PROJECT REPORT

Northern Wyoming Community College District / National Science Foundation
Summer Energy Education Program 2012

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Douglas Wyoming
Summer 2012

TITLE

IN SITU MINING FOR ROLL FRONT PRECIPITATES
Uranium Deposits in Wyoming

SUMMARY

In the Powder River Basin, many uranium deposits are found as part of a roll front. A very efficient way to mine these deposits is to use an In-Situ technique in order to economically severe the mineral from the ground. This technique involves creating a solution in which the mineral will dissolve and pump the material to the surface where several other chemical processes will be used the separate the desired mineral. Uranium will continue to become an important energy mineral in Wyoming's future as nuclear energy projects move ahead.

ENERGY CONTEXT

Uranium is an important element used in the production of electricity at nuclear power plants. Wyoming is important as a producer of uranium but not in the production of electricity with uranium. The important thing for Wyoming students to think about in the production of nuclear energy is protection of water resources. the mine engineers have to take into consideration many factors when mining these resources. Fortunately for Wyoming many of these mines are very far from civilization.

ANTICIPATED TIME REQUIRED

Introduction: 20 minutes

Lecture to introduce concept of uranium in powder river basin.

Lab: 1 hour in class time

Set up 10 to 15 minutes following lecture and procedure

Lab will run 1 full class period

Drying phase may run for several days to complete

Assessment: 30 minutes to full class period

Lab write up in formal format.

INTENDED STUDENT LEVEL

The intended level for this activity is 9-12 high school

ASSUMED PRIOR KNOWLEDGE

- The students must be able to perform basic chemistry lab skills.
- The students will be required to perform basic skills in math.
- The students will be expected to work in a group to accomplish the goal.
- The student will need to use basic computer skills to develop the lab write up.
- Students will need to create charts and graphs (use Microsoft word and excel to create documents)

LEARNING OBJECTIVES

The intended learning outcome is an understanding that metal elements can be dissolved in a solution and then stripped from the solution and collected in a useful form. The student will have an opportunity to demonstrate skills in measuring volumes and calculating percent composition based on recovery rates from the soluble metal solutions they will be working with. The ultimate product will be a crystal they will have formed from the solution and a demonstration of an In-Situ mining operation.

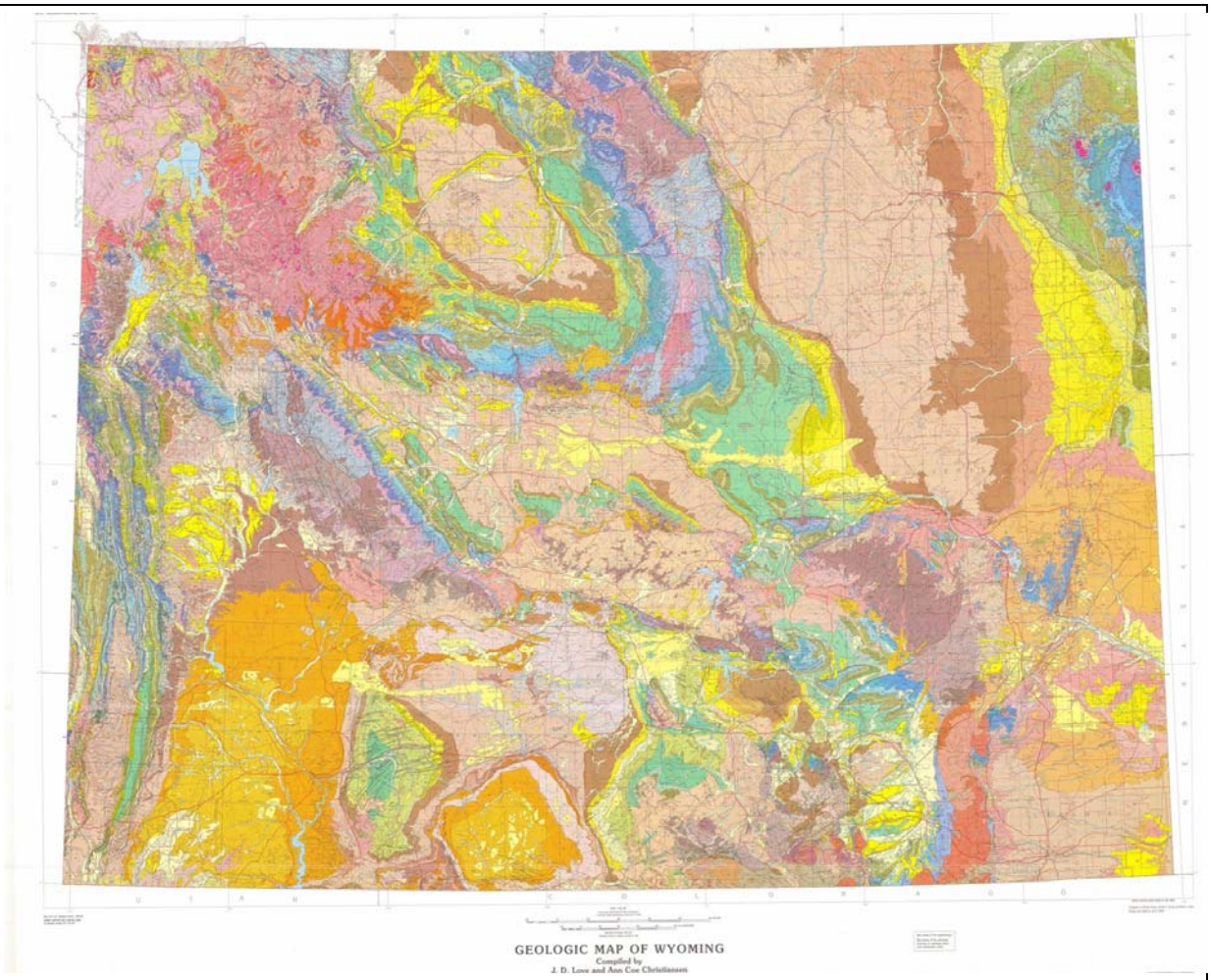
MATERIALS

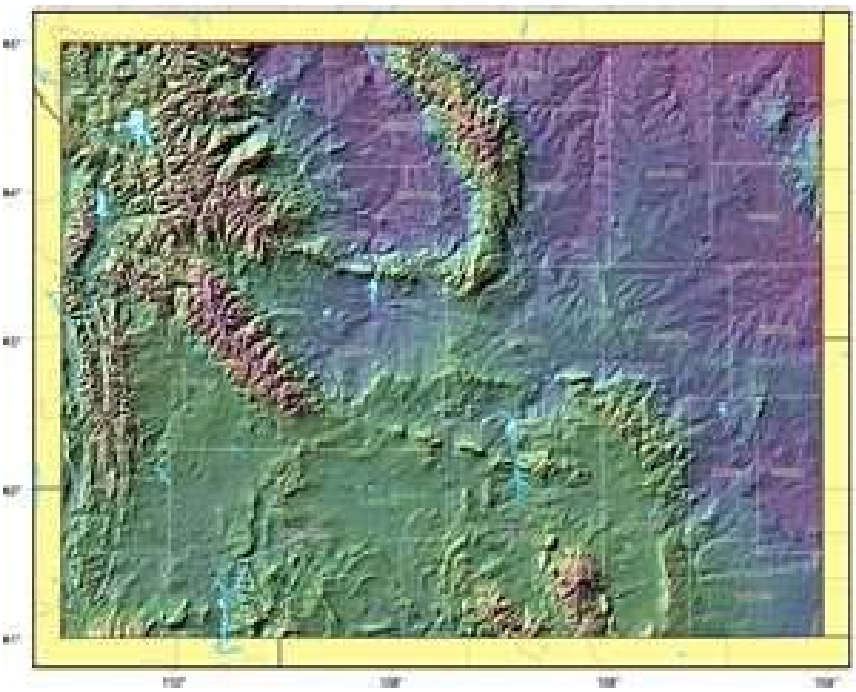
Materials needed:

- Plastic columns to represent sediment types
- Sand in grades fine and medium
- Copper chloride, copper sulfate, potassium chloride, sodium chloride
- 5g of each compound for both a fine sand and medium sand test
- Cheese cloth to cover the tubes
- Rubber band to hold cheese cloth on the tube
- Beaker for solution collection
- Petri dishes for final drying
- Hot plate or burner for initial concentrating of solution

INTRODUCTION / MOTIVATION FOR STUDENTS

Many Wyoming students will become involved in mining and drilling activities. This lab will show a practical application of a modern mining technique that they may become involved in. The core objective is to show how chemistry is really tied to the mining industry and a real life experience that would demonstrate a common mining technique.


GEOLOGIC MAP OF WYOMING
Compiled by
J. D. Love and Ann Coe Christiansen



PROCEDURE

1. Prepare the sediment column with one open end covered with cheese cloth and a rubber band to hold it
2. Place 100 g of coarse or fine sand into tube
3. Repeat #2 for 3 more samples using the same sand grain size for each tube
4. Measure 5 g of copper chloride and add to tube 1
5. Shake tube to evenly distribute the salt
6. Repeat with each salt and place in respective tubes keeping track of data in your note book
7. Use 200 ml of H2O to dissolve your mineral in the tube
8. Capture your elute in a beaker, decide how long the solvent gets to remain in contact with the solute.
9. On your own prepare a method to stop the flow of water for the wait period
10. Use a hot plate or Bunsen burner to concentrate you elute , do not boil violently
11. Take the concentrate and pour into a petri dish for final drying and possible crystal growth
12. Measure mass of collected dry material
13. Figure percent of recovery from your lab

SAFETY ISSUES

Some of the salts may have toxicity, familiarize yourself with the msds sheets from Flinn and use Flinn for disposal directions. Hot materials can burn use extreme caution when transferring hot materials.

TROUBLESHOOTING TIPS

New lab, not sure what will go wrong

ASSESSMENT
Formal lab write up to show the collected data and compare group capture rates to show best or optimal methods. Write up needs a quality conclusion that describes the idea of In-Situ mining and how this could be more environmentally friendly for Wyoming.
SUGGESTED EXTENSIONS
Have students try different salts and add different parameters to the ore. You could try a placement of the ore body vs. the spread out method Restrict the volume of water available. Add dollar values to the time for drying, more time equals penalties from the buyer Methods for removal of the water from the sand could increase the difficulty of the lab You may also want to include chemistry to separate the metal ions into the collectible metals 1. Using an iron nail to extract the copper from the copper sulfate solution 2. Using electroplating to remove the metal ions