

THE ZINZULUSA CAVE: AN ENDANGERED BIODIVERSITY »HOT SPOT« OF SOUTH ITALY

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The historical, geological, faunistic and ecological characteristics of the Zinzulusa cave (Castro Marina, South Italy), one of the most remarkable anchialine aquifers of Italy, are presented in this paper. The results of recent explorations and discoveries, in both the above-ground and submerged part of the cave, are pointed out. The cave is at present endangered and it requires measures aimed at keeping aquifer levels adequate to assure protection of its precious stygofauna. A list of threatened species living in the cave is appended.

Key words: Zinzulusa cave, Italy, endangered taxa

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U radu se predstavljaju povijesne, geološke, faunističke i ekološke osobine špilje Zinzulusa (Castro Marina, Južna Italija), jedne od najznačajnijih anhidralnih akvifera. Istaknuti su rezultati posljednjih istraživanja i otkrića, i to u potopljenom i nepotopljenom dijelu špilje. Špilja je trenutno ugrožena i potrebno je uvesti mjere za održavanje odgovarajućih razina akvifera, da bi se osigurala zaštita dragocjene stigofaune. Priložen je popis ugroženih vrsta koje žive u toj špilji.

Ključne riječi: špilja Zinzulusa, Italija, ugrožene svojte

INTRODUCTION

In recent years the pollution of subterranean aquifers has been becoming a serious problem in several Italian regions and, notwithstanding their remarkable scientific and economical importance, the subterranean fresh and coastal biological resources of this country are declining at a very high rate.

The proliferation of agricultural and pastoral activities, chemical manufacturers and petroleum refineries which discharge their waste into the large and small aquatic reservoirs of the country, the high pollution of the Mediterranean coasts, particularly those related to smaller basins such as the Adriatic and Ionian seas, as well as the pollution of the coastal caves, anchialine habitats included, are rapidly

leading to communities with great economical and scientific value either disappearing or becoming increasingly rare.

Among the most endangered biota of Italy, the Zinzulusa cave (Castro Marina, Lecce) has been recently included in the »Ten Most Endangered Karst Communities for 1999« by the Karst Water Institute since, notwithstanding it probably harbours the most diverse and rich cave animal fauna in Europe (more than 60 stygobitic or stygophilic taxa, mostly endemic and of ancient lineage), is at present strongly polluted from urban discharge, waters threatens the cave, as do tourists who litter and destroy the natural formations mainly near the entrance of the cave. Moreover, in the past the intensive extraction of guano removed an already limited energy resource for the species communities living within the cave.

The fauna of this extraordinary subterranean aquifer is certainly vulnerable and protection requires habitat preservation as well as conservation of the associated epigeal habitat since, as in most situations, protection of surface environments might be the »key« to the conservation of groundwater ecosystems.

In this last regard, local speleological and protectionist groups (Gruppo Speleologico Salentino – P. De Lorentiis, Gruppo Speleologico Neretino, Corpo Nazionale Soccorso Alpino Speleologico – C.N.S.A.S., Dipartimento di Scienze Ambientali – University of L'Aquila) hope that sufficient publicity will encourage the authorities to implement measures aimed at keeping aquifer levels adequate to assure the survival of such precious fauna.

Particularly, the Municipal Administration of Castro is currently developing a protection program for the cave in response to the negative impact of tourism.

The same Administration recently passed a »Regolamento di Sicurezza e Salvaguardia dell'Ecosistema e della Vita Umana in grotta Zinzulusa« (C.C. n. 17, 15.04.1997, reporter N. Ciccarese), and last year the Marine Council of the Environmental Council entrusted the »Istituto di Zoologia«, University of Lecce, with the establishment of the »Area marina protetta di grotta Zinzulusa e Romanelli«.

CAVE DESCRIPTION AND BIOLOGY

Zinzulusa reveals itself by a large entrance opening on to the Ionian sea, 2 km north of Castro Marina (Lecce, Italy). The cave, which originated by karst erosive processes during the Pleistocene, is composed of three distinct parts. The first, which extends from the entrance to the room named »La Cripta«, is formed in compact Eocene limestone, and it is characterized by numerous and beautiful stalactites and stalagmites, vault ruins and a large brackish pool (»La Conca«); the second part, from »La Cripta« to the large room »Il Duomo«, shows a typical erosive morphology going back to the Cretaceous age; in this part there are fewer stalactites and stalagmites and no vault ruins. In the terminal part, about 25 m from the »Il Duomo«, also formed in cretaceous rocks, the most remarkable hydrological phenomenon of the cave, »Il Cocito«, can be observed. In this pond a freshwater, colder lens, about 1 m thick, overlies a layer about 1.5 m deep of brackish water, confirming the anchialine nature of this hydrological system.

The cave was discovered in the year 1793 by Del Duca, and was successively mentioned or described by MONTICELLI (1807), BROCCHI (1821), DE GIORGI (1874) and BOTTI (1871). Later on, from 1922 to 1958, numerous visitors, viz. Bottazzi, De Lorentiis, Stasi, Lazzari, Stammer, Larini, Müller, Dresco, Anelli, Cardini, Blanc, Pasa, Parenzan and Ruffo described the cave, some of them collecting and analyzing the remarkable terrestrial and water animals living inside. Some of these authors supplied the first reliable data on the stygofauna of the cave; particularly, RUFFO (1958) furnished comprehensive information on the extraordinary aquatic stygofauna inhabiting the two inside ponds (»La Conca« and »Il Cocito«), pointing out some of the most ancient and important stygobitic species of the South Italy (Apulia) karst.

In more recent years, from 1972 to 1981, researchers of the »Dipartimento di Scienze Ambientali« of the University of L'Aquila carried out a project to investigate the Zinzulusa cave, as well as the other cave and phreatic habitats (wells) of the Salentine Peninsula, referring to further systematic and bio-geographical data concerning the subterranean aquatic crustaceans living in the ground waters of the Salentine Peninsula.

At present, a program of intensive research in the same karstic area and particularly into the »Zinzulusa« cave (»Zinzulusa: Speleosub '96«) has been promoted by the Castro Commune and Councillor G. Ciccarese. In this research the following are collaborating: the »Gruppo Speleologico Salentino – P. de Lorentiis«, the »Gruppo Speleologico Neretino«, the »Dipartimento di Scienze Ambientali« of the University of L'Aquila, and the following diving operators of the »Gruppo Speleologico Neretino« and the »Corpo Nazionale Soccorso Alpino Speleologico – C.N.S.A.S.«: Antonio Danieli, Raffaele Onorato, Giovanni Contessa, Riccardo Leonardi, Marco Poto and Giancarlo Calsolaro.

In the course of the above research, still in progress, a new N-W way into the Zinzulusa cave has been discovered: the new cavity extends for more than 110 m from the known »Cocito«, it is totally submerged, and shows in addition a wide variety of sediments, stalactites, stalagmites and a remarkable stygofauna. In this part of the cave too, a freshwater lens (about 1.5 m) overlies a brackish water layer about 11.5 m deep. The present discovery brings the total length of the cave to about 260 m (before only 150 m were known), and definitively contradicts the main, past hypotheses regarding the length and the hydrology of the cave (PARENZAN, 1958; LAZZARI, 1966), which suggested that the »Cocito« pool was completely closed, representing the terminal part of the cave.

From a biological point of view the first pond inside the cave (»La Conca«) is characterized by more brackish waters and harbors directly sea-originated species, for the most part copepod crustaceans such as *Neocyclops remanei mediterraneus* (Kiefer, 1960), *Schizopera clandestina* Klie, 1924, *Nitokra affinis* (Gurney, 1927), *Esola spelaea* (Chappuis, 1938), as well as fresh water taxa, viz. *Eucyclops serrulatus* (Fischer 1851), *Bryocamptus pygmaeus* (Sars, 1863), *Bryocamptus dentatus* Chappuis, 1937; in the second pool, »Il Cocito«, characterized as oligohaline, lives a typical stygobitic fauna including the copepods *Nitocrella stammeri* Chappuis, 1938, *Metacyclops subdulus* Kiefer, 1938, *Metacyclops stammeri* Kiefer, 1938, *Ameira scotti* Sars, 1911, *Psyllocamptus monacus* (Chappuis, 1938) and *Halicyclops rotundipes* Kiefer, 1935, the

ostracod *Pseudolymnocythere hypogea* Klie, 1938, the amphipod *Metahadzia minuta* (Ruffo, 1947), the thermosbaenacean *Monodella stygicola* Ruffo, 1949, the gastropod mollusc *Ovatella myosotis* Draparnaud, 1801 and the remarkable decapod *Typhlocaris salentina* Caroli, 1923.

The stygophilic copepods *Metacyclops minutus* (Claus, 1863) and *Nitokra spinipes* Boeck, 1864, the water mite *Soldanellonix monardi* Walter, 1922 and the mysid *Spelaeomysis bottazzii* Caroli, 1924 can be found in both the pools, apparently being less affected by temperature and salinity variations. In the deep »Cocito« (the new, submerged N-W way), still in the course of exploration, to our great surprise, beside other known noteworthy stygobitic material (copepods, water mites, decapods), the amphipod *Salentinella gracillima* Ruffo, 1947, the mysid *Stygiomysis hydruntina* Caroli, 1937, polychaete worms, previously unrecorded from the cave, and a new stygobitic sponge, *Higginsia ciccaresei* Pansini & Pesce, 1998 have been collected.

The discovery of *Higginsia ciccaresei* in the subterranean waters of Italy is remarkable, since the sponges are rarely found inhabiting caves or other subterranean habitats, and till now strictly stygobitic representatives of this taxon were known only from caves in San Salvador (*Pellina penicilliformis* van Soest & Sass, 1981, *Prosuberites geracei* van Soest & Sass, 1981, *Cynachyra subterranea* van Soest & Sass, 1981) and Croatia (*Eunapius subterraneus subterraneus* Sket & Velikonja, 1985, *Eunapius subterraneus mollisparspanis* Sket & Velikonja, 1985).

Moreover, recent studies regarding the ostracod fauna of Italy are revealing newer and rarer interesting species (genera *Trapezicandona*, *Pseudolimnocythere*), still in course of description, living in the ground waters of south Italy and in the Zinzulusa cave.

For the most part the stygobitic taxa living in the cave, including the recently discovered sponge and ostracods, could be considered palaeo-Mediterranean elements belonging to a warm fauna which survived the post-Pliocene climatic changes that occurred in the Mediterranean basin; the other taxa, including stygophilic species and subspecies, most probably colonized the groundwater systems of the cave, as well as the remaining groundwater network of the Salentine Peninsula, in a rather recent age. The present subaqueous research and the discoveries in the new path leading from the »Cocito«, actually in course of exploration, seem to strengthen the above hypothesis, as well as suggesting that the extent and the biological complexity of this cave could be much greater than previously thought.

THREATENED STYGOFAUNA

Groundwater taxa living in the cave could be classified as variously threatened, most of them fitting the Red List category »VU«, as they show an acute restriction in their distribution, or in the number of locations (generally 1, or less than 3); other taxa, such as the copepods *Esola spelaea* and *Psyllocamptus monachus*, and the thermosbaenacean *Monodella stygicola* quite fit the category »EX« since exhaustive surveys in known or expected habitats, throughout the last 40 years, have failed to record any individual; remaining species belong to the category »LR.nt«, because they currently do not qualify for »Conservation Dependent«, but are close to qualifying for »Vulnerable«. (Tab. 1).

Tab. 1. List of endangered taxa in the Zinzulusa cave according to IUCN categories

PORIFERA	<i>Higginsia ciccaresei</i>	VU
COPEPODA	<i>Halicyclops rotundipes</i>	LR.nt
	<i>Neocyclops mediterraneus</i>	LR.nt
	<i>Metacyclops minutus</i>	LR.nt
	<i>Metacyclops stammeri</i>	VU
	<i>Metacyclops subdolosus</i>	VU
	<i>Nitocrella stammeri</i>	LR.nt
	<i>Esola spelaea</i>	EX
	<i>Psyllocamptus monachus</i>	EX
OSTRACODA	<i>Pseudolymnocythere hypogaea</i>	VU
MYSIDACEA	<i>Spelaeomysis bottazzii</i>	VU
	<i>Stygiomysis hydruntina</i>	VU
AMPHIPODA	<i>Salentinella gracillima</i>	VU
	<i>Metahadzia minuta</i>	VU
DECAPODA	<i>Typhlocaris salentina</i>	VU
THERMOSBAENACEA	<i>Monodella stygicola</i>	EX
ACARINA	<i>Saldonellonix monardi</i>	LR.nt
GASTROPODA	<i>Ovatella myosotis</i>	LR.nt

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