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ANTHROPOGENIC HAZARDS AND THEIR IMPACT UPON THE HISTORICAL CULTURAL LANDSCAPE IN ROȘIA MONTANĂ AREA

Gabriel NICULA[1], Camelia-Ina GAVRA[2], Ileana-Cristina VASILIȚĂ-CRĂCIUN[3]

ABSTRACT. Anthropogenic Hazards and Their Impact upon the Historical Cultural Landscape in Roșia Montană Area. The cultural landscape is a result of the continuous human actions of satisfying the communities' various needs and the response of the natural system, in its attempt to balance its components in relation to the modelling factor - the human society. Thus, the cultural landscape displays the imprint of the infinite possibilities of the human and natural joint manifestation, sometimes hazards bringing their own contribution to the shaping of the cultural landscape. Hazards, whether natural or anthropogenic, are unforeseen phenomena in terms of space or time of their manifestation, and most often have considerable negative consequences. In particular, anthropogenic hazards, which are directly or indirectly related to human activities, appear mainly as a manifestation of the resilience of natural elements in the cultural landscape, as a complex system. Thus, major interventions, such as mining in Roșia Montană area (an activity that had been lasting for over 2000 years) in relation to the unpredictable evolution of the social, economic, technological and political context (on local, national and global level) have favoured the manifestation of some unforeseen events with a negative connotation such as: complex pollution, depreciation of the living standards (in Roșia Montană area mostly due to the cessation of mining activities), demographic aging, etc. The complex analysis of these implications in the above mentioned area allows us to outline an eloquent assessment of the present state of the local cultural landscape and to identify the opportunities of systemic resilience. These include: the awareness of the planning, protection and conservation of the local historical cultural landscape as a primary need, restoration of the cultural landscape

[1] *Romanian Academy, Cluj-Napoca Branch, Geographic Research Center, Republicii Street, 9, Cluj-Napoca, Romania, e-mail: gabriel.nicula@academia-cj.ro*
[2] *e-mail: camelia.gavra@yahoo.com*
[3] *Romanian Academy, Cluj-Napoca Branch, Geographic Research Center, Republicii Street, 9, Cluj-Napoca, Romania, e-mail: ileana.vasilita@academia-cj.ro*

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(through the aesthetic rehabilitation of degraded cultural elements), the implementation of projects that target the sustainable development of Roșia Montană, as a source of identity and sustainable development, the tourism conversion of activities, etc.

Keywords: *Roșia Montană, cultural landscape, historical cultural landscape, anthropogenic hazards, mining, gold deposits.*

1. Introduction

Over time, people, in order to fulfil various needs, have used their creativity to enrich the environment with various cultural products. And so, "the constant interaction between human intervention and the natural environment, throughout time/history" (Latif Gürkan Kaya, 2002, p. 55), outlined the so-called *cultural landscapes*. Nature and the social factor (people) have adjusted to each other, the technological advance tilting the balance visibly in favour of people.

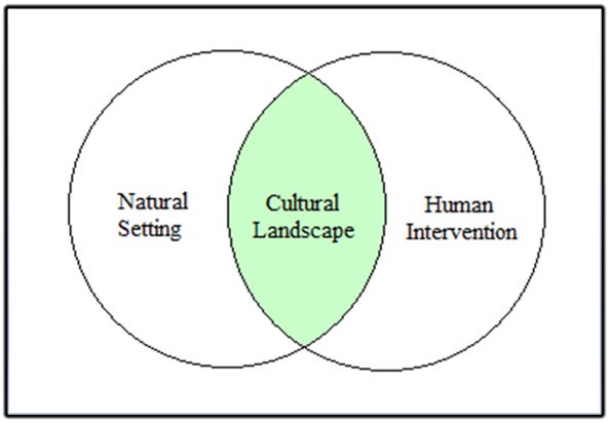

Fig. 1. The Cultural Landscape
Source: O'Hare (1997, in Latif Gürkan Kaya, 2002, p. 55, with annotations)

Thus, the resulting landscapes "are the work of people and a more complex work than an edifice or object, because it is collective. The action of nature is intertwined with the action of people, which implies a continuous effort to direct the transformations of a territory" (Hărmănescu Mihaela, 2015, p. 75).

At the same time, in this context, the culture highlights the human activities practiced according to traditions, perpetuated throughout the generations along with the various general trends of universal culture.

The various cultural elements, introduced into the landscape over time, define in particular the historical periods of the landscape's formation and implicitly generally outline the social evolutionary trajectory. Thus, "the elements and structures of a cultural landscape are historical if, for economic, social, political or aesthetic reasons, they no longer appear, would not be created or continue in the current way, i.e., if they come from an ended historical era. […] LVR, online" (Büttner, Th., 2006, slide 8). According to the same author, the historical cultural landscape can therefore be defined as "a section of the current cultural landscape that is strongly influenced by historical, archaeological, or cultural-historical elements and structures".

It can be stated, in this context, that man can bring value to the cultural landscape by capitalising on the resources related to the function(s) of the cultural landscape. Usually the historical functions are those that hold a special value due to their uniqueness and intrinsic significance.

We have presented above the particular relevance of the human factor in shaping the landscapes. We should certainly mention the analysis of the importance of natural elements in the above-mentioned systemic structure. These elements provide general support for the existence of the social component, being modelled according to needs. The natural elements ensure a dynamic systemic balance, especially when human intervention gives way to resilience. The major changes in the cultural landscape have always depended on the natural-cultural dualism. Successively, but in different proportions, the two categories of elements have acted more meaningfully and they have imprinted various directions of evolution. At this point, we can take into consideration hazards - whether natural or anthropogenic - as distinct modelling phenomena, and discuss their major impact and special force of intervention in cultural landscapes.

According to DEX (1975, p. 393), hazard is defined as an "unforeseen, unexpected event", while I. Mac and D. Petrea (2002, p. 15), consider it as "the source of an extreme event with energy discharge at a moment and on a scale that is difficult to predict". The same authors (2002, p. 15) further emphasise that "the event whose major significance is to interrupt a linear evolution trend sums up the hazard and the (extreme) phenomenon arising from it". The hazard is undoubtedly "harmful to the anthropogenic component, and its negative connotations are due to exceeding the existing safety measures for each individual community" (Gh. Roșian, 2011, p. 174). In particular, "the hazards induced by the creative processes of man, manifest in an extremely discrete manner, but lead to serious and irreversible transformations" (I. Mac, D. Petrea, 2002, p. 18), with major implications in optimal manifestation of the cultural landscape and its functions.

The present study aims to bring into the analysis the historical cultural landscape of the commune of Roșia Montană, created by major anthropogenic interventions, especially those of mining (with a duration of over 2000 years), but also of the unpredictable evolution of social, economic, technological and political events (local, national and global) which favoured the manifestation of unforeseen events with a negative connotation in terms of various types of hazards such as: complex pollution, cessation of mining activities, depreciation of the standard of living, demographic aging, etc.

2. Methodological Aspects

The natural and anthropogenic factors have shaped the cultural landscape related to the territory of Roșia Montană for a very long time. In order to study their variety and complexity, we have employed a complex research methodology, which is meant to highlight specific anthropogenic interventions, especially the mining activities and the related hazards.

The complexity of the phenomena required the use of both traditional, established methods (specific to a wide range of research fields) and means of research more specific to the study of the cultural landscape. Detailed analysis of the elements and phenomena identified through bibliographic documentation and observation (as traditional methods). The synthesis of the relevant information acquired also by means of field research was equally useful.

As specific means of research, the method of the *Register of the components of the cultural landscape*, provides relevant information about the cultural elements, such as details about their properties, structure, functions. In addition, the ECOVAST Method succeeds the recording of the elements of the cultural landscape on various layers, which, in an integrative way, outlines and individualises the analysed space[4].

According to ECOVAST, "at the base of the amphora are the rock (the geological surface), the climate and the hydrography along with the shape of the land (from a morphological point of view). The second layer includes vegetation, fauna and the anthropogenic component. Its upper layer incorporates the features induced by [...] human settlements, as well as other specific features induced by human activity, for example industry, tourism, etc. The upper layer also includes the historical features along with the researcher's associations and feelings" (Camelia-Ina Gavra, 2013, p. 61).

[4] ECOVAST Method = European Council for the Village and Small Town, presented in the *Landscape Identification guide. A guide to good practice (2006)*, in the form of the *Landscape Amphora*

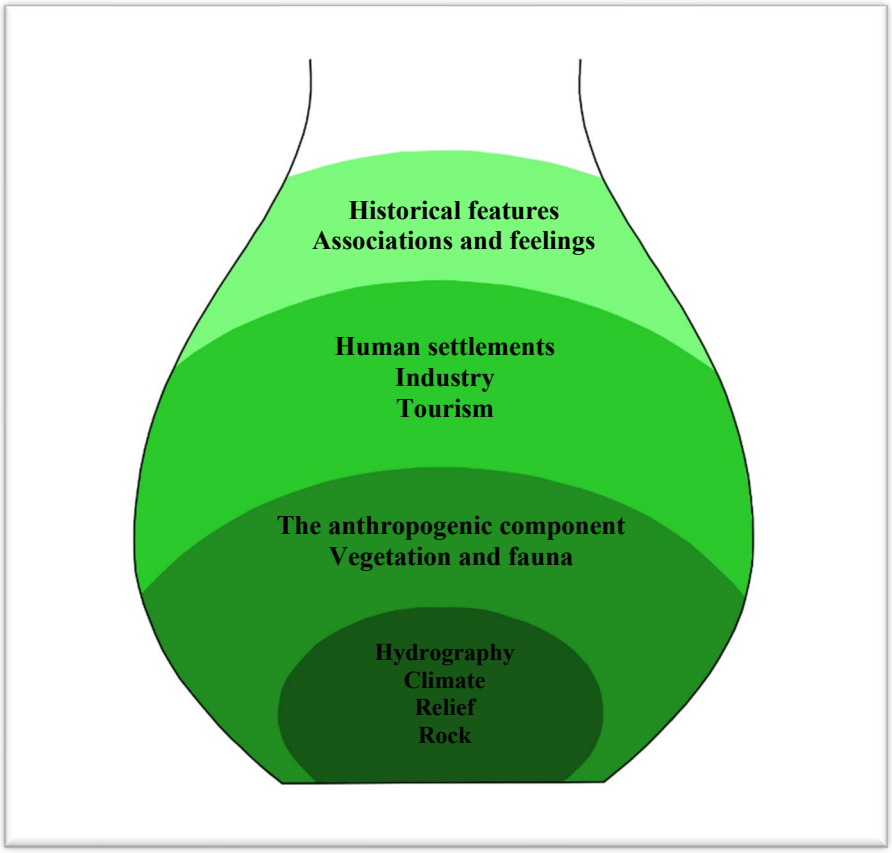

Fig. 2. Landscape Amphora.

Source: ECOVAST - European Council for the Village and Small Town (2006)

3. Roşia Montană Commune. Territorial Framework

Topographically, the settlement "Roşia Montană - the old Alburnus Maior, later Rubeo Flumine, Verespatak, Goldbach, Rotbach, Roşia de Munte - is located in the Metaliferi Mountains" (V. Apostol, Şt. Bâlici, 2012, p. 31), a space rich in "gold and silver deposits that integrate into the large mining region of the Apuseni Mountains, known in the geological and geographical literature as the "gold quadrilateral" Brad-Săcărâmb-Zlatna-Roşia Montană" (T. Morariu, Octavia Bogdan, A. Maier, 1980, p. 38).

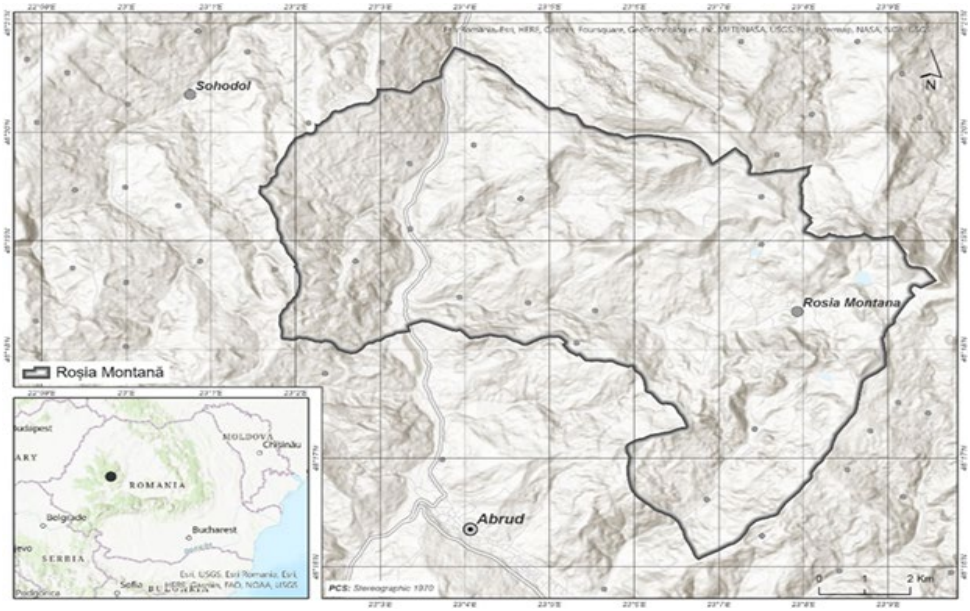

Fig. 3. Map of Roșia Montană.
Source: the authors

The commune is formed by 16 villages with a relatively small number of inhabitants spread over several scattered villages and hamlets. These villages are: Corna, Bunta, Dăroaia, Gura Roșia, Coasta Henții, Curături, Cărpiniș, Soal, Vârtop, Gârda Bărbulești, Iacoștești, Ignațești, Bălmoșești, Țarina, Blideşti and Roșia Montană, the latter with the function of administrative center.

The relief is visibly subordinated to its two main genetic factors. First, the volcanic and magmatic phenomena that generated various specific observable landforms, while the second is the fluvial and pluvial erosion, manifested over time. Together, they shaped the previous landforms, also creating erosional forms and sedimentation. We can notice mamelons and volcanic plateaus, but also hills, torrential bodies, valleys or small depressions created by erosion.

Without a trace of doubt, "volcanic landforms dominate Roșia Montană on the south, east and north sides through the massifs of Tile (918 m), Cetate, Cârnic (1087 m), Ghergheleu (1157 m), Rotunda (1187 m), Brădețel (1011 m), Ghipele (1050 m) and Dealul Coltău (1094 m)" (A. Sântimbrean, H. Bedelean, Aura Bedelean, 2009, p. 22). Some, such as Piatra Corbului and Piatra Despicată, can be seen prominently in the landscape "as volcanic hills, modified by human activities" (N. Ciangă, Cristina Bolog, 2012, p. 184).

Due to the level differences of 700-800 m and the different hardness of the rocks, erosion has contributed intensively to shaping the terrain's morphology (A. Sântimbrean, H. Bedelean, Aura Bedelean, 2009, p. 23) and also to outline the two main valleys, that of Abrud and that of Arieș.

From a geological point of view, we can see here a considerable diversity, the complex telluric phenomena replacing various "metamorphic rocks, Mesozoic ophiolites, Neogene magmatic rocks, Mesozoic and Quaternary sedimentary rocks" (S. Duma, 2012, p. 38) etc.

The latitudinal and longitudinal geographical position gives the local temperate continental climate characteristics specific to the mountainous landforms with low altitudes. Thus, "the annual average temperature at Roșia Montană weather station is 5.4°C. The monthly average values range between 15.4°C in July and – 3.8°C in February. Average temperatures below 0°C are specific to the months of December, January, February and March. The monthly average of maximum daily temperatures varies between 19.9°C in August and -0.4°C in January, while the monthly average of minimum daily temperatures were between 12.1°C in August and – 10.7°C. in February. Because of their low values, including summer months, the air temperature may not have an important role in the dispersion of the pollutants in the area" (F. Moldovan, Adina-Eliza Croitoru, I. H. Holobâcă, 2012, p. 101). In terms of precipitation, (according to the same authors, p. 103) "the rainiest month is June, 98.6 mm, while the driest month is February (38.2 mm). The amounts are much more important in the warm half of the year (April-September). In the same period, there is a higher probability of acid rain to occur".

The dominant winds are those of the western circulation, specific to the temperate zone in the northern hemisphere, implicitly determined by the latitudinal position of the analyzed territory.

Field research reveals the existence of water resources, at the surface or underground, in various forms. A surface drainage network with upper basin characteristics is formed mainly by Roșia, a tributary of the Arieș River, flowing from east to west. In turn, Roșia Valley is fed by several streams, temporary torrents and "groundwater resulting from gold mining" (Sorana Olaru-Zăinescu, 2006, p. 8). Groundwater is currently exploited on a large scale by means of wells integrated into the commune's households or by springs used for livestock.

The lakes, called "tăuri", are also notable. They have an anthropogenic character, being built in the past as an integral part of the technological process of obtaining the gold ore. One example is Tăul Mare (Fig. 4) as a reference resource.

Fig. 4. Tăul Mare.
Source: the authors

The relief and the climate have shaped the evolution of the vegetation formed by mixed forests (of beech, hornbeam, fir, spruce) and coniferous forests alongside meadows with specific plant associations or meadow vegetation within the valleys. In isolated areas, at low altitudes, the presence of oak can be observed sporadically.

The fauna is linked to the vegetation area, and includes species that are listed as protected. Some of these mammal species are: "the lynx (*Lynx lynx*), the fox, the wolf (*Canis lupus*), in the forest areas; the otter (*Lutra lutra*) near the ponds; many bat species (*Myotis blythii, M. daubentonii, M. myotis*) due to the large mine galleries that make up a favourable environment for their development; fish and amphibians (*Triturus vulgaris, Titurus alpestris*) in the ponds. There are also birds: storks (*Cioconia nigra*), hawks (*Accipiter nisus*), eagles (*Aquila pomarina*), falcons (*Falco subbuteo*), little owls (*Athene noctua*), woodpeckers (*Dendrocopos minor, Dendrocopos major*), hoopoes (*Upupa epops*), swallow (*Hirundo rustica*), thrush (*Turdus philomelos*); many insects, reptiles (*Lacerta agilis, Vipera berus*)" (V. Gligor, 2012, p. 122).

4. Landmarks in the History of the Cultural Landscape of Roșia Montană

The petrographic variety, and implicitly that of the underground resources, facilitated the development of appropriate activities. According to the existing archaeological evidence, mining has been practiced since the Antiquity, the intensity of exploitation increasing with the technological advance and culminating in the specific exploitation on an industrial scale.

From a historical point of view, the chronology of this activity is distinguished by "three significant periods: Antiquity, with the vast system of Roman exploitations; The Middle Ages, with the traditional type of exploitation, and the modern period, characterized by technological development" (S. Duma, 2012, p. 37).

The intensive and prolonged exploitation of gold resources represented the overwhelming factor of outlining, shaping and imprinting the function of the cultural landscape, respectively the mining one. This activity found its echo in various aspects of the local society, "putting its mark on a number of aspects related to the evolution of the commune, such as its structure and its urban fabric, architecture, ethnography, economic and spiritual life, and of course on the natural environment of this mountain region" (****Studiu de condiţii iniţiale ...,* pp. 13-14).

We can assert that the varied cultural elements (especially those related to the exploitation of local resources), which "accumulated successively over the natural features, and shed light on the long history and local culture in the generic form of a cultural landscape" (Ileana-Cristina Vasiliţă-Crăciun, 2015, p. 49), represent a benchmark in this regard.

4.1. History of mining - an ancient occupation

Inhabited since ancient times, Roșia Montană has a long history of exploitation of the main local resource, in various forms and processes, according to the spatio-temporal context. Thus "the antiquity of mining is lost in the mist of the Iron Age, when the Scythians and Dacians were the first inhabitants of these lands, extracted gold and silver from the alluvium of Mureș and Arieș rivers" (A. Sântimbrean, H. Bedelean, 2004, p. 16).

Precious deposits continued to attract interest from various populations and brought social and economic development, "the Roman period marking the first mention of the existence of Roșia Montană (under the Roman name of Alburnus Maior) in the year 131, date mentioned on the Roman wax

tablets discovered in the Roman galleries in the area. They contain "banking" related contracts and transactions. The name Alburnus Maior appears on six of the twenty-five recovered tablets" (Alina Albu *et al*, 2007, p. 39).

Later, during the Middle Ages, the area recorded a considerable evolution in the general exploitation technique, through the frequent use of gunpowder by the "German colonists [...], the stones being removed with black powder" (Sântimbreanu and Bedelean, quoted by S. Duma, 2012, p. 38).

The post-war period marks the end of private exploitation. "The process of nationalization, started in 1948, and the fact that the state had total control over gold led to an industrial exploitation of gold only underground. In the 1970s, open-pit mining replaced underground mining. It led to the destruction of a large part of the underground system of galleries, including those from the Roman period, and brought a homogeneous character of life in Roșia Montana, which lost its status as a city" (N. Ciangă, Cristina Bolog, 2012, p. 183).

Although mining ceased in 2006, the extremely long mining activity generated, over time, a mining cultural landscape through the permanent addition of specific cultural elements.

4.2. The defining elements in the history of the cultural landscape of Roșia Montană

Through the long continuity and intensity of exploitation, the ancient occupation of mining has created, developed and perpetuated the specific cultural landscape, which is, nowadays, valued and exploited in the economic benefit of the local society.

The special value of the analysed space is therefore conferred by a cultural landscape defined by the existence of rich historical elements that shed light on various specific eras in the local social evolution.

The *old houses* complex, visible near the central square, reveals elements of architecture belonging to the 18th and the 19th centuries, among which medallions and variously ornamented columns, stone walls and gates are easily noticeable, all pointing towards the social prosperity of the periods of their construction.

The number and variety of the *churches* induce the idea of the vast spread of the religious factor in society and at the same time highlight the ethnic and religious mixture caused by the existence of precious resources, as a factor of attraction for various populations.

Observations in the field led to the identification of some remarkable places of worship such as the Greek-Catholic Church dating from 1741, and the Old Orthodox Church built in 1781, with a bell tower over 31 m high. Also worth

noting is the Unitarian Church built in 1796, the Protestant Church, built after 1800, and the Roman-Catholic Church built in 1866 on the site of an old church burned down during the 1784 uprising led by Horea, Cloșca and Crișan. It houses the precious Icon of the Virgin Mary adorned with black pearls, given by Empress Maria Theresa.

As elements related to mining, the many galleries dating from various historical periods, are remarkable. They are visible "essentially in four sites [...] linked by underground galleries that cross the village of Roșia Montană. Mount Cârnic is an exceptional site in Europe due to its wealth of galleries dating back to the Roman era. In order to maintain and remind the mining tradition of the commune, there is a museum dedicated to the mining activity, with a small part of the Roman and modern gallery set up for public access" (Sorana Olaru-Zăinescu, 2006, p. 26).

Fig. 5. Roman gallery (Mining Museum, Roșia Montană).
Source: the authors

Archaeological excavations at the *Alburnus Maior Citadel*, located on the Citadel Hill, revealed various dwellings, tombs, mining tools, and inscriptions in Greek and Latin, languages widely used in antiquity. These historical cultural elements are real evidence of the complexity of local social life and connections with neighbouring regions.

The *stamp mills*, currently visible in the specific local museum, proved their usefulness in the process of extracting the gold ore in close correlation with the pit lakes that ensured the necessary water stock during the active summer.

The *pit lakes* can be territorially identified as belonging to the Roșia and Corna hydrographic basins, "the vast majority of which are currently drained, appearing in the cultural landscape in the form of drained lacustrine basins covered by specific vegetation, difficult to distinguish compared to those still active. Few in number, the pit lakes occupying larger areas managed to maintain their water through the input from rains or rivers. Ex. part of this lacustrine category are Tăul Mare, Țarina, Brazi, Anghel, Corna, Tzapului, Gauri, Cartus" (Camelia-Ina, Gavra, p. 179). Currently, the original mining function has been converted into a tourist one, as the pit lakes are used for recreation or fishing.

The *quarry* is a cultural element that appeared following the surface mining of gold ore. It has various shapes and sizes according to historical time and specific extraction methods. "For example, the Cetate quarry stands out in particular, as a relict element; alongside stand similar elements from the Cârnic, Orlea and Jig massifs. Also, in the Piatra Corbului sector, the Roman exploitation sites, dug with the help of fire, (impressive due to their dimensions)" (Ileana-Cristina Vasiliță-Crăciun, 2015, p. 50).

Fig. 6. Cetate Quarry.
Source: the authors

Based on the territorial identification of the main cultural elements within the local cultural landscape and their analysis, we can assert that the existence of gold resources constituted an essential factor for social consolidation and growth. Their continuous exploitation in various ways required the development of a specific and complex mining cultural landscape whose elements can be exploited for tourism today to increase the local socio-economic well-being.

5. Anthropogenic Hazards and Repercussions Within the Historical Cultural Landscape. Conclusions

The long-term or large-scale exploitation of resources causes various systemic transformations, some of which involve the appearance of considerable changes in its dynamics. In this sense, anthropogenic hazards, considered as unforeseen events with negative connotations related to human activities, can represent factors that induce imbalances in the local cultural landscape.

In particular, recently "the historical landscape of the area has been constantly assaulted by the open pit exploitation of the Cetate and Cârnic massifs [...] significant parts of the two massifs have been destroyed, together with traces of the greatest importance for historical mining. More than the damage and, locally, the destruction of the cultural heritage of the Roşia Montană site, this exploitation continues to put in danger the natural environment" (***_Plan de management ..._, partea I, p. 49).

Technological hazards are "related to the collapse of mine galleries, to underground explosions, to the instability of tailing dams, to the discharge of settling ponds and to pollution with dangerous materials" (D. Tanislav, Andra Costache, 2007, p. 106). The local historical course of Roşia Montană has known each of these phenomena, some being countered by rehabilitation, protection or conservation measures, as is the case with tailing dams, others perpetuating themselves without any countering anthropogenic intervention, as is the case with ponds loaded with polluting substances, of surfaces affected by erosion, torrentiality or landslides, of rivers polluted by contamination with "waste waters" (Albu Alina *et al*, 2007, p. 14), and of "soil surfaces loaded with heavy metals (Cu, Zn, Pb, Mn, etc.)" (Albu Alina *et al*, 2007, p. 17).

"The metallogenic activity was particularly intense here, affecting almost entirely the volcanic structure" (V. Ianovici, M. Borcoș, M. Bleahu, D. Patrulius, M. Lupu, R. Dimitrescu, H. Savu, 1976, pp. 457, 458); it led to the existence of considerable resources, intensively exploited, which is why "in Roșia Montană we see the mixture of complementary natural and human factors that must be interpreted to understand and conserve the site" (Mitchell, 1986; Rackham, 1986 cited by J. R. Akeroyd, 2012, p. 107).

The objective research of the elements belonging to the historical cultural landscape of Roșia Montane through positive connotations and negative features contributes to the detection of potential problems and the identification of strategies to follow. In this sense, the diagnostic analysis highlights significant aspects, useful in the design and implementation of the valorisation, protection and conservation actions of the cultural landscapes in the researched area.

Table 1. Diagnostic (SWOT) analysis of the cultural landscape in Roșia Montană

Strengths (positive internal aspects)	**Weaknesses (internal negative aspects)**	**Opportunities (positive external conditions)**	**Threats (external negative influences)**
- the wide spread of the industrial cultural landscape (mining), in the area; -representative historical cultural landscape; - the existence of some inherited cultural elements (e.g. various archaeological remains - related to gold mining, dating from the Dacian, Roman, medieval and up to the present day); - the existence of unique cultural elements (waxed tablets); - the quality of gold that can be exploited (economically), planned, protected and/or conserved.	-insufficient perception and development of the cultural value of the historical landscape; - the disappearance of the vestiges of traditional mining; -lack/reduced actions regarding the protection of representative cultural elements; - the degradation or disappearance of some cultural elements as a result of their abandonment; - particularly low (tourist) exploitation of the cultural landscape; - ignorance of the existence of the cultural landscape (due to lack of promotion); - abandoning the principle of continuity (in architecture, local economy, etc.).	- awareness of the planning, protection and conservation of the cultural (historical) landscape as a primary need; - the restoration of the cultural landscape (through the aesthetic rehabilitation of degraded cultural elements); - the development of rural, cultural, ecotourism, scientific tourism, which integrates landscape elements into the attractive offer; - projects that support concerns for the quality of landscapes and the sustainable development of the characteristic elements of Roșia Montana, as a source of identity and sustained development; - preservation of a millennial cultural landscape.	- the degradation of the cultural landscape as a result of anthropogenic activities, especially mining; - potential dangers following some activities (industrial/mining), translated into anthropogenic hazards; - the uniformity of the cultural landscape (as a result of the increasingly prominent manifestation of globalization and implicitly interchangeability); -replacing the local cultural landscape with one (degraded) devoid of cultural value following the implementation of aggressive mining projects.

Source: Camelia-Ina Gavra, 2013, p. 225, with annotations.

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