

# The Rock Cycle 岩石圈的物质循环

## Fossils 化石

Fossils are the remains or impression of a prehistoric organism preserved in rock. Fossils are formed when an animal or an organism dies and sediment builds up over the remains of that organism. Eventually the remains of the organism and the sediment buildup around it form a preserved impression in sedimentary rock.

地史时期留在岩石里的生物遗体或遗迹。当动物或有机物死亡，其遗体经过沉淀，并最终保存在沉积岩中形成化石。

The province of Alberta has the greatest abundance and diversity of dinosaur fossils in the country of Canada. More than 38 different types of dinosaur specimens have been found in the province. The Oldman Formation and the Dinosaur Park Formations are the two most studied dinosaur bearing strata in Alberta. (Strata: A layer or series of layers of rock in the ground)

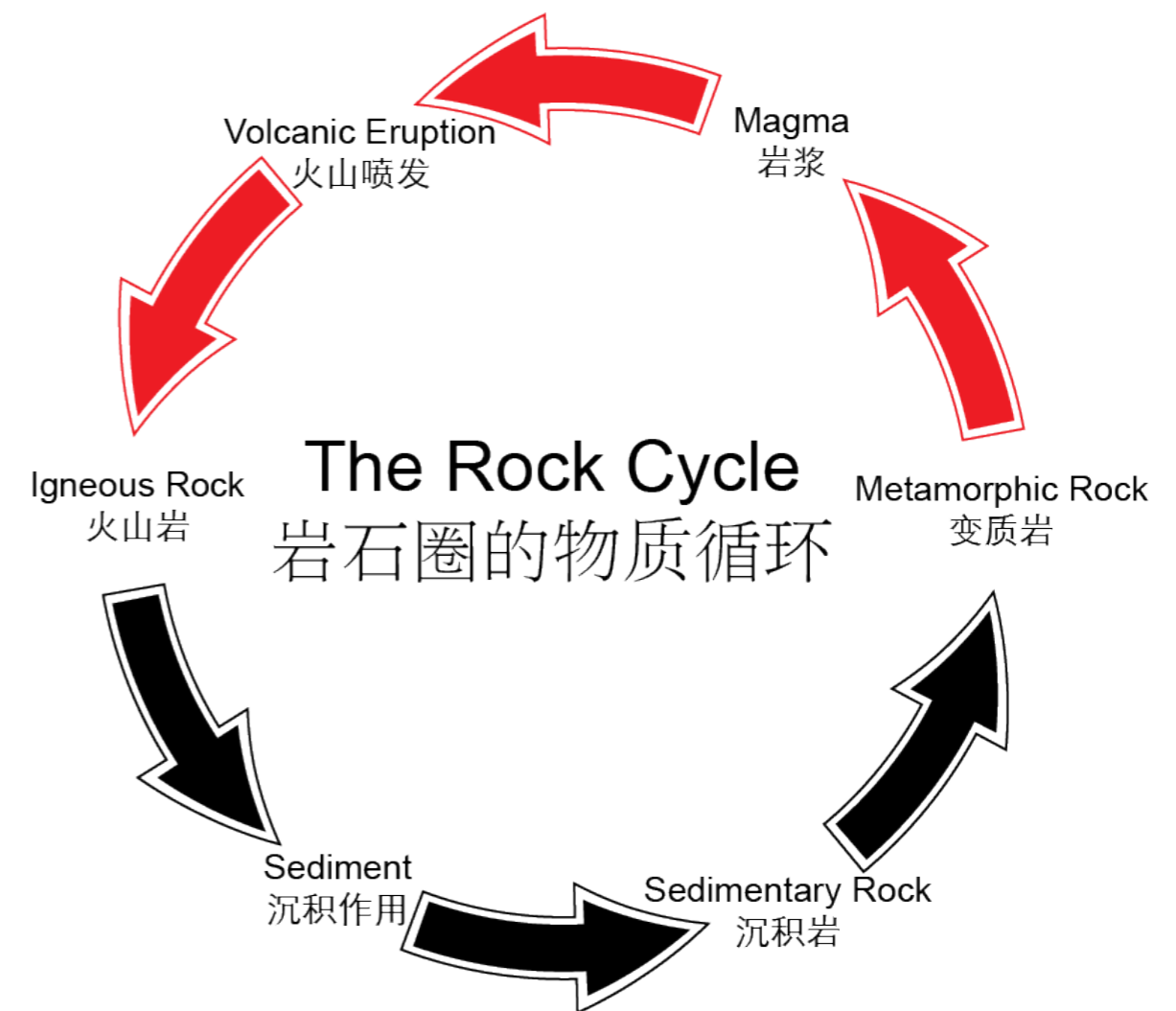
亚伯达省是加拿大恐龙化石保存最丰富且最多样的省份，已发现38种不同的样本，其中老人地层和恐龙公园地层是亚伯达省研究最大的恐龙地层。（地层：历史上某一时代形成的层状岩石）

### Rock Cycle Vocabulary 岩石圈物质循环词汇

<b>Erosion</b> 腐蚀	The process where rock is transported and deposited by wind, water, or other natural agents.	在风、流水或其他自然外力作用下岩石的搬运和沉淀过程。
<b>Fossil</b> 化石	The remains or impression of a prehistoric organism preserved in petrified form or as a mold or cast in rock.	地史时期留在岩石里的生物遗体或遗迹。
<b>Igneous Rock</b> 火山岩	A rock that has been formed from solidified lava or magma.	由火山岩浆或岩浆形成的岩石。
<b>Lava</b> 火山岩浆	Hot molten or semifluid rock erupted from a volcano or fissure.	火山喷发出来的炽热熔融体或半流体岩石。
<b>Magma</b> 岩浆	Hot fluid or semifluid material below or within the earth's crust from which lava and other igneous rock is formed.	地壳深处形成的炽热熔融体或半流体。
<b>Metamorphic Rock</b> 变质岩	A rock that has undergone transformation by heat, pressure, or other natural agents.	由于温度、压力或其他自然外力使得岩石进行改造和变化。
<b>Sediment</b> 沉积作用	Particulate matter that is carried by water or wind and deposited on the surface of the land or the bottom of a body of water, and may in time become consolidated into rock.	由于外力风、流水等的搬运、沉淀、堆积形成大陆沉积岩和海洋沉积岩的一种作用。
<b>Sedimentary Rock</b> 沉积岩	A rock that has formed from sediment deposited by water or air	由于流水或大气形成的沉淀岩石。
<b>Weathering</b> 风化作用	The breaking down of rocks as a result of natural processes such as rain, wind or other natural events.	由于自然外力如雨、风等岩石进行分解。

Rocks are continuously transformed by the Earth's forces. These changes are called the "Rock Cycle". Every rock on the planet under goes this process. These changes take millions of years. Rock will form magma, erode into sediment and then form into a sedimentary rock. It will eventually become a metamorphic rock under heat and pressure before melting and once again becoming magma.

地球上各种力的存在使得岩石在不断的变化和改造，这一过程称为“岩石圈的物质循环”。每一块岩石都会经历此过程，而这些改变需要几百万年的时间。岩石会形成岩浆，经过沉积作用形成沉积岩，在温度和压力的作用下形成变质岩，最后经过重熔再生又变成岩浆。



## Rocks 岩石

Rocks are made of a combination of many minerals. Minerals are naturally occurring substances with a specific chemical composition. Pure minerals will form crystals, which are both strong and beautiful. Quartz crystal, which is the second most abundant mineral in the Earth's crust, is a combination of silicon and oxygen atoms (SiO<sub>2</sub>).

岩石是由各种各样的矿物质构成，每一种矿物质都包含特定的化学元素。纯矿物质会形成坚硬美丽的水晶晶体。地壳中含量第二丰富的矿物质石英就是硅和氧原子的结合体。

Rocks contain many different types of crystals. Granite is a common igneous rock. By definition Granite is a rock that contains at least 20% quartz by volume. There are many other compounds that form Granite such as Aluminum Oxide (Al<sub>2</sub>O<sub>3</sub>), Potassium Oxide (K<sub>2</sub>O), and almost a dozen other compounds.

岩石包含各种不同的晶体。花岗岩是一种常见的火山岩，火山岩里至少包含20%的石英。还有其他很多化合物会形成花岗岩，如氧化铝、氧化钾等等。

The world wide average composition of Granite based on a study done by Chisholm Hugh which analyzed 2,485 samples from various regions, revealed that the four most dominate minerals in Granite are Silicone Oxide (SiO<sub>2</sub>) 72.04%, Aluminum Oxide (Al<sub>2</sub>O<sub>3</sub>) 14.42%, Potassium Oxide (K<sub>2</sub>O) 4.12%, and Sodium Oxide (Na<sub>2</sub>O) 3.69%. Depending on the combination of these minerals the colour of the rock could vary greatly. Some granite is dark, while granite that contains more Iron Oxide (Fe<sub>2</sub>O<sub>3</sub>) is more red in colour.

Chisholm Hugh通过分析取自不同地区的2,485个样品进行研究，结果表明世界范围内花岗岩的构成有四大主要矿物质，分别是72.04%的氧化硅，14.42%的氧化铝，4.12%的氧化钾和3.69%的氧化钠。这些矿物质的含量不同会导致岩石的颜色大不相同，有的花岗岩颜色较深，而有的因为氧化钠含量较多则颜色偏红。

## Reference 参考书目

Chisholm, Hugh, ed. (1911). "Petrology". Encyclopedia Britannica (11th ed.). Cambridge University Press

## Sorting Rocks 岩石分类

With all the different types of minerals on Earth there are thousands of different types of rocks; however every rock on Earth can be sorted into one of three categories.

由于地球上又各种各样的矿物质所以也就形成了各种各样的岩石，但是基本上分为以下三种：

<b>Igneous Rocks</b>	火山岩
<b>Sedimentary Rocks</b>	沉积岩
<b>Metamorphic Rocks</b>	变质岩

**Igneous Rocks** are formed when magma from the Earth's mantle cools and hardens forming new rock. The word igneous means "from fire". Igneous rocks can be formed above or below the Earth's crust. Igneous rocks formed under the Earth's crust are "Intrusive" and typically have tiny crystals in them. Igneous rocks formed above the Earth's crust are "Extrusive", and are usually dark in colour and have no crystals in them as the rock cools quickly.

火山岩是地幔中的岩浆经过冷却硬化形成新的岩石，igneous意为“来自火的”。火山岩可在地壳上面或下面形成。地壳下面形成的火山岩是侵入岩，嵌有小的晶体；地壳上面形成的火山岩是喷出岩，颜色通常较暗，由于冷却速度快所以没有晶体。

## Examples 例

<b>Intrusive Igneous Rock: Granite</b>	侵入火山岩：花岗岩
<b>Extrusive Igneous Rock: Obsidian</b>	喷出火山岩：玄武岩

**Sedimentary Rocks** are formed by the build up of sediment on the Earth's surface. Sediments are eroded from other rock formations and are deposited into layers. As the Layers build up they begin to compress and harden forming new rock. Examples of Sedimentary rock include Shale, Sandstone, and Limestone.

沉积岩是在地表沉淀而成，其他岩石腐蚀之后并堆积成层，通过压缩变得坚硬聪明形成沉积岩。沉积岩包括页岩、砂岩和石灰岩。

**Metamorphic Rocks** are formed under the Earth's surface where existing rocks are transformed creating new rocks under extreme heat and pressure. Examples include Slate which was originally Shale, or Marble which was originally Limestone.

变质岩是在地表下岩石经过高温和挤压过程形成新的岩石。变质岩有从页岩变质成的板岩和从石灰岩变质成的大理岩。