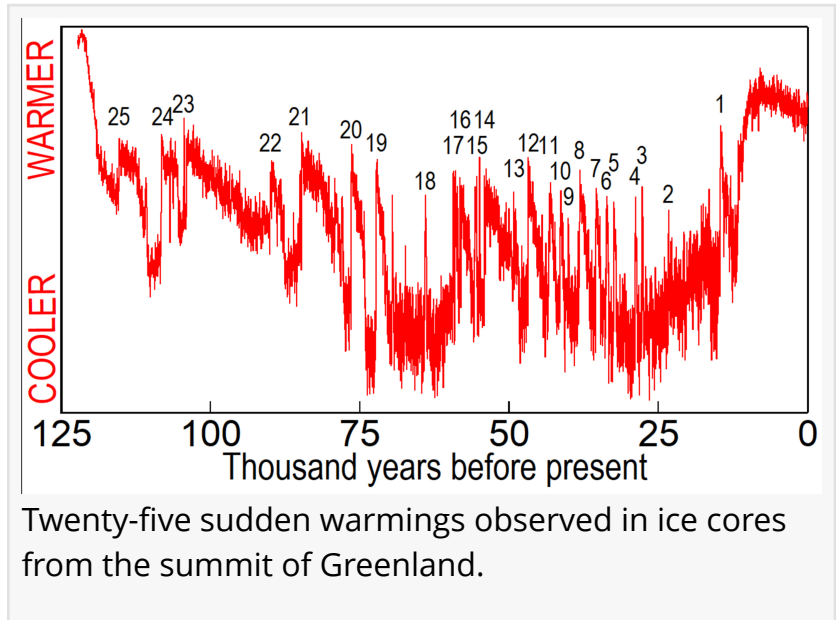


New Data Shows That Climate Changes Far More Rapidly and Frequently Than Currently Imagined

For millions of years, air temperatures rose suddenly within years and cooled slowly over a few thousand years forming highly erratic, saw-toothed sequences.

JACKSON, WYOMING, UNITED STATES, October 22, 2020 /EINPresswire.com/ -- Detailed analyses of air bubbles in ice cores drilled under Summit Greenland document 25 times from 115,000 to 10,000 years ago when air temperatures in Greenland warmed 10 to 16° (18 to 29°) out of ice-age conditions within years but then cooled incrementally back into ice-age conditions over millennia. These saw-toothed sequences were highly erratic in onset, intensity, and duration but averaged about 4000 years in length.



Twenty-five sudden warmings observed in ice cores from the summit of Greenland.

“

I started wondering how volcanic eruptions could cause warming. As I worked my way through more than 10,000 scientific papers, clear scientific evidence led me to these most unexpected conclusions.”

Dr. Peter L. Ward

“Any explanation for the cause of climate change must explain these very distinctive footprints,” according to Dr. Peter L. Ward, a volcanologist and geophysicist who worked 27 years with the US Geological Survey. Ward has spent the last 14 years trying to understand both the relationship between volcanism and climate change and the physics of [why climate changes](#).

Ward will be presenting his conclusions at the annual meeting of the Geological Society of America on Thursday, October 27th in a session focused on volcanism and tectonics along rift zones and volcanic arcs.

All major explosive volcanic eruptions throughout recorded history have been followed by two to

four years of global cooling by approximately 0.5° (0.9°). For centuries, volcanologists and climate scientists have thought the primary effect of volcanic eruptions on climate was cooling. Throughout written history, many major famines and even the fall of empires have been contemporaneous with cooling following major explosive volcanic eruptions.

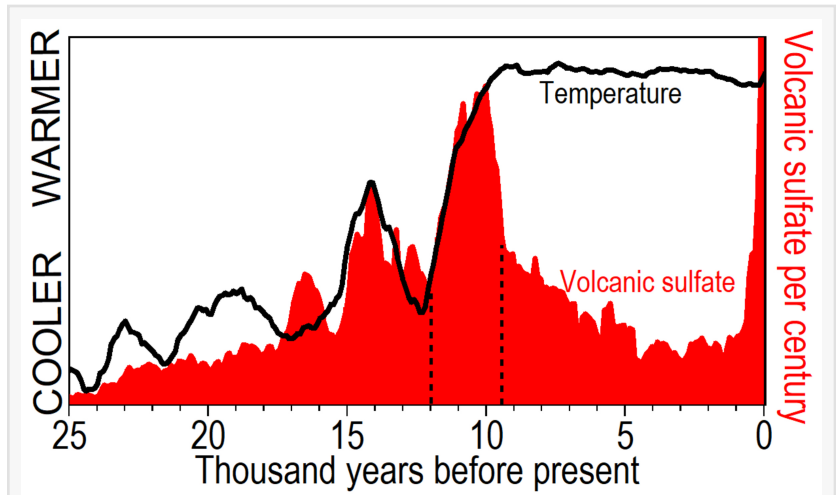
Explosive volcanoes eject megatons of water vapor and sulfur dioxide into the lower stratosphere where they form sulfuric-acid aerosols, or a mist, that spreads around the world within months, reflecting and scattering sunlight. The larger the explosive eruption the longer-lived the aerosols.

The largest explosive volcanic eruption since 1912 was in June 1991 when Mt. Pinatubo in the Philippines erupted. Using data from satellites, scientists were able to track the formation and spread of the aerosols.

Modelling shows that when ocean surface temperatures are decreased for only a few years, deeper ocean temperatures are decreased for as much as a century. Thus, several major explosive eruptions per century, continuing for millennia, can cool oceans slowly, incrementally, down into ice age conditions as observed.

“You can imagine my surprise,” Ward explains, “when I discovered excellent data showing that rapid warming at the end of the last ice age was contemporaneous with the greatest concentrations of volcanic sulfur dioxide in Greenland ice cores. This suggests that volcanic eruptions can also cause global warming. How could that be?”

The warming at the end of the last ice age was contemporaneous with basaltic volcanism primarily in Iceland. Basalt is a primitive magma that rises directly from deep within Earth’s mantle. Basalts are much hotter than explosive magmas. Basaltic eruptions are not usually very



The greatest volcanism (red) was contemporaneous with the greatest temperature (black) at the end of the last ice age.



The Bárðarbunga basaltic eruption in 2014-15 covered 33 square miles of land in central Iceland.

explosive. They just ooze basaltic lava out over the land as seen in Hawaii.

Twelve basaltic volcanic centers in Iceland formed precisely during the periods of greatest warming at the end of the last ice age. Throughout Earth history, periods of rapid warming have been contemporaneous with extensive flows of basaltic lavas. Two-hundred and fifty-one million years ago, for example, basaltic lavas covered an area in Siberia almost as large as the United States. Oceans became as hot as hot tubs. Nearly 96% of all marine species and 70% of all land species went extinct.

The most important evidence for explaining how basalts could cause warming started to accumulate in the late 1960s. Humans began manufacturing large volumes of chlorofluorocarbon gases (CFCs) used widely for refrigerants, spray-can propellants, and foam blowing agents. By 1970, the ozone layer in the lower stratosphere began to disappear. In late winter, ozone over Antarctica became depleted by as much as 90%, forming the well-known Antarctic ozone hole.

In 1974, atmospheric chemists discovered that CFC gases, when they reach the stratosphere, are broken down by solar ultraviolet radiation to release atoms of chlorine. One atom of chlorine can destroy 100,000 molecules of ozone. These scientists earned the 1995 Nobel Prize in Chemistry for their discovery.

When the ozone layer is depleted, more solar ultraviolet-B radiation is observed to reach Earth where it warms polluted air and oceans very efficiently. As production of CFCs increased, average global temperatures rose.

In 1987, the United Nations passed the Montreal Protocol on Substances that Deplete the Ozone Layer severely limiting production of CFCs. Sure enough, the increase in CFCs stopped in 1993. The increase in ozone depletion stopped in 1995. And the increase in global temperatures stopped in 1998. Humans had caused the warming by production of CFCs and humans stopped the increase in warming by curtailing the production of CFCs. Unfortunately, CFCs are very stable chemicals, so the warming will continue for many decades as the ozone layer slowly recovers.

Average global temperatures did not change much from 1998 through 2013. But they rose quickly from 2014 to 2016, the hottest year on record. In 2014, the basaltic volcano Bárðarbunga in central Iceland began erupting for six months. This was the largest basaltic eruption since 1783.

Since the last ice age, periods of major warming have been contemporaneous with major flows of basaltic lavas covering hundreds of square kilometers of land. Ward explains that “we do not yet know the precise chemical path for how the unusually high concentrations of chlorine and bromine in basaltic lavas reach the stratosphere, but convection above 12000 ft lava surfaces must play a major role.”

“But,” Ward exclaims, “[the greatest surprise](#) came when I discovered a mistake in the physics of warming that shows greenhouse gases cannot physically be the cause of warming observed since 1950 or throughout Earth history. Climate change appears to be controlled primarily by volcanoes. Basaltic lava flows cause rapid warming. Sequences of major explosive volcanic eruptions cause slow incremental cooling.”

Ward is somewhat amazed as he looks back at what happened. “In 2006, I started wondering [how volcanic eruptions could cause warming](#). As I worked my way through more than 10,000 scientific papers, clear scientific evidence led me to these most unexpected conclusions that appear to be revolutionary.”

Peter Ward

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