CASTLE RUINS AS SITES WHERE GEODIVERSITY AND CULTURE MEET: A CASE STUDY OF JANŠTEJN (CZECHIA)

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Abstract
Geocultural sites are perceived as sites where links between geodiversity and culture are particularly strong and interconnected. They may be represented by quarries, anthropogenic landforms, and historical buildings or constructions. Thanks to their values, geocultural sites possess an important potential for geotourism and geoeducation, but at the same time, they may become endangered by threats such as natural degradation, vegetation overgrowth, overtourism, inappropriate use, or indifference to their values. This contribution introduces a case study of Janštejn castle ruins situated in Jihlavské vrchy Highland (Czechia). The area represents a typical granitic landscape with the occurrence of rock walls, tors, frost cliffs and blocky accumulations. The ruins of Janštejn castle are situated on the rocky elevation formed by the Moldanubian granite. The construction of the castle dates back to the 14th Century, and it significantly affected the surroundings due to the extraction of local material and anthropogenic transformation of the relief. The site has been described in terms of geomorphological processes and landforms, mapped by the use of 3D laser scanning, and assessed by geomorphosite concept. Based on the SWOT analysis, threats and opportunities were identified, and possible management measures, proposals for further sustainable use, and research directions were designed.

Key words: geocultural site, geomorphosite, geomorphological mapping, cultural heritage, granitic landscape

Introduction

Geocultural sites are defined as locations where geological features interact with cultural elements, such as historical, archaeological, or religious structures, so that geoheritage and cultural values are jointly expressed (Reynard and Giusti, 2018, Bollati et al., 2023). Generally, geocultural sites possess an important potential for geotourism and geoeducation, but at the same time, they may become endangered by numerous threats (degradation, vegetation overgrowth, overtourism, inappropriate use).

Castle ruins may be considered geocultural sites par excellence as the interplay of geomorphological settings and architectonical aspect is highly relevant there. Usually, they are situated on distinctive landforms, which are closely related to and influence the proper construction of castle or its architectonical disposition. These landforms are very often important from geoheritage point of view (e.g., outcrops, rocky promontories, frost cliffs, tors) and moreover, they may be modified by anthropogenic activity that resulted from the requirements in the period of construction (e.g. formation of defence walls, ramparts or ditches, extracting local stone as a resource for construction, re-arrangement or removal of the blocks and debris from natural accumulations etc.). Castle ruins are also important regarding the use of natural stone and local material. Logically, the castle ruins are also important from archaeological point of view. At last but not least, castle ruins serve as inspiration for artists and their geomythological relevance is also very high, representing an important part of local identity and folklore. All these aspects increase not only cultural, but also natural heritage values of the site, they are closely connected and thus, represent an important resource for geoeducation, geotourism and recreation.

The interconnection between human activities and landscape diversity is particularly evident in areas that have been settled for a long time with suitable bedrock and other natural resources, which allowed a wide range of uses in human activities. In our context, these specific areas include territories formed by granite rocks, which are characterized by distinctive rock micro- and mesoforms. Within the framework of the geological memory of the landscape, it may be referred to a granite landscape (Migoń, 2006).

This contribution presents an example of Janštejn castle ruins. This geocultural site has been described in terms of geomorphological processes and landforms (including the use of advanced visualisation methods), and evaluated by using the geomorphosite concept. Based on the SWOT

analysis, threats and opportunities were identified as a starting point for the further research and activities oriented towards the sustainable geotourist and geoeducational use.

Methods

The basis for this study is a review of existing literature (Tabuer, 1987 and Czech Geological Survey, 2026 for regional settings, Migoń, 2006 for granitic landscape frameworks, Natural Monument Institute, 2026 for historical aspects) and a detailed geomorphological mapping and field work. The visualisation of the castle structure and its surroundings was geodetically surveyed using 3D terrestrial laser scanning (Leica ScanStation C10) connected to the Global Navigation Satellite System (GNSS) (Leica Viva NetRover GS08 receiver connected to the network of permanent GNSS stations of the Czech Republic, CZEPOS, in RTK (real-time kinematics) mode). All this served as a basis for the assessment of the heritage values and SWOT analysis.

Results

The site of interest is located approximately 21 km southwest of Jihlava (Vysočina Region, Czechia), 1.2 km SW of Nová Ves (Figure 1). A rocky outcrop with castle ruins rises from the western slope of a flat ridge at elevations of 694–702 m near the 723.5 m elevation point “U hradu”.

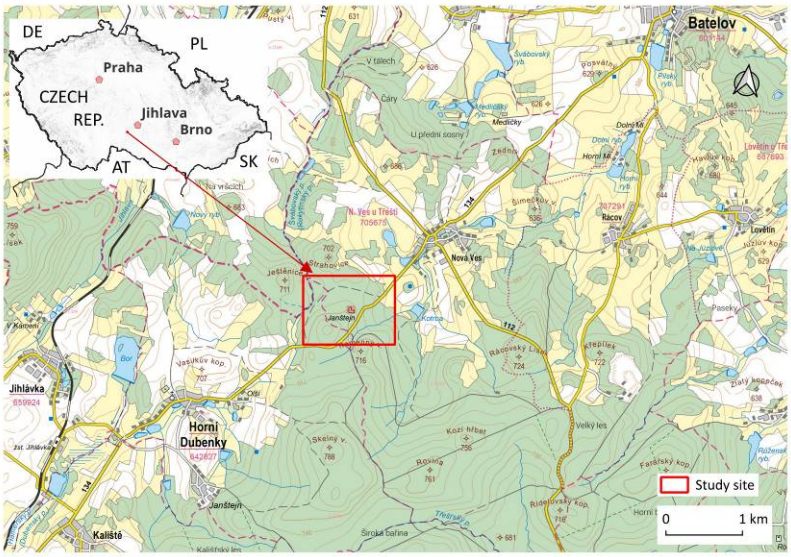

Fig. 1: Situation map displaying the position of the study site within Czechia. (Data sources: Base topographic map ČR 1 : 50 000, Czech Office for Surveying, Mapping and Cadastre).

The bedrock of the study area consists of granular biotite granite (Mrákotín type) from the Moldanubian Plutonic Complex (Czech Geological Survey, 2026). Geomorphologically, the area is characterized by a diversity of landforms that have been formed by a range of geomorphological agents and processes. Thus, the relief may be considered as polygenetical (Kirchner et al., 2025). The following morphogenetic landforms may be identified: 1) Structural-denudational, especially structurally-denudational rock wall (a remnant of a more extensive formation, constituting a rocky elevation that arose after the removal of tropical weathering deposits from the basal weathering surface), and boulder accumulations (remnants of a weathering mantle), 2) Cryogenic (frost cliffs, cryoplanation terrace, cryoplanation plateau, debris accumulations), 3) Gravitational (weathered and lose rock faces, niches, resulting in the formation of debris), 4) Anthropogenic, especially historical settlement features and military defensive structures (embankments, moats or ramparts), modifications of natural outcrops and block accumulations during the construction of the castle. Figure 2 displays the typical cryogenic landform and main cultural aspect of the site (the ruin of tower of Janštejn castle). The longitudinal section (created by use of Laser Scanner) is displayed on Figure 3.

Fig. 2: Frost cliffs affected by weathering (left), Janštějn castle ruins (right). Photo: authors.

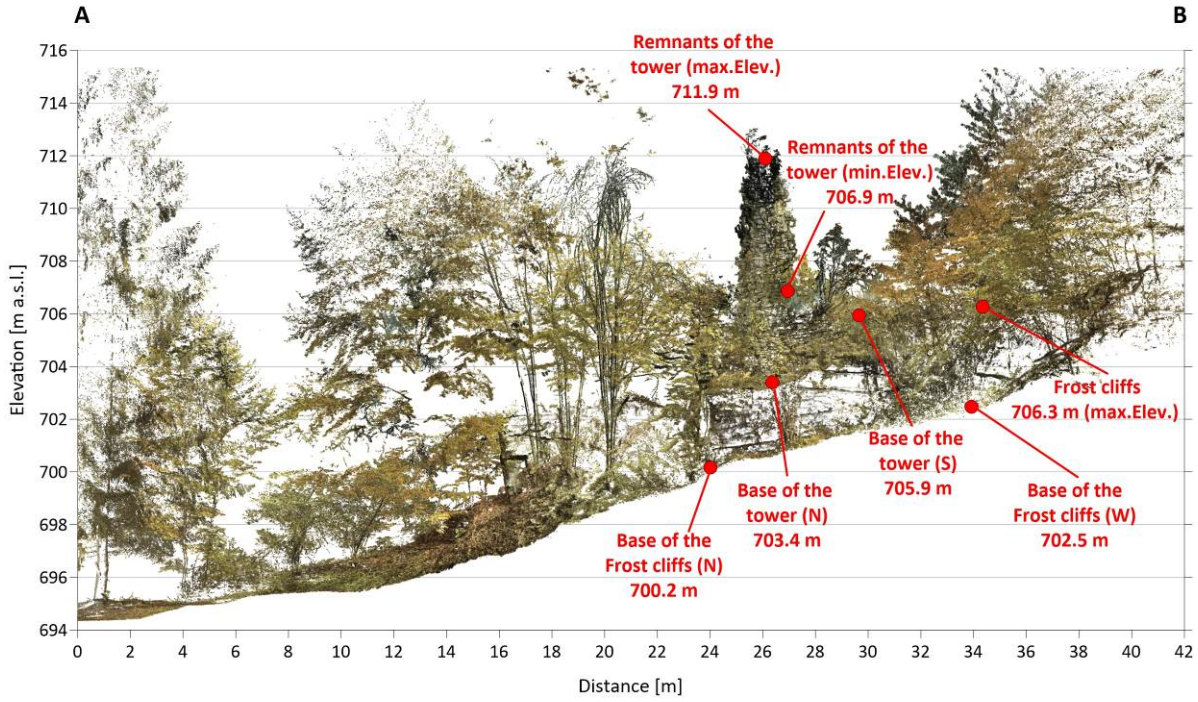

Fig. 3: Longitudinal section (AB) of the frost cliffs with remnants of Tower S–J (azimuth 178.8°W)

In order of identifying and documenting the key heritage values, a “geomorphosites” approach was used. The assessment of geocultural sites is based on the cultural landscape approach (Reynard and Giusti, 2025), it reflect the geoheritage and cultural heritage links (Pijet-Migoń and Migoń, 2022), and the geosite assessment criteria (Brilha, 2016). It is accompanied by SWOT analysis. A brief evaluation of particular heritage values follows: 1) Representativeness: the main landforms represent typical features resulting from the long-term geomorphological evolution (granitic landscapes, cryogenic processes), 2) Integrity: The rock wall has been modified by cryogenic and anthropogenic processes, so its state of preservation is more or less average. The cryogenic landforms can be considered well-preserved, 3) Interpretative value: The site shows the typical phenomena of granitic landforms, although the visibility is limited and the landforms are remodelled, so the interpretative value is average. Cryogenic and anthropogenic landforms are considered typical examples, their pedagogical and interpretative value is very high, 4) Paleogeographical importance: The geomorphological processes and phenomena reflect the long-term geomorphological evolution of the wider region (the formation of a levelled surface during the Paleogene, cryogenic processes associated with cold periods in the Quaternary), the paleogeographic importance is high, 5) Aesthetic value: The site appears to be somewhat hidden and does not stand out prominently in the landscape. However, the

spatial structure is interesting, with rock outcrops alternating with remnants of old masonry, complemented by anthropogenic landforms. Aesthetically, the site can be considered “picturesque,” but it is not particularly unique, 6) Cultural value: The castle ruins hold the status of Cultural Monument with archaeological and historical importance. The cultural value quite high, not only thanks to the presence of ruins, but also thanks to the presence of anthropogenic landforms, or the use of local rock material as building stone.
Based on the detailed fieldwork and heritage values assessment, the SWOT analysis was elaborated, including the identification of threats and opportunities of a rational use of the geocultural site (Table 1).

Tab. 1: SWOT analysis of Janšejn geocultural site

Strenghts	**Weaknesses**
- The geo-phenomena (especially cryogenic landforms) are representative, clearly visible, and easily recognizable - The site is of high cultural (archaeological and historical) significance - A close relationship between geoscientific and cultural values	- The site is not a unique or exceptional (within the broader region) - There is a lack of information on the biota and its relationship to geodiversity features - Due to the reshaping of the relief by cryogenic processes, older landforms (typical of granite landscapes) are less easily recognizable
Opportunities	**Threats**
- Leveraging the close connections between geoscientific and cultural values for multi- and transdisciplinary education (Earth sciences, history…) - The development of sustainable forms of tourism (especially geotourism) - More detailed geomorphological and archaeological research can contribute to further increasing the overall value of the site	- Active processes at the site (slope instability, deterioration of the castle walls) may pose a risk both in terms of the site’s overall degradation and in terms of its potential future use for geotourism and education - Risks at the site associated with a potential increase in visitor numbers need to addressed regarding the tourism infrastructure and safety

Conclusion

The Janštejn castle is a typical example of geocultural site which may be defined as a site where geodiversity and culture are closely interconnected and they influence each other. Indeed, the geological resources and geomorphological setting (presence of significant outcrops as suitable platform for constructing the castle, possibility of use the local stone) played a substantial role in the sites history. On contrary, the anthropogenic activities also influenced the geodiversity: the rock outcrops were modified during the construction, new landforms appeared, and the material was moved.
The detailed literature review, field work (including the use of advanced visualisation methods), and use of geomorphosite assessment approaches enabled the identification, documentation, and evaluation of the heritage values. Based on this, the preliminary analysis of threats and opportunities were identified. This will serve for a further rational use of the site that may be used also by local stakeholders, including the municipalities, schools, or Vysočina National Geopark. In further research, we plan to conduct a more detailed analysis and assessment of the site’s potential for education and the development of sustainable forms of tourism, as well as a more detailed identification, analysis, and assessment of threats and risks.

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Souhrn
Příspěvek představuje geokulturní lokalitu Janštejn jako typický příklad lokality, kde dílčí složky geodiverzity (horniny moldanubika, kryogenní a antropogenní tvary reliéfu jako např. tory, sklaní stěny, balvanová more, hradní příkopy, valy) ovlivňují a jsou ovlivňovány kulturními, historickými nebo archeologickými aspekty. Lokalita byla podrobně popsána, zmapována a zhodnocena z hlediska jejího potenciálu pro rozvoj udržitelného turismu a vzdělávání. Dále byly identifikovány potenciální hrozby a rizika, která mohou negativně ovlivnit hodnoty lokality a rovněž bylo diskutováno její udržitelné využívání.

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