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专业英语基础丛书

Advanced GEOGRAPHY through diagrams

地理学专业英语基础

（图示教程）

Garrett Nagle
Kris Spencer

上海外语教育出版社
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OXFORD REVISION GUIDES

A Level

Advanced

GEOGRAPHY

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OXFORD
UNIVERSITY PRESS

图书在版编目（CIP）数据

地理学专业英语基础 /（英）奈格尔，（英）斯宾莎编；李道季译注. —上海：上海外语教育出版社，2000
（牛津专业英语基础丛书）
ISBN 7-81046-870-7

Ⅰ. 地… Ⅱ. ①奈…②斯…③李… Ⅲ. 地理学-英语 Ⅳ. H31

中国版本图书馆CIP数据核字（2000）第49737号

图字：09-1999-312号

出版发行：上海外语教育出版社
（上海外国语大学内） 邮编：200083
电　　话：021-65425300（总机），65422031（发行部）
电子邮箱：bookinfo@sflep.com.cn
网　　址：http://www.sflep.com.cn　http://www.sflep.com
责任编辑：孙　玉

印　　刷：上海市印刷三厂
经　　销：新华书店上海发行所
开　　本：880×1230　1/16　印张 12　字数 379 千字
版　　次：2000年 11 月第 1 版　2000年 11 月第 1 次印刷
印　　数：5 000 册

书　　号：ISBN 7-81046-870-7 / K · 038
定　　价：20.00 元
本版图书如有印装质量问题，可向本社调换

OXFORD
UNIVERSITY PRESS
Great Clarendon Street, Oxford OX2 6DP

Oxford University Press is a department of the University of Oxford.
It furthers the University's objective of excellence in research, scholarship,
and education by publishing worldwide in

Oxford New York

Athens Auckland Bangkok Bogotá Buenos Aires Calcutta
Cape Town Chennai Dar es Salaam Delhi Florence Hong Kong Istanbul
Karachi Kuala Lumpur Madrid Melbourne Mexico City Mumbai
Nairobi Paris São Paulo Singapore Taipei Tokyo Toronto Warsaw

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To Angela

ISBN 0 19 913404 9 Student's Edition
First published 1997
New Edition 1998
Reprinted in 1999

ISBN 0 19 913405 7 Bookshop Edition
First published 1997
New Edition 1998
Reprinted in 1999

出 版 前 言

1999年出版的《大学英语教学大纲(修订本)》明确提出，“学生在完成基础阶段的学习任务，达到四级或六级后，都必须修读专业英语”。这是大纲修订组在对用人单位进行了广泛调查的基础上，结合英语学习的规律，对大学英语教学提出的新要求。因此，目前国内急需一套内容全面、语言地道的专业英语教材和读物。

《牛津专业英语基础丛书》原版由牛津大学提供，包括物理学、化学、生物学、人体生物学、商务、地理学、心理学、经济学等8种。该丛书原为英国A-level(相当于大学预科)考试的复习用书。书中以图表的形式，归纳整理了学科的主要知识。其中不仅包括常用的专业词汇和句型，还有连贯的短文，十分适合作为大学生专业英语的自学教材。

为了方便读者使用，本社约请了复旦大学、华东理工大学、华东师范大学、上海理工大学、上海财经大学等高校有关专业既有专业特长，又精通英语的教授对该丛书作了详细的注释，并给难读的单词加注了音标。

本丛书既能帮助大学生复习巩固专业知识，又能提高专业英语水平，还可以作为有关专业的人员提高专业阅读和翻译能力的教材或读物。

目　录

POPULATION
人口

SETTLEMENT
居住地

AGRICULTURE
农业

INDUSTRY
工业

The structure of the Earth

WORKING FROM THE CENTRE OUTWARDS

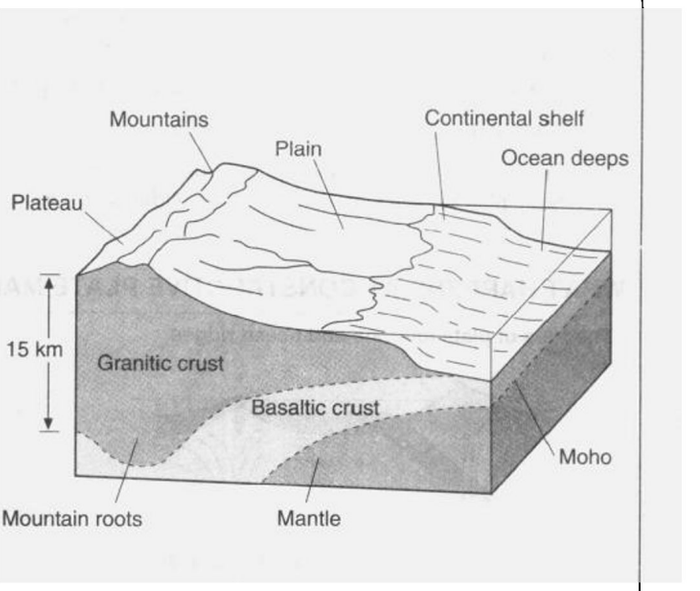
1 **Core:** Solid, consists of iron and nickel. Density about 13.6 g cm^{-3}, approximately five times more dense than surface rocks.

2 **Outer core:** Liquid, consists largely of iron. Density about 10–12 g cm^{-3}. It is believed that the earth's magnetic field is generated by movements in the liquid outer core.

3 **Mantle:** Solid, consists of lower density material (4–5 g cm^{-3}) known as peridotite, a material composed of silicate minerals. Approximately 2900 km thick, may be divided into two subdivisions, the upper and lower mantle.

4 **Crust:** Solid, divided into two different types, continental and oceanic crust. Depth varies from 10 to 35 km, density about 3 g cm^{-3}.

Continental crust is largely composed of granite and is sometimes referred to as *sial* due to the volume of *si*lica and *al*uminium in its make up. Continental crust is less dense than the basaltic oceanic crust (also known as *sima*, because of the *si*lica and *ma*gnesium in its make up) and also considerably thicker. It appears that the oceanic crust plunges down beneath the continental crust; the division between the two layers is known as the Conrad Discontinuity.

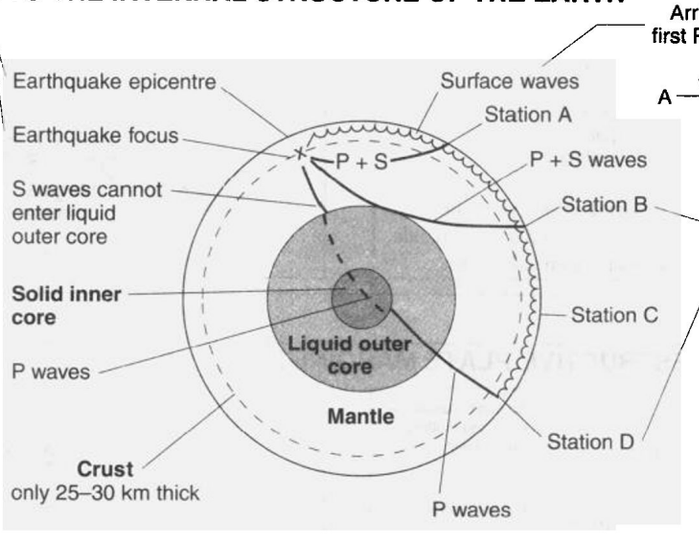


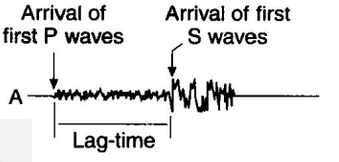
EVIDENCE RELATING TO THE INTERNAL STRUCTURE OF THE EARTH

Two types of waves produced:

- surface waves from epicentre
- body waves from focus - body waves can be divided into primary (P) waves and secondary (S) waves

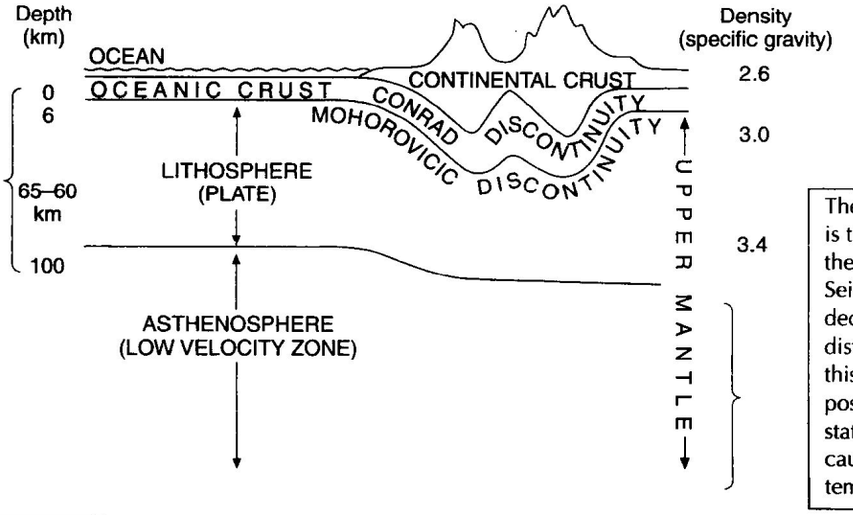
P waves travel in the Earth's crust at an average speed of 6.1 km/s. S waves travel at 4.1 km/s. S waves cannot travel through liquids.





P waves take 14 minutes to reach here, S waves take 25 minutes. At D there are no S waves, and the P waves arrive much more slowly than would be suggested by their normal speed through the mantle. The lack of S waves and the slowness of P waves suggests that the outer core is liquid.

The **lithosphere** is a relatively inflexible and bouyant layer. It is this layer which floats on the material underneath and as it moves carries the continents - the tectonic plates - that produce *continental drift*.



The **asthenosphere** is the layer below the lithosphere. Seismic waves decrease with distance through this region. This is possibly due to a state of flux caused by the high temperature.

Processes at plate margins

LANDFORMS AND PLATE TECTONICS

The lithosphere is divided into a number of large and small rigid plates. There are three types of boundary:
(i) divergent - where plates are moving apart at ocean ridges or continental rifts

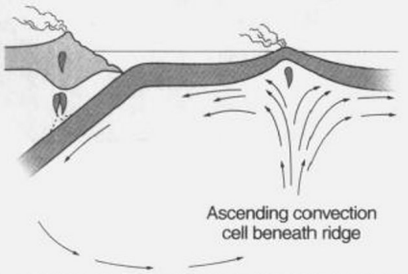
(ii) convergent - where plates are moving together and one plate is forced beneath another forming ocean trenches

(iii) transform or transcurrent - where plates are moving past each other and are neither constructive nor destructive

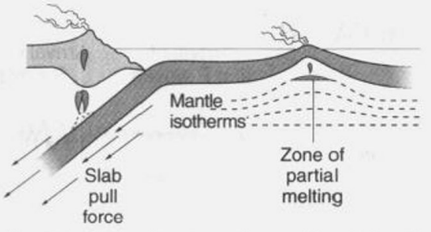
Diverging plates spread apart, splitting the crust. This is followed by the formation of new crust. They are therefore CONSTRUCTIVE. Converging plates involve major mountain building and subduction of the crust. They are known as DESTRUCTIVE.

WHAT HAPPENS AT CONSTRUCTIVE PLATE MARGINS?

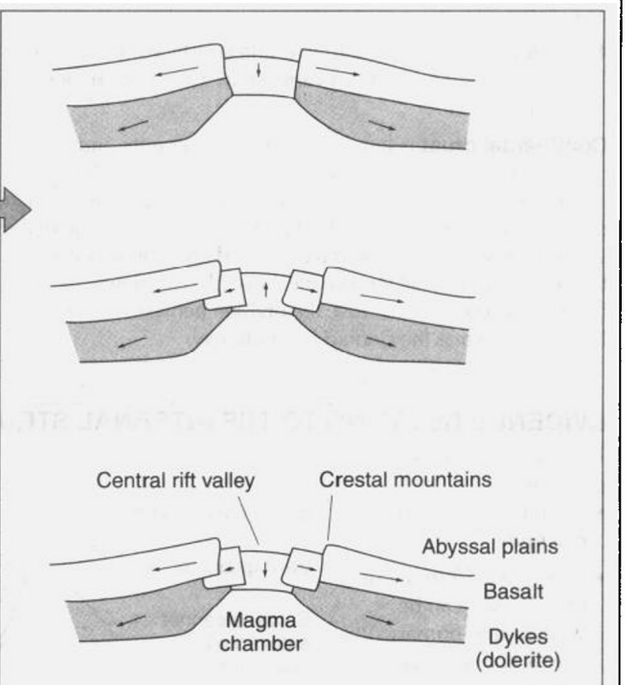
Theories of plate motions and ocean ridges



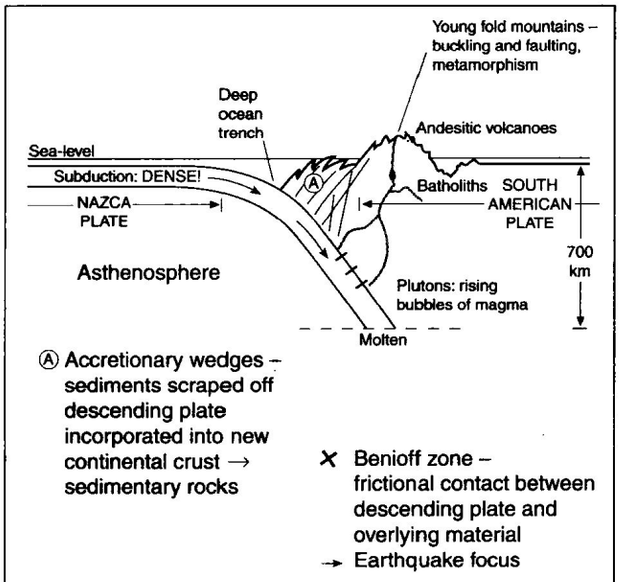
Theory 1 – 'ridge-push', whereby ascending convection cells push ridge upwards



Theory 2 – 'thinning', whereby a descending slab pulls the ocean lithosphere and stretches it. This extension causes mantle isotherms to rise so that melting and volcanism can occur.



WHAT HAPPENS AT DESTRUCTIVE PLATE MARGINS?

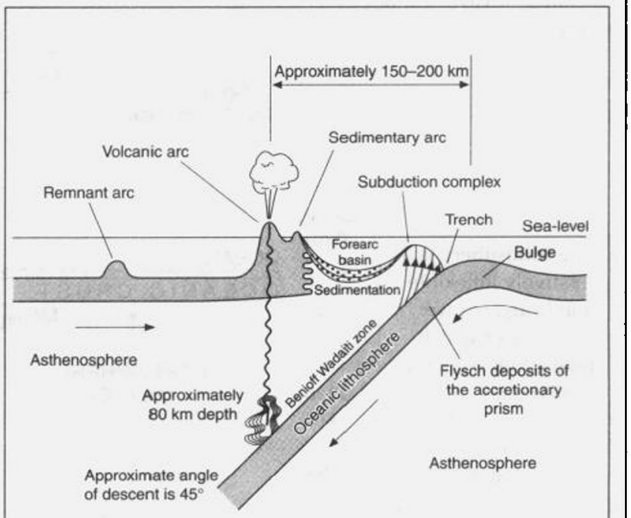


Ⓐ Accretionary wedges – sediments scraped off descending plate incorporated into new continental crust → sedimentary rocks

✕ Benioff zone – frictional contact between descending plate and overlying material

→ Earthquake focus

Fold mountains
Fold mountains are formed by extreme pressure which has folded and uplifted sedimentary rocks, often changing them metamorphically.

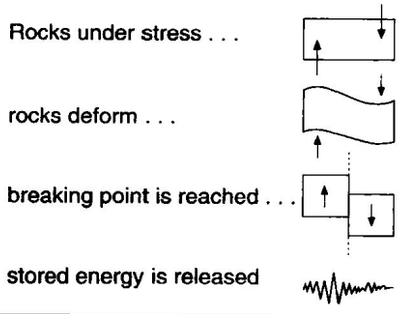


Island arcs
Arcs of islands form on the landward side of oceanic trenches, e.g. the Aleutian Islands.

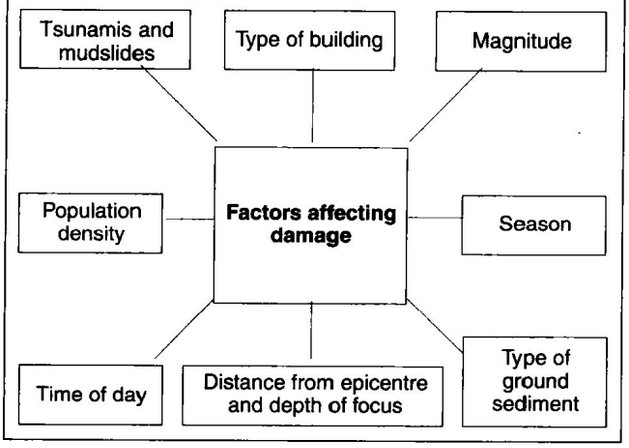
Earthquakes

CAUSES

Earthquakes occur when normal movements of the crust are concentrated into a single shock or a series of sudden shocks. Aftershocks occur later as stresses are redistributed. The sequence is as follows:



EARTHQUAKE DAMAGE



SHOCKWAVES

Waves associated with the focus

P waves: fast/compression
S waves: slower/distortion
} travel through the interior

Waves associated with the epicentre

Love and Rayleigh waves which travel on the surface and cause the damage.

PREDICTION

- Crustal movement.
- Historical evidence.
- Seismic activity.
- Minor quakes before 'The Big One'.
- Change in properties of ocean crust.
- Gas omissions from ground.
- Changes in electrical conductivity.

CASE STUDY: THE KOBE EARTHQUAKE

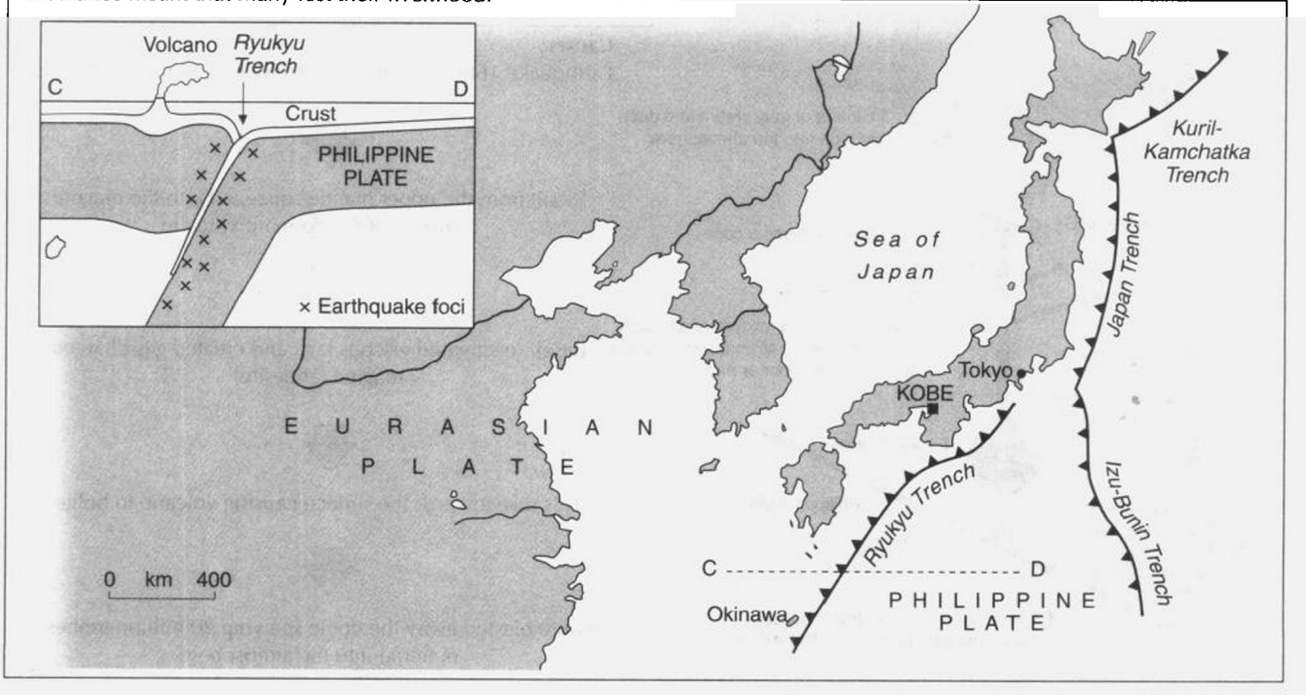
Details: 17th January 1995, killed over 5000 people, injured over 30,000, and made almost 750,000 homeless.

Causes: Philippine plate is being subducted beneath the Eurasian plate. Kobe is situated in a geographically complex area near the northern tip of the Philippine plate.

Secondary factors: Rain and strong winds increased landslide risk; damp, unhygienic conditions encouraged disease; fires, broken glass, broken water pipes, and lack of insurance meant that many lost their livelihood.

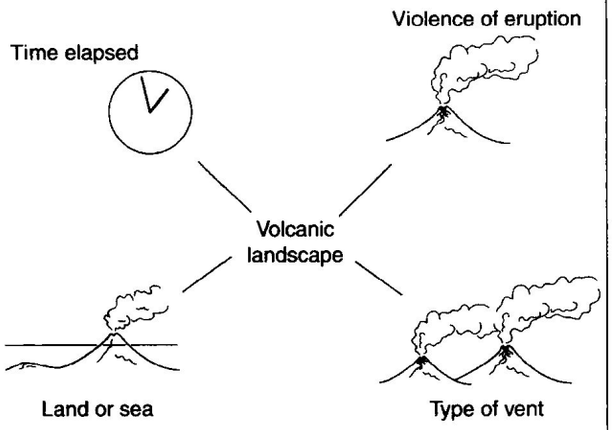
HUMAN IMPACT

- Mining - gold-mining in the Witwatersand area of South Africa has been blamed for frequent seismic activity because of changed rock stress.
- Reservoirs - previously an area free from tectonic tremors, the states of Nevada and Arizona in the USA experienced over 100 tremors in 1937 following the construction of the Hoover Dam and the creation of Lake Mead due to seepage.



Volcanoes

FACTORS AFFECTING VOLCANIC LANDSCAPES



Type of flow

Aa flow is a few metres thick; consists of two distinct zones - an upper rubbly part, and a lower massive part of solid lava which cools slowly.

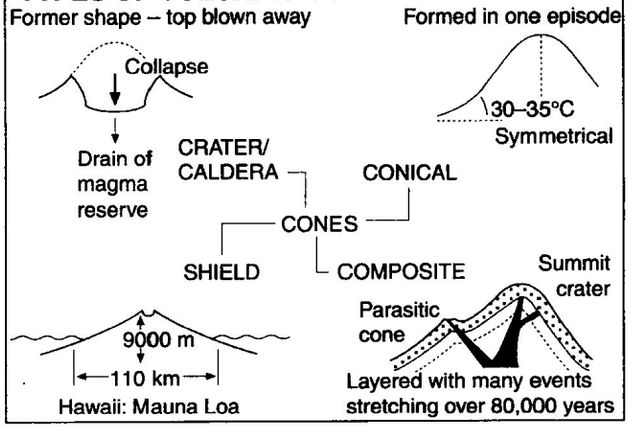
Pahoehoe flow is the least viscous of all lavas; rates of advance can be slow; cool surface, flow occurs underneath.

Nature of lava

Aa surfaces are a loose jumble of irregularly shaped cindery blocks with razory sides.

Pahoehoe surfaces can be smooth and glossy but may also have cavities; surface may also be crumpled with channels.

TYPES OF VOLCANIC CONES



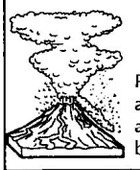
TYPES OF VOLCANIC ERUPTIONS

HAWAIIAN TYPE Runny basaltic lava which travels down sides in lava flows. Gases escape easily.

STROMBOLIAN TYPE Frequent gas explosions which blast fragments of fairly runny lava into air, to form cone.

VULCANIAN TYPE Violent gas explosions blast out plugs of sticky or cooled lava. Fragments build up cone of ash and pumice.

VESUVIAN (SUB-PLINIAN) TYPE Very powerful blasts of gas push ash clouds high into sky. Lava flows also occur. Ash falls to cover surrounding area.

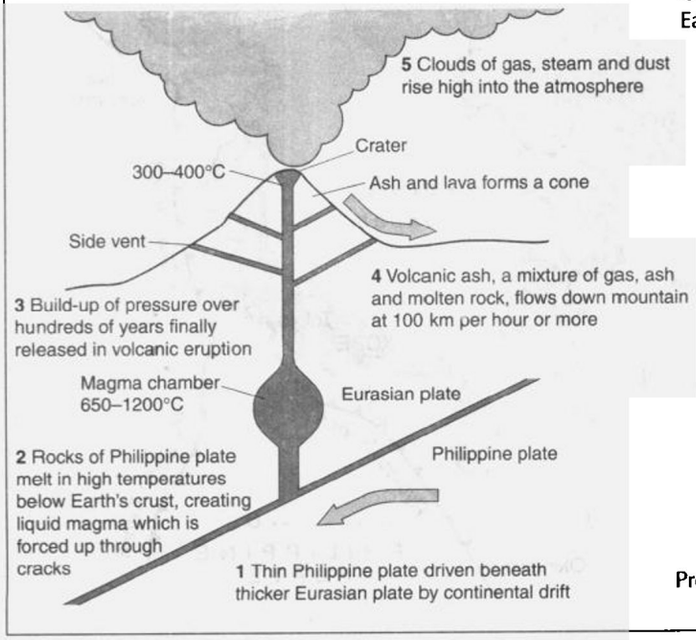


PLINIAN TYPE Gas rushes up through sticky lava and blasts ash and fragments into sky in huge explosion. Gas clouds and lava can also rush down slopes. Part of volcano may be blasted away during eruption.

CASE STUDY: MOUNT PINATUBO

Details: 9th June 1991; eruption after 600 years; between 12th and 15th June ash and rock was scattered over a radius of 100 km; killed 350 people and made 200,000 people homeless, largely due to mudslides.

Effects: Mudslides covered 50,000 ha of cropland and destroyed 200,000 homes; 600,000 people lost their jobs.



Causes:

Earthquake 16th July 1990 (7.7 on Richter Scale; 1600 dead)

↓

Basalt from the upper mantle squeezed into the magma chamber of the dormant volcano

↓

Basalt reactivated viscous lava and created gas-charged magma (andesite)

↓

This rose towards the surface causing volcano to bulge

↓

Pressure blasted away the dome spewing 20 million tonnes of material into the atmosphere

Weathering

Weathering is the decomposition and disintegration of rocks in situ. Decomposition refers to the chemical process and creates altered rock substances whereas disintegration or mechanical weathering produces smaller, angular fragments of the same rock. Weathering is important for landscape evolution as it breaks down rock and facilitates erosion and transport.

MECHANICAL (PHYSICAL) WEATHERING

There are four main types of mechanical weathering: freeze-thaw (ice crystal growth), salt crystal growth, disintegration, and pressure release.

Freeze-thaw occurs when water in joints and cracks freezes at 0°C and expands by 10% and exerts pressure up to 2100 kg/cm^2. Rocks can only withstand a maximum pressure of about 500 kg/cm^2. It is most effective in environments where moisture is plentiful and there are frequent fluctuations above and below freezing point, e.g. periglacial and alpine regions.

Salt crystal growth occurs in two main ways: first, in areas where temperatures fluctuate around 26-28°C, sodium sulphate (Na_2SO_4) and sodium carbonate (Na_2CO_3) expand by 300%; second, when water evaporates, salt crystals may be left behind to attack the structure. Both mechanisms are frequent in hot desert regions.

Disintegration is found in hot desert areas where there is a large diurnal temperature range. Rocks heat up and expand by day and cool and contract by night. As rock is a poor conductor of heat, stresses occur only in the outer layers and cause peeling or *exfoliation* to occur. Griggs (1936) showed that moisture is essential for this to happen.

Pressure release is the process whereby overlying rocks are removed by erosion thereby causing underlying ones to expand and fracture parallel to the surface. The removal of a great weight, such as a glacier, has the same effect.

CHEMICAL WEATHERING

There are four main types of chemical weathering: carbonation-solution, hydrolysis, hydration, and oxidation.

Carbonation-solution occurs on rocks containing calcium carbonate, e.g. chalk and limestone. Rainfall and dissolved carbon dioxide forms a weak carbonic acid. (Organic acids also acidify water.) Calcium carbonate reacts with an acid water and forms calcium bicarbonate, or calcium hydrogen carbonate, which is soluble and removed by percolating water.

Hydrolysis occurs on rocks containing orthoclase feldspar, e.g. granite. Orthoclase reacts with acid water and forms kaolinite (or kaolin or china clay), silicic acid, and potassium hydroxyl. The acid and hydroxyl are removed in the solution leaving china clay behind as the end product. Other minerals in the granite, such as quartz and mica, remain in the kaolin.

Hydration is the process whereby certain minerals absorb water, expand, and change, e.g. anhydrate becomes gypsum.

Oxidation occurs when iron compounds react with oxygen to produce a reddish brown coating.

LIMESTONE WEATHERING

Factors controlling the amount and rate of limestone solution

1 The amount of carbon dioxide (CO_2), which is controlled by:
   - the amount of atmospheric CO_2
   - the amount of CO_2 in the soil and groundwater
   - the amount of CO_2 in caves and caverns
   - temperature - CO_2 is more soluble at low temperatures
2 The amount of water in contact with the limestone.
3 Water temperature.
4 The turbulence of the water.
5 The presence of organic acids.
6 The presence of lead, iron sulphides, sodium, or potassium in the water.

Rates of limestone solution

Rates of solution vary. In the Burren, western Ireland, the average depth of solution is 8 cm on bare ground, 10 cm under soil, and 22 cm underground. This has taken place over the last 10,000 years, representing an average of 15 cm in 10,000 years or 0.0152 mm per year.

Accelerated solution

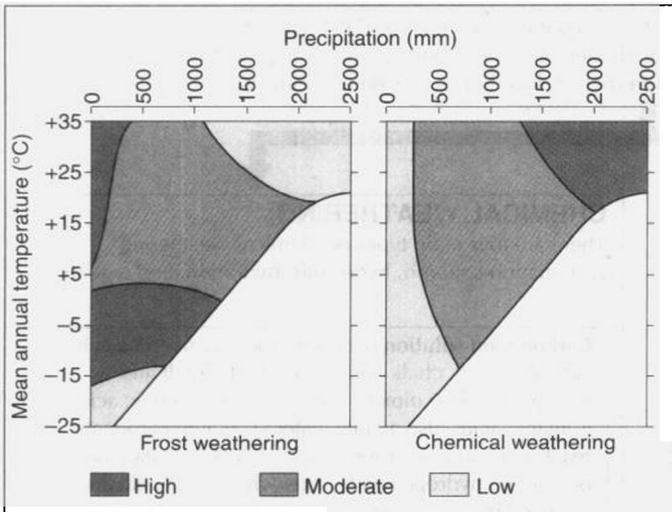
Accelerated solution occurs under certain conditions:

- Impermeable rocks adjoin limestone - waters from non-karstic areas have aggressive waters and will cause above average rates of solution.
- Alluvial corrosion - intense solution takes place by water which passes through alluvium and morainic sands and gravels.
- Corrosion by mixture - this occurs when waters of different hardness mix.
- At the margins of snow and ice fields - snow meltwater is able to dissolve more limestone than rain-water.
- Limestone denudation increases as annual rainfall and runoff increase.
- Limestone weathers more quickly under soil cover than on bare surfaces.

Human activity has more impacts on the nature and rate of limestone denudation:

- the burning of fossil fuels and deforestation has increased atmospheric levels of carbon dioxide and thus the weathering of limestone might accelerate
- acid rain is increasing levels of acidity (sulphur dioxide and nitrogen oxides) in rain-water
- agriculture and forestry are affecting soil acidity and carbon dioxide levels

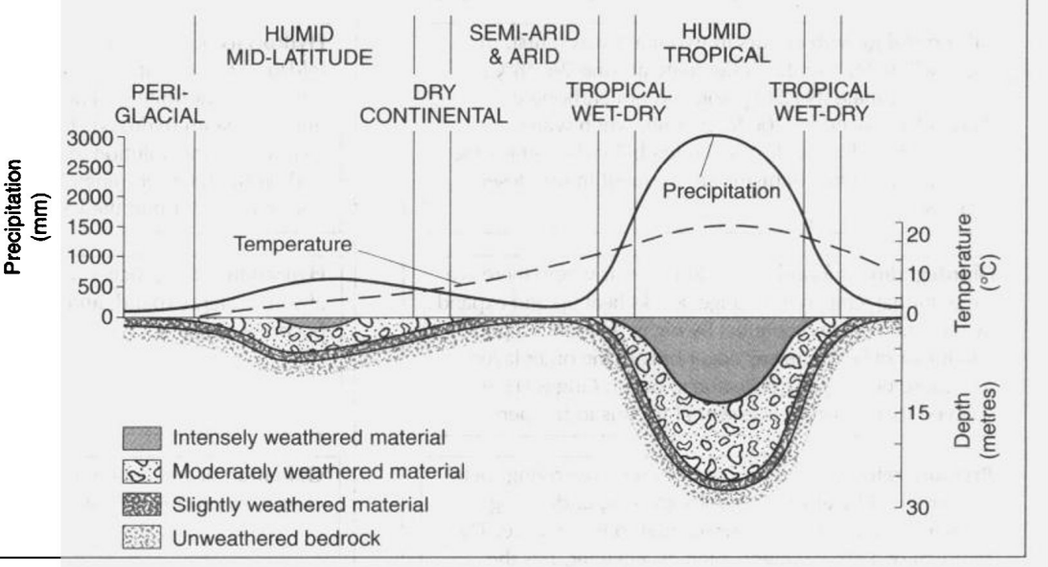
Controls on weathering



CLIMATE

Rates of weathering vary with climate. Peltier's diagrams (1950) show how weathering is related to moisture availability and average annual temperature. Frost shattering increases as the number of freeze-thaw cycles increases. Chemical weathering increases with moisture and heat. According to Van't Hoff's Law, the rate of chemical weathering increases 2-3 times for every increase in temperature of 10°C (up to 60°C).

Variations in the depth of weathering for climatic zones from the poles to the tropics



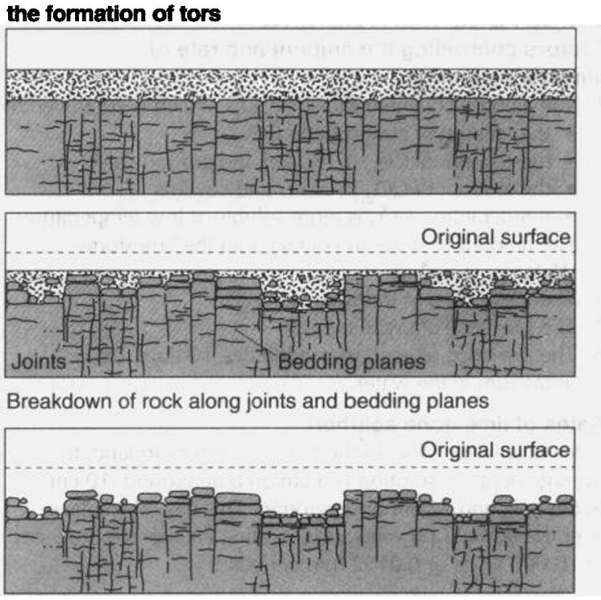
GEOLOGY

Rock type influences the rate and type of weathering in many ways due to:

- chemical composition
- the nature of cements in sedimentary rock
- joints and bedding planes

For example, limestone consists of calcium carbonate and is therefore susceptible to carbonation-solution, whereas granite with orthoclase feldspar is prone to hydrolysis. In sedimentary rocks, the nature of the cement is crucial: iron-oxide based cements are prone to oxidation whereas quartz cements are very resistant.

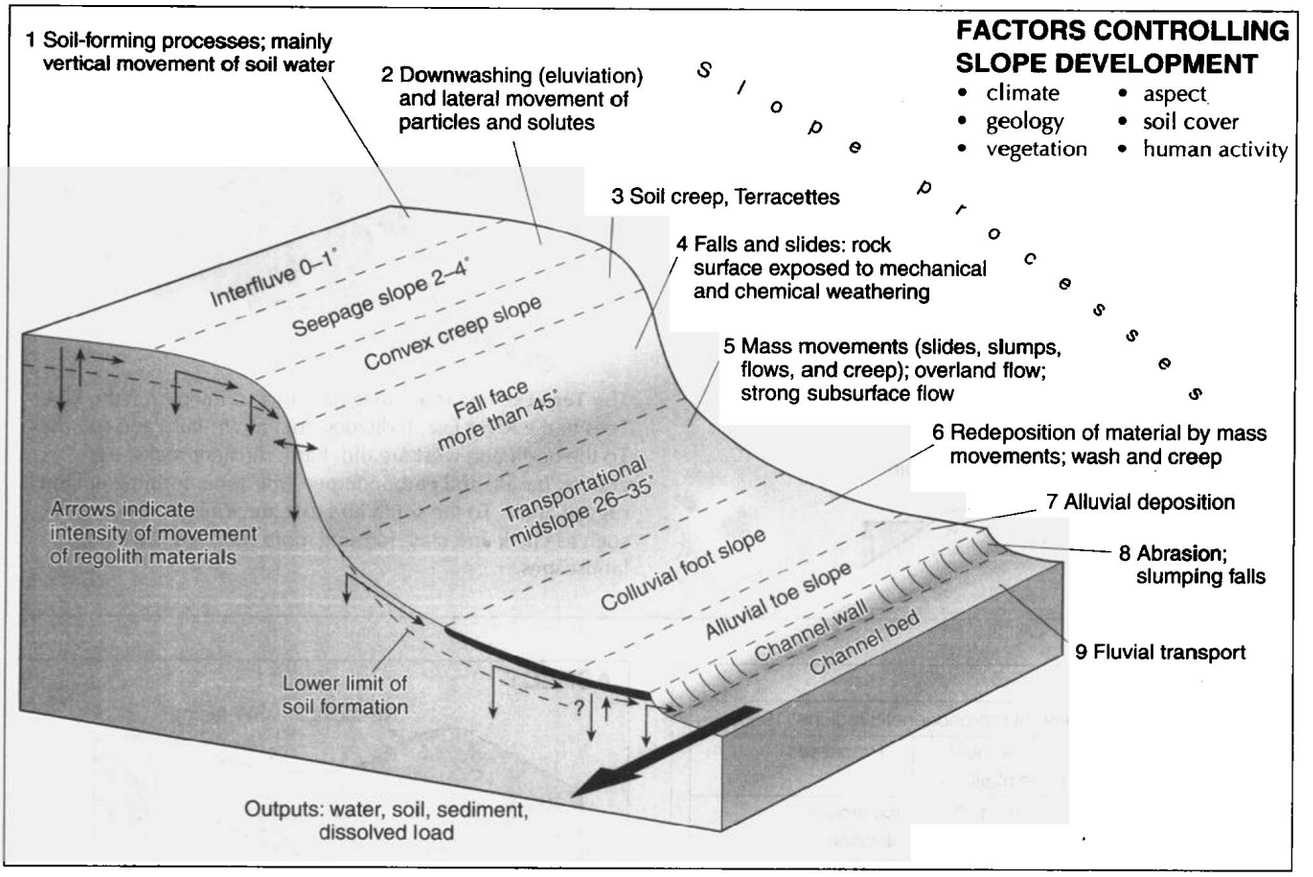
The importance of joints and bedding planes: the formation of tors



Removal of weathered material to expose tors, e.g. Hay Tor, Yes Tor on Dartmoor

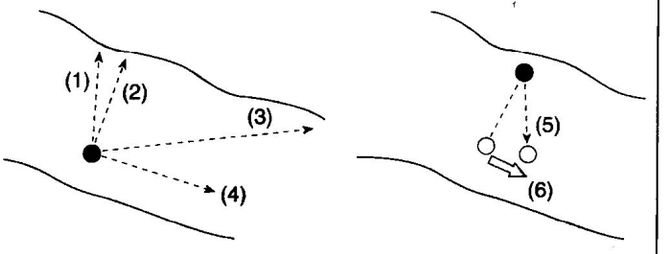
Slopes

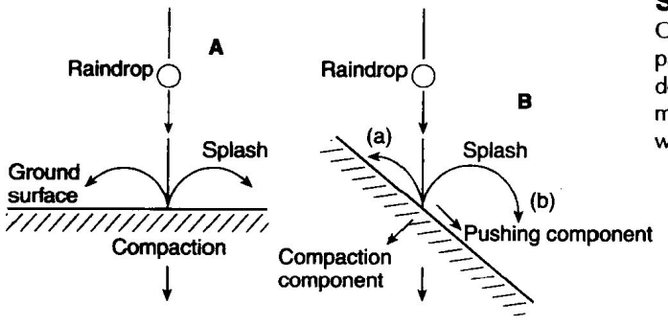
Slopes can be defined as any part of the solid land surface. They can be **sub-aerial** (exposed) or **sub-marine** (underwater), **aggradational** (depositional), **degrational** (eroded), or **transportational**, or any mixture of these. Geographers study the **hillslope**, which is the area between the **watershed** (or drainage basin divide) and the **base**, that may or may not contain a river or stream. Slope **form** refers to the shape of the slope in cross-section; slope **processes** the activities acting on the slopes; and slope **evolution** the development of slopes over time.



SLOPE PROCESSES: SOIL CREEP

Individual soil particles are pushed or heaved to the surface by wetting, heating, or freezing of water. They move at right angles to the surface (2) as it is the zone of least resistance. They fall (5) under the influence of gravity once the particles have dried, cooled, or the water has thawed. Net movement is downslope (6). Rates are slow - 1 mm/year in the UK and up to 5 mm/year in the tropical rainforest. They form **terracettes**, e.g. those at Maiden Castle, Dorset, and The Manger, Vale of the White Horse.





SLOPE PROCESSES: RAIN-SPLASH EROSION

On flat surfaces (A) raindrops compact the soil and dislodge particles equally in all directions. On steep slopes (B) the downward component (b) is more effective than the upward motion (a) due to gravity. Hence erosion downslope increases with slope angle.