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Làjos Bethlen's crypt (Chiraleş, Romania): a geological viewpoint

Tudor Tămaş[1,2,], Codruța Valea[1,2], Szabolcs Attila Kövecsi[1,3], Eusebiu Szekely[1,2]*

Abstract

The crypt of Count Làjos Bethlen from Chiraleş (Romania) was built between 1815 and 1818 in a small cliff face on his property, with the purpose of burying the earthly remains of the count and his wife. At present, the crypt is affected by various degrees of weathering and vandalism. A detailed survey of the crypt was done along with constructing sedimentological logs and sampling for lithology, palaeontology, and mineralogy; the samples were taken from inconspicuous places along the walls and were studied by means of X-ray diffraction and optical and electron microscopy. The crypt ensemble is 40 m long and has two entrances leading to two tunnels, 15 and 13 m long, that connect in a central chamber, decorated with bas reliefs. This chamber connects to the smaller tomb chamber. The cavity was dug in late Sarmatian (middle Miocene) weakly cemented sands, sandy clays and silty clay sediments with occasional rip-up clasts, deposited in a delta channel facies. The fossil remains identified consist of reworked foraminifera, probably Badenian age, and fragments of limonitized wood. The secondary deposits found along the galleries consist of goethite crusts and gypsum crusts and crystals, as well as mirabilite and thenardite in the alcove and the main entrance area.

Keywords: XIX century crypt, lithology, mineralogy, late Sarmatian deposits, Chiraleş, Romania.

Introduction and historical background: what was it like and what is left

A large number of artificial cavities are known to exist in the upper Oligocene - Miocene continental and deltaic deposits of NW Transylvania; they represent mostly mining adits, storage cellars or even supposedly hideouts (Kádár**,** 1901), with ages estimated to vary from the early - late middle age to the communist period. Among these objectives occurring across 3 counties and which did not receive much attention from a caving viewpoint, the crypt of Lájos Bethlen from Chiraleş (Hungarian: Kerlés), located in Bistrița-Năsăud County in Romania**,** stands out as a historically well documented site with a particular designation (fig. 1). At present, this artificial cavity is the only remaining vestige of a formerly famous domain with a small castle and garden (Pataky, 1847; Makkai**,** 1941) (fig. 1). A simple internet search gives a quite large number of hits regarding tourist visits to the crypt, conveniently located on the side of the county road 151 (47° 5' 27.546" N, 24° 18' 51.5514" E). Many of these also document its poor state of preservation. To our knowledge, no speleological or geological investigation was done so far at the site. Therefore, we decided to document the cavity by the means available to us: we surveyed the cavity in detail, completed sedimentological profiles and sampled the crypt for paleontological and mineralogical analyses. This paper presents the results of our investigations.

Count Lájos Bethlen (1782 – 1867) took over the prop-

Fig. 1 – a) Location of Chiraleş in Northern Transylvania; b) Drawing of L. Bethlen's park and castle, with the crypt in the little cliff underneath, from Kőváry (1853).

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erty in Chiraleş in 1803 (Nagyajtai Kovács, 1861), then proceeded to build the castle, where he settled with his wife Klára by 1810, according to his autobiography (Makkai, 1941). The crypt in a small cliff facing towards the Şieu river was dug between 1815 and 1818: "*…cut a thirty-two* öl *tunnel and into its depths I finished my crypt, with the three Parcae statues, with great skill, with a foreign sculptor, in two and a half years. This crypt now hides the remains of the best, holiest woman - my dear partner in faith Countess Klára Bethlen - who died in 1839, October 30, at the age of forty-nine"* (Makkai, 1941).

After being liberated from a term in prison in 1826, Bethlen continued working on the property until 1848, when much of it was damaged during the revolution (Kőváry, 1853; Hegyesy, 1917; Bíró, 1943); other than old drawings and some photos, very little is known, since the building plans were also destroyed during the looting (Zador and Rados, 1943). Bethlen spent most of his last living years afterwards trying to repair the damage. He died on March 16, 1867, at the age of 85 and was buried in the crypt (Lukinich, 1927). An article 13 years after his death documents the state of the property, by then inhabited by his daughter Klára, and gives a description of the crypt: *"At the bend in the tunnel, a rusty door creaks open […] In one half of the cavern, two plaques on the wall show who sleeps further inside: Count Lájos Bethlen, the creator of the garden and crypt, with his loving wife: Countess Klára Bethlen. On the side of the sleeping count, the traveler reads from a slanted stone slab: "Pax vobi" and on the side of the countess, death stares […] A large alcove is cut into the side of the hollow with a grouping of mythological statues: three Parcae carved in larger than life proportions […]. The corridor going up from the other exit of the crypt leads to the slope from where you can get down on a narrow path"* (Ödön, 1880). Over the years, many visitors of the castle and park inscribed their names in the rock on the cliff face at the entrances, and there were several verses of poems carved in the rock, now affected in various degrees by weathering and vandalism.

By 1898, the monography of the region - then known as the Szolnok-Doboka county - has a last note on the heirs of the property (Kádár, 1901); the castle was not inhabited after 1900. The crypt containing the remains of the count and his wife was then desecrated during World War I (Bordás, 2011), while the castle, still existing in a precarious condition in 1943 (Zador and Rados, 1943) was completely demolished after World War II, with the installation of the communist regime. At present, although the crypt is relatively well known and frequently visited, it lies in a very poor state of conservation.

Materials and methods

We surveyed the cavity with a DistoX2 and PDA, using the Pocket Topo software (Heeb, 2014), drawing lithological cross-sections and sampling for sedimentology, paleontology and mineralogy. The samples were so chosen as to not affect any inscription or sculpture still left in the cavity and on the cliff face. For microfossil identification, the samples were prepared using the method proposed by Armstrong and Brasier (2005): they were dried in the oven, then soaked in water and boiled for one hour, washed over a 64 μm mesh sieve, and the resulted residuum (> 64 μm) dried again for 24 h in oven at 50°C. The foraminifera were determined under the optical microscope. To obtain the granulometric fractions, we used a set of sieves ranging from 4 mm to > 32 μm. The dried sediment was placed on the largest mesh sieve and with a help of sieve shaker the samples were vibrated for 5 minutes. After this step the percent participation of each fraction was calculated. Mineralogical samples were analysed by X-ray diffraction (XRD) and scanning electron microscopy.

Results and discussion

Survey and description of the cavity

The general situation of the entrances to the crypt and the alcove is shown in figure 2a and the survey of L. Bethlen's crypt is presented in figure 2b. Based on our survey, the crypt ensemble is 40 m long, including the tomb chamber - a bit shorter than thirty-two Transylvanian *öl*, which would measure ca. 60 m (*1 Transylvanian öl = 1,866 m* - Bogdán, 1990). Assuming our references for the length measurements in the era are correct, we can only infer that Bethlen's estimation was exaggerated. The empty alcove (or niche) between the two entrances (fig. 2a, b), 2.5 m deep, was said to be initially decorated as a hermit shelter. The tunnel starting from the main, lower entrance (2.4 x 2.4 m) is 15 m long and has a roughly semicircular cross-section, with notches on the sides corresponding to clay intercalations with lower resistance to digging, and possibly also affected by weathering later on. This tunnel leads, after a 90° turn to NW, to a central elliptic chamber, 6.2 m long and 5 m wide, with a higher ceiling (4 m) dug along a more resistant bedding plane within the massive sand strata (fig 2b). The ceiling has been shaped as a cupola, but the encounter of several parallel fissures oriented SE-NW, almost parallel to the cliff face at the surface, may have caused its irregular shape of its western side (fig 3). The unstable rocks fallen along the direction of these fissures were probably removed during the digging stage. The only art features left from the initial work are encountered in this part of the cavity, namely the bas-relief sculptures surrounding the entrance to the tomb chamber: one can recognize a seated winged silhouette holding an hourglass and a scythe (the Grim reaper) on the left of the entrance, the owl at the top, a few branches and leaves and some tools (fig 4, 5). The right knee of the statue was damaged and has traces of mortar from an unsuccessful attempt of restoration (fig 5). Opposite to the tomb entrance there is a 2.3 m wide niche dug for the three Parcae statues. The empty tomb chamber (3.8 x 2.3 m), which was probably gated (Bor-

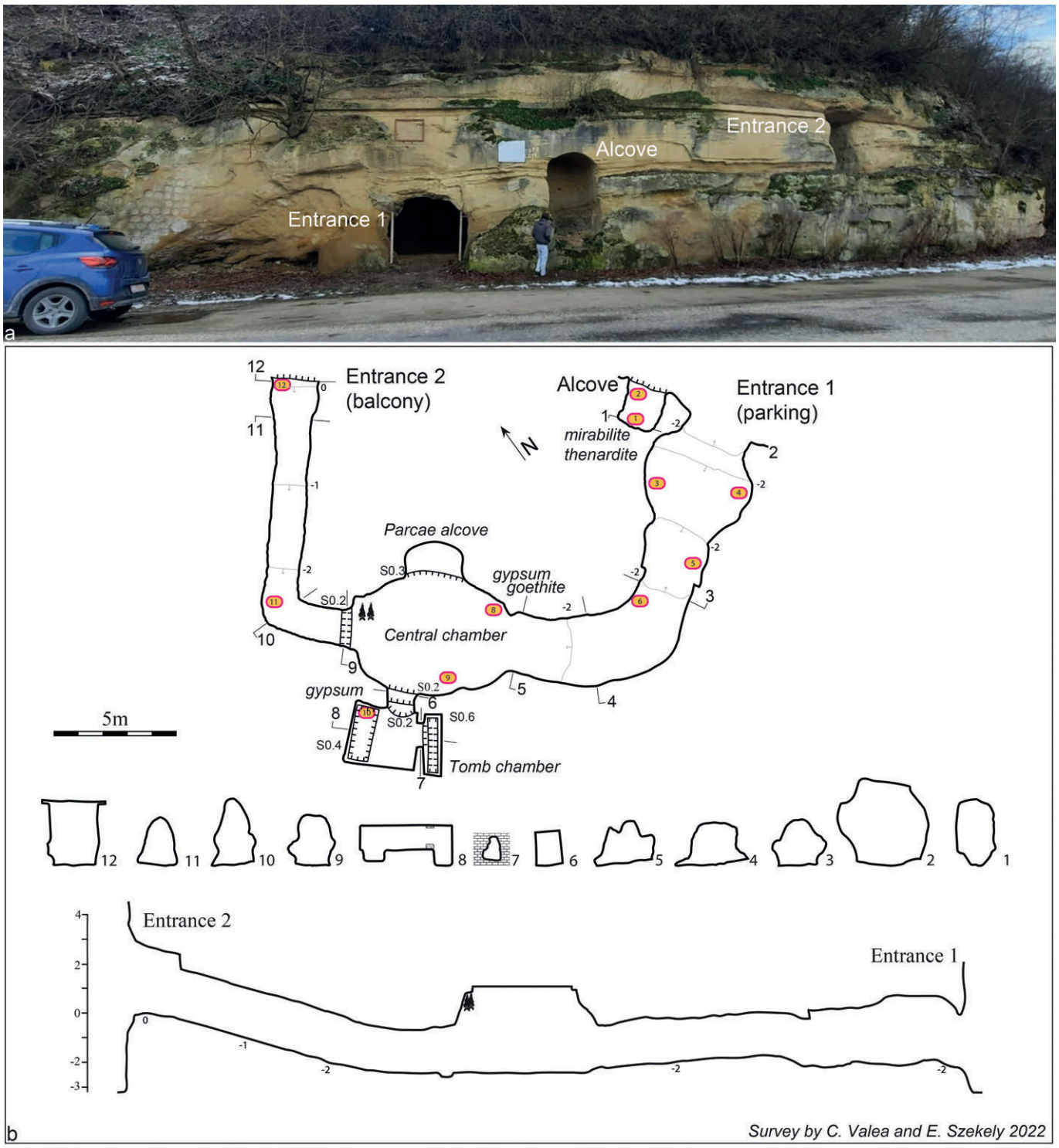

Fig. 2 – a) The cliff face at the side of county road 151 with the entrances to L. Bethlen's crypt indicated (photo C. Valea); b) Map of L. Bethlen's crypt indicating the main features and the location of samples (orange dots) (drawing C. Valea).

dás, 2011), contains two rectangular excavations, 0.62 m and 0.4 m deep: the one on the left, where Klára Bethlen was deposed, was separated by a brick wall which is now partly broken (fig 2b, 6). The one on the right uncovers 4 centimetric clay layers with various gypsum crusts deposited at their surface. One such less resistant layer also occurs in the ceiling of the low chamber and was partially removed during the initial digging of the cavity (fig 6). A trapezoidal, 2 x 2 m cut in the SW wall of the central chamber (probably marking a door frame) marks the connection to a smaller tunnel, curved almost symmetrically to the former. This tunnel, 13 m long, ascends on the angle of the bedding and has an ogival cross section until the second entrance (2.6 m high and 2.1 m wide), where the ceiling is flat, dug along another bedding plane. The second entrance leads to a narrow ledge on the cliff face, 3 m above the road level, and in the past a railing was emplaced here to descend after the visit (Ödön, 1880).

Fig. 3 – The Central chamber of the crypt facing NW towards the tunnel leading to Entrance 2, with the cupola and the SE-NW fissures in the ceiling. Part of the bas-reliefs are visible on the left hand wall, right above the door frame leading to the tomb chamber (photo T. Tămaş).

Fig. 5 – Sculpture of Death on the left of the tomb chamber entrance, with mortar traces visible on the knee. Gypsum crusts along the thin clay layers and debris resulted from weathering are visible below the sculpture (photo T. Tămaş).

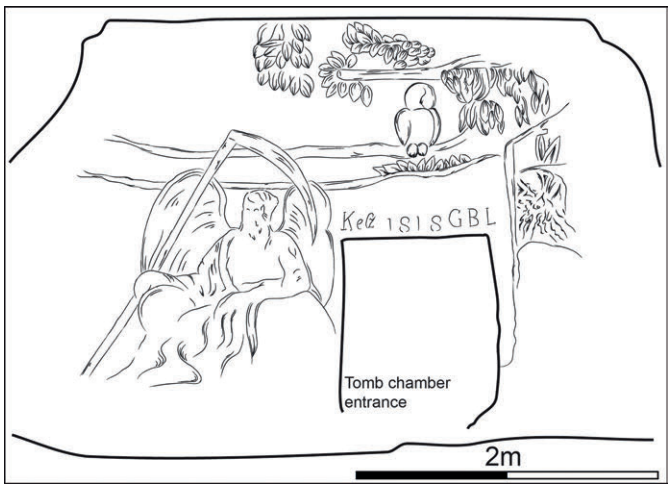

Fig. 4 – Longitudinal view of the SW wall of the Central chamber, with the position of the bas reliefs and the door leading to the tomb chamber (drawing C. Valea).

Description of the deposits

The sediments exposed by L. Bethlen's crypt are represented by siliciclastic deposits - sands, sandy clays, and black clays, with a few levels of rip-up clasts. To constrain the depositional environment of these deposits, two sedimentological profiles were studied (fig. 7). The first, longer profile is located on the cliff face, between the lower entrance and the alcove, where the height of the profile is ~7.5 m. The succession is made up of decimetric to metric medium-grained, well-bedded or parallel laminated sands, with three distinct levels of rip-up clasts in the middle part of the profile and erosional surfaces, while toward the top, two decimetric parallel laminated siltic levels were identified.

The second profile is situated 4 m inside the tunnel starting from the lower entrance, on the left wall. Here an approximately 2 m high profile was described, consisting of decimetric levels of medium-grained sands with rip-up clasts at the bottom and

Fig. 6 – Tomb chamber, facing E towards the brick wall delimiting K. Bethlen's tomb. Chisel marks visible in the ceiling, where a less resistant layer was encountered by the digger (photo T. Tămaş).

top. Sedimentological structures such as erosional surfaces are visible throughout the section at various levels, while trough and planar cross-beddings were observed in the first half of the profile. In the top part a decimetric finer level with clay and silt was encountered. This is covered erosionally by medium-grained parallel laminated sands. Based on the sedimentological observations and the sedimentary structure types encountered, we infer that the rocks in which Bethlen's crypt was dug were deposited in a submarine channel. This depositional environment is also proven by the observed U-shaped surface seen on the cliff face, usually associated to channel type deposits.

The main mineral phases identified in the composition of the deposits include quartz, muscovite, and feldspars with subordinate calcite and clay minerals (kaolinite and chlorite). The intercalated clay/silty clay layers contain dominant quartz, muscovite and chlorite, with lesser kaolinite and smectite. Traces of pyrite could also be detected in the clay layers.

The foraminiferal fauna is represented by very poorly preserved, reworked Badenian (middle Miocene) assemblages. Due to their poor preservation, we could determine them only at the genus level. The most frequently encountered generas are *Elphidium* spp., *Cibicides* spp., and *Cibicidioides* spp., with some broken Milliolids in fewer numbers, and a few pyritized/limonitized wood fragments at various levels. Unfortunately, the reworked fauna did not allow us to constrain the age of the studied deposits, in consequence we refer to previous studies which consider these deposits to be of late Sarmatian (middle Miocene) age (Răileanu *et al.*, 1967 and references therein).

Mineralogy of secondary deposits

The secondary minerals identified in Làjos Bethlen's crypt are represented by goethite, gypsum and somewhat surprisingly, mirabilite and thenardite. Several samples containing goethite $Fe^{3+}O(OH)$ were collected from rust-colored films occurring on the walls of the cavity, usually near the clay layers, obviously as the result of pyrite oxidation. In one particular

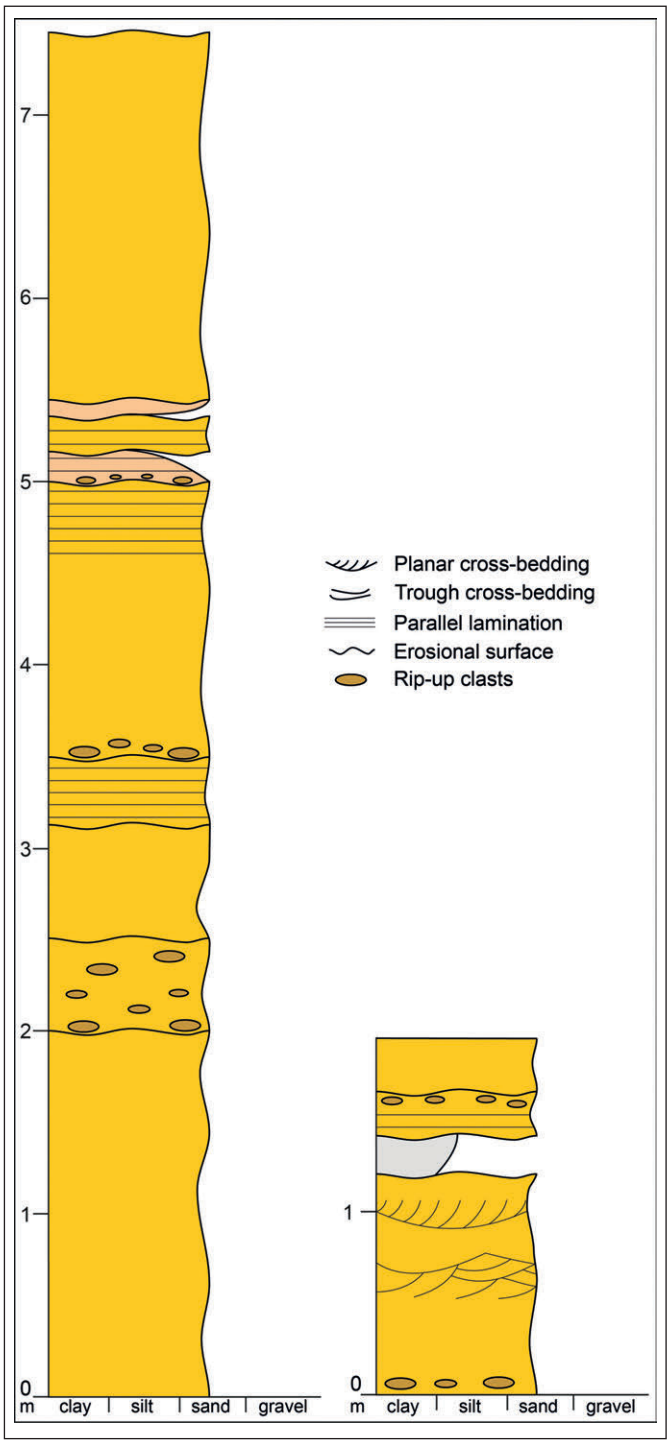

Fig. 7 – Sedimentary log of the studied sections (details in text) (drawing S. A. Kövecsi).

case, goethite was identified covering small fragments of fossil wood (probably pyritized) we found in the walls of the central chamber.

Gypsum $CaSO_4 \cdot 2H_2O$ forms crusts of white to grey color, translucent crystal aggregates, and millimetric colourless acicular crystals, usually 2-3 mm long. The samples were collected from the clay intercalations occurring near the base of the right wall of the central chamber, and at various levels on the right side of the tomb chamber. In the crusts, gypsum crystals are lamellar euhedral monoclinic prisms, generally 5-10 μm in size, associated after (010) (fig. 8).

Mirabilite, $Na_2SO_4 \cdot 10H_2O$, and thenardite Na_2SO_4 were sampled from the alcove near the main entrance as white, soft cotton-wool fibrous crystal aggregates, always lining the edge of clay clasts (fig. 9a). Occasionally they occur along with milimetric dots of white powdery material, most likely thenardite. Similar smaller size crystals were noticed in the entrance tunnel just after Entrance 1 of the cavity, but the amount was too small to be sampled. Two different samples were taken in sealed plastic bags from the same spot in the alcove in 4 December 2022 and 5 February 2023, in very different temperature and relative humidity conditions (ca. 1°C and rain/persistent fog, vs. -12°C and clear). The samples were analysed by XRD at ca. 24 hours after collection (fig. 9b). While both mirabilite and thenardite were present in the first sample, only thenardite was found in the second when, according to weather data, the local relative humidity values fell below 60 during a week long episode of below freezing temperatures. Depending on the conditions of temperature and relative humidity, mirabilite may either dissolve or transform into thenardite (Steiger and Asmussen, 2008; Donkers *et al.*, 2015). In this location, mirabilite occurs only within 3 m from the entrance of the cavities (2.5 m in the case of the alcove) and, although protected from the direct action of rainwater, it is exposed to high temperature and humidity variations throughout the year, therefore a mirabilite - thenardite association/transition is possible during favourable conditions (Germinario and Oguchi, 2022). At a first observation it would appear that the mirabilite crystals grow from capillary fissures in porous and soft rocks, at the contact with the compact yellow rip up clay clasts. All these secondary minerals indicate a local source of sulfate ions derived mainly from the weathering of the iron sulfides inside the late Sarmatian deposits, particularly in the clay layers, with the formation of iron oxy-hydroxides and gypsum. Ca^{2+} ions are available through the dissolution of calcite in the deposits, while the altered plagioclase feldspars with an intermediary composition, may also constitute a sufficient source for both calcium and sodium in the composition of the sulfates identified.

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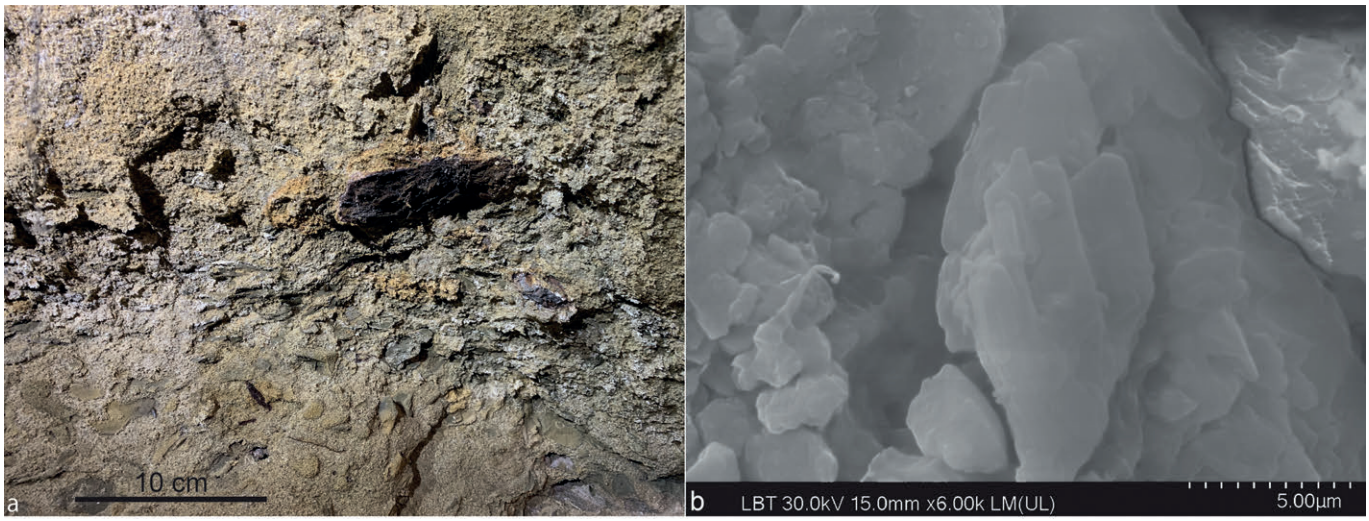

Fig. 8 – a) Gypsum crusts and limonitized wood fragment at the base of the eastern wall of the Central chamber (photo T. Tămaş); b) SEM image of gypsum crystals in a crust taken from L. Bethlen's tomb.

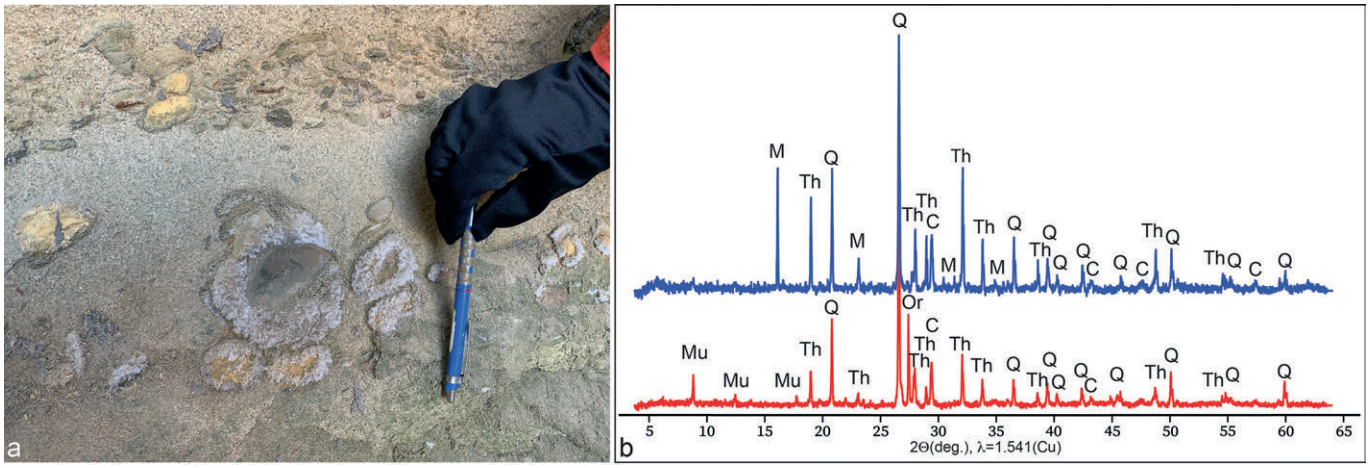

Fig. 9 – a) Mirabilite crystals occurring around rip up clasts in the sand wall of the Alcove (photo T. Tămaş); b) XRD patterns of the two samples collected from the Alcove on 4 December 2022 and 5 February 2023 (M - mirabilite, Th - thenardite, Q - quartz, C - calcite, Ort - orthoclase, Mu - muscovite).

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