

TRENDS AND OBSERVATIONS

**Weather—
In case you want to worry**

BY RAUNO PERTTU

As a geologist, I have long been fascinated by the repeated wild climate changes that have marked our planet's long history. I don't want to harangue you with yet another argument either supporting or dismissing man's potential to change our future climate. Instead, I want to remind you that earth's climate has always been marked by dramatic temperature swings. Ongoing studies of earth's past climates are giving us an increasingly better understanding of just how extreme and sudden those climate shifts have been.

We tend to think of climate periods as being long and steady. I, for one, think of "ice ages" as long, relentlessly frozen periods and picture mammoths trudging across a frozen plain. However, I need to rethink that image. An article, printed in *Science*, Volume 327, Issue 5967, February 12, 2010, by Jeffrey A. Dorale et al, discusses evidence from the Spanish island of Majorca that sea levels fluctuated dramatically during a time period studied by Professor Dorale and a group of coworkers. Their observations indicate that 85,000 years ago sea levels were about 65 feet lower than today, as would be expected because this was in the middle of the last ice age, when large amounts of water were locked up in continental ice sheets. What the researchers didn't expect was that the Majorca records also indicate sea level jumped to about three feet higher than today by 81,000 years ago, then dramatically dropped back down to 50 feet lower than today 79,000 years ago.

The researchers interpret these puzzling sea level gyrations to mean that the world's ice sheets, complete with mammoths, were in full display 85,000 years ago, then rapidly melted over the next four thousand years to less ice than today, then even more rapidly reestablished over the next two thousand years. While these events seem implausible, data from certain other sites support these dramatic climate

and sea level swings. Furthermore, well-established events like the Younger Dryas, (explanation follows), show that similar major abrupt climate changes and associated sea level swings have occurred in our even more recent past. Prior to the Younger Dryas, which occurred from 12,900 to 11,500 years ago, our planet had just come out of our last ice age into very warm conditions. During the Younger Dryas, bitter ice age conditions returned in a temperature drop that apparently occurred in less than 10 years. After 1,300 icy years, the Younger Dryas deep freeze event ended as quickly as it began.

A paper discussing other rapid climate changes was presented last month by Dr. Don Easterbrook, an Emeritus Professor at Western Washington

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University. In it, Dr. Easterbrook charts at least ten major abrupt temperature changes within the past 15,000 years that were up to twenty times greater than the temperature changes of the past 100 years. Four of these abrupt temperature swings were temperature increases and six were temperature drops. Dr. Easterbrook points out that atmospheric carbon dioxide levels were not involved in these temperature swings. As a geologist, he reiterates that these types of abrupt temperature swings have occurred continuously in our geological past, and appear to be associated with a series of regular climate cycles.

The major temperature swings discussed by Professors Dorale and Easterbrook marked the boundaries of strongly differing climate cycles. These cycles mostly occurred before any influence from human activities, and do not appear to have been caused by

changes in atmospheric carbon dioxide or other greenhouse gases. These abrupt major climate shifts, were they to happen today, would cause world-wide social chaos. We have been conditioned to assume that global temperature changes are largely the result of changes in atmospheric carbon dioxide, and if we can only keep carbon dioxide levels from climbing, the climate will remain steady. This is clearly a false assumption. Mostly lost in these greater climate cycles are much shorter-lived events, which haven't been fully recognized in our history books, and the impacts of which also haven't been fully appreciated. In historical times, the majority of these events have been brief cold events that, if recognized, are remembered because they created human catastrophes.

The years 536 and 540 AD highlight a decade of abrupt bitter cold and famine across the Northern Hemisphere, possibly the coldest period in the past 2,000 years. In 535, a dark cloud was reported across Europe and Asia Minor, as well as obscured skies and famine in China. These events have been attributed to a major volcanic eruption, likely in the tropics, based on volcanic sulfate in Greenland's ice records. A less likely interpretation of a comet or asteroid impact has not been definitively ruled out.

The years 1783 and 1784 again marked weather extremes across the Northern Hemisphere. In Europe, the summer of 1783 was extremely hot, with a thick reddish haze that was blamed for the deaths of thousands. This record-hot summer was followed by a long bitterly cold winter across Europe and North America. Famines impacted Europe and Asia as far away as China and Japan, and

have been blamed for two million deaths.

All these seemingly disparate events appear to have been caused by the eruption of Iceland's Laki volcanic fissure zone and of a nearby associated volcano. The fissure zone released very large volumes of sulfur dioxide that spread across Europe in a poisonous haze. This sulfur dioxide cloud has been blamed for the deaths and freakish weather.

Thirty-three years later, across Europe and North America, 1816 was called the "year without a summer". Snow fell and crops froze repeatedly during the summer months, causing major food shortages. In China, the year was marked by extreme cold spells that killed crops and even trees, and by major flooding. These disasters have been linked to the major eruption of the Indonesian volcano Tambora in 1815.

Except for their record of human misery, these short, devastating events would be unknown by us today, yet they have occurred throughout history, and will continue to occur indefinitely into the future. We have been fortunate during the past two centuries to have largely avoided similar events.

A potentially important footnote is that the Iceland volcano that recently caused the air travel problems in Europe has been linked to the volcanic system and fissure zone, the eruption of which caused the 1783 climate disasters across Eurasia and North America. Some geologists are predicting that we could have a repeat of historic events. The Icelandic volcanoes apparently have cyclic periods of activity and quiet, and may now be finishing their quiet mode. As bad as our recent spring weather was, it could have been much worse. One of those memorable years is inevitably in our future.

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