科技英语丛书

English for Coal Mining Engineering

采矿工程专业英语

主编 杨 科

中国科学技术大学出版社

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内 容 简 介

本书内容包含煤矿地质与测量、矿山岩石力学、矿井开拓、井巷施工与支护、矿井生产系统、采煤工艺与采煤方法、矿山压力及其控制、特殊开采、开采沉陷与控制、矿井通风与安全、露天开采、煤层气开采、洁净煤技术与环境保护、煤炭气化和液化、安全与健康、煤与瓦斯共采、采矿新技术等，反映了当前煤炭工业的新技术和新发展。每个单元皆有常用表达或一些短语的注解。本书还介绍了科技英语的特点，较为系统和详细地讲解了科技英语的写作技巧，简单介绍了科技论文中英文摘要和结论的写作要点；列举了国内外采矿行业、大学、期刊等学术信息；提供了部分采矿专业英语泛读文章，有利于学生进一步理解和掌握。

本书无论是在内容选材上还是在内容编写上都具有专业特色和学术价值，是一本实用的矿业类高等院校采矿工程专业本科教材，也可供采矿工程专业研究生及从事采矿工程专业的技术或管理人员学习参考。

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Preface　前言

随着中国经济的快速发展，中国的煤炭工业也正向国际化、全球化方向发展。中国煤炭企业不断走出去的发展战略，必将给中国的煤炭工业发展带来新的机遇和挑战。同时，在经济国际化的大背景下，社会对国际化矿业人才的需求也越来越迫切。对于通过采矿工程专业认证（全国工程教育专业认证专家委员会）的矿业类高等院校来说，必须把握时代脉搏，培养出适应社会发展的国际化人才。正是在这样的背景下，我们编写了本教材。考虑到采矿工程专业学生知识面需要拓宽的要求，本教材的内容包括煤矿地质与测量、矿山岩石力学、矿井开拓、井巷施工与支护、矿井生产系统、采煤工艺、采煤方法、矿山压力及其控制、特殊开采、开采沉陷与控制、矿井通风与安全、露天开采、煤层气开采、洁净煤技术与环境保护、煤炭气化和液化、安全与健康、煤与瓦斯共采、采矿新技术等专业英语知识，以及科技英语写作、采矿工程专业学术信息、采矿工程专业英语泛读文章等相关内容。

在编写本书的过程中，编者精心挑选了一些概括性较强的文章。全书包括 16 个单元和 3 个附录，每个单元含 2～4 篇精读文章，附录 C 包括 9 篇泛读文章。为帮助学生更好地理解课文内容，在每个单元后列举了与课文内容相关的专业词汇。在安排教学进度时，原则上每单元 4 个学时，16 个单元需 64 个学时；泛读部分 32 学时，共计 96 学时。通过阅读和学习，读者能够掌握最基本的采矿专业英语词汇、英文表达方式，提高专业英语技能。同时，希望本书能够抛砖引玉，读者可结合自己的实际情况，去查阅和掌握更多的采矿专业英语材料。

本书由安徽理工大学能源与安全学院采矿工程系杨科教授主编，付志亮副教授、李英明副教授、刘钦节博士任副主编。在编写过程中，参考了与采矿工程相关的国内外文章和书籍，在此谨向有关文献的作者表示衷心的感谢！感谢美国国家工程院院士、西弗吉尼亚大学采矿工程系资深教授 Syd S. Peng 博士和西弗吉尼亚大学采矿工程系教授罗毅博士为本书提供的素材和指导；感谢祁连光、闫书缘、陆伟、王猛等研究生为本书在文字录入、绘图、排版方面所做的工作；感谢首批国家级采矿类复合型人才培养模式创新实验区和第三批国家级采矿工程特色专业等国家

质量工程项目以及安徽理工大学采矿工程专业教学团队资助经费对本书出版的支持！

本书既可作为矿业类高等院校采矿工程专业本科生、研究生的专业英语教材，也可供矿山企业管理、工程技术人员以及从事矿产资源开发的人员自学参考。

由于编者的水平有限，错漏、不足之处在所难免，恳请广大读者及相关专家批评指正！

编　者

2012 年 7 月

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Introduction to Coal Mining

煤炭开采概述

Coal is one of the world's most important resources of energy, fuelling almost 40% of electricity worldwide. In many countries this figure is much higher: Poland relies on coal for over 94% of its electricity; South Africa for 92%; China for 77%; and Australia for 76%. Coal has been the world's fastest growing energy source in recent years—faster than gas, oil, nuclear, hydro and renewable.

1. What is Coal?

Coal is a fossil fuel, which is a combustible, sedimentary, organic rock, and it is composed mainly of carbon, hydrogen and oxygen. It is formed from vegetation, which has been consolidated between other rock strata and altered by the combined effects of pressure and heat over millions of years to form coal seams.

The build-up of silt and other sediments together with movements in the earth's crust (known as tectonic movements) buried these swamps and peat bogs, often to great depths. With burial, the plant material was subjected to high temperatures and pressures. This caused physical and chemical changes in the vegetation, transforming it into peat and then into coal. Coal formation began during the Carboniferous Period (known as the first coal age), which spanned 360 million to 290 million years ago.

The quality of each coal deposit is determined by temperature and pressure and by the length of time in formation, which is referred to as its "organic maturity". Initially the peat is converted into lignite or "brown coal"—these are coal-types with low organic maturity. In comparison to other coals, lignite is quite soft and its color can range from dark black to various shades of brown.

Over many more millions of years, the continuing effects of temperature and pressure produces further change in the lignite, progressively increasing its organic maturity and transforming it into the range known as "sub-bituminous" coals.

Further chemical and physical changes occur until these coals became harder and blacker, forming the "bituminous" or "hard coals". Under the right conditions, the progressive increase in the organic maturity can continue, finally forming anthracite.

2. Importance of Coal

Due to its abundance, coal has been mined in various parts of the world throughout history and continues to be an important economic activity today. Compared to wood fuels, coal yields a higher amount of energy per mass and could be obtained in areas where wood is not readily available. Though historically used as a means of household heating, coal is now mostly used in industry, especially in smelting and alloy production, as well as electricity generation.

Coal is one of the world's most important sources of energy since the Industrial Revolution of the 1800s. As of 2010, coal is fuelling almost 40% of electricity worldwide. In many countries this figure is much higher: Poland relies on coal for over 94% of its electricity; South Africa for 92%; China for 77%; and Australia for 76%. Coal has been the world's fastest growing energy source in recent years—faster than gas, oil, nuclear, hydro and renewable.

Over 6185 million tonnes (Mt) of hard coal is currently produced worldwide and 1042 Mt of brown coal/lignite. The largest coal producing countries are not confined to one region—the top five hard coal producers are China, the USA, India, Australia and South Africa. Much of global coal production is used in the country in which it was produced; only around 15% of hard coal production is destined for the international coal market.

Top Ten Hard Coal Producers (2010)

China	3162 Mt	Russia	248 Mt
USA	932 Mt	Indonesia	173 Mt
India	538 Mt	Kazakhstan	105 Mt
Australia	353 Mt	Poland	77 Mt
South Africa	255 Mt	Colombia	74 Mt

(Source: International Energy Agency, 2011)

3. History of Coal Mining

The Industrial Revolution, which began in Britain in the 18th century, and later spread to continental Europe and North America, was based on the availability of coal to power steam engines. International trade expanded exponentially when coal-fed steam engines were built for the railways and steamships. The new mines that grew up in the 19th century depended on men and children to work long hours in often dangerous working conditions. There were many coalfields, but the oldest were in Newcastle and Durham, South Wales, Scotland and the Midlands, such as those at Coalbrookdale.

The oldest continuously worked deep-mine in the United Kingdom is Tower Colliery in South Wales valleys in the heart of the South Wales coalfield. This colliery was developed in 1805, and its miners bought it out at the end of the 20th century, to prevent it from being closed. Tower Colliery was finally closed on 25 January 2008, although production continues at the Aberpergwm drift mine owned by Walter Energy of the USA nearby.

Coal was mined in America in the early 18th century, and commercial mining started around 1730 in Midlothian, Virginia.

Coal-cutting machines were invented in the 1880s. Before this invention, coal was mined from underground with a pick and shovel. By 1912 surface mining was conducted with steam shovels designed for coal mining.

4. Problems in Face of Coal Mining

Despite the tremendous importance of coal, the industry is faced with serious problems, such as:

(1) Dust and noise pollution

(i) Dust at mining operations can be caused by trucks being driven on unsealed roads, coal crushing operations, drilling operations and wind blowing over areas disturbed by mining.

(ii) Main sources of noise pollution are blasting, movement of heavy earth moving machines, drilling and coal handling plants.

(2) Mining subsidence

Mine subsidence can be a problem with underground coal mining, whereby the ground level lowers as a result of coal having been mined beneath. The major factors affecting the extent of subsidence are seam thickness and its depth beneath the surface. Roof collapse will often start within 24 hours of coal extraction, but the full effects are transmitted rather slowly upwards, eventually resulting in subsidence at the surface. But it may be over 10 years before the surface is completely stable again.

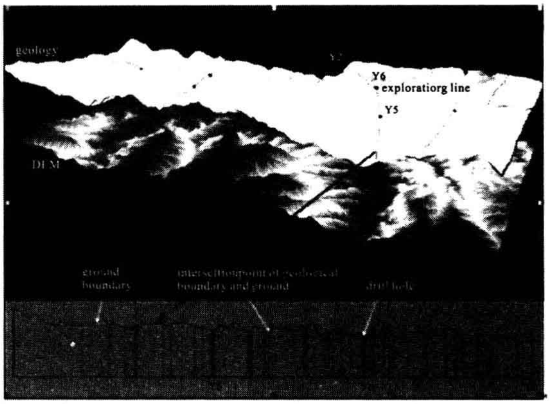
(3) Water pollution

Most underground and some surface mines lie well below the water table. Both, therefore, have the potential to pollute any groundwater that flows through them. Waste water from coal preparation pant and mine water are other sources of water pollution.

In addition to the obvious disturbance of the land surface, mining may affect, to varying degrees, groundwater, surface water, aquatic and terrestrial vegetation, wildlife, soils, air, and cultural resources. Actions based on environmental regulations may avoid, limit, control, or offset many of these potential impacts, but mining will, to some degree, always alter landscapes and environmental resources. Regulations intended to control and manage these alterations of the landscape in an acceptable way are in place and are continually updated as new technologies are developed to improve mineral extraction, to reclaim mined lands, and to limit environmental impacts.

Unit 1 Coal Mine Geology and Exploration

煤矿地质与测量



Coal is a combustible sedimentary rock formed from ancient vegetation which has been consolidated between other rock strata and transformed by the combined effects of microbial action, pressure and heat over a considerable time period. This process is commonly called "coalification". Coal occurs as layers or seams, ranging in thickness from millimeters to many tens of meters. Coal reserves are discovered through exploration. Modern coal exploration typically involves extensive use of geophysical surveys, including 3D seismic surveys aimed at providing detailed information on the structures with the potential to affect longwall operations, and drilling to determine coal quality and thickness.

Text 1 Geologic Structure of Coalfield 煤田地质构造

Many geologic factors influence thickness, continuity, quality, and mining conditions of coal. Some features formed during peat accumulation or shortly thereafter, whereas others developed long after deep burial and coalification. Several of the more common features that have been observed are described in the following sections:

1. Shale Partings in Coal and Split Coal

In the peat swamp in which vegetable material accumulated, streams periodically overflowed their banks, depositing thin mud and silt layers that became bands of shale or siltstone after the vegetable material was coalified. Particularly close to the flooding rivers, relatively thick deposits were laid down, with reestablishment of the swamp vegetation after the flood stage, and this resulted in one type of split coal observed in coalfields (Fig. 1. 1).

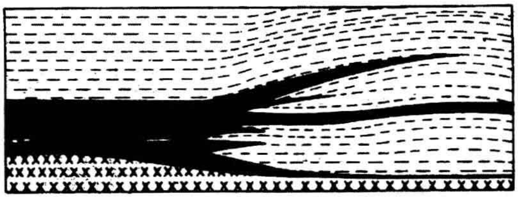


Fig. 1.1 Splitting of a coal seam

2. Washouts

After plant material accumulates and is buried by various sediments, it may be removed by the downward erosive action of streams. Its absence in the rock sequence is termed a washout or cutout (Fig. 1. 2). Washouts may happen shortly after deposition of the peat or much later, even after the coal has been covered by other sediments. The channel is later filled with mud and sand deposits so that the normal position of the coal is occupied by shale or sandstone.

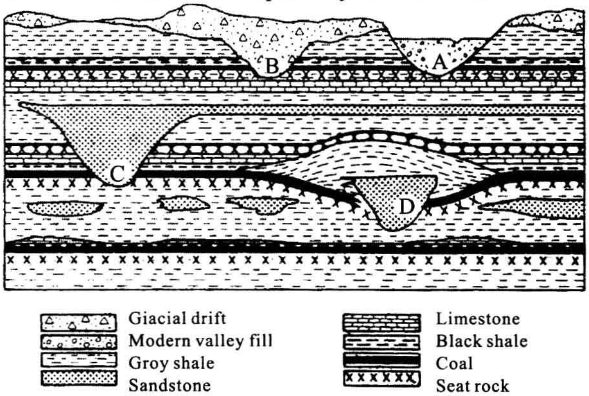


Fig. 1.2 Some features affecting continuity of coals

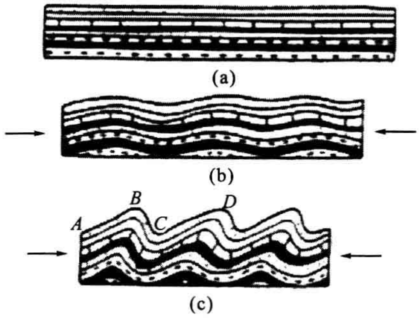
Coal removed by modern stream erosion at A; pre-glacial erosion at B; by a stream after coal deposition at C; and at D. The stream was present throughout the time of peat accumulation

3. Folds

Throughout geologic time, pressed by horizontal forces, coal and rock strata distort into a continuous wavy forms, this structure is known as a fold(Fig. 1. 3).

The basic unit of a fold is named a fold unit which is one bending. Fold units have two patterns: closing upwards in the plane of the fold profile are known as termed anticlines, such as ABC in Fig. 1. 3; synclines folds are those closing downwards in the same plane, such as BCD in Fig. 1. 3.

The fold unit is described by fold parameters illustrated in Fig. 1. 4. The parameters include: core zone, limb zone, hinge surface, hinge axis, fold hinge, etc.



(a) Horizontal; (b), (c) Fold

Fig. 1.3 Folding and folds

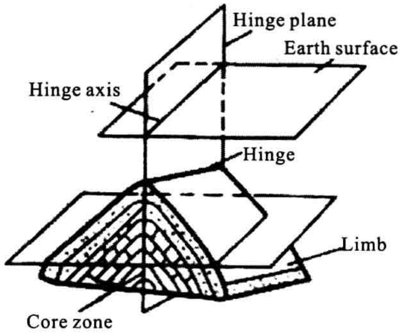


Fig. 1.4 The parameters of fold

Fold limb: beside the hinge zone.

Hinge surface: a surface dividing the two fold limbs in the middle. The surface may be vertical, inclined, or horizontal.

Hinge axis: the intersection line between hinge surface and the earth's surface. Hinge axis may be a straight or curved line, the direction of the hinge axis indicates the direction of the fold extension.

Fold hinge: the intersection line between a rock stratum surface and the hinge surface. It may be horizontal, inclined, or wavy. Fold hinge can indicate the fold occurrence changes along the direction of the fold extension.

4. Faults

Faults are fractures in the rock sequence along which strata on each side of the fracture appear to have moved in different directions. The movement may be measured in inches, tens or hundreds of feet, or less commonly, in miles. Movement may be in any direction, from horizontal to vertical. The two most common types of faults observed are illustrated in block diagrams shown in Fig. 1. 5. Where stresses are in opposite directions or tensional, rocks have "pulled apart" at the fracture surface and displacement is as illustrated for a normal fault [Fig. 1. 5 (a)]. Where horizontal compressive forces are responsible for faulting, one block may be showed over the other in the manner illustrated in Fig. 1. 5(b) to produce a thrust or reverse fault. A borehole drilled very close to a normal fault may have a shortened interval between key strata, whereas in a reverse fault, part of the sequence may be repeated in the boring.

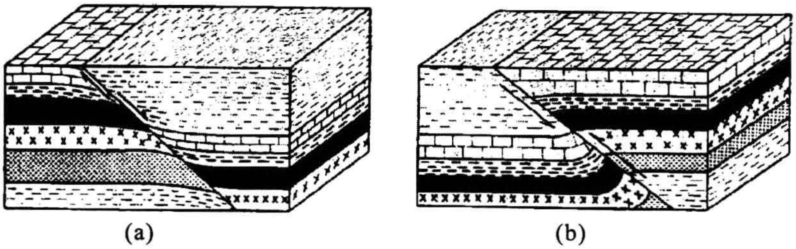


Fig. 1.5 Faults

With Normal Fault (a) strata above fault have moved down relative to those above; with Reverse Fault (b) strata above have moved up

The faults are divided into three kinds according to the relationship between the fault planes strike direction and rock strike direction (Fig. 1. 6). If the fault plane strike is paralleled to the rock strike, the fault is known as a strike fault. If the fault plane strike is perpendicular to the rock strike, the fault is known as a dip fault. If the fault plane strike is intersected with a rock strike, the fault is known as an intersected fault.

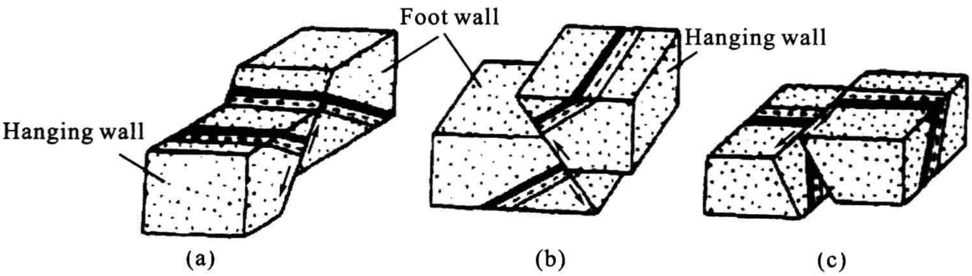


Fig. 1.6 Block diagram illustrating the three types of faults

(a) Normal dip-slip fault; (b) Reverse dip-slip fault; (c) Strike-slip fault