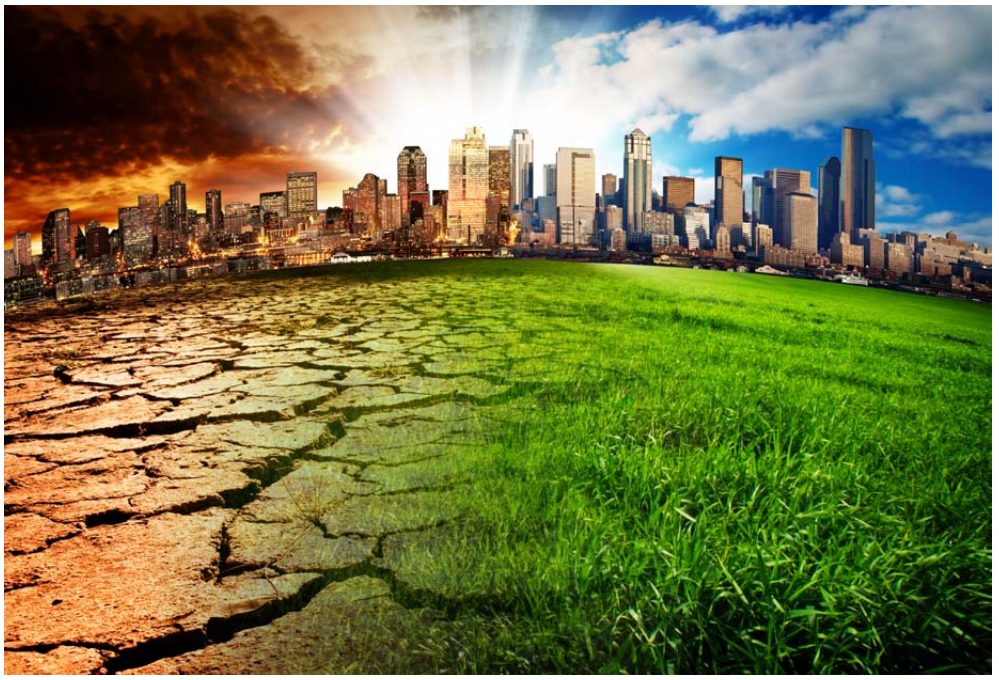
How quickly will our planet recover from global warming?

Green. The Earth is under extreme stress due to the enormous amount of CO2 we release into the atmosphere. Metro finds out what to expect.



Situation. According to experts, we are currently adding around 40 billion tons of CO2 per year to the atmosphere, and weathering is annually removing just 0.5 billion tons. / ISTOCK

Daniel Casillas
Metro World News

For several years we have been able to observe the impact of global warming on the environment in different parts of the world, including an increased number of floods, storms and forest fires. That is why many people started to wonder whether our planet can actually recover.

Scientists at Johannes Gutenberg University of Mainz (JGU), Germany have recently decided to investigate that. Professor Philip Pogge von Strandmann looked at the significant increase in global temperatures – between five and eight degrees Celsius – that occurred 56 million years ago, the most rapid natural warming period that has had an impact on our climate, known as the Paleocene-Eocene Thermal Maximum.

This natural warming period is believed to have been triggered by a volcanic eruption that released enormous amounts of carbon dioxide into the atmosphere.

The JGU experts explained that the higher the temperature, the faster the rock weathers and, in addition, if there is a lot of CO2 in the atmosphere, some of it reacts with water, forming carbonic acid, the same acid that promotes and accelerates the weathering process. Because of this process, the atmospheric carbon will eventually reach the seas through rivers, where it will bind with CO2 in the form of carbonate and form a persistent reservoir of carbon dioxide in the ocean.

"Our theory was that if rock weathers faster due to the increased temperatures, it also helps convert a lot of carbon dioxide from the atmosphere into insoluble carbonate in seawater – meaning that, over the long term, CO2 levels would end up falling again and the climate would ultimately recover," Pogge von Strandmann, explained to Metro.

> "The theory is that the Earth has a "weathering thermostat" that stabilizes climate and stops it from going runaway greenhouse (like Venus) or runaway icehouse (like Mars)."
>
> **PHILIP POGGE VON STRANDMANN,** professor at Johannes Gutenberg University Mainz and lead author of the research.

To prove that rock weathering contributes to climate stabilization, the scientist and his team decided to analyze similar processes that occurred during the warming event 56 million years ago.

CIFRA

20-50K

Years passed for the climate to stabilize after the global warming event that happened 56 million years ago.

"Rock weathering during that time increased by 50 per cent as a result of global warming; erosion – the physical part of weathering – actually tripled. Another consequence of the rise in temperature was that evaporation, rainfall, and storms also increased, which then led to even more erosion. As a result of this increased rock weathering, the climate stabilized. But it took between 20k and 50k years for this to happen," he concluded.

The authors pointed out that in the future it is likely that weathering and erosion will increase, as well as storms and extreme weather.

Metro talked with Philip Pogge von Strandmann to learn more.

R-UP

Four effects of global warming

1 Heat
As climate change progresses, phenomena such as heatwaves, which occur when maximum temperatures persist for an unusual period of time, become more common.

2 Floods
Hundreds of millions of people in urban areas around the world are expected to be affected by rising sea levels, intercontinental flooding, increased precipitation, cyclones and stronger storms.

3 Extreme weather events
Exceeding the 1.5°C temperature limit would result in a further increase in extreme heat, torrential rains and the likelihood of droughts.

4 Fires
Climate change will transform the fire regime in the coming years, leading to more intense phenomena and greater deforestation.

3 QUESTIONS TO...

Philip Pogge von Strandmann

professor at Johannes Gutenberg University of Mainz, Germany

1 Why is it important to know the climate recovery time?
—Firstly, because it's important for understanding the effect of CO2 on climate. If you only concentrate on the addition of CO2 to the atmosphere, but ignore the removal, you don't get the whole picture – and you don't necessarily know how much CO2 causes a certain amount of warming (say, if the removal is very fast, more CO2 will have to have been added to cause a certain amount of warming).

Secondly, because climate change in the past always led to mass extinctions, it has never managed to wipe out all life. In other words, how has the Earth managed to keep life for around 3.5 billion years (around 80% of its existence) without life being wiped out? The recovery time and method from a change in climate are important.

2 How did you conduct the research?
— We used the two isotopes of lithium, (Li-6 and Li-7), whose ratio to each other is changed by the weathering process. We then analyzed Li isotopes in ocean rocks that were deposited during the PETM (Paleocene-Eocene Thermal Maximum). These rocks are marine limestones that record ocean chemistry as they form.

Effectively, rivers cause the weathering that altered the lithium isotope ratio, and this is then washed into the oceans by the rivers. This alters the chemistry of the oceans and is recorded in the limestone. We measure this chemistry change and work back to understanding the weathering changes.

3 How might our planet recover from the current situation and how long would it take?
– Increased weathering will occur (and is already occurring) due to current warming. Unfortunately, it is a slow process and is currently still removing far less CO2 than we are adding. So we are adding around 40 billion tons per year to the atmosphere, and weathering is currently removing about 0.5 billion tons per year. So it will be at least 30,000 to 50,000 years after we stop adding significant CO2 to the atmosphere (possibly even up to 100,000 years, depending on how much CO2 we continue to add) before the climate recovers from this.

There is a potential method known as "enhanced weathering", where we could artificially speed up weathering and CO2 removal. You do this by grinding up rock into a powder (so it weathers faster) and plowing it into fields, where it also acts as a fertilizer. This is now being studied experimentally at the field scale. But even if it works, we need to reduce emissions, because it still won't remove enough CO2 if we don't.