Frozen in time: hands on evidence

Education in Chemistry
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Teacher/technician notes

This activity requires ice cores to be prepared for the students to analyse. These take a few days to prepare as each layer needs to be added once the previous one is frozen. Eight layers or so will provide a good quantity of data.

Consumables for preparation

- Tubes (those used to hold crisps are particularly suitable)
- Water with blue food dye added
- Boiled water
- Carbon powder
- Salt water
- Finely chopped grass

Apparatus per group

- Potato/apple corers
- Rulers or calipers for measuring depth
- Evaporating basin
- Heating equipment
- Measuring cylinders of assorted sizes
- Indicator paper

Each layer represents a season of snowfall. There are two seasons per year, summer and winter, and their ice is slightly different. In this activity, the winter ice is shown using blue dye to make the exercise easier for students to interpret.

Component	Significance within the ice core
Boiled water	Boiled water has a lower gas content than water drawn from the tap.
Carbon powder suspension	Ash from volcanic eruptions
Water (colourless)	The colourless layers represent the summer ice which is less dense than the winter ice.
Water (blue)	The blue layers represent the winter ice which is more dense than the summer ice.
Carbonated water (either blue or colourless)	This leaves large bubbles in the ice which can be tested for gases. In this activity students will test the pH of the melted sample to test for the presence of dissolved CO_2.
Chopped grass	The chopped grass represents phytoplankton, organic material that is present when sea ice has expanded into the ice core area.
Salt water (dilute not concentrated brine)	The presence of salt in an ice core shows that sea ice has expanded into the ice core area.

Preparation method

Preparation needs to be carried out at least a week in advance of any lesson. Once prepared the ice cores should be able to be used again for other classes.

1. Set up the number of tubes you need per class on the bench.
2. Add the solution to a suitable depth. Ideally add different solutions from the choices outlined in the table above and to different depths so each group's ice core is different.
3. Put the tubes in the freezer overnight until the solution freezes solid.
4. Add the next layer of solutions and repeat the freezing process.
5. Repeat until the tube is full or sufficient layers have been poured.

Teaching notes

This activity can be planned to focus on different skills depending on the needs of the class.

Planning – students can plan their approach to collecting evidence from their ice core. Give them copies of the table of evidence types and ask them what they will look for or what analysis they could carry out.

Recording/presenting data – carrying out the practical analysis generates lots of different data. Students can practise accurate and concise record keeping, perhaps with a mock lab book.

Drawing conclusions – once all the data has been gathered, students can focus on writing up their conclusions to show the story of their ice core sample site.