COMPRESSED RARITIES

GEO-, PALEO- AND MORPHOLOGICAL PARTICULARITIES

WITHIN THE SPELEAN ENVIRONMENT

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ABSTRACT

Ursului Cave from Cracul Stâna Tomii (Retezatul Mic Mountains) shows remarkable features, unique to Romania's speleological environment being the calcite-cemented concretions or so-called "trovanți" formed *in-situ* and not allochtone.

Keywords: calcite-cemented concretions, cave sediments, *Ursus spelaeus*, Retezat Mountains, Southern Carpathian.

INTRODUCTION

Retezatul Mic (Piatra Iorgovanului-Piule-Pleșa Mountains), belonging to Retezat National Park, is a distinct unit of Southern Carpathian Mountains (Romania), spanning between Jiul de Vest River in the south, and Lăpușnicul Mare River in the north. It represents an alpine karstic carbonates plateau (around 2000 m above sea) shaped by ancient rivers and glaciers, during three erosional stages (De Martonne, 1906).
Retezatul Mic stands out for the presence of at least 158 known caves (Goran, 1982), only a small number of them exceeding a few hundred meters in length. However, some of these caves show remarkable features, like several vertical caves hosting perennial ice, the 114 meters drop from the vertical cave known as Avenul din Stâna Tomii, the almost 5 meters long stalactites and 2 meters wide disk found in Zeicului Cave, or, the calcite-cemented concretions or so-called "trovanți" (*sensu* Murgoci, 1907) which can be found in Ursului Cave from Cracul Stâna Tomii.

GEOLOGICAL SETTING

The rocks exposed in Retezatul Mic Mountains belong to Lower Danubian nappes (Fig. 1), consists of metamorphic basement (Drăgșanu metavolcanic and Laicini-Păiuș metasedimentary series; see Liégeois et al., 1996) with granitoides intrusions (Retezat, Buta) capped by sedimentary rocks of Paleozoic and Precambrian age, overlain by Mesozoic sedimentary cover.
The sedimentary cover forms a wide asymmetrical syncline oriented NE-SW, its southern flank cut by the Cerna-Jiu Fault and a series of secondary fractures (Bădescu, 1991). It

starts with Permian conglomerates, unconformably overlain by Early-Middle Jurassic with arkoses and calcareous sandstones, followed by 1000 meters thick Late Jurassic-Aptian limestones (arenitic, algal and bioclastic types). The Upper Cretaceous siliciclastic deposits (conglomerates, sandstones, marls) (Pop, 1963) end the sedimentary sequence.
The present day structural style was defined by multistage tectonics (Ratschbacher et al., 1993; Berza and Drăgănescu, 1988; among others).

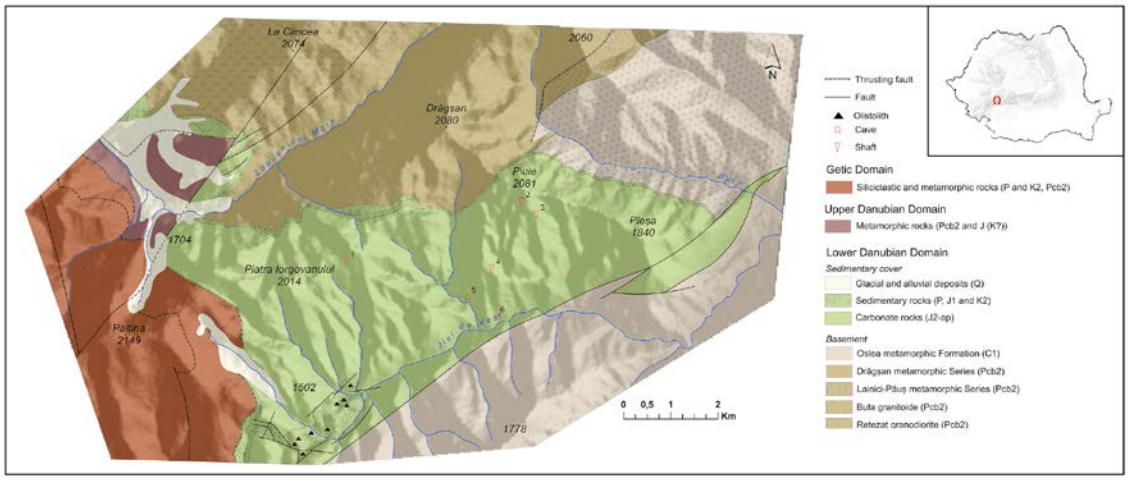

Figure 1 – The location of Retezatul Mic Mountains within the Romanian territory; the geological map of the area (after Oslea Sheet 1:50000, unpublished) and the location of the shafts and caves mentioned in the text: [1] Avenul mare cu Zăpadă din Albele Găuroanele, [2] Avenul cu gheață de sub Vârful Piule, [3] Avenul cu gheață din Dâlma Brazii cei Vineți, [4] Avenul Stâna Tomii, [5] Zeicului Cave, [6] Ursului cave from Cracul Stâna Tomii.

NEW RESEARCH BRINGS NEW DATA

Ursului Cave from Cracul Stâna Tomii was discovered in August 1981 by a "Focul Viu" Speleological Association team, recently the exploration and scientific observations there have been resumed. The cave, located on the left side of Jiul de Vest Valley (Fig. 1), is the longest cavity in the Retezatul Mic (Piatra Iorgovanului-Piule-Pleșa) Mountains with a 429 meters in length including the newly discovered passages and halls. It is entirely developed in blackish-grayish limestones of Upper Jurassic, intensely fractured, and was shaped by underground waters probably during an active Riss-Würm interglacial period, corresponding to the end of Pliocene-Pleistocene interval. The cave is hydrologically inactive, the water finding its way inside nowadays comes exclusively from meteoric infiltrations (rain and melting snow).
Ursului Cave proves to be unique in Romania through a sedimentological perspective, but is also showing morphological and paleontological particularities.

Morphological particularities

Ursului Cave, with a 63 meters vertical extent and 78 meters extension, is really impressive for such a small cave. The cave comprises of four distinct levels (Ponta et al., 1984) (Fig. 2), separated by vertical drops ranging between 6 and 28 meters, and consists of a series of superposed halls of various sizes; the largest of all having around 33 meters

in height, 35 meters in length, and 25 meters wide. The second and third levels are punctuated with monumental flowstones, uniquely shaped stalactites (Plate I, A and B), and moonmilk domes (Plate I, C) that can reach up to 30 meters in height.
The cave's halls acted as an inflow point for the drained waters from the torrential valley above. The short and narrow passage which nowadays gives access to the cave was formed at a later stage.

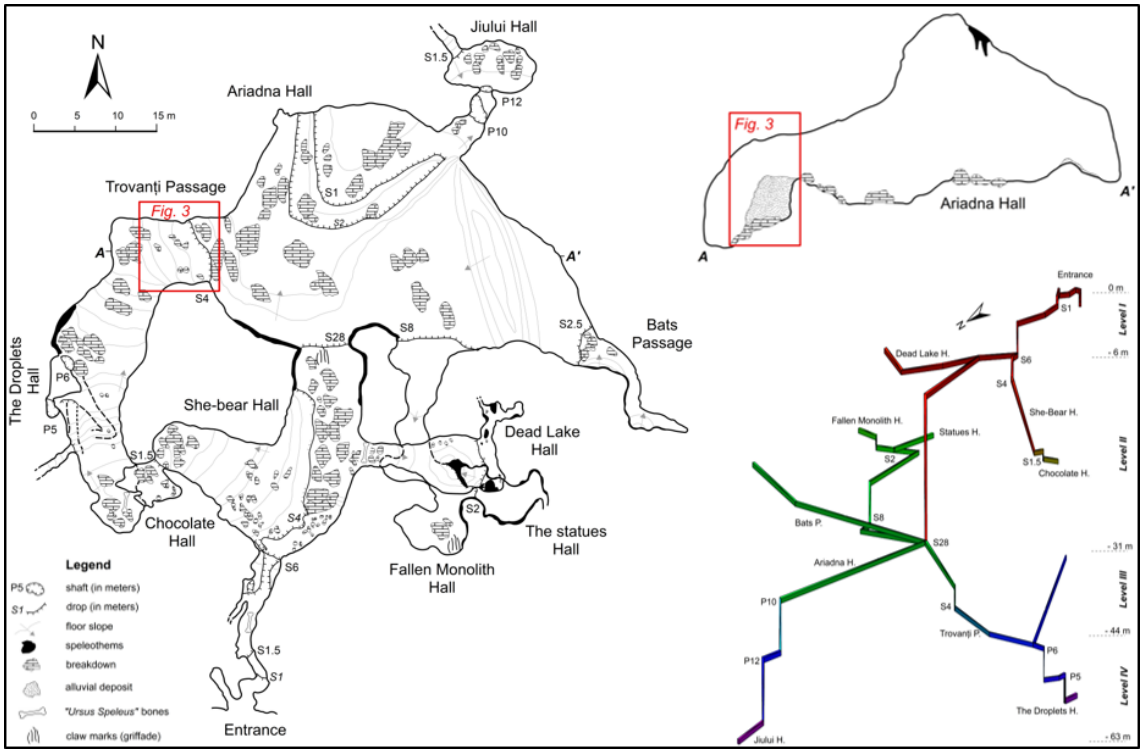

Figure 2 - Ursului Cave from Cracul Stâna Tomii map (after Bădescu, 1991) completed with the newly discovered parts (The New Passage, Fallen monolith and Statues Halls), from 2019-2020. Cross-section (A-A') with the position of the outcrop containing the calcite-cemented concretions. 2D depth profile showing 4 distinct levels of cave development.

Paleontological particularities

Ursului Cave, as its name suggests, contains Pleistocene cave bear fossils, being surpassed in variety/quantity of the remains only by Zeicului Cave.
In recent days, the passages located shortly after the entrance and in between the She-Bear Hall on the one hand and The Dead Lake Hall on the other, host scattered remains of *Ursus spelaeus* (Fig. 2). Some of the fossil remains are buried within the sediment, while others are scattered on the passage floor and coated with thin layers of calcite (Plate I, D). The skeletal remains identified include: long bones (femur, tibia, humerus, ulna), scapula, pieces of pelvis (ischium and pubis), ribs, many vertebrae, cervical area included (atlas and axis) (Plate I, D and E), several small bones (phalanges) and teeth. The size of the bones and their number hint at a she-bear and cub remains.
Another noticeable rarity is the presence of claw marks (griffade), found in the recently discovered Fallen monolith and Statues Halls. Dozens of claw marks are randomly distributed on the steep sides of a stalagmitic dome (Plate I, F), the scratched surface of

which is up to almost 1.0 meter in height, and also on an almost 2.0 meters high soft moonmilk dome. The chaotic aspect of the assemblage suggests an attempt in finding an exit, which hints at a story of survival. Since no skeleton was found, we deduced that this was the escape route from the Statue Hall, through a narrow passage. The distance between the claw marks suggests that a small mammal, probably attributed to a member of Mustelidae family, was involved.

Sedimentological particularities

The most intriguing feature of this cave is the calcite-cemented concretions found in one of the siliciclastic deposits (Nuțu-Dragomir, in prep.), located on Trovanți passage (Fig. 3).

The subject of calcite-cemented concretions is well documented since it is a relatively common occurrence in marine and fluvial deposits (Melinte-Dobrinescu, 2019; Wanas, 2008; McBride et al., 2003 and many others). However, the only calcareous concretions mentioned in the spelean environment are cave pearls (pisoliths). The only other mention of a documented similar phenomenon worldwide is in a Cave in Tounj quarry, Croatia (Lacklović, 1998). On the Romanian territory, such occurrences (calcite-cemented concretions) in the spelean environment were not mentioned, to our knowledge.

In Ursului Cave, the calcite-cemented concretions are found within an alluvial deposit (6 m X 2-5 m X 2 to 4 m) (Fig. 3a and 3b) of gravelly sand which passes into fine sand and coarse silt toward the top. More than a score of calcite-cemented concretions can be observed, gathered at the lower end of the outcrop. The concretions, from spheroidal to more flattened geometries (Fig. 3c and 3d), have diameters between 1-2 to 30 centimeters, and may weigh up to 7 kilograms. The spheroidal shapes are scattered through the deposit mass, while the flattened geometries tend to be found at the bottom sand layers, they are scarcer, and can only be observed in a small area on the first 3 meters along the outcrop. Similarly to inference of Seilacher (2001), the calcite-cemented concretions origin is early diagenetic, the spherical ones formed before the beginning of the compaction process, while the flattened geometries are caused by the increasing of compactional gradient.

The framework grains consists of metamorphic (gneiss, mica schist, amphibolites) and sedimentary rocks (shale, siltstone) fragments, mostly monocrystalline quartz, rare feldspars, and heavy mineral (pyroxene, epidote, hornblende, ilmenite, pyrite). The petrographic composition of the concretions reflects the sediment composition (Fig. 3e and 3f), and varies within the siliciclastic deposit. The source of the detritic clasts is assigned to both Permian siliciclastic rock and Upper Precambrian metamorphic rocks of the Lower Danubian, meaning the Drăgșan Group.

In addition, the concretions are cemented with blocky or poikilotopic calcite (Fig. 3e), which reflects a meteoric origin. We noticed that the quantitative increase of the clay matrix within the concretions, to the detriment of the calcite cement, was stimulated by an increase of shale clasts percentage. Some of the quartz grains and metamorphic rock fragments display signs of partial replacement, which is evidenced through the clasts peripheral corrosion by the calcite cement (Fig. 3e).

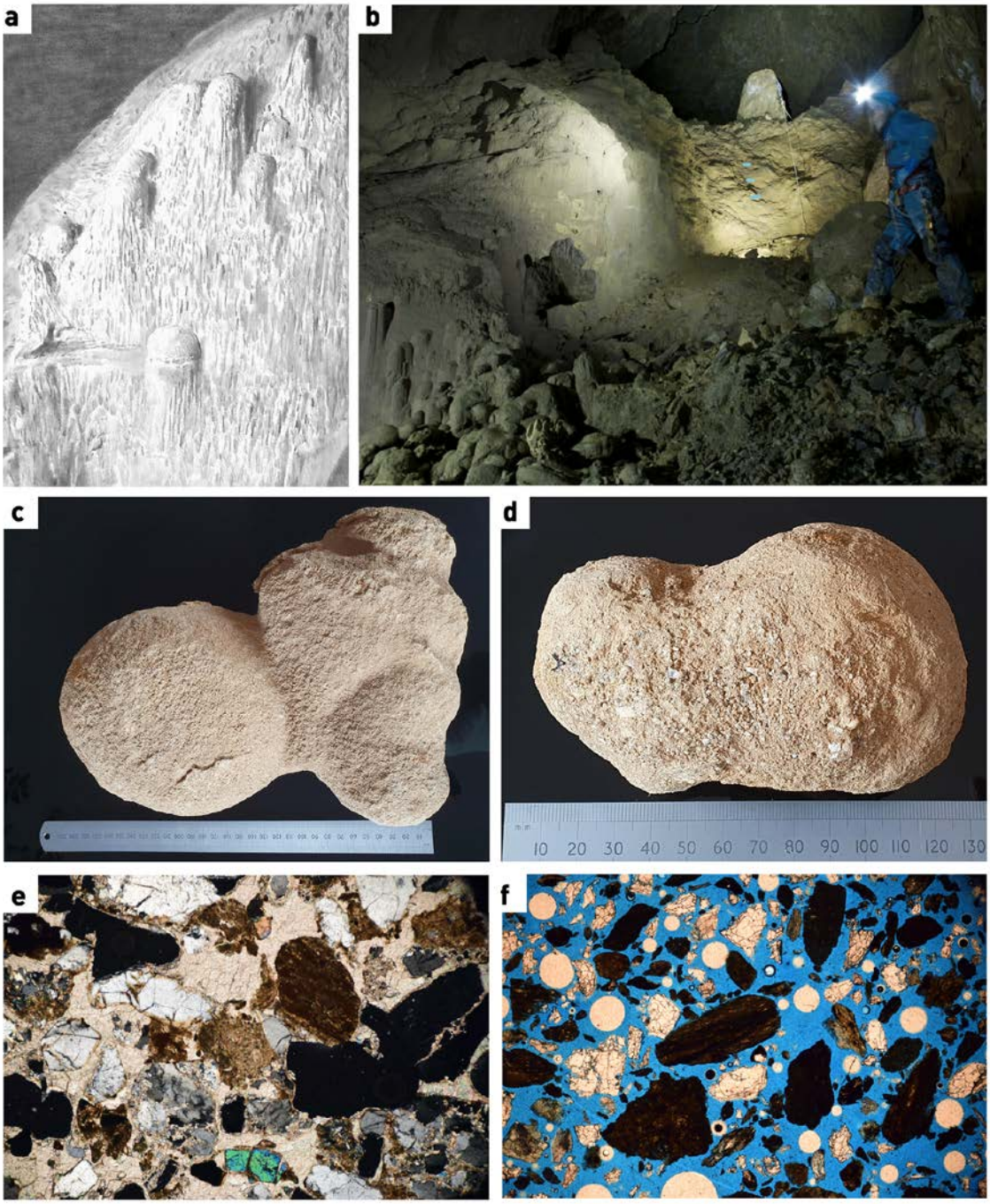

Figure 3 - Photographs representing: a) detailed sketch (drawing) with "trovanți" found *in-situ*; b) the siliciclastic deposit hosting the calcite-cemented concretions; c) and d) examples of concretions with various geometries and different grain-sizes. Thin-section photomicrographs of concretions and host sediment: e) detail from a concretions with subequal amounts of quartz, sedimentary and metamorphic rocks fragments, feldspar, heavy minerals and calcite cement; f) fine sand containing mostly quartz and sedimentary rock fragments.

The surprising result of the observations is that "the trovanți" have developed *in-situ* opposite to transported, a fact confirmed by the concretions petrography which is identical

with the gravelly sand, fine sand and coarse silt layers in which they are formed (Fig. 3e and 3f).

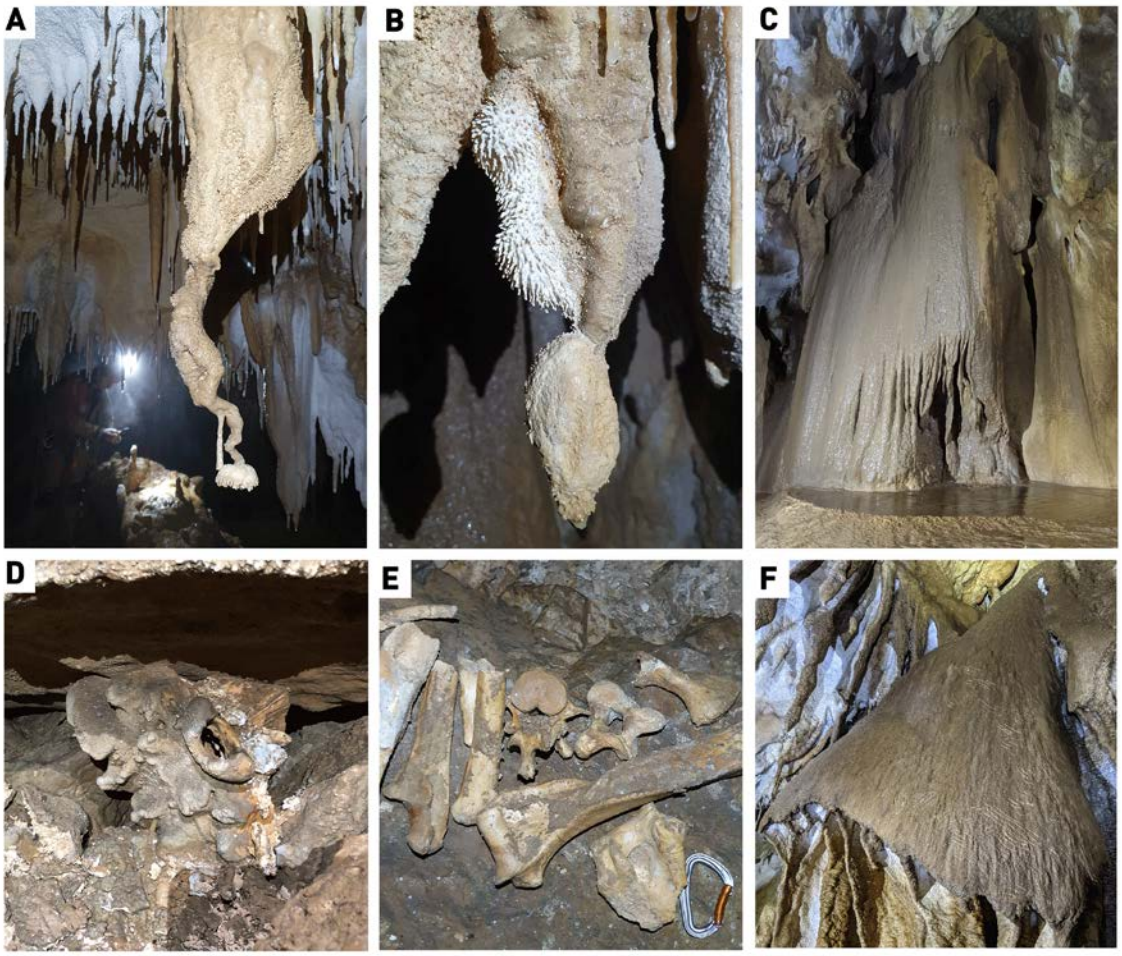

Plate I - Photographs from from Ursului Cave showing: A) and B) spectacular stalactites from the Fallen Monolith Hall; C) 3.5 meters moonmilk dome from Statues Hall; D) and E) cave bear (*Ursus spelaeus)* remains; F) stalagmitic dome from the Fallen monolith Hall showing claw marks of a small animal, possible from Mustelidae family.

CONCLUSIONS

Retezatul Mic Mountains, after decades of explorations, still deliver speleological novelties. In addition to the already known superlatives in this massif (Zeicului Cave, Avenul Stâna Tomii and others), we can add the recent discoveries from Ursului Cave from Cracul Stâna Tomii. The recently studied calcite-cemented concretions or so called "trovanți" developed *in-situ*, in one of the siliciclastic cave deposits, seems to be an unique occurrence in Romanian geology, as far as we know. The claw marks (grifade) located in the recently discovered halls, as well as its peculiar morphology add to the uniqueness of Ursului Cave.

ACKNOWLEDGEMENTS

We would like to thank you to Dr. Relu-Dumitru Roban (University of Bucharest), Tiberius Marian and our colleagues from A.S. "Focul Viu" Mihai Hristescu, Gabriel Constantinescu, Maria Ungureanu, Răzvan Olaru and Adrian Rădulescu for their support.

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