



# The human **epoch**

Humans have only been part of Earth's history for the blink of a geological eye, but in that time we have made a profound mark on the planet. Fifty years ago we were starting to realise the extent of our influence; today we are debating whether it has moved Earth into a new geological epoch. Alex Peel explains what's behind the concept.

**I**t will take quite some power of deduction to piece the puzzle together.'

Dr Jan Zalasiewicz, a palaeobiologist at the University of Leicester, is speculating on what evidence humanity will leave for the geologists of future civilisations.

He's one of a growing number of scientists who believe our imprint on the planet is now so profound that we have entered a new phase in Earth's history – the epoch of humans.

Last year a disparate group of experts from around the world, dominated by geologists, ecologists and climate scientists, embarked on a lengthy process aimed at deciding whether to formally recognise the Anthropocene, as it's been called, as a new

unit of geological time.

It will be a momentous decision for humanity and our relationship with the planet. Is Earth, for the first time in its 4.6-billion-year history, being fundamentally changed by just one of its species?

The evidence is compelling. From pole to pole and the deep ocean to the upper atmosphere and beyond, humanity's imprint is inescapable.

We've shifted rainfall patterns, changed the course of major rivers and almost dried out the Aral Sea. Each year, we're cutting down an area of rainforest the size of Greece, and around a third of Earth's land is now used for agriculture.

We've altered the chemistry of the

atmosphere to the extent the climate has warmed and a hole has opened up in the ozone layer above Antarctica.

Our litter extends to the remotest regions of the Southern Ocean, the deepest sea floors, and even beyond the planet's boundaries – NASA is tracking more than half a million bits of old satellite racing around the Earth at speeds of up to 17,500mph.

Perhaps the most visually striking demonstration of humanity's influence comes in the twinkling lights scattered across the dark half of Earth's surface, clustered around towns and cities and captured in images taken from our outposts in space.

## Going underground

Our mark extends too into the unseen world beneath our feet. Our imprint on Earth's geology dates back more than 5,000 years, to shallow mines dug for metals and flint.

As the industrial revolution unfolded from around 1760, the world's hunger for minerals and coal grew rapidly. Mines became deeper and more widespread and, in 1863, the first underground transport network was built in London.

These endeavours have all altered the fabric of the rock and, in some cases, introduced man-made materials never before seen in the Earth's geological record.

From the mid-20th century, our excursions into deep rock gathered pace, spreading from land to the sea. Deep caverns, like Germany's 750-metre-deep Asse II, have been dug out to store hazardous waste, and nuclear bomb tests have fractured and melted rock up to 1.5km below the surface.

The total length of all the world's oil-field boreholes is now estimated at 50 million kilometres – roughly the distance between Earth and Mars.

The world's deepest borehole, the Kola Superdeep in Russia, extends 12km into the Earth's crust. The closest any other animal is known to have come to these depths are the 12-metre-deep caves dug by Nile crocodiles for hibernating in the dry season.

All this has happened in the geological blink of an eye. If the planet's history were strung out across outstretched arms, modern humans would exist for less than the length of a fingernail. Our species, *Homo sapiens*, has been witness to less than 0.005 per cent of the whole show.

And much of our mark has been created in just the last 250 years, driven by the growth of technology and an explosion in our numbers. Since 1800 our population has risen from one billion to just over seven billion. By 2050, some estimate there will be more than ten billion of us.

## Writing ourselves into the geological record

One of the big questions facing the International Commission on Stratigraphy (ICS) is how much of that mark is permanent and how much will be rubbed away with the passing of time.

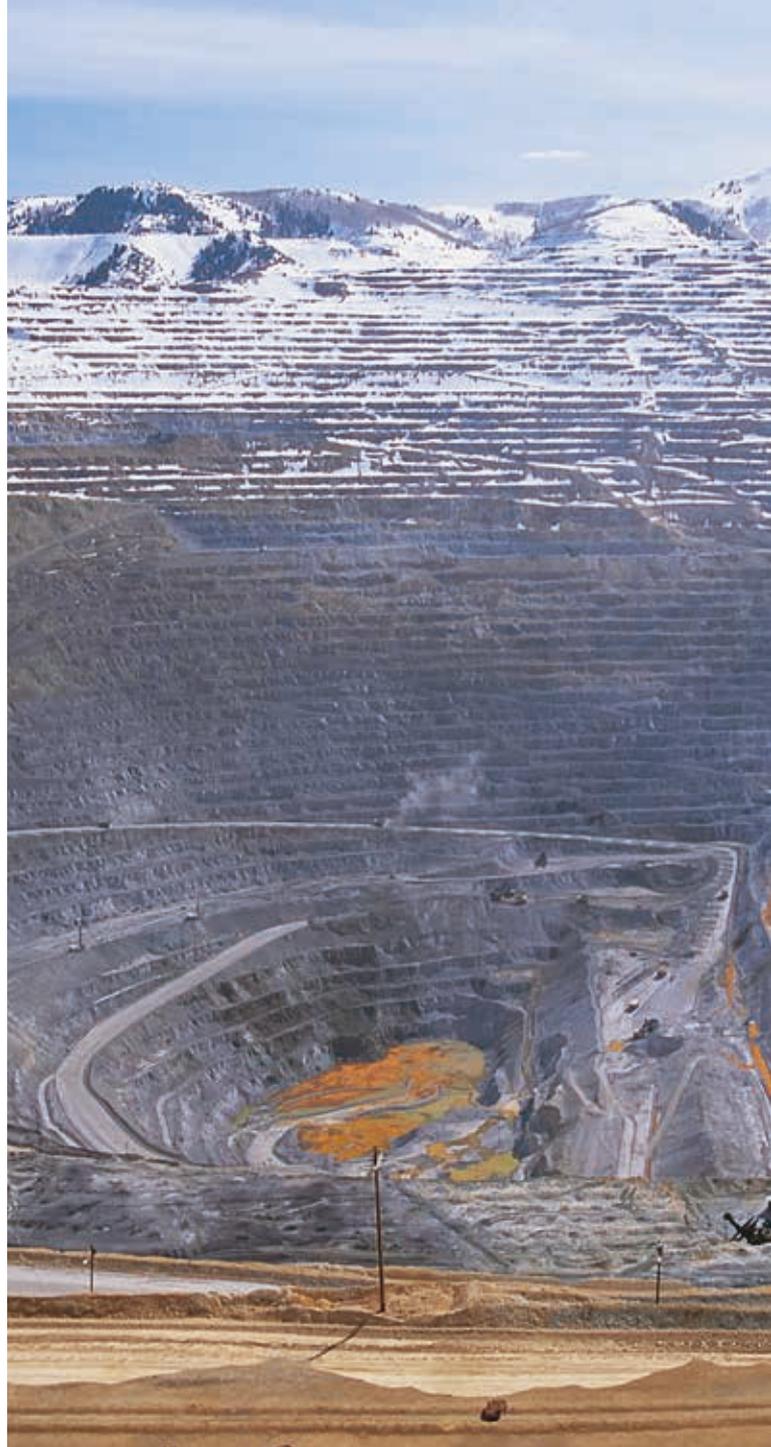
The vast changes that we've set under way at the surface will eventually form a highly distinctive layer in the Earth's rocks, explains Zalasiewicz. But there it will be subject to weathering and erosion which, over time, will wear it down. The mark we're leaving beneath the surface will be harder to shift.

'The underground world is not one that most of us experience directly,' he says. 'Effectively it's out of sight, out of mind. But we're leaving a mark on the geology that will last for millions of years, probably more. Whatever we do in the future, that influence is only going to grow.'

The other big issue to decide is when the Anthropocene began. Officially at least, we are still in the Holocene epoch, which began at the end of the last ice age around 10,000 years ago. When did it end?

Paul Crutzen, the Dutch chemist and Nobel prize-winner who first coined the term Anthropocene, favoured the beginning of the industrial revolution. Others argue for 1945 and the introduction of radionuclides from atomic bombs.

These will form a clear, global line in the rock, a blessing for those geologists of the future. 'If they are very lucky, they will find



“It will be a momentous decision for humanity and our relationship with the planet.”

a distinct surface layer with lots of cross-cutting features extending down for a number of kilometres,' says Zalasiewicz.

A 37-strong working group plans to submit a proposal to the International Geological Congress in 2016. The group's dossier will then be passed to the sub-commission on Quaternary stratigraphy. If approved, it goes to the whole of the ICS for a final decision.

Like most things geological, it's a slow but important process. The final decision could say much about how we see ourselves and our place in the environment.