

Counting to one million? Trying to imagine the enormity of geological time

Ask the pupils what is the average age of their class?
Probably about 8 years.

How old is the oldest person they know about?

Can they imagine 1,000 (one thousand) years?

That's 100 x 10

Can they imagine 1,000,000 (one million) years?

That's 1,000 x 1,000

Have they ever thought about how big a number one million actually is?

Using a stopwatch showing seconds, count together to ten, saying one number each second.

This will take 10 seconds.

Tell them that if they were to count to one thousand, it would take them 16.67 minutes, that's just over a quarter of an hour. Ask them what they might be able to do in a quarter of an hour instead of counting.

Once they've had the chance to think about that, ask them how long they think it would take to count to one million, without stopping (no eating; no sleeping; no talking).

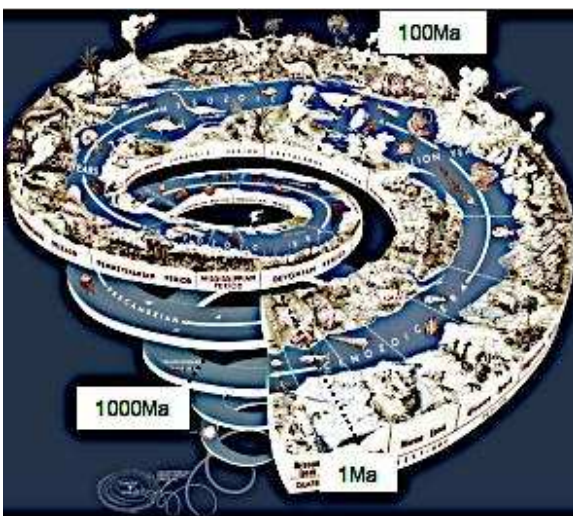
The answer is about thirty days.

Now if it takes 30 days to count to one million, how many days would you be counting to go back to the time when the big dinosaurs lived on Earth, say 150 million years ago

$150 \times 30 = 4,500$ days, that's 12 years and just over 17 weeks of non-stop counting.

Impossible, right?

The age of the Earth is about 4,600 million years (4.6 billion). You would be counting for a very, very, very long time.



Spiral of deep time (Ma = million years)
Image is in public domain; originally from the
United States Geological Survey

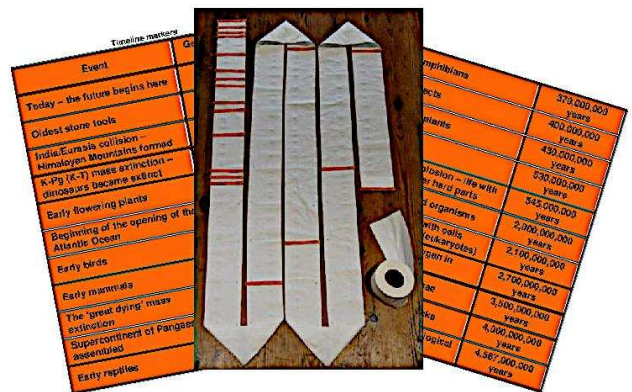
Now ask the pupils if they can think of a good way of explaining geological time, or deep time, to people who do not understand.

Possible answers:

Toilet roll of time:

Use 46 sheets of toilet paper where every sheet represents 100 million years, as in the Earthlearningidea - 'The toilet roll of time; make a geological timeline to take home'

Choose some of the main events from this activity to mark on your sheets of toilet paper.



Photos: Chris King

Chalk in the playground:

Measure 46 metres with chalk in the playground. Each metre would be 100 million years. You could mark the main events as suggested above.

How many for a million:

Use graph paper as in the Earthlearningidea 'How many for a million? How many sheets of graph paper for 1 million, or 100 million, or a 1,000 million squares?'

How thick is the book?

One sheet of paper from a book is 0.1mm thick and represents one year. Work out how thick the book would be, cover to cover if you represented the 4.6 billion years of Earth's history.

The book would be 460 km thick, (nearly the distance from London to Edinburgh (c. 540 km) . On this scale, if you go back to the Big Bang 13.7 billion years ago, the book's thickness would be nearly the distance from London to Rome (c.1450 km)!

The back up:

Title: Counting to one million?

Subtitle: Trying to imagine the enormity of geological time

Topic: An activity to help young children to understand deep time

Age range of pupils: 7-11 years

Time needed to complete activity: about 15 minutes, longer if one of the suggestions is carried out

Pupil learning outcomes

Pupils can:

- realise that one million is a very big number;
- calculate how long they would have to do non-stop counting to go back to the time of the big dinosaurs;
- devise others ways of explaining deep time to other people.

Context:

Geological time, or deep time, is a difficult concept for everyone. It is very difficult to imagine millions of years in the past and to understand events like moving continents when, in a human life time, they don't seem to move much at all. Similarly, when we are walking on limestone hills and we know they formed under the sea, it is difficult to imagine the landscape we see under water. Many changes happen very, very slowly; too slowly for humans to notice.

Following up the activity:

Carry out other calculations with large figures, such as:

- How many 300 mm rulers end-to-end would you need to measure one million mm (1 km)?
A. 3,333.3 rulers.
- How long is a million seconds?
A. 11.57 days.
- If you made £1,000 per week, and you did not spend anything, how long would it take you to make £1 million?
A. Nearly 20 years (19.2 years).

Underlying principles:

- Since pupils find difficulty in working with large numbers, it helps to ask them to visualise what the large numbers would look like in different contexts.

Thinking skill development:

A pattern develops as pupils try to imagine larger and larger numbers. Cognitive conflict occurs when the numbers seem impossibly large. Discussion of the best ways to explain this to other people involves metacognition. Applying pupils' counting and various methods of showing deep time to the reality of geological time involves bridging.

Resource list:

- good imagination
- Optional;*
- toilet roll and cut-out cards
- chalk and measuring tape
- graph paper
- access to the internet

Useful links:

Toilet roll of time:

https://www.earthlearningidea.com/PDF/234_Toilet_roll_of_time.pdf

How many for a million?

https://www.earthlearningidea.com/PDF/149_Million.pdf

Source:

Developed by Elizabeth Devon and the ELI Team from an idea in the Stoke-on-Trent publication, 'Geology Activities for Primary Schools and Museums'.

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