William Smith

威廉•史密斯

In 1769 in a little town in Oxfordshire, England, a child with the very ordinary name of William Smith was born into the poor family of a village blacksmith. He received rudimentary village schooling but mostly he roamed his uncle’s farm collecting the fossils that were so abundant in the rocks of the Cotswold hills. When he grew older, William Smith taught himself surveying from books he bought with his small savings and at the age of eighteen he was apprenticed to a surveyor of the local parish. He then proceeded to teach himself geology and when he was twenty-four, he went to work for the company that was excavating the Somerset Coal Canal in the south of England.

1769年，在英国牛津郡的一个小镇上，一个小男孩儿出生在村里一户穷铁匠家，他的名字很普通，叫做威廉•史密斯。史密斯只在村里的学校接受了最基本的教育，他大部分的时间都是在叔叔的农场里搜寻化石，这些化石在科茨沃尔德山的岩石里是很常见的。长大后，他开始用微薄的积蓄买书自学测量，18岁的时候，史密斯成为了当地教区测量员的助理。后来，他又自学了地质学，24岁时，他开始为挖掘英格兰南部Somerset Coal运河的一家公司工作。

This was before the steam locomotive, and canal building was at its height. The companies building the canals to transport coal needed surveyors to help them find the coal deposits worth mining as well as to determine the best courses for the canals. This job gave Smith an opportunity to study the fresh rock outcrops created by the newly dug canal. He later worked on similar jobs across the length and breadth of England all the while studying the newly revealed strata and collecting all the fossils he could find. Smith used mail coaches to travel as much as 10,000 miles per year. In 1815 he published the first modern geological map “A Map of the Strata of England and Wales with a Part of Scotland”, map so meticulously researched that it can still be used today.

那是在蒸汽火车发明之前，运河建设正处于顶峰时期。致力于开掘运河来运输煤的公司需要测量员帮助他们探寻值得挖掘的煤矿的地址以及最佳的运河路线。这份工作为史密斯提供了机会，使他能够接触和学习那些因为运河开掘而露出地面的新鲜岩层。后来他仍从事类似的工作，行遍全国，不断地研究那些新出现的地层，同时收集他所能发现的化石。史密斯乘着邮件马车每年行进将近1万英里。1815年，他绘制了第一张现代地质学地图——《英格兰、威尔士及部分苏格兰地区地层地图》，这张地质地图绘制得非常精确，直到现在仍有参考价值。

In 1831 when Smith was finally recognized by the Geological Society of London as the “father of English geology”, was not only for his maps but also for something even more important. Ever since people had begun to catalog the strata in particular outcrops, there had been the hope that these could somehow be used to calculate geological time. But as more and more accumulations of strata were cataloged in more and more places, it became clear that the sequences of rocks sometimes differed from region to region and that no rock type was ever going to become a reliable time marker throughout the world. Even without the problem of regional differences, rocks present a difficulty as unique time markers. Quartz is quartz — a silicon ion surrounded by four oxygen ions—there’s no difference at all between two-million-year-old Pleistocene quartz and Cambrian quartz created over 500 million years ago.

1831年，史密斯最终被伦敦地质学会认可，并赋予他“英国地质学之父”的称号，这不仅仅是因为那张地图，同时也是为了其他更重要的原因。从人们开始对露出地面的特殊岩层进行分类的时候起，大家就开始认为这些岩石可能会以某种方式被用于计算地质年代。但是，随着各地越来越多的岩层的积累和分类，岩层顺序也因地区的不同而不同，因此，全世界没有一种特定的岩层能被认作是划分地质年代的标志。即便排除区域差异的影响，岩石作为确定年代的标记还是存在一些难题。石英就是石英——四个氧离子包围一个硅离子的化合物——而200万年前更新世的石英和5亿年前寒世纪的石英并无差别。

As he collected fossils from strata throughout England, Smith began to see that the fossils told a different story from the rocks. Particularly in the younger strata the rocks were often so similar that he had trouble distinguishing the strata, but he never had trouble telling the fossils apart. While rock between two consistent strata might in one place be shale and in another sandstone, the fossils in that shale or sandstone were always the same. Some fossils endured through so many millions of years that they appear In many strata，but others occur only in a few strata, and a few species had their births and extinctions within one particular stratum. Fossils are thus identifying markers for particular periods in Earth’s history.

史密斯在全英国的岩层中不断搜集化石，后来他发现化石所反映的史实和岩石反映的完全不同，尤其是那些新产生的地层里的岩石，这些岩石非常类似，不易于区分地层。而区分其中的化石对史密斯来说简直就是轻而易举。在同一地层中发现的岩石可能在这片地层中属于泥板岩，而在另一片地层中可能是砂岩，而在那些泥板岩或者砂岩中的化石往往都是一样的。有的化石经历了数百万年之久，它们存在于很多岩层中，但有的化石只存在于部分地层，还有一部分生物的化石从出现至灭绝都只出现在一个特定的岩层中。因此，化石才是真正划分地球历史特定年代的指针。

Not only could Smith identify rock strata by the fossils they contained, he could also see a pattern emerging: certain fossils always appear in more ancient sediments, while others begin to be seen as the strata become more recent. ■ By following the fossils, Smith was able to put all the strata of England’s earth into relative temporal sequence. ■ About the same time, Georges Cuvier made the same discovery while studying the rocks around Paris. ■ Soon it was realized that this principle of faunal (animal) succession was valid not only in England or France but virtually everywhere. ■ It was actually a principle of floral succession as well, because plants showed the same transformation through time as did fauna. Limestone may be found in the Cambrian or — 300 million years later — in the Jurassic strata but a trilobite — the ubiquitous marine arthropod that had its birth in the Cambrian — will never be found in Jurassic strata, nor a dinosaur in the Cambrian.

史密斯不仅可以通过岩石中包含的化石来识别地层，而且可以看出它们显露出来的模式：一些特定的化石往往出现在更为久远的沉积物当中，而其他的化石则可以在距今年代较近的地层中发现。通过追踪化石，史密斯将英国范围内所有的地层按照出现时间进行了排序。同时，乔治•居维叶在研究巴黎周围的岩石时也得出了同样的发现。很快人们就开始认识到，这种动物物种的延续性是符合逻辑的，不仅仅是在英国、法国，而且几乎在全世界范围都是适用的。事实上，这一原则同样适用于证实植物的延续性，因为植物和动物一样，它们的化石也显示了时间的推移。人类有可能在侏罗纪时期的地层中发现寒世纪或者3亿年后的石灰岩，但绝不可能在侏罗纪时期地层中发现三叶虫化石（三叶虫是寒世纪非常普遍的水生节肢动物），也不可能发现寒世纪时期的恐龙化石。