

MINING AND GEOLOGIC CIRCUMSTANCES IN THE MAYRAU MINE

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ABSTRACT. Summary about mining and geologic circumstances in the coal mine Mayrau in Vinařice near Kladno is presented in this paper. Recapitulation of the mining history of this mine from its foundation in 1874 to a drawing close is mentioned in the first part. Mining location with a view to a pillar shaft and brief geological circumstances at the deposit are described further. Two basic extraction methods used at this mine at present time are describes in the closing part.

KEY WORDS: Vinařice allotment, pillar shaft, opening, Kladno Formation, Radnice Member, coal seam, room-and-pillar working, shortwall working.

1. RECAPITULATION OF THE MINING HISTORY OF MAYRAU MINE

In the district of Vinařice Village, mining has been allegedly undertaken since 1871. It was controlled by the Společnost státní dráhy (the State Railroad Company). In the archive of the former Kamenouhelné doly (Black-coal Mining Concern) Kladno, the beginning of the mining is documented by a Mine Record Book of the Mayrau Mine from the year 1874. Still in 1872, the drilling was unsuccessful and the mine was filled up. On March 14th, 1874, the Společnost státní dráhy transferred the rights over that geologically diverse and technically demanding area to Prague Iron Company for 40 000 Austrian ducats. An important role in the transfer was played by the lawyer JUDr. Kajetán Mayer, who was not only a member of the board of directors in both companies, but also the director of Verein der Montan Eisen und Maschinen Industriellen Company, whose activities covered the whole territory of the Austrian Empire [Mayová, 1983].

The drilling was reopened on July 28th, 1874, and, on October 8th, 1877, a final depth of 525.25 m was reached. From the very beginning, the pit, and afterwards the whole mine, was called Mayrau. A coal seam nine meter thick was discovered at the depth of 512.2 m. On the basis of chemical analyses, it was established that it is high quality coal. In northeastern direction, about 50 meters away from the Mayrau Pit, a second pit was drilled in the period from the December 1st, 1880, to February 29th, 1884. Its name was Robert and it was named after the F. Robert, who owned a commercial company, and mines which were previously owned by V. Černý.

For the drilling, instead of the by then antiquated rectangular profile, it was used the circular English profile with brick lining. As for the ventilation, the Mayrau Pit was acting as outlet airway pit and the Robert Pit as an intake airway pit. For the drilling of the pit, designed for the transport of material, a hand winch was used first, and then, from August 14th, 1874, a semi-portable steam engine. By the end of 1875, a duplex reel hoisting steam engine was transported from Stelhčeves Mine. To transport of both people and material, a hoisting bucket was used. Its volume was one cubic metre. Produced by Ringhoffer Joint-stock Company from Smíchov, a hoisting steam engine from the Mayrau Pit has been preserved as a technical monument. In 1906, it was directly transferred from the World Fair in Paris to the pit, where it was installed and it has been in operation to this day. Only in 1940, the steam drive was replaced by a pneumatic one [Šmrž, 1983].

For the Robert Pit, there is no information about both its manufacturer and date of production of the original drive. It is supposed, though, that it had been purchased before 1890 and, later in 1933, it was dismantled and replaced by a more powerful engine with direct-current drive.

In the early years of the underground workings, hand drive had been used for the transport. Later, there were utilized horses. Later on, horses were replaced by cableways and locomotive transport. We cannot avoid to mention briefly of one of these means of transport used both underground and on the surface – the transport by horses. In the Mayrau Mine, according to the documentation dated on November 22nd, 1929, there was working the total of 25 horses underground and 10 on the surface. That kind transport persisted, though in limited dimensions, to 1957, when the two remaining horses, Karel and Baron, were taken out of the mine [Šnobl, 1983].

For the underground lighting, there were first used oil lamps, then they were replaced by Wolf carbide lamps, and finally by electric lighting, since it was not only more reliable but also less dangerous.

Up to 64 meters of depth, the drainage was carried out by hand pumps. The scale of the water inflow required to improve the drainage installing a twin steam pump and, when necessary, the bucket was used as well. Later, in 1879, new drainage engines were constructed utilizing as drive a steam engine combined with Mayer's valve and condensation. In the course of time, these were replaced by electric pumps. The Pražská železářská společnost (Prague Iron Company) went into troubles when it tried to produce coke for blast furnaces. The quality of coke produced by the Státní železniční společnost was low. For this reason, in 1885 the effort to start coke production was abandoned and coke was imported from the region around the Ostrava Town and from Silesia.

In the years from 1930 to 1939, there was carried out a large concentration project, i.e. a thorough reconstruction of mines owned by Pražská železářská společnost designed to rationalize the operation of mines around Kladno. The Max and Mayrau Mines were connected with each other by means of a footwall cross tunnel. Later on, the Mayrau and Ronna Mines were interconnected as well [Mayová, 1985].

After the nationalization of mining industry in the year 1946, the Mayrau Mine

has been renamed. Its new name was Fierlinger Mine and it was integrated into Středočeské uhelné a železnorudné doly Kladno, n.p. (Central-Bohemian Coal and Iron-ore Mining, National Company Kladno). In 1956, this company was transformed into the Sdružení kamenouhelných dolů Kladno, n.p. (Association of Black-coal Mines of Kladno, National Company), and afterwards into Kamenouhelné doly Kladno (Black-coal Mines of Kladno Concern). In 1958, the mine was renamed again, that time to Gottwald Mine II and it was incorporated in the complex called Klement Gottwald Mine, in which the mining was concentrated to Nejedlý Mine I (the former Schoeller Mine; today it is the Kladno Mine – Plant 1).

After the impressive social and political changes, which have taken place after 1989, the Kamenouhelné doly Kladno Concern has disintegrated. The Klement Gottwald Mine complex, under its new name – Kladno Mine, has been incorporated into the Českomoravské doly, a.s., (Bohemo-Moravian Mines, Joint-Stock Company). Now, the official name of the Mayrau Mine is Kladno Mine – Plant 2 (Kladno Mine 2). In view of the fact, that the Plant 2 recently merged with Ronna Mine too (former Gottwald III), it has become more precise to identify the mine with its original name again and to call it Mayrau Mine.

Recently, the history of the original Mayrau Mine is coming close to its end as the mining is restricted to the shaft pillar. After its extraction during the next few years, the mine will be closed down.

2. MAYRAU MINE DESCRIPTION

In the Mayrau mine, a deposit of black coal at Vinařice mining allotment is extracted. It covers an area of 4.8 km² located to the northeast of Kladno in the territory of following village districts – Vinařice, Třebichovice, Švermov, and Libušín. The mining allotment is situated in the Kladno coal mine district, as it is shown in Fig. 1. The deposit is approached by two pits – Mayrau and Robert, drilled 50 m from each other and reaching the depth of 527 m. From the beginning, the Robert Pit has been used as intake airway pit and Mayrau Pit as outlet airway. Recently, the Mayrau Mine functions as a subsidiary plant of Kladno Mine utilized for transport of colliers and material. The extracted coal is transported in the underground to Plant 1 at the Libušín Village, where preparation plants are installed and where the bulk of the mining operations of Kladno Mine is carried out.

In the Vinařice deposit, mining operations are realized at two principal depth levels – on the 7th and 10th floor, i.e. about 400 m under the surface. At the 7th floor level, in the past there were hoisted upper tectonic blocks in the more distant parts of the deposit northeasterly from the pits (former Robert and Sever hoisting sections). Currently, at that level, there are being hoisted the remaining coal reserves from the Engert coal field to the southeast of the pits. Apart from the shaft pillar, this is the last section of that deposit that is still being hoisted now. At the 10th floor level, only the shaft pillar is currently hoisted. All the remaining sections (Robert, Mayrau, Sever, Západ), in spite of the fact that they have been exploited until very recently, are now exhausted. A comprehensive view on the mining location in Vinařice mining allotment is displayed in the Fig. 2.

The fact that mining activity is beginning to concentrate to the shaft pillar area which is exactly where the bulk of the investigation by the scientists of the Institute of Rock Structure and Mechanics is being carried out implies that the following description is restricted only to mining location of the pillar shaft.

2.1. Description of Mining Situation in the Pillar Shaft

The pillar shaft (safety pillar) of Mayrau and Robert Pits has about 400 m in diameter. It is located in the southern section of Vinařice mining allotment. Both of the shaft mouths are in 352.9 metres above the sea level. An overall description of the mining location is surveyed in Fig. 3, with schematic representations of all the underground workings currently accessible.

The 7th floor level is drilled into the pillar in the upper overlying rock of the coal seam and its position is at the altitude figure of -47.8 metres above the sea level. It consists of a network of short openings in the shafts' surroundings and of three cross tunnels. "VII cross tunnel" runs in the northeastern direction to the area of former Robert hoisting section. "Cross tunnel No 5001" running in southwestern direction represents the connection to the Engert mine district and the incline "outlet cross tunnel of Mayrau" connects, in western direction, the 7th and 10th floors. In the "cross tunnel No 5001", a 4-metre-long chamber was carried up 150 m from the Robert Pit. In that chamber, one of the monitoring sites of the Institute of Rock Structure and Mechanics is installed. It is utilized monitor the rock massif behaviour especially in the area of upper overlying rock above the coal seam. In Fig. 3, the chamber is indicated as K7.

The 10th floor, whose immediate surroundings are at -167.5 m above the sea level, has been mostly in a coal seam or in its underlying bed or in the overburden. The main transport tunnels form the axis of the pillar shaft. Namely, there are the "northern cross tunnel", "Max - Mayrau" opening and its continuation in "Ch 3103" opening, which run across all of the shaft pillar. They are followed by development and preparatory underground workings concentrated into three areas within the pillar shaft. In N and NW directions, there are the "Ch 3100", "Ch 3105", "Ch 3106", and "Ch 3113" openings, in which the NW section of the shaft pillar is being extracted now. At the eastern side, there are the following openings: "Ch 3107", "Ch 3114", and, particularly, "Ch 3110" and "Ch 3111", that will be used to extract the subsided E and SE sections of the shaft pillar. On the south, the extraction of the uplifted S and SE sections of the shaft pillar is making use of the "Ch 3108" and "Ch 3109" openings. The development and preparatory underground workings mentioned are continued by shorter preparatory openings and cut-off tunnels, designed for shortwall driving in the different block sections to extract.

Apart from the prevalently recently-driven underground workings, there is, on the 10th floor, certain number of older openings which make the connection to the western sections of the shaft pillar. They are, namely: "western cableway", "4a. inside hoisting raise", and "Ch 2231" and "Ch 2135" openings. On the "western cableway" opening, there is in the overlying rock very closely above the coal seam and 140 m away from the shaft station at Robert Pit, there is a three-metres-long

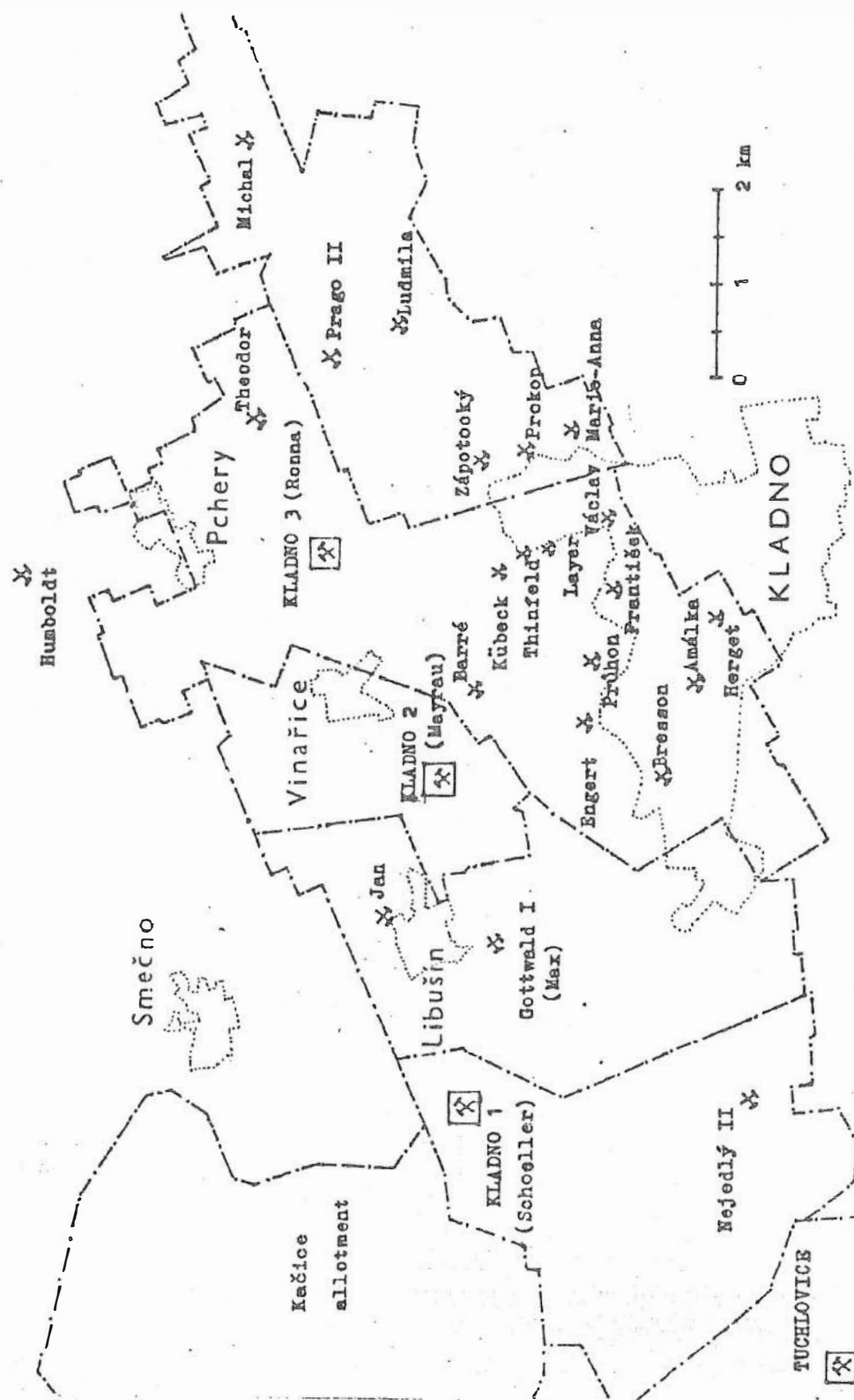


FIG. 1. A map of Kladno coal-bearing region with identification of allotments and the individual mines

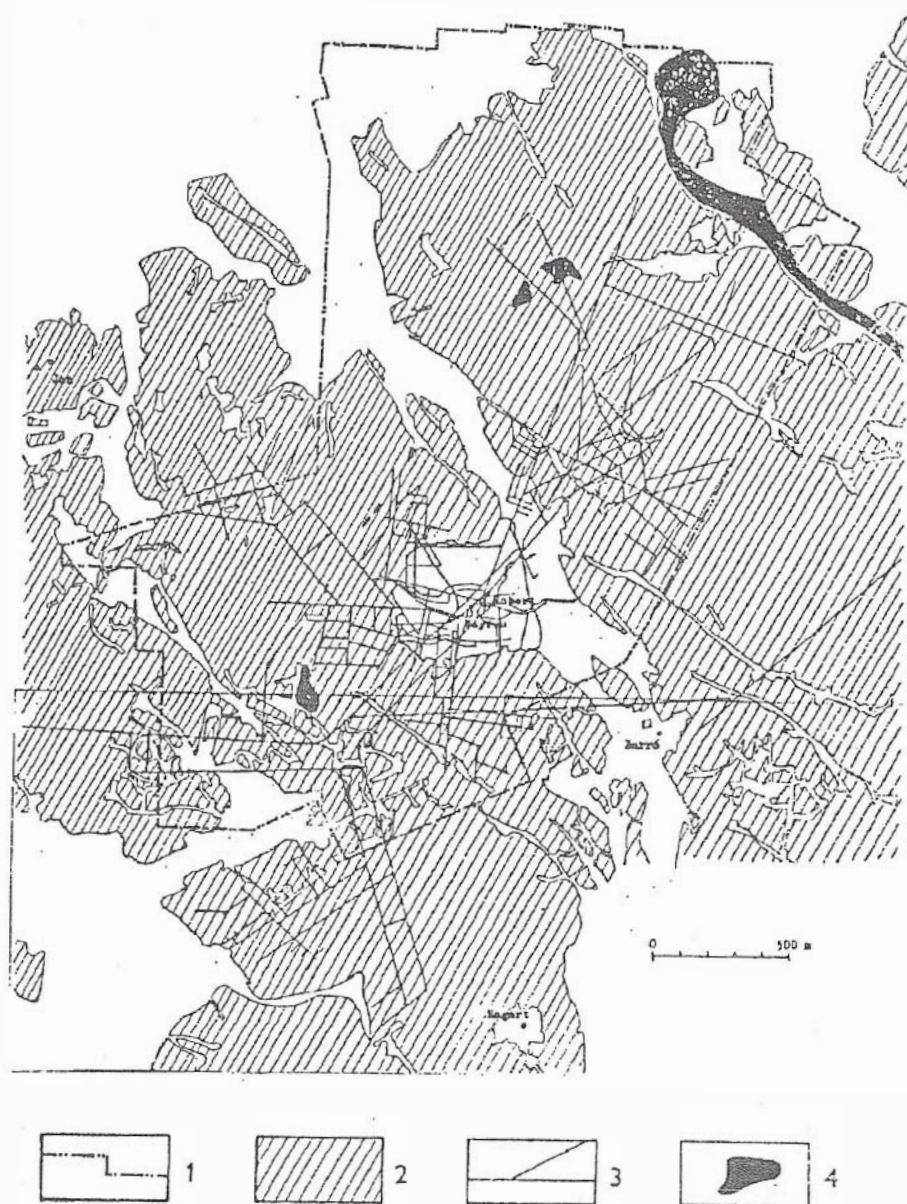


FIG. 2. Mining location in the Vinařice allotment
 1 – boundary of shaft pillar; 2 – worked-out area; 3 – cross tunnels and openings; 4 – Tertiary volcanites

chamber (in Fig. 3, it is identified as K10). Situated on the 10th floor, the chamber and its immediate surroundings contain the monitoring station of the Institute of Rock Structure and Mechanics.

3. GEOLOGICAL CIRCUMSTANCES AT THE DEPOSIT

The geological circumstances at the Vinařice mining allotment were thoroughly

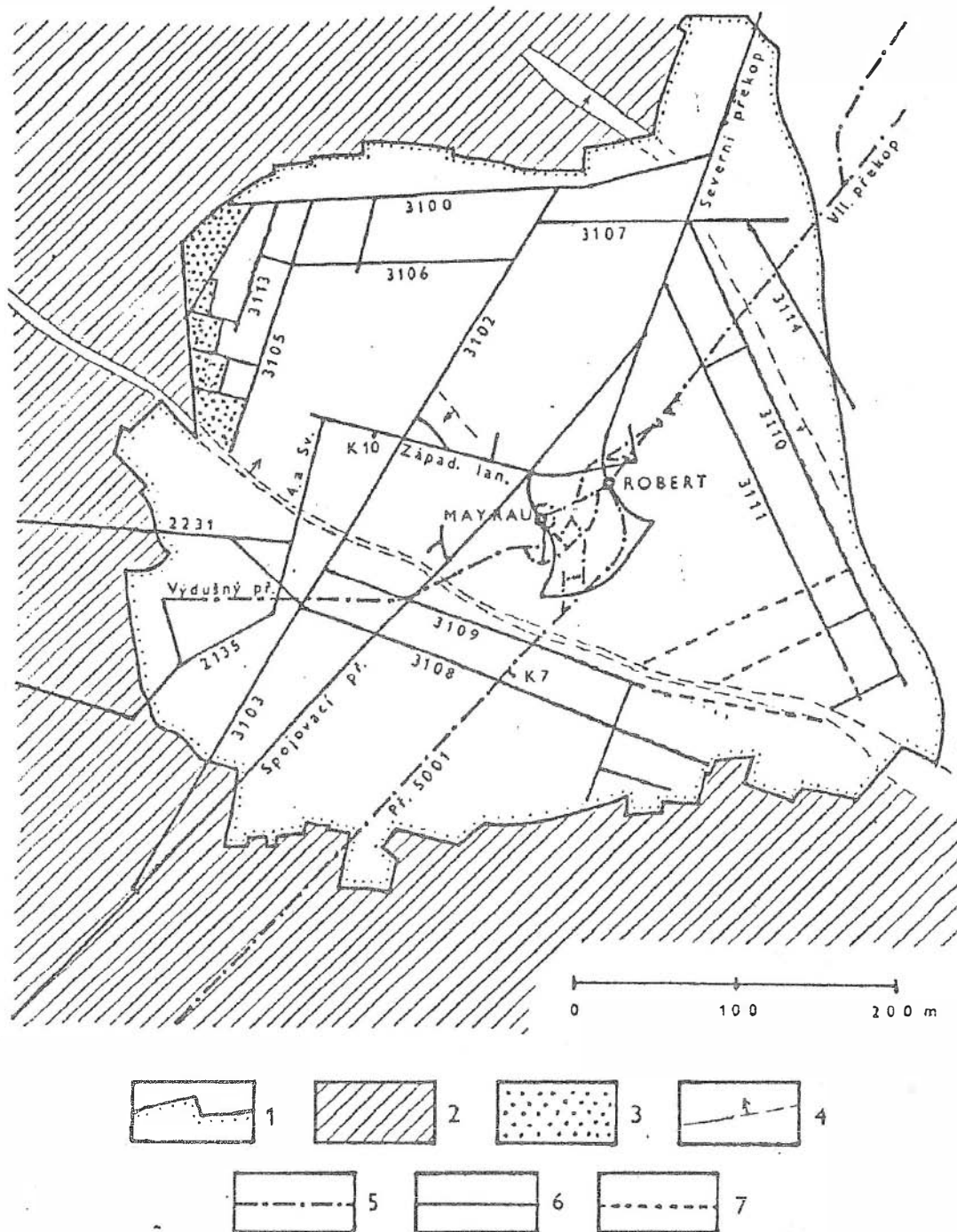


FIG. 3. Mining location in the shaft pillar of Mayrau Mine

1 - boundary of shaft pillar, 2 - worked-out area, 3 - exhausted section of shaft pillar, 4 - faults, 5 - 7th floor, 6 - 10th floor, 7 - new designed openings

described by one of the authors of the present article in a recent issue of *Acta Montana* [Živor, 1994]. Therefore the following passages contain only fundamental data on the geological structure of this deposit to allow the reader to form a general idea about the geological circumstances at the deposit. For a more detailed description, see the above-mentioned article.

The Vinařice mining allotment is situated in southeastern part of the Kladno Basin, which, in turn, is only one of a number of basins assembled in the Central Bohemian limnic Carboniferous. The limnic Carboniferous forms here a praeplat-formic intra-mountain depression originated as a consequence of taphrogenic post-geosynclinal stage of the Hercynian geotectonic cycle [Havlena, 1971]. The basin contains prevalently of clastic deposits of the intracontinental molasse accompanied by surface igneous rocks of subsequent Hercynian volcanism.

As a result of the fact that two stratigraphically stable complexes of red sediments occur throughout the whole region, the Central Bohemian limnic Carboniferous has been divided, since the times of Weithofer's study on the Plzeň Basin from 1896, into four formations: Kladno (lower grey), Týnec (lower red), Slaný (upper grey), and Líně (upper red) – a division by Havlena and Pešek (1980). Only the two grey formations are coal-bearing. In the Vinařice mining allotment, from the lithostratigraphic units mentioned, only the Kladno Formation and a part of Týnec Formation are present. The remaining members of the Carboniferous strata sequences are denudated. At this locality, the thickness of Carboniferous sediments grows up to 550 m. Their deposition is subhorizontal with a slight dip of 8° towards NNW.

The Carboniferous layers are placed discordantly over their underlying bed, which is formed of fyllite slates of the Upper Proterozoic. The overlying rock is composed of denudation relics of Cretaceous layers belonging to Cenomanian and Lower Turonian. Besides the elements mentioned, the geological structure of the locality includes basal igneous rocks of Tertiary origin (olivinite neffelinite). In the northeastern part of the mining allotment, they are represented by Vinařické hory (Mts) stratovolcano accompanied by an underground swarm of veinous effusions which, at several places, run through the coal seam.

Havlena and Pešek (1980) subdivide the Kladno Formation into two members: Radnice and Nýřany. The Radnice Member is further differentiated into Lower and Upper Radnice Members. In the Vinařice mining allotment, coal-bearing seams are concentrated to the Radnice seam Group of Coals which is bound to the basal part of Kladno Formation – the Lower Radnice Member. In contrast to some other parts of the Kladno Basin (Kačice, Slaný), the Upper Radnice Member and Nýřany Member do not contain any coal seams.

In the described locality, the Radnice Group of Coals is composed of two seams – the Basic Kladno Seam and Main Kladno Seam. They are separated by an important tuffogenic layer, the so-called whetstone horizon. In the whole mining allotment, the Basic Kladno Seam did not develop and its average thickness, within the shaft pillar is 90 cm. Due to its poor quality and low thickness in the locality in question, the seam has not been extracted. In the Mayrau Mine, the only seam extracted is the Main Kladno Seam. In the shaft pillar, it attains thickness up to

7.55 m and it is usually separated by six tuff interlayers into several benches. The interlayers themselves are called "opuka" (= arenaceous marl) by the colliers.

The whetstone horizon is a volcanogenic layer of exceptional stratigraphic importance, which, in a form of a tuff with graded bedding, accompanies and, consequently, identifies the Radnice Group of Coals in almost all of the Central Bohemian Carboniferous. It is composed of two completely different petrographic rock types called by traditional names of miners' origin "bělka" and "brousek". In the rock immediately overlying the Main Kladno Seam, there occurs a layer of bluish-grey claystone to siltstone of 1.5 m average thickness (colliers call that rock "mydlák"), which marks the end of the Lower Radnice Member. At the Mayrau Mine, the whole formation, comprising the sediments from the Upper Radnice Member and Týnec Formation, attains an overall thickness ranging from 480 to 530 m. It is formed by fluvial lithic facies with thicker psammite layers alternating with isolated occurrences of psephites and thin aleuopelite layers. The coal-bearing beds are missing in the formation, whose remaining members are arranged into incomplete sedimentation cycles. The brownish-red of its aleuopelite members is the feature which distinguishes the Týnec Formation from the underlying stratigraphic units.

Tectonic activity caused the emergence of numerous faults which run through the deposit, prevalently in NW-SE direction. Similarly to other parts of the Kladno Basin, there are compound faults of curved shape with unstable course. Their displacement heights fluctuate and their dips show considerable variations as well. The most important fault found in the Vinařice mining allotment is the main fault of the Mayrau Mine running from the E section of the shaft pillar and whose displacement height reaches grows up to 117 m. The safety pillar is affected by a fault running throughout the entire shaft pillar which disrupts the course of the coal seam. Its displacement height ranges from 8 m on the east to to 15 m on the west. Apart from that fault, the shaft pillar is disrupted by a number of minor, quickly vicarized faults with displacement heights of 5 m.

As to the occurrence of rock-bursting phenomena, the Vinařice mining allotment is situated within the so-called rockburst-prone area of the Kladno mine district which offers favourable conditions for the emergence of such phenomena [Matějovský, 1980]. The area in question is situated eastwards of the safety pillar of the former Max Mine (Gottwald I). The relatively thick layers of sandstone overlying the coal seams are probably responsible for the occurrence of different forms of rock bursts, for their physical and mechanical properties create conditions which stimulate the accumulation of stress in the rock massif [Příbyl and Rudajev, 1960].

4. EXTRACTION METHODS IMPLEMENTED AT THE Kladno MINE

For the extraction of the thick, horizontally deposited seams of Kladno mine district, two basic methods are implemented: room-and-pillar working and the so-called shortwall working with back blasting (further only as shortwall).

The oldest method of extraction still in use is room-and-pillar working on the full thickness. That method of extraction consists in the following steps: the coal