

Underground tourist routes as an element of Poland's cultural heritage

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Underground tourist routes respond to current trends in museum development. They can be treated as interactive exhibitions focused primarily on the visitor. Former underground mines are also important elements of cultural heritage. They preserve mining equipment and traces of mining techniques. Through interactivity they can perform an educational function, presenting mining memorabilia and customs. Underground routes are also tourist destinations, attracting a significant number of visitors. The present study covered eight routes located in different regions of Poland. Their tourist value was assessed and tourists were asked to complete a survey regarding the routes. The significance of the mining heritage was described and evaluated. On this basis, the strengths and weaknesses of the underground mine routes as places of presentation of cultural heritage were identified. The sites surveyed are characterised by their high potential but the level of awareness and tourist use is not high. The underground routes with the highest cultural heritage value are also those with high tourist potential.

Keywords: mining heritage, geotourism, education, interactive exhibitions

Introduction

One important component of local cultural heritage, specifically that related to industrial activities, is the remains of mineral exploitation.¹ There are aspects of mining heritage that can be used for tourism.² Cultural heritage encompasses the historical tangible and intangible heritage of humanity. In addition to traditions and customs (e.g., celebration of festivals, superstitions, religious practices), intangible heritage can include industrial production methods.³ Cultural heritage encompasses a coherent symbolic layer determined by the way it is interpreted, which, together with the material aspects, can become the basis for creating a marketable tourism product. Nowadays, the aim of protecting cultural resources is seen more broadly. It is not only about conservation and protection of the values represented by the sites, it also relates to (sustainable) use in the process of local development.⁴ Mining heritage represents historical, technological, scientific, architectural and social values.⁵

The mining industry is an important sector of the economy, but the material remains of mining activities have long been seen as unattractive elements of the landscape.⁶ In recent years, the way mining history is perceived has changed; old mines are increasingly seen as cultural heritage sites to be protected and made accessible to tourists. This has been the case, for example, with resource extraction in Wales and Cornwall, where mining activities have left a significant and lasting mark on the local culture and identities. Mining heritage is characterised by material and cultural authenticity, performativity, and the inclusion of visitors actively participating in learning about the exhibition.⁷

The use of a post-mining area for tourism requires preparation. This should include a planned and professional selection of those elements that should be preserved and protected in order to preserve the mining heritage of the site.⁸ In recent years, intensive efforts have been taking place to adapt further historic underground spaces for use. The process of revitalising historic underground mines is not easy, as it often requires restoring accessibility to disused

¹ JELEN, Jakub. Mining Heritage and Mining Landscape Krušnohoří/Erzgebirge as a Part of the UNESCO Heritage. In: *Land*, 11 (7), 2022, p. 955, <https://doi.org/10.3390/land11070955>; EDWARDS, J. Arwel, LLURDÉS COIT, Joan Carles. Mines and quarries: Industrial heritage tourism. In: *Annals of Tourism Research*, 23 (2), 1996, pp. 341-363.

² RUIZ-BALLESTEROS, Esteban, RAMÍREZ, Macarena, H. Identity and community—Reflections on the development of mining heritage tourism in Southern Spain. In: *Tourism management*, 28 (3), 2007, pp. 677-687; JELEN, Jakub. Mining heritage and mining tourism. In: *Czech Journal of Tourism*, 7 (1), 2018, pp. 93-105; KIMIC, Kinga, SMANIOTTO COSTA, Carlos, NEGULESCU, Mihaela. Creating Tourism Destinations of Underground Built Heritage—The Cases of Salt Mines in Poland, Portugal, and Romania. In: *Sustainability*, 13 (17), 2021, 9676, <https://doi.org/10.3390/su13179676>.

³ COUPLAND, Bethan, COUPLAND, Nicolas. The authenticating discourses of mining heritage tourism in Cornwall and Wales. In: *Journal of Sociolinguistics*, 18 (4), 2014, pp. 495-517.

⁴ PURCHLA, Jacek. Heritage and cultural mega-events: backgrounds, approaches and challenges. In: *European Planning*, 30 (3), 2022, pp. 566-572, <https://doi.org/10.1080/09654313.2021.1959727>

⁵ COLE, Denise. Exploring the sustainability of mining heritage tourism. In: *Journal of Sustainable Tourism*, 12 (6), 2004, pp. 480-494.; MIKOS VON ROHRSCHEIDT, Armin. *Turystyka kulturowa. Fenomen, potencjał, perspektywy*. Gniezno: Wydawnictwo GWSHM Milenium, 2008.

⁶ FRAGNER, Benjamin, ZIKMUND, Jan. *Co jsme si zbořili. Bilance mizějící průmyslové ery/ deset let (What we have destroyed. The Balance of the Dying Industrial Age/Ten Years)*. Prague: ČVUT, 2009, ISBN 978-80-01-04387-5.

⁷ COUPLAND, Bethan, COUPLAND, Nicolas. The authenticating discourses of mining heritage tourism in Cornwall and Wales. In: *Journal of Sociolinguistics*, 18 (4), 2014, pp. 495-517.

⁸ JELEN, Jakub. Mining Heritage..., p. 955.

and degraded facilities in order to prepare an interesting and safe tourist route. Underground tourist routes contribute to the dissemination of the cultural heritage of past generations and the historical education of society and local development.⁹

Academics are paying increasing attention to the growing tourist interest in post-mining heritage.¹⁰ The problems of inventorying sites, adapting them for tourism purposes, assessing their value, and ensuring sites are safe and secure have all come under scrutiny.¹¹ It has been pointed out that the cultural heritage value of post-mining sites is the basis for the inscription of many such sites on the UNESCO World Heritage List. These include Zollverein mine (Ruhr area, Germany), the Big Pit mine (England) and many others.¹² Surveys indicate that post-mining tourist routes are perceived as tourist attractions.¹³

The term ‘mining tourism’ relates to cultural tourism based on mining heritage, its authenticity, the protection of its values and the interpretation of its meaning.¹⁴ It is also often seen as a type of geotourism.¹⁵ The aim of mining tourism is to explore abandoned mines, the remnants of mining activities and mining heritage in order to preserve cultural and historical knowledge and use them in tourism.¹⁶ “According to Kršák et al., “Mining tourism combines industrial, technological, cultural and ethnographic heritage into a cognitively-oriented, educational and experiential form of tourism””.¹⁷ Geotourism involves the conscious exploration of the Earth’s heritage, its abiotic elements and those aspects of human activity that relate to the use of these planetary resources. It constitutes a type of cognitive, nature-based and sustainable tourism which takes place in the field and focuses on geological, geomorphological

⁹ WIEJA, Tomasz, CHMURA, Janusz, BARTOS, Maciej. Underground tourist routes in the context of sustainable development. In: *Archives of Mining Sciences*, 60 (3), 2015, pp. 859–873.

¹⁰ EDWARDS, J. Arwel, LLURDÉS COIT, Joan Carles. Mines and quarries: Industrial heritage tourism. In: *Annals of Tourism Research*, 23 (2), 1996, pp. 341–363; CONLIN, Michael, JOLLIFFE, Lee. *Mining Heritage and Tourism*. Oxford: Routledge, 2011; RYBÁR, Pavol, HRONČEK, Pavel. Mining tourism and the search for its origins. In: *Geotourism*, 3–4, 2017, pp. 27–66; JELEN, Jakub. Mining heritage and mining tourism. In: *Czech Journal of Tourism*, 7 (1), 2018, pp. 93–105; CAAMAÑO-FRANCO, Iria, SUÁREZ, Maria Andrade. The Value Assessment and Planning of Industrial Mining Heritage as a Tourism Attraction: The Case of Las Médulas Cultural Space. In: *Land*, 9 (11), 2020, <https://doi.org/10.3390/land9110404>; KIMIC, Kinga, SMANIOTTO COSTA, Carlos, NEGULESCU, Mihaela. Creating Tourism Destinations of Underground Built Heritage—The Cases of Salt Mines in Poland, Portugal, and Romania. In: *Sustainability*, 13 (17), 2021, 9676, <https://doi.org/10.3390/su13179676>.

¹¹ RUIZ-BALLESTEROS, Esteban, RAMÍREZ, Macarena, H. Identity and community...; JELEN, Jakub. Mining heritage and mining tourism. In: *Czech Journal of Tourism*, 7 (1), 2018, pp. 93–105.

¹² TOST, Michael, AMMERER, Gloria, KOT-NIEWIADOMSKA, Alicja, GUGERELL, Katharina. Mining and Europe’s World Heritage Cultural Landscapes. In: *Resources*, 10 (2), 2021, 18, <https://doi.org/10.3390/resources10020018>

¹³ RÓŻYCKI, Paweł, DRYGLAS, Diana. Mining tourism, sacral and other forms of tourism practiced in antique mines—Analysis of the results. In: *Acta Montanistica Slovaca*, 22 (1), 2017, pp. 58–66; JAGIELŁO, Anna. Ocena kierunków adaptacji podziemnych obiektów pogórnich w odniesieniu do ich atrakcyjności turystycznej. In: *Technical Issues*, 2, 2015, pp. 16–23.

¹⁴ SCHEJBAL, Ľirad. Montánni turismus (Mining tourism). Ostrava: Technical University of Ostrava, 2016.

¹⁵ HOSE, Thomas. A. 3 G’s for modern geotourism. In: *Geoheritage*, 4, 2012, pp. 7–24.

¹⁶ SCHEJBAL, Ľirad. Montánni turismus (Mining tourism). Ostrava: Technical University of Ostrava, 2016; JELEN, Jakub. Mining heritage and mining tourism...

¹⁷ KRŠÁK, Branislav, SIDOR, Csaba, STRBA, Lubomir, MOLOKÁČ, Mário, HVIZDÁK, Ladislav, BLISTAN, Peter, KOEVEKOVÁ, Gabriela, LIPTÁKOVÁ, Erika, DELINA, Radoslav, MÉŠÁROŠ, Peter. Maximizing the potential of mining tourism through knowledge infrastructures. In: *Acta Montanistica Slovaca*, 20 (4), 2015, pp. 319–325.

and landscape features.¹⁸ At the same time, geotourism is strongly linked to cultural tourism because in many cases abiotic elements are accompanied by cultural sites or evidence of human activity related to the exploitation, processing and use of these resources.¹⁹ In situ conservation of mining heritage enables a holistic approach to interpreting the past.²⁰ Mining remains are not only preserved but also studied and documented, and rescued and reinterpreted. Jones and Munday²¹ argue that mining heritage sites should be maintained not only as a place for the preservation of mining artefacts but also of a wide range of intangibles.

In Poland, as elsewhere, the issue of tourism involving post-mining sites is being addressed. P. Zagożdżon and K. Zagożdżon studied geotourism attractions which include underground sites.²² The authors drew attention to the ever-increasing interest in geotourism in Poland which may eventually lead to more such facilities being made available. They also pointed out problems connected with the tourist offer, such as a lack of adequate promotion and preparation of high quality geotourism products. A number of studies deal with the description of underground routes in Poland, including Złoty Stok, Kowary, Kletno,²³ Tarnowskie Góry silver mine,²⁴ Krzemionki Opatowskie²⁵ and chalk tunnels in Chelm.²⁶ For some sites, the authors note that the geotourism offer is insufficiently developed.

As defined by ICOM: ““A museum is a not-for-profit, permanent institution in the service of society that researches, collects, conserves, interprets and exhibits tangible and intangible heritage. Open to the public, accessible and inclusive, museums foster diversity and sustainability””.²⁷ In Poland, a museum is a not-for-profit organisational unit whose purpose is to collect and permanently protect the natural and cultural heritage of mankind of a tangible and intangible nature, to inform the public about the values and contents of the collected

¹⁸ DOWLING, Ross K. Geotourism's global growth. In: *Geoberitage*, 3 (1), 2011, pp. 1-13; HOSE, Thomas. A. 3 G's for modern geotourism. In: *Geoberitage*, 4, 2012, pp. 7-24; MIGOŃ, Piotr. *Geoturystyka*. Warszawa: Wydawnictwo PWN, 2012.

¹⁹ GORDON, John E. Geoheritage, Geotourism and the Cultural Landscape: Enhancing the Visitor Experience and Promoting Geoconservation. In: *Geosciences*, 8 (4), 2018, 136, <https://doi.org/10.3390/geosciences8040136>

²⁰ EDWARDS, J. Arwel, LLURDÉS COIT, Joan Carles. Mines and quarries: Industrial heritage tourism. In: *Annals of Tourism Research*, 23 (2), 1996, pp. 341-363; DICKS, Bella. The view of our town from the hill: Communities on display as local heritage. In: *International Journal of Cultural Studies*, 2 (3), 1999, pp. 349-68.

²¹ JONES, Calvin, MUNDAY, Max. Blaenavon and United Nations World Heritage Site status: Is conservation of industrial heritage a road to local economic development? In: *Regional Studies*, 35 (6), 2001, pp. 585-90.

²² ZAGOŹDŹON, Paweł, P., ZAGOŹDŹON, Katarzyna. Podziemne obiekty geoturystyczne na terenie Polski. In: *Hereditas Minariorum*, 3, 2016, pp. 267279.

²³ ZAGOŹDŹON, Paweł, P., ZAGOŹDŹON, Katarzyna. Udostępnione pogórnice obiekty podziemne Dolnego Śląska jako zaplecze geoturystyczne. In: *Przegląd Geologiczny*, 61 (1), 2013, pp. 19-24; BORZEŹCKI, Robert, WÓJCIK, Dariusz, KALISZ, Maciej. Pozostałości górnictwa rud uranu i żelaza w rejonie Kowar. Część II. In: *Hereditas Minariorum*, 5, 2018, pp. 51-84.

²⁴ DZIĘGIEL, Marian. Podziemne trasy turystyczne w Tarnowskich Górach (Górny Śląsk). In: *Geoturystyka*, 4 (15), 2008, pp. 51-62; DZIĘGIEL, Marian. The geotouristic attractiveness of the underground trails in Zabrze, Dąbrowa Górnicza and Tarnowskie Góry towns (Silesian Upland). In: *Geotourism*, 17 (1-2), 2020, [https://doi.org/10.7494/geotour.2020.1-2\(60-61\).23](https://doi.org/10.7494/geotour.2020.1-2(60-61).23).

²⁵ BARCICKI, Mirosław. Krzemionki opatowskie jako unikatowy produkt turystyczny. In: *Autobusy – Technika, Eksploatacja, Systemy Transportowe*, 5, 2013, pp. 51-84.

²⁶ CHYLIŃSKA, Dagmara, KOSMALA, Gerard. Turystyka miejska schodzi pod ziemię. Rola piwnic i podziemi w turystyce – zarys zagadnienia. In: *Turystyka kulturowa*, 6, 2018, pp. 25-43.

²⁷ ICOM. *International Council of Museums*, accessed August 28th, 2023, <https://icom.museum/en/resources/standards-guidelines/museum-definition/>

collections, to disseminate the fundamental values of Polish and world history, science and culture, to shape cognitive and aesthetic sensitivity, and to enable the use of the collections.²⁸

There has been longstanding growth in the number of museums and visitors around the world. Reasons for this include globalisation, rising living standards, the IT revolution, the development of tourism, and the intensive promotion of museums.²⁹ The future character of museum facilities (apart from financial factors) will be shaped by the expectations of visitors and the media (press, radio, television, internet, social networks). In 2001, there were 656 museum facilities in Poland, which were visited by 15 million people. In 2021, there were already 939 museums, 70.5% of which were in the public sector. They were visited by 25.3 million people. The total number of museum collections was 20.1 million pieces. Museum artefacts in the field of archaeology (25.2%) predominated, with the smallest numbers from the fields of geology (0.2%) and cartography (0.2%).³⁰

Museums have long ceased to be temples of art visited by a few connoisseurs. They must now perform as multifunctional cultural centres that make their resources available and widely disseminate knowledge about them. At the same time, museums organise various artistic, cultural and scientific events (temporary exhibitions, concerts, performances, shows, lectures, seminars).³¹ There has been a gradual shift away from traditional forms of museum presentation towards interactivity, using the latest multimedia technologies (film, music, multimedia installations, visualisations), original exhibits and photographs, or interactive forms of presentation (scenography, replicas, mock-ups that everyone can touch) to present material. This approach enables direct contact with the exhibition, engaging all the visitor's senses (sight, hearing, smell, taste), engaging them in active visiting and self-education. Museum resources are also made available for viewing online, via virtual museums or exhibitions.³² The COVID-19 pandemic led to a particularly intensive development of this form of dissemination. Contemporary museums are increasingly audience-centred.³³

Underground tourist routes can be classified as interactive museums and exhibitions. They are viewer-oriented, so as to convey as much as possible to visitors in an interesting and engaging way. They interact with the various human senses and encourage the visitor to be active and involved.

The aim of this research is to assess underground mining tourist routes as an element of cultural heritage and tourist attractions. Some are open-air museums of technology, others archaeological museums or active mines. An attempt was made to assess the cultural and geotouristic value of selected underground routes made available to tourists. This allowed

²⁸ *Ustawa z dnia 21 listopada 1996 r. o muzeach*. Dziennik Ustaw nr 5, poz. 24, tekst jedn. Dz. U. 2022 poz. 385.

²⁹ POMIAN, Krzysztof. Kilka myśli o przyszłości muzeum. In: *Muzealnictwo*, 55, 2014, pp. 7–11; FOLGAN-JANUSZEWSKA, Dorota. History of the museum concept and contemporary challenges: introduction into the debate on the new ICOM museum definition. In: *Muzealnictwo*, 61, 2020, pp. 37–59.

³⁰ Statistics Poland. Activity of museums in 2021, accessed August 28th, 2023, <https://stat.gov.pl/en/topics/culture-tourism-sport/culture/activity-of-museums-in-2021,8,5.html>

³¹ POMIAN, Krzysztof. Kilka myśli o przyszłości muzeum. In: *Muzealnictwo*, 55, 2014, pp. 7–11.

³² STEFANIK, Magdalena, KAMEL, Marta. Muzea i wystawy interaktywne w Polsce – współczesna atrakcja turystyczna. In: *Turystyka Kulturowa*, 8/2013, 2013, pp. 5–23.

³³ JANCOVICH, Leila. Breaking down the Fourth Wall in Arts Management: The Implications of Engaging Users in Decision-Making. In: *International Journal of Arts Management*, 18(1), 2015, 14–28; AYALA, Inigo, CUENCA-AMIGO, Macarena, CUENCA, Jaime. The Future of Museums. An Analysis from the Visitors' Perspective in the Spanish Context. In: *The Journal of Arts Management, Law and Society*, 51(3), 2021, pp. 171–187, <https://doi.org/10.1080/10632921.2021.1901813>

for a comprehensive assessment of the potential of these sites, indicating their strengths and weaknesses. The study aims to take a comprehensive look at the use of tourism to promote post-mining heritage in Poland.

Post-mining cultural heritage in Poland

Cultural heritage is defined in legal acts, international treaties and national documents. The most important international document is the convention concerning the Protection of World Cultural and Natural Heritage, approved at the UNESCO General Conference in Paris, 1972. At the national level, cultural heritage is formally defined in different ways by different countries. There is no defined concept of cultural heritage in Polish law. According to the Act on the Protection and Care of Monuments,³⁴ a monument is “an immovable or movable object, parts or complexes thereof, being a work of man or connected with his activity, constituting a testimony of a bygone era or event, the preservation of which is in the public interest due to its historical, artistic or scientific value”. Cultural heritage is reflected in the cultural landscape,³⁵ which is defined as “the space perceived by people, containing natural elements and products of civilisation, historically shaped by natural factors and human activities”.

Cultural heritage, in both its material and non-material elements, may be subject to legal protection. Immovable monuments such as cultural landscapes and technical sites, including mines, are subject to protection and care regardless of their state of preservation. Monuments can be protected by entry into the register of monuments, entry into the Heritage Treasures List, recognition as a monument of history, the establishment of a cultural park, and the establishment of protection in the local spatial development plan or through a Decision on the Conditions of Development and Land Use.³⁶

Among the 123 historical monuments in Poland, there are several sites related to the exploitation of mineral resources. These are mainly technical sites: the Bochnia salt mine (which has been on Poland's List of Historical Monuments since 2000); Bóbrka, Poland's oldest oil mine (2019); Tarnowskie Góry, the underground part of a historic silver ore mine and the “Black Trout” adit (2004); Wieliczka salt mine (1994); Zabrze, a complex of historic coal mines (2020); and an archaeological site at Krzemionki Opatowskie, near Ostrowiec Świętokrzyski, which encompasses flint mines from the Neolithic period (1994).³⁷ A historical monument can be an site that represents universal values and has exceptional significance.³⁸ It represents the highest and most prestigious form of protection. The fact of being recognised as a historic monument should strengthen the process of building awareness among the authorities and within the local community, as well as assisting the site's branding and promotion.

One of the most attractive tourist sites in Poland is Wieliczka salt mine. Its importance stems from its rich history, its cultural and educational value, and its distinctive physical properties – it is the only underground spa in Poland, and its waters are used for treatment. In 1978, it was

³⁴ *Ustawa z dnia 17 września 2003 r. o ochronie zabytków i opiece nad zabytkami*. Dziennik Ustaw nr 162/2003, poz. 1568, tekst jedn. Dz. U. 2022 poz. 840.

³⁵ TOST, Michael, AMMERER, Gloria, KOT-NIEWIADOMSKA, Alicja, GUGERELL, Katharina. Mining and Europe's World Heritage Cultural Landscapes. In: *Resources*, 10 (2), 2021, 18, <https://doi.org/10.3390/resources10020018>

³⁶ *Ustawa z dnia 17 września 2003 r. o ochronie zabytków i opiece nad zabytkami*. Dziennik Ustaw nr 162/2003, poz. 1568, tekst jedn. Dz. U. 2022 poz. 840.

³⁷ *Pomniki historii*, accessed March 13th, 2023, <https://nid.pl/pomniki-historii>

³⁸ MARCINEK, Roman. *Pomniki historii. Najcenniejsze obiekty i zespoły zabytkowe w Polsce*. Warszawa: Narodowy Instytut Dziedzictwa, 2019.

among the 12 sites and objects placed on the first UNESCO World Heritage List.³⁹ Its presence on this prestigious list confirms the universal value and global significance of the mine, and also represents a commitment to its preservation. Salt exploitation started in the thirteenth century. The mine has nine levels and 360 km of galleries, with statues and altars carved in salt. In 2022, 1.1 million visitors from 179 countries visited the mine.⁴⁰ In 2013, the UNESCO listing was extended to include the Bochnia salt mine and the Saltworks Castle in Wieliczka, renaming it the Royal Salt Mines in Wieliczka and Bochnia. The UNESCO World Heritage List also includes the following mining sites located in Poland: Tarnowskie Góry lead, silver and zinc mine and its underground water management system, and Krzemionki Prehistoric Striped Flint Mining Region.⁴¹

In Poland, the National List of Intangible Cultural Heritage was created as a result of the inventory of manifestations of this type of heritage under the 2003 UNESCO Convention for the Safeguarding of the Intangible Cultural Heritage. There are currently 64 entries on the list, including two related to mineral exploitation: Barbórka of the Coal Miners of Upper Silesia (2018) and Barbórka of the Coal Miners of Lower Silesia (2022). St Barbara's Day is an annual festive gathering of the professional group of miners and is an integral part of the cultivation of the miner's identity. Of particular importance in Lower Silesia, following the closure of the mines in the 1990s, today's St Barbara's Day in Walbrzych is an expression of continuity in preserving local cultural heritage and nurturing the miner's identity, and refers to events in the past that can no longer be continued in their original form. The tangible element of this heritage, supporting the preservation of the intangible one,⁴² is the Stara Kopalnia Science and Art Centre, which was opened in 2014 on the site of the historic Julia coal mine in Walbrzych.⁴³ The facility encompasses a wide range of museum and educational offerings. Visitors can tour the coal face and learn about coal mining methods and techniques (Figure 1). The Old Mine is one of the region's most popular attractions. The Polish Tourist Organisation awarded it the Best Tourism Product of Poland 2022 certificate.⁴⁴ The Polish Tourist Organisation also awarded its Gold Certificate to Guido mine and Queen Luisa Adit, which are part of the Coal Mining Museum. Previously, the gold mine in Złoty Stok (2015) and the historical silver mine in Tarnowskie Góry (2019) were awarded this certificate.⁴⁵

There are 71 underground tourist routes in Poland in 2023. They operate in natural caves (19 sites) and sites related to human activity: former mines (20 sites), military sites (16), religious sites (5) and urban sites (11). Most of the tourist routes in the accessible mines are located in southern Poland – in Lower and Upper Silesia and in Lesser Poland (16) (Figure 2). Half of the tourist routes (10) are made available in former mines related to metal ore mining (e.g., uranium, gold, silver). Underground excavations are also made available in former coal mines (4), rock salt mines (3 – including one maintaining the process of exploitation of the raw material) and historical rock mines (3).

³⁹ UNESCO. *World Heritage Convention*, March 12th, 2023, <https://whc.unesco.org/en/statesparties/pl/>

⁴⁰ *Kopalnia Wieliczka. Turysci w kopalni w 2022*, accessed March 11th, 2023, <https://www.kopalniawieliczka.eu/turysci-w-kopalni-w-2022/>

⁴¹ UNESCO. *World Heritage Convention*, accessed March 12th, 2023, <https://whc.unesco.org/en/statesparties/pl/>

⁴² *Stara Kopalnia. Centrum Nauki i Sztuki*, accessed February 4th, 2023, <http://www.starakopalnia.pl>

⁴³ KONIOR, Agnieszka. *Zarządzanie dziedzictwem kulturowym w kontekście rewitalizacji obszarów poprzemysłowych*. Kraków: Wydawnictwo Attyka, 2021.

⁴⁴ *Stara Kopalnia. Centrum Nauki i Sztuki*, accessed February 4th, 2023, <http://www.starakopalnia.pl>

⁴⁵ *Polska Organizacja Turystyczna*, accessed March 9th, 2023, <https://www.pot.gov.pl>



Fig. 1: Historic equipment at the Old Mine Science and Arts Centre (Photograph: W. Zglobicki)

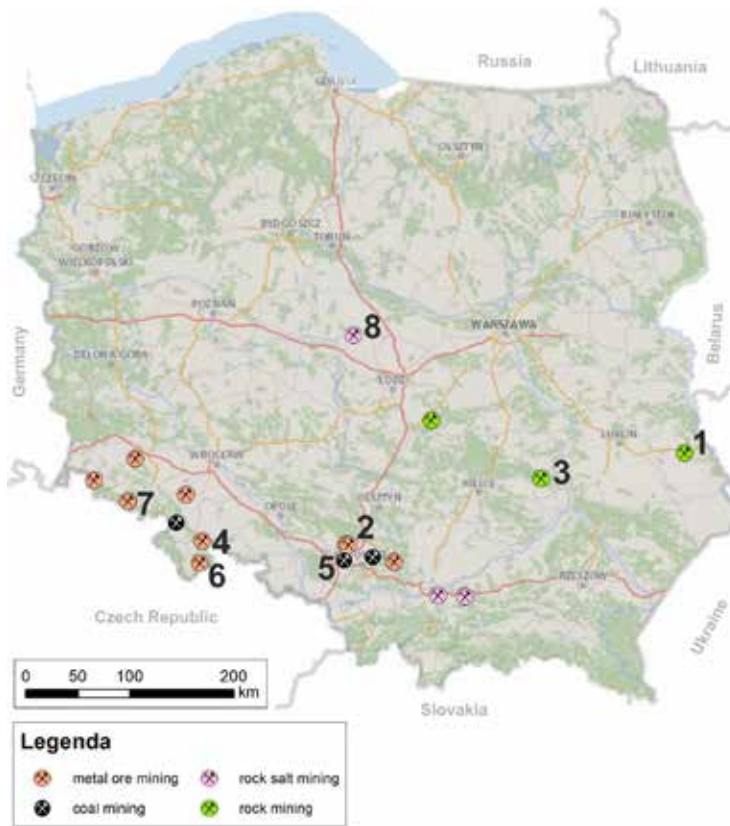


Fig. 2: Underground mining tourist routes. Studied sites: 1 – Chalk tunnels in Chelm; 2 – Silver mine in Tarnowskie Góry; 3 – Krzemionki Opatowskie; 4 – Gold mine in Złoty Stok; 5 – Guido mine in Zabrze; 6 – Uranium mine in Kletno; 7 – Podgórze mine in Kowary; 8 – Kłodawa salt mine.

Methods

The author's geotourism assessment was developed based on a set of criteria previously used by other researchers.⁴⁶ The study included eight sites characterised by a similar size and intensity of tourist traffic. For this reason, the Wieliczka salt mine (a UNESCO first-listed site and a world-class attraction for many years) was excluded from the study. The aim of the assessment was to determine the value of the sites, making it possible to rank them and identify those most attractive to tourists. Finally, it was possible to identify the strengths and weaknesses of the routes, which in turn makes it possible to take measures to improve their offer.

Two categories were distinguished: scientific–didactic value (main values) and functional–tourist value (additional values). Each of these values encompasses specific criteria; there are 13 in total, set out in Table 1). A graded scale was used (0–2, where 2 is the highest score). The maximum number of points that a site could receive was 26: 12 for its scientific and educational value and 14 for its functional–touristic value.

The category of scientific and educational value contains six criteria (Table 1). It was assumed that these are the main benefits and the most important for this assessment. The functional–tourist category is broken down into seven criteria. The assessment was carried out independently by three experts and the final assessment was the result of consensus. All those who participated in the assessment had experience of this type of development. They also visited all of the investigated underground routes.

The next step was to juxtapose the tourism benefits of the studied sites with their cultural heritage benefits. An expert assessment of the cultural heritage value was also undertaken by the authors. Sites were evaluated according to five criteria: uniqueness of heritage, authenticity of the site, expositions, tangible heritage and accompanying intangible heritage. As before, measurement was according to a three-grade scale.

An internet survey was also carried out. The main task of the questionnaire was to check knowledge of the sites. Respondents were asked to rate the tourist value of the underground routes. The survey was created using Google Forms and was made available on the internet through several outlets, including geotourism/tourist groups on social media (e.g., the Facebook groups “Geotourism – Lower Silesia” and “Tourism”) in late May and early June 2022. The survey contained 13 questions.

⁴⁶ DMYTROWSKI, Piotr, KICIŃSKA, Anna. Waloryzacja geoturystyczna obiektów przyrody nieożywionej i jej znaczenie w perspektywie rozwoju geoparków. In: *Problemy Ekologii Krajobrazu*, 29, 2011, pp. 11-20; BRILHA, José. Inventory and Quantitative Assessment of Geosites and Geodiversity Sites: a Review. In: *Geoh Heritage*, 8, 2016, pp. 119–134, DOI 10.1007/s12371-014-0139-3; GAJEK, Grzegorz, ZGŁOBICKI, Wojciech, KOŁODYŃSKA-GAWRYŚIAK, Renata. Geoeducational Value of Quarries Located Within the Malopolska Vistula River Gap (E Poland). In: *Geoh Heritage*, 11, 2019, pp. 1335-1351; CHROBAK, Anna. Przegląd metod waloryzacji obiektów przyrody nieożywionej wykorzystywanych w geoturystyce. In: *Prace Komisji Geografii Przemysłu Polskiego Towarzystwa Geograficznego*, 35 (3), 2021, pp. 116–145.

Tab. 1: *Criteria for the assessment of underground tourist routes*

| | Criteria | Point value |
|---|--|-------------|
| Scientific and educational value | Scientific knowledge | |
| | No publication | 0 |
| | Single publications (1-3) | 1 |
| | Significant number of publications (>4) | 2 |
| | Uniqueness of the facility | |
| | Site of regional importance | 0 |
| | Site of national importance | 1 |
| | Site of international importance | 2 |
| | Diversity | |
| | One visible feature/process | 0 |
| | Two visible features/processes | 1 |
| | Three or more visible features/processes | 2 |
| | Possibility of workshops/lessons for students | |
| | No possibility | 0 |
| | Workshops may be held | 1 |
| | Extensive range of workshops | 2 |
| | Educational products | |
| | Lack of educational products | 0 |
| | Individual educational products | 1 |
| | Significant number of educational products (e.g., leaflets, multimedia displays, maps) | 2 |
| Legibility of features | | |
| Features readable only by specialists | 0 | |
| Features readable by secondary school and university students | 1 | |
| Features readable by all tourists | 2 | |

| | | |
|--|--|---|
| Functional and tourist value | Number of tours (capacity) | |
| | Only one | 0 |
| | Two | 1 |
| | Three or more | 2 |
| | Ticket prices (normal ticket) | |
| | Over 50 PLN | 0 |
| | 30–50 PLN | 1 |
| | Under 30 PLN | 2 |
| | Accessibility (distance from national roads) | |
| | Location of the facility beyond 10 km | 0 |
| | Location of the facility within 5 km | 1 |
| | Location of the facility less than 5 km away | 2 |
| | Presence of other tourist attractions | |
| | No tourist attractions within 10 km | 0 |
| | Up to 2 tourist attractions within 10 km | 1 |
| | More than 3 tourist attractions within 10 km | 2 |
| | Presence of supporting infrastructure – car parks | |
| | Further away than 500 m | 0 |
| | At a distance of less than 500 m | 1 |
| | Parking facilities directly adjacent to the site | 2 |
| | Routes website and social media | |
| | The website provides basic information about the facility. No social media profiles | 0 |
| | The website contains basic information about the facility. There are social media profiles, i.e., Facebook, Instagram | 1 |
| | The website includes extensive information about the facility, multimedia resources, a map of the facility. There are social media profiles, i.e., Facebook, Instagram | 2 |
| Additional activities on the premises (e.g., boat trips, train rides) | | |
| None | 0 | |
| 1 additional attraction | 1 | |
| More than 1 additional attraction | 2 | |

Cultural heritage of selected sites

Chalk tunnels in Chelm

Chelm is located in eastern Poland, in the Lublin Province (Figure 2). The reason for underground exploitation was chalk. The first records of chalk mining in Chelm date back to the Middle Ages, and the sixteenth and seventeenth centuries saw intensive development

of its exploitation. In 1974, a c. 1.5 km long tourist route was opened to the public.⁴⁷ Twenty years later, the mine was entered in the register of monuments of the Lublin Province. As a result of the preservation works carried out, the pits' original character has mostly been lost. The few unchanged pavements with a clear relief showing how the walls were worked with pickaxes, niches relieving the ceilings, mining faces, or cavities for caving are a unique record of underground chalk-mining activity, the only such mine in Europe. The mine has been awarded many prizes, and in 2006 it received a Certificate "for "Best Tourist Product"".⁴⁸

Silver mine in Tarnowskie Góry

Town of Tarnowskie Góry is located within the Silesian Province (Figure 2). The tradition of mining in the area, recorded on numerous archaeological sites, dates back to the third century CE. The first written records from the twelfth century inform about prospectors and silver miners operating in the area. The mine was exploited for lead, silver and zinc ores. The discovery of rich deposits of lead and silver ores in the sixteenth century led to an intensive boom in mining activity. Tarnowskie Góry grew to become one of the largest lead and silver mining centres in this part of Europe. Bullion mining at the beginning of the twentieth century began to disappear due to depletion of resources. In 1922 the last mine was closed.⁴⁹ The Historic Silver Mine was opened to the public in 1976. The accessible route is about 1,740 m long.⁵⁰ Tourists have the opportunity to see, authentic, perfectly preserved mine faces and galleries, mining chambers, and equipment of the historic mine. In addition, visitors to the mine site can take a train ride and visit the Open-air Museum of Steam Machines⁵¹ or Halda popluczkowa Cultural Park.

Krzemionki Opatowskie

The archaeological museum and reserve Krzemionki Opatowskie is located in the Świętokrzyskie Voivodship (Figure 2). A unique raw material was mined here – striped flint. Mining activity lasted from the Neolithic to the Early Bronze Age (3900–1600 BCE). Approximately 5,000 mine shafts were inventoried here. The flint was used to make axes, knives and sickles. The miners' engineering mastery is evidenced by the excellently preserved different types of pits – from simple, very shallow pits and niches with galleries to sophisticated mine systems with pillar chambers and, eventually, chamber arrangements (Figure 3).⁵² The area covered by Neolithic strip flint mining is also a unique, complete and perfectly preserved example of a prehistoric cultural landscape with a mining and industrial character, with post-mining pits and dumps and the remains of flint workshops.⁵³ Unique on a European scale, the oldest mine in Poland, was opened to tourists in 1985. It was the first tourist route in the world

⁴⁷ GOŁUB, Stanisław. Podziemia kredowe w Chelmie – zarys historii eksploatacji górniczej. In: *Materiały 43. Sympozjum Speleologicznego*, Kraków, 2009, pp. 34–36.

⁴⁸ *Podziemia Kredowe w Chelmie*, accessed January 7th, 2023, <https://podziemiakredowe.com.pl>

⁴⁹ DZIĘGIEL, Marian. Podziemne trasy turystyczne w Tarnowskich Górach (Górny Śląsk). In: *Geoturystyka*, 4 (15), 2008, pp. 51–62.

⁵⁰ KOWOL, Magdalena, RÓŻYCKI, Paweł. Turystyka przemysłowa w Tarnowskich Górach. In: *Geoturystyka*, 3, 2008, pp. 41–48.

⁵¹ *Kopalnia Srebra. Zabytkowa Kopalnia Srebra i Sztolnia Złotego Pstrąga*, accessed February 13th, 2023, <https://kopalniasrebra.pl/>

⁵² BĄBEL, Jerzy, Tomasz. *Krzemionki. Pomnik historii, rezerwat, muzeum. Prahistoryczne kopalnie krzemienia pasiastego*. Warszawa: Eneteia, 2013.

⁵³ UNESCO. *World Heritage Convention*, accessed February 21st, 2023, <https://whc.unesco.org/en/list/1599>

presenting underground mines from the Stone Age. An exposition corridor hollowed out in solid limestone with specially prepared “windows” leads around the mine. The Prehistoric Striped Flint Mining Region has been on the UNESCO World Heritage List since 2019.⁵⁴



Fig. 3: *Underground galleries in Krzemionki Opatowskie* (Photograph: W. Zgłobicki)

Gold mine in Złoty Stok

Złoty Stok is located in southwest Poland, in the Lower Silesian Province (Figure 2). The richest ore mineral in the deposit is leingite with up to 40% arsenic content. An important metal for which the area is famous and was of interest to explorers was gold.⁵⁵ Exploitation was carried out through a system of shafts and adits. Heaps, funnels, buried and collapsed shallow shafts, galleries and chambers remain after the mining activities.⁵⁶ The mining works ceased in the early 1960s and an attempt was made at that time to create an underground tourist route. The site was finally developed in 1996.⁵⁷

There are two adits open to tourists: Upper Black Adit, from which a well-preserved complex of fifteenth- and sixteenth-century excavations and galleries can be observed, and Gertruda Adit, where there is an exhibition presenting the area's mining heritage. In 2017, Ochrowa Adit was opened with its perfectly preserved passages and shafts dating back more than 300 years. The mine offers an extensive complex for tourism, boasting attractions such as train rides, gold panning, coin minting and gold bar casting. In addition, there is the Museum of Mining and History of Złoty Stok on the mine site. It is also possible to visit a medieval mining settlement

⁵⁴ *Muzeum Historyczno-Archeologiczne w Ostroncu Świętokrzyskim*, accessed February 21st, 2023, <https://muzeumostro-wiec.pl/krzemionki/>

⁵⁵ ZAGOŹDŻON, Paweł, P., ZAGOŹDŻON, Katarzyna. Udośćępnione pogórnice obiekty...

⁵⁶ MIKOŚ, Tadeusz, CHMURA, Janusz. Rewitalizacja i zagospodarowanie turystyczne podziemnych wyrobisk górnicych zabytkowej Kopalni Złota i Arsenu w Złotym Stoku. In: *Górnictwo i Geoinżynieria*, 32 (4), 2008, pp. 41–53.

⁵⁷ ZAGOŹDŻON, Paweł, P., ZAGOŹDŻON, Katarzyna. Podziemna trasa turystyczna w „Kopalni złota w Złotym Stoku” – propozycja. In: ZAGOŹDŻON, Paweł, P., MADZIARZ, Maciej (eds) *Dzieje górnictwa – element europejskiego dziedzictwa kultury*, Wrocław: Oficyna Wydawnicza Politechniki Wrocławskiej, 2010, pp. 519-538.

(Figure 4).⁵⁸ The mine is visited annually by 120,000 tourists.⁵⁹ In 2022, the owner of the mine was awarded Europe's most prestigious heritage award, the European Heritage Awards,⁶⁰ for her special contribution to heritage conservation and the mine's sustainable business model.



Fig. 4: *The mill in the reconstructed mining settlement in Złoty Stok* (Photograph: B. Baran-Zglobicka)

Guido mine in Zabrze

Located in the Silesian Voivodeship, Zabrze is one of the best examples in Poland of the co-existence of a city and underground coal mining. In the southern part of the city, there is the historic Guido mine, whose history dates back to the mid-nineteenth century (Figure 2). Operations at the site lasted from the late nineteenth century until 1904. In 1982, the Guido Open-Air Museum was established. Level 170 was opened to the public and in 2007 the Guido historical mine was established. The present tourist route makes it possible to visit the site from the period of the mining activity. At the level of 170 m, there are also historical mining pits (made between 1860 and 1870), especially the large chambers, restored and secured for museum purposes in the 1980s.⁶¹ The mine is located on the Industrial Monuments Route of the Silesian Voivodeship. It was honoured with an award in the competition for the “Best Public Space in the Silesian Voivodeship”.⁶²

⁵⁸ *Kopalnia Złota w Złotym Stoku*, accessed February 13th, 2023, <https://kopalniazlota.pl>

⁵⁹ MIKOŚ, Tadeusz, CHMURA, Janusz. *Rewitalizacja i zagospodarowanie...*

⁶⁰ *European Heritage. Europa Nostra Awards*, accessed February 13th, 2023, <https://www.europeanheritageawards.eu/winners/elzbieta-szumaska/>

⁶¹ CHMURA, Janusz, WÓJCIK Andrzej, J. *Problemy ochrony i udostępnianie podziemnych geostanowisk w kopalniach Górnośląskiego Zagłębia Węglowego*. In: *Górnictwo i Geoinżynieria*, 29, (3/1), 2005, pp 135–144.

⁶² *Kopalnia Guido*, accessed February 14th, 2023, <https://kopalniaguido.pl/>

Uranium mine in Kletno

This mine is located in the Lower Silesian Voivodship in the town of Kletno (Figure 2). Activity in the uranium mine began in 1948, when strong radioactivity was recorded within the former St Paul's adit and heaps, associated with former iron, silver and copper mining. During the five years of the plant's operation, 20 adits and three shafts were constructed. The final depletion of the deposit brought the long-term mining activities on this site to an end.

Numerous adits remain from the decommissioned mine. In 2001, the perfectly preserved gallery No. 18 was opened to the public for tourism. Visitors can learn about the history and geology of the site; admire occurrences of minerals such as fluorite, amethyst and malachite; view numerous exhibitions;⁶³ and take part in a field game, "Minerals as treasure of Kletno". The theme is the cultural, natural and landscape heritage of the Śnieżnik Massif.⁶⁴

Podgórze mine in Kowary



Fig. 5: Interior of Kowary mine (Photograph: B. Baran-Zgłobicka)

In the well-preserved galleries and rock cavities, remnants of equipment and infrastructure used in uranium mining (train cars, steel tunnel casings) are on display (Figure 5).⁶⁶

Podgórze mine is located in the Lower Silesian Voivodship, in the Śnieżnik Massif. After a strong radon anomaly was detected in the vicinity of Kowary in 1950, uranium ore mining began. The ore was mined to a depth of about 660 m, and about 41 km of pits were created in eight years. In 2014, the Podgórze Mine underground tourist route was established.⁶⁵ Those on the tour use old mining lamps to illuminate the

Kłodawa salt mine

This mine is located in the province of Wielkopolska, in the town of Kłodawa (Figure 2). Salt extraction and construction of the mine began in 1949–1950. After the salt's extraction, empty chambers of regular shape separated by pillars and shelves remain. The route made available to tourists is the largest and deepest of its kind in Poland, and the tour takes place

⁶³ CIEŻKOWSKI, Wojciech., GUSTAW, Andrzej. Górnictwo podziemne Masywu Śnieżnika – stara kopalnia uranu w Kletnie. In: *Materiały 41. Sympozjum Speleologicznego*, Kletno, 2007, pp. 25–26.

⁶⁴ *Kopalnia Uranu. Podziemna Trasa Turystyczna*, accessed February 14th, 2023, <https://www.kletno.pl/>

⁶⁵ BORZEŃCKI, Robert, WÓJCIK, Dariusz, KALISZ, Maciej. Pozostałości górnictwa rud uranu i żelaza w rejonie Kowar. Część II. In: *Hereditas Minariorum*, 5, 2018, pp. 51–84.

⁶⁶ *Kopalnia Podgórze. Podziemna Trasa Turystyczna*, accessed February 14th, 2023, <http://www.kopalniapodgorze.pl/>

in a mining facility that continues to operate.⁶⁷ It is possible to observe mining machinery and infrastructure, and different types of excavations, including abandoned mining chambers, mining transport and ventilation galleries (Figure 6).⁶⁸ In 2007 the Klodawa Tourist Route was added to the Register of Historic Places. In 2009 the mine was awarded the Certificate of the Polish Tourist Organisation for the Best Tourist Product.⁶⁹



Fig. 6: Salt mine in Klodawa (Photograph: B. Baran-Zglobicka)

Results

In the assessment carried out, the highest total score was awarded to the gold mine in Złoty Stok (77% of the maximum score). Guido mine (73%) and Krzemionki Opatowskie (69%) also received high marks. The lowest rated were Podgórze mine in Kowary (50%) and chalk tunnels in Chelm (58%). The highest score for scientific and educational value was awarded to Krzemionki Opatowskie (100% of the maximum score) and the lowest score to the Podgórze mine (33%). For functional–tourist value, the Złoty Stok mine received the highest score (85%), while Krzemionki Opatowskie received the lowest (42%). Guido mine was also highly rated (78%) (Table 2).

⁶⁷ PODBORSKA-MŁYŃNARSKA Katarzyna. Assessment of the geological environment in respect of waste disposal in salt mine workings. In: *Geology, Geophysics & Environment*, 39(3), 2013, pp. 223–231, DOI 10.7494/geol.2013.39.3.223.

⁶⁸ *Kopalnia Soli Klodawa*, accessed February 14th, 2023, <https://sol-klodawa.com.pl/>

⁶⁹ *Polska Organizacja Turystyczna*, accessed March 9th, 2023, <https://www.pot.gov.pl/>

Tab. 2: *Results of the assessment of geotourism value*

| Tourist route | Scientific and educational value | Functional and tourist value | Total |
|--------------------------------|----------------------------------|------------------------------|-------|
| Chalk tunnels in Chełm | 6 | 9 | 15 |
| Silver mine in Tarnowskie Góry | 7 | 9 | 16 |
| Krzemionki Opatowskie | 12 | 6 | 18 |
| Gold mine in Złoty Stok | 8 | 12 | 20 |
| Guido mine in Zabrze | 8 | 11 | 19 |
| Uranium mine in Kletno | 7 | 10 | 17 |
| Podgórze mine in Kowary | 4 | 9 | 13 |
| Kłodawa salt mine | 7 | 8 | 15 |

In the case of Podgórze mine and Złoty Stok gold mine, the highest and lowest points from individual criteria had a major impact on the final result. The latter route received points in all criteria of functional–tourist value, whereas Podgórze mine did not receive the maximum number of points in any of the criteria for either category. The lack of points for the criterion of legibility of the features and the possibility to hold workshops lowered the final assessment of the site (Table 3). A high score (100%) for scientific and educational value played an important role in the assessment of Krzemionki Opatowskie.

Tab. 3: *Average values for each criterion*

| | Criteria | Average score |
|----------------------------------|--|---------------|
| Scientific and educational value | Scientific knowledge / Scientific publications | 1.8 |
| | Uniqueness of the facility | 1.4 |
| | Diversity | 0.9 |
| | Possibility of workshops/ lessons for students | 0.8 |
| | Educational products | 1.8 |
| | Legibility of features | 1 |
| Functional and tourist value | Number of tours | 1 |
| | Ticket prices | 0.9 |
| | Availability | 1.2 |
| | Presence of other tourist attractions | 1.9 |
| | Presence of associated infrastructure | 1.3 |
| | Routes website and social media | 1.9 |
| | Additional attractions in the facility | 0.8 |

The average score for each criterion was calculated. This shows that under the scientific and educational value category, the criteria scientific knowledge (i.e. scientific publications) (1.9 points) and educational products (1.9 points) were rated highest and represent the strong points of sites. The criterion concerning the delivery of workshops or lessons to students was rated lowest (0.8 points). Sites that were exceptions and received the maximum number of points in this criterion were the gold mine in Złoty Stok, Guido mine and the uranium mine

in Kletno (Table 3). For the functional and tourist value category, the lowest scoring criteria concerned additional attractions at the facility (0.8 points). Only two sites scored 2 points in this criterion – the gold mine in Złoty Stok and the uranium mine in Kletno. An average of close to 2 points was awarded to the following criteria: presence of other tourist attractions (1.9 points) and the route's website and social media presence (1.9 points) (Table 3).

The assessment of cultural heritage value indicated that the mine in Tarnowskie Góry, Guido mine and Krzemionki Opatowskie have particularly high heritage value (Table 4).

Tab. 4: *Heritage assessment of underground tourist routes*

| Tourist site | Uniqueness of heritage | Authenticity of the site | Exhibitions | Material heritage | Accompanying intangible heritage | Total |
|--------------------------------|------------------------|--------------------------|-------------|-------------------|----------------------------------|-------|
| Chalk tunnels in Chełm | 1 | 1 | 1 | 1 | 1 | 5 |
| Krzemionki Opatowskie | 3 | 3 | 2 | 2 | 1 | 11 |
| Gold mine in Złoty Stok | 2 | 2 | 2 | 3 | 1 | 10 |
| Uranium mine in Kletno | 1 | 2 | 1 | 1 | 1 | 6 |
| Podgórze mine in Kowary | 1 | 3 | 2 | 1 | 1 | 9 |
| Silver mine in Tarnowskie Góry | 2 | 3 | 3 | 3 | 3 | 14 |
| Guido mine in Zabrze | 1 | 2 | 2 | 3 | 3 | 11 |
| Kłodawa salt mine | 2 | 3 | 1 | 1 | 1 | 10 |

Scores: heritage value: 1 – low, 2 – medium, 3 – high

A total of 315 people took part in the survey, of whom 57% were women. The largest group of respondents was young, aged 18–26 years (71%), followed by those aged 27–35 years (13%). The largest group of respondents were people living in cities with more than 500,000 inhabitants (32% of respondents). A similar number of respondents came from cities with 150,000 to 500,000 inhabitants and villages – 23% and 22% respectively. The most common place of residence was Małopolskie Voivodeship (17%), followed by Mazowieckie Voivodeship (15%), Dolnośląskie Voivodeship and Pomorskie Voivodeship (11% each).

The vast majority of respondents had never heard of the mines. In the case of Podgórze mine, 83% of the respondents said they had not heard of it. Awareness was also low for Guido mine (80%), Krzemionki Opatowskie (78%), Kletno uranium mine (78%) and the chalk tunnels in Chełm (76%). The best-known sites were Kłodawa salt mine (64% of respondents) and Złoty Stok mine (64%). Most respondents had never visited the sites. The more well-known (visited) sites were the gold mine in Złoty Stok (37%) and the salt mine in Kłodawa (31%). Krzemionki Opatowskie and the chalk tunnels in Chełm (22%) and Guido mine in Zabrze (17%) saw the fewest visitors (Table 5).

Tab. 5: Respondents' responses regarding knowledge and visitation of selected sites

| | Have you heard of these facilities? | | Have you visited these facilities? | |
|--------------------------------|-------------------------------------|----|------------------------------------|----|
| | responses (%) | | | |
| | YES | NO | YES | NO |
| Chalk tunnels in Chelm | 24 | 76 | 22 | 78 |
| Krzemionki Opatowskie | 22 | 78 | 22 | 78 |
| Gold mine in Złoty Stok | 49 | 51 | 37 | 63 |
| Uranium mine in Kletno | 22 | 78 | 23 | 77 |
| Podgórze mine in Kowary | 17 | 83 | 24 | 76 |
| Silver mine in Tarnowskie Góry | 42 | 58 | 24 | 76 |
| Guido mine in Zabrze | 20 | 80 | 17 | 83 |
| Kłodawa salt mine | 64 | 36 | 31 | 69 |

The primary source of information for respondents about the sites was the internet. A number of respondents searched for data in tourist guides and asked friends or family.

Leisure activity was indicated as the main reason for visiting the underground trails (this answer was given by 300 respondents). Respondents also highlighted the opportunity to learn about the geology of the sites (210 respondents) and their cultural value (180 respondents). The dominant motive for arrival was cognitive (interest), particularly evident in the case of Guido mine in Zabrze (59%). Education in the form of school/student trips was the main motive for visiting Kłodawa salt mine (35%) and Krzemionki Opatowskie (32%). Rest/recreation was the main motive for visiting the historic silver mine in Tarnowskie Góry (29%).

Visiting an underground route was the only motive for choosing to visit a region for 15–25% of respondents. This indicator reached the highest value in the case of Guido mine (35%) and the uranium mine in Kowary (29%). This motive was least important in the case of the chalk tunnels in Chelm and Krzemionki Opatowskie (14%). For 40–45% of respondents, visiting an underground route was one of several main motives for coming to a particular region. This was most often the case for Krzemionki Opatowskie (59%), the Kłodawa salt mine (55%) and the Uranium mine in Kowary (54%). Visiting a mine was not important in choosing a region to visit for tourism in the case of the chalk tunnels in Chelm (36% of respondents), Tarnowskie Góry mine (50%) or Podgórze mine (64%).

In terms of tourist attractiveness, the underground tourist routes were rated according to a 4-grade scale: low, moderate, high, very high. Podgórze mine in Kowary and the silver mine in Tarnowskie Góry were rated high by 46% of respondents. In the case of the chalk tunnels in Chelm, 36% of respondents indicated that it has a “moderate” tourist attractiveness and 14% rated it low. The uranium mine in Kletno was given a low rating by 13%. On the other hand, a very high rating was most frequently indicated by respondents for Krzemionki Opatowskie (36%), the Kłodawa salt mine (35%) and the gold mine in Złoty Stok (32%) (Table 6).

Tab. 6: *Assessment of tourist attractiveness of facilities in respondents' answers*

| | Low | Moderate | High | Very high |
|--------------------------------|----------------|----------|------|-----------|
| | % of responses | | | |
| Chalk tunnels in Chelm | 14 | 36 | 32 | 18 |
| Krzemionki Opatowskie | 9 | 19 | 36 | 36 |
| Gold mine in Złoty Stok | 9 | 16 | 43 | 32 |
| Uranium mine in Kletno | 13 | 18 | 43 | 26 |
| Podgórze mine in Kowary | 13 | 21 | 46 | 20 |
| Silver mine in Tarnowskie Góry | 4 | 25 | 46 | 25 |
| Guido mine in Zabrze | 12 | 18 | 41 | 29 |
| Kłodawa salt mine | 13 | 13 | 39 | 35 |

According to respondents, the most attractive aspects were the opportunity to learn about the geology and history of the site visited and to learn about mining heritage. Additional attractions at the site, as well as the adaptation of the tour programme to different audiences, are assets of the visited sites (Table 7).

Tab. 7: *Top tourist attractions of the surveyed sites among respondents*

| Site | Respondents' answers |
|--------------------------------|---|
| Chalk tunnels in Chelm | Interesting history of the site, Bieluch Ghost, exhibits |
| Silver mine in Tarnowskie Góry | Interesting history of the site, boat passage |
| Krzemionki Opatowskie | Uniqueness, a unique striped flint mine |
| Gold mine in Złoty Stok | Rafting, many sightseeing possibilities adapted to different age groups, multimedia attractions, high level of work of guides |
| Guido mine in Zabrze | Going underground, the history of coal mining, the high standard of the guides' work |
| Uranium mine in Kletno | History of uranium mining in the Sudety Mountains, geological structure, Museum of Minerals in Kletno |
| Podgórze mine in Kowary | Interesting history of the site, high level of work of the guides |
| Kłodawa salt mine | Underground slide, underground excavations, geological structure, Poland's deepest underground tourist route |

Respondents cited the following as the greatest weaknesses of the sites surveyed: high ticket prices, long travel distances, the need to book visits in advance, and poor tour development, for example, outdated exhibitions. An important element when visiting underground tourist routes is the work of the guide. The vast majority of respondents indicated that the level of information provided by the guide during the tour of the sites was high (180 people); 120 respondents said it was moderate. Among the elements that needed to be changed, respondents indicated that ticket prices should be lowered, tourist routes should be lengthened, and lighting should be improved. Among the factors influencing the attractiveness of the underground routes, respondents indicated the professional preparation of the guide (240 people), the interactivity of the tour (191 people), the ticket price (176 people) and the presence of supporting infrastructure, for example, car parks, accommodation within the site (125 people) were important.

Discussion

The development of cultural tourism is determined by the rank and importance of tourist attractions. The flagship attractions – that is, the most important and unique ones – can become a tool for economic development and a factor accelerating revitalisation. Kruczek⁷⁰ identified the following Polish sites as flagship attractions with the greatest potential to attract tourist traffic: the gold mine in Złoty Stok, Wieliczka mine, Guido mine and Królowa Luiza Open-Air Museum, and the silver mine in Tarnowskie Góry. At the same time, it should be remembered that the potential to use heritage in tourism is proportional to its value, which is determined mainly by its legibility, authenticity, tourist accessibility and visual attractiveness.⁷¹ Mining heritage attractions are viable tourism enterprises, integrating industrial heritage tourism into regeneration policies.⁷² Tour operators need recognised and highly valued tourist attractions. Official lists created by international organisations (e.g., UNESCO's list), national bodies (e.g. Poland's List of Historical Monuments) or media-created lists of attractions and interesting places are used in the creation of tourism offers (Figure 7).



Fig.7: Entrance to the buildings of the flint mine in Krzemionki Opatowskie (Photograph: W. Zgłobicki)

The results of the assessment indicated a high diversity in terms of the scientific and educational value of the mines, including those related to post-mining heritage. Similar results were found when it came to functional and tourist value. It was a positive finding that high scientific–education value generally accompanied high tourist–functional value. The exception was Krzemionki Opatowskie mine, which is of outstanding scientific and educational value but relatively low functional–touristic value. In the former category, scientific knowledge and the availability of educational products were highly rated, while criteria such as diversity and the possibility of workshops/classes for students received the lowest marks. The highest-rated tourism–functional factors were its website and social media presence and the proximity of other tourist attractions. Its weak points were high ticket prices and a lack of additional attractions at the sites.

⁷⁰ KRUCZEK, Zygmunt. *Frekwencja w atrakcjach turystycznych w latach 2011-2015*. Kraków-Warszawa: Polska Organizacja Turystyczna, 2016.

⁷¹ PURCHLA, Jacek. *Heritage and cultural mega-events...*

⁷² COLE, Denise. *Exploring the sustainability...*

The surveys revealed a lack of knowledge about a large proportion of the post-mining sites, including Krzemionki Opatowskie (a UNESCO site) (Figure 7). Only 20–25% of respondents had heard of them (depending on the mine). For the least known sites, only around 20% of respondents had actually visited, and for Guido mine this figure was only 17%. Visiting underground tourist routes is primarily a form of leisure activity, but 60% of respondents indicated cultural value as an important reason. Underground routes were rated highly by respondents and can, in their opinion, be good tourist attractions. However, they are not usually the main reason for choosing a tourist destination (only 15–25% of respondents said they were). Among the weaknesses of the facilities, respondents listed high ticket prices, lack of adequate promotion, and poor adaptation of routes to tourist traffic. They also emphasised the importance of good preparation by guides, who were usually rated highly.

The cultural heritage of the underground tourist routes was felt to be high and varied, as seen from Table 8. In general, originality is characterised by preserved equipment and underground elements, accompanied by reconstructions of the mining method or directly in the vicinity, e.g., exhibitions of mining equipment or reconstructions of settlements. The sites with the highest post-mining heritage value include the silver mine in Tarnowskie Góry, Guido mine and the flint mine in Krzemionki Opatowskie. At the same time, these are the sites rated highest in the geotourism assessment. This creates very good opportunities for making this heritage accessible in the form of active museums. However, between 50 and 80% of respondents had not heard of these sites, and only between 17 and 20% of respondents had visited them.

Tab. 8: *Cultural heritage accompanying underground tourist routes*

| Tourist site | Post-mining heritage |
|--------------------------------|---|
| Chalk tunnels in Chelm | Old Town well shaft, mining corridors with characteristic niches, individual tool displays. |
| Krzemionki Opatowskie | Preserved original flint mine (pillar and chamber mines), reconstruction of mining methods and equipment. Flint-ware, reconstruction of a Neolithic settlement. |
| Gold mine in Złoty Stok | Preserved adits (original), underground railway, museum of mining and history, reconstruction of a medieval mining settlement, gold panning workshop. |
| Silver mine in Tarnowskie Góry | Preserved adits, mine equipment (carriages), mining methods, open-air museum of steam engines. |
| Guido mine in Zabrze | Coal mine galleries, mining machinery and equipment (the largest park in Europe), active tour (mining costumes, impersonation of miners), preserved abandoned hard coal wall. |
| Uranium mine in Kletno | Preserved adits. |
| Podgórze mine in Kowary | Preserved adits, military significance of uranium, railway carriages. |
| Kłodawa salt mine | Original mine galleries (active mining), mining machinery. |

A SWOT analysis showed that the weaknesses of the underground routes outweigh the strengths, but the external conditions for the development of this type of tourism are favourable (Table 9). The most serious problem is the low level of knowledge about the underground routes and the lack of well-prepared tourism products. Underground tourist routes have a very

high cultural value, which, with appropriate marketing support, could be of wider interest to tourists.

Tab. 9: *SWOT analysis of underground tourist routes*

| Internal conditions | |
|---|--|
| Strengths | Weaknesses |
| <ul style="list-style-type: none"> - wide variety of underground tourist routes - high profile of certain sites - authenticity of the sites - good tourist offer in some facilities - proximity to other cultural sites | <ul style="list-style-type: none"> - poor promotion of mining heritage - low level of awareness of existing assets - lack of well-developed educational products - high ticket prices - peripheral location of some sites <li style="text-align: center;">- lack of a wide range of accompanying services - low involvement of the local community and local government in the preparation of new facilities |
| External conditions | |
| Opportunities | Risks |
| <ul style="list-style-type: none"> - shift away from mass tourism towards cognitive tourism - systematic regulation of rules for the operation and provision of mining facilities - increasing interest in the site through certificates, heritage lists - development and promotion of tourism products and mining heritage trails | <ul style="list-style-type: none"> - lack of resources to carry out adaptation work (high costs) - legislative issues related to maintenance and safety in post-mining facilities (current Polish geological and mining law) |

Results from other studies indicate that in terms of sites' attractiveness for tourists, important factors include proper preparation of the site, the ability to move around it without major problems, and reliable presentation of information (including history) about the site, together with a properly prepared guide. For respondents, the educational value of an site was of primary importance when deciding where to visit, and people most often obtain knowledge of these destinations' existence from the internet.⁷³ Other authors also point out the important educational value of post-mining facilities, both surface and underground.⁷⁴ It is important to be able to actively engage visitors (travelling by underground train, working with mining tools) (Figure 8).

⁷³ JAGIEŁŁO, Anna. Ocena kierunków adaptacji podziemnych obiektów ...

⁷⁴ GAJEK, Grzegorz, ZGŁOBICKI, Wojciech, KOŁODYŃSKA-GAWRYSIK, Renata. Geoeducational Value of Quarries Located Within the Malopolska Vistula River Gap (E Poland). In: *Geoheritage*, 11, 2019, pp. 1335-1351; JELEN, Jakub. Mining heritage and mining tourism...



Fig. 8: Control panel – coal mine in Nowa Ruda (Photograph: W. Zglobicki)

An important issue in efforts to make underground sites available for tourism is the problem of interference with the original excavations.⁷⁵ Safety undoubtedly comes first, but care must be taken to ensure that the cultural heritage of the mine is altered as little as possible.⁷⁶ For sites that are inaccessible to tourists, primarily for safety reasons, it is possible to use modern technologies – for example, laser scanning and 3D modelling, to present them to the general public.⁷⁷ One problem in some former mining sites is the lack of development and accessibility.⁷⁸ In Poland there are many such sites, for example, the unique phosphate mine in Annopol. Issues relating to the provision of underground tourist routes were analysed. The authors concluded that there should be legal regulations on the provision and subsequent control of such sites to provide even greater safety for tourists.

Over the last decade, the number of people visiting underground tourist routes has steadily increased, although there was a collapse in numbers in 2020 due to the coronavirus pandemic.

⁷⁵ DUŻY, Stanisław, DYDUCH, Grzegorz, PREIDL, Wojciech, STACHA, Grzegorz, CZEMPAS, Artur, UTKO, Sandra. Evaluation of the technical condition of the “Fryderyk” adit in Tarnowskie Góry for the purpose of eventual revitalization. In: *Czasopismo Techniczne*, 6, 2017, pp. 85-99, DOI: 10.4467/2353737XC17.089.6565.

⁷⁶ CHMURA, Janusz, WIEJA, Tomasz. Profilaktyka i zapobieganie zagrożeniom w procesie adaptacji i użytkowania podziemnych tras turystycznych. In: *Przegląd Górniczy*, 4, 2015, pp. 83-89.

⁷⁷ HRONČEK, Pavel, GREGOROVÁ, Bohuslava, TOMETZOVÁ, Dana, MOLOKÁČ, Mário, HVIzdÁK, Ladislav. Modeling of vanished historic mining landscape features as a part of digital cultural heritage and possibilities of its use in mining tourism (case study: Gelnica town, Slovakia). In: *Resources*, 9 (4), 2020, 43, <https://doi.org/10.3390/resources9040043>

⁷⁸ RUIZ-BALLESTEROS, Esteban, RAMÍREZ, Macarena, H. Identity and community—Reflections on the development of mining heritage tourism in Southern Spain. In: *Tourism management*, 28 (3), 2007, pp. 677-687.

In the case of Wieliczka mine, the number of tourists doubled from 1,600,000 in 2011 to 2,078,000 in 2019). Of the routes surveyed, the gold mine in Złoty Stok (145,000 in 2011, 217,000 in 2016) and Guido mine and Queen Luisa Adit (89,000 in 2011, 228,000 in 2019) were the most popular. Traffic was lower at the silver mine in Tarnowskie Góry (54,000 in 2011) and the Krzemionki Opatowskie Mine (38,000 in 2011, 42,000 in 2019).⁷⁹

Conclusions

The existing cultural heritage resources (underground mining routes) are an important basis for the development of tourism and education. Exceptionally, these heritage sites are under a form of legal protection but many of them are valuable heritage destinations and attract tourists. Certainly, being covered by various forms of protection and being on prestigious lists strengthens a site's position and confirms its value, which attracts interest from tourists. This provides opportunities to prepare underground tourist routes well, while not only maintaining authenticity but also meeting safety requirements and providing complementary services and necessary infrastructure. The joint promotion of tangible and intangible cultural heritage lends authenticity and also brings educational benefits.

However, the research carried out here indicates that potential tourists have poor awareness of the existence of many such sites (even those on the UNESCO list). If tourists do find themselves visiting the underground routes, they generally rate them highly in terms of tourist attractiveness, but they also point out specific weaknesses. Some of the mining sites provide very diverse services, and this allows for better use of promotional tools. Strengthening post-mining cultural heritage in tourism requires the preparation of an offer of branded tourism products widely promoted via the internet. In our opinion, underground tourist routes are an excellent response to the challenge of the need for the intensive development of museums and exhibitions of an interactive nature.

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⁷⁹ KRUCZEK, Zygmunt. Frekwencja w atrakcjach turystycznych w latach 2016-2018. Kraków-Warszawa: Polska Organizacja Turystyczna, 2019; KRUCZEK, Zygmunt, NOWAK, Karolina. Frekwencja w atrakcjach turystycznych w 2021 roku. Kraków-Warszawa: Polska Organizacja Turystyczna, 2022.

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