The fossils once known as "tongue stones" are actually the teeth of ancient sharks.

Steno and the Shark

Believe it or not, some of the most important scientific thinking about how to determine the age of a rock came from a scientist who was studying sharks. In 1666, fishermen caught a huge great white shark off the coast of Italy. Because it was so large and interesting, they sent the dead shark to Nicholas Steno, a Danish scientist working in Italy who enjoyed studying the animals, plants, and rocks he found in nature.

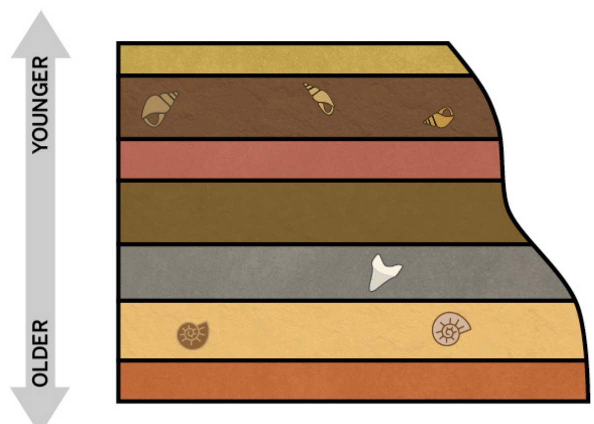
As Steno studied the shark, he noticed something surprising about its teeth: they looked like triangular rocks that he had seen before. These triangular rocks were known as "tongue stones." Scientists had found tongue stones stuck inside rocks all over the world, but could not explain where they came from.

This diagram of a shark and "tongue stones" was based on Steno's sketches.

Some scientists claimed that tongue stones grew inside rocks. This did not make sense to Steno, because the tongue stones fit so perfectly inside the rocks. The tongue stones were completely surrounded by rock, with no breaks or cracks. Steno reasoned that the tongue stones could not have grown inside the rocks. Comparing the tongue stones to the teeth of his shark, Steno realized that tongue stones must be the teeth of sharks that had lived long before. How could teeth end up inside solid rock?

Steno argued that the rock around the tongue stones had not always been solid. He claimed that the rock had once been sand or mud at the bottom of an ocean. Sharks swimming in that ancient ocean had lost their teeth, and the teeth fell to the bottom of the ocean and were covered with sand or mud. Eventually, the sand or mud hardened into rock. The sharks' teeth became fossils embedded in the hard rock. The end result was a tongue stone: a fossil in the shape of a tooth, surrounded by rock.

Steno's study of fossils helped him explain how rock layers form. He argued that certain kinds of rock formed in layers, with older layers below and newer layers added on top. Steno explained that the lower a rock layer was, the older it was. Steno's ideas about how rocks can form in layers, with the older layers on the bottom and the newer ones on top, are still used by geologists today, about 350 years later. For example, when scientists study a rock with many layers in order to understand how it was formed, they often make observations about the position of each layer compared to all the others. When they compare one rock layer to another just above it, they know that the lower layer of rock was formed before the one on top of it. This process of determining which layers are older or younger is also called relative dating.



Much of the rock beneath our feet is layered, with the oldest layers on the bottom and the newest layers on top. Different fossils can be found in different layers, and the layer they're found in can give us clues about how old they are. For example, using the idea of relative dating, scientists can explain that fossils found in a rock layer near the bottom are older than fossils found in any layer above them.

Steno couldn't say exactly how old rock layers were, but he introduced the concept of relative dating. This concept helped scientists understand that some rock layers are older than others. He also explained what fossils were. These important insights led to our current understanding of Earth's history.

Geologic Time

Steno's work helped scientists to interpret and understand the history of specific rock layers in a certain location. However, scientists eventually needed a way to organize and explain the entire history of all the rock (and everything else) that exists on Earth. Since Earth is approximately 4.6 billion years old, that is a long history! It is almost impossible to talk or even think about a timeline that is 4.6 billion years long. Scientists began to break Earth's history into different units of time. The result was what scientists call the geologic time scale. Eons are the largest unit of time. Thinking about Earth's history at this scale makes it possible to talk about huge chunks of time. How long is an eon? Well, it depends. Like all units of time on the geologic time scale, eons are identified based on important events in Earth's history. Eons can range from several hundred million years to two billion years long. An eon is still a huge amount of time. Eons are broken into smaller chunks of time, called eras, which can range from about 65 million years to hundreds of millions of years. An era is still an extremely long time! Eras are broken into smaller units of time called periods, which are then broken into smaller units of time, and so on. The geologic time scale is a tool that provides scientists with an easy way to talk about Earth's history.

Geologic Time Scale