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TOURIST INTEREST IN ILLICIT ZONE OF ICE CAVES

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Abstract
Ledové sluje (Ice Caves) in the Podyjí National Park represents one of the most spectacular sites within the area. It consists of the large boulder field and several pseudokarst caverns on the north-western slope of the ridge that are very important from the ecological and geomorphological point of view. The access to the site is restricted for the visitors of National Park as there exists a risk of damage and disturbance of these unique phenomena; tourist can use the marked paths leading around the site, they can reach the top part of the ridge.
Currently, there are only several persons who have legal access to the site (employees of the National Park Administration and other researches with the permission issued by NP Administration). However, the installed sensor that counts the passages proved that the site is visited more frequently than it should be. The number of people who visit this site (situated within the first zone of National Park where there is no marked path and so the access is forbidden by decree) is quite alarming. Based on these findings, some proposals for the solution of this unfavourable situation are proposed and other possibilities how to avoid this undesirable phenomenon are discussed.

Key words: Podyji National Park, restricted area, passages monitoring

Introduction: history of the tourism on the Ledové sluje (Ice Caves)
The Ice Caves were visited already in the 18th century and probably earlier by locals (Skutil 1950). Under the influence of Romanticism and in order to make the mysterious surroundings of the caves accessible, the owner of the Vranov County, Princess Helena Mnizsková (née Lubomirská) let built a path across the slope from the Dyje river to the ridge in 1858 – 1859. In 1860, an obelisque on the top of the ridge was built by Vranov Beautification Society to honor the Princess.
The Obelisque and the passage trail increased the popularity of the Ice Caves, so at the end of the 19th century, the Znojmo section of the Austrian Tourist Club marked one of the first hiking trails. This red marked path from Čížov to Vranov through Ice Caves describes Zobal (1927) in the historical tourist guide Podyjí.
The hundred year old tourist tradition was interrupted by the integration of the site and its surrounding into the border zone and the inaccessible zone of the Iron Curtain in the years 1960 - 1990. After the establishment and declaration of the Podyjí Protected Landscape Area and subsequently the Podyjí National Park (in 1991), there was no restoration of the tourist route in order to protect the unique natural phenomena and also regarding visitor safety due to increased risk of rock fall and boulder movements. In addition, the natural processes have gradually limited the viability of the original trail due to loosening the stone blocks or blocking by fallen trees. At present, it is possible to visit the Ice Caves very rarely (once per several years) on the occasion of popularizing excursions for the public under the auspices of the Administration of the Podyjí NP. However, the non-intervention and inaccessible mode of the site is very often violated.

Study area and its assessment

For the description and assessment of the Ice Caves, we come out from the geomorphosite concept which define geomorphosites as „landforms that have acquired a scientific, cultural/historical, aesthetic and/or social/economic value due to human perception or exploitation" (Panizza 2001). Within this concept, numerous assessment methods were introduced and used for various purposes, especially for geoconservation, geoheritage management and geotourism (e.g. Coratza and Giusti 2005, Cendrero and Bruschi 2005, Reynard et al. 2007, Zouros 2007, Pereira and Pereira 2010, Fassoulas et al. 2012, Kubalíková and Kirchner 2016) and critically reviewed (e.g. Kubalíková 2013, Brilha 2016 or Reynard et al. 2016). Generally, these methods are based on the detailed examination and description of the site and they include several groups of values, e.g. scientific, added or conservation values. For the purposes of this case study, we propose to use an integrated method which comes out from the aforementioned methods and which consists of a set of questions. The assessment is qualitative, because in the case of unique site, the numerical assessment is irelevant. The assessment of the site is presented in Table 1.

Tab. 1: Assessment of the Ice Caves

Values	**criteria (in bold)** / question	answers
Scientific values	**Integrity or current status of the site:** Is the site (including particular Earth-science features) well conserved or is it damaged?	The site - including particular Earth-science features is well preserved especially thank to its today's position in the first zone of National Park and its position within the inaccessible area (proximity to the Iron curtain) in the past.
	Diversity of the Earth-science features: How many Earth-science features is displayed within the site? (specific landforms – macro, mezo and microforms, stratotypes, lithological boundaries, fossils, minerals, soil profiles, current processes etc.)	Landforms: pseudokarst caves, block and debris accumulations, frost cliffs, crevasses Processes: weathering, slow movements of the boulders within block accumulations, rock fall, the formation of debris heaps, opening the crevasses
	Rarity: How many similar sites lies within a study area? Is the site unique or is it current within the area?	The pseudokarst caves are unique, however, in the Podyjí National Park, there are a lot of similar block accumulations and frost cliffs.
	Scientific knowledge of the site: Is the site known within scientific community? Are there some papers, monographies etc.?	The site is widely known within scientific community, it has been explored since 19th century, numerous scientific papers were elaborated (e.g. Roth 1863, Jarz 1884, Koláček 1922, Špalek 1935, Skutil 1950, Gruna and Reiter eds. 1996, Pospíšil and Pazdírek 1998, Wagner 2001, Košťák 2001, Demek 2007, Kuda 2016).
	Exemplarity and representativeness of the site: Are the features (both landforms and processes) visible and comprehensible? Is there a possibility of simple explication of the corresponding processes?	The site is an excelent example of pseudokarst caves, frost cliffs and block accumulations in crystalinic rocks, the processes cannot be observable by eye, but the traces of the processes are visible (opening the crevasses, rock fall), so there is a possibility to explain the processes to the laic public. There are no educational facilities on the site, only the mention about it on the panel on the top of the ridge near obelisque.
	Palaeogeographic importance: Is the site significant for the understanding of the geomorphological evolution of the area?	The site's palaeogeographic importance is very high as it allows to reconstruct the evolution of the Dyje Valley and surrounding area. Nevertheless, the origin of the site has not been satisfactorily explained yet and there are numerous hypothesis

		about it.
Tourist value	**Accessibility:** Is the site accessible or is the access limited/restricted?	The access is restricted due to the site's great scientific value. It is situated within the first zone of NP and there is no marked path leading there (however, in the past, there was, and today, some tourists do not respect the rules and laws and they visit the site).
	Safety: Are there any phenomena that can endanger visitor?	The site is not safe due to the movement of boulders on the block accumulations, the visit of the pseudokarst caves requires specific equipment and experience.
	Tourist infrastructure: Are there some tourist facilities nearby? (transport – parking place, catering, shelters, marked paths)	A marked path leads nearby, the access of cars is restricted, in Vranov or Lesná (cca 4 km), a complete tourist infrastructure can be found.
Added value	**Ecological aspect:** Are there some particular species/ecosystems?	*Cimicifuga europaea* (critically threatened plant) *Discus ruderatus* (mollusque; relic from the last glacial) *Microchiroptera* (bats) – 19 out of a total of 26 species living in the Czech Republic were observed, it is considered one of the largest gathering place. *Araneae* (spiders) – 21 relic species Specific case of vegetative reproduction of spruce (*Picea abies*) Generally, the biodiversity (resp. species diversity) is very high thanks to the diversity of the geo(morpho)logical conditions and specific microclimatic conditions: 159 species of lichens, 133 species of moss, 28 species of liverworts, 502 species of vascular plants, 58 species of spiders and 39 species of mammals.
	Cultural aspect: How many different cultural aspects can be recognized? (e.g. historical aspect – historical importance, historical object related to the site; archeological aspect – archaeological findings; artistic aspect – site as an inspiration for artists; geomythological aspect – myths about the site; other aspects)	Historical importance: traditional and favourite tourist destination of the area, old stone path, obelisque on the top of the ridge (raised in the 19th century), important landmark Artistic aspect: the site is displayed on several drawings of J. Doré (19th century) Geomythological aspect: several legends about the caves and obelisque.
Conservation value	**Existing legislative protection:** Is the site legally protected? (declared as monument, reservation)	The site is situated in the first zone of National Park, the management is based on the Care Plan.
	Current threats: Are there any threats that can contribute to the damage of the site? (both natural (e.g. vegetation growth, invasion species, landslides) and anthropogenic (e.g. vandalism, inapropriate conduct of tourists, pollution))	Natural threats: practically, there are no natural threats that could endanger the site or decrease its value (especially the diversity of landforms and processes) Anthropogenic threats: tourists that illegally visit the site – the specific microclimate can be modified, the intensity of some natural processes can be increased (movements of the boulders), the specific ecosystem can be endangered.

To conclude the most important points of the assessment, the SWOT analysis is done (see Table 2).

Tab. 2: The SWOT analysis of the Ice Caves

Strenghts:	Weaknesses:
- high diversity of the landforms and processes, the uniqueness of some of them - strong scientific interest on the site, high degree of exploration, continuing monitoring of the site - high ecological value of the site - the highest level of legal protection – the position of the site in the first zone of NP	- fragility of ecosystems, microclimate and landforms - disturbing of the site by tourists
Opportunities:	Threats:
- the continuous exploration can bring the answer to the question of origin of this unique site and surrounding area - high potential for environmental education (ecology, biology, geology, geomorphology) – the question is if it should be used and for whom (laic public? students?)	- continuing disturbances caused by tourists - the lack of finances on further monitoring and research

Methods and results

For the counting of the visits on the Ice Caves, the data scanned by pyroelectric sensor which does not take into accoutn the disrection of the movement, was used. The data were statistically processed and evaluated in the MS Excel.

Overall statistics shows the collected year-round monitoring data (March 2017 to February 2018). Average daily attendance is 2.04 people per day (1.22 on working days and 3.84 on non-working days), see Figure 1.

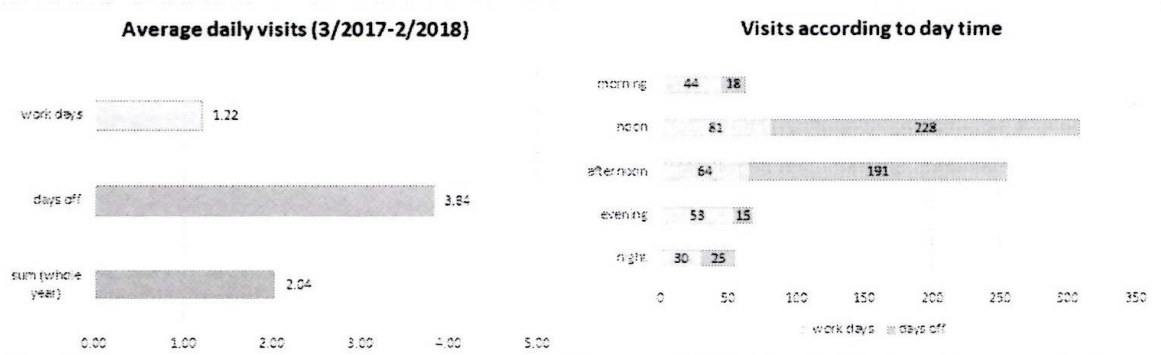

Fig. 1: Average daily attendance on Ice Caves (3/2017 – 2/2018) & Figure 2: The number of passages regarding to the day time

Concerning the passages regarding to the day time, in the non-working days (weekends and public holidays), the passages around noon and afternoon prevail (between 10 am and 5 pm). During week days (working days), the visits are spread evenly throughout the day, the highest intensity is around noon, followed by afternoon and evening passages, see Figure 2.

The maximum absolute number of passes was recorded in May 2017, also after the conversion on relative passages per day, May remained the most visited month with 4 passes per day, see Figure 3.

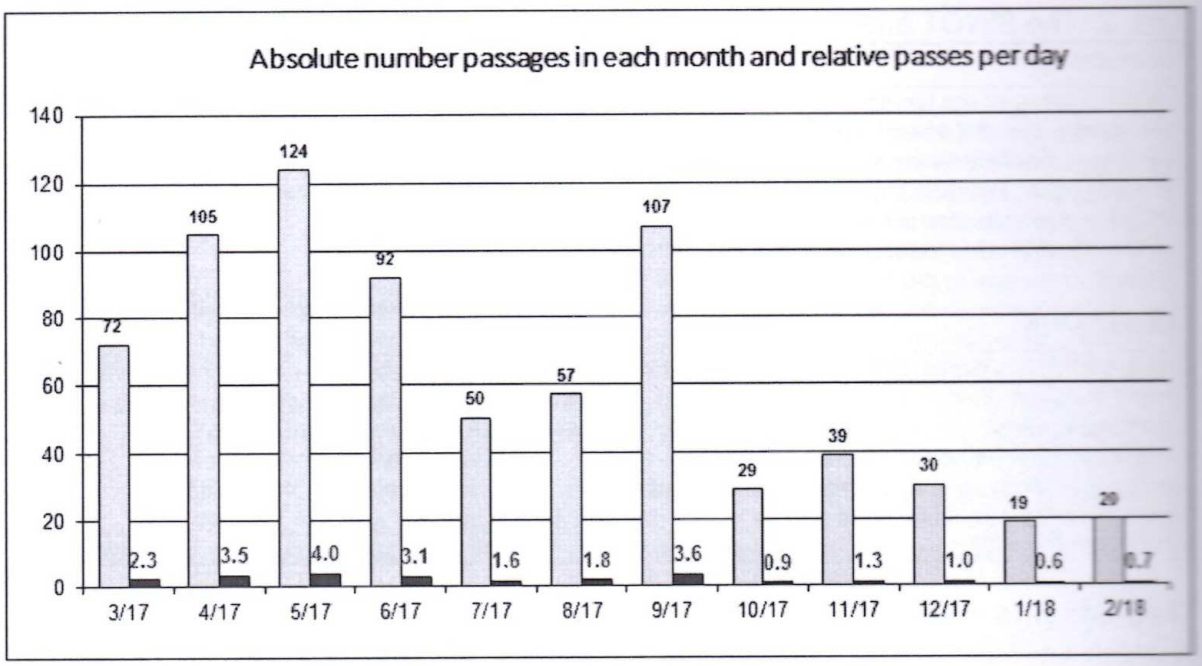

Fig. 2: The passages in particular months

Discussion and conclusions

Based on the assessment, SWOT analysis and data/statistics of the visits, some proposals for the future use of the site can be presented:

- leave the site unaccessible because of its uniqueness, inner diversity and fragility and the possible risks
- increase the number of controls of nature guardians on the site, especially on the weekends and holidays during the most exposed times of passages (according to the results of the monitoring)
- in case of lack of the nature guardians, discuss the possibility of recruitment of voluntary nature guardians
- discuss the possible use of the site for education (organized tours for small groups, environmental education for students), use of the digitalised model of the pseudokarst caves for the illustration, however, it can attract people's attention to the site and illegal visits can continue
- inform the public about the gravitational movements on the block accumulation in general and consequently, about the risks and dangers of the non-controlled movement of the tourists on the block accumulations
- discuss the possibility of opening new marked trails leading to similar block accumulations or frost cliffs (as an alternative to the tempting Ice Caves), e.g. on the opposite slope (Braitava) – to use already existing paths and ways – from the foot bridge at Zadní hamry over Braitava and Braitavský letohrádek back to the Dyje Valley
- continuous further research of the site

These points are just in the state of proposals, so the further discussion, detailed analysis and research is needed. Based on that, the management of this unique site can be efficient and succesfull.

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Souhrn
Využití nástrojů SWOT analýzy a monitorování počtu nelegálních návštěvníků přináší cenné informace pro management ochrany přírody. V případě Správy NP Podyjí bude hodnocení využito pro přípravu popularizačních materiálů s cílem zvýšit povědomí o jedinečnosti a křehkosti lokality Ledové sluje. Podle výsledků sčítání vstupů do zakázané zóny bude upraven režimu kontrol prováděných strážci přírody. Po dlouhodobějším monitorování pak bude možné odpovědět na otázku, zda se zveřejňování informací o slujích projevu negativně ve zvýšené návštěvnosti, nebo pozitivně poklesem vstupů díky rozšíření povědomí o riziku poškození lokality a nebezpečí vlastního úrazu.

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