

Lesson Name: Mountains of Doom

Expedition Link: Geology – Investigate the volcanic crater at Licancabur Lake to understand the environment, including the composition of rocks and slope material. Samples will be brought back to the lab for analysis. The investigation will also study how processes like creep can contribute to the lake sediment material by bringing slope material into the lake, and if the watershed created by the crater slope is enough to supply the crater. This investigation includes the search for hot sources also in the crater that could include search with an IR thermal imager. The geologic investigation will be finally completed by a morphological and topographical survey that will map the crater using a GPS, a camera and altimeter. This survey will help understand the dynamic processes that shaped the crater interior and formed the lake.

National Science Standards:

K-4.3 students

California State Science Standards:

California State Science Standards 4th

Investigation and Experimentation

6. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations.

California Science Standards 5th

Earth Science

Scientific Investigation

6. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations.

California State Science Standards 6th

Earth Science

Scientific Investigation

7. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations.

California State Science Standards 7th

Earth and Life History (Earth Science)

Scientific Investigation

7. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations.

California State Science Standards 8th Grade

Scientific Investigation

9. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other three strands, students should develop their own questions and perform investigations.

9th-12th California State Science Standards

Dynamic Earth Processes

5. Heating of Earth's surface and atmosphere by the sun drives convection within the atmosphere and oceans, producing winds and ocean currents. As a basis for understanding this concept: Students know how differential heating of Earth results in circulation patterns in the atmosphere and oceans that globally distribute the heat.

Ecology

6. Stability in an ecosystem is a balance between competing effects.

Biogeochemical Cycles

7. Each element on Earth moves among reservoirs, which exist in the solid earth, in oceans, in the atmosphere, and within and among organisms as part of biogeochemical cycles.

Investigation and Experimentation

1. Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept and addressing the content in the other four strands, students should develop their own questions and perform investigations.

Mountains of Doom

Materials: Each group of 3 – 4 students will need:

- 1 tub or basin 6-8 inches deep
- 1 liter container filled with clean sand
- goggles
- 1 small balloon
- 1 wooden skewer with pointed end
- a funnel with a large enough throat for paper dots to pass through
- colored paper dots
- 1 “Scientific Process” record sheet per student
- 1 3 x 5 index card
- cloth or plastic measuring tape



Procedure:

- A. Carefully pull the neck of the balloon over the throat of the funnel. Make sure to work the neck of the balloon far enough down the funnel throat so that the funnel actually empties into the round body of the balloon.
- B. Pour as many colored dots as you can into the balloon.
- C. Carefully remove the balloon from the funnel.
- D. Blow up the balloon. Each group should blow theirs up to a different size. None should be extraordinarily huge.
- E. Instruct each group to measure the circumference of the balloon & record it onto the index card. They should write the measurement large so others can see it when they come to observe their results. They are to place the card on the table next to their tubs.
- F. Place the balloon into the tub and cover it with sand.

STOP AND GUIDE THE STUDENTS THROUGH THE COMPLETION OF THE PURPOSE QUESTION, HYPOTHESIS AND PROCEDURE SECTIONS OF THE “SCIENTIFIC PROCESS RECORD SHEET”.

- 2.1 Instruct students to put their goggles on.
- 2.2 Gently place the skewer stick into the sand until it just touches the balloon
- 2.3 Instruct the students within each group to carefully observe the simulated blast from the balloon and the resulting crater created.
- 2.4 Instruct students to push the skewer into the balloon.

- 2.5 Encourage them to look for signs of the colored paper dots as well as examine the size and slope of the crater created by the simulated explosion.

STOP AND HAVE THE STUDENTS COMPLETE THE OBSERVATION AND CONCLUSION SECTIONS OF THE “SCIENTIFIC PROCESS RECORD SHEET”.

- 2.2 Rotate each group by the other students’ experiment so that they can observe the different craters created, taking special care to note the size of the balloon, the size of the crater, and the slope of the crater.
- 2.3 Debrief the students by holding a class discussion to review the relationship between circumference of the balloon (representing volume of gas in the volcano) to the diameter and depth (slope) of the resulting crater.

OPTIONAL EXTENSION ON DEBRIEFING STUDENTS

- 3.1 Debrief the students. Have each group report the circumference of the balloon and the diameter of the resulting crater. Record this in an “Excel” spreadsheet. Print off enough copies for each group to review or an overhead transparency. Use the data provided to compare the size of the blast (as it relates to the volume of air/gas in the balloon to the size of the crater) to the resulting size of the crater.

The Scientific Process

I. **Purpose** (ask a question that will be answered by the experiment or research)

II. **Hypothesis** (make a prediction on the outcome of the experiment or research)

III. **Procedure** (list of materials and steps to perform the experiment or research)

Materials Needed:

Experiment/Research Steps:

IV. **Experiment or Research**

V. **Observations** (record results in written form below or attach a data table and/or graph)

VI. **Conclusions** (Answer the "Purpose" question, compare results to "Hypothesis", & explain why you either did or didn't obtain the results you expected.)
