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自然科学初级读物— 第 2 册

EARTH

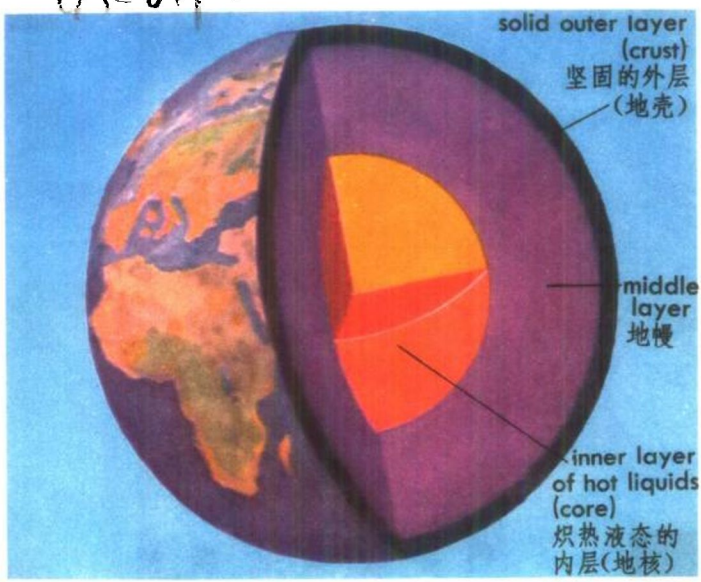
地球

徐烈成　　译
董元骥　　校
成　果　　插图

科学普及出版社

OUR PLANET EARTH

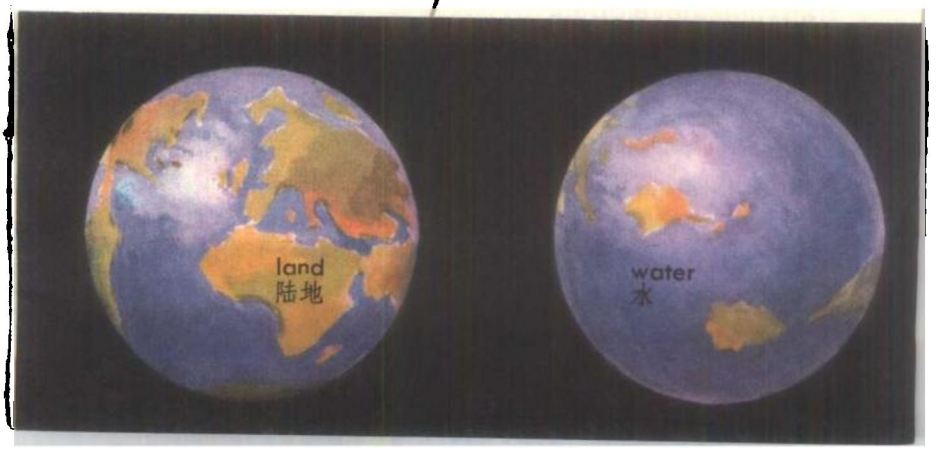
The Earth which we live on is a beautiful planet. It is made up of land and oceans, mountains and rivers, plants, animals and people. It is actually very, very old and was not always as beautiful as it is now. It is not certain how the Earth began. Probably it began as a huge globe of gas and dust. The globe became smaller and denser, and most of the gas drifted away leaving behind bodies of solid



matter. These bodies eventually collected together to form solid Earth. Then the inside of the solid Earth became hot and molten causing certain materials to rise to the surface. This probably resulted in the formation of the Earth's layers. To-day the outer layer or crust is cool and hard, while the core is probably hot and molten.

我们的星球——地球

我们居住的地球是一个美丽的星球。地球由陆地和海洋、山脉和河流、植物、动物及人组成。实际上，地球非常非常古老，而且并不一直象现在这样美丽。现在还不清楚地球是怎样起源的。可能它起源于一个由气体和尘埃组成的庞大球体。后来这一球体体积缩小，密度增大，大部分气体飘散，留下一块块固态物质。这一块块固态物质最终又聚集在一起，形成固态的地球。然后，固态地球的内部变得炽热、熔融，引起某些物质上升到地球表面。其结果也许就形成了地球的层次。今天，地球的外层，即地壳，是又冷又硬，而地心则可能又热又呈熔融状态。



Some of the materials which were pushed up to the crust from the molten core of the Earth formed water. Others formed the gases of the atmosphere. The water evaporated to form clouds. These rose into the sky to form rain. Soon rain fell down on the Earth's crust and filled all the valleys, cracks and hollows. In this way, rivers, lakes, oceans and seas were formed. Throughout the ages, Earth has received a lot of rainfall and now most of the Earth's crust is covered with water. About $\frac{7}{10}$th of the Earth's surface is covered with water while $\frac{3}{10}$th of it is covered with land.

For a long time the Earth's atmosphere did not contain much oxygen. The oxygen was combined with the other materials in rocks. This oxygen was slowly freed and escaped into the atmosphere. After a very long time, as the amount of oxygen in the atmosphere increased, the Earth became a more suitable place for plants to develop. Plants produced more oxygen which was freed into the atmosphere. Later on animals developed.

从熔融的地心挤上地壳的某些物质形成了水。另一些物质则形成了大气层的各种气体。水蒸发形成云。云上升到空中形成雨。雨随即落到地壳上，填满所有山谷、裂隙和洼地。河流、湖泊和海洋就是这样形成的。古往今来，地球接受了大量雨水，现在大部分地壳布满了水。地球表面约有十分之七布满了水，十分之三覆盖着陆地。

过去漫长的岁月里，地球的大气层并不含有大量氧气。氧在岩石中和其他物质化合。这部分氧缓慢游离而释放出来，逸入大气层。经过很长时间，由于大气层中氧含量的增加，地球变成更适合于植物生长的地方。植物制造出更多的氧，逸入大气层。后来，出现了动物。

SOIL FROM ROCKS

At first, the Earth's crust was made up of huge blocks of hard, solid rocks. The outer layers of these rocks slowly broke up into smaller and smaller pieces. Finally stones, pebbles and grains of sand were formed. Many sorts of plants and animals lived and died on the surface of the Earth. Their remains mixed up with the stones, pebbles and sand of the Earth's crust to form **soil**. The outermost layer of the Earth's crust is soil.

从 岩 石 到 土 壤

最初，地壳是由巨大的坚硬而结实的岩石块组成的。这些岩石的表层缓慢地破碎成越来越小的碎块。最后形成了石块、石砾和砂粒。种类繁多的植物和动物在地球表面生活和死亡。它们的残体和石块、石砾、砂粒混合，形成了**土壤**。地壳最外面的一层就是土壤。

There are many ways in which large pieces of rock break into smaller pieces. Wind, water, heat and cold help to break up rocks. When winds blow sand particles against a large rock for a long time, the softer layers of the rock are slowly worn away. These leave holes and cracks in the rock. The holes and cracks become bigger until finally the rock breaks up into smaller pieces.

The moving water of streams and rivers also helps to break large rocks into smaller pieces. As the water moves along, it carries with it small pieces of rock. These rub against the large rocks. As this happens, the larger rocks are worn down to smaller pieces These smaller pieces are carried away and they in turn wear down other larger rocks.

The heat of the sun helps to break up rocks too. When the sun shines, the rocks become very hot. If these rocks are suddenly cooled they may crack. Therefore, a sharp change in temperature can cause rocks to break into smaller pieces.

Ice also helps to break up rocks. When it rains, water collects in the cracks of a rock. If the weather becomes very cold, this water will turn to ice. When water becomes ice, its volume becomes bigger. Therefore, the crack becomes wider. Soon the crack becomes so wide that the rock breaks into smaller pieces.

Things to Do

(i) Let's find rocks. We can find rocks if we go into the open fields, or near the sea-shore. Collect as many rocks as you can. Take a bag or box along to put your rocks into. Write down where you found each rock and what you found near it.

大块岩石破裂成小块有各种途径。风、水、热、冷都能促使岩石破裂。风将砂粒刮起来碰撞大块岩石，久而久之，较松软的岩石层就被慢慢地磨损，于是在岩石上留下窟窿和裂隙。窟窿和裂隙越来越大，最后岩石破裂成了小碎块。

溪涧和河流的流水也促使大块岩石裂成小块。水流动时，夹带着小块岩石。小块岩石在大块岩石上摩擦。这么一来，大块岩石就被磨损成小石块。这些小石块被冲走，又去磨损别的大块岩石。

太阳的热也在促使岩石破裂。阳光照射时，岩石变得很热。如果这些岩石被突然冷却，就可能破裂。因此，气温的骤变会引起岩石破裂成小石块。

冰也在促使岩石破裂。下雨时，水积集在岩石缝里。如果天气变得很冷，岩石缝中的水会变成冰。水结成冰时，体积增大。因此，裂缝就加宽。裂缝不久就宽得使岩石裂成小碎块。

动 手 做

一、让我们来寻找岩石。如果我们走到旷野或走近海岸，我们就能找到岩石。尽可能多采集些岩石。手头带一个包或盒子去装岩石。记下每块岩石的发现地点和附近发现的东西。

(ii) Now look at your rock collection. Wash each rock with water and examine it. Is it large or small? Touch each rock to find out whether it is smooth or rough. Look at its edges. Are they rounded or jagged? Scratch each rock with a blade or pen-knife. Is it hard or soft? Describe the colour of the rock.

(iii) Let's look inside our rocks. Try to break each rock up with your hands. If the rock is too hard, use a hammer. What do you see inside the rock? Is the colour inside the rock the same as the colour outside? Do small pieces of sand fall out?

(iv) Use a hammer to pound each rock up into small pieces. Pound the pieces until they become very small. Now pour water on them and mix them with the water. Do you get sticky mud? What colour is the mud? Now you have made mud from rocks.

SOIL EROSION AND CONSERVATION

Look at the slopes of a hill on a rainy day. You will see many streams of muddy water running down the slopes. The water is muddy because it washes away soil from the hill slopes. Sometimes soil is blown away by strong winds. When the soil is carried away by water or wind we say that the land is **eroded**. This is known as **soil erosion**.

二、现在来观察你采集到的岩石。用水冲洗并检查每块岩石。岩石是大的还是小的？摸摸每块岩石，弄明白它是光滑的还是粗糙的。观察它的棱边，棱边是圆的还是尖的？用刀片或铅笔刀刮刮每块岩石，岩石是硬的还是软的？描述每块岩石的颜色。

三、让我们看看岩石的内部。试用你的双手扒开每块岩石。如果岩石太硬，就用锤子。你看到岩石内部有什么东西？岩石内部和岩石外面的颜色是相同的吗？有小砂粒掉出来吗？

四、用锤子把每块岩石敲成小块。捣碎这些小块，一直捣得很细为止。然后倒上水，使它们同水拌和。你得到了粘糊糊的泥浆吗？泥浆呈现什么颜色？现在你已经用岩石做成了泥浆。

土壤侵蚀和土壤保持

在雨天观察山坡，你会看到许多股浑浊的水流往坡下流。水是浑浊的，因为水冲走了山坡上的土壤。有时，土壤被大风刮走。土壤被水或风带走时，我们说，土地被侵蚀了。这种现象叫做**土壤侵蚀**。

Soil erosion takes place most easily on hill slopes. Rain water runs down slopes quickly and carries plenty of soil with it. Erosion can also take place on flat, open land. Heavy rain can quickly wash away the rich top soil on flat, open land.

Plants cannot grow on eroded land. There is not enough soil on eroded land to give them the things they need. Plants need water and salts from the soil.

We must try to stop soil erosion. We can do this in a number of ways. This is known as **soil conservation**. One way of stopping soil erosion on flat, open ground is to grow small plants such as grasses. These plants are called **cover crops**. Their roots hold the soil tightly together. The rain water cannot wash away the soil. When trees and tall bushes are planted at the edges of an open field, soil erosion by strong winds cannot take place. The trees and bushes protect the open land from the winds. They act as a very big wall.

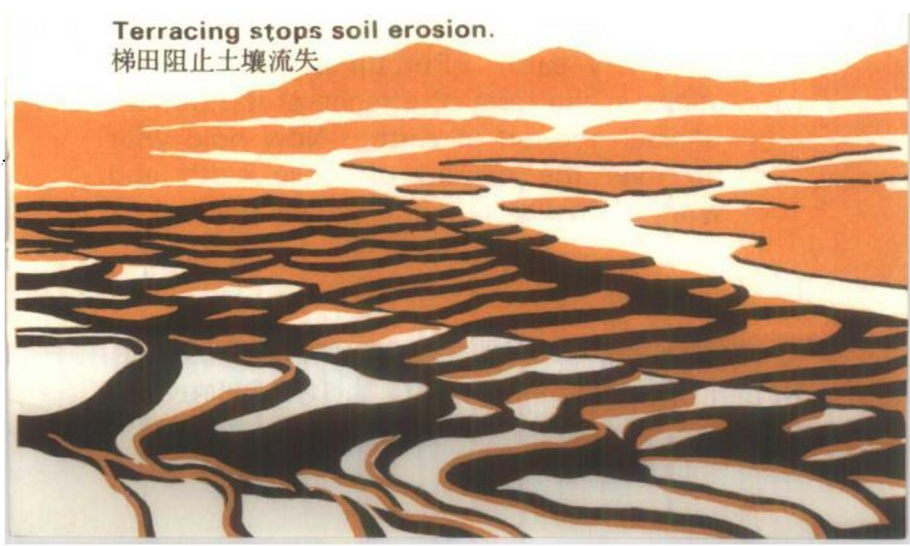
Soil erosion on slopes can be stopped in a number of ways. One way is to cut a slope into "steps" called **terraces**. Water carrying soil cannot run straight down the slope now. It has to run down the terraces. This slows down the flow of the water. Most of the soil in the water is left behind on the terraces.

土壤侵蚀最容易在山坡上发生。雨水沿坡奔流而下，夹带大量土壤。在平坦开阔的土地上也会发生土壤侵蚀。大雨会很快地冲走平坦开阔土地上的肥沃表土。

植物不能在受侵蚀的土地上生长。受侵蚀的土地没有足够的土壤为植物提供所需的东西。植物需要从土壤中吸取水分和盐类。

我们必须设法防止土壤侵蚀。我们可以用多种方法来做到这点。这叫做**土壤保持**。在平坦开阔的土地上防止土壤侵蚀的方法之一，是种植禾草一类的小植物。这些植物叫做**覆盖作物**。它们的根把土壤紧紧地抓在一起。雨水就没法把土壤冲走了。在开阔田野的四周种上树木或高大灌木丛，就不会发生强风造成的土壤侵蚀。乔木和灌木象一堵很大的墙，保护旷野免受强风侵袭。

可以通过多种途径防止斜坡上的土壤侵蚀。方法之一就是把斜坡开辟成叫做**梯田**的“台阶”。这样，夹带着土壤的水就不能直接沿坡下流了。它必须一块梯田接一块梯田地往下流。这就降低了水流的速度。水中大部分土壤就沉积在梯田里。



Water can carry away the soil only if it is flowing fast. In this way, the soil washed away from the upper part of the slope will be left on the terraces. The edges of the terraces can also be raised. The raised edges are called **bunds**. These will hold back the rain water and the soil it carries. Sometimes trees are planted in narrow steps cut into the hill slopes. These steps which are called **contours** slow down the flowing rain water. Cover crops growing on contours or the slopes between terraces also help to stop soil erosion.

Things to Do

(i) We can make our own rain and see what happens when it falls on different types of land. Take a big tin and make a number of holes in the bottom. Prepare a mound of loose earth. Next, find a mound of earth covered with grass or other plants. Finally find a mound of hard, dry earth. Put up a line of small sticks in the form of a fence at the bottom of each mound of earth. Now hold your tin over the mound of loose earth and with a smaller tin, pour some water into it.

水只有在流速很快时才能带走土壤。采用这种方法，从山坡上部冲走的土壤便沉积在梯田里了。也可以把梯田的边缘筑

高。筑高的边缘叫埂。埂会滞留雨水和雨水中夹带的土壤。有时在山坡上开出一条条狭台阶，里面种树。这些叫做等高阶的台阶，能降低雨水的流速。生长在等高阶或台阶之间斜坡上的覆盖作物，也有助于制止土壤侵蚀。

动 手 做

一、我们可以自己造雨，看它降到不同类型土地上时发生什么现象。取一只大铁皮罐，罐底开许多小孔。准备好一个松土的土堆，再找一个长满草或其他植物的土堆，最后找一个又硬又干的土堆。在每个土堆底部插一行小木棍，做成篱笆样子。现在拿住铁皮罐，放在松土堆上方。用小铁皮罐往大铁皮罐里倒些水。

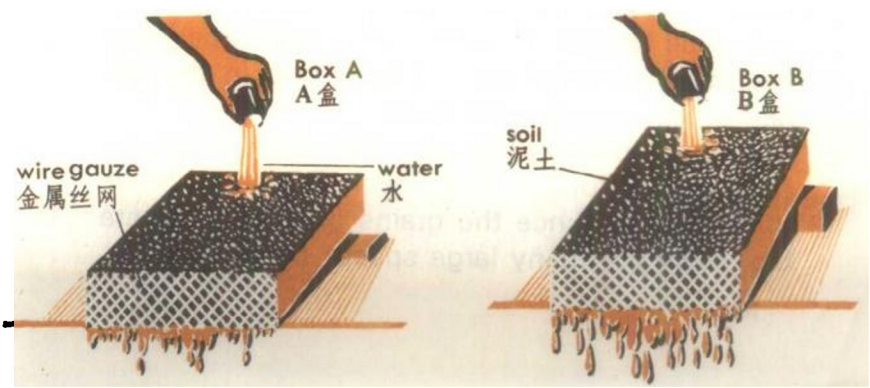
The water will pass through the holes at the bottom of the tin like rain. Watch it falling on the loose earth. You will see that some soil is washed away. The water flowing down the mound is not clean but brownish. This is because it is carrying away some soil. As it flows past the fence it slows down and some soil is caught by each stick. The water is eroding the mound while the fence is helping to conserve the soil. Now do the same thing with the mound covered with plants and the other made up of hard ground. See what happens and explain. Do soil erosion and soil conservation occur like before?

(ii) You can find out more about soil erosion on slopes in this way. Make two long narrow wooden boxes, both open at one end. At each open end nail a piece of wire gauze. Fill both boxes with equal amounts of the same type of soil. Tilt both boxes, making sure that you tilt Box B much more than Box A. Now pour exactly one tin of water over the upper end of Box A and collect the muddy water from the other end. Do the same thing with Box B. Compare the amounts of soil washed away from Box A and Box B. You will find that more soil is washed away from Box B.

This shows that more soil will be washed away when the slope is steeper.

水就会象雨那样从罐底的小孔流出。观察降到松土上的“雨”。你会看到，有些土壤被冲走了。从土堆上流下的水不是清澈的，而是带褐色的，这是因为它夹带一些土壤。当它流过篱笆时，流速降低了，每根小木棍阻拦住一些土壤。水侵蚀着土堆，而篱笆有助于土壤保持。现在再用长满植物的土堆，和另一个由硬土组成的土堆做同样的实验。看看发生什么情况，并加以解释。是否也象前一实验那样发生土壤侵蚀和土壤保持现象？

二、下面的实验可使你进一步弄清楚坡地上的土壤侵蚀。做两个一端敞开的狭长木盒。在每个木盒敞开的一端钉一块金属丝网。两个木盒装满等量的同类土壤。使两个木盒倾斜，务必使B盒比A盒倾斜得多。现在向A盒的高端倒入整整一罐水，收集从另一端流出的泥浆水。用B盒做同样的实验。比较从A盒和B盒中冲走的土壤量。你会发现，B盒冲走的土壤较多。这就说明，坡度越陡，冲走的土壤越多。



This time tilt both Box A and Box B in the same way. Pour two tins of water into Box A and one tin into Box B. Collect the muddy water from both boxes, and compare the amounts of soil washed away. You will find that more soil is washed away from Box A. This shows that if there is more water, more soil will be washed away.

Next, find a slope which is made of bare, hard soil, another of bare, loose soil and a third of soil covered with plants. Pour water on each slope and look at what happens. Is soil washed away from all the three slopes? Do the plants on the third slope help to prevent soil erosion? Now build little terraces across each slope and pour water on the slopes. Talk about what happens.

WHAT SOIL IS MADE UP OF

Soil is made up of **stones, sand, clay** and **loam**. It also contains **air** and **water**. Stones are small pieces of rock. They are larger than the other parts of soil. The stones in the soil are of all shapes and sizes.

When stones break up, they form grains of sand. The soil on the beach is mainly made up of sand. Since the grains of sand are quite big, there are many large spaces between them.