TPO 45 – 1 The Beringia Landscape
洞察白令地貌

During the peak of the last ice age, northeast Asia (Siberia) and Alaska were connected by a broad land mass called the Bering Land Bridge. This land bridge existed because so much of Earth's water was frozen in the great ice sheets that sea levels were over 100 meters lower than they are today. Between 25,000 and 10,000 years ago, Siberia, the Bering Land Bridge, and Alaska shared many environmental characteristics. These included ***a common*** mammalian fauna of large mammals, ***a common*** flora composed of broad grasslands as well as wind-swept dunes and tundra, and ***a common*** climate with cold, dry winters and somewhat* warmer summers. The recognition (**that** many aspects of the modern flora and fauna were present *on both sides of the Bering Sea* as remnants of the ice-age landscape) led to this region being named Beringia.

上一次冰期高峰，东北亚（西伯利亚）和阿拉斯加被一名为白令陆桥的广阔大陆块连接起来。这座大陆桥的出现是因为，那时候地球上大量的水被冻结成巨大的冰盖，所以海平面比现在低 100 米。 在 10000 年到 25000 年之前，西伯利亚、白令大陆桥和阿拉斯加有许多共同的环境特征。其中包括，这三个地方都有常见的由大型哺乳动物组成的哺乳动物群和由广袤的草地、寒风凌厉的沙丘和冻原组成的植物群，以及冬季寒冷干燥、夏季较暖和的气候。 人们认为现在白令海两岸的植物群和动物群在许多方面都可以被认为是冰河时代的残存者，所以这个地区被命名为白令陆桥。

It is through Beringia **that** small **groups** of large mammal hunters, slowly expanding their hunting territories, eventually colonized North and South America. On this, archaeologists generally agree, but that is where the agreement stops. One broad area of disagreement in explaining the peopling of the Americas[1] is the domain of paleoecologists, but it is **critical** to understanding human history: what was Beringia like?

正是通过白令陆桥，一些捕捉大型哺乳动物的猎人小**团体**慢慢地扩大了他们的狩猎领地，最终占领了北美洲和南美洲。 在这一点上考古学家普遍表示认同，但是在其他方面大家就产生了分歧。 在解释美洲印第安人的居住情况 [1] 时产生的一个比较大的分歧在于古生物学的范畴，但这关键是要理解人类历史：那时候的白令陆桥是什么样的？

The Beringian landscape was very different from what it is today. Broad, windswept valleys; glaciated mountains; sparse vegetation; and less moisture created a rather forbidding land mass. This land mass supported herds of now-extinct species of mammoth, bison, and horse and somewhat modern versions of caribou, musk ox, elk, and saiga antelope. These grazers supported in turn a number of **impressive** carnivores, including the giant short-faced bear, the saber-tooth cat, and a large species of lion.

彼时白令陆桥的景观与如今大不相同。 那时山谷宽广，海风吹拂，山脉被冰覆盖，植被稀疏；降水稀少，令人望而生畏。 这个陆块中生存着成群的现今已灭绝的猛犸象、野牛、马，以及现代版的驯鹿、麝牛、麋鹿和赛加羚羊。 以这些食草动物为食的是大型食肉动物（*这些食草动物反过来又供养了许多大型食肉动物*），包括巨型短面熊、剑齿猫、和大型狮子。

The presence of mammal species that require grassland vegetation has led Arctic biologist

批注 [1]: mammalian
•adj. 哺乳类动物的
•n. 哺乳类

批注 [2]: 挡风的；被风乱吹的；荒凉的；风卷残云的

批注 [3]: somewhat
英 ['sʌmwɒt] 美 ['sʌmwʌt]
•adv. 有点，稍微
•pron. 某物；几分

批注 [4]: remnant
•n. 剩余
•adj. 剩余的

批注 [5]: peopling
英 美
•n. 人；人类；民族；公民
•vt. 居住于；使住满人

批注 [6]: paleontologist
英 美 [ˌpeɪliːɑːn'tɑːlədʒɪst]
•n. 古生物学者

批注 [7]: rather
•adv. 宁可，宁愿；相当；准确地说；或多或少地
•conj. 而不是
•int. 当然啦（回答问题时用）

批注 [8]: impressive
英 [ɪm'presɪv] 美 [ɪm'presɪv]
•adj. 感人的；令人钦佩的；给人以深刻印象的

Dale **G**uthrie to argue that **while**★ cold and dry, there must have been broad areas of dense vegetation to **support** herds of mammoth, horse, and bison. **Further**, nearly all of the ice-age fauna had teeth that indicate an adaptation to grasses and sedges; they could not have been supported by a modern flora of mosses and lichens. **G**uthrie has also demonstrated that the landscape must have been subject to★ intense and continuous winds, especially in winter. He makes this argument based on the **anatomy** ★of horse and bison, which do not have the ability to search for food *through* deep snow cover. They need landscapes *with strong winds that remove the winter snows*, exposing the dry grasses beneath. **G**uthrie **applied**★ the term "mammoth steppe" to **characterize**★ this landscape.

哺乳动物的存在需要草地植被，这使得北极生物学家戴尔•古思莱认为虽然★白令陆桥地区寒冷干燥，但是应该有大面积的茂密植被来养活庞大的猛犸群、马群和野牛群。 此外，几乎所有冰河时代动物的牙齿都表明它们适应了禾草和莎草；他们不可能只吃现代植物苔藓和地衣。古思莱还表明，陆桥地区应该时常持续刮强风，特别是在冬季。 对野马和野牛的解剖可以发现它们没有*穿过*深雪寻找食物的能力，这就证明了他的论点。野马和野牛需要大风吹走积雪，使得下面的干草显露出来。古思莱用了“猛犸草原”一词来描述陆桥地区。

In contrast, Paul Colinvaux has offered a counterargument based on the analysis of pollen in lake sediments **dating** to the last ice age. He found that the amount of pollen recovered in these sediments is so low that the Beringian landscape during the peak of the last glaciation was more likely to have been what he termed a "polar desert," with little or only sparse vegetation. In no way was it possible that★ this region could have **supported** large herds of mammals and thus, human hunters. **G**uthrie has **argued against** this view by pointing out that radiocarbon analysis of mammoth, horse, and bison bones from Beringian deposits revealed that the bones date to the period of **most** **intense**★ **glaciation**.
与这个论点相反，保罗.柯林沃斯基于对湖泊沉积物中发现的可追溯至冰河时期的花粉的研究，提出了反对论据。 他发现，在这些沉积物中的花粉是如此之少，以至于他认为末次冰河时代高峰期的白令陆桥很可能是“极地荒漠”，由于植被稀疏，所以这个地区不可能养活那么大群的大型哺乳动物，因此也不会有那么多猎人。 古思莱表示反对，他指出，对白令陆桥地区猛犸象、马、草原野牛的骨头沉积物进行放射性碳定年分析发现这些骨头可以追溯到冰川作用最强烈的时期。

The argument seemed to be at a **standstill** until a number of recent studies resulted in a spectacular suite of new finds. The first was the discovery of a 1,000-square-kilometer preserved **patch** of Beringian vegetation **dating** to just over 17,000 years ago-the peak of the last ice age. The plants were preserved under a thick **ash fall** from a volcanic eruption. Investigations of the plants found grasses, sedges, mosses, and many other **varieties**★ in a nearly **continuous** cover, as was predicted by Guthrie. But this vegetation had a thin root mat with no soil formation, demonstrating that there was little long-term stability in plant cover, a finding supporting some of the arguments of Colinvaux. A mixture of **continuous** but thin vegetation supporting herds of large mammals is one that **seems** **plausible** and realistic with the available data.

批注 [9]: support 养活

批注 [10]: subject to
•使服从；使遭受；受…管制

批注 [11]: anatomy
英 [ə'nætəmi] 美 [ə'nætəmi]
•n. 解剖；解剖学；剖析；骨骼

批注 [12]: intense★
英 [ɪn'tens] 美 [ɪn'tens]
•adj. 强烈的；紧张的；非常的；热情的

批注 [13]: glaciation
•n. [地质] 冰川作用；冻结成冰

批注 [14]: standstill
•n. 停顿；停止

批注 [15]: suite
英 [swiːt] 美 [swiːt]
•n. （一套）家具；套房；组曲；（一批）随员，随从

批注 [16]: patch
•n. 眼罩；斑点；碎片；小块土地
•vt. 修补；解决；掩饰
•vi. 打补丁

批注 [17]: variety
英 [və'raɪəti] 美 [və'raɪəti]
•n. 多样；种类；杂耍；变化，多样化

两种观点一直以来处于僵持状态，直到最近才有了一些重大的新发现。 首先是发现了一个保存下来的 1000 平方公里的白令陆桥植被区，该植被区可以追溯到 17000 多年前，也就是上一次冰期高峰。 植被区被火山喷发出来的厚厚的灰烬覆盖，故而得以保存。 对其调查发现，正如古思莱预测的那样，在这几乎不断的灰层覆盖之下，这个地区生长着包括禾草、莎草、苔藓在内的多种植物。 不过这个植被区有一层细细的根系，但是并没有土壤形成，说明本地区的植被不具备长期稳定性，这与柯林沃斯的一些观点吻合。 以现有的数据来看，目前看似合理和现实的解释是，大型哺乳动物群是以这些连续生长的、薄薄的植被层为食的。

TPO 45 – 2 Wind Pollination
风媒传粉

Pollen, a powdery substance, which is produced by flowering plants and contains male reproductive cells, is usually carried from plant to plant by insects or birds, but some plants rely on the wind to carry their pollen. Wind pollination is often seen as being primitive and wasteful in costly pollen and yet it is surprisingly common, especially in higher latitudes. Wind is very good at moving pollen a long way; pollen can be blown for hundreds of kilometers, and only birds can get pollen anywhere near as far. The drawback is that wind is obviously unspecific as to where it takes the pollen. It is like trying to get a letter to a friend at the other end of the village by climbing onto the roof and throwing an armful of letters into the air and hoping that one will end up in the friend's garden. For the relatively few dominant tree species that make up temperate forests, where there are many individuals of the same species within pollen range, this is quite a safe gamble. If a number of people in the village were throwing letters off roofs, your friend would be bound to get one. By contrast, in the tropics, where each tree species has few, widely scattered individuals, the chance of wind blowing pollen to another individual is sufficiently slim that animals are a safer bet as transporters of pollen. Even tall trees in the tropics are usually not wind pollinated despite being in windy conditions. In a similar way, trees in temperate forests that are insect pollinated tend to grow as solitary, widely spread individuals.

花粉，一种由开花植物产生且含有雄性生殖细胞的粉状物质通常是由昆虫或鸟类在植物间传播的，但有些植物也靠风来携带花粉。 风媒传粉常被视为是原始和低效率的方式，但这种传粉手段极其常见，特别是在高纬度地区。 风可以把花粉带到很远的地方，远至几百公里，只有鸟类传播才能勉强达到这个距离。 但风媒传播有个缺点，那就是传播的不定向性。 这就好比爬上屋顶，把一大堆信扔到空中，希望其中一封能落在村子另一端的朋友家的花园里。 如果是在只有相对较少的几个树种占主导地位的温带森林，花粉的传播范围内有众多相同的树种，风媒传播就相对低风险的赌博。 这就像是村子里有许多人都把信从屋顶扔下来，你的朋友终归会收到一封。 相比之下，在热带地区，每种树的数量很少，而且散布在各处，靠风把花粉从一棵吹到另一棵的几率太小，这时靠动物来传播花粉就会更保险。 因此，即便是热带的高大树木也不会靠风来传播花粉，即使它们处于大风环境中。 类似地，在温带森林中靠昆虫授粉的树木通常会长成孤立的广泛分布的大树。

Since wind-pollinated flowers have no need to attract insects or other animals, they have dispensed with bright petals, nectar, and scent. These are at best a waste and at worst an impediment to the transfer of pollen in the air. The result is insignificant-looking flowers and catkins (dense cylindrical clusters of small, petalless flowers).

由于风媒传粉的花不需要吸引昆虫或其它动物，它们无需鲜艳的花瓣，诱人的花蜜与花香。 因为这些东西对于风媒传粉的花来说充其量只是多余的，搞不好还会变成花粉在空中传播的阻碍。所以这些花只有不起眼的外观和花序（密集的圆柱状、无花瓣小花团）。

Wind pollination does, of course, require a lot of pollen. Birch and hazel trees can produce 5.5 and 4 million grains per catkin, respectively. There are various adaptations to help as much of the pollen go as far as possible. Most deciduous wind-pollinated trees (which shed their leaves every fall) produce their pollen in the spring while the branches are bare of leaves to reduce the surrounding surfaces that "compete" with the stigmas (the part of the flower

that receives the pollen) for pollen. Evergreen conifers, which do not shed their leaves, have less to gain from spring flowering, and, indeed, some flower in the autumn or winter.
当然，风媒传粉需要大量的花粉。 桦树和榛子树的每个花序可分别能产生 550 万和 400 万粒花粉。 要使得更多的花粉传得更远，植物们各有各的适应方式。 大多数风媒传粉的落叶植物（每年秋天落叶的植物）在春天产出花粉，这时候树枝光秃秃的，花粉就有更大几率落到柱头（接收花粉的部分）上，落到树的表面上的部分就不会太多。 常绿针叶树由于不会落叶，春天开花对它们来说并没有什么好处，因此，确实会有部分树在秋天或冬天开花。

Pollen produced higher in the top branches is likely to go farther: it is windier (and gustier) and the pollen can be blown farther before hitting the ground. Moreover, dangling catkins like hazel hold the pollen in until the wind is strong enough to bend them, ensuring that pollen is only shed into the air when the wind is blowing hard. Weather is also important. Pollen is shed primarily when the air is dry to prevent too much sticking to wet surfaces or being knocked out of the air by rain. Despite these adaptations, much of the pollen fails to leave the top branches, and only between 0.5 percent and 40 percent gets more than 100 meters away from the parent. But once this far, significant quantities can go a kilometer or more. Indeed, pollen can travel many thousands of kilometers at high altitudes. Since all this pollen is floating around in the air, it is no wonder that wind-pollinated trees are a major source of allergies.
越高的树枝上产生的花粉，就越有可能飘得越远，因为高处风更多（也更大），花粉在落地前也就可以吹得更远。 此外，悬挂的榛序直到被风吹弯了才会把花粉释放出来，确保花粉只在风力够强时脱落进入空气中。天气也很重要。只有当空气干燥的时候，花粉才会被释放出来，以防止花粉被潮湿的表面粘住或者被雨打落到地面。 尽管有这些适应方式，大部分花粉还是无法离开顶端的树枝，只有千分之五到百分之四十的花粉能够飘到离树木 100 米以外的地方。不过飘过 100 米后，这些花粉相当一大部分就能飘到一公里或者之外的地方。 事实上，花粉可以在高海拔地区飘至数千公里外。 有这些花粉在空气中漂浮，难怪风媒传粉的树是过敏的主要来源。

Once the pollen has been snatched by the wind, the fate of the pollen is obviously up to the vagaries of the wind, but not everything is left to chance. Windborne pollen is dry, rounded, smooth, and generally smaller than that of insect-pollinated plants. But size is a two-edged sword. Small grains may be blown farther but they are also more prone to be whisked past the waiting stigma because smaller particles tend to stay trapped in the fast-moving air that flows around the stigma. But stigmas create turbulence, which slows the air speed around them and may help pollen stick to them.
一旦花粉被风带走，花粉的命运就交给喜怒无常的风了，但也并非说一切都取决于运气。 风传花粉是干燥的，圆形的，光滑的，比虫媒传粉的植物的花粉小。 但是花粉的大小是一把双刃剑。 小花粉可能被吹得更远，但它们也更容易拂过花的柱头，因为较小的颗粒会被困在在柱头周围快速流动的空气中。 但与此同时柱头处也会有动荡，从而降低风速，有助于花粉附着在柱头上。

TPO 45 – 3 Feeding Strategies in the Ocean
海洋动物的喂食策略

In the open sea, animals can often find food reliably available in particular regions or seasons (e.g., in coastal areas in springtime). In these circumstances, animals are neither constrained to get the last calorie out of their diet nor is energy conservation a high priority. In contrast, the food levels in the deeper layers of the ocean are greatly reduced, and the energy constraints on the animals are much more severe. To survive at those levels, animals must maximize their energy input, finding and eating whatever potential food source may be present.

在开阔的海洋中，动物通常能在特定的地区或季节找到可靠的食物（如春天的沿海地区）。 在这种情况下，动物既不用尽力消化吸收食物，也不用节约能源。 相比之下，在更深层次的海洋中的食物数量大大降低，对动物的食物约束更严重。 为了在这些地方生存，动物必须最大限度地提高他们的能量输入，去寻找和食用任何食物。

In the near-surface layers, there are many large, fast carnivores as well as an immense variety of planktonic animals, which feed on plankton (small, free-floating plants or animals) by filtering them from currents of water that pass through a specialized anatomical structure. These filter-feeders thrive in the well-illuminated surface waters because oceans have so many very small organisms, from bacteria to large algae to larval crustaceans. Even fishes can become successful filter-feeders in some circumstances. Although the vast majority of marine fishes are carnivores, in near-surface regions of high productivity the concentrations of larger phytoplankton (the plant component of plankton) are sufficient to support huge populations of filter-feeding sardines and anchovies. These small fishes use their gill filaments to strain out the algae that dominate such areas. Sardines and anchovies provide the basis for huge commercial fisheries as well as a food resource for large numbers of local carnivores, particularly seabirds. At a much larger scale, baleen whales and whale sharks are also efficient filter-feeders in productive coastal or polar waters, although their filtered particles comprise small animals such as copepods and krill rather than phytoplankton.

在海平面附近，有很多大型的、敏捷的食肉动物以及大量的浮游动物，浮游动物以浮游生物为食(小的浮游植物或动物)的，这些动物有专门的身体结构过滤海水，吃掉其中的小浮游生物。在有可见光的海平面附近，滤食性动物非常繁盛，因为海洋有这么许多很小的生物，从细菌到大型藻类到甲壳类幼体。甚至有些情况下鱼类也是滤食性动物。虽然绝大多数海洋鱼类是食肉动物，但滤食性沙丁油鱼和凤尾鱼靠吃海洋表面区域丰富大量的浮游植物(浮游生物的植物成分)而大量繁殖。这些小鱼使用它们的鳃丝滤食他们生活区域内的藻类。沙丁油鱼和凤尾鱼成为当地大规模渔业的基础，并且是大型肉食动物，特别是海鸟的食物。规模更大的须鲸和鲸鲨也是沿海或极地水域的高效滤食动物，虽然它们的滤食对象不仅限于浮游植物，还有桡足类、磷虾等小动物。

Filtering seawater for its particulate nutritional content can be an energetically demanding method of feeding, particularly when the current of water to be filtered has to be generated by the organism itself, as is the case for all planktonic animals. Particulate organic matter of at least 2.5 micrograms per cubic liter is required to provide a filter-feeding planktonic organism with a net energy gain. This value is easily exceeded in most coastal waters, but in the deep sea, the levels of organic matter range from next to nothing to around 7 micrograms

per cubic liter. Even though mean levels may mask much higher local concentrations, it is still the case that many deep-sea animals are exposed to conditions in which a normal filter-feeder would starve.
过滤海水来获取其中的微小营养成分是一种非常费力的摄取食物的方法，尤其是当被过滤的水流需要生物体自己来生成时（正如浮游动物所做的那样）。 每立方米的海水中，必须要含有至少 2.5 微克的颗粒有机物质，才能保证滤食浮游生物的净能量摄入。 大多数沿海水域都很容易超过这个值，但是在深海，有机物的浓度从几乎没有到每立方米 7 微克都有可能。 即使平均水平可能忽略了局部可能有机物密度很高这一点，但依然说明很多深海动物面临的条件很恶劣，一般的滤食动物可能会饿死。

There are, therefore, fewer successful filter-feeders in deep water, and some of those that are there have larger filtering systems to cope with the scarcity of particles. Another solution for such animals is to forage in particular layers of water where the particles may be more concentrated. Many of the groups of animals that typify the filter-feeding lifestyle in shallow water have deep-sea representatives that have become predatory. Their filtering systems, which reach such a high degree of development in shallow-water species, are greatly reduced. Alternative methods of active or passive prey capture have been evolved, including trapping and seizing prey, entangling prey, and sticky tentacles.
因此，深水中的滤食性动物很少，这部分滤食性动物中有一部分有较大的过滤系统来应对有机物的稀缺。 还有一些滤食性动物会在特定的有机物密度高的水层中觅食。 许多浅海区的典型滤食性动物都可以在深海区找到代表，但是它们已经演化为捕食性动物。 在浅海区形成的特别发达的过滤系统，在深海区都退化了。 相对的，它们进化出主动或者被动的捕猎方式，包括诱抓和缠住猎物，长出粘性的触须。

In the deeper waters of the oceans, there is a much greater tendency for animals to await the arrival of food particles or prey rather than to search them out actively (thus minimizing energy expenditure). This has resulted in a more stealthy style of feeding, with the consequent emphasis on lures and/or the evolution of elongated appendages that increase the active volume of water controlled or monitored by the animal. Another consequence of the limited availability of prey is that many animals have developed ways of coping with much larger food particles, relative to their own body size, than the equivalent shallower species can process. Among the fishes there is a tendency for the teeth and jaws to become appreciably enlarged. In such creatures, not only are the teeth hugely enlarged and/or the jaws elongated but the size of the mouth opening may be greatly increased by making the jaw articulations so flexible that they can be effectively dislocated. Very large or long teeth provide almost no room for cutting the prey into a convenient size for swallowing; the fish must gulp the prey down whole.
在更深的海域，动物更倾向于被动等待食物颗粒或者猎物的来临，而不是主动去寻找它们(这样一来减少了能量消耗).于是就产生了一种更隐秘的觅食方式，这种方式强调诱捕和/或身体需要有很长的附属物，以便增加动物控制或者监测的活动水量。猎物数量有限的另外一个后果是，很多动物经过进化都可以处理相对于自身体积来讲更大的食物，比相应的浅海区动物能处理的食物要大得多。这些鱼类有一个共同的趋势，它们的牙齿和颌骨明显增大。这些动物不仅是牙齿变得很大和/或下巴变长，而且它们的下颌关节可以随意的脱臼，所以嘴巴能够张得很大。由于牙齿特别大或特别长，这些鱼没有办法把猎物切割成合适的大小，只能把猎物整个地吞下去。