

The background image is a photograph of a cave interior. It features a pool of dark water in the foreground, reflecting the blue light. The cave walls are made of rough, brownish rock. A bright blue light source is visible in the distance, illuminating the cave walls and the water. The overall atmosphere is mysterious and underground.

Underground treasures ***discovering the Pertosa-Auletta Caves***

Simona Cafaro and Sergio Bravi

MIda Ambiente book series

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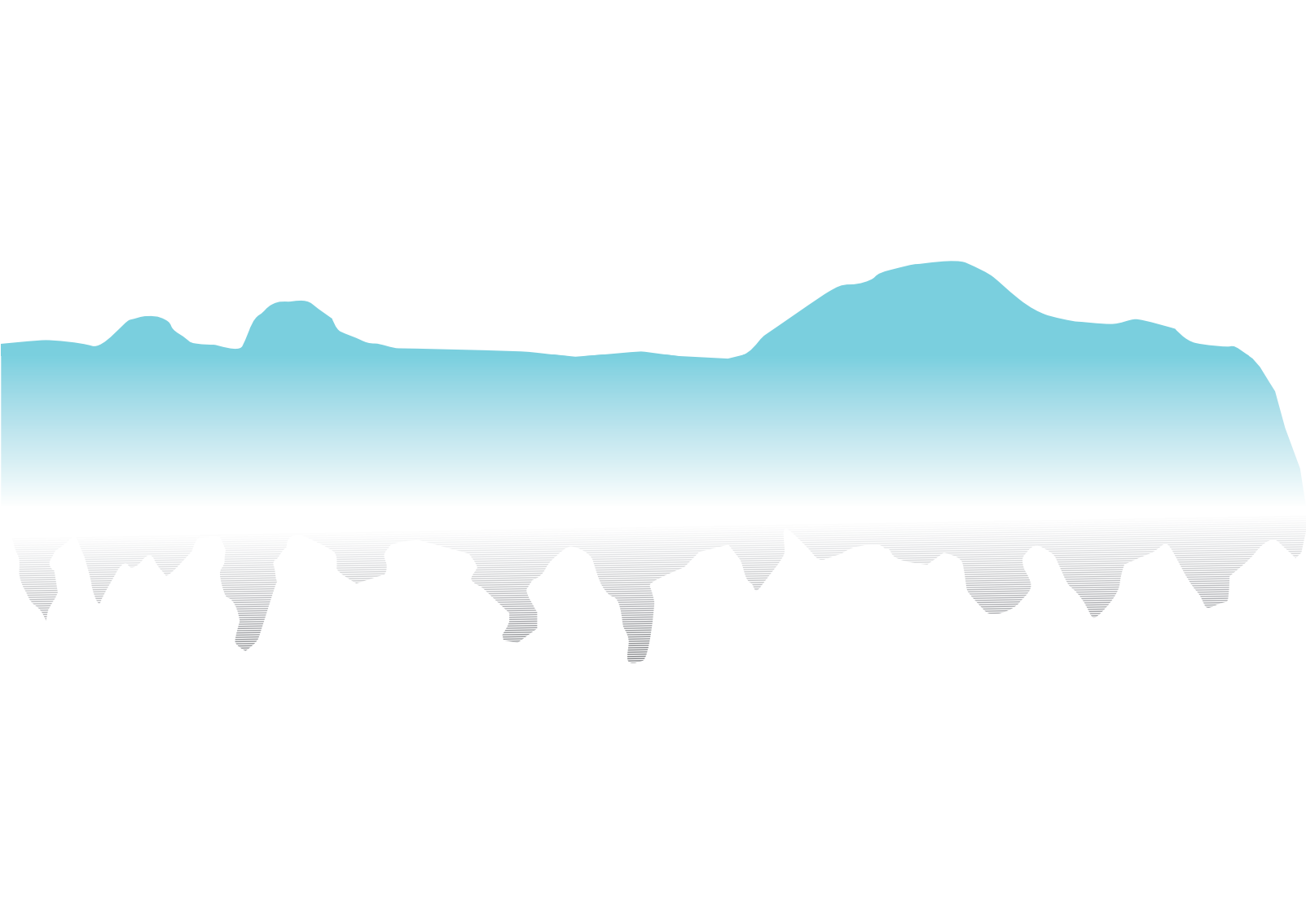
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Preface

A Geopark is a territory which includes a particular geological heritage and a sustainable territorial development strategy. A European Geopark must comprise a certain number of geological sites of particular importance in terms of their scientific quality, rarity, aesthetic appeal or educational value. The majority of sites present on the territory of a European Geopark must be part of the geological heritage, but their interest may also be archaeological, ecological, historical or cultural.

The Cilento Geopark lies in southern Italy within the province of Salerno and extends from the Tyrrhenian coast to the mountains of Lucania for 181.048 hectares. The territory is characterized by a twofold geological nature:

- the system of carbonate massifs with their karst activity and landforms
- the Cilento Flysch system, where terrigenous clastic deposits (conglomerates, sandstones, marls and clays) are mainly modeled by stream erosion and slope processes.

Soils formed *in situ* especially on the conglomerates or on sediments transported by wind and by water in the other areas, host a wealth of ecosystems in reliefs and valleys. This Geodiversity is therefore matched by a remarkable diversity in landscapes and ecosystems, with unique emergencies of naturalistic value, and endemisms (plant or animal species exclusively found in limited areas). The system of reliefs, valleys and waterways and their dynamics are also linked to an extreme diversity in history, culture and anthropic activities such as agriculture, industries and crafts. The Pertosa-Auletta caves: a focal geosite. The definition of Geopark involves the development of geotourism, therefore in the Cilento Geopark the Pertosa-Auletta caves have been identified as a focal geosite due to the long-dating management of the site for geotourism and linked activities in education and development of a local economy based on quality agriculture and preservation of heritage. Within this context an integrated project on environmental education has been set up by MIdA, the geosite manager, through the development of ateliers and book series on the geosite and Karst systems, and on natural and managed resources of the whole

Geopark with their traditional uses. The project targets geotourists visiting the geosite, students and the local community. The idea is to reinforce the identity of the local community, to increase awareness on the links between geo-heritage, natural resources and intangible heritage, and to promote a more dynamic approach to understanding the whole ecosystem's functions not only as a part of conservation but also as a tool for developing sustainable activities. This guide linking karst and paleontology, from the Pertosa-Auletta caves to the Paleontological museum of Magliano, is targeted to visitors wishing to explore some of the highlights of the Geopark and to raise their curiosity about processes behind the beauty of the show caves and the charme of fossils.

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The Cilento, Vallo di Diano and Alburni National Park is a protected natural area of about 181,000 hectares located in Campania, southern Italy. In 1998 it was included in the UNESCO World Heritage list due to the presence of archaeological sites such as Paestum and Velia, and the Certosa of Padula. In 2010 it was the first National Park of Italy to become a Geopark¹.

In this vast area elements of great value in terms of scientific quality, rarity and educational value have been recognized. Geosites² include karst landforms over a wide area of the Park, with distinctive surface and underground morphologies, such as ponors³, dolines⁴, canyons⁵ or gorges and caves⁶. Most of the sites, of course, have geological relevance, but many places bear remarkable archeological, natural, historical or cultural value. The Alburni Massif is the heart of the National Park of Cilento-Vallo di Diano-Alburni.

Bordered by the Tanagro river to the east and the Calore river to the west, with an approximately rectangular shape and an area of about 250 km², it is one of the most important karst areas in southern Italy and may be explored through a network of footpaths and trails.

The massif's rocks formed in marine depositional environments called Carbonate Platforms: vast areas of hundreds of square

kilometers, covered by shallow sea, with emerging zones in the innermost portion and with outer edges bordered by coral reefs sloping towards deep waters.

Such sedimentary rocks are formed by deposits of predominantly biogenic nature, originated from the accumulation of calcareous skeletons of organisms or by the precipitation of calcium-carbonate as a by-product of the activity of living organisms. Figure 1 shows the genesis of the platforms and the subsequent orogenesis caused by different tectonic processes: (1) billions of tiny organisms with calcareous shells, similar to many of the current forms, thrived in warm waters. Once dead, their tiny shells would fall and pile up at the bottom. (2) The shells underwent diagenesis: a series of physico-chemical processes transforming sediments in a compacted and coherent rock mass. (3) About 24 million years ago, Africa and Europe collided and peninsular Italy began to emerge from the waters. Deformed by the plate collision, limestone rocks began to fracture. The ancient sea-floor, clamped between Europe and Africa, was forced to break and overthrust reaching thicknesses of thousands of meters and heights up to about 2000 m above the sea level! (4) Once emerged from water, the fractured, dismembered and deformed rock mass became a part of the southern Apennines. For millions of years the rain water has been going through fractures in the rock, dissolving

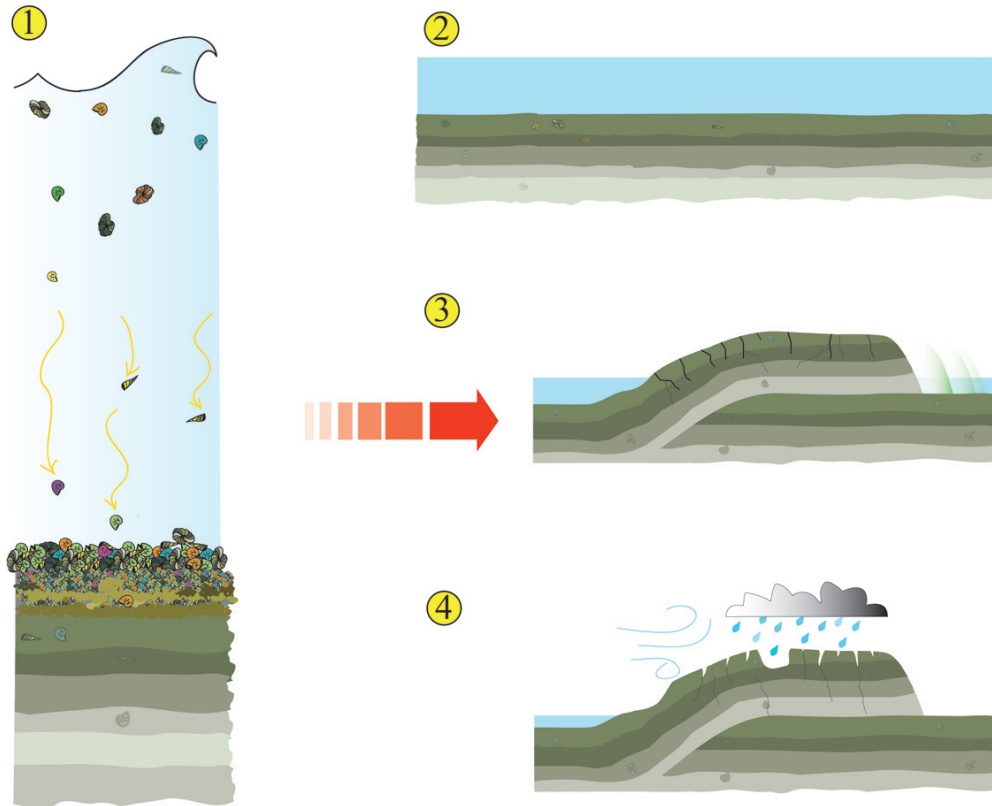


Figure 1: schematic representation of the genesis of a carbonate platform and the related orogenesis (drawing by Salvatore Lucente)

and carving them further.

The genesis and development of karst processes as important as those observed in the Alburni massif is linked to the rock origin.

Carbonate rocks are in fact highly soluble in rainwater, enriched with carbon dioxide passing through air and soil and therefore weakly acidic. The calcium carbonate is thus dissolved and the rocks are partly corroded. This way surface karst landforms called dolines or sinkholes and ponors are created on different timescales. Water seeps into the ground through such landforms and continues its work of dissolution underground. A peculiarity of karst landscapes, therefore, is the absence of surface hydrography. Waterways are created where water is channeled in typical underground fashions (diffuse⁷ or localized⁸). Such underground streams emerge at lower altitudes on the slope through resurgences⁹. The Grotte di Pertosa - Auletta site is an example of resurgence. Figure 2 shows a “section” inside a hypothetical karst massif. We observe **dolines**, **sinkholes** and **canyons** (epigean forms), and a

real system with underground **caves** (underground forms) where we can identify speleothems (chemical cave-deposits) such as stalactites (hanging from a cave roof), stalagmites (formed by upward growth from a cave floor) and columns (produced by the union of a stalactite and a stalagmite).

The name of the speleological complex “Grotte di Pertosa-Auletta” comes from the two villages where it lies. The route to the entrance of this karst cave offers a variety of landscapes. Taking the exit “Polla” on the A3 motorway, follow the tourist signals to the caves along the SS19 road.

After a series of switchbacks and an old bridge on big arches, the Campostrino gorge lies on the left side of the road.

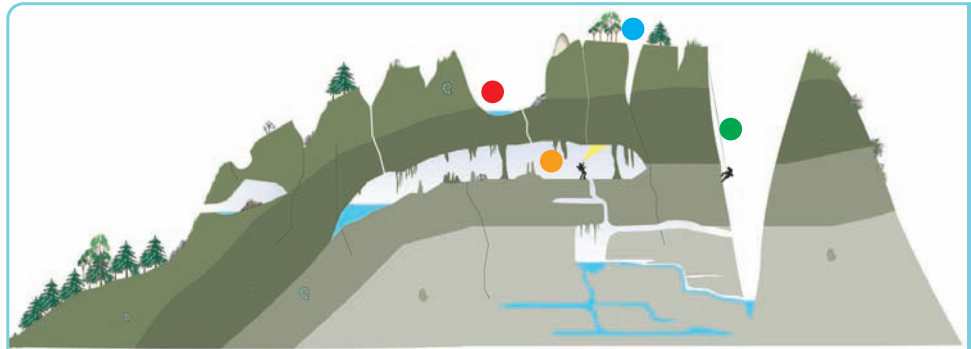


Figure 2: cross-section of a karstic massif (drawing by Salvatore Lucente)

In this gorge of considerable scenic and natural value the Tanagro river flows since the Bourbons reclaimed the valley of Polla with the creation of the Maltempo's moat. On the left of the river a remarkable phenomenon occurs during floods: a cascade activates on the slope and is visible as a white high water-fall called "Il velo della sposa" (the Bride's Veil) (Figure 3). The waterfall is one of the overflow¹⁰ points of emergence of the underground karst system. After leaving the SS19 road towards the "Grotte di Pertosa-Auletta" geosite, a second bridge crosses the Tanagro river and allows to observe the Maremanico waterfall, where the river flows out of the Campostrino gorge at two points with a drop of about 10 m, and forms a pond. Leaning over the bridge the remains of an industrial archeology site related to water are visible: on the top right an iron factory dating at the beginning of the '900 and later converted into a paper mill; further down, the ruins of a mill, already existing at the beginning of the 12th century.

Figure 3: the Bride's veil (photo by Filippo Marmo)

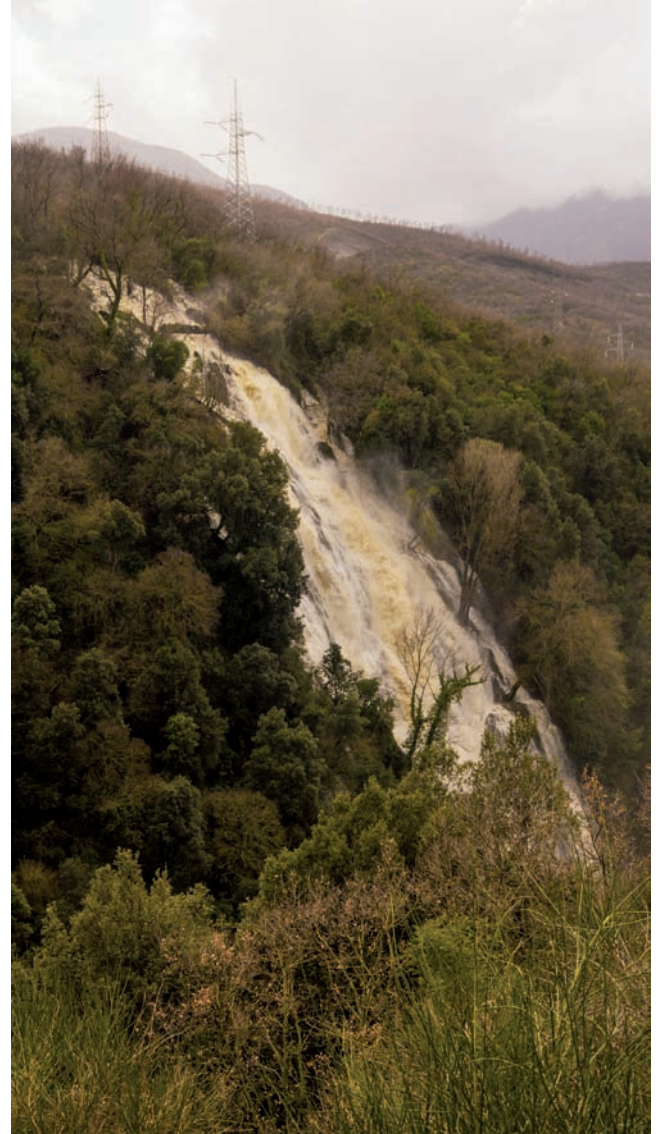




Figure 4: main entrance to the Pertosa-Auletta caves (photo by MIdA)

Pertosa-Auletta have fascinated and intrigued several travelers and explorers as reported by writers since Plinio il Vecchio in the first century AD, who mentions an alleged underground

Continuing the route to the geosite entrance, various limestone outcrops can be observed, consisting of inclined layers of variable thickness, and, looking up to the right, a gap (Figure 4) hidden by thick vegetation marks the entrance to the Grotte di Pertosa-Auletta. The Grotte di

course of river Tanagro; Leandro Alberti, visiting the cave in 1526, gives a description of its “... size and nature”. Only at the end of the 19th century, however, Giovanni Patroni and Paolo Carucci, scholars of the site, pay particular attention to the karst and the precious archaeological evidence that it hides. As a matter of fact, they unearth artifacts in clay, stone, bone and metal right from the cave entrance. Such objects testify of a human presence in the cave throughout a long period from the late prehistoric period to the Hellenistic-Roman age (Larocca, 2010). In addition, the two scientists are able to identify two overlapping layers of pile-dwelling structures present along the whole extent of the entrance of the Caves (Carucci, 1921). Today, the place of these findings is submerged by water, due to the construction of a dam for the production of electricity (Figure 5).

The first significant exploration of the Grotte di Pertosa-



Figure 5: Entrance to the karst cave, where the dam can be noticed (photo by Filippo Marmo)

Auletta occurs at the beginning of the 20th century. In 1924, the Società Meridionale Elettrica (SME - Southern Electricity Company) conducts a first survey of the karst cave for the purposes of using underground waters for hydropower, since water from both the Vallo di Diano and the North-East portion of the Alburni massif is delivered through the cave. Before the reclamation of Vallo di Diano, which once housed a large lake basin, the water infiltrated in some ponors locally named “Le Crive”, located at the foot of the Alburni massif; they apparently emerged at the Grotte di Pertosa - Auletta after an underground path of about 3 km (Carucci, 1907a; De Paola, 1939a, 1939b). In 1926 speleologists of the Cave Commission of the Julian Alpine Society of Trieste explored, photographed and measured this karst complex. In addition, they were the pioneers of speleology in southern Italy, by performing systematic research and discovering many of the karst cavities that are known today in the National Park of Cilento and Vallo di Diano. In 1952 the cave was opened to the public, and, thanks to the growing interest, in 1952 the Military Geographic Institute (IGM) surveyed it using precision measurement methods (Bellucci et al., 1995). The Grotte di Pertosa - Auletta extend for a total length of about 3000 m. The initial stretch, flooded by the waters of the underground river Negro, may be accessed by special slow motorless boats operated through ropes. After

docking three parallel branches are found, each with distinct morphological peculiarities.

In general, the evolution of a cave may be described as a 3-stage process, and the karst complex Grotte di Pertosa-Auletta is an excellent site for the observation of the different stages of evolution:

- in the juvenile stage, the cavity is constantly invaded by water which models and corrodes the rocks that crosses (in the Pertosa-Auletta geosite this is clearly seen in the south branch, also named “the spring branch”);
- in the mature stage, the presence of water is seasonal and sensitive to external climate. Chemical deposits¹¹ start to develop (as happens in the median branch, also called “speleological branch” in our geosite);
- in the senile stage, water is absent and speleothems are important; such formations might completely fill the cavity with time (the touristic or northern branch of the Pertosa-Auletta caves is a great example of senile stage).

The differentiation of branches in our geosite, though, is not a result of a different temporal evolution, e.g. we would not be correct in thinking that a branch is older than the other. Very probably this differentiation is caused by a different permeability (ability of a rock unit to conduct water under specified conditions)

of the rocks in which it develops. From a speleogenetic¹² point of view, the cave has developed following both layers¹³ or tectonic structures¹⁴ present in the rock (Cafaro et al., 2010). These geological features, in fact, constitute preferential pathways for water infiltration.

Figure 6 shows the layout of the Grotte di Pertosa - Auletta from the Cave Cadastre of Campania Region, by the Campania Speleological Federation, and it represents cadastral number I.

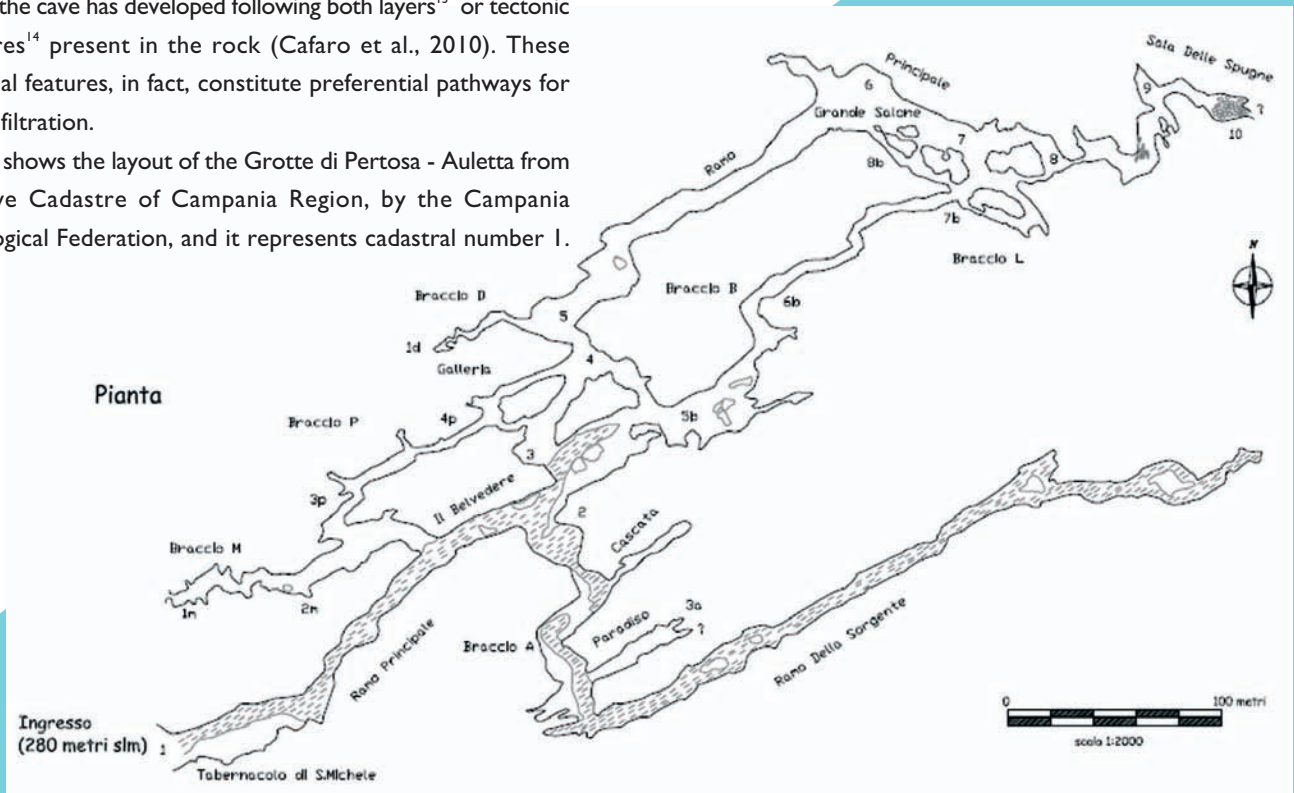


Figure 6: plan view of the Pertosa-Auletta caves (Cave Cadastre of Campania Region, Campania Speleological Federation)

Figure 7 shows the water access to the cave. The branches have the following features:



Figure 7: a stretch of the initial path, flooded by the underground river Negro (photo by Fernando Cerrone)

- The southern branch, called the “spring branch” develops for about 450 m and is the only active branch of the cavity, though not accessible; in fact, the river Negro waters flow perennially, continuing its relentless work on the carbonate rocks.

- The median or speleological branch can be accessed with special equipment. The presence of water is seasonal: in the rainy season it is possible that some parts of the cave are flooded. A gap created by the rock collapses is the entrance to the branch. After that, on the right side, gours may be observed: calcite concretions formed by flow of water supersaturated with calcium carbonate, on an inclined floor surface. We can observe that water coming out of a low discontinuity on the wall, ran on collapse deposits, and where it ran into obstacles calcium carbonate was precipitated.

This process, repeated in time, led to the formation of barriers (Figure 8) and of a calcite veil which cemented the deposits. This phenomenon of collapse deposit cementation shows that the water flow has occurred after the vault collapsed. The presence of fractures intersecting each other and also the limestone bedding



Figure 8: gours o barriers, which can be observed in the first stretch of the speleological branch

(photo by Giovanni Bocchino)

has led to the genesis of countless rock collapses from the cave roof. In the first stretch collapsed materials range from the cm^3 to the m^3 scale; after a short and narrow passage dimensions increase, reaching even to tens of m^3 . Unlike the other branches, along the median branch of the cave, concretions are sparse except for few sectors and it is therefore possible to observe the rock mass clearly and to recognize some fossils (Figure 9a - 9b). In addition, in the same area, between the limestone layers it is easy to observe interbedded greenish - gray thin layers that gradually switch to a deep red (Figure 10). These intercalations have been interpreted as bauxite levels (Cafaro et al., 2010). These deposits testify to phases of uplift and emersion of the Carbonate Platform, when it was subject to weather agents and therefore to erosion. Bauxite is a sedimentary rock which is also characterized by the presence of aluminum and iron oxides and hydroxides. The speleological branch continues for another 300 m, where tunnels and conduits characterized by enormous concretion phenomena with stalactites and stalagmites.



Figure 9a - 9b: fossil coral (photo by Filippo Marmo)

**Figure 10: Bauxite levels intercalated
in the calcareous beds** (photo by Christian Babino)

- The northern branch, a fascinating tourist route of about 800 m, is characterized by a succession of large cavities adorned with impressive speleothems. At about 100 m from the entrance, at the top left, a connection window, called the Belvedere, is visible, with the so-called branch of the Bats (Figure 11).

Proceeding towards the interior of the cavity, the rushing roar of a waterfall (Figure 12) can be heard. The fall is created by water coming from the branch of the Spring. Just off the boat, on the right, there is a connection and first access to the speleological branch.



Figure 11: suggestive picture of the branch of the Bats or P branch (photo by Fernando Cerrone)



(photo by Fernando Cerrone)

Figure 12: the waterfall and the landing point for a short but suggestive tour in the Paradise branch (photo by Fernando Cerrone)

The tourist branch continues to the left and unwinds through a long tunnel ending in one of the largest halls of this karst cave: the Great Hall (Figure 13). Abundant concretions can be observed in the form of large columns and curtains. Calcareous layers and

various fractures are also visible on the walls.

In the Great Hall, on the left, there is a series of small lakes (Figure 14). The interaction between these elements produced some collapses, which in some cases have put in communication

the various branches. Shortly before leaving the Great Hall, deposits are seen on the right. They consist of well-rounded pebbles (Figure 15), and this rounding indicates that materials have been transported by water; their size variability suggests that they were delivered with different energy: larger pebbles are indicative of a high energy transport, while smaller ones suggest a lower energy.

After the Great Hall, areas with a lower number and size of concretions are found, and they become progressively smaller.



Figure 13: the Great Hall (photo by Filippo Marmo)



Figure 14: detail of the Great Hall: the small lakes (photo by Fernando Cerrone)

Figure 15: Deposits transported by water in the past
(photo by Christian Babino)



A careful observer will notice that the myriads of concretions that dotted the immense hall (Figure 16) disappear and give way to thick, intensely fractured limestone layers (Figure 17). The last sector of the tourist branch is also the most fascinating: the



Figure 16: concretions on the roof (photo by Fernando Cerrone)

Sponges Hall (Figure 18). This cavity once collected water from one of the two large collapse dolines which may be seen at the ground surface site corresponding to this branch. This charming

environment is composed of a series of rock tanks, which are now fossils, with white calcite crystals on the walls. Water has created these morphologies through a mechanism similar to that described for the barriers: water dropping from the vault to the tanks full of water, caused splashing of calcium carbonate on the walls, and this originated the spongy appearance of these concretions. The cave continues for about 50 m and ends in the debris of the terminal landslide. The tourist



Figure 17: stretch leading from the Great hall to the Sponges Hall: concretions make way to the “naked” limestone, where beds and joints can be observed (photo by Christian Babino)



Figure 18: the Sponges Hall (photo by Christian Babino)

route continues from the waterfall, cited earlier, in the so-called “Paradise branch”. The environment is dotted by different types of calcite concretions (Figure 19) which develop on the vault, but also by white flowstones that branch off from the walls. The Grotte di Pertosa - Auletta hide peculiar geological features that make it one of the most important geosites of the National Park of Cilento-Vallo di Diano-Alburni. Tectonic structures¹⁴ and carbonate beds¹³ have produced three very different underground environments. The presence of an archaeological site makes it interesting from a prehistoric and historical point of view. Also, fossils found in the caves provide a tool to understand the environments of carbonate sedimentation in which they developed and even the possibility of dating the deposits.

The Meso-Cenozoic sequence cropping out in the Alburni and



Figure 19: detail of the Paradise branch



The geology and archaeology of the site are illustrated in the **MIdA** - Integrated Environmental Museum, in the area of the geosite. The museum also offers collections and exhibits on soils and vegetation of the Geopark and activities for schools and geotourists on geology, archaeology and the knowledge, use and conservation of natural resources and heritage.





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MUSEO

DELLA FLORA DELLA VEGETAZIONE DEL PIEMONTE



Vesole-Chianiello mountain chains is a thick, shallow-water carbonate platform succession ranging in age from the middle Jurassic (about 165 MA15) up to the Lower Miocene (about 20 MA). The main body of the carbonate sequence is constituted by Cretaceous, inner platform limestones that contain significant fossil deposits of "Plattenkalk" type, sometimes considerably rich in well-differentiated and well-preserved plants and animals specimens.

In the Mt. Chianiello area these are respectively, the Campanian-Maastrichtian (about 70 MA) Mt. Vesole fossil site, with shrimps belonging to the new species *Palaemon vesolensis* (Bravi et al., 1999 - Figure 20), and the Cenomanian (about 95 MA) land plants bearing, Magliano Vetere deposit (Bravi et al., 2004). Both the fossil deposits represent very shallow, coastal-to-intertidal environments. Their fossils association consist of a decapod crustaceans, oligotypic fauna (Vesole) and a coastal, pioneer plants assemblage (Magliano Vetere) including *Frenelopsis* and *Sapindopsis* (Figure 21).

At the Alburni Mts., the Albian (about 105 MA) deposit of Petina



Figure 20: the fossil crustacean *Palaemon vesolensis*



Figure 21: Leaves of the pioneer plant *Sapindopsis*

contains fishes, crustaceans as *Alburnia petinensis* (Bravi & Garassino, 1998 - Figure 22), a recent new genus that is only found in this site, and land plants as *Sagaria cilentana* Bravi et al., 2010, (Figure 23), one of the oldest primitive Angiosperm (Ranunculales), up to now only reported from this area.

A middle Eocene (about 45-40 MA), fossil fish-bearing deposit is also present in the Ottati municipal area (Bravi & Schiattarella, 1986, 1988). It shows a monospecific assemblage with the *Cyclopoma gigas* Agassiz species (Figure 24). The fishes are all in juvenile stages of growth form, being protected in the coastal pond environments as a nursery for young fishes. This fossil site remarks the only with an Eocenic age in Southern Italy. The same species, but with very larger specimens, is present in the Bolca (province of Verona) fossil site.



Figure 22: The fossil crustacean *Alburnia petinensis*



Figure 23: the primitive *Ranunculacea Sagaria cilentana*

All the above mentioned fossil deposits are well illustrated in the Magliano Vetere Paleontological Museum. This institution is a multi-purposes educational-scientific museum center with collecting and displaying of fossil materials for the public entertaining and scientific applications for specialists.



Figure 24: fossil *Cyclopoma gigas* fish

The evolution of life on earth is summed up by particularly significant fossil specimens (Figure 25) that introduce the theme of the Cilento area fossil deposits. A large diorama in the central hall recreates a Cretaceous environment with natural size fauna and flora (Figure 26); it is entirely viable by groups of visitors, allowing them to “see with their own eyes” the concepts that have been explained in the previous four exhibition rooms. A set of laboratories offers the possibility of insights and experiences to the visitors, that simulate the paleontologists’ activities of research by microscope (Figure 27) and digging in the field (Figure 28).



Figure 25: detail of a museum display

Figure 26: detail of the Diorama room





Figure 27: students in the microscope room



Figure 28: simulated excavation activity

Glossary

Geopark¹: a territory, which includes a particular geological heritage and a sustainable territorial development strategy supported by a European program to promote development.

Geosite²: an area whose geological features carry scientific, socio-economic or cultural value; it may be a single form or element, or a wider area with a variety of geo-morphological aspects.

Ponor³: a hole in the bottom or side of a closed depression through which water passes to or from an underground channel.

Doline⁴: a basin- or funnel-shaped depression in limestone, ranging in diameter from a few meters up to a kilometer and in depth from a few to several hundred meters.

Canyon⁵: a steep-walled chasm, gorge, or ravine cut by running water.

Cave⁶: a natural or artificial opening formed in the rocks below the surface of the ground, large enough for a man to enter. It may consist of a single connected opening or a series of small or large chambers connected by galleries.

Diffuse circulation or flow⁷: circulation of ground water in karst aquifers (or other aquifers) under conditions in which all, or almost all, openings (primary and secondary) in the karstified rock intercommunicate and are full of water but have not been selectively enlarged in specific zones by dissolution, thus no concentration of ground water occurs in restricted conduits.

Localized circulation⁸: circulation in karst aquifers in which the water moves in certain preferred zones and does not occupy all or most of the openings below this level.

Resurgence⁹: point at which an underground stream reaches the surface and becomes a surface stream.

Spring overflow¹⁰: a spring that is part of a distributary but which drains only at the level above base flow.

Chemical deposit¹¹: a sediment precipitated out of solution by chemical action.

Speleogenesis¹²: birth, origin or mode of formation of caves

Layer or bed¹³: a sheetlike deposit of sediments

Tectonic structure¹⁴: geological structure due to the deformation of the crust

MA¹⁵: Million Years ago

Bibliography

Aloia A., Bartiromo A., Bravi S., 2011 – The Plattenkalk-type Fossil-lagerstätten in the Parco Nazionale del Cilento e Vallo di Diano Area (S-Italy): An Overview – Proceedings of the 10th European Geoparks Conference 2011

Bellucci F., Giulivo I., Pelella L., Santo A., 1995 - Monti Alburni. Ricerche speleologiche, De Angelis, Avellino.

Bravi, S., Garassino, A., 1998. "Plattenkalk" of the lower Cretaceous (Albian) of Petina, in the Alburni Mounts (Campania, S Italy), and its decapod crustaceans assemblage. Atti della Società Italiana di Scienze Naturali, Museo Civico Storia Naturale Milano 138, 119-171.

Bravi S., Coppa M.G., Garassino A., Patricelli R., 1999. *Palaemon vesolensis* n. sp. (Crustacea, Decapoda) from the Plattenkalk of Vesole Mount (Salerno, Southern Italy). Atti Soc. It. Sci. nat. Museo civ. Stor. Nat. Milano. 140/1999 (II): 141-169.

Bravi, S., Civile, D., Martino, C., Barone Lumaga, M.R., Nardi, G., 2004. Osservazioni geologiche su di un orizzonte a piante fossili nel Cenomaniano di Monte Chianello (Appennino meridionale). Bollettino della Società Geologica Italiana 123, 19-38.

Bravi, S., Barone Lumaga, M.R., Mickle, J.E., 2010. *Sagaria cilentana* gen. et sp. nov.—A New Angiosperm Fructification from the Middle Albian of Southern Italy. Cretaceous Research 31, 285-290.

Bravi S., Schiattarella M., 1986. Segnalazione di livelli ittiolitici eocenici a *Cyclopoma gigas Agassiz* ai Monti Alburni (Appennino Campano). Boll. Soc. Natur. Napoli, 95, 255-279.

Bravi S., Schiattarella M., 1988. Stratigrafia dei livelli ittiolitici eocenici dei Monti Alburni (Appennino Campano). Mem. Soc. Geol. It., 41, 587-591.

Cafaro S., Gueguen E., Adurno I. & Schiattarella M., 2010 – Il controllo geologico nella speleogenesi della grotta dell'Angelo (Appennino campano-lucano). Atti II convegno regionale di speleologia "Campania Speleologica 2010", 3-6 Giugno 2010, Caselle in Pittari (SA), 71-81.

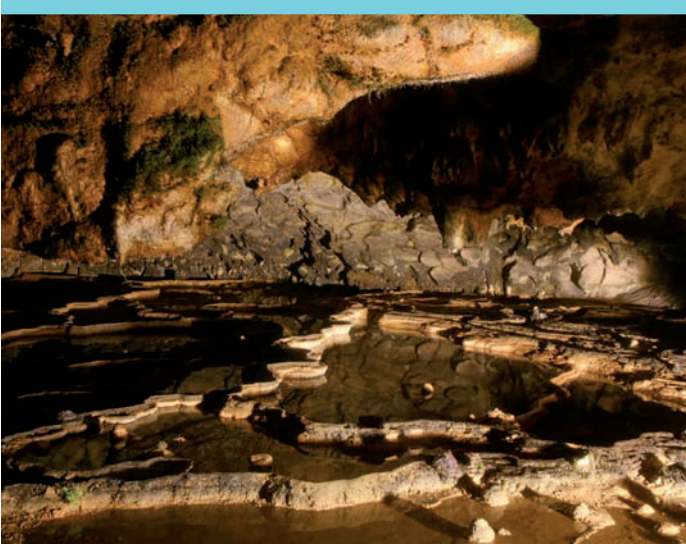
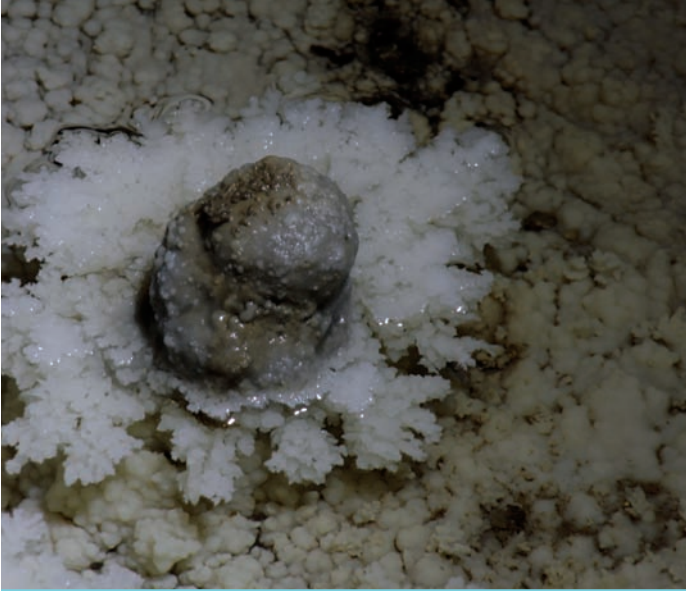
Carucci P., 1907a – La grotta preistorica di Pertosa (Salerno). Contribuzione alla Paleontologia, Speleologia ed Idrografia. Stabilimento Tipo-Stereotipo F. Di Gennaro & A. Morano, Napoli, (ristampa anastatica, Litografia Dottrinari, Fratte, 1985).

Carucci P., 1921 – La Grotta dell'Angelo di Pertosa e la sua completa esplorazione speleologica, in "Archivio storico per la provincia di Salerno", a. I, fasc. I, 91-105.

De Paola G., 1938 - Sull'origine della Grotta di Pertosa in provincia di Salerno, Stabilimento Tipografico N. Jovene, Napoli, estratto da "Gli Abissi", vol. I, n. 4, 249-255 e tavv. I-IV.

De Paola G., 1939 – Sull'origine della Grotta di Pertosa. Paradiso di meraviglie. Stabilimento Tipografico N. Jovene, Napoli.

Larocca F., 2010 – Le Grotte dell'Angelo a Pertosa: il sistema sotterraneo e il giacimento archeologico. Fondazione Mida, Pubblicità & Stampa, Bari.



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