

Abiotic ecosystem services: an effective tool for geoconservation

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INTRODUCTION

The concept of **ecosystem services** developed in the second half of the 20th century, but the **Millennium Ecosystem Assessment** was crucial for its acceptance. This assessment identified the services that ecosystems provide to society, but **geodiversity (as an indispensable component of ecosystems) was somewhat underestimated**. At present, geodiversity is intensively used by human society and it provides numerous services including cultural ones—geodiversity can be seen as a **resource for tourism, recreation, as a part of natural heritage, and it can also satisfy matters of spiritual importance**. This poster presents partial results of the practical application of ecosystem services concept on particular site of geoheritage importance—**Stránská skála in Brno** (Czech Republic). The identification, description and assessment of cultural ecosystem services which are provided by geodiversity confirms the high cultural and geoheritage value of this site. Based on this, practical applications such as **updating Care plan or landscape planning can be designed**.

METHODS

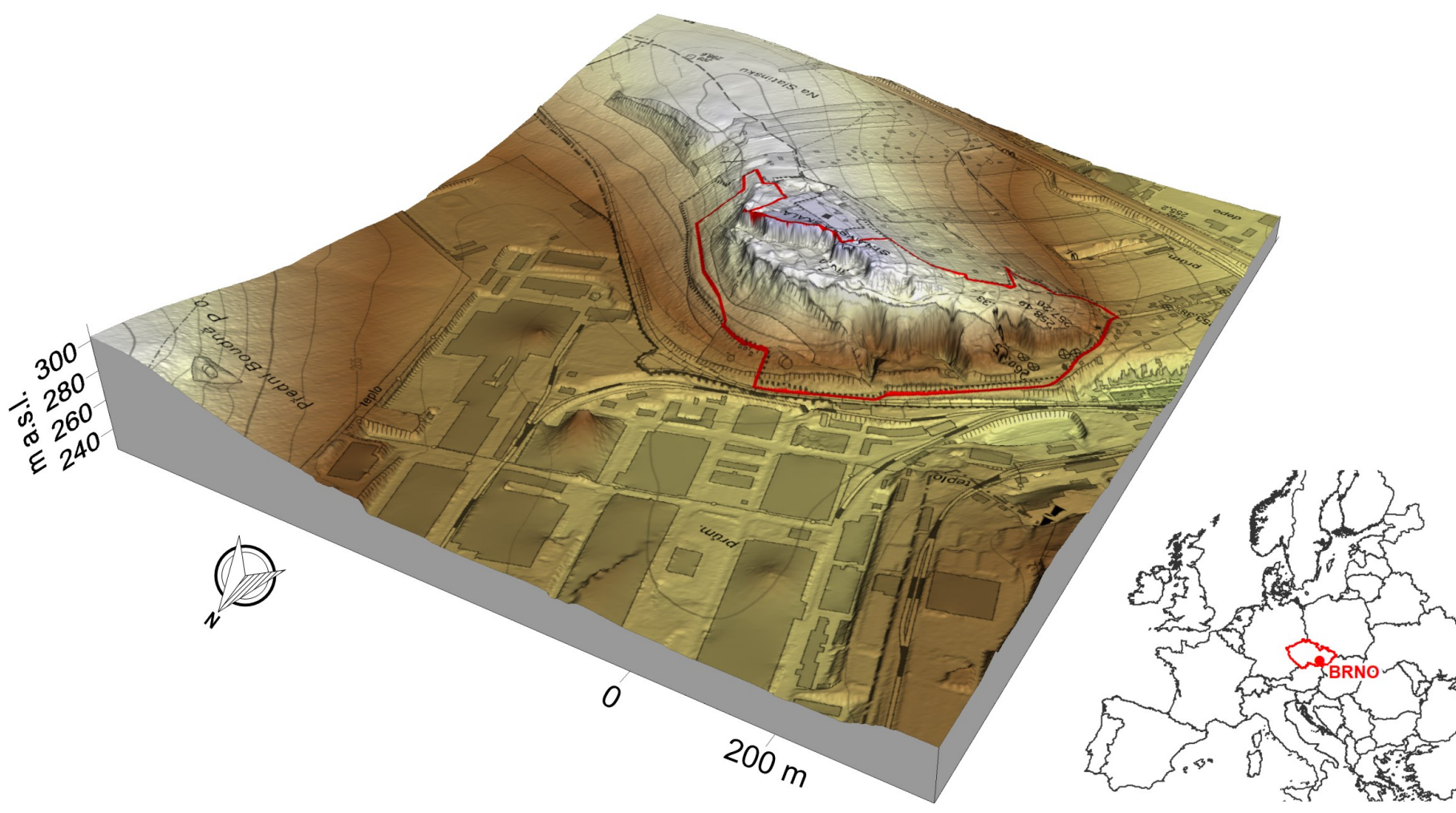
- Identification of ecosystems with important abiotic components
- Description and assessment of cultural ecosystem services - based on the detailed literature review and fieldwork
- Using the approach elaborated and presented by **Gray (2013) and Gordon (2018)** - Table 1
- *Note: Abiotic ES were also included in the CICES as a “supplement” or “extension”, so there is a question of whether abiotic ES are counted as a “full-value” component of the ES concept within this approach (Gray 2018). There are five abiotic cultural services (or subcategories) defined which try to cover all the variability of services which can be provided by geodiversity; nevertheless, some aspects are rather problematic and the explication remains rather ambiguous. That is why the abovementioned concept proposed was used for the identification of cultural ecosystem services of the presented study area.*

Table 1: CES of geodiversity

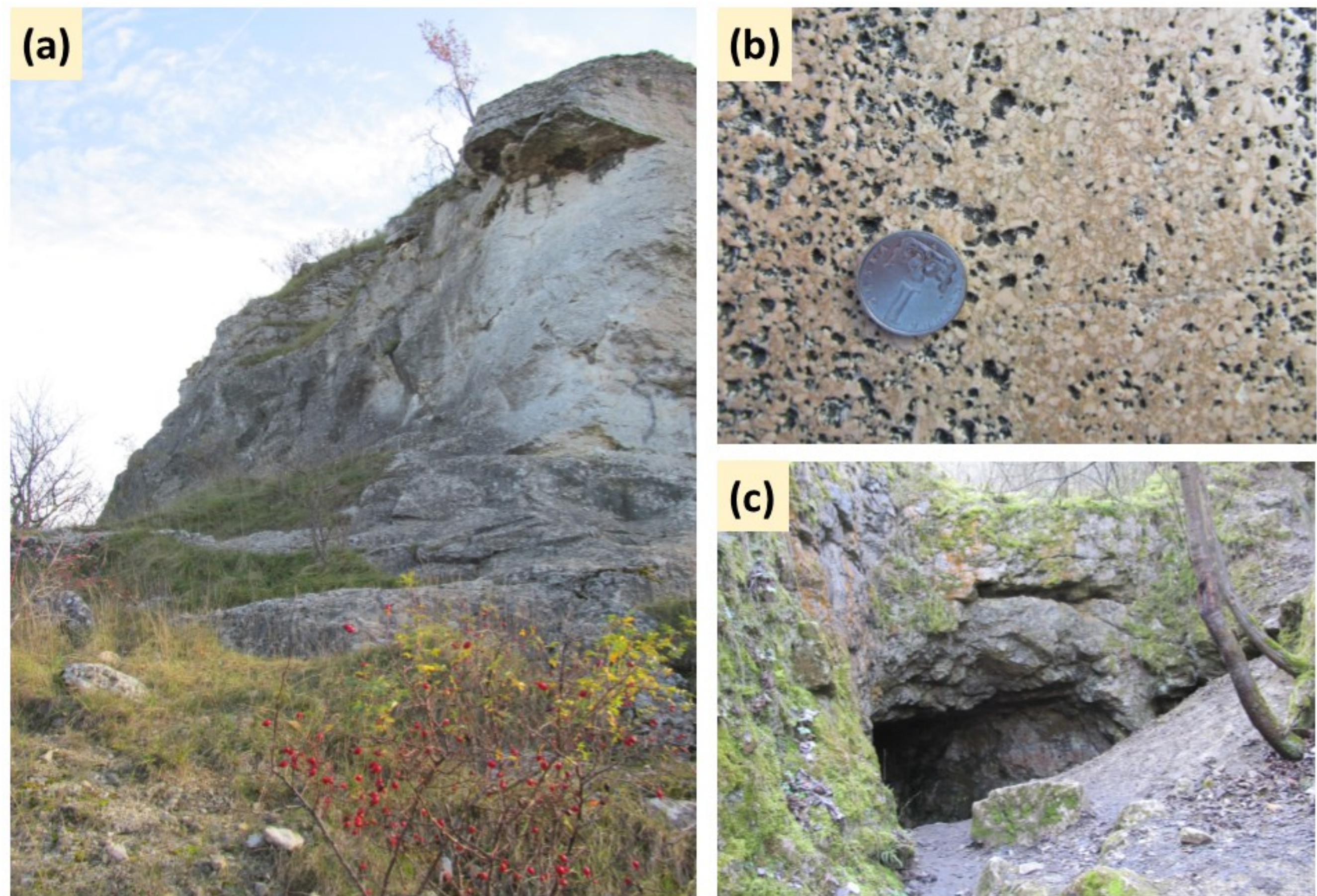
Service	Examples
Environmental quality and aesthetics	local landscape character; therapeutic landscapes for well-being
Geotourism, recreation, leisure	spectacular mountain views; outdoor recreation; rock climbing
Spiritual and religious meanings	folklore; sacred sites; legends; sense of place
Artistic inspiration	literature; music; poetry; painting
Other cultural values	archaeological and historical; values relevant to local history
Social development	local geological societies; volunteering; field trips
Earth history	evolution of life; origin of landforms; paleoenvironments
History of research	early identification of unconformities; fossils
Environmental monitoring	climate research; sea-level change; geoforensics
Education and employment	sites for field trips and professional training; geoparks
Heritage values	a site or landscape feature as a part of natural heritage

STUDY AREA AND RESULTS

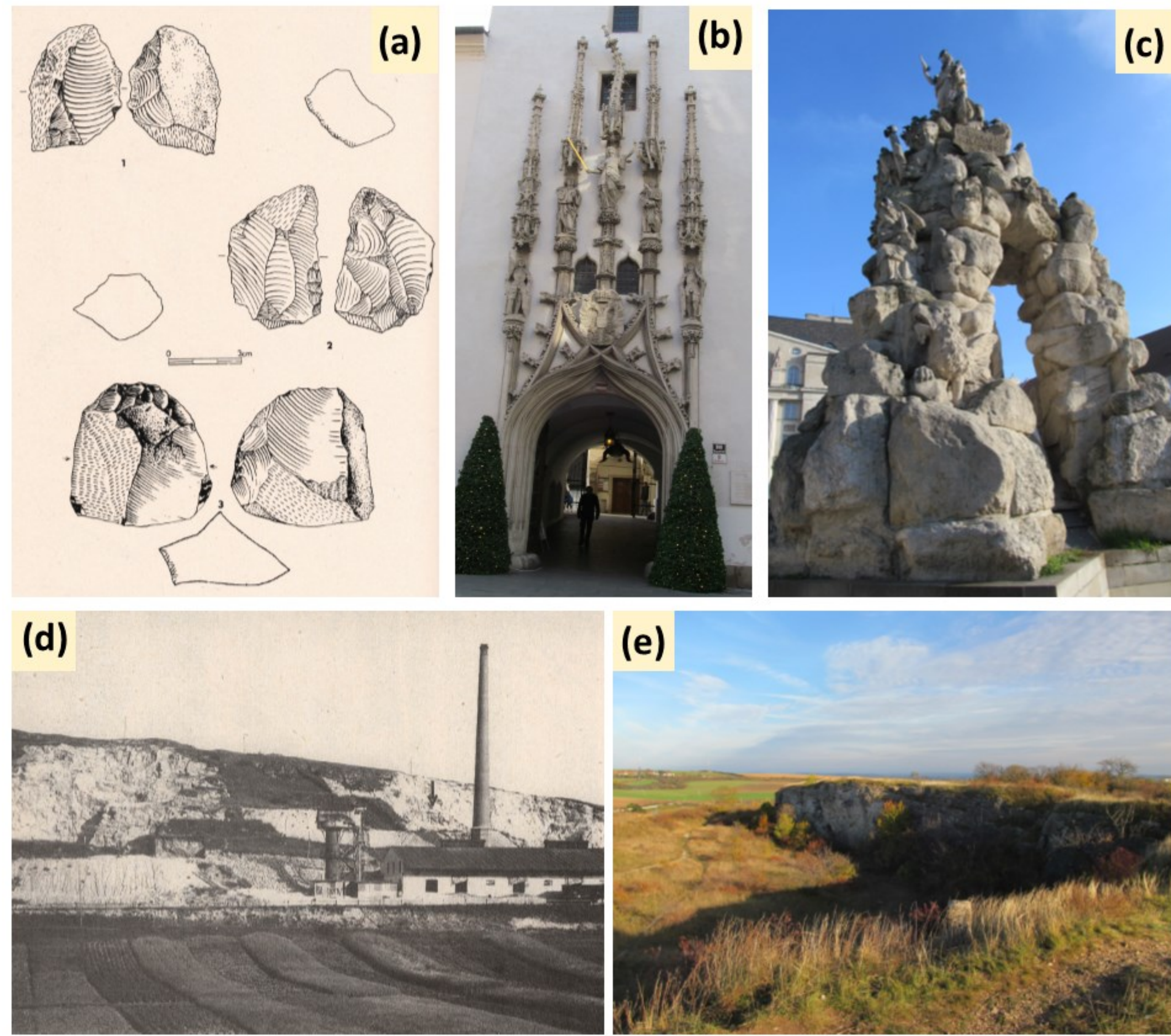
- Brno, South Moravian Region, Czech Republic
- Denudation relic of Jurassic limestones affected by karstification, paleontologically important
- Geoheritage value recognized (site protected as National Natural Monument)
- Ecosystems: **limestone outcrops, underground spaces, sedimentary areas**



Type of the value/ service/benefit	Limestone outcrops and quarries	Underground spaces	Sedimentary areas
Environmental quality and aesthetic values	The outcrops contribute to the typical panorama of Brno city, it increases the environmental quality of the urban area. From a certain point of view, the outcrops and quarry walls can be considered dramatic and they are aesthetical valuable thanks to its structuration. The site forms an important part of the city's prehistory and history.	Officially, the underground spaces are not accessible (except speleologists and with permit), so the assessment of this value was not possible. The mystic underground partly contributes to the specific genius loci.	Forestless areas are covered mostly by steppe and bush vegetation and they complete overall pleasant look of the site and they contribute to structuration of the space (the study area is a mosaic of outcrops, grasslands, bush and forests). The site forms an important part of the city's prehistory and history.
Geotourism, recreation, leisure	Popular for local people and visitors, climbing, fossil collecting, recreation. Viewpoint to the surroundings.	Practically accessible only for speleologists. Unofficially explored by people interested in underground spaces and related phenomena.	Popular for local people and visitors, walking, recreation. Viewpoint to the surroundings.
Spiritual and religious meanings	For local people, it is a site with a strong sense of place.	The caves (both natural and artificial) are a subject of several modern legends.	For local people, it is a site with a strong sense of place.
Artistic inspiration	The site with its outcrops was a subject of several drawings and old photographs. It appears in several poems.	Not found.	The site with its outcrops was a subject of several drawings and old photographs. It appears in several poems.
Other cultural values	The stone which was extracted here in the Middle Age was used on numerous buildings in Brno and became the iconic rock for Brno. Archaeological findings (e.g. flint processing)	The anthropogenic landforms (tunnels of the underground factory) have strong links to the industrial history of the city. The bunker of the civil defence has an importance to military history.	Archaeological findings (first evidence of fire use by Homo Erectus, evidences from Paleolithic, Neolithic, Eneolithic, traces of opportunity horse hunting)
Social development	The site is favourite within NGOs that organize the educational programmes focused on nature protection.	Officially not accessible, so the social aspects cannot be described and assessed.	The site is favourite within NGOs that organize the educational programs focused on nature protection.
Earth history	Important palaeontological site (Jurassic fossils), palaeogeographical studies (paleovalley of Svitava River), remains of the river terraces.	Analysis of cave sediments, Quaternary deposits in the caves that consist of bones and teeth of Quaternary (Pleistocene) animals.	An important site for palaeogeographic reconstructions, findings of animal bones in Quaternary sediments deposited on the slopes and depressions.
History of research	One of the best-explored sites in the Moravian region, classical site of Moravian paleontology, numerous important findings in the past (e.g. shark teeth)	Contribution to the early findings of the Moravian Paleontology and Quaternary geology, important place for exploring cave systems at Jurassic limestones.	One of the best-explored sites in the Moravian region, important for Pleistocene studies since the half of 20th century.
Heritage values	The locality as a whole (including all the ecosystems) is a part of geoheritage of Southern Moravia. Currently, it is protected within a category of National Natural Monument.		



Natural features of Stránská skála: (a) Upper Jurassic limestones displayed in an old quarry; (b) A detail of Crinoidea limestone with debris of Jurassic (Oxfordian) fossils; (c) Underground spaces: most of the caves are modified by human activity



Cultural aspects of Stránská skála: (a) Stone artifacts from the Cromerian age – the testimony of Neolithic settlements; (b) Example of the use of the Crinoidea limestone—Old Town Hall; (c) Use of limestone on Parnas Fountain at Zelný Trh Market; (d) Stránská skála at the beginning of 20th Century when individual quarries were still in operation; (e) A mosaic of rock outcrops, grasslands and bushes contributes to the aesthetical qualities of the site

CONCLUSIONS

The cultural functions and services of geodiversity are important for their **overlaps and mutual relationships with natural and cultural heritage**, as evidenced by the example of Stránská skála: the site represents a significant part of natural heritage, it provides a background for recreation and tourism, it has strong links to archaeological issues and the built heritage of Brno City, and it is an important site in terms of scientific knowledge (understanding of environmental history). **A comprehensive description of cultural abiotic ecosystem services enables these linkages to be explored and their significance to be highlighted.**

References:

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