

## **UNUSUAL MINING HERITAGE OF LOWER SILESIA, POLAND**

### **Lower Silesia as a region of former mining works**

Poland is a country of several-century-old mining tradition. Nowadays, the symbol of dynamics and economic success of the Polish mining industry is KGHM Polska Miedź S.A., one of the largest producers of copper and silver in the world, exploiting a vast and rich polymetallic deposit in the northern part of Lower Silesia – the area associated over the ages with the exploration and exploitation of numerous mineral deposits, including, first of all, ore deposits. The evidence-supported history of copper ore mining in this area encompasses the period of more than 700 years, as the first survived information on the existence of a copper mine in the mountains (*Cuprifodina in montibus*) goes back to the years 1310-1311. The gold mining started here much earlier, but first of all the former miners were interested in numerous, easy-accessible, small polymetallic deposits, which were periodically exploited over the period from the 13th to 20th century. Lower Silesia – a region situated in the south-western part of Poland – is a geographical, historical region and an administrative unit, encompassing the areas of Silesian Lowlands, Silesian-Lusatian Lowlands, Sudeten Foothills and Sudeten Mountains. It borders Germany to the west, and the Czech Republic to the south. Lower Silesia lies in the belt of large population density and the largest concentration of mineral resources in Europe, stretching from northern France, through Germany, Poland and Ukraine to the Donieck Basin. This fact was of especially great importance for the history of the region, it also had an impact on the development and transformation of the local economy, especially in the Middle Ages and in the modern age. Historians dealing with the mining issues tend to treat Lower Silesia as a separate mining region within the area of Central Europe. Its shaping was first of all influenced by gold deposits occurring here as primary and secondary deposits, and polymetallic deposits. This clearly distinguished it from the mining centres coming into being in the area of Upper Silesia and Little Poland as well as German, Czech and Hungarian centres. Over the ages, the areas of Lower Silesia often changed their nationality. After the end of World War II (after 1945) they fell within the borders of the Polish

state. This led to the loss of plenty of source information about the development history of mining works in this area and the location of former mining sites. The basic sources of knowledge when studying the history of mining in Lower Silesia are written texts, iconographic and cartographic sources, archive materials and museum pieces. The specific nature of mining, as a branch of medieval and modern economy, with numerous legal rules and regulations and its administrative and supervisory apparatus, caused that this category of sources is extremely rich and highly diversified at the same time. Of significant importance for the area of Lower Silesia are the documents published by the German scholars: K. Wutke, in the 20th and 21st century in the volume *Codex Diplomaticus Silesiae* (originating from the years 1136-1740), and publications of materials collected by E. Steinbeck and H. Festenberg-Packisch. This category of documents is complemented by the archive materials of the former Higher Mining Office in Wrocław (before 1945). However, the results of archaeological examinations, both excavations and surface explorations, are becoming more and more respected and significant for learning the history of former works and state of mining technique.

### **Lower Silesian mining in historical perspective**

Numerous circumstances, including the so-called “graves of foundrymen” – discovered in the burial ground in Legnica (dated back to the turn of Bronze and Iron Ages), as well as a metallurgical workshop discovered in the area of settlement in Grzybiany, indicate a possibility of local exploitation of copper deposits as far back as the Bronze Age. However, the beginning of evidenced history of mining non-ferrous metal ore deposits in Lower Silesia – mainly Lower Silesian gold is dated back to the 13th century. This fact is confirmed by the written text sources as well as by the results of archaeological examinations. It is linked to the period of deep transformation taking place in Europe at that time, which had also considerable impact on mining. As the so-called freedom of mining had become widespread, mining works developed then in an extremely unrestrained manner. It was also an important period for the development of mining technique, as well as cities – often connected with metal ore mining centres.

The beginning of the 17th century (and especially the outbreak of the Thirty Years' War 1618 - 1648) closed the development period of Lower Silesian mining centres which had been flourishing over the 16th century, as the whole mining industry in Central Europe, associated mainly with the transformation in the system of conducting mining works and their financing as well as the progress in drainage methods (widespread application of mechanical drainage equipment and drain adits) and melting. As far back as the second half of the 16th century the downturn could be noticed in the case of significant centres of Lower Silesian mining centres, such as Złoty Stok, Zlate Hory, Boguszów or Miedzianka. It was only in the 18th century that a distinct revival of mining works in Lower Silesia became noticeable, after it passed on to Prussia. The economic crisis of the 1920s was the reason for final stoppage of mining works in a number of historical mining and metallurgical centres operating over the ages (with interruptions) in the area of Lower Silesia. Intensive geological and exploratory works were started again in this area after 1945. Initially, their main reason was to discover uranium ore deposits (as far back as 1926 German geologists confirmed the occurrence of uranium ores in the iron ore mine deposits in Kowary). In 1948, extensive and intensive exploratory works in hopes of finding ores of radioactive elements were started and continued until 1956. The exploitation of uranium ores was terminated in 1963. Apart from the exploration and exploitation of uranium ores, treated as a priority due to strategic reasons, after connecting the area of Lower Silesia to Poland, intensive geological and exploratory works began there with the aim of creating a raw material resource base for the developing post-war industry. The geological and exploratory works were also conducted in the areas of historic mining activity, however, the small resources of formerly exploited deposits turned out to be practically exhausted. There were, however, few attempts to resume their exploitation, e.g. in the area of historic tin ore mining in the Gierczyn region. At present, the formerly exploited, numerous, small and almost exhausted deposits and occurrences of polymetallic ores in Lower Silesia are not exploited for economic reasons.

### **Heritage of former mining works**

Hundreds of years of exploratory and exploitation works conducted in the area of Lower Silesia left numerous, still identifiable transformations of land surface, marking the areas of former mining works. These are mainly relics of former (open and underground) workings, heaps of waste rock, metallurgical slags or ore enrichment wastes, remains of hydrotechnical equipment – inherently connected with the former mining technique, and even survived fragments of superficial infrastructure. Their condition depends to a large extent on their location. Least obliterated and easy to identify are objects located far away from buildings, roads and other elements of modern infrastructure. The former ore mining sites in the Sudeten and their foothills were usually located on steep slopes, in relatively hardly accessible places, and after terminating their exploration and exploitation their remains were not subjected to any disposal and reclamation process. This is the reason of many hazards resulting from such condition of post-mining objects but, at the same time, it makes the conduct of research and cataloguing work in the places of historical mining easier. The best survived remains of former mining works are opening-out headings of mines, mainly in the form of drifts and shaft relics. In Lower Silesia, due to the favourable topography of former mining areas, drain adits were used as far back as the 14th century. Since adits, especially drain adits, were to serve their purpose for many years, great importance was attached to their careful workmanship and durability, therefore, and as well as due to the small dimensions of their cross-section and small depth, most adits still remain in good condition. Usually, the initial adit section only is filled (in the whole or in part), and rock falls only occur locally, mainly in the geological fault zones. Practically, each old adit constitutes an original work of art and monument of mining technique. The condition of old mine shafts looks much worse. Apart from few exceptions, only sink holes can be found at present in the places of their former existence. It results from the nature of such workings (vertical or steeply inclined), secured mainly by timber support, the near-surface section of which cut through a layer of loose rocks – being susceptible to collapse. Furthermore, after terminating the mining works, shafts became a storage place for all sorts of wastes (in the case of survived workings this illegal practice is still going on), which in combination with rock

material gradually filled the workings. The survived drifts and shafts of old mines can be found practically in each region of former mining works in Lower Silesia. Apart from the above-mentioned relics of former mining works, remains of exploratory workings can be located – mainly in the form of a series of shallow pits or trenches. Exploration with the use of such methods were also conducted after 1945 usually in the areas of former ore mining activity, which nowadays can lead to misinterpretation of the origin of such objects. Similar in nature to the relics of exploratory works are remains of a primitive, multi-shaft underground mining method, mainly known from the area of the Oławiane and Sowie Mountains and Radzimowice. Due to their location on the hardly accessible, steep slopes of the hills (Modliszów, Radzimowice), or in their top parts (the Ołowiane Mountains), these relics have survived in relatively good condition and today constitute an excellent example of old mining methods. There is no point in ignoring the remains associated with open-pit mining of the deposits in the area of their outcrop. These are often vast series of lengthened pits of land, usually located on the slopes of the hills, in places where small thickness of overburden made it possible to conduct such type of exploitation. Such workings are known, inter alia, from the sites of former tin and cobalt ore mining in the neighbourhood of Gierczyn. The areas of historic mining activity are also marked with heaps of waste rock coming from underground workings and heaps of wastes from ore enrichment. Unlike the extensive dumps constituting the evidence of intensive development of coal mining in the region of Wałbrzych and Nowa Ruda (at the turn of the 19th and 20th centuries), the heaps associated with former ore mining are relatively small, often hardly distinguishable from the surroundings. An important group of relics giving evidence of past mining and metallurgical works are the remains of hydrotechnical equipment – especially those used to dam water up, in the form of earth barriers partitioning the stream valleys in the neighbourhood of mines. The use of water energy for driving drainage and transport equipment in the processes of ore treatment and for driving the bellows of metallurgical furnaces, required gathering large amounts of water and its supply. In the case of water-driven drainage and vertical transport equipment it was necessary to supply considerable amounts of water to Koepe

pulleys installed in the shafts (or in their direct vicinity), by means of a system of channels and gutters. The transfer of mechanical energy from water-wheels located in the neighbourhood of streams to distant equipment by means of pusher systems was technically complicated, expensive and not always feasible. The remains of water supply channels, due to their small cross-sectional dimensions, survived in small sections only. An exceptional, most valuable group of the remains of former mining works are the remains of drainage and transport machinery and equipment. The most important monuments of this kind are the fragments of original water pump from the year 1783, pulled out in 1954 from the shaft of former *Hundsrück* mine, in the neighbourhood of Gierczyn. Two complete suction pumps and their associated elements for power transmission from the water-wheel were found there. They are now exhibited in the Museum of Mining in Zabrze and constitute the only original, partly survived water pump in Poland. During the exploratory works conducted in 1950s in the above-mentioned mine a number of other historic elements of mining equipment were found and they have been catalogued in the "Catalogue of Gierczyn Monuments" (in total, 81 exhibits). It is assumed that in the inaccessible workings of other former mines in the area of Lower Silesia there are similar invaluable exhibits of historic mining technique waiting for their discovery and conservation. The proof of that is the find made during the research and cataloguing works, conducted under the leadership of the author of this publication, in one of the former polymetallic ore mines, where a perfectly-survived hand windlass (with a bucket). The results of dendrochronological examinations allowed dating of the wooden structure of the windlass to the beginning of the 19th century, and the fragments of working support to the 16th century.

### **Development and state of research in the scope of mining archaeology in Lower Silesia**

Interest in the relics of former mining activity was vivid for ages in the environment of miners. The research history on non-ferrous metal ore mining has very long traditions in Lower Silesia. As far back as the 16th century, in the documents and descriptions there appeared information about the remains of former

mining works that were found by the then miners. The first studies concerning the former mining activity in Lower Silesia appeared in the second half of the 18th century, inter alia, in *Schlesische Provinzialblätter* or *Bergmannisches Journal*. The interest in these issues rose in the 19th century – the researchers of that period included: E. Steinbeck, K. Wutke and E. Ziviera, whose works referred mainly to issues associated with the development of Silesian law and mining regale [10]. The first attempts of monographic depiction of mining history in the area of Lower Silesia also appeared then, based on the wide collection of then available sources. The set of documents associated with the history of Lower Silesian mining over the years 1136 – 1740 published by K. Wutke (in volumes XX and XXI of *Codex Diplomaticus Silesiae*) still constitutes the basic source of knowledge for studies on the mediaeval and modern mining in this area [11]. Publications that appeared in the journals: *Zeitschrift für das Berg-Hütten- und Salinenwesen in dem Preussischen Staate*, *Zeitschrift für Bergrecht*, *Zeitschrift des Vereins für Geschichte und Altertums Schlesiens* made an important contribution in the development of studies on the mining history in the area of Lower Silesia. They contained valuable information concerning the operation of Fuggers' and Thurzons' trading companies in this area. At the same time, the first studies on the mining development in particular centres appeared. At the beginning of the 20th century H. Quiring published an important study concerning the medieval gold mining in the neighbourhood of Złotoryja. The study had an exceptional character as it contained information on the relics of former mining works, which had been found during the attempts to resume the exploitation in the 18th and 19th century, and also the results of author's site surveys. The interest in historic mining issues in Lower Silesia rose in the 1920s and 1930s, when the research concentrated mainly on the alleged origins of mining and metallurgy in the Bronze Era. The important objects of mining heritage were discovered in 1938, during the works aimed at assessing the possibility to resume exploitation in the area of historic tin ore exploitation in Gierczyn, when from the drained shaft of the *Hundsrucken* mine (operating in the period of the 16th and 17th centuries) the remains of historic drainage equipment were pulled out along with a series of other relics of the former mine equipment

(more relics were pulled out in the 1950s). After the year 1945 and connecting the areas of Lower Silesia to Poland, intensive geological and exploratory works began, with the primary aim of searching for ore deposits of radioactive elements. These works had a huge impact on the condition of old ore mining sites, as most of historic workings were explored (in the deposit aspect) and partly reconstructed then. From obvious reasons the historic and archaeological value of former works relics was not a subject of interest then. However, a rich documentation was produced the part of which (mainly in the form of studies in the Russian language) is now kept in archives (inter alia, in the archives of the Higher Mining Office in Katowice). The revival in the field of mining heritage research works took place in Poland in the half of the 1950s, when the specialist publication dedicated to these issues and entitled „Studies on the history of mining and metallurgy” appeared. Among the others, studies concerning former ore exploitation in Lower Silesia were published in there. The 1960s brought an interest in the material relics of former mining works in the studies on mining history and development. The term *mining archaeology* (German: Bergbauarchäologie) was used for the first time as far back as the second half of the 19th century by an engineer (not by archaeologist or historian), Theodor Haupt. In the studies of this mining expert who, in the course of his long professional practice in Toscana and Sardinia, often dealt with the footprints of former mining activity, the role and importance of such objects for learning the history and culture of our civilisation was emphasized. The first professional and methodical archaeological examinations in sites associated with historic mining activity were carried out in 1960s in the areas of Germany and the Czech Republic. The 1970s brought about the revival of studies on mining sediments in the area of the Kruszcowe Mountains (Erzgebirge, Germany), in the 1980s and 1990s German archaeologists carried out long-term, interdisciplinary research programmes in this area. Archaeological examinations considerably complemented and extended the picture of historic mining in Europe, historic mining technique and exploitation methods, but also of everyday life, material culture or even games and sports of miners. In the area of Lower Silesia, using the excavation method, the sites associated with the extraction and rinsing of secondary gold



deposits in the region of Złotoryja, Legnickie Pole, Wądroż Wielki, Lwówek Śląskie, Jelenia Góra, Głucholązy and Lubawka were examined. The broad range of conducted examinations caused that we now have at our disposal a relatively rich material associated with this branch of Lower Silesian mining. The originator of archaeological examinations associated with former gold mining and their continuator was J. Kaźmierczyk from the Institute of Archaeology of the University of Wrocław. Dr R. Grodzicki, a then employee of the Institute of Geology of the University of Wrocław, also took part in the examinations, which determined their interdisciplinary character. The pioneering research on identification of chemical composition of gold products coming from excavation works in the area of Lower Silesia were undertaken. The first excavation works (1973, 1974) had already shown that the archaeologist examining the sites of former mining works were to face serious challenges and problems. The further transformations of sites associated with mining activity as well as the occurrence of heaps of extracted or rinsed material and waste rock caused that, in order to recognise the oldest objects in a proper manner, excavation works must descend into substantial depths. Also, the proper interpretation of discovered relics is extremely complex. Lack or very small amount of historic material and its character made it extremely difficult to determine the chronology of objects discovered. The archaeological research on the mining issues in the area of Lower Silesia entered a new stage at the beginning of the 1980s. The work of J. Kaźmierczyk was continued by a new generation of researchers. In the 1980s the knowledge on the sites associated with medieval and modern mining in the area of Lower Silesia was broadened by the programme Archaeological Picture of Poland, within the framework of which the historic mining sites associated with gold exploitation in the region of Złoty Stok, Szklarska Poręba, Karpacz and Wądroż Wielki and in the region of Lubawka, Jeżów Sudecki and Dziwiszów were identified as well as those associated with polymetallic ore exploitation in the Sowie Mountains, Wałbrzych Foothills and Mountains, in the neighbourhood of Srebrna Góra and in the area of the Kaczawskie Foothills. However, the subject of interest of the researchers included the most important and widely known historic workings only, so the information obtained had a selective character to

a considerable degree. The development of archaeological research on the gold mining issues in 1990s was connected mainly with the works concerning identification of gold mining sites in the Kaczawskie Mountains and in the close vicinity of Jelenia Góra. Recent years brought an important stage in the development of archaeological research on the issues of non-ferrous metal ore mining. In the year 2006 within the framework of the programme Archaeological Picture of Poland the examinations of historic mining sites in the area of the Rudawy Janowickie Mountains and the southern part of the Kaczawskie Mountains, in the neighbourhood of Miedzianka, Janowice Wielkie and Ciechanowice were carried out. They confirmed a considerable concentration of relics of historic mining activity. A detailed analysis of archive (mainly cartographic) materials contributed to such a good identification of the structure of former mining and metallurgical sites. A substantial contribution to the development of research on the medieval and modern non-ferrous metal ore mining made the studies conducted over the years 2008 - 2009 by Dr T. Stolarczyk, the essential aim of which was to make up for shortcomings in the hitherto identification of the issue in question and to develop or update the existing documentation of the relics of former mining works. The studies covered the main centres of historic exploitation of gold, silver and lead ores, copper and tin. As many as 146 sites of former mining works were documented, including 57 sites associated with former gold mining. In the years 2007 - 2009 a substantial progress in learning the material culture of mining in Lower Silesia was made as well. As a result of the archaeological examinations a substantial number of former working tools and other monuments associated with historic mining were acquired. The growth of interest in the issues in question, among the archaeologists as well as other groups of researchers (historians, mining engineers, and even representatives of natural sciences) allows us to assume that the level of knowledge about the non-ferrous metal ore mining in the area of Lower Silesia will be extended and complemented in a continuous manner. A number of specialist conferences dedicated to Lower Silesian mining heritage issues are to be considered as an important event in the development of research and interest in these issues. The first interdisciplinary meeting of this kind was organised in 1999 under the initia-

tive of the Regional Museum in Jelenia Góra. Apart from the studies conducted by archaeologists, concentrating mainly on examining the former gold mining centres, since the 1990s there has been an evident growth in interest in the issues of former mining heritage among research workers of the Mining Institute of the Wrocław University of Technology, under the initiative of whom (since the year 2005) the conference “Mining heritage and history and making use of remains of former mining works” is organised annually. At present, this conference constitutes a recognised and important forum for presenting research results and exchanging experiences in the scope of research on the mining history and heritage, especially in the area of Lower Silesia, evidence of which is, inter alia, the joint organisation of its deliberations (in the year 2011) with “Altbergbau-Kolloquium” – the largest European conference dedicated to broadly defined issues of research and preservation of remains of former mining works.

### **Industrial tourism and geotourism in Poland**

In the Polish conditions industrial tourism and geotourism are rapidly developing but relatively new areas of activity. Although one of the most valuable objects of global mining heritage – the Wieliczka Salt Mine, combining the values of industrial tourism and geotourism, is situated in the Polish territory, and in the area of Poland (and especially in Lower Silesia) there are numerous survived remains of multi-century mineral ore mining site deposits, complex activities aimed at identification, preservation, protection, but also modern use of historic mining sites for tourist purposes have not been conducted, apart from few exceptions, until recently. Former industrial objects (also including mines) are of great potential attractiveness, the use of which is dependent on the proper adaptation for tourism purposes, emphasizing the specific features of a monument to arouse the interest of visitors in it. There are many various possibilities of making use and emphasizing tourism values based on the specific features of particular objects – e.g. interesting technical equipment, untypical environment - e.g. underground workings of former mines (or other underground structures), on the initial purpose and character – e.g. fortifications, connection with important historic events, etc. The basic effectiveness criterion for making use of an object is inventiveness in its adaptation and further use conception and ap-

appropriate promotional activities. The *Polish Tourism Organisation* has worked out a conception of the promotion and development of tourism products based on the monuments of technique and industry. Such monuments include, inter alia, inactive, former mines – in the form of underground mining plants with superficial infra-structure or appropriately adapted workings only (mainly underground workings because of their attractiveness for visitors). Making use of mining heritage for tourist purposes combines industrial tourism and geotourism – the tourism branch taking advantage of the attractiveness of geological structure of selected areas. As the mines are located in the regions of specific, usually diverse, and hence interesting geological structure (the formation of mineral raw material deposits is a result of complex natural processes), it is easy to observe its properly exposed features in their workings. These are mainly different signs of mineralisation, geological faults, fossils, etc., and other natural attractions constituting the subject of tourists' interest. Hence, it is possible to talk about "mining geotourism" – based on appropriately prepared sites of former mining works, of varied character – from complete industrial objects to single workings or their remains only. Activities of this type are based on the appropriate exposition of selected features of inanimate nature. It allows organising mass tourism as well as specialist tours, dedicated for geologists, miners, representatives of natural sciences, etc. or simply of teaching character. The elements of geological tourism have been included in the UNESCO educational programmes.

Nowadays in Poland there is a distinct growth of interest in the modern, economic use of mining heritage objects, first of all the adapted historic complexes of underground workings as underground tourist routes. Obviously, it is not possible to ignore objects that have been functioning for a long time now, the most important among which is the "Wieliczka" Salt Mine (for more than 30 years on the UNESCO World Cultural Heritage List), but also of great importance are: the "Bochnia" salt mine, historic lead and silver ore mine in Tarnowskie Góry (where in the 18th century, for the first time in the European continent, a steam engine was used to power the drainage equipment), nature reserve and Neolithic flint mine in Krzemionki Opatowskie – the oldest underground mine in Poland (the

peak of development of which was more than 2000 years B.C.), or “Królowa Luiza” (Queen Luiza) mining heritage park in Zabrze (with the survived steam hoisting machine). The intensification of industrial tourism and geotourism development activities in Poland began in the middle of 1990s. Then, the survived workings and buildings of the historic gold mine in Złoty Stok – in one of the oldest and most important historic centres of gold exploitation and metallurgy in Europe were adapted for tourist purposes. Also then, other similar projects were started. An interesting example of making use of post-mining objects is the Multicultural Park “Stara Kopalnia” (Old Mine) – a museum located in the area of the historic Hard Coal Mine “Julia” in Wałbrzych, the foundation of which was connected with the termination of multi-century exploitation of hard coal deposits in the region of Wałbrzych and Nowa Ruda (the Lower Silesian Coal Basin). Some of the objects belonging to the former coalmine were made available to visitors and these objects included a bathhouse (with the rooms for keeping working clothes), hoisting machine building, electrical workshop, mining yard (where, inter alia, mining locomotives and haulage cars are located) and a fragment of the 18th-century fox adit – the first drain adit intended for coal haulage in the European continent. The workings of the liquidated coalmine in Nowa Ruda were also made available to visitors. The currently largest in Poland (and probably in Europe) investment in this field is the project of reconstruction and adaptation for tourist purposes of the Główna Kluczowa Sztolnia Dziedziczna “Królowa Luiza” (Queen Luiza’ Main Key In-heritance Gallery) in Zabrze (one of the longest drain adits in the European continent). The tourist object will include the complex of underground routes, making use of more than 4 km of workings. For the needs of tourism, replicas of mine equipment from the period of the 18th - 19th centuries are being made there, on the basis of their archival, original technical drawings.

Apart from the large tourist objects, making use of vast complexes of underground workings and survived mine buildings, single and often small workings (mainly drifts) are also made available to visitors. Such relics of former mining activity are found in great numbers in the area of Lower Silesia, especially in the Sudeten Mountains and their foothills, where the history of metal ore explora-

tion, exploitation and metallurgy goes probably as far back as the Bronze Age, and its documented development is dated back in the 13th century. First gold mining was started there, but the main subject of former miners' interest were numerous and easy accessible, small polymetallic deposits. The long-lasting exploratory and exploitation works left in the area of Lower Silesia numerous, well preserved workings, aged hundreds of years, with potentially large tourist values. The sites of former ore mining in the Sudeten Mountains and in their foothills were usually located on steep slopes of hills, in places that were relatively hardly accessible, and after terminating the exploration and exploitation activities their remains were not subjected to liquidation or reclamation. Due to the favourable topography of former mining areas, drain adits were commonly used – these were mainly drain adits, and great importance was attached to their careful workmanship and durability. Most of them still remain in good condition, and practically each former adit constitutes an original work of art and monument of mining technique, which can be successfully adapted for the needs of tourism.

In the Lower Silesian voivodeship, as many as 3800 different objects are recorded as the elements of industrial heritage (250 of them have been entered in the register of monuments). The largest number of objects associated with hard coal mining occurs in the Wałbrzych district (60 mines in the record, with 14 of them in the register of monuments), and also in the Kłodzko district (the mine in Nowa Ruda).

Many historic objects, including those associated with former mining works, is known only to a small number of researchers and passionate people, the activities of whom, can be of fundamental importance for saving the heritage of technique and for making its modern use in industrial tourism and geotourism.

### **Geopark “Along the footprints of old ore mining”**

One of the important regions of former mining works in the area of Lower Silesia is situated in the neighbourhood of Krobica, Gierczyn and Przecznicza - the places located in the vicinity of the well-known health resort Świeradów Zdrój, where in the period from the 16th century to the first half of the 20th century the exploration and exploitation of tin and cobalt ores were conducted. The above

mentioned places were founded along the medieval trade route – the so-called Old Żytawa - Jelenia Góra Trade Route, connecting former Silesia with Saxony and constituting one of the most important his-toric transport and trade routes in this part of Europe. On the slopes of the Izerskie Mountains, numerous remains of former mining works survived there, in the form of relics of workings and elements of mines' superficial infrastructure. It must be empha-sized that the ex-ploitation of tin ores (from the 16th century) and cobalt ores (from the second half of the 18th century) conducted in this centre were of major economic im-portance then. In the turn of the 18th and 19th centuries, the “Św. Maria – An-na” (St. Mary-Ann) mine in Przeczница supplied about 10% of the whole Euro-pean production of cobalt, the then precious raw material, used in the textile, ceramic and glass-making manufacture as a blue dye (the so-called royal blue). The exploration works in the area of historically exploited deposits were con-ducted in this region in the 20th century – initially the subject of the exploration included ores of radioactive elements, then their aim was to assess the possibil-ity to resume exploitation of tin ores. The mining exploration works were finally terminated in the year 1958 with the liquidation of the “Gierczyn” mine, created on the basis of the historic workings of “Hundsrucken” (Dog’s Back) and Reicher Trost (Rich Consolation) mines. It must be emphasized that only the main opening-out workings (shafts) of the “Gierczyn” mine were liquidated then, leaving the other – both historic ones (reconstructed during the exploration works) and then-deepened ones in an unprotected state. Over dozens of years they were destroyed, becoming an illegal waste dump. As after the end of World War II and after connecting the area of Lower Silesia to Poland a complete population exchange occurred there, present-day inhabitants associated the survived post-mining objects only with the post-war exploration of uranium ore, and then tin – which constituted a problem in the works aimed at adapting the survived workings for tourism purposes, because of fear associated with alleged places of uranium occurrence.

The research and cataloguing works aimed to identify and assess the condition of survived historic mining objects in the neighbourhood of Gierczyn were start-ed in the 1990s. They proved the occurrence of numerous foot-prints of historic

mining activity in this area, in the form of workings, dumps, remains of hydrotechnical equipment and fragments of superficial infrastructure of the former mines. The results of the long-term research and cataloguing works were published and presented, inter alia, during the fifth session of the conference “Mining heritage and history and making use of remains of former mining works” (in 2009), arousing interest of the local self-governing bodies in the area of which the above-mentioned objects are located. Attention was drawn to the possibilities of making use of catalogued objects of mining heritage in geotourism and industrial tourism, in order to improve the tourist attractiveness of the region of their location (so far ignored by tourists). As a result of cooperation of the Mining Institute of the Wrocław University of Technology and KGHM CUPRUM Research and Development Centre with the local self-governing bodies, the project under the title “Reclamation of the regions degraded by mining activity in the area of Mirsk Commune with the creation of the tourist path ‘Along the footprints of old ore mining’” was developed. It was financed to a substantial extent from the European Union resources, within the framework of the Regional Operating Programme for the years 2007 – 2013. The project, executed under the leadership by KGHM CUPRUM was of innovative and piloting character in the conditions of Lower Silesia.

**For the first time, in a complex manner, an attempt has been made to save and use for tourism purposes the vast complex of historical mining sites, which have been subjected to intensive destruction since the 1950s - when the exploration works were finally terminated there.** The area covered by the project extended in the lower parts of the Kamieniecki Ridge (the lower range of the Izerskie Mountains), within the strip 7.8 km in length and about 0.4 to 0.7 km in width. The complex reclamation (towards the forest and tourism direction) of the former mining sites has been carried out and the “Geopark tourist and teaching path: *Along the footprints of old ore mining*” presenting the history and remains of the former mining activity was created. The project, in its assumptions, featured the environmentally-oriented and socially-oriented values. Despite the expected environmental benefits and social acceptance, the design, construction and further use of the path in the light of the



law did not have any specific preferences and were treated as a standard investment project. The location of the sites of former mining works within the borders of Natura 2000 areas presented special environmental conditions. The Regional Nature Conservator in Wrocław established, inter alia, the requirements and conditions concerning habitat protection for bats living in the former workings. Due to the high environmental values, specific features of post-mining equipment and in order to ensure the real environmental protection of the area covered by the project, numerous preventive measures have been undertaken – inter alia, permanent natural (including chiropterological) and archaeological monitors were assigned. Along with the work progress a detailed natural inventory of post-mining objects and sites earmarked for reclamation or revitalisation was systematically developed. Within the area covered by the project the technical and biological reclamation of post-mining objects and sites on the area of more than 38 hectares was made. The actual reclamation measures were preceded by the removal of all kind of wastes (including hazardous wastes) abandoned in the post-mining objects and sites. In total, more than 220 Mg of wastes was disposed. The reclamation was carried out towards the substantial improvement of environmental condition and to obtain new material values in the form of a tourist path with an educational function. The developed technical designs covered the reclamation and management issues of post-mining objects and sites in an individual manner for each of them, with the use of the best domestic and foreign experiences. In the design and execution, the degree of site transformation, its natural values, hydrogeological and geotechnical features and a number of other conditions were taken into account. Despite the individual character of design solutions, the principle of design coherence was maintained, which was essential for achieving the intended purpose in the area of occurrence of post-mining historic objects, located within the area featuring high landscape and natural values. The post-mining objects envisaged for exposing on the path route were secured, reconstructed and prepared for tourist traffic. As a result of fulfilling the assumed objectives, the environmental balance once disturbed as a result of conducted mining works, improper liquidation of post-mining objects (or even its lack) and further pollution of sink holes and workings

with wastes was restored. **The final effect of the execution of the Project is the marked tourist and teaching path “Geopark - Along the footprints of old ore mining”, with the length of 7 600 m, on which it is possible to make familiar with numerous remains of historic ore mining, and to admire beautiful mountain landscapes from the viewing points.** The largest attraction of the path is the underground tourist route “Kopalnia św. Jan” (St. John Mine) in Krobica, prepared on the basis of historic mines from the period of the 16th - 19th centuries (St. John and St. Leopold adits).



*St. John Mine* in Krobica



*St. John Mine in Krobica – Leopold adit*

### **Conclusion**

Lower Silesia should be regarded as one of the most interesting, though still insufficiently recognised in respect of the heritage of former mining and metallurgical works, areas of Central Europe. Specialist archaeologists have relatively early joined in its research, concentrating their efforts mainly in the study of medieval gold mining. As a result of the works conducted the main centres of historic exploitation have been identified. Other branches of non-ferrous metal ore mining in Lower Silesia (primary deposits of gold, silver and lead ores, copper ores, tin ores) still remain to be properly identified. The areas associated with their sites so far have not been the subject of examination by archaeologists except for the superficial works conducted mainly within the framework of the programme Archaeological Picture of Poland. The latest catalogue, prepared by T. Stolarczyk, includes **146 archaeological sites associated with the exploitation of non-ferrous metal ores in Lower Silesia, dated back at the 13th - 17th centuries**. These are, first of all, sites associated with gold mining (50 % of their total number). Next come sites associated with the extraction of copper ores (32 sites) and silver and tin ores (31 sites). The next 9 sites constitute rel-

ics of tin and cobalt mining. However, apart from the research done by the specialist archaeologists, the work of, for example, historians and miners constitutes a valuable and important contribution to the knowledge of the issues in question. Their published results are in many cases the only source of information on the current condition of survived objects.

Further studies concerning the heritage of Lower Silesian mining should be, first of all, aimed at bringing closer the interdisciplinary cooperation of specialists from different fields of science in order to identify, preserve and protect the multi-century heritage of mining exploitation in Lower Silesia and to create a complex research programme in this area. The first steps in this direction have already been undertaken, but it is necessary to intensify works, because only in this manner, as proved by the achievements of the research work conducted in the area of Germany, it is possible to make up for the existing research shortcomings. The present state of identification of the sites of former mining works in the area of Lower Silesia seems to be insufficient and requires further, intensive, interdisciplinary efforts, especially in the field of mining archaeology.

An interesting aspect of the historic mining heritage issues is a modern-day use of properly secured and adapted workings and objects of technical infrastructure of old mines as tourist attractions - mainly underground trails. It is connected with the intensive growth of the new branches of tourism – post-industrial tourism and geotourism, both in Poland (especially in Lower Silesia) and in Europe.