



STUDY MATERIAL

**VIVEKANANDA COLLEGE
THAKURPUKUR**

NAAC Accredited Grade—A

BOTANY

(HONOURS & GENERAL)

The Geological Time Scale

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The Geological Time Scale

The age of the Earth is approximately 4,700 million years¹. The rock strata² present in the Earth's crust are like the pages of the history of the Earth and the life it supports. They hold the key to the events that occurred during the immense timespan from the formation of the Earth to the present day, and therefore have been studied, deciphered and placed in the proper order by the geologists. The **geological time scale** is an internationally standardized vertical time table that divides the Earth's long and unique geological past into a hierarchy of time intervals, *viz.* **chronostratigraphic units** in the following order: the **eon**, the **era**, the **period**, the **epoch** and the **age**. The range of the **absolute age** of these units are determined by the **radiometric dating**³ of the rocks representing them. This absolute age is expressed as years before present (b.p.)⁴.

The eons, the largest interval of geological time, covers a period of several hundred million years. The history of the Earth has been divided into the two eons: the **Cryptozoic** (570—4,700 Ma) and the present **Phanerozoic** (0—570 Ma). The much older and longer Cryptozoic eon, informally called the **pre-Cambrian**, has been divided into three eras: the **Azoic** or Hadean (4,000—4,700 Ma), the **Archaean** (2,500—4,000 Ma) and the **Proterozoic** (570-2,500 Ma). The younger and shorter Phanerozoic eon has also been divided into three eras: the **Palaeozoic** or Primary (225—570 Ma), the **Mesozoic** or Secondary (65—225 Ma) and the present **Cenozoic** (0-65 Ma). The oldest and longest era, the Palaeozoic, has been divided into six periods: **Cambrian**⁵, **Ordovician**⁶, **Silurian**⁷, **Devonian**⁸, **Carboniferous**⁹ (with two sub-periods: **Mississippian** and **Pennsylvanian**¹⁰) and **Permian**¹¹. The median era, the Mesozoic, has been divided into three periods: **Triassic**¹², **Jurassic**¹³ and **Cretaceous**¹⁴. The youngest and shortest era, the Cenozoic, has been divided into two periods: **Tertiary** and **Quaternary**. The periods or sub-periods of the Palaeozoic and Mesozoic eras have three epochs: **Early**, **Middle** and **Late**, but Ordovician, Silurian, Mississippian, Permian and Cretaceous have only the Early and Late epochs. In the Cenozoic era, the penultimate period, the Tertiary, has five epochs: **Palaeocene**, **Eocene**, **Oligocene**, **Miocene** and **Pliocene** and the ultimate period, the Quaternary, has two epochs: **Pleistocene** and **Holocene** i.e. **Recent**—the current epoch. Epochs are eventually subdivided into ages. The currently accepted geological time scale is represented up to the epochs in the following page (Table 1).

¹ Based on the radiometric dating of rocks.

² The study of rock strata is called stratigraphy which involves the study of their mineral content (lithostratigraphy), their fossil content (biostratigraphy) and their age (chronostratigraphy).

³ The best-known techniques are uranium–lead, potassium–argon and radiocarbon dating.

⁴ As kilo-annum (Ka) for thousand (10^3) years b.p., mega-annum (Ma) for million (10^6) years b.p. and giga-annum (Ga) for billion (10^9) years b.p. from 1950.

⁵ Named after Whales (also called Cambria in Latin).

⁶ Named after the Celtic tribe called Ordovices.

⁷ Named after the Celtic tribe called Silures.

⁸ Named after the county of Devon in England.

⁹ Named after deposits of coal (which is called *carbo* in Latin).

¹⁰ Named after the states of Mississippi and Pennsylvania in the United States.

¹¹ Named after the city of Perm in Russia.

¹² Named after deposits with three (the prefix *tri* from Greek) layers.

¹³ Named after the Jura Mountains in Germany.

¹⁴ Named after deposits of chalk (which is called *creta* in Latin).

Table 1: The Geological Time Scale

| Eon | Era | Period | Epoch | Ma | |
|-------------|---------------|--------------|---------------|----------|-----|
| Phanerozoic | Cenozoic | Quaternary | Holocene | 0 | |
| | | | Pleistocene | 2.5 | |
| | | Tertiary | Pliocene | | |
| | | | Miocene | | |
| | | | Oligocene | | |
| | | | Eocene | | |
| | Palaeocene | | | | |
| | Mesozoic | Cretaceous | Late | 65 | |
| | | | Early | | |
| | | Jurassic | Late | 140 | |
| | | | Middle | | |
| | | | Early | | |
| | | Triassic | Late | 195 | |
| | | | Middle | | |
| | | | Early | | |
| | | Palaeozoic | Permian | Late | 225 |
| | Early | | | | |
| | Carboniferous | | Pennsylvanian | Late | 280 |
| | | | | Middle | |
| | | | | Early | |
| | | | Mississippian | Late | |
| | | | | Early | |
| | | | | Devonian | |
| | Middle | | | | |
| | Early | | | | |
| | Silurian | | Late | 395 | |
| | | | Early | | |
| Ordovician | Late | 435 | | | |
| | Early | | | | |
| Cambrian | Late | 500 | | | |
| | Middle | | | | |
| | Early | | | | |
| Cryptozoic | Proterozoic | Pre-Cambrian | 570 | | |
| | Archaean | | 2500 | | |
| | Azoic | | 4000 | | |
| | | | 4700 | | |

Ma mega-annum or million (10⁶) years b.p.
 (Modified from Stewart and Rothwell, 1993).

Further Reading

Arnold, Chester A. (1944) *An Introduction to Paleobotany*. New York: McGraw Hill Book Co. Inc.

Holmes, Arthur (1944) *Principles of Physical Geology*. London: Thomas Nelson & Sons Ltd.

Stewart, Wilson N. and Gar W. Rothwell (1993) *Paleobotany and the Evolution of Plants*. Cambridge: Cambridge University Press.

Taylor, Thomas N. and Edith L. Taylor (2009) *Paleobotany: the Biology and Evolution of Fossil Plants*. New York: Academic Press.

