English for Mining Engineering

采矿工程英语

（第二版）

蒋国安 主编

中国矿业大学出版社
China University of Mining and Technology Press

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内容提要

本教材所有课文均选自近年来国外新出版的专业书刊，反映了当前煤炭工业的新技术和新发展。内容包括煤矿地质和测量，矿井设计和开拓，井巷工程，岩体结构，矿山压力和巷道支护，长壁采煤法及其装备，房柱采煤法及其装备，矿井运输、提升、通风、排水、供电、事故防治、通讯和照明；选煤，矿区环境保护，特殊条件下开采，露天开采，采矿系统工程和新型采矿方法等专业知识。每课均包括课文、生词和词组、语言难点注释、阅读练习等内容。

本书既可作为煤炭高等院校采矿工程专业的英语教材，也可供有一定英语基础的矿山工程管理及技术人员自学参考。

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第二版前言

结合全国高等院校采矿类专业“专业外语”教学的需要，对根据原煤炭部“八五”教材规划编写的《采矿工程英语》教材进行修订。由于本书原作者都已退休，而且分散在徐州、西安、哈尔滨和泰安，不便集中进行，修订工作全部由本人承担。

教材修订的主要指导原则是：

1. 保持本书内容篇幅和编排格式基本不变。

2. 尽可能使课文和练习的内容具有连贯性和互补性。

3. 教材内容范围略有扩大，从煤炭开采到其他能源矿物的开采。

4. 教材内容反映采矿工业当前的新技术和新发展。

根据以上指导原则，教材内容做了如下修改：

1. 对不合适的内容进行了更换，如：第3课的练习，第14课第1、2节的练习，第28课的课文和练习等。

2. 对不全面的内容进行了增补，如：第10课井巷工程中增加了第一节凿井的课文和练习。

3. 对所有课文和练习的主标题进行了修正或增补；部分课文和练习增加了小标题。

本教材的内容包括了煤矿地质和测量，矿井设计，矿井开拓，井巷工程，岩体结构，矿山压力和巷道支护，长壁采煤法及其装备，房柱采煤法及其装备，矿井的运输、提升、通风、排水、供电和事故防治、通讯和照明，选煤，煤矿环境保护，特殊条件下开采，采矿系统工程和新型采矿方法等专业知识。其中，第14课第1、2节的练习、第10课井巷工程第一节凿井的课文和练习由朱学军编写。绝大部分图片的扫描工作是由程文泉完成，在此深表感谢。

本教材所有课文和练习均选自国外出版的专业书刊。全书选编成28课共47节。为帮助读者更好地理解课文内容，在课文正文后有生词和词组、语言难点注释。每课（节）末还附有一篇英文短文（无生词、词组和注释）供读者阅读练习。

在安排教学进度时，原则上每课（节）课文用两个学时，47节需94个学时，本课程可以根据各校的具体情况在教学计划中安排90～110个学时，教学内容可以适当选择增减。

原教材前言中提到的关于“拟另外出版与本教材配套使用的《采矿工程英语参考资料》供读者参考使用。该参考资料包括每课（节）的中文译文；专业英语的语法特点（文体结构的特点，词汇特点和语法特点）；科技论文中英文摘要的写作技巧及摘要示例”的设想，因为各种原因没能实现。关于科技英语语法特点和英文摘要写作技巧，读者可参阅由戴炜华、陈文雄编著的《科技英语的特点和应用》一书。至于课文和练习的中文译文，见仁见智，由于各人的中英文水平和专业知识不同，译文自然会有差异，不必强求统一。

蒋国安

2010年11月26日

1.岩层控制的关键层理论
2.矿山压力与岩层控制

第一版前言

为了满足全国煤炭高等院校加强专业外语教学的需要，根据原煤炭部“八五”教材编写规划的要求，我们组织编写了这本《采矿工程英语》教材。考虑到采矿工程专业学生专业知识面需要拓宽的要求，本教材的内容，包括了煤矿地质和测量，矿井设计和开拓，井巷工程，岩体结构，矿山压力和巷道支护，长壁采煤法及其装备，房柱采煤法及其装备，矿井的运输、提升、通风、排水、供电和事故防治、通讯和照明，选煤，煤矿环境保护，特殊条件下开采，露天开采，采矿系统工程和矿业管理等专业知识。因此，本教材相当于一本简明的英文版采煤概论。

在本教材的编写过程中，特别注意到其内容应能反映煤炭工业当前的新技术和新发展，故所有课文均选自近年来国外新出版的专业书刊。全书选编成28课计44节。为帮助读者更好地理解课文内容，在课文正文后有生词和词组、语言难点注释。每课(节)的最后还有英文原文(无生词、词组和注释)供读者阅读练习。拟另外出版与本教材配套使用的《采矿工程英语参考资料》供读者参考使用。该参考资料包括每课(节)的中文译文；专业英语的语法特点(文体结构的特点，词汇特点和语法特点)；科技论文中英文摘要的写作技巧及摘要示例。

在安排教学进度时，原则上原课(节)课文用两个学时，44节需88个学时，考虑到要安排一定分量的练习以及其他事宜，本课程共需安排90～110个学时。

本书由蒋国安，吕家立任主编。参加编写工作的有蒋国安(第1、2、3、4、5、6、24、27、28课)，吕家立(第7、11、12、20、21、22)，侯忠杰(第8、9、10、18、19课)，马翼飞(第13、14、15、16、17、23、25、26课)。

由于编者的水平有限，加之时间仓促，不足之处在所难免，恳请读者批语指正。

编者

1998年4月

目　录

LESSON 1

HISTORY OF COAL MINING

The exact date of man's first use of coal is lost in antiquity. The discovery that certain black rock would burn was undoubtedy accidental and probably occurred independently and many times in the world over thousands of years[1]. It is quite likely that these independent discoveries were made when primitive man chanced to build camp fires on exposed ledges of a black rock, then was amazed when it caught fire.

The Chinese recorded the use of coal 1100 years before the Christian Era and from the *Bible* we learn that King Solomon was familiar with coal in what is now Syria[2]. In Wales, there is evidence that the Bronze Age people used coal for funeral pyres, and it is known that the Romans used this fuel. There are other ancient references.

So the knowledge that coal would burn, and even some uses of that knowledge, go back thousands of years. However, practical and consistent use of coal seems to date to England in the Middle Ages.

In the Americas, there is evidence here and there of occasional use by the Indians. However, the first recorded discovery of coal, in what is now US, was by French explorers, who reported an outcrop exposure on the Illinois River in 1679. Following this, other discoveries were made by French and British explorers, but the first recorded actual usage was in Virginia in 1702, where a French settler was granted permission to use coal for his forge.

Earliest recorded commercial mining was in 1750, from the James River coalfield near Richmond, VA, a deposit now abandoned. Besides local consumption from this field, shipments were made to Philadelphia, New York, and Boston.

At first, all coal was hewed by hand from the solid bed by use of pick and bar. It was then shoveled into baskets, boxes, or wheelbarrows and dragged by men, or women, to the outside or to the foot of a shaft. Later, cars were developed but still drawn over wood plank by humans. As time went on[3], iron straps, then rails, were used for the cars while mules, ponies, or horses did the pulling.

Gradually, black powder was introduced to blast down the coal, but undercutting, sidecutting, and drilling were still done by hand. During the late 1700s and 1800s, a number of basic developments greatly aided the mining of coal. The first steam engine was invented by James Watt in 1775 in Britain to pump water from coal mines, a very important application that made it possible for mines to go deeper[4]. The first rail transportation was for mining, the first steam locomotive was developed in 1814 by George Stephenson in England for a colliery, and the first electric locomotive was developed in 1883 in Germany for underground use.

Mechanization of operations at the face started befor 1900 with development of punching

machines and chain-type cutters for undermining the coal seam before blasting, of coal and rock drills, electric and compressed air locomotives, and even some early experiments with continuous mining machines.

Longwall mining was used here and there in the US until about 1910, particularly in Illinois, but then became noncompetitive with room-and-pillar methods in thicker seams that better lent themselves to mechanization. In the meantime, longwall continued to be dominant in Europe and Asia because of thin coal and depth of cover.

During World War Ⅱ, the Germans developed the longwall scraper for continuous loading onto a chain conveyer at the face. This was followed by various types of shearing machines developed in several countries. However, the most important development was in hydraulic, self-propelled roof jacks and chocks that greatly reduced the manpower formerly required to set and reset individual jacks and to build cribs by hand.

With these developments, US coal companies again became interested in the longwall system. Numerous modifications and a general "beefing-up" were found necessary for US conditions but, after some failures and misapplications, longwall mining has become practical in this country, providing mining conditions are right, as attested by the gradually increasing number of units.

Surface mining was the earliest method of extracting coal. It consisted of recovering coal exposed in stream beds and visible outcrops with zero to a few feet of loose dirt cover. Under deeper cover and under rock the cheapest method—in fact the only means of recovery at first—was by underground mining, so surface developments were insignificant until about 1910, although, here and there, slip and cart scrapers drawn by mules were used to a very small extent.

NEW WORDS AND EXPRESSIONS

antiquity [æn'tikwiti] *n.* 古代,古人们
coalfield ['koulfi:ld] *n.* 煤田,产煤区
discovery [dis'kʌvəri] *n.* 发现,被发现的事物
VA=Virginia 弗吉尼亚[美国州名]
undoubtedly ['ʌndautidli] *ad.* 毋庸置疑地,肯定地
deposit [di'pɔzit] *vt. vi.* 存放,沉积
n. 矿床,沉积,储藏量,存积
accidental [æksi'dentl] *a.* 偶然的,意外的
likely [laikli] *a.* 很可能的,像是会的
ad. 很可能,或许,大概
abandon [ə'bændən] *vt.* 抛弃,废弃
n. 放任,无拘无束
primitive ['primitiv] *a.* 原始的,远古的
hew [hju:] *vt.* 砍,劈
chance [tʃa:ns] *vi.* 碰巧,偶然发生
solid ['sɔlid] *a.* 实体的,坚固的,立体的
ledge [ledʒ] *n.* 架状突出物,矿脉,岩石的突出部
pick and bar 镐和钎杆
amaze [ə'meiz] *vt.* 使惊奇
n. 惊奇,惊愕
shovel ['ʃʌvl] *n.* 铲,铁锹
vt. 铲,用铲子掘起,推,涌流
Syria [siriə] *n.* 叙利亚(亚洲)
wheelbarrow *n.* 独轮小车,手推车
Wales [weilz] *n.* 威尔士(英国)
drag [dræg] *vt.* 拖,拉
the Bronze Age 青铜时代
drawn [drɔ:n] draw 的过去分词
funeral ['fju:nərəl] pyres [paiəs] 火葬用柴堆
plank [plæŋk] *n.* 板,厚板,支持物,板条

vt. 铺以厚板，在……上铺板
fuel [fju:əl] *n.* 燃料
the Middle Ages 中世纪
strap [stræp] *n.* 铁皮，革，板
evidence ['evidens] *n.* 迹象，证据
black powder *n.* 黑火药
reference ['refrens] *n.* 参考，出处，参考书目
undercutting *n.* 底部掏槽，拉底
consistent [kən'sistənt] *a.* 一贯的，始终如一的
sidecutting *n.* 侧面掏槽，侧面采掘
here and there 各处
drilling [driling] *n.* 钻孔，钻眼
occasional [ə'keiʒənl] *a.* 偶然的
invent [in'vent] *vt.* 发明，创造
Indian [indjən] *n.* 印第安人
locomotive ['loukəˌmoutiv] *n.* 机车，火车头 *a.* 有运转力的，移(机)动的
explorer [iks'plɔ:rə] *n.* 探险者，勘探者
outcrop ['autkrɔp] *n.* 露头
colliery ['kɔljəri] *n.* 煤矿
exposure [iks'pouʒə] *n.* 揭露，方位
mechanization [mekənai'zeiʃən] *n.* 机械化，变更，改进
Illinois [ili'nɔi，ili'nɔiz] *n.* 伊利诺斯[美国州名]
operation [ɔp'reiʃən] *n.* 操作，作业，运转
settler ['setlə] *n.* 移居者，殖民者，开拓者
punching machine 冲床，冲压机，冲击式机械
grant [gra:nt] *vt.* 同意，准予(补助等)，授予(权利等)
chain-type cutter 链式截割机
forge [fɔ:dʒ] *n.* 锻炉，铁匠炉
undermining 底部掏槽，采动
commercial [kə'mə:ʃəl] *a.* 商业的，商品化的
compressed air 压缩空气，压气
continuous mining machine 连续采矿机械
self-propelled roof jacks and chocks 自移式液压顶柱和垛式液压支架
longwall mining 长壁开采
noncompetitive [nɔnkəm'petitiv] *a.* 不可竞争的
individual jacks 单体支柱
room-and-pillar method 房柱法
crib [krib] *n.* 木垛，支垛
lent(lend 的过去式和过去分词)提供，给予
modification [ˌmɔdifi'keiʃən] *n.* 更改，修改，改变
dominant ['dɔminənt] *a.* 支配的，占优势的，主要的，显著的 *vt.* 统治，支配 *n.* 主要物，要素
beef up 加强，充实
failure ['feiljə] *n.* 失败，故障，失效，疏忽，缺少
misapplication [misˌæpli'keiʃən] *n.* 误用
attest [ə'test] *vt.* 证实，证明，表明
scraper ['skreipə] *n.* 铲运机，耙斗，扒矿机
surface mining 露天开采
chain conveyer 链式运输机
slip scraper 刮土铲运机
shearing machine *n.* 剪机，滚筒式采煤机
cart scraper 铲运车
hydraulic [hai'drɔ:lik] *a.* 液压的，水力的
providing＝provided *conj.* 以……为条件，假如

NOTES

〔1〕over thousands of years 在几千年中。over 在……期间，thousands of 许许多多，无数，几千。

〔2〕in what is now Syria 在现在叫叙利亚的地方。what is now Syria 是介词 in 的宾语，这里是宾语从句。如 in what follows 如下，在下文中。

〔3〕As time went on 随着时间的推移。as 连词，当……的时候。

〔4〕a very important application what made it possible for mines to go deeper 一种非常重要的作用，使得矿井有可能开采更深的部分。it 是形式宾语。如：The invention of radio

has made it possible for mankind to communicate with each other over a long distance. 无线电的发明使人类有可能进行远距离通讯联络。

EXERCISES

Serious Problems in Face of the Mining Industry

For many years the continually improving productivity in US coal mines was the envy of the world. Such steady improvement meant a fairly level, or even slightly declining, price to the consumer despite large increases in wages, materials, taxes, and other costs of production. However, this trend has drastically declined since 1968 because of the new stringent Federal safety regulations; rigid controls on surface water, and air pollution; and the mass of newly introduced, and constantly changing, bureaucratic reports. See Fig. 1.1.

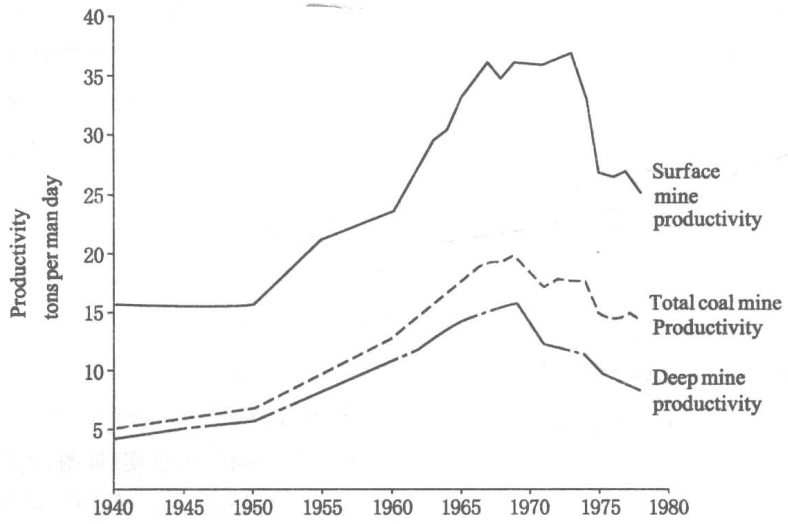

Fig. 1.1 Productivity per man day

Metric equivalent: 1 st × 0.907 184 7 = t.

The problem now is to not only meet the new safety and environmental requirements but, at the same time, to revive the steady progress of the past.

Reserves of all fossil fuels are limited, but the Untied States has more reserves in coal than in oil, gas, oil shale, and tar sands combined. Even if coal reserves are over estimated, as some in the industry believe, the relative dominance compared to other fossil fuels is apparent, Table 1.1. Reserves of all fossil fuels are finite, so for the long pull the world is fortunate in having nuclear energy. The distant future may see all fossil fuels consumed for higher uses than boiler fuel, for example, petrochemicals, lubricants, gasoline, chemicals, etc.

Table 1.1 US Reserves of Fossil Fuels Expressed in Heat Value

Reserves	Coal	Oil	Natural gas	Tar sands	Oil shale	Total
Quadrillions of Btu*	17 307	2 373	1 906	7	4 060	25 653

* Metric equivalent: 1 Btu×1 055.056=J.

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

(1) Air and water pollution both at the mines and at the consuming end.

(2) The onerous new Federal safety regulations.

(3) Public outcry against surface mining and lack of satisfactory restoration in some cases.

(4) A shortage of qualified supervisory and engineering personnel, as well as mine workers, to meet the growing demand for coal and the increasingly more difficult mining conditions.

(5) A need to improve machinery, techniques, and managerial ability to resume the former yearly improvement in productivity and cost.

There are certainly solutions to all of these problems, which are challenges that a young person entering the industry should welcome as great opportunities.

LESSON 2

ORIGIN OF COAL

That coal has formed from accumulations of plant material has been well established. Estimates indicate that approximately 0.9 to 2.1 m (3 to 7 ft) of reasonably compacted plant material was required to form 0.3 m (1 ft) of bituminous coal. What were the conditions that so many times permitted the accumulation of great thickness of plant material that sometimes blanketed hundreds and even thousands of square miles[1]?

Conditions similar to at least some of those that must have prevailed in the geologic past exist today in a wide variety of swamp areas in different parts of world[2].

Accumulation of vegetal matter is now occurring in areas of the world ranging from subarctic to tropical resulting in formation of peat. Two major types of peat land can be recognized: (1) that developing on continental interior areas relatively elevated above sea level, and (2) that forming in low coastal areas close to sea level. In both types of areas, peat formation requires that growth of vegetation exceed that of decay and that the plant material be allowed to accumulate and not be removed by erosion[3]. Both types of peat land meet this condition because they are in poorly drained areas where high levels of ground water protect vegetable from normal rapid decay[4].

Small peat bogs also occur in a variety of small undrained depressions, both in land and on coastal areas. Originally in these bogs only water-dwelling plants grew, but as the shallow border areas of these depressions filled in, larger plants, including trees, gradually were able to grow and progressively fill the depression. In some places these bogs, commonly ranging from only a few acres up to a few hundred acres, are still unfilled, and the process of peat formation is continuing.

The character of most of the widespread coal seams that occur in the rock sequence indicates that they formed under conditions similar to those found in modern coastal or near-coastal swamps. The Everglades of Florida, the Okefenokee Swamp of Georgia, and the Dismal Swamp of North Carolina and Virginia are modern examples of such swamps. Extensive peat lands adjacent to the northwest coast of Europe also suggest conditions with many similar characteristics.

The accumulations of peat found on and in the sediments deposited as the delta of the Mississippi River have a somewhat different history but many similar characteristics. The several layers of peat and associated strata of the delta indicate conditions were much like those that prevailed during formation of the great coal deposits of Pennsylvanian age in the eastern United States and in similar strata in other parts of the world. Fig. 2.1 diagrams the distribution of peat on a modern delta plain.

Coastal swamps are more likely to be preserved than inland swamps because they have a better chance of being covered by the sea and buried by sediments deposited on the sea floor.

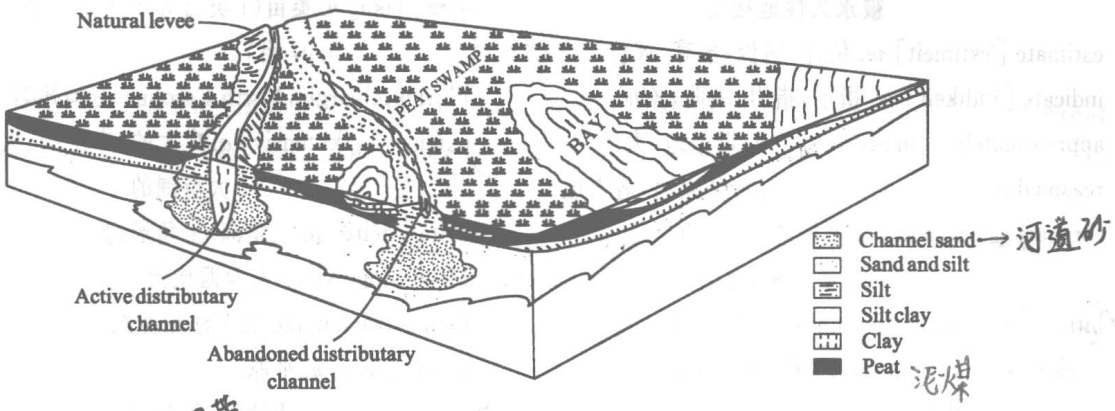

Fig. 2.1 Block diagram showing peat accumulation and related sediments on a portion of a large delta.

The climate prevailing during the time the extensive coal swamps existed is believed to have been temperate to subtropical. It may have been much more uniform over broader areas of the earth than is true today.

In summary, conditions necessary for accumulation of peat that could be subsequently converted to coal are:

1) Swamp or marsh environment and climate favorable to plant growth.

2) Some subsidence (sinking) of the area during accumulation of vegetal debris, or compaction of deposited plant material, permitting further accumulation.

3) Sufficiently wet conditions to permit exclusion of air from much of the vegetal material before it decays, and sufficiently rapid accumulation to thwart bacterial action, even in water of the swamp. Acidity of the swamp water normally prevents bacterial action at a few inches or a few feet below the water level in the swamp.

4) Proximity to the sea or a subsiding area so that vegetal material can be buried by sediments when the sea level rises or the land subsides.

5) Site of accumulation such that removal by erosion does not subsequently occur.

As peat accumulated, the weight of the top layers of peat compacted the lower layers, primarily by squeezing out large amounts of water. Variable chemical effects and bacterial action on the vegetable debris also took place in the swamp environment. Burial by sediments, physical-chemical effects associated with the changed environment, and loss of water and volatile materials resulted in formation of lignite, the earliest stage in the formation of coal.

With increasingly deeper burial, pressure continues to compress the lignite, and the increase in heat associated with the increasing depth of burial will further devolatilize the coal-forming materials. The rank of the coal became progressively higher, rising from lignite through subbituminous, bituminous, semianthracite, and anthracite to meta-anthracite.

NEW WORDS AND EXPRESSIONS

accumulation [əˌkju:mjuˈleiʃən] *n.* 积累,积聚,堆积　　establish [isˈtæbliʃ] *vt.* 建立,使(风俗,先例等)

被永久性地接受

estimate [ˈestimeit] *vt.* 估计，估价，预算，评价

indicate [ˈindikeit] *vt.* 指示，指出，表明，象征

approximately [əˈprɔksimitli] *ad.* 近似地，大约

reasonably [ˈri:znəbli] *ad.* 合理地，公道地，适当地

compact [kəmˈpækt] *a.* 紧密的，结实的

vt. 使紧密，使结实

bituminous coal [biˈtju:minəs koul] 烟煤

thickness [θiknis] *n.* 厚度，密(度)，稠密，浓(度)

blanket [blæŋkit] *vt.* 覆盖

mile [mail] *n.* 英里，哩(1 哩＝1.609 km)

prevail [priˈveil] *vi.* on(upon，with)胜过，流行，普遍

geologic(al) [dʒiəˈlɔdʒik(əl)] *a.* 地质(学)的

variety [vəˈraiəti] *n.* 多样化，种类，[a～]种种

swamp [swɔmp] *n.* 沼泽，煤层聚水洼

vegetal [ˈvedʒitl] *a.* 植物的

n. 植物，蔬菜

subarctic [sʌbˈa:ktik] *a.* 近北极的，亚北极的，副极带的

tropical [ˈtrɔpikəl] *a.* 热带的，位于热带的

formation [fɔ:ˈmeiʃən] *n.* 形成，构成，层系，层

peat [pi:t] *n.* 泥炭，泥煤

continental [kɔntiˈnentl] *a.* 大陆的，大陆性的

interior [inˈtiəriə] *a.* 内部的，内地地，国内的

n. 内部，内地，内务，内政

elevate [ˈeliveit] *vt.* 抬起，使升高

coastal [koustəl] *a.* 海岸的，沿海岸的

exceed [ikˈsi:d] *vt.* 超过，越过

decay [diˈkei] *v. n.* 腐烂，衰败

remove [riˈmu:v] *vt.* 移动，去掉，撤去，除掉

erosion [iˈrouʒən] *n.* 腐蚀，侵蚀

drain [drein] *vt.* 排水，喝干，耗尽

protect [prəˈtekt] *vt.* 保护，警戒

debris [ˈdebri:] *n.* 碎片，岩屑，碎石，尾矿，废石

bog [bɔg] *n.* 泥塘，沼泽

originally [əˈridʒənəli] *ad.* 最初，原先

water-dwelling 含水性的

depression [dipreʃən] *n.* 降低，凹地，洼地，萧条

acre [ˈeikə] *n.* 英亩(1 英亩等于 40.47 公亩或 6.07 亩)

Florida，Georgia，North Carolina 美国州名

extensive [iksˈtensiv] *a.* 广大的，广泛的，大面积的，大范围的

delta [ˈdeltə] *n.* 三角洲，三角形物

Mississippi River 密西西比河

Pennsylvanian age 宾夕法尼亚纪

plain [plein] *n.* 平原

a. 清楚的，普遍的

preserve [priˈzə:v] *vt.* 保护，维护

n. 禁区，保护区

inland [ˈinlənd] *a.* 内地的，国内的

n. 内地

bury [beri] *vt.* 埋葬，埋藏，遮盖

sediment [ˈsedimənt] *n.* 沉积，沉积物

subtropical [ˈsʌbˈtrɔpikəl] *a.* 亚热带的

uniform [ˈju:nifɔ:m] *a.* 一样的，均匀的

summary [ˈsʌməri] *a.* 概括的，扼要的

n. 摘要，概要，一览

subsequently [ˈsʌbsikwəntli] *ad.* 随后地，后来地

convert [kənˈvə:t] *vt.* 转变，变换

favorable [ˈfeivərəbl] *a.* 赞成的，有利的，讨人喜欢的，有促进作用的

subsidence [sʌbˈsaidəns，ˈsʌbsidəns] *n.* 沉陷，下沉，下降

sinking [siŋkiŋ] *n.* 沉陷，下沉，凿井

exclusion [iksˈklu:ʒən] *n.* 排斥，排除在外

sufficiently [səˈfiʃəntli] *ad.* 足够地，充分地，能胜任地

thwart [θwɔ:t] *vt.* 反对，阻挠，挫败

bacterial [bækˈtiəriəl] *a.* 细菌的

acidity [əˈsiditi] *n.* 酸味，酸性

volatile [ˈvɔlətail] *a.* 易挥发的

n. 挥发物

lignite [ˈlignait] *n.* 褐煤(＝brown coal)

anthracite [ˈænθrəsait] *n.* 无烟煤，硬煤

meta-anthracite 变质无烟煤