

TPO 16 – 1 Trade and the Ancient Middle East

古代中东与贸易

Trade was the **mainstay** of the urban economy in the Middle East, as **caravans negotiated** the surrounding desert, restricted only by **access to water** and by **mountain ranges**. This has been **so** since ancient times, *partly due to the geology of the area, which is mostly limestone and sandstone, with few deposits of metallic ore and other useful materials*. Ancient demands for obsidian (a black volcanic rock useful for making mirrors and tools) led to trade with Armenia to the north, while **jade** for cutting tools was brought from Turkistan, and the precious stone lapis lazuli was imported from Afghanistan. One can **trace such expeditions back to** ancient Sumeria, the earliest known Middle Eastern civilization. Records show merchant caravans and **trading posts set up** by the Sumerians in the surrounding mountains and deserts of Persia and Arabia, where they traded grain for raw materials, such as timber and stones, as well as for metals and gems.

<b>mainstay</b> 英 ['meɪnstet] 美 ['meɪnstet] n. <b>支柱</b> ; 中流砥柱; 主要的依靠; 主桅支索	<b>negotiate</b> 英 [nɪ'gəʊʃiet] 美 [nɪ'gouʃiet] vt. 谈判, 商议; 转让; <b>越过</b> vi. 谈判, 交涉	<b>expedition</b> 英 [ˌɛkspə'dɪʃn] 美 [ˌɛkspə'dɪʃn] n. 远征; 探险队; 迅速
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贸易是中东地区城市经济的主要支柱, 商旅车队穿行于周围的戈壁, 只有水源和山峦构成贸易的障碍。这种情况(贸易是主要支柱)从古至今**都是如此**, 一部分原因是中东地区的地质环境——多为沙石和石灰岩, 金属矿藏和其它有用材料很少。古代对黑曜石(一种火山岩, 可以用来制作镜子和工具)的需求引发了与北方的亚美尼亚之间的贸易; 用作切削工具的玉石是从土耳其斯坦购买; 而稀有贵重的琉璃青金石是从阿富汗地区进口的。探险活动最早可以追溯至古苏美尔——已知最早的中东文明。记录显示商队和**贸易站**由古苏美尔人在周围山区及古波斯和阿拉伯的沙漠地区**建立**, 他们用谷物交换原材料, 例如木材和石头, 还有金属和宝石。

**Reliance on trade** had several important consequences. Production was generally in the hands of skilled individual **artisans** doing **piecework** under the **tutelage** of a master who was also the shop owner. In these shops, differences of rank were **blurred as** artisans and masters **labored side by side** in the same modest establishment, were usually members of the same **guild** and religious **sect**, lived in the same neighborhoods, and often had assumed? or real? **kinship** relationships. The worker was bound to the master by a mutual contract that either one could **repudiate**, and the relationship was **conceptualized** as one of partnership.

<b>piecework</b> 英 ['pi:swɜ:k] 美 ['pi:swɜ:rk] n. 计件工作	<b>tutelage</b> 英 ['tju:tələdʒ] 美 ['tu:tələdʒ] n. 监护; 指导	<b>guild</b> 英 [gɪld] 美 [gɪld] n. 协会, 行会; 同业公会
<b>sect</b> 英 [sekt] 美 [sekt] n. 宗派	<b>kinship</b> 英 ['kɪnʃɪp] 美 ['kɪnʃɪp] n. [法] 亲属关系, 家属关系; 亲密关系	<b>repudiate</b> 英 [rɪ'pjʊ:diət] 美 [rɪ'pjʊ:diət] vt. 拒绝; 否定; 批判; 与...断绝关系; 拒付

**批注 | 1: caravan**  
英 ['kærəvæn] 美 ['kærəvæn]  
•n. (可供居住的)拖车, 大篷车; (穿过沙漠地带的)旅行队(如商队); <英>活动住宅; <美>移民列车  
•vi. 乘拖车度假; 参加旅行队旅行

**批注 | 2: mountain range**  
•山脉

**批注 | 3: jade**  
英 [dʒeɪd] 美 [dʒeɪd]  
•n. 翡翠; [宝] 碧玉; 老马  
•adj. 玉制的; 绿玉色的  
•vi. 疲倦  
•vt. 使疲倦

**批注 | 4: blur**  
英 [blɜ:(r)] 美 [blɜ:r]  
•n. 模糊不清的事物; 模糊的记忆; 污迹  
•v. 使.....模糊不清, 变模糊; 使暗淡; 玷污, 沾上污迹

**批注 | 5: conceptualize**  
英 [kən'septʃuəlaɪz] 美 [kən'septʃuəlaɪz]  
•vt. 使概念化  
•vi. 概念化

依赖贸易造成了一些重大影响。生产工作一般在师傅也是店主的监视下，由熟练的**工匠**计件完成。在这些店铺中，阶级差异并不明显，**因为**工匠和店主同在一个相对舒适的环境中**共事**，通常有着相同的**宗教信仰**，而且又是街坊邻里，彼此之间还很有可能（没准真的）是亲戚关系。工人和店主双方具有劳务关系，任一方都有权终止，这是合作关系中的一种。

This mode of craft production **favored** the growth of self-governing and **ideologically egalitarian** craft **guilds** everywhere in the Middle Eastern city. These were **essentially professional associations** that provided for the mutual aid and protection of their members, and allowed for the **maintenance** of professional standards. The growth of independent guilds was furthered by the fact that surplus was not a result of domestic craft production but resulted primarily from international trading; the government **left** working people to govern themselves, much as shepherds of tribal **confederacies** were left alone by their leaders. In the multiplicity of small-scale local egalitarian or **quasi**-egalitarian organizations for **fellowship, worship**, and production that flourished in this **laissez-faire** environment, individuals could interact with one another within a community of harmony and ideological equality, following their own popularly elected leaders and governing themselves by shared **consensus** while minimizing distinctions of wealth and power.

<p><b>egalitarian</b> 英 [iˌgæliˈteəriən] 美 [iˌgæliˈteriən] adj. 平等主义的 n. 平等主义; 平等主义者</p>	<p><b>maintenance</b> 英 ['meɪntənəns] 美 ['meɪntənəns] n. 维护, 维修; 保持; 生活费用</p>	<p><b>confederacy</b> 英 [kənˈfɛdərəsi] 美 [kənˈfɛdərəsi] n. 联盟; 联邦; 私党</p>
<p><b>fellowship</b> 英 ['feləʊʃɪp] 美 ['feləʊʃɪp] n. 团体; 友谊; 奖学金; 研究员职位</p>	<p><b>worship</b> 英 ['wɜːʃɪp] 美 ['wɜːrɪʃɪp] n. 崇拜; 礼拜; 尊敬 vt. 崇拜; 尊敬; 爱慕 vi. 拜神; 做礼拜</p>	<p><b>consensus</b> 英 [kənˈsɛnsəs] 美 [kənˈsɛnsəs] n. 一致; 舆论; 合意</p>

这种生产模式**有助于**自主管理制度的发展，在中东城市里**意识形态上**秉持人人平等的手**行会**比比皆是。他们**实质上是****专门**提供互助且保护组织成员的**协会组织**，同时注重**维持**行业标准。独立行会不断增加，是因为剩余价值的产生并非由于国内生产，而是主要来自于国际间的贸易活动。政府**允许**劳动人民自主管理，这和部落首领让牧羊者们自由放牧一样。在当地，团体、信仰以及生产方面的小型平等主义团体或**类似**平等主义的组织在这种**自由放任的**环境里遍地开花，和谐平等的团体中，成员之间相互影响，追随着他们自己选举的领导人，在缩小财富和权力差距的同时通过分享意见进行自我管理。

The mercantile economy **was also characterized by** a peculiar **moral stance** that is typical of people who live by trade—*an attitude that is individualistic, calculating, risk taking, and adaptive to circumstances*. As among tribespeople, personal relationships and a careful weighing of character have always been crucial *in a mercantile economy with little regulation*, where one's word is one's bond and where informal **ties** of trust **cement** together an international trade network. **Nor** have merchants and artisans ever had much tolerance for

**批注 | 6: quasi**

英 ['kweɪzɑː; 'kweɪsɑː; 'kwɑːzi] 美 ['kweɪzɑː; 'kweɪsɑː; 'kwɑːzi]

- adj. 准的; 类似的; 外表的
- adv. 似是; 有如

**quasi-**

英 美 [kweɪzɑː; kweɪsɑː; kwɑːzi]

- pref. 准; 类似 (用以构成复合词)

**批注 | 7: stance**

英 [stæns; staːns] 美 [stæns]

- n. 立场; 姿态; 位置; 准备击球姿势

**道德立场**

**批注 | 8: cement**

英 [sɪˈment] 美 [sɪˈment]

- n. 水泥; 接合剂; 纽带; 使人们团结的因素; 黏固粉; 骨质; 沉积岩基质
- v. 粘牢, 胶合; 巩固, 确定; 在.....上抹水泥; (物质) 在沉积岩中黏附 (颗粒)

aristocratic professions of moral superiority, favoring **instead** an egalitarian ethic of the open market, where steady hard work, the loyalty of one's fellows, and entrepreneurial skill make all the difference. And, like the pastoralists, Middle Eastern merchants and artisans unhappy with their environment could simply **pack up** and **leave for** greener pastures—an act of **self-assertion** **wholly** impossible in most other civilizations throughout history.

<p><b>entrepreneurial</b> 英 [ˌɒntreɪprəˈnɜːriəl] 美 [ˌɑːntreɪprəˈnɜːriəl] adj. 企业家的, 创业者的; 中间商的</p>	<p><b>self-assertion</b> 英 [ˌself əˈsɜːʃn] 美 [ˌself əˈsɜːrʃn] n. 自信; 自作主张; 一意孤行</p>	<p><b>wholly</b> 英 ['həʊlɪ] 美 ['hoʊlɪ] adv. 完全地; 全部; 统统</p>
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批注 [ 9]: **pack up** 整理; 把... 打包

批注 [ 10]: **leave for** 动身去

商品经济也通过靠贸易为生的商人所秉持的特定**道德立场表现出来**。他们具有独立自主、精于计算、敢于冒险和**随遇而安**的优秀品质。就像部落成员之间一样, **在几乎没有规则的商品经济中**, 人际关系和对个人品格的评估至关重要, 口头契约和非正式的诚信**关系**塑造了一个国际贸易网络。**没有**商人和工匠会宽容贵族职业的道德优越感, **相反**, 他们倾向于开放市场中的平等主义, 在市场中, 辛勤的工作, 随从的忠诚以及企业家精神才是决定性因素。而且, 这和畜牧文明类似, 中东的商人和工匠们若对自己所处的环境不满意, 简单收拾一下就可迁移到一个更加丰茂的牧场——纵观历史, 如此**随性而为**的行为在其他多数文明中是无法想象的。

Dependence on long-distance trade also meant that the great empires of the Middle East were **built both literally and figuratively on** shifting sand. The central state, **though often very rich and very populous**, was **intrinsicly** fragile, since the development of new international trade routes could **undermine** the **monetary base** and erode **state power**, as occurred when European seafarers **circumvented** Middle Eastern merchants **after Vasco da Gama's voyage around Africa in the late fifteenth-century** opened up a southern route. The ecology of the region also permitted armed predators to **prowl** the surrounding barrens, which were almost impossible for a state to control. Peripheral peoples therefore had a great advantage in their dealings with the center, making government authority insecure and anxious.

批注 [ 11]: **intrinsicly**

英 [ɪnˈtrɪnzɪkli; ɪnˈtrɪnsɪkli]  
i) 美 [ɪnˈtrɪnzɪkli; ɪnˈtrɪnsɪkli]  
•adv. 本质地; 内在地; 固有地

批注 [ 12]: **monetary base**

•[金融] 货币基础

批注 [ 13]: **circumvent**

英 [sɜːkəmˈvent] 美 [sɜːrəkəmˈvent]

•v. 包围; 智取; **绕行**, 规避

批注 [ 14]: **prowl**

英 [praʊl] 美 [praʊl]

•v. 潜行; 徘徊; 搜寻

•n. 徘徊, 潜行; 悄悄踱步;  
(动物) 出动捕猎; 四处搜寻  
(干某事的机会)

对远距离贸易的依赖也意味着伟大的中东帝国是建立在沙土之上的, 不仅在**文字意义上**, 而且在**象征意义上**。帝国中部尽管非常富足繁盛, 但本质上脆弱不堪, 因为新的国际贸易线路的出现会**动摇经济基础并腐蚀国家权力**。就在 15 世纪晚期达伽马绕过非洲开辟南部航线以后, 欧洲的水手们便绕过中东商人改走南部航线了。该地区的生态环境也允许武装“捕食者”在周围的荒漠**潜行**, 几乎很难被帝国控制。外围的人借此得到一个应对中央帝国的绝好机会, 这让政府惴惴不安。

## TPO 16 – 2 Development of the Periodic Table 元素周期表的演进

The periodic table is a chart that reflects the periodic **recurrence** of chemical and physical properties of the elements when the elements are arranged in order of increasing atomic number (the number of protons in the nucleus). It is a **monumental** scientific achievement, and its development illustrates the **essential interplay** between observation, prediction, and testing required for scientific progress. In the 1800's scientists were searching for new elements. By the late 1860's more than 60 chemical elements had been identified, and much was known about their descriptive chemistry. **Various proposals were put forth to** arrange the elements into groups based on similarities in chemical and physical properties. The next step was to recognize a connection between group properties (physical or chemical similarities) and atomic mass (the measured mass of an individual atom of an element). When the elements *known at the time* were ordered by increasing atomic mass, it was found that successive elements belonged to different chemical groups and that the order of the groups in this sequence was fixed and repeated itself at regular intervals. Thus when the series of elements was written so **as to begin a new horizontal row with each alkali metal**, elements of the same groups were automatically assembled in vertical columns in a periodic table of the elements. This table was the **forerunner** of the modern table.

元素周期表是按原子序数（元素原子核中质子的数量）由小到大依次排列，反映元素的化学和物理特征的周期性的图表。这一科学发现**具有里程碑**的意义，它的发现表明了科学探索过程中观察、预测和实证之间的**重要互动**。19世纪一开始，科学家们不断探索新的元素。到19世纪60年代后期，已经发现了60种以上的化学元素，而许多描述性化学被认知。人们提出各种建议，认为应该基于化学和物理特征的相似性将化学元素排列成组。他们接下来又认识到元素的族群特性（物理或是化学相似性）和原子质量（一种元素的单个原子的测量质量）之间存在联系。把当时的已知元素按照原子质量从小到大排列，人们发现，一些具备连续性的元素却分属不同的化学组，并且发现在这种排列方式下，元素群组的顺序是固定的且定期重复。因此，当每一新行都以碱性金属元素开始并逐步将这一系列的元素排列出来时，元素周期表中同一组中的元素就会自动归入一个垂直纵列中。这个表格就是现代元素周期表的**雏形**。

When the German chemist Lothar Meyer and (independently) the Russian Dmitry Mendeleev first introduced the periodic table in 1869-70, one-third of the naturally occurring chemical elements had not yet been discovered. **Yet** both chemists were sufficiently farsighted to **leave gaps where their analyses of periodic physical and chemical properties indicated that new elements should be located**. Mendeleev was bolder than Meyer and even assumed that if a measured atomic mass put an element in the wrong place in the table, the atomic mass was wrong. In some cases this was true. Indium, for example, had previously been assigned an atomic mass between those of arsenic and selenium. Because there is no space in the periodic table between these two elements, Mendeleev suggested that the atomic mass of indium be changed to a completely different value, where it would fill an empty space between cadmium and tin. In fact, **subsequent work has shown that** in a periodic table,

### 批注 [ 15]: recurrence

英 [rɪ'kʌrəns] 美 [rɪ'kɜːrəns]

- n. 再发生；循环；重现；重新提起

### 批注 [ 16]: monumental

英 [mɒnju'mentl] 美 [mə'nju'mentl]

- adj. 不朽的；纪念碑的；非常的

### 批注 [ 17]: essential

英 [ɪ'senʃl] 美 [ɪ'senʃl]

- adj. 基本的；必要的；本质的；精华的
- n. 本质；要素；要点；必需品

### 批注 [ 18]: interplay

英 [ɪntəpleɪ] 美 [ɪntərpleɪ]

- n. 相互影响，相互作用
- vi. 相互影响，相互作用

### 批注 [ 19]: put forth

英美

- 提出；发表；启航；（植物等）长出；放出

### 批注 [ 20]: forerunner

英 ['fɔːrʌnə(r)] 美 ['fɔːrʌnər]

- n. 先驱；先驱者；预兆

elements should not be ordered strictly by atomic mass. For example, tellurium comes before iodine in the periodic table, even though its atomic mass is slightly greater. Such **anomalies** are due to the relative abundance of the "**isotopes**" or varieties of each element. All the isotopes of a given element have the same number of protons, but differ in their number of neutrons, and hence in their atomic mass. The isotopes of a given element have the same chemical properties but slightly different physical properties. We now know that atomic number (the number of protons in the nucleus), *not atomic mass number (the number of protons and neutrons)*, determines chemical behavior.

当德国化学家迈耶和俄国化学家门捷列夫（彼此独立的）在 1869 年到 1870 年间首次发布元素周期表时，有三分之一的天然化学元素还没被发现。然而这两位化学家都极富远见，他们在周期表上留白，留给依据元素物理性和化学性的分析表明有待发现的新元素。门捷列夫比迈耶更为大胆，他甚至做出假设，如果周期表按原子质量排列，但元素位置不对的话，那么原子质量也是错的。在某些情况下，这个设想是正确的。以镭为例，先前测量出镭的原子质量在铯和钡之间。但是因为周期表中这两个元素之间没有缝隙，由此门捷列夫提出把镭的原子质量变为截然不同的一个值，这样就可以将其置于铯和钡之间的空位。事实上，接下来的研究表明，元素周期表中元素不能严格按照原子质量排列。例如，尽管铯的原子质量比钡略大，但在元素周期表中，它却排在钡前面。出现这种**反常现象**，主要是因为相对丰富的“**同位素**”或者各种元素的多样性。同一元素的所有同位素具有相同的质子数，但中子数不同，因此它们的原子质量也不一样。一个特定元素的同位素具有相同的化学特征，但在物理性质上有一些细微差异。现在我们知道，是原子序数（原子核中质子的数量）而非原子质量（质子和中子的数量）决定着元素的化学性质。

Mendeleev went further than Meyer in another respect: he predicted the properties of six elements yet to be discovered. For example, a gap just below aluminum suggested a new element would be found with properties **analogous to** those of aluminum. Mendeleev **designated** this element "eka-aluminum" (eka is the Sanskrit word for "next") and predicted its properties. Just five years later an element with the proper atomic mass was isolated and named gallium by its discoverer. The close correspondence between the observed properties of gallium and Mendeleev's predictions for eka-aluminum **lent strong support to** the periodic law. When elements are arranged in order of their atomic number, most of the properties of the elements reoccur at regular intervals. **Additional support came** in 1885 when eka-silicon, which had also been described in advance by Mendeleev, was discovered and named germanium.

门捷列夫在另一个研究上也比迈耶更为深入：他预测了有待发现的六种元素的性质。例如，就在铝下面有一个空位，这表明还有一个性质和铝类似的新元素存在。门捷列夫将该元素定义为“铝下元素”（eka 是梵语词，意思是“下一个”）并且还预测了其性质。仅仅 5 年之后，原子质量相吻合的元素就被分离出来，发现者将其命名为“镓”。镓所表现出的特性和门捷列夫对“铝下元素”的预测一一对应，这为元素周期法则提供了一个强有力的依据。当元素按照它们的原子序数排列时，大多数元素的性质按固定周期重现。还有一个支持例证，1885 年发现“硅下元素”，同样为门捷列夫所预测，后来命名为锗。

批注 [ 21]: **analogous to**

[ə'næləgəs tu]

•类推为；类同于

批注 [ 22]: **designate**

英 ['deziɡneɪt] 美 ['deziɡneɪt]

•vt. 指定；指派；标出；把...定名为

•adj. 指定的；选定的

批注 [ 23]: **lend strong**

**support to**

大力支持

批注 [ 24]: **additional**

英 [ə'dɪʃənəl] 美 [ə'dɪʃənəl]

•adj. 附加的，额外的

The structure of the periodic table appeared to limit the number of possible elements. It was therefore quite surprising when John William Strutt, Lord Rayleigh, discovered a gaseous element in 1894 that did not *fit into the previous classification scheme*. A century earlier, Henry Cavendish had noted the existence of a residual gas when oxygen and nitrogen are removed from air, but its importance had not been realized. Together with William Ramsay, Rayleigh isolated the gas (separating it from other substances into its pure state) and named it argon. Ramsay then **studied** a gas that was present in **natural gas deposits** and **discovered** that it was helium, an element whose presence in the Sun had been noted earlier in the spectrum of sunlight but that had not previously been known on Earth. Rayleigh and Ramsay **postulated** the existence of a new group of elements, and in 1898 other members of the series (neon, krypton, and xenon) were isolated.

元素周期表的框架似乎限制了可能存在的元素数量。因此，当约翰·威廉姆·斯特拉特（瑞利男爵），在 1894 年发现一种气态元素不能适应之前的元素表时会非常惊讶。一个世纪以前，亨利·卡文迪许就注意到，当氧气和氮气从空气中被移除后仍然有残余气体存在，但当时没人意识到该发现的重要性。瑞利和威廉·拉姆齐一道，共同分离出一种气体（将之与其他物质隔离并存于一个真空环境）并将其命名为氩。拉姆齐经过研究又发现了另一种存在于自然界中的气体元素——氦，该元素在太阳中存在，并且很早就被发现存在于太阳光谱中，但是之前并没有在地球上找到过。瑞利和拉姆齐做出**假设**，认为存在一组新元素，1898 年，这一系列元素中的其他元素（氖，氙，氡）也被成功分离出来。

## TPO 16 – 3 Planets in Our Solar System 太阳系中的行星

Note: The following text indicates that Pluto is a planet. It was written before the matter of Pluto **being defined as a planet** became unsettled in the scientific community. The associated questions are **answerable** based on the content in the text.

注意：下文把冥王星称为行星，这篇文章写于科学界重新评估冥王星的行星身份之前。相关问题需要基于本文文本回答。

The Sun is the **hub** of a huge rotating system consisting of nine planets, their satellites, and numerous small bodies, including asteroids, comets, and meteoroids. **An estimated 99.85 percent of the mass of our solar system is contained within the Sun, while the planets collectively make up most of the remaining 0.15 percent.** The planets, in order of their distance from the Sun, are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, and Pluto. Under the control of the Sun's gravitational force, each planet maintains an elliptical orbit and all of them travel in the same direction.

九大行星、它们的卫星以及数量众多的小天体，包括小行星、彗星和陨星，共同构成了一个巨大的公转系统而太阳是这个公转系统的核心。太阳系中，太阳的质量占大约 99.85%，而所有行星的质量加起来占剩下的 0.15%。九大行星按照距离太阳的远近依次为：水星、金星、地球、火星、木星、土星、天王星、海王星和冥王星。在太阳引力的作用下，每个行星都沿着椭圆形的轨道，按照相同的方向公转。

The planets in our solar system fall into two groups: the terrestrial (Earth-like) planets (Mercury, Venus, Earth, and Mars) and the Jovian (Jupiter-like) planets (Jupiter, Saturn, Uranus, and Neptune). **Pluto is not included in either category**, because its great distance from Earth and its small size **make this planet's true nature a mystery**. The most obvious difference between the terrestrial and the Jovian planets is their size. The largest terrestrial planet, Earth has a diameter only one quarter **as great as** the diameter of the smallest Jovian planet, Neptune, and its mass is only one seventeenth **as great**. Hence, the Jovian planets are often called giants. Also, because of their relative locations, the four Jovian planets are known as the outer planets, while the terrestrial planets are known as the inner planets. **There appears to be a correlation between** the positions of these planets **and** their sizes.

太阳系中九大行星分为两类：类地行星（和地球类似，包括水星、金星、地球和火星）和类木行星（与木星类似，包括木星、土星、天王星和海王星）。冥王星不属于这两类中的任何一个，因为它距地球很远且体积较小，所以目前冥王星的真实形态仍然是个谜。类地行星和类木行星最为明显的差别就在于它们的体积。比如最大的类地行星地球的直径仅仅是最小的类木行星海王星的四分之一，而质量更是只有海王星的 1/17。因此，类木行星通常又被称为巨行星。又因这四颗类木行星的相对位置，它们也被称为外行星，而类地行星则相应被称作内行星。这表示行星的位置与体积之间是有关联的。

批注 [ 25]: **answerable**

英 ['ɑ:nsərəbəl] 美 ['ænsərəbəl]

•adj. 应负责任的；可回答的；有责任的

批注 [ 26]: **hub**

英 [hʌb] 美 [hʌb]

•n. 中心；毂；木片

批注 [ 27]: **collectively**

英 [kə'lektivli] 美 [kə'lektivli]

•adv. 集体地，共同地

Other dimensions along which the two groups differ **markedly** are density and composition. The densities of the terrestrial planets average about **5** times the density of water, whereas the Jovian planets have densities that average only **1.5** times the density of water. One of the outer planets, Saturn, has a density of only 0.7 that of water, which means that Saturn would float in water. Variations in the composition of the planets are largely responsible for the density differences. The substances that make up **both groups** of planets are divided into three groups—gases, rocks, and ices—based on their melting points. The terrestrial planets are mostly rocks: dense rocky and metallic material, with minor amounts of gases. The Jovian planets, on the other hand, contain a large percentage of the gases hydrogen and helium, with varying amounts of ices: mostly water, ammonia, and methane ices.

两类行星其它方面的区别中，比较显著的是密度和构成成分。类地行星的平均密度大约为水的 5 倍，而类木行星的平均密度大概只有水的 1.5 倍。外行星中土星的密度只有水的 0.7 倍，也就是说土星可以浮在水上。行星的构成成分不同很大程度上是因为密度差异。两类行星的构成物质根据熔点可以划分为三类——气体、岩石和冰。类地行星多数由岩石（致密岩石和金属材料）以及少量气体构成。而类木行星恰恰相反，包含较大比例的气态氢和氦，以及各种形态的冰（大部分是水、氨和甲烷冰）。

The Jovian planets have very **thick** atmospheres consisting of varying amounts of hydrogen, helium, methane, and ammonia. **By comparison**, the terrestrial planets have meager atmospheres **at best**. A planet's ability to retain an atmosphere depends on its temperature and mass. **Simply stated**, a gas molecule can "evaporate" from a planet if it reaches a speed known as the escape velocity. For Earth, this velocity is 11 kilometers per second. Any material, including a rocket, must reach this speed before it can leave Earth and go into space. The Jovian planets, *because of their greater masses and thus higher surface gravities*, have higher escape velocities (21–60 kilometers per second) than the terrestrial planets. Consequently, it is more difficult for gases to "evaporate" from them. Also, because the molecular motion of a gas depends on temperature, at the low temperatures of the Jovian planets even the lightest gases are unlikely to acquire the speed needed to escape. On the other hand, a **comparatively** warm body with a small surface gravity, like Earth's moon, is unable to hold even the heaviest gas and thus lacks an atmosphere. The slightly larger terrestrial planets Earth, Venus, and Mars retain some heavy gases like carbon dioxide, but even their atmospheres **make up only an infinitesimally small portion of their total mass**.

类木行星有非常致密的大气层，主要由变化量的氢、氦、甲烷和氨组成。**相比之下**，类地行星的大气层则要稀薄得多。一个行星保持大气的的能力取决于其温度和质量。**简单来说**，如果气体达到逃逸速度，那么气体分子可以从行星上“蒸发”。地球的逃逸速度大约为 11 千米/秒。任何物质，包括火箭，要离开地球进入太空就必须达到这个速度。由于类木行星的质量较大并因此产生更高的表面引力，因此，类木行星的逃逸速度（21~60 千米/秒）要比类地行星高得多。所以，气体从类木行星的表面“蒸发”就更为困难。同时又因为气体分子运动取决于温度，所以在类木行星这样的低温环境下，即使是最轻的气体也无法达到所需要的逃逸速度。而从另一个角度讲，一个相对温暖表面引力很小的天体，比如月球，甚至无法留住最重的气体，

批注 [ 28]: **markedly**

英 ['mɑ:kɪdli] 美 ['mɑ:rkɪdli]

•adv. 明显地；显著地；引人注目地

批注 [ 29]: **thick**

英 [θɪk] 美 [θɪk]

•adj. 厚的，有……厚；浓密的；粘稠的；浑浊的；迟钝的；明显的；粗壮的；（字体）粗体的；（气味）浓烈的；沙哑的；口音重的；思路不清的；大量的；（非正式）交情厚的

•n. 最激烈处；最密集处；中心处

•adv. 厚厚地；密集地

批注 [ 30]: **at best**

充其量，至多

批注 [ 31]: **comparatively**

英 [kəm'pærətɪvli] 美 [kəm'pærətɪvli]

•adv. 比较地；相当地

批注 [ 32]: **infinitesimally**

[ɪn'fɪnɪ'tesɪməli]

•adv. 极小地



因此没有大气层。体积稍大的类地行星，比如地球、金星和火星，保持了二氧化碳等一部分较重的气体，但即便如此，大气构成也只占它们总质量的很小一部分。

The orderly **nature** of our solar system leads most astronomers to conclude that the planets formed at **essentially** the same time and from the same material as the Sun. 【It is hypothesized that the **primordial** cloud of dust and gas *from which all the planets are thought to have condensed* had a composition somewhat similar to that of Jupiter. 】 However, unlike Jupiter, the terrestrial planets today are **nearly void** of light gases and ices. The explanation may be that the terrestrial planets were once much larger and richer in these materials but **eventually** lost them because of these bodies' relative closeness to the Sun, which meant that their temperatures were relatively high.

太阳系有序的性质使得大部分天文学家得出结论：行星基本形成于同一时间并且构成物质与太阳相同。天文学家们推测，所有行星原始状态的尘埃和气体形成的云状物凝聚，合成物与木星的有些类似。然而，和木星不同的是，如今类地行星上的轻质气体和冰极度缺乏。有一种解释认为，类地行星曾经体积更大并且物质构成上更为丰富多样，但因为它们距太阳较近致使温度相对较高而最终失去这些物质。

批注 | 33]: **nature**

英 ['neɪtʃə(r)] 美 ['neɪtʃər]

•n. 自然；性质；本性；种类

批注 | 34]: **essentially**

英 [ɪ'senʃəli] 美 [ɪ'senʃəli]

•adv. 本质上；本来

批注 | 35]: **primordial**

英 [praɪ'mɔːdiəl] 美 [praɪ'mɔːrdiəl]

•adj. 原始的；根本的；原生的

批注 | 36]: **nearly**

英 ['niəli] 美 ['niːrli]

•adv. 差不多，几乎；密切地

批注 | 37]: **void**

英 [vɔɪd] 美 [vɔɪd]

•adj. 无效的；空的；无人（居住）的；缺乏的

•n. 空间；空白；空虚感

•v. 使无效；排放（大小便）

批注 | 38]: **eventually**

英 [ɪ'ventʃuəli] 美 [ɪ'ventʃuəlɪ]

•adv. 最后，终于