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地质专业英语文选

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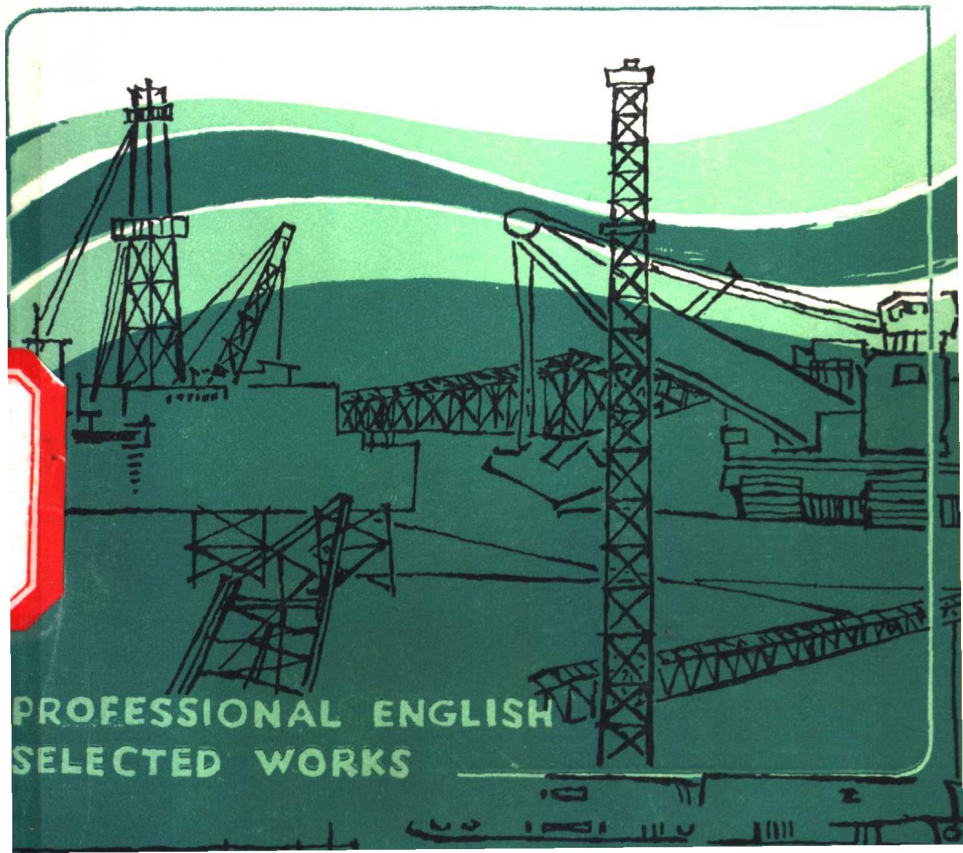

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南京大学外文系公共英语教研室编

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CONTENTS

31. THE AGE OF THE EARTH

Many scientists have estimated the age of the earth, starting from various postulates, but failed to determine it correctly because of false starting premises. The way to more realistic estimates① was opened by Becquerel's discovery of radioactivity (1896). A few elements, among them uranium and thorium, spontaneously disintegrate into lighter elements by changes in their nuclei that give rise to radiation of three kinds: alpha, beta, and gamma.② Alpha radiation is the emission of helium ions from the nucleus at speeds of thousands of kilometers per second, converting the original atom into another with atomic weight four units less.③ The emitted ions collide with those④ in the surroundings to produce considerable heat. Beta emission consists of electrons, derived from the breakdown of neutrons in the nucleus to form protons and the ejected electrons.⑤ Though the electron is ejected at an even higher speed than the alpha particle, its mass is so small that the heat produced by its collisions is negligible. Gamma rays are short X-rays, emitted with the speed of light.⑥

The emission of either alpha or beta particles from the nucleus of an unstable atom converts it into a different element. Thus an atom of U_{238} decays slowly through a series of seven intermediate daughter elements, all themselves radioactive, until a stable, nonradioactive isotope of lead, Pb_{206}, is produced.

The rate of disintegration is constant for each radioactive isotope, but rates differ greatly from one isotope to another.

Disintegration rates are expressed in terms of the half-life of a radioactive substance—the time required for half of its atoms to disintegrate.⑦ The half-life of some members of the U_{238} series is only a fraction of a second, but U_{238} itself has a half-life of 4,468 million years. Thus, of an initial gram of U_{238},⑧ only half a gram is left after 4,468 m.y.; after another 4,468 m.y., a quarter gram; and so on. The rest has changed into lead, helium atoms, electrons, and small amounts of intermediate elements in the decay series. Similarly, thorium, Th_{232}, with a half-life of 14,010 m.y., disintegrates to another stable isotope of lead, Pb_{208}. In no experiment has the disintegration rate been changed by heat, pressure, state of chemical combination of the element, or time.⑨ The half-life of a radioactive element is thus considered a constant.

Many minerals—most comparatively rare—contain measurable amounts of uranium, thorium, or both. By analyzing such minerals for the ratio of radiogenic lead isotopes to radioactive parental isotopes,⑩ the age of the mineral can be computed. Obviously, the minerals analyzed⑪ must be absolutely fresh, for circulating solutions might have leached out lead and its parental isotopes at different rates, thus producing great errors in the calculated age.

Uranium and thorium are relatively rare elements, found in but few minerals in quantities adequate for analysis. Radiometric dating began with them, and suitable materials containing them are still avidly sought. In 1948, however, it was found that the very common element potassium, also known to be radioactive, can be used in geochronology; K-bearing minerals are abundant in many rocks and consequently radiometric dating has advanced briskly in the past 30 years.

It is now probable that the earth's crust is at least 4580 m.y. old; rocks of this age have been reported in eastern Siberia. Simple organisms such as bacteria and algae have been found fossil in rocks more than 3000 m.y. old,⑫ and multicelled organisms have existed since late in Precambrian time, more than 600 m.y. ago. Some meteorites have given ages as great as 4600 m.y. — an age that many workers think from this and other evidence is the approximate age of the earth as a plannet.

词　汇

fail [feil] *v.i.* 未能，没能
false [fɔ:ls] *a.* 假的，错误的
premise ['premis] *n.* 前提
realistic [ri:ə'listik] *a.* 现实的
Becquerel ['bekwərəl] *n.* 贝克勒尔（科学家名）
radioactivity ['reidiəuæk'tiviti] *n.* 放射性
thorium ['θɔ:riəm] *n.* 钍
spontaneously [spɔn'teinjəsli] *ad.* 自然地，天然地
nuclei ['nju:kliai] *n.* 原子核(nucleus 的复数)
radiation [reidi'eiʃən] *n.* 放射
alpha ['ælfə] *n.* α(射线)
beta ['bi:tə] *n.* β(射线)
gamma ['gæmə] *n.* γ(射线)
emission [i'miʃən] *n.* 发射
ion ['aiən] *n.* 离子
kilometer ['kiləmi:tə] *n.* 公里
per [pə:] *prep.* 每
second ['sekənd] *n.* 秒
atom ['ætəm] *n.* 原子
atomic [ə'tɔmik] *a.* 原子的
emit [i'mit] *v.t.* 发射
collide [kə'laid] *v.i.* 碰撞
surrounding [sə'raundiŋ] *a.* 周围的
electron [i'lektrɔn] *n.* 电子
derive [di'raiv] *v.t.* 得来
breakdown ['breikdaun] *n.* 分裂，断裂
neutron ['nju:trɔn] *n.* 中子
proton ['prəutɔn] *n.* 质子
eject [i'dʒekt] *v.t.* 发射
collision [kə'liʒən] *n.* 碰撞
negligible ['neglidʒibl] *a.* 很小的，可以忽视的
ray [rei] *n.* 射线
unstable ['ʌn'steibl] *a.* 不稳定的
decay [di'kei] *v.i.* 衰变
daughter ['dɔ:tə] *n.* 女儿
stable ['steibl] *a.* 稳定的
nonradioactive ['nɔn'reidiə'æktiv] *a.* 无放射性的
isotope ['aisotəup] *n.* 同位素
disintegration [dis,inti'greiʃən] *n.* 蜕变
express [iks'pres] *v.t.* 表示
require [ri'kwaiə] *v.t.* 需要
m. y. = million years 百万年
initial [i'niʃəl] *a.* 最初的，开始的
gram [græm] *n.* 克

similarly ['similəli] *ad.* 同样
experiment [iks'periment] *n.* 实验
measurable ['meʒərəbl] *a.* 可测量的，适度的
analyze ['ænəlaiz] *v.t.* 分析
ratio ['reiʃiəu] *n.* 比，比率
radiogenic ['reidiəu'dʒenik] *a.* 放射产生的
parental [pə'rentl] *a.* 母的，父母的
compute [kəm'pju:t] *v.t.* 计算
obviously ['ɔbviəsli] *ad.* 明显地
absolutely ['æbsəlu:tli] *ad.* 绝对地
fresh [freʃ] *a.* 新鲜的
circulating ['sə:kjuleitiŋ] *a.* 流动的
leach [li:tʃ] *v.t.* & *v.i.* 滤，溶化
error ['erə] *n.* 过错，误差
adequate ['ædikwit] *a.* 适当的，足够的
radiometric ['reidiə'metrik] *a.* 放射性计算的
suitable ['sju:təbl] *a.* 适合的，适当的
avidly ['ævidli] *ad.* 渴望
geochronology ['dʒiokrə'nɔlədʒi] *n.* 地质年代学
k-bearing ['kei'beəriŋ] *a.* 含钾的
consequently ['kɔnsikwəntli] *ad.* 因此
briskly ['briskli] *ad.* 迅猛地，兴旺地
probable ['prɔbəbl] *a.* 或许的，大概的
least [li:st] *n.* 最少，最小
report [ri'pɔ:t] *v.t.* 报道，报告
Siberia [sai'biəriə] *n.* 西伯利亚
bacteria [bæk'tiəriə] *n.* 细菌(bacterium 的复数)
algae ['ældʒi:] *n.* 藻类 (alga 的复数)
multicelled [,mʌlti'seld] *a.* 多细胞的
Precambrian ['pri:'kæmbriən] *a.* 前寒武纪的
meteorite ['mi:tiərait] *n.* 陨石
planet ['plænit] *n.* 行星

词　组

(to) start from 从...出发
(to) fail to 未能，没能
(to) disintegrate into 衰变成
(to) give rise to 产生
(to) collide with 与...碰撞
a series of 一系列的
(to be) expressed in terms of 用...来表示
and so on 等等，以此类推
the ratio of...to... ...与...之比
(to) leach out 滤去，溶化掉
(to) begin with 以...开始
it is probable that 也许...
at least 至少
(to) give ages as great as 年龄高达...

注　释

1. to more realistic estimates 是修饰 the way 的介词短语.
2. A few elements, among them uranium and thorium, spontaneously

disintegrate into lighter elements by changes in their nuclei that give rise to radiation of three kinds: alpha, beta, and gamma.

这句中，that ... gamma 是修饰 changes 的定语从句. 此外，本句的主语和谓语之间还有一个解释性的插入语 among them uranium and thorium，这个插入语相当于一个语序倒装的省略句，即 among them are uranium and thorium，其中 them 指 a few elements. 整个插入语的意思是："在这些元素中有铀和钍".

3. converting the original atom into another with atomic weight four units less 是现在分词短语，作句子的结果状语，其中 with ... less 是修饰 another 的定语，此处 another 指 another atom.
4. those 此处代 ions.
5. derived from the breakdown of neutrons in the nucleus to form protons and the ejected electrons 是过去分词短语，在句中作非限制性定语，修饰 electrons，其中 to form ... electrons 则是修饰 the breakdown 的不定式短语.
6. emitted with the speed of light 是修饰 x-rays 的分词短语.
7. required for half of its atoms to disintegrate 是修饰 the time 的过去分词短语，其中的不定式 to disintegrate 用作目的状语，half of its atoms 是不定式的逻辑主语，介词 for 则是表示这种作用的符号，失去介词本身的词汇意义.
8. of an initial gram of U_{238} 是作状语用的介词短语，此处 of 表示部分与整体的关系，通常可译作"在...中".
9. In no experiment has the disintegration rate been changed by heat, pressure, state of chemical combination of the element, or time.

这是倒装句. 当一个句子以包含有 no 的状语开头时，句子多用倒装语序. 这句子的自然语序是：In no experiment the disintegration rate has been changed by ... or time. 全句的意思为："在实验中，裂变速度从未因热、压力、元素的化合状态或时间而产生任何的变化".

10. for the ratio of radiogenic lead isotopes to radioactive parental isotopes 是动名词 analyzing 的目的状语，介词 for 此处作"找出"解.
11. analyzed 是过去分词，此处作定语，修饰 the minerals.
12. fossil in rocks more than 3000 m. y. old 是主语 bacteria 和 algae 的补足语.

32. CONTINENTAL DRIFT

In the early part of the twentieth century, Alfred Wegener, the German Meteorologist, became impressed by the similarity of opposing coastlines — a "jigsaw puzzle fit" of the shorelines of Africa and South America.① Wegener found the problem intriguing and for several years gathered data on ancient climates, paleontology, and the structural history of the continents. In 1915, Wegener put forth his observations and interpretations in a book entitled "The Origin of Continents and Oceans". He proposed that the present continents once comprised one large landmass which he named Pangaea.

According to Wegener, Pangaea began to break apart and the individual continents started to move toward their present positions during the Mesozoic Era. Wegener's work also provided evidence of movement of the earth's rotational poles relative to Pangaea.② It is now believed that there is both a shift of the crust of the earth relative to the poles, as well as displacement of individual continents.

Wegener's book created a storm of controversy among geologists and geophysicists. Most of them rejected Wegener's conclusions and the evidence supporting continental drift③ because the author had failed to offer a really convincing mechanism, and because of some minor errors and inconsistencies.

In the 1950s, the results of measurements of the earth's ancient magnetic field provided quantitative evidence of both continental drift and movement of the poles relative to the con-

tinents. At the same time, an Australian geologist showed that the outlines of South America and Africa matched almost exactly at a depth of 2000 m below sea level. At this depth, approximately half-way down the continental slope, both erosion and deposition would have been minimal since the formation of the continental margins.④

The majority of earth scientists did not support the concept of continental drift, however, until the publication of the studies on marine geomagnetic anomalies associated with mid-ocean ridges, such as the Mid-Atlantic Ridge and East Pacific Rise.⑤ These studies provided convincing evidence for the movement of large blocks of sea floor relative to one another. In 1960, Harry Hess was the first to propose the term of sea-floor spreading,⑥ which describes the movement of sea-floor's blocks relative to one another in response to the motion of convection currents within the mantle.

In 1968, W. Jason Morgan introduced the concept of plate tectonics in which the earth's crust is considered to be divided into a series of rigid plates bounded by mid-oceanic ridges, oceanic trenches, great faults, and active fold belts. According to this theory the movements of the continents and the sea-floor are part of large-scale movements of plates.

词　汇

Alfred Wegener ['ælfrid 'vegnə] 阿尔弗来德·魏格纳(人名)
German ['dʒə:mən] *a.* 德国的
meteorologist [ˌmi:tjə'rɔlədʒist] *n.* 气象学家
impress [im'pres] *v.t.* 给...留下印象
similarity [ˌsimi'læriti] *n.* 类似，相似
opposing [ə'pəuziŋ] *a.* 相对的，对立的
coastline ['kəustlain] *n.* 海岸线
jigsaw puzzle ['dʒigsɔ: 'pʌzl] *n.* 类似益智分合图或七巧版的一种

玩具
fit [fit] *n.* 适合，吻合
shoreline ['ʃɔ:lain] *n.* 海岸线
Africa ['æfrikə] *n.* 非洲
problem ['prɔbləm] *n.* 问题
intriguing [in'tri:giŋ] *a.* 引起兴趣的
gather ['gæðə] *v.t.* 搜集，聚集
structural ['strʌktʃərəl] *a.* 构造的
put [put] *v.t.* 提出，放
forth [fɔ:θ] *ad.* 向前方，向前
entitle [in'taitl] *v.t.* 给(书、文章)题名
propose [prə'pəuz] *v.t.* 提出，提议
landmass ['lænd'mæs] *n.* 陆块
Pangaea ['pæŋdʒi:ə] *n.* 联合大陆
apart [ə'pɑ:t] *ad.* 分离，分开
rotational [rəu'teiʃənl] *a.* 旋转的
pole [pəul] *n.* 极
shift [ʃift] *n.* 移动，位移
storm [stɔ:m] *n.* 风暴
controversy ['kɔntrəvə:si] *n.* 争论
geophysicist ['dʒiəu'fizisist] *n.* 地球物理学家
reject [ri'dʒekt] *v.t.* 拒绝，否决
author ['ɔ:θə] *n.* 作者
fail [feil] *v.t.* 没能，未能
offer ['ɔfə] *v.t.* 提出，提供
mechanism ['mekənizəm] *n.* 机理，机制
inconsistency [ˌinkən'sistənsi] *n.* 矛盾，不一致
quantitative ['kwɔntitətiv] *a.* 量的，数量的
Australian [ɔs'treiljən] *a.* 澳大利亚的
outline ['autlain] *n.* 外形，外廓
match [mætʃ] *v.t.* 相称，相吻合
exactly [ig'zæktli] *ad.* 确切地，精确地
approximately [ə'prɔksimeitli] *ad.* 大约，大概
half-way ['hɑ:f'wei] *a.* 半途
minimal ['miniməl] *a.* 极微的
until [ʌn'til] *prep.* 直到
publication [ˌpʌbli'keiʃən] *n.* 发表，出版
geomagnetic [ˌdʒiəumæg'netik] *a.* 地磁的
anomaly [ə'nɔməli] *n.* 异常
Harry Hess ['hæri'hes] 哈利·赫斯(人名)
spreading ['spreding] *n.* 扩张，伸开
response [ris'pɔns] *n.* 答复，响应
convection [kən'vekʃən] *n.* 对流
Jason Morgan ['dʒeisn 'mɔ:gən] 杰逊·摩尔根(人名)
plate [pleit] *n.* 板块
tectonics [tek'tɔniks] *n.* 构造学
rigid ['ridʒid] *a.* 坚固的，硬的
bound [baund] *v.t.* 形成…的边界
belt [belt] *n.* 地带，区

词 组

in the early part of 在初期
(to) become impressed by 对…印象深刻
jigsaw puzzle fit 镶嵌吻合，益智分合图的吻合
(to) put forth 提出
(to) break apart 分离
(to) creat a storm of controversy 引起激烈的争论
(to) fail to 未能

in the 1950s 在50年代　　*in response to* 与...相应
at the same time 同时

注　释

1. a "jigsaw puzzle fit" of the shorelines of Africa and South America 是 the similarity of opposing coastlines 的同位语，其中的词组 a "jigsaw puzzle fit"原指"象益智分合图那样的吻合"，此处借用来表示"镶嵌吻合"的意思.
2. relative to Pangaea 是作定语用的形容词短语，修饰 movement.
3. supporting continental drift 是修饰 the evidence 的分词短语.
4. At this depth, approximately half-way down the continental slope, both erosion and deposition would have been minimal since the formation of the continental margins.
   这句的谓语动词 would have been 是虚拟语气，用 have been 表示对过去事物的推断.
5. The majority of earth scientists did not support the concept of continental drift, however, until the publication of the studies on marine geomagnetic anomalies associated with mid-ocean ridges, such as the Mid-Atlantic Ridge and East Pacific Rise.
   这是主从复合句，主句在前，后面是由连接词 until 引导的时间状语从句. 注意 not ... until 意思是"直到...才"，因此本句可译为："然而，直到有关洋中脊，例如大西洋中脊和东太平洋隆起，与海洋地磁异常的研究成果发表以后，多数地学家才支持大陆漂移的学说".
   又如: I did not know his name until a few years ago (直到不多几年以前，我才知道他的名字).
6. Harry Hess was the first to propose the term of sea-floor spreading.
   句中，the first 作"第一个人"解，不定式短语 to propose ... spreading 则是修饰 the first 的定语.

33. GLOBAL PLATE TECTONICS

In this new synthesis, three units in the Earth's interior are emphasized. The *asthenosphere* corresponds approximately to the low-velocity zone, occurs in the upper mantle, has a thickness of a few hundred kilometers, and is considered to be a zone of weakness in which slow plastic flow can occur. The *lithosphere*, some 50 to 100 km or more in thickness, lies on the asthenosphere, is made of crust and uppermost mantle, and is a relatively strong unit. The *mesosphere* comprises the rest of the mantle below the asthenosphere and may not be actively involved in the tectonic processes that occur nearer the surface.

Recent, more precise data on the locations of earthquake epicenters show them aligned in relatively narrow, nearly continuous belts,① whereas earthquakes tend to be infrequent within the wide expanses between the belts. This observation, together with other clues, has led to the widely held view that the lithosphere is subdivided into a number of large movable plates that can slide gradually across the top of the underlying weak asthenosphere;② the lines of earthquake epicenters mark the boundaries of these plates. The lithospheric plates differ in both size and shape, and some uncertainty exists concerning precise shapes and exact numbers③—as few as six in one view, but as many as twenty in another. Since the boundaries of the plates do not necessarily coincide with present-day boundaries between continents and oceans, the top of a lithospheric plate may be for-

med by a continent, by part of the sea floor, or by a mixture of continent and ocean. Moreover, since plates may form in one place (at a mid-ocean ridge) and be destroyed in another (at a deep-sea trench), the plates of today are presumably not the plates of long ago.

Since about all of the deep-sea floor seems to have formed during the Cenozoic and Mesozoic Eras, it follows that an equivalent amount of older sea floor has been destroyed during this same interval .

Apparently these huge lithospheric plates tend to interact in three general ways. Two or more plates may move laterally away from a spreading ocean ridge where new oceanic crust is being formed continuously.④ Earthquake activity is confined to a rather shallow surface zone along such belts of divergence. Elsewhere, two plates may shift toward each other and converge along a deep-sea trench and island arc. Here one of the plates tends to move downward at a slant beneath the arc and trench, which may explain why earthquake foci tend to occur along a plane that slants at about 45 degrees from a trench downward beneath an adjacent continent.⑤ In this region of convergence we find the deepest earthquakes, great topographic relief, and intensive volcanic activity. In the third general type of interaction, lithospheric plates slide past one another along major strikeslip faults.

Although the existence and movement of large lithospheric plates seems well established, the cause of the movement is uncertain. It is widely held that convection currents produce sea-floor spreading, continental drifting, and compression at deep-sea trenches; however, a number of problems remain.

词　汇

global ['gləubəl] *a.* 全球的,球形的
emphasize ['emfəsaiz] *v.t.* 强调
asthenosphere [æs'θenəsfiə] *n.* 软流圈
correspond [ˌkɔris'pɔnd] *v.i.* 相当
velocity [vi'lɔsiti] *n.* 速度
upper ['ʌpə] *a.* 上部的
kilometre ['kiləmi:tə] *n.* 公里，千米（略作 km.）
uppermost ['ʌpəməust] *a.* 最上的，最高的
mesosphere ['mesəsfiə] *n.* 中间圈，中层
precise [pri'sais] *a.* 精确的,准确的
epicenter ['episentə] *n.* 震中
align [ə'lain] *v.i.* 排列
infrequent [in'fri:kwənt] *a.* 很少发生的,稀罕的
wide [waid] *a.* 广阔的
expance [iks'pæns] *n.* 宽阔，地段
held [held] *v.t.* 持有（见解）(hold 的过去分词)
movable ['mu:vəbl] *a.* 可移动的
slide [slaid] *v.i.* 滑动
uncertainty [ʌn'sə:tnti] *n.* 不确定
necessarily ['nesisərili] *ad.* 必定，必然
coincide [ˌkəuin'said] *v.i.* 一致，相符
mixture ['mikstʃə] *n.* 混合,混合物
destroy [dis'trɔi] *v.t.* 破坏
equivalent [i'kwivələnt] *a.* 相等的，相同的
interact [ˌintə'rækt] *v.i.* 互相作用，互相影响
laterally ['lætərəli] *ad.* 向旁边，侧向
continuously [kən'tinjuəsli] *ad.* 连续地，不断地
shallow ['ʃæləu] *a.* 浅的
divergence [dai'və:dʒəns] *n.* 扩散，趋异
converge [kən'və:dʒ] *v.i.* 聚合，会聚
arc [a:k] *n.* 弧
downward ['daunwəd] *ad.* 向下
slant [sla:nt] *n.* & *v.t.* 倾斜
explain [iks'plein] *v.t.* 解释
foci ['fəusai] *n.* 震源 (focus 的复数)
adjacent [ə'dʒeisənt] *a.* 邻近的
convergence [kən'və:dʒəns] *n.* 聚合，会聚
relief [ri'li:f] *n.* (地势的) 起伏
intensive [in'tensiv] *a.* 强烈的
interaction [ˌintə'rækʃən] *n.* 相互作用，相互影响
strikeslip ['straik'slip] *n.* 走向
establish [is'tæbliʃ] *v.t.* 确定，建立
cause [kɔ:s] *n.* 原因，起源
uncertain [ʌn'sə:tn] *a.* 不确定的
compression [kəm'preʃən] *n.* 压缩

词　组

(to) correspond to 相当于
(to be) made of 由...组成，由...构成
(to be) involved in 涉及，卷入