



# Factors to be Considered for the Design of Face Supports in Longwall Mining Method

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## Abstract

The main purpose of mine workings is the exploitation of ores and minerals that are used in different aspects of life. The most common underground method all over the world is the longwall mining method. The increasing demand for minerals and ores and the difficult mining conditions at greater depths make the longwall mining system a good candidate in mining. The equilibrium condition is disrupted when the longwall face advances, and as a result, the surrounding rocks eventually fracture and cave. Moreover, the induced pressure due to caving or fractures of the immediate roof rocks and the tilting of the main roof exerts an excessive load on the hydraulic supports in the longwall faces. Induced disturbances of the overburden rocks must be thoroughly investigated since this will enhance our understanding of rock pressure and ground control. The main objectives of this paper are to review the importance of the longwall mining system as an exploitation method and its applications around the world, as well as the main factors affecting the stability of supports in longwall faces, especially hydraulic supports. From this study, it can be seen that the most important technical factor that affects face stability is the rate of face advance. In addition, the significant natural factors affecting the stability of workings are roof conditions and the geometry of the panel.

## 1. Introduction

Longwall mining is one of the most common caving methods, related to massive caving of the ore body, the overlying rock, or both [1]. The role of caving in the mining process is to aid the breakage of the in-situ ore while permitting the immediate roof to cave safely and

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hence protect the supports from damage by excessive superincumbent loads. For instance, the longwall mining method comprises about 15% of the USA's mineral production. It is applied in horizontal and tabular deposits, mainly coal, and has some applications in inclined or vertical massive deposits. It is considered a large-scale method of exploitation as well as one of the main underground methods in the world [2, 3]. Roof fall risks occur in nearly all underground mines and are known to be one of the most important hazards in underground mines [4]. Strata management and/or roof control require the control of strata to allow the effective and secure operation of mining operations. The strata on the face and the neighbouring regions (front and back) need vigilance to avoid uncontrolled ground failure. Thus, it is essential to have an accurate grasp of the mechanics of ground movement due to mining operations. The hydraulic supports permit a rapid advance of the face, which, in turn, leads to better control of the roof conditions. The system is constructed so that the cutting machine, conveyor, and powered roof support are virtually combined and function as a single machine [5].

One of the major machines in the longwall framework is hydraulic roof support. Its key role is to ensure the security of the mining process and its consistency under different mining conditions. In this way, an acceptable approach should be created that will help to build, evaluate, and choose roof support suited to any condition [6]. For efficient longwall mining, the option of the right support capability is important. Powered support selection depends on some factors such as natural factors such as roof rocks, floor rocks, and so on; technical factors such as panel geometry, face advance, and so on, and mechanical and physical properties of ore rocks [4,7]. Some longwall faces have experienced stability problems during ore exploitation. These problems are directed at the designer to fully appreciate the conditions they would encounter. Some faces have stopped during the exploitation process because the face support provided to compensate for the expected load conditions was inadequate. A very careful investigation and analysis must be carried out for the roof loading conditions before choosing the powered roof supports. This paper introduces a review of the importance and usage of the longwall mining method, the technical factors that are affecting the stability of face supports, and the natural factors which are affecting the working stability. The remainder of this manuscript is organized as follows. In Section 2, we figure out the history of longwall mining. In Section 3, the importance of the longwall mining method is clarified. In Section 4, we show some statistical data about longwall mines. In Section 5, we figure out the zones of disturbance in longwall faces. In Section 6, the longwall mining application is elucidated. In Section 7, we describe the main factors affecting the stability of hydraulic support. Finally, in section 8, applicable research directions are indicated.

## **2. History of Longwall Mining**

Longwall mining originated in the coal mines of Europe in the seventeenth century. Miners undercut the coal along the width of the coal face, using wooden props to control the fall of the roof behind the face. While the technology has changed considerably, the basic idea remains the same, to remove essentially all of the coal from a broad coal face and allow the immediate roof and overlying rock to collapse into the void behind the face support. The main idea is to maintain a safe working space along the face for the miners. Starting around

1900, mechanization was applied to this method. By 1940, some referred to longwall mining as "the conveyor method" of mining, after the most prominent piece of machinery was involved. The only other machinery used was an electric cutter to undercut the coal face and electric drills for blasting to drop the face. Once dropped, manual labour was used to load coal onto the conveyor parallel to the face and to place wooden roof props to control the fall of the roof. Longwall mining method has enjoyed success in the United States, only since the 1960s when self-advanced hydraulic support systems were developed [8, 9].

### 3. Importance of Longwall Mining Method

Longwall is the most effective and profitable underground mining process. Under similar conditions, a theoretical analysis demonstrated that longwall may have a lower operating cost than the room and pillar mining method. It's still been more profitable (based on net present capital value calculations) because of higher recovery and longer mining life.

Longwall mining machines consist of multiple ore shearers mounted on a series of self-advancing hydraulic supports (powered supports). The entire process is mechanized.

Finally, the main advantages of the longwall mining method can be summarized as follows:

- Higher productivity than the room and pillar mining method, which results in high output.
- Fairly lower mining costs than the room and pillar mining method.
- High production rate in terms of tons per hour (mass production method).
- Continuity of production, permitting a nearly simultaneous cycle of operations to be conducted.
- Suitable for total mechanization, remote control, and automation.
- Low labour requirement.
- Fairly high recovery (about 59% on average).
- Concentrated operations, facilitating transport, supply, and ventilation.
- Good health and safety factors, especially for roof-fall accidents [8].

### 4. Statistical Data about Longwall Mines

Longwall mining is now one of the most used mining techniques because it is a mass production method. In this article, we will review some data about the production of the longwall mining method in some countries around the world.

#### 4.1. U.S.A. longwall production

Longwall is considered to be a large-scale method of exploitation and is one of the cheapest underground mining methods as shown in table (1) [8,9]. Reports indicate that 59 longwalls are currently operating in the United States at 52 mines. Of the longwalls in operation, 57 use a shearer for coal winning; the other two faces use a plow to exploit the coal. Southwestern Pennsylvania has six of the United States' top 25 longwall mines. The remaining 19 U.S. mines are scattered among West Virginia, Ohio, Virginia, Kentucky, Indiana, and western states [10].

Table (1): Coal production in the U.S.A. by the longwall mining method

Year	Production in millions of tons
1975	648
1977	665
1985	956
2000	1200-1400

#### 4.2. China's longwall production

Longwall mining accounts for about half of all coal production worldwide, owing to the significant amount of coal production accomplished using longwall technologies [11]. With the third-biggest known reserves, China is number one in coal production, with the third-largest coal reserves. Underground mining methods account for around 96 percent of China's total coal output. The longwall mining technique accounts for the vast majority of the output [12, 13]. Based mostly on the Statistical Review of World Energy, coal production in China is shown in table (2).

Table (2): China's coal production in millions of tons [14].

Year	2020	2019	2018	2017	2016	2015	2014	2013
Production	3,902.0	3,846.3	3,697.7	3,523.2	3,411.0	3,747.0	3,874.0	3,974.3

China's coal production in 2020 was expected to be around 3,692 million short tons [15]. In China, there are over 20 underground coal mining technologies, practically all of which are longwall. More than 60% of underground mining output is accounted for by longwall mining. Longwall production was around 3,210 million short tons in 2009. China produces 2,757 million short tons of coal by using longwall mining methods [16,17]. By 2030, China's coal production is expected to reach 4.5 short billion tons [18].

#### 4.3. Australian longwall production

The mechanized method of longwall mining was first introduced to Australia in 1963. 27 longwall faces are operating in Australia. Production from Australia's longwall faces represented 18% of Australia's raw black coal production of 398 million tons in 2005. This percentage accounts for 89% of Australia's total underground black coal production of 80 million tons [19].

### 5. Zones of disturbance

Underground mining works disturb existing in-situ conditions, leading to a sequence of strata activities and mine (rock) pressure that is the origin of all problems of ground control. It is widely believed that three different disturbed zones are produced in the roof after the exploitation of ore: the caved zone, fractured zone, and deformation zone [20].

#### i. The caved zone

It is the first zone that is called the immediate roof before it caves. The caved zone ranges in thickness from 2–8 times the mining height.

## ii. The fractured zone

It is located just above the caved zone, where the strata are fragmented into blocks by vertical or sub-vertical cracks and horizontal fractures caused by bed separation. The fractured zone's thickness varies between 28 and 42 times the mining height.

## iii. The deformation zones

Between the fractured zone and the ground surface is the deformation zone, in this zone, the strata deform without causing any major cracks through the thickness of the strata. The three zones are shown in figure (1).

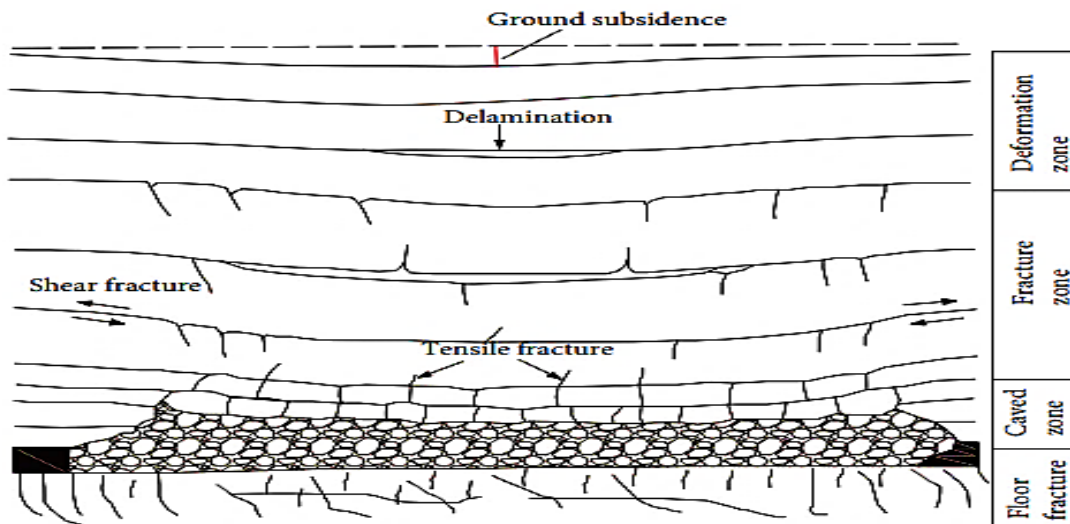


Fig. (1): General profile of longwall mining zones of disturbance [20].

## 6. Longwall Mining Application

The longwall mining method is a continuous mining system that was developed for mining coal and ore deposits. Some of these deposits are usually uniform in thickness and slope. This method relies on the complete exploitation of the ore in a designed area referred to as a panel. Therefore, this method is characterized by a high extraction ratio and productivity. As the panel is mined, complete caving of the overlying rock strata (immediate roof) occurs in the mined-out area behind the hydraulic supports. The longwall mining method used in weak to moderate must break and cave; ideally, thin-bedded intermediate roof and floor must be firm [21]. There are two ways of longwall mining that are used throughout the world:

- **Longwall retreat mining**

A longwall face is being mined on the retreat, that is, toward the main entries and primary access, as shown in figure (2).

- **Longwall advance mining**

A longwall face is mined on the advance from the main entries toward the mine boundary. In the United States, federal regulations currently favour retreat longwall mining.

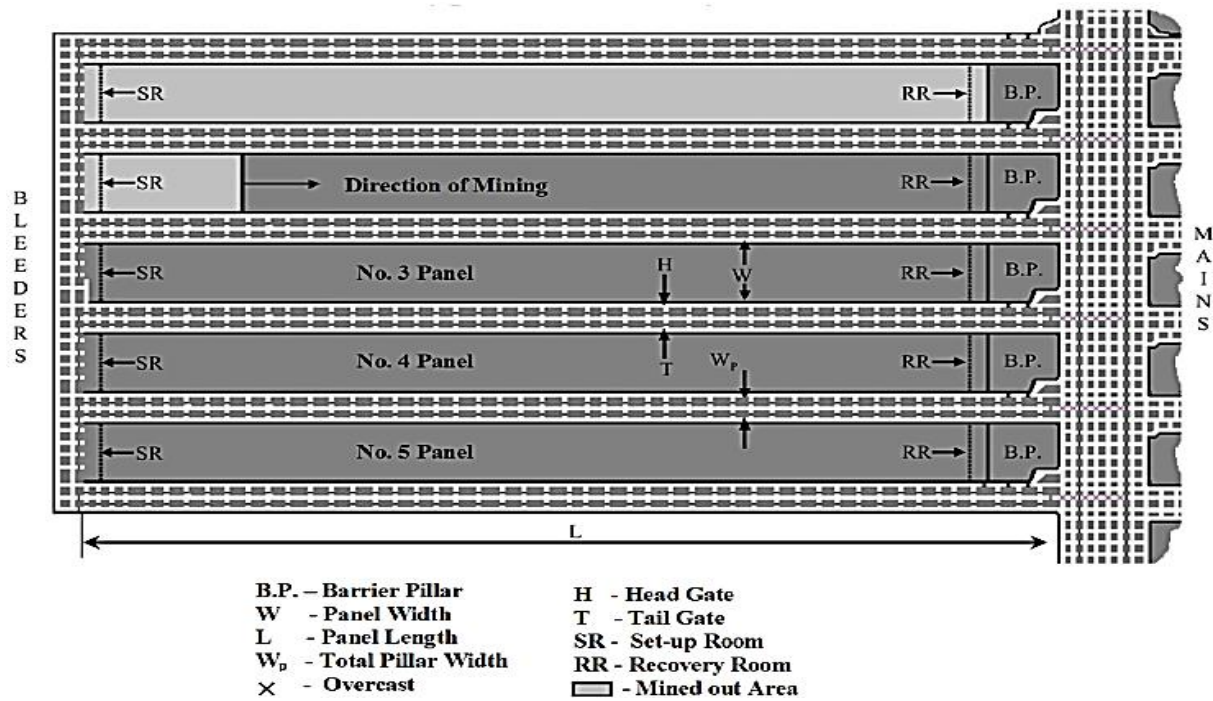


Fig. (2): Longwall mining method [21].

## 7. Main Factors Affecting the Stability of Hydraulic Support

Mine support design is a fundamental demand for the mining engineer, and it is the first step toward successful roof management. Just before World War II, longwall automation led to the introduction of steel for support. Hydraulic supports have emerged following a lengthy stage of transition from using steel supports on longwall faces [22]. Mine working stability is determined by several factors, which are dependent primarily on the natural and technical conditions of the conducted mining operations. Knowledge and understanding of these factors will facilitate economic planning and optimum mining design.

### 7.1. Technical Factors

Technical factors, also called operational factors, depend on the mine operator and result from human activity. Some of the main factors can be summarized as follows:

#### 7.1.1. Rate of face advance

The rate of face advance is considered one of the most important factors and has a big impact on the stability of my workings. The increase in face advance will increase productivity. An approach for the prediction of face advance rate prior to the mining operation and the determination of the operation efficiency after the mining operation in retreat longwall panel is presented based upon the concepts of Rock Engineering System (RES). It is found that the maximum available face advance rate is equal to 9 to 10 m/d in the best conditions at the Parvadeh-I coal mine [23].

Roof sagging is reduced by up to 30% when the longwall face advance rate is increased from 0.5 to 2 m/day. The roof condition improved as the face advance rate increased to 3.0–4.5 m/day. When compared to a face advance rate of 3–4 m/day, a longwall face advance

rate of 10–12 m/day lowers roof sagging by 10%. The increasing of the longwall face advance rate will reduce the frequency and magnitude of dynamic displacements in roof rocks. Around 24 m/day is the most advantageous face advance rate. The favourable geotechnical situation in the face region results from a higher rate of longwall face advance [24]. It is found that with the advance of the longwall face, regular falls of the immediate roof and large falls of the hard roof are observed. A major roof fall causes massive fractures in the roof strata that extend from the face to the ground surface. With a slower face advance rate, it is observed that a major roof fall interval is slightly less than with a faster rate. At a slower rate, larger strata fractures are noted. Maximum displacement occurs on a major roof fall, which is larger at a slower rate [25]. The major effective parameters for the face advance rate may be discussed as follows:

#### 7.1.1.1. Factor of safety

Failure and falling of the face increase the unconfined span and induce horizontal pressures on the immediate layers of the floor and roof, affecting the rate of face advance. The relationship between the safety factor of the longwall face and the face advance rate is shown in figure (3). The higher the safety factor, the higher the face advance rate (direct relationship). Fewer roof collapses occur, which means less wasted time [23].

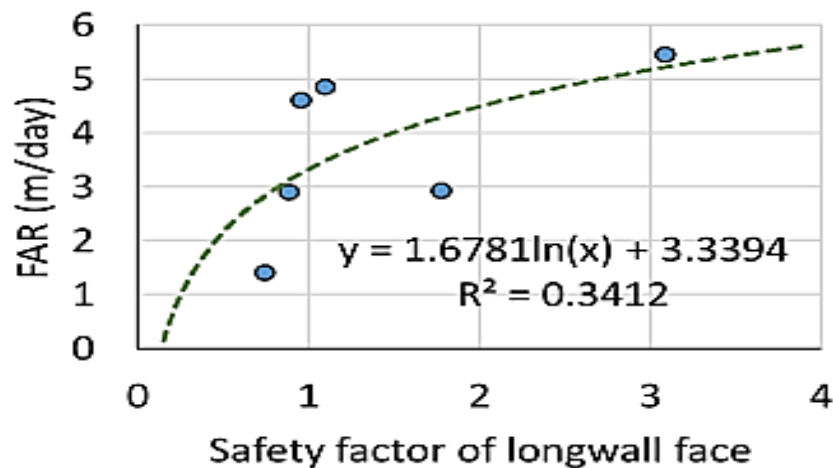


Fig. (3): Relationship between safety factor of longwall face and face advance rate [23].

#### 7.1.1.2. The ratio of joint spacing to cutting depth

The effect of joints expressed as a ratio of joint spacing to cutting depth at the face has been studied. The ratio of joint spacing to cutting depth has a significant impact on the probability of a sudden roof collapse, which will affect the stability of the face [23].

#### 7.1.1.3. longwall face's longitudinal inclination

The increased longitudinal inclination of a longwall face will cause heterogeneous loading of hydraulic supports and lower operating efficiency. From figure (4), it is clear that an inverse relationship between longwall face inclination and face advance rate is observed. As the face inclination increases, the process of exploitation of the ore will be difficult, so the rate of face advance decreases, and thus it affects the work stability process [24].

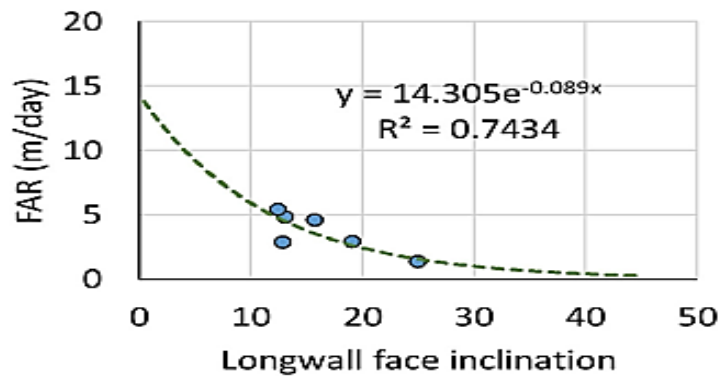


Fig. (4): Relationship between longwall face inclination of face and face advance rate [24].

#### 7.1.1.4. Floor Rock Mass Rating (RMR)

In a longwall face, loading conditions of hydraulic supports on the floor will almost certainly affect the roof stability. Usually, as RMR increases, the face advance rate also increases [24].

#### 7.1.1.5. Face length and panel width

Panels with a large width result in more convergence, deflection, and excessive support loads, all of which will reduce the face advance, the efficiency of the system, and the stability of the workings [25].

#### 7.1.2. Design of hydraulic supports

In designing hydraulic supports, geological and stress characteristics are of vital importance. If low yield capacity supports are employed, the pressures will not be met by the supports. The roof will fall over the supports, which will cause instability and support damage. On the contrary, if high-yield support is utilized on a weak roof, roof intrusions will occur, and the needless usage of high-cost supports will raise the cost. The correct hydraulic support capacity should therefore be chosen to satisfy the roof loading requirements. There is no single set of formulas or systems in the designing of hydraulic supports. Almost every country has established its system [22]. There is a relationship between the yield and the setting or operating pressure as follows:

$$P_y = 1.25 P_i$$

Where:

$P_y$ : Yielding pressure in KN/m<sup>2</sup>,  $P_i$ : Operating pressure in KN/m<sup>2</sup>

By studying the behavior of the roof, floor, and supports on the longwall, it was clear that the periodic roof weighting was one of the most significant aspects in the design and selection of hydraulic support [26]. Underground observations have shown that the stiffness of the support is an important design parameter that must not be overlooked in the design of supporting systems [27]. Studies and experience reveal that 2-legged shield supports provide better roof control on weak, shale, and clay roofs [28]. The geometry of the hydraulic support section, particularly the proper placement of the floor base and canopy, has a major effect on its stability. The developed method for determining the position of the hydraulic support section based on the angle of inclination of its different components is certainly a new approach [29]. In the situation of a weak immediate roof, the front legs were more overloaded than the rear legs during the first and periodic roof weightings due to the



failure and early caving nature of the roof [30,31]. For the sake of productivity and safety, the roof exposed in the working area of a longwall face must be supported and protected. Falls at the face may result from hydraulic roof support with an inappropriate structural design or inadequate capacity. By using artificial neural network models, we can predict and determine with confidence the support capacity, intervals of periodic roof weighting, and yield frequency of the face support [32].

### 7.1.3. Hydraulic roof support canopy ratio

There must be complete awareness of the construction and selection of hydraulic roof supports to increase both personnel safety and longwall working stability, as well as accomplish better ore production. Results of numerical calculations demonstrated that the longwall working stability conditions are dependent not only on the hydraulic support capacity but also on the hydraulic support's correct dimensions and geometrical features. An unsatisfactory geometric layout of the hydraulic roof support may cause instability in longwall faces [33,34]. Load distribution is achievable if the location of the resultant force is within approximately one-third of the length,  $L$ , from the end of the canopy, as shown in figure (5). There is a considerable impact of the hydraulic support canopy ratio on the face stability. The correct collaboration of the support with the rock mass, as well as the longwall working stability conditions, can be greatly affected by moving the hydraulic legs along the length of the canopy. The ideal hydraulic support canopy ratio value is obtained by a hydraulic leg socket distance (resultant force) to the end of the canopy at a maximum ratio of 2.6:1 [35].

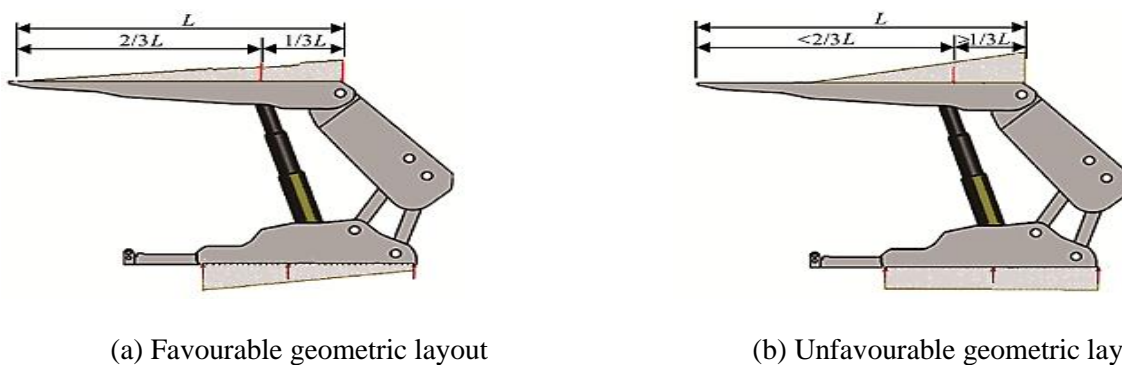


Fig. (5): The effect of powered support canopy ratio on the active support variation distribution of the longwall working roof [35].

### 7.1.4. Distance between the support canopy tip and the face line

There is usually a tiny distance between the face and the end of the support canopy. This distance grows as the cutting machine drives. This distance can range from 0.25 to 0.8 m depending on the depth of the cutting machine [22]. According to underground studies, the distance between the support canopy tip and the face line has an impact on the roof stability. The support canopy should be applied as close as possible to the face. In certain scenarios, the unsupported distance of a canopy may cause the roof to fall on a longwall face. So, this distance should be determined carefully to maintain the stability and safety of mine workings [4].

### **7.1.5. The geometry of the panel**

Increasing longwall panel width will increase ore production [36]. Big panels will require additional design considerations for supporting systems, roof control, infrastructure, and longwall moves [37]. The panel's width should be sufficient to justify hydraulic roof supports. The expenditure is lowest on big panels. Face length has an impact on the panel's life and the number of working faces [22]. By increasing the panel width from 100 m to 260 m, the support convergence will increase by 33 %. Big panels will cause a roof to fracture more severely than small panels [7]. The size of the longwall panel influences whether the gob pressure approaches a full load of overburden weight. Small panels do not reach the full load of the overburden in the gob, while big panels, gob pressure reaches the full load of overburden weight [38].

## **7.2. Natural factors**

Natural factors are dependent on the physical and mechanical properties of roof and floor rocks, the thickness of immediate and main roofs, and the geological conditions of these rocks. The most important natural factors are:

### **7.2.1. Roof conditions**

In the longwall mining method, the roof should cave after face advance. When an extremely weak roof falls during face advance, a portion of the ore is left to support the roof [22]. The roof can be classified into two main categories:

#### **7.2.1.1. Immediate roof**

The immediate roof is that portion of overburden strata that lies above the roofline that will cave immediately following the advance of hydraulic supports [1]. In general, the stability of the roof is based on the immediate roof. In most cases, the loading on the supports is due to the load produced by the convergence of the immediate roof. The immediate roof can be divided into three groups as follows:

The first group is the unstable immediate roof, which is characterized by these features:

- a. It usually consists of weak or soft rocks like carbonaceous shale and sandy shale.
- b. The unsupported roof will collapse in a short time (less than 10 min).
- c. Immediately after support advances, the roof in the gob caves [20].

The second group is the medium-stable immediate roof, which is characterized by these features:

- a. This formation is made up of hard shale, sandy shale, and weak sandstone.
- b. In most cases, the roof caves in quickly after the support has been advanced.
- c. The loading is equally distributed between the front and back parts of the support [20].

The third group is the stable immediate roof, which can be divided into three cases:

- a. The immediate roof is made of hard and strong rocks.
- b. The roof not only overhangs in a wide region but also remains stable for a long time.
- c. It gradually sags and breaks into blocks. Further sagging causes a semi arch [20].

**Mineralogical composition of immediate roof rocks:** If the immediate roof rocks contain clay minerals such as clay shale, fireclay, or mudstone (which contain montmorillonite minerals), they will affect roof stability. Montmorillonite minerals cause a volume increase of immediate roof rocks, which will result in swelling that causes additional pressure on the supports. Rock swelling pressure is the pressure exerted by the increasing volume of clay when absorbing water or subjected to moist air. Underground observations of studying the behavior of roof papery clayey-shale at Abu-Tartur phosphate have shown that the swelling pressure in humid air is 0.21 and 0.14 MPa in vertical and horizontal directions, respectively, which exerts excessive loads on hydraulic supports [39].

#### 7.2.1.2. Main roof

The main roof refers to the slightly cracked but unsaved strata in the lower portion of the fractured zone [1]. Its movements impact the immediate roof stability, as well as the face supports. The main roof may be cantilevered behind the hydraulic support and exert excessive loads on the face support [20]. It is observed that, when the immediate roof is quite thick, the main roof will act as a stable voussoir beam. As a result, the hydraulic support is not subjected to excessive pressure. When the immediate roof is relatively thin, the main roof tends to behave like a cantilever beam, thus exerting higher pressure on the hydraulic support [40]. The position of the roof fracture ahead of the face area is mainly affected by the length of the cantilever behind the support [41].

**Mechanical behavior of the main roof (tilting of the main roof):** Generally, right before and during periodic weighting, the main roof acts vigorously. The movement of the immediate roof is mainly based on that of the main roof. The main roof begins to separate into blocks that vary in length according to the properties of the roof rocks. At the place where the separation of broken blocks of the main roof occurs, the end of the block rests above the face area and exerts an additional load to the support.

The intensity of the main roof movements depends on the breaking length of the main roof, the remaining gap between the rock piles and blocks of the main roof, the face length, and the angle of inclination due to sagging. Underground observations have shown that the rear end of the main roof broken block did not touch the rock piles. Under normal conditions, the main roof forms a semi-arch. When the semi-arch reaches a certain length, its weight plus the weight of the overlying strata will break the arch. This process repeats itself periodically [19].

#### 7.2.2. Floor conditions

The floor must be strong enough to withstand intrusions. Soft floor intrusions are problematic for support advancing [22]. If the longwall floor contains clay minerals, then the supports, both at setting and under significant load, tend to penetrate the floor [42,43]. Y.S. Mahmoud studied the bearing capacity of hydraulic support in front of the longwall face. He concluded with a formula that gives an acceptable value for the bearing capacity of hydraulic support [44]. The floor of the Abu-Tatur mine consists of green clay. So, it swells because, which will cause cracks and floor heave as shown in figure (6). The operating height decreases in many places, whether inside roadways or on working faces. In turn, it affects the stability of support and productivity. Floor heave causes problems with movement and material transport. As a result, predicting the location, amount, and time of

floor heave is extremely useful in floor heave management to avoid production delays and financial losses [45].



Fig. (6): Floor heave [45].

### **7.2.3. Effect of faults**

Faults are ruptures in which opposite walls have shifted toward one another. An extensive fault zone reduces the quality of the rock mass, which will require a higher support capacity [46]. Fault cutting and fault dipping have a marked effect on mining operations [4]. The danger of rock burst and roof falls on the footwall is greater than that of the hanging wall [47]. Stress along the footwall has been increased, which leads to instability of the workings. Furthermore, the footwall strata move completely, and the displacement is significant [48].

### **7.2.4. Joint directions in the roof strata**

Joints are ruptures with no visible relative movement [46]. Joints most often result from the influence of tectonic forces, which influence the stability of the roof [4]. It is concluded from underground observation, that when joints are parallel to longwall faces, this will cause unfavorable conditions for working. A high frequency of joints causes strata-control problems [49]. It is believed that measured joint data is a crucial input for the successful design of underground hydraulic support [50].

## **8. Research Directions**

The results of this study show the importance of studying technical and natural factors affecting the longwall face stability. This study is, therefore, a pioneering attempt to adapt the concept of longwall working stability.

Another goal of this study is to outline the research directions for factors to be considered in the design and selection of hydraulic supports in the longwall mining method in a systematic, step-by-step manner, based on international knowledge and experience. Through a series of underground mining studies, a research strategy for studying the stability of hydraulic support in longwall faces has been made. Based on the information proposed in this paper, the authors have highlighted the following research directions:

- 1) Longwall mining method mechanism
  - i. Zones of disturbances.
  - ii. Roof conditions.
- 2) Operational factors affecting on stability
- 3) Natural factors affecting stability
- 4) Prediction
  - i. Monitoring.
  - ii. Identification of failure mode domains on a mine site.
- 5) Control
  - i. Preventive measures - risk reduction (i.e., mine design criteria).
  - ii. Risk mitigation (i.e., design and selection of suitable hydraulic support).

## 9. Conclusions

From this study, the following conclusions can be drawn:

1. The longwall mining method is one of the most important underground methods in the world and will continue to be so in the foreseeable future. Billions of tons of ores are produced annually by the application of this method in different countries.
2. It is important to carefully study the causes of face instability which are related to roof conditions.
3. Roof stability, in general, refers to the integrity and stability of immediate and main roofs, which are measured by the maximum exposed area and time duration without support.
4. Many technical parameters are studied in this paper. The most important technical parameters affecting the stability of the face are the rate of face advance and the selection of suitable powered roof support.
5. Many natural parameters are studied in this paper. Roof conditions and the geometry of the panel are the most significant natural parameters affecting the stability of the work.
6. From studying technical and natural parameters, we can determine the forecasted loads impacting the supports and the suitable choice of hydraulic supports at the face area.

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## العوامل التي يجب مراعاتها عند تصميم دعائم واجهات الاستخراج في طريقة التعدين بالحائط الطويل

### الملخص العربي:

الغرض الرئيسي من المناجم هو استغلال الخامات والمعادن التي تستخدم في جوانب مختلفة من الحياة. طريقة التعدين بالحائط الطويل هي الأكثر شيوعاً في جميع أنحاء العالم لاستغلال الخامات الموجودة تحت الأرض. يعد الطلب المتزايد على المعادن والخامات وكذلك ظروف التعدين الصعبة في الأعماق الكبيرة من أهم الأسباب التي تجعل طريقة التعدين بالحائط الطويل مرشحاً جيداً في مجال التعدين. تتأثر حالة التوازن عندما يحدث تقدم في واجهات الحش أو الاستخراج، ونتيجة لذلك، تنكسر وتتكهف الصخور المحيطة. علاوة على ذلك، فإن الضغط الناجم عن التجويف أو الكسور في صخور السقف المباشرة وكذلك إمالة السقف الرئيسي يؤدي إلى حمل مفرط على الدعائم الهيدروليكية في واجهات الاستخراج. يجب الدراسة الجيدة للاضطرابات المستحدثة في الغطاء الصخري لأن هذا سيعزز فهمنا لضغط الصخور والتحكم الأرضي. تتمثل الأهداف الرئيسية لهذا البحث في مراجعة أهمية طريقة التعدين بالحائط الطويل كوسيلة لاستغلال الخامات في جميع أنحاء العالم. بالإضافة إلى العوامل الرئيسية التي تؤثر على اتزان الدعائم الهيدروليكية في واجهات الاستخراج. من هذه الدراسة يتضح أن معدل تقدم الوجه أكثر العوامل التقنية تأثيراً على اتزان العمل. بالإضافة إلى ذلك، فإن ظروف السقف وابعاد الوجه من العوامل الطبيعية الهامة التي تؤثر على استقرار المنجم.