

Science in the Service of Occupational Health: The Case of the Commission for “Miner’s Disease of Jáchymov” in the Inter-war Czechoslovakia

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Introduction

The subject of this article is the historical case of the so-called “miner’s disease of Jáchymov”; this is how the increased incidence of lung carcinoma in miners employed in uranium mines as well as workers of the uranium dye and radium factory in Jáchymov in Bohemia was called. This case epitomizes the problems connected with the research, definition and control of one particular occupational disease, combined with the elaborate complex of political and social relations in the inter-war Czechoslovakia.

The attitude of the Czechoslovak authorities at that time towards the problem of “miner’s disease of Jáchymov” was influenced, among others, by the relation between the ethnic German minority and the Czechoslovak state, by the attempts of political parties to establish their positions within the democratic parliamentary system, and by the effort of the state to create labour legislation at a worthy level, compatible with international law. The task of Science, in this case, was to combine the forces of a number of fields for interdisciplinary co-operation in identifying the disease and its causes, and to suggest the most effective measures for the solution of the problem. The scientific research as well as the suggested health and social measures, however, often met distrust and opposition of the mine workers, who were afraid for their health but – on the other hand – worried about a possible loss of their jobs. This fear was intensified by the Depression, whose economic and social impact in Czechoslovakia was particularly grinding in the industrial areas of the North-West, with prevalent German population; later, in connection with Nazi German propaganda, there was a dangerous political impact as well. For nationalist and socially oriented political parties, competing for the way of solution of the burdensome situation, Jáchymov was a favourite political topic again and again, around which the parliamentary debates kept revolving.

Our topic can also be followed from the point of how the problem of the “miner’s disease of Jáchymov” immediately contributed to promotion of progressive tendencies both not only in labour legislation but also in public health in general.

Jáchymov Region

The Jáchymov region was in a special position as a uranium ore (pitchblende) deposit, which – at that time – was substantial for both research and application of natural radioactivity. Because of the geographical location of Jáchymov (on the border with Germany) and the ethnic composition of the population in the area (predominantly inhabited by Germans) the above mentioned social and political factors played an important role as well, particularly coming to the fore in the second half of the twenty-year period when the democratic Czechoslovakia was in existence.

Since the turn of the 19th and 20th century, the working and health conditions of the miners on both the Czech and German sides of the Ore Mountains

(in Bohemian Jáchymov and Saxonian Schneeberg) had been the subject of particular medical studies, which gave the reasons for suspicion that the incidence of lung carcinoma in the miners was higher than normal. Within the limits of medical knowledge of the period, it was believed that potential triggering factors of the disease could be inhalation of metal dust, fungi of rotten mouldy wood and – eventually – radioactive substances (such as “radium emanation”, i. e. radon) released from the radioactive rock. The results of systematic research, organized in Schneeberg by the Saxonian Committee for the Research and Control of Cancer between 1921 and 1926, were submitted to the Commission for Research of Cancer established at the League of Nations. Several cases of lung carcinoma, also diagnosed in employees of the mines in Jáchymov, were presented by Julius Löwy, professor of Occupational Diseases at the German Medical Faculty in Prague, at the 4th International Congress of Industrial Diseases in Lyon in 1929.

Investigation into the “Miner’s Disease of Jáchymov”

The case of the “miner’s disease of Jáchymov” was repeatedly debated in the Czechoslovak Parliament between 1928 and 1938. The interest was triggered by the results of the mentioned study into an analogous phenomenon in the miners of cobalt mines in Schneeberg and by the following campaign, launched in the Czechoslovak press. Another important impulse came from the International Commission for Study of Industrial Carcinoma, established by the League of Nations. The Commission recommended to observe the problem of health conditions of cobalt and similar metal mine workers all over the world, which was substantiated by the results of the Schneeberg study. The recommendation was also addressed to the Czechoslovak authorities in 1928 (with an explicit reference to the uranium mines in Jáchymov and cobalt mines in Dobšiná, Slovakia).

In 1928, the Czechoslovak Ministry of Public Health and Physical Training (under Minister J. Tiso), acting together with the Czechoslovak Ministry of Public Works (under Minister F. Spina), whose province the mines in Jáchymov fell within, opened a screening station in Jáchymov to make a methodical expert judgement about the issue of the “Jáchymov miner’s disease”. Within the Station’s activities, the first clinical and radiology investigations of all (active or retired) employees of



Figure 1 – Uranium and Radium Factory in Jáchymov.

the mines and the factory were performed by the end of January 1929, which were also completed with post-mortem examinations of the deceased persons in 1929–1931. The results of the first stage of the research proved – similarly to those of the Schneeberg research – an increased incidence of lung carcinoma in the employees of the uranium enterprise in Jáchymov. Concurrently with medical examinations, a technical research of working and health conditions in the uranium mines and factory in Jáchymov was performed (including the measurements of airborne dust production, as well as radioactivity of the air, pit drainage water and boring rubble in the mines).

Further systematic and long-term research of the disease was supported by the donation (of 300,000 CzK) of the Czechoslovak President (Tomáš Garrigue Masaryk) in 1931. Making use of this support as well as the existing scientific and institutional basis, an interdisciplinary commission was put into activity, staffed by both Czech and German specialists, whose task consisted in designing and implementing of a scientific programme of further research in order to establish the reasons and aetiology of the disease and to observe the effectiveness of the measures taken. Apart from the ongoing clinical examinations (complemented with special investigations, such as otorhinolaryngological examinations, bronchoscopies of both the working and retired miners, and blood tests) and post-mortems (including sampling of the lungs and spines, followed by a histological tumour examination), new aspects were introduced into the research, in particular, radio-physical research and complex chemical analysis of deceased miners' body organs, aimed at establishing the content of silicon dioxide, calcium oxide, metals, and radioactivity (measurement of the total alpha-activity and the radium content). Based on the technical recommendations of mining specialists, some more or less routine industrial health measures had been introduced in the uranium mines and the uranium and radium factory, such as a new ventilation projects, or water-irrigated pneumatic picks. (The protective dust-filtering masks were opposed by the workers and were not used.) Concerning the radioactivity in mines, however, science was still unable to answer the question what maximum percentage of radon in the air could possibly be held for harmless.

Trying to evaluate the activity of the Commission with the benefit of hindsight, we can state that science was in debt in the respect of identification of the primary cause of the “miner's disease” or clear identification of the most dangerous risk factors: Clinical diagnosis of the disease was usually ambiguous, and there was no reliable proof available until the post-mortem examination. While science needed more long-term research to provide more definite answers, from the point of view of miners' health protection the requirement – both subjective and objective – was to find a solution as quickly as possible. Uncertain evidence of science could, to some extent, be blamed for postponing the much needed legislative measures; eventually, the only measure taken was including the “Jáchymov miner's disease” in the detailed list of ailments in the new – and first in Czechoslovakia – law of

indemnification for occupational diseases in 1932 (and, following that, eventually Czechoslovak ratification of the Geneva International Convention of 1925). The Act of Occupational Diseases provided an analogous satisfaction as the Injury Act of 1888, that is to say it only meant financial compensation. In the case of Jáchymov miners' lung carcinoma, alas, only the bereaved families were entitled. Apart from indirect pressure for control and Trade Office supervision, the law could not, however, prevent any new damage to health. Nevertheless, social preferential treatment and danger money were only provided to a negligible extent: the miners' social claims did not meet a sufficient – from their point of view – response for a long time. There was a difficulty in adopting any legislation for preferential treatment of one trade group without substantial scientific argument (which could hardly be provided as the mechanism of development of the disease was largely unknown in detail and its diagnosis was difficult).

Looking for Solution – Confrontation of Interests

The problem of “Jáchymov miner's disease” included quite a number of paradoxes: radium salts used in cancer therapy at that time (and looked upon as a means to alleviate suffering of people) potentially brought about untimely death to those who produced them. Another paradox, when compared with the radioactive environment of the Jáchymov mines, was the radium spa, where visitors from all over the world were coming every year for radon baths and short-time inhalation treatment (radon inhalation). The requirement by the Ministries in question to keep the activity of the Commission confidential, which was met with criticism from socialist parties and trade unions, was partly due to the fear that the spa clients could be scared off and “radio-phobia” could therefore take away a chance from the locals to earn their living in businesses connected with the spa.

Considering the role that radium played at the initial stage of the research and application of natural radioactivity, Czechoslovakia placed great hopes in radium production and trading (before the USA, then Belgian and finally Canadian competitors took up the chance), and mining for pitchblende in Jáchymov was therefore considered as a matter of prestige, the country's pride.

Not only the knowledge of radiation disease was at its early stage at that time, but also oncology had only taken the first steps little by little, although cancer was becoming common knowledge as an increasing general threat. The level of radium therapy was more or less tentative as well: until 1930s, the standards and units of radioactivity were not established that would provide the necessary basis for the study of biological effects of ionising radiation and for defining the first regulations of occupational health in the field.

The most radical solutions considered for prevention of the disease were practically unacceptable. An immediate closing down of the mines, which could have best protected the miners from the insidious disease, would have deprived them of their jobs at a time. Moreover, the country would have lost the

production of radium and uranium dyes, which would have to be purchased abroad at high prices. This kind of solution was only suggested once, just as a way of holding back the above-mentioned hysterical “radio-phobia”.

Also unviable was another solution proposed, which consisted in a transfer of ill mine workers to the local tobacco factory. For the factory workers, this would have meant either to become redundant, or to take the risk of “miner’s disease” themselves, replacing the ill miners at their workplaces. The number of afflicted person would have been multiplied in this way.

Only a minor recovering effect on the miners’ health could have been brought about by proposed paid curative stays, lasting several weeks, in Slovak salt mines (which were state-owned too).

Surprisingly, the miners saw a satisfactory solution in sufficient and early financial security – which was, however, beyond the possibilities of the State finance. During the Depression, even the costs of the research and immediate measures taken were a burden for the Treasury. Then, the only solution left was palliative measures, which was perhaps honest, considering the time and the given conditions. Thanks to the recommendation of the Commission as well due to the miners’ own pressure (particularly the strike of 1938), the miners finally achieved some extra preferential treatment connected with pursuance of the high-risk occupation (a longer leave, shorter working hours, nutrition allowance, etc). Following the strike, there was also a special policy adopted in judging the “Jáchymov miner’s disease” as an occupational disease according the amended law: for the purpose of indemnification, the diagnosed degree of affection of lungs by dust could be lower than in other trade groups.

For prevention as the only effective defence against cancer, which had been called for among the specialists but only with difficulty promoted in health policy, Jáchymov was the first experience outside clinical setting, and outside big cities. Similar to the Masaryk League against Tuberculosis, which ran hundreds of clinics in all over the country, setting up a nationwide network of anti-cancer clinics – for early diagnosis of the disease – would have been a chance for the fight against cancer. One of the last outputs of the Commission’s activity was the establishment of the State Consultation Clinic for Lung Disease for Jáchymov and Vicinity in 1937 (whose services were financed from the Ministry of Health budget item “fight against people’s ailments”). The Clinic carried on the systematic medical examinations of the miners, commenced in 1928. Beyond that, however, this time the service was intended to take care of the whole population of the area. The practical activity of the Commission was interrupted by the German occupation of Jáchymov in 1938, although theoretical evaluation of the results went on even in the first years of the war. During the war, the mines of Jáchymov became an object of a wide interest of specialists from Germany. At that time, allegedly, the mines were visited by Professor Boris Rajewsky, the head of the *Kaiser-Wilhelm-Institut für Biophysik* in Frankfurt-Main, and new measurements of radioactivity were done.

It seems that hygienic and epidemiological studies into the problem of exposition of miners' organisms to radon in Jáchymov mines were carried on following the re-opening of the mines after the war. However, the available information about their nature is very scarce and incomplete. Political importance of uranium from Jáchymov after the war (races in nuclear weapons production) and the connection of the mines with labour camps for political prisoners in 1950s and 1960s make this subject very interesting but – at a time – very difficult, considering the degree of availability and reliability of historical sources.

Conclusions

The Jáchymov case seems to have played a positive role in parliamentary readings of Czechoslovak legislation concerning occupational diseases (being, as one of the hottest issues, a catalyst for the debates). Political necessity of solution of this issue contributed to an earlier ratification of international conventions.

Scientific research of the “miner’s disease” was advocated by Professor Jaroslav Hlava, an outstanding Czech pathologist, as early as at the beginning of 1920s, but without a due response. One of the first scientists active in the research of the disease was Julius Löwy, who was a professor of Occupational Diseases (*Gewerbekrankheiten*) at the German medical faculty in Prague – at that time there was no professorial chair for occupational diseases at the Prague universities yet. When the Committee for Industrial Health of the International Office of Labour invited national governments to establish professorial chairs of this kind in July 1934, this only supported the endeavour of Czechoslovak specialists. However, not earlier than in late 1930s the Ministry of Education discussed the establishing of the professorial chairs at Czechoslovak universities with the Ministry of Health. At Charles University, the chair was only established after the war, in 1946, with Professor Jaroslav Teissinger as the Head, who had run an outpatient department for occupational diseases at his medical clinic since 1934.

Competent authorities started supporting the endeavour of Czechoslovak specialist, who had tried – with little success before – to promote legal regulation of work with ionising radiation. The law of 1932 resolved the controversy between the scientific and the lay sides concerning postmortem examinations, as a proof of the disease, which (in most cases) practically could be only a postmortem, was a sine qua non for any claims according to the above mentioned Law of Indemnification. This also enabled the scientific research to continue, whose results, naturally, were of a more general importance.

In the specialist aspect, the case was an interesting and – in the conditions of Czechoslovakia at that time – rather unique example of interdisciplinary co-operation between physicians, physicists, chemists and technicians. It was a long-term scientific project, which in many respects became an acid test of Czechoslovak science, and an impulse for its further development.

The main cause of “Jáchymov miner’s disease” was explained in 1952, when in light of recent knowledge of inhalation of radioactive aerosols the hypothesis was suggested – now proved – that the main noxa in uranium mining works was not radon itself but rather its daughter products, adsorbed on dust particles (radioactive aerosols) and deposited in lungs epithelium. In those times, in 1930s, however, practical measures had to come before scientific knowledge ...

Postscript

This study was restricted on the period between the two World Wars, with only partial time overlaps. The investigation of the “miner’s disease of Jáchymov” proceeded after the World War II and in fact it continues up to the present day when the 100-year period of systematic epidemiological studies necessary for gathering and serious interpretation of the statistical data comes to an end.

Jáchymov (St. Joachimsthal), Bohemia

LOCATION: small mining town on Bohemian side of the Ore Mountains (Cz. Krušné hory), ca 30 km off Schneeberg

HISTORY: 1516 beginning of mining activities: mining for Ag, later for Ni, Co and As;
 1853 mining for uranium and production of uranium dyes commenced;
 1908 production of radium salts started;
 1906 spa with first therapeutic baths established, exploiting medicinal effects of radioactive pit drainage water;
 1918 mines as well as uranium dye and radium factory taken over by Czechoslovak state (Ministry of Public Works);
 after 1924 there were three state mines in operation (Svornost, Werner, Štola saských šlechticů);
 1967 mining industries in Jáchymov closed

DEMOGRAPHIC AND SOCIAL CONDITIONS AT TURN OF THE 1930S

POPULATION: Jáchymov (with nearby villages) ca 7,500 inhabitants, mostly ethnic Germans; 7,000 regular and 3,000 passing visitors of spa per year, incl. 50 % foreigners of 14 nationalities

MAJOR WORKPLACES: mines and uranium and radium factory (males) – 300 to 400 jobs; tobacco and cigarette factory (mostly females) – 600 jobs; spa services; cork ware factory, soap factory, brewery; home crafts

Schneeberg, Saxonia

LOCATION: small mining town on the German side of the Ore Mountains (Germ. Erzgebirge);
1410 beginning of mining activities: mining for Cu and Fe, later for Ag, Co, As,
Bi, Ni and U, in 1920s predominantly for Co.

Research into “Miner’s Disease” in Schneeberg in 1922–1925

ORGANIZED BY: Saxonian LANDESAUSSCHUSS ZUR ERFORSCHUNG UND BEKÄMPFUNG
DER KREBSKRANKHEIT; in charge of the research: internist O. ROSTOSKI, radiologist
E. SAUPE and pathologist O. SCHMORL from Dresden.

RESEARCH: Clinical and X-ray screening of health of

- a) employees of Schneeberg mines: 154 persons (116 active employees,
32 invalids miners, 6 having changed occupation);
- b) other local career groups: 176 employees of blue dye factory in nearby
Oberschlema (where Schneeberg ore was processed);
- c) general population: 186 inhabitants of Schneeberg and vicinity
(especially those complaining of lung condition).

Measurement of the air radioactivity in Schneeberg mines

1923 by RADIUM-INSTITUT DER BERGAKADEMIE IN FREIBERG – in 6 mines, concentrations of
radon in air established from 1–50 Mache units (4–182.10–10 ci/l).

Results

- pneumoconiosis diagnosed in 20 miners (incl. 4 miners with subsequent diagnosis
of lung carcinoma as well);
- lung carcinoma diagnosed in further 17 miners;
- neither of these diagnosed in other 362 persons (not employed in mines);
- postmortems performed in 22 cases of deceased miners, revealing 21 cases
of lung carcinoma and 1 case of lung tuberculosis.

Conclusion of research

- “Miner’s disease” in Schneeberg is lung carcinoma, which only affects those groups of local
inhabitants that are employed in the mines.
 - Considering the high content of radon in the air in local mines, the idea cannot be excluded
that breathing the air can contribute to lung carcinoma.
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Research into “Miner’s Disease” in Jáchymov (the International and National impulses)

Early 1920s suspect of incidence of lung carcinoma among Jáchymov mines staff expressed by
Prof. JAROSLAV HLAVA, pathologist from Prague; he tried to instigate in-depth study of issue
– without a response

1923 COMMISSION OF LEAGUE OF NATIONS FOR STUDY OF CRAFT CARCINOMA established;
Sir GEORGE BUCHANAN, chairman (Great Britain), EWALD TOMÁNEK, secretary (CSR)

1922–25 research into „miner’s disease“ in Schneeberg, Saxonia, organized by
LANDESAUSSCHUSS ZUR ERFORSCHUNG UND BEKÄMPFUNG DER KREBSKRANKHEIT

1928 (beginning of the year) news of Schneeberg results published in Czechoslovak daily press; interpellation by ethnic German deputies in the Czechoslovak Parliament

1928, May 6 bill submitted in Chamber of Deputies of Czechoslovak Parliament for “*law of protection of persons employed in works where radium is mined, processed, or used*”; argued for by unsatisfactory condition of occupational health of workers in state-owned uranium mines in Jáchymov

1928, November 13 letter from SECTION OF PUBLIC HEALTH OF LEAGUE OF NATIONS addressed to the Czechoslovak Ministry of Health with recommendation to perform screening of incidence of lung carcinoma among miners employed in Czechoslovak uranium mines in Jáchymov and cobalt mines in Dobšiná in the Slovak Ore Mountains; similar recommendation was made considering mines in the following countries (localities): Germany (Freiberg, Annaberg, Johanngeorgenstadt, Altenberg-Zinnwald; Biber; Müssen, Siegen, Saalfeld, Querbach; Riechelsdorf), New Caledonia, India, France (Allemont), England (Botallack in Cornwall), Norway (Skutterud), Sweden (Tunaberg, Riddarhyttan, Gladhammar, Vena), the USA (Missouri), the USSR (Caucasus), Canada (Cobalt City, Ontario), Spain (Asturia), Rumania (Opawieza);

1929 4th CONGRESS OF STANDING INTERNATIONAL COMMITTEE FOR STUDY OF INDUSTRIAL DISEASES, Lyon, France; JULIUS LÖWY, Professor of craft diseases at German university, Prague, presented cases of lung carcinoma diagnosed in employees of Jáchymov mines.

First Stage of the Research into “Miner’s Disease” in Jáchymov (1928–1931)

Screening of health of employees of Jáchymov uranium mines and factory

1928 (end of year) station is established in Jáchymov by Ministries of Health and Public Works to examine health of employees of Jáchymov uranium mines and factory; physicians J. MARKL and A. PIRCHAN of state-owned spa put in charge of examinations;

1929 (by end of January) 323 active and 83 retired workers examined; in some cases lung carcinoma suspected but could not be categorically diagnosed;

1929–30 postmortem examinations performed in 13 cases (out of 22) deceased employees; lung carcinoma diagnosed in 9 cases;

1931 postmortems suspended by Jáchymov district authorities under pressure of mineworkers;

Study of working conditions and occupational health in mines

1928–30: random measurements of radon concentrations in the air in mines; as much as 40 Mache units measured in places; dust pollution in workings monitored;

Conclusion of First Research

- 1) Lung carcinoma did occur in Jáchymov miners, and its occurrence was very frequent.
- 2) Nearly a half of the deceased had been employed in the mines for 16–25 yrs.
- 3) Average age of the deceased was 53 yrs.
- 4) Considerable content of radon in the air in mines supported the suspicion that inhalation of radon was the main cause of development of the disease.

Immediate Measures

- 1) Replacement of pneumatic picks with water-irrigated ones (in order to reduce dust in workings).
 - 2) Experiments with protective masks equipped with dust filters (finally not adopted for use by workers).
 - 3) Raising minimum recruitment age for mines and factory to 22 yrs.
 - 4) Project and implementation of artificial ventilation in mines (fresh air pumped to mines with pressure fans; average radon concentration in air reduced to 2 Mache units).
 - 5) Including of lung carcinoma in employees of Jáchymov mines and uranium and radium factory among 25 diseases that were considered by first Czechoslovak law of indemnification for occupational diseases (Act No. 99 of June 1, 1932).
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Establishment and Activities of the Scientific Commission for Research and Therapy of “Miner’s Disease” in Jáchymov (1931–1938)

- 1931 Donation of 300,000 Czk. by President of the Czechoslovak Republic T. G. Masaryk for further research and therapy of “miner’s disease” in Jáchymov
- 1931 (end of the year) establishment of the SCIENTIFIC COMMISSION FOR RESEARCH AND THERAPY OF “MINER’S DISEASE” in Jáchymov
- 1932 programme of further actions in the Research and Therapy of “Jáchymov miner’s disease” submitted to the Commission:
- 1) continuation of medical examinations, completed with laryngological and bronchoscopical investigations and blood tests;
 - 2) resumption of postmortems;
 - 3) research of necropsy tissue samples (of lungs and spines) in aspects of
 - a) radiology – measurement of total alpha-radioactivity and Ra content;
 - b) chemical analysis – measurement of content of SiO₂, CaO, As and heavy metals;
 - 4) specialist technical research into
 - a) dust pollution in mines, especially generation of fine dust;
 - b) radiological map of mines (radioactivity of air in mines as function of site, time/season, ventilation conditions, mining activities, etc.)
- 1937, October 17 STATE CONSULTATION CLINIC FOR LUNG DISEASE FOR JÁCHYMOV AND VICINITY opened at the Radiotherapeutic Pavilion of the State Spa in Jáchymov; MD FRANTIŠEK ŽĎÁRSKÝ appointed its Head Physician; the service financed from the Ministry of Public Health budget item “fight against people’s ailments”
- 1938–39 research interrupted by German annexing of the Czechoslovak border regions (“Sudeten”) and outbreak of the World War II.
- 1952 review of pre-war results of the research into “Jáchymov miner’s disease”; in light of the recent knowledge of inhalation of radioactive aerosols, the hypothesis was suggested by Czech physicist František Běhounek that radon daughter products, adsorbed on dust particles, might be the main noxa triggering development of lung carcinoma in Jáchymov miners.

Members of the Scientific Commission for Research and Therapy of “Miner’s Disease” in Jáchymov (1931)

Chairman

RUDOLF ZIEL (b. 1876) Ministry of Health and Physical Training Counsellor, Associate Professor (after 1935 Full Professor) of Social Medicine at the Czech Medical Faculty (Charles University) in Prague

Members

PHYSICIANS MEDICAL FACULTY OF CHARLES UNIVERSITY, PRAGUE

JOSEF PELNÁŘ (1872–1964), Professor of Internal Medicine, Head of the 2nd Medical Clinic;

HEŘMAN ŠIKL (1888–1955), Professor of Pathological Anatomy;

KAREL GREIF (1885–1964), Associate Professor (after 1935 Full Professor) of Otorhinolaryngology;

MEDICAL FACULTY OF DEUTSCHE UNIVERSITÄT, PRAGUE

WILHELM NONNENBRUCH (1887–1955), Professor of Internal Medicine, Head of the 2nd Medical Clinic;

JULIUS LÖWY (1885–1944), Professor of Occupational Diseases, Head of the Department of Craft Health and Occupational Diseases at the Institute of Hygiene and Public Health;

JOSEF BUMBA (1894–1967), Associate Professor of Laryngology, Head of the ENT Department of German Polyclinic

Physicist/radiologist

STATE RADIOLOGICAL INSTITUTE OF CZECHOSLOVAK REPUBLIC, PRAGUE

FRANTIŠEK BĚHOUNEK (1898–1973), research worker (after 1933 Head) of the Institute, Associate Professor of Radioactivity and Atmospheric Electricity of the Faculty of Science, Charles University;

Mountanist

COLLEGE OF MINING ENGINEERING, PŘÍBRAM

ALOIS PARMA (1885–1943), Professor of Mining and Ore Dressing;

IN SUBSEQUENT YEARS, THE FOLLOWING PEOPLE TOOK PART IN THE ACTIVITIES OF THE COMMISSION

Chemist

OLDŘICH TOMÍČEK (1891–1953), Professor and Head of the Institute of Analytic Chemistry of the Faculty of Science, Charles University;

Physicians

JAROSLAV TEISSINGER (1902–1985), Associate Professor of Pathology and Therapy of Internal Diseases (after 1946 Full Professor of Occupational Diseases), at Charles University;

FRANTIŠEK V. NOVÁK (1894–1940), Associate Professor of Medical Radiology, since 1934 Head of the Radiotherapeutic Institute, Prague;

FRANTIŠEK ŽDÁRSKÝ, head of the State Consultation Clinic for Lung Disease for Jáchymov and Vicinity;

Representatives of the Ministry of Public Health, Ministry of Public Works, Mineworkers' Union, and Mining Area Council in Falknov (Bohemia).

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