**Exploring Geologic Time Guided Notes: Instructor Version**

*Objectives of Presentation*

* *To outline the history of how we understand geologic time*
* *To describe how the geologic time scale is organized*

What is Geologic Time?

* The events of \_\_earth history\_\_\_\_ through time as they relate to the rocks that make up our planet
* Each rock on the earth formed at a particular \_\_time\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_place\_\_\_\_\_\_\_\_\_\_\_\_

What do each of the following reveal to scientists about what the prehistoric world was like?

| Fossils- a record of prehistoric life  Chemical composition- what the rock is made of and how it relates to earth processes  Structures in the rock- provide clues about past earth events and environments  Uranium/Lead content- allows scientists to assign an actual age to the rock |
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How did humans in antiquity think about the age of the Earth?

| Aristotle- an ever existing earth with no first moment  Cultures and religions in antiquity: age of the earth in thousands, tens of thousands, or hundreds of thousands of years  Hinduism- earth and universe as infinite, with death and rebirth of universe itself  Bishop Ussher- earth was created in 6004 B.C., using biblical chronology |
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Who was Blessed Nicholas Steno (1638-1686)?

| * Considered the father of geology, paleontology, stratigraphy * Became a Catholic priest and eventually bishop |
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What did Bl. Nicholas Steno do?

| * Determined that rock layers formed in different events over long periods of time * His work brought about scientific understanding of an ancient earth |
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Stratigraphy: the study of rock layers and their relative ages

* Involves determining whether a rock layer is \_\_\_\_\_older or younger\_\_\_\_\_\_\_\_\_\_ than another

Example of Stratigraphic Concept: Law of Superposition

| W |
| --- |
| L |
| A |
| F |

According to the law of superposition, which layer in the illustration to the above is oldest, and which is the youngest?

| Oldest: F  Youngest: W |
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Example of Stratigraphic Concept: Law of Faunal Succession

* \_\_\_\_\_Fossil organisms\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ can be used to put rock layers in sequence.

| Example of the Law of Faunal Succession:  dinosaurs lived only during the Mezosoic Era, and so rocks bearing dinosaur fossils can be assigned to that age |
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**The Concept of Geologic Time**

Steno and the science of stratigraphy allowed scientists to put rock layers in sequence, but what allowed scientists to *assign actual ages* to rock layers and events in earth history?

| radiometric dating |
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The Geologic Time Scale

**What are the major Eons in order from Oldest to youngest?**

| **Precambrian (made of the Hadean, Archaean, and Proterozoic Eons), Phanerozoic** |
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**What are the eras of the Phanerozoic from oldest to youngest?**

| **Paleozoic, Mesozoic, Cenozoic** |
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**Provide the correct era to the categories below:**

| **“Time of Mammals”: Cenozoic**  **“Early Life”: Paleozoic**  **“Time of Dinosaurs” Mesozoic** |
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**Question to Ponder:**

What do you think causes a scientist to place a boundary in a particular place on the time scale?

In other words: why do you think scientists decided to start and end the various Eons, Eras, Periods, and Epochs at the boundary dates listed on the right side of the time scale?

| *Students may come up with multiple answers to this question—mass extinctions, changes to rocks, changes to climate, etc. An accurate answer is also presented on the next slide (slide 19) of the presentation:*  The boundaries between Eons, Eras, Periods and Epochs are largely defined by events and changes in Earth history.  The rocks themselves reveal that history in their chemistry, stratigraphy and fossils. |
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So how did scientists determine when intervals of geologic time begin and end?

| Provide examples of how each of these would be recognized in a rock:  Changes to environments: rocks under water overlain by rocks that formed on land because of global sea level fall  Changes to chemicals: rocks suddenly contain more carbon and are darker in color  Changes to Fossils: a mass extinction where many fossils disappear from the fossil record after a particular rock layer |
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How old is the earth? \_\_\_\_\_\_~4.6 billion years old\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

How old is the universe? \_\_\_\_\_\_~13.7 billion years old \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Why is it important to recognize that our universe is so old?

| We need an old universe (with stars being born and dying) to create the heavier elements that form our Earth and even our bodies! |
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When and how do humans fit into all of this?

| Right now we are a part of the last 300,000 years of earth history, right at the very end of the geologic time scale (Phanerozoic Eon, Cenozoic Era, Quaternary Period, Holocene Epoch)  The students may not necessarily know this, but early humans date back to the later part of the Pleistocene epoch (think Ice Ages) |
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**Summary Points:**

* The geologic time scale organizes and depicts the events of \_\_earth history\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
* Rocks provide the \_\_\_\_\_evidence\_\_\_\_\_\_\_\_\_\_\_\_ for the history of our planet
* In the 17th century, Blessed Nicholas Steno founded the science of \_\_\_stratigraphy\_\_\_\_that uncovered this geologic history
* The scientists of the 20th century crafted the modern geologic time scale and \_\_assigned dates\_\_\_\_\_ to geological eons, eras, periods, epochs
* The geologic time scale is divided up into times \_\_\_\_defined by events\_\_\_\_ that happened in Earth’s history.