Riches from the Earth: Growing Halite Crystals

Subject/Grade: Grade 4, 7 Science
Lesson Title: Growing Halite Crystals

Stage 1: Identify Desired Results

Outcome(s)/Indicator(s)

Grade 4 Science

RM4.1 Investigate physical properties of rocks and minerals, including those found in the local environment.

a. Pose questions about the properties of rocks and minerals (e.g., What is the difference between rocks and minerals? Where do we find rocks and minerals? Do rocks become minerals?).

b. Document the locations and characteristics of rocks that exist in their local environment.

k. Differentiate between rocks and minerals.

RM4.2 Assess how human uses of rocks and minerals impact self, society, and the environment.

b. Identify objects in their local environment that are made from rocks and minerals (e.g., nickel, table salt, pottery, cement, carvings, brick, jewelry, bicycle, nutrients, battery, copper wiring, soda can, plumbing pipe, and sidewalk).

c. Research historical (e.g., flint arrowhead, gold jewelry, paint pigment, and coal heating) and contemporary (e.g., fertilizer, building products, ceramics, glass, salt, silver fillings, and electronics) uses for rocks and minerals in Saskatchewan.

e. Relate uses for rocks and minerals to characteristics such as functionality, mineral shape, cost, availability, and aesthetics.

f. Identify locations where minerals, including potash, sodium sulphate, salt, kaolin, uranium, copper, coal, diamond, and gold, are extracted in Saskatchewan.

Grade 7 Science

EC7.2 Identify locations and processes used to extract Earth's geological resources and examine the impacts of those locations and processes on society and the environment.

d. Identify locations of Saskatchewan's primary mineral resources (e.g., potash, gold, diamond, salt, uranium, copper, and graphite) and their primary uses.

j. Identify uses for rocks and minerals, such as healing, recuperative powers, and ceremonies, which include ideas not explained by science.

Geoscape Southern Saskatchewan: Geoscience for Prairie Communities.

Key Understandings: ('I Can' statements)	**Essential Questions:**
I can… describe how the Earth may have been different long ago. **I can….** explain how sedimentary rocks form. **I can….** list examples of natural resources found in Saskatchewan. **I can**…Explain the difference between minerals and rocks	In what ways has the earth changed over time? How are sedimentary rocks formed? What are some natural resources found in Saskatchewan and how are they used? How are salt crystals formed? What is Potash? Is Potash a mineral or a rock?

Teacher Background

Saskatchewan has a diverse geological history. During the Devonian Period (418- 360 million years ago) Saskatchewan was covered by the Elk Point Sea. This sea gradually became a restricted basin that was almost completely disconnected from the open ocean. As the water evaporated, minerals such as halite (common table salt, NaCl), anhydrite, and sylvite (KCl) precipitated from the sea water and now form thick layers of Potash called the Prairie Evaporite. It is from these layers that Saskatchewan's massive potash deposits are mined.

These deposits also provide a cap rock to trap oil beneath them in massive reef complexes. This lesson will simulate the precipitation of evaporite minerals to give students a visual example of how these massive deposits were formed.

Stage 3: Build Learning Plan

- **Split into 2 classes with a week of observation time in between**

Set (Warm-up, Focusing the Learning): Time: 7 min

1. Introduce the concept of evaporation to the students. Where have they seen evaporation before (steam kettle)? Do all things evaporate?

2. Show the students a potash crystal or a large salt crystal. Explain that the crystal is an evaporite mineral, meaning that it was left behind when salt water evaporated. Mention that potash is a valuable part of Saskatchewan's economy.

Development: Time: 15 min

3. Explain that the students will be growing evaporite minerals.

4. Group the students and give each group two plastic containers, some water, salt (Epsom works best but rock or table salt will also work), string and a spoon. The students must fill each plastic container halfway with water and then add salt. Begin by adding salt, one teaspoon at a time, and mix until no more salt can be dissolved. At this point, the water is saturated with salt. Place the string so that one end hangs in each of the plastic containers. The salt water will move up the string and evaporate leaving the salt crystals to form a pile beneath the string.

5. Ask the students to record the following information in their science journals or on the student activity sheet:
Purpose: what are we doing?
Procedure: what did we do?
Observations: what is happening? These must be done over several days. Stress that it is the students' responsibility to obtain the data.

Learning Closure: Time: 10 min

6. After several days re-examine the salt crystals as a class. Guide the students through the question sheet. Some questions may be more suited to older students.

Materials/Equipment:

* Plastic containers
* Table Salt or Epsom Salt or Rock Salt
* Water
* Spoons
* String
* Potash Crystal or large salt crystal
* Student Activity Sheet (optional)
* Answer Sheet

Key Vocabulary:

- Halite
- Saturated
- Potash
- Evaporation

Possible Adaptations/ Differentiation

- Take pictures of the salt sample each day

Stage 4: Determine Evidence for Assessing Learning

Product: Successful completion of the student activity sheet.

Extensions

* Students may choose to research the uses of potash, halite and anhydrite.
* Students may choose to research the amount of income brought into the province by potash and speculate as to the impact the loss of this income would have on the province. Information is available from Saskatchewan Industry and Resources' Annual Reports.
Students may choose to learn more about fertilizer.

Useful links for information on Saskatchewan minerals:
http://www.ir.gov.sk.ca/minerals
http://www.saskmining.ca
http://mineralogicalassociation.ca/poster/index.php*
* Minerals of Canada poster - Can be downloaded.
Along with this poster there is a Pedagogical Guide and a website for young people.

Look at the Digital Geological Highway Map of Saskatchewan (*GeoExplore Saskatchewan*) website for further information and a deeper understanding of the local context:

Main Website
https://skgeolhighwaymap.maps.arcgis.com/apps/MapSeries/index.html?appid=a845cbb370f7401597806887318e2676

For more background information related to this lesson check out

- Main tab “Our Resources”

Geoscape Southern Saskatchewan: Geoscience for Prairie Communities.

Growing Halite- Student Activity Sheet

Purpose: What are you trying to do?

_____

Procedure: What did you do?

_____

_____

_____

Observations: What is happening?

Day One Date: _____ _____ _____ _____ _____	**Day _____** Date: _____ _____ _____ _____ _____
Day _____ Date: _____ _____ _____ _____ _____	**Day _____** Date: _____ _____ _____ _____ _____

Can you see any individual crystals? What shape are they?

How long did it take for the crystals to grow?

How thick is your salt deposit?

How would the rate of crystal growth change if the room was hotter and drier?

Would you expect to find fossils in this type of water? Why or why not?

Has the salt/water mixture changed physically since day one?

The potash that is mined in Saskatchewan was deposited over a period of 2 million years and is 60 meters thick. Explain how this may have happened.

What is Potash?

Is Potash a rock or a mineral?

Growing Halite
Student Activity Sheet
Answers

Can you see any individual crystals? What shape are they?
The crystals should be cubic in shape.

How long did it take for the crystals to grow?
_____

How thick is your salt deposit?
_____

How would the rate of crystal growth change if the room were hotter and drier?
It would speed up the evaporation and crystallization process.

Would you expect to find fossils in this type of water? Why or why not?
No the water is too salty. There are no recorded fossils from this time of deposition in Saskatchewan.

How has the salt/water mixture changed physically since day one?
Water has turned into a gas and the salt has moved from solution to solid.

The potash that is mined in Saskatchewan was deposited over a period of 2 million years and is 60 meters thick. Explain how this may have happened.
Saskatchewan was much closer to the equator and therefore in a warmer climate. The water in the restricted Elk Point Sea was very saline.

What is Potash?

Potash is the common name given to a group of minerals containing potassium that are typically used in agriculture to help plants grow.

Is Potash a rock or a mineral?

This is a tricky question because it could be either. If you have naturally formed crystals of the salt sylvite (KCl), then you have a mineral. If you have many crystals of sylvite intergrown with NaCl (halite), and other minerals, like the potash deposits in Saskatchewan, then you have a rock.