Post-Mining Land Use for the Function of Geotourism and Spa

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Abstract. The issue of land reclamation and post-mining land use appears to be extremely topical. In addition to traditional methods of excavation revitalization, such as directions: forest, water and communal, there is a very attractive solution which is an adaptation of these areas for geotouristic- or other functions designed to accommodate people, for example spa function. In addition to aesthetic assets, quarries have specific features predestining them to the location of the spa complexes. The article presents an example of the methods for selecting optimal locations and urban and architectural solutions for the needs of users of geotouristic and spa facilities.

1. Introduction
Geotourism is a relatively new concept [7]. Until recently, post-mining objects were the destination for almost exclusively for professionals (except for existing units here for a long time, which are “absorbed” by the spontaneous vegetation and thus embedded in the landscape. At the same time there is a need of managing existing (raw) objects and the problems related to their revitalization and adaptation seems to be very relevant. In addition to traditional quarry rehabilitation courses such as forestry- water- and communal-related, in recent years has appeared a very attractive solution which is an adaptation of these areas for broad geotouristic or other features designed to accommodate people. It seems that quarries, in addition to geological and aesthetic values, have special features predestining them to the location of recreational complexes, resorts and spas.

2. Shaping the spa area
Competitive spa offer is one of the factors that in multidirectional way activate the territories, as well as improve the quality of life (quality of residence, work and leisure). Spas, climate spas, mud-based and thelassotherapeutic ones with diversified therapeutic profile are the great asset of areas requiring catalyzation of development processes which is particularly important in the case of the less developed regions, e.g. in the eastern and south-eastern Poland.

If we compare the number of spas in selected European countries, we can conclude that in Poland there is relatively large number of spas (45), most of which are located in mountainous areas and foothills. Historically, spas locations were influenced by many factors. In addition to the obvious need for having natural medicinal resources, the following factors were important: scenically attractive location, high quality of public spaces and architecture, good accessibility in respect of transport, the...
possibility of practicing sport and the diversity of available forms of recreation and relaxation, including those related to water [3]. Contemporary trends of spas development are primarily based on conservation-based revaluation of historical assumptions, as well as modernization, development and revitalization of existing centres. At the same time there is a tendency of “creating new multifunctional spa and tourist facilities assumptions” [9]. An example of such contemporary creation is the spa in Uniejow, created in 2012, where based on the extracted geothermal water rich in trace elements, were located pools which affected the dynamics of change in the city.

3. Specific features of the quarries vs. the requirements arising from the needs of spas

Areas of occurrence of rock materials are, by their assumptions, areas with interesting terrain topography, by what they appear to be extremely attractive to a potential user looking for a place to rest. Mountain areas, which naturally reveal the structure of the rock, can be found only in the southern part of the country and are heavily exploited in terms of tourism and recreation, including spa. In the foothills and lowland areas, you will find that those seeking an attractive place to spend leisure time, very often choose rock coastal cliffs, monadnocks groups (e.g. the valley villages near Cracow in the Malopolska province or the reserve named Prządki in the Subcarpathian region), and post-mining areas - quarries. Landscaping of recreational areas in post-mining areas is an opportunity to create a unique offer for daily and weekend leisure.

Extraction of rock materials causes damage to the surface of the ground, and until recently this damage was called in the literature in the field of landscape design “wounds in the landscape” [1]. However, we can venture to say that it is a kind of creation of a new landscape that gives the chance to experience the quasi-mountain scenery manifesting many specific qualities.

The main features that affect the specificity of post-mining areas of rough surface of the rock are: the shape of (around) the entire pit (sometimes together with the mining area) and its size. These “macrolandmarks” - visible to every potential user - affect his/her interest in the region. Size of the excavation can vary from a few square meters to the large-scale investment of several hundred hectares, as for example Calcite Quarry near Rogers City and Lake Hudson in Canada. The shape of the pit can be seen as a form of two-dimensional: organic or oblong and three-dimensional image: the nature of the floor in the presence of water and a statue of the walls of the quarry for example vertical, block or stepped. The second group of "special features" make minor elements making up the perception both in terms of visual, sensory and relational (colour that changes over time, a specific range of colours, atmosphere, texture and smell) and other elements such as the level and nature of the natural succession in the post-mining area and its environment [5].

If we analyze the requirements to be met by areas of existing or potential spas we should note that they are varied and depend on the “healing” elements and factors. It should be noted that very often positive phenomena – which are necessary for the existence of medical conditions in accordance with the principle of equilibrium of ecosystems – are accompanied by negative phenomena. For example, in watering places (spas) the sources of water resources are often located in shady river valleys, and construction projects in the mining area or zone may sometimes be subject to the applicable harassments e.g. the requirement to construct shallow foundations or limiting the height of objects, which can often be a big investment problem.

Urban and architectural requirements for development of spas are somewhat independent of the space in which they are located. Such requirements are for example the existence of natural medicine plants, where the proper distance should be kept between water sources and objects, buildings for medicinal water pump room with hall for walking, swimming pools or other water-related equipment, the towers or areas for storing the therapeutic agent, i.e. mud products. A special type of establishments are climate spas where medicinal element is primarily the climate and the factors related mainly to the ambient
temperature, sunlight and humidity, medicinal aerosols occurring in the area of intensity of winds [8]. In the climatic health resort, it is necessary to create a space to commune with the climate - places suitable for recreation, contact with art and entertainment, leisure and recreation [6], both in the open spaces and areas, as well as closed caves and rocky areas (for example, they often include areas of disused salt mine, sulphur mine, etc.).

4. Architecture in quarry
Quarry areas for a long time have inspired the creators to locate a wide range of tourist services and leisure in the complexes of mining pits (workings, excavations and headings) or in the individual pits and their environment (for example, we are talking about dumps and spoil tips that bring the variety to the terrain development and enrich the landscape). Among the earliest implementation of land use of quarries are nineteenth-century parks Buttes-Chaumont in Paris and Bednarski Park (Twardowski School) in Cracow. In subsequent years, the quarries were adapted for cultural function (Kadzielnia amphitheatre in Kielce (1980), Dalhalla opera in Draggangarna (Sweden) (1991)), for sports (Braga Municipal Stadium in Braga (Portugal) (2004)), and at the turn of the twentieth and twenty-first century, benefiting from the use of evolving technology, they began to design objects integrated into the structure of the floor and walls of the excavation. This evolution can be interpreted symbolically showing the relationship between thinking about the city in the days of the industrial revolution, the late modernism or finally – the widely understood postmodernism.

Recent projects to create an integrated space in the existing disused quarries show that the most desired by the local authorities, planners and investors are objects and the grounds of the features of hotel and spa, sometimes referred to as “health resort”. The main thrust of innovative urban development, architecture and construction locates in Asian countries, especially China; three of the four examples of projects and investments come from these countries and regions.

The first important land use project for post-mining raw rock areas adaptation to the function of hotel and spa is Groundscarper InterContinental Shanghai Wonderland Shimao, which will soon be put to use. The property is located approximately 30 kilometres from Shanghai in an abandoned Songjiang quarry. In a holiday complex they located hotel rooms, a spa, a set of devices for sports recreation and water sports. Designers of this facility tried to create a multi-purpose space in which place will find both active people as well as those looking for relaxation, and for which the excavation is filled with water and they created an artificial waterfall. Another example is the project involving a resort with spa section, planned to be established in an abandoned quarry over the lake near Changsha. In contrast to the previous investment project, this one is located in an area with a colder climate and its offer is targeted to users of equipment for winter recreation: ice skating rink and ski resort. An interesting solution they used here is the integration of formal pursuit of inner and outer space through the use of glass in the facade. Organically shaped body of the object fits into the landscape giving a sense of stability, peace and relaxation. Establishments of a similar range of functions but with different spatial expression are also designed in Zhou Shan in China and Åland Islands in Finland.

5. Healthy climate
If we consider the possibility of locating the spa area in the quarry, both in a pit (excavation) and its surroundings, it should be noted that there are both strengths and weaknesses of such a placement of area which is to accommodate people. As we mentioned earlier, most of the mining areas is located in the mountainous landscape where the probability of rock mining is greatest. At the same time mountain areas are characterized by a number of factors beneficial for spa features: resources of mineral and geothermal water, aerosols, specific relaxing atmosphere. The weaknesses of spa development of quarries seem to be a lack of ventilation, the risk of shading, inversion and other phenomena associated with this type of tectonic changes. These phenomena can be overcome or minimized by using a simplified method to determine the areas of thermodynamics developed by Pawel Deroń, Ing. Arch.,
under the care of Dr. Anna Sikora, Ing. Arch. (the promoter) under diploma project titled „Kamienne miasto – urbanistyczna rekultywacja terenów poeksploatacyjnych” (“Stone city - urban reclamation of abandoned post-mining areas”).

This work uses the method of thermodynamics analysis of urban spaces presented in 2007 by the G. Clement, P. Rahm and G. Borasi in the paper titled „Environ(nej)ment: Approaches for Tomorrow” [2] followed in the example of the Jaźwica quarry in the village named Chęciny, Świętokrzyskie Voivodeship (Holy Cross province) in Poland. In addition to standard methods of searching the urban form through the analysis of the desired structure of function and form, the study on the context and identity of the place and the outer and inner composition, during the design were verified core factors influencing the climate of establishment. Ventilation and shading were taken into account, separating optimal use of the area at the highest possible functionality of the pit (excavation). These elements are defined using the software 3ds Studio Max with plug-in Krakatoa and Fume FX.

Due to the impossibility of conducting specialized point test, we omitted factors such as humidity, temperature and air pollution. It is worth noting that if the relevant climatic maps were prepared, changes in these properties could be regulated through a “system of meteorological devices” from which the individual reduce excess heat, moisture or dirt. The phrase “meteorological devices” is used when defining the concentrations of the respective plants and trees, fountains and waterworks, air driers and speakers with ultrasound [4].

**Figure 1.** Analysis of Jaźwica quarry excavation area thermodynamics. A- hypsometry analysis, B and C- preliminary search of the desired urban layout, D- shading analysis, T- thermodynamics of the city – Diagnosis: designation of areas with different potential (from ‘very good’ to ‘low’) the existence of buildings intended for permanent human residence (developer: P. Deroń).
Isolation (distinction) of the optimal locations for buildings and facilities intended for permanent human residence, landscaping and communication while refining the functional and procedural issues (in this case, in order to increase the wind flow we proposed organic- and parametric systems - both for urban design and architecture as well) allows for the proper use of space, what favours the creation of an appropriate and healthy environment of user’s residence.

Figure 2. Jaźwica quarry development concept, separation of functional flows network with penetration of their impact isochrones, the final visualization of establishment (development of P. Deron).

Location of urban system within the multi-level pit (excavation) is the chance to create a unique and creative complex, which in itself can be the target of the so-called spa tourism. The great advantage of abandoned post-mining areas is their crystallized structure; thus the concept is formed on an isolated “Greenfield” where creative inventiveness of the creator is unlimited. Areas of spa complex cores (corresponding to the potential health resort protection zone A) by assumption are separated from the residential and non-business services development areas, not connected with health prevention activities. In this case, the boundary of the quarry basin is the perfect distinction of area to be strictly designed for the purposes of treatment and rest of patients. The multi-layer area can clearly prioritize space and the need to maintain a large biologically active area to ensure adequate ventilation or use of ecosystems as climate apparatus allows meeting the required demand for open green areas (minimum 75%). Workings (pits) with an appropriate therapeutic atmosphere can provide users aesthetics different than that everyday found in the place of residence. Isolation from the environment enables minimizing the noise and undesirable (e.g. in the case of neurological rehabilitation) interaction with the urban environment. Silence, large green spaces and natural rock landscape constitute ‘guarantees’ for a successful revitalization of the human body.

6. Conclusions
In conclusion it can be argued that the quarries with particular emphasis on post-mining pits (excavations) constitute the area predisposed to the location of urban establishments in areas of high landscape values. In Poland, spas and quarries coexist in mountain and foothill regions, because their reclamation, proper management and provision are an opportunity to create an attractive and innovative, and thus competitive space for geotourism and spa.

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