

New opportunities for geotourism development at geoarcheological site Holedná Hill (Brno, Czech Republic)

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Abstract

Holedná Hill (Brno, Czech Republic) represents a traditional tourist and recreational background for Brno citizens. Until now, the area was appreciated especially for its living nature and other values were omitted. In the last years, the area has been a subject of geomorphological research. Based on the fieldwork and analysis of LiDAR Data, elongated embankments and shallow ditches of anthropogenic origin were identified. Radiocarbon dating confirmed the age between 1200 – 1050 BC (Bronze Age). These anthropogenic landforms probably represent remnants of fortified settlement or sacred place. The site is also important from the Earth-science point of view: the bedrock is composed of resistant Proterozoic rocks of Brno Massif which form a remarkable ridge above the deeply incised valley of Svatka River. Moreover, the occurrence of remnants of a crust rich in iron has been noticed and the area is important thanks to the presence of specific hydrological features. The new lookout tower complements the tourist attractiveness of the study area. These aspects represent a significant potential for the development of geotourism and environmental education at this newly discovered geocultural site. Based on the evaluation within the geomorphosite concept, proposals for further use are designed.

Key words:

geoheritage, cultural heritage, environmental education, geocultural site, recreation

Introduction

Special Interest Tourism is often seen as a form of 'alternative', 'ethical' or 'environmentally responsible' tourism and it occurs when the tourists' motivation and decision-making are primarily determined by a particular special interest with a focus either on activities and/or destinations and search for novel experiences. There are numerous types of Special Interest Tourism that can be classified according to the typology of niche tourism, e.g. cultural tourism, energy tourism, dark tourism, agrotourism, ecotourism, industrial tourism, spa tourism and many others (Novotná et al. 2019). As geotourism meets the criteria that define Special Interest Tourism (sustainability, environmental responsibility, existence of special interest – in this case, geodiversity and landscape), it can be considered a type of Special Interest Tourism.

Concerning the resources for geotourism, they vary from strictly natural geosites or landscapes to cultural sites or areas with strong links to geodiversity (or natural sites/areas with strong links to culture), which is in accordance with holistic approach to geotourism (Dowling and Newsome 2018). The latter type of site is called geocultural site (Reynard and Giusti 2018). Geoarcheological site can be included among geocultural sites and can be defined as a site where geological aspects are accompanied and closely related to archaeological issues. The Holedná Hill (Brno, Czech Republic) can be considered an example of such geoarcheological site – it is both important from the Earth-science point of view and it includes archaeological issues closely related to the geodiversity. Moreover, the site has high relevance concerning the living nature and represents recreational and tourist background for Brno citizens. Taking into account these aspects, it can be supposed that the area is going to be more and more used for recreational and tourist purposes (also in relation to Covid-19 pandemic when the possibilities of indoor activities are limited and people prefer to spend their free time in nature) that can result in

overcrowding, destruction or overexploitation of geo/archaeological phenomena. It is thus necessary to design such rules and activities that would help visitors to recognize the importance of this area. This paper briefly sums natural and cultural values of Holedná Hill. Based on the site assessment and SWOT analysis, proposals for sustainable use of the area can be designed.

Methods

The first step of the research was represented by a geomorphological reconnaissance trip and subsequently a detailed fieldwork and literature and other resources review (e.g. LIDAR scans). Geoarcheological methods (radiocarbon dating of charcoal wood) were implemented to know the age of the structures. Site assessment was elaborated based on the methods already used for the assessment of geomorphosites with important cultural features (Reynard et al. 2016, Kirchner et al. 2018). The criteria that allow to evaluate anthropogenic landforms were added as anthropogenic landforms are considered a part of geomorphological heritage (Coratza and Hobléa 2018, Kubalíková et al. 2019, 2020). SWOT analysis then served as a base for proposals for sustainable use of the site.

Study area

The study area encompasses the northern part of the Holedná Ridge – Kohoutovická Highland (Figure 1) and reaches the altitude of 391 m a.s.l. The area is a part of the geomorphological unit Bobravská vrchovina Highland, which belongs to the Hercynian mountains of the Bohemian Highland. The bedrock is built of diorites, metadiorities, tonalities (metadiorite zone of the Brno Massif); vein rocks (rhyolites) are less frequent (Hanžl et al. 2020). On the northern and north-eastern edges, the Holedná ridge falls along steep slopes into the deeply incised Svatka River valley, on the north-western and western sides, the relief descends into the valley of the Vrbovec Brook. The steep slopes are divided by deep valleys and gullies and small rock outcrops occur there. Occasionally, gravel-stone sediments and loess-loams occur.

Hydrological features are represented by springs (e.g. the locality U jezírka) and small ponds.

During geomorphological reconnaissance trip in 2017, an accumulation wall was documented. It is composed of stones and boulders (max. height 0.5-0.7 m) and surrounded by a shallow ditch (width up to 250 cm). The exact position of accumulation was specified using a digital relief model - DMR 5G (LIDAR). In cooperation with archaeologists and geologists, three excavated probes were made in the years 2017-2020. Artificially stored boulders were found in the probes at the base, which proved the anthropogenic origin of the wall. In the forefield of the wall (probe 2), a burnt layer of soil with remnants of charcoal (rarely 20 cm in diameter) was found. Based on the radiocarbon dating of two samples (Sample 1 - calibrated age 1224 - 1038 BC, Sample 2 - calibrated age 1208 - 1019 BC), the accumulation wall was dated to the Late Bronze Age. Based on the microphotographic analysis, the sample of charcoal was determined as oak wood. So far, multidisciplinary research has confirmed that accumulation wall with an original base with a length 2 m and a height of 1 m was constructed in the Late Bronze Age, and oak poles were part of wall. The wooden construction was destroyed by fire. The purpose of the construction is not yet fully explained; the most acceptable explanation is that it was a planned fortified settlement (hillfort). Construction of the fortified settlement began, but the site was abandoned relatively soon (Kirchner et al. 2019).

Other cultural values are represented by Neolithic settlement and 16th century boundary stones. On the flat ridge near Holedná Hill, about 300 m west of the locality U jezírka, late Neolithic settlement was investigated (Kirchner and Kuča 2007). Along the tourist path to the locality U jezírka there are four historical boundary stones carved the year 1589. Inscriptions about former owners can be found on them: SM (Jundrov village, belonging to the monastery of the Church of the Virgin Mary), SA (Kohoutovice village, belonging to the St. Anne's monastery) and KK (Králové Monastery in Old Brno).

The attractiveness of the area with regard to geotourism is complemented by a network of paths within the Holedná Deer-park, good access to the site and public transport connections, and especially the possibility of visiting the new

Holedná lookout tower on a partial ridge (305 m a. s. l.) to the east of the Holedná Hill.

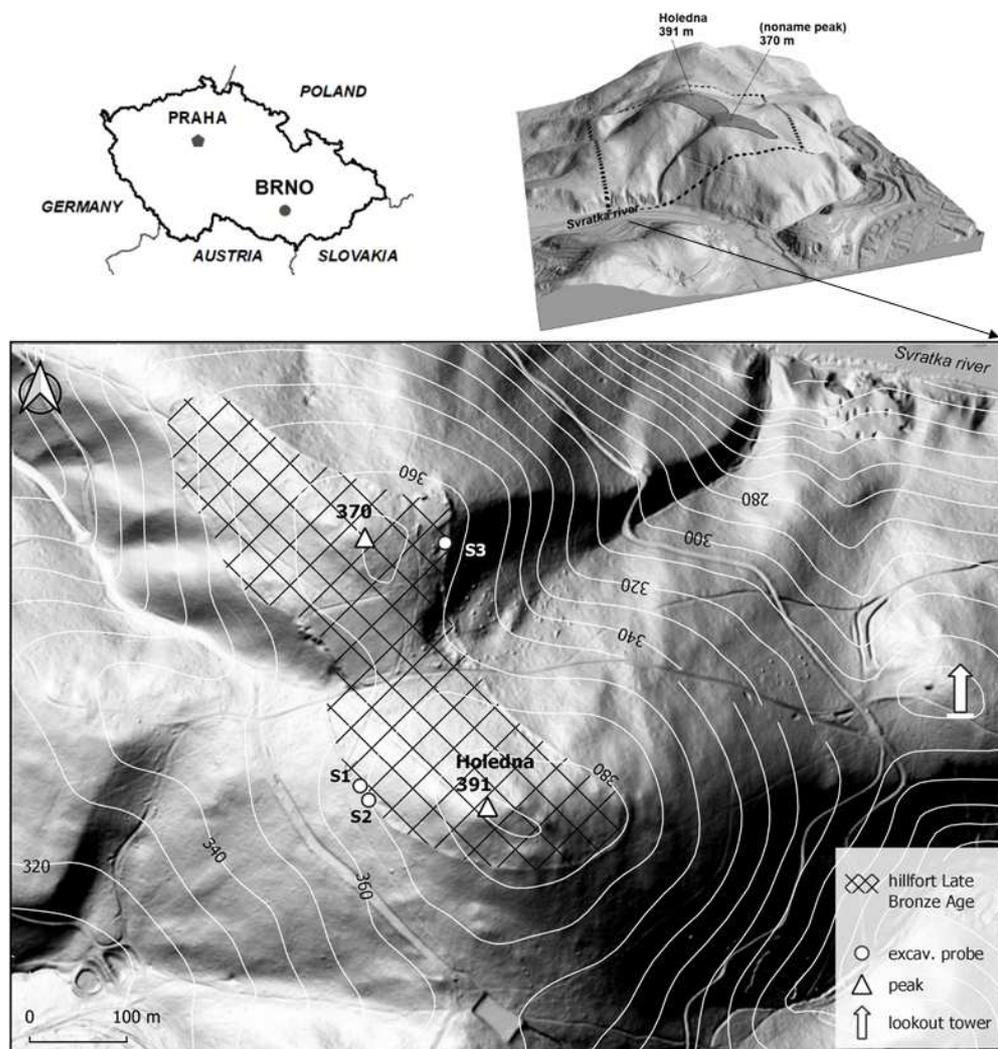


Figure 1: Situation map of the study area

Results and discussion

The Holedná Hill was assessed by using the concept of geomorphosites, respectively set of criteria described in Table 1. The assessment was qualitative as quantitative assessment is relevant only in case of more sites. Based on the fieldwork and assessment, simple SWOT analysis (Table 2) was done.

Table 1: Assessment of Holedná Hill

scientific value	integrity	Generally well-conserved, occasional damage by visitors (erosion on pathways), outcrops suffer from weathering and occasional rockfall, slopes endangered by game (erosion, no herb layer)
	representativeness	Representative geomorphology (remarkable ridge, deep river valley), occurrence of typical rocks of Brno massive and remnants of the iron ore crusts
	rareness	Several similar ridges built of pre-cambrian rocks in the area of Brno city, but iron ore crusts are unique within the wider area
	paleogeographical interest	Deeply incised valley of Svatka River is important for paleogeographical studies – terraces and phases of deepening
added value	ecological	Presence of protected species, existence of natural oak-beech forests, water components with specific ecosystems (small ponds)
	aesthetical	Harmonic forest landscape, viewpoints
	cultural	Archaeological importance (Bronze age fortification), Neolithic settlement, historical boundary stones
	anthropogenic landforms	Ramparts and ditches recognisable in terrain with a help of interpretive materials; road cuts allow to study typical rocks
use characteristics	protection status	No protection according to Nature Conservation Act (n. 114/1992 Coll.), southern part of the ridge (neighboring with study area) declared as Special Conservation Area according to the European Directive on Habitats; diorite outcrop on the northern part of the ridge is included in the Database of Geological Localities kept by Czech Geological Survey. There is no cultural protection.
	damage, threats	Uncontrolled visitors (vandalism, littering), soil erosion by tourists and game, intensive rock weathering in the road cuts
	accessibility	Accessible by urban transport, dense network of maintained paths
	security	Paths in relatively good conditions, the only danger can be occasional rockfall on outcrops (it can damage road)
	site context	Harmonic forest landscape, from several places there are views on Brno and deep valley of Svatka River
	tourist infrastructure	Marked paths, shelters, catering within walking distance, lookout tower, activities for children
	interpretive facilities	Educational path with information about living nature
educational interest	Possible interpretation of geology and geomorphology of the area, necessary to add the information about anthropogenic landforms and archaeological findings – setting the links between geodiversity and cultural aspects	

Table 2: SWOT analysis of Holedná Hill

<p>Strengths</p> <ul style="list-style-type: none"> Important geological and geomorphological site Archaeological and historical aspects Importance of the site for research Existing tourist infrastructure Good accessibility (both municipal and individual transport) Well known and favourite place, traditional recreational background for citizens 	<p>Weaknesses</p> <ul style="list-style-type: none"> Overcrowding during weekends, holidays Problems related to new lookout tower (lack of parking places and overcrowded access way) Problems with parking Focus on the living nature in educational path and generally in the site promotion Lack of information about geodiversity and archaeological aspects of the area No legal protection of natural and cultural heritage
<p>Opportunities</p> <ul style="list-style-type: none"> Complex promotion of natural and cultural heritage Sustainable use of heritage for educational 	<p>Threats</p> <ul style="list-style-type: none"> Continuing overcrowding and consequent damage of the area Lack of interest on geoheritage and cultural

<p>purposes</p> <p>Promoting public transport as a more comfortable possibility to get to the site</p> <p>Creating the conduct rules both by authorities (municipal office, municipal forests), stakeholders (landowners) and visitors</p> <p>Redistribution of visits (all the year)</p> <p>Cooperation with different institutions (academic, municipal, non-governmental)</p>	<p>heritage by local stakeholders and authorities</p> <p>Lack of finances for suitable promotion of the site values</p> <p>Irresponsible amateur research (inappropriate digging in order to find some artefacts from Bronze Age based on metal detector users)</p> <p>Threats to anthropogenic landforms</p> <p>Continuing problems with parking that may result in the damage of surroundings and reductions of life quality of local inhabitants</p>
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Based on assessment and SWOT analysis, some proposals for sustainable use can be designed, e.g. educational activities or proposals for trails for different target groups. It is also desirable to reconsider legal protection of geodiversity and archaeological phenomena. For achieving this, it is necessary to include wide spectrum of stakeholders and other institutions (authorities, non-governmental organisations, public, landowners, local schools) into the future research and discussions.

Conclusion

The Holedná Hill geoarchaeological site has a remarkable geotourist potential, respectively it is a suitable place for development of specific types of Special Interest Tourism. Valuable Earth-science features and archaeological findings represent an important resource for environmental education that can make visitors understand the value of the area. The integrated promotion allow to interconnect natural sciences (Earth-sciences) and humanities (archaeology, history, anthropology), respectively to interconnect natural and cultural heritage of the area. The effective and targeted educational activities can be achieved by close cooperation with local stakeholders and different institutions. In the future, specific sites within study area can become a subject of legal protection. Further research and detailed elaboration of these proposals can help to avoid overexploitation and of the area and assure its sustainable use.

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Summary

Mezi speciální formy cestovního ruchu lze zařadit i geoturismus, neboť splňuje kritéria, která jsou na speciální formy cestovního ruchu kladena (např. udržitelnost nebo předmět speciálního zájmu – v tomto případě geodiverzita a krajina). Na příkladu geoarcheologické lokality Holedná, která zahrnuje archeologické aspekty, geodiverzitu a zároveň je turistickým a rekreačním zázemím obyvatel Brna, je zpracováno hodnocení dle konceptu geomorphosites a SWOT analýzy. V zájmovém území se nacházejí zbytky akumulárního valu z mladší doby bronzové (snad zárodek hradiště), v blízkém okolí bylo doložena neolitická lokalita, hodnotné jsou i historické hraniční kameny z konce 16. století. Vše je zasazeno do členitého reliéfu s pestrým geologickým podložím. Lokalita má pozoruhodný geoturistický potenciál, její využití je možné i v environmentální výchově při propojování přírodních a kulturních aspektů oblasti včetně budoucí možné právní ochrany.

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