Rocks can restore our climate... after 300,000 years

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(Phys.org) —A study of a global warming event that happened 93 million years ago suggests that the Earth can recover from high carbon dioxide emissions faster than previously thought, but that this process takes around 300,000 years after emissions decline.

Scientists from Oxford University studied rocks from locations including Beachy Head, near Eastbourne, and South Ferriby, North Lincolnshire, to investigate how chemical weathering of rocks 'rebalanced' the climate after vast amounts of carbon dioxide (CO_2) were emitted during more than 10,000 years of volcanic eruptions.

In chemical weathering CO_2 from the atmosphere dissolved in rainwater reacts with rocks such as basalt or granite, dissolving them so that this atmospheric carbon then flows into the oceans, where a large proportion

is 'trapped' in the bodies of marine organisms.

The team tested the idea that, as CO2 warms the planet, the reactions involved in chemical weathering speed up, causing more CO2 to be 'locked away', until, if CO2 emissions decline, the climate begins to cool again. The Oxford team looked at evidence from the 'Ocean Anoxic Event 2' in the Late Cretaceous when volcanic activity spewed around 10 gigatonnes of CO2 into the atmosphere every year for over 10,000 years. The researchers found that during this period chemical weathering increased, locking away more CO2 as the world warmed and enabling the Earth to stabilise to a cooler climate within 300,000 years, up to four times faster than previously thought.

A report of the research is published in this week's *Nature Geoscience*.

'Looking at this event is rather like imagining what the Earth would be like if humans disappeared tomorrow,' said Dr Philip Pogge von Strandmann of Oxford University's Department of Earth Sciences, who led the research. 'Volcanic CO2 emissions in this period are similar to, if slightly slower than, current manmade emissions so that we can imagine a scenario in which, after human CO2 emissions ceased, the planet's climate would start to recover and cool down. The bad news is that it's likely this would take around 300,000 years.'

Reconstructing a record of past chemical weathering is challenging because of how plants and animals take carbon out of the environment. To get around this the team used a recently-developed technique involving studying lithium isotopes in marine limestone (this lithium could only come from weathering and is not changed by biological organisms).

The Ocean Anoxic Event 2 is believed to have been caused by a massive increase in volcanic activity in one of three regions: the Caribbean,

Madagascar, or the Solomon Islands. The event saw the temperature of seawater around the equator warm by about 3 degrees Celsius. It is thought that this warming caused around 53% of marine species to go extinct. Animals like turtles, fish, and ammonites were amongst those severely affected.

'Everyone remembers the mass extinction of land animals caused by the K-T meteorite impact 30 million years later, thought to be responsible for the demise of the dinosaurs, but in many ways this was just as devastating for marine life,' said Dr Pogge von Strandmann. 'Whilst nutrients from weathering caused a population boom of some species near the surface of the oceans, it also led to a loss of oxygen to the deeper ocean, killing off over half of all marine species and creating a 'dead zone' of decaying animals and plants. It's a scenario we wouldn't want to see repeated today.

'Our research is good news, showing that the Earth can recover up to four times faster than we thought from CO2 emissions, but even if we stopped all emissions today this recovery would still take hundreds of thousands of years. We have to start doing something soon to remove CO2 from the atmosphere if we don't want to see a repeat of the kind of mass extinctions that global warming has triggered in the past.'

A report of the research, entitled 'Lithium isotope evidence for enhanced weathering during Oceanic Anoxic Event 2', is published in *Nature Geoscience*.

More information: www.nature.com/ngeo/journal/va … nt/abs/ngeo1875.html

Provided by Oxford University