researches. In this way, the Alburni Massif became an important meeting point for all Italian cavers.

The main outcome of this crucial period in the exploration history of the area is the book "Alburni Mountains – speleological researches" (Bellucci et al. 1995). It is still today the main reference for anybody interested in exploring the Alburni caves. During the middle '90s further cavers are attracted to the Alburni. As a consequence, new results are obtained in caves such as Grava del Casone Vecchio, Auletta, Piani di S. Maria, and Grava d'Inverno. In the time period 1994–96, systematic explorations were carried out in branches of Grava II dei Gatti, and the overall cave topography increased three times (from 500 to 1,500 m of development).

In 1997, at Grava del Casone a 140-m deep shaft was found and explored and new ways of continuation in the karst system were hypothesized. Unfortunately the following exploration camps were not able to produce significant results. During the 1998 summer camp, remains of a cave bear were found at the grotta Milano; the remains were later recovered in November 2005 in collaboration with the Earth Sciences Department of "Federico II" University in Naples (Meloro 2007).

During the 2001 summer camp the Piani di Santa Maria karst complex was examined, and previously known caves were connected (Proietto and Buongiorno 2001). In two years (2002–2003) exploration activities performed mostly in winter times were carried out at Grava dell'Auletta by cavers from Campania, Apulia, Molise, Latium and Umbria; the exploration efforts allowed to double the original depth of the cave (Buongiorno 2003; Russo et al. 2003). New caves have been found in the meanwhile (2005) in the massif, adding further data and information to the overall development of karst in the area: Grava di Cesare (23 m deep) and Grava di Matteo (85 m deep).

3.3. Scuba diving explorations

Notwithstanding the huge karst potential in the Alburni Massif, scuba diving explorations have been limited so far to a quite small number of caves. This because many sumps end in lakes of small size, with unpassable narrow conduits, or water flow moving within passages with gravel and sand deposits. At this regard, we recall here the dives at Serra Carpineto and at Falco, carried out between the end of the '80s and the early '90s by GS Neretino.

Most of the scuba diving explorations, on the other hand, were interested in the sprints located at the massif foothills:

Old Mill and Ausino in the Castelcivita territory, and Auso at S. Angelo a Fasanella. At Castelcivita the first attempts date back to the '60s, but only in the following decade the research became systematic, thanks to the efforts by CAI Napoli. A tragic event, however, marked the beginning of a still period, when in 1973 three divers (Giulio de Julio Garbrecht, Giandavide Follaca and Sergio Peruzzy) lost their lives at the Old Mill resurgence. After this tragedy, the scuba diving activity by CAI Napoli re-started only in 2005. Nevertheless, some activity was produced by other divers from different parts of Italy: in the early '90s a group from Foligno succeeded to link Castelcivita and Ausino caves. In about the same years, M. Bollati, L. Casati and J.J. Bollanz brought the Old Mill explorations to a depth of 117 m, with an overall development of 450 m. In 2001 the activity went ahead, again thanks to L. Casati and Z. Zenkak, who were able to increase the development of the explored cave to 550 m, with a branch rising upward to -85 m.

Explorations at the Auso started in the '90s and had no significant outcomes initially. This was due to the impossibility to open a passage in the slide deposits in the main basin. During the same years, the lucky discovery by GS Martinese of an inclined phreatic conduit ending with a 10m-deep shaft flooded at its bottom (Lo Mastro, 2010) has to be noted. A preliminary inspection, carried out without the use of tanks, resulted in the identification of a large passage, with an estimated length of some 30 m. In 1993 R. Onorato and in 1994 M. Diana explored the passage and, through a large room, came out in another air-filled cavern leading back to the slide deposits in the basin. The last explorations are dated 1998, when a team composed of M. Diana, R. Malatesta and G. Caramanna, entering the new passage identified in 1994, surveyed about 200 m of air passage, and found a new submerged gallery of about 30 m, that remained unexplored so far.

3.4. The Alburni Exploration Team (AET)

During a national cave meeting in 2008, the idea of joining again the efforts was shared by cavers from Apulia and Campania. Immediately after, it was decided to give life to the Alburni Exploration Team (AET) as a natural follow-up of AIRES. An important point was the will to directly involve the local populations, both to disseminate the results reached and to add further value (that is, the karst caves) to this territory, very rich of natural beauties.



Figure 5. Grava d'Inverno: the meanders in the newly explored sectors (photo: F. Maurano).

The main explorations carried out in the last years by AET are those at Grava d'Inverno, Grava del Campo, Grava dei Vitelli, and Grotta del Vento.

Tens of cavers have worked in the time period 2006–2008 at Grava d'Inverno, carrying out an exploration that, even though mostly sub-horizontal, had several degrees of difficulties due to the many narrow passages, the presence of mud, and several areas with breakdown deposits. Nevertheless, the final outcome resulted in greatly extending the known development of the cave, reaching 201 m of depth, and a length of over 1.4 km, which makes Grava d'Inverno one of the longest caves in the massif (Maurano et al. 2009).

Grava del Campo was one of the many swallow holes clogged by sediments at its bottom; however, a small climb allowed in August 2008 to find a narrow meander through which, after a number of steps, a further winding sector, with sharp bends, was reached. The difficulties to move in that part of the cave were overcome by the evidence of further voids ahead, testified by the strong air current. Thus, after much work to widen the passage, at the end of the summer 2009 a caver went through and explored alone the two successive shafts beyond the narrow passage. Continuing the exploration later resulted in finding alternating shafts and horizontal passages, until the final meander, ending in a sump at the depth of 403 m, was reached. Grava del Campo represents today the fourth deepest cave in Campania, and is over 1.5 km long.

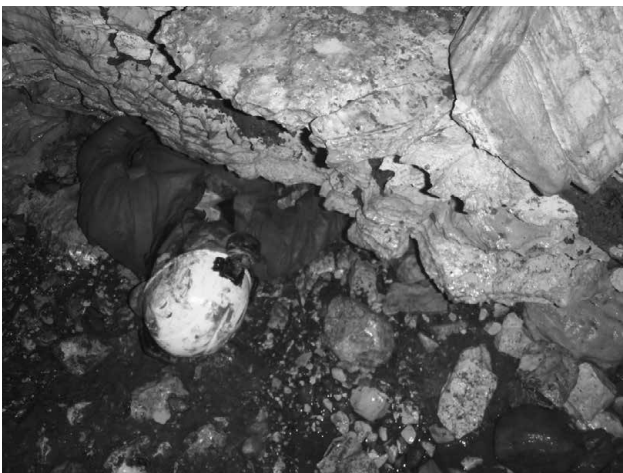


Figure 6. Grava del Campo: coming out from one of the narrow passages (photo: G. Pinto).

Grava dei Vitelli was discovered in 1962 by CGEB and was later object (1987–1990) of explorations that brought its development to 1,880 m, with depth of 385 m (Bellucci et al. 1995). In 2009, at a depth of 270 m, some cavers have performed a 30-m high climb, finding new spaces consisting of meanders and conduits alternating with small rooms with breakdown deposits and some shafts. After some 500 mt of development, for a difference in elevation of +100 m, cavers are today blocked by an intermittent sump. During the explorations, a remnant of a red deer antler was found.

Starting from field observations and analysis of the main caves in the area, in the last years GS Martinese has worked in the sector of the massif where three of the most important caves (Madonna del Monte, Fra' Gentile, and Fumo) are

located. The three caves are likely parts of a single karst system and should connect to a basal underground river, so far never reached. With such an aim, detailed surveys allowed in 2010 to identify an important fault, and a work of identification and mapping of the dolines in the area brought to discover what seemed a fossil cave: 30-m deep, it ended clogged by mud and sediments, but with an open crack on one side, from which a very strong air current came out that gave the cave its name: Grotta del Vento (Wind Cave). The obstacle was finally removed with much work, reaching new underground void. From there a narrow passage (passed after many days of hard work), led to a tectonically-controlled shaft that was estimated to be about 150 m deep. At around half of its depth, the shaft is divided in two sectors by a wide rock terrace; this passage allows, on one side, to connect to Grava del Fumo, in a 100 m-deep shaft (Fig. 7). Thus, Wind Cave is the fossil sector of the same system of Grava del Fumo.

As demonstrated, even though this area has always been one of the most frequented by cavers, further possibilities of explorations still exist, and hopefully will result in the future to discover and understand the functioning of the hydrologic system of the Alburni Massif.

4. Conclusions

The Alburni Massif is without any doubt one of the most remarkable karst areas of Italy and has been too often underestimated in the past, in terms of its karst potential. The history of speleology briefly described in this paper documents that the activities carried out in the area have often had no continuity, with many efforts produced individually by small groups of cavers. On the other hand, remarkable results have been reached when carefully planning the activities (also on a sound scientific basis), and concentrating the efforts on a single cave or karst system. In this latter regard, the recent foundation of the Alburni Exploration Team and the derived will to strongly move toward a common goal, is very important and hopefully will yield other, important results in the near future.

At the same time, we would like to close this article by highlighting a very crucial aspect that so far was never been dealt with in such a manner: that is, the communication with the local population. It is aimed at disseminating the results of the caving activities, by involving as much as possible the local communities in speleological activities, and in transferring to them the importance to safeguard and protect the very peculiar and fragile environment represented by karst, both at the surface and underground, in an attempt toward living in a sustainable way in karst areas.

Acknowledgments

The researches and explorations carried out in the Alburni Massif would not have been possible without the passionate work and the fatigue of many cavers from different parts of Italy that over the years made it possible to reach the results described here. We warmly dedicate the present article to all of them.

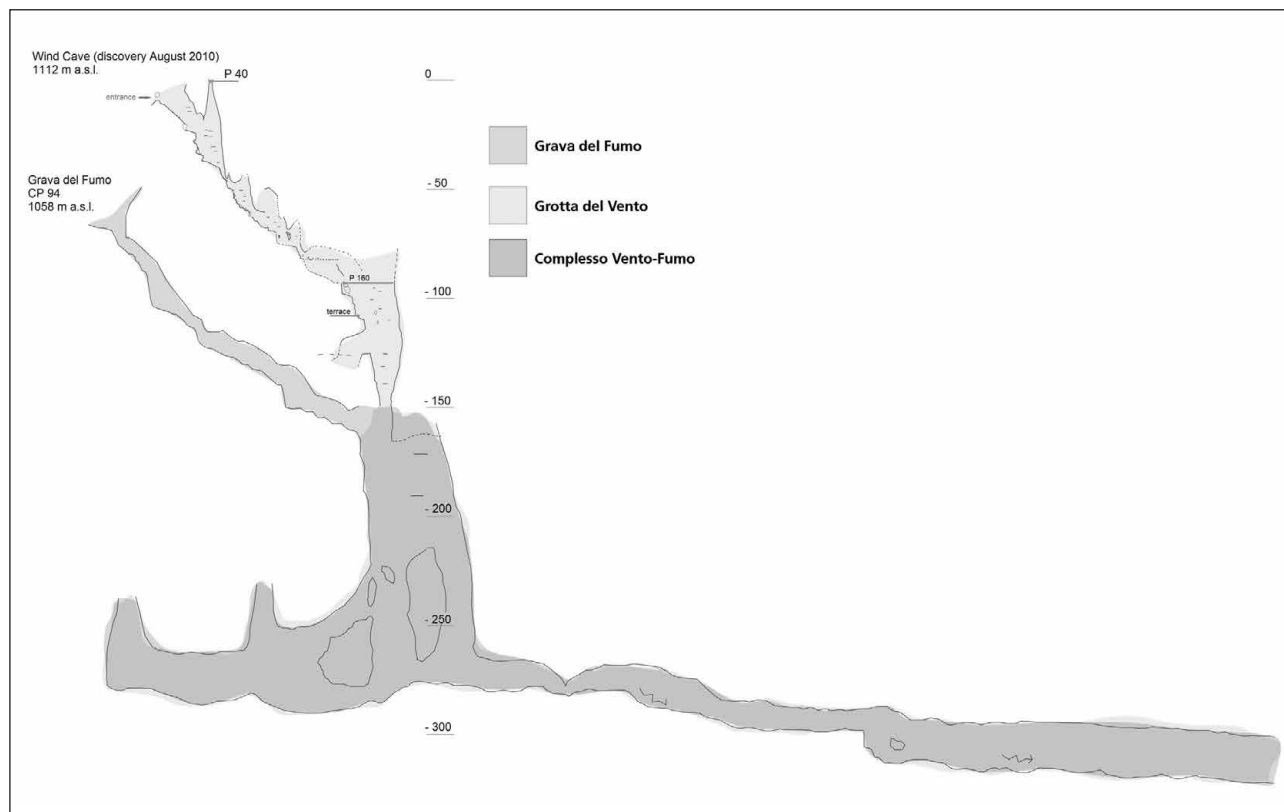


Figure 7. The system Grava del Fumo – Grotta del Vento, that now is the deepest karst cave in Campania (-443 m). Drawing: O. Lacarbonara.

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