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EARTH SCIENCE

地球科学

Uncovering Earth's History

地球历史揭秘

GLEN PHELAN (美) 著

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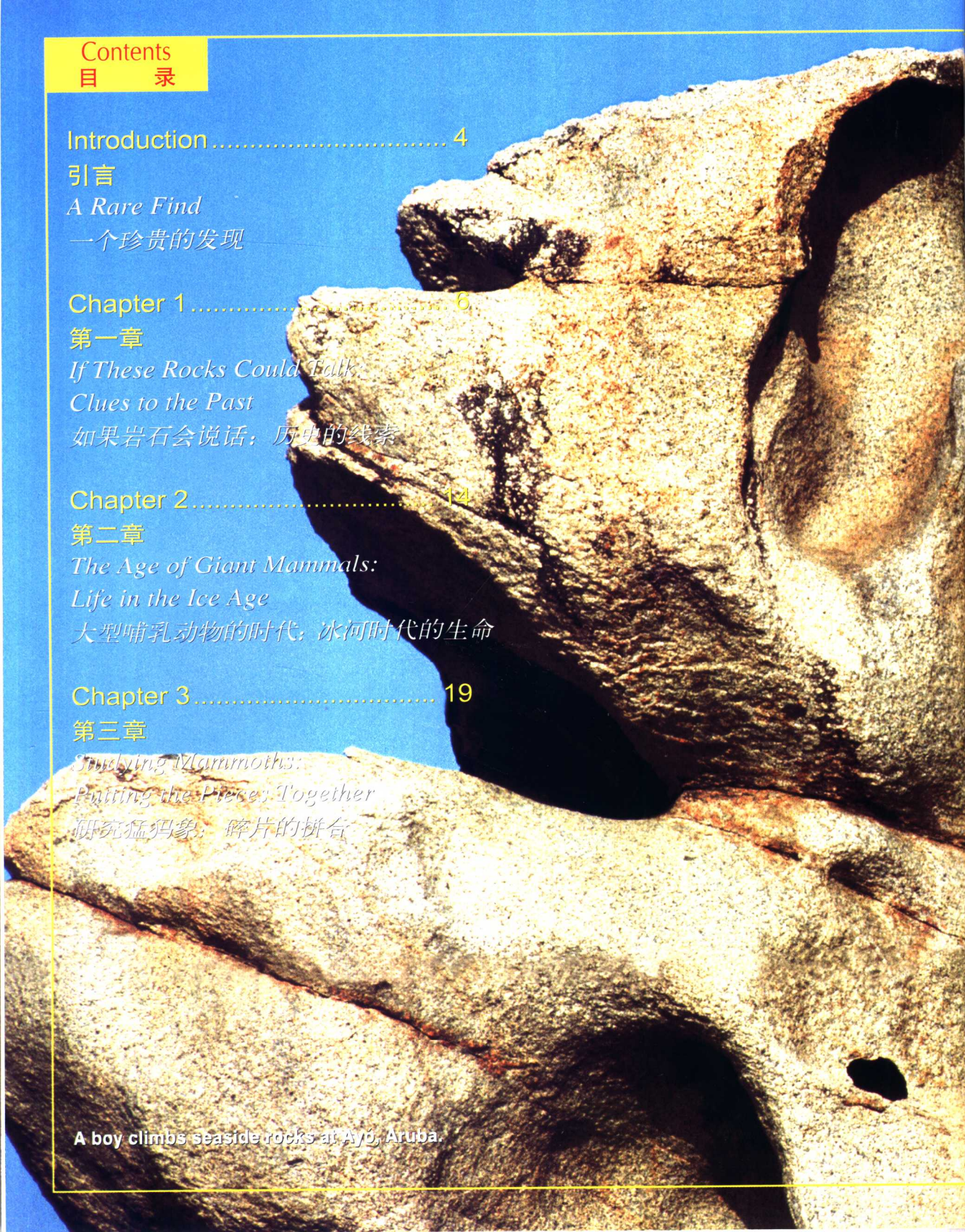
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A Rare Find

一个珍贵的发现



woolly *adj.* 多毛的
Pleistocene *n.* (巴纳利的古代)
猛犸, 毛象

Woolly mammoth²



The day was much like any other winter day in 1997—windy and cold. Nine-year-old Kostya Jarkov was used to that. He and his family were reindeer¹ herders² in northern Siberia³, part of Russia north of the Arctic Circle⁴. Suddenly, Kostya spotted⁵ something sticking out⁶ of the frozen⁷ ground. It looked like a rock.

The “rock” was no rock at all. It was part of the head of a giant⁸ woolly mammoth! Mammoths are ancient⁹ relatives¹⁰ of elephants. These gentle giants roamed¹¹ Earth for about 4 million years, then died out¹², or became extinct¹³, about 10,000 years ago. Why? Scientists are trying to find the answer to this mystery¹⁴.

Scientists learn about mammoths by studying their fossils¹⁵. Mammoth bones have been found in rock, frozen soil, or pools of sticky¹⁶ tar¹⁷, and sometimes someone finds an entire preserved¹⁸ mammoth. That’s what makes the Jarkov Mammoth, named after the boy who found it, so special. Hair, skin, bones, flesh¹⁹—all the parts seem to be there. Scientists examine every detail of the giant animal to gather clues²⁰ about its life.

This is a book about clues to Earth’s past. Fossils, like the Jarkov Mammoth, provide many clues. Other clues can be found in the rocks of a canyon²¹ wall, the shape of a valley, or even right where you live. You probably won’t find a mammoth buried²² nearby, but many other clues to our past exist outside your front door. You can discover how to read these clues.

1. reindeer	<i>n.</i>	驯鹿	12. die out		灭绝
2. herder	<i>n.</i>	牧人	13. extinct	<i>adj.</i>	灭绝的
3. Siberia		西伯利亚	14. mystery	<i>n.</i>	谜
4. Arctic Circle		北极圈	15. fossil	<i>n.</i>	化石
5. spot	<i>v.</i>	发现	16. sticky	<i>adj.</i>	黏性的
6. stick out		突出; 伸出	17. tar	<i>n.</i>	焦油; 沥青
7. frozen	<i>adj.</i>	冰冻的; 冻结的	18. preserved	<i>adj.</i>	保留的; 保存的
8. giant	<i>adj.</i>	巨大的	19. flesh	<i>n.</i>	肉
9. ancient	<i>adj.</i>	古代的	20. clue	<i>n.</i>	线索
10. relative	<i>n.</i>	亲缘动物	21. canyon	<i>n.</i>	峡谷
11. roam	<i>v.</i>	漫游	22. bury	<i>v.</i>	埋葬; 掩埋

If These Rocks Could Talk:

Clues to the Past

如果岩石会说话：历史的线索

Something happened here. Something big. What was it? The clues are there. The wide sweeping¹ valley, the steep² valley walls, the kinds of rocks beneath³ the soil. They tell a story of how this place came to be⁴.

- | | | |
|--------------------------|---------|---------|
| 1. sweeping | valley | 广阔的 |
| 2. steep | valley | 陡峭的 |
| 3. beneath | glacier | 在……底下 |
| 4. come to be | glacier | 形成；产生 |
| 5. glacial | valley | 冰河的；冰川的 |
| 6. Northwest Territories | | 西北地区 |

Glacial⁵ valley, Northwest Territories⁶, Canada

Earth's Clues

What happened to make our planet¹ the way it is today? Look at the valley pictured on the opposite² page. Most valleys are carved³ over millions of years by the rivers that flow through them. But this valley is different. It's wide like the letter U, not narrow like a V. The valley walls are scratched⁴ and polished⁵, as if rocks and other material had been dragged⁶ against the walls. The valley contains⁷ boulders⁸ of many different sizes, as if something had dropped them there. These are all clues geologists⁹ use to figure out¹⁰ how this breathtaking¹¹ landscape¹² came to be.



Lower¹⁹ Yellowstone River Valley²⁰, Wyoming²¹

The deep, U-shaped valley was carved by ice, not by running water. A million years ago, the climate¹³ here was colder. Snow built up year after year and turned to ice, filling much of the valley. A glacier¹⁴, or large body of moving ice, slowly traveled down the valley like a giant ice cream scoop¹⁵, deepening and widening it. When the glacier melted¹⁶, the rocks it had plucked¹⁷ from the valley walls dropped to form a ridge¹⁸.

How is the valley on page 7 different from the one on page 6?

1. planet	<i>n.</i>	行星(此处指地球)	12. landscape	<i>n.</i>	地形; 地貌
2. opposite	<i>adj.</i>	对面的	13. climate	<i>n.</i>	气候
3. carve	<i>v.</i>	切开; 分割	14. glacier	<i>n.</i>	冰川
4. scratch	<i>v.</i>	划; 刻	15. scoop	<i>n.</i>	铲
5. polish	<i>v.</i>	擦; 擦亮	16. melt	<i>v.</i>	融化
6. drag	<i>v.</i>	拖; 拉	17. pluck	<i>v.</i>	(冰川)拔削; 拔蚀(岩石)
7. contain	<i>v.</i>	包含; 容纳	18. ridge	<i>n.</i>	山脊; 山脉
8. boulder	<i>n.</i>	巨砾	19. lower	<i>adj.</i>	下游的
9. geologist	<i>n.</i>	地质学家	20. Yellowstone River Valley		黄石河河谷
10. figure out		断定	21. Wyoming		怀俄明州
11. breathtaking	<i>adj.</i>	惊人的; 令人兴奋的			



Reading the Rocks

The moving and melting of glaciers are just some of the mind-boggling¹ events that have happened during Earth's 4.6-billion-year history. What else shaped Earth? Mountain ranges² have been pushed up and worn down. Rivers have carved out canyons and sculpted³ the landscape. Oceans have covered vast⁴ portions⁵ of continents⁶ and then moved back. The continents themselves have drifted⁷ to their present places. Millions of different kinds of plants and animals have come and gone.

How do we know all this? No one was around to videotape, photograph, or even write down what happened. Much of Earth's history is written in the rocks. The trick⁸ is knowing how to read the rocks, how to recognize⁹ the clues and piece them together.

What Came First?

Actually, reading rock clues is no trick at all. Often it means just using common sense¹⁰. Think about making a sandwich. You

start with a slice¹¹ of bread. Next, you spread a little mayonnaise¹² or mustard¹³ on the bread. Then you add meat, cheese, lettuce¹⁴, and tomato, one layer¹⁵ at a time. One more slice of bread and your sandwich is complete. The bread on the bottom was the first layer, right? Think of it as the oldest part of the sandwich. The next layers get younger and younger. The youngest layer is the bread on top.

Layers of rock form in much the same way. Look at the layers of rock in the photograph

1. mind-boggling	<i>adj.</i>	令人难以想象的
2. range	<i>n.</i>	山脉
3. sculpt	<i>v.</i>	雕刻; 雕塑
4. vast	<i>adj.</i>	辽阔的
5. portion	<i>n.</i>	一部分
6. continent	<i>n.</i>	大陆
7. drift	<i>v.</i>	漂流
8. trick	<i>n.</i>	技巧; 窍门
9. recognize	<i>v.</i>	发现
10. common sense		常识
11. slice	<i>n.</i>	薄片; 片
12. mayonnaise	<i>n.</i>	蛋黄酱
13. mustard	<i>n.</i>	芥末
14. lettuce	<i>n.</i>	莴苣
15. layer	<i>n.</i>	层



of the Grand Canyon¹ above. The layers look a bit like a pile of sandwiches. Each layer was made from sediments²—bits of sand, mud³, clay⁴, and plant and animal remains⁵. The sediments sank to the bottom of ancient seas, lakes, and swamps⁶ that covered this area at different times in the past. Pressure⁷ on the bottom sediments squeezed⁸ out the water and helped bind⁹ the sediments into hard, solid¹⁰ sedimentary rock¹¹. The oldest rock layers are at the bottom. The youngest are at the top.

- | | | |
|----------------------|-------------|---------|
| 1. Grand Canyon | | 大峡谷 |
| 2. sediment | <i>n.</i> | 沉积物 |
| 3. mud | <i>n.</i> | 泥；泥浆 |
| 4. clay | <i>n.</i> | 黏土 |
| 5. remains | <i>n.</i> | 残骸 |
| 6. swamp | <i>n.</i> | 沼泽地 |
| 7. pressure | <i>n.</i> | 压力 |
| 8. squeeze | <i>v.</i> | 用力挤压 |
| 9. bind | <i>v.</i> | 使粘合；使结合 |
| 10. solid | <i>adj.</i> | 坚固的 |
| 11. sedimentary rock | | 沉积岩 |
| 12. vary | <i>v.</i> | 变化；使多样化 |
| 13. erode | <i>v.</i> | 被腐蚀；遭侵蚀 |
| 14. wear away | | 磨损 |
| 15. compress | <i>v.</i> | 压紧；压缩 |
| 16. expose | <i>v.</i> | 暴露；显露 |
| 17. Colorado River | | 科罗拉多河 |

The Colorado River¹⁷ carved out the Grand Canyon.

Did you ever

wonder...

... what makes rocks look like they have layers?

Layers look different for many reasons. Varying¹² sizes of sediments often make a layer look different from layers above and below. Some rocks are weaker or stronger than others, so they erode¹³, or wear away¹⁴, at different rates. Also, rocks are made of different materials. When these materials are compressed¹⁵ and exposed¹⁶ to water and air, they turn different colors. The changing colors mark some of the different layers.

More Sandwich Science

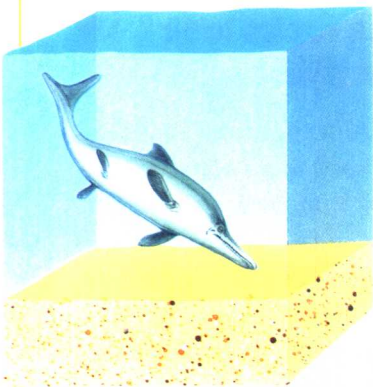
Think about the sandwich again. After you make the sandwich, you cut it in half. Then you might stick a toothpick¹ in each half to hold the layers together until you eat it. Both of these actions are completed after you assemble² the sandwich.

The pictures, at right, illustrate³ the order of different events occurring⁴ in Earth's rocks. In photograph A, the rock layers formed before the cracks⁵ running through them—just like making a sandwich before cutting it. In photograph B on page 11, the reddish⁶ rock formed before the darker rock. The dark rock cut through the reddish rock just as the toothpick cut through the layers of the sandwich. The dark rock formed from magma⁷—hot liquid⁸ rock. The magma forced its way into a crack in the reddish rock, then cooled and hardened.

1. toothpick	<i>n.</i>	牙签
2. assemble	<i>v.</i>	装配
3. illustrate	<i>v.</i>	(用图画等)说明; 阐明
4. occur	<i>v.</i>	发生
5. crack	<i>n.</i>	裂缝
6. reddish	<i>adj.</i>	带红色的; 淡红的
7. magma	<i>n.</i>	岩浆
8. liquid	<i>n.</i>	液体
9. sink	<i>v.</i>	下沉
10. seabed	<i>n.</i>	海底; 海床
11. bacterium	<i>n.</i>	(<i>pl. bacteria</i>)细菌



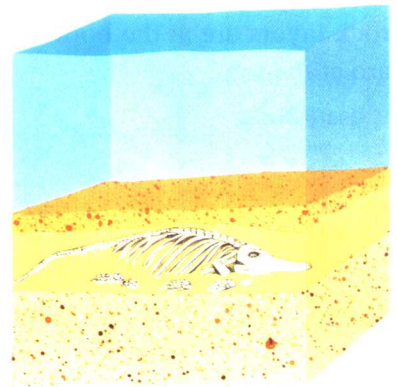
How an Animal Can Become a Fossil



- 1** The dead animal sinks⁹ to the seabed¹⁰.



- 2** Other animals and bacteria¹¹ eat its flesh.



- 3** Sediments pile on top.

Fossil Clues

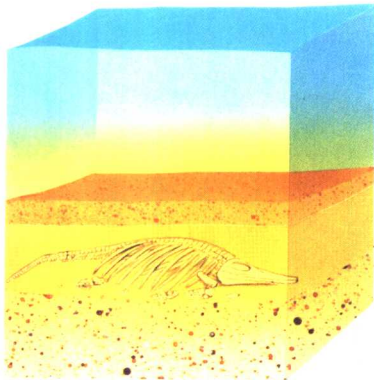
Fossils provide some of the best clues for figuring out what life was like long ago. Few animals ever turn into fossils. When an animal dies, other animals and bacteria devour¹ the flesh. Unless the hard parts such as bones are buried fairly² quickly, they will decay³, break up⁴, and crumble⁵ until there's nothing left. However, some animal and plant parts do remain. A fossil can be a bone or shell⁶ turned to stone. It can be an insect⁷ trapped⁸ in tree sap⁹ or the imprint¹⁰ of a leaf left in a rock. A fossil also can be an entire mammal¹¹, like the Jarkov Mammoth, frozen in soil.

How can rock layers help determine¹² the age of fossils?

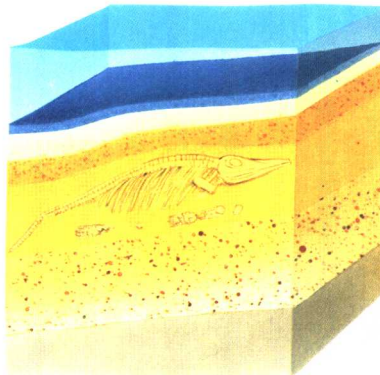
1. devour	v.	吞食
2. fairly	adv.	相当
3. decay	v.	腐烂
4. break up		分解
5. crumble	v.	瓦解；消失



6. shell	n.	动物的壳
7. insect	n.	昆虫
8. trap	v.	陷入
9. sap	n.	液汁
10. imprint	n.	痕迹
11. mammal	n.	哺乳动物
12. determine	v.	确定
13. dissolve	v.	溶解
14. mineral	n.	矿物；无机物
15. seep	v.	渗出；渗漏
16. compact	adj.	紧密的；坚实的
17. replace	v.	代替；取代
18. chemical	n.	化学物质



4 Dissolved¹³ minerals¹⁴ seep¹⁵ into the rocks and the animal's remains.



5 Water is squeezed out and the rock becomes hard and compact¹⁶. The minerals from the water replace¹⁷ the chemicals¹⁸ in the bones.



6 Millions of years later the rocks are lifted up and become dry land. Wind or water wear away rocks, exposing fossils.

Every Fossil Is a Treasure¹

If you ever go fossil hunting, don't be disappointed² if you don't find a dinosaur³ bone or a fish skeleton⁴. Those kinds of fossils are very rare. You are more likely to find smaller fossils like clams⁵ and corals⁶. But every fossil find is exciting. Imagine breaking off a loose piece of rock and finding a clam shell. You would be the first person to see that fossil. You would know that an animal with this shell once lived there when a sea covered the area millions of years ago. Every fossil tells us a little more about Earth's history.

1. treasure	<i>n.</i>	珍宝
2. disappointed	<i>adj.</i>	失望的
3. dinosaur	<i>n.</i>	恐龙
4. skeleton	<i>n.</i>	骨骼
5. clam	<i>n.</i>	蛤
6. coral	<i>n.</i>	珊瑚
7. define	<i>v.</i>	给……下定义
8. experience	<i>n.</i>	经历
9. operational definition		操作型定义
10. sugar cube		方糖
11. represent	<i>v.</i>	代表
12. partly	<i>adv.</i>	部分地
13. stir	<i>v.</i>	搅拌
14. observe	<i>v.</i>	观察
15. partially	<i>adv.</i>	部分地

Thinking Like a Scientist: Defining⁷ Operationally

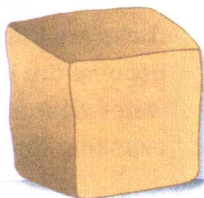
If a friend asked you to define a bicycle, what would you say? As you answered, you'd probably think about the last time you rode a bike. A definition that is based on your experiences⁸ with something is called an operational definition⁹. Operational definitions are “doing” definitions.

Suppose you use clay and sugar cubes¹⁰ to model how sediment preserves animals that become fossils. The clay represents¹¹ sediment and the sugar cubes represent fossils. You cover one sugar cube completely with clay. You cover another cube

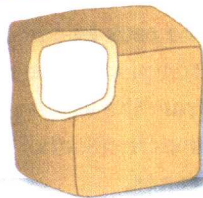
partly¹² with clay, and you leave one cube uncovered. You put the cubes in a glass of water and stir¹³ for three minutes. You observe¹⁴ that the covered cube was protected by the clay. The exposed part of the partially¹⁵ covered cube has dissolved. Only a small portion of the uncovered cube remains.

Based on what happened to the three sugar cubes, write an operational definition of the word *preserve*. Now look up *preserve* in a dictionary. How does this definition compare with the one you wrote?

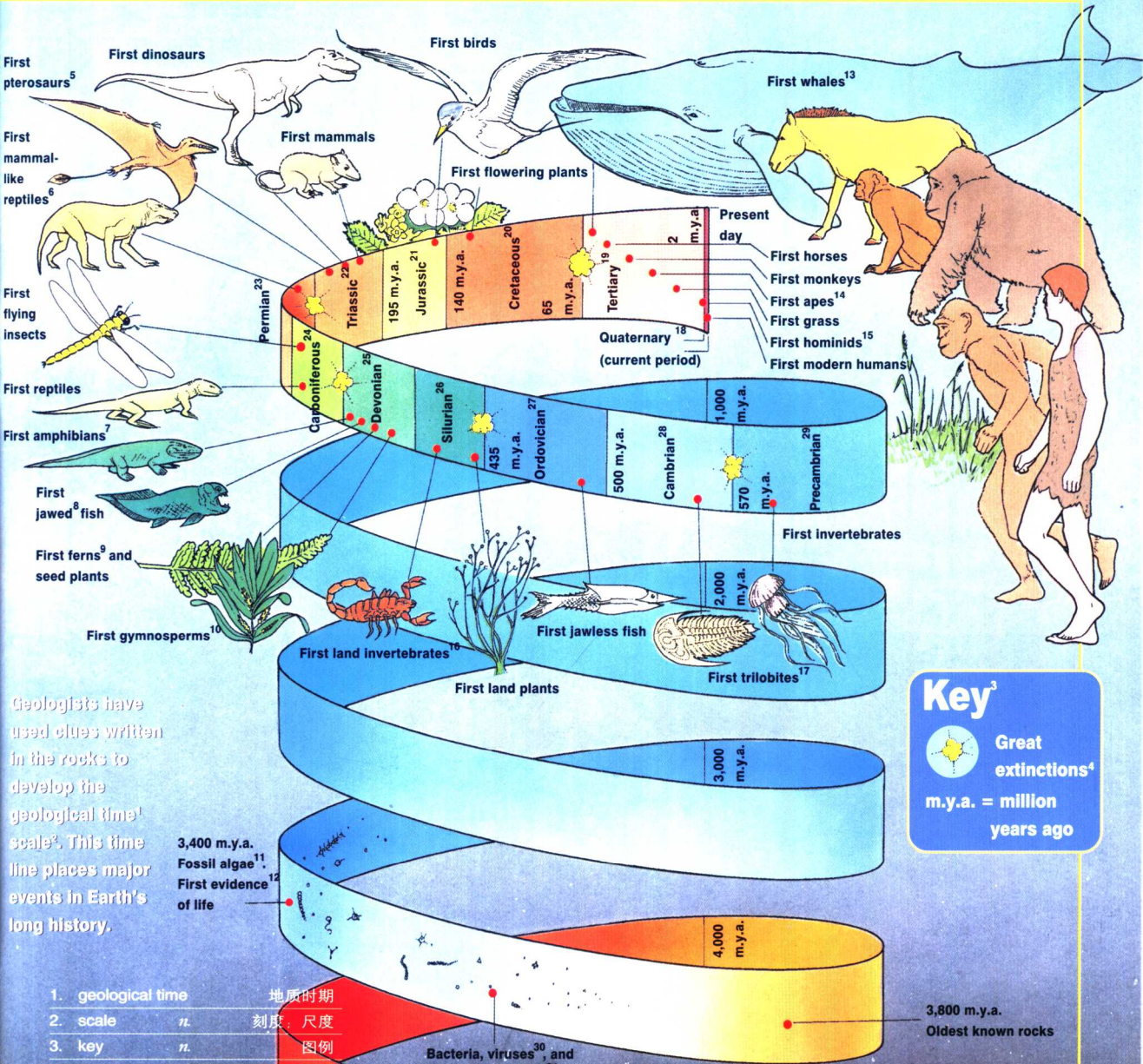
**Clay-covered
sugar cube**



**Partially covered
sugar cube**



Sugar cube



1. geological time	地质时期
2. scale	n. 刻度 尺度
3. key	n. 图例
4. great extinction	大灭绝
5. pterosaur	n. 翼手龙
6. reptile	n. 爬虫类
7. amphibian	n. 两栖动物
8. jawed	adj. 有颌的; 有腭的
9. fern	n. 蕨; 蕨类植物
10. gymnosperm	n. 裸子植物
11. algae	n. 水藻; 海藻
12. evidence	n. 证据
13. whale	n. 鲸
14. ape	n. 无尾猿; 类人猿

15. hominid	n. 人科动物
16. invertebrate	n. 无脊椎动物
17. trilobite	n. 三叶虫
18. Quaternary	n. 第四纪
19. Tertiary	n. 第三纪
20. Cretaceous	n. 白垩纪
21. Jurassic	n. 侏罗纪
22. Triassic	n. 三叠纪
23. Permian	n. 二叠纪
24. Carboniferous	n. 石炭纪

25. Devonian	n. 泥盆纪
26. Silurian	n. 志留纪
27. Ordovician	n. 奥陶纪
28. Cambrian	n. 寒武纪
29. Precambrian	n. 前寒武纪
30. virus	n. 病毒
31. evolution	n. 演变; 进化

The Age of Giant Mammals:

Life in the Ice Age

大型哺乳动物的时代：冰河时代的生命

There is little about Greenland¹ that is green. Most of this large island northeast of Canada is covered by a glacier. Today glaciers can be found in places such as Antarctica and high mountain ranges. Long ago, a glacier might have been in your own backyard²!

1. Greenland

格陵兰岛

2. backyard

n.

后院；场院

Glacier in Qaanaaq, Greenland

About 2 million years ago, Earth was in a period called the Ice Age, when glaciers covered large areas of the planet. Glaciers crept¹ south from the Arctic, covering all of what is now Canada and parts of Europe, Russia, and the United States.

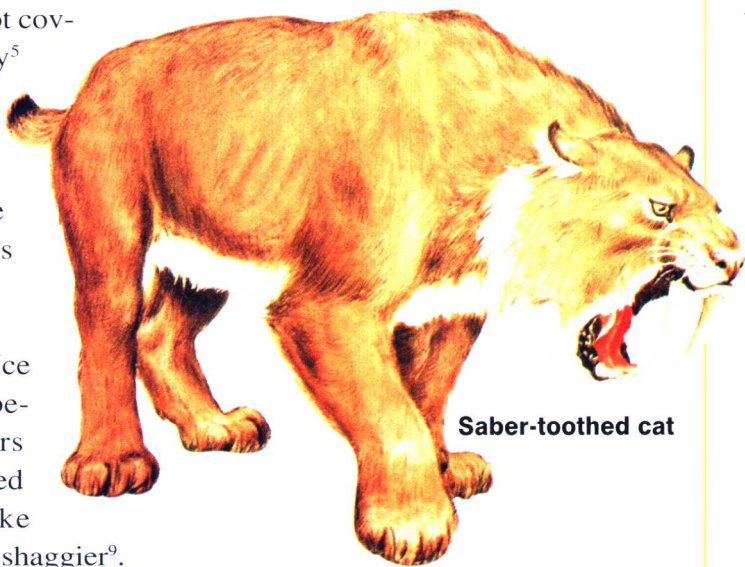
The Land of Giant Creatures²

What was Earth like during the Ice Age? Well, for one thing, it was a lot colder. In the area that is now the United States, average temperatures³ often were more than 20 degrees Fahrenheit⁴ colder. It was wetter in many places too.

During the Ice Age, part of the land not covered by glaciers was an open grassy⁵ plain⁶. It was sometimes covered with snow, but not always. Beyond the plains was a combination⁷ of forests and open areas, including land in the southwestern United States that is mostly desert⁸ today.

There were no dinosaurs during the Ice Age. They were long gone, having become extinct about 65 million years earlier. Some of the mammals that lived during the Ice Age were much like today's mammals except bigger—and shaggier⁹.

Some mammoths stood more than 1 meter (3 feet) taller than the largest elephants today. Mammals such as woolly rhinoceroses¹⁰, giant deer, large wolves, and the ferocious¹¹ saber-toothed cat¹² existed at this time.



Saber-toothed cat

- | | | | | | |
|----------------|------|-------------|-----------------------|------|----------|
| 1. creep | v. | 爬行; 匍匐 | 7. combination | n. | 结合体; 联合 |
| 2. creature | n. | 动物 | 8. desert | n. | 沙漠 |
| 3. temperature | n. | 温度 | 9. shaggy | adj. | (毛发等)粗浓的 |
| 4. Fahrenheit | adj. | 华氏温度计的; 华氏的 | 10. rhinoceros | n. | 犀牛 |
| 5. grassy | adj. | 多草的; 绿色的 | 11. ferocious | adj. | 凶猛的 |
| 6. plain | n. | 平原 | 12. saber-toothed cat | n. | 剑齿虎 |