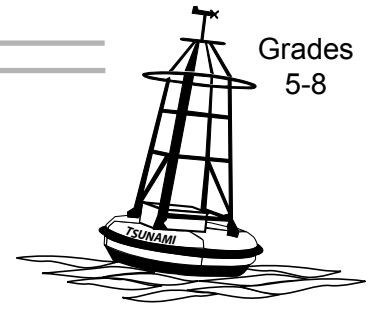


Finding Fairweather Fault

Grades
5-8



Overview:

In this lesson, students explore the scientific basis of local legends surrounding Lituya Bay, Alaska by examining its topography. Students also investigate a shaded-relief map for the presence of faults then compare topographical maps to shaded-relief maps. (NOTE: This activity should follow lessons *Sliding Plates* and *How the Mighty Fall*.)

Targeted Alaska Grade Level Expectations:

Science

- [5-8] SA1.1 The student demonstrates an understanding of the processes of science by asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring, and communicating.
- [8] SD2.1 The student demonstrates an understanding of the forces that shape Earth by interpreting topographical maps to identify features (i.e., rivers, lakes, mountains, valleys, island, and tundra).
- [7] SD2.2 The student demonstrates an understanding of the forces that shape Earth by describing how the movement of the tectonic plates results in both slow changes (e.g., formation of mountains, ocean floors, and basins) and short-term events (e.g., volcanic eruptions, seismic waves, and earthquakes) on the surface.
- [6] SD2.3 The student demonstrates an understanding of the forces that shape Earth by describing how the surface can change rapidly as a result of geological activities (i.e., earthquakes, tsunamis, volcanoes, floods, landslides, avalanches).
- [5] SF1.1-SF3.1 The student demonstrates an understanding of the dynamic relationships among scientific, cultural, social, and personal perspectives by telling a local or traditional story that explains a natural event (e.g., animal adaptation, weather, rapid changes to Earth's surface) and relating it to a scientific explanation.
- [6] SF1.1-SF3.1 The student demonstrates an understanding of the dynamic relationships among scientific, cultural, social, and personal perspectives by telling a local or traditional story that explains a natural event (e.g., animal adaptation, weather, rapid changes to Earth's surface) and relating it to a scientific explanation.
- [7] SF1.1-SF3.1 The student demonstrates an understanding of the dynamic relationships among scientific, cultural, social, and personal perspectives by investigating the basis of local knowledge (e.g., describing and predicting weather) and sharing that information.

Objectives:

The student will:

- investigate the scientific basis of a local story;
- create a topographic map;
- interpret a topographic map to identify features;
- infer locations of major faults in Alaska by analyzing a shaded-relief map of Alaska; and
- compare topographic maps to shaded-relief maps.

Materials:

- Water
- Blue food coloring
- Potato (1/2 per group)
- Clear plastic tub with flat bottom and clear plastic lid (one per group)
- Water soluble marker (one per group)
- Centimeter ruler (one per group)
- Kitchen knife
- Bowl (one per group)
- White paper
- Scissors
- Clear tape
- Sticky note flags
- Topographic map of Mt. Fairweather (C-5) Quadrangle, Scale 1:63,360 (NOTE: Print on tabloid-size sheets of paper)
- Poster and Pamphlet: Digital Shaded-Relief Image of Alaska by Riehle et al., USGS
- VISUAL AID: “Lituya Bay”
- VISUAL AID: “Tlingit Legends of Lituya”
- VISUAL AID: “Major Active Faults in Alaska”
- STUDENT INFORMATION SHEET: “Tater Topography”
- STUDENT WORKSHEET: “Digital Shaded-Relief Image of Alaska”
- STUDENT WORKSHEET: “Alaska Maps and Tectonics”

Science Basics:

Lituya Bay, Alaska is a dangerous place with a history of earthquakes, landslides, tsunamis, and violent tidal action. The Tlingit Indians who lived around this area for thousands of years have stories that illustrate the danger of this locality. In this lesson, students see two Tlingit stories recorded by anthropologists G. T. Emmons and Frederica de Laguna in the mid- to early 1900s. Viewing the topography of this region can help answer questions about the scientific basis of the legends. The Fairweather fault, a strike-slip fault, crosses the head of the bay and is surrounded by steep slopes.

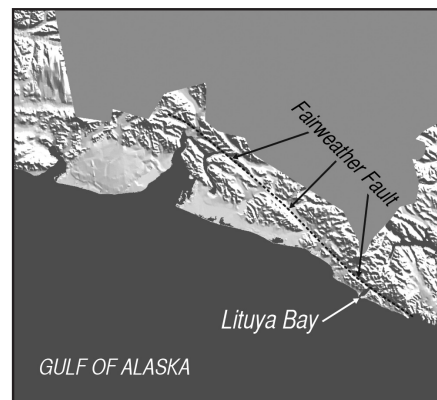
Alaska’s fault-controlled valleys are more prominent on the USGS poster: Digital Shaded-Relief Image of Alaska than on most other maps. The most prominent strike-slip faults include the Denali fault, the Tintina fault, and the Kaltag fault. The volcanoes on the Alaska Peninsula and Aleutians are signs of an associated thrust fault – the Aleutian Megathrust. (See the pamphlet that accompanies the map for more information.)

Activity Preparation:

1. Prepare water for the student activity by adding blue food coloring to the bowls until the water is a dark blue color.
2. Cut potatoes in half.
3. Access topographic map of Mt. Fairweather (C-5) Quadrangle, Scale 1:63,360 online at the Digital Raster Graphics – Alaska from the Alaska Geospatial Data Clearinghouse (http://agdc.usgs.gov/data/usgs/geodata/drg/temp/drglist_M.html) and print in color onto tabloid sheets of paper. Note: PC users should download the open source software program 7-Zip (<http://www.7-zip.org/>) to decompress this type of file.

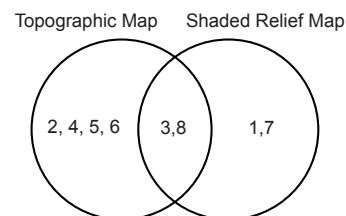
Activity Procedure:

1. Display VISUAL AID: “Lituya Bay” and explain after students make topographic maps to help interpret land features and changes on the surface as a result of tectonic action, students will explore the scientific basis of local stories surrounding Lituya Bay, Alaska.
2. Divide students into groups (preferably pairs) and distribute STUDENT INFORMATION SHEET: “Tater Topography.” Distribute: a clear plastic tub, clear plastic lid, marker, ruler, bowls of dyed water, and half a potato to each group. Guide students through the activity, providing assistance as needed.
3. When students are finished with the mapping exercise, distribute tape, a white sheet of paper, and a pair of scissors to each group. Ask groups to cut out a white circle and tape it to the back of the container lid to increase visibility of the contour lines. As a class, compare students’ maps and discuss how they compare and contrast. Ask students to consider how they know which part of their potato island was the “steepest” by looking at the contour lines. (*Steeper areas will have contour lines that are closer together.*)
4. Distribute one Mt. Fairweather (C-5) Topographic Map to each group. Ask students to explore the information on the map then mark each of the following items with small sticky note flags: island, mountain, glacier, river, and valley. Also ask students to identify the contour interval (*100 feet*). The contour interval of their potato maps is 1 centimeter. Circulate throughout the class and check for understanding then ask students to remove the flags.
5. Display VISUAL AID: “Tlingit Legends of Lituya” and discuss briefly. Ask students how the topography of Lituya Bay may contribute to the basis for the stories. If it is necessary to guide students to recognizing the potential for slope failure as a tsunami trigger in several areas around the bay, remind them that the steepest part of the potato maps were areas where contour lines were closer together. Where are the steep areas around the bay?
6. Explain another factor that may aid in generating a tsunami, in this particular bay, is the location of a strike-slip fault. Desolation Valley is part of a strike-slip fault called the Fairweather Fault. This means that if a person was standing on Cenotaph Island and facing the inland area of the bay, then the mountains on the other side of Desolation Valley and Crillon Inlet are moving to the right. This area has a history of strong earthquakes. Another factor that may contribute to stories of this area is the violent tidal action at the small mouth of this bay.
7. Display the USGS poster: Digital Shaded-Relief Image of Alaska. Explain that locations of fault-controlled valleys like the Fairweather fault are more obvious on the Digital Shaded-Relief Image of Alaska. Show the location of Lituya Bay and the Fairweather fault.
8. Distribute STUDENT WORKSHEET: “Digital Shaded-Relief Image of Alaska,” and ask students to identify other possible faults. Major faults that are most obvious are the Denali fault, the Tintina fault and the Kaltag fault. Ask students to compare their inferences to VISUAL AID: “Major Active Faults in Alaska.”
9. Distribute STUDENT WORKSHEET: “Alaska Maps and Tectonics” for student completion.

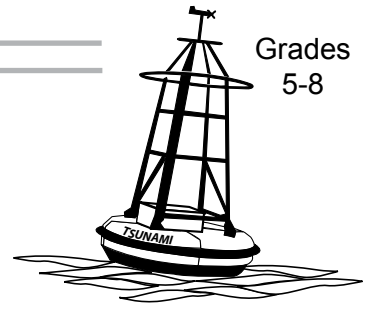


Answers:

1. *Student responses should list slope failure, earthquakes connected to the Fairweather fault along Desolation Valley, or violent tidal action at the mouth of the bay.*
2. *See Venn diagram at right.*
3. *Shaded-Relief*



Student Information Sheet



Directions:

1. Place the lid on the container and draw a vertical line along the edge of the lid and the side of the container so that they can be matched up later.
2. Use the ruler and marker to draw a scale in one-centimeter increments along the side of the container.
3. Remove the lid and place the potato, cut side down, in the clear plastic container.



4. Add colored water carefully until the level reaches the two-centimeter mark. Do not pour water directly on the potato.
5. Replace the lid and orient it so that the lines drawn in the first step of this procedure are aligned.



6. Look straight down into the container and draw a line that represents where the water meets the potato. This is the shoreline.

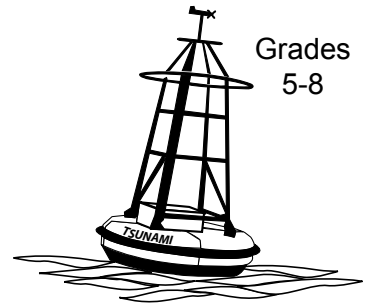


7. Repeat steps 4, 5, and 6, adding one centimeter of water each time until the potato is submerged.

Name: _____

Student Worksheet

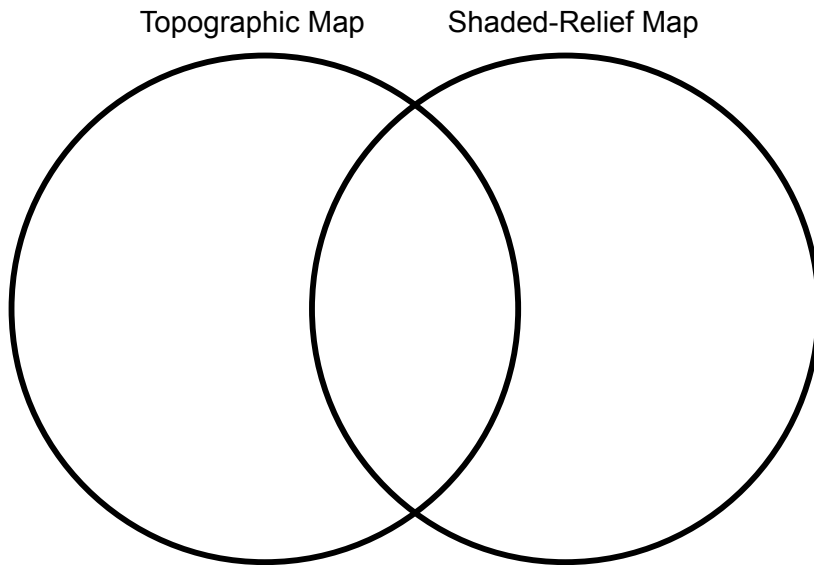
Alaska Maps and Tectonics



1. What is a possible scientific basis for the Tlingit legends of Lituya Bay, Alaska?

2. Compare the topographical map to the shaded-relief map. Place the *number* of each phrase from the bank into the Venn diagram below.

BANK	
1. Shows elevation by shading	5. Shows inland water features
2. Shows vegetation	6. Shows elevation by contour lines
3. Shows elevation	7. Shows land obscured by glaciers
4. Shows place names	8. Shows land features



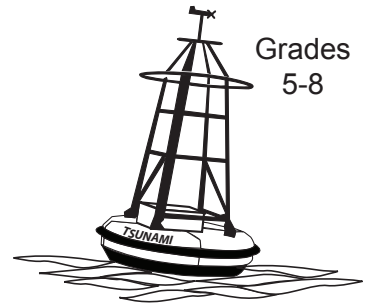
3. Which map shows faults more obviously? Circle one.

Topographic Shaded-Relief

Name: _____

Student Worksheet

Digital Shaded-Relief Image of Alaska



Map source: Riehle, J. R., Fleming, M. D., Molina, B. F., Dover, J. H., Kelley, J. S., Miller, M. L., and Nokelberg et al. (1996). Digital shaded-relief image of Alaska. U. S. Geological Survey.