

## IMPLICATIONS OF TOPOGRAPHY IN THE REHABILITATION OF NATURAL HERITAGE OBJECTIVES

Luciana OPREA, Assoc. Prof. Dr. Eng., „1 Decembrie 1918” University of Alba Iulia,  
Romania, [lucii\\_oprea@yahoo.com](mailto:lucii_oprea@yahoo.com)

Tudor POPA, Eng., Romania, [tudor\\_popa10@yahoo.com](mailto:tudor_popa10@yahoo.com)

**Abstract:** *The preservation of the cultural and natural heritage contributes to the formation of the local identity and the increase of the social cohesion by capitalizing on it. The national heritage has major implications for the tourism sector, which in turn has broad ramifications for all economic sectors, regardless of the object of activity. The topography, through the complex of works that serves a project of rehabilitation of a tourist objective, offers the necessary tools to carry out the work of all defining stages: topographic survey of the real situation in the field, transposition of projected elements in the field and updating data according to new arrangements.*

*For the suggestiveness of the work, the „Poarta lui Ionele” Cave was chosen as a case study - an objective that is part of the patrimony of the Apuseni National Park.*

**Keywords:** *topography, topographic documentation, rehabilitation, natural heritage, tourism*

### 1. Introduction

The sustainable economic and social development of the rural area is indispensable related to the improvement of the existing rural infrastructure and basic services, as well as to the cultural and natural heritage, which form the resource generating development in the field of tourism.

Inadequate infrastructure and basic services are the main element that maintains the sharp gap between rural and urban areas in Romania and which, moreover, is an obstacle to equal opportunities and socio-economic development of rural areas.

The following relevant aspects for the development of the Romanian rural area were identified:

- development of basic infrastructure and services in rural areas;
- job creation in rural areas;
- preservation of rural heritage and local traditions;
- reducing the degree of poverty and the risk of social exclusion.

For this paper, the „Poarta lui Ionele” Cave was approached as a case study. The land on which the „Poarta lui Ionele” Cave is located, is located in the area included in the patrimony of the Apuseni National Park and under the direct supervision of the Institute of Speleology and has an area of 1000 sqm. related to the cave and the surrounding land.

### 2. Materials and Methods

The „Poarta lui Ionele” Cave is located on the territory of Gârda de Sus Commune, Alba County, in the Bihor Mountains.

The access to this objective is made from Valea Arieşului, from Gârda de Sus commune, following the road DJ750 having as starting point the center of the commune,

towards Scărișoara Cave on Ordâncușa Valley, the cave being located on the right slope of Ordâncușa Valley, at an altitude of 800 m.

The location is included in the outlying area of Gârda de Sus commune, with the destination of natural reservation, the cave being surrounded on three sides by forest and on the northern side by the communal road DC 182.

The access to the cave is made from DC 182 through a concrete bridge and a wooden bridge, both in an advanced state of degradation. The route is a path type, positioned on the edge of the valley, currently presenting on the steeper areas packages of steps, wooden bridges and partially damaged railings.

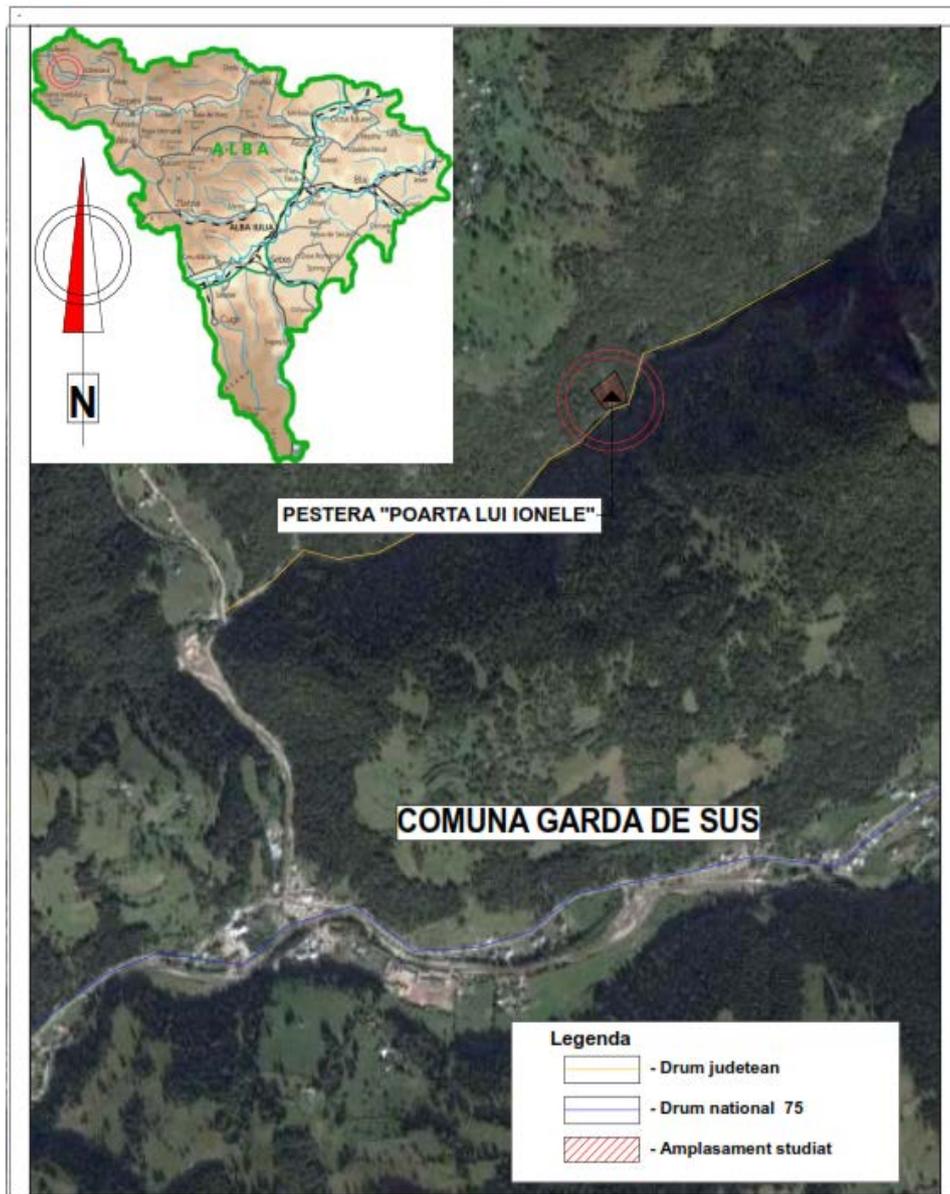


Fig. 1. Geographical location of the cave

The cave is an interesting karst formation, with a mouth 17 m high and 12 m wide, with a total length of 131 m.

The cave is the place where the waters that are lost in the pontoons and sinkholes on the blind valley between Iapa (Dealul Frumos) and Mununa hamlet come to light. The water

saturated with dissolved limestone precipitates on the distance between the cave and the estuary in Ordîncușa, 150 m below and forms beautiful waterfalls of travertine and guru.

The entrance to the cave is made through a 22 m high portal, which after the first 10 m descends the rubble slope and we meet the karst spring under the left wall, active all year round.

In heavy rains or melting snow, there is a strong current of water that floods the entire floor of the cave from this first level, the cave being flooded for much of the year, as evidenced by the walls that have different colors depending on the water level.

It was proposed to rehabilitate the existing access alley, to build an information point, to sell tickets and souvenirs, to arrange the access and the visiting route - the „Poarta lui Ionele” Cave.

The actual visit route will be arranged with metal stairs and platforms with protective railings. Protective railings are provided along the entire visit route. The construction of the gate and fencing is intended to protect the cave from possible unsupervised visits that may endanger the integrity of this speleological reservation.

At the same time, the placement of two signage and presentation panels is provided (at the access from the county road and at the entrance to the cave),

The arrangement of the access from the county road area to the cave is made on a picturesque ascent route, through the forest and along the valley formed by the stream that springs right from the cave. It is also planned to build metal stairs and platforms with protective railings, on the entire proposed visit route, as well as general electric lighting of the cave. The distance from the cave to the communal road is about 100 m.

The access to the cave is made on one side: north, through an alley, like a path, having 100 m long.



Fig. 2. Access of „Poarta lui Ionele” Cave

Due to the field conditions, the topographic works were carried out using the total station and the GPS equipment to determine the support points in carrying out the work.

The starting points of the polygon were determined using the GPS equipment by the static method, these being materialized in the field by metal poles.

The total station was used to pick up the details of the cave area.

The coordinates of the new station points and the radiated points were calculated with the help of the calculation program Toposys 7.0, and the situation plan was drawn up with the help of the AutoCAD program.

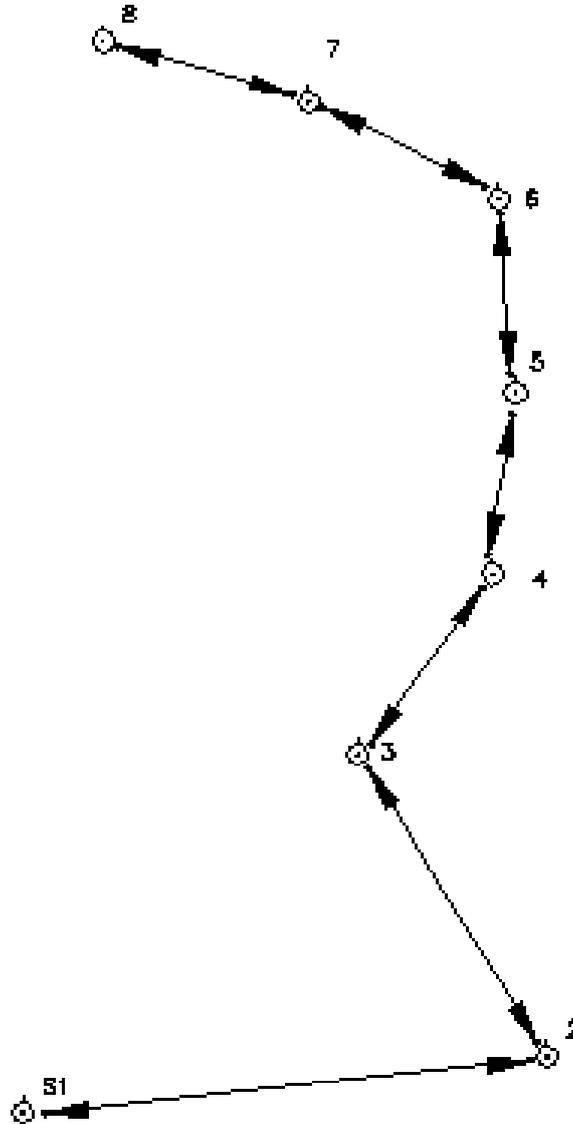


Fig. 3. Sketch of the topographic network

### 3. Results and Discussion

The topographic works carried out for the elaboration of the topographic documentation necessary for the design must ensure the satisfaction of the specifics of these surveys, ie the collection of more detailed data than those currently required for an ordinary topographic survey.

Following the computerized processing of the data, the situation plan of the entire set was obtained in digital format.

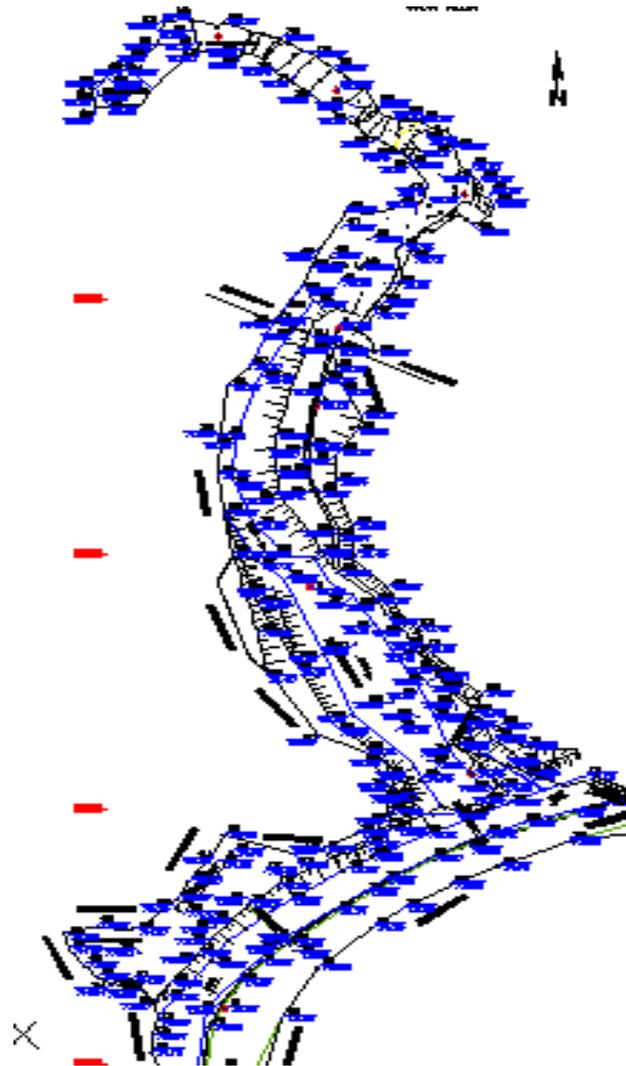


Fig. 4. The topographic plan of the objective

In order to carry out the entire rehabilitation process of the „Poarta lui Ionele” Cave area, it was also necessary to collect the data related to the elaboration of the transversal and longitudinal profiles for the critical development areas.

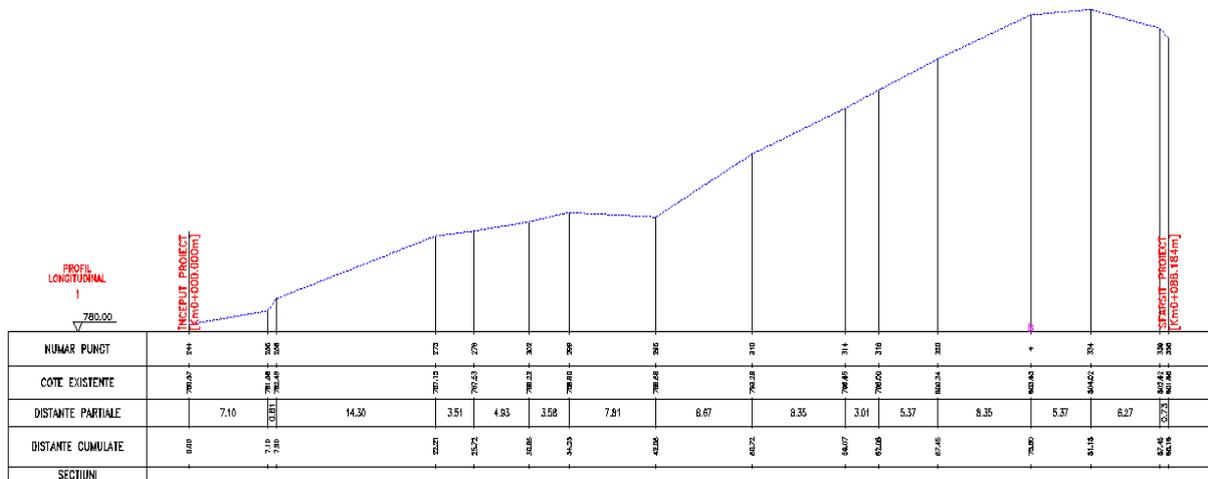


Fig. 5. Longitudinal profile

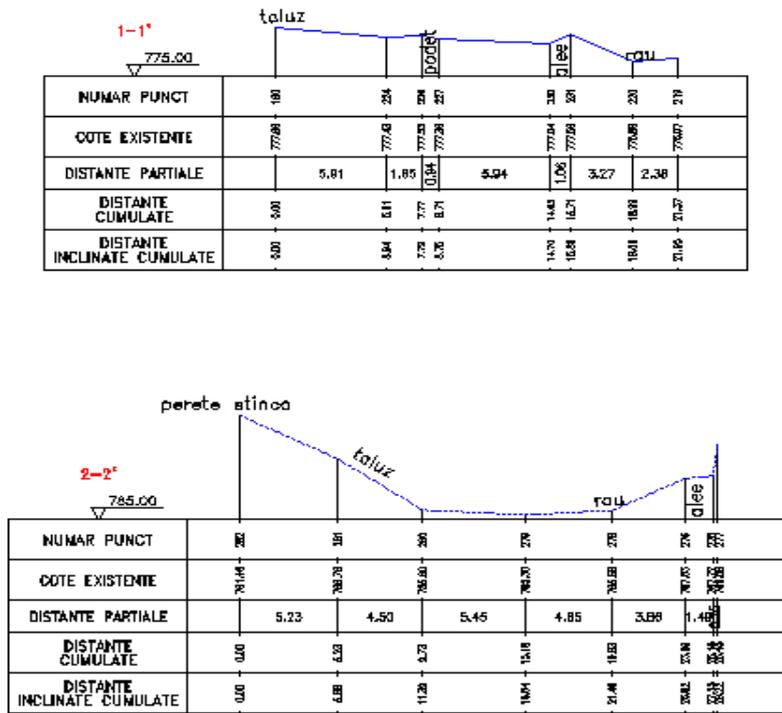


Fig. 6. Transverse profiles

Based on the topographic survey and the digital models resulting from the measurements, the development plans were drawn up and all the structures provided for rehabilitation were applied and built in the field.

Currently, the „Poarta lui Ionele” Cave is under the administration of Gârda Commune City Hall, being a class C cave, and is under the direct supervision of the Institute of Speology. At the same time, the area is part of the patrimony of the Apuseni National Park.

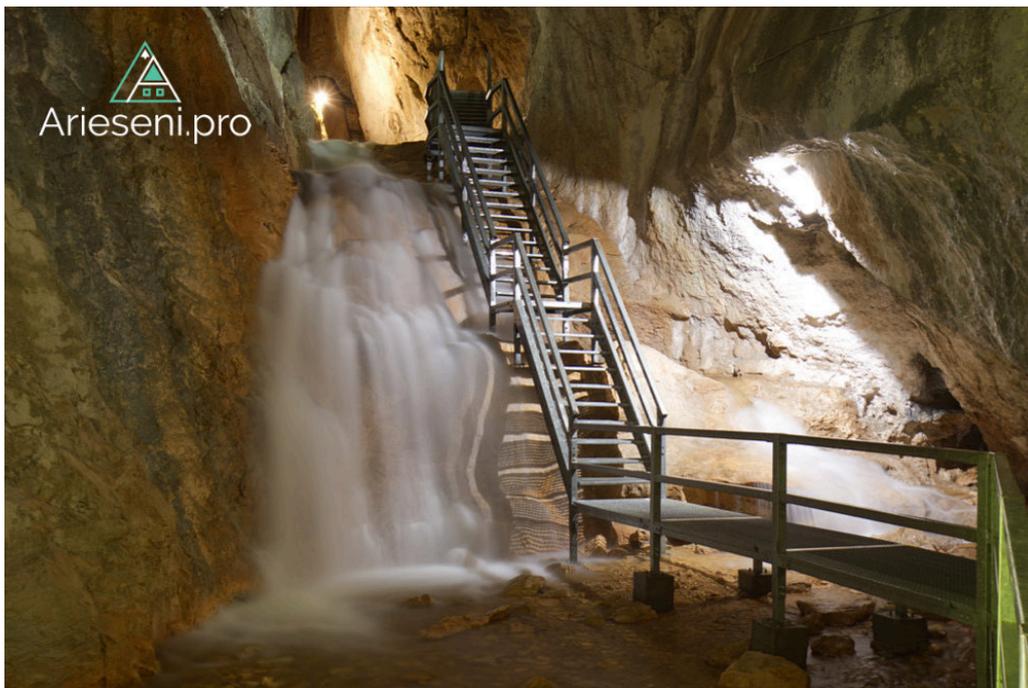


Fig. 7. Inside the „Poarta lui Ionele” Cave

#### 4. Conclusions

Based on the complex of topographic works performed and the digital models of the terrain, the optimal solutions for designing the rehabilitation works of the access route, the stairs and the protection railings, but also the fencing and the tourist information points could be chosen.

The involvement of a surveyor from the beginning of the rehabilitation project leads to high efficiency throughout the work. The topography, by its nature, provides information about the location and spatial data related to the analyzed objective.

The opportunity to extend the involvement of topography in rehabilitation works consists in providing various data models and offers the possibility to provide a detailed understanding of the entire project to all specialists who contribute to the completion of the entire set of engineering works.

The use of up-to-date data leads to informed strategic decisions. Under these conditions, the surveyor's expertise can help to identify possible errors and potential deficiencies in the design phase, so that there is no need to adopt remedial measures that would adversely affect both the project itself and the costs associated with its implementation.

Currently, „Poarta lui Ionele” Cave is a cave designed for tourism, being illuminated and equipped with metal stairs and bridges, fencing and kiosk, so that access can be easily made by all visitors, regardless of age.

#### 5. References

1. Badea, A.C.; Badea, G.; David, V., *Aspects about Green Management of Urban Areas in Romania, 15th International Multidisciplinary Scientific Geoconference SGEM 2015*, p. 721-728, 2015
2. Borşan, T.; Ienciu, I.; Dimen, L.; Oprea, L.; Voicu, G.E., *An Exploratory Analysis of Topographic and Archeological Data Gathered during Systematic Research, SGEM2013 Conference Proceedings, Vol. 1*, p. 629 – 636, 2013
3. Dimen, L.; Borşan, T.; Herban, S., *3D Modeling of the Historical Buildings and Archeological Sites, International Multidisciplinary Scientific GeoConference: SGEM 22012*, p. 925, 2012
4. Dimen, L.; Borşan, T.; Vinţan, I.; Găban, L., *Creating and Managing a Database for Planning and Monitoring the Achievement of the Objectives of Sustainable Development in Zlatna Locality, Alba County, Journal of Environmental Protection and Ecology 16 (4)*, 1414-1421, 2015
5. Grecea, C.; Ienciu, I.; Dimen, L.; Bălă, A.C.; Oprea, L., *Impact of Surveying Engineering on the Environmental Protection Problems, Journal of Environmental Protection and Ecology, 13 (1)*, p. 352-360, 2012
6. Grecea, C.; Ienciu, I.; Dimen, L.; Bălă, A.C.; Oprea, L., *Cadastral Support for an Efficient Town Planning in Timisoara, Journal of Environmental Protection and Ecology, 13 (2A)*, p. 1099-1106, 2012
7. Herban, S.; Grecea, C.; Muşat, C.C., *Using a Geographic Information System (GIS) to model, manage and develop urban data of the Timisoara city, Journal of environmental protection and ecology 13 (3)*, 1616-1624, 2012
8. Ienciu, I.; Vorovencii, I.; Oprea, L.; Popescu, C., *Urban Development of Mountain Areas with the Aim of Developing Local Tourism, Journal of Environmental Protection and Ecology, 14 (3)*, p. 980-985, 2013

9. Ienciu, I.; Popa, M.; Grecea, C.; Oprea, L.; Varvara, S., *Topographic Surveys to Re-integrate Waste-rock into the Natural Cycle*, *Journal of Environmental Protection and Ecology*, 12 (4), p. 1925-1934, 2011
10. Iliescu-Cremeneanu, A.; Badea, A.C.; Vasilca, D.; Badea, G.; Badea, D., *GIS and Remote Sensing for Urban Protected Green Areas*, *International Multidisciplinary Scientific GeoConference SGEM 18 (2.3)*, p. 417-424, 2018
11. Oprea, L.; Ienciu, I.; Tudoraşcu, M.; Filip, L., *Implications of Topography and Cadastre in Tourism Planning and Sustainable Development of 'Alba Carolina' Vauban Citadel*, *Journal of Environmental Protection and Ecology*, 16 (3), p. 1016-1023, 2015
12. Oprea, L.; Ienciu, I.; Grecea, C.; Popa, D., *Protection and Inclusion of Nature Reserve Areas into the Romanian General Cadastre*, *Journal of Environmental Protection and Ecology*, 12 (4), p. 1935-1940
13. Popa, T., *Lucrări topografice în vederea reabilitării accesului la obiectivul turistic „Poarta lui Ionele”*, Alba Iulia, 2017
14. Voicu, G.E.; Voicu, F., *Urban Development of the Touristic Area Poarta Raiului Through the Implementation of GIS*, *15th International Multidisciplinary Scientific Geoconference SGEM 2015*, p. 1183-1190, 2015
15. Voicu, F.; Voicu, G.E., *Identification of Climate Phenomenes which Are Influencing the Tourism Activity in Şureanu Massif Area*, *International Multidisciplinary Scientific GeoConference: SGEM 18 (2.3)*, 441-448, 2018
16. <https://www.arieseni.pro/9-arieseni-obiective-turistice/32-pestera-poarta-lui-ionele>
17. [https://ro.wikipedia.org/wiki/Pe%C8%99tera\\_Poarta\\_lui\\_Ionele](https://ro.wikipedia.org/wiki/Pe%C8%99tera_Poarta_lui_Ionele)