IDENTIFYING HYPOGENIC FEATURES IN GREEK CAVES

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ABSTRACT

Hypogene speleogenesis is studied during the last 5 years in Greece. Many caves considered previously as epigenic are now reinterpreted as hypogenic. In Central and Northern Greece hypogenic caves are related with confined speleogenesis and the dominance of impermeable rock exposures. Many characteristics indicative of hypogenic speleogenesis are distinguished and related to the general geological setting such as network mazes, gypsum concentrations and confined aquifers. Hydrothermalism plays a key role in hypogenic caves' speleogenesis in Greece. Several features indicative of H_2S concentrations have been identified in caves. Melissotrypa cave is the biggest cave in Central Greece where the speleogenesis processes are interpreted under the prism of hypogenic processes. The cave has been developed under water table from hypogenic solutions following the main tectonic discontinuities.

INTRODUCTION

Carbonate rocks in Greece crop out over 50% of its surface. An extensional tectonic process in Greek mainland since Miocene (Pavlides & Mountrakis, 1987) has led to big areas uplift and to disclosure of underground karstic systems. The biggest karst regions with numerous caves are bounded mainly in Peloponnesus and Crete Island. However few studies have been conducted concerning speleogenetical aspects till last decade. Several caves, mostly in Northern Greece, are being studied last 5 years by speleologists of the Department of Geology in Thessaloniki. Cave exploration has been conducted by the Hellenic Speleological Society (Thessaloniki's Local Department) and the Thessalian Society of Speleological Research "Chiron". Many of the investigated caves present well disguisable characteristics that imply their genetical history (Fig.1). Some of them have hypogenic features but in most cases it's very difficult to define because of the epigenic overprint.

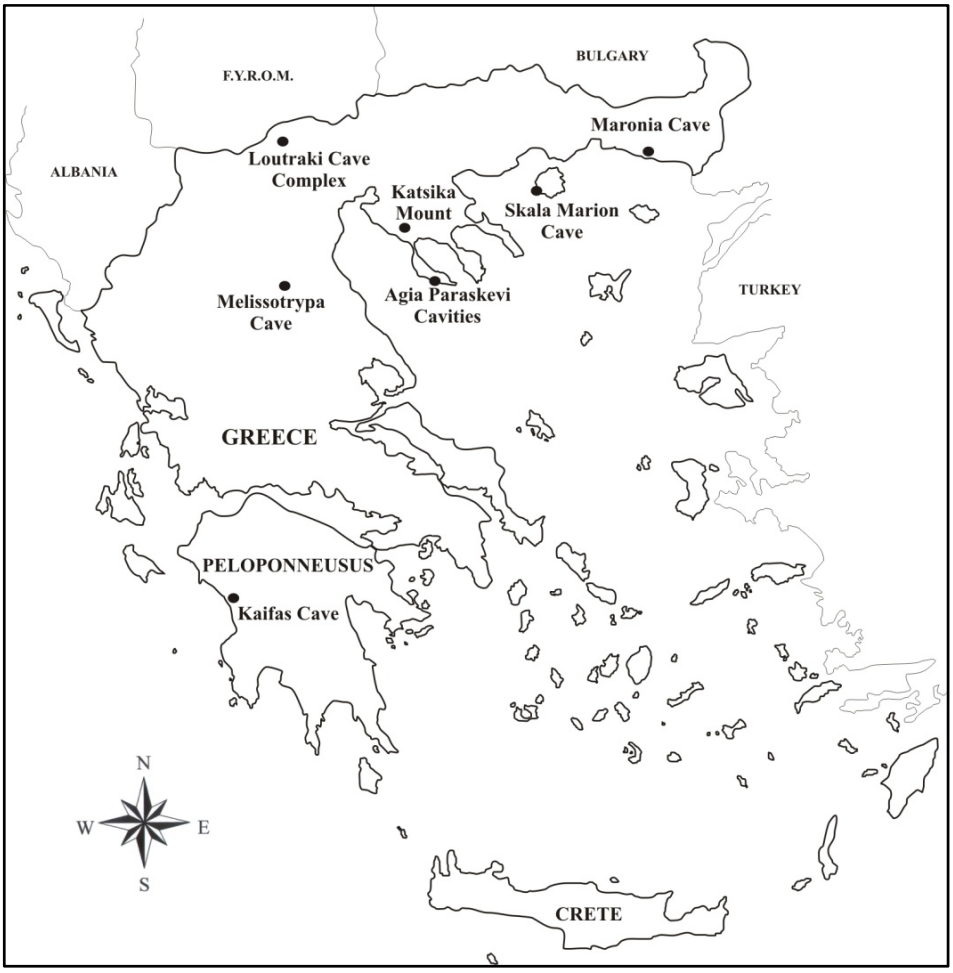

Fig.1 Map of Greece showing the caves with implications of hypogenic solutions activity. Kaiafas, Loutraki and Agia Paraskevi caves are located to areas with thermal springs. Katsika mount is near to area with deep thermal fluids' activity

MELISSOTRYPA CAVE

Melissotripa cave is located in Larissa prefecture 12km west of Elassona town. The entire cave system is developed in the neritic carbonate “Kranea unit”, over which ophiolitic bodies and the Pelagonian nappe were thrust during the Alpine orogeny (Kilias & Mountrakis, 1987). The Kranea karstic aquifer starts its formation during the end of Oligocene. It covers an area of 90 Km^2 and 1850m thickness. The large spring of Kefalovriso, which is of overflow type, is formed by the northeastern edge of the aforementioned karst system and is its only discharge point.

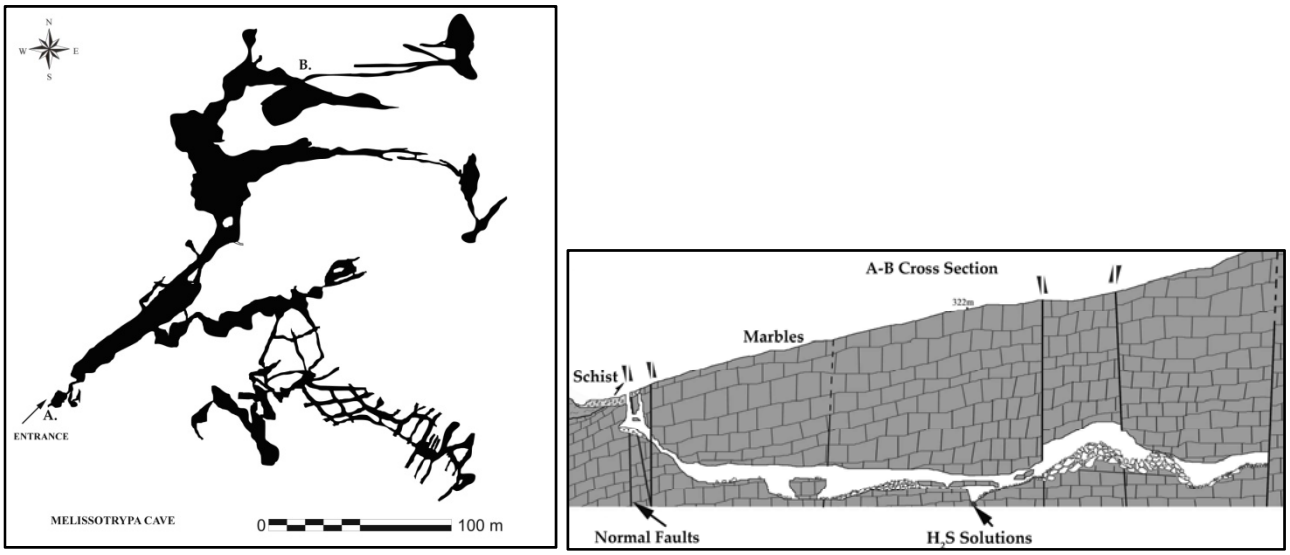

Fig. 2 Map of Melissotrypa (left) and A-B cross – section (right).

The entrance of the cave (alt.299m) forms a 14,6m shaft, starting its developing at marble’s debris for 5,3m and continues at a fault zone inside the marble mass (Fig. 2). Melissotrypa can be conveniently divided into two distinctive segments: The main karstic tube at the northwestern part and the maze area at the southeastern part.

More than 2000m of passages and chambers were mapped during 2006. All the areas at the northwestern part are characterized of breakdown morphology, more or less and stop their widening in the marble’s normal faults. Some of the faults were found at the cave’s surface too.

Melissotripa cave has been developed under confined conditions from hypogenic solutions following the main tectonic discontinuities (Vaxevanopoulos, 2006). Joints and faults are the planar breaks that have served the principal structural guides for underground flows. The area’s uplift leads the phreatic formed cave to the vadose zone where the phreatic tubes are destroyed under the air filled corrosion phenomena (Fig. 3). Speleothems such as stalactites, stalagmites, columns, flowstone, coralloids, frostwork, boxwork, cave blisters, powder, pearls and helictites are found in Melissotrypa’s great chambers and big corridors. At present day, hypogenesis is still occurs under the water table where fluids enriched in H_2S dissolve the marbles.

Hydrogen sulfide and methane are the only seepage gases responsible for inducing biological effects in caves, while radon and carbon dioxide do not induce any biological effects (Forti et al, 2002). Several biocommunities were found at Melissotrypa’s speleothems with important relation with H_2S concentrations and they are now studied by biologists at University of Thessaly in Greece.

Fig. 3 The inner part of Melissotrypa a) Phreatic tube at the southeastern part b) Lake with H_2S solutions c) Cupolas from the main tube’s ceiling cross-cut by a fault (camera angle is ~80° up from horizontal, looking toward the ceiling) d) Scallops, cupolas and breakdown domes from the western part of Melissotrypa

KAIAFA'S CAVE

Kaiafa's cave is located in west Peloponnesus at a thermal spring's area. The entrance of the cave has been developed for touristic reasons. There is a big lake at the cave's first part with thermal water where tourists are having their hot bath. The cave consists of a big cave gallery and its western part is described by maze like cave corridors. Hypogenic thermal waters seem to have exclusively influenced the cave's maze part.

LOUTRAKI CAVE COMPLEX

Loutraki constitutes a very common Greek name for a village with vicinity to a thermal spring, meaning "small bath". One of the most famous Loutraki villages is located in the Pella Prefecture, Northern Greece (Macedonia). The cave complex consists of 16 cave formations in a steep gorge with altitude range from 400 to 650m. The caves are formed at the Pelagonia Zone's recrystallized limestones. Hypogenic features such as feeders, pendants, network mazes, hypogenic outlets are found in most of them although vadose processes are destroying the phreatic characteristics (Fig.4). Thermally ascending water was probably responsible for the formation of the caves where thermal springs occur even today (Lazaridis, 2006). The majority of Loutraki Caves exhibit hypogene origin.

Fig. 4 Pendants from the Antarton Cave in Loutraki Cave Complex.

KATSIKA MOUNT

Katsika mount is located in Chalkidiki Prefecture (Macedonia) and hosts the cave of Petralona where many paleontological remains have been excavated. The most interesting finding was a transitive from Homo Erectus to Homo Sapiens skull dated to Middle Pleistocene (Stringer et al, 1979). Three other caves have been investigated under the prism of hypogenesis. The presence of thermal fluids in deep drills shows a thermal fluid circulation. Combining with the maze formation of the Petralona cave and the speleothems in the Bat Cave (500m south of Petralona cave) we can assume fluid circulation through a fault zone N-S trending (Vaxevanopoulos, 2003).

SYNOPSIS

Many caves in Greece present hypogenic characteristics. We assume that 20% of the horizontal Greek caves exhibit hypogenic origin. This is caused by the plurality of areas with geothermal activity affecting karstic aquifers. Melissotripa is the most representative hypogenic cave in central Greece. Other caves present fewer implications for hypogenic origin like the Maronia cave, Agias Paraskeyis cave and Skalas Marion. At latte, crystals of barite were found at its upper part. More speleological studies have to be conducted because there are many examples of hypogenic caves considered as epigenic.

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