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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.

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Customer Reviews

I have lived in a good many places in the world, and I think I have never lived in a place where people didn't voice the witticism, "If you don't like the weather here, stick around twenty minutes and it'll change." We are quite used to rapid changes in weather, and all of us seem fascinated by the way one day is different from another, or at the mistakes the weather forecasters make. Only over the past few decades, however, have scientists been able to get a grip on something else fascinating: climate. Ice in Greenland has been piling up year by year for 100,000 years. This ice carries inside it a record of the climate that produced each yearly layer. In *The Two-Mile Time Machine: Ice Cores, Abrupt Climate Change, and Our Future* (Princeton University Press), Richard B. Alley, who has done research in Greenland and Antarctica, gives us a view of his narrow and deep studies, and tells us why they are important. It is the first book for the layman to show how climate historians are doing their jobs, drilling five inch cores two miles down, and analyzing the ice in many clever ways. For most of the 100,000 year record, the climate has had wild jumps, centuries of cold followed by abrupt heating. Humans have lived in an anomalous period of stability. There have been climate changes that influenced human life, like the warm spell that lured the Vikings to Greenland and the cold that drove them out, but these represent one degree shifts shown in the recent ice records. Teensy temperature changes have made what we would consider big climate differences, but when it comes to the wild changes, we ain't seen nothing yet. Yet.

Although I never completed the degree, I have most of a baccalaureate in geology. Since paleontology and earth history were my main interests, the title *Two-Mile Time Machine: Ice Cores, Abrupt Climate Change, and Our Future* by Richard B. Alley naturally caught my eye. The book is an excellent exposition on the recent data collection from ice cores obtained from the more stable portions of the Greenland ice sheet. I had come across this data source before while on a geologic field trip on Santorini helping with research on the volcanic activity that occurred there during the Minoan period. It had been information from this source that had helped to date the volcanic event, so I was particularly interested in learning more about how it was obtained and about its reliability. In part two of the text, the author lucidly describes the rationale behind the selection of ice and of

Greenland as an "archival" source. He discusses the methods in and problems of obtaining and preserving the material intact and uncontaminated and the methods of analysis that produced the data. Throughout the following chapters, he lays out for the reader the thinking that went into its interpretation and how this information can be used as a paradigm with which future outcomes of climate change might be predicted. Because Alley, a professor of geoscience at Penn State, took an actual part in all of these proceedings and is an active scientist himself, he is well positioned to give an informative account of the topic. He also has a readable writing style which many such individuals do not. Although I felt that his attempt to "get down to" the level of his non-technical audience was sometimes a little patronizing, I did think that his explanations of some of the physical systems was very clear.

One of the most critical aspects of science appears on page 174 of *The Two-Mile Time Machine* by Richard B. Alley: ALL scientific ideas are subject to revision; we should never be absolutely sure that the truth has been reached. Old ideas should be tested continually, in an effort to tear them down and replace them with better ones. Ideas that survive this constant attack will be especially robust. Experience shows that if we behave as if these surviving ideas are true, we will succeed.... But, on the other hand, the ideas may be true, they may be reasonable approximations of the truth, or we may just be lucky. In science, no idea, be it speculation, hypothesis, theory, law, model, or FACT, is ever considered to be the final answer. That's the way science works. We ALWAYS act on uncertain answers; we never know if something is the truth with a capital T. *The Two-Mile Time Machine* is not only an excellent exposition of the use of ice core [and other] data to figure out the recent and future climate situation on Earth, but it is an excellent exposition of how science in general works. Richard B. Alley, a participating scientist in the GISP2 ice core project in Greenland, has written an easy-to-read, but pull-no-punches book on a complicated scientific topic. The book starts out with the basics of coring, dating, and analyzing ice, and takes the reader through to the political, social, and ethical implications of future climate changes, and concludes with Alley's take on what our responses should be. He always states how much uncertainty is attached to any of the ideas he writes about. If a person of a non-scientific background is going to have a complaint about the book, it will probably be that the book goes into too much detail about the evidence supporting the ideas.

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