Historical Geology

What is Historical Geology?

The planet you live on has some stories to tell. Earth has had 4.5 billion years to rack up experiences that range from ordinary to unimaginably violent. Through a variety of rock-forming processes, Earth has written her autobiography. Historical Geology is the science of reading that autobiography. But in order to read it, we first need to understand the language in which it is recorded.

Stories from stone

What stories has the Earth written in the language of Rock?

This rock contains features that we can translate into information. The variety of materials it is made from, how those materials are arranged, other features that cut across them, and the shape of the sample all convey information about past processes and circumstances. What would it take to make a rock just like this one?

What is the history of a rock like this?
What did it take for this thing to exist?

Sequences of strata

Decoding the handful of past processes encoded into a single cobble is powerful, but more power still comes from looking at sedimentary rock in outcrop, and comparing the conditions of one layer with those below it and those above it. The *lingua franca* of historical geology is sedimentary rock, and vast epic tales have been inscribed in the sequence of accumulated strata, or rock layers. If a shale means former mud, and that mud's deposition implies calm, offshore conditions, and sandstone means former sand, and that sand's deposition implies more energetic, nearshore conditions, then what does this photo show?

A sequence of sedimentary layers can tell a story of changing conditions over time.

A sedimentary sequence of mud-rich strata overlain by sand-rich strata is the record of a shift in depositional conditions at a site over time. In the image above, from Chilean Patagonia, the vertical sequence of layers shows that as time went by, there was less and less mud being deposited at this location, and more and more sand. The progressive stack of layers is a record of time, with older, earlier chapters at the bottom, and more recent chapters at the top.

Here, the strata are not in their original horizontal orientation. They have been rotated during tectonic accretion of these deep ocean strata to the Japanese mainland. The layers get younger to the right (rather than “up”).

The important thing is to note that a distinctive color change occurs across the outcrop: the layers shift from black to red. This is a signature of changes in the amount of oxygen in the deep ocean: there was almost no oxygen (black) and then there was plenty (red).

Fossils

Within those layers, we find clues of various kinds. One of those varieties of information is fossils. Earth is a planet that has hosted life for most of its 4½ billion years, and especially for the last ½ billion years, there have been plenty of animal skeletons and plant tissues to be included in the strata as clues to when they were deposited.

Trilobite fossil.

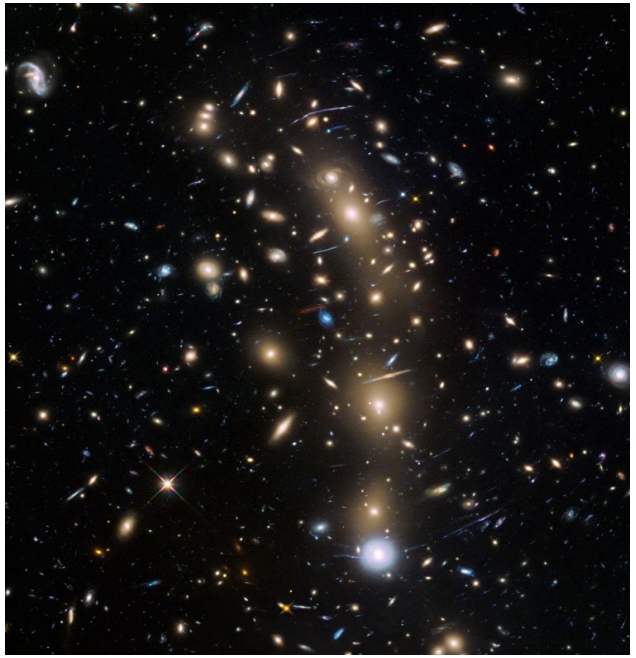
Similarly, in historical geology, fossils are served to indelibly mark their strata with the time of their formation. Some sediments speak a strain of Rock with a pachycephalosaur patois or a trilobite tone. Others communicate with an ichthyosaur inflection or a brachiopod brogue. As with language, these distinctive fossil “words” are emblematic of a specific time or a specific place, or both.

A Brief History of Earth

The main topics studied in Earth history are paleogeography, paleontology, and paleoecology and paleoclimatology—respectively, past landscapes, past organisms, past ecosystems, and past environments.

1-Origin of the Universe

The universe appears to have an infinite number of galaxies and solar systems and our solar system occupies a small section of this vast entirety.



Every light on this image that does not have diffraction spikes is believed to be an entire galaxy, with hundreds of billions of stars.

2-Big-Bang Theory

The prevailing idea about how the universe was created is called the **big-bang theory**. The big-bang theory proposes the universe was formed from an infinitely dense and hot core of material. The bang in the title suggests there was an explosive, outward expansion of all matter and space that created atoms.

3-Origin of the Solar System: The Nebular Hypothesis

Our solar system formed as the same time as our Sun as described in the nebular hypothesis. The **nebular hypothesis** is the idea that a spinning cloud of dust made of mostly light elements, called a nebula, flattened into a protoplanetary disk, and became a solar system consisting of a star with orbiting planets.