

Possibilities of using of abandoned mining sites in tourism

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ABSTRACT

Abandoned quarries contribute to the development and biodiversity conservation. Actually, it extends our knowledge of the abiotic and biotic nature. It is therefore appropriate that these sites are included in the scheduling of tourism products, focusing both on nature and technical monuments. They can be part of special tourism products oriented to a certain knowledge of botanical, zoological, geomorphological, geological and mineralogical-petrographic relationships. In many cases, the abandoned mining sites pose a very interesting position with a specific and unique flora and fauna, paleontological findings, unique features, which anybody can observe and study. In addition, they provide evidence of mining and finishing technologies. It is inevitable that any use of abandoned mining sites should respect the applicable laws that govern these places and activities run there. In particular, the respect for property rights, respect for obligations arising from the Mining Act, restrictions on laws affecting conservation, security of persons and property must be followed.

Key words: Use of abandoned mining sites in tourism, terms of use, specialized tourism

INTRODUCTION

Anthropogenic activities since the beginning of the development of agriculture eight thousand years ago gradually transform the nature of the cultural landscape. Some activities increase and enhance geodiversity (Ložek, 2005). Some interventions such as prehistoric mounds and moats of medieval castles or strongholds provide suitable habitat range of plants and animals (Ložek and Skalický, 1983). Geodiversity was increased earlier in small-scale agricultural economy, while the subsequent large holdings reduced it, respectively negatively influenced it.

The cultural landscape in the negative and positive effect for centuries influenced the construction and mining activities, particularly opencast mining, which affects all elements of the landscape and environment. It leads to the range of many

diverse areas, from small to large ones. These include small shelf and pit quarries and heaps, great multi-shelf quarries and large dumps hundreds of hectares in area. In areas short on rocky localities there has been positive impact of surface mining (mainly oriented on construction materials), which creates a special habitat suitable for a wide variety of plant and animal species. A similar role of favourable habitat may be also played by deep cuts or embankments of highways and other roads. An indispensable fact is that the vast unreclaimed mining areas have very low content of nitrogen and phosphorus, the main elements responsible for the eutrophication of the flat landscape (Heneberg, 2009). Those areas are a potential refuge for species sensitive to excessive amounts of the elements as their natural habitats are vanishing. In Krušné Hory there are basins with salt loving

species which became haven pools and wet places rich in salts, flushed from the coal shale removed from dumps.

Far more attention than ever should be given to geodiversity in the large environmental programmes and special protection of nature acts. In particular, large-scale surface mining, which affects all components and functions of the landscape, contributes to the dynamic changes of the landscape in the following items (Štýs 2001):

- thanks to heaps (external dumps) and residual quarries there is more geomorphologic differentiation of landscape;
- mining, transporting and storing removed rocks formed distinct petrographic and stratigraphic properties in the territory;
- hydrosphere is deformed significantly in the subsystems of groundwater, surface water infiltration and runoff conditions, evaporation and precipitation;
- mining throughout the area in question is the degradation and destruction pedosphere;
- large surface of mining affects large areas without vegetation, the microclimatic and mesoclimatic characteristics and air quality;
- throughout the mining area and in the majority of surrounding area there is significantly affected the biota in the subsystems of phytocoenoses, zoocoenoses and microbial coenoses.

Quarries are thus becoming an important landscape elements, which represent both environmental and aesthetic enrichment of the country. Landscape, ecological, botanical, geomorphological and other valuable sites which are now abandoned quarries can be by the Act No. 114/1992 Coll. (Law on the Protection of Nature and Landscape) declared specially protected areas (Smolová, 2006). Some quarries are important paleontological sites. Examples are the NPP (national natural monument) Růžičkův lom, NPP Státní lom in area Čelechovice in Haná, with a large number

of palaeozoic fossils in devonian marine limestones. The world's unique geological profiles of the palaeozoic were uncovered in NPP Požáry (Praha - Řeporyje, PP (natural monument) Opatřilka–Červený lom or in NPP Dalejský profil (Dalejské údolí, Praha). Mesozoic sediments were discovered in NPP Kaňk in Kutná Hora or PP Lom u Radimi, which maintain a unique document of upper cretaceous coastline. The PP Mořská transgrese (Marine transgression) even maintained a unique document covering land and sea to save marine sediments of terrestrial sediments (Řehounek et al., 2010). Similar examples are included in the entire series.

Most deposits of solid building materials are mined by shelf quarries in sloping terrain, or by pit quarries. Mining experience has shown most nature-friendly land reclamation - denaturalization, ie. back to nature. The best solution is a natural or little regulated natural succession. For large quarries such autoregenerated processes it is not enough. There are rules that lead to the rugged scenery, possibly supplemented by surface water or wetland. Where appropriate, it is preferred to retain exploitation benches of quarry (after necessary treatment in terms of stability) in their original state and thus maintain the demonstration of geological structures. Revitalization leads to formation of varied mosaics of new xerothermal or wetland biotops, in which frequently are protected, endangered or exotic species of flora and fauna. Diversity of birds and amphibian species corresponds to variety of biotops.

It is worth noting that some of the shelf and pit quarries pose unique technical objects, which should be preserved as technical monuments. Typical examples are pit mines in the Central bohemian karts (Amerika, Mořina) or the granite quarries near Telč in the Czech-Moravian Highlands, and many shelf quarries with interesting geology profiles (eg. basalt rock quarry Panská skála in the district Česká Lípa, Vrkoč near Ústí nad Labem and quarries in Nížký Jeseník).

Important landscape element is the water surface, which arise as a result of mining activities in some pit quarries, sand pits, gravel pits or clay pits. It is most often a case of extraction of gravel from the river flat where flooding mining area is already in the actual mining and extraction is then carried out from the bottom of surface water (lakes of anthropogenic origin).

In addition to the concave shapes that arise due to raw materials extracting, convex form of relief formed in the form of storage dumps. Their particularity is that they are entirely new landscape feature, which was the accumulation of tailings from the extraction and processing of raw materials. Their use may be the end of mining activities and significantly different.

We must not forget that the abandoned quarries with uncovered walls are of great scientific and educational significance. Hence many sites are protected as nature reserves and monuments. Some sites are or may be used as very interesting tourist attractions.

SPECIALIZED TOURISM

As mentioned above, it would contribute to the development of abandoned mining and biodiversity conservation, respectively extend our knowledge of living and lifeless nature. For this reason, it is appropriate that these sites are put on the agenda of the tourism product, focusing both on the nature and the technical sites (such as real examples of different ways of mining). In addition, they may be part of specialized tourist products based on knowledge of botanical, zoological, geomorphologic, geological and mineralogical and petrographic relations. In many cases, abandoned mining locality is a very interesting habitat with specific and unique flora and fauna ("biological islands"), paleontological findings, unique morphogenetic features etc., which elsewhere cannot be observed and studied. Examples of such programs,

geological applications are processed by Palacky University staff in Olomouc (Dolníček, 2008).

Another possible use of abandoned mines is their integration into the landscape by landscape parks, botanical gardens or arboretums (Smolová, 2006). As an example, there has already been made use of a limestone quarry in Štramberk, where a botanical garden and arboretum were set up in 1996 in a former limestone quarry and the surrounding area to an area less than 10 hectares. Apart from the quarry area it includes the adjacent pasture and forest debris in the vicinity and at present there is an arboretum. The trail, which is divided into three basic parts (geological, botanical and zoological) is the constituent of garden. Another interesting feature of this site are Štramberk block limestones exposed by mining that are rich in various types of fossilized organisms (total was reported about 600 kinds of fossil animals). A similar example is at the arboretum in Paseka near Šternberk, based on a reclaimed landfill in an old quarry.

We cannot forget the recreational use of abandoned mining sites as relaxing and quiet location, which is widespread for decades. Just recall the limestone quarries in the Central Bohemian karts, or vicinity of Most with a number of recreational uses (parks, natural swimming pool, racing circuit, horse-racetrack, airport etc.), unique landscape solutions of area limestone quarry Dálky at Čebín, the use of conical heap Ema of former mine Bezruč in Ostrava, etc.

Abandoned mining sites (surface mines, waste dumps, underground mine workings) can be applied as an tourist attraction, from recreational orientation to the various sports activities up to extreme ones, or for therapeutic purposes like some of the caves.

Summing up the possibility of using abandoned mining sites in tourism, we can allocate the following activities:

1. recreational use as a natural rest and relaxation area;

2. use of artificially induced water as a natural swimming areas;
3. sporting use of artificial reservoirs;
4. sporting use of quarries for organizing motorsports, cycling and running events;
5. use of quarry walls for rock climbing instruction and operation;
6. nature science excursions (geological, botanical, zoological);
7. tour focused on surface and underground mining technology and mineral processing;
8. exploitation of underground workings for therapeutic purposes in specialized programmes.

General procedure for the selection and use of abandoned mining sites shows some common features that can describe the scheme as presented in Figure 1. It is understandable that the contents of each step will vary both according to the anticipated using of site under consideration, and the specific local conditions.

It goes without saying that any use of abandoned mining sites must comply with applicable laws, which are subject to the objects and the operations run. In particular, the respect for property rights, enforcement of obligations under the Mining Act, restrictions on the laws concerning environmental protection, security of persons and property, etc.

EXAMPLES OF THE USE OF ABANDONED MINING SITES IN PŘEROV REGION AND EVALUATION CRITERIA

The use of surface exploitation sites as natural swimming pools is well known and widespread throughout the world. In Přerov region there are several localities used for recreational purposes, such as Olšovec, Výkleky, Osecký Jadran or Tovačov lakes. Assessing the appropriateness of the use of abandoned and flooded pit quarries and gravel pits in the river basins for recreational activities as a general scheme (Fig.1) based on a valuation range of fundamental and technical criteria, according to the criteria listed in Table 1.

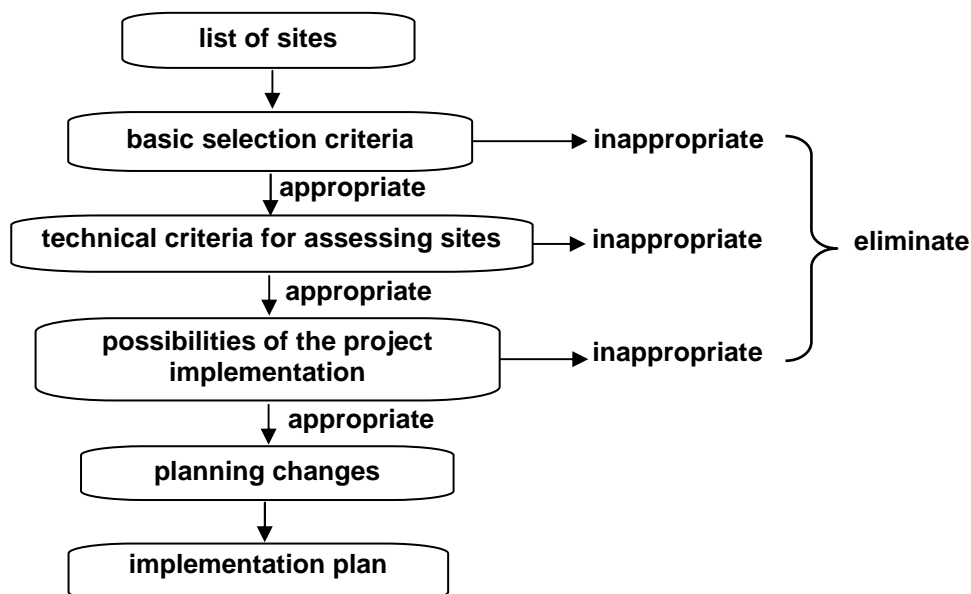


Fig. 1 General schema of selecting sites for use in tourism

Tab. 1 Criteria for evaluation of artificial lakes for recreation and sports activities

FACTOR	SCORE	EVALUATION ASPECT
distance from large settlement	3	< 10 km
	2	10 – 20 km
	1	> 20 km
accessibility	3	paved roads
	2	unpaved roads
	1	on foot
ownership of land	3	public
	1	private
land value	3	reservation or heritage
	2	large
	1	small
water area	3	large
	2	medium
	1	small
depth	3	large
	2	medium
	1	small
bottom type	3	rocky
	2	gravelly-sandy
	1	muddy
character of banks	3	flat, sandy or grassy
	2	mild, grassy and wooded
	1	steep, rocky
Visibility in the water	3	very good
	2	average
	1	small
vegetation in water	3	none
	2	medium
	1	rich
Attractions in water	3	frequent
	1	no

If the total rating 27-33 points it is very suitable, for 19 to 26 points it is suitable and for 11 to 18 points it refers to the wrong object. A similar approach shows Rybár (2010).

Large water surface of artificial lakes were created after gravel extraction in the sediments of the Morava and Bečva rivers can be used for a variety of sporting activities. Like the Osecký Jadran it can be considered for water sports as windsurfing, water skiing, rowing, competitive swimming (especially remote) and diving.

The account would be worth introducing courses in these sports as a special tourism product. This includes also events such as fishing competitions.

The flooded quarries are convenient locations for scuba diving. Examples include localities Olšovec and Výkleky. It is clear that the implementation of all activities and outlined their successful integration into the supply of tourism products would be necessary to build the needed facilities and equipment.

In the case of dry shelf and quarry pits

can be considered - assuming of course appropriate to their morphology - to use for activities like autocross, motocross, cycle-cross, etc., as is the case, as in the famous race Přerovská rokle. The implementation of such activities would require compliance with laws relating to environmental protection and safety. Examples of such usage might be a former limestone quarry Žernava in Přerov outskirts which hosts cycling races and training.

Adventure tourism oriented on rock climbing at appropriate abandoned quarries is introduced to the world (eg Italy) and here (Štramberk, Central Bohemian and Moravian Karst, etc.). In detail this issue was analyzed by Amanti et al. (1996). In central Italy, a number of abandoned mines assessed for suitability for the construction of training centres, rock climbing. The analysis focused on both the safety conditions and environmental renewal within the meaning of harmony with the landscape and the economic issues of funding and operations. The procedure describes the analysis diagram in Fig.2.

The proposed procedure for selecting suitable sites can be easily applied to quarry objects in Přerov region. When evaluating sites, we can follow the criteria listed in Table 2. So you can receive recognition site for the planned use of an individual rock-climbing, respectively possible to organize special courses in adventure tourism products. The method of using abandoned quarries requires very serious consideration, in particular in terms of safety. It will be observed as well as our existing foreign standards related to building a climbing wall.

The final assessment may be similar to the assessment of water bodies. If a total evaluation will be of 28-36 points, the object is very appropriate, at 20 to 28 points it is suitable, for 12 to 19 points the object is unsuitable.

In the last period generally worldwide interest rises in living and non-living nature. In addition to the existing protected objects like national parks, protected

Tab. 2 Criteria for assessment of wall fractures according Amanti et al. (1996)

FACTOR	SCORE	EVALUATION ASPECT
rock wall	3	artificial
	2	mixed
	1	natural
distance from large settlement	3	< 10 km
	2	10 – 20 km
	1	> 20 km
accessibility	3	paved roads
	2	unpaved roads
	1	on foot
ownership of land	3	public
	2	groups
	1	private
land value	3	reservation or heritage
	2	large
	1	small
accessible rock climbing area	3	large climbing area
	2	medium climbing area
	1	small climbing area
litho logy	3	hard rock
	2	alternating rocks
	1	soft rock, soil
behaviour of rock masses	3	very good, good
	2	satisfactory
	1	bad, very bad
stability of rock masses	3	stable
	2	minor adjustments needed
	1	significant adjustment needed
protective climbing points	3	1 point to 3 meters in good conditions
	2	1 point to 2 m in good conditions
	1	circuit-breaker points in poor conditions
unstable rock blocks	3	regularly
	2	irregular
	1	are not
site reclamation	3	good
	2	average
	1	poor

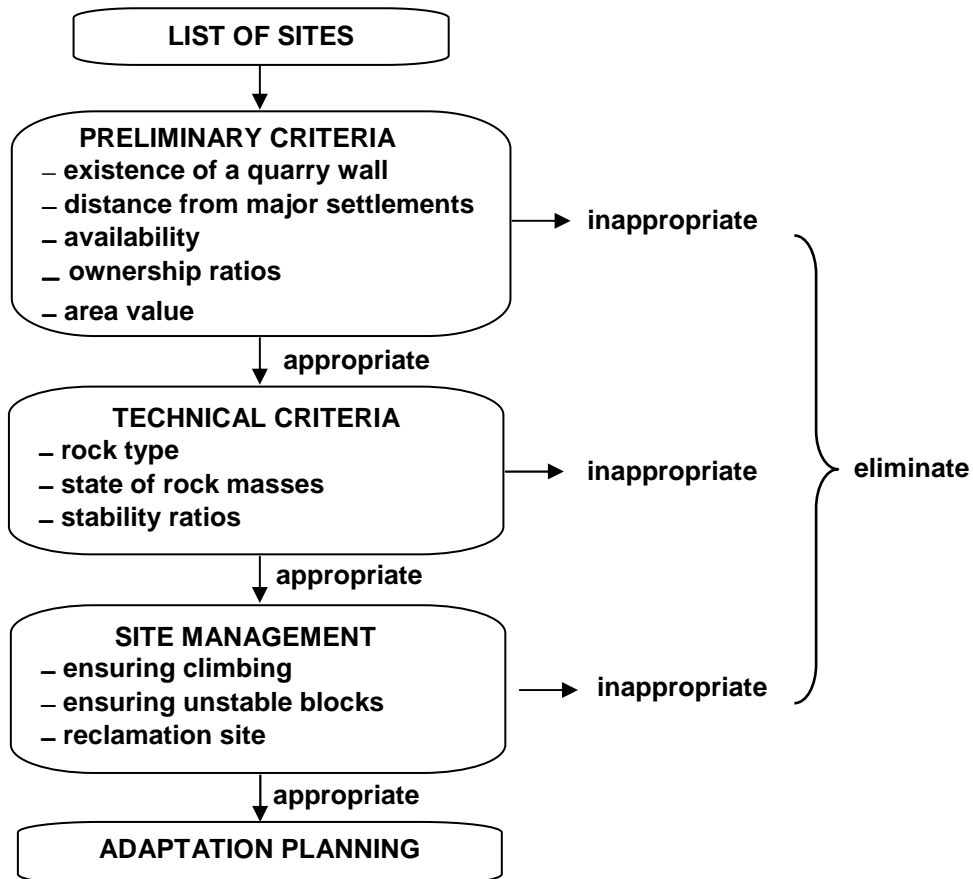


Fig. 2 Scheme of the methodological approach (Amanti et al. 1996, modified)

landscape areas, nature reserves etc., respectively will be added to existing or planned program of specialized tourism products represent interesting objects abandoned surface and underground mines and dumps. For illustration, examples of such objects are presented:

Very interesting geological objects in the Přerov region seem to be travertine mounds that are worth consideration in the preparation of tourism products. They are associated with the occurrence of Olomouc-Přerov fault. Their origin was determined by the presence of devonian limestones in connection with young tectonic activities, which is accompanied by sprains of carbonate springs and gaseous carbon dioxide. Travertine have been mined by small quarries in Kokory and Tučín in Přerov surroundings. It should also be noted that the Přerov castle, respectively the original fort was built on just such a pile of

travertine.

Attractive area for specialized tourism is a Hranice kart that lies on both banks of the river Bečva. At its inception in devon limestones there were mainly tectonic disturbances, precipitation and thermal water saturated with carbon dioxide. Hranice Karts has two remarkable natural creations: Zbrašov aragonite caves formed by thermal water karsting and Hranice light hole resulting from the collapse of the whole system of caves. Hranice light hole is the deepest abyss in the Czech Republic, but the final depth is not known. The depth of the abyss to the lake is 69.5 m. On the south side of town there are NPP Hůrka, Velká Kobylanka, Malá Kobylanka and Nad Kostelíčkem, that can be integrated into the tourism product oriented on nature.

The district frequently gravel mining can be reclaimed or left in their original conditions. This will allow the completion

of mining in certain areas, creating long time-scale alternative ecologically valuable habitats for many species of plants and animals living in an intensely cultivated agricultural land lost its original wetland and aquatic habitats. As such, it will be an interesting site dedicated to tourism. An example is the area of Tovačov used for ornithological activities.

The hallmark of social development in recent decades is not only a growing interest in nature, but also the history of mankind, cultural and technical monuments and their protection. Throughout the world, interest in mining and related processing, metallurgical and engineering plants significantly increases. Mining objects represented technically challenging works in all stages of human history. Therefore they attract the attention of professionals and the general public. Caring for the mining sites is of great importance to public education. The benefit is also used for tourism oriented products on search and rescue historical works, respectively for the education of archaeologists specialized in the field. Nor should we forget the economic benefits, especially on a local level.

The attractiveness of Hranice area is increased by the limestone quarries and cement works; as interesting objects illustrating the extraction and processing technology of cement raw materials, respectively after abandonment usable as objects in different ways, ranging from montan tourism through natural sciences tourism or for various sports activities.

Accessing these objects requires compliance with the required security measures. These are contained in the Mining Act, or issued by the State Mining Administration of specific legislation. Their performance is ensured by the owner or operator of the mining and supervised by staff supervising authorities.

The use of underground space - caves and underground mines - to implement treatments speleotherapy, which is based on the use of the microclimate of the

underground environment is becoming increasingly widespread. An example is their application in Mladeč caves or in mines of Zlaté Hory.

CONCLUSION

There is no doubt that the abandoned mining sites and waste dumps can become important objects of tourism and recreation (swimming, water sports, nature trails, botanical gardens and arboretums) and specially protected sites, which inter alia are of scientific and educational significance. When considering the inclusion of these objects into tourism programs it will need to find a compromise between the interests of tourists, miners and conservationists, that in some cases will not be easy. Complications can arise if the object is established mining area for privately owned buildings or buildings subject to a special regime of nature conservation, etc.

In the case of exploited and protected objects a possible solution seems to be to build trails, specialized hiking trails that provide information to visitors (e.g., information panels, printed materials or the interpretation of professional staff). These pathways can have different interests, such as natural science, geology, mining and conservation. In the case of large active mining sites it would be best to build an entrepreneurial information centre, as it is common in many countries. In this way, it would be possible to transmit information to visitors, and to effect the safety and conservation aspects. A significant aspect is that these activities can be a good advertisement for mining and promotion for a company.

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