

## Romanian Karst — special zones and caves

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*Д. Бадеску — Румынский карст — особые зоны и пещеры.* Румыния характеризуется исключительным богатством карстовых форм. Они приурочены к нескольким регионам: Горы Апусены, Южные Карпаты, Восточные Карпаты, Добруджа. Большинство пещер должны быть включены в Список защищенных природных заповедников, а некоторые представляют интерес как часть мирового геологического наследия.

*Abstract.* Romania is characterized by a great wealth of karst forms. The most important are bound to several regions, and namely: the Apuseni Mts., South Carpathians, Eastern Carpathians, Dobrogea. Most of the caves should be included in the List of the protected natural sites, and some of them are of interest as a part of the World Geological Heritage.

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*Key words:* geological heritage; Romania; karst; caves

### 1. Introduction

Romanian karst represented for a long time a tool study for research scientists, and especially, biologists. In Romania, Emil Racovita and Rene Jeannel set the bases for biospeleology. Systematic research for physical speleology (including the influence of geology and tectonics in caves' genesis) began in the midst of our century.

The total karst area is small, approximately 1.5 % from the surface of Romania. According to Bleahu (1972), this low percentage is due to Pliocene and Quaternary deposits that overlie the old formations, including the karst-forming rocks, in broad regions. In spite of the small karst area, there are several zones with a great variety of karst phenomena.

For obvious reasons, we will speak here only of the most important karst regions.

### 2. Regional distribution of the karst-forming rocks

Because of the geological and tectonical evolution of the Romanian territory, the karst forming rocks distribution is not uniform (fig. 1). The major part of these rocks is found in the Apuseni Mountains and in the western part of

the Southern Carpathians. In Dobrogea, in spite of the large area with karst-forming rocks, the thick loess cover and the less favourable climate conditions have inhibited the karst generating phenomena (fig. 2).

One can meet in Romania karst phenomena in all kinds of rocks: limestones, dolomites, metamorphic rocks, sandstones, conglomerates, volcanic rocks, salt, gypsum, loess, etc. However, limestones and dolomite karst prevails (Table 1).

For limestones and dolomites, the percentual distribution was plotted against age (Triassic — 17.8 %; Jurassic and Cretaceous — 47.3 %; Neozoic — 16.8; another ages — 18.1 % — see fig. 3). Among these rocks, most of them originate in Alpine thrust belts.

From a structural point of view, Bleahu (1972) describes three kinds of karst with specific features (fig. 4).

### 3. Karst areas with European importance

In this chapter we will shortly describe the most important karst phenomena, in order to integrate them in the future south-east European geological heritage list. The caves have not only a geological importance, but paleontological,

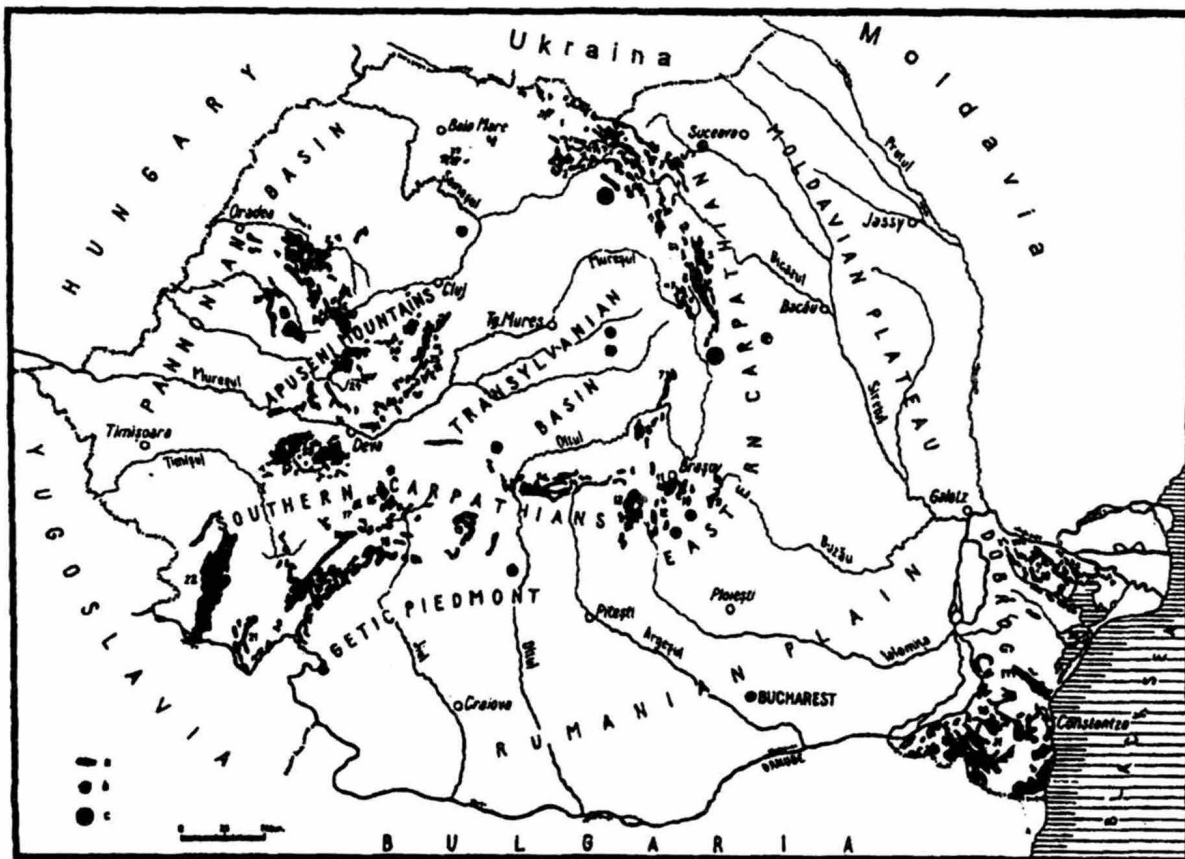


Fig. 1. Distribution of karst-forming rocks in Romania (after Bleahu, 1972). a — limestones and dolomites; b — karst developed on salt and gypsum; c — karst in volcanic rocks. 1 — Maramuresh Mountains; 2 — Rodna Mountains; 3 — Rarau Massif; 4 — Giurgeu Mountains; 5 — Ceahlau Massif; 6 — Haghimas Massif; 7 — Virghish Valley Massif; 8 — Pershani Mountains; 9 — Ciucash Massif; 10 — Piatra Mare Massif; 11 — Postavarul Massif; 12 — Bucegi Mountains; 13 — Piatra Craiului Massif; 14 — Fagarash Mountains; 15 — Lotru and Capatsina Mountains; 16 — Sebes Mountains (Luncani Platform); 17 — Retezat Mountains; 18 — Vulcan Mountains; 19 — Mehedintzi Plateau; 20 — Mehedintzi Mountains; 21 — Almaj Mountains; 22 — western side of the Banat Mountains; 23 — Poiana Rusca Mountains; 24 — Metaliferi Mountains; 25 — Trascau Mountains; 26 — Bihor Mountains; 27 — Codru-Moma Mountains; 28 — Padurea Craiului Mountains; 29 — Preluca Mountains; 30 — northern Dobrogea; 31 — southern Dobrogea

Table 1. Caves distribution in function of rocks lithology (Goran, 1982)

| Rocks     | limestones and dolomites | salt gypsum conglomerates | sandstones | volcanic magmatic | metamorphic loess |    |   |    |   |
|-----------|--------------------------|---------------------------|------------|-------------------|-------------------|----|---|----|---|
| Caves nr. | 6713                     | 23                        | 5          | 20                | 26                | 12 | 6 | 10 | 1 |

archaeological, biological, climate importance. Table 2 shows the most important features of the karst phenomena comprised in the official list with the geological heritage from Romania<sup>1</sup>. Figure 5 represents the location of the areas that are preserved.

<sup>1</sup> The official list of geological heritage proposed to conservation is for the period between 1932-1991 and, in my opinion, at least from speleological point of view, is quite incomplete.

### 3.1. Apuseni Mountains

The Apuseni Mountains are clearly the most representative and interesting karst region from Romania. There are both remarkable underground systems and complex exokarst phenomena. The great density of these phenomena, especially in the Bihor Mountains, represents the first reason to create "Apuseni Mountains" National Park.

In Apuseni Mountains exists one of the greatest and remarkable karst phenomena from Europe: Cetatile Ponorului. Three large collapse dolines

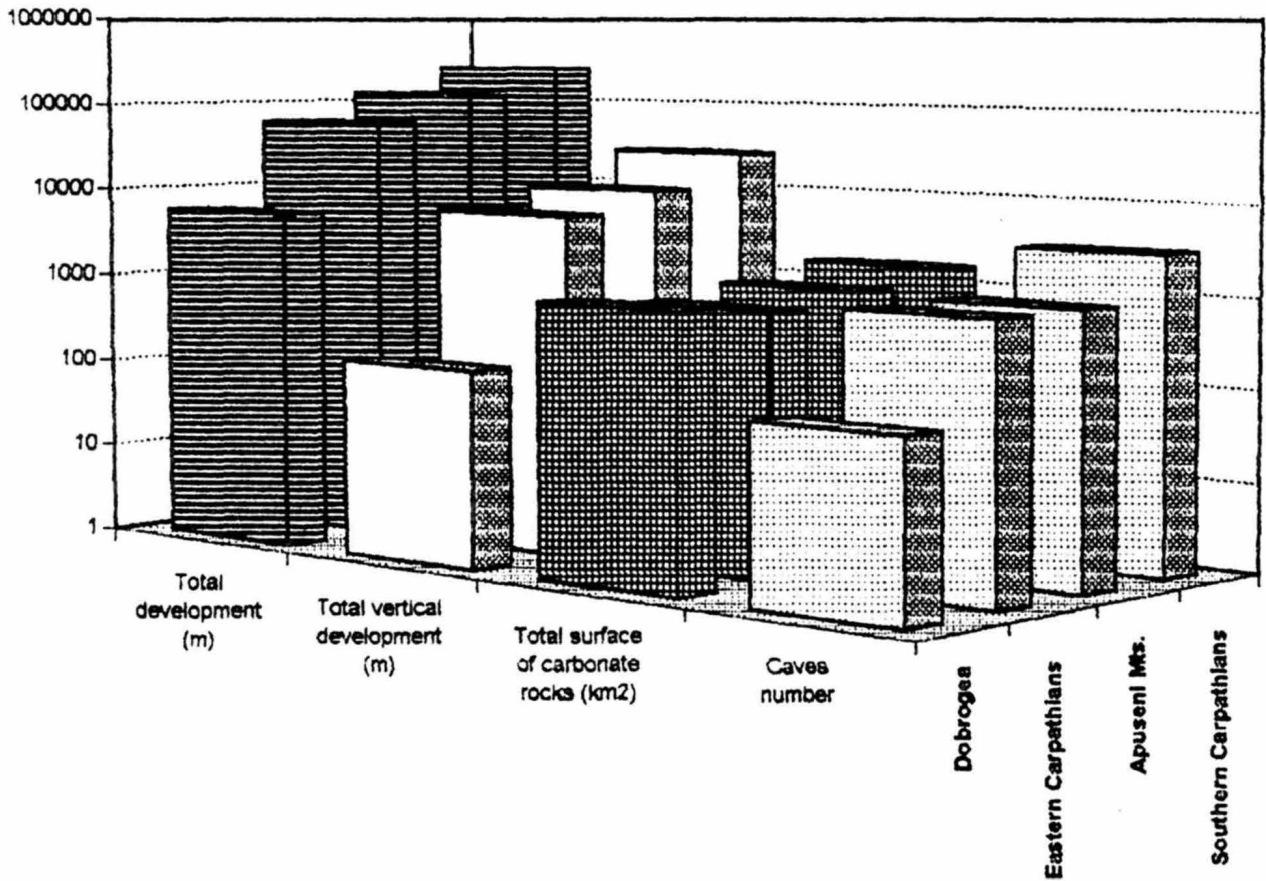


Fig. 2. Distribution of the number of caves by geographic units, as function of the surface of carbonate rocks

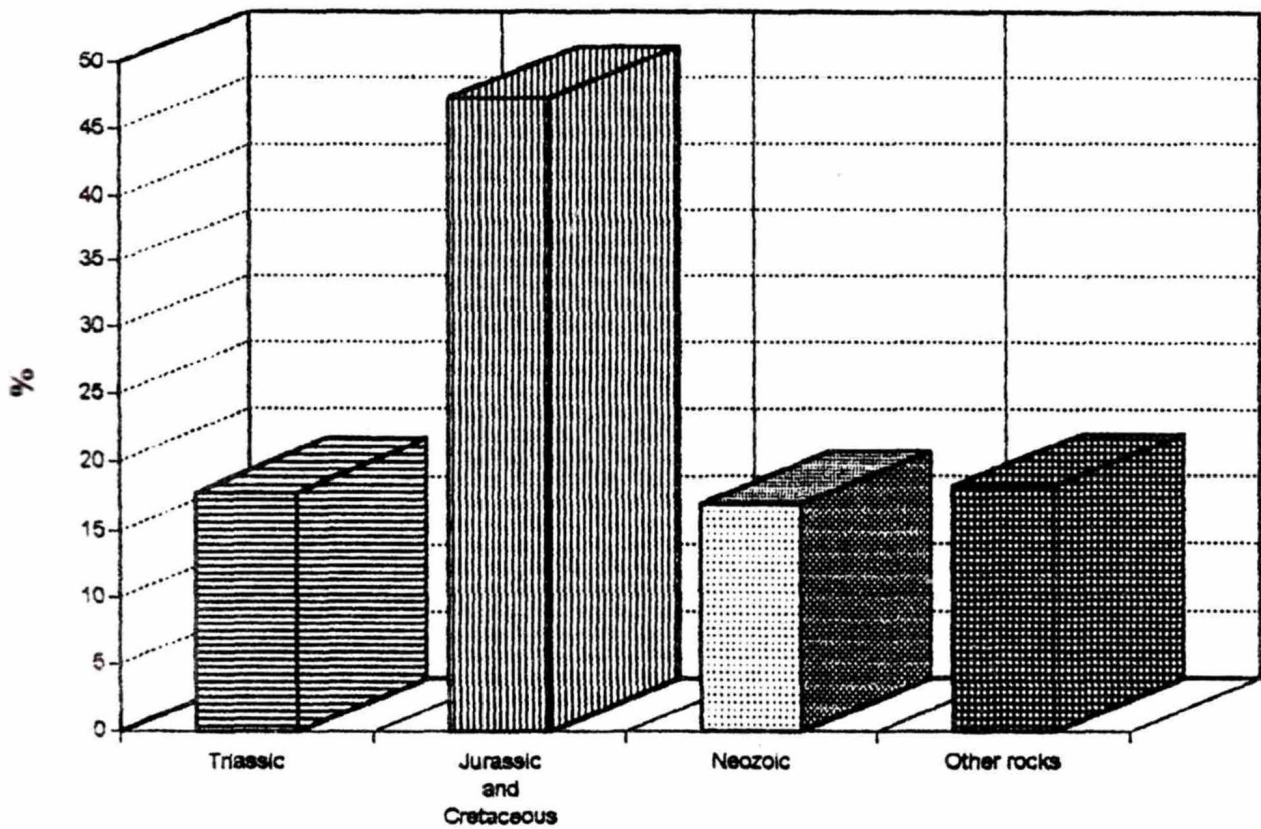


Fig. 3. Percentage distribution of karst-forming rocks against age



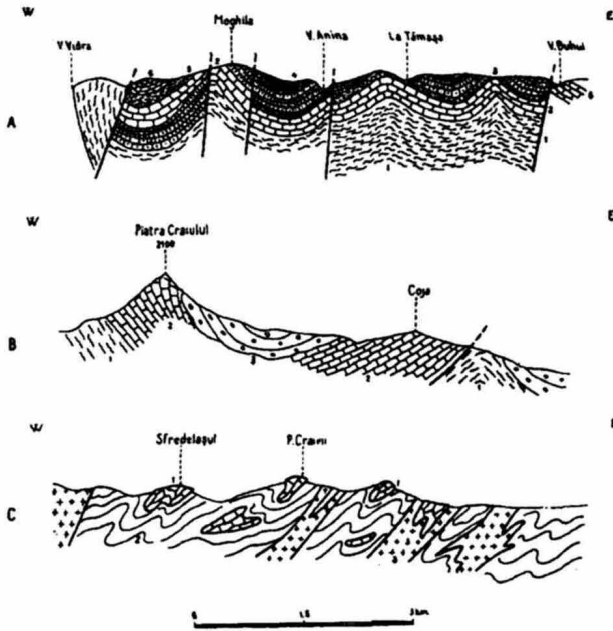


Fig. 4. Structural types of Karst (after Bleahu, 1972).  
 A. Calcareous plateau. Geological section on the western side of the Banat Mountains: 1 – sandstone and marl (Lias-Dogger); 2 – limestone (Callovian); 3 – marl (Oxfordian); 4 – limestone (Lusitanian-Tithonian); 5 – marl (Hauterivian-Lower Barremian); 6 – limestone (Urgonian).  
 B. Calcareous ridges. Geological section through the Piatra Craiului Massif: 1 – crystalline schists; 2 – limestone (Callovian-Berriasian); 3 – conglomerate (Vraconian-Cenomanian).  
 C. Isolated calcareous massifs. Geological section in the Metaliferi Mountains: 1 – olistoliths of Jurassic limestones; 2 – Lower Cretaceous flysch; 3 – diabases

Department

1. Alba
2. Arad
3. Arges
4. Bihor
5. Bistrita-Nasaud
6. Brasov
7. Caras-Severin
8. Cluj
9. Constanta
10. Dambovita
11. Gorj
12. Harghita
13. Munedoara
14. Maramures
15. Mehedinti
16. Neamt
17. Suceava
18. Valcea

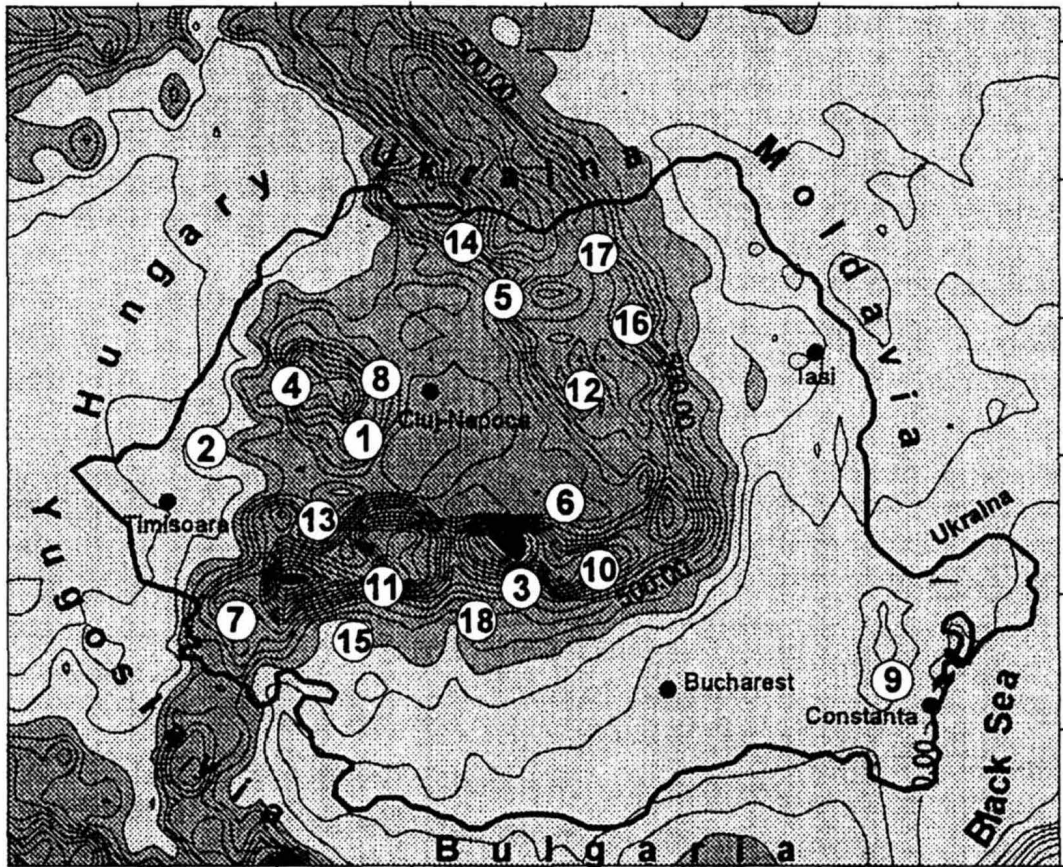


Fig. 5. Departments with important karst phenomena (see also table 2)

built of limestones, with walls over 200 metres, are located in a depression over 1 km diameter. Two of them are united by a huge gate in gothic style of 70 m high. A stormy water course flows through the dolines and then disappears underground in a remarkable cave of a huge volume.

Besides the karst system of Cetatile Ponorului there is a beautiful karst plateau (Lumea Pierduta Plateau) penetrated with several potholes that lead to an underground active system with water courses.

To the north, at 3-4 km, there is a closed depression named "Groapa de la Barsa". The

Table 2. Main "official" karst phenomena in Romania.

| Type                      | Department                                | U<br>I<br>C<br>N | Karst morphology<br>(only for karstic zones) |                                 |                            |                                      |                       | G<br>&<br>T | P | I<br>C | K<br>S | H<br>G | S<br>&<br>M | C | B | A | T |
|---------------------------|-------------------------------------------|------------------|----------------------------------------------|---------------------------------|----------------------------|--------------------------------------|-----------------------|-------------|---|--------|--------|--------|-------------|---|---|---|---|
|                           |                                           |                  | L<br>a<br>p<br>i<br>n<br>e<br>s              | d<br>o<br>l<br>i<br>n<br>e<br>s | g<br>o<br>r<br>g<br>e<br>s | p<br>o<br>t<br>h<br>o<br>l<br>e<br>s | c<br>a<br>v<br>e<br>s |             |   |        |        |        |             |   |   |   |   |
| <b>1. Alba</b>            |                                           |                  |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| K                         | *Complexul carstic Scărișoara             | 3                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                         | P. Ponor                                  | 3                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   | X |
| C                         | Ghețarul de la Vârtop                     | 3                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   | X |
| C                         | Huda lui Păpără                           | 3                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| G                         | Cheile Intregalde                         | 4                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| G                         | Cheile Râmetului                          | 4                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| G                         | Cheile Vălișoarei                         | 4                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| G                         | Valca Mănăstirii                          | 4                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| <b>2. Arad</b>            |                                           |                  |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                         | P. Valea Morii                            | 3                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| <b>3. Arges</b>           |                                           |                  |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| M                         | Cetățeni area                             | 3                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| K                         | Cheile Brusturet-<br>Cheile Dâmbovicioara | 4                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| <b>4. Bihor</b>           |                                           |                  |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| S                         | *Izbuluc de la Călugări                   | 3                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                         | Porțile Bihorului                         | 3                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                         | P. Cămpenească                            | 3                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   | X |
| C                         | Ghețarul Focul Viu                        | 3                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                         | *P. Ciur-Izbuc                            | 3                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                         | P. Osoiu                                  | 3                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                         | P. Urșilor de la Chișcău                  | 3                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                         | P. Ciur-Ponor                             | 3                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   | X |
| C                         | *P. Valea Leșului                         | 3                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   | X |
| C                         | *P. Vântului                              | 3                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   | X |
| C                         | P. Micula                                 | 3                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   | X |
| C                         | P. Gălășeni                               | 3                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                         | *P. Vadu Crișului                         | 3                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| P                         | Av. Bortigul                              | 3                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   | X |
| K                         | *Cetățile Ponorului                       | 4                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                         | *Cetatea Rădesei                          | 4                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| K                         | Platoul Padig-Poiana Ponor                | 4                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| K                         | *Valea Sighistelului                      | 4                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| G                         | *Defileul Crișului Repede                 | 4                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| K                         | Groapa de la Barsa                        | 4                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| K                         | Platoul Lumea Pierdută                    | 4                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                         | *P. Meziad                                | 4                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| <b>5. Bistrița-Năsăud</b> |                                           |                  |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                         | P. Tăușoare                               | 3                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   | X |
| <b>6. Brașov</b>          |                                           |                  |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| K                         | *Piatra Craiului                          | 1                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                         | P. Bârlogul Ursului                       | 3                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                         | P. Valea Cetății                          | 3                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                         | P. Liliacilor                             | 3                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| G                         | Cheile Zămeștișor                         | 4                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| <b>7. Caraș-Severin</b>   |                                           |                  |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                         | P. Bârzoni                                | 3                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                         | P. Comarnic                               | 3                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   | X |
| K                         | *Cheile Nerei                             | 1                |                                              |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |



| T<br>y<br>p<br>e | Department                       | U<br>I<br>C<br>N | Karst<br>morphology<br>(only for<br>karstic zones) |                                 |                            |                                      |                       | G<br>&<br>T | P | I<br>C | K<br>S | H<br>G | S<br>&<br>M | C | B | A | T |
|------------------|----------------------------------|------------------|----------------------------------------------------|---------------------------------|----------------------------|--------------------------------------|-----------------------|-------------|---|--------|--------|--------|-------------|---|---|---|---|
|                  |                                  |                  | L<br>a<br>p<br>i<br>s<br>s                         | d<br>o<br>l<br>i<br>n<br>e<br>s | g<br>o<br>r<br>g<br>e<br>s | p<br>o<br>t<br>h<br>o<br>l<br>e<br>s | c<br>a<br>v<br>e<br>s |             |   |        |        |        |             |   |   |   |   |
|                  | <b>Caraş-Severin<br/>(cont.)</b> |                  |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| M                | *Dealul Domogled                 | 1                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| G                | *Valea Ciclovei                  | 1                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| G                | *Cheile Caragului                | 1                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| G                | Cheile Gârliștei                 | 1                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| G                | Cheile Susarei                   | 1                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| S                | Izbucul Bigăr                    | 1                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
|                  | <b>8. Cluj</b>                   |                  |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                | P. Vârful                        | 3                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| G                | *Cheile Turzii                   | 4                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
|                  | <b>9. Constanța</b>              |                  |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                | *P. La Adam                      | 3                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                | *P. Gura Dobrogei                | 3                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                | P. Limanu                        | 3                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
|                  | <b>10. Dâmbovița</b>             |                  |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| G                | Cheile Horoabei                  | 3                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| G                | Cheile Zănoagei                  | 3                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| G                | Cheile Ursilor                   | 3                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
|                  | <b>11. Gorj</b>                  |                  |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                | *P. Muiceni                      | 1                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                | *P. Cloșani                      | 1                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   | X |
| S                | Izbucul Izverna                  | 3                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| S                | Izbucul Jaleș                    | 3                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                | P. Cioaca cu Brebeni             | 3                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   | X |
| M                | Piatra Cloșanilor                | 1                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| M                | Ciucevele Cemci                  | 1                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                | *P. Gura Plăului                 | 3                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                | P. Martel                        | 3                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                | P. Lazului                       | 3                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                | P. Iedului                       | 3                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                | P. Polovragi                     | 3                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| G                | Valea Gropul Sec                 | 4                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| G                | Cheile Șohodol                   | 4                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| M                | Muntele Oslea                    | 4                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| G                | Cheile Olteșului                 | 4                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| M                | Cometul Pocrnici                 | 4                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| G                | Cheile Corcoaiei                 | 4                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| M                | Piatra Borostenilor              | 4                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
|                  | <b>12. Harghita</b>              |                  |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                | P. Șugăn                         | 3                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| P                | Av. Licaș                        | 3                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   | X |
| G                | Cheile Bicazului                 | 4                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| G                | Cheile Vârghișului               | 4                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| M                | Piatra Singuratică               | 4                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
|                  | <b>13. Hunedoara</b>             |                  |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| M                | Muntele Vulcan                   | 4                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| M                | *Podul natural de la Grohot      | 4                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| G                | *Cheile Măda                     | 4                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| G                | *Cheile Crivădiei                | 4                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                | *P. Bolii                        | 4                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                | *P. Șura Mare                    | 1                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   | X |

| T<br>y<br>p<br>e     | Department                     | U<br>I<br>C<br>N | Karst<br>morphology<br>(only for<br>karstic zones) |                                 |                            |                                      |                       | G<br>&<br>T | P | I<br>C | K<br>S | H<br>G | S<br>&<br>M | C | B | A | T |
|----------------------|--------------------------------|------------------|----------------------------------------------------|---------------------------------|----------------------------|--------------------------------------|-----------------------|-------------|---|--------|--------|--------|-------------|---|---|---|---|
|                      |                                |                  | L<br>a<br>p<br>i<br>e<br>s                         | d<br>o<br>l<br>i<br>n<br>e<br>s | g<br>o<br>r<br>g<br>e<br>s | p<br>o<br>t<br>h<br>o<br>l<br>e<br>s | c<br>a<br>v<br>e<br>s |             |   |        |        |        |             |   |   |   |   |
| Hunedoara<br>(cont.) |                                |                  |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                    | *P.Tecuci                      | 1                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   | X |
| C                    | *P.cu corali                   | 1                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   | X |
| C                    | P.Valca Stăneă                 | 3                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   | X |
| C                    | *P.Zeicului                    | 3                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   | X |
| C                    | P.Cizmei                       | 3                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| 14. Maramureş        |                                |                  |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                    | P.Şomcuta                      | 3                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   | X |
| C                    | P.cu oase                      | 3                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| S                    | Izvorul Albastru al Izci       | 4                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| 15. Mehedinţi        |                                |                  |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                    | P.Epuran                       | 1                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   | X |
| C                    | P.Topolniţa                    | 3                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| S                    | Izvorul Cămana                 | 3                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| M                    | Cazanele Mari<br>Cazanele Mici | 4                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| K                    | Complexul carstic Ponoarele    | 4                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| M                    | Izvoarele Coşuştei             | 4                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| M                    | Cometul Babelor                | 4                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| M                    | Cometul Piatra Incălecată      | 4                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| G                    | Cheile Tolpolniţei             | 4                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| G                    | Valca Teşna                    | 4                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| 16. Neamţ            |                                |                  |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                    | P.Toşorog                      | 3                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   | X |
| C                    | P.Munticelu                    | 3                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   | X |
| 17. Suceava          |                                |                  |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| M                    | *Pietrele Doamnei              | 4                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                    | P.Luanci                       | 5                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| 18. Vâlcea           |                                |                  |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                    | P.Caprelor                     | 3                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| P                    | Av.Picionul Boului             | 3                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   | X |
| C                    | P.Lilieşilor                   | 3                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                    | P.Munteanu-Murgoci             | 3                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                    | P.Pagodelor                    | 3                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                    | P.Rac                          | 3                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                    | P.Valca Bistriţa               | 3                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                    | P.cu lac                       | 3                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                    | P.cu perle                     | 3                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                    | P.Arnăuţilor                   | 3                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |
| C                    | P.Clopot                       | 3                |                                                    |                                 |                            |                                      |                       |             |   |        |        |        |             |   |   |   |   |

Importance: K – karst complex; G&T – geology and tectonic; P – Palaeontology; IC – glacier; KC – karstic source; HG – hydrogeology; S&M – stalactites, stalagmites and minerals; C – climate; B – biology; A – archeology; T – tourism; X – natural protection; \* – under a clear jurisdiction.

C = cave; P = pothole; G = gorges; M = special morphology; K = karst complex; S – spring

waters which flow along the impermeable of a thrust nappe, at the contact with Mesozoic limestones, are disappearing in this depression. Thus were generated several interesting caves.

Cetatile Ponorului, Lumea Pierduta Plateau and Groapa de la Barsa represent the skeleton

of the future Apuseni Mountains National Park, as we have already mentioned.

In Bihor Mountains there are also several underground glaciers; the most important is Ghetarul Scarisoara, which is about 3000 years old.

Another interesting cave is Ursilor cave (near Chiscau village). It hosts a lot of *Ursus spelaeus* skeletons and very beautiful stalactites and stalagmites. For this reason a part of this caves has been excellently arranged for tourists.

North of Bihor Mountains there are Padurea Craiului Mountains, where is the longest cave from Romania, Wind cave (peștera Vantului). It is 50 km long and comprises a multi-storied network of galleries. This cave is a paradise for endokarst morphology studies.

Ciur Ponor cave represents the longest hydrogeological course in Romania which human being wandered through, including several siphons. Being related to tectonics, this cave represents an excellent geological profile (Fig. 6), but there are also very beautiful and very rare helictites. Close by Ciur Ponor cave is Ciur Izbuca cave which has a lot of prehistorical traces of human steps. Ciur Izbuca cave is accessible for tourists and, unfortunately, part of these were destroyed.

### 3.2. Southern Carpathians

Without the complexity of karst phenomena from Apuseni Mountains, nevertheless karst from Southern Carpathians is represented by several remarkable caves, as Topolnita cave (a labyrinth of over 20 km with impressive galleries), Sura Mare cave (a very difficult active cave which has a difference of level over 400 m and exceptional underground landscape) or

Closani cave (one of the most beautiful in Romania, with its calcite crystals, very special indeed).

In the Southern Carpathians exists the only zone with typical alpine karst: Retezat Mountains. This zone comprises an impressive number of caves (Fig. 7) and potholes, some of them having very beautiful coralites (Coralilor cave, Toplita cave, etc.). In the same region exists the biggest underground glacier from Southern Carpathians, in the Albele pothole: an impressive cave located at altitude of 2000 m.

Another remarkable region are Danube gorges (Cazanele Mari and Cazanele Mici), which are caved in Upper Jurassic limestones. Although the wildness of these gorges was diminished by the construction of the Iron Gate barrage, they still remain a special phenomenon.

In the eastern part of the Southern Carpathians is Piatra Graiului Mountains where one can meet gorges, caves and potholes in Upper Jurassic limestones. Here is located the deepest pothole in Romania (approximately 700 m on this moment).

### 3.3. Eastern Carpathians

This segment of the Carpathians has not special caves with exception of Tausoare cave (several kilometers development and 400 m vertical development). From a geological point of view, it is a "stratigraphic" cave because it is developed at the contact between metamorphic rocks and

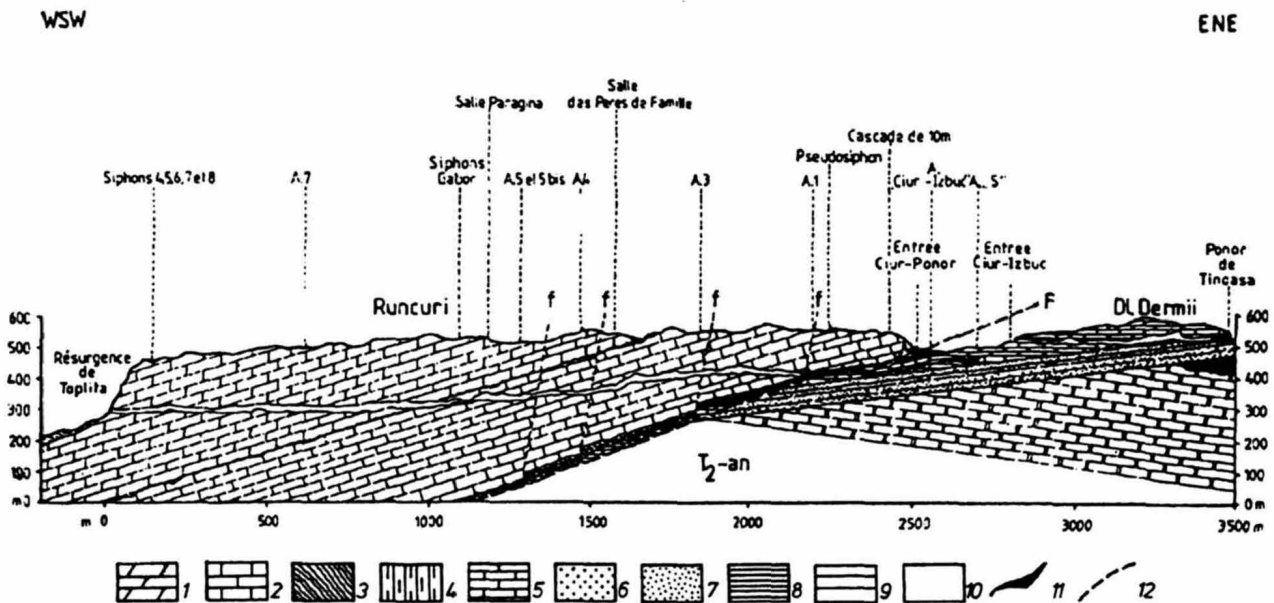


Fig. 6. Geological cross section through the Runcuri plateau and the caves Ciur-Ponor and Ciur-Izbuca. 1 — limestone with pachyodonts; 2 — limestones of Farcu and Albioara; 3 — detritic limestones; 4 — marls; 5 — limestones with *Gryphaea*; 6 — quartz sandstones; 7 — conglomerates and quartz sandstones; 8 — red shales, calcareous breccia; 9 — grey massive dolomite; 10 — black limestones; 11 — oolitic red bauxites; 12 — fault and thrust



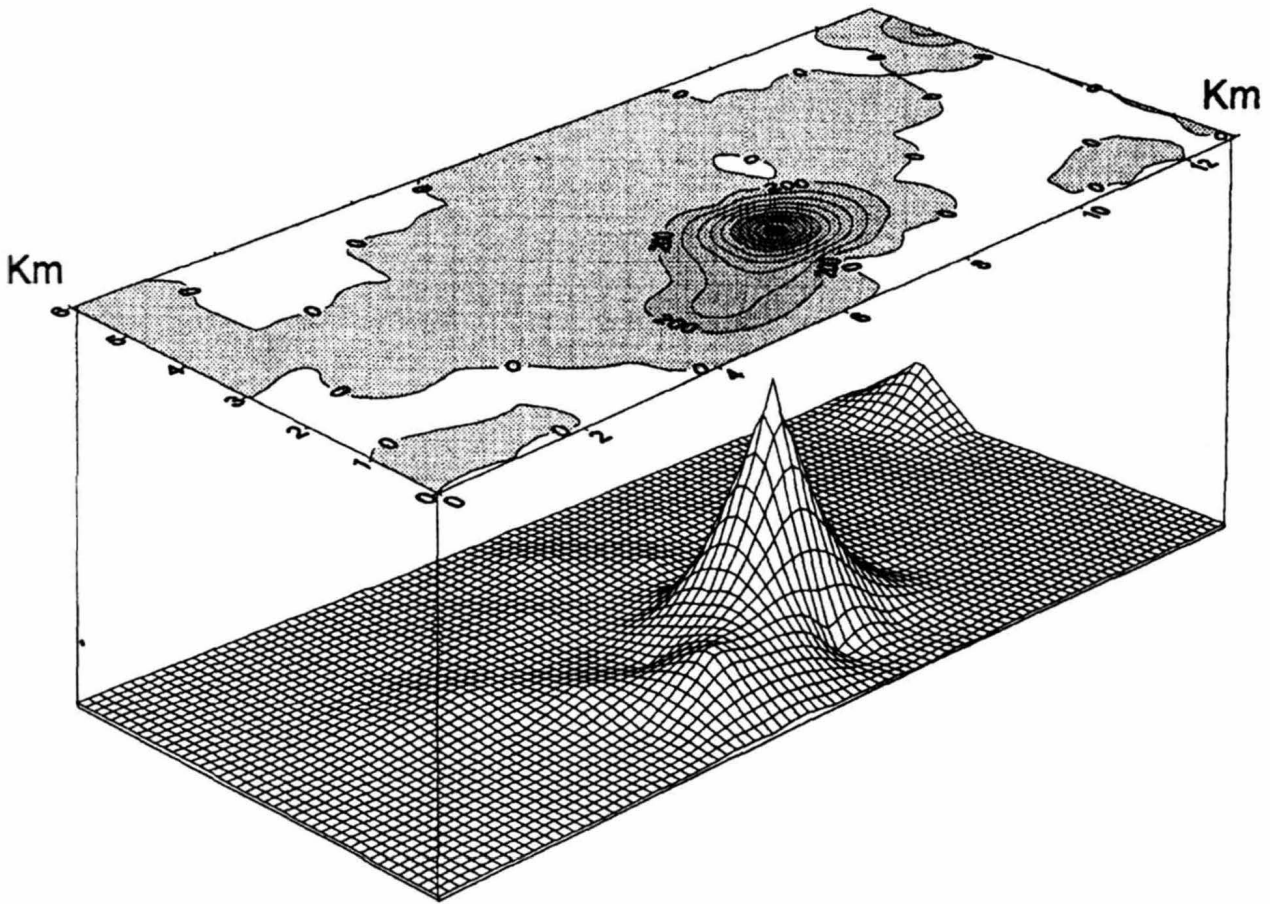


Fig. 7. Distribution of the caves in the alpine karst of the Retezat Mountains (after Badescu, 1991). Data are calculated with summing the lengths of the horizontal passages

their sedimentary cover (Eocene limestones).

Most important, in Eastern Carpathians, is the exokarst. We mention here the Bicz gorges (Harghita department). With 6 km length and 250-300 m vertical walls these gorges represent, in our opinion, the most representative gorges of Romania. Also, this region is rich in important geological object; for these reasons Romanian geologists hopes to realise a national park.

### 3.4 Dobrogea

As we can see in table 2, in this Romanian region 3 caves are under protection. Here we have not a speleological interest but a paleontological one. Quaternary fauna is well developed and the stratigraphic profiles are, maybe, unique in Europe. These profiles covered the period between Riss glacial phase and the historic present. For this reason, they are an excellent

field for archaeological studies. Also, by Oxfordian limestones disintegration, there are a lot of fossils.

### 4. Conclusions

After this short summary we must say that the table 2 covered only the protected sites proposed between 1932-1991. There are a lot of caves that are not protected yet by special laws like Humpleu cave (a giant cave in Padurea Craiului Mountains probably the bulky cave of Romania), 6S cave (the second cave in salt of entire the world—3500 m), Cuciulat cave (with magdalenian pictures), Movile cave (an exceptional biotop, a well-known cave in the whole world), etc.

We can suppose that all these caves will be introduced in the future official list of protected areas of Romania.

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