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Jubilee of Jan Hempel's *Geognostic map of coalfield in Polish Kingdom*

(1) Introduction

Mining, later together with steel industry, was perceived as a constant process of human being's economic activity. Unfortunately, Polish experiences in the mining and geological field couldn't be called continuous. This was mainly caused by unfavorable geopolitical environment.

The development of specialized education system, inter alia, by opening Mining Academy in Kielce, contributed to the successful organization of particular industrial plants in Polish Kingdom. Many foreign specialists employed by the Academy, as well as its graduates had no problems with finding job in the industry of those days. Moreover, they contributed to the great and significant development of geological and mining sciences in The Polish Kingdom.¹

In the 30' and 40' of the 19th century, the Bank of Poland together with the Governmental Income and Treasury Committee concentrated on the settlement and development of the steel industry (steel-works in Henrykowo and "Bank Steelworks" in Dąbrowa [Górnicza]) which finally contributed to the increase in openings of new deposits of hard coal. Its maximum falls on the early 50' of the 19th century when the geological works in the West Mining Region of the Polish Kingdom were conducted by Jan Marian Hempel.

Due to the unavoidable changes, that the entire mining and metallurgic industry were exposed to, many plans and intentions were completely changed. Also, because of political decisions there was a complete liquidation of state industrial companies.

It should be stated though, that working under the ground requires a great and expert knowledge of the mining industry. All the information concerning the search of mineral resources were handed on from generation to generation. Discovering, especially new ores deposits, became a highly valued activity. Although, such skills were rather useless in case of hard coal deposits and other mines. Searching and exploitation of these deposits, in fact, became very expensive and work consuming activities.²

(2) Gaining work experience and the works in West Mining Region

Jan Marian Hempel was born in 1818, December 12, in the Burc village near Łuków on Podlasie Region. The son of napoleon's officer Joachim Hempel,³ started his education in the Regional School of Piarists in Łuków. He was also studying at a technical department in gymnasium, which he finished in 1838. Next, for two years he was attending Additional Courses in Warsaw, which was established

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¹ A. J. Wójcik, Project of the mining law of Stanisław Staszic (in Polish). *Bud. Górn. i Tunel.*, 2005, 1, 39–46; *Ibidem*, Stanisław's Staszic Miners — The organization of mining authorities of Polish Kingdom (in Polish). *Bud. Górn. i Tunel.*, 2005, 2, p. 41–50.

² A. J. Wójcik, The study of geological and mining of Siewierz Duchy in times of "Ziemiorodztwo Karpatów..." Stanisław Staszic (in Polish). *Bud. Górn. i Tunel.*, 2005, 3, p. 34–41.

³ Public Record Office in Katowice, AGD (in Polish: Archiwum Górnicze Dąbrowy (Mining record Office [of Mining]), no 2913, 5258, 5259; J. Pazdur, "Hempel Jan Marian" (in Polish), Polish Bibliographical Dictionary, 9, p. 379–380 and Z. Janota-Bzowski, *The history of Hempels family recorded in partnership of Kazimierz Hempel* (in Polish). Państw. Inst. Wydaw., Warszawa, 1987, p. 1–263. Sometimes the name Marcin was mistakenly assigned.

by the Council of Public Education at the Warsaw Provincial Gymnasium. The Council's main duty was to train teachers for district schools.⁴

Since 1840, at the age of 22 Hempel started his work in mines in the West Mining Region of the Polish Kingdom. At the beginning, he worked as a cadet (with no remuneration) in "Reden" mine, later in a plant in Niwka. During his work in Niwka, he had a serious accident when he was in a pit-shaft.⁵ After he had recovered, he was sent by the Director Jerzy Schumann to work under the supervision of Waclaw Borowski.⁶

In 1841 Hempel was employed as an assistant of geodetic engineer "to copy plans"⁷ and later on in the building section.⁸ Since the end of 1843 (5 December), he was staying in Warsaw, where he was appointed to apprenticeship in a Technical Section at the Mining Department.⁹ During his stay in the capital, he was deepening his knowledge, probably attending classes in Real Gymnasium. In 1847, he came back to Dąbrowa, with the instruction to organize so called "służba markszajderyjna" (surveying service) in coal mines.¹⁰ At that time Hempel introduced various methods of coordinate calculus and applied theodolite into surveying.¹¹ He was working from November 1846 till March 1847, when he was "delegated to introduce mining plans and improve tests concerning the usage of gunpowder in mines".¹²

Hempel, when he was working in "Reden" mine used to keep records in the form of "*measurement diaries*" and one of his diaries remained.¹³ These are handwritten, loose paper sheets.¹⁴ At the very end there is a comment: "works ended 1846, in Dąbrowa, February 30, 1847 Measured and Calculated by [signature of J. Hempel]" and "in Dąbrowa February 30. 1847, I saw Regional Director [signature of A. Pollini] Mines Director [signature of J. Cieszkowski]". Hieronim Łabecki the chief executive of the Technical Section at the Mining Department, praised Hempel for his precision in measurement in mine "Reden", analyzing at the same time the reasons of mistakes connected with using compasses for surveying.¹⁵

In connection with taking the service in mining Hempel took over Krumpel's all surveying instruments,¹⁶ as well as geological and mining maps. It took place on the basis of following document: "The list of inventory properties rented so far by Mr Krumpel the previous engineer, given

⁴ J. Miąso, *Vocational Education in Polish Kingdom in 1815–1915* (in Polish). Zakł. Narod. im. Ossolińskich, Wyd. PAN, Wrocław, 1966, p. 1–324; Z. Wójcik, *Researches form the period of mineral resources recognition in Świętokrzyskie region* (in Polish). Tow. Przyj. Gór., Hutn. i Przem. Staropol., Kielce, 1997, p. 1–211.

⁵ Hempel sustained skull injury, when he was working in "Reden" mine, the falling bucket full of coal stroak his head. A deep scare under a strand could be seen on his forehead.

⁶ AGD no 3082, document from 14 IX 1840.

⁷ AGD no 5258.

⁸ *Ibidem*, document from 4 V 1843. His work was highly assessed by his supervisors, the evidence may be given by, inter alia, praising note (with illegible signature probably of regional director Józef Cieszkowski) placed on the leave application, from 10 VII 1841.

⁹ *Ibidem*, document from 27 X 1843.

¹⁰ AGD no 5258, document from 29 V 1847.

¹¹ K. Jurkiewicz, "Jan Hempel" (Obituary) (in Polish). *Bibl. Warsz.*, 1886, 3, p. 89–92.

¹² AGD no 5258, document from 14 VI 1847.

¹³ AGD no 1830.

¹⁴ *Ibidem* Hempel's *Measurement Diary* — from hard coal mine — "Reden". To make the scale of technical measurement of that time more clear, it is advisable to give the names of diary's sections: "stands, accurate points, distance measured, angle of direction, rake, gallery dimensions (width, height) bed's signs (coal bed, slope), azimuth of the line of accurate, length logarithm, logarithm to the slope, logarithm of slope's arrangement, logarithm of vertical projection, logarithm of stand's level removal, removal over the stand's level, logarithm of azimuths' measurement, logarithm of azimuths' supply, logarithm of length regarding stands, logarithm of width regarding stands, length regarding stand, width regarding stand, removal over the level of exploitation, length regarding main point, width regarding main point".

¹⁵ H. Łabecki, "Fires in mines, mainly in coal mines of Polish Kingdom" (in Polish). *Bibl. Warsz.* 1860, 3 (11), p. 391.

¹⁶ A. J. Wójcik, "Geologic and mining activity of Fryderyk Krumpel in West [Mining] Region of Polish Kingdom in early 19th century" (in Polish). *Analecta* (2004/1–2), p. 201–220.

to Mr Hempel who takes over the post of engineer of Western Region up to February 2, 1847".¹⁷ The same day a protocol concerning placing Mr Hempel at the position of mining engineer and director assistant of the Mining Department in West Mining Region was made. He also took the mining oath at the presence of witnesses.¹⁸

(3) "Geognostic map of the coalfield in Polish Kingdom"

In 1856 Jan Hempel finished four year long work on *Mapa geognostyczna zagłębia węglowego w Królestwie Polskiem (Geognostic map of the coalfield in Polish Kingdom)*.¹⁹ His map was prepared and published on government expenditure in 1857 by M. Fajans' Company in Warsaw. It was printed in 18 sheets in dimensions: sheets I–XII: 43,2 x 55,3 cm, sheets XIII–XVIII: 42,2 x 37,2 cm.²⁰ On the fourth sheet there are two transversal scales and two numerical scales (separately for 1:20.000; and for sections — 1:2.000), as well as sheets' index and explanation concerning the realization of description based on the triangulation settled for Karol Tenner's map.²¹

There is a chart on the tenth sheet: "Designation of the main mines rising above the sea level". The geological sections are presented on sheets XIII–XVII and X–XI, there is also wind rose and the information concerning "yaw of magnetic needle in the Ulisses mine" (declination) also. The sheet no XII contains the explanation of conventional signs, the sheet no XVIII is the title map.

The map presents the area between Czeladź (in the west) and Olkusz (in the east); it reaches Ujejsce and Ząbkowice in the north and national border on Biała and Czarna Przemsza Rivers in the south. Hempel's map presents a very detailed specification of the area. It consists of many topographical details, elaborated with the line method (of Lehmann), moreover, it gives the localization of particular buildings.²²

The whole topographical data was probably collected by using photographs, special table for measurement and various cartographic data that was available.²³ For better orientation in the area, special "mining pyramids" was used. They served usually as land marks and stabilization points. They were earth mounds localized at the top of the hills, which enabled to observe situation in the area and to plot on the topographical bed all the interesting points. Hempel marked on his map the localization of each "pyramid".²⁴ Unfortunately, none of his handwritings or map's descriptions remained, that is why all the conclusions can be drawn only on the basis of the map itself and its sections. The expert characteristic of hard carbon deposits in this region was created not until half a century later.

¹⁷ AGD no 5258. Probably, this is the only set of tolls that was used for surveying in West Mining Region that remained.

¹⁸ *Ibidem*. The witnesses are: Aleksander Pollini, Fryderyk Krumpel, Józef Cieszkowski, Wacław Borowski, Franciszek Łabęcki and two other rather not identified people.

¹⁹ J. Hempel, *Geognostic cart of coalfield in Polish Kingdom, made on the command of Mining Director General Major Szyszyn*. Litogr. M. Fajans, Warszawa, 1856, scale 1:20.000.

²⁰ Following map's pieces: 18a. Title cart – section XVIII and Section layout – section VI; 18b. Region of Niwka–Zagórze – section II; 18c. Region of Sławków–Bukowno – section IV; 18d. Region of Bolesław–Olkusz – section V; 18e. Region of Żychcice–Strzyżowice – section VII; 18f. "Intersection of coalfield" – section X.

²¹ Implemented for map: *Voенно-топографическая карта Россii*. Detailed description [in:] T. Paćko, W. Trzebiński, (ed.): *Central record of cartographical collection in Poland. Book 5. Multi-sheet topographical maps of Poland 1576–1870*. Part. 1. Text (in Polish). Zakł. Narod. im. Ossolińskich, Wyd. PAN, Wrocław, 1983, p. 1–109.

²² S. Pietkiewicz, *Ways of area presentation on maps* (in Polish). Gł. Druk. Wojsk., Warszawa, 1930, 1–57, [1–15].

²³ L. Sawicki, "Topographic pictures of Colonel Antoni barona Mayer von Heldensfeld in Poland from 1801–1804" (in Polish). *Pr. Inst. Geogr. Univ. Jagiell.*, 10, 1928, 1–112; K. Sawicki, *Five centuries of Polish geodesy. Historical drafts from 15th to 19th century*. Państw. Przed. Wyd. Kartogr., Warszawa, 1960, p. 1–259.

²⁴ On the fourth sheet of Hempel's map also a note has been placed: "All the benchmarks are coordinates to "Warsaw" meridian, this is due to detailed combination of area's triangulation with the main surveying of Polish Kingdom, made by Headquarters and supervised by General Lejtnant Tenner. The removals calculations above the sea level was done by trigonometric calculation, taking as a rule the pyramid's removal of headquarters on Grodziec and Rodaki".

The Hempel's map met with positive reviews.²⁵ For his elaboration Hempel received a high financial reward and was decorated with St. Stanisław's order of the third class.²⁶ In 1857 during the Session of the Geological Society in Berlin, Rudolf A.W. von Carnall discussed and prepared extensive report on his work.²⁷ The map was also positively described by Bernhard von Cotta, the professor of the Mining Academy in Freiberg. During his stay in West Mining Region in 1859, the professor prepared a vast commentary to the map and handed it over to Hieronim Łabecki.

He argued the relevance of exhalation by Hempel the Permian products, as it was not supported by "featured fossils", he also suggested that they should be classified as the products of lower Triassic. At the same time, he presented the characteristic of hard coal deposits in West Mining Region, supported by the map analysis and his own observations.

Also Carl Mauve — the director of mining in Mysłowice – Katowice region — assessed the map positively. In the subheading of his cartographic elaboration, which was printed in 1860, enclosed the reference to the Hempel's map: "*Herren Dr von Carnall und Hempel*". The map "*Flötz-Karte des Oberschlesien Steinkohlengebirges*", was one of the first regional geological and mining maps, that were made in Prussian Silesia.²⁸

The map composed a great summary of knowledge about hard coal deposits, all the remarks were presented by its author in the attached commentaries.

Probably, Hempel's elaboration was published and made accessible in at least two versions: black and white version and a colored one that also had its own versions. Apart from the fact that the colored version seems to be clearer and is better to read and analyze, both versions do not differ too much. Although, colored geological frontiers allow to recognize the lands' geological structure, the black and white map is more useful in analyzing topographic elements, and also an infrastructure localization.

The Hempel's map was colored by various people according to their needs and its potential purposes, that is why there are many different versions, which can vary from the author's first version.

The "geognostic map" contains not only geological formations,²⁹ but also ores deposits signs and industrial plants. These are: hard coal beds, red calamine, white calamine, iron ore, lead ore, quarry, cement limestone, fire-clay, state and private coal mines, state and private calamine mines, and state and private iron ore mines.

The coal's deposits have regular names and the author grouped some of them. The outcropping beds possess the information about the dip angle. In the region of Strzyżowice, where the coal has been extracted for over 80 years, Hempel marked Strzyżowice coalfield. It includes the outcropping beds ("Hoym = Hojm", "Andrzej", "Tadeusz") which are positioned into a characteristic round coalfield. This tectonic form has been known from the very beginning of the West Region's activity.

²⁵ H. Łabecki, "Fires in mines..." (1860), also W. Kosiński, "Few remarks concerning latest geognostic research in south-west area of Polish Kingdom, also in Silesia and Galicia" (in Polish). *Bibl. Warsz.*, 1869, 1, p. 245–257; *Ibidem*, "Geological researches and maps of Polish Kingdom", in: J. T. Lubomirski, E. Stawiski, S. Przystański *et al.*, *Encyclopedia of agriculture and other matters that concern it* (in Polish). 2, D–G, 1874, p. 546–555.

²⁶ AGD no 5172A, 5259.

²⁷ H. Łabecki, "The geognostic cart of Polish Kingdom coalfield, produced by Jan Hempel" (in Polish). *Bibl. Warsz.*, 1, 1860, p. 443: "The map's introduction at the time it was being produced, was required as the Polish beds connect the Silesian mines. The results of researches and conclusions that arisen enabled to explain the relationships of coalfields of both regions". It should be stated, that Rudolf v. Carnall was a mining official, firs in Tarnowskie Góry and then in Wrocław. Also he contributed to the opening of Mining school in Tarnowskie Góry in 1838.

²⁸ C. Mauve, *Flötzkarte de oberschlesischen Steinkohlengebirges bei Beuthen, Gleiwitz, Myslovitz und Nikolai*. Breslau, 1860 (the map consists of 12 sheets in scale 1:16.000, and 1 summary – sheet i scale 1:80.000) also *ibid*; *Erläuterungen zu der Flötzkarte des Oberschlesischen Steinkohlengebirges zwischen Beuthen, Gleiwitz, Nikolai und Myslowitz*. Commissions-Verlag von E. Trewendt, Breslau, 1860, p. 1–20.

²⁹ In parenthesis the colour of marking was given (ag to the map's spelling): 1 – coal product (*blue*); Permian product's traces: 2 – conglomerate sandstone (*nut brown*); Triassic products: 3 – bituminous limestone (*yellow in blue stripes*), 4 – yellow crystal limestone (*yellow*), 5 – basic shell limestone (*light vermilion*), 6 – bottom dolomite (*green*), 7 – upper shell limestone, upper dolomites, sandy claystone, younger white calamine (*purple*); Jurassic limestone: 8 – (*sepia*), 9 – sand (*light ink*) and 10 – porphyry (*carmine*).

In Dąbrowa and Będzin regions the hard coal beds ("Cieszkowski", "Reden") have been marked as a one bed and called "systemat". The thickest one that reaches even 25 thicknesses, in some parts comes out to the surface. Also the faults ("cuts of coal beds") have been marked on the map.

The map also shows the project of adit, which runs across as a canal on the land's surface. Its main purpose would be the drainage of orogen near Olkusz (from "Józef" mine towards west direction), at the same time it should make the calamine deposits accessible for exploitation. The Ullmann adit route, which was designed before was also marked on the map (entirely under the land's surface, runs across the area of diversified morphology) its purpose was also to drain mines in Olkusz.³⁰

(4) Hempel's field researches in mines

The elaboration and map design, that contains huge area of the West Mining Region of the Polish Kingdom, couldn't have been done without basic observations that were probably conducted by Hempel in particular mines. Unfortunately neither notes nor drawings from measurement made by coal miners remained. First handwritten materials came from 1842–1843. In case of hard coal mines, such sources are even younger.³¹

Measurement drawings realized in calamine mines have rock's and minerals descriptions, which are, e.g. "dolomite yellow rock", "dark-gray stone and calamine's traces", "calamine hairy with iron ore, hard in all pillar". The descriptions are fairly concise, associated with schematic drawings, that show mutual retention of rock formations and elements of old horsts (post-mining excavations made behind the lead ore), that can be found during calamine's deposits exploitation. Some of the drawings present various forms of metallic mineralization that exist in the Triassic shell limestone formation.³²

Most of information enclosed in the notes applies to the technical determinants of exploitation, deposits that was not extracted, as well as the infrastructure of galleries (their length measured from pit-shaft, their width, and point of refraction).

The introduction of theodolite into surveying contributed to the improvement of drawing quality. As well as, the implementation of printed notebooks in 1855 enabled to plot the collected data (drawings and information) on particular maps.³³

Due to deposits' composition in beds, their localization didn't cause any troubles and particular elements of the excavation system could be precisely identified. This concerned mostly various excavations, galleries, and the non-extracted deposits that were used as safety pillars.

During underground geological observations all the information concerning faults, their course (extent), and the size of their fault's throw was collected in measurement diaries. The most significant information, both for geologist and miners, is the information concerning thickness of particular coal beds, as well as their variability and the configuration of sill surface, as such relevant information influence the choice of excavation system.

A number of works were realized also on the terrain surface. The works were related to remaining the slope stability in the outcrops where the coal was excavated, also managing (filling up) chosen parts of deposit, as it was e.g. in "Reden" and "Cieszkowski" mines.³⁴

(5) Hempel's achievements in mining

Hempel visited Eastern Mining Region of the Polish Kingdom many times.³⁵ At the beginning of 1856, Hempel brought to Dąbrowa new measurement tools from Kielce. In 1857 he left Dąbrowa due

³⁰ A. Albrecht, "Materials concerning mines of calamine in Polish Kingdom" (in Polish). *Prz. Górn.-Hutn.*, 9, p. 246–250; 10, p. 273–276; 15, p. 426–428; 16, p. 444–448; 17, p. 476–482; 20, p. 550–555; 21, p. 574–576.

³¹ AGD no 499, 708, 710, 711, 713, 714, 715.

³² AGD no 709, 2225, 5243.

³³ AGD no 773, 774.

³⁴ AGD no 765.

³⁵ W. Różański, A. Rembalski, Z. J. Wójcik, *The book of historical and statistical news of blast furnace in Rejów* (in Polish).. Tow. Prz. Górn., Hutn. i Przem. Staropol. w Kielcach. Kielce, 1995, p. 64.

to severe criticism concerning the evaluation of ways of coal excavation, also abandoning non-excavated parts of deposit, leaving big amounts of coal-dust, that contributed to underground fires.³⁶

Point that, before he was criticized, repeatedly was awarded for his cooperation in scope of fire put outs in mines, particularly in “Ksawery” mine.³⁷ After that he was sent to Eastern Mining Region in order to prepare “geognostic map and searching for hard coal”.³⁸ He took from Dąbrowa some of his tools and theodolite.³⁹ The geologic map of the Kielce region (in scale 1:262.500), as well as the results of his geological researches were published in 1867.⁴⁰

On the 5th of January 1861 Jan Hempel took over the responsibilities of Mine-master in West Mining Region.⁴¹ After his come back he took part in the fire put up in “Reden”, which broke out from spontaneous combustion of the coal-dust.⁴² Various ways of setting it up were considered, including mine’s flooding with Czarna Przemsza River.

The fire was put up by the restraint of bonfires, contained closure of the danger zone that reduced air supply. The project of workings’ flooding was eventually used for liquidation of enormous fire in “Ksawery” mine in 1870.⁴³ To emphasize the efficiency of his activities Hempel was nominated in 1861 to the position of Director of West Mining Region.⁴⁴

Hempel was interested in scientific progress of that moment; he didn’t stop importing new measurement tools to Dąbrowa. In October 1861 a pantograph made by Gustaw Perlach’s (a mechanic from Warsaw) Company in Warsaw was imported⁴⁵, that year also, “universal instrument theodolite for measurement in mines” was bought in Katowice, in the Kuznicky et Comp., produced by Pistor et Martius Company in Berlin.⁴⁶

Repeatedly, Hempel was travelling abroad (1853–1855), where he had an opportunity to learn about mining and metallurgical technical progress. He visited the wire cables and elevator chains plants. He also had a close look at calamine’s scrubbers in Tarnowskie Góry. In 1863 he went to France to learn about ways of coal beds mining.⁴⁷

Very often he received guests visiting industrial plants in Dąbrowa. They were mainly geologists and miners that were working in Prussia or Austria.⁴⁸ He also helped with collecting minerals for the Mineralogical Office in Vienna.⁴⁹ “An open letter” — the Hempel’s approval for visiting plants

³⁶ AGD no 750 and K. Srokowski, “The history of Mining Industry in Poland” (in Polish). *Prz. Górn.-Hutn.*, nr 6, 578–584; J. Pazdur, “Hempel Jan...”, 1961.

³⁷ AGD no 750, document from 3 V1849.

³⁸ AGD no 5258, document from 27 X 1857.

³⁹ AGD no 4182, document from 19 XI 1857 and AGD no 4178, 4181.

⁴⁰ J. Hempel, “Description géologique des environs de Kielce, de Chenciny et de Malagoszcz, situes au centre de la Pologne.” *Annales des mines*, 1867, 6 (12), 141–183.

⁴¹ AGD no 5258: “To undertake [organise plans of rebuilding “Reden” and “Cieszkowski” mines] *Mr. Hempel is going to take over the responsibilities of mine-master in mines of the region, the raport of that even should be given to authorities.*”, document from 10 VII 1860.

⁴² K. Srokowski, *From the history of industry...*, 1923.

⁴³ AGD no 5258.

⁴⁴ Hempel was acknowledged: – AGD no 5258, document from 29 XI 1861, no 7196: “In the name of Alexander The Blessed the Great Emperor of Russia and the King of Poland etc. etc. The Board of Administration of Polish Kingdom. Hereby for the position of main director presided in Governmental Income and Treasury Committee decided: the mine-master of mines of Governmental mining Jan Hemel, for the position of a director of Mining Institutions of West Region, with the employment marked from 16 October 1861”. Hempel’s appointment was announced on the ground of decision no 23385 of the Polish Kingdom Governor from 31 XII 1860.

⁴⁵ AGD no 773, 774.

⁴⁶ AGD no 4182, protocol from 20 XII 1861.

⁴⁷ AGD no 5258, 5259.

⁴⁸ AGD no 370, 5258.

⁴⁹ AGD no 370, document of Civil Governor of Radom Province no 637, from 16 VIII 1853.

remained. It was addressed to mine-masters in coal and calamine mines that enabled the entrance to the plants and to collect rock samples.⁵⁰

Again in 1867 Hempel was commanded to conduct geological works in East Mining Region.⁵¹ At his request he was dismissed in 1868, but after his work in private company, he came back to mining in 1876. He took over the position of chief manager of mining in Polish Kingdom. He was working till 1885.⁵² He started to apply for retirement in 1873. He was given the pension on 30th of November 1888 at the amount of 2 100 Rs. Annually.⁵³

Hempel was also engaged in other geological matters. Between 1868 and 1876 he was organising and supervising underground exploration of natural sulfur deposits in Czarkowy near Nowy Korczyn,⁵⁴ also he analyzed the results of his rock salt's researches. That resulted in publication of tests data.⁵⁵ Jan Marian Hempel died at the age of 67 on January 19th 1886 and was buried in Suchedniów.

(6) The significance of Hempel's geological works

In face of constant growth of the demand for coal, the number of mines and the depth of their exploitation increased. At the beginning of the 60' of 19th century systematic geological researches were introduced in the Prussian Silesia Region. Those researches were sponsored and organized by mining authorities, mostly by the Superior Mining Department in Wrocław (Breslau).⁵⁶ The realization of new geological maps for the entire Upper Silesia Region including Dąbrowa Region (West Mining Region), and Kraków Region was commanded to Ferdinand Roemer and Oscar Degenhardt.

In fact, new geological maps in scale 1: 100.000 were the result of Degenhardt's⁵⁷ and Roemer's researches. The maps' atlas together with later publication was the first complex geological elaboration of the Upper Silesia Region.⁵⁸ The maps are covered, published in many colors with additional sashes. Degenhardt's publication is the uncovered version that presents the area without Quaternary deposits and partly without Tertiary, although it marks out the route of hard coal beds. The relief is presented by using the line method.

Roemers' achievements in the geological field should be appreciated. The introduction of new stratigraphical divisions, description of geological formations' frontiers, paleontology as well as the recognition of new fossils from Triassic enabled the author to use the enlarged topographic map (from 1839⁵⁹) as a topographic base for the area of Polish Kingdom. Nevertheless, the geological contents of the map presented, didn't go beyond the information that was exposed on the Hempel's map,⁶⁰ as

⁵⁰ AGD no 370, letter from 12 VI 1865. The following document may be an example — AGD no 3087, from 25 VI 1860: "Mr. Jan Trejdosiowicz the current Tutor of Mining Department, was directed to mining plants in Dąbrowa before his trip to Freiberg's Mining Academy. Therefore, when he visited our plants the director offered him his assistance and made close familiarization of our plant possible".

⁵¹ AGD no 5259, circular from 9 VIII 1867.

⁵² K. Jurkiewicz, "Jan Hempel..." (1886).

⁵³ AGD no 5259.

⁵⁴ K. Jurkiewicz, "Jan Hempel..." (1886).

⁵⁵ J. Hempel, "Comments concerning rock salt's researches within Polish Kingdom frontiers" (with map). *Bibl. Warsz.*, 1877, 3 (147), 88–98.

⁵⁶ J. Jaros, "The development of Upper – Silesian coalfields' geological knowledge" (in Polish). Part I. *Wiad. Gór.*, 1962, 2, p. 68–71; Part II, 3, p. 108–111; *Ibidem*, "The development of geological researches of Upper-Silesia coalfields" (in Polish). 1963, 2, p. 203–218.

⁵⁷ O. Degenhardt, *Geologische Karte von Oberschlesien*, 1865, scale 1:200.000.

⁵⁸ F. Roemer, *Geognostische Karte von Oberschlesien und den angrenzenden Gebieten in 12 Blättern im Auftrage des Königl. Preussischen Handelsministeriums unter Mitwirkung des Königlichen Oberbergamts zu Breslau und unter besonderer Beihilfe des O. Degenhardt, A. Halfar, H. Eck, A. Dondorff und J. Janik*. Wyd. Neumann, Berliner Lithograph. Inst., Berlin, 1867 [scale 1:100.000].

⁵⁹ W. Kosiński, "Few remarks concerning latest geognostic researches in south-west areas of Polish Kingdom Kilka, also in Silesia and Galicia" (in Polish). *Bibl. Warsz.*, 1869, 1, p. 245–257.

⁶⁰ J. Hempel, "Geognostic cart..." (1856).

well as Carl Mauve's map.⁶¹ Although, Roemer often visited Dąbrowa and was guided round by Wincenty Kosiński, he didn't mention about the sources and materials used for the elaboration of West Mining Region part of his map.⁶²

The Hempel's conclusions in review of Roemer's map gave the basis of further coal beds divisions into "under-reden" (coastal), "Reden" (anticline), called central beds. This central beds composed in West Mining Region of one very thick bed marked later as "Reden", "Chrobry" (after 1918) also 510 (after 1945 — in accordance with introduced numerological order of hard coal, occurred in Upper Silesia Coalfield), and "over-reden"⁶³.

The work of Trejdosiwicz, where the Hempel's map was used, should be mentioned as well.⁶⁴ The plaque that was attached to the article concerning the characteristic of porphyries in the Polish Kingdom contains the diminished sheet (marked with A): "*Section IX*" [Strzemieszyce region] *of the geognostic cart of the Polish Kingdom Coalfield composed by J. Hempel, diminished in proportion 2:5*" (dimensions 18,8 x 11,8 cm, scale 1:50.000). Apart from the map, there was also other document included — diminished (marked with B) "section part "Huta Królewska" (Königshütte, Blatt no 9) geognostic cart of Upper Silesia and frontier-land composed by F. Roemer".

The works of Staszic, v. Oeynhausien, v. Carnall, Pusch, Łabecki summed up and generalized all experiences gained by the mining industry of those years. Still the depth on which the works were conducted were not very deep, usually the level on which dehydration of the ground was possible (using shallow adits) was not exceeded. It was common to conduct researches rather on the ground's surface and by digging ditches and small and shallow adits.

(7) Conclusions

Jan Marian Hempel highly contributed to the development of geological knowledge of Upper Silesia Region. He undertook very difficult task of creating a geological map, although he didn't have a specialist geological education. At the bottom of his activity there was a great knowledge of mining, that enabled him to determine components of structural hard coal beds. Yet, such results could not been achieved without the through knowledge concerning mineral resources occurred in the analyzed area.

Self-taught geologist discovered traces of Permian products. Moreover he grouped together coal beds in the West Mining Region of the Polish Kingdom (called till the 19th century Dąbrowa Coalfield) into systems that were later called "under-reden", "Reden" and "over-reden". In the 19th century when the region's mining and geology knowledge was developing, the information given by Hempel on his map had a fundamental significance.

This data were also used by Prussian geologists of that time freely. Although, the region was divided with three frontiers it was required to conduct uniform descriptions and analyses. Indeed, geology do not acknowledge any political frontiers, to conduct a complex regional analysis the knowledge of local matters in highly required.

⁶¹ C. Mauve, "Flötzkarte..." (1860).

⁶² Simultaneously W. Kosiński, "Few remarks..." (1869), p. 248, argues, that: "Comparing Mr. Hempel's map with the latest map [F. Roemer], it can be observed that, in places where Mr. Hempel marked Permian's beds, gaudy sandstone can be found on new map [...] For rocks of that period [Permian] porphyry, that on the new map is marked on the east excavation line [Dąbrowa – Iwanogród railway line], should be included. In that excavation the sea fossils of coal formation were founded." [so called sea level Štur, consisting the bottom of productive deposits of later In Silesia, for the first time it was defined near Ostrawa]".

⁶³ J. Hempel, "Few words about *The cart ...*" (1876), p. 264: "previously knowing the marking of beds in our qualified region. It can be easily observed, that Römer's marking is a simple copy of signs that we have known since ages". Simultaneously he proposed further division of coal formation: "taking into account only sandbanking of coal beds in our coalfield, it is advised to divide them into bottom beds, middle beds — that our enormous coal beds accounts to, and the top beds".

⁶⁴ J. Trejdosiwicz, "The porphyry in Polish Kingdom" (in Polish). *Spraw. Kom. Fizjogr. Akad. Umiejętn.* (Kraków), 1880, 14, 2, p. 258–271.