Activity II.F. Sand That Isn't Sand

PURPOSE Investigate water chemistry of Great Salt Lake

FORMAT Group observation and experiment, classroom discussion

BACKGROUND *The Great Salt :Lake Story*, Activity 8, "Oolitic Sand," pgs. 27–28 (Utah Museum of Natural History, 1997)

STAGES Students will . . .

1. Examine and compare characteristics of two substances, ooids and regular sand (activity);
2. Learn about the formation and composition of the unique ooids formed in Great Salt Lake (activity and discussion);
3. Verify their understanding of ooid composition and formation (scrapbook assignment).

MATERIALS For each group

- ✓ a Petri dish, small plate or piece of foil
- ✓ oolitic sand specimens
- ✓ ordinary sand
- ✓ 10x hand lenses

Plus

- ✓ weak acid (e.g., vinegar)
- ✓ eyedropper
- ✓ Student Scrapbooks

IN ADVANCE Gather materials and prepare sand and ooid specimens for distribution

DURATION TBA

SEQUENCE

ENGAGE WHAT IS THIS STUFF?

1. Divide the class into groups of two or three.
2. . Inform the students that they are about to be introduced to a mystery substance. This substance is what makes most of the beaches at Great Salt Lake, but it is not beach sand. Adding even more to the mystery, this substance grows in many parts of the lake, and yet is not alive.
3. Suggest to the students that we sometimes need to look carefully and up close at things to make the most interesting discoveries.
4. Without revealing the name of the substance, provide each group with hand lenses and a small sample of ooids on one side of a Petri dish or similar small, open container.

EXPLORE GRAINS OF TRUTH

1. Give the students a few minutes to examine the specimens with their hand lenses. Then, ask them to write down three words that best describe what they see.

   (Some of the more notable characteristics to observe relate to size, shape, color, uniformity, surface texture and hardness.)
2. Ask the students to share some of their descriptions.
3. Can any students correctly identify this material? (If not, withhold the identification until later.)
4. With students still in groups, tell them that your are about to distribute a second mystery substance. These particles are found along the foothills of the Salt Lake valley and throughout Utah, but unlike the first particles that grew *up* to be the size they are, the new specimens are all much *smaller* than they were at one time.
5. Distribute specimens of ordinary sand for inspection as before. Place just a few grains in a section of the dish separated from the ooids.
6. Ask the students to compare the second specimens to the first. What similarities and differences are noticed? Direct the students to write down three words that best describe these differences.

   (The most notable differences to observe relate to size, shape, color, uniformity, and surface texture.)
7. Ask the students to share some of their comparisons.
8. Can any students correctly identify this material?

   (No correct response is necessary at this time but, unless the students believe this to be a trick question, someone is likely to identify the substance as sand.)

EXPLAIN ORIGINS

1. If the students have not already identified the specimens, reveal the identities. Mention that ooids are often referred to as *oolitic sand*, but that it is not really sand as we usually think of it.
2. Ask volunteers to explain what sand is made of. Ask someone to describe how sand is made in nature.

   As needed, explain that a sand grain is more than just a broken piece of rock. It is the result of long history of tumbling, bumping, grinding, crushing, flushing, freezing and thawing of an object that at one time was much bigger; maybe even a giant rockface at the top of a mountain. It may take thousands of years or more, but gravity, friction, water and time are, in a sense, forever making molehills out of mountains in this way.
3. Remind the students that ooids are formed in the waters of Great Salt Lake. They are not formed on land or in rivers and only rarely in lakes or oceans. Ask for suggestions as to what ooids are made of. See if anyone knows how ooids are formed. (Some may recall a description from the presentation of "The Lake Affect.") Tell them that you have an experiment for them to uncover some more clues about differences between ooids and ordinary sand.
4. Inform the students that you are going to come around and place a drop of weak acid (vinegar) on each of their specimens as an experiment. Tell the students to be prepared to notice any changes that might take place with their specimens. Place a drop or two of vinegar on both the sand and the ooids for each group.
5. Discuss student observations.
6. Explain as needed about ooid composition and formation. Explain that one of the main mineral ingredients of an ooid is calcium carbonate. Calcium carbonate reacts with acid by fizzing, which the students were likely able to both see and hear.

   Describe how minerals such as calcium carbonate are *dissolved* in warm, saturated Great Salt Lake waters, and can be attracted to microscopic particles of dust and other debris. Over time, layer upon thin layer of chemicals *precipitate* out from *solution* onto the building ooid. After a few months or years, it reaches the sizes you see now. In some tropical parts of the world, ooids get to be bigger than golf balls!
7. Have the students consider other objects that are formed by layers building up from a small center. Baseballs and dipped candles are made in a similar way. In nature, pearls from oysters form similarly. Also, cave formations (stalactites and stalagmites) are formed by accumulating layers of calcium carbonate that moved in solution through cracks in rock, and then precipitated into crystals from the cave ceiling or floor.

Activity II.G. Mystery of the Missing Salt

(Adapted from *The Great Salt Lake Story,* Museum of Natural History, 1997.)

PURPOSE Explore crystal growth & structure through experiment, graphing
Investigate water chemistry of Great Salt Lake

FORMAT Teacher-led classroom demonstration
Student at-home or after school projects
Class discussions

BACKGROUND *The Great Salt Lake Story,* text pg. 29 and Activity #11, "Mystery of the Missing Salt," (Utah Museum of Natural History, 1997)

STAGES Students will . . .

1. Consider how to go about retrieving salt that has been dissolved in water (discussion);
2. Learn important steps in designing a scientific experiment (discussion);
3. Design, discuss and revise a plan to retrieve salt dissolved in water (individual and group activity);
4. Conduct an experiment to retrieve dissolved salt (activity);
5. Display methods and share results from experiments (classroom exhibit and discussions);
6. Relate methods used in classroom experiments to methods used in mineral mining at Great Salt Lake (discussion);
7. Verify their participation and understanding of evaporation, temperature, saturation and crystallization (scrapbook activity).

MATERIALS

- ✓ water
- ✓ 4 teaspoons table salt dissolved in 500 ml water in a clear glass container
- ✓ various cups, bowls, pie tins, or other containers for student experiments
- ✓ "Mystery of the Missing Salt" worksheet II.G.
- ✓ Student Scrapbooks

IN ADVANCE Mix the salt solution for the initial display.
Gather materials for student experiments.

DURATION TBA

SEQUENCE

ENGAGE WHAT'S IN THERE?

1. Display the clear container of 500 ml salt water to the class. Inform the students that you have just stirred four teaspoons of salt into the water.
2. As a review of earlier learning, ask the students to explain what happened to the salt, and why.
   (It has dissolved in the water, because it is soluble.)
3. Have students think silently about how they would go about getting the salt back. Could they get it all back? What would be the quickest way? Without discussing possible answers to this mystery, describe the experimental process you would like them to undertake:
   a. Each student will design an outline for solving the mystery, using the 7 Steps For A Scientific Experiment worksheet.
   b. The class will gather in groups (of 4–6) to share ideas and brainstorm new ones.
   c. Student researchers will then work individually or in teams of two to put together a final 7-step plan for the experiment, and conduct the experiment over the next few days.
   d. At the end of the research time, each student or team will present a display and description of results in class.

EXPLORE PREVIOUS EXPERIENCE

Because the students have had some previous background in designing investigations, begin the design process by asking for suggestions about what steps should be included in planning a scientific experiment. List suggestions on the board.

EXPLAIN THE EXPERIMENTAL SEQUENCE

1. List the following seven steps on the board, acknowledging similar steps already identified by students:
   a. *Question* (what are you trying to find out?)
   b. *Hypothesis* (what you think the answer to your question is)
   c. *Methods* (describe what you will do to test your hypothesis, what variables need to be controlled, and what tools you will need)
   d. *Data Collection* (conduct the experiment)
   e. *Results* (record what you did, saw, used and measured while doing your experiment)
   f. *Conclusions* (what new knowledge did you gain?)
   g. *New Question* (what new question has come out of this experiment that another experiment could try to answer?)

2. Provide the students with advance information and warnings about materials available, safety precautions, time constraints and other guidelines.

EXPLORE CRAFTING AN EXPERIMENT

1. Distribute Experimental Sequence worksheets. Instruct each student to work alone thinking up an experimental design by filling in Steps 1, 2 and 3 on the worksheet. Assist students as needed.
2. Split the class into discussion groups of four to six. Instruct the students to take turns sharing their ideas for each step, one step at a time. They should hold any comments or discussion for each step until all students have contributed. Suggest to the groups that their discussions should be as those of a research group, brainstorming and combining different ideas. This way, by putting heads together, each student might come away with an even better plan for the experiment.
3. Following the group sharing, have students separate as individuals or in teams of two to construct a final plan. Each student, whether on a team or alone, should fill out a new experimental sequence form.
4. Observe and assist students as needed.

EXPLAIN GUIDELINES

Instruct the students as to the procedure for finding, checking out and using materials. Repeat the due date for their results, and go over how they will be displaying and presenting their research (see below).

EXPLORE STUDENTS CONDUCT THE EXPERIMENTS

EXPLAIN RESULTS

1. Have students set up their displays so that others can visit them. Displays should include the container with salt that was recovered, and a written report of their seven experimental steps (which could be a completed Experimental Sequence Worksheet).
2. Provide the students time to view all of the displays.
3. Ask a number of students or teams to provide an oral presentation of their procedure and results, so that a variety of approaches and results can be discussed.

   Discuss with the students what methods were used to get rid of the water. What was left after the water left? Did they get all of the salt back (They did if all water was evaporated and nothing spilled, because the salt cannot escape from evaporation.) What happened to all the water? (It entered the atmosphere as water vapor.) Which method proved to be the quickest? Invite other questions students might have.
4. Distinguish between crystalline and non-crystalline substances, such

as by comparing the way salt crystals and ooids look and are formed. For the crystals, the salt came out of solution by evaporation; for the ooids, the calcium carbonate built up in layers around a nucleus while still in water.

5. Be sure to emphasize that in research an incorrect hypothesis (not to say a "wrong" hypothesis) is just as valuable as one that proves correct. Both results teach the researcher something very important and are therefore successful.

   Emphasize, too, how important to science that "new question" on their worksheet is. Most progress in science is based upon two things: 1) learning from mistakes, and 2) coming up with new questions that had not been asked before.

ELABORATE **MINERAL MINING**

Ask the students how someone who wanted to mine chemicals from Great Salt Lake could make use of the information they now have about evaporation, temperature, and saturation. Have them present their responses in writing or orally.

EVALUATE Instruct students to file their reports into their Scrapbooks

Activity II.H. Mining Your Own Business

PURPOSE Discover how properties of water influence mining at Great Salt Lake
Investigate water chemistry of Great Salt Lake

FORMAT Field trip or classroom visitation

BACKGROUND Project SLICE Speakers Bureau

STAGES Students will . . .

1. Make advance preparations for a field trip to or a classroom visitor from a Great Salt Lake mineral company;
2. Participate in a field trip to or a visit from a representative of a Great Salt Lake mineral company;
3. Discuss learning and impressions from their guest or field trip experiences;
4. Insert comments and/or specimens into their scrapbooks.

MATERIALS ✓ Student Scrapbooks

IN ADVANCE Arrangements for a guest speaker from a mineral company. Inform the speaker of your recent class studies and suggest that s/he incorporate concepts such as solutions, saturation, and crystallization into the presentation. Inform the speaker, too, of your students' interest in asking questions as part of the visit.

DURATION TBA

SEQUENCE

ENGAGE A SPECIAL GUEST

Suggest to the students that there is sometimes no better way to learn about something than visiting with someone who actually makes a living by knowing as much as they do. Inform them that an expert in mining minerals from Great Salt Lake is coming in for a special visit with the class.

Explain that not only do the students want to be polite, but they also want to learn as much as they can from the visitor. It would be a good idea to prepare for the visit, so as to know what to expect and have good questions.

EXPLORE PREPARE THE STUDENTS

1. Give the students a briefing as to who is coming, how long they visit will be, and what special subjects (if any) the visitor plans to discuss.
2. Remind the students that all they have been learning—about evaporation, solutions, saturation, crystals, and chemicals in Great Salt Lake—is exactly the kind of knowledge that goes into mining. Besides just telling us what s/he does, the visitor can also answer our questions. But it would be very unfortunate if a guest speaker arrived and no one could think of a good question to ask!
3. Discuss various questions the students have that they could ask the visitor. Have them each write down a question to have handy on the day of the visit.

EXPLAIN THE GUEST SPEAKER

ELABORATE REFLECTIONS FROM THE VISIT

1. Conduct a follow up discussion with students about their impressions of the visit, about mining at Great Salt Lake, and about any new things they learned.
2. Have the students place any souvenirs or specimens brought by the visitor into their scrapbooks.

Activity II.I. Water In Review

PURPOSE Summary and Evaluative Activities

FORMAT Student Scrapbook entries
Classroom Mural enhancements

BACKGROUND See Activities I.D. and I.E.

MATERIALS ✓ Student Scrapbooks
✓ the evolving Classroom Mural

IN ADVANCE none

DURATION TBA

SEQUENCE

EXPLORE REVIEW ACTIVITY

Describe and facilitate one of the following activities as a way for the students to demonstrate knowledge and insights gained from recent water activities. They might wish to refer to their scrapbooks in brief preparation for the activity.

1. Round Robin
   Students take turns sharing different pieces of information learned from the water unit.
2. Ideas Dominoes
   Like the Round Robin, students contribute a piece of information about water, but the added stipulation is that each student must follow the previous student by picking up on a word or concept used. The teacher starts the process, and each student can "pass" one time.
3. Skits
   Have students create and perform skits that act out one of the processes they have studied relating to water.
4. Water Jeopardy
   Devise and administer a Jeopardy-like game incorporating Great Salt Lake and water-related answers and questions into the play.

EXPLAIN Discuss and clarify any demonstrated gaps or misconceptions

ELABORATE SCRAPBOOK AND MURAL WORK

1. Instruct students to make any necessary revisions to or improvements in their scrapbooks.
2. Select students to assist in Classroom Mural enhancements.

EVALUATE COLLECT AND REVIEW STUDENT SCRAPBOOKS
Assess learning demonstrated by student mural contributions.