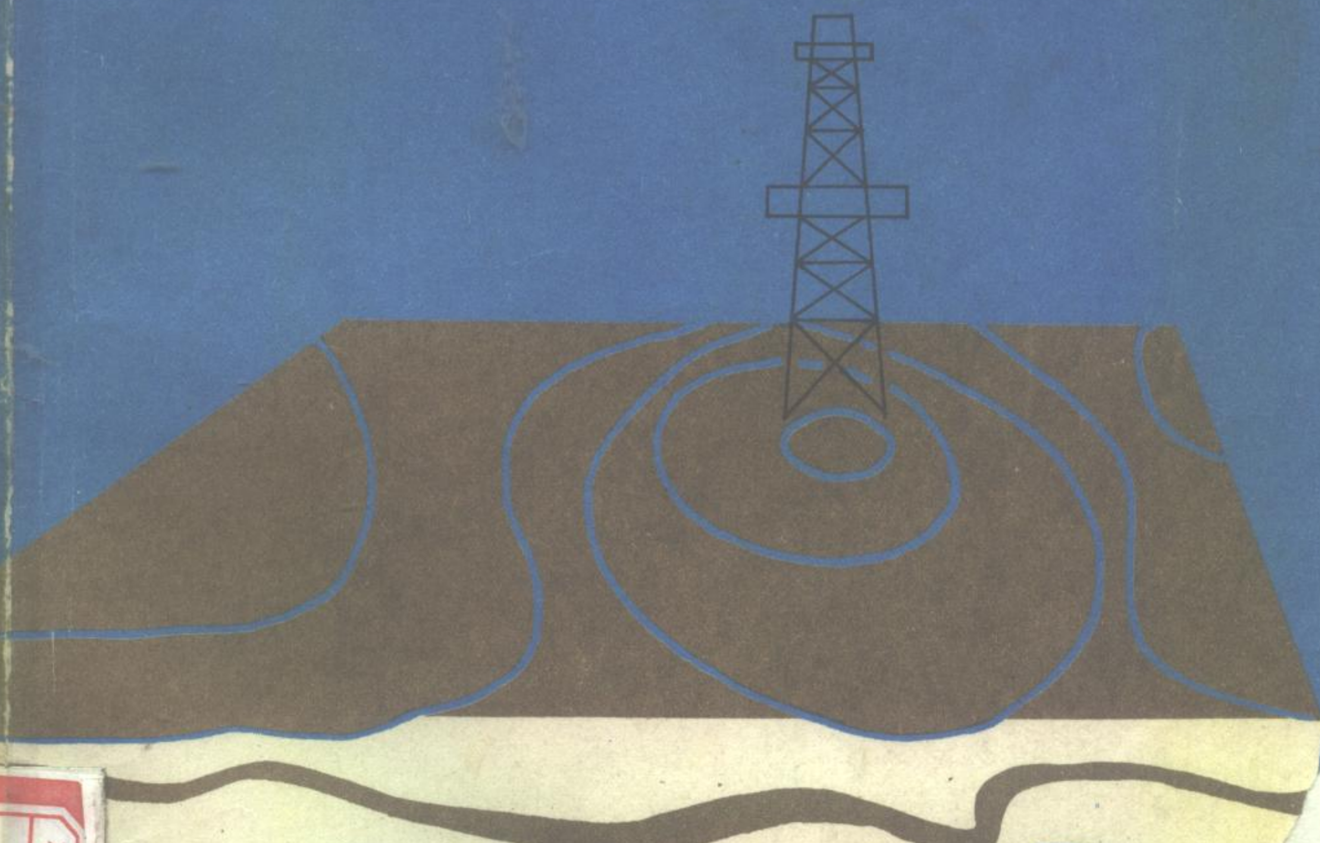
石油地质专业英语

陈建渝　陈全茂
阎永林　赵华芳　编



中国地质大学出版社

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陈建渝　陈全茂　阎永林　赵华芳　编
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内 容 提 要

本书共二十课，内容包括课文、生词和词组注释、疑难点解释及理解问题。课文皆选自较新版的英美石油地质专业原著，按石油地质专业学科内容编排，其中包括石油地质、沉积学、构造学、油气生成、运移、聚集及开采等内容，选题广泛，重点突出，程度适当，是一本石油地质专业英语教科书，同时，也可供其他地质专业人员参考。

前　言

外语是实现科技现代化的有力武器．能源工业是我国四化建设的战略重点．石油地质专业的大学生和石油地质战线的科技人员，在掌握了一定的实用英语的基础上，需进一步掌握一些专业英语，以便更好地掌握国外的新信息，为我所用．因此，在总结我校近年来开设石油地质专业英语课经验的基础上，校石油系和外语教研室教师合作编写了该教材．它适用于石油地质专业的本科高年级学生，也可供本专业英语培训班和具一定英语水平的石油地质科技工作者使用．其目的是帮助学生逐渐熟悉并掌握本专业的英语常用词汇、语法现象及文章结构，以便提高阅读和翻译英文专业文章的水平．

全书共二十课．内容包括课文、生词和词组注释、疑难点解释及理解问题．生词量总计约600个．课文皆选自较新版的英美石油地质专业原著，按本专业学科内容编排，其中包括石油地质、沉积学、构造学、油气生成、运移、聚集及开采等内容．本教材选题广泛，重点突出，程度适当，自成体系．除少数课文有自然段落的删减之外，一般未做文字改动．

本书共分五个单元．每单元之后附有常用科技英语疑难点的解释和练习，旨在帮助学生熟悉、并熟练掌握这些用法．

参加编写本书的有中国地质大学石油系教员陈建渝，陈全茂，外语教研室教员阎水林，赵华芳．

本书还得到成都地质学院高纪清教授、中国地质大学(北京)徐怀大教授和我校外语教研室的大力支持和帮助，并承蒙中国地质大学出版社负责编辑出版，特此鸣谢．

由于编者的水平和经验有限，书中错误和不妥之处在所难免，敬请读者指正．

编　者

1987.3

Contents

Lesson One

Text

General Petroleum Geology

Petroleum (rock–oil, from the Latin *petra,* rock or stone, and *oleum,* oil) occurs widely in the earth as gas, liquid, semisolid, or solid, or in more than one of these states at a single place. Chemically any petroleum is an extremely complex mixture of hydrocarbon (hydrogen and carbon) compounds, with minor amounts of nitrogen, oxygen, and sulfur as impurities. Liquid petroleum, which is called *crude oil* to distinguish it from refined oil, is the most important commercially. It consists chiefly of the liquid hydrocarbons, with varying amounts of dissolved gases, bitumens, and impurities.

[1]Petroleum gas, commonly called *natural gas* to distinguish it from manufactured gas, consists of the lighter paraffin hydrocarbons, of which the most abundant is methane gas(CH_4). The semisolid and solid forms of petroleum consist of the heavy hydrocarbons and bitumens.

Because of its wide occurrence and its unique appearance and character, petroleum has always been readily observed by man, and is repeatedly mentioned in the earliest writings of nearly every region of the earth. Oil and gas seepages and springs, and tar, asphalt, or bitumen deposits of various kinds exposed at the surface of the ground, were regarded as local curiosities and attracted visitors from great distances. From the earliest times recorded by man, petroleum is frequently mentioned as having an important part in the religious, the medical, and even the economic life of many regions. [2]Not until after the middle of the nineteenth century, however, when it was first discovered in large quantities underground, did its potential commercial importance become apparent.

Since 1900, the geology of petroleum has assumed growing importance as a special economic application of geology. From the first, geologists attempted to explain the occurrence of oil and gas in terms of geologic phenomena. Then, as the petroleum industry grew and developed, they were called in more and more to guide the programs of exploration for the raw materials upon which the industry depended. New geologic concepts relating to petroleum were thus developed, and at the same time enormous volumes of new data were made available with which to test and prove or disprove many established principles of geology. As a result, not only the petroleum industry, but the science of geology as a whole, has benefited greatly.

When a petroleum pool has been discovered, we know (a) that a supply of petroleum originated in some manner, (b) that it became concentrated into a pool, and (c) that it has been preserved against loss and destruction. The evidence for the speculative theories about the geologic history of the petroleum before it was discovered–its origin, migration, accumu lation, and preservation—can come only from a study of the pool.

The fundamental geologic requirements for oil and gas pools are, of course, the same the world over. Whether one is exploring in the Americas, along the continental shelf, the Middle East, or the Far East, the essential elements of a pool are simple. *A porous and permeable body of rock, called the reservoir rock, which is overlain by an impervious rock, called the roof rock, contains oil or gas or both, and is deformed or obstructed in such a manner that the oil and gas are trapped.*

Commercial deposits of crude oil and natural gas are always found underground, where they nearly always occur in the water–coated pore spaces of sedimentary rocks. Being lighter than water, the gas and oil rise and are concentrated in the highest part of the container; in order to prevent their escape, the upper contact of the porous rock with an impervious cover must be concave, as viewed from below. Such a container is called a *trap,* and the portion of the trap that holds the pool of oil or gas is called the *reservoir.* The significant thing is that reservoirs can be of various shapes, sizes, origins, and rock compositions.

The actual discovery of a pool is made by the drill, but the proper location of the wildcat well to test a trap, the depth to which it should be drilled, and the detection and outlining of the oil or gas pool from what is revealed by that well and others, are wholly geologic problems. They constitute the essence of the geology of petroleum and are the most important work of the petroleum geologist. He may need to consider only a simple combination of stratigraphy and structural geology, or he may have to take account of a complex combination of data, involving such various fields as stratigraphy, sedimentation, paleontology, geologic history, fluid flow, structural geology, petrography, geophysics, geochemistry, and metamorphism. In addition to all this, he may have to draw on his own and other people's knowledge of many related sciences, such as physics, chemistry, biology, and engineering.[3]He must do his best to work out the geology of an area from what is visible or what can be mapped at the surface, and from all available well and geophysical data for depths ranging up to three miles or more below the surface, His prediction, however, may often be based on the most fragmentary data, some of which are obtained by specialists or experts who may or may not have a working knowledge of geology, or by geologists who have worked with no thought of the petroleum possibilities of the region. [4]This information is assembled on maps and cross sections, and fitted together in the mind of the petroleum geologist, where it is interpreted and translated into the best place to drill a well that will penetrate a trap below the surface of the ground and thereby enable the well to test the trap's content.

As the search for petroleum gets deeper below the surface, the geology becomes more complex and uncertain, and the data upon which the geologist must base his conclusions become progressively fewer. As drilling is costly, there are never as many test wells as the petroleum geologist would wish. Every scrap of information must therefore be squeezed out of the record and put to use, and the data from each record must be projected outward in all directions. Yet all these maps and data do not, of themselves, tell the whole story. If they are to be fully used in the discovery of petroleum, they must be interpreted, correlated, and integrated. [5]This interpretation of the combined basic geological, geophysical, and engineering data, for the purpose of finding new oil and gas pools, is what constitutes the special province of the petroleum geologist. It results, first of all, in locating an oil and gas ***prospect,*** which is the set of circumstances, both geologic and economic, that will justify the drilling of a wildcat well. The petroleum geologist's work does not stop, however, when he has located a prospect; it continues during the drilling of the wildcat well. He must relate the new facts encountered in the drilling to the problem of identifying and testing the potential producing formations and of completing the well in the producing formation if the well becomes a discovery well. The petroleum geologist thus spans the gap between geology and the related sciences, on the one hand, and the oil and gas prospect and the pool, on the other.

Petroleum prospecting is an art. It requires combining and blending many geologic variables in varying proportions, since each pool, field, or province is characterized by a unique combination of many different geologic conditions. Some of these conditions can be known in advance, but most cannot, and the most successful geologist is the one who can visualize the pool or locate the extension with the least advance information. He may be likened to the artist who can draw the picture with the fewest lines, or to the paleontologist who can identify a fossil vertebrate from the least number of bones.

From *Geology of Petroleum*
by A. I. Levorsen

New Words and Expressions

hydrocarbon	['haidrəu'kɑ:bən]	n. 烃，碳氢化合物
nitrogen	['naitrədʒən]	n. 氮(N)
paraffin	['pærəfin]	n. 石蜡，链烷烃
methane	['mi:θein]	n. 甲烷，沼气
seepage	['si:pidʒ]	n. 油苗
tar	[tɑ:]	n. 焦油沥青，焦油
asphalt	['æsfælt]	n. 沥青，地沥青
bitumen	['bitjumin]	n. 沥青
religious	[ri'lidʒəs]	a. 宗教的
pool	[pu:l]	n. 水池，油(气)藏
originate(from)	[ə'ridʒineit]	v. 发源，引起
preserve	[pri'zə:v]	v. 储存，储藏，保存
preservation	[prezə'veiʃən]	n. 储存，储藏
speculative	['spekjulətiv]	a. 推测的
migrate	[mai'greit]	v. 运移，迁移
migration	[mai'greiʃən]	n. 运移，迁移
accumulate	[ə'kju:mjuleit]	v. 聚集，堆积

accumulation	[ə kju:mju'leiʃən]	n. 聚集，堆积
reservoir	['rezəvwa:]	n. 油藏，储油层
bluntly	['blʌntli]	ab. 直截了当地，坦率地
porous	['pɔ:rəs]	a. 多孔的，有孔隙的
permeable	['pə:mjəbl]	a. 可渗透的，透水的
impervious	[im'pə:vjəs]	a. 不透水的
trap	[træp]	n. 圈闭
contact	['kɔntækt]	n. 接触(带)
concave	['kɔn'keiv]	a. 凹的，凹面的
carbonate	['ka:bənit]	n. 碳酸盐类
episode	['episəud]	n. 幕，期
stratigraphic	[strætiˈgræfik]	a. 地层(学)的
facies	['feiʃii:z]	n. 相，岩相，期
cement	[si'ment]	v. 胶结
cementation	[simen'teiʃən]	n. 胶结(作用)
diagenetic	[daiədʒə'netik]	a. 成岩(作用)的
truncation	[trʌŋ'keiʃən]	n. 削平，截去顶端
unconformity	['ʌnkən'fɔ:miti]	n. 不整合
unravel	[ʌn'rævəl]	v. 解开，阐明，散开
evaluate	[i'væljueit]	v. 评价
evaluation	[i vælju'eiʃən]	n. 评价
wildcat well		初探井
essence	['esns]	n. 本质，实质
paleontology	[pæliɔn'tɔlədʒi]	n. 古生物学
structural geology		构造地质学
metamorphism	[metə'mɔ:fizm]	n. 变质作用
cross section		横断面，横剖面
scrap	[skræp]	n. 碎屑，碎片;少许
correlate (with, to)	['kɔrileit]	v. 相互关联，对比(地层，油源)
correlation	[kɔri'leiʃən]	n. 相互关系，对比
contour	['kɔntuə]	n. 等高线，等值线
density	['densiti]	n. 密度
mechanics	[mi'kæniks]	n. 力学,机制,机理
prospect	[prɔs'pekt]	n. 勘探区，远景区，远景
span	[spæn]	v. 跨越，弥补
variable	['veəriəbl]	n. 变量
blend	[blend]	v. 调和，合成
visualize	['vizjuəlaiz]	v. 设想，想象
vertebrate	['və:tibrit]	n. 脊椎动物

Notes

1. Petroleum gas, commonly called natural gas to distinguish it from manufactured gas, con-

sists of the lighter paraffin hydrocarbons, of which the most abundant is methane gas (CH_4).石油气，为区别于人造气，通常又称天然气，由较轻的石蜡烃组成，其中甲烷的含量最丰富。of which the most abundent is methane gas 是介词+which 结构的非限定性定语从句，用来修饰 paraffin hydrocarbons, 介词 of 后面的 which 代替 paraffin hydrocarbons。又如:

1)Shallow domes are those in which the top of the core is less than 3500 feet beneath the surface. 盐核顶部在地表以下 3500 英尺以内者为浅盐丘。

2)The speed of light is the only fixed quantity that is always the same speed regardless of the conditions under which it is measured. 唯有光速是一定的，无论在什么样的条件下测量，其大小都不变。

2. Not until after the middle of the nineteenth century, however, when it was first discovered in large quantities underground, did its potential commercial importance become apparent. 然而，直到 19 世纪中叶首次从地下发现大量的石油后，石油潜在的商业重要性才显示出来。Not until…did…(直到 …才)以否定词 not 开头，故主语 its potential commercial importance 中助动词 did 与谓语倒装。when 引导的是表示时间的定语从句，说明 the nineteeth century。另外，以否定词 never, hardly, scarcely, no sooner…than 开头的句子，主语和谓语一般也颠倒。又如:

1)Not until more than 100 years ago was aluminum used. 直到100多年前才开始使用铝。

2)No sooner are the new highlands and mountains created than they begain to be attacked by weathering and erosion. 新的高地和山脉一旦形成，就开始受到风化和侵蚀。

3. He must do his best to work out the geology of an area from what is visible or what can be mapped at the surface, and from all available well and geophysical data for depths ranging up to three miles or more below the surface.他必须通过综合分析地表上可以看到或可以测绘到的现象，以及从地表以下三英里或更深处获得的所有钻井资料和地球物理资料，尽力弄清一个地区的地质情况。what is visible or what can be mapped at the surface 是介词 from 的宾语从句。 what 可用 something that (anything that)来代替。又如:

He was not conscious of what an importanant discovery it is. 他没意识到这一发现多么重要。

4. This information is assembled on maps and cross sections, and fitted together in the mind of the petroleum geologist, where it is interpreted and translated into the best places to drill a well that will penetrate a trap below the surface of the ground and thereby enable the well to test the trap's content. 地质学家将这些资料综合编制在地质图和剖面图上，经过周密的思考和解释，确定最理想的钻井地点，这样将可钻穿地表以下的圈闭，从而测试出圈闭中油气的含量。where it is interpreted and translated into the best place 是非限定性定

语从句, where 指 the mind of the petroleum geologist, it 指 this information.

5. This interpretation of the combined basic geological, geophysical, and engineering data, for the purpose of finding new oil and gas pools, is what constitutes the special province of the petroleum geologist. 为了寻找新的油气藏而对基础地质、地球物理以及工程的资料进行综合解释，乃是石油地质学家的特殊任务. what 引导的是表语从句. 表语从句可由 that, what 和其它连接代词或副词引导. 例如:

   A point of fundamental importance is that the strain gives us no direct evidence of the external forces that caused the deformation. 基本要点是，应变不是引起变形的外力的直接证据。

Comprehension Questions

1. What is the meaning of the word " petroleum "?
2. What is the essence of petroleum geology?
3. What are the fundamental geological requirements for the accumulation of oil and gas?
4. How do you understand "petroleum prospecting is an art"?

Lesson Two

Text

Concept of Facies

The first use of the term facies is generally attributed to Amanz Gressly, a Swiss geologist who applied it to lateral changes he observed within time-stratigraphic units of the Mesozoic. "Facies" is now somewhat broadened to include the total of both lithologic and biologic characteristics of a stratigraphic unit. It is also used in metamorphic rocks and even into biological sciences.

Beginning in the 1930s the term "facies" was used widely in classical stratigraphic studies. Applications to stratigraphy and to the analysis of the rock record were typically from either the lithologic or the paleontologic point of view. The former are called lithofacies and the latter are biofacies. Although such usage is still proper and is still applied, there has been a more environmental and genetic use of the term in recent years. We now typically speak of "reef facies," "delta-front facies," or "tidal flat facies." In other words, each environment, no matter how broad or restricted in its definition, is characterized by its own facies. For example, "fluvial facies" covers the broad spectrum of stream deposits, whereas "point-bar facies" is restricted to a particular sedimentary environment within the fluvial system.

The operational use of the term "facies" is therefore likely to be based on somewhat different characteristics in the modern environment than it might be in the rock record. [1]Characteristics of, and boundaries for, a modern sedimentary environment can be rather easily established using sediment parameters, biologic attributes if any, and sedimentary structures. Also, topography, water depth, and physical processes can be used in describing a modern facies. By contrast, the resulting rocks have only their preservable attributes, such as petrology, paleontology, sedimentary structures, and geometry, which geologists can use for the facies definition. It is not uncommon for sediments of adjacent and similar modern environments to exhibit the same or very similar appearance in the rock record. For example, it is often difficult to separate the beach and adjacent nearshore sediments in the rock records, as it may be to distinguish the fluvial from the deltaic facies. These potential problems provide yet another demonstration of the importance of a knowledge of modern sedimentary environments to the geologist working with the rock record, either on the surface or in the subsurface.

Probably the most important single concept that must be thoroughly understood and applied by the sedimentologist and stratigrapher was formulated by Johannes Walther in 1894.[2]He stated that "only those facies and facies-areas can be superimposed primarily which can be observed beside each other at the present time". Also called the Law of the Correlation (or Succession) of Facies, this fundamental principle of geology is used universally but with-out knowledge of its origin and is frequently misstated.

The practical use that is made of Walther's concept is the relationship between the lateral distribution of modern sedimentary facies and the vertical succession of facies in the rock record. It is common for the geologist who is examining the ancient record to experience some difficulty in interpreting depositional environments, due perhaps to lack of experience, absence of diagnostic criteria, or a multitude of other reasons. Perhaps one or two paleoenvironments can be recognized with some degree of certainty, but overlying and underlying ones cannot. Use of Walther's law enables one to make a logical interpretation of the stratigraphic succession. Typically, lagoons separate barriers from the coastal plain, and the inner shelf or shoreface is seaward of a barrier. It is axiomatic ,therefore, that the vertical succession of environments or facies must reflect these relationships (Fig.1); if it does not, the succession may contain interruptions such as the erosion of some facies.

Detailed studies of the broad spectrum of modern environments and the stratigraphic record have shown that there is a limited number of associations of lithology, structures, fossils, and so on. As a result, a number of sedimentary depositional models exists which characterizes various sedimentary environments. Models of modern environments may be characterized by their lateral surficial associations, whereas emphasis on the ancient record is in the vertical sequence. Walther's Law is applied in order to properly understand the relationships between adjacent or related modern depositional systems and their counterparts preserved in the rock record.

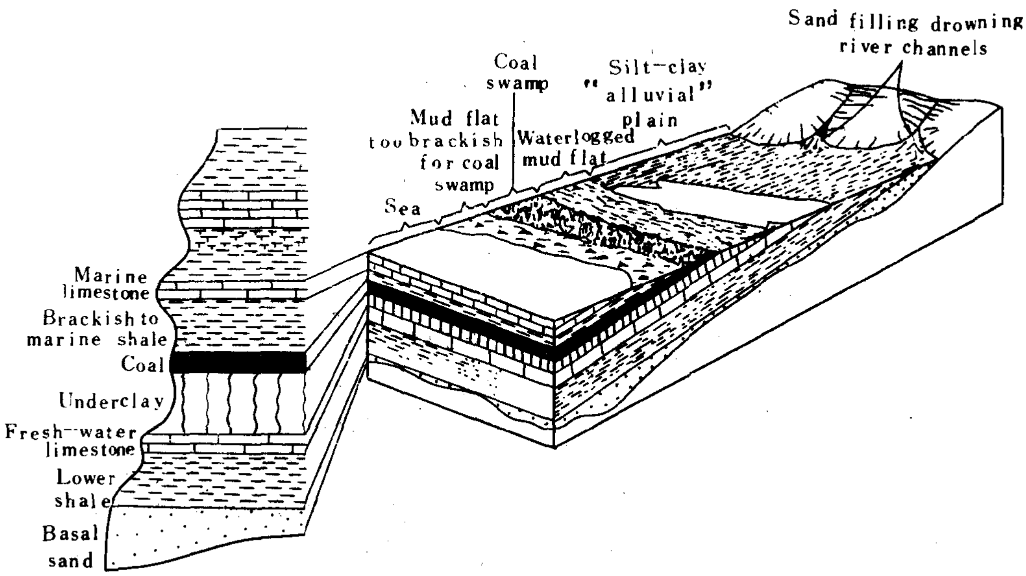

Fig.1 Diagram showing modern sedimentary environments and their relationship to stratigraphic succession in the rock record (From Shaw, 1964).

In order to accumulate a vertical sequence of changing rock types, changes must have taken place which caused the spatial shifting of the sedimentary environments that produced these rocks. [3]The shift may be accomplished, for example, by tectonic activity, which in turn may cause sea level to change, or which may cause the relief to change; it may be caused by glacial activity, which can also change sea level and change climate, or by any other phenomena which will cause sedimentary environments to be displaced in space during time.

An association of environments which is useful as an illustration is found along the marine coast and related shelf. Commonly, a coastal plain is bounded by a lagoon or estuary, barrier island, nearshore, and shelf environments as one proceeds seaward. A major change in sea level will cause these environments to shift in response to the moving shoreline. Two basic si tuations exist: **progradation (regression)**as the shoreline moves seaward or **retrogradation (transgression)**as the shoreline moves landward. Most discussions on this topic center around transgression and regression, with sea level implied as rising in the former and being lowered in the latter. Another equally important consideration in the movement of the shoreline is the amount of sediment being transported to the coast. It is not uncommon for coastal deposits to build seaward or prograde during rising sea level, such as in a delta or in some barrier islands. As a result,"transgression"will be used in this text to refer to the situation of landward movement of the shoreline and"progradation"will be used in reference to the seaward migration of the shoreline. In either case the vertical succession of environments or facies shows those environments which are geographically adjacent to be stratigraphically adjacent. The sequence will be reversed but the relationships are the same (Fig.2). In a progradational situation the shallow water or the landward environments are on the top of the sequence, and in a retrogradational or transgressive sequence the deeper–water environments are on top at a given locality.

Depositional systems that are not coastal or marine undergo similar shifts, which result in similar sequences. For the most part the commonly preserved sequence is a progradational situation where one environment migrates over another. For example, in an arid region of at least moderate relief, one might find playa lake deposits over which dunes have migrated and an alluvial fan might cover the dunes. Again, environments which are geographically juxtaposed become vertically arranged in the stratigraphic record at a given locality.

A prograding marine model contains all those environments mentioned above and more. In addition to the textural and mineralogical parameters of the sediment, one must consider sedimentary structures, sediment body geometry, and biogenic constituents. This example represents the general types of successions that may be encountered in the rock record and also the criteria that are used to characterize them. It should be observed that these examples are general ones; many others have been formulated. In examining stratigraphic sequences for features that will be of value in environmental reconstruction, the geologist should utilize all the data available.

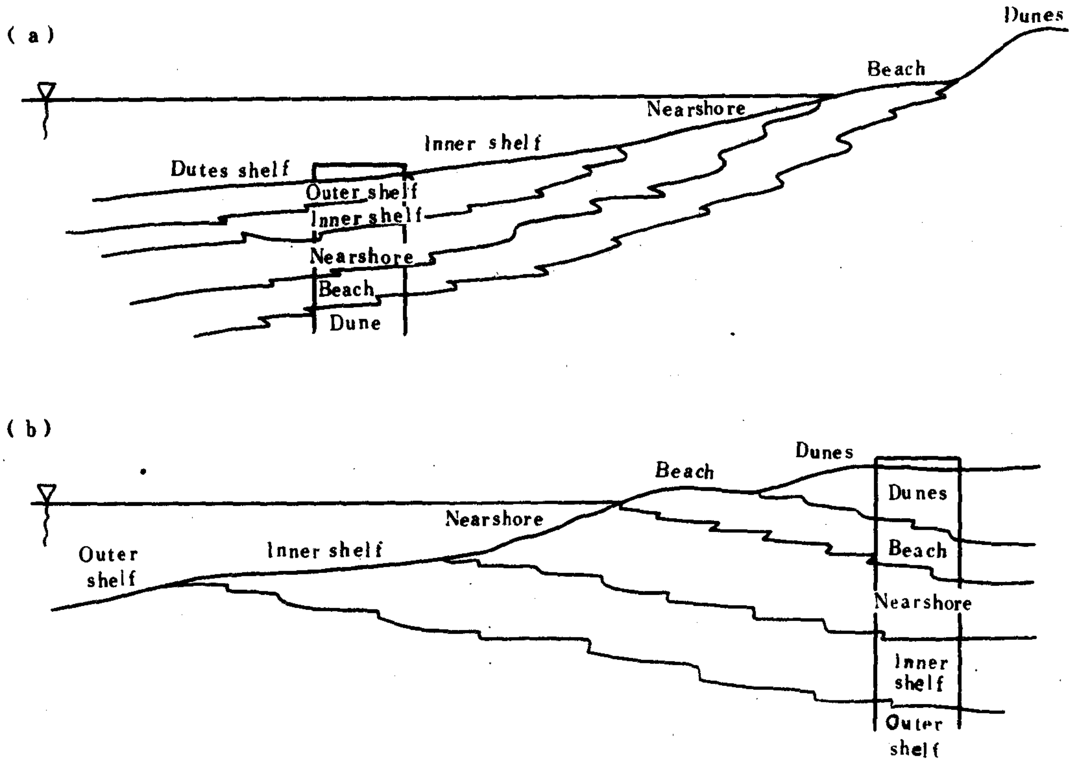

Fig.2 Generalized diagram depicting (a) a transgressive sequence and (b) a progradational sequence. A typical stratigraphic section is designated for each.

From *Depositional Systems by*
Richard A. Davis

New words and Expressions

attribute(to)	[ə'tribju:t]	v. 把…归因于
Mesozoic	[mesəu'zəuik]	n. & .a.中生代(的)，中生界(的)
lithologic	[liθə'lɔdʒik]	a. 岩性的
lithofacies	[liθə'feiʃii:z]	n. 岩相
biofacies	['baiəu'feiʃii:z]	n. 生物相
delta-front		三角洲前缘
fluvial	['flu:viəl]	a. 河流的
spectrum(sing.)	['spektrʌm]	n. 范围，光谱
spectra(pl.)	['spektrə]	
point-bar		曲流沙坝，点沙坝
criterion(sing.)	[krai'tiəriən]	n. 标准，准则
criteria(pl.)	[krai'tiəriə]	

parameter	[pə'ræmitə]	n. 参数，参量
topography	[tə'pɔgrəfi]	n. 地形学，地形测量学
preservable	[pri'zə:vəbl]	a. 可保存的
petrology	[pi'trɔlədʒi]	n. 岩石学
geometry	[dʒi'ɔmitri]	n. 几何学
superimpose(on)	['sju:pərim'pəuz]	v. 叠加，加上
succession	[sək'seʃən]	n. 连续，序列
misstate	['mis'steit]	v. 谎报，伪称
depositional	[depə'ziʃənl]	a. 沉积的
diagnostic	[daiəg'nɔstik]	a. 特征的，有鉴定意义的
multitude	['mʌltitju:d]	n. 大量，众多
lagoon	[lə'gu:n]	n. 泻湖
barrier	['bæriə]	n. 堡坝，海岸沙坝，障壁
axiomatic	[æksiə'mætik]	a. 自明的，理所当然的
association	[ə səuʃi'eiʃən]	n. 联合，组合
counterpart	['kauntəpɑ:t]	n. 对应物
compile	[kəm'pail]	v. 编辑，汇编
come into being		形成，产生
shift	[ʃift]	n.& v. 移动，变位
estuary	['estjuəri]	n. 海湾，河口湾
in response to		响应…
progradation	[prəugrei'deiʃən]	n. 前积，进积，渐进作用
regression	[ri'greʃən]	n. 海退，回归
transgression	[træns'greʃən]	n. 海进，海侵，超复
retrogradation	[retrəugrə'deiʃən]	n. 退积，海岸线后退
arid	['ærid]	a. 干旱的
moderate	['mɔdərit]	a. 中等的，适度的
playa	['plɑ:jə]	n. 干盐湖
alluvial fan		冲积扇
juxtapose	['dʒʌkstəpəuz]	v. 使…并置
encounter	[in'kauntə]	v. 遇到
formulate	['fɔ:mjuleit]	v. 把…化成公式，系统地阐述

Notes

1. Characteristics of, and boundaries for, a modern sedimentary environment can be rather easily established using sediment parameters, biologic attributes if any, and sedimentary structures. 运用沉积物参数、生物属性(如果有的话)以及沉积构造，很容易确定现代沉积环境的特征和界线。a modern sedimentary environment 修饰 characteristics 与 boundaries. if any 是省略的状语从句，相当于 if there are (or is) any.

2. He stated that "only those facies and facies—areas can be superimposed primarily which can be observed beside each other at the present time." 他指出，"只有那些现在可以观察到的彼