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Geomorphosites and ongoing anthropogenic changes: concepts and implications regarding the heritage value of geotourism sites in the Bran–Rucăr–Dragoslavele Corridor (Romania)

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Abstract

This study contributes to the inventory and understanding of the heritage value of four geomorphosites (two caves, a pit and a partially karstified plateau with anthropic relief of a military tactical device) located in the central part of the Bran – Dragoslavele Corridor, an important tourist axis in the Romanian Carpathians. The main purpose of the research is to propose to the Scientific Council of the Piatra Craiului National Park and the National Agency for Protected Natural Areas the declaration of the four geomorphosites as nature reserves, as they are at risk of being affected by negative anthropogenic actions. The inclusion of these geomorphosites in the PNPC/ROSCI 0194 Piatra Craiului Management Plan could lead to their subsequent declaration as protected natural areas. At the same time, the underground cavities could be declared habitats of national/community interest in the category "Caves closed to public access". A secondary objective of this study is to promote the concept of geotourism within the geographical area subject to geomorphological analysis. For this reason, it could also be useful to local legal and administrative authorities in the villages of Rucăr, Podu Dâmboviței, Dâmbovicioara and Fundata. Their decisions, in conjunction with those at national level, could lead to the implementation of the concept and the development of geotourism in the region, through the creation of geotourism circuits promoted appropriately, precisely because of the high potential offered by the numerous geological and geomorphological tourist resources existing in the administrative territories of the aforementioned localities. The geomorphosite files inventoried in the central area of this transcarpathian corridor could serve as a basis for information for the promotion and establishment of a large protected natural area that would include (conserve, protect and/or sustainably exploit) the geotourism objectives in the region (other than those included in the "The Gorges of Dâmbovița – Dâmbovicioara – Brusturet Karst Area" Geological and Geomorphological Reserve) and which would bear the proposed name: "Moieciu – Fundata – Dâmbovicioara – Rucăr Geological and Geomorphological Complex" Nature Reserve.
Keywords: *Bran – Rucăr – Dragoslavele Corridor, protected natural area, nature reserve, geotourism, speleological geomorphosite, heritage value*

Introduction

Geotourism, as a form of cultural tourism, offers tourists an in-depth perspective on visiting natural attractions, such as geosites of geological relevance, geomorphosites and geoparks. In-depth knowledge of landforms, constituent rocks (sometimes the minerals they are made of), and their structures generates qualitative information accumulated through understanding the geological and geomorphological phenomena and processes that generated them and influenced their evolution, analysed in the present and for the future. At the same time, information can be constructed regarding the systematic classification of landforms and their related deposits (Dowling & Newsome, 2018). Scientific knowledge associated with the educational aspect (Joice, 2006) allows tourists interested in the morphology of the Earth's crust to integrate the relief with its forms into the surrounding geographical landscape, in order to highlight the role and function of the relief in supporting the other geosystemic components of the geographical environment. In particular, relief developed on limestone (represented by ridges with peaks, cliffs and isolated rocks, gorges, caves, plateaus with minor forms etc.) can represent one of the tourist resources of remarkable attractiveness due to the diversity and complexity of their forms, viewed both individually and collectively, or integrated into natural landscapes at different latitudes and altitudes, shaped in places by certain anthropogenic activities. Tourists may be fascinated and interested in the limestone and karst

relief forms due to their uniqueness, novelty, structural complexity, vertical display, panoramic perspective (belvedere function), typological diversity, as well as the manifestation of the attractive, subjective and objective eclipse phenomenon (Cocean, 2011).

In the current context of economic development in the geographical area belonging to the Bran – Dragoslavele Corridor, the concept of geotourism is virtually non-existent in approaches related to the promotion of tourism in the region. Under these circumstances, the significance of re-evaluating the resource potential of the relief, taking into account the components with exceptional potential, the geomorphosites, is also pragmatic, linked to the diversification of the tourist offer in the region, naturally continued with the promotion and valorisation of geomorphosites, with the ultimate goal of increasing the number of tourists and the income generated by economic activities interdependent with tourism. In parallel with the promotion of geotourism, actions are also targeted that will allow for the legalisation of an extended protected natural area that will take into account the sustainable management, conservation and protection of the existing geological and geomorphological heritage. To this end, we propose the creation of a new geological and geomorphological nature reserve called "Moieciu – Fundata – Dâmbovicioara – Rucăr Geological and Geomorphological Complex" (RNGG2), IUCN category IV, which could include geotourism sites in the central part of the Bran – Rucăr – Dragoslavele Corridor (other than those included in RNGG1 – the "The Gorges of Dâmbovița – Dâmbovicioara – Brusturet Karst Area" geological and geomorphological nature reserve, established in 1972). This new protected natural area may be established in accordance with Government Emergency Ordinance No. 57 of 20 June 2007 on the regime of protected natural areas, the conservation of natural habitats, wild flora and fauna, supplemented by the provisions of Law No. 49 of 7 April 2011. Tourists visiting the future protected area (RNGG2) will be able to obtain information from the Dâmbovicioara Tourist Information and Promotion Centre, located in Podu Dâmboviței, which provides up-to-date information on recreational, cultural and rural tourism. The proposed nature reserve could bring together four speleological geomorphosites (Pleașa Cave, Posada Cave, Uluce Cave and Pereți Pit), seven gorge type valley sectors (Orății Gorge, Cheia de Mijloc or "În Pereți" Gorge, Rudăriței Gorge, Crovului Gorge, Prepeleacului Gorge, Urdăriții or Giuvala Gorge and Izvorului Gorge), three Paleolithic archaeospeleosites (Peștera Mare and Peștera Mică from the village of Peștera and Coacăzei Cave), two geomorphological sites of the isolated massif type or of the calcareous or partially karstifiable mountain plateau type (Movila Neamțului with the Oratea Fortress and the Sasului Hill Plateau), twelve geosites with paleontological relevance (Trif, 2020) for elements of marine fauna from the Mesozoic era (Upper Jurassic - Lower Cretaceous), two thematic summit viewpoints for geomorphological observations and birdwatching, as well as other geotourism attractions. From an educational and practical point of view, the development of geotourism in the Bran – Rucăr – Dragoslavele Corridor area requires the design of thematic geotourism circuits, in line with international trends in geotourism, with their adequate promotion through tourist information panels and brochures, created in accordance with the "6 F" rule (Summermatter, 2003): familiarisation, fascination, functionality, loyalty, formation and fusion.

Study area

The geographical area of Rucăr–Podu Dâmboviței–Dâmbovicioara–Fundata, the central part of the Bran – Dragoslavele (or Bran – Rucăr – Dragoslavele) Corridor, is a subunit of the Transylvanian Alps (Badea et al., 2001) and an important tourist axis in the Romanian Carpathians. The territory represented on the map (Fig. 1) includes the following geotourism objectives: 18 morphological sectors of gorge type valley, a limestone torrential valley (Hornul Orății), 13 speleological sites (two of which are pits) and a flooded sinkhole (The sinkhole with the "Bottomless Lake"). Morphometric (length, height, depth, slope value, absolute altitude, relative altitude etc.) and morphographic characteristics, as well as other attributes of the measured and mapped speleosites can be found in the related research data (Constantinescu & Dobrescu, 2006; Constantinescu, 2009; Pologea, 2023; Bilașco et al., 2024; Trif et al., 2025). The 18 gorges (Popescu-Argeșel, 1986), numbered from 1 to 18 in black (Fig. 1), are: Cheia Mare and Cheia Mică (Dâmboviței Gorges) (1, 4), Ghimbavului Gorge (2), "Cheița" Gorge (3), Cheița Dâmbovicioarei and Dâmbovicioara Gorge (5, 6), Peșterii Gorge (7), Ciocanului Gorge (8), Brusturetului Gorges (9, 10), Văii Seci Gorge (11), Cheia de Mijloc or "În Pereți" Gorge (12), Orății Gorge (13), Rudăriței Gorge (14), Crovului Gorge (15), Prepeleacului Gorge (16), Urdăriții or Giuvala Gorge (17) and Izvorului Gorge (18). The first 11 sectors listed belong to the Geological and Geomorphological Natural Reserve "The Gorges of Dâmbovița – Dâmbovicioara – Brusturet Karst Area", included in the strict protection zone (SPZ) of the PNPC. The geomorphologic objectives listed above can be joined by other sites with geomorphological relevance, among which the most well-known are: the "Babele Orății" morphosculpture (from the village of Podu Dâmboviței), "The Sasului Hill Plateau" (geomorphosite with paleogeographic, paleontological and archaeological relevance), as well as several geosites with paleontological relevance for the marine invertebrate fauna of Lower Jurassic - Upper Cretaceous age (Lazăr et al., 2017).

Throughout the entire area of the Bran – Rucăr – Dragoslavele transverse depression corridor, over 40

geotourism objectives with certain morphotourist value could be inventoried, of which 17, declared geomorphosites, are the most representative. Most of the geomorphosites, 13 in number (Fig. 13, Table 1), are positioned mainly in the central part of the analyzed carpathian subunit. Of these, one geomorphosite, Miresii Cave, was proposed in 2024 as a natural monument (Bilașco et al., 2024) and four others are currently proposed (in 2025) as natural reserves (Table 4).

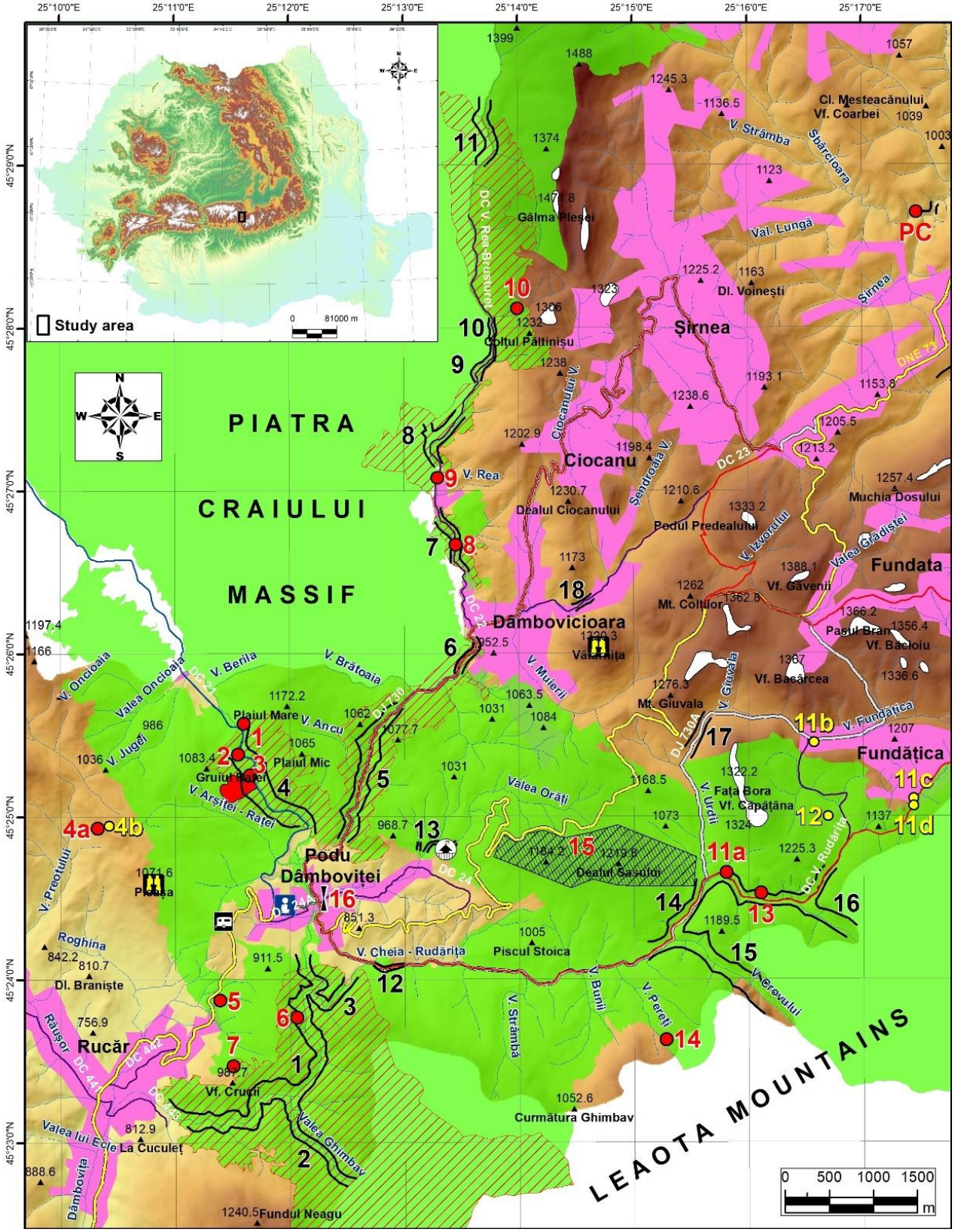

Figure 1: Geoturistic objectives (1-17) from the Rucăr – Podu Dâmboviței – Dâmbovicioara – Fundata geographical area integrated in natural protected areas from Romania and the European Union (the names of the 18 gorges valley sectors are given in the text)

Materials and methods

The geomorphological research, completed with the proposal of four geomorphosites as natural reserves (IUCN category IV), followed several work stages listed in the methodological flow diagram (Fig. 2): field observations, morphometric and morphographic analysis, morphogenetic interpretation and establishment of the heritage value of the inventoried geomorphosites.

With regard to the methodology for selecting, inventorying, and evaluating geomorphosites, we believe that there is no generally accepted and used version, due

to the original (sometimes unique) characteristics of geographical regions from a geological and geomorphological point of view, for which specific criteria are required. At the same time, the ultimate goals of applying these methodological approaches do not coincide in all situations. Internationally, within the International Association of Geomorphologists (IAG), some of the best-known methods for inventorying and evaluating geomorphosites were developed by members of the working group on geomorphological sites. Among them, representatives of the University of Lausanne (Reynard, 2009), the University of Cantabria (Bruschi & Cendrero, 2005), the University of Modena and Reggio Emilia (Coratza & Giusti, 2005; Panizza, 2009), the University of Minho (Pereira et al., 2007), the University of Valladolid (Serrano & Trueba, 2005), as well as Professor Jean-Pierre Pralong (Pralong, 2005), who proposed an evaluation method, often used by Romanian geomorphologists, which focuses primarily on the tourist value of geomorphosites. The methods for evaluating geomorphosites proposed in the aforementioned works are used to pursue different objectives, but all include the following evaluation criteria: integrity, rarity, and scientific representativeness. Criteria relating to the need to protect geomorphological heritage, addressed due to the possible threats to which geomorphosites are or may be subject, have been promoted within the inventory methods designed by Viola M. Bruschi and Antonio Cendrero (Bruschi & Cendrero, 2005). At the same time, Emmanuel Reynard (Reynard, 2009), who described, summarized, and extracted the common characteristics of the geomorphosite inventory and the assessment methods proposed in the IAG working group, concluded, among other things, that a scientific assessment of geomorphosites should always be carried out, to which should be added the assessment of additional values such as: the promotion of tourism or the use of the site for educational purposes, the assessment of its potential use, and the affirmation of the reasons for the need to protect the geomorphological heritage.

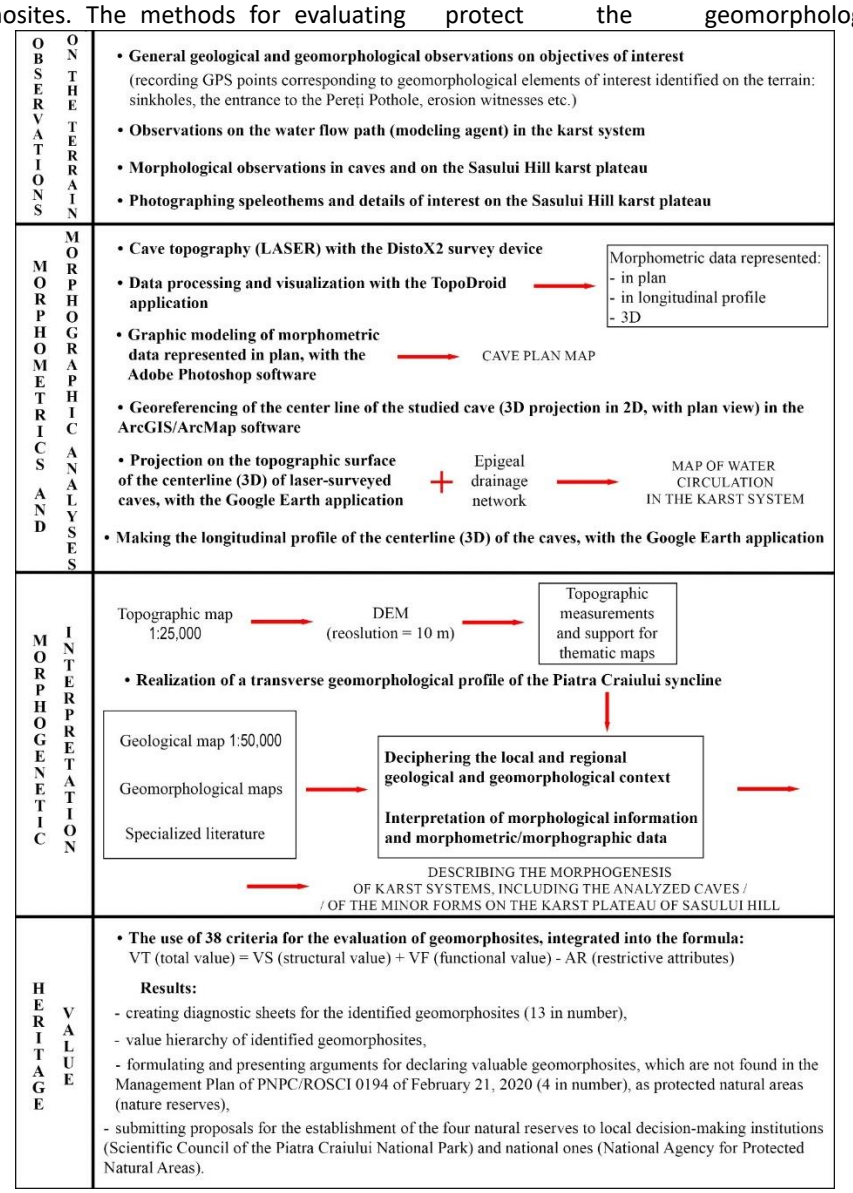

Figure 2: Methodological workflow

Romanian contributions to the inventory and analysis of geomorphosites located in limestone mountain areas have been made by representatives of geographical schools in Bucharest (e.g., Comănescu et al., 2009; Comănescu et al., 2010; Comănescu et al., 2012), Cluj-Napoca (e.g., Cocean, 2012; Cocean & Cocean, 2017; Cocean & Surdeanu, 2011; Munteanu, 2021), Oradea (e.g., Ilieș & Josan, 2009), Timișoara (e.g., Artugyan, 2017) etc. The criteria used for inventorying, addressed by the Romanian authors listed, include, among others, characteristics related to the vulnerability of the constituent elements of the geomorphosites area, as well as aspects related to the conservation and protection of the existing heritage.

In the present study, the evaluation of geomorphosites, preceded by rigorous selection and followed by their value ranking, was achieved using 38 criteria (partially taken, modified, and adapted to the morphological characteristics of the Bran – Rucăr – Dragoslavele Corridor in the Romanian Carpathians) inspired by the methodology designed and proposed by Cocean G. and Surdeanu (Cocean & Surdeanu, 2011), applied to the analysis of geomorphosites in the Trascău Mountains (Cocean, 2011), a division of the Apuseni Mountains. We justify the use of this evaluation method due to the relative similarity between the relief developed on the Mesozoic limestones in the two carpathian geographical areas, where there are numerous gorges valley sectors and caves developed on their slopes. The method used for the inventory and evaluation of geomorphosites targeted the intrinsic or structural values (geomorphological, aesthetic and ecological) of the geomorphosites, their functional values, as well as those attributed by man (cultural, scientific and economic). The formula used to calculate the total value of the proposed geomorphosites was as follows: VT (total value of the geomorphosite) = VS (structural value) + VF (functional value) − AR (restrictive attributes); VS = VS1 (geomorphological value) + VS2 (aesthetic value) + VS3 (ecological value); VF = VF1 (cultural value) + VF2 (scientific value) + VF3 (economic value); and AR = AR1 (vulnerability to natural phenomena and processes) + AR2 (presence of economic activities with negative impact or that could affect tourism and/or the geomorphosite) + AR3 (unaesthetic elements). The heritage value of some geomorphosites, which are not included in the Management Plan of PNPC/ROSCI 0194 of February 21, 2020, suggested that we submit proposals (in a first stage, to the Scientific Council of the Piatra Craiului National Park) for the establishment of four natural reserves: two caves, a pit and a partially karstifiable plateau in which contain forms of an anthropic relief (built by the Romanian army between 1915 and 1916). The submitted proposals followed the stage of formulating arguments in favor of declaring the four geomorphosites as protected natural areas.

Results

Geomorphosites proposed as nature reserves in 2025

Pleașa Cave (Dobrescu & Everac, 2003; Giurgiu, 1977-1978; Giurgiu, România-natura50), located in the village of Rucăr (Argeș County), is a geomorphological feature of scientific importance for physical speleology. It is 125.5 m long, has a vertical range of +37 m and is located on the left slope of the Pleșei (Preotului) Valley in the Râușorul basin. It was explored for the first time by Dobrescu I., accompanied by members of the "Piatra Craiului" Câmpulung Muscel Speleology Club. Its topography and survey were carried out in 1975 and 1977 by Giurgiu I.V. and Silvășanu G. ("Emil Racoviță" Speleology Club, Bucharest). Subsequently, Giurgiu I.V. created the map (plan) of the cave, entitled "The Cave under Pleașa Mountain" (Giurgiu, România-natura50). Laser surveying was performed by speleologist Dumitru I. from the "Silex" Brașov Speleology Club on November 17, 2024.

From a speleogenetic point of view, this underground cavity was formed due to the infiltration of water from the surface of a small karst plateau called Podul Peșterii, through a sinkhole with a diameter of about 22 m and a depth of about 8 m (Fig. 4b), mostly along the path of a tectonic traction diaclase (formed and deepened in the carbonatic deposit) developed in the south-western flank of a small horst located north-west of the Pleașa horst. The cave extends from 949 m (cave entrance absolute altitude) to 986 m absolute altitude (Fig. 3). From the human reachable cave end (upstream) to the deepest point in the sinkhole basin, there is a 16 - 18 m vertical distance and a straight line distance of 44 - 46 m.

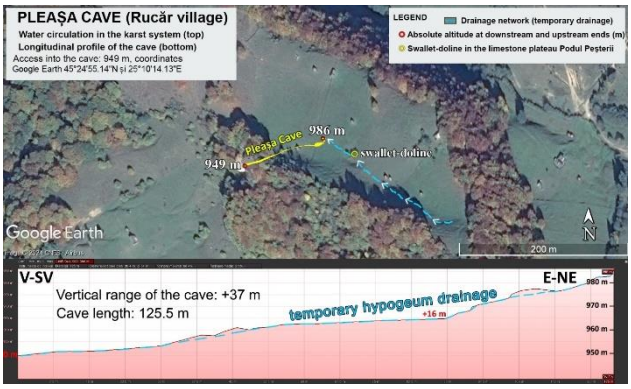

Figure 3: Water circulation in the karst system of Pleașa Cave with the area of water accumulation and infiltration, the floor plan of the cavity projected onto the topographic surface and the longitudinal profile of the hypogeum thalweg

Observations on some cross-sections in the middle third of the cave indicate a succession of phases of episodic torrential erosion within the single stage of erosion and karstification. In the last 100 m of the

passage, upstream, a previous evolutionary phase of a pressure flow regime was observed. Subsequently, with the establishment of the vadose regime, the cavity deepened and widened towards the base, conditioned by the free-level flow of water, manifested in a torrential regime. The arguments for this evolutionary phase are related to the presence of sand and river pebbles in the riverbed, but also to the evidence of two levels of erosion benches arranged bilaterally in the narrowest section (<0.5 m) of the passage located in the middle of the cave. The vadose regime of the cavity's evolution also favoured the precipitation of calcium carbonate, resulting in gravitational dripping formations and dripping formations. It is a subfossil cave with hypogenic drainage only during rainfall. The water that penetrates through the sinkhole enters through diffuse infiltration into the allochthonous alluvial bed along the current riverbed.

The morphological appeal of the cave is evident from the entrance. The elongated ogival entrance portal (Fig. 4a) is 8.7 m high, and above it, on the limestone façade, the line of the diaclase that allowed water to penetrate the karst system is clearly visible. The first passage, about 30 m long, is notable for its heights ranging from 5 to 11 m, with walls that are close at the top and flared towards the base, a defining feature of caves developed on lateral tectonic traction diaclases, deepened by free-flowing water (Bleahu, 1974). The passage that follows upstream is narrow, but retains the ruptural morphology of the high sector downstream. This middle sector, with a steep slope upstream of +16 m, is rich in concretions, with crusts and wall drips (Fig. 4c). The final chamber, measuring 10 m in length and 4 m in height, abounds in formations resulting from dripping (Fig. 4d). Conical and candle stalagmites predominate, accumulated mainly on clasts resulting from incision, and small tubular stalactites (macaroni type), more rarely conical, are noticeable on the ceiling.

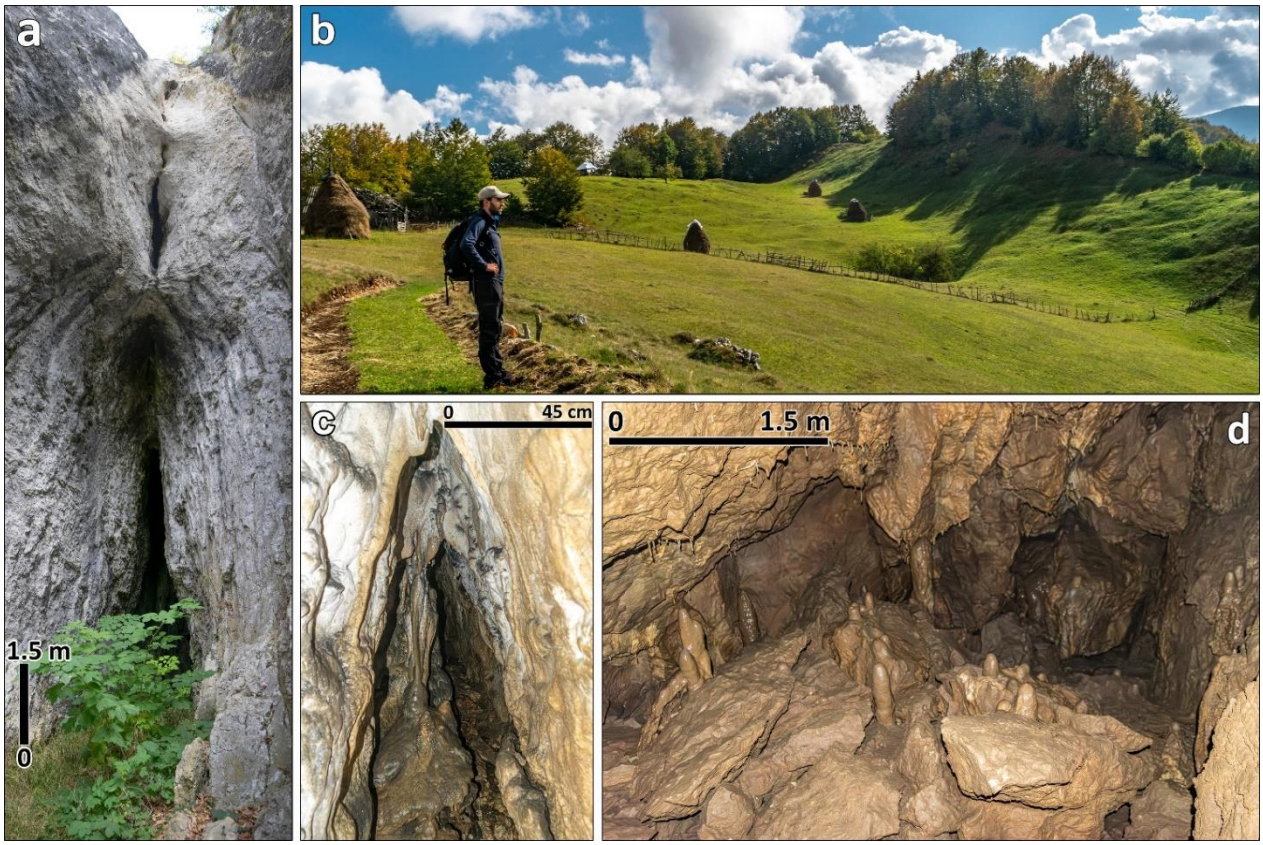

Figure 4: Pleașa Cave, developed along the path of a tectonic traction diaclase (a); swallet-doline on the surface of the limestone plateau called Podul Peșterii (b); gravitational leakage forms in the middle sector (c); dripstone formations and interlocked (incasional) blocks in the final hall (d)

Posada Cave or Gaura Posăzii (Dobrescu & Everac, 2003; Giurgiu, România-natura49) or Possada Cave (Munteanu-Murgoci, 1898), located in the village of Podu Dâmboviței (Argeș County), is a geomorphological feature of scientific importance, with relevance to zoospeleology and physical speleology. It was rediscovered by Dobrescu I. in February 1975. In June and September 1975, the cave was surveyed (Giurgiu I.V. and Giurgiu Mihaela, both from the "Emil Racoviță" Speleology Club in Bucharest; Dobrescu I. and Bleonț O., both from the "Piatra Craiului" Speleology Circle in

Câmpulug Muscel). Subsequently, a map (plan) of Posada Cave was drawn up (Fig. 5).

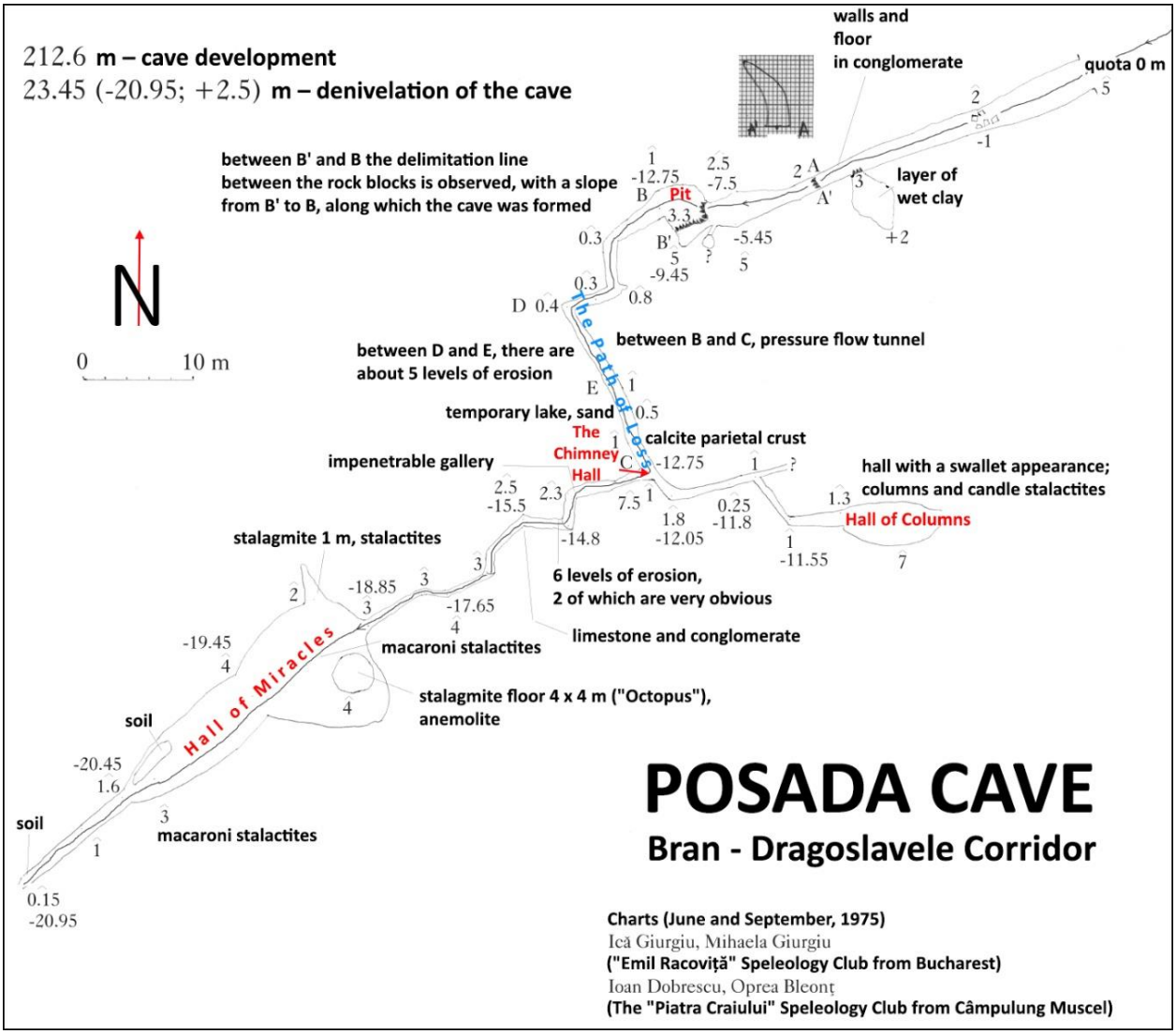

Figure 5: Posada Cave. Source: Giurgiu (România-natura49)

The cave is 212.6 m long, with a difference in elevation of 23.45 m (maximum +2.5 m and minimum -20.95 m). The cave, located in the Roghina basin, on the western edge of the Muntele Posada horst, opens at the base of a swallet-doline (Fig. 6a) oriented northeast-southwest. This swallet-doline has a maximum depth of about 10 m and an absolute altitude of ±810 m at the opening, located in the place called Podul Grecului. It is the point of underground loss of a temporary water flow, with a flow rate influenced by the amount of precipitation received in the torrential valley basin with its source and thalweg insinuated on the western slope of Mount Posada. The water captured by the swallet enters through the cave portal (elevation 0 m) framed by two almost vertical diaclases (Fig. 6b), deepened in the banks of conglomerates, breccias and calcareous megabreccias (Upper Albian - Cenomanian age). After travelling a distance of about 35 m, at the base of the of the shaft marked at elevation -12.75 m (Fig. 6c), a narrow and low passage opens up, called Calea Pierdută (The Lost Path), developed on the lithological contact between the covering Cretaceous sedimentary cover (monoclinal) and the Kimmeridgian - Berriasian? - Upper Valanginian limestones at the base. After about 43 m of crawling, an attraction in itself for sports caving enthusiasts, the passage opens into the conical Horn Hall (a hall formed by collapse), with a base diameter of about 9 m, covered on the floor with incasion deposits intertwined with those resulting from torrential activity. The hall is extended vertically by a chimney of about 13 m, on whose walls calcite crusts have precipitated, attesting to frequent infiltrations of rainwater. A narrow passage leads from the Horn Hall in a south-easterly direction to the Hall of Columns, adorned with tubular stalactites (macaroni type) and columns. Continuing south-west towards the large hall downstream, there is a passage

(whose evolution was tectonically conditioned) perpendicular to the direction of the upstream one, on whose walls several erosion benches can be observed, two of which are developed bilaterally and are clearly visible. The morphology of this sector of the cave attests to the existence of episodes of free-flowing water, following episodes of torrential and pressurised flow. The Hall of Wonders (20 m long, 8-12 m wide and 3-4 m high) is rich in speleothems, one of which has a physiognomy unusual, an accumulation of carbonate precipitate in the form of a dome (Caracatița) with a diameter of about 4 m, resulting from the prolonged drainage of the carbonate solution in the same direction. The ceiling of the hall is decorated here and there with clusters of tubular stalactites associated with conical ones (Fig. 6d). Dripping stalactites can also be seen. The rare anemolites present above the calcite dome indicate that the dripping process was directed by the circulation of an air current during periods when the downstream end of the cave was unblocked. In the Hall of Wonders, the presence of the chiropter species Rhinolophus ferrumequinum (large horseshoe-nosed bat) was observed (on 8 November 2020). Two specimens were spotted, which gives the cave biospeleological relevance.

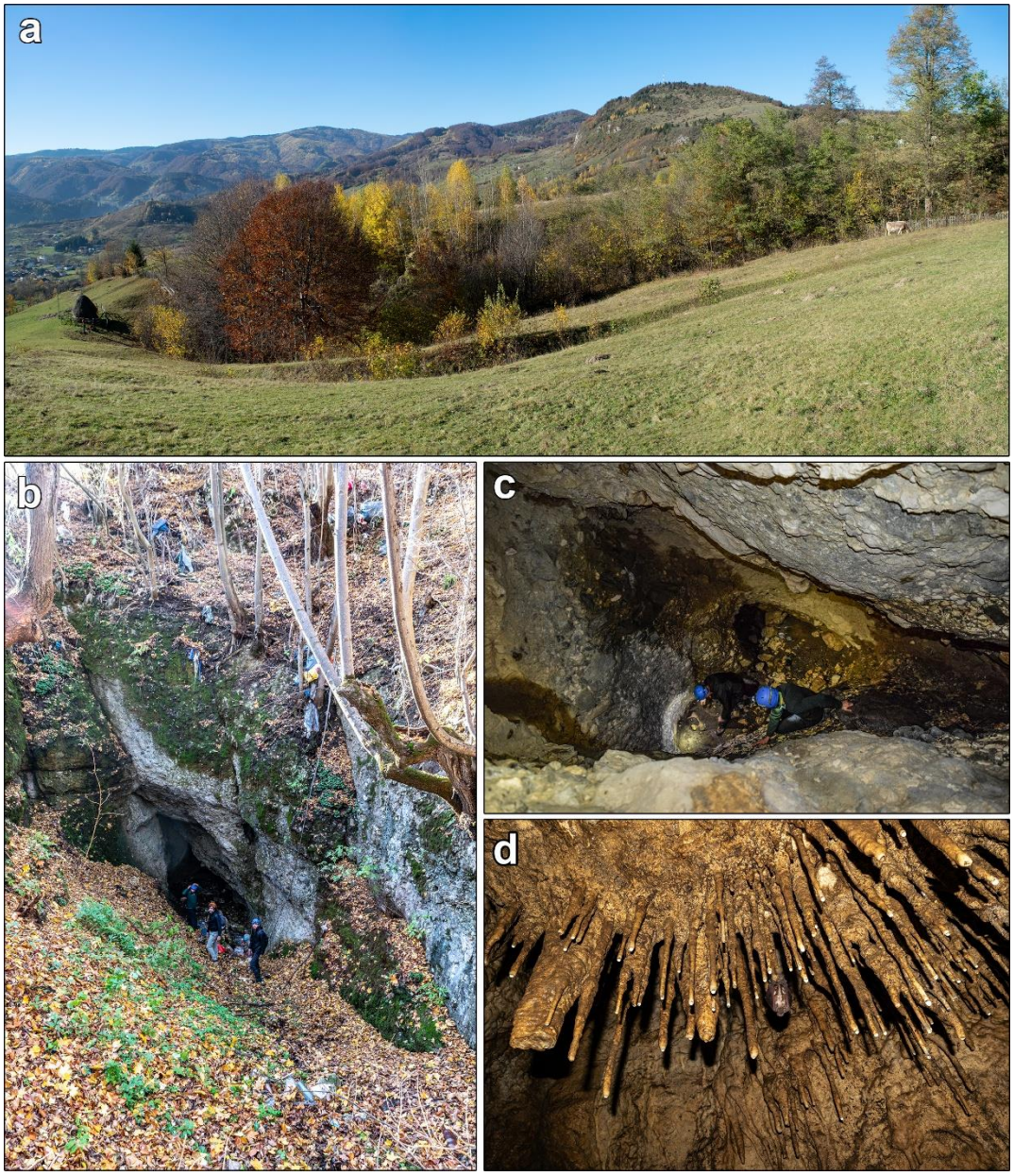

Figure 6: Posada Cave: swallet-doline in Podul Grecului, developed in limestone conglomerates (a); access portal (elevation 0 m) inside the swallet-doline receiving the temporary epigeal stream (b); the shaft with its base located at a depth of -12.75 m, at the boundary between the limestone and calcareous conglomerates (c); Hall of Wonders – tubular and conical stalactites, with one specimen of the species Rhinolophus ferrumequinum (d)

Pereți Pit (Dobrescu, 1978; Dobrescu & Everac, 2003; Giurgiu & Dobrescu, 1983) in the village of Rucăr (Argeș County), cadastral code 127/21, is located in the Zacotelor Mountain at the boundary between the Bran-Dragoslavele Corridor and the Leaota Mountains. This underground cavity is recognised as a geomorphological and speleological site of scientific importance, with hydrogeological and morphogenetic relevance.

The access point is located on the right slope of the Pereți Valley (a left tributary of the Vărzăriei Valley) in the Cheia Valley basin (Fig. 7), at a relative altitude of about 7–8 m above the valley thalweg, with an elevation of 0 m defined by GPS coordinates 45°23'36.73"N, 25°15'11.10"E and an absolute altitude of about 1100 m. The pit was first explored in September 1977 by a team from the "Piatra Craiului" Speleology Club in Campulung Muscel, coordinated by Dobrescu I., the second exploration being carried out in October of the same year by members of the "Emil Racoviță" Speleology Club in Bucharest, coordinated by Giurgiu I.V. and Silvășanu G. The last exploration, completed by partial laser surveying (up to the water mirror) of the cavity was achieved on 1 June 2025 by a team from the "Silex" Brașov Speleology Club consisting of Pologea A., Olteanu D. and Trif S.

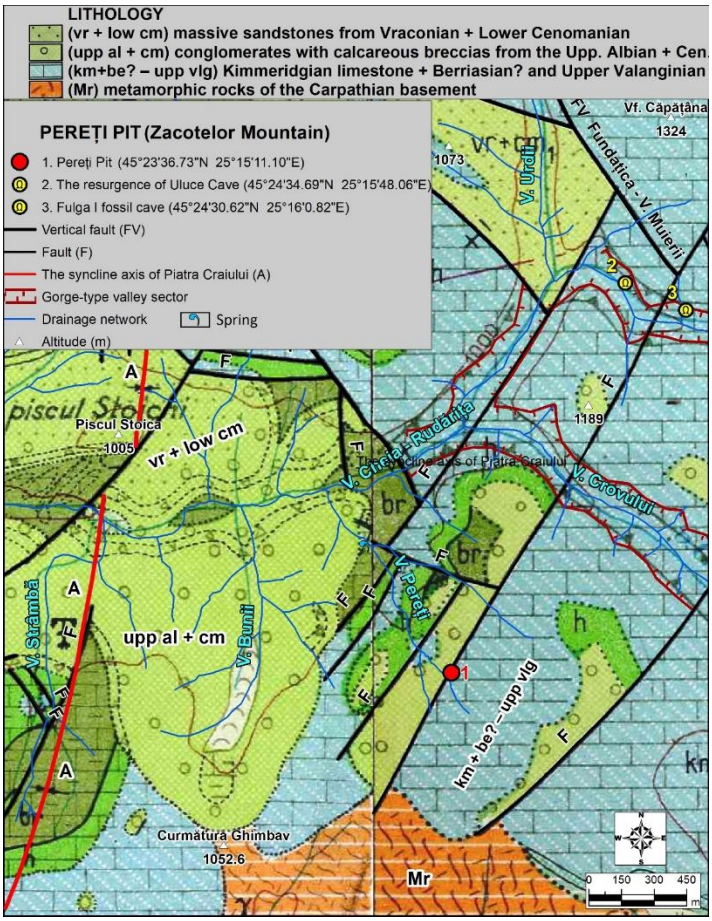

Figure 7: Pereți Pit from Zacotelor Mountain – geological framework at the surface (Source: Geological map of Romania, scale 1:50,000)

The cavity opens through a sinkhole developed in conglomerates, approximately elliptical in shape (Fig. 10a), whose north-south axis measures approximately 3.8–4 m and the west-east axis approximately 2.8–3 m. For the first 15 m from elevation 0 m, the sinkhole develops in conglomerates and Cretaceous limestone breccias (Upper Albian + Cenomanian). The post-tectonic cover sediment (Upper Albian + Cenomanian) rests on Jurassic limestones (Kimmeridgian + Tithonian), the sharp contact between them being observable at a depth of 15 m (Fig. 10c). The depth of the karst cavity exceeds 57 m and cannot be recorded due to the accumulation of organic matter (mainly decomposing wood) and sediments fallen on the basal surface, over the bedrock. Measurements recorded on 1 June 2025 indicated the following values: -55.4 m (the depth to which it is possible to descend to the base of the sinkhole, above the local water table), to which another (-)1.6 m (the depth measurable by sounding below the water table) must be added.

The shape of the shaft (pit), designed in plan, approximately elliptical (Figure 9), is defined by the two dimensions (axes): approximately 4.7–5.2 m on the west-east axis, in limestone, and 3.5–4 m on the north-south axis, in limestone (but with a maximum width of approximately 7 m, in Cretaceous sedimentary rock with heterogeneous texture, at a depth of minus 6.5 m). This

elliptical shape was imposed by the trajectory of the long axis along which karstification evolved, materialised by the presence of a diaclase highlighted in limestone and directed west–northwest – east–southeast (Figure 9). According to the 1:50,000 geological map and the projection on its surface of the GPS point taken at 0 m, the pit is apparently crossed by a fault oriented approximately northeast–southwest (Fig. 7). Based on these observations, we admit that it is possible that the formation and evolution of the Pereți Pit could have taken place at the intersection of the fault with the aforementioned diaclase, tectonic elements that could have directed water, as a modelling agent, into the system.

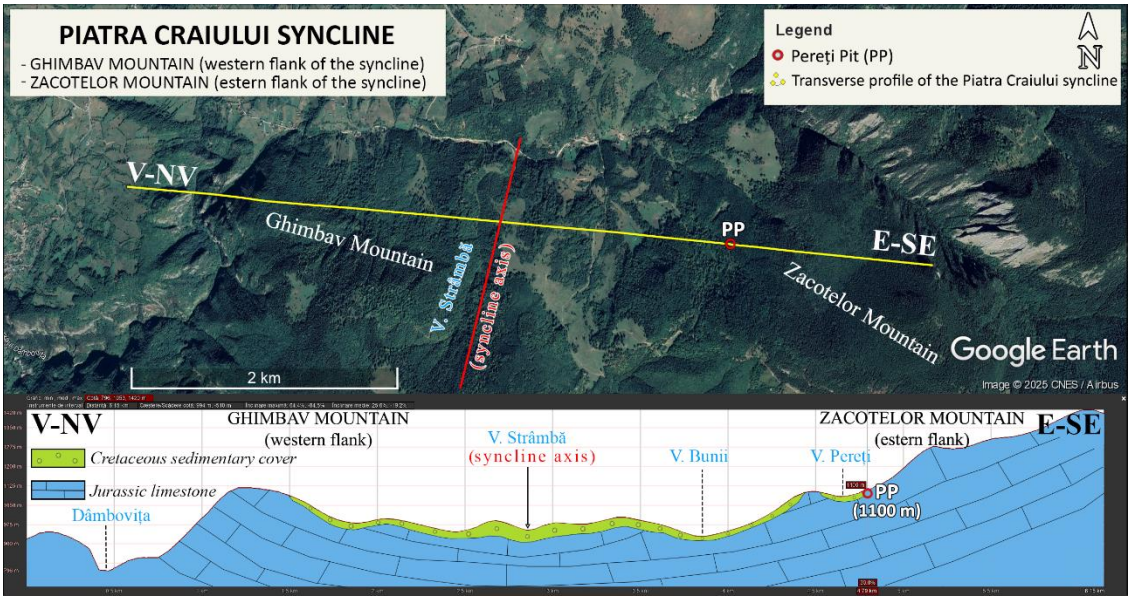

Figure 8: Position of the Pereți Pit within the southern compartment of the Piatra Craiului syncline (Source of geological data: Geological map of Romania, scale 1:50,000)

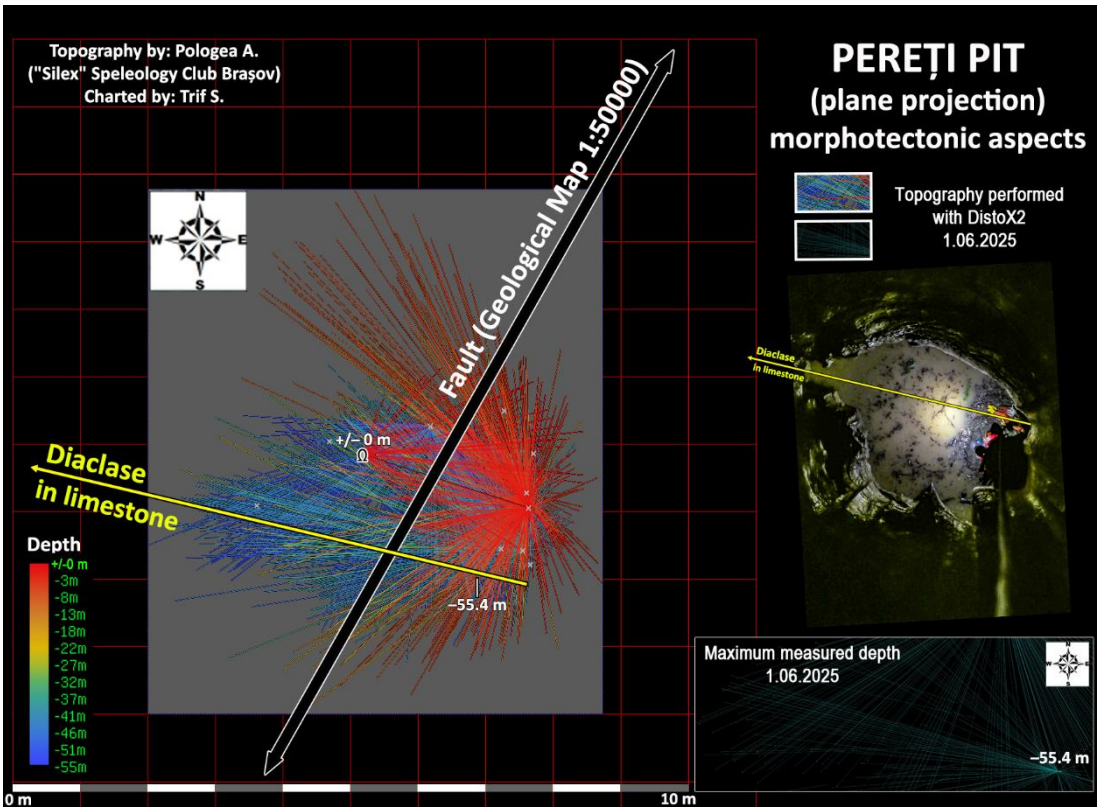

Figure 9: Pereți Pit (plan projection) – morphotectonic aspects

Observations made in situ (1 June 2025) indicate that the water in the pit comes mainly from meteorological sources, penetrating through the opening (doline) at the top. During rainy periods, the water was/is guided towards the doline through a torrential valley (observable upstream of the opening) with a length of about 120 m, dry and with a relatively wide bed, a tributary on the right of the Pereți Valley. At the same time, we also admit that the source ofthe water in the pit, according to the position of the cavity in the corresponding geographical area and in that of the Piatra Craiului syncline (Fig. 8) is represented by the drainage channels in the limestone mass that make up the upper part of Zacotelor Mountain (the eastern flank of the southern compartment, which is sunken, faulted and detached from the aforementioned syncline). Water infiltration into the cavity was/is probably achieved on the stratification planes between the limestone banks and/or through cracks in the limestone mass, which communicate with the pit and discharge through the inner wall, at least at two points, at two levels (unverified, for now). Observations and measurements of the evolution of the water level in the pit were carried out unsystematically, but in different years and at different times of the year. The citations in this regard are as follows: "its level in the well reaching 32-35 m vertically" (Dobrescu, 1978), i.e. at elevations (-32) - (-35) m; "In winter ... its level was lower, at about 35-40 m" (Dobrescu, 1978), i.e. at elevations (-35) - (-40) m; in September 1977, during the first exploration, the cave was completely drained (Dobrescu, 1978); "the water level can rise up to 41–42 m above the level of -57 (!)" (Giurgiu & Dobrescu, 1983), i.e. at levels (-15) – (-16) m; on 1 June 2025, the water level was at -55.4 m (Fig. 10c).

Regarding the discharge point of the water drained through the pit, in the absence of chemical tracer markings, we assume, on the one hand, that the liquid flows underground in the direction of the limestone layers in the syncline flank, towards the west-northwest, towards its axis. On the other hand, we admit that drainage could also occur approximately in the direction of the Pereți Valley downstream, in a north-northwest direction, towards the Cheii Valley, an indication of this being the spring located in the riverbed (after the confluence with the Vărzăriei Valley) at an absolute altitude of about 910 m (Fig. 7).

From a tectogenetic and morphogenetic point of view, we believe that this vertical cavity is, at its origin, a lithoclase (diaclase) resulting from the tensioning of the sedimentary cover (Neo-Jurassic–Eo-Cretaceous), conditioned by tectonic traction (Bleahu, 1974) manifested on the eastern flank (Zacotelor Mountain) of the southern compartment belonging to the Piatra Craiului syncline (Fig. 8), dictated by the pressure below exerted by part of the crystalline foundation of Leaota (Patrulius, 1969).

From a morphosculptural point of view, the tectonic diaclase (at the intersection with the fault marked on the 1:50,000 geological map?) was shaped by corrosion caused mainly by surface drainage (meteoric water penetrating through the conglomerate swallet), probably also by infiltration (via underground drainage channels), which partially and temporarily flooded the cavity. An argument in this regard is provided by the overall shape of the pit, which is approximately cylindrical (quasi-elliptical in cross-section through limestone), with pronounced verticality and symmetry, aspects that suggest an initial development in a phreatic (flooded) regime. During periods of heavy and prolonged rainfall, the pit temporarily stored water with its sediments. The drainage of water through the sinkhole facilitated, in the recent period of its modelling, the dissolution of calcium carbonate, leading to the formation of wall lapies (septums and vertical grooves) clearly visible on the inner surface o f the karst cavity (Fig. 10b).

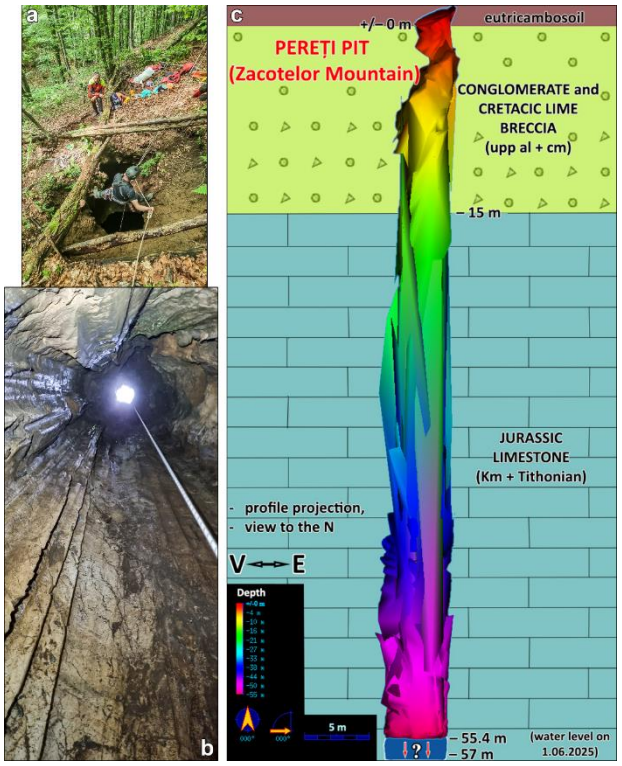

Figure 10: Pereți Pit – access sinkhole to the cave, developed in conglomerates (a); wall lapies (septums and vertical grooves) developed on limestone (b); 3D model and lithology (c). Topography: Pologea A. (2025, "Silex" Speleology Club Brașov), Cartography: Trif S.

The Sasului Hill Plateau in the village of Podu Dâmboviței (Dâmbovicioara commune) is a system-type geomorphosite with fourfold relevance: landscape, palaeogeographic, palaeontological and archaeological (modern history).

From a landscape perspective, the summit plateau (marly, marly-calcareous and calcareous) of Sasului Hill

(Ciocanu Level, Lower and Middle Pliocene age, according to studies conducted by Niculescu & Roată, 1995), a complete 360° panorama can be enjoyed, which includes the homonymous horst in a spectacular adjacent landscape. From several panoramic viewpoints, observations can be made on the tectonic-structural forms and lines of the neighbouring mountain subunits (but also on the morphological components of the studied mountain subunit), the sculptural reliefs, as well as the levelling steps (erosion levels) characteristic of the analysed depression corridor. The following are visible: the Piatra Craiului hogback (western flank of the Piatra Craiului syncline), Culmea Coja (eastern flank of the Piatra Craiului syncline), the northern and north-western tectonic-structural escarpments of the Bucegi Mountains, the "gâlme" relief characteristic of the median sector of the transcarpathian corridor, the local "brănene" levelling steps (Ciocanu and Moieciu). In the relatively close visual perspective, the following morphotectonic and/or morphosculptural elements can be clearly distinguished within the aforementioned corridor: the Urdărița minigraben, the horst between the Urdea and Urdărița graben, the Pleașa Mountain horst, Posada Mountain horst (partially visible), Vătarnița and Giuvala Mountain horsts, the Dâmbovicioara basin (erosion on friable formations – sandstones, conglomerates and "Dâmbovicioara marls"), the "Lunca Cheii" basin of the Cheii Valley (erosion in the sandstone facies at the contact with Jurassic limestones), the upper slopes of the The Great Gorge of Dâmbovița (with visibility of Miresei Rock on the right slope), Pești Gorge, Ciocanului Gorge (with the opening of Muierii Valley Gorge on its right slope), The Gorge of the Dry Valley, as well as the high slopes of Crovului Valley Gorge, deepened in the limestones of Zacotelor Mountain.

The paleogeographic and paleontological relevance is fully justified by the display on the surface of the summit plateau of Sasului Hill, in the place called "Sălătruc", at an altitude of 1184 m, of the white Barremian reef limestones that make up the "Sălătruc" paleontological geosite Sasului Hill. These appear as a group of isolated rocks, highlighted by selective erosion, with altitudes of about 4-8 m (Fig. 11a), scattered on the surface of the limestone plateau, in association with sinkholes and buried or partially exhumed lapiaz. They are bioconstructions, formed as subtidal deposits within the inner coastal platform (Fig. 11c), of the "patch reef" type that inhabited shallow lagoons in the northern Tethys Ocean during the Lower Cretaceous period. The fossil patch reef at Sălătruc consists mainly of the intensely diagenised skeletons of scleractinian coral polyps (Fig. 11b), accompanied by calcareous algae, phyrids and crustaceans (Patrulis, 1969).

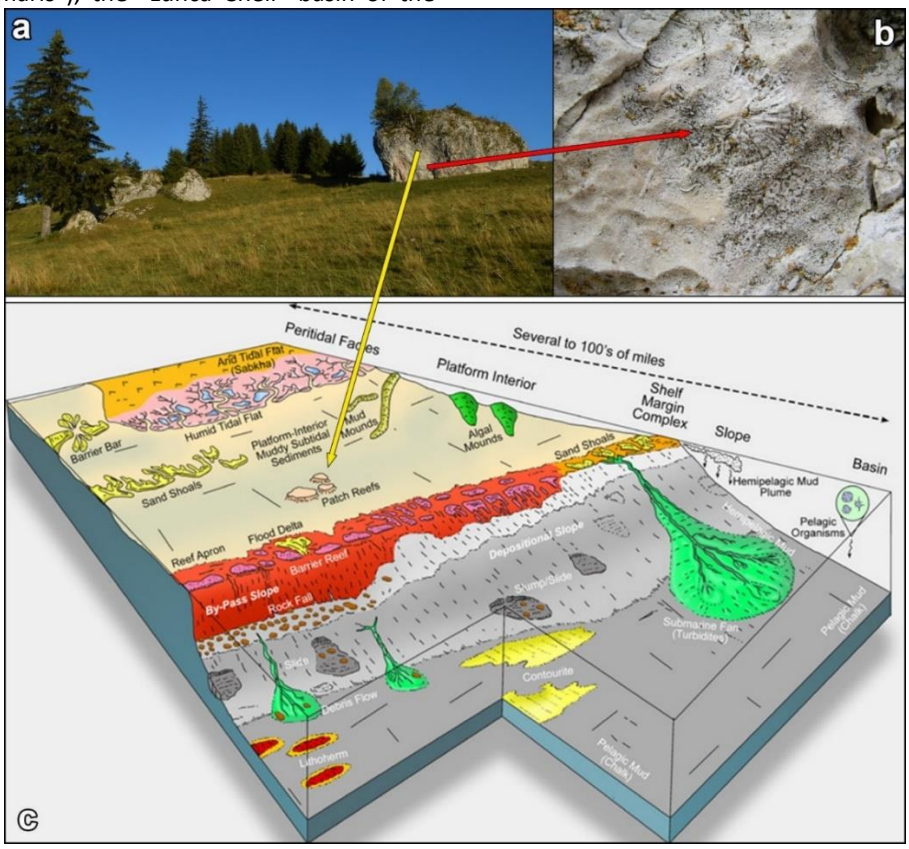

Figure 11: The "Sălătruc" paleontological geosite on Sasului Hill (at 1184 m) – evidence of erosion of white reef limestone (fossil "patch reefs") from the Barremian age (a); fossils of scleractinian coral polyp skeletons (b), detail from the base of the high cliff in photo "a". Source: Trif (2020); "Patch reefs" – subtidal deposits within the inner coastal platform (c). Source: Handford & Loucks (1993)

The archaeological relevance (an episode of modern history) is highlighted by the omnipresence of anthropic relief depicting old infantry trenches (Fig. 12a, 12b) with firing positions (machine gun nests), command posts and artillery positions located on the line of the high ground or immediately behind it, on the slope towards Cheii Valley. The traces of the old military device belong to the First World War Fortification at Dâmbovicioara - Sasului Hill, RAN Code 16338.01 (Fig. 12c), built as the second line of defence against a potential incursion by the Austro-Hungarian imperial army from the border at Fundata. The site, classified as a military construction, is located on the hilltop and its northern slopes, south of the European national road (DN 73/E 574), north of Cheii Valley and south of the upper sector of the Orăți river valley. The battlefield at Sasului Hill, built in the spring of 1916 after the consolidation of the defensive line at Posada, illustrates the Romanian Kingdom's determination to enter the war against Austria-Hungary in order to liberate Transylvania (Teodor & Bolba, 2022).

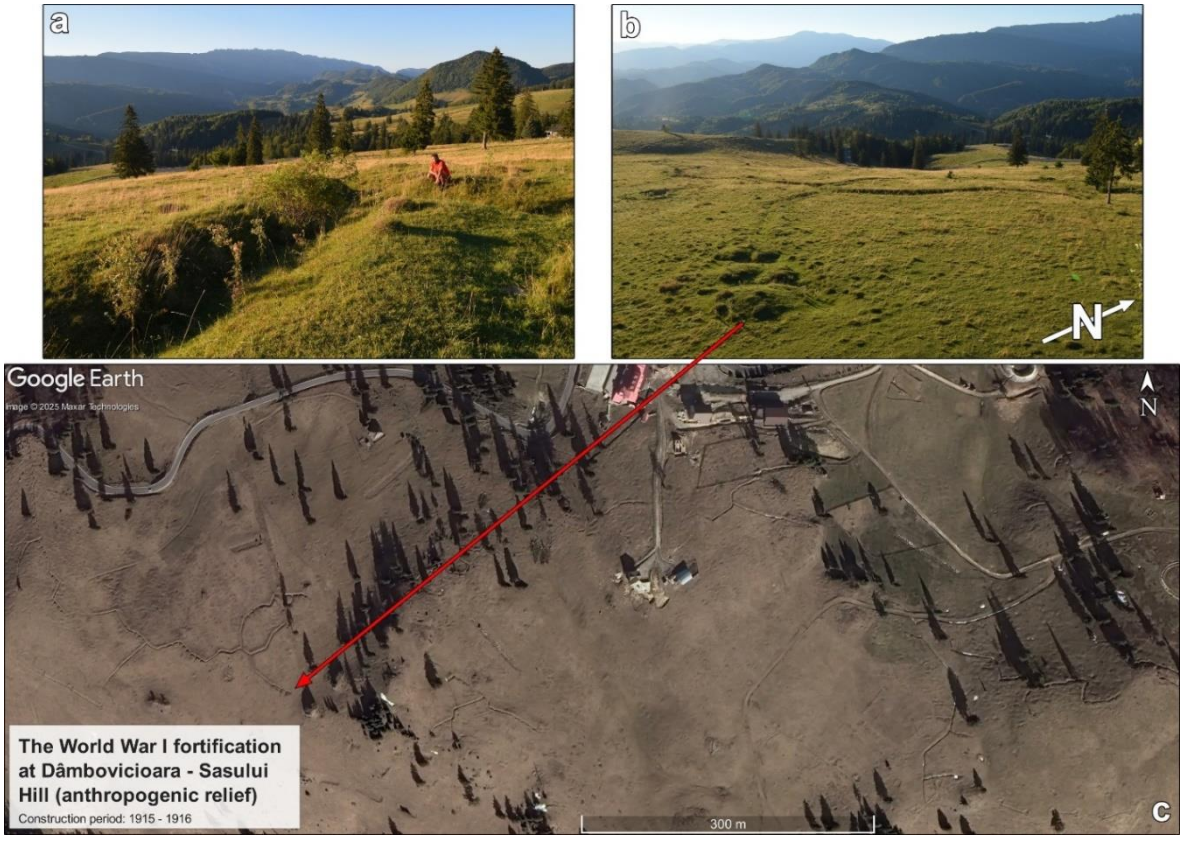

Figure 12: First World War fortification at Dâmbovicioara – Sasului Hill (anthropogenic relief): infantry trenches facing the road along the mountain corridor – detail (a); connecting trenches between the defensive lines, in the western half of the ridge (b); infantry trenches, artillery positions (to the south) and command posts (c). Source of information: Teodor & Bolba (2022); Source of satellite image: Google Earth - World Imagery, 23.02.2016

Discussion

The heritage value of the geomorphosites in the central area of the Bran – Rucăr – Dragoslavele Corridor

In order to inventory and evaluate representative geomorphosites for the central area of the Bran – Rucăr – Dragoslavele Corridor (the Rucăr – Podu Dâmboviței – Dâmbovicioara – Fundata area), 38 evaluation criteria were designed and applied within the methodology. For each criterion, the most appropriate score was awarded, as objectively as possible, from the three fractions of a point (0.25 p, 0.50 p and 0.75 p), including the minimum and maximum values between which the aforementioned fractions fall (0.00 p and 1 .00 p). The most representative 13 declared geomorphosites were selected and evaluated from a total of about 30 geotourism objectives with certain morphotourism value (key valley sectors, karst hydrosystems, caves, sinkholes, swallets, erosion witnesses etc.). Following the application of the evaluation criteria, a diagnostic sheet for the geomorphosites was drawn up. The geomorphosites were classified according to their value hierarchy (Table 1) and positioned in the corresponding geographical space (Fig. 13). The 13 proposed

geomorphosites are currently the most valuable morphotourism objectives in the central sector of the analysed transcarpathian depression corridor. Measures to promote and develop geotourism in the region could start from the documentation provided by the diagnostic sheets of these geomorphosites. Among the 13 geomorphosites identified are the four geomorphosites proposed as nature reserves in 2025, located on the map and marked with the codes G4, G11, G12 and G13.

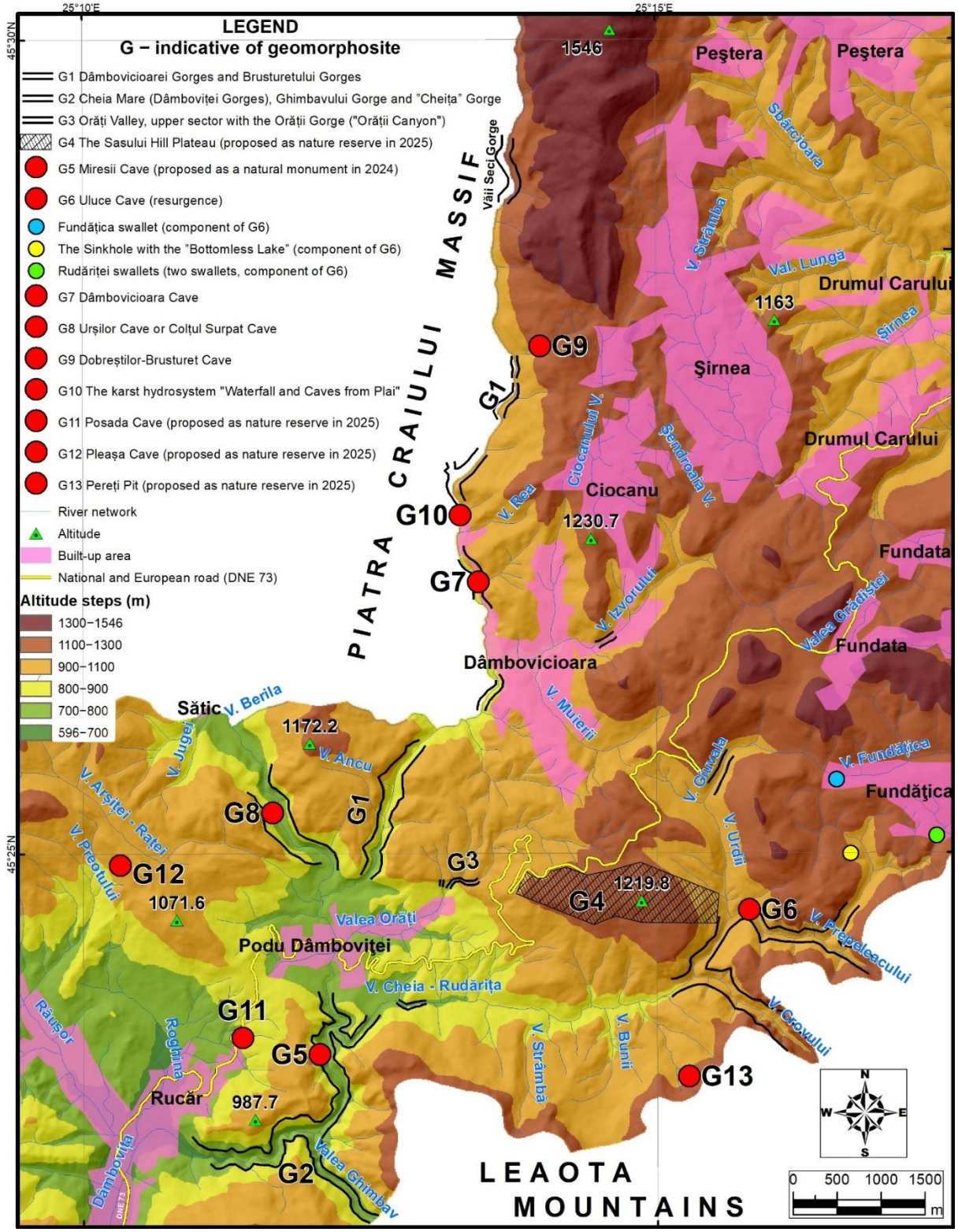

Figure 13: Geographical location of the geomorphosites belonging to the Rucăr – Podu Dâmbovițel – Dâmbovicioara – Fundata geographical area

Table 1: Value hierarchy of the geomorphosites belonging from the Rucăr–Podu Dâmboviței–Dâmbovicioara–Fundata geographical area and the status of the protected natural area, proposed in 2024 and 2025

Geomorphosite (G - indicative)	Structural value			Functional value			Restrictive attributes	Total value
	VS1	VS2	VS3	VF1	VF2	VF3		
G1 Dâmbovicioarei Gorges and Brusturetului Gorges	5.00	3.25	3.00	2.75	5.00	8.25	0.75	26.50
G2 Cheia Mare (Dâmboviței Gorges), Ghimbavului Gorge and "Cheița" Gorge	5.00	3.25	3.00	1.25	4.75	5.75	0.50	22.50
G3 Orăți Valley, upper sector with Orății Gorge ("Orății Canyon")	4.25	2.50	2.00	2.50	4.00	5.75	1.25	19.75
G4 The Sasului Hill Plateau – proposed as a nature reserve in 2025	3.75	3.50	2.25	1.25	4.75	4.75	0.75	19.50
G5 Miresii Cave – proposed as a natural monument in 2024	5.25	2.50	2.25	1.25	4.00	4.50	0.25	19.50
G6 The karst hydrosystem "Fundățica swallet and Rudărița Valley–Uluce Cave (resurgence)"	5.50	1.75	2.00	1.25	3.50	5.50	1.50	18.00
G7 Dâmbovicioara Cave	3.00	1.50	1.75	1.75	3.25	7.25	1.25	17.25
G8 Urșilor Cave or Colțul Surpat Cave	3.75	1.75	2.00	2.00	3.50	5.25	1.25	17.00
G9 Dobreștilor-Brusturet Cave	4.75	2.00	2.00	0.75	3.25	3.75	1.00	15.50
G10 The karst hydrosystem "Waterfall and Caves from Plai"	3.50	1.75	1.50	0.25	3.25	5.50	1.25	14.50
G11 Posada Cave – proposed as a nature reserve in 2025	4.00	1.50	1.50	1.25	2.50	5.00	1.50	14.25
G12 Pleașa Cave – proposed as a nature reserve in 2025	4.00	1.50	0.25	0.25	1.50	4.50	0.75	11.25
G13 Pereți Pit – proposed as a nature reserve in 2025	3.00	1.50	0.75	0.75	1.25	3.75	0.25	10.75

Total value = Structural value (VS1+VS2+VS3) + Functional value (VF1+VF2+VF3) – Restrictive attributes

The diagnostic sheets presented as examples, only for the Sasului Hill Plateau geomorphosite (Table 2) and the Posada Cave speleological geomorphosite (Table 3), show the justifications for the scores awarded based on the inventory criteria proposed in the evaluation methodology, of which 34 (respectively 33) are applicable. Although it ranked fourth in the hierarchy, after three geomorphosites representing key valley sectors, the Sasului Hill Plateau geomorphosite obtained the third highest score (9.50 p) in the section on structural value (geomorphological, aesthetic and ecological) in the evaluation ranking of all geomorphosites designated for the central sector of the Bran – Rucăr – Dragoslavele Corridor. This aspect argues for the high intrinsic value of the analysed geomorphosite system, despite the anonymity in which it currently finds itself (October 2025) in terms of information and promotion. The position in the value hierarchy, according to the structural value criterion, further strengthens the justification for initiating the proposal launched during the present research, for the designation of the Sasului Hill Plateau geomorphosite as a protected natural area (nature reserve).

Similarly, the Posada Cave, although located within the Natura 2000 site (ROSCI 0194 Piatra Craiului), is a virtually unknown geotourism destination, so it is not currently included in the PNPC Management Plan, even though its intrinsic attributes (especially those of a speleological nature) "propose" it to be declared at least a habitat of community/national interest in the category "Caves closed to public access (Code 8310)". In fact, within the established value hierarchy, Posada Cave ranks fifth among all speleological sites evaluated according to the structural value criterion (with 7.00 points accumulated), being surpassed in this section only by the speleological geomorphosites marked with the codes G5, G6, G8 and G9 (Table 1).

Table 2: Diagnostic sheet for the Sasului Hill Plateau geomorphosite

Name	THE SASULUI HILL PLATEAU
Call sign	**G4**
Geographical position	The summit area of the Sasului Hill horst, located north of the Cheii Valley and west of the Urdii Valley
Administrative territorial unit	The village of Podu Dâmboviței (Dâmbovicioara commune)
Types	Geomorphological system – partially karstified plateau that includes the paleontological site at "Sălătruc" (1184 m) and a military archaeological site
Extension	Area
Total value	19.50 p
Structural Value	9.50 p
Functional Value	10.75 p
Restrictive attribute	0.75 p

STRUCTURAL VALUE (VS) = VS1 + VS2 + VS3		
TYPE	SCORE	JUSTIFICATION
Geomorphologic Value (VS1)	3.75p	- **Genesis** (SV 1a): complex genesis, involving several morphogenetic factors: bioconstructions in the subtidal depositional environment (permanently submerged), tectonics, lithology, karst denudation and anthropogenic erosion. Representative fragment of the Ciocanu erosion level, from the Lower and Middle Pliocene (1.00 p) - **Dynamics** (VS 1b): landforms with slow, deducible dynamics (0.50 p) - **Complexity** (VS 1c): three elements of geomorphological interest: the summit plateau, suspended in relation to the neighbouring regions, with exokarstic forms (lapies and small sinkholes), evidence of erosion from white reef limestone (Barremian) of the "patch reef" type; anthropogenic relief with infantry trenches and artillery positions of the military fortification built during the First World War (0.75 p) - **Integrity or conservation status** (VS 1d): geomorphosite moderately affected by anthropogenic modelling: tactical device for military purposes (1915–1916) and expansion of current constructions for tourism purposes (0.50 p) - **Rarity** (VS 1e): geomorphosite system, unique at least at regional level (0.50 p) - **Geological structure** (VS 1f): Barremian "reef nests" with a massive structure, relief on the surface of the summit plateau, a level of erosion that cuts through the monocline structure of the Sasului Hill horst (0.25 p) - **Vertical development** (VS 1g): the summit plateau has unevenness ranging from 25 to 100 m, and on its surface, in the place called "Sălătruc" (1184 m), the relief of some fossil "reef basins", isolated witnesses, highlighted by selective erosion, with altitudes of approximately 4–8 m (0.25 p)
Aesthetic Value (VS2)	3.50 p	- **Physiognomy** (VS 2a): geomorphosite with unique physiognomy, mainly due to prominent erosion witnesses of the Barremian "reef nests" type (1.00 p) - **Chromaticity** (VS 2b): chromatic harmony between the grey tones of the carbonate rocks and the colour palette of chlorophyllous vegetation (0.50 p) - **Maximum visual reception** (VS 2c): the geomorphosite is partially visible from the thematic summit viewpoints on the Pleașa (Pleașa peak, 1071.6 m) and Vătarnița (Vătarnița peak, 1320.3 m) mountains (1.00 p) - **Landscape Attractiveness** (VS 2d): the geomorphosite is an essential landscape component in the overall panorama, being protected also due to its landscape content. It may belong to RNGG2 (IUCN category IV) and is currently included in the ROSCI 0194 and ROSPA 0165 Piatra Craiului protected natural areas of Community interest (1.00 p)
Ecological Value (VS3)	2.25 p	- **Vegetation** (VS 3a): biotope characteristic of mountain hay meadow habitats with plant species of Community/national interest in the ROSCI 0194 protected natural area, but also for the carpathian endemic species Dianthus spiculifolius (barba ungurului), identified on limestone erosion witnesses (1.00 p) - **Fauna** (VS 3b): biotope characteristic of migratory bird species, occasionally also of mammals of Community/national interest in transit (*Ursus arctos* and *Canis lupus*), belonging to the ROSPA 0165 and ROSCI 0194 Piatra Craiului protected natural areas. The meadows and forest edges are habitats for the invertebrate of community/national interest Pholidoptera transsylvanica (cosaș transilvan) (0.50 p) - **Degree of protection as part of a protected natural area** (VS 3c): the geomorphosite is partially protected, being included in ROSCI 0194 and ROSPA 0165 (0.75 p)

FUNCTIONAL VALUE (VF) = VF1 + VF2 + VF3		
TYPE	SCORE	JUSTIFICATION
Cultural (VF1)	1.25 p	- **Archaeological remains with historical relevance** (VF 1a): remains from the First World War – military tactical device built between 1915 and 1916 (0.25 p) - **Symbolism** (VF 1b): the name "Dealul Sasului" ("Sasului Hill") given to Mount Oretzi (old name) could originate from the Saxon colonization in the 13th century (Popescu-Argeșel I., 1998). The name is a symbol indirectly associated with the geomorphosite (0.25 p) - **Artistic and as graphic, cartographic and photographic representations** (VF 1c): there are between 20 and 50 graphic representations (sketches and military tactical plans, maps) and photographs of Sasului Hill in articles for information/popularization tourism or scientific research (0.75 p)
Scientific (VF2)	4.75 p	- **Scientific references in publications** (VF 2a): brief references to Sasului Hill can be found in occasional publications on historical topics and in articles dedicated to promoting tourism. Scientific references appear in several articles in national journals on historical (archaeology), palaeontological and geomorphological topics (0.50 p) - **Formative scientific resource/economic resource (tourism etc.)** (VF 2b): scientific resource with multiple uses, due to its geological/geomorphological, palaeogeographical, palaeontological, archaeological and landscape (panoramic viewpoint) interest and for tourism (recreational, cultural and mixed forms of tourism) (1.00 p) - **Function as a didactic model for landforms and/or geomorphological processes** (VF 2c): model with maximum expressiveness (1.00 p) - **Scientific representativeness representativeness (relevance)** (VF 2d): geomorphosit system with representative at least at regional level (0.50 p) - **Palaeogeographic interest** (VF 2e): geomorphosite of great palaeogeographic interest, useful for deciphering the genesis and evolution of bioconstructions such as "reef nests" (Barremian) in the subtidal depositional environment of a marine basin belonging to the Tethys Ocean, to the current state of the relief with erosion witnesses in reef limestone, protrusions of the Sasului Hill plateau surface (1.00 p) - **Palaeontological remains** (VF 2f): relatively well preserved in the erosion witnesses (fossil "patch reefs"), represented by marine invertebrates (corals, lamellibranchs etc.) from the Barremian age (0.75 p)

Economic (VF3)	4.75 p	- **Number of possible activities** (VF 3a): archaeological and palaeontological research activities (based on special permits), geotourism, ecotourism (birdwatching), mountain hiking, as well as cultural-rural tourism with a historical character for World War I relics – a military tactical device with a defensive role built on the Sasului Hill Plateau in the area of the village of Dâmbovicioara (0.75 p) - **Tourism potential** (VF 3b): potential for tourism of local interest, especially for geotourism and cultural-rural tourism with a historical character, with easy access from the DN(E) 73 road (0.50 p) - **Accessibility** (VF 3c): car access up to 500 m from the Sasului Hill Plateau, from DN(E) 73 (0.75 p) - **Related tourist infrastructure** (VF 3d): the Sasului Hill guesthouse located in near the Sasului Hill Plateau (1.00 p) - **Tourist improvements** (VF 3e): poor facilities on the edge of DN(E) 73, near the Sasului Hill guesthouse, with a directional sign ("Here, true heroes fought for union!"), without an information panel, towards the ruins of the military tactical device on Sasului Hill (0.25 p) - **Distance to nearby localities with complex services** (VF 3f): the distance to Rucar and Zărnești is between 10 and 15 km (0.50 p) - **Urban centres in the neighbouring region** (VF 3g): distance to Rucăr, the nearest locality with complex services, < 10 km (0.75 p) - **Tourism exploitation during the year** (VF 3h): simple, unorganized exploitation, predominantly during the summer season (0.25 p) - **Tourism promotion of geomorphosite** (VF 3i): The Sasului Hill Plateau is not promoted

RESTRICTIVE ATTRIBUTE (AR) = AR1 + AR2 + AR3	
SCORE	JUSTIFICATION
0.75 p	- **Vulnerability to natural phenomena and processes** (AR1): the geomorphosite is vulnerable to processes such as limestone desagregation, solifluction, gully erosion and torrentiality, and, less frequently, collapse, but may be affected to a lesser extent (0.25 p) - **Presence of economic activities with negative impact or which could affect tourism and/or the geomorphosite** (AR2): there is a clear trend towards the expansion of tourist facilities, investments that affect the eastern half of the archaeological site, especially the lower half of the slope towards the national/European road (0.50 p)

Table 3: Diagnostic sheet for the Posada Cave geomorphosite

Name	**POSADA CAVE (Possada or "Gaura Posăzii")**
Call sign	**G11**
Geographical location access (elevation 0 m)	In the Roghina basin, Mount Posada, with the access portal located in inside a sinkhole, at an absolute altitude of ±800 m
Administrative territorial unit	Podu Dâmboviței village (Dâmbovicioara commune)
Types	Geomorphological-speleological
Extension	Linear
Total value	14.25 p
Structural Value	7.00 p
Functional Value	8.75 p
Restrictive attribute	1.50 p

STRUCTURAL VALUE (VS) = VS1 + VS2 + VS3		
TYPE	SCORE	JUSTIFICATION
Geomorphologic Value (VS1)	4.00 p	- **Genesis** (SV 1a): complex speleogenesis, involving four morphogenetic factors: tectonic-gravitational processes (diaclases and incasional forms), corrosion (in certain sectors), torrential erosion, chemical precipitation (dripstone formations and gravitational leakage forms) (1.00 p) - **Dynamics** (VS 1b): slow, deducible dynamics (0.50 p) - **Complexity** (VS 1c): three elements of geomorphological interest: swallet-doline in the catchment area of a temporary epigeal stream, shaft (-12.75 m) continuing with the narrow passage "Calea Pierdută" (43 m long) and abundant dripstone formations in the Hall of Wonders (0.75 p) - **Integrity or conservation status** (VS 1d): slightly affected geomorphosite (0.75 p) - **Rarity** (VS 1e): regionally unique speleological geomorphosite, with a general negative slope (-20.95 m) from sea level, due to the underground loss of a temporary epigeal stream through a large swallet-doline (0.50 p) - **Geological structure** (VS 1f): access to the cave from the swallet-doline is framed by two almost vertical diaclases, and the cavity developed partially on the stratification plane between the upper conglomeratic-breccia bank (Cretaceous) and the carbonate bank at the base (Upper Jurassic - Lower Cretaceous). The Cretaceous sedimentary rock is arranged monoclinal, on the western periphery of the Muntele Posada horst (0.25 p) - **Cave development** (VS 1g): the cave development is 212.6 m (0.25 p)
Aesthetic Value (VS2)	1.50 p	- **Physiognomy** (VS 2a): geomorphosite with attractive physiognomy, due to the elements of geomorphological interest mentioned (0.50 p) - **Chromaticity** (VS 2b)**:** chromatic degradation characteristic of karstic hollows (0.25 p) - **Maximum visual reception** (VS 2c): selectively perceived speleological geomorphology, from observation points along the route (0.50 p) - **Landscape Attractiveness** (VS 2d): the geomorphological feature (with a sinkhole incorporated into the base of the south-western flank of the Muntele Posada horst) is a component with local landscape appeal. It may belong to RNGG2, IUCN category IV (0.25 p)

Ecological Value (VS3)	1.50 p	- **Vegetation** (VS 3a): biotope lacking vegetation (0 p) - **Fauna** (VS 3b): the cave is home to species of community/national interest: chiroptera of the species *Rhinolophus ferumequinum,* the invertebrate *Chilostoma banaticum* or Banat keeled snail (glacial relict) and the amphibian *Bombina variegata* or yellow-bellied toad, the latter being identified occasionally (0.75 p) - **Degree of protection as part of a protected natural area** (VS 3c): the geomorphosite is partially protected, the sinkhole being included in ROSCI 0194, but the underground cavity has not been declared a habitat type "cave closed to public access" (0.75 p)

FUNCTIONAL VALUE (VF) = VF1 + VF2 + VF3		
TYPE	SCORE	JUSTIFICATION
Cultural (VF1)	1.25 p	- **Symbolism** (VF 1b): the name "Gaura" (Posăzii) given to the cave by the locals (Dobrescu and Everac, 2003) means "dangerous cave", an aspect with symbolic significance, directly related to the geomorphosite due to the access portal located inside the doline (0.75 p) - **Artistic and as graphic, cartographic and photographic representations** (VF 1c): for Posada Cave there are 10-20 graphic representations (sketches, maps) and photographs in tourist and scientific information/promotional works (0.50 p)
Scientific (VF2)	2.50 p	- **Scientific references in publications** (VF 2a): scientific references in an occasional publication, in an article on speleological exploration in an online magazine, as well as in a national scientific journal (0.50 p) - **Formative scientific resource/economic resource (tourism etc.)** (VF 2b): scientific resource with limited appeal, due to the prevailing interest in speleology (physical speleology and zoospeleology – invertebrates and chiroptera), but also due to the possibility of practising sports-oriented speleotourism (0.50 p) - **Function as a didactic model for landforms and/or geomorphological processes** (VF 2c): model with medium expressiveness (0.50 p) - **Scientific representativeness (relevance)** (VF 2d): speleological geomorphosite with regional representativeness (0.50 p) - **Paleogeographic interest** (VF 2e): geomorphosite of moderate paleogeographic interest, useful for deciphering the genesis and evolution of the cave (0.50 p)
Economic (VF3)	5.00 p	- **Number of possible activities** (VF 3a): activities related to *scientific research* (especially zoospeleological), *geotourism,* as well as *sports caving* can be practised*,* only on the basis of a permit issued by the PNPC administration (0.50 p) - **Tourism potential** (VF 3b): potential for regional tourism development for the purpose of sports caving, due to its geographical location near the DN(E) 73 road (0.75 p) - **Accessibility** (VF 3c)**:** car access up to 500 m from the geomorphological site, from DN(E) 73 (0.75 p) - **Related tourist infrastructure** (VF 3d): Camping Panorama approximately 1.5 km from the site (0.75 p) - **Tourist improvements** (VF 3e)**:** lack of facilities and services - **Distance to nearby localities with complex services** (VF 3f): distance to Rucăr, the nearest locality with complex services, < 5 km (1.00 p) - **Urban centres in the neighbouring region** (VF 3g): the nearest urban centre is the city of Câmpulung (27,574 inhabitants/2021), 25.1 km away (0.50 p) - **Tourism exploitation during the year** (VF 3h): simple, occasional exploitation - **Tourism promotion of geomorphosite** (VF 3i): tourism promotion on a single website (Giurgiu, Romania-natura49), with a maximum national reach national level (0.75 p)

RESTRICTIVE ATTRIBUTE (AR) = AR1 + AR2 + AR3	
SCORE	JUSTIFICATION
1.50 p	- **Vulnerability to natural phenomena and processes** (AR1): this speleological geomorphosite with high negative unevenness can be severely affected by possible silting, being vulnerable to seismic movements and other processes that can cause subsidence (0.50 p) - **Presence of economic activities with negative impact or which could affect tourism and/or the geomorphosite** (AR2): irrational pastoral activities in the water drainage area towards the sinkhole and in its vicinity affect the habitat of the speleological geomorphosite (0.50 p) - **Unsightly elements** (AR3): massive accumulation of various household and industrial waste materials, dumped in the swallet-doline and transported by temporary torrential streams to the Hall of Wonders (0.50 p)

Relevance and reason for protecting the geomorphosites proposed as nature reserves in 2025

Table 4: Geomorphosites from the Bran – Rucăr – Dragoslavele Corridor proposed as nature reserves in 2025

Indicative	**GEOMORPHOSITE / protected natural area status:** RNGG2 – Natural Reserve (proposed) "Moieciu - Fundata - Dâmbovicioara - Rucăr Geological and Geomorphological Complex" (IUCN category IV); ROSCI 0194 Nature 2000 site, ROSPA 0165 Nature 2000 site	**RELEVANCE** for other fields of research (other than geomorphology) and applicability	**REASON FOR PROTECTION** (other than preventing degradation caused by certain human activities)
G4	**THE SASULUI HILL PLATEAU (geomorphosite system – partially karstifiable plateau that includes the paleontological geosite at "Sălătruc", 1184 m and a military archaeological site)** / geomorphosite included in ROSCI 0194 and ROSPA 0165; proposed as a nature reserve (IUCN category IV) component of RNGG2	- paleogeographic (evidence of erosion in the form of Barremian-era "patch reefs") - paleontological (fossils of Mesozoic	- preservation and conservation of the integrity of erosion witnesses such as "patch reefs" - preservation, maintenance, and tourist exploitation of the ruins of the military

		marine invertebrates) - cultural-historical /archaeological (ruins of a military tactical device from World War I) - landscape (panoramic viewpoint)	tactical device from World War I
G11	*** POSADA CAVE** **(speleological geomorphosite)** / located within ROSCI 0194; proposed as a nature reserve (IUCN category IV) component of RNGG2	- physical speleology - zoological speleology (chiroptera)	- distinctive morphological attributes - presence of chiroptera fauna
G12	**PLEAȘA CAVE** **(speleological geomorphosite)** / proposed as a nature reserve (IUCN category IV) component of RNGG2	- physical speleology - zoological speleology (chiroptera)	- distinctive morphological attributes - existence of chiroptera fauna
G13	*** PEREȚI PIT** **(speleological geomorphosite) /** located within ROSCI 0194; proposed as a nature reserve (IUCN category IV) component of RNGG2	- physical speleology - hydrogeology	- distinctive morphological attributes - ensuring hydrogeological functionality

** The cave has not been declared a habitat of Community/national interest, code 8310: "Caves closed to public access"*

Conclusions

Through the present study, given the possibility of establishing the new natural reserve proposed with the name "Moieciu - Fundata - Dâmbovicioara - Rucăr Geological and Geomorphological Complex", category IV of the IUCN, we suggest to the competent institutions, existing at local level (in a first stage, the Scientific Council of the PNPC) and national level (National Agency for Protected Natural Areas), the establishment of new protected natural areas, as natural reserves of category IV of the IUCN, integrated into RNGG2. These, four in number (two caves, a pit and a partially karstifiable plateau, with an anthropogenic relief of military strategy), could function in order to prevent the degradation caused by certain present anthropogenic activities, with a potentially negative impact, detected in the area of the respective geomorphosites, as well as due to the other arguments specified under "reason for protection" (Table 4).

The three underground cavities analysed (Pleașa Cave, Posada Cave and Pereți Pit), although partially explored and inventoried, have not yet been studied from a morphological, morphodynamic and morphogenetic point of view. Viewed from the perspective of speleological geomorphosites, they were analysed using 38 criteria (from the evaluation method) relating to the structural value, functional value and restrictive attributes of each. In the near future, given that these sites could be declared protected natural areas, access for exploration and research purposes (or for other legally permitted purposes) will only be possible on the basis of authorisations issued by the Speleological Heritage Commission, with the approval of the National Agency for Protected Natural Areas and the PNPC administration.

At present, October 2025, *Pleașa Cave* is located outside the boundaries of the protected areas designated for PNPC and ROSCI 0194, at a distance of about 500 m to the west, but in the near future it could be included in the management of the PNPC Administration, a reality that could be recorded in a future, approved version of the relevant management plan. In accordance with Law No. 49 (2011) approving Government Emergency Ordinance No. 57 (2007) on the regime of protected natural areas, the conservation of natural habitats, wild flora and fauna, Pleașa Cave could be included in protection class C – caves with sectors of local importance (according to Article I, point 64, regarding the classification of caves or sectors thereof according to scientific and cultural-educational value). At the same time, the cave can be designated as a nature reserve, IUCN category IV (according to Article I, point 68, regarding the classification of caves or parts thereof according to the purpose and management regime of protected natural areas), thanks to considerations related to its morphological attributes. According to the legislation in force, class C caves may be subject to speleological exploration, documentation activities, scientific research, tourist development (e.g. for sports speleotourism) or other forms of exploitation.

Posada Cave is not included in the strictly protected area of the PNPC, but only in the protected natural area ROSCI 0194, without being declared a habitat of community/national interest in the category "Caves closed to public access (Code 8310)". The name of the cave does not appear in the Management Plan of the PNPC and ROSCI 0194. Its proximity to the DN(E) 73 road and the possible involvement of the local administration in the greening of the cave, affected by the massive accumulation of various household and industrial waste materials, could allow it to be transformed in the near future into a category IV IUCN nature reserve, intended, for example, for speleological exploration.

Although it is included in the Natura 2000 site ROSCI 0194 Piatra Craiului, Pereți Pit is not mentioned in the management plan of the Piatra Craiului National Park.

The geographical location of the cave was determined for the first time in this study, the sinkhole leading to the underground cavity being rediscovered. The geological and geomorphological arguments presented in this study could suggest that the members of the Scientific Council of the PNPC decide that this cave should become a habitat of community/national interest in the category "Caves closed to the public (Code 8310)", at least for the study of the water circuit within the local karst system, as well as for the study of invertebrate fauna (coleoptera, arachnids etc.).

The archaeological site of the First World War military construction on Sasului Hill, recently discovered by LiDAR scanning (11 August 2019), is receiving increased attention for research. Thus, following the observations and records made on the dedicated website (National Archaeological Repertory, RAN Code 16338.01), its discoverer, Eugen S. Teodor from the "Vasile Pârvan" Institute of Archaeology in Bucharest, states, with reference to the potential anthropogenic risk, that "there is a clear tendency to expand tourist facilities in the eastern half of the archaeological site".

Within the same geomorphological system (the Sasului Hill Plateau), the erosion witnesses of the "Sălătruc" palaeontological geosite, studied in the 1960s by the renowned geologist Dan Patrulius, have not received the attention they deserve until recently. The present study aims to highlight the relevance and paleogeographic importance of the Barremian reef nests (ruiniform relief with positive shapes on the surface of the mountain plateau), as well as their value and potential from a geotourism perspective, as geotourism resources of certain ontological value.

The transverse depression corridor analysed is a mountainous area renowned for the harmonious coexistence of traditional human life and activities with the elements of the surrounding natural environment. The Bran-Dragoslavele Corridor offers a variety of opportunities characteristic of recreational and multi-purpose rural tourism. At the same time, this transcarpathian mountain area is also known for the scientific, educational, didactic and cultural value of its geomorphological and geological sites, which are mainly concentrated in its central part, the Rucăr - Podu Dâmboviței - Dâmbovicioara - Fundata area. Furthermore, the geotourism objectives found in the central area of the analysed carpathian relief subunit are almost entirely included in the protected natural areas belonging to PNPC and ROSCI 0194. This fact has led us to propose the declaration of the three speleological geomorphosites (Pleașa Cave, Posada Cave and Pereți Pit) as nature reserves. At the same time, we highlight the importance of promoting them within the broader framework of the geotourism resources to which they belong, included in the proposed thematic geotourism circuit called "The Road of Gorges and Caves in the Upper Dâmbovița Basin". We would like to point out that other geomorphological tourist attractions, geosites of palaeontological and palaeogeographical significance (such as the one at "Sălătruc" on Sasului Hill), as well as two proposed thematic summit viewpoints (Pleașa Peak and Vătarnița Peak) are also located in the vicinity of this geocircuit..

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Author contribution

Conceptualization, S.T. and M.M.; methodology, S.T. and A.P.; formal analysis, M.M. and A.P.; investigation, S.T. and A.P.; writing—original draft preparation, S.T.; writing—review and editing, S.T., M.M. and A.P. All authors have read and agreed to the published version of the manuscript.

Conflicts of interest

The authors declare no conflict of interest.

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