COAL HERITAGE

RFCS Accompanying Measure Project

NEWSLETTER

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3D models of coal heritage assets

by Magdalena Rozmus

a) Why to create 3D models

In post-industrial areas, objects can be found that bear witness to the industrial activities carried out in the area. These objects may include, among others: old machines, monuments, figures, industrial plants or other industrial buildings as well as characteristic landforms. Some of these facilities are in public areas, but there may also be some that are located in a closed area that cannot be freely accessed. Another aspect is the durability of such exhibits. Most of them are not included in the list of monuments, therefore they are not legally protected. Over the years, they may deteriorate, be destroyed or cease to exist as a result of, for example, changes in land use (e.g. demolition of buildings or shaft towers). One way to disseminate information about such objects and preserve information about them for the future is to prepare 3D models of these objects. These models present the selected object in a photorealistic way. In this way, it is possible to show and demonstrate these objects to a wide audience, also via Internet.

b) What can be represented in the form of a 3D model

3D models can be prepared from virtually any object. The smallest mining-related objects from which 3D models can be prepared are tools, mining souvenirs or everyday items such as helmets, pickaxes, mining mugs, etc. Another type of objects for which the use of 3D models is a very good solution are mining machines. In this case, it is not possible to transport these objects freely. Using 3D models, you can show details of the construction of mining machines, such as hoisting machines, longwall shearers or machines related to the transport of coal or people. The biggest challenge is preparing 3D models of buildings. These facilities include, for example: shaft towers or buildings located in a coal mine.

c) How 3D models are created in the CoalHeritage project – photogrammetry

In the Coal Heritage project, we use photogrammetry technology to prepare 3D models of selected objects. In this technology, 3D models are created in specialised software on the basis of appropriately taken photographic images. The algorithm for creating a 3D model of a selected object is shown in the figure below.

As shown in the Figure 1, the preparation of a 3D model consists of several steps.

The first step is to take a series of photographs of the selected object. These photographs are then processed using specialised computer software. In this software, the photos are linked together and a point cloud is generated, followed by a surface model of the object. In the final processing step, textures are applied to the model to create a photorealistic visual effect. Once the model is ready, it is exported to one of the popular model types such as obj or gbl. Sometimes, a model of a human figure of 50th percentile male is added to the model to show the machine size. The 3D models can be made available through, for example, sharing platforms or selected websites. In the CoalHeritage project, the models developed in the presented manner will be embedded in the European Visual Map Journal (EVMJ).

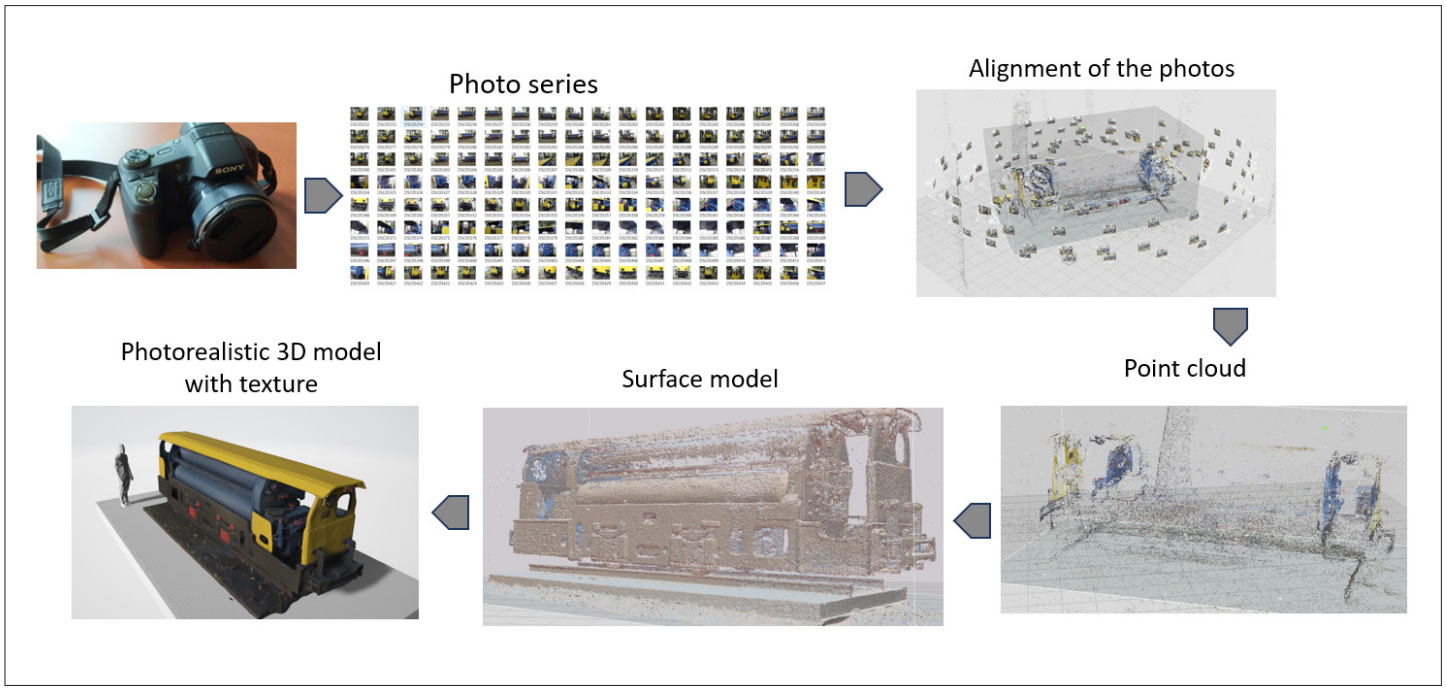


Figure 1. Creation of a 3D model based on photos of an object

d) Examples of developed 3D models

One of the smaller mining machines is "Olownica" – a machine used for making wooden supports. The machine was used to make special half-round cuts (called "olunek" – in Polish) in elements of wooden supports to join them. This supports were used to support roof in roadways in the mine. Dates back to the first half of the 20th century.

In the picture we can see a photo of such machine that now is exhibited on the premises of the Queen Louise Adit in Zabrze (Poland) and its 3D model.

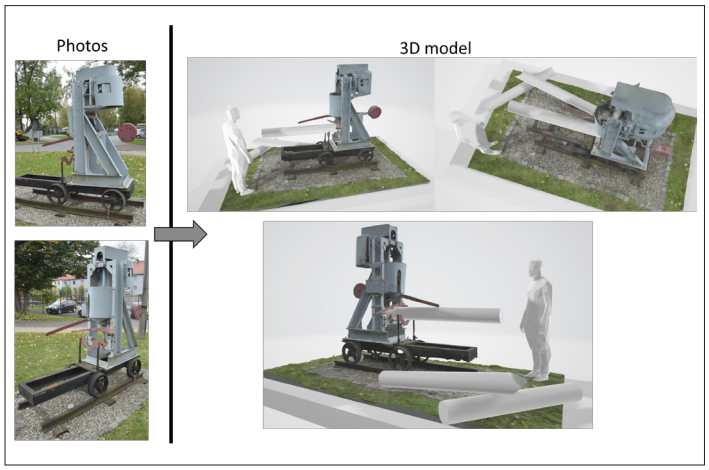


Figure 2. A machine called 'Olownica' - photos and a 3D model

An example of a machine used to transport workers or transport material is air locomotive type Pz45 JUNG. It's 3D model was prepared based on photos of this machine that is now exhibited on the premises of the Guido Mine in Zabrze (Poland). It was made in Germany in 1985. Its main use was the transport of excavated material and materials in carts in the area of the shaft. The air locomotive was powered by compressed air with a pressure of 20 MPa, supplied from the surface compressor station via pipelines, through the shaft to the network of underground air pipelines. The air engine was driven from 3 high-pressure tanks with a total capacity of 1,300 liters. The locomotive driver's cabin is equipped with a driving control device with the ability to control from both sides of the locomotive, depending on the direction of travel. Such a locomotive worked, for example, in the KWK Krupinski Mine in Suszec (Poland) until 2010.

Technical specification:

- Weight: 10,5 t
- Length with bumpers – 5,48 m
- Width: 1,1 m
- Height: 1,63 m
- Maximum pulling force: 33.350 N
- Engine power:36,75 kW
- Driving speed: 3m/s

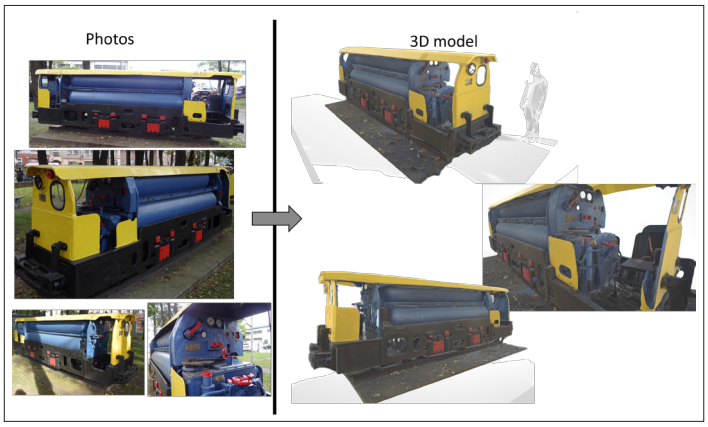


Figure 3. A locomotive - photos and a 3D model

One of the largest machines working at a mine is a hoisting machine. Below is an example of a 3D model of a steam hoisting machine that worked in the shaft "Staszic II" of the coal mine "Siemianowice" (Poland) from 1910 to 1995.

It is a 2-expansion steam machine, working with blowing. The supplied superheated steam had a temperature of 280°C and a pressure of 8-10 atm. The machine consists of two horizontal twin units, made up of a high-pressure cylinder and a low-pressure cylinder, installed in a post-similar arrangement. Two rope drums with a diameter of 6.5 m and a width of 1.4 m, were mounted with a shaft on the ends of which two cranks were mounted. The shaft was set in motion by a crank attached to the crank, connected to a rods and a piston rod on which two pistons of low and high steam pressure were installed. The machine had 1.900 horsepower and was controlled via valves and a servo motor. It lifted loads at a speed of 6 to 14 m/s. The double steam expansion allowed saving a lot of energy, but machines of this type were used in mines very rarely. In 1995, the machine was donated to the Coal Mining Museum in Zabrze. Dissasembly, transport and reassembly on the premises of the Królowa Luiza Mining Open-Air Museum was carried out by the PEMUG company.

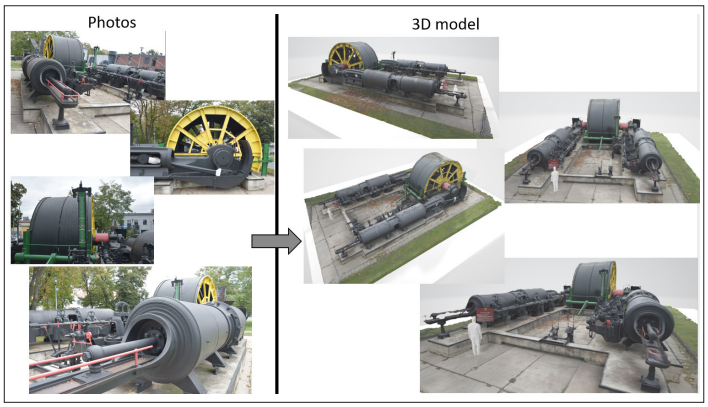
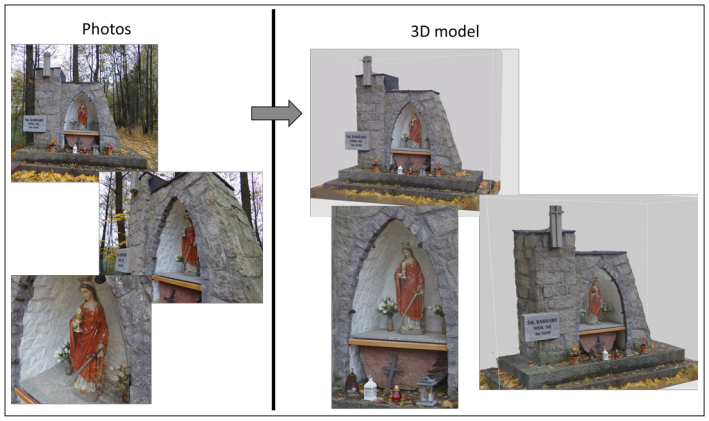


Figure 4. A steam hoisting machine - photos and a 3D model

Among the models developed are models of buildings, an example of which is the chapel of St. Barbara, the saint patron of miners, in Bobrowniki Slaskie (Poland). The chapel standing on the edge of the canyon is a reminder of the Bobrowniki Dolomite Mine that operated here

Platform link: https://storymaps.arcgis.com/collections/987904b97d664cedb2ea4c161fb0f31e

until the 1990s. The chapel was built in 1981 thanks to the efforts of the NSZZ Solidarność which was active at the Bobrowniki Silesian Dolomite Mine. It was made by Mieczyslaw Filipiak and Ryszard Jachim according to the design created by Gerard Dominiak. The plant was decommissioned in the mid-1990s, but the Local Miners' Club began taking care of it in 2001. Inside was originally to be the image of St. Barbara which later found its way to the chapel named after her in the church in Bobrowniki Slaskie. Currently, inside the chapel is a statue of St. Barbara - the patron saint of miners.



How we use models in the Coal Heritage project

by Andreas Karavias and Pavlos Krassakis

a) What is EVMJ - a brief description and assumptions of the map

The European Visual Map Journal (EVMJ) is designed to enhance the preservation of coal mining heritage across Europe. This platform integrates various aspects of mining heritage, including legislation, funding, management, conservation, promotion and best practices examples. It presents these elements on an interactive web platform that employs storytelling techniques to effectively and engagingly represent complex data and spatial relationships. EVMJ comprises a collection of story maps that narrate the history of places and topics related to coal mining. These story maps combine multimedia, web maps, and text to engage a broad audience and deepen their understanding of coal mining heritage through diverse themes and interest categories. The platform uses both 2D and 3D visualizations to make the exploration of coal mining heritage accessible to visitors utilizing a user-friendly interface. Hosted on a cloud database, the content covers coal mining heritage assets from several European countries, including Greece, Poland, Slovenia, Germany, and France (Figure 6). Ultimately, EVMJ serves as both an inventory and a dissemination tool to promote the preservation and awareness of coal mining heritage in Europe.

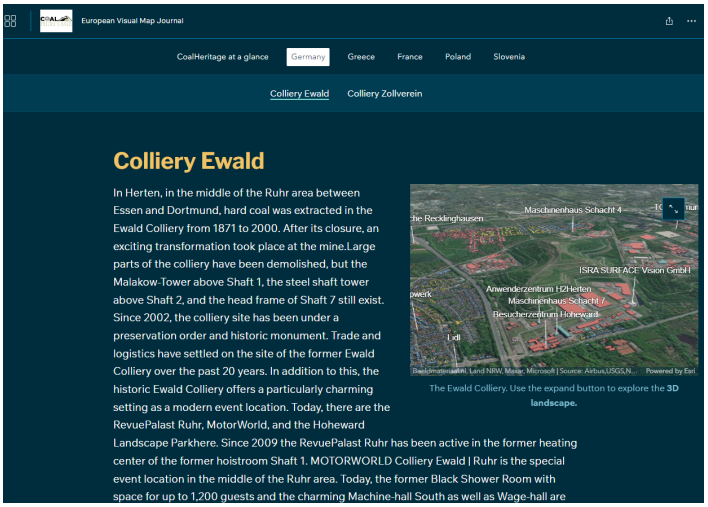


Figure 6. EVMJ's Germany storymap section including the Ewald Colliery site. The user can click the upper right expand button to explore the available 3D environment.

b) Example of model location on EVMJ map

In the context of the European Visual Map Journal (EVMJ), showcasing 3D models of coal machineries on the real world can serve as an excellent example to highlight the possibilities for machine location and scale. The selected uploaded models are placed on the map with true coordinates in Poland country. By placing the historical 3D model on these specific locations within the EVMJ map, it provides a contextual visualization of their historical operation. The models are scaled appropriately to match the geographical and environmental context of the map.

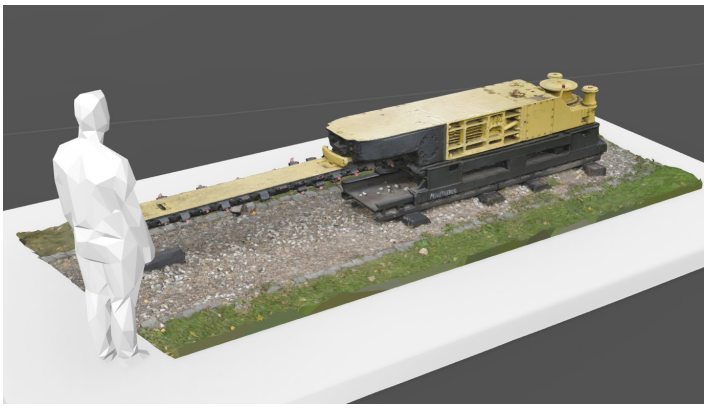


Figure 7. Screenshot from the 3D model of Frederick Hurda's first chain coal cutting machine located in Poland, which was used widely in English and German mines in the 19th century.

For instance, the 3D model of Frederick Hurda's first chain coal cutting machine (Figure 7) located in Poland, which was used widely in English and German mines in the 19th century is depicted at a real scale providing a realistic sense of size and space. This scale helps in understanding the physical dimensions of the machine relative to the surrounding area, such as adjacent buildings or infrastructure. This placement not only enriches the map with historical context but also enhances user interaction

by allowing them to explore how such machinery was an integral part of the coal mining landscape. It also aids educational purposes by providing a tangible connection to the past techniques and technologies used in coal mining, emphasized through interactive and scaled representations.

c) Brief presentation of the tools available on EVMJ in relation to 3D models (e.g. ability to take measurements)

The European Visual Map Journal (EVMJ) platform is equipped with various tools designed to enhance the visualization and interaction with 3D models related to coal mining heritage. These tools aim to provide a deeper understanding of the spatial relationships and dimensions within the historical and present contexts of mining sites. Here is a brief overview of some of the key functionalities available on EVMJ concerning 3D models:

Measurement Tools: One of the standout features of the EVMJ is the capability to perform precise measurements directly within the 3D environment. This tool allows users to measure distances and heights (Figure 8) in 3D models, which is very important for assessing the scale and spatial relationships between different elements in the 3D model. Whether it's determining the height of a coal cutting machine or the distance between two historical sites, these tools provide essential data and practical planning.

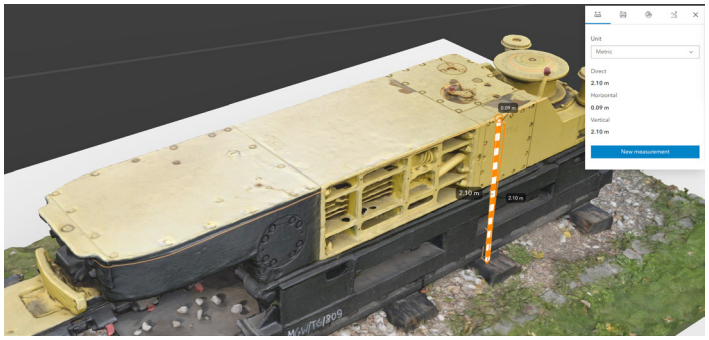


Figure 8. Top view of the first chain coal cutting machine where measurement tool has been applied, indicating the height of the machine at approximately 2,10 meters.

Interactive Viewing Options: The platform supports interactive viewing options, enabling users to explore 3D models from various angles and perspectives. Users can rotate, zoom, and pan across different models, offering a comprehensive view that helps in understanding the detailed features and mechanics of mining equipment.

Sharing Capabilities: The platform facilitates the export and sharing of findings and models. Users can share the 3D model in order to support the dissemination of knowledge and the promotion of coal mining heritage.

Summarizing, these tools make EVMJ a robust platform for the exploration and presentation of coal mining heritage in an interactive and educational manner, supporting a wide range of users from researchers and educators to general enthusiasts. The integration of these tools into the 3D models not only makes the learning experience more engaging but also enhances the understanding of historical and geographical data.

European Visual Map Journej QR CODE

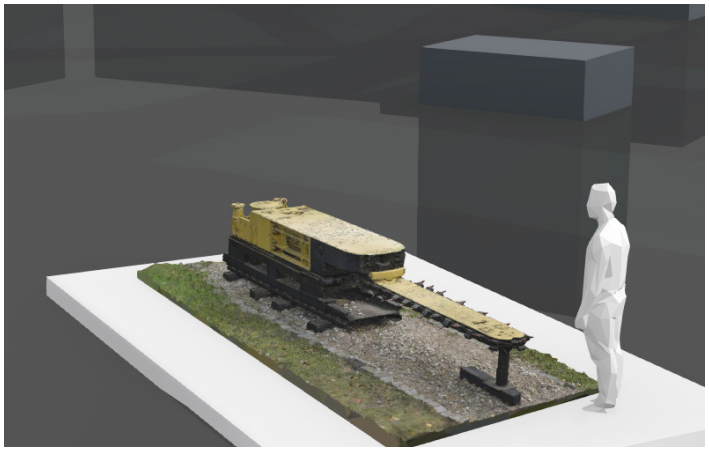


Figure 9. Cutting machine (front view)

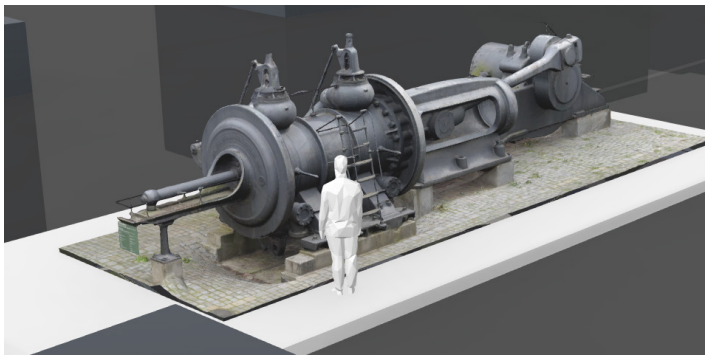


Figure 10. Coal steam machine (back view)

Ongoing and Upcoming Events

Shape the Future of Coal Transition: Participate in Our Stakeholder Awareness Online Survey

by Hernan Flores

We extend a warm invitation to all our readers to seize the opportunity and contribute to shaping the future of coal transition! Our stakeholder awareness survey is now live and open for participation.

This survey serves as a crucial platform for gathering insights into coal transition initiatives and the revitalization of former mining sites across our partners' regions. We encourage you to join us in this endeavor by sharing your thoughts and preferences on industrial coal heritage, transition strategies, and the preservation of these historic sites.

Whether you have direct involvement in the coal industry, reside in communities impacted by its transition, or harbor a passion for heritage preservation and sustainable development, your perspective is invaluable to us.

To participate, simply scan the QR code or click on the link provided:
https://tuwcbeo3e5n.typeform.com/to/AkdvbZ6V

The CoalHeritage Project Makes Waves at International Mining Event

by Hernan Flores

The CoalHeritage Project recently took center stage at two prominent industry gatherings: the West Virginia Mine Drainage Task Force Symposium and the 15th International Mine Water Association Congress in Morgantown, West Virginia. These event brought together over 300 participants from various sectors, including pragmatic consultants, mining company personnel, academic researchers (spanning faculty, graduate students, and undergraduates), as well as government scientists and regulators representing diverse nationalities and countries.

Figure 11. Poster and Networking Session at the West Virginia Mine Drainage Task Force Symposium & 15th IMWA Conference in Morgantown, West Virginia (Photos: Hernan Flores)

The symposium and congress provided a vital platform for disseminating information and fostering collaboration within an international network committed to envisioning safe and socially acceptable post-mining landscapes. Central to this vision is the preservation and promotion of coal heritage sites across Europe.

During the poster presentations and networking sessions, our partner, Hernan Flores, showed the project's primary objectives, its current status, and actively engaged with numerous interested participants. A notable theme that emerged from discussions was the increasing significance of stakeholder awareness and engagement in achieving the project's overarching goals.

These events not only facilitated knowledge exchange but also reinforced the importance of collective efforts in shaping sustainable post-mining futures. As the Coal Heritage Project continues to garner momentum, it remains dedicated to fostering dialogue, collaboration, and tangible outcomes towards realizing its vision.

Conference "Cultural Heritage and the Investment Process" in the Silesian Museum in Katowice, Poland

by Sylwia Jarosławska-Sobór

On April 8 2024, a scientific conference entitled "Cultural Heritage and the Investment Process" took place at the headquarters of the Silesian Museum in Katowice. During the conference, Sylwia Jarosławska-Sobór, GIG-PIB representatives, had the opportunity to present the Coal Heritage project.

Cultural heritage, combining the richness of history and tradition, plays a key role not only in shaping the identity of a community, but also in generating economic influence. Especially in the context of the mining heritage of Upper Silesia, its importance becomes undeniable. The Upper Silesian mining heritage is not only a valuable cultural resource, but also an important economic factor in the process of transformation of the mining region. Historic collieries and mining districts are not only a reminder of the region's rich tradition, but also might be seen as potential centers for tourism and cultural development.

The conference, with the participation of the Silesian Voivode, was an opportunity for a lively discussion on the most important problems related to cultural heritage in Poland, especially in the area of mining region of Upper Silesia. One of them was the challenge of post-mining land development and sustainable development of the region using the cultural and social potential of hard coal mining heritage.

The event attracted specialists from various fields of science, including humanities, social sciences, economics and law, but also natural sciences and practitioners of cultural heritage investments. It was held under the honorary patronage of the Polish Ministry of Culture and National Heritage, the Marshal of the Silesian Voivodeship, the Mayor of Katowice and the Rector of the University of Silesia in Katowice.

Figure 12. Silesian Museum conference (author: Silesian University)

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