

GRANTING THE DAM! TEACHER GUIDE

Subject: Chemistry

Grade Level: High School

Case Summary

Dams are being built around the world resulting in various archeological sites that are being flooded. The deposits on the salvaged artifacts will be investigated and the identity of the salts will be determined.

Credits

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This case was adapted from Salty Ceramics Lab (Smith, Commander, Etre, & Stein, 2013). Smith, T., Commander, J., Etre, K., & Stein, R. (2013). Salty Ceramics lab. Presented at The Science Behind Art Conservation Teacher Workshop, Emory University, July 8-12, 2013.

Learning Objectives

1. Predict formulas for ionic and covalent compounds.
2. Identify the unknown ions present.
3. Making observations.
 - a. Identify substances based on physical and chemical properties of ionic and covalent compounds.
4. Conduct an investigation, collect and analyze data, and draw a conclusion.

Georgia Performance Standards

SPS2. Students will explore the nature of matter, its classifications, and its system for naming types of matter.

- b. Predict formulas for stable binary ionic compounds based on balance of charges.
- c. Use IUPAC nomenclature for transition between chemical names and chemical formulas of binary ionic compounds and covalent compounds.

SC1. Students will analyze the nature of matter and its classifications.

- b. Identify substances based on chemical and physical properties.

Assessment

- Box chart Preserving our past scene-1 can be taken up for verification of thought process from images displayed
- Box chart preserving our past scene-2 can be taken up for verification of their action plans.
- Write a lab report of the investigations conducted to identify the unknown salts, conductivity graph and conclusion. Use Rubric Below for grading.
- Write a letter to the Sudan government explaining the identity of the salts and the process of deposition on the surface of the structure. Students will also include the methods to prevent future damages done on the structures. Use Rubric for Business Letter Writing: cte.sfasu.edu/wp-content/uploads/2012/01/Letter.doc

Laboratory Rubric

During the Lab	0	1	2	3
<i>Came prepared to work: on time, cleared work area, brought lab paper.</i>				
<i>Read through experiment: locates and uses correct (clean) equipment, completes the experiment with few questions on procedure.</i>				
<i>Worked efficiently: finished in the time allowed, stayed on task, followed all written and oral instructions.</i>				
<i>Works with safety in mind: Clean work area free of excess material, no horse play, no breakage of equipment, follows safety measures during lab (goggles, apron, hair tied back, no loose clothing, no open toe shoes), notifies instructor of injuries and breakage.</i>				
<i>Cleaned up after experiment: All glassware cleaned and restocked in proper place, all equipment returned to proper storage, lab table free of debris and spills, no garbage in sink!</i>				
Laboratory Report				
<i>Presentation: Neatly done in pen, all sections complete, handed in on time, diagrams are labeled, research, where appropriate, is completed.</i>				
<i>Data Collection: Lists appropriate observations, records the appropriate data. Measured values are recorded and listed in an organized in a table. Measured values are recorded to the appropriate significant figure. Data values, when appropriate, are within the expected range of accuracy.</i>				

Data Analysis: <i>Numerical data is manipulated; calculations shown and labeled. Calculations performed with accuracy to the appropriate significant figures and labeled with the correct units. Graphs (used when appropriate) are neat, complete, and accurate.</i>				
Evaluation: <i>Student reflects upon lab to find appropriate outcomes and relationships. Inferences made, interpolation and extrapolation of graphs cited. Possible errors are identified/listed that may affect the outcome. Possible modifications are included that might remedy errors.</i>				
Write up: <i>Reflects care in thought and time prepared. Answers all possible questions that may have arisen in the lab. Grammar, spelling, punctuation reflect maturity. Conclusion stated reflects the hypothesis.</i>				

Total points earned by student	
Total points possible for this experiment	
Average	

Implementation Strategy

Day 1:

- Post an image of the Philae Temple partially submerged in water found online.
Allow students to complete a Box chart regarding the image independently and then share with a partner or a small group (Think Pair Share- TPS) (10 min).
- Look at the image of the damaged section of stone wall and complete the Preserving our Past Scene 2 box chart regarding the image. Conduct a class discussion regarding the student responses. Discuss student results as a class & write vocabulary terms to research what they mean.
 - Vocabulary terms- cation, anion, salt, ionic compounds, covalent compounds, conductivity, any other terms students are unfamiliar with from the box charts and discussions.
- Next, let the students read the letter provided and then have a mini lecture on the Nomenclature of ionic and covalent compounds.

Day 2:

- Conduct Salty ceramics lab part-1 to identify the unknown ions (45 min). Students begin to write the formal lab report.

Day 3:

- Students will also write a letter to the Sudan government explaining the identity of the salts and the process of deposition on the surface of the structure.
- Students will also include the methods to prevent future damages done on the structures.

Day 4:

- Students should conduct part-2 of the lab. *If conductivity probes are not available, teachers may choose to take a specific quantity of water bath solution to evaporate and measure the mass of the salt residue. The salt content can be used to determine the concentration of the salt solution for each consecutive water bath. Students should continue or finish working on the lab report and the letter.

*Optional: Students could present their findings to the class using power point presentation, talk show or big post-its and have a museum/gallery walk.

*Extension: Students can complete an action project by informing the general public about the loss of artifacts from flooding to create dams around the world. Students can make posters, pamphlets, a television commercial, a YouTube video, a blog, conduct a fundraiser to help support the cause, or students can develop their own action plan.

Facilitator Guide

- Image Prompt – Write down specific information regarding the image in your box chart.
- *If needed, ask students what they see, what they know about the image, what current events may be related to the image, what is different from what they expected to see in the image?

Resources

Sites regarding the dam and the fourth cataract

http://academia.edu/1363890/Archaeological_Salvage_in_the_Fourth_Cataract_Northern_Sudan_1991-2008

<http://www.nubiansociety.org/PDF/MDASParticles/S&N7/S&N7Kolosowska.pdf>

<http://popular-archaeology.com/issue/june-2012/article/sudans-archaeological-sites-threatened-by-proposed-dams>

<http://archive.archaeology.org/0611/abstracts/sudan.html>

http://www.britishmuseum.org/research/research_projects/all_current_projects/merowe_dam_project.aspx

<http://www.sudantribune.com/spip.php?article20843>

Image Citations

Image of flooded Philae temple:

Ampin, M. (n.d.). Save Nubia Project. Retrieved on July 12, 2013 from
<http://www.savenubia.org/images/SaveNubia/Places/04-PhilaeTemple.jpg>

Images of spalling:

Art of Counting. (2011, April 03). [Web log message]. Retrieved on July 12, 2013 from

http://www.artofcounting.com/wp-content/uploads/2011/03/SetiG_20060504_168.jpg

and http://www.artofcounting.com/wp-content/uploads/2011/03/SetiG_20060504_169.jpg

Granting the Dam: Scene 1

Look at the image of the Philae Temple partially submerged in water.

Complete the Preserving our Past Scene 1 box chart regarding the image.

Scene 1 Box Chart:

<p>Facts: What we know from the image; scenario; data; observations.</p>	<p>Questions: What we want to ask about the scenario to gather more information (but not things we could look up the answer).</p>
<p>Hypotheses: What we think is going on; possible diagnoses, predictions.</p>	<p>Learning Issues: What we need to know to address the problem. Questions we could find the answer to in our texts, on the web, from an expert, etc.</p>

Granting the Dam: Scene 2

Look at the image of the damaged section of stone wall.

Complete the Preserving our Past Scene 2 box chart regarding the image. Be prepared to discuss your results.

Preserving our Past Scene 2 Box Chart:

Facts/Data	Learning Issues	Action Plan

Granting the Dam: Scene 3

Read the letter below.

To whom it may concern,

It is a grave time for the people of Sudan. Over the past 10 years our country's energy demands have outpaced our ability to provide energy to the growing population. While solar and wind power are a large portion of our energy sources, our primary energy source is from fossil fuels. Three years ago the rising cost of fossil fuels led the Sudanese government to turn to hydroelectric power. This form of energy is cleaner and doesn't require very costly raw materials. As such the Aswan and Merowe Dams were constructed on the Nile River and the construction of the Kajbar, Shereik, and Dal Dams has been scheduled.

These dams instead of being the answers to our prayers became our worst nightmares. Constructing the dams caused the Nile River to back up creating lakes upriver of the dams. Unfortunately this flooding covered up sacred archeological sites along the banks of the river. When this was discovered archeologists and historians in Sudan worked feverishly to preserve our culture and heritage. While most of the artifacts were preserved many structures and artifacts were either submerged or partially submerged. After considerable effort, excavating them or moving them to higher ground rescued the antiquities.

Unfortunately this was not the end of our problems. After relocating the structures and artifacts we noticed that there was damage at the water line on the objects. The objects display some type of white mineral deposit and spalling (breaking off into fragments). Since moving these artifacts required large amounts of money our scientists have not been able to fund research on these deposits and the damage they caused. I have enclosed a sample of the deposits and ask that you perform an analysis of them to determine what they are, where they came from, and how they can be avoided.

Thank you again for your help in preserving the cultural heritage of Sudan.

Sincerely,
Dr. Jordan Rose, PhD
Dean of the School of Antiquities
University of South Firka, Sudan

To assist Dr. Rose, your team will now perform the Salty Ceramics Lab. Afterwards, you should write a lab report following the guidelines provided **AND** write a brief professional letter to Mr. Rose about the identity of the substance, how the deposits came about on the surface of the stone, and possible methods that could be implemented to prevent future damage to the salvaged structures.

Sites regarding the dam and the fourth cataract

http://academia.edu/1363890/Archaeological_Salvage_in_the_Fourth_Cataract_Northern_Sudan_1991-2008

<http://www.nubiansociety.org/PDF/MDASParticles/S&N7/S&N7Kolosowska.pdf>

<http://popular-archaeology.com/issue/june-2012/article/sudans-archaeological-sites-threatened-by-proposed-dams>

<http://archive.archaeology.org/0611/abstracts/sudan.html>

http://www.britishmuseum.org/research/research_projects/all_current_projects/merowe_dam_project.aspx

<http://www.sudantribune.com/spip.php?article20843>