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PCB 4674

May 12, 2016

1. In lab, we handed you a sheet with all of the dates of the geologic time scale and the various fossil evidence already on it. How do we know this? What kinds of evidence is this based on?

It’s only until recently that we are able to actually test fossils for their precise age using radiometric technology. But before this, scientists were able to use a “relative” geological time scale. Since they could not test for the actual age of the rock layers in mountains, they could often tell the correct sequence of their formation using relative dating principles and fossils. They observed the rates of processes such as lakes and ponds filling of sediment, so they could estimate it took to do this process. After seeing that these processes have virtually a small change in the geological area, they estimated that it must have taken millions of years for the rock accumulate in so many layers. As the scientist kept finding more and more rocks and layers, they kept realizing that the Earth was much older than they originally thought.

2. What biases exist in the fossil record? What types of organisms are very likely to get fossilized?  What types of organisms are very unlikely to become fossils? How does this affect what we know about the history of life on Earth?

The biases that exist in the fossil record are the composition and size of the organism. Usually animals with hard parts are more likely to be preserved than those with just soft tissue. If the animal has a resistant structure it will be kept in a better preserved state. Vertebrates with bony skeletons are held together with soft tissues. Once the animal is dead the soft tissue dissolves, or gets eaten, and the bones end up being scattered. Sometimes bones are found near each other, but many times because of natural causes they are moved around. Larger animals are also better to be preserved. They can be easily found in rock formation, and determining what the animal is can be easier in a larger rather than small animal. Small animals are most likely to be wholly eaten, so finding small vertebrates can be difficult. Some arthropods molt, so we find that there are select sizes found of the arthropod. Location of where the animal died is also a major factor of if it becomes a fossil. If the animal dies in a sandy humid environment, it is less likely to be wholly preserved. Good environments for fossilization are dry climates with low humidity.

3.  Now that you’ve done the butcher paper example, try to think of another scale of measurement. What would the history of life on Earth look like if you tried to fit it onto a marathon course? Across the country? What about all Earth’s time in a year? An average human lifespan? Pick one (or come up with your own!), define your start and end points, and plot at least four major events on it (for example: Pangaea breaks up at the 16-yard line, or multi cellular organisms appear on March 12th, etc.) to give yourself a different sense of scale.

On the science documentary Cosmos: A Spacetime Odyssey, Neil deGrasse Tyson makes a really good Earth time scale comparison. He translates the beginning of the universe and the Earths 4.5-billion-year history in a 12-month calendar year. Ever since I saw this representation I felt it was very accurately depicted. In the “Cosmic Calendar” the Big Bang starts on January 1. Soon after we have the Milky Way forming around “March”. A lot of formation happens and the Sun forms around “August” along with the rest of the planetsand the first organism life form is created in “September”. A lot of other formation happens on Earth and we see that on the last day of the year, December 31, the first apes appear at 6:12 AM, the first humans appear at 9:11 PM, and in the last minute 11:59:49 PM the Great Pyramid is built at Giza 2560 BC. Somehow it seems that people think that we have been around “forever”, but really humans have only existed for the last “few hours” of the “Cosmic Calendar”. This representation puts a really good perspective on the age of the universe and how life as we know it, is still very new. Below is the image that is shown on the show.

