Teacher's Notes
Activity 1: THE WASHING LINE OF TIME

Activity summary:

This is a practical activity where students sort and hang pictures that represent important events in the geological history of the Earth on a "washing line of time".

Level: 5th and 6th class

Time required: 25 mins (activity) plus 5-10 mins (set-up)

Curriculum links: *SESE Geography:*

Strand: Natural Environments
- Unit: The local natural environment
- Unit: Rocks and Soil
- Unit: Planet Earth in Space

Strand: Environmental Awareness
- Unit: Environmental Awareness

SESE Science:

Strand: Materials
- Unit: Science and the Environment
- Unit: Energy and Forces

Objectives:

- To appreciate the immense age of the Earth
- To consider the various important stages of Earth's history
- To form a sense of how life on Earth is affected by environment and vice Versa
- To appreciate where events associated with the development of the Burren fit into the history of the Earth
- To appreciate how humans have only recently arrived on Earth

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Skills and concepts development:

Maps, Globes and Graphical Skills

- Using Pictures, Maps and Models
- Maps and Globes

A Sense of Place and Space

- A Sense of Place
- A Sense of Space

Geographical Investigation Skills\Working Scientifically\Designing and Making

- Observing
- Investigating and Experimenting
- Estimating and Measuring
- Analysing
- Recording and communicating
- Evaluating

Background information and context:

In human terms, the age of the Earth is immense. The Earth and solar system were formed 4560 million years ago when an interstellar cloud (nebula) of gas and dust began to collapse. Collapse of the cloud may have been triggered by a shockwave from a nearby supernova or star explosion. Collisions of dust particles in the cloud built up small asteroids and eventually protoplanets. The proto-Earth was molten and was subject to frequent bombardment by comets, asteroids, and other planetary debris. The Moon was formed when a Mars-sized object struck the original Earth, pulverizing both; the matter ejected into space after the impact gradually coalesced to form the Moon.

The atmosphere of the early Earth was composed of gases such as sulphur dioxide, nitrous oxide, methane, and ammonia (similar to the gases produced by volcanoes), and would be toxic to most organisms today. Nonetheless, life – the first bacteria - did evolve; in fact, bacteria adapted to these harsh conditions became very diverse. One type of bacterium – the Cyanobacteria – began to produce oxygen as a metabolic byproduct. This gas built up in the atmosphere over time, and enabled the rise of animal life. The first animals were worm-like and only their burrows are preserved in rocks. Due to increasing pressure from predators, however, animals began to secrete hard outer skeletons for protection, e.g. shelly animals such as snails.

Oxygen eventually built up to its present levels, generating the ozone shield that screens out UV radiation and allows complex forms of life to live on land. Animals such as fish, amphibians, insects, and reptiles evolved over time (the rocks of the Burren and Cliffs of Moher formed roughly when amphibians and insects were evolving). Dinosaurs, which are the largest land-based animals to ever have evolved on Earth, evolved. Mammals evolved shortly afterwards but were small and insignificant. A large meteorite impact is commonly thought to have killed the dinosaurs, but this is only one of several contributing factors. Other factors were (1) the release of large amounts of toxic gases and dust into the Earth's

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atmosphere by prolonged and catastrophic volcanic eruptions in what is now India, and (2) changes in the configuration of the Earth's continents.

The appearance of grass allowed the evolution and diversification of the grazing animals which dominate temperate and subtropical zones of the Earth today. The expansion of grasslands between 2.5 and 1 million years ago (caused by a change to a drier climate), and therefore of grassland grazing animals, may have triggered the evolution of humans.

Over geological time there have been at least 6 ice ages, where continuous masses of ice form at the Earth's poles. The most recent ice age began 2 million years ago and ended roughly 12,000-14,000 years ago. The uncertainty is because the ice melted in different places at different times.

Geologists date events in Earth's history by measuring tiny amounts of radioactive elements (e.g. uranium) in certain types of rocks. Because radioactive elements decay over time at a constant rate, the ratio of the radioactive element to the radioactive decay product tells you how old the rock is. Radioactive dates are usually accurate to within 0.2 – 2 million years.

Prior Knowledge:

Students should be familiar with the following terms and concepts:

- the Earth's crust
- the ozone layer
- dinosaurs
- the Ice Age
- all animals today need to breathe oxygen

Apparatus and materials:

Two "washing line" sets are included, each containing:

Sixteen laminated pictures, each representing an important event in the geological history of the Earth:

- formation of the solar system
- formation of the Moon
- Earth's crust forms
- first life on Earth
- first oxygen in the Earth's atmosphere
- ozone layer forms
- first animals with hard skeletons
- first life on land CONTINUED ON NEXT PAGE

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- Rocks of the Burren form
- Rocks of the Cliffs of Moher form
- First dinosaurs
- Atlantic Ocean opens
- First grass
- Extinction of the dinosaurs
- First humans
- End of the last Ice Age

- 16 laminated A7 cards with the following dates (all in millions of years): 4560, 4520, 4300, 3500, 2700, 580, 545, 475, 330, 318, 225, 150, 90, 65, 2, 0.01
- A box of paper clips to attach the "date cards" to the larger "event" cards
- 5 metre length of cord
- clothes pegs to attach laminated sheets to the washing line
- pins to fix the line to the wall
- one completed 'washing line' for comparison
- student worksheets

Organisation of students:

- If the class contains 16 students or less, the class works as a single group and use just one washing line.
- If the class contains more than 16 students, divide the class into two groups; each group will work on a separate washing line.
- Students may have to take more than one laminated event card each

Activity:

Students are told that the washing line represents the 4560 million years since the formation of the Earth, and which end of the washing line represents today.

(1) The students try to place the laminated event cards in the correct order. There are helping hints contained in the text underneath many of the pictures.

(2) Next, they try to place the events on the washing line in the position of the time that they think the events happened.

(3) The teacher rolls out the pre-completed washing line and students answer the questions below as part of a guided discussion.

This table shows the date and distance for each event on a 4.65 m washing line, where 1 mm = 1 million years.

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Event	Date (millions of years)	Distance from "today" (cm)
End of the last Ice Age	0.01	~ 0
First humans	2	0.02
Extinction of the dinosaurs	65	6.5
First grass	90	9
Atlantic Ocean opens	150	15
First dinosaurs	225	22.5
Rocks of the Cliffs of Moher form	318	31.8
Rocks of the Burren form	330	33
First life on land	475	47.5
First animals with hard skeletons	545	54.5
First ozone layer	580	58
First oxygen in the atmosphere	2700	270
First life on Earth	3500	350
Earth's crust forms	4300	430
Formation of the Moon	4520	452
Formation of the solar system	4560	456

Student questions and answers:

Q. In general, do you think you placed the events in the correct order or not? What events did you place in roughly the correct position? What events did you place far from the correct position?

A. Students should recognise which events were in the wrong order, and which they had placed in the correct / incorrect positions on the washing line.

Q. Which events were hard to place on the washing line? Why?

A. (discussion / subjective answer)

Q. Did anything surprise you? Why?

A. (discussion / subjective answer)

Q. What was the most interesting thing that you learned? Why?

A. (discussion / subjective answer)

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