

Geologic Time Line Helper

The Geologic TimeLine Concentration	1
The Geologic TimeLine Spreadsheets	1
The Geologic TimeLine Graphics.....	2
Related Topics or Components:	2
Models, Ideas, Metaphors:	3
From the Web:	3
Feedback is Welcome!	3

Geology is a science that that uses all four dimensions, length, width, depth and time. Unique to earth science is the concept of Geologic Time. You can learn more about Geologic Time, fossils, evolution and non-renewable geologic resources found in Michigan by making a TimeLine.

The process is simple. Determine into what you want to convert all or part of geologic time. Then make your model. The choices for the model are many and varied. Many use some linear approach involving twine, rope, adding machine tape or some distance on the ground like a football field or the perimeter of an area on school grounds. Others involve items like grains of rice, marbles, drops of a liquid or, one of my favorites, pennies.

In order to do this you need to decide how many years the basic unit of your model will represent. For example one penny represents 20 years. If you are using a 'linear' model you might choose one centimeter to represent (is equal to) 100 years. The value you assign to the basic unit determines the scale or overall size or dimensions the resulting model.

After you have selected the items you are going to include, a spreadsheet is a useful tool to quickly and easily see what impact changing the value of the basic unit has on the model.

The ideas outlined above are a general recipe that can be modified based on the background of your students (individually or in teams) and available resources you can decide how many options you want the students to consider. You can use the TimeLine exercise to bring in wide variety of related topic or components.

Make your own version that suits your background, resources and students. There are plenty of different ways students can participate in this hands-on activity. Substitutions allowed and encouraged.

Your results will vary. Void where creativity is not allowed.

The Geologic TimeLine Concentration

This is an interactive PDF document with links that lets one jump from one part of the file to another. It is something like a web in a document. It is meant to be used on-line or off-line - even without an internet connection. You will need Adobe Acrobat Reader. The file can be printed and used by students for various activities like making your own Geologic TimeLine (see the recipe file for details). Two versions are available one is "concentration" http://www.michigan.gov/documents/deq/ogs-gimdl-GTLH_con_307672_7.pdf which covers geologic time, biology and geology. Another is "geology" which is focused on geology http://www.michigan.gov/documents/deq/ogs-gimdl-GTLH_geo_307674_7.pdf.

The Geologic TimeLine Spreadsheets

For more advanced, computer-comfortable students. The files need Microsoft Excel. Microsoft has free reader/viewer files you can download from www.microsoft.com. If you or your students are accustomed to spreadsheets you can develop new and more expansive models. For newer students these resources could serve as an introduction to this interesting tool.

The current version has the following 8 worksheets:

- 🌟 **Events in Geologic Time** a list of events and the corresponding age in years
- 🌟 **TimeLine - Example** - 1 mile a selected subset of events (the ones that have available graphics) and the ages in years - In this example the number of years is converted to a distance with the assumption that 4.6 billion years is equal to 5280 feet - good for learning about spreadsheet calculations while you learn about geologic time
- 🌟 **Blank / Make Your Own** a selected subset of events (the ones that have available graphics) and the ages in years - determine which model or algorithm you want to use and calculate the equivalent units for geologic time - good for learning about spreadsheet calculations while you learn about geologic time
- 🌟 **1 Cent basics** if 1 ¢ was equal to 20 years ...
- 🌟 **1 Cent plus** more data for even more conversion possibilities - how much would the pennies weigh

- how tall would the stack be (maybe you would want to lay them down - how far would they go?)
- how many rolls of pennies - what if you used dimes, nickel or quarters?

- ❖ **Coin Info** even more data about those metallic disks we have in our pockets or find in the coach
- ❖ **Measurement Conversion Factors** switch from metric to U. S. Customary or vice versa
- ❖ **Size of numbers** (what does zepto mean?). common decimal prefixes for number large and small.

Get the Geologic Time Line Helper spreadsheets at http://www.michigan.gov/documents/deq/ogs-gimdl-GTLH_xls_307678_7.xls (an Excel viewer is available from www.Microsoft.com)

The Geologic TimeLine Graphics

This is a set of graphics to help student create their own model or as flashcards just to name a couple of uses. Let me know how your students use these and what they add.

Small size set of graphics

http://www.michigan.gov/documents/deq/ogs-gimdl-GTLH_Gpdf_307675_7.pdf

Full page set

http://www.michigan.gov/documents/deq/ogs-gimdl-GTLH_Gzip_307677_7.zip

Related Topics or Components:

(other things to include as time allows)

- ❖ Absolute time / relative time
- ❖ Art, drawing / graphic skills of the students to edit or expand what is included in the timeline
- ❖ Atmosphere changes over time (O₂, CO₂ etc)
- ❖ Biology / Exobiology
- ❖ Cambrian "Explosion"
- ❖ Changes in Geologic Time (dates and interpretation) during its history and evolution
- ❖ Chemistry, geochemistry
- ❖ Climate changes today and in the geologic past
- ❖ Computer spreadsheets, word processing &/or graphics

- ❖ Dendrochronology
- ❖ Distribution / area of rocks by geologic age
- ❖ Distribution and location of geologic resources / metallics / non metallics
- ❖ Earth in space / why are there seasons / solstice / perihelion
- ❖ Evolution, origin of life
- ❖ Extinctions, Impact phenomenon, other causes
- ❖ Geologic principles - superposition, uniformitarianism, catastrophism, original horizontality, cross cutting relationships, punctuated equilibrium
- ❖ History and effects of the Moon on the earth (tides, rotational speed and stability, changes over time)
- ❖ History of the development of geologic time
- ❖ How big is a hundred / million / billion?
- ❖ How long would it take to count to a hundred / million / billion?
- ❖ ID does not apply
- ❖ Luminescence dating
- ❖ Mathematics, modeling and scaling
- ❖ Measuring the age of the earth / solar system / universe / techniques / requirements
- ❖ Non-geologic measurement of time, day / night, development of sun dials (make one), clocks, calendars / time zones, / daylight savings time
- ❖ Origin of time period names
- ❖ Paleontology, Paleoecology / paleogeography, fossils / index fossils
- ❖ People involved (Wm. Smith, N. Steno, C. Lyell, J. Hutton, C. Darwin, Douglass Houghton)
- ❖ Physics, geophysics
- ❖ Plate tectonics / paleogeography / paleoecology / changes in the earth
- ❖ Radiometric age dating / half life (U²³⁸ / C¹⁴)
- ❖ Snowball earth / glaciations / Milankovitch Cycles
- ❖ Social Sciences (effects of weather, distribution of resources, impacts of mining)

- ❖ Stratigraphy
- ❖ Why are there 60 seconds per minute, 60 minutes per hour, 24 hours per day, 7 days per week, 12 months per year
- ❖ Why do the some dates for time divisions not agree among sources?
- ❖ Writing skills of the students to edit or expand what is included in the timeline

Models, Ideas, Metaphors:

(things one can use to represent geologic time):

- ➔ Adding machine tape / roll of paper
- ➔ Sheets of paper (whole sheets / strips)
- ➔ Twine / rope
- ➔ Distance in a classroom, hallway, school grounds, a park, a football field, a kilometer, a mile, Los Angeles to New York City / City A to City B
- ➔ Length of a movie
- ➔ Seconds / minutes / hours
- ➔ Length of your arm
- ➔ Drops of water / cans of soda / other beverage
- ➔ Ceramic tiles
- ➔ Chalk or (removable) paint / marker
- ➔ Grains of rice
- ➔ Marbles
- ➔ Pennies or other coins or buttons
- ➔ Paper clips
- ➔ M&Ms

From the Web:

just a sampling the MANY possibilities: go to www.michigan.gov/deqgeologyinmichigan (deq geology in michigan - all lowercase - no spaces) then select [Digital Geology Library](#). Her you can find:

Geologic Time Line Helper (GTLH) files / Spreadsheet / Hyperlink PDF with graphics & text / 3 column sets / Starter set of items to include in your TimeLine.

The Glacial Lakes Around Michigan

Stratigraphic Lexicon for Michigan

Stratigraphic Nomenclature chart

Michologic Time Line, Learn about fossils with a Michigan perspective and how they have changed through geologic time.

Geologic Time chart

Honey I Shrunk the Glacier - PowerPoint presentation learn about glaciers and landforms that can be found in Michigan

The Rock Cycle in Michigan - PowerPoint presentation about the Rock Cycle with a real Michigan twist

Something Rare Yet Common - PowerPoint presentation for those who want to learn more about the Petoskey stone.

The references for absolute geologic age dates used are based on information from UCMP Web Time Machine **Geologic time** scale with links for each time interval.

www.ucmp.berkeley.edu/help/timeform.html

National Mapping Atlas - select what you want to see then make your own maps on-line
<http://nationalatlas.gov/articles/geology/legend/ages/devonian.html>

Microsoft makes a wide range of viewers for various Microsoft products available on their web site. This web site changes all too quickly to post a specific URL - go to www.microsoft.com then select/search for OFFICE - downloads - viewers - excel...

Feedback is Welcome!

Please feel free to send any comments, concerns or material / photographs you want to share with others to Steve Wilson at wilsons15@michigan.gov. Material provided will be used in future revisions or new projects.

Other file formats for the excel spreadsheets are available upon request to Steven E. Wilson via email at wilsons15@michigan.gov.