### Riches from the Earth: Growing Halite Crystals

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| Subject/Grade: Grade 4, 7 ScienceAdapted by: Diana Joy Jensen & Dr. Kate MacLachlan | | |
| 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.  c. Observe and record physical properties of rocks and minerals using appropriate terminology such as colour, luster, hardness, cleavage, transparency, and crystal structure.  d. Use appropriate tools (e.g., hand lens, safety glasses, brush, rock pick, knife, measuring tape, and gloves) safely while making observations and collecting information on the physical properties of rocks and minerals.  g. Record observations of rocks and minerals using jot notes, labelled diagrams, and charts.  k. Differentiate between rocks and minerals.  l. Develop simple generalizations about the physical characteristics of rocks and minerals based on observation and research.  **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.**  c. Classify rocks and minerals based on physical properties such as colour, hardness, cleavage, luster, and streak.  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. | | |
| **Key Understandings: (‘I Can’ statements)**  **I can** describe how the Earth may have been different long ago (grade 2).  **I can** describe some characteristics of the crust (grade 3).  **I can** explain how ...sedimentary...rocks form (grade 4).  **I can** identify some physical properties of objects (grade 5).  **I can** list examples of natural resources found in Saskatchewan (grade 5). | **Essential Questions:**  In what ways has the earth changed over time?  Describe the earth’s crust and what it is made of.  How are sedimentary rocks formed?  What are some natural resources found in Saskatchewan and how are they used?  How are crystals formed? | |
| Stage 2: 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 a result, minerals such as halite (common table salt, NaCl), anhydrite, and sylvite (KCl, target mineral in potash) precipitated from the sea water and now form thick deposits called the Prairie Evaporite. It is from these deposits that Saskatchewan‛s massive potash deposits are mined.  These deposits also provide a cap rock to trap oil deposits 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 (water cycle)?  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, pencil/stick 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 the middle of each of the plastic containers not touching the bottom or sides. 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 these 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 or jars * Table Salt or Epsom Salt or Rock Salt. You can even use sugar (rock candy) * Water * Spoons * String * Pencil or stick to tie string to * Potash sample * Student Activity Sheet   **Tips for Rapid Growth**  Supersaturate by heating the solution which will speed up the growing time.  Dip the entire string in the solution and then roll coat the string in extra salt.  Faster cooling plus rapid growth = smaller crystals.  **Possible Adaptations/**  **Differentiation**   * Take pictures of the salt sample each day * Use pipe cleaners to create shapes that the minerals can grow on (ornaments). * Add food colouring * Use this lesson for an example of mineral formation * Have students compete to create the best crystal and have a “Rock Show” |
| Stage 4: Determine Evidence for Assessing Learning | | |
| **Product:** Successful completion of the student activity sheet. | | |
| **Extensions** | | |
| Look at the GeoExplore Saskatchewan website for further information and a deeper understanding of the importance of Saskatchewan’s geological history. It is a digital version of the original paper Geological Highway Map of Saskatchewan:  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” * Subtab “Minerals and Mines” | | |
| **Additional Resources** | | |
| Check out Saskatchewan Mining Association website under their Outreach to order a free classroom Potash Kit with a series of lessons on Potash Mining in Saskatchewan. <http://www.saskmining.ca>   * Potash: What is it? * Healing Waters of Manitou * Is there Potash Under My Feet? * Dissolving Potash * Potash Solution Mining Model * Recovering Potassium Chloride, KCl * How Do We Know it is KCl? | | |

**Growing Halite- Student Activity Sheet**

Purpose: What are you trying to do?

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Procedure: What did you do?

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**Observations: What is happening?**

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| **Day One**  Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_   |  | | --- | |  |   \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | **Day \_\_\_\_\_\_**  Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_   |  | | --- | |  |   \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |
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Can you see any individual crystals? What shape are they?

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How long did it take for the crystals to grow?

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How thick is your salt deposit?

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Would the location of your containers have changed the speed of growth of the crystals?

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

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Has the mixture changed physically since day one?

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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.

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**Growing Halite**

**Student Activity Sheet**

**Answers**

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

The crystals should be square or cubic in shape.

How long did it take for the crystals to grow?

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How thick is your salt deposit?

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Would the location of your containers have changed the speed of growth of the crystals?

Placing the containers someplace warm would have helped speed up the evaporation 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 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.