

Evolution of the Living Earth Autumn 2021

Practical Exercise

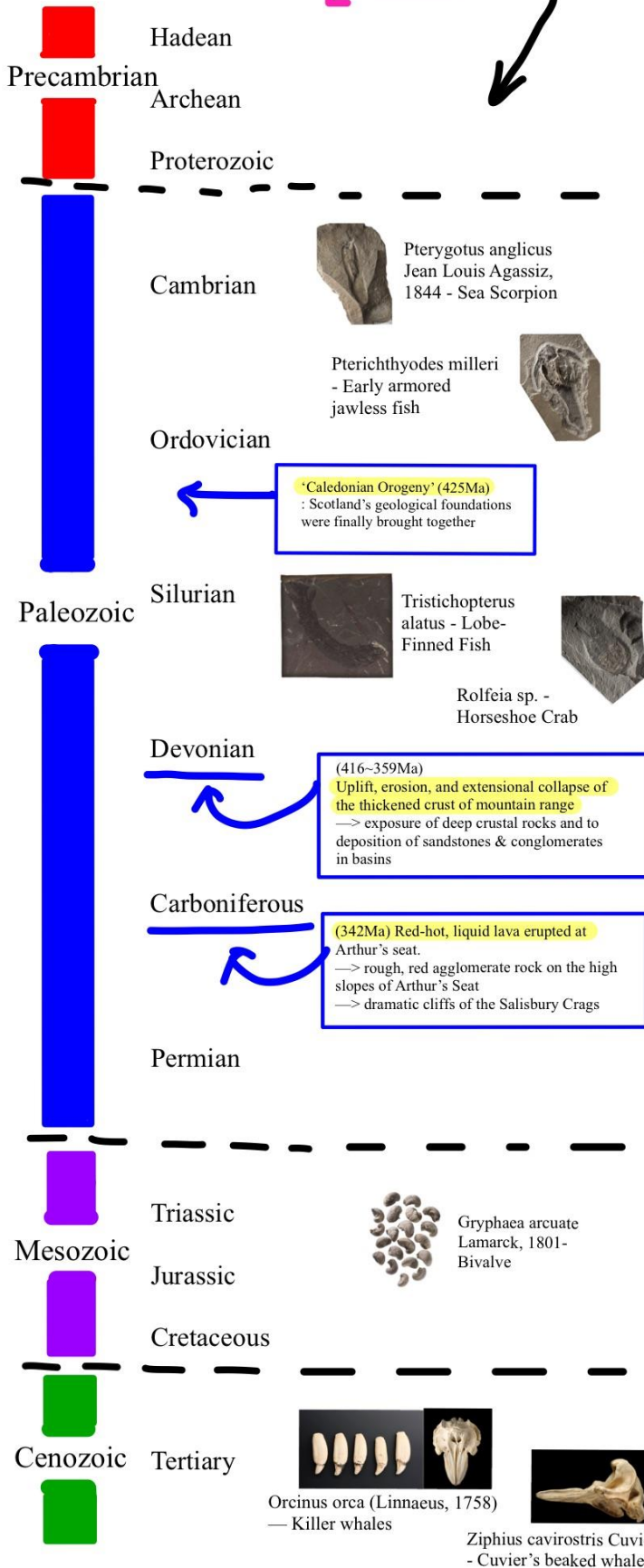
This exercise is broken down into 3 questions (one of them has a few sub-questions). The number of marks per question (out of 100 total) are specified. Good luck!

You will have one week to complete this assessment in your own time. It is due at 12:00 noon on Tuesday October 26. You will submit it digitally via the dropbox on Learn. The easiest way to do this is to use this Word document as a template. Type your answers directly into this document, and paste in scanned versions of any drawings or other work you do by hand.

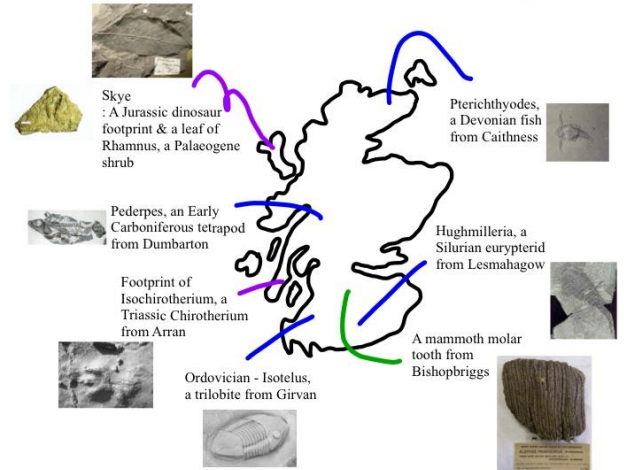
Question 1: Based on your self-guided trip to the National Museum of Scotland, construct an A4-sized geological timeline that highlights key fossils or sites from Scottish prehistory, with accompanying images. This can be hand-drawn and scanned, or constructed with a digital illustration program. 35 marks.

B209011

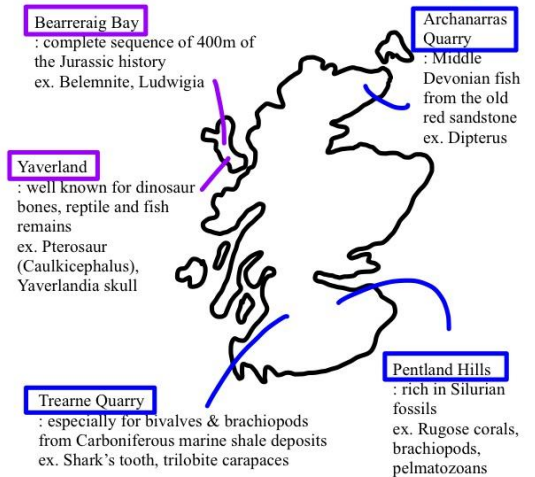
Significant Scottish Geological Events & Fossils from Scotland in National Museum of Scotland



Significant Fossils from Scotland



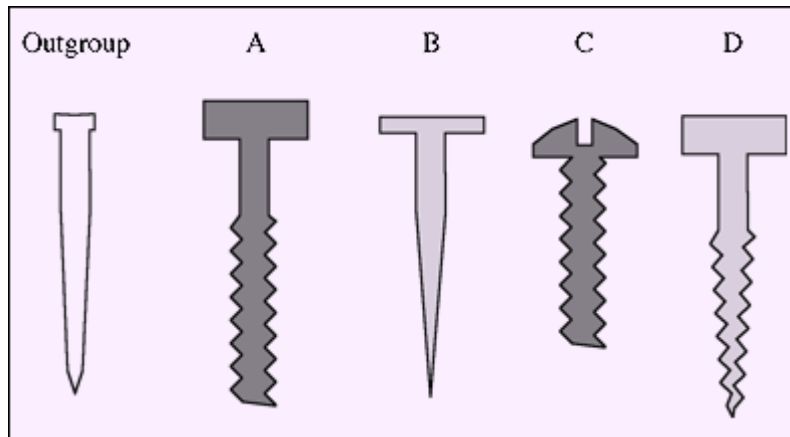
Main Fossil Spots in Scotland



Citation

1. Geological Timeline
 - International Commission of Stratigraphy, International Chronostratigraphic Chart. <https://stratigraphy.org/chart>
 2. Fossils in National Museum of Scotland
 - mindat.org, Gryphaea arcuate. <https://www.mindat.org/taxon-4595515.html>
 - Florida Fish and Wildlife Conservation Commission, Marine Fisheries Research, Crustaceans – Marine Arthropods, Horseshoe Crabs, Facts About Horseshoe Crabs and FAQ. <https://myfwc.com/research/saltwater/crustaceans/horseshoe-crabs/facts/>
 - Wikipedia, Tristichopterus. <https://en.wikipedia.org/wiki/Tristichopterus>
 - Paleozoic Highlander Fossils, Pterichthyodes, Armoured Fish. <https://www.highlanderfossils.com/periods/devonian/placodermi/pterichthyodes/>
 - Wikipedia, Pterygotus. <https://en.wikipedia.org/wiki/Pterygotus>
 - Wikipedia, Killer whale. https://en.wikipedia.org/wiki/Killer_whale
 - Wikipedia, Cuvier's beaked whale. https://en.wikipedia.org/wiki/Cuvier%27s_beaked_whale
 3. Main Geological Event
 - Britannica, T. Editors of Encyclopaedia. "Caledonian orogenic belt." Encyclopedia Britannica, June 7, 2017. <https://www.britannica.com/place/Caledonian-Orogenic-Belt>.
 - Scottish Geology Trust, Getting Started – Scotland – the home of geology. <https://www.scottishgeology.com/geo/getting-started/>
 - Scottish Geology Trust, Holyrood Park, Edinburgh: The volcano in the heart Scotland's capital city. <https://www.scottishgeology.com/best-places/holyrood-park/>
 4. Main fossil-hunting sites in Scotland
 - Geological Society of Glasgow, Home, Local Rocks, Scottish Fossils. <https://geologyglasgow.org.uk/local-rocks/scottish-fossils/>
 - Wikipedia, Yaverland. <https://en.m.wikipedia.org/wiki/Yaverland>
 - UK Fossils Network, UK Fossil Collecting, Berreraig Bay. <https://ukfossils.co.uk/2011/10/20/berreraig-bay/>
 - UK Fossils Network, UK Fossil Collecting, Pentland Hills. <https://ukfossils.co.uk/2008/11/12/pentland-hills/>
 - UK Fossils Network, UK Fossil Collecting, Trearne Quarry. <https://ukfossils.co.uk/2009/09/18/trearne-quarry/>
 - Scottish Geology Trust, Scotland – the home of geology, Achanarras Quarry, Caithness: Where ancient fish shoals lie. <https://www.scottishgeology.com/best-places/achanarras-quarry-caithness/>
-

Question 2: Below are five types of screws. You will build a family tree of these screws.



2.1: Come up with a list of characters that vary in the screws, write them out and assign numbers of 0,1,etc. to the states. 5 marks.

- 1) Head: flat (0), rounded (1)
- 2) Shank: non-threaded (0), threaded (1)
- 3) Tip: cone point (0), plain point (1)
- 4) Color: absent (0), present (1)

2.2: Construct a character-taxon matrix. 10 marks.

Character-Taxon Matrix

Characters:

- 1) Head: flat (0), rounded (1)
- 2) Shank: non-threaded (0), threaded (1)
- 3) Tip: cone point (0), plain point (1)
- 4) Color: absent (0), present (1)

Characters as scored in various screws:

Outgroup 0000

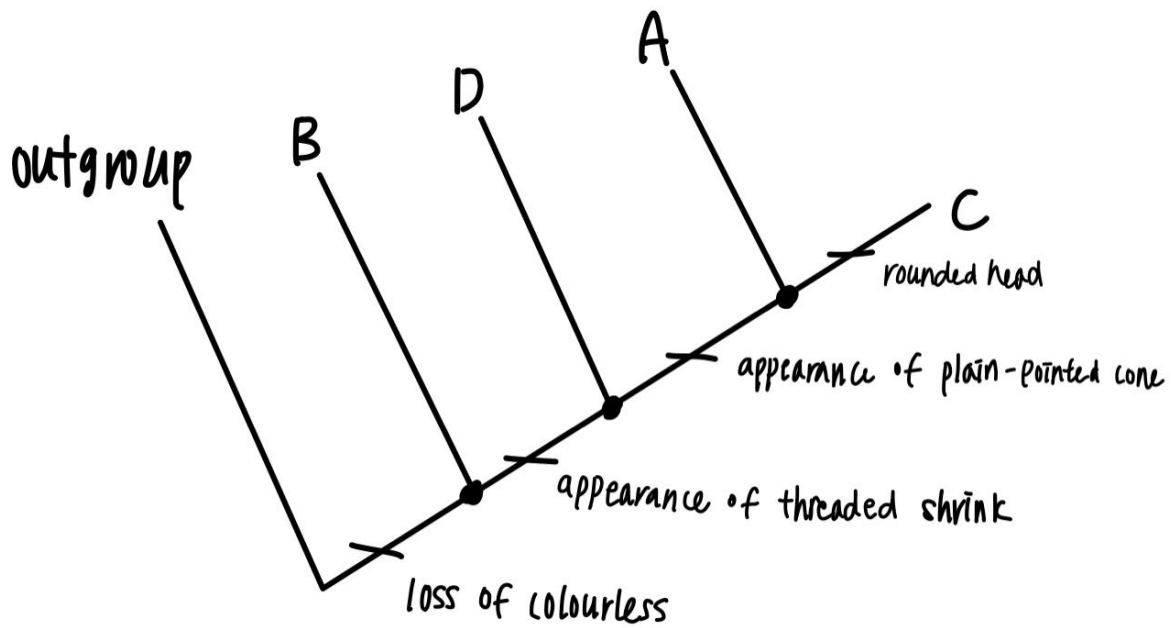
A 0111

B 0001

C 1111

D 0101

2.3: Draw a family tree and label which shared, derived character states unite each grouping (each node) on the phylogeny. 10 marks.



2.4: White colour is an example of a (circle one): **primitive character state**, derived character state, homoplasy, redundant character state. 1 mark.

: primitive character state

2.5: Which is a derived character state (circle one): a pointy bottom tip or a **squared-off bottom tip**? 1 mark.

: squared-off bottom tip

*in previous questions, I concerned 'cone point tip' as a pointy bottom tip and 'plain point tip' as a squared-off tip.

2.6: Give an example of a unique derived character state of one of the screws. 1 mark.

: A rounded head is one of unique derived character states.

2.7: What does it mean if two species are sister taxa? 1 mark.

: Sister taxa are two lineages(species) from the same branch point, which means they are closely related to each other than other species.

2.8: Birds and bats both have wings, but they did not inherit them from a common ancestor. Rather, they evolved them independently. What is this type of character state called? 1 mark.

: The mentioned type of character state is called analogous character states.

Question 3: Write a review of Henry Gee's book *A (Very) Short History of Life on Earth*. It can be in either academic peer-reviewed or popular newspaper format. I have given one example of each on Learn (in a folder called 'Practical Assessment Book Reviews.'). Your review should be approximately 500 words, text only. It should provide a brief overview of the book (its tone, style, subject matter etc.), aspects of the book you enjoyed, and constructive feedback for improvement. Please note that your reviews might be shared with Dr Gee and his editor, so please be professional and constructive. Please give your review a title and put your name as the author. 35 marks.

Book Review in a popular newspaper format by Hwayeon Kang

This book is just for you if you wonder how the desperate magma destroyed the Earth or are impressed with the nourishment after those disasters. Gee comes up with the various stages of life evolution on Earth, from supernova to the appearance of apes.

Life first began in the deepest depth of the ocean. Not only the subduction spot but also boiling spots of water with rich minerals borne the life. It started evolving from the form of "scummy membranes across microscopic gaps in rocks," Gee writes. Life has flourished within the ozone layer, oxygen, and bacteria.

We also met a number of hazards that killed almost all the lives on Earth. Ice age, mass extinction, and enormous magma destroyed the Earth. However, life has re-flourished again and again. Gee offers many life forms, including amniotes, flowers, birds, terrestrial tetrapods, and dinosaurs. In the warm, moist interior of Gondwana, the dinosaurs began in silence. There was no drama on dinosaurs. Unlike the rumour, the dinosaurs, some of which were herbivores, started with relatively smaller sizes than other animals, such as giant amphibians. "Theropods such as *Coelophysis* and *Eoraptor* were small, darting opportunists, very far from the monsters of the Jurassic and Cretaceous," Gee mentions.

"How could those dinosaurs become bigger?"

"If a body grows but retains its shape; its volume will grow much faster than its surface area," Gee answers. Thus, he points out the effectiveness of the air-cooled internal workings of dinosaurs as the reason for the bigger size than that of mammals.

In Gee's words, dinosaurs have a winning formula. Pin-sharped brains and nervous systems enable them to stand, run, strut, pivot, and pirouette with poise.

Interestingly, the author suggests the mystery that dinosaurs leave: Why the dinosaurs survived while crocodile-like creatures which highly resemble the dinosaurs could not. For this reason, Gee mentions a matter of luck and lottery. Yet, it would be better to develop various theories or possibilities that can open further research or discussion because we do not know the actual reason yet.

Along with other glaciations and mass extinctions, dinosaurs, mammals, and apes appeared and went extinct. Then, finally, we met the age of *Homo sapiens*. Readers can summarise the main streams of such a long history of evolution with simple timelines attached to every end of chapters.

Readers need to spotlight the last chapter, especially in which Gee comes up with the possibility of the next mass extinction, the end of *Homo sapiens*. The idea here is that *Homo sapiens* will have disappeared within the next few thousand years since a failure of population replacement and a combination of insufficient genetic variation due to events in prehistory. Like Nostradamus predictions, he delivers further predictions as more giant reptiles will have died out, which sounds worthy of further self-research and discussion to check the fact.

All in all, the value of this book is on the details. We could find extra enjoyment in adding details into the prior knowledge and breaking of the wrong rumours.