



The Seashell on the Mountaintop: A Story of Science, Sainthood, and the Humble Genius who Discovered a New History of the Earth

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Author : Alan Cutler

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From Reader Review *The Seashell on the Mountaintop: A Story of Science, Sainthood, and the Humble Genius who Discovered a New History of the Earth* for online ebook

Eppursimuov3 says

I picked up this book by Alan Cutler while browsing through the popular science section in a local bookstore, drawn to it mainly because of its nice cover! It turned out to be quite a gem, unlike anything I have ever read. It's a short biography on the life of Nicolaus Steno, a 17th century anatomist who is also widely considered to be the pioneer of the geological sciences. The reader is transported into the 17th century; a world in which science and religion went hand in hand, both playing a huge role in any intellectual discourse. The discovery of sea-shells and shark teeth on mountain-sides and some of the most unexpected places would lead Nicolaus Steno on a journey that would change his life, his faith and his world forever. Ultimately, it resulted in the laying down of foundations for paleontology and geology, as well as the beatification of Nicolaus Steno by the Catholic Church in 1987. *The Seashell on the Mountaintop* shows us how science and faith can rub shoulders with each other without having to part ways after that – using an example from the very pages of our own history.

KennyO says

Most books looking back on the genesis of geology as a field of study cite men of the past and mention one or another way each pushed forward the study of the earth. In Alan Cutler's short volume centered on the life and work of Nikolas Steno he neatly depicts the interplay of 17th century church and science with human wit and frailty. If you're looking for the science keep looking but if the roots of the modern study of the earth are your interest this is a wonderful entry.

Todd Martin says

The Seashell on the Mountaintop is a biography of Nicolaus Steno (pronounced STAY-no) a Danish anatomy scholar who lived between 1638-1686 and was an early contributor to the field of geology. Although Steno's discoveries seem rather obvious today, they can be better appreciated if you have a basic understanding of the prevailing beliefs at the time. These were influenced in large part by the ancient Greeks and the Christian Church.

With respect to science, the writings of Aristotle and the ancient Greeks still held considerable influence in the 1600s thanks to the intervening period where little new research was performed that we now call 'the Dark Ages'. As for religion, most Europeans were biblical literalists. They thought that the Earth and all living things were created by god in their present form. As a result, people believed all sorts of things that seem childishly simplistic today (assuming you live outside of the bible belt). For example, they thought:

- The Earth was 6,000 year old.
- Many creatures were believed to arise through a process of spontaneous generation. For example that flies were created by meat as it decomposed.
- Fossils were thought to be naturally occurring phenomena that were formed in the earth (that just happened

to look like such things as seashells, bones or shark teeth).

- The Genesis flood story was thought to be literally true (providing a convenient explanation as to how those titular seashells wound up on the tops of mountains).

With that as a background, let's return to Steno who was studying anatomy at the time and had become somewhat of a sensation thanks to his dissection skills. One day he came into possession of a shark's head and noticed that the teeth looked a lot like the things people called glossopetrae or "tongue stones" because they were thought to be petrified tongues of dragons and snakes (which is kind of adorable).

Many were convinced that these tongue stones formed naturally within the rocks in which they were found (or fell from the sky). Steno was convinced that the stones were actual teeth, but noticed that the composition of his fresh teeth differed from those found in rock. Steno argued that the corpuscles in the teeth were replaced bit by bit, by corpuscles of minerals (corpuscles being minute particles akin to molecules – though molecules hadn't yet been discovered). In this gradual process, the teeth were able to retain their shape as they turned from tissue to stone (which is a pretty decent explanation as to how fossilization works).

If fossil shells and teeth were the remnants of actual animals then this gives rise to additional questions:

- How did fossilized shells get to locations far from the sea, such as the tops of mountains?
- Why were some of these shells entirely different from those that existed in the present?

To answer these questions Steno began a broader investigation of geology and this is where he made his greatest scientific contribution. Noticing that rocks were arranged in layers, he came up with what would become known as 'Steno's law of superposition', which stated that layers of rock are arranged in a time sequence, with the oldest on the bottom and the youngest on the top (unless later processes disturb this arrangement).

This seems obvious today, but was an entirely novel idea at the time ... an idea with dangerous implications. Recall that biblical literalists were convinced of the Earth's six day creation as depicted in Genesis. How could rocks be older the deeper they are found if the universe was created in 6 days? Steno solved this riddle using his powerful intellect in combination with what psychologists refer to today as 'motivated reasoning'. Referring to Genesis:

- In the beginning God created the heavens and the earth. Now the earth was formless and empty, darkness was over the surface of the deep, and the Spirit of God was hovering over the waters.

So, the waters were there first. In the next few verses God creates light, then separates the sky from the water. Then:

- And God said, "Let the water under the sky be gathered to one place, and let dry ground appear."

Steno figured that when solid land was created the heavier particles settled out of the water first creating the older, bottom layers of the earth. Subsequent, younger layers, then precipitated out of solution in turn and Voila!! ... science and religion are made compatible (in Steno's mind at any rate).

After this landmark discovery Steno decided to give up science and became a bishop in the Catholic church. To show his devotion he chose a life of voluntary poverty and personal deprivation. Living on a bread and beer diet he became emaciated and died at the age of 48. The Catholic Church has proceeded down the path to canonize Steno as a saint (if only 'evidence' of a miracle could be found).

So – what did we learn from Steno's story? I'd boil it down to two key points.

1. The human struggle towards understanding: It's always interesting to see how people grappled with

scientific issues that have since been solved. With 20/20 hindsight you can see how they were on the right track here, were sidetracked there and instances where they were tantalizingly close, but the answer remained just beyond their grasp. Steno's tale contains all of these elements.

2. Where Steno went furthest afield from reality, he did so for religious reasons, just as many today deny objective reality because it conflicts with their faith (should you have any doubts feel free to perform a web search for the phrase 'ark park').

This story has a hopeful ending. Thanks to science we now understand with a high degree of certainty all of the questions with which Steno was struggling so desperately. We know, for example that: the Earth is 4.543 billion years old, that continents move on plates (plate tectonics), about the processes of uplift and subduction, that species evolve and sometimes go extinct, and how mountains and landscapes form and change with time. The scientific method has provided the human species the means to tell true hypotheses from false ones. It is, in a nutshell, a window on the truth. Religion, being unable to test factual claims, is often just the opposite.

We'll end with the following quote:

In dark ages people are best guided by religion, as in a pitch-black night a blind man is the best guide; he knows the roads and paths better than a man who can see. When daylight comes, however, it is foolish to use blind old men as guides.

- Heinrich Heine, Gedanken Und Einfalle

Charlene says

This book was beautiful and reminded me a bit of Swerve by Stephen Greenblatt. Swerve followed Poggio Bracciolini on his quest to recover ancient books. Eventually, he found the only surviving writing of Lucretius, On the Nature of Things and preserved it so that all future generations could know the history of the study of nature (and atoms), learn from it, and enjoy it. Lucretius, who is one of my favorite people to have ever lived, is also covered in this book. However, Seashell on the Mountain top's main focus is not on searching for an finding a book that describes ancient thought about the nature of things. Rather, it brings to life the history of Nicolaus Steno, the father of geology, who learned to piece together Earth's history through reading its rocks.

I often think I am done reading books about the debate between science and religion. However, when the history is written in such an artful way, as it is in this book, I am captivated and transported through the ages as I follow the passionate individuals who *had* to know the truth, who *had* to understand, even if they got in trouble for what they found out.

Alan Cutler is obviously someone who appreciates art and science equally. The way wrote about the history of epistemology was wonderful but not nearly as exquisite as the way he was able to weave science and art into a seamless beautiful tale that took my breath away. No book that I have read has ever done a better job of that. Here is a very brief summary of his beautiful argument: Living organisms die and are fossilized under incredible pressure to make the Carrara Marble that Michelangelo used to carve the Pieta, David, and other works. We appreciate the beauty of the dead fossil as we stare at them in the form of a marble statue. We appreciate the tale the fossils tell about our earthly home as we trace our origins back to tiny organisms, which help us understand our place in the world and maybe even in the cosmos (since the stars provided all the material that turned into organisms that turned into you and me).

What a wonderful and unusual history of geology.

Kevin says

The Seashell on the Mountaintop is on the one hand, a biography of the scientist known in English as Nicolaus Steno, a fascinating man in his own right. But it's also a history of the foundation of the science of geology, and it's a window into the early days of scientific exploration.

Steno, a Dane, started as a brilliant anatomist, wandering Europe dissecting and teaching. He was the first to propose the idea that muscular action comes from the contraction of muscle fibers not the ballooning of the muscle mass, the accuracy of which was not recognized for a hundred years. It was the dissection of a great white shark's head that led to Steno to recognize that its teeth were identical to "tongue stones" found high up on the mountaintops all throughout Italy. That, along with other marine fossils that had been found in the Alps and the Apennines in Italy, led him to conclude that much of Europe had been covered by water and not just once simply to launch Noah, but again and again. Contrary to both the literal interpretation of the bible and the popular theory that the earth had some sort of "plastic power" that produced stones in the shapes of sea creatures, or anything else. He later publishes a short but more formal thesis of ideas entitled Concerning Solids naturally contained within solids. In which he lays down his four fundamental principles of stratigraphy: law of superposition, principle of original horizontality, principle of lateral continuity, and the principle of cross-cutting discontinuities (oddly omitted from the book). Ideas that for the most part were soundly rejected by his contemporaries for several decades after his death.

Steno later abandons his life as a renowned scientist to live the life of an improvised priest after converting from Lutheranism to Catholicism. Steno dies rather sadly before he can complete more thorough treatment of his ideas. Leaving it up to his contemporaries: Hooke, Ray, and Leibniz to convince the scientific community that he was right.

Aside from a straight forward biography of Steno a defacto history of the early years of the science of geology right up to Hutton, Cutler also takes the time to explain a brief history of science from the ideas of the pre-Socrates (thinking) to the ideas that emerged during the enlightenment and scientific revolution (doing). I'm glad I've been reading Sophie's World to come to grips with all the philosophical ideas and methods mentioned throughout the book.

Cheryl says

I was a little disappointed, this is a biography of a man who started asking the first questions about how seashells got on the top of the Alps, which to me is pretty miraculous and I know how they got there. Imagine being in the time where no one knew! But the tone wasn't very engaging or interesting. I still can't believe that people in that day and age (1600's) thought mountains were hideous and offended God... but they did. I did like that Steno started as an anatomist so there are parallels to exploring the human body and exploring the earth that were cool.

Jane says

I'm not really one for books on science because usually they are too abstruse and complicated for me. This was a happy exception. Written in an easily accessible style, this was the biography, discussion of the scientific theories and importance of the self-effacing 17th century Dane, Nicolaus Steno, who can be called the 'father' of geology.

In a student journal he wrote of his thought that: *"Snails, shells, oysters, fish, etc. [have been] found petrified on places far remote from the sea. Either they have remained there after an ancient flood or because the bed of the seas has slowly been changed."* He also wrote: *Sedimentary rocks were "soils from which shells ... were dug."* He felt these were indeed "sediments from a turbid sea." From the dissection of 2800 shark's teeth, he was led to the possibility that the so-called *glossopetrae* [tongue stones] were petrified shark's teeth. Through much research, he theorized about the stratification of rocks, existence of fossils [the seashells on the mountaintops], the glimmerings of what we call crystallography, and other conjectures. He posited the age of the earth as billions of years and changes in the earth's structure. Ancient seas became mountains in later years, and the seashells and creatures once in the sea, then land, ended up as fossils in the mountains. These theories were noted in his "De Solidi" and were not accepted at that time. They met with much opposition. At one point, in the 18th century, the age of the earth was pinpointed as ancient, later on, geological eras were given names. And from then, his theories have been generally accepted and built upon. A small accomplishment in his work as an anatomist were the discoveries of the salivary and lachrymal glands.

After spending so much time in Italy, he became a devout Catholic, later priest and titular bishop in Germany. In recent years, he has been beatified. This book was a fascinating look at a man and his scientific work; the name Steno was new to me and I can hardly believe his theories were not always the explanation for what happens geologically. Today, they seem so logical. I can't imagine people's accepting the fanciful theories floating around before and during his time.

Clare O'Beara says

The story of the first man to study the geology of the ages, and write a scientific treatise on how seashells and fossil sharks' teeth got embedded in rocks, is an interesting read.

Nicholaus Steno (he spelt it several ways depending on which language, as he learnt about ten) was a Danish man in the seventeenth century. Denmark actually produced many science students from a small, related cadre, including Tycho Brahe who mapped the stars more precisely than had been done before, at a time when astronomy was tied up with astrology and chemistry with alchemy. Studying any branch of natural philosophy required money, and many men needed a wealthy patron such as a king, Medici lord or Pope. Steno met all these patrons and got through many interests.

One of his early loves was anatomy and he was first to discover tear ducts and saliva ducts and the glands responsible. Much later in life he disproved the leading expert of the day who thought that the heart was a furnace which heated blood; Steno dissected an ox heart and found that it was made of the same muscle as a rabbit's leg and must contract to push blood like a pump. This told him that he had to question all assumed

knowledge unless he could see it himself. In between, he dissected the head of a great white shark which was caught in the Mediterranean. Animals were easier to dissect than people. The shark's head contained many teeth which reminded Steno of the glossoptera or tongue stones found in rocks; thought to be petrified tongues of creatures and ground up for cures, they were often found along with stone seashells. Steno went to Malta where many of these discoveries were made.

The creation myth and Noah's flood story were believed to be true and literal, and the earth only a few thousand years old, so how did seashells get into rocks? More, how did they get into rocks on top of mountains? Denmark was flat and sandy but the Alps and Appennines were high, ridged and contained marble and other calcium stone. The more Steno looked - and he travelled and looked - the more puzzled he got, so having to work carefully because of religious pressure he formulated the theory of layers of sediments.

The repetitive, stultifying, dumbing-down influence of the religions of the day is hard to read. Steno was a religious man but he changed from Protestant where everything was dogma to Catholic where there was room for flexibility and interpretation at the time. This meant that he could not go home. Galileo had been forced to recant over his Sun-centred vision of the Solar System. Steno had to write carefully, saying that "sediment could have formed rocks in such a way, though everyone knew the creation story to be true."

Not only that, but women do not appear in this book as religions determinedly kept them powerless and pregnant while ensuring that the brightest men did not breed. (And that Steno died young from starving and whipping himself.) The sole mention of anything to do with women - apart from a woman calling directions which Steno took as a sign - is that women's ovaries were considered to be 'degenerate testes' until they were proven to contain eggs. Intelligence had to be devoted to wondering how many angels could dance on the head of a pin rather than any actual enlightenment. Just think of how much earlier the human race could have achieved penicillin and electricity if the churches had not actively prevented it.

This book is aimed at general readers, but is often a compilation of all the wrong reasons people believed some fact, odd suggestions to account for the fact, and explanations of why the true facts were not established. After so many repetitions that Genesis said this or that, the reader's eyes gloss over (as they must have done at the time too) which is why I am not giving this book more stars, though it is hardly the author's fault.

There is an excellent summing up sentence quote from John McPhee in 1998: The summit of Mount Everest is marine limestone.

Nick says

Alan Cutler does a fine job of providing us with an introduction to Father Niels Stensen's achievements, and he left my interest piqued. Cutler writes from the perspective of a paleontologist, and so the aspects of Stensen's life of most interest to me personally were not treated in much detail--though I might almost be grateful for this, given the way religious themes are often handled by those not familiar with them! Cutler is quite respectful, however, and manages to offer some rough sketchwork on what Stensen was struggling to reconcile in his own life, and what led him to abandon what had every appearance of being a tremendous scientific career for a thankless life as a Catholic bishop in Protestant territory. Perhaps "thankless" is not the right word--being beatified by John Paul II in 1988 is certainly meaningful in some sense! (Non-catholic

readers should be informed of the difference between beatification and canonization--having received only the former and not the later, Catholics do not consider Stensen a "saint" but prefix his name with the term "blessed".)

The most interesting parts of this book pertained to the discoveries and theories Stensen advanced before taking his leave of the scientific community. Cutler does a fine job of portraying the voraciousness and wide-ranging scope of his subject's mind. He also includes an excellent bibliography at the end with many suggestions for further reading--almost a requirement for anyone more interested in a more substantial look at other areas of Stensen's life and interests, especially his theological ones. No finer summary could be offered than the words of the man himself, spoken at the dedication of Copenhagen's newest anatomical theater in 1673:

Beautiful is what we see.

More beautiful is what we understand.

Most beautiful is what we do not comprehend.

Stan Paulsen says

Wow! This is the coolest overview of early geologic discovery and methodology. The realization that rocks are very ancient and the fossils embedded in those rocks are just as ancient as the rocks was unheard of until Nicolas Steno. Nicolas Steno was the first man in recorded history to link geologic layers with the time line of geologic history. Before he added his ideas to the pantheon of science, there were some pretty wacky ideas about how sea life fossils were embedded in the rock high on mountain tops hundreds of miles from the nearest ocean. No one thought of the meaning of the striped sediment exposed on cliff faces and mountain sides until Mr. Steno. Very interesting in terms of modern geology/paleontology and science history.

Karry says

The story of Nicolai Stenonis (Steno) told in this book is one that, though a short read, was filled with fabulous information about the life story of someone I had never heard of before. Although I have been to the basilica of San Lorenzo in Florence, I didn't even know that he was buried there nor would I have guessed that I would have wanted to visit his shrine as other pilgrims do. He was a Dane, converted to Catholicism, worked for the Medici's in Florence and was WAY ahead of his time in understanding the earth's strata and the reasons for our ability to find a seashell on top of a mountain. He was brilliant, he was caught in between trying to find scientific explanation of a phenomenon that conflicted with current religious beliefs of the time and he was a Christian who devoted his life to the church. What a wonderful story of someone who is largely forgotten and ignored in our educational institutions.

Margie says

At the end of the book, Cutler wrote, "*A full-blown biography of Steno in English has yet to be written. This book is no more than a start. Because I was mainly interested in his contribution to science as a geologist, I*

had to leave out many details of his careers as an anatomist and a priest."

It's a short book, but surprisingly fleshed out, given that Steno lived in the late 1600s. Well worth a read for geonerds.

Steven Shane says

So cool to hear a story with temporary suspension of earth's gravity, spontaneously generating seashells and shark teeth, seas looming above the earth, impending apocalypse of the 6000 year lifespan of the planet while telling how the dirt held millions of years of history.

Excellent paired with Radiolab's, A Coral Moon from The Time's They Are a-Changing, December 30, 2013.

Special guest stars The Brethren of Purity, Leonardo da Vinci, Royal Society of London for Improving Natural Knowledge, Ferdinando and Leopoldo de 'Medici's del Cimento; an all star cast.

Dave says

Fascinating story of one of the pioneers of modern geology.

Ray says

More than one man may lay claim to the title as the father of modern geology, and Nicholas Steno is one of the earliest. His work with fossils from the late 17th Century did not make a significant contribution to the understanding of the world around us during his time, but his work as later re-discovered was revolutionary. Anyone who read Simon Winchester's book "The Map That Changed the World: William Smith and the Birth of Modern Geology" should like this book as much if not more. An interesting element of the book is the description of how influential the church was in the late 16th and 17th Century regarding scientific understanding, and how so many things we take for granted today were impossible to believe given the biblical interpretations so strong during those times.
