FEATURE 4 May 2016

Last days of Earth: Timeline to the end of everything

The first living molecules appeared 3.8 billion years ago and on current estimates, the last cells will be snuffed out in another 3 billion years. Along the way, several factors could have huge consequences for what survives and where

3.8 billion years ago

The spark of life animates molecules for the first time

3.5 billion

The first cells form in water, somewhere

2.4 billion

Photosynthesising bacteria start coughing oxygen into the atmsophere

2 billion

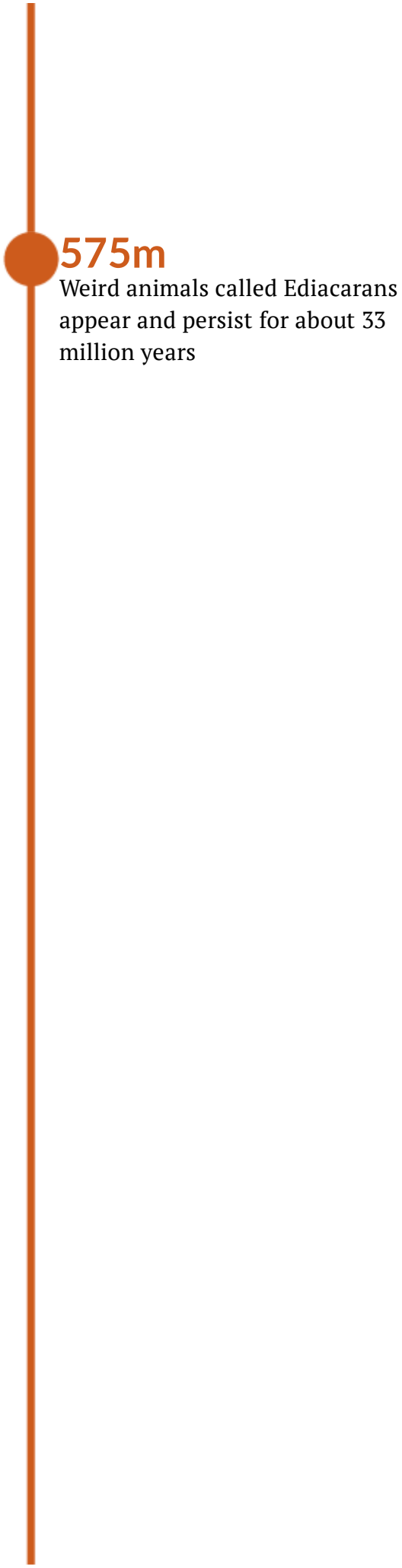
The first complex cells are “born” and…

1.5 billion

…divide into three groups: the ancestors of plants, animals and fungi

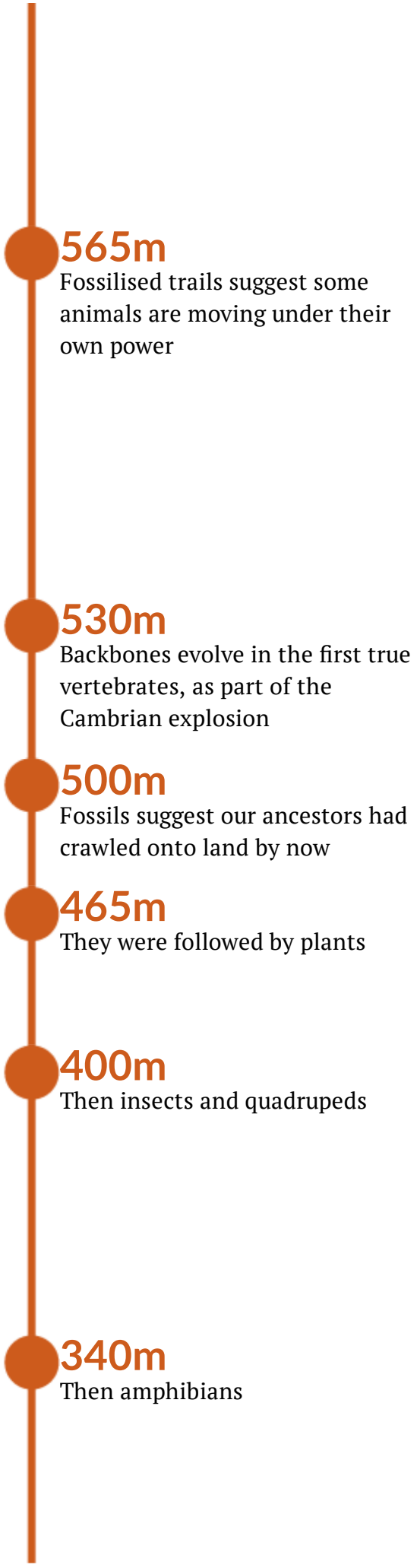
650 million years ago

Tiny jellyfish are the first complex animals. Some say sponges came first, but recent genetic evidence suggests not



575m

Weird animals called Ediacarans appear and persist for about 33 million years


565m
Fossilised trails suggest some animals are moving under their own power
530m
Backbones evolve in the first true vertebrates, as part of the Cambrian explosion
500m
Fossils suggest our ancestors had crawled onto land by now
465m
They were followed by plants
400m
Then insects and quadrupeds
340m
Then amphibians


250m
Early dinosaurs make an appearance
150m
Archaeopteryx takes to European skies
130m
Flowers!
65m
Bye bye dinosaurs, hello mammals

25m

Apes split from monkeys

7-6m

Our ancestors split from chimps and bonobos

All of humanity fits in this box

200,000 years ago

Homo sapiens stands up and walks out onto the African savannah

YOU ARE HERE

Humans colonise every corner of the planet

800,000 years ahead

If we have the same lifespan as other big mammals, we go extinct. But extra smarts and technology could give us more time

If, by some remarkable feat, *Homo sapiens* or its descendants manage to keep going for hundreds of millions of years, the soaring temperatures would start to be a real problem. Humans could perhaps buy even more time by building a planetary sunshade, or (why not?) pushing Earth out of orbit

500 million years ahead

Water world scenario

Earth's core cools and plate tectonics grind to an early halt. Mountains stop rising, and erosion flattens most of them within 20 million years.

As erosion flattens the land, the oceans start to flood the continents. Remaining peaks become refuges for life. Elsewhere, only marine life survives. Plants die as CO_2 levels fall

500 million years ahead

As the sun gets hotter, rising temperatures boost silicate rock weathering (see main story). As a result, more and more CO_2 is sucked out of the atmosphere. Plants struggle to photosynthesise and start to die. With plant food becoming scarce, the great animal die-off begins

Large mammals are first, followed by small mammals, then birds, amphibians, large fish, reptiles, small fish, until only marine invertebrates and microbes remain. Battered by rising temperatures and radiation, life goes through a renewed evolutionary explosion. Completely new life forms could arise

800m

The last mountains are eroded. Earth becomes a water world. Without nutrients flowing off the land, even marine life starts to go extinct

900m

CO2 levels drop below the minimum needed for plant life. Only microbial photosynthesisers are left.

For a while, insects that can eat dead plants will hang around, but soon only creatures that don't need plants can survive. Tube worms feed off chemicals from underwater hydrothermal vents. Tardigrades could eat bacteria and other, smaller, tardigrades

1 billion

The sun is 10 per cent brighter than in the 21st century. The average temperature is 47 ˚C. Oceans start to evaporate. Only microbes survive. Go to 3 billion

1 billion

The sun is 10 per cent brighter than in the 21st century. The average temperature is 47 °C. Oceans start to evaporate. This spells the end for even the hardiest animals. For the first time in about

4 billion years, Earth is a microbial world

1.1 billion

CO2 levels fall so low that even microbial photosynthesis ends. Some microbial life marches on, using energy from chemical compounds rather than light

1.2 billion

The equator becomes too hot for the microbes still clinging on in pockets of water. They are extinguished first at sea-level…

1.5 billion

Tilted planet scenario

The moon has been slowly moving away, and by now it is causing Earth's axis to swing. Earth settles at an extreme tilt. Some regions are protected from the sun, temperatures dip below 100 °C for part of the year, and some cave systems even have liquid water year-round. Even deeper down, it freezes, and in these cold-trap caves microbes survive for more than a billion years

1.5 billion

…then at the tops of equatorial mountains

1.85 billion

It's now getting too hot even at the poles. Microbes start to die in sea-level pools…

2.2 billion

…and then at altitude. The surface is now sterile. Underground, microbes stick around for a little while longer

2.8 billion

On the tilted planet, even the deepest caves have become too hot for life. Microbes in the subsurface hold on for another 200 million years

3 billion
3 billion
3 billion

Evaporating oceans cause a runaway greenhouse effect. Temperatures rocket. Even microbes deep beneath the surface cannot hold out. Earth becomes sterile

4 billion

The heat is now great enough to melt rock

7.5 billion

The sun expands to become a red giant. Soon after that, Earth and the moon are engulfed by it. The sun's habitable zone shifts to the outer solar system. Jupiter's moon Titan might just warm up enough for life to evolve. Maybe

Read more about the weird evolution, wild weather, and possible ways to escape the last days of Earth

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Magazine issue 3072 published 7 May 2016