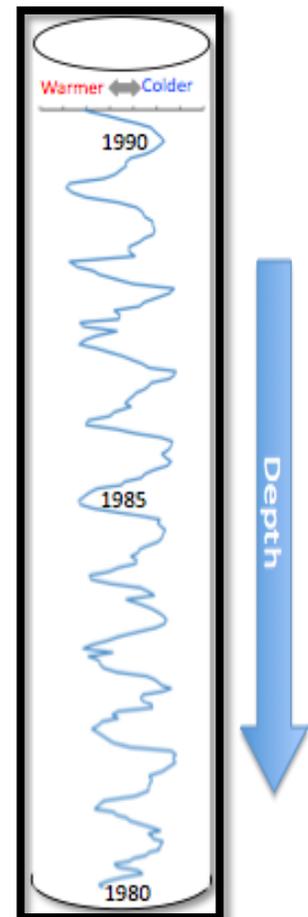




## CRITICAL THINKING ACTIVITY: READING AN ICE CORE

The ice sheets and glaciers that cover 10% of the Earth's surface have provided evidence of a changing planet. Drilling projects in Greenland and Antarctica have revealed information about Earth's climate going back over 400,000 years. Ice cores taken from both locations indicate changes in climate conditions. The ice sheets that cover both Greenland and Antarctica are between 3000-4000 m deep. Radar is used to measure the thickness of the ice sheets and to map the landscape beneath.

An *ice core* is a cylinder-shaped piece of ice drilled from a glacier. Ice core records provide the most direct and detailed way to investigate past climate and atmospheric conditions. Snowfall that collects on glaciers each year contains atmospheric concentrations of dust, sea-salts, ash, gas bubbles and human pollutants. Analysis of the physical and chemical properties of an ice core can reveal past changes in climate ranging from seasons to hundreds of thousands of years. Ice core records can be used to reconstruct temperature, atmospheric circulation strength, precipitation, ocean volume, atmospheric dust, volcanic eruptions, solar variability, ocean productivity, sea ice and desert extent and forest fires.



Ice cores provide excellent seasonal markers allowing very accurate dating. Seasonal markers such as stable isotope ratios of water vary depending on temperature and can reveal warmer and colder periods of the year. Other seasonal markers may include dust; certain regions have seasonal dust storms and can be used to count individual years. Dust layers may be high enough to be visible in the ice.

Student Sheet 2

**INTERPRETATION:**

1. Crater Lake in Oregon was formed about \_\_\_\_\_years BP.
2. The "Year Without a Summer" occurred \_\_\_\_\_years BP and was caused by a \_\_\_\_\_in Indonesia.
3. A widespread layer of dust in the atmosphere was recorded in \_\_\_\_\_BP.
4. Ice formed after \_\_\_\_\_years BP is considered older ice.
5. Nuclear testing began about \_\_\_\_\_years BP.
6. The Vikings settled in Greenland about \_\_\_\_\_BP.
7. During the Viking's rule, the Earth underwent a \_\_\_\_\_period.
8. The skies over Rome were darkened for an entire year in \_\_\_\_ BP.
9. Layers of \_\_\_\_\_in the ice record indicate the volcanic eruptions of 9700-9890 BP.
10. The Ice Age may have been triggered by a period of extensive\_\_\_\_\_ in about 60,000 BP.
11. \_\_\_\_\_ activity is an indication of radioactive testing.
12. A signal of a cooler climate that occurred about 130-150 years ago was a decrease in \_\_\_\_\_.
13. A volcanic eruption took place in \_\_\_\_\_about 877 BP.
14. \_\_\_\_\_ is a large volcano in Iceland.
15. Around \_\_\_\_\_BP ocean temperatures may have been warmer than normal.

## ANALYSIS AND CONCLUSIONS:

1. Briefly describe the Greenland and Antarctic ice sheets.
2. Why can layers be pinpointed much easier in the Greenland ice cores?
3. What kind of information can ice cores provide?
4. How are portions of the ancient atmosphere preserved in ice?
5. Does this record show a correlation between climate change and volcanic eruptions?
6. Theoretically, how could ice cores be helpful in identifying countries using illegal chemicals like CFCs?
7. Why would it have been inadvisable for the Vikings to attempt to colonize Greenland earlier than they did?
8. From your reading and research, how do scientists learn about Earth's past from ice sheets and glaciers? What kinds of information do they gather?
9. How do scientists estimate temperature and carbon dioxide levels from thousands of years ago, using their ice core analyses?

## THE GREENLAND ICE CORE RECORD

### PRESENT

55	-----Increase in beta activity indicates nuclear testing
130-150	----Decreased summer melting indicates cooler climate
165	----Ash from Tambora volcano causes "Year Without Summer"
655	----Heavy melting
550-1030	----Warm period; Vikings settle Greenland
877	----Hekla volcano in Iceland erupts
1200-1300	----Heavy melting
2030	----Volcanic activity darkens skies over Rome for 1 year
6381	----Crater Lake, OR formed
9700-9890	----Acid layers from volcanoes
10000	----Emergence of larger ice crystals; dust period ends
25000	----Widespread dust around the globe;
60000	----Extensive volcanic activity may have triggered Ice Age
100000	---- Older ice

### YEARS BP (Before present)

# ICE CORE SIMULATION

