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AUTHOR	Lee, Alice
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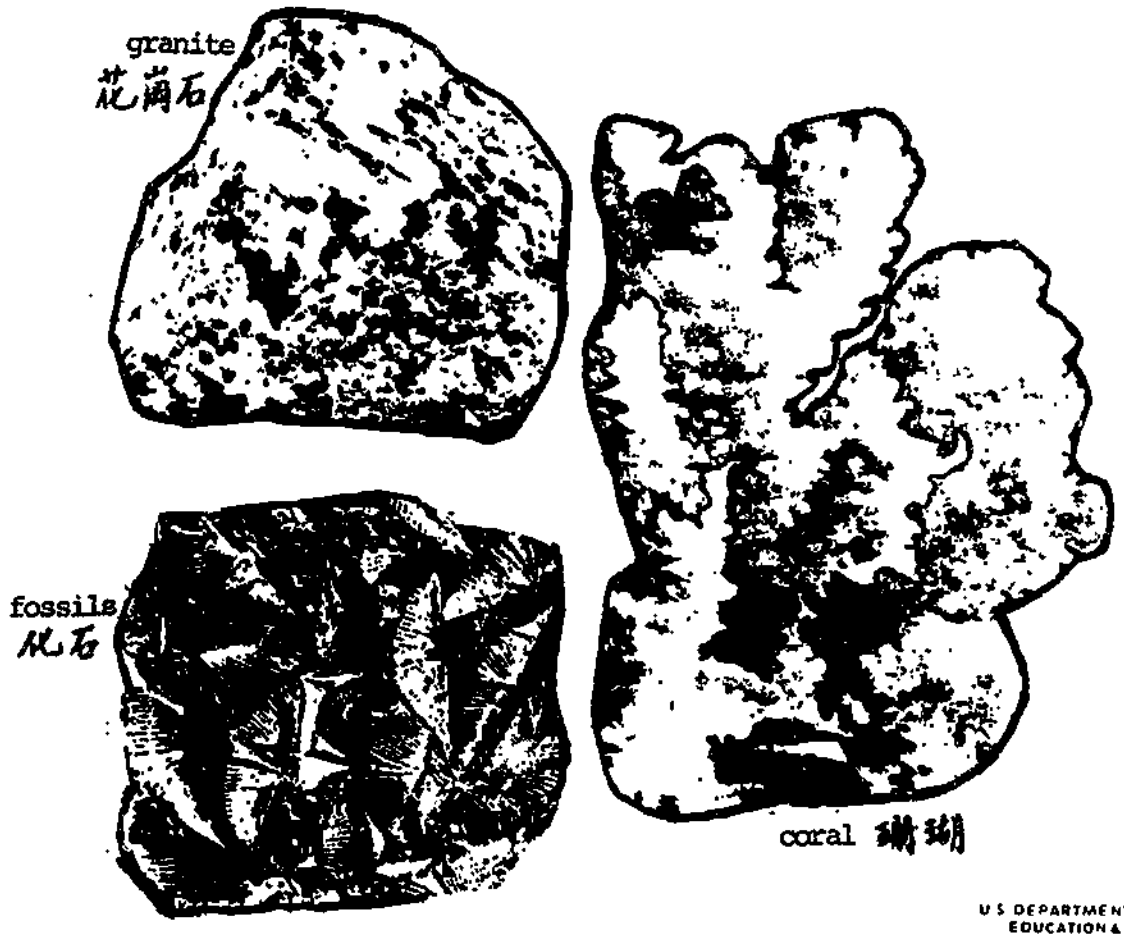
ABSTRACT

This science unit is designed for limited- and non-English speaking students in a Chinese bilingual education program. The unit covers rock material, classification, characteristics of types of rocks, and rock cycles. It is written in Chinese and simple English. At the end of the unit there is a list of main terms in both English and Chinese, and student activities. The booklet may be used along with "Matter--An Earth Science, Unit 4." (AMH)

ROCKS 岩石



By Alice Lee 李潔蓮

Chinese Bilingual Pilot Program, E.S.E.A. Title VII
San Francisco Unified School District
San Francisco, California

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Experimental Material * Subject to Revision * Not for Publication

Contents 目錄

Preface

This science unit is primarily for the newcomer Chinese students and for those who are continuing in the ESEA Title VII Chinese Bilingual Pilot Program at the middle school level. It is designed for limited and non-English speaking students.

The unit is on Rocks: Rock Material, Classifying Rocks, Characteristics of Types of Rocks and Cycle of the Rocks. It is written in Chinese and simple English in order to meet the needs of these Chinese students. There is also a list of main terms in both languages and activities at the end of the unit. The arrangement of the main terms is according to the order of appearance in the Chinese section. This book may be used along with Matter - An Earth Science - Unit 4, published by Harcourt Brace Jovanovich.

Many thanks to Maria Julin and Herb McCall for suggestions and review, Dr. David Law for proofreading and Beatrice Choi for the calligraphy.

Alice Lee
San Francisco, CA
1980

編後話

本書是爲三藩市中美語文教育計劃下之初中學生而編。目的是幫助在英語上有困難的新移民學生。他們以學習英語爲第二種語言。

自然課本的編寫是採取單元制。本單元是關於岩石，內容分爲以下數點：岩石的本質，岩石的分類，各類岩石的特性和岩石循環。課文內容，除中國語文外，並用簡易英文寫出，以適應初學英語學生之需要。課本附有生字中英對照及習作，以爲參考之用。生字編排的次序是依據牠們在中文單元出現的先後次序而定。此單元可與自然課本 Matter - An Earth Science - Unit 4, 相配合運用。

本書在編寫過程中，得蒙富蘭克林中學自然科教師繆愛群女士及加里奧中學自然科教師 Herb McCall 賜寶貴意見及覆閱，羅國銓博士幫助校對，蔡春好女士書寫，本人在此謹表謝意。

李 潔 蓮

一九八零年於三藩市

Picture Credits

1. Brandwein, Paul F. et al. Concepts in Science (5). Sacramento: State Department of Education, 1967. Cover, pp. 4, 7, 8.

2. Brandwein, Paul F. et al. Matter - An Earth Science (5) New York: Harcourt Brace Jovanovich, 1975. Cover, pp. 3, 4, 5, 6.

岩石

岩石的本質

岩石是構成地殼的物質。它的本質是固體質，是由一種或多種礦物集合而成。那些組成岩石的礦物質有長石，石英，雲母和方解石。

岩石是礦物的混合物。我們常會在一塊岩石中找到許多不同礦物的晶體。不過，有些岩石只有石英這一種礦物質。

岩石的分類

我們常根據岩石本質的顏色和堅硬的程度來把岩石分類，這樣的分類叫做描述分類。自然分類就是根據岩石本身的起源。

我們可以把岩石分為三大類：

1. 火成岩　2. 水成岩　3. 變質岩

各類岩石的特性

火成岩

根據岩石的構成，火成岩可分為以下兩種：一種是深成岩或侵入岩，另一種是火山岩或噴出岩。

深成岩或侵入岩是由地殼內熱的溶液叫做岩漿形成的。當熱的液體岩漿在地殼內的時候，可能會變硬，慢慢的冷卻，便產出質地粗糙的岩石，斑糲岩就是其中的一種。

當火山破裂時，液態岩石被擠出在地球的外殼上。這些液態岩石叫做熔岩，冷卻得很快，凝結成質地幼細的岩石，玄武岩就是其中的一種，玄武岩和其他經過一樣過程造成的火成岩，我們叫它做火山岩或噴出岩。

我們能在火成岩中找到的礦物大概有七種。有三種礦物的顏色是淺淡的，例如石英和兩種長石。其他四種深顏色的礦物有角閃石，輝石，雲母

和橄欖石。在不同的混合中，差不多所有粗糙及幼細紋理的火成岩，都是由這七種礦物組成的。

花崗石 granite

花崗石是一種粗糙的深成岩石。它是由石英、長石、角閃石和雲母等組成。花崗石經過研磨後，顏色光澤美麗，是建築的好材料，如建屋、造橋等。在美國阿帕拉契山南端喬治亞州的石山，內華達山脈和玉樹美山谷等，都是由花崗石造成。

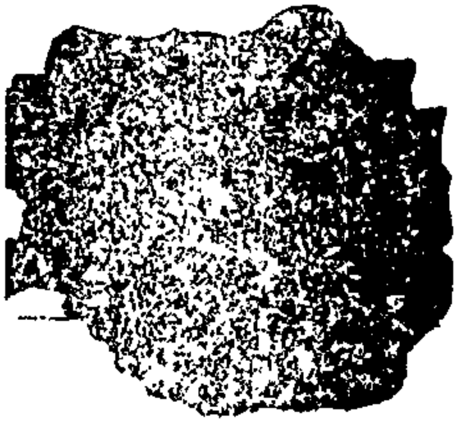
流紋岩 rhyolite

流紋岩是一種褐色或紅色質地精細的火山岩。它和花崗石有同樣的礦物質。流紋岩是熔岩在地面冷卻凝結而成的。

斑糲岩是一種粗糙深成岩石。它是由長石、輝石及橄欖石構成。在哈得遜河的帕利塞得絕壁便可以看到這種岩石。


斑糲岩 gabbro

玄武岩是一種精細紋理的火山岩。它的礦物質是和斑糲岩的一樣。但顏色不一，有些是灰色，有些是黑色。在美國西北部的哥倫比亞高原中的岩石，便是最好的例子。


玄武岩 basalt

水成岩

水成岩是由別的細小沙粒岩石和其他物質的碎屑沉澱堆積而成。這些沉澱物是由風、雨及冰雪帶來的。

沉澱物黏結在一起，被水的重力和上層的沉澱物緊壓着，漸漸的硬化成為岩石。這過程叫做岩化。

沙質岩、頁岩和礫岩等，都是碎屑水成岩。牠們是由其他粗粒岩石和岩石碎片岩化而成。

沙質岩含石英的成份最多，在沙礫之間有空間，所以它是一種多孔岩。這種岩常是地下深層石油或水的存放地。

頁岩是泥土受壓凝硬而成。它不是多孔岩。它是很容易分裂成薄層的。

礫岩是一種粗糙岩石。它是由小圓石或小的石頭堆積而成。

有機水成岩的本質是有機物，可能是由陸上或水中動物的遺骸等堆積而成。例如灰石中的介殼石便很清楚顯示出動物的本質。

介殼石 cou[illegible]ia

煤也是屬於有機水成岩的一種。當千年古樹枯謝後，牠們被埋沒在地層下面，受到壓力和熱力的影響，經過幾千萬年的長時間，便變成煤。沼鐵也是有機水成岩的一種。

化石是化學形成的水成岩。牠們是古代動植物遺留下來的印跡。動植物堅硬的部份，是最好的保留部份，如骨及貝殼等。


化石 fossils

變質岩

變質岩是屬於層狀岩的一類。它是由別種岩石經過高度熱力和壓力，把原有岩石的本質轉變而成。有時候，水和化學物也可以做成這樣的變化。變質岩並不是由熔岩形成，它是由固體岩石轉變而成的。

岩岩一分的做。石是裂的光用　沙而裂的質頁是以它以路夾不分石很物　由質破硬變由它可。可舖由它會雲得築。是變易堅是是。，層，來是。不。磨建飾岩岩容很石，成石層廣用石成，層以多裝英礫不種板種而狀一很或雲而石層可許做石或宅一。

一質葉為途蓋　質狀一面，來　岩。是石的變種裂用瓦　變葉成表亮它　質成，岩

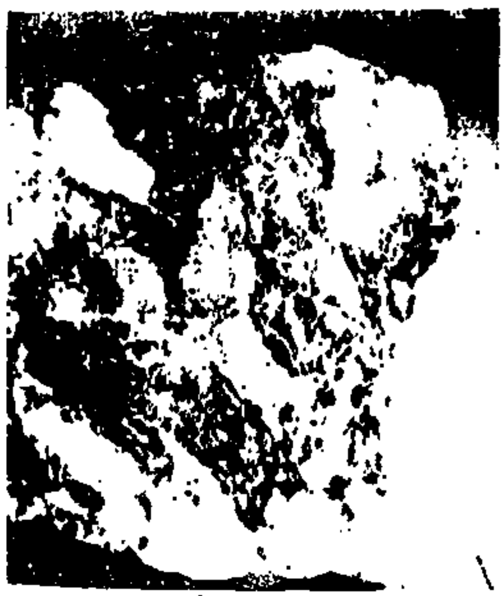
板石 slate

雲石 marble

片岩是變質岩的一種。它有一層層的表面。雲母片岩含有片片雲母。石英片岩含有石英晶體。

片岩 schists

片麻岩是一種粗糙的岩石。它可能由很多不同的岩石，如花崗石或沙質石等變質而成。



石英片岩 quartz schist

片麻岩 gneiss

岩石循環

火成岩、水成岩和變質岩這三類岩石不停的、慢慢的相互轉變。

變質岩溶化後變為岩漿。岩漿在地殼內冷卻便成為火成岩。火成岩風化後就成為沉澱物，沉澱物岩化便成為水成岩。水成岩經過高度的熱力和壓力便轉為變質岩。變質岩溶化後又再成為岩漿，岩漿凝結後便又是火成岩。這是岩石的完整循環過程。

ROCKS

Rock Material

Rock is a solid material that is made up of one or more substances called minerals. Some of the minerals that make up rock are feldspar, quartz, mica and calcite. Sometimes a rock is made up of a single mineral, such as quartz. But, usually, many crystals of various minerals are found together in a rock.

Classifying Rocks

There are two ways in classifying rocks. The two ways are the descriptive classification and the genetic classification. The descriptive classification is based on such physical characteristics as color and hardness. The genetic classification is to classify rocks according to their origin.

There are three main classes of natural rocks:

1. Igneous Rocks - fire-formed
2. Sedimentary Rocks - hardened remains of sediments
3. Metamorphic Rocks - changed form

CHARACTERISTICS OF TYPES OF ROCKS

Igneous Rocks

Igneous rocks can be identified into two large classes based on texture. They are plutonic or intrusive rocks and volcanic or extrusive rocks.

Plutonic or intrusive rocks are coarse-grained igneous rocks that cool slowly and solidify underground. They are formed from hot molten material below the surface called magma. Gabbro is an example of this kind of igneous rock.

Some of the molten mixture may find its way to the surface and pour out of the earth's crust. This molten mixture called lava cools quickly and produces fine-grained rocks. They are volcanic, or extrusive, igneous rocks. Basalt is one of this kind of fine-grained texture igneous rocks that cools quickly at the earth's surface.

Seven minerals are commonly found in most igneous rocks. Three of these minerals are light colored: quartz and two feldspars. The four common dark minerals are hornblede, pyroxene, mica and olivine. In various combinations, these seven minerals make up most of the coarse-grained and fine-grained igneous rocks.

Granite is a coarse-grained plutonic rock composed mostly of quartz, feldspar, hornblende and mica. It is very strong and is often used to build bridges and buildings. Stone Mountain, Georgia, at the southern end of the Appalachian Mountains is made of granite, as are the Sierra Nevada Mountains and Yosemite Valley.

Rhyolite is a fine-grained volcanic igneous rock that contains the same minerals as granite. It ranges in color from tan to red. Rhyolite is formed as lava pours slowly out over the surface of the ground.

Gabbro is a coarse-grained plutonic rock. Gabbro is composed of feldspar, pyroxene and olivine. It is the rock that forms the Palisade Cliffs along the Hudson River.

Basalt is a fine-grained volcanic igneous rock that contains the same materials as gabbro. It is the common igneous rock which formed as lava flows hardened. It is gray or black in color. The Columbia plateau of the northwestern United States is an excellent example of basalt.

Sedimentary Rocks

Sedimentary rocks are formed from tiny sandlike pieces of other rocks called sediment. Sediment is brought together by wind, rain and ice. Sediment is cemented together and compressed by the weight of water and new sediment above it; the particles stick firmly together. This process is called lithification, which means "turning into rock."

Sandstone, shale and conglomerate are rocks that come from lithification of fragments and grains of other rocks. They are known as clastic sedimentary rocks.

Sandstone is made up mostly of particles of quartz cemented together. Because of the spaces between the particles, sandstone is a porous rock that often holds underground deposits of oil or water.

Shale is formed when deposits of clay are put under pressure. Unlike sandstone, shale is porous, and it breaks easily into thin layers.

Conglomerate is a coarse-grained rock made up of rounded pebbles or small boulders.

Some sedimentary rocks may have an organic origin. They may be formed from living things. For example, coquina is a limestone that clearly reveals its animal origin. Bog iron is another sedimentary rock of organic origin.

Coal is considered as an organic sedimentary rock. When ancient trees fell, they were sometimes covered by sediment. Over thousands of years, the pressure of this sediment and the heat caused by the pressure produced coal.

Fossils are chemically formed sedimentary rocks. They are the remains or prints of ancient plants and animals. Best preserved are hard parts of the animal or plant, such as a shell or bone.

Metamorphic Rocks

Metamorphic rocks are rocks that have been changed from other types of rocks by great heat and pressure. This heat and pressure will change the form and minerals that make up the rock. Sometimes water and chemicals help in making the change too. Metamorphic rocks are not formed from molten material. Their changes occur in the solid rock.

Slate is a metamorphic rock formed from shale. It is a type of foliated rock that breaks into layers. Slate is usually used for roofing tiles or "flagstone" walks.

Marble is limestone that has metamorphosed. It is an unfoliated rock. It does not form sheets or layers when broken. It can be made to have a very smooth and highly polished surface. Buildings are often decorated with marble because it can be cut and polished beautifully.

Quartzite results from the metamorphism of sandstone or conglomerates. It is a hard, durable rock which is not easily worn away.

Schists are metamorphic rocks which have a layered appearance. Mica schist contains flakes of mica. Quartz schist has crystals of quartz in it.

Gneiss is a coarse-grained, banded rock. It may be formed from many different rocks, such as granite or sandstone.

CYCLE OF THE ROCKS

Igneous, sedimentary and metamorphic rocks are continually, though slowly changing into one another.

Metamorphic rocks melt to make magma. Magma becomes igneous rocks which may weather to form sediment.

Sediment is lithified into sedimentary rocks which may be changed by heat and pressure to form metamorphic rocks. The melting of the metamorphic rocks again produce magma. This production then completes the full cycle of the rocks on earth.

中英對照 Vocabulary:

岩石 — rocks
固體 — solid
物質，本質 — material
物質 — substance
礦物 — minerals
組成 — make up
長石 — feldspar
石英 — quartz
雲母 — mica
方解石 — calcite
混合物 — mixture
不同的 — various
晶體 — crystals
分類 — classify, classification
堅硬 — hardness
描述 — descriptive
自然，遺傳 — genetic
根據 — according
起源 — origin
火成岩 — igneous rocks
水成岩 — sedimentary rocks
變質岩 — metamorphic rocks
特性 — characteristics
溶液 — molten material

岩漿 — magma
質地粗糙的 — coarse-grained
斑獨岩 — gabbro
深成岩 — plutonic
侵入岩 — intrusive rocks
熔岩 — lava
質地幼細的 — fine-grained
玄武岩 — basalt
火山岩 — volcanic rocks
噴出岩 — extrusive rocks
角閃岩 — hornblende
輝石 — pyroxene
橄欖石 — olivine
花崗石 — granite
阿帕拉契山 — Appalachian Mountains
南端 — southern end
石山 — Stone Mountain
喬治亞州 — Georgia
內華達山脈 — Sierra Nevada
玉樹美山谷 — Yosemite Valley
流紋岩 — rhyolite
帕利塞德絕壁 — Palisade Cliffs
哈德遜河 — Hudson River
哥倫比亞高原 — Columbia Plateau

最好的 — excellent
例子 — example
沉澱物 — sediment
黏結 — cemented
緊壓 — compressed
岩化 — lithification
碎屑岩 — clastic rocks
沙質岩 — sandstone
頁岩 — shale
礫岩 — conglomerate
碎片 — fragments
多孔的 — porous
地下深層 — underground
薄 — thin
一層層 — layers
小卵石 — pebbles
大石頭 — boulders
有機的 — organic
介殼石 — coquina
灰石 — limestone
顯出 — reveal
煤 — coal
壓力 — pressure

熱力 — heat
沼鐵 — bog iron
化石 — fossils
印跡 — prints
保管 — preserved
板石 — slate
葉狀的 — foliated
瓦蓋 — roofing tiles
大石板（鋪路用的） flagstone
雲石 — marble
石英岩 — quartzite
片岩 — schist
一片片 — flakes
片麻岩 — gneiss
循環 — cycle
風化 — weather

中英對照 Vocabulary:

岩石 — rocks
固體 — solid
物質，本質 — material
物質 — substance
礦物 — minerals
組成 — make up
長石 — feldspar
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方解石 — calcite
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喬治亞州 — Georgia
內華達山脈 — Sierra Nevada
玉樹美山谷 — Yosemite Valley
流紋岩 — rhyolite
帕利塞德絕壁 — Palisade Cliffs
哈德遜河 — Hudson River
哥倫比亞高原 — Columbia Plateau

最好的—	excellent	熱力—	heat
例子—	example	沼鐵—	bog iron
沉澱物—	sediment	化石—	fossils
黏結—	cemented	印跡—	prints
緊壓—	compressed	保管—	preserved
岩化—	lithification	板石—	slate
碎屑岩—	clastic rocks	葉狀的—	foliated
沙質岩—	sandstone	瓦蓋—	roofing tiles
頁岩—	shale	大石板（鋪路用的）	flagstone
礫岩—	conglomerate	雲石—	marble
碎片—	fragments	石英岩—	quartzite
多孔的—	porous	片岩—	schist
地下深層—	underground	一片片—	flakes
薄—	thin	片麻岩—	gneiss
一層層—	layers	循環—	cycle
小圓石—	pebbles	風化—	weather
大石頭—	boulders		
有機的—	organic		
介殼石—	coquina		
灰石—	limestone		
顯出—	reveal		
煤—	coal		
壓力—	pressure		

練習：

I. 問答

1. 試說出岩石和礦物質的分別。

2. 一般來說，岩石可以分爲幾大類，試把牠們的名稱說出來？

3. 深成岩和火山岩有些什麼不同？

4. 試寫出火成岩的七種礦物質。

5. 爲甚麼花崗石是粗糙岩石，流紋岩是質地幼細的岩石呢？

6. 甚麼是水成岩？

7. 板石是屬於那一類岩石？它有些甚麼用途？

8. 試述說岩石的循環過程。

II. 課外活動

到郊外，公園或海灘拾取石塊來研究，看看牠們是屬於那一類岩石。分析後把牠們記錄下來，做一個詳細的報告。

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