Renaissance Geology

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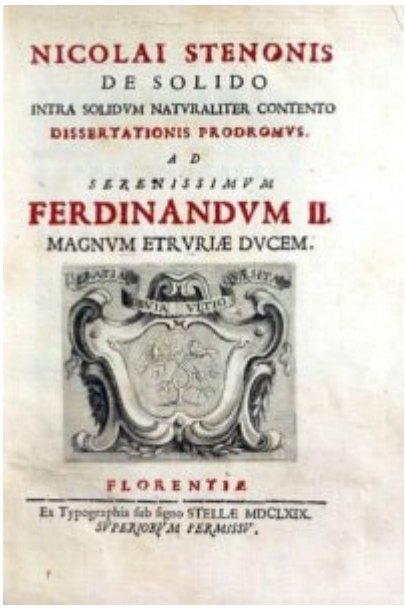
Part II - The Foundation of Earth Science

The great anatomist, Nicolaus Steno, born Niels Stenson, took the next leap forward in geology. Steno hailed from Copenhagen, Denmark and, like his predecessor, Agricola, was trained as a physician.

Renaissance Geology – The Foundation of Earth Science Part I

Niclas Steno – the Star That Burned Brightly

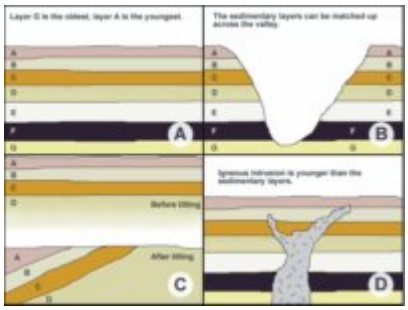

NICOLAI STENONIS
DE SOLIDO
INTRA SOLIDVM NATVRALITER CONTENTO
DISSERTATIONIS PRODROMVS.
AD
SERENISSIMVM
FERDINANDVM II.
MAGNVM ETRVRIÆ DVCEM.
FLORENTIÆ
Ex Typographia sub signo STELLÆ MDCLXIX.
SUPERIORUM PERMISSU.

Steno's Prodromus 1669 (Public Domain)

Steno traveled throughout Europe as part of his studies and work, before becoming the chief physician to Grand Duke Ferdinand II of Florence. He shared a passion for geology with the Duke, who may also have seen the potential for making money by a more efficient process of finding and smelting ores. Following from Gessner, Steno looked at glossopterae (tongue stones) and set out to prove that they came from animals. In the autumn of 1666, fishermen landed a shark and the Grand Duke of the Medici, Ferdinand the Second, ordered it brought to court for Steno to dissect and study. Steno, the following year, produced a report stating that these fossils derived from the teeth of sharks rather than by the action of any force inherent within the earth. Previously, scholars believed that these stones were created in the earth, although some did note the resemblance to the tongues of various animals and even shark's teeth, so Steno did have a base of knowledge on which he could build. His study was laid down in his great work, *De Solido Intra Solidium Naturaliter Contento Dissertationis Prodromus* (The Forerunner of a Dissertation on a Solid Naturally Contained within a Solid), usually referred to as the *Prodromus*. This book, published in 1669, laid down his belief in an organic origin of fossils and, some time after his death, became a staple text for geologists throughout Europe and the New World. Like his predecessors, he looked at the various types of mountains, created by volcanism or the force of erosion, but he also looked at fault mountains and felt that forces such as earthquakes could create them.

A Conflict of Interests

Sadly, Steno suffered from a conflict between his scientific work and his Catholic religious beliefs. He studied this field for three years before giving it up, eventually becoming a Catholic priest and later a bishop, performing missionary work in Northern Europe. Despite this, he left an awe-inspiring legacy, and he established the fundamental laws of stratigraphy, the first time that a geologist proposed the processes of sedimentation and fossilization. Considering that this theory conflicted with the Catholic idea of creationism and a great flood, it is little surprise that he felt unable to continue with his research in this field. He proposed that each stratum is deposited from a fluid suspension onto a solid surface, and that fossils are often incorporated at this stage. Three laws define his ideas about stratigraphy:



Stenos Laws (Creative Commons [1])

- The Law of Original Horizontality: Each stratum is continuous and in the horizontal plane.
- The Law of Superposition: Stacking of strata takes place, with younger strata at the top
- The Law of Concealed Stratification: These layers can be disturbed by volcanism and movements of the earth. If the edge of a layer is exposed, this demands an explanation, such as earthquake, volcanism or erosion

Steno's observations were in and around Tuscany, so he did not study igneous rocks that are non-native to that particular area, but his work on stratigraphy was excellent in its breadth, depth, and insight. He knew that the process of organic material turning into crystal took an extremely long amount of time, and he proposed that the processes behind geology were ancient. Steno's work included a likely history of the geology of Tuscany, the first example of a geological case study, and he used diagrams and concise text to describe the processes of stratification, also recognizing the importance of water in shaping landscapes.

Tuscany Geology (Creative Commons [2])

His work had to pass the Catholic censors and it was during a period of waiting for approval that the geologist lost interest in the subject. The work of Steno is a great example of fringe science [3] causing a paradigm shift [4]: His work was ignored by his contemporaries and subjected to censorship by the church, but a century later, as culture moved into the Age of Enlightenment, his rediscovered work became a crucial part of not just geology, but of natural science. This great, intuitive geologist influenced paleontologists and his work was the seed around which Linnaeus, Wallace, and even Darwin could grow their theories about the origin of animal species. Their theories owed much to Steno's diligence in showing that fossils were organic in origin, as well as his idea that strata could be dated comparatively. This scholar, although he only studied geology for three years, earned a place as one of the great Renaissance Men.

Geology and the Renaissance

It is inaccurate to say that geology as a scientific discipline truly began during the Renaissance, because it tended to be studied alongside other fields. The 18th century would see the true study of geology and the closely related paleontology as distinct disciplines. However, many of the great Renaissance Men laid the foundations, showing that the traditional creationist view had holes in the theory, proving that fossils were once alive and proposing that rocks arose from sedimentation, following a strict timeline. These scholars opened up new areas that would see geology become one of the most important sciences of the Enlightenment, drawing it away from the study of mineralogy and mining, and moving it towards studying the structure and the formation of the earth. Ultimately, geology and paleontology would influence many areas of science, from physics to evolutionary biology, giving a timescale for the formation of life on earth.

Links
[1] http://cafreetextbooks.ck12.org/science/CK12_Earth_Science_rev.pdf
[2] http://creativecommons.org/licenses/by-sa/2.5/deed.en
[3] https://explorable.com/fringe-science
[4] https://explorable.com/paradigm-shift