

TPO 52 – 1 Stream Deposits

河流沉淀

A large, swift stream or river can carry all sizes of particles, from clay to boulders. When the current slows down, its competence (how much it can carry) decreases and the stream deposits the largest particles in the streambed. If current velocity continues to decrease—as a flood **wanes**, for example—finer particles **settle out** on top of the large ones. Thus, a stream **sorts** its sediment **according to** size. A waning flood might deposit a layer of gravel, overlain by sand and finally topped by silt and clay. Streams also sort sediment in the downstream direction. Many mountain streams are choked with boulders and cobbles, **but far downstream**, their deltas are composed mainly of fine silt and clay. This downstream sorting is curious because stream velocity generally increases in the downstream direction. Competence increases with velocity, so a river should be able to transport larger particles than its **tributaries** carry. One explanation for downstream sorting is that **abrasion** wears away the boulders and cobbles to sand and silt as the sediment moves downstream over the years. Thus, only the fine sediment reaches the lower parts of most rivers.

一条大而湍急的溪流或河流可以携带各种大小的颗粒，小到粘土，大到巨石。当水流放缓的时候，其携带能力（能够携带的颗粒量）会减弱，最大的颗粒会沉淀在河床上。如果水流的速度继续减弱——比如洪水消退时——更细的颗粒会沉淀在大颗粒上。因此，溪流按大小将沉积物分类。洪水消退时最先可能会沉积一层砾石，接着沙子会覆盖在砾石之上，最后淤泥和黏土会覆盖在最上面。河流也会沿着下游的方向将沉淀物分类。许多山间的溪流会被巨砾和鹅卵石阻塞，**但在更远的下游**，三角洲主要是由细泥和黏土堆积成的。这种顺流而下的分类是很奇妙的，因为河流的速度通常在下游方向加快。水流的携带能力随着流速的加快而提升，因此一条河流可以输送的颗粒应该比它的**支流**所携带的颗粒更大。对这种顺流而下分类的一种解释是，随着沉淀物年复一年地向下游移动，水流的摩擦力将巨砾和卵石磨成了沙子和淤泥。因此，只有细泥沙能到达大多数河流的下游。

A stream deposits its sediment in three environments: Alluvial fans and deltas form where stream **gradient** (angle of **incline**) suddenly decreases as a stream enters a flat plain, a lake, or the sea; **floodplain** deposits accumulate on a floodplain adjacent to the stream channel; and channel deposits form in the stream channel itself. **Bars**, which are elongated **mounds** of sediment, are transient features that form in the stream channel and on the banks. They commonly form in one year and erode the next. Rivers used for commercial navigation must be **recharted** frequently because bars shift from year to year. Imagine a **winding** stream. The water on the outside of the **curve** moves faster than the water on the inside. The stream erodes its outside bank because the current's **inertia** drives it into the outside bank. At the same time, the slower water on the inside point of the **bend** deposits sediment, forming a point bar. A **mid-channel bar** is a sandy and gravelly deposit that forms in the middle of a stream channel.

一条河流会在三种环境下发生沉淀：在河流进入平原、湖泊或大海的时候，河流坡度（倾斜的角度）会突然下降，在那些地方会形成冲积扇和三角洲；**河漫滩**沉积物会堆积在河道附近的漫滩上；河流内部也会形成河道沉积物。**砂坝**，即细长条的泥沙**堆积物**，是河流内部和河流两岸所形成的沉淀物的瞬态特征。砂坝通常在一年内形成，下一年就会被消磨掉。用于通航航行的

批注 | 1: wane

英 [weɪn] 美 [weɪn]

•vi. 衰落；变小；亏缺；退潮；消逝

•n. 衰退；月亏；衰退期；缺损

批注 | 2: settle out

[ˈsetl aʊt]

•沉淀出来

•沉积

•稳定（趋于稳定）

批注 | 3: abrasion

英 [əˈbreɪʒn] 美 [əˈbreɪʒn]

•n. 磨损；磨耗；擦伤

批注 | 4: gradient

•n. 梯度，陡度；（温度、气压等）；倾斜度，坡度；变化率，梯度变化曲线

•adj. 倾斜的；步行的，能步行的

批注 | 5: incline

•v. 倾向于；（使）倾向于；赞同（某人或某事）；有……倾向；（使）倾斜；低头

•n. 斜坡；斜面

批注 | 6: inertia

英 [ɪˈnɜːʃə] 美 [ɪˈnɜːrʃə]

•n. [力] 惯性；惰性，迟钝；不活动

河道必须频繁地修整，因为砂坝每年都会变。想象一条蜿蜒的河流。曲线外缘的水流速度要比河流中心的水流速度快。河流会对其外围的河岸造成侵蚀，因为水流的惯性驱使河流冲向河岸。与此同时，弯道内点上较慢的水会沉积沉积物，形成一个点沙洲。河流内部较缓的水流会沉淀砂石，形成一个点坝。河心沙洲是在河道中央形成的，由沙子和碎石组成的沉积物。

Most streams flow in a single channel. In contrast, a braided stream flows in many shallow, interconnecting channels. A braided stream forms where more sediment is supplied to a stream than it can carry. The stream dumps the excess sediment, forming mid-channel bars. The bars gradually fill a channel, forcing the stream to overflow its banks and erode new channels. As a result, a braided stream flows simultaneously in several channels and shifts back and forth across its floodplain. Braided streams are common in both deserts and glacial environments because both produce abundant sediment. A desert yields large amounts of sediment because it has little or no vegetation to prevent erosion. Glaciers grind bedrock into fine sediment, which is carried by streams flowing from the melting ice. If a steep mountain stream flows onto a flat plain, its gradient and velocity decrease sharply. As a result, it deposits most of its sediment in a fan-shaped mound called an alluvial fan. Alluvial fans are common in many arid and semiarid mountainous regions.

大多数的河流为单河道。相反，辫状河由很多浅的、互相连接的河道组成。当河流携带更多的泥沙，泥沙量超出河流的携带能力的时候，这些地方就会形成辫状河。河流会卸下多余的泥沙，形成河心沙洲。沙洲会渐渐填满河道，迫使水流溢出堤岸，侵蚀出新的河道。其结果是，辫状河在多个河道同时流动，并在河漫滩上来回流动。辫状河在沙漠和冰川环境中都很常见，因为沙漠和冰川都能产生大量的沉淀物。沙漠能产生大量沉积物，因为它几乎没有或者根本没有植被来防止其被侵蚀。冰川将基岩研磨成细小的沉积物，这些沉淀物会被冰川融化后形成的水流所携带。如果一条陡峭的山溪流到平坦的平原上，它的坡度和速度就会急剧下降。结果，它会把大部分的泥沙沉淀下来，形成一个扇形土丘，被称为冲积扇。冲积扇在许多干旱、半干旱的山区很常见。

A stream also slows abruptly where it enters the still water of a lake or ocean. The sediment settles out to form a nearly flat landform called a delta. Part of the delta lies above water level, and the remainder lies slightly below water level. Deltas are commonly fan-shaped, resembling the Greek letter "delta" (Δ). Both deltas and alluvial fans change rapidly. Sediment fills channels (waterways), which are then abandoned while new channels develop as in a braided stream. As a result, a stream feeding a delta or fan splits into many channels called distributaries. A large delta may spread out in this manner until it covers thousands of square kilometers. Most fans, however, are much smaller, covering a fraction of a square kilometer to a few square kilometers. The Mississippi River has flowed through seven different delta channels during the past 5,000 to 6,000 years. But in recent years, engineers have built great systems of levees (retaining walls) in attempts to stabilize the channels.

当河流汇入湖泊或海洋中的静水时，水流速度也会骤然减慢。泥沙会沉淀下来，形成一个近乎平坦的地貌，被称为三角洲。三角洲的一部分在水面之上，而剩余的部分略微低于水面。三角洲通常为扇形，形状和希腊字母“ Δ ”很类似。三角洲和冲积扇都变化得很快。沉积物会填满河道（水道），然后这些河道就会被废弃，而新的河道就会像辫状河那样形成。结果是，一条形

成三角洲或冲积扇的河流会分裂成多条河流，这些河流被称为支流。一个大三角洲可能会以这种方式延展开，直到占地数千平方公里。然而，大多数冲积扇，规模要小得多，覆盖一平方公里至几平方公里的小片土地。过去的 5000 到 6000 年内，密西西比河流经之处，已经形成了 7 个三角洲。但是近年来，工程师们建造了堤坝（挡土墙）系统以试图加固河道。

TPO 52 – 2 Natufian Culture 纳图夫文化

In the archaeological record of the **Natufian** period, from about 12,500 to 10,200 years ago, in the part of the Middle East known as the Levant—**roughly** east of the Mediterranean and north of the Arabian Peninsula—we see clear evidence of agricultural origins. The stone tools of the Natufians included many **sickle-shaped** cutting **blades** that show a pattern of **wear** characteristic of cereal harvesting. Also, querns (hand mills) and other stone tools used for processing grain occur in abundance at Natufian sites, and many such tools show signs of long, **intensive** use. Along with the sickle blades are many grinding stones, primarily **mortars**³ and **pestles**⁴ of **limestone**¹ or **basalt**². There is also evidence that these heavy grinding stones were transported over long distances, more than 30 kilometers in some cases, and this is not something known to have been done **by people of preceding periods**. Fishhooks and weights for sinking fishing nets attest to the growing importance of fish in the diet in some areas. Stone vessels indicate an increased need for containers, but there is no evidence of Natufian clay working or pottery. Studies of the teeth of Natufians also strongly suggest that these people specialized in collecting cereals and may have been cultivating them and in the process of domesticating them, but they were also still **hunter-foragers** who **intensively** hunted **gazelle** and **deer** in more **lush** areas and wild **goats** and **equids** in more arid zones.

在大约 12500 年到 10200 年之前，纳图夫文明时期的考古记录中，我们可以看到**农业起源**的明确证据，纳图夫位于中东的一个被称为累范特的地区——**大约**在地中海东部，阿拉伯半岛的北部。纳图夫人的石器包含许多**镰刀状**的刀片，这些**刀片**显示出了收割谷物的**磨耗**特征。同时，手推石磨和其他被用来加工谷物的石器在纳图夫遗址中大量出现，并且很多这样的石器都显示出了长期、集约利用的痕迹。和镰状刀片一起出现的还有很多研磨石，它们主要是**石灰石**¹或**玄武岩**²制成的**研钵**³和**杵**⁴。也有证据表明，这些沉重的研磨石是从很远的地方运过来的，某些情况下运输距离可能超过 30 公里，这不是目前已知的早期人类能做到的事情。用于使渔网下沉的鱼钩和砣码证明鱼类在一些地区的饮食结构中变得越来越重要。石头容器表明了人们对容器需求的增加，但是没有证据表明纳图夫人用黏土或陶土制作器皿。对纳图夫人牙齿的研究也强有力地表明这些人专门收集谷物并且可能会种植谷物，或正处于驯化作物的过程中，但是纳图夫人也仍然是狩猎者，他们会在一些植被更繁茂的地区**集中** **adv.** 猎杀**羚羊**和**鹿**，在较为干旱的地区猎杀**野山羊**和**马**。

The Natufians had a different settlement pattern from that of their predecessors. Some of their base camps were far larger (over 1,000 square meters) than any of those belonging to earlier periods, and they may have lived in some of these camps for half the year or even more. In some of the camps, people made foundations and other **architectural** elements out of **limestone blocks**. Trade in shell, obsidian, and other commodities seems to have been on the rise, and **anthropologists suspect** that the exchange of **perishables** (such as skins, foodstuffs) and salt was also on the increase. With the growing importance of wild cereals in the diet, salt probably became **for the first time** a near necessity: people who eat a lot of meat get many **essential** salts from this diet, but diets **based on cereals** can be deficient in salts. Salt was probably also important as a food **preservative** in early villages.

批注 [7]: **preceding**

英 [ˈpriːsiːdɪŋ] 美 [ˈpriːsiːdɪŋ]

- adj. 在前的；前述的
- v. 在...之前 (precede 的 ing 形式)

批注 [8]: forager

英 [ˈfɔːrɪdʒə] 美 [ˈfɔːrɪdʒər]

- n. 搜寻（食物）的人；四处寻找的人

批注 [9]: intensive (**intensive reading**)

- adj. 加强的；集中的；透彻的；加强语气的
- n. 加强器

intensively

- adv. 强烈地；集中地

批注 [10]: **lush**

- adj. 丰富的，豪华的；苍翠繁茂的
- vi. 喝酒
- n. 酒；酒鬼
- vt. 饮

纳图夫人有着和他们祖先不同的聚居模式。他们的一些营地要比以前的任何营地都大得多（超过 1000 平方米），而且他们有可能在一些营地住上超过半年，甚至是更长的时间。在一些营地里，人们用石灰石岩块搭建了地基和其他建筑构件。贝壳、黑曜石以及其他商品的贸易在不断增长，人类学家们猜测易腐食品的交换（例如兽皮和食物）以及盐的交换也在不断增长。随着野生谷物在日常饮食中的重要性日益增加，食盐可能第一次几乎成为一种必需品：吃很多肉的人可以从肉类中获取必要的盐分，但是以谷物为食的是会导致盐分的缺乏。在早期的村庄里，盐可能是一种重要的食品防腐剂。

As always, there is more to a major cultural change than simply a shift in economics. The Natufians made (and presumably wore) beads and pendants in many materials, including gemstones and marine shells that had to be imported, and it is possible that this ornamentation actually reflects a growing sense of ethnic identity and perhaps some differences in personal and group status. Cleverly carved figurines of animals, women, and other subjects occur in many sites, and Natufian period cave paintings have been found in Anatolia, Syria, and Iran. More than 400 Natufian burials have been found, most of them simple graves set in house floors. As archaeologist Belfer-Cohen notes, these burials may reflect an ancestor cult and a growing sense of community emotional ties and attachment to a particular place, and toward the end of the Natufian period, people in this area were making a strict separation between living quarters and burial grounds. In contrast with the Pleistocene cultures of the Levant, Natufian culture appears to have experienced considerable social change.

一如既往地，一个重大的文化变革不仅仅是由简单的经济的变化所造成的。纳图夫人用很多材料制作了（可能穿戴了）小珠子和垂饰，包括宝石和海里的贝壳，这些材料都需要进口才能获得，可能这些装饰品事实上反映了民族认同感的增强，或者反映了身份和族群地位上的一些不同。巧妙雕刻的动物、女人以及其他物品的塑像出现在了許多纳图夫遗址中，纳图夫时期的洞穴壁画曾在安纳托利亚、叙利亚和伊朗被发现。超过 400 座纳图夫人的墓葬被发现，其中大多数都是建在楼层里的简单的坟墓。据考古学家 Belfer-Cohen 记载，这些墓葬可能反映出了一种祖先崇拜，团队意识情感纽带的增强以及对特殊地区的一种依赖性，直到纳图夫时代后期，这里的人们才将生活区和墓葬区严格地区分开。与累范特的更新世文化相比，纳图夫文化好像经历了更大的社会变化。

The question of why the Natufians differed from their predecessors in these and other ways and why they made these first steps toward farming as a way of life remains unclear. There were climate changes, of course, and growing aridity and rising population densities may have forced them to intensify the exploitation of cereals, which in turn might have stimulated the development of sickles and other tools and the permanent communities that make agriculture efficient. But precisely how these factors interacted with others at play is poorly understood.

关于为什么纳图夫人与他们的祖先有着这样或那样的不同，以及他们为什么身先士卒将农耕作为一种生活方式，至今仍然是个谜。当然，天气变化是一个原因，越来越严重的干旱 n. 以及人口密度的增长可能迫使他们加强对谷物的开发利用，这转而可能会促进镰刀、其他工具以及使农业变得高效化的永久 adj. 群落的发展。但是人们还不清楚这些因素具体是什么时候与其他起作用的因素发生相互影响的。

批注 [11]: As always

• 一如既往

批注 [12]: Presumably★

• adv. 大概；推测起来；可假定

批注 [13]: pendant

• n. 垂饰，坠饰；吊灯；短索；
补充作品；三角旗

• adj. 下垂的

批注 [14]: ethnic★

英 ['eθnik] 美 ['eθnik]

• adj. 种族的；人种的

批注 [15]: burial★

• n. 埋葬；葬礼；弃绝

• adj. 埋葬的

批注 [16]: cult

• n. 狂热；异教团体；宗教信仰；膜拜仪式；时髦的人（或事物）；信徒

• adj. 受特定群体欢迎的

批注 [17]: intensify

• vi. 增强，强化；变激烈

• vt. 使加强，使强化；使变激烈

批注 [18]: precisely

英 [prɪ'saɪsli] 美 [prɪ'saɪsli]

• adv. 精确地；恰恰

TPO 52 – 3 Early Food Production in Sub-Saharan Africa

撒哈拉以南非洲的早期粮食生产

At the end of the Pleistocene (around 10,000 B.C.), the technologies of food production may have already been employed on the fringes of the rain forests of western and central Africa, where the common use of such root plants as the African yam led people to recognize the advantages of growing their own food. The yam can easily be resprouted if the top is replanted. This primitive form of "vegeculture" (cultivation of root and tree crops) may have been the economic tradition onto which the cultivation of summer rainfall cereal crops was grafted as it came into use south of the grassland areas on the Sahara's southern borders.

在更新世末期（大约公元前 10000 年），食品生产的技术可能已经在非洲西部和中部的热带雨林的边缘地区使用，在那里非洲山药等根茎型植物的普遍使用，使人们认识到自己种植食物的好处。山药的顶部如果被再植的话，很容易再次发芽。这种原始形式的“蔬菜栽培”（块根植物和树本作物的种植）可能已经成为了一种经济传统，基于这种传统，夏季降水谷类作物的种植也采用嫁接的办法，这种种植技术已经在撒哈拉沙漠南部边界地区的草原南部被使用。

As the Sahara dried up after 5000 B.C., pastoral peoples (cattle herders) moved southward along major watercourses into the savanna belt of West Africa and the Sudan. By 3000 B.C., just as ancient Egyptian civilization was coming into being along the Nile, they had settled in the heart of the East African highlands far to the south. The East African highlands are ideal cattle country and the home today of such famous cattle-herding peoples as the Masai. The highlands were inhabited by hunter-gatherers living around mountains near the plains until about 3300 B.C., when the first cattle herders appeared. These cattle people may have moved between fixed settlements during the wet and dry seasons, living off hunting in the dry months and their own livestock and agriculture during the rains.

随着撒哈拉沙漠在公元前 5000 年之后干涸，游牧民族（牧民）向南沿着主要河道迁移到了西非和苏丹的热带草原地带。直到公元前 3000 年，正如埃及文明发源于尼罗河流域一样，这些游牧民族定居在了离南部很远的东非高原地区的中心。东非高原是理想的养牛场所，如今也是像马赛人（肯尼亚和坦桑尼亚的游牧狩猎民族）这样的有名的牧牛民族的家园。直到大约公元前 3300 年，第一批牧牛人出现时，高地上居住着狩猎采集者，他们居住在平原附近的山区。在旱季和雨季，这些放牧人可能在固定的定居点之间移动，在旱季他们过着打猎的生活，在雨季靠畜牧和种植为生。

As was the case elsewhere, cattle were demanding animals in Africa. They required water at least every 24 hours and large tracts of grazing grass if herds of any size were to be maintained. The secret was the careful selection of grazing land, especially in environments where seasonal rainfall led to marked differences in graze quality throughout the year. Even modest cattle herds required plenty of land and considerable mobility. To acquire such land often required moving herds considerable distances, even from summer to winter pastures. At the same time, the cattle owners had to graze their stock in tsetse-fly-free areas. The only protection against human and animal sleeping sickness, a disease carried by the tsetse fly, was to avoid settling or farming such areas- a constraint severely limiting the movements of cattle-owning farmers in eastern and central Africa. As a result, small cattle herds spread

south rapidly in areas where they could be grazed. Long before cereal agriculture took hold far south of the Sahara, some hunter-gatherer groups in the savanna woodlands of eastern and southern Africa may have acquired cattle, and perhaps other domesticated animals, by gift exchange or through raids on herding neighbors.

和其他地方的情况一样，在非洲，牛是饲养起来很费劲的动物。如果要饲养各种规模的牛群的话，这些牛至少每 24 小时就需要喝一次水，而且需要大片的牧场。饲养的秘诀在于仔细挑选放牧场地，尤其是在季节性降雨会导致全年牧草质量有明显差异的环境中。即使是规模适中的牛群也需要大片的土地和相当大的可移动性。为了获得这样的土地，经常需要牛群移动相当远的距离，甚至是从夏季牧场移动到冬季牧场。同时，放牧人不得不在有舌蝇出没的地带吃草。唯一能够保护人类和牲畜，不患上昏睡病（一种由舌蝇传播的疾病）的办法，就是避免在这些地区定居或者放牧——对非洲东部和中部地区的牧民来说，这个办法严重地限制了他们的迁移。结果是，小牛群迅速地向南部地区迁移，在那里人们可以放牧。在谷类农业占领最南部的撒哈拉沙漠之前，非洲东部和南部稀树草原地区的一些依靠狩猎和采集生活的人可能已经饲养了牛群和其他家养动物，他们将牲畜作为礼物交换，或者通过劫掠放牧的邻居，来获得这些牲畜。

Contrary to popular belief, there is no such phenomenon as "pure" pastoralists, a society that subsists on its herds alone. The Saharan herders who moved southward to escape drought were almost certainly also cultivating sorghum, millet, and other tropical rainfall crops. By 1500 B.C., cereal agriculture was widespread throughout the savanna belt south of the Sahara. Small farming communities dotted the grasslands and forest margins of eastern West Africa, all of them depending on what is called shifting agriculture. This form of agriculture involved clearing woodland, burning the felled brush over the cleared plot, mixing the ash into the soil, and then cultivating the prepared fields. After a few years, the soil was exhausted, so the farmer moved on, exploiting new woodland and leaving the abandoned fields to lie fallow. Shifting agriculture, often called slash-and-burn, was highly adaptive for savanna farmers without plows, for it allowed cereal farming with the minimal expenditure of energy.

和主流观点相反：没有所谓的“纯粹”的牧民，即只依靠牧群生存的社会。撒哈拉沙漠地区为了躲避干旱而向南迁移的牧民，几乎肯定的是他们也在种植高粱、小米和其他热带降雨作物。到公元前 1500 年，谷类作物已经广泛分布于整个撒哈拉沙漠南部的稀树草原带。小型农业社区遍布在草原和西非东部森林的边界处，这些小型农业社区都依赖于所谓的轮耕法。这种形式的农业包括清理林地，焚烧清理过的地块上的那些被砍倒的灌木丛，将灰烬混合在土壤中，然后在这些制备好的土地上耕种。几年后，土地耗尽了养分，于是农民们继续前进，开辟新的林地，让原来的荒地休耕。轮耕法，也被称为“刀耕火种”，高度适用于没有犁的稀树草原地区的农民，因为这种方法能够消耗最少的能量来种植谷类。

The process of clearance and burning may have seemed haphazard to the uninformed eye, but it was not. Except in favored areas, such as regularly inundated floodplains, tropical Africa's soils were of only moderate to low fertility. The art of farming was careful soil selection, that is, knowing which soils were light and easily cultivable, could be readily turned with small hoes, and would maintain their fertility over several years' planting, for cereal crops rapidly

remove nitrogen and other nutrients from the soil. Once it had taken hold, slash-and-burn agriculture expanded its frontiers rapidly as village after village took up new lands, moving forward so rapidly that one expert has estimated it took a mere two centuries to cover 2,000 kilometers from eastern to southern Africa.

在不知情者的眼中,清除林地和燃烧林地的过程看似是随意的,但事实并非如此。种植谷类除了在耕种条件较好的地区,比如经常被水淹没的河漫滩地区:热带非洲的土壤的肥力只在中等水平甚至很低。农业的艺术就在于小心地选择土地,就是说,知道哪些土壤是轻土壤,容易耕种,很容易用小锄头翻种,并且可以在经过几年的耕种之后,仍然保持它的肥力,因为谷类植物会迅速地消耗氮和土壤中其他的养分。一旦谷类植物被种植,刀耕火种的农业会迅速扩大其范围,就如同在新土地上出现一个又一个的村落一样,轮耕农业会迅速地发展,以至于一个专家估计它仅仅只用了两个世纪的时间,就覆盖了从非洲东部到南部 2000 公里范围的土地。