A NEW GLACIATED AREA IN RODNA MOUNTAINS - TARNIŢA DIN CIUNG CIRQUE

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Cuvinte cheie: relief glaciar, circuri alpine, morfometrie, mediu carpatic, Rodna.

Un nou areal glaciat din Masivul Rodna – circul glaciar Tarniţa din Ciung. În studiul de faţă se pune în discuţie un exemplu de nou areal glaciat din Masivul Rodnei, dar şi de un tip aparte de circ glaciar, cel de tip alpin (înalt carpatic). În urma cercetărilor de teren şi a materialelor cartografice, a fost identificat circul Tarniţa din Ciungi, situat în lungul culmii Piciorul Pleşcuţei, versantul nordic, bazinul hidrografic Bila. Aceasta a scăpat investigaţiilor cercetătorilor precedenţi dată fiind poziţia sa laterală faţă de creasta principală. Însă definirea, demonstrarea şi inventarierea lui ca circ glaciar devine importantă pentru glaciaţia din nordul Carpaţilor Româneşti, în primul rând pentru că întregeşte populaţia circurilor carpatice înalte (de tip alpin) mai slab reprezentate în Carpaţii Orientali şi Cernahora. Acestea sunt printre cele mai tinere circuri care au funcţionat până târziu, dincolo de limita cronologică a Pleistocenului. În afară de altitudinea sa ridicată, circul se mai defineşte printr-o formă de mici dimensiuni dar cu elemente clare cum ar fi podeaua de tip şorţ şi spătar-bumerang. Corelaţiile, mai ales altitudinale, cu celelalte circuri de altitudine demonstrează existenţa unei populaţii aparte de circuri care s-au format doar în jurul nodurilor orografice importante din Rodna (fostele horduri glaciare) şi în Munţii Călimani. Acestea trădează existenţa unei generaţii aparte de gheţari de circ care s-au dezvoltat atât independent de linia regională a zăpezilor, dar şi la mare distanţă pe verticală faţă de aceasta. Totodată se evidenţiază caracter crud de tip glaciar a acestui sit montan. În cele din urmă, acest areal atrage prin splendoarea peisajului şi caracterul său de sit montan natural neinfluenţat de activităţile antropice, de natură fizică sau chimică. Totodată el reprezintă un perimetru foarte senzitiv la schimbările actuale de mediu, dat fiind ecosistemul său foarte fragil. Acest spaţiu îşi caută, încă, echilibriul dinamic de după deglaciaţie, însă schimbările actuale de mediu îl pot dezechilibra foarte uşor în tendinţa sa de readaptare.

Introduction

The Rodna Mountains attracted many researchers because of the high number of glacial cirque and the duration of glaciation here. However, there have been no exhaustive studies regarding the glaciation of this mountainous area, even though over a century has passed from the first study of glacial geomorphology (Lehman, 1891). Recently, previously unmentioned glaciated areas have been discovered. Therefore, in this study a new glaciated area from Rodna is discussed; a high-altitude glacial cirque (high Carpathian type), Tarniţa din Ciung, situated below the Pleşcuţei summit, on the right slope of the hydrographic basin of Bila.

Research history

Until the 1978 study of I. Sârcu, no geomorphologic map showed any glaciated area anywhere around the Pleşcuța ridge. Even though this mountain, detached from Inău peak (2279 m), is massive and has no altitude below 2000 m along 4 kilometers from, Inău it did not attract attention. Not even on the map created by I. Sârcu, one of the most precise for this area (even though it was completed by the text of that study), do we find this glaciated area (fig.1).

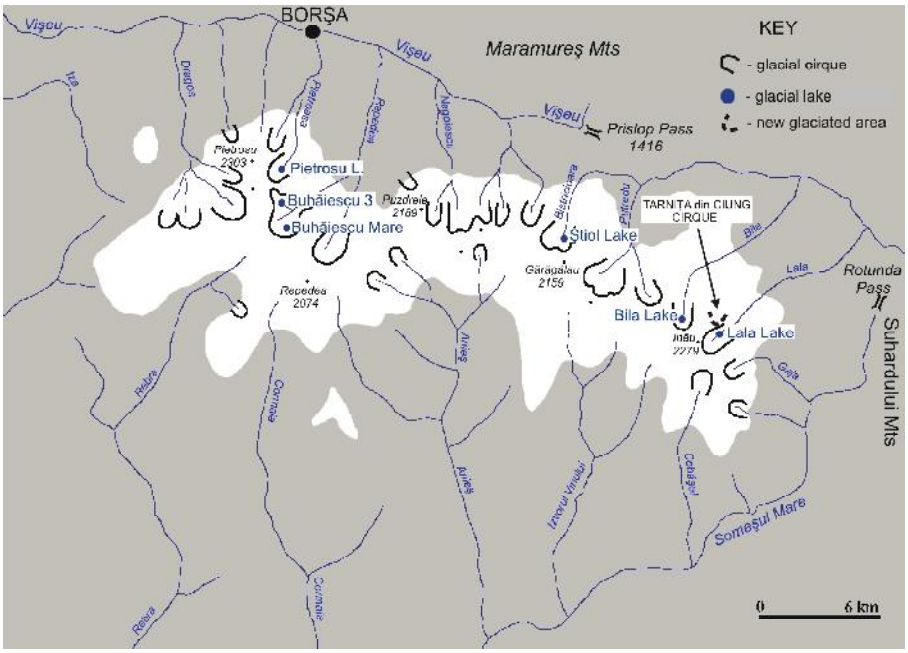

Fig. 1. Position of the glacial cirque Tarnița din Ciungi in Rodna Mts (I. Sârcu, modified by M. Mîndrescu).

Morphological and morphometric analysis of the cirque

Even though the glacial asymmetry in Rodna has been mentioned, I have insisted that glaciated areas can be found on the southern slope, especially around the main mountain knots. So, during my field campaign in the area, and with the help of topographic maps, the glacial cirque below Pleşcuța summit in the hydrographic basin Bila was identified. The cirque is below a peak with an altitude of 2055 m, at a distance of 2.87 km from Inău peak. Along this distance, the ridge does not fall below 2050 m altitude, which gives it the quality to be a massive unitary (unfragmented) mountain peak. Also, if we were to name an arête in the Rodna Mountains, this would be the most obvious example. Around the spot height of 2055, Pleşcuța peak is separated into two parts, and the ridge starts to descend steeply, by 200m in a horizontal distance of 860 m (1m at every 4.3 m). Both of secondary branches decrease together; that is why we consider that this peak divides into two parts.

Between these two parts the high glacial cirque Tranița din Ciung formed. This one developed asymmetrically with the peak of 2055m, the floor being pushed to the left. The floor is between 1800 and 1850 m and the steep headwall is 200m high. This height was enough to keep a cirque glacier (the critical cirque value[1] was 100 – 120 m, in Eastern Carpathians, Mîndrescu, 2004).

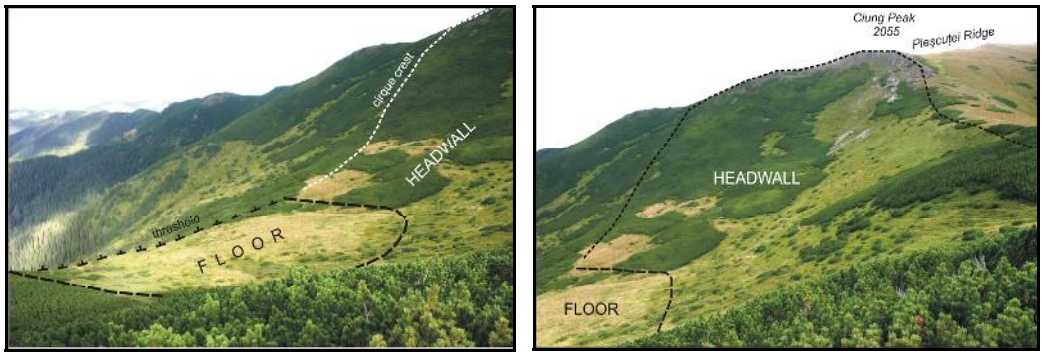

Photo 1. Floor (left) and headwall (right) of Tarnița din Ciung cirque.

Together with the altitude, the massiveness and orientation, the topographic background was very favorable for firn and ice to form in this mountainous site. Within distances of 1 km and 2 km, from the cirque focus (situated at the intersection of horizontal axes), altitude does not decrease below 1390 m and 1230 m respectively, and the maximum altitude is comparable to the average for cirques in Rodna, 2103 m and 2170 m respectively. Practically, according to the data, the cirque is within the compact high mountain area of the Rodna Mountains. Moreover, at a distance of only 1.5 km in front of the cirque, is the Tomnatecul ridge, which, according to its altitude (situated right in front of the cirque, the altitude does not decrease below 1914 m over a distance of 800 m) completes the topographic background profitable for the susceptibility to glaciation in the studied area.

Altitudinally, the cirque from Pleşcuța's summit (Piciorul Pleşcuței) is above 1800m; from this point of view, even though it seems to be isolated from the rest of the cirques in Rodna, it presents altitudes similar to the cirques situated in the surrounding area, such as Lala Mica and Fundul Bilei ("cirque in cirque") or Cobăşel and Gaja Mică. Therefore we can talk about a group of high cirques in the Inău - Inăuț area. Considering the close values of this cirques, it appears that there are common elements during their evolution, less at the beginning of the glaciation and more towards its end, when these cirques functioned at the same time under the influence of some ore glaciers situated at over 1800m. Cirques at similar altitudes are found both in Rodna (close to the main mountain knots: Pietrosu Obârşie, Găragălău and Galațu) and southward in the Călimani Mountains. In altitude, the high cirques in Rodna closely resemble those in Călimani.

[1] Minimum elevation of the headwall in order to allow formation of the cirque glacier

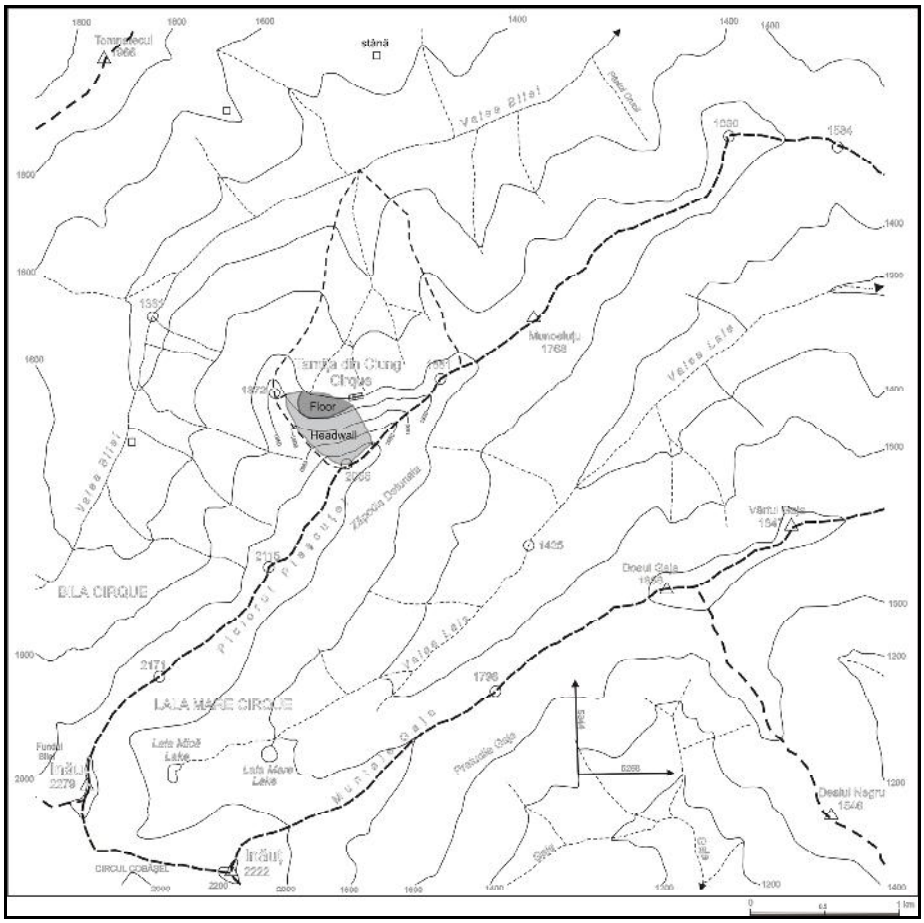

Fig. 2. Topographic background of Tarnița din Ciung cirque.

Morphometric data

The Tarnița din Ciung cirque was given the code 078Rd_i (cirque number 78 from the Romanian Carpathians situated in Rodna mountains, Inău glaciated group) in the list of glacial cirques from the Romanian Carpathians (Mîndrescu, 2006). Its position is given by the following mathematical coordinates, determined by the middle of the long axis: east – 5342477 and north – 5270307. Morphometric data from the table below describe the cirque as follows: high-altitude cirque (the seventh in relation to minimum altitude of the floor in Eastern Carpathians), asymmetrical development, with a high headwall which allowed the formation of a cirque glacier, medium dimensions with some tendency of development of the width rather than the length (also, the horizontal development is dominant rather than the vertical), wide open horizontally (young cirque), with floor and the headwall gradients which are within the acceptable limits of the morphometric definition of a cirque (Evans and Cox, 1995), oriented northwards and formed by micaschists.

Tab. 1. Morphometric data of Tarnița cirque in Ciungi (F_{min}- floor minimum altitude, F_{max}- floor maximum altitude, H_{max}- headwall maximum altitude, H_e – headwall elevation, mingrad – minimum slope (along 10m), maxgrad –maximum slope (along 50m), grade – development stage of the cirque).

Fmin, m	Hmax, m	He	Length, m	Width, m	Area, ha
1800	2050	170	462	592	21.77
Plancirque	Mingrad	Maxgrad	Grade	Orientation	Geology
65	14.75	39.83	3 - definite	353	micaschists

The slope map for the studied area shows very well the existence of the two main elements belonging to glacier cirques: the floor and the headwall. The floor has small dimensions but the slopes are below 20º (according to the morphometric classifications) and its shape is apron-like as in the case of all high-altitude alpine cirques. The headwall is curved around the floor and the slopes are as much as 53º (fig. 4). These numbers are sufficient to trigger the rotational movement of the cirque glacier.

Moreover, the axial profile of slope gradients indicates the cirque elements which are best defined by their gradients (fig. 3).

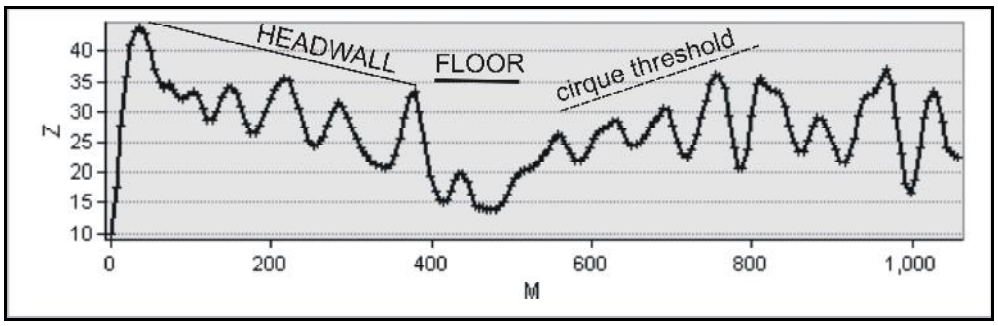

Fig. 3. Longitudinal profile along cirque axis based on map of field bias.

Tarnița cirque in Ciung – a clue for the glaciation in Rodna Mountains

The identification of a new cirque in the Rodna which is situated at the level of a secondary peak completes and consolidates a separate group of cirques in the northern part of the Eastern Carpathians, the high-altitude cirque, Carpathian – type. Moreover, their existence at a specific altitude and in the mountainous area having various positions, exposition and massiveness, demonstrates the existence of a specific generation of cirques. These are the younger cirques and they were formed, mostly, under the action of cirque glaciers of small dimensions. Both the ablation and the accumulation areas were around the cirques so that the rotational cell (Lewis, 1949) of the glacier had a better efficiency.

The distribution of these cirques in the Rodna suggests that by the end of the glaciation only the main mountainous knots (Pietrosu, Pusdrele, Gărgălău, Inău) were 'capable' of sustaining cirques. The surprise comes when we refer to the number of

cirques around these glacial horns. This means that most of the high-altitude cirques were on the eastern part of the area Inău – Inăuț. If we corroborate this data with the aspect of glacier horn typical for Inău and with the supposed arête of Pleşcuței, we can sustain that the 'heart' of the Rodna glaciation, at least during the later stage of the glaciation, was in the eastern part of the range.

Their presence at similar altitudes both in Rodna and Călimani (Leoata cirque is at similar altitudes but at a great distance from these) shows also the existence of a different generation of cirques in the northern part of the Eastern Carpathians. Even the 'miniature' cirque in Suhard (Sârcu, 1964; Popescu Argeşel, 1981) is at similar altitudes, but as yet we are unsure of its glacial origin.

Tarnița din Ciung – a natural Carpathian environment

The access to this glaciated area is not easy, because it is isolated from the main ridge but also far above the deep glacial valleys around, Bila and Lala. This may be one of the reasons why researchers did not notice it for such a long time. The way along the Piciorul Pleşcuței is very spectacular (because it is arête-like, especially closer to Inău peak) but it requires a good physical condition, therefore we recommend climbing along the Bila valley, immediately after the forest line on the left side, as you climb along Bila stream. The track is a slope, but the view is splendid. Once you are below the peak of 2055 m, Tarnița din Ciung, the homonymous cirque opens. The aspect of a mountainous glacial site is completed by the scenery, with compact bunches of *Pinus mugo* which make the detailed investigation of the cirque almost impossible. The clean aspect of the area makes us think that not even the shepherds get here; as for tourists, no trace at all. Together with the Jupania Mountain in the southern Maramureş Mountains (Mîndrescu, 2002), this is another example of natural mountainous environment in Eastern Carpathians which seems untouched by modern or "near modern" human civilization.

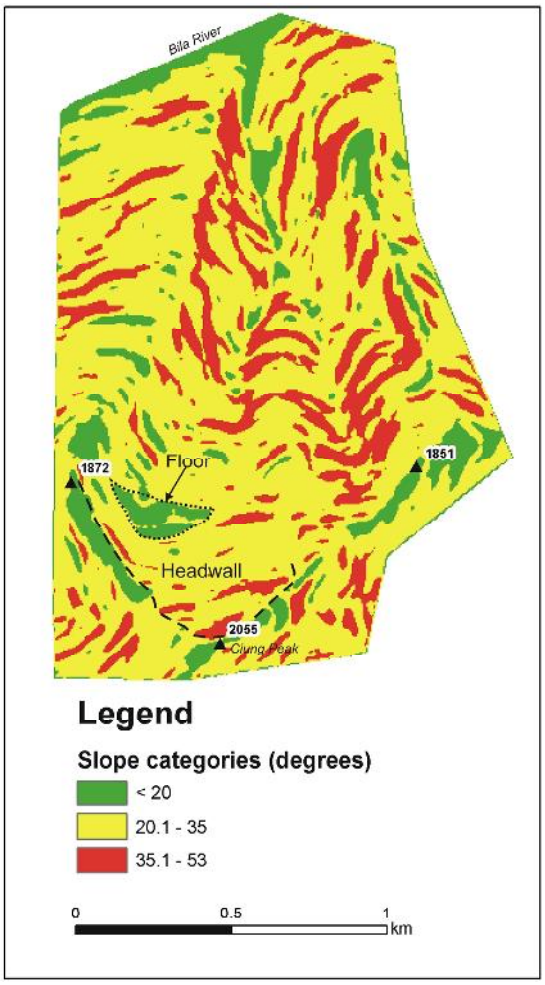

Fig. 4. Tarnița din Ciung cirque. Slopes map.

Conclusion

Even though we refer just to one former glacial site in the Rodna mountain area, this is important from several points of view, firstly, this one was missed by previous researchers because of its lateral position from the axis of glaciation, the main ridge of the Rodna Mountains. Secondly, the cirque, with its altitude and shape, completes a population of cirques less represented in the Eastern Carpathians, compared with the Alps of Transylvania. These are called alpine cirques in the world literature, but we prefer this term of '*Carpathian*' to fit better with the geomorphologic reality of the Romanian Carpathians. These alpine cirques have small dimensions, with apron floors where there were cold glaciers (in the ablation and accumulation areas situated inside the cirque) but short ones, which ended immediately after the floor, without being continued by glacier tongues. Nowadays, after the disappearance of *Quaternary* glaciers, these appear hanging on the high mountain ridges (being also valley-side cirques), far from the bottom of the valleys, and have a clean aspect. Finally, this mountainous site is important and interesting, at the same time, because it is a natural mountainous environment, untouched by pollution and human influence, and very sensitive to the environmental changes. It is a 'fresh' glaciated site which undergoes changes because of the ending of glaciation, so any change of the environment will be sensed by its ecosystem. Therefore, this area represents a potential site for scientific research to evaluate the impact of present changes in the environment.

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