Ice Core Basics

Objectives

Students will:

- understand what we can learn from ice core analysis
- see how ice coring is done (in development)

Materials

Projector and Speakers
Student Worksheets

Video Links
Internet Connection

Overview

Part A: Ice core basics

Part B: Climate Change and water quality

Part C: Extension

Time Required

30 min

Ice Core Basics

Alberta Curriculum Connections:

Grade 5 Science: Wetland Ecosystems
Grade 7 Science: Interactions and Ecosystems
Grade 8 Science: Freshwater and Saltwater Systems
Grade 9 Science: Environmental Chemistry
Grade 10 Science: Energy Flow in Global Systems
Biology 20: Energy and Matter in the Biosphere
Science 14: Investigating Matter and Energy

Teacher Key:

PART A: What are ice cores and why do we take them?

Video: What we learn from ice cores?

1. What is Paleoclimate?a climate prevalent at a particular time in the geological past
2. What does Dr. Criscitiello's research look at? shallow ice cores looking 100 years ago to study how global atmospheric variability affects the poles? and how sea ice cover has changed in the past.
3. Look up the definition of an Isotope:

Isotope: each of two or more forms of the same element that contain equal numbers of protons but different numbers of neutrons in their nuclei, and hence differ in relative atomic mass but not in chemical properties; in particular, a radioactive form of an element

Video: piccaro

4. What does the Piccaro machine measure? oxygen isotopes
5. What is the difference between Oxygen 16 and 18? their weights
6. What do they tell us? The ratio of 18 to 16 is a temperature dependent ratio. As temp increases, the ratio increases. They allow us to reconstruct temperature.

Video: measuring isotopes

7. What does the ratio of Oxygen 18 to 16 tell us? Specific temperatures. What kind of activities does Dr. Criscitiello mean when she refers to "anthropogenic"human influences. When there's a long term record we can see the impacts humans are having compared to normal variability.
8. What else can the Picarro machine do? Measure the gases in air bubbles trapped in the ice. This is how we know that carbon dioxide is responsible for increased temperature.
9. Review the water cycle in this video:
10. What processes in the water cycle allow water to move from say the oceans to the atmosphere to glaciers?

Watch this video that explains the circulation of oxygen isotopes.

11. So, glacier ice would have a higher concentration of which isotope? O16

12. Fossilized animals would have higher concentration of which isotope? 018
13. Look up what an anion and cation is

Anion: a negatively charged ion (it has gained electrons)

Cation:a positively charged ion (it has lost electrons)

Video: ion chromatograph

14. What does the ion chromatograph do? Measures and anion or cation in a liquid ice sample.
15. What does Dr. Criscitiello do with it? Measures the impact marine cover, or sea ice cover has on ice caps and ice sheets.
16. What can she learn from this machine? She can determine the type and the concentration of anion or cation in the sample.

Part B: Climate Change and water quality

Watch this video.

17. What determines our water quality?

Watch Dr. Cristiciello talk about what she finds when she analyses ice cores

Video: How do atmospheric chemicals get into the water?

18. Research what CFCs are. Why are they a problem?any of a class of compounds of carbon, hydrogen, chlorine, and fluorine, typically gases used in refrigerants and aerosol propellants. They are harmful to the ozone layer in the earth's atmosphere owing to the release of chlorine atoms on exposure to ultraviolet radiation
19. Look up a definition for persistent chemicals?Persistent chemicals are those chemicals that tend to endure in the environment for years after they are released into it. It takes longer to remove them from the environment after their use is over.

Video: Persistent chemicals

20. What does Dr. Criscitiello say about the replacement compounds to CFC's? The replacement chemicals may be just as bad as what they replaced.
21. How did something like DDT get in the ice? Before DDT was banned in 1885 (stocks were used up until 1990) DDT in the atmosphere got deposited on the glacier.
22. What are the impacts of melting glaciers on the levels of DDT released into the environment?

    With the melting of the glaciers, DDT and other CFCs and persistent chemicals will be released into our drinking water.

Video: Endocrine disruptors

23. Research what endocrine disruptors are. Why are they dangerous? Endocrine disruptors are chemicals that mimic human hormones such as estrogen. The endocrine disruptors have been linked to breast cancer and early menstruation in females and low sperm count in males.
24. Why don't we want them in our drinking water? Melting glacier ice will result in higher levels in our drinking water.

Part C: Extension

Go out into your watershed. Use the www.albertatomorrow simulator to look at the landuses surrounding your local body of water to understand what may be affecting that water quality.

Measure parameters you have test kits for: dissolved oxygen, phosphates, nitrates, turbidity, etc and record your findings in the "observations" section of the Alberta Tomorrow simulator.

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