Earth HISTORY 1404 Class Exercise

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**DMC 2-12**

THE MAGNITUDE OF GEOLOGIC TIME

(A Metaphor For Geologic Time)

"High up in the North, in a land called Svithjod, there stands a rock. It is a hundred miles high and a hundred miles wide. Once every thousand years a little bird comes to this rock to sharpen its beak. When this rock has thus been worn away, then a single day of eternity will have gone by." (Hendrick Van Loon, 1962, in *The Story of Mankind*)

This quote may be a bit of an overstatement, but the point is that the duration of geologic time is enormous, and comprehension of the enormity of geologic time is difficult, especially for introductory geoscience students. An understanding of the immensity of the Earth's history is invaluable, however, not only as an aid in studying geologic processes and rates of geologic changes, but also for a fuller understanding of evolutionary concepts and the impact of humans on the planet. This knowledge is especially important for environmentally aware citizens.

A metaphor is the application of a word, phrase, or description to an object or concept that the word, phrase or description does not literally indicate or describe. Hopefully, the object or concept will therefore be better understood. "A mighty fortress is our God" is a good example of a metaphor, applying a word we can readily understand (fortress) to a much more difficult concept (God).

A calendar year is often used as an example of a metaphor for geologic time. If we could compress the 4.6 billion years of Earth's history into a single year, we could consider geologic time on a scale with which we are all familiar. On that scale, the oldest known Earth rocks date from mid-February. Single-celled organisms first appeared in the sea on April first. It wasn’t until months later, in mid-July, that single-celled eukaryotes arose. Multicellular animals didn’t appear on Earth until the second week of November. The first land plants and animals did not emerge until late November, and the widespread swamps that formed the Pennsylvanian coal deposits flourished for only about a day and a half in early December.

Dinosaurs became dominant in mid-December, but became extinct ten days later, on December 26th. Our earliest human ancestors (genus Homo) appeared late in the evening of December 31st, about four hours before midnight, but anatomically modern humans didn’t arise until just 23 minutes before midnight. The most recent continental ice sheets started to recede about two minutes before midnight. The Romans ruled the Western world for 3.5 seconds from 11:59:46 to 11:59:49. Columbus sailed to America about 4 seconds before midnight, and the science of Geology began with the writings of James Hutton just a second and a half before the end of our metaphorical year.

The above metaphor is a direct time-for-time conversion. The list of possible metaphors can be expanded by considering comparisons of time-to-distance, time-to-volume, time-to-weight, and so forth. The chapter on geologic time in *Earth's Dynamic Systems*, for example, (a popular introductory geology textbook) compares geologic time to the length of a football field. Using this metaphor, the Precambrian constitutes almost the first 90 yards. The great Pennsylvanian coal swamps are found at approximately the 6-yard line. The dinosaurs became extinct about a yard and a half from the goal line, and the Pleistocene Ice Age began only two inches from the goal line. All of recorded human history corresponds to less than the width of a blade of grass at the very end of the 100-yard-long field!

ASSIGNMENT

Your assignment is to develop your own metaphor for geologic time. A personalized metaphor, one that has special significance to you, is best. (As an example, the football field metaphor would have special significance to an ex-player or avid football fan.) Your metaphor could serve as a source of comparison that can be referred to throughout the rest of the course as we consider the Earth's history in chronologic sequence, starting with the Earth's origin approximately 4.6 billion years ago.

**TO FULLY COMPLETE THIS PROJECT YOU MUST DO THE FOLLOWING:**

**1.) Develop your own metaphor for geologic time. Be creative!** Use the list of events below. There are several ways of doing the actual calculations, but be accurate. Check with instructor if you have specific questions about the math involved! *On a separate sheet of paper or papers attached to the back of your report, you must include all of your mathematical calculations—please keep it neat and easy to read.*

**Please note: Because they were used as examples, you can’t choose a calendar year or football field for your metaphor. And if choosing a time comparison, don’t use any time interval that is significantly less than a year. If choosing a distance comparison, don’t choose any distance less than the length of a football field.**

2.) **Submit a written description of your metaphor.** Report should be at least 1½ pages long. (Please use single-spaced, Times New Roman, 12 pt type—that's what I'm using here.) In the report, explain your metaphor and why you chose it. Narrate the metaphor, describing the entire list of events as they relate to your metaphor. (See example)

3.) **Evaluate the effectiveness of using your metaphor to better comprehend geologic time.**

**What did you learn?**

4*.)* **OPTIONAL** — **Submit a visual representation of your metaphor/time scale.** This will, of course, vary according to the metaphor chosen. As an example, for the metaphor using a year to represent all of geologic time, an appropriate visual representation might be a calendar, with the major events (see below) marked at the appropriate dates.

17.) ?? Your birth (How old are you?)

16.) 6,000 Beginning of recorded history

15.) 11,700 End of the Ice Age (End of Pleistocene)

14.) 2,000,000 Earliest "human" ancestors (Genus Homo)

13.) 66,000,000 End of Mesozoic Era (Mass extinction)

12.) 200,000,000 to 66,000,000 Dominance of the dinosaurs

11.) 251,000,000 End of Paleozoic Era (Mass extinction)

10.) 397,000,000 First tetrapods (tracks)

 9.) 428,000,000 First land animals (millipedes)

 8.) 475,000,000 First land plants (fossil spores)

 7.) 542,000,000 End of the Precambrian

 6.) 635,000,000 First metazoans (multicellular animals)

 5.) 2,100,000,000 First eukaryotic cells

 4.) 3,465,000,000 Oldest body fossils

 3.) 3,850,000,000 Oldest chemical fossils

 2.) 4,000,000,000 Oldest rocks on Earth

 1.) 4,600,000,000 Origin of the Earth