Opinion

Fossil fuel burning once caused a mass extinction – now we’re risking another

George Monbiot

The Devon coastline reveals that Earth was in a near-lifeless state for up to five million years after the last extinction event

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Budleigh Salterton, on the south coast of Devon, sits above the most frightening cliffs on Earth. They are not particularly high. Though you don't want to stand beneath them, they are not especially prone to collapse. The horror takes another form. It is contained in the story they tell. For they capture the moment at which life on Earth almost came to an end.

The sediments preserved in these cliffs were laid down in the early Triassic period, just after the greatest mass extinction in the history of multicellular life that brought the Permian period to an end 252m years ago. Around 90% of species died, and fish and four-footed animals were more or less exterminated between 30 degrees north of the equator and 40 degrees south.

Most remarkably, while biological abundance (if not diversity) tends to recover from mass extinctions within a few hundred thousand years, our planet remained in this near-lifeless state for the following 5m years. In studying these cliffs, you see the precipice on which we teeter.

The lowest stratum at the western end of the beach is a bed of rounded pebbles. These are the stones washed off Triassic mountains by flash floods and deposited in great dumps by temporary rivers. Because the forests and savannahs that might have covered the mountains had died, there was nothing to hold the soil and subsoil together, so erosion is likely to have accelerated greatly.

At the top of the pebble bed is a stony desert surface. The pebbles here have been sculpted by the wind into sharp angles and varnished with shiny oxides, suggesting the surface was unchanged for a long time. Above it are towering red Triassic sand dunes. Through a quirk of erosion, these soft deposits have been sculpted into hollows that look uncannily like fanged and screaming skulls.

We now know that there were two main pulses of extinction. The first, which began 252.1m years ago, mostly affected life on land. It coincided with a series of massive volcanic eruptions in the region now known as the Siberian Traps. The second, more devastating phase, started about 200,000 years later. It almost completed the extinction of terrestrial life, as well as wiping out the great majority of species in the sea.

Though we cannot yet be sure, the first phase might have been triggered by acid rain, ozone depletion and metal pollution caused by volcanic chemicals. As rainforests and other ecosystems were wiped out, more toxic compounds were released from exposed soils and rocks, creating an escalating cycle of collapse.

The second phase appears to have been driven by global heating. By 251.9m years ago, so much solidified rock had accumulated on the surface of the Siberian Traps that the lava could no longer escape. Instead, it was forced to spread underground, along horizontal fissures, into rocks that were rich in coal and other hydrocarbons. The heat from the magma (underground lava) cooked the hydrocarbons, releasing vast amounts of carbon dioxide and methane. In other words, though there were no humans on the planet, this disaster seems to have been caused by fossil fuel burning.

Temperatures are believed to have climbed by between 8C and 10C, though much of the second phase of extinction might have been caused by an initial rise of between 3C and 5C. The extra carbon dioxide also dissolved into the oceans, raising their acidity to the point at which many species could no longer survive. The temperature rise appears to have brought ocean currents to a halt, through the same mechanism that now threatens the Atlantic meridional overturning circulation, which drives the Gulf Stream. As wildfires raged across the planet, incinerating the vegetation protecting its surface, ash and soil would have poured into the sea, triggering eutrophication (an excess of nutrients). In combination with the high temperatures and stalled circulation, this starved the remaining life forms of oxygen.

A paper released as a pre-print in September might explain why recovery took so long. Because so many of the world's rich ecosystems had been replaced by desert, plants struggled to re-establish themselves. Their total weight on Earth fell by about two thirds. Throughout these 5m years, no coal deposits formed, as there wasn't sufficient plant production to make peat bogs. In other words, the natural processes that remove CO2 from the atmosphere and turn it into wood and soil or bury it as fossil carbon stalled. For 5m years, the world was trapped in this hothouse state. In the cliffs at the eastern end of the bay, you can see when conditions began, at last, to change, as the fossilised roots of semi-desert plants twist down through the ancient sand dunes.

The story the cliffs tell is of planetary tipping points: Earth systems pushed past their critical thresholds, beyond which they collapsed into a new equilibrium state, that could not be readily reversed. It was a world hostile to almost all large life forms: the monsters of the Permian were replaced nearly everywhere by dwarf fauna.

Could it happen again? Two parallel and contradictory processes

are in play. At climate summits, governments produce feeble voluntary commitments to limit the production of greenhouse gases. At the same time, almost every state with significant fossil reserves - including the UK - intends to extract as much as they can. A report by Carbon Tracker shows that if all the world's reserves of fossil fields were extracted, their combustion would exceed the carbon budget governments have agreed sevenfold. While less carbon is contained in these reserves than the amount produced during the Permian-Triassic extinction, the compressed timescale could render this release just as deadly to life on Earth. The increase in atmospheric CO2 at the end of the Permian took about 75,000 years, but many of our fossil fuel reserves could be consumed in decades. Already, we seem to be approaching a series of possible tipping points, some of which could trigger cascading collapse.

Everything now hangs on which process prevails: the sometimes well-meaning, but always feeble, attempts to limit the burning of fossil carbon, or the ruthless determination - often on the part of the same governments - to extract (and therefore burn) as much of it as possible, granting the profits of legacy industries precedence over life on Earth. At the climate summit this month in Egypt, a nation in which protests are banned and the interests of the people must at all times cede to the interests of power, we will see how close to the cliff edge the world's governments intend to take us.

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