NEWS

Snowball Earth events may have been triggered by explosive underwater volcanoes

ABC Science By Stuart Gary

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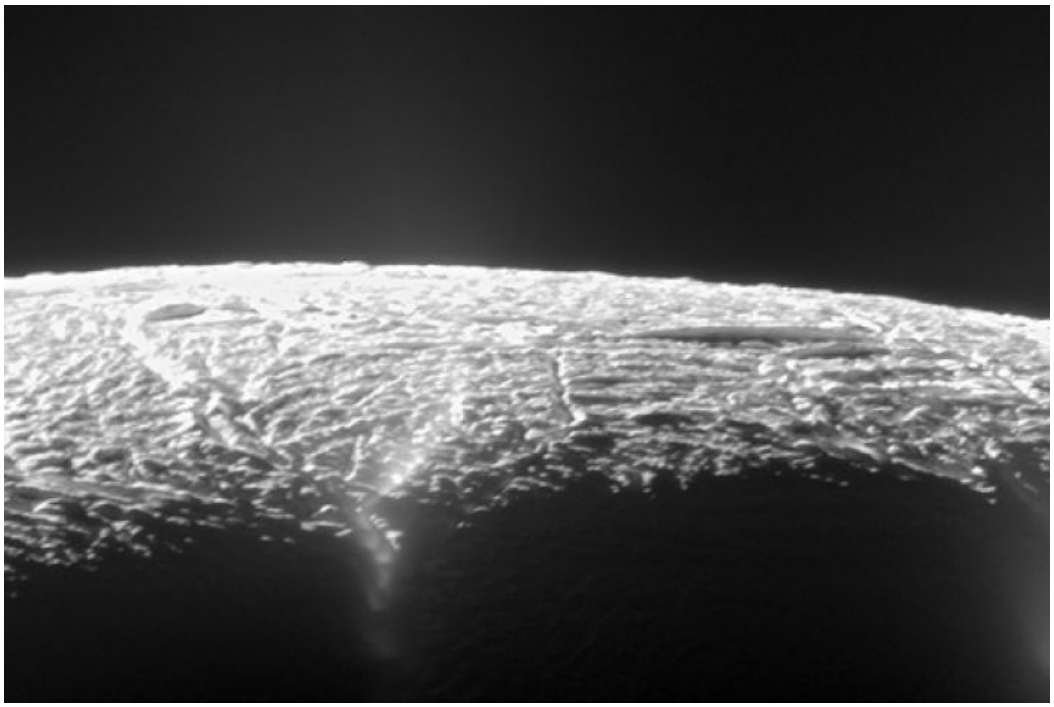

PHOTO: The world may have been completely covered in frozen ice sheets during 'Snowball Earth' events. (NASA/JPL)

Extensive underwater volcanism caused by the breakup of an ancient supercontinent may have pushed the Earth into a period of extreme freezing 750 million years ago, according to a new study.

The research, reported in the journal Nature Geoscience, may also help explain how animal life began on Earth millions of years later, scientists said.

"A Snowball Earth is an extreme event and the planet almost didn't get out of it," one of the study's authors Professor Eelco Rohling, of the Australian National University, said.

"Our hypothesis provides a single mechanism that explains several different aspects of the Snowball Earth state."

According to the Snowball Earth hypothesis, most or all of Earth was covered in ice sheets at least once in the planet's history, but it is not clear what caused this extreme glaciation.

Key facts:

- Volcanic chemicals released in eruptions saturate oceans, removing carbon-dioxide from atmosphere and cooling the planet
- Chemicals leached from glassy volcanic rock formed sediment on the sea floor
- The chemicals may also explain high levels of phosphorus in oceans thought to be catalyst for origin of animal life

It had been widely thought that the run-off from rivers into the ocean caused by the break-up of the vast supercontinent Rodinia changed the chemistry of the ocean, reducing the amount of carbon-dioxide (CO_2) in the atmosphere, which in turn increased global ice coverage.

The vast icesheets covering the continents reflected sunlight away from the Earth, further cooling the planet.

"That kicks the world through a tipping point into a snowball state where the oceans start to freeze over as well," Professor Rohling said.

"The sea ice forms because of the large scale glaciation on land."

The Earth stayed locked in this state for millions of years.

"Eventually land-based volcanism pumps so much CO2 into the atmosphere that it pushes the planet out of the Snowball Earth phase," Professor Rohling said.

But the existing hypothesis does not explain how thick deposits of carbonate rock such as limestone — known as cap carbonates — were laid down as the Earth warmed.

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>
> Professor Eelco Rohling

Volcanoes altered ocean chemistry

Simulations by Professor Rohling and colleagues indicated the breakup of the Rodinia supercontinent may have released huge volumes of volcanic chemicals that saturated the oceans and drew CO2 out of the atmosphere cooling the planet.

As the supercontinent Rodinia started to break up, extensive shallow marine volcanic activity produced large amounts of glassy volcanic rock, called hyaloclastite, that readily break down releasing large amounts of chemicals into the ocean.

"In the past the big question has been: how could large continental weathering deposit so much mineral into the oceans if the land is covered in icesheets," Professor Rohling said.

"The hyaloclastite eruptions do that — turning the ocean very rich in calcium, magnesium, silicon and phosphorus."

Eventually when the Earth warmed and the ice broke apart, light penetrated the oceans allowing algal life to pick up again and undertake photosynthesis.

"The phosphorus [leached from the hyaloclastite minerals] is a nutrient generating huge algal blooms which fix carbon and release oxygen, essential for the development of animal life," Professor Rohling said.

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