Name: _____ **Physical Geology 101 Laboratory** **Grade:**_____

The Geological Timescale and Earth History

Learning Objectives

- Explore major events through Earth's history.
- Appreciate the magnitude of geologic time.
- Become familiar with the geologic time scale

Pre-Lab Resources

- An EXCELLENT video on the history of life and the geo-timescale: Will help you progress through this lab with a much better understanding (~12 min.)
  - o https://www.youtube.com/watch?v=rWp5ZpJAIAE

ACTIVITY #1 – Becoming familiar with the time scale

Study the geologic timescale and its divisions. Check out how the geologic timescale is divided into different units/segments of time. The four columns - eons, eras, periods, and epochs – are organized according to nested levels of time, going from left to right, with eons the broadest chunks of time, and epochs the smallest. Time runs from **bottom to top – oldest to youngest**, respectively. The eons, eras, periods, and epochs each have a number of uniquely named time segments. For example, the Era column includes the Paleozoic, Mesozoic, and Cenozoic, and the Mesozoic era includes the Triassic, Jurassic, and Cretaceous periods. **The divisions and subdivisions for eons, eras and periods – post-Archean - are primarily defined by the unique assemblages of various types of fossil species** that are found in the rocks of respective age range, and the **boundaries between the time periods are defined by sharp changes in the types of fossils,** most likely a consequence of massive extinction events. Good examples include the beginning of the Proterozoic eon, the beginning of the Cambrian period, the Permian-Triassic period boundary, and the Cretaceous-Tertiary period boundary.

QUESTIONS: Use the summary above and figures on the following pages to help answer questions.

1) List the four **Eons** on the geologic timescale and their numeric age when they started (millions years = MY or billions years = BY)

Eon Name	**Start age** *(millions (MY) or billions (BY) of years ago)*
_____	_____ MY
_____	_____ BY
_____	_____ BY
_____	_____ BY

2) List the three **Eras** on the geologic timescale and their numeric age when they started (millions years = MY)

Era Name	**Start age** *(millions (MY) of years ago)*
_____	_____ MY
_____	_____ MY
_____	_____ MY

3) Which of the four time units – eons, eras, periods, or epochs, spans the longest amount of geologic time?

4) Which of the four time units span the shortest amount of geologic time? _____

5) What is the oldest **Eon** in the geologic timescale? _____

6) The **Phanerozoic Eon** represents the time span on Earth with abundant, complex life. Roughly **what percentage of Earth's geologic time does the Phanerozoic Eon take up** on the geological timescale?

_____ %

Data and Calculation: Earth age: _____MY Time span of Phanerozoic: _____MY

Hint: *Time span of Phanerozoic / Earth Age x 100* ***Show work::***

7) The **Paleozoic Era** represents the "***Age of Complex Life****"*. It was time of great changes in the evolution of complex, multi-cellular life with the appearance and rapid development of most invertebrate phyla, land plants, fishes, and ultimately amphibians and reptiles. This Era ended with the Earth's greatest extinction event.

How many years did this Era last? _____ MY

This Era came to a tragic end (90% of all life wiped out) at what time? _____ MY ago

8) The **Mesozoic Era** represents the "***Age of the Dinosaur"***. How many years of geologic time did the dinosaurs get to reign on Earth before they were suddenly wiped out at the end of the Cretaceous Period?

_____ MY *Hint: It spans the time across the entire "middle life" Era*.

This Era also came to a tragic end (dinosaurs wiped out) at what time? _____ MY ago

9) The **Cenozoic Era** represents the "***Age of the Mammals"***. How many years of geologic time have the mammals been reigning on Earth so far? *Hint: It spans the time across the entire "new life" Era.*

_____ MY

11) Which **Era** has the most **Periods**? _____ What's the most likely reason this Era has the most Periods?

12) The **Quaternary Period** represents the current interglacial interval and when human civilizations arose, referred to as the "*Age of the Humans"*. *Homo sapiens* evolved during this period, when did it begin?

_____ MY

ACTIVITY #2 – The History of Earth...on paper!

INTRODUCTION:
The Earth has changed dramatically and repeatedly over a history that spans nearly 5 billion years. Such immense spans of time are difficult for most of us to comprehend. They fall outside our range of human experience. We normally deal with much shorter time intervals, like the time of our next class or the number of days until the next exam, or even the number of years until graduation!
It is important for students of the Earth Sciences to expand their sense of time. Extremely slow geologic processes, considered only in terms of human experience, have little meaning. To appreciate the magnitude of geologic time and the history of our incredible planet, you will be creating a timeline of important geologic events scaled to a size more tangible and familiar.

INSTRUCTIONS:

1. Construct a timeline of Earth's history on a long strip of adding machine tape. The timeline should be done to scale.
    - 1 meter (100 cm) = 1 billion years (1000 million years)
    - 10 cm = 100 million years
    - 1 cm = 10 million years
    - 1mm = 1 million years
    - There are ten 100 million years in one billion years, or 100 cm in 1 meter.
    - There are ten 10 million years in 100 million years.

a) **Measure out a strip of adding machine tape 5 meters long**. A meter stick will be provided in lab.

b) Refer to the **Geologic time scales** in this exercise. Dates might vary slightly.

c) Select one end of the tape to represent **today**. . Beginning at that end, **mark off and write each billion years** (1 billion, 2 billion, etc.) at 1 meter increments.

d) Draw a **bold line and label** (in color) to **show the beginning of Earth at 4.6 billion yrs. ago.** *To help you get started: 4.6 billion yrs**. Go to the 5 billion mark and plot 4.6 billion: 5 - 4.6 = .4 billion = 400 million = 40 cm. Measure 4 cm "up, or towards today, from 5 billion", draw a line and label "Beginning of Earth"***

e) **Draw** a bold line and **label** (in color) to **show the beginning of the three eras (Paleozoic, Mesozoic, Cenozoic**). *To help you get started: 542 Million yr. ago from today would be (50 cm+ 4cm + 2mm) from the "today" end of the paper roll.*

f) **Mark off and write numbers** at 10 cm increments **ONLY WHEN NECCESARY** (plotting boundaries or events)

g) **Starting with the oldest event** (Event #1), mark off all of the important events in Earth's history shown in the list on the next page. In each case you should **write the date and event directly on the timeline.**

h) Come up with your own Earth-shattering event (do some research), plot the event on your time scale, and present to the class.

Event #	Date in years before present	Event
1	4.56 billion	Earth forms
2	4.1 billion	Oldest rock
3	3.9 billion	Oldest evidence of a continent
4	3.8 billion	First evidence of life
5	3.5 billion	First fossils (algae and bacteria)
6	1.8 billion	Free oxygen in atmosphere
7	1.1 billion	First fossil of a complex organism (a worm)
8	540 million	First abundant life found in the rock record
9	460 million	First fish
10	440 million	First land plants
11	410 million	First land animals
12	250 million	Largest mass extinction occurs
13	247 million	First dinosaurs
14	240 million	First mammals
15	220 million	Breakup of super-continent Pangaea begins
16	145 million	First flowering plants
17	65 million	Dinosaurs and other animals go extinct
18	1.8 million	First primate in genus Homo
19	40,000	First Homo *sapiens*
20	13,000	Humans first inhabit North America
21	10,000	End of last Ice Age
22	500	European rediscovery of the Americas
23	?	Your birthday

(Please note that some of these ages may differ slightly from those given in your text or that you found in another source. These dates change, but the general order and rough position stay constant.)

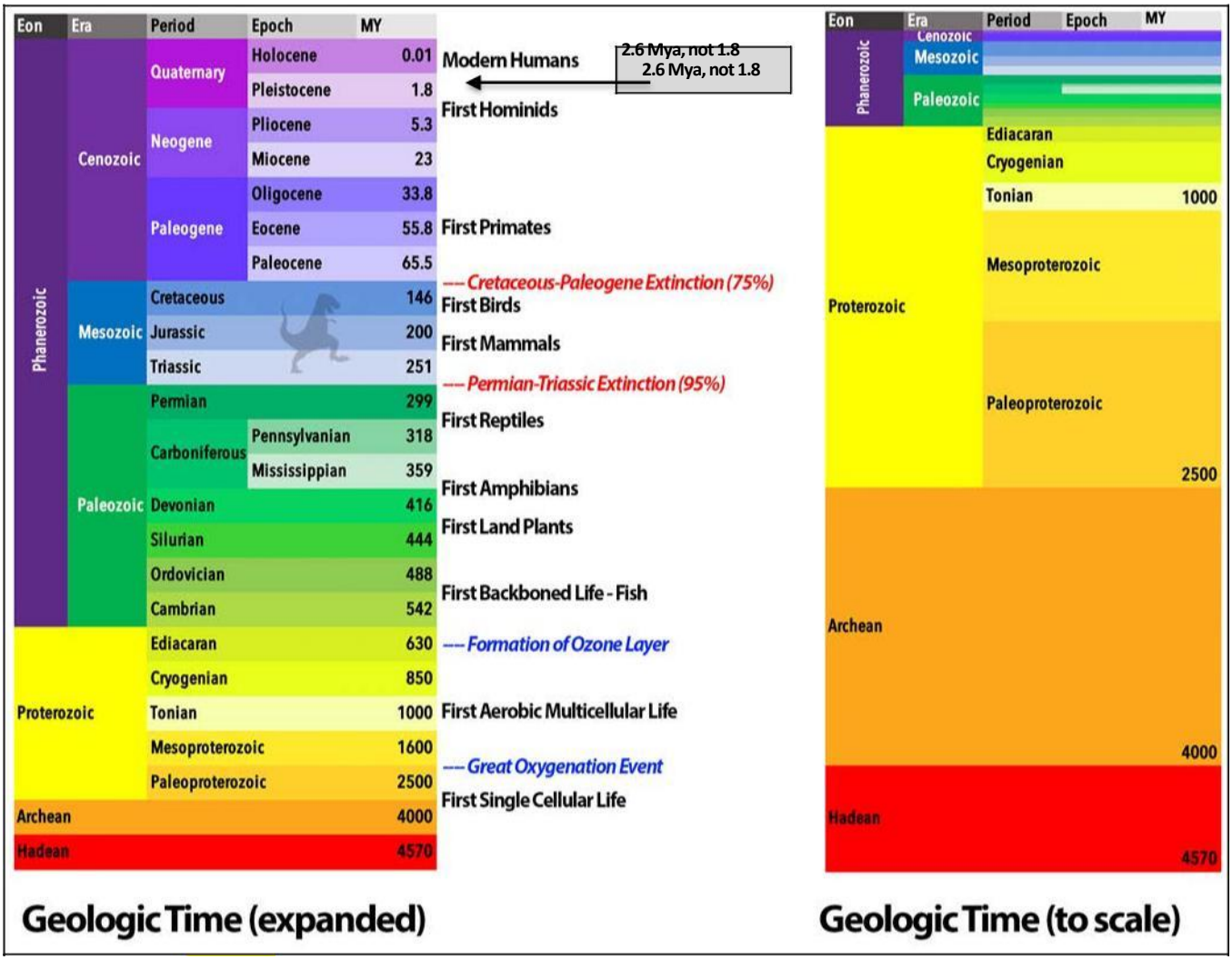

Figure 1 – Geological Timescale (Ga = billions of years; Ma = millions of years)

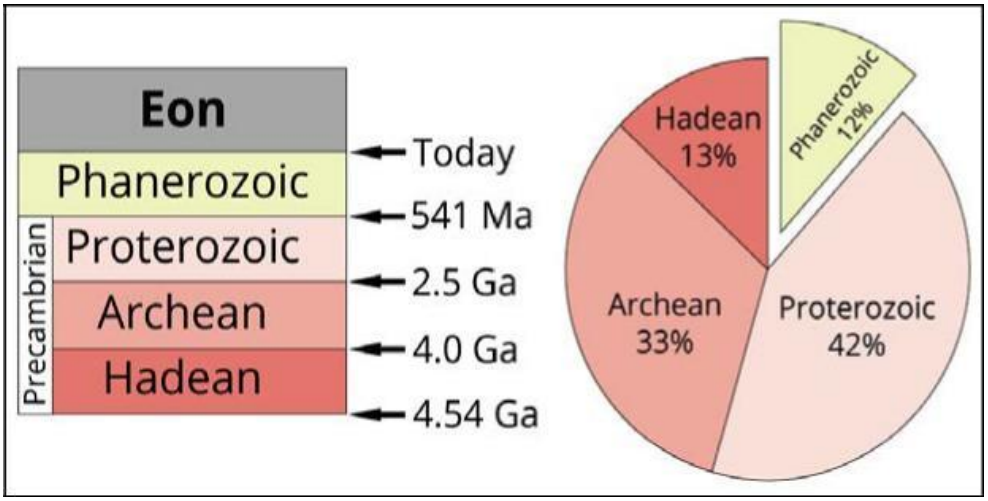

Figure 2: The Eon Time Divisions of the Geologic Timescale.

Image by Jonathan R. Hendricks. Creative Commons License This work is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License.

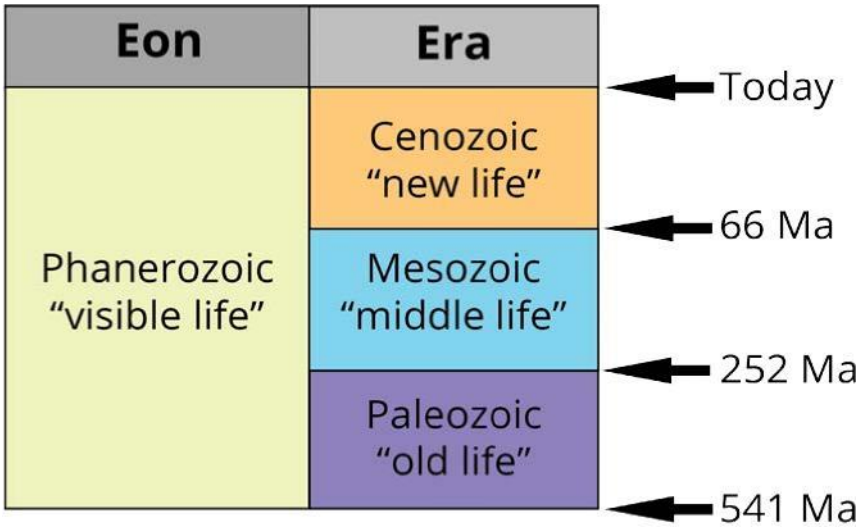

Figure 3: The Era Time Divisions of the Geologic Timescale

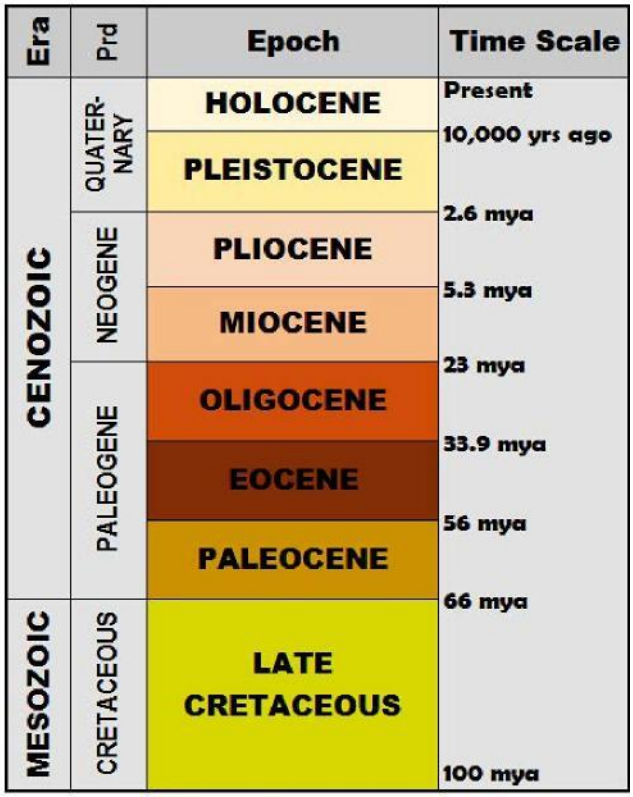

Figure 4: The Epochs of the Cenozoic Era

https://floridadep.gov/fgs/fgs/media/house-graphics-dep-data-portal-screenshot-icon

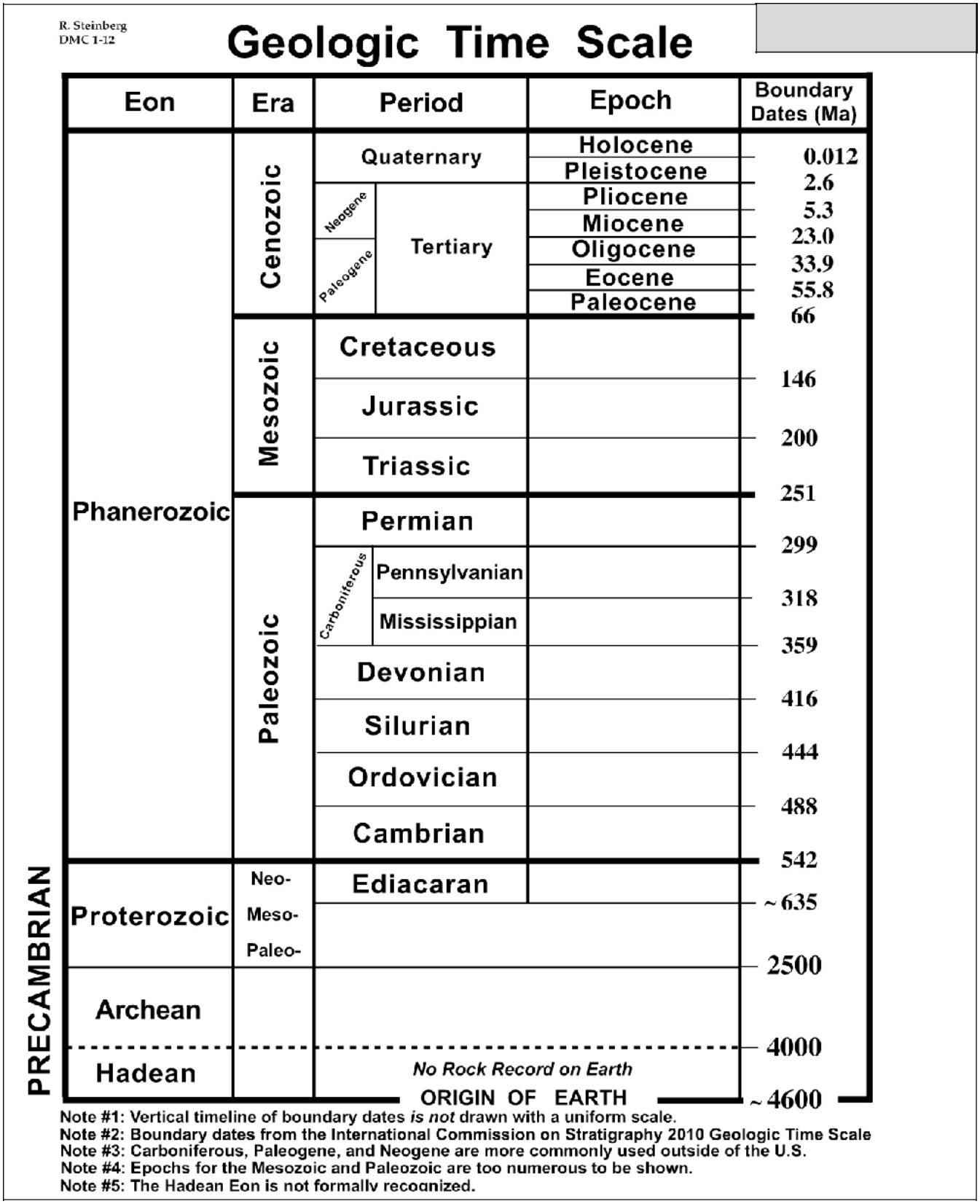

Figure 5: Geological Timescale.

by Roger Steinberg, Department of Natural Sciences, Del Mar College
https://serc.carleton.edu/NAGTWorkshops/time/visualizations_teachtips/60786.html

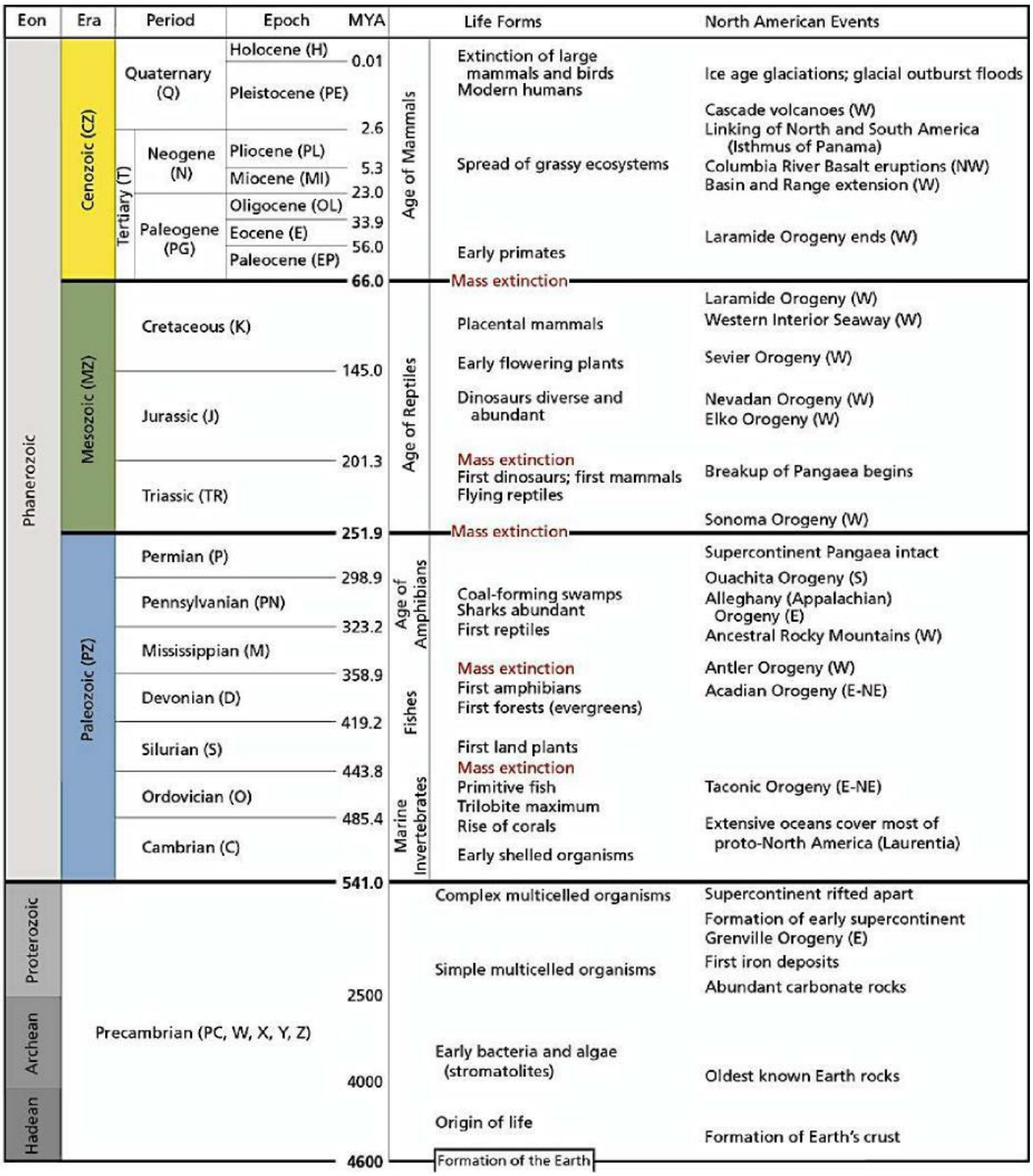

Figure 6: Geologic time scale showing the geologic eons, eras, periods, epochs, and associated dates in millions of years ago (MYA). The time scale also shows the onset of major evolutionary and tectonic events affecting the North American continent.
From the National Park Service

Part III. Geologic Timescale Laboratory Reflection

Directions: Write a reflection of the lab activity, explaining its purpose, the methods used, the results obtained, and a brief personal reflection of what you enjoyed and learned about doing this geologic timescale and earth history lab (*3 points possible*). Answer the following 3-point question reflection set

1) *What was the purpose of this lab? What did you discover and learn during this lab?*

_____

_____

_____

_____

2) *What did you enjoy most about this lab? Also, what was challenging or thought-provoking?*

_____

_____

_____

_____

3) *What are your constructive comments about the design and execution of this lab? What's good? What's bad? Offer suggestions for making the lab better.*

_____

_____

_____

_____