Il Quaternario
Italian Journal of Quaternary Sciences
***18**(1), 2005 - Volume Speciale, 155-162*

THE ITALIAN REGISTER OF NATURAL HYPOGEAN GEOSITES: A PRELIMINARY REPORT

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ABSTRACT: L. Piccini *et al.*, *The italian register of natural hypogean geosites: a preliminary report*. (IT ISSN 0394-3356, 2005).
Since a couple of years, the Italian Speleological Society (SSI) is carrying out a project for the realisation of a national inventory of Hypogean Natural Geosites (Geositi Ipogei Naturali = GIN). A GIN can be defined as "every subterranean natural void that represents exceptional naturalistic and/or cultural value, in the widest sense, in at least one of the following features: its intrinsic characteristics, its geological, geomorphologic or hydrogeological context, its morphodynamic significance, its content of hypogean landscape elements or significant materials or, finally, for the use Man has made of it in time". The exceptionality mostly regards the scientific interest of the already performed or potential researches (global, European, national, regional or local relevance of the acquired or acquirable information), the historical and cultural interest and elements such as beauty, dimension, rarity, representativity and didactic or cultural interest. As a GIN, entire cave complexes, single caves or single passages of caves can be chosen. Five types of GIN have been identified. GIN for the intrinsic characteristics of the cave: concerns particularly well preserved parts of caves and their morphologies (erosion and corrosion forms), but also caves derived from particular speleogenetic processes (e.g. hyperkarst caves) or formed in special types of rock (e.g. gypsum caves). GIN for the interest of the hosting karst area: in this type, caves with no special interest but representing important karst areas can be inserted. GIN for the nature of the outcropping rocks: caves that allow a better understanding of petrography, mineralogy, tectonics, stratigraphy or palaeontology of the area. GIN for the material contained in them: caves with scientifically important sediments, speleothems, evidences of palaeo-seismicity, palaeo-environmental indicators, archaeological or palaeontological deposits. GIN for the importance in Man's history: caves used by Man in prehistory, but also the ones used more recently as places of cult, or caves important for the development of the speleological and karst explorations and studies. For all these types of GIN, which can also coexist in the same site, the exceptional conditions of the phenomena have to be maintained, having different scales ranging from local up to global importance. A first list of Italian GIN has been compiled by a Working Group that has been instituted by the Italian Speleological Society, composed of the Regional Responsibles of the Cave Registers and several experts. For every Italian region no more than 1% of the total amount of natural caves has been identified as GIN. In this paper a preliminary overview of some Italian GIN is given, reporting their names, distribution, type and importance. This provisional list already shows the exceptionality of the Italian hypogean heritage on a European and global scale and these results encourage the Working Group to continue this research that aims for a better understanding and a growth of public awareness of this incredible speleological heritage.

RIASSUNTO: L. Piccini et al.*,* Il Catasto italiano dei geositi ipogei naturai: risultati preliminari. *(IT ISSN 0394-3356, 2005).*
Da alcuni anni la Società Speleologica Italiana sta svolgendo un progetto, nato da un accordo con il Servizio Geologico Nazionale (ora Agenzia per la Protezione dell'Ambiente e per i servizi Tecnici – APAT), che ha come obiettivo il censimento dei Geositi Ipogei Naturali (GIN). Sono da ritenere GIN tutti quei vani sotterranei di origine naturale, le grotte per intenderci, che per le loro caratteristiche ambientali intrinseche, per i contesti geologici, geomorfologici e idrologici in cui si trovano, per il loro significato morfodinamico ed il loro contenuto d'elementi del paesaggio ipogeo, di materiali significativi o per l'uso che l'uomo ne ha fatto nel tempo, presentano caratteri di eccezionalità naturalistica e/o culturale in senso lato. L'eccezionalità riguarda soprattutto l'interesse scientifico delle ricerche già svolte o potenziali (rilevanza mondiale, europea, nazionale, regionale o locale dei dati acquisiti o acquisibili), l'interesse storico e culturale e i fattori di tipo estetico o dimensionale, di rarità, rappresentatività e interesse didattico-culturale. Possono essere definiti GIN interi complessi carsici, singole grotte oppure parti di esse. Si distinguono cinque tipi di GIN. GIN per le caratteristiche intrinseche della grotta (GINCI): comprende soprattutto cavità (o porzioni di esse) ben preservate con morfologie (forme d'erosione e/o di corrosione) e/o depositi di eccezionale importanza. In questa classe ricadono anche grotte dovute a processi genetici particolari (es. grotte ipercarsiche) oppure formate in rocce peculiari (es. grotte nei gessi). GIN per l'interesse dell'area carsica in cui si trovano (GINAC): comprende grotte rappresentative per aree carsiche di grande interesse. GIN per la natura delle rocce affioranti (GINRA): comprende quelle grotte che consentono di osservare le caratteristiche petrografiche, mineralogiche, tettoniche, stratigrafiche, paleontologiche delle rocce da esse attraversate, con un dettaglio e una ricchezza di informazioni non rilevabili all'esterno, in situazioni interessanti da un punto di vista strettamente geologico. GIN per i materiali contenuti (GINMC): sono da considerare in questa categoria le cavità che contengono depositi fisici e/o chimici di particolare rilevanza scientifica. GIN per l'uso da parte dell'uomo (GINAN): rientrano in questa categoria le grotte che sono state utilizzate dall'uomo in tempi preistorici, storici o recenti a fini abitativi, di culto, di studio o altro. Per ognuna di queste caratteristiche, che possono ovviamente anche coesistere, dovranno essere rispettate condizioni di eccezionalità dei fenomeni. Tale eccezionalità può comunque spaziare da un contesto globale o continentale (GIN di valore mondiale o europeo) a regionale o locale (GIN di interesse nazionale, regionale e locale). E' stata compilata una lista preliminare dei GIN italiani da un gruppo di lavoro istituito dalla Società Speleologica Italiana, composto dai responsabili regionali dei Catasti delle Grotte e da vari esperti. Per ciascuna regione sono stati definiti come GIN circa l'uno percento del totale numero di grotte censite a Catasto. In questo lavoro è pubblicato un primo elenco di alcuni GIN italiani, che mostra già da ora l'eccezionalità del patrimonio sotterraneo nazionale a livello Europeo e Mondiale, e questi risultati incoraggiano a proseguire questa ricerca, con l'obiettivo di aumentare le conoscenze e di sensibilizzare maggiormente l'opinione pubblica in modo da tutelare il nostro immenso patrimonio speleologico.

Keywords: Caves, Geosites, Speleology, Italy.

Parole Chiave: Grotte, Geositi, Speleologia, Italia.

1. INTRODUCTION

The Italian Speleological Society (SSI) and the National Geological Service (SGN, now Agency for the safeguard of environment and technical services - APAT) have stipulated an agreement for the identification of the Hypogean Natural Geosites (GIN) of Italy.

Actually, the exact meaning of the word “geosite” is not yet clear. For some researchers the main characteristic of a geosite is to be enjoyable for tourism and cultural purposes (geo-tourism); in this case a geosite can be regarded as an important element in the framework of economic development of local communities. For other researchers the scientific elements are the most important ones, and thus the geosite becomes an object that has to be studied and protected (Brancucci & Burlando, 2001; Sauro & Grandgirard, 1997).

Enjoying natural caves becomes a secondary fact because not all caves are of easy access, and the tourist adaptation of these difficult environments normally collides with their protection needs.

In many cases the cave itself represents a geological site *sensu latu*, mostly combined with its naturalistic, environmental and/or cultural interest. In the speleological sense a GIN could be defined as follows: "every subterranean natural void that represents exceptional naturalistic and/or cultural value, in the widest sense, in at least one of the following features: its intrinsic environmental characteristics, its geological, geomorphologic or hydrogeological context, its morphodynamic significance, its content of hypogean landscape elements or significant materials or, finally, for the use Man has made of it in time".

The exceptionality mostly regards the scientific interest of the already performed or potential researches (global, European, national, regional or local importance of the acquired or acquirable information), the historical and cultural interest and elements such as beauty, dimension, rarity, representativity and didactic or cultural interest.

2. DEFINITIONS

The following categories of geological and geomorphologic sites can be classified as GIN:
- Karst systems (or cave complexes);
- Single caves;
- More or less important portions of caves.

Rarely entire karst systems can be considered as GIN for the difficulty of their delimitation and their description. In the framework of this work five types of GIN have been defined.

1) GIN for the intrinsic characteristics of the cave

In this category, those caves that contain relevant elements and forms that acquire exceptionality for their quantity, quality, exemplarity, dimension or aesthetic value are considered. These characteristics concern particularly well-preserved parts of caves and their morphologies (erosion and corrosion forms). As examples can be mentioned: caves with extremely well developed phreatic tubes, impressive underground canyon passages, immense underground rooms, extremely well developed erosion or corrosion forms on the ceilings and walls etc. In this category caves derived from particular speleogenetic processes (e.g. hyperkarst caves, thermal caves) or formed in special types of rock (e.g. gypsum caves, conglomerate caves, etc.) are also inserted. The morphologic and speleogenetic aspects acquire particular importance when these are in relation with the evolution of the environment in its multiple aspects (geology, geomorphology, climate, biology etc.).

2) GIN for the interest of the hosting karst area

In this type, caves with no special interest but representative for important karst areas can be inserted. This category comprises caves that, if evaluated singularly would not be considered GIN because of the lack of special interest, but considered on a local scale they become important elements if evaluated in their geomorphologic and environmental context.

3) GIN for the nature of the outcropping rocks

It regroups caves that allow a better understanding of petrography, mineralogy, tectonics, stratigraphy or palaeontology of the area. In fact, in certain areas, caves can allow a much better and more detailed study of geological sequences, their structure and their mineralogical and/or palaeontological content. Especially vertical caves sometimes cross through thick sedimentary sequences, and rocks are sometimes very well exposed.

4) GIN for the material contained in them

Caves are geological traps in which sediments and biological remains are extremely well preserved, enabling the understanding of past morphological, climatic and biological conditions. Among the scientifically important deposits the physical (alluvial deposits, detritus infillings, ancient loess-like sediments, palaeokarst deposits, etc.) and the chemical ones (speleothems, secondary minerals, etc.) can be mentioned, at the condition that they are of relevant importance for their characteristics (extension, dimension, representativity, aesthetic value, rareness, etc.) or for the indirect information that they can give on the evolution of the cave itself or of its environment (palaeo-climate, palaeo-geography, palaeo-seismicity, etc.). Those caves that have enabled the reconstruction of past conditions thanks to their physical and/or chemical deposits are necessarily inserted in this category. Also caves with important palaeontological, palaeo-ethnological or archaeological material refer to this class (fossil woods, guano deposits, prehistoric findings, important human fossils etc.) because these findings are also related to the favourable geomorphologic situation of the caves itself. Finally, also those caves of particular biological interest can be inserted in this type of GIN because both fossil fauna and flora (e.g. pollen) and cave dwelling fauna can represent testimonials of past biogeographical situations.

5) GIN for the importance in Man's history

This category contains caves used by Man in prehistory, but also the ones used more recently as places of cult (hermitage, palaeochristian rupestrian churches, etc.) or caves important for the development of the speleological and karst studies.

For all these types of GIN, that can also coexist, the uniqueness of the phenomena have to be maintained. This exceptionality can be defined in a global or continental (GIN with a global or European value) up to a regional or local context (GIN of national, regional or local interest). A single GIN, in function also of its interest, can comprise an entire karst system (normally great cave systems with a complex evolution), entire caves for the presently known portions (in the case of caves with a peculiar genesis or the ones that allow a better understanding of geological sequences crossed by the cave itself, etc.) or only parts of caves (e.g. prehistoric and archaeological caves in which often only the entrance halls are of interest).

3. CRITERIA FOR THE DEFINITION OF GIN

A first list of GIN is now in progress, compiled simply relying on the personal knowledge of every single responsible of the regional cave registers, combined with the information given by local speleological experts. Many situations are already well known and well documented even at a national level (Piccini *et al*., 2001).

A further selection can be derived from the interrogation of the cave register database (Ferrari & Piccini, 1996): the simple analysis for the longest and deepest caves, the altitude of the entrances (high mountain or submarine caves), the nature of the rocks (e.g. gypsum caves), the scientific interest (archaeology, biospeleology, mineralogy, etc.) or even the number of bibliographical references, can give rise to a reliable selection of possible GIN. This list of "potential GIN" needs of course further specific investigation to individuate the cases of real interest.

For every region a first list of GIN has thus been compiled, inserting the most important and interesting speleological sites, together with an essential reference list. Following up every region will have to compile a list of potentially interesting sites that need a more appropriate and detailed study also in loco. For those sites that do not need any further examination a preliminary data base sheet, derived from the one used by the SGN (now APAT), has been compiled.

The characteristics of a GIN are reported on a card which resemble that one proposed by the SGN and the Centro Documentazione Geositi of the Dipartimento Polis - Università di Genova. The recorded data concern localisation, fields of scientific interests, relevance valutation, description and bibliography.

4. SOME EXAMPLES OF GIN IN ITALY

In this initial stage of cataloguing the working group instituted by the Italian Speleological Society has already made a preliminary list of GIN distributed in several regions. For some of these sites a database sheet has already been compiled and the necessary fieldwork has confirmed its compatibility with the minimum criteria for its classification as a GIN. Hereunder some of these GIN are briefly illustrated.

4.1 GIN for the intrinsic characteristics of the cave

Monte Corchia karst complex (caves register number of main entrances: 51, 52, 120, 741, T/LU; Apuan Alps, Tuscany)

The Corchia Cave is presently the longest cave in Italy, being about 52 km long and 1195 m deep. The complex has 12 different entrances, from the top of the mountain, at 1637 m a.s.l., to the lower at 930 m a.s.l. (Fig. 1). The morphologic setting of this exceptional karst system pertains to many interesting features of several points of view. Anywhere, the most peculiar aspect probably concerns the relationship between morphological setting of cave passages and morphotectonic evolution (Piccini, 1997).

Based on the vertical distribution of the phreatic and epiphreatic passages in the caves, four major generations of karst levels can be identified in the Corchia Complex. The first and most ancient generation lies above 1450 m a.s.l. and probably dates to Late Pliocene. The second level comprises more than 10 km of phreatic tubes located between 1000 and 1200 m a.s.l. The latter form a wide maze network that was subsequently affected by a major phase of vadose entrenchment. A recent dating (Drysdale *et al*., 2001) suggests that also low levels passed from phreatic to vadose condition in the Early Pleistocene. The cave is also important for the in-filling deposits, with exotic pebbles related to an ancient hallogenic feeding (Piccini, 1991).

Veja natural arch (caves register: 117, 465, 466, 467, 468 V/VR; Monti Lessini, Venetia)

The Veja bridge, the most known natural arch in the Monti Lessini (Venetian Prealps), represents the remnant of the roof of a large cave chamber (Fig. 2). This cavern collapsed mostly to form a karst window, a kind of collapse doline open downward, delimited by

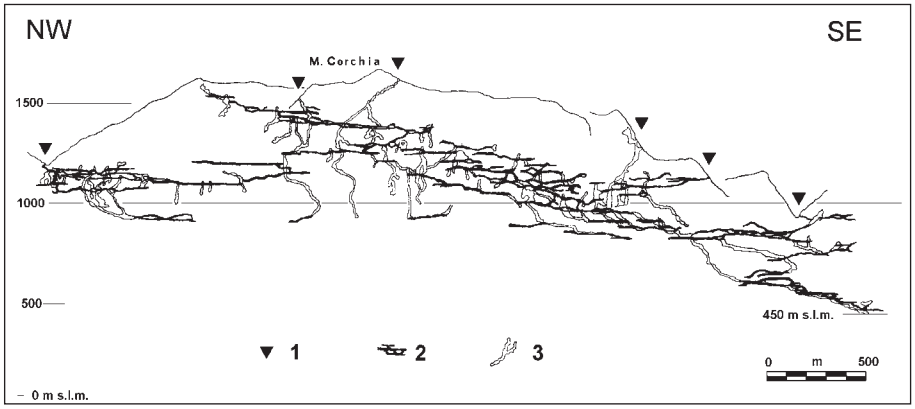

Fig. 1 – The Monte Corchia karst complex. The sketch profile shows the vertical pattern of the cave emphasizing the morphological complexity and the policyclic evolution. 1) Main cave entrances; 2) relict phreatic passages; 3) vadose passages.

Il Complesso carsico del Monte Corchia. La sezione schematica mostra l'andamento verticale della grotta mostrandone la complessità morfologica e l'evoluzione policiclica. 1) Ingressi principali; 2) condotti relitti d'origine freatica; 3) condotti d'origine vadosa.

rocky faces with several entrances of caverns (Pasa, 1954; Perna & Sauro, 1976).

This natural monument has been destination of field trips of the dwellers of the town of the Po' Plain since Middle Ages. In 1496 the Mantegna painted this bridge, as seen from the valley below and with the enrichment of some fantastic elements, in the Camera degli Sposi of the Ducal Palace of Mantova. So this form represents one of the first natural monuments ever represented by an artist (Mietto & Sauro, 2000).

From the point of view of its natural history the arch and the related caves are really interesting. The fillings of the karst cavities include very different materials as: a) very old soil sediments, probably of Paleogene age, similar to those of the Verona hills (Latella & Zorzin, 1989), b) basaltic lavas intruded inside karst galleries during late Oligocene or early Miocene (Rossi & Zorzin, 1993), c) Pleistocene age fillings (Pasa, 1950, Bartolomei & Broglio, 1975).

The Pleistocene age sediments are rich in palaeontological and archaeological remains that have been studied starting from the early XIXth century. The presence of prehistoric man in the area is documented since lower Palaeolithic.

The Geosite of Veja Bridge, which is now part of the Natural Regional Park of the Monti Lessini, may be considered of global importance according to the coexistence of very different and relevant aspects.

4.2 GIN for the interest of the hosting karst area

Spluga della Preta cave (caves register: 1 V/VR; Monti Lessini, Venetia)

The Spluga della Preta in the Monti Lessini (Venetian Prealps) is one of the four early-explored deepest vertical cave systems in the World (Fig. 3), with depths ranging, after the first campaigns, between 300 and 500 m. The early exploration of the Preta took place in the years 1925, 1926 and 1927. Due to the fact that the first explorers have overestimated the depth, this system was considered for nearly 30 years as the deepest cave in the World (Stegagno, 1927; Corrà, 1975; Mietto & Sauro, 2000). During more recent explorations the present bottom has been reached at the depth of 877 m (Sauro *et al*., 1995). In the second half of the 20th Century, its old fame attracted tens of expeditions from many different countries.

For this reason the cave system was explored and studied and the great scientific importance of the cave itself and of the relative environment has been under-

Fig. 2 – The natural arc of Ponte di Veja, in the Monti Lessini karst area.

L'arco naturale del Ponte di Veja, nell'area carsica dei Monti Lessini.

Fig. 3 - A view from air of the summit plane of Corno d'Aquilio. The arrow indicates the entrance-doline of the Spluga della Preta cave (photo OCA).

Veduta aerea del pianoro sommitale del Corno d'Aquilio. La freccia indica la dolina d'ingresso della Spluga della Preta (foto OCA).

stood (Maucci, 1954; Sauro, 1974).

The Preta system is the result of a speleogenetic evolution occurred in a peculiar geological and geomorphologic environment. Speleogenesis has been controlled by: a) the lithological sequence, characterised by a hanging aquifer hosted inside the dense network of fractures of a marly limestone (Biancone), similar to the chalk, loosing water in the underlying pure limestone, b) the tectonic setting of the area (the cave system is inside a tectonic wedge evolving as a thrust structure), c) the deepening of the large lateral valley of the Adige River, very near to the cave.

The cave is also of great biological interest. It hosts endemic species of invertebrates discovered in this cave, and among these the largest cave carabid ever found in the World can be mentioned. The Geosite of Spluga della Preta, which is now part of the Natural Regional Park of the Monti Lessini, may be considered of global importance according to the coexistence of very different and relevant aspects.

4.3 GIN for the nature of the outcropping rocks

Olivifer cave (caves register: 1000 T/LU; Apuan Alps, Tuscany)

This typical alpine-like karst system has a depth of 1215 and is one of the deepest caves in Italy (Fig. 4). The cave has two entrances and develops mainly in metadolomite of Triassic age (Carnian-Norian) (Piccini, 1992). The first part of the cave, until the depth of 900 m, follows the overturned stratigraphic contact between dolomitic marble (a heteropic facies of Carrara Marble) and dolomite. The cave allows an exceptional vision of this geologic passage that is fundamental in the comprehension of the evolution of the Tuscan carbonate shelf at the passage between Triassic and Jurassic.

Being an active cave, the vertical passages show the petrographic and sedimentological features of the rocks with great detail and, despite the local intensive tectonic deformation, allow to reconstruct the phases of emersion that affected this part of the carbonate shelf.

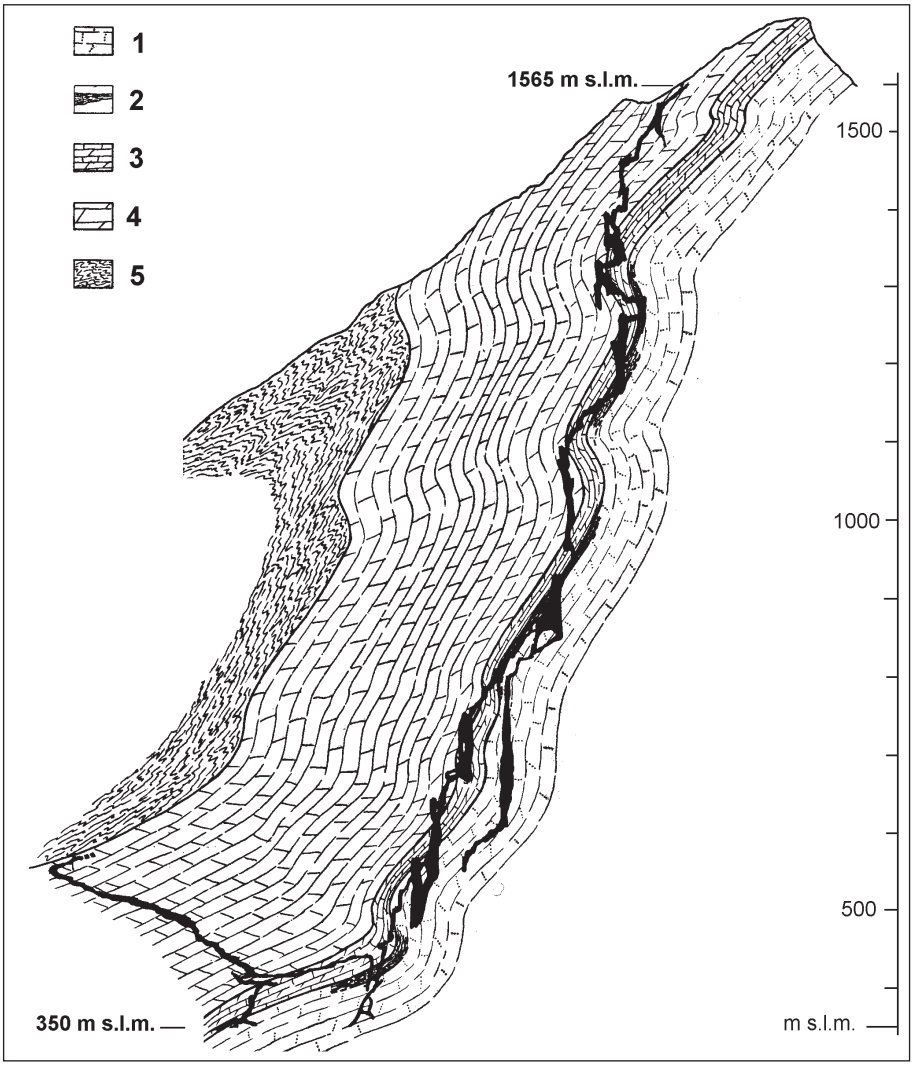

Fig. 4 - Sketch geologic profile of Olivifer Cave: note the structure-controlled vertical pattern of the cave. 1) Dolomitic marble, 2) phyllite lens, 3) shaly marble, 4) dolomite, 5) Palaeozoic basement. (from: Piccini, 1992).

Profilo schematico dell'Abisso Olivifer: si noti il controllo esercitato dalla struttura sull'andamento verticale della grotta. 1) Marmi dolomitici; 2) lenti di filladi; 3) marmi scistosi; 4) dolomie; 5) basamento paleozoico. (da: Piccini, 1992).

4.4 GIN for the material contained in them

Santa Barbara cave (caves register: 210 SA/CA; Iglesiente, Sardinia)

This cave, open to public since a couple of years, has been discovered in the early fifties during the excavations inside the San Giovanni mine at Iglesias and has no natural entrance (Fig. 5). The importance of this small cave, that has a total development of only about 110 meters (Fabbri & Forti, 1981), is to be found in its geologic characteristics (Forti & Perna, 1981); it is probably one of the oldest caves in Italy. The natural void has been formed in the limestone of Lower Cambrian age and could be related to a Triassic karst cycle. The big room is well decorated by great columns, attractive stalactites and stalagmites, while the roof and the walls are completely covered with barite crystals, certainly a rare mineral in the cave environment, testifying its complex genetic history (Rossetti & Zucchini, 1957; Forti & Perna, 1982).

Onice cave (caves register: 234 T/LU; Apuan Alps, Tuscany)

The Onice Cave is a typical example of cave affected by a long and almost continuous phase of chemical and physical in-filling, following the first phreatic enlarging phase.

It consists of a 150 m long segment of a large phreatic

tube, which opens at 573 m a.s.l. along a secondary crest of the Frigido Basin, near to Massa. This cave hosts a flowstone, at least 5 m thick that was quarried in the past for getting ornamental stone. The top bed of the flowstone has an age exceeding the limits of alpha U-Th dating (>350 ka), thus, according to these data, we can assert that Onice was active as a phreatic conduit in the Middle Pleistocene, probably before 500 ka BP (Piccini *et al.*, 2003). The flowstone is covered by an 8 m thick sediment made up of dolomitic fine sand, probably related to Upper Pleistocene cold periods characterized by mechanical denudation and removal of soils. The sediment, which shows a varve-like banding, is interlayered with datable calcite crusts. The flowstone, presently under investigation, offers the possibility to get a complete and medium-definition record of environmental changes during Middle and Late Pleistocene.

Lamalunga cave (caves register: 1295 PU/BA; Altamura, Apulia)

The cave, in the area of the Murge of Altamura, is made up of a tunnel, which extends not far beneath the surface. The morphologic setting suggests a long evolution from phreatic condition to a phase in which the cave turns into a vadose zone and then progressively undergoes a decrease in the water flow. The cave was then affected by collapsing and concretioning cycles over an unknown time period. It is during this last evolution phase that the palaeontological deposition occurs.

The cave of Lamalunga rose to the world attention in 1993 thanks to the discovery of a complete skeleton of an archaic man (Forti, 1993). The skeleton of the now named Man of Altamura, is located in a lateral branch of the main gallery. The bones are almost completely covered by calcite, a stalagmitic formation covers part of the maxillary, leaving the supraorbital arch visible (Fig. 6). The cranium morphology resembles that of the Neanderthal type, and the characteristics of the skeleton indicate that the individual was an adult male. Thanks to the completeness and exceptional state of preservation and to the presence of numerous elements of the almost complete post-cranial skeleton, the Man of Altamura represents one of the most surprising palaeontological discoveries ever made in Italy and in Europe.

4.5 GIN for the importance in Man's history

La Verna caves (caves register: 51and 600 T/AR; Arezzo, Tuscany)

The La Verna Sanctuary is one of the most famous cult sites of catholic church in Italy (Vianelli, 1994). The sanctuary stays on a hanging cliff made up of calcareous sandstone lying on shale, of Tertiary age. The relief is affected by de-stressing fractures due to gravitative deformation, which led to the formation of trenches on the top surface and fissures at the base. The

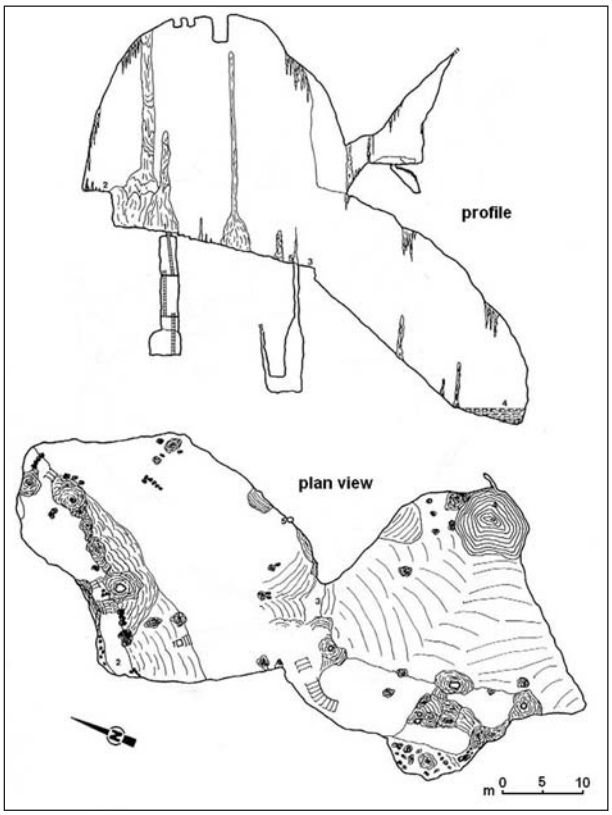

Fig. 5 – Vertical and plan view of the Santa Barbara Cave, (from: Fabbri & Forti, 1981).

Vista verticale ed in pianta della Grotta di Santa Barbara, (da: Fabbri & Forti, 1981).

Fig. 6 - The skeleton of the Man of Altamura, partially cemented by speleothems, (reprinted from: Forti, 1993).

Lo scheletro dell'Uomo di Altamura, parzialmente inglobato da speleotemi, (ristampato da: Forti, 1993).

site is located along one of the main old ways crossing the Northern Apennines and thus it is since a long time a site of refuge for Man.

In May 1213, San Francesco made the mountain a site for hermitage and pray. During the work for building the small church of Santa Maria degli Angeli, San Francesco and his friars found a refuge in small caves and niches, formed by rock collapses.

The morphological relevance of these caves is minimal, but the geological setting, the particular genetic process of the caves and, moreover, the historical events, made this site one of the most important geomorphosites of the Northern Apennines.

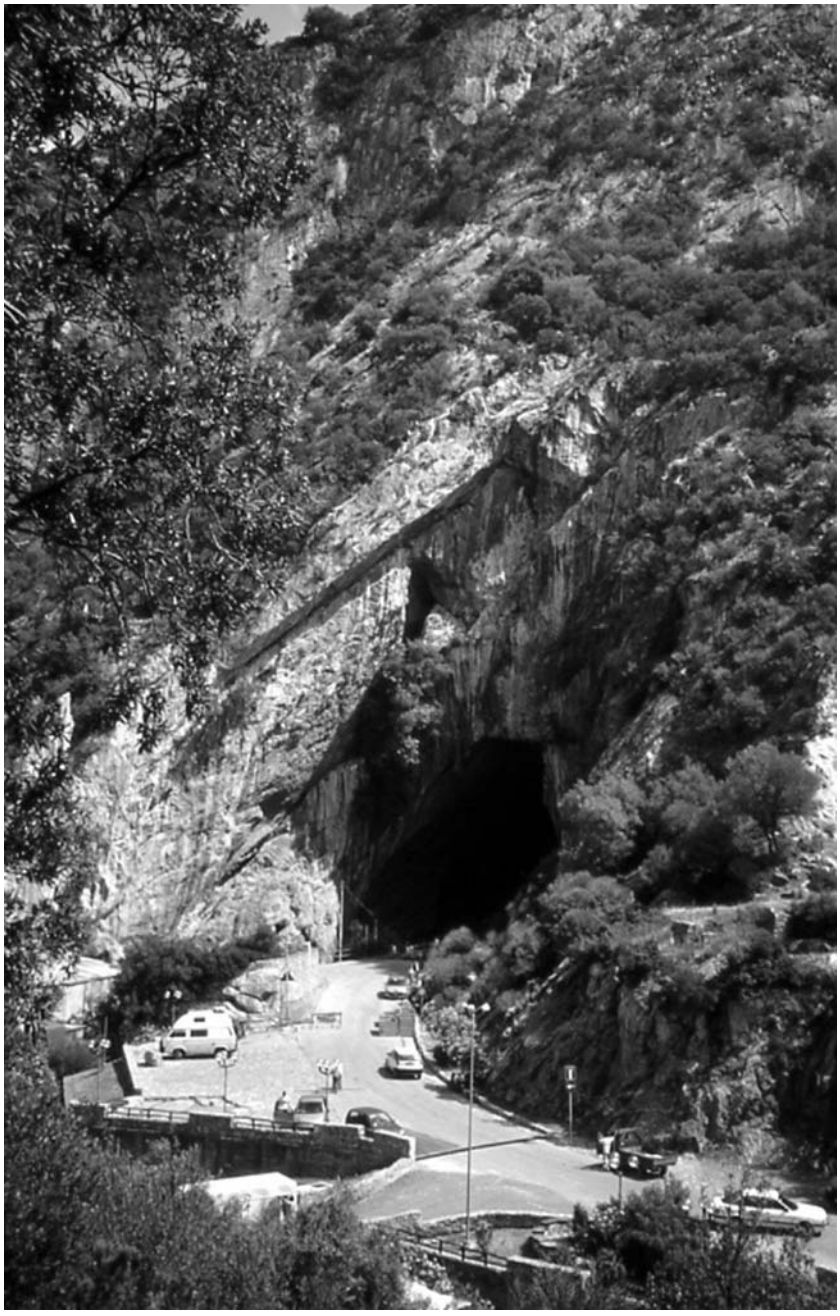

Fig. 7 - The lower entrance of San Giovanni cave, close to Domusnovas.
L'entrata inferiore della Grotta di San Giovanni, presso Domusnovas.

San Giovanni cave (caves register: 81 SA/CA; Iglesiente, Sardinia)

San Giovanni cave is located near the little town of Domusnovas in Cagliari province, and is characterised by a natural tunnel that crosses Monte Acqua from North to South for a total length of more than 800 meters (Fig. 7). This tunnel has been excavated by the Sa Duchessa river in the waxy limestone of the so-called "Metallifero" (Gonnesa Group, Lower Cambrian) (De Waele & Pisano, 1998). The cave has a partially explored submerged branch from which rises a river with an average discharge of 100 l/s. In roman times this water was conveyed into an aqueduct that supplied Cagliari until some decennia ago. Known since prehistory, only in the last decades this cave was the subject of intense speleological exploration, bringing its development to about 5 km with the discovery of at least two fossil cave levels testifying a complex speleogenesis (Bianco *et al*., 1992; Papinuto & Naseddu, 1996; Naseddu, 1998).

From an archaeological point of view, aside the already mentioned roman aqueduct, a big megalithic wall (ca. 1500 B.C.) is still clearly visible at the Southern entrance (Alba, 1982).

The cave has a historical interest for the presence of a road that crosses the whole natural tunnel. Since half the 19th century, in fact, this natural passage enabled horse-carts first, trucks later, to carry the Pb and Zn mineral mined in the Sa Duchessa valley and in the mountains to the Cixerri valley where a railway brought the ore to the industrial plants or harbours.

The cave has also great biospeleological interest, with the presence of an important bat colony and many species of arthropods, several of which are endemic and sometimes of great biogeographical importance (Grafitti, 2002)

5. CONCLUSIONS

Presently, about 50 GIN have been preliminary selected by the Working Group in the whole Italian territory, but we presume that the number of GIN will be probably more than 300. For all these sites a sheet will be compiled that will enable the construction of a database.

The preliminary data already show the great importance of the speleological heritage in Italy, probably representing one of the most important of the European continent.

Many work is still to be done, such as the raise in public awareness of our important speleological geosites, their sustainable management and their protection where needed, in order to deliver our subterranean heritage to the future generations.

ACKNOWLEDGMENTS

A special thank to Franco Cucchi and Paolo Forti for their reviews. Research supported by Società Speleologica italiana.

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