

## CONTRIBUTIONS TO INVENTORY AND ASSESSEMENT OF THE GEOMORPHOSITES IN CĂLIMANI NATIONAL PARK. CASE STUDY: 12 APOSTLES GEOLOGIC RESERVE

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**Abstract:** Contributions to inventory and assessment of the geomorphosites in Călimani National Park. Case study: 12 Apostles Geologic Reserve. The 12 Apostles Geomorphosite is located in the National Park Călimani, on the north-eastern border of the Călimani caldera, and its geological reference object is 12 Apostles Geologic Reserve, IVth category according to IUCN. The geomorphosites include several residual rock formations, shaped in volcanic conglomerates, presenting phytomorphic (mushrooms), zoomorphic (lizards, dragons), and anthropomorphic (historical figures, apostles etc.) physiognomies, with a high touristic attraction. Therefore, the geomorphosite is a major regional tourist attraction, integrated in tourist circuits in the Călimani Mountains. Starting from these premises, this paper aims the evaluation of this geomorphosite in terms of scientific, aesthetic, ecological, cultural and economic value, and to establish its global value, an extremely important parameter for future strategies, and for preservation and tourism exploitation. This approach was based on rich literature and methodology regarding inventory and evaluation of geomorphosites, applied to the particularities of this area. The results are particularly relevant, emphasizing the importance of the 12 Apostles geomorphosite within the Călimani National Park.

**Key words:** geomorphosite, geologic reserve, geoheritage, geotourism, Călimani Mountains, Călimani National Park, IUCN

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### FOREWORD

The last decade witnessed intensified concerns about inventory and assessment of the geomorphosites and geosites as landforms with scientific, aesthetic, ecologic, economic and cultural value from human perspective (Panizza and Piacente, 1993; Panizza, 2001; Panizza and Piacente, 2003; Pralong, 2005; Pralong and Reynard, 2005; Reynard and Panizza, 2005; Reynard et al., 2009a; Reynard et al., 2009b; Ilieș and Josan, 2009); elements of biodiversity and human creations complement the assets of a particular region that can be exploited through tourism activities (Marthaler, 2003).

At European level, numerous works in this field have been published; for Romania, we can mention studies by teams of researchers from the Faculty of Geography of the Oradea University (Ilieș and Josan, 2009), from the Faculty of Geography of the Bucharest University (Comănescu et

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al., 2009; Comănescu and Dobre, 2009; Comănescu and Nedelea, 2010), and from the Faculty of Tourism Geography from Bistrița (Bâca, 2011; Bâca and Schuster, 2011).

This paper, as part of the project „*Inventory and assessment of the geomorphosites from Călimani National Park*” initiated by the Faculty of Tourism Geography from the Babeș-Bolyai University Cluj-Napoca, intends to submit to analysis one of the most relevant geomorphosite in this area, namely 12 Apostles Geologic Reserve, which is a particularly attractive target, included in tourist circuits from this Carpathian sector.

### WORK METHODOLOGY

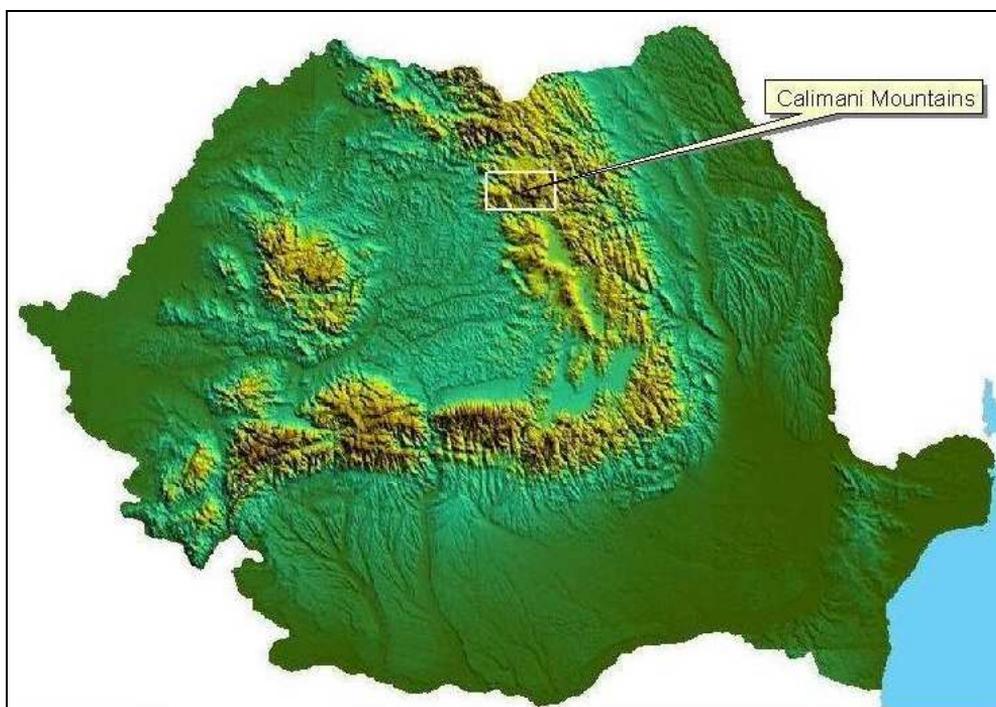
In preparing this study, several methodological stages were followed:

- consulting the literature regarding this geomorphosites (Naum and Butnaru, 1969; Naum, 1970; Naum, 1974; Naum and Butnaru, 1989);
- processing tourism information and the existing literature and articles from various tourist websites ([www.alpinet.ro](http://www.alpinet.ro), [www.turismland.ro](http://www.turismland.ro), [www.inromania.info](http://www.inromania.info), [www.dordeduca.ro](http://www.dordeduca.ro), [www.vatradornei.net](http://www.vatradornei.net), [www.lasuceava.ro](http://www.lasuceava.ro), [www.panoramio.com](http://www.panoramio.com));
- consulting existing literature regarding inventory and evaluation of various geomorphosites (Panizza and Piacente, 1993; Reynard, 2006);
- conducting field research, implementation of inventory and evaluation sheets for the 12 Apostles geomorphosite, according to international methodology.

### RESULTS AND DISCUSSIONS

#### STUDY AREA

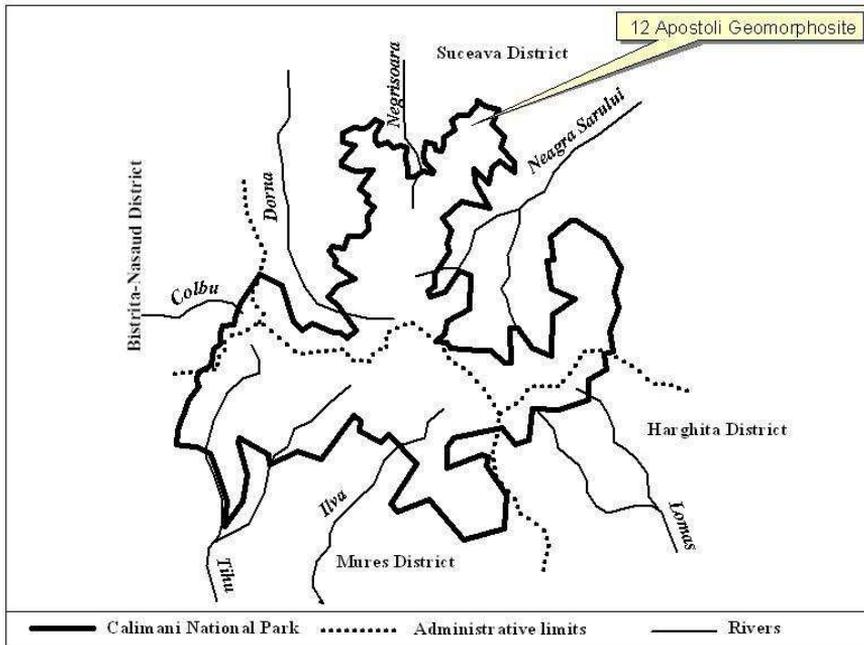
The Călimani National Park is located in Călimani Mountains, covering an area of 24,041 hectares and was established by Law no. 5 / 2000 and Government Decision no. 230/2003 (figure 1). It is classified as a protected area of II<sup>nd</sup> category according to IUCN, and its main purpose is to protect ecosystems, and recreation.



**Figure 1.** Geographic position of the Călimani Mountains in Romania

The main points of interest in the park are the Scientific Reserve of *Juniper trees* with *Pinus cembra* - IUCN category Ia, with an area of 384.2 ha, the Iezer Lake Reserve - Category IV of IUCN, with an area of 322 ha, and the Geologic Reserve 12 Apostles, category IV of IUCN, with an area of 200 ha.

12 Apostles Geologic Reserve is located in the north-eastern part of Călimani National Park, on the northwest border of the Călimani caldera (the segment Tămău – Pietrele Roșii – 12 Apostoli – Luciaciu – Cerbu), at an altitude of 1770 m in an area of maximum visibility, which dominates the valleys of Negrișoara (Little Black) and Neagra (Black River), tributary to the Dorna river (figure 2).



**Figure 2.** The location of the 12 Apostles geomorphosite in the Călimani National Park

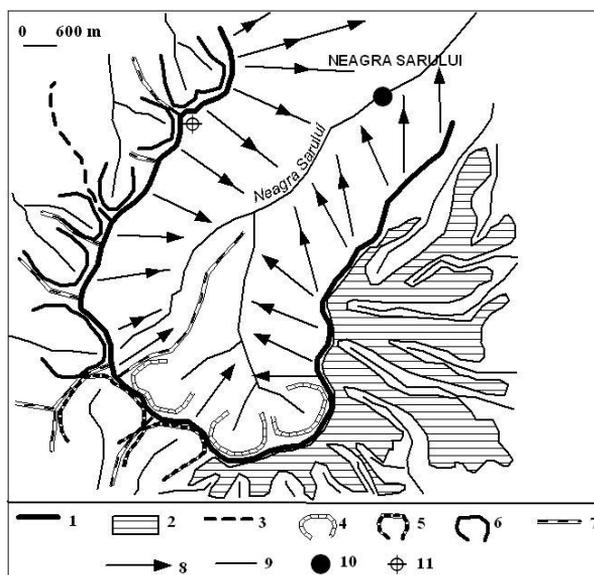
### GEOMORPHOLOGICAL FEATURES

The 12 Apostles geomorphosite consists of several residual rock formations, detached by differential erosion from the mass of volcanic agglomerates which form the border of Călimani caldera. This caldera was formed by the collapse of few stratovolcanos which existed here in the Pliocene, and who have built around their a huge volcano-sedimentary plateau which extends between The Gorge of Bistrița Ardeleană and Dornelor Depression to the North, Drăgoiasa-Bilbor-Secu depressions to East, Mureșului Valley to South, Șieului Valley and Bistrița Ardeleană Valley to West (Naum, Butnaru, 1989; Geografia României, 1987). The edifice of caldera is distinguished by very large in size, having a diameter of 10 km and a depth of 500-800 m, which ranked first in the arc of the Oriental Carpathians Neogene eruptive arch. The border of caldera is maintained between 1700 m and 2000 m, culminating in the Pietrosu Peak (2100 m), and North-eastern part of it was pierced by the Neagra Șarului River.

The volcanic activity was particularly complex in this sector and manifested in explosive, efuzive and intrusive forms, thereby generating specific products: piroclastic flows, andesitic and dacitic lava flows and andesitic and dioritic intrusive bodies.

Emptying the magmatic reservoir in late pliocene and the intensity of terminal eruptions caused the collapse of the system of joint cones and shaping the caldera, which was modelade by fluvial, glacial and periglacial processes in the following period.

Therefore, the detailed morphology of the caldera is distinguished by systems of valleys and ridges, secondary volcanic craters (Pârâul Calului, Iezerul Călimanului, Rățiș, Pietricelu), intrusive massifs (Negoiu Românesc), glacial cirques (Pietrosu, Rețiș, Bradu Ciont, Negoiu Unguresc), crinival semifunnels and residual forms carved on volcanic agglomerates (needles, towers, pillars, apostles, walls, etc.) (figure 3).



**Figure 3.** Geomorphologic sketch of Călimani caldera

1-the border of caldera; 2-structural surfaces; 3-structural ridge; 4-glacial cirques; 5-crinival semifunnel; 6-catchment area; 7-ridge; 8-fluvial slopes; 9-rivers; 10-village; 11-12 Apostles geomorphosite

The rock formations of 12 Apostles geosite have heights from 3 to 12 m, phytomorphic (mushrooms), zoomorphic (lizards, dragons), anthropomorphic (apostles, characters) and amorphic physiognomies, allowing their separation into three megalithic sectors (figure 4):

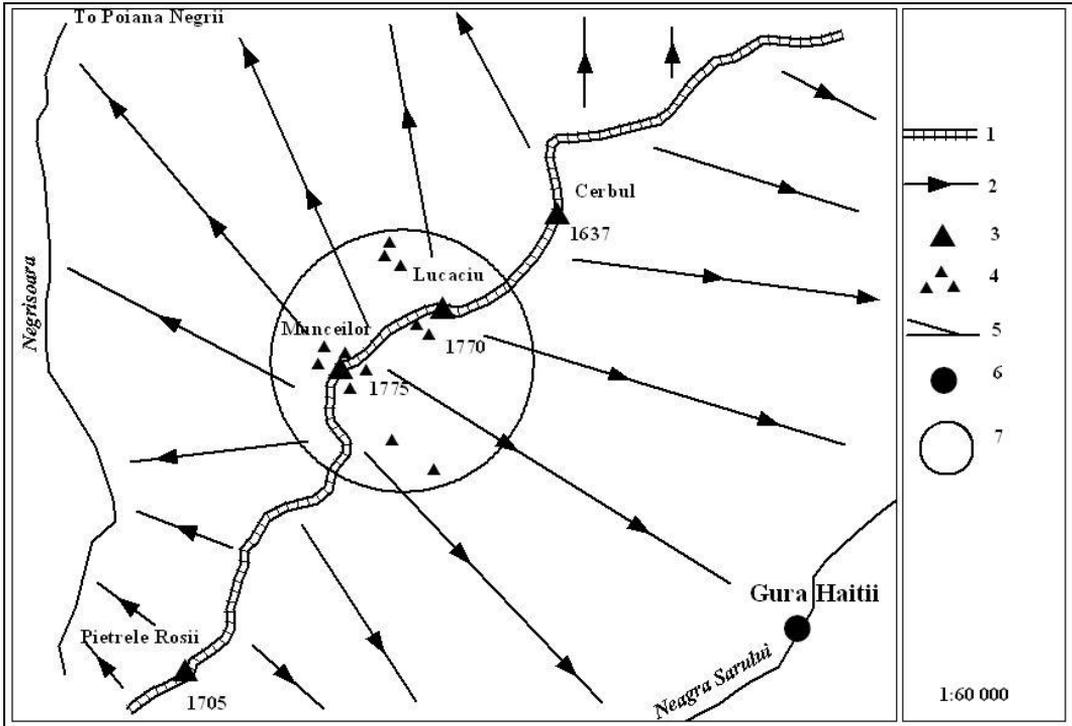
- 1) Lucaciu sector, with scattered rock formations around Lucaciu peak (1770 m);
- 2) 12 Apostles sector, with residual formations distributed around the Munceilor peak (1775 m);
- 3) Piciorul Hârlei sector, with scattered rocks on the southeast flank of the caldera, in the Neagra Șarului Valley.

In terms of physiognomy and aesthetic features, the formations with zoo- and anthropomorphic look received suggestive names, which gives personality to the geomorphosite and a high degree of attractiveness (Naum and Butnaru, 1989). Thus, in the Lucaciu sector there is a rock formation named Green Lizard, while in the 12 Apostles sector, following groups can be separated (figure 5):

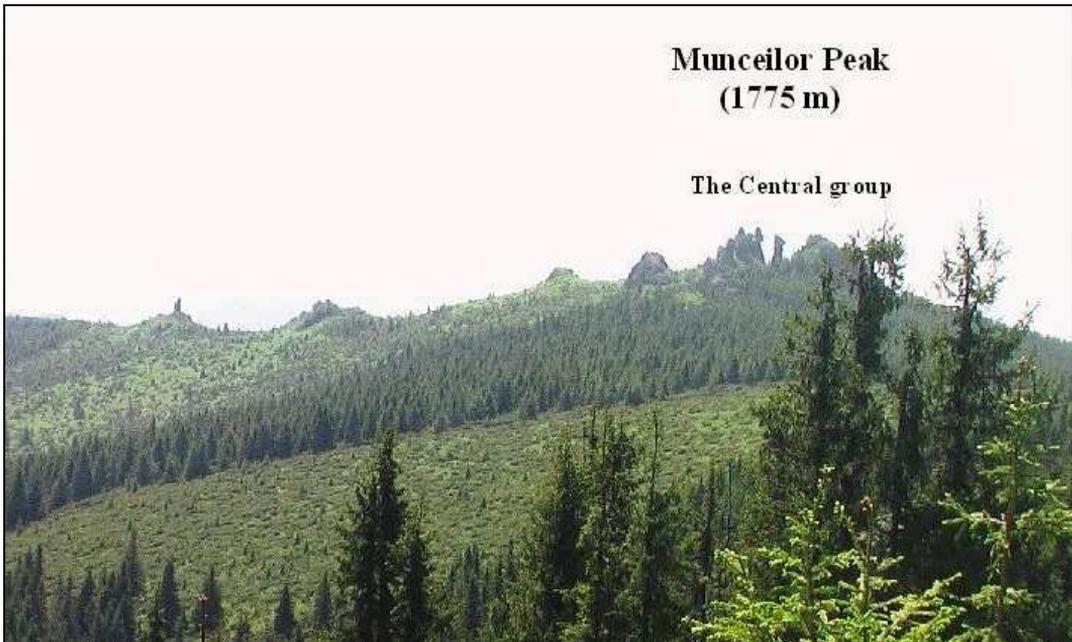
- the group Moșul (Old Man) and Mucenicul (The Martyr);
- the central group, with the most representative rocky formations (Ramses, Godzila, Nefertiti, The Marshal, The Camel);
- the group Ursoaica cu puii (Mother Bear with Bear Cubs);
- the group Străjerul (The Watchman).

A detailed analysis of these rock formations highlights a number of relevant geomorphological features on attractive and evolutionary levels.

Thus, there are isolated rocks and groups of rock cliffs, bordered by slopes, with niches, steps and shelves carved on its facade, and talus at their base, resulted through the processes of fragmentation and removal of the wall rock. The rocks of the Central Group of 12 Apostles sector are sometimes separated by narrow passages (crevice), which gives a spectacular configuration to the geomorphosite.



**Figure 4.** The localisation of The 12 Apostles geomorphosite on the Călimani caldera and the geomorphologic map  
1-residual ridge; 2-fluvial slopes; 3-peaks; 4-rocky formations; 5-rivers; 6-rural settlements; 7-the area of the geomorphosite



**Figure 5.** The areal distribution of the rocky formations from the 12 Apostles geomorphosite

## CULTURAL CONNOTATIONS

In addition to their suggestive physiognomy, the rock formations from 12 Apostles geomorphosite have an important cultural dimension, with mythical and historical background, specific also for a number of geomorphosites in the Romanian Carpathians (Brill, 1974; Sârbu, 2009). This cultural dimension of the geomorphosite is briefly described by the Călimani National Park website ([www.Călimani.ro](http://www.Călimani.ro)) as follows:

The 12 Apostles Statuary Complex and the neighbouring Lucaciu peak invoke the testimony of magic and mythic events descended from ancient Dacian culture, reshaped over time in the form of Romanian Orthodox faith. Climbing mountains and ceremonial events held during the summer solstice, known in local language „*Moșii de la Călimani*” (The Elders from Călimani) or „*Moșii de Sânpetru*” (The Elders of Saint Peter), originate in the ancient Dacian worship of the sun, tree and fire, with the cult of ancestors as central element.

The transfer from the solstice-celebrating Dacian tradition to the Christian Orthodox Rite gave rise to the celebration of the 12 Apostles, which had got in time a strong patriotic overlay, becoming The Nedeia from Călimani (The Celebration from Călimani). During the celebration of the 12 Apostles on June 29, a lot of people from surrounding areas follow established trails to Lucaciu peak, to attend the great meeting. The sacred fire, which first separated crowd from divinity at evening hours, now purifies the offerings for the souls of those passed away. The stories were born, song and dance accompanied the Romanians separated by the peaks of Călimani Mountains, but united by faith, language and nation.

Historical and geographical context caused a distinct evolution of the people around the Călimani, as they lived separated from one point in time at the border of three provinces: Ardeal, Bucovina and Moldova. In such circumstances, the celebrations from 12 Apostles and Lucaciu appear as real moments of struggle for national unity. It seems that the last celebration took place under a condition of unbearable restrictions imposed by occupation authorities in 1914.

Historian Nicolae Densușianu (2002) constructed the hypothesis that these megalithic figures from Călimani and the whole area of the Carpathians would be the work of ancient Pelasgians, and that they would have been made in honour of some deities (The Sphinx from Bucegi Mountains, the rocky formations from Ciucaș Mountains, etc.). Although this view seems fantastic, the intervention of ancient populations on rock formations shaped by natural processes is not to be excluded.

Another proof of the cultural-historical value of 12 Apostles geomorphosite are the megalithic engravings discovered in 1987 on Paltin Valley, near the village of Gura Haiti, which apparently was part of a dolmen set type (Naum and Butnaru, 1989), erected by populations living here in prehistoric times. Whichever the truth, the fact that the rocky formations of the 12 Apostles Geologic Reserve quicken the imagination of scientists and visitors point once again the cultural value of the geomorphosite.

## EVALUATION OF THE GEOMORPHOSITE

After establishing the theoretical and methodological framework, a detailed field research has been undertaken, during which various geomorphologic features were charted, such as the configuration of rocky formations, present-day geomorphological processes, the impact of human intervention on the relief etc. The final step consisted in creating the evaluation sheets for the geomorphosite, defining the inventory and evaluation of the scientific, ecological, aesthetical, cultural and economic dimensions of the geosite, basing on relevant criteria. For each criterion, a score between 0 and 1 was appointed, with steps of one quarter of a point, resp. 0 = nothing, 0.25 = low, 0.50 = high and 1.00 = very high. After each criterion was noted, the global value was calculated by summing the points and dividing the result to the total number of criteria. Due to the scientific and cultural importance of the 12 Apostles geomorphosite, a complex evaluation has been implemented, basing on an inventory file suggested by Reynard (2006), with necessary adaptations. The results of this process are represented in the tables 1 to 6.

**Table 1.** Scientific value of the 12 Apostles geomorphosite  
(Data source: after Reynard, 2006, whit adaptations)

Criteria	Evaluation	Score
Integrity	Anthropogenic activities undertaken in this area (deforestation, grazing, tourism) have not particularly affected the integrity of the megalithic complex	0.75
Representativeness	12 Apostles Geological Reserve is representative for the Călimani National Park	1.00
Uniqueness	By position, structure and configuration, the 12 Apostles geomorphosite is unique within the Călimani Mountains	1.00
Paleogeographic value	The area of the 12 Apostles geomorphosite is a geological sequence of space-time modelling of the Călimani caldera	1.00
Educational value	The geomorphosite provides information about residual landscape shaped by differential erosion processes on volcanic conglomerates	1.00
Scientific value	By geological structure and geomorphological features, the 12 Apostles Geologic Reserve is an scientifically important objective	0.95

**Table 2.** Ecologic value of the 12 Apostles geomorphosite  
(Data source: after Reynard, 2006, with adaptations)

Criteria	Evaluation	Score
Ecological influence	With its features, the 12 Apostles geomorphosite support the development of specific ecosystems (rocky, grassland, forest)	1.00
Vulnerability	Tourist flows and camping activities could affect the ecosystems	0.50
Ecological value	12 Apostles geomorphosite provides natural support for the development of specific ecosystems in coniferous forests of the mountain	0.75

**Table 3.** Aesthetic value of the 12 Apostles geomorphosite  
(Data source: after Reynard, 2006, with adaptations)

Criteria	Evaluation	Score
Visibility	The geomorphosite is visible from great distances and provides maximum visibility over the surrounding landscape	1.00
Contrast, vertical development and space structuring	The rocky formations are distributed in 6 groups, with heights of 3-12 m; the show anthropogenic-zoo-phytomorphic forms, and by their altimetric position they are arranged on three levels	1.00
Cromatic diversity	Alternation of grey rocks with green open meadows and dark green of the coniferous forests	0.75
Aesthetic value	Through the configuration of its rocky formations, the 12 Apostles geomorphosite is characterised by a high aesthetic level	0.91

**Table 4.** Cultural value of the 12 Apostles geomorphosite  
(Data source: after Reynard, 2006, with adaptations)

Criteria	Evaluation	Score
Religious and symbolic importance	Mythical and magical ceremony events related to the Dacian population rites about the summer solstice to worship the sun, the trees and the fire. Christian holidays during summer solstice, such as Călimani Sânpetru celebration, Nedeia of Călimani, Moșii din Călimani, Moșii de Sânpetru, Nedeia din Călimani. Near the geomorphosite lies the 12 Apostles hermitage	1.00

Historical importance	Habsburg Empire border. On the 12 Apostles-Lucaciu ridge, fortifications of World War I-II (trenches) are preserved	0.75
Literary and artistic importance	The Rocky formations of 12 Apostles geomorphosite are mentioned in many works of belletrist tourism, as well as on travel websites	1.00
Cultural value	By its position, structure and configuration, the 12 Apostles geomorphosite was since ancient times a place of worship and pilgrimage and a source of inspiration for various literary-tourism works	0.91

**Table 5.** Economic value of the 12 Apostles geomorphosite  
(Data Source: after Reynard, 2006, with adaptations)

Criteria	Evaluation	Score
Accessibility	Forest roads and marked tourist trails from Poiana Negrii, Neagra Șarului and Gura Haitii	0.75
Present recovery and geomorphological interest	The 12 Apostles Geological Reserve is a major attractive objective from the Călimani National Park integrated in tourism circuits of this area	1.00
Present recovery and cultural and historical interest	Place of pilgrimage during the celebration, on June 29, of the 12 Apostles Convent	1.00
Legal protection and utilization restrictions	Protected area, IV-th category IUCN	1.00
Equipment and services	There are no tourist facilities in this area. Accommodation can be arranged at the 12 Apostles Hermitage and in traditional farms in the surrounding villages	0.25
Economic value	The geomorphosite 12 Apostles is an important tourist attraction, but economically not sufficiently utilised	0.8

**Table 6.** Synthesis

Global value	The 12 Apostles Geologic Reserve represent an important attractive objective in the Călimani National Park, supporting various tourist activities (trekking, hiking, biking, ecotourism, cultural and educational tourism)
Potential threats	Climbing activities can affect the rock formations and gully erosion processes may cause gully erosion on tourist trails
Management measures	It requires a strategy of access, placement of public signposts, resting places and scenic points and the development of promotional materials

## CONCLUSIONS

The 12 Apostles Geologic Reserve is an area-type geomorphosite, which, in addition to the scientific dimension, is characterized by significant aesthetic, cultural and historical connotations, enhancing its tourism attractiveness.

The global value of the geomorphosite, obtained by adding other values (Sci+Eco+Sce+Cult+Econ/5), is high, and indicates its importance within the Călimani National Park, situation requiring protective measures and appropriate strategies for tourism utilisation (table 7).

**Table 7.** Global value of the 12 Apostles geomorphosite

Scientific value	Ecological value	Scenic value	Cultural value	Economic value	Global value
0.95	0.75	0.91	0.91	0.8	0.864

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