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# The Two-Mile Time Machine: Ice Cores, Abrupt Climate Change, And Our Future



## Synopsis

Richard Alley, one of the world's leading climate researchers, tells the fascinating history of global climate changes as revealed by reading the annual rings of ice from cores drilled in Greenland. In the 1990s he and his colleagues made headlines with the discovery that the last ice age came to an abrupt end over a period of only three years. Here Alley offers the first popular account of the wildly fluctuating climate that characterized most of prehistory--long deep freezes alternating briefly with mild conditions--and explains that we humans have experienced an unusually temperate climate. But, he warns, our comfortable environment could come to an end in a matter of years. The *Two-Mile Time Machine* begins with the story behind the extensive research in Greenland in the early 1990s, when scientists were beginning to discover ancient ice as an archive of critical information about the climate. Drilling down two miles into the ice, they found atmospheric chemicals and dust that enabled them to construct a record of such phenomena as wind patterns and precipitation over the past 110,000 years. The record suggests that "switches" as well as "dials" control the earth's climate, affecting, for example, hot ocean currents that today enable roses to grow in Europe farther north than polar bears grow in Canada. Throughout most of history, these currents switched on and off repeatedly (due partly to collapsing ice sheets), throwing much of the world from hot to icy and back again in as little as a few years. Alley explains the discovery process in terms the general reader can understand, while laying out the issues that require further study: What are the mechanisms that turn these dials and flip these switches? Is the earth due for another drastic change, one that will reconfigure coastlines or send certain regions into severe drought? Will global warming combine with natural variations in Earth's orbit to flip the North Atlantic switch again? Predicting the long-term climate is one of the greatest challenges facing scientists in the twenty-first century, and Alley tells us what we need to know in order to understand and perhaps overcome climate changes in the future.

## Book Information

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## Customer Reviews

Recent news reports about large holes in the ice and open waters at the Arctic Circle have prompted renewed concerns about the effects of global warming. In measured tones, however, geoscientist Alley reminds us that during the last 100,000 years or so the earth has experienced a wildly varied climate pattern. Using readings of ice cores taken from Greenland, where he participated for several years in the '90s in far-reaching research projects, Alley demonstrates that periods of slow cooling and centuries of cold have been punctuated by periods of sudden warming. In fact, he notes, climatic stability is the exception rather than the rule, and he contends that the unusually warm, stable climate we have experienced for the past 10,000 years is an anomaly. Through his study of the two-mile-long ice cores, Alley reveals a number of elements that contribute to global climatic changes: wind patterns, drifting continents and ocean currents. In lively prose, he illustrates that climate can be stable, but when pushed to change by either human or natural forces such a change can occur more dramatically and at a faster rate than our industrial society has ever witnessed. Yet Alley is no alarmist in predicting the ways that human activities will affect climate and climatic changes will affect humans. Although not all scientists will agree with Alley's conclusions, his engaging book is a brilliant combination of scientific thriller, memoir and environmental science that provides instructive glimpses into our climatic past and global future that will appeal to readers interested in how our environment affects us. (Nov.) Copyright 2000 Reed Business Information, Inc. --This text refers to an out of print or unavailable edition of this title.

Alley, a participant in five expeditions to Greenland and three to Antarctica, well explains how the ice caps in both places record climate history, how to read those records in cylinders of bored ice, and what they reveal about changes in climate. He waits until the end to discuss the possibility of disaster, which, unfortunately, he thinks is highly likely, perhaps soon. The ice borings disclose a history of sudden changes in a continuity that is predominantly much colder than the period during which humanity has developed. Moreover, change can be triggered by "pushes" as large as continental drift or as seemingly puny as a change in the atmospheric balance of greenhouse gases. The latter can slow or stop the huge oceanic "conveyor belt" that warms the North Atlantic,

and then habitable, cultivable lands shrink due to plummeting temperatures and reduced precipitation. Is doom inevitable in our time? Given current knowledge, we can't say. But proceeding as if humanity could affect climate change is only prudent. Wonderfully accessible, information-packed science reading. Ray Olson Copyright © American Library Association. All rights reserved --This text refers to an out of print or unavailable edition of this title.

I've used this book in a course on the physics of the Earth and environment that I teach at a major university. Oddly enough, this year, this book was optional reading due lost instruction time in the aftermath of Hurricane Sandy (2012, Fall). The author really knows his stuff about ice core dating and the extraction of physical climate data from the ice record. The first half of the book is a fascinating and engaging read. The second half is very speculative. The conveyor belt analogy of ocean circulation is carried rather too far, it's not good enough to warrant the long discussion. There is an apparent logical error in the discussion, in that an influx of fresh water supposedly switches off a major circulation, and supposedly this is what drove past climate change. However those large ice sheets are now gone (Canada, Northern US) so all there is left for the switch is Greenland's and there is no evidence that the snow accumulation rate is decreasing. I'm left with the impression that increasing the atmospheric carbon dioxide level is a good thing because past ice ages were due to the ephemeral nature of water vapor in the atmosphere. The author rightly points this out about water vapor, and it is a fact that is not widely known. The book could use some serious stylistic editing. The discussion of the role of fresh water on the ocean circulation went in circles. It would be helpful if the discussion was simplified into a linear and cogent presentation. I recognize the problems because the same ones permeate my own writing. The cleaning-up that is needed in the second half represents the real work in writing a book like this. In its present form, the second half is a stream of consciousness that is somewhat formless. First Half: 5 stars (A+) Second Half: 2 stars (C) There really is no other book like this one that explains so nicely how physical historical climate data is extracted from environmental measurements. I plan to continue to use it.

This is fascinating stuff and is very readable for the non-professional earth scientist, but written by one of the foremost scientists in the field. The Two-Mile Time Machine is a two-mile ice core from Greenland, and what scientists can conclude from it. Any amateur with a good interest in earth science and climate change over the past 400,000 years will find this a very readable account of how ice cores can be deciphered to read past climates over that time-span. Unfortunately, this book is a bit out-of-date with regard to the current state of the global warming debate. Atmospheric CO<sub>2</sub>

has risen since this book was published, thus the reader will not read that CO<sub>2</sub> levels are now well above the peaks of the past 400,000 years. When this book was published the level was no higher than past peaks, and as these past peaks always presaged an on-coming ice-age, the author proffers the speculative prediction that we could quite suddenly descend into a new ice-age. This prediction is based on the remarkable observation which came from these ice cores that the onset of past ice ages are timed perfectly with the wobbles and eccentricities in the Earth's orbit, as argued by Milutin Milankovitch, a Serbian mathematician, in the 1920s. My one negative is the graphs are at too small a scale to read any fine detail, and in particular the important details of the past millenium. Otherwise, this is a 'must read' for anybody who is interested in past climates, climate change and ice-ages.

No one can dispute Alley's credentials in climatology. He is one of the most experienced in glaciology which is where most of what we know about the history of climate comes from. Here in plain language he describes how climate works and how drilling into ice tells us about climate's past. That past reveals larger and faster changes than civilized man has ever seen. The causes are many and complex. But we are far from knowing all of those causes and how they react with each other. We can be certain, however that significant climate change is not the result of a simplistic phenomenon. Alley writes as a scientist, not as a politician or advocate. He welcomes dissent and like all good scientists realizes that it is the road to progress. Try this. "What are the odds that natural or human activities will trigger an abrupt climate change big enough, fast enough, and soon enough to matter in economic discussions? The simple answer again is that we do not know." .... "Much knowledge is needed before we can begin to predict the known light switch, and it remains possible, though unproven, that "chaos" in the system will render such predictions difficult or impossible". "Nature certainly can start the climate jumping again. But can humans? The answer is 'maybe'. I have read dozens of books on climate change and have studied it for nineteen years. If you want the best general book on this subject, one that tries to make a complex science understandable, that even uses real humor, then read this. It is a book that is clear on its science. That is so because it is not dirtied up with politics, social advocacy or secular religion. After reading it, think for yourself. Then you will realize that scientific forecasts for the future of climate are merely the opinions of some scientists and those opinions are all over the place. Opinions are not science. Clear, falsifiable conclusions based on real evidence are. Such does not exist for the future of our climate. One should not confuse the elevation of some scientific opinion to authority with science itself. Science arose in opposition to authority. If you are truly interested in the real nature and status

of the science of climate, read this.

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