Cool Crystals:
Stimulating Understanding through Experiments

Can you imagine holding a piece of rock or metal that has come from space?

That is amazing in itself! Now try to imagine the age of your extra-terrestrial boulder! During your workshop at Dynamic Earth pupils will get the chance to hold meteorite samples, observing scratch lines across the surface and large crystals of iron. This experiment will add an extra dimension, helping you follow up on your workshop, bringing into perspective the phenomenal age of some of our meteorites!

To achieve crystals of the sizes seen in our samples. Our meteorites must have cooled at a rate of about 1ºC for every one million years!

Thankfully, your experiment won't take quite that long!

In this experiment, your pupils will grow their own crystals of salol. Will the rate of cooling affect the crystal size? Perform this experiment to find out.

At a glance, you will need for each group:

3 x Pyrex watch glasses or microscope slides
3 x Petri dishes 1 containing crushed ice
1 containing water at room temp
1 containing hot water
1 x Hand lens or microscope
10g Salol (phenyl salicylate)
1 x Spatula

Bunsen burner, heatproof mat, safety glasses, tongs, stop clock

Workshop	Title	Pre/Post	Suggested CfE Stage
Voyage Through the Solar System	Cool Crystals: Stimulating Understanding though Experiments	Post	Third

Learning Intention

We are learning about the relationship between crystal size and cooling and applying this knowledge to a specific example.

Task

We will carry out an investigation into the relationship between crystal size and the cooling period of “salol”.

Success Criteria

- Through group activity and discussion pupils should be able to produce crystals of different lengths.
- Through observation and group discussion pupils should be able to describe the relationship between cooling period and crystal size.
- Pupils will gain skills in extrapolating experimental data and applying this in a novel context.

CfE Capacities

Successful learners:

- with an openness to new thinking and ideas
- able to make reasoned evaluations based on experimental observations and prior knowledge
- able to link and apply different kinds of learning to new situations and across the curriculum.

Confident individuals:

- able to achieve success in practical tasks, evaluation and discussion.

Responsible citizens:

- able to evaluate environmental and scientific issues based on their knowledge and understanding through analysis of evidence.

Effective contributors:

- with an enthusiasm for collaborative learning
- able to work in partnership and in teams, collaborating effectively during enquiry and investigative tasks and discussions
- able to apply critical thinking to interpret data, make deductions and draw conclusions based on experimental evidence

CfE Outcomes(to be updated with the final publication of CfE/April 2009)

Science Planet Earth – Climate and Earth science
Leads to -Having carried out activities to support my learning, I can use my understanding of models of matter to create a dynamic representation to show how matter changes when heated or cooled in terms of movement of particles. SCN 304D

Leads to - I can design and carry out activities on dissolving, interpret experimental evidence to draw a valid conclusion on the conservation of mass, and explain my findings to others. SCN 306D

Description

During the ‘Voyage through the Solar System’ workshop at Dynamic Earth pupils had the opportunity to handle a range of meteorite samples. Of these, one was a sliced section of a much bigger sample allowing scratch lines across the surface and large crystals of iron to be easily seen. This experiment will add an

extra dimension to their discovery, helping you follow up on the workshop with a practical experiment that aims to bring into perspective the phenomenal age of some of the meteorites the pupils were handling.

The Experiment
Salol (phenyl salicylate) melts at about 45ºC and solidifies rapidly at room temperature. The sizes of the crystals formed are very different depending on the rate of the cooling. In this experiment, three small amounts of salol are placed on warm watch glasses and allowed to cool at different rates. The glass which is kept warm for the longest will show large crystals, the glass which is cooled rapidly will show small crystals and the intermediate glass will show moderate sized crystals. Crystal size is thus demonstrated to be dependent on speed of cooling.

Practical details
Each pupil or small group will need:
3 x Pyrex watch glasses or microscope slides
3 x Petri dishes 1 containing crushed ice
1 containing water at room temp
1 containing hot water
1 x Hand lens or microscope
10g Salol
1 x Spatula

Bunsen, heatproof matt, safety glasses, tongs, stop clock.

Instructions
Wear appropriate protective clothing throughout.

1. Draw up a results table for the three samples leaving a column for the crystal size
2. Set out the three Petri dishes containing the three different temperatures of water.
3. Place one spatula of salol on each watch glass
4. Light the Bunsen and very carefully, holding the glass in the tongs, gently warm the salol until it melts
5. Place the watch glass on the selected Petri dish and watch them carefully.
6. Record the time when each has completely solidified.
7. Observe the crystals on the cooled watch glasses using the hand lens

Working in groups, pupils can then be encouraged to apply their knowledge linking evidence from experimental observations to formulate a hypothesis to explain crystal formation in the meteorite samples seen at Dynamic Earth.

Web Resources

http://www.geolsoc.org.uk/webdav/site/GSL/shared/pdfs/education%20and%20careers/RockCycle/Salol%20Experiment.pdf

http://www.esta-uk.org/jesei/cooling/teachers.pdf