TPO 15 – 1 A Warm-Blooded Turtle
温血海龟

When it comes to **physiology**, the leatherback turtle is, in some ways, more like a reptilian whale than a turtle. It swims farther into the cold of the northern and southern oceans than any other sea turtle, and it deals with the chilly waters **in a way unique** among reptiles.
从生理学上讲，棱皮龟在某些方面上更像爬行类的鲸而不是海龟。 跟其他海龟相比，它们能够游入更寒冷的北部和南部海洋，并且和其他爬行类动物相比，它们在应对寒冷水域时**有其独特的方式**。

A warm-blooded turtle may seem to be a **contradiction** in terms. **Nonetheless**, an adult leatherback can maintain a body temperature of between 25 and 26°C 77–79°F in seawater that is only 8°C 46.4°F. Accomplishing this **feat** requires adaptations both to generate heat in the turtle's body and to keep it from escaping into the surrounding waters. Leatherbacks apparently do not generate internal heat the way we do, or the way birds do, as a by-product of **cellular metabolism**. A leatherback may be able to pick up some body heat by **basking** at the surface; its dark, almost black body color may help it to absorb solar radiation. However, most of its internal heat comes from the action of its **muscles**.
温血海龟似乎是一个**自相矛盾的术语**。 **尽管如此**，成年棱皮龟能够在仅 8 摄氏度（46.4 华氏度）的海水中将体温维持在 25～26 摄氏度（77-79 华氏度）之间。 要实现这一**壮举**，棱皮龟不但要能够在体内生成热量，还要防止温度散失到周围水域。 很显然，棱皮龟产生体内热量的方式与我们或者鸟类不同，并非**细胞代谢**的副产物。 棱皮龟可能会通过晒太阳来收集身体所需的热量。其深色近乎黑色的体色有助于吸收太阳辐射。 然而，它的大部分体热来自于肌肉运动。

Leatherbacks keep their body heat in three different ways. The first, and simplest, is size. The bigger the animal is, the lower its **surface-to-volume ratio**; for every ounce of body mass, there is proportionately less surface *through which* heat can escape. An adult leatherback is twice the size of the biggest cheloniid sea turtles and will therefore take longer to cool off. Maintaining a high body temperature through **sheer bulk** is called gigantothermy. It works for elephants, for whales, and, perhaps, it worked for many of the larger dinosaurs. It apparently works, in a smaller way, for some other sea turtles. Large **loggerhead** and green turtles can maintain their body temperature at a degree or two above that of the surrounding water, and gigantothermy is probably the way they do it. Muscular activity helps, too, and an actively swimming green turtle may be 7°C 12.6°F warmer than the waters it swims through.
棱皮龟通过三种方式保持体温。 第一种也是最简单的方式就是体型大小。 动物体型越大，**表面和体积的比例**越小。体重每增加一盎司，相应的容易流失热量的表面就越少。 成年棱皮龟是最大的海龟的两倍，因此它变凉就需要更久的时间。 完全依靠**庞大体积**维持体温的方法叫巨温法。 大象、鲸鱼也许包括很多恐龙也是通过这种方法保持体温的。 其它海龟或多或少也存在这种现象。 巨大的**红海龟**和绿甲海龟可以维持与周围水温略高 1 摄氏度或 2 摄氏度或的体温，可能就是利用的巨温法。 肌肉活动也有帮助，积极游动的绿海龟比它游过的水温度高出 7° C 12.6° F。

批注 [1]: physiology
英 [ˌfɪzi'ɒlədʒi] 美 [ˌfɪzi'ɑːlədʒi]
•n. 生理学；生理机能

批注 [2]: bask
英 [bɑːsk] 美 [bæsk]
•vi. 晒太阳；取暖；愉快或舒适
•vt. 使…晒太阳；使暖和而舒适

批注 [3]: muscle
英 ['mʌsl] 美 ['mʌsl]
•n. 肌肉；力量
•vt. 加强；使劲搬动；使劲挤出
•vi. 使劲行进

批注 [4]: sheer
英 [ʃɪə(r)] 美 [ʃɪr]
•adj. 绝对的；透明的；峻峭的；纯粹的
•adv. 完全；陡峭地
•vi. 偏航
•vt. 使偏航；使急转向
•n. 偏航；透明薄织物

bulk
英 [bʌlk] 美 [bʌlk]
•n. 体积，容量；大多数，大部分；大块
•vt. 使扩大，使形成大量；使显得重要

Gigantothermy, though, would not be enough to keep a leatherback warm in cold northern waters. It is not enough for whales, which supplement it with a thick layer of insulating blubber fat. Leatherbacks do not have blubber, but they do have a reptilian equivalent: thick, oil-saturated skin, with a layer of fibrous, fatty tissue just beneath it. Insulation protects the leatherback everywhere but on its head and flippers. Because the flippers are comparatively thin and blade like, they are the one part of the leatherback that is likely to become chilled. There is not much that the turtle can do about this without compromising the aerodynamic shape of the flipper. The problem is that as blood flows through the turtle's flippers, it risks losing enough heat to lower the animal's central body temperature when it returns. The solution is to allow the flippers to cool down without drawing heat away from the rest of the turtle's body. The leatherback accomplishes this by arranging the blood vessels in the base of its flipper into a countercurrent exchange system.

然而，在寒冷的北部水域巨温法不足让棱皮龟保暖。 同样，巨温法对鲸来说也是不够的，鲸还通过厚厚的绝缘脂（脂肪）来帮助维持体温。 棱皮龟没有鲸那样的脂肪，但是它们和爬行类的动物有着相似的结构：厚且含油的皮肤，皮肤下有一层纤维，而脂肪组织就在这个纤维层下面。 除了头部和鳍，这个“绝缘”结构可以保护它们的所有部位。 因为棱皮龟的鳍相对较薄且呈叶片状，这一部位很有可能会被冻僵。 **如果不损害鳍部气动外形**，海龟几乎什么也做不了。 问题是血液流经海龟鳍部时，很容易损耗热量，血液回流时便降低了动物的中心体温。 解决办法是在身体其余部分的热量还没有损耗前，允许鳍部降低温度。 棱皮龟通过把流入鳍部血管变为逆流交换系统来实现这一点。

In a countercurrent exchange system, the blood vessels *carrying cooled blood from the flippers* run close enough to the blood vessels *carrying warm blood from the body* to pick up some heat from the warmer blood vessels; thus, the heat is transferred from the outgoing to the ingoing vessels before it reaches the flipper itself. This is the same arrangement found in an old-fashioned steam radiator, in which the coiled pipes pass heat back and forth as water courses through them. The leatherback is certainly not the only animal with such an arrangement; gulls have a countercurrent exchange in their legs. That is why a gull can stand on an ice floe without freezing.

在逆流交换系统中，从鳍部回来携带冷血的血管足够靠近来自体内携带热血的血管并吸取部分热量。因此，血在到达鳍部前就通过流入的血液和流出的血液完成了热量转移。 人们发现老式蒸汽式暖气片有着与之类似的装置，当水流经这些盘绕的管子时热量进行了交换。 当然并不只是棱皮龟有这种结构。 海鸥的腿部也有一个逆流交换系统。 这就是为什么海鸥可以站在冰川上而不被冻结的原因。

All this applies, of course, only to an adult leatherback. Hatchlings are simply too small to conserve body heat, even with insulation and countercurrent exchange systems. We do not know how old, or how large, a leatherback has to be before it can switch from a cold-blooded to a warm-blooded mode of life. Leatherbacks reach their immense size in a much shorter time than it takes other sea turtles to grow. Perhaps their rush to adulthood is driven by a simple need to keep warm.

批注 [5]: blubber
英 ['blʌbə(r)] 美 ['blʌbər]
•n. 鲸脂；哭泣
•vi. 又哭又闹
•vt. 又哭又闹
•adj. 肿大的

批注 [6]: fibrous
英 ['faɪbrəs] 美 ['faɪbrəs]
•adj. 纤维的，纤维性的；纤维状的

批注 [7]: compromise
英 ['kɒmprəmaɪz] 美 ['kɑːmprəmaɪz]
•n. 妥协，和解；妥协（或折中）方案；达成妥协
•v. 妥协，折中；违背（原则），达不到（标准）；（因行为不当）使陷入危险，名誉受损

批注 [8]: aerodynamic
英 [ˌeərəʊdaɪ'næmɪk] 美 [ˌeroʊdaɪ'næmɪk]
•adj. 空气动力学的，[航] 航空动力学的

批注 [9]: 值得学习一下/worth learning
It is worth learning.

批注 [10]: countercurrent
英 ['kaʊntə,kʌrənt] 美 ['kaʊntɚ,kɝənt]
•n. 逆流；逆电流
•adv. 相反地

批注 [11]: course
英 [kɔːs] 美 [kɔːrs]
•n. 科目；课程；过程；进程；道路；路线，航向；一道菜
•vt. 追赶；跑过
•vi. 指引航线；快跑

批注 [12]: floe
英 [fləʊ] 美 [floʊ]
•n. 浮冰；大浮冰

当然，这些都仅适用于成年棱皮龟。 刚孵化的棱皮龟太小，即使有绝缘层和逆流交换系统也不能保存体温。 现在我们还不知道棱皮龟要达到多大年龄或者多大尺寸才能从冷血动物转变成温血动物。 棱皮龟庞大体型的形成时间要比其它海龟短得多。 可能它们是为了保暖才急着向成年过渡。

TPO 15 – 2 Mass Extinctions
大规模物种灭绝

Cases *in which* many species become extinct *within a geologically* short interval of time are called mass extinctions. There was one such event at the end of the Cretaceous period around 70 million years ago. There was another, even larger, mass extinction at the end of the Permian period around 250 million years ago. The Permian event has attracted much less attention than other mass extinctions because mostly unfamiliar species perished at that time.

地质年代中，在一个短期的时间段内有大量物种灭绝的现象就被称为大规模物种灭绝。 白垩纪时期后期（大约七千万年前）就曾经发生过一次大规模物种灭绝。 而在二叠纪时期后期（大约两亿五千万年前）还发生过一次规模更大的物种灭绝。 由于当时灭绝的物种很少为人类所熟悉，所以二叠纪时期的大规模物种灭绝受到的关注远远不如其他几次大规模物种灭绝。

The fossil record shows at least five mass extinctions in which many families of marine organisms died out. The **rates** of extinction happening today are as great as the rates during these mass extinctions. Many scientists have therefore concluded that a sixth great mass extinction is currently in progress.

化石记录显示，历史上至少发生过五次大规模物种灭绝，造成大批海洋生物消亡。 如今物种灭绝的比率和之前五次大规模物种灭绝时期一样高。 因此许多科学家推断：当前，第六次大规模物灭绝正在发生。

What could cause such high rates of extinction? There are several hypotheses, including warming or cooling of Earth, changes in seasonal fluctuations or ocean currents, and changing positions of the continents. Biological hypotheses include ecological changes **brought about by** the evolution **of** cooperation between insects and flowering plants **or of** bottom-feeding predators in the oceans. Some of the proposed mechanisms required a very brief period during which all extinctions suddenly took place; other mechanisms would be more likely to have taken place more gradually, **over an extended period,** or at different times on different continents. Some hypotheses fail to account for simultaneous extinctions on land and in the seas. Each mass extinction may have had a different cause. Evidence points to hunting by humans and habitat destruction as the likely causes for the current mass extinction.

是什么原因引起如此高的物种灭绝率呢？ 有几种假说，包括：地球变暖或变冷；季节型波动的改变或洋流变化；大陆位置移动。 生物假说包括因昆虫与开花植物之间的合作式进化或海洋底层肉食动物进化引起的生态变化。 这些生物机制，有些在极短的时间内就会灭绝，而有些则很有可能**经过长时期**在不同时代或不同大陆缓慢地进行。 有些假说未能解释在陆地和海洋同时发生的物种灭绝。 可能每次大规模物种灭绝都有不同的原因。 但有证据指出，人类狩猎以及人类破坏栖息地很可能是当前大规模物种灭绝的原因。

American paleontologists David Raup and John Sepkoski, who have studied extinction rates in a number of fossil groups, suggest that **episodes** of increased extinction have recurred

批注 [13]: **case**
英 [keɪs] 美 [keɪs]
n. 情况；实例；箱
•vt. 包围；把…装于容器中

批注 [14]: **geologically**
美 [ˌdʒiːəˈlɑːdʒɪkli]
•adv. 从地质学角度

批注 [15]: 这是一个细节。
全文并不讨论它。

批注 [16]: **rate**
英 [reɪt] 美 [reɪt]
n. 比率，率；速度；价格；等级
•vt. 认为；估价；责骂
•vi. 责骂；被评价

问的是速度，对应的选项里问了：

regularity
英 [ˌregjuˈlærəti] 美 [ˌregjuˈlærəti]
•n. 规则性；整齐；正规；匀称

with regularity
•整整齐齐

regularly，说的是频率

regularly
英 ['regjələli] 美 ['regjələrli]

批注 [17]: **ecological**
英 [ˌiːkəˈlɒdʒɪkl] 美 [ˌiːkəˈlɑːdʒɪkl]
•adj. 生态的，生态学的

批注 [18]: **brought about by**
可带来的 ；所带来的 ；带来的

批注 [19]: **episode**
英 ['epɪsəʊd] 美 ['epɪsoʊd]
•n. 一段经历；插曲；一段情节；（电视连续剧或广播的）一集；插话；有趣的事件

periodically, approximately every 26 million years since the mid-Cretaceous period. The late Cretaceous extinction of the dinosaurs and ammonoids was just one of the more drastic in a whole series of such recurrent extinction episodes. The possibility *that mass extinctions may recur periodically* has given rise to **such** hypotheses **as that** of a companion star with a long-period orbit **deflecting** other bodies from their normal orbits, making some of them fall to Earth as meteors and causing widespread devastation upon impact.
美国古生物学家 David Raup 和 John Sepkoski 曾经从大量化石群中研究物种灭绝的比率。他们指出，自从白垩纪时期中期以来，灭绝的物种不断增多，大约每隔两千六百万年就会定期发生一次。 白垩纪时期后期的恐龙和菊石（的灭绝是一系列此类周期性物种灭绝中更为剧烈的一次。 对于周期性出现大规模物种灭绝的可能性，引发了这样的假设：一颗具有长周期轨道的伴星体使其他天体从正常轨道偏离，导致其中一些天体变成流星掉落到地球，撞击时造成大范围破坏。

批注 [20]: deflect
英 [dɪ'flekt] 美 [dɪ'flekt]
•vt. 使转向；使偏斜；使弯曲
•vi. 转向；偏斜

Of the various hypotheses attempting to account for the late Cretaceous extinctions, the one that has attracted the most attention in recent years is the asteroid-impact hypothesis first suggested by Luis and Walter Alvarez. According to this hypothesis, Earth collided with an asteroid with an estimated diameter of 10 kilometers, or with several asteroids, the combined mass of which was comparable. The force of collision **spewed** large amounts of debris into the atmosphere, darkening the skies for several years before the **finer** particles settled. The reduced level of photosynthesis led to a massive decline in plant life of all kinds, and this caused massive starvation first of herbivores and **subsequently** of carnivores. The mass extinction would have occurred very suddenly under this hypothesis.
各种假说都试图对白垩纪时期后期物种灭绝做出解释，近年来 Luis 和 Walter Alvarez 最先提出的小行星撞击假说备受人们关注。 根据这一假说，地球与一个直径约为 10 公里的小行星或者总体积与之相当的几个小行星发生碰撞。 碰撞的力量把大量碎片喷射到大气中，在这些细小颗粒沉积之前好几年的时间里天空都是灰蒙的。 光合作用减弱会造成各种植物的生命大规模下降。这首先会造成草食动物大规模饿死，接着就是肉食动物大规模饿死。 按照这种假说，大规模物种灭绝就会突然间发生。

批注 [21]: spew
英 [spjuː] 美 [spjuː]
•vt. 喷出；呕吐
•vi. 喷涌；呕吐

批注 [22]: finer
英 [faɪnə] 美 ['faɪnər]
•adj. 更出色的；更好的；更健康的；更优质的；更纤细的；更锋利的

One interesting **test** of the Alvarez hypothesis is based on the presence of the rare-earth element iridium Ir. Earth's crust contains very little of this element, but most asteroids contain a lot more. Debris *thrown into the atmosphere by an asteroid collision* would presumably contain large amounts of iridium, and atmospheric currents would carry this material all over the globe. A search of sedimentary **deposits** that span the boundary between the Cretaceous and Tertiary periods shows that there is a dramatic increase in the abundance of iridium briefly and precisely at this boundary. This iridium anomaly offers strong support for the Alvarez hypothesis even though no asteroid itself has ever been recovered.
对于Alvarez假说的一个有趣测验是基于稀土元素铱的存在。这种元素在地壳中的含量极少，但在大多数小行星中的含量却多得多。 因小行星碰撞而被抛进到大气中的碎片可能会含有大量铱元素，并且大气流会把这些物质带到全球各地。 白垩纪时期与第三纪时期交替之间的沉积物的研究显示：在这两个时期的交替时期，铱元素的含量急剧增加。 尽管还没有发现过撞击的小行星，铱元素的异常还是为 Alvarez 假说提供了有力支持。

批注 [23]: presumably
英 [prɪ'zjuːməbli] 美 [prɪ'zuːməbli]
•adv. 大概；推测起来；可假定

批注 [24]: deposit
英 [dɪ'pɒzɪt] 美 [dɪ'pɑːzɪt]
•n. 存款；押金；订金；保证金；沉淀物
•vt. 使沉积；存放
•vi. 沉淀

An asteroid of this size would be expected to leave an immense crater, even if the asteroid itself was disintegrated by the impact. The **intense** heat of the impact would produce heat-shocked quartz in many types of rock. Also, large blocks thrown aside by the impact would form secondary craters surrounding the main crater. **To date,** several such secondary craters have been found along Mexico's Yucatán Peninsula, and heat-shocked quartz has been found both in Mexico and in Haiti. A location called Chicxulub, along the Yucatán coast, has been suggested as the primary impact site.

按理说，这样大小的一个行星，即使受到冲击碎裂之后也会留下一个巨大的陨石坑。 撞击所释放的**极度**高温使得许多种岩石产生热冲击石英。 撞击也会将一些大石块抛出去，在主要陨石坑周围形成次级陨石坑。 **迄今为止**，人们沿着墨西哥尤卡坦半岛已经找到了一些此类次级陨石坑。并且在海地和墨西哥找到了热冲击石英。 尤卡坦沿海一个叫做希克苏鲁伯的地方，被当作是主要的撞击点。

批注 [25]: intense
英 [ɪn'tens] 美 [ɪn'tens]
•adj. 强烈的；紧张的；非常的；热情的

TPO 15 – 3 Glacier Formation
冰川的形成

Glaciers are slowly moving masses of ice that have accumulated on land in areas where **more** snow falls during a year **than** melts. Snow falls as **hexagonal** crystals, but once on the ground, snow is soon transformed into a compacted mass of smaller, rounded grains. As the air space around them is **lessened** by compaction and melting, the grains become denser. With further melting, refreezing, and increased weight from newer snowfall above, the snow reaches a **granular** recrystallized stage **intermediate between** flakes **and** ice known as firn. With additional time, pressure, and refrozen meltwater from above, the small firn **granules** become larger, interlocked crystals of blue glacial ice. When the ice is thick enough, usually over 30 meters, the weight of the snow and firn will cause the ice crystals toward the bottom to become **plastic** and to flow outward or downward from the area of snow accumulation.

冰川就是缓慢移动的巨大冰块，这种冰块是由于每年降雪量大于融雪量不断积累形成于陆地的。雪花降落时是六角晶体，可一旦落在地面，雪花就迅速凝结成大量小而圆的颗粒。 由于凝结和融化这些颗粒周围空气空间也随之减少，从而颗粒就会变得更为紧密。 雪继续融化、再结冰，并且还要承受上方新的积雪增加的重量，这些积雪就达到一种**介于冰片与冰之间**的被称为粒雪的颗粒状再结晶阶段。 时间、压力不断增加，并且位于上方的融雪重新结冰，那些较小的积雪颗粒开始变成大且与透明的相互连结的蓝色结晶冰川冰。 当这些冰块足够厚（一般是30 米以上），积雪的重量就会使底部的冰晶变得具有可塑性，会从积雪处向外或向下流动。

Glaciers are open systems, with snow as the system's input and meltwater as the system's main output. The glacial system is governed by two basic climatic variables: **precipitation** and temperature. For a glacier to grow or maintain its mass, there must be sufficient snowfall to match or exceed the annual loss through melting, evaporation, and calving, which occurs when the glacier loses solid **chunks** as icebergs to the sea or to large lakes. If summer temperatures are high for too long, then all the snowfall from the previous winter will melt. Surplus snowfall is essential for a glacier to develop. A surplus allows snow to accumulate and for the pressure of snow *accumulated over the years* to **transform** buried snow **into** glacial ice with a **depth** great enough for the ice to flow. Glaciers are sometimes classified by temperature as faster-flowing temperate glaciers or as slower-flowing polar glaciers.

冰川是开放的系统，降雪是该系统的补给，融水是该系统的主要输出。 冰川系统受两个基本气候变量控制：**降水**和气温。 要保持或增加冰川的体积，就必须具备足够的降雪量，以抵消或者超过每年因融雪、蒸发或者以海洋和湖泊中的冰山形式的裂冰的数量。 如果夏季温度持续长时间的高温度，上一个冬季所有的降雪都会融化。 剩余降雪对形成冰川非常重要。 有剩余的积雪就能够积累，并且由于多年积雪形成的压力，将积雪转化为流动冰，深度足以保证冰川流动。 按照温度分类，冰川可分为快速流动温带冰川和慢速流动极地冰川。

批注 [26]: **hexagonal**
英 [hek'sægənl] 美 [hek'sægənl]
•adj. 六边的，六角形的

批注 [27]: **lessen**
英 ['lesn] 美 ['lesn]
•vt. 使…变小；使…减轻；使…变少
•vi. 减少；减轻；变小

批注 [28]: **granular**
英 ['grænjələ(r)] 美 ['grænjələr]
•adj. 颗粒的；粒状的

批注 [29]: **intermediate**
英 [ˌɪntə'mi:diət] 美 [ˌɪntər'mi:diət]
•adj. 中间的，过渡的；中级的，中等的
•n. 中级生；（化合物）中间体，中间物；中介，媒介
•v. 充当调解人，起媒介作用

批注 [30]: **granule**
英 ['grænju:l] 美 ['grænju:l]
•n. 颗粒

批注 [31]: **plastic**
英 ['plæstɪk] 美 ['plæstɪk]
•n. 塑料；塑料学；（非正式）信用卡
•adj. 塑料制的；人造的，不自然的；（物质、材料）可塑的；产生立体感的；塑性的；有创造力的；适应环境变化的

批注 [32]: **precipitation**
英 [prɪˌsɪpɪ'teɪʃn] 美 [prɪˌsɪpɪ'teɪʃn]
•n. [化学] 沉淀，[化学] 沉淀物；降水；冰雹；坠落；鲁莽

批注 [33]: **chunk**
英 [tʃʌŋk] 美 [tʃʌŋk]
•n. 大块；矮胖的人或物

Glaciers are part of Earth's hydrologic cycle and ***are second only to*** the oceans in the total amount of water contained. About 2 percent of Earth's water is currently frozen as ice. Two percent may be a deceiving figure, however, since over 80 percent of the world's fresh water is locked up as ice in glaciers, with the majority of it in Antarctica. The total amount of ice is even more **awesome** if we **estimate** the water released **upon the hypothetical** melting of the world's glaciers. Sea level would rise about 60 meters. This would change the geography of the planet considerably. In contrast, ***should*** *another ice age occur*, sea level would drop drastically. During the last ice age, sea level dropped about 120 meters.

冰川是地球水循环的一部分，水容量***仅次于排名第一***的海洋。 目前地球上大约有 2%的水源处于冰冻状态。 2%这个数字可能并不让你惊奇，然而，全球有超过 80%的淡水以冰块的形态存在于冰川中，其中大部分处于南极洲。如果我们估算一下假设全球冰川融化能释放的水量，冰的总量必定让人更加吃惊。海平面将会上升 60 米左右。这会显著的改变地球的地貌形态。相反，***如果***另一个冰期到来，海平面会迅速降低。 在上一个冰期，海平面下降了 120 米左右。

When snow falls on high mountains or in polar regions, it may become part of the glacial system. Unlike rain, which returns rapidly to the sea or atmosphere, the snow *that becomes part of a glacier* is involved in a much more slowly cycling system. Here water may be stored in ice form for hundreds or even hundreds of thousands of years before being released again into the liquid water system as meltwater. In the meantime, however, this ice is not **static**. Glaciers move slowly across the land with tremendous energy, carving into even the hardest rock formations and **thereby** reshaping the landscape as they **engulf**, push, drag, and finally deposit rock debris in places far from its original location. As a result, glaciers create a great variety of landforms that remain long after the surface is released from its **icy** covering.

当雪降落在高山或者极地地区，便成为冰川系统的一部分。 这和降水不同，降水可以迅速回到海洋或者大气中，但降雪要成为冰川的一部分，循环过程非常缓慢。 在这里，水会以冰的形态存在几百年甚至几十万年，直到作为融水释放进入流水系统。 然而，冰也并非完全静止。在巨大的能量的作用下，冰川在陆地上缓慢移动，甚至切碎最坚硬的岩石，将其吞没、推动、拉拽，最后在离原位置很远的地方沉淀下这些岩石的残余物，在这个过程中它重新改造了地形地貌。 因此，冰川创造出了各种各样的地形，冰川退却之后，这些地形能够长时间保持不变。

Throughout most of Earth's history, glaciers did not exist, but at the present time about 10 percent of Earth's land surface is covered by glaciers. Present-day glaciers are found in Antarctica, in Greenland, and at high elevations on all the continents except Australia. In the recent past, from about 2.4 million to about 10,000 years ago, nearly a third of Earth's land area was **periodically** covered by ice thousands of meters thick. In the much more distant past, other ice ages have occurred.

纵观地球历史，大部分时期内并不存在冰川，但现在 10%的地表为冰川覆盖。 目前，在南极洲、格陵兰岛，以及除了澳洲以外大陆的高海拔地区都有冰川存在。 不久以前，在 240 万年至 1 万年前，大约三分之一的地表被上千米厚的冰层**定期**覆盖。 在更遥远的过去，其他冰期也曾出现过冰川覆盖地表的情况。

批注 [34]: hydrologic
•adj. 水文的
hydrologic cycle
[ˌhaɪdrə'lɔdʒɪk]
•水文循环，水循环

批注 [35]: *Should 开头的陈述句，虚拟语气。*
Should + 动词原形：与现在事实相反；
Should + have + 过去分词：与过去事实相反；

批注 [36]: thereby
英 [ˌðeə'baɪ] 美 [ˌðer'baɪ]
•adv. 从而，因此；在那附近；在那方面

批注 [37]: engulf
英 [ɪn'gʌlf] 美 [ɪn'gʌlf]
•vt. 吞没；吞食，狼吞虎咽

批注 [38]: icy
英 ['aɪsi] 美 ['aɪsi]
•adj. 冰冷的；结满冰的；冷淡的；（语气、态度）非常不友好的，带有敌意的

批注 [39]: periodically
英 [ˌpɪəri'ɒdɪkli] 美 [ˌpɪri'ɑːdɪkli]
•adv. 定期地；周期性地；偶尔；间歇