Grade 2 (Grade Band K-2)
Unit 3: Earth Science
Disciplinary Core Idea: Earth's Place in the Universe
Investigation 1

Overarching Questions

- How can we explain how the world works (without experimentation)?
- Does change on Earth happen slow or fast?

Overarching Goals

Students will understand that changes to Earth's surface can occur rapidly with events such as earthquakes and volcanic eruptions or slowly due to the occurrence of erosion by water and ice. Students will also be able to construct an explanation in response to a problem that is supported by observations made from several different sources.

Objectives

Next Generation Science Standards

[2-ESS1-1] Use information from several sources to provide evidence that Earth events can occur quickly or slowly.

- After instruction and observing several sources the student will be able to identify natural processes and events that are able to change the landscape through weathering, erosion and deposition at the proficient level of a teacher made rubric.
- After instruction and observing several sources the student will be able to explain through a written description how Earth processes and events are able to change the landscape slowly or rapidly, at the proficient level of a teacher made rubric.
- After instruction and observing several sources the student will be able to construct two separate diagrams that display an event happening quickly and event that happens more slowly, a the proficient level of a teacher made rubric.

Materials

Lesson 1: Pre-Assessment- What do you know?

- Pre-Assessment- 2-ESS1-1 written (1 per student)
- Glue and/or double sided tape
- Science notebooks

Lesson 2: What is a Meteorologist? (What is erosion?)

- Student worksheet: Career Profile (1 copy per student)
- Science A-Z Career File: Volcanologist (1 copy per student)
- Science A-Z Graphic Organizer: KWL (5 copies per student)
- What is Erosion? (p. 5 of *Erosion* by Becky Olien)
- Large sheets of chart paper (9)
- Crayons/colored pencils
- Science notebooks

Lesson 3: Traditional Knowledge
Day 1 (option 2)

- Geological Changes in the Yakutat Area: Russell Fiord (Volume 2 p. 286-288 in "Under Mount St. Elias: The History and Culture of the Yakutat Tlingit" by de Laguna- Available in YSD library)
- Student worksheet: How long does it take glaciers to change the land? (1 copy per student)
- 1 long sheet of white paper (approximately 7 feet)
- Hubbard and Nunatak Glacier Map
- Markers
- Colored pencils
- Notebooks

Day 2 (option 2)

- Glaciers **and** Rocks (Volume 2 pp. 818-820 in "Under Mount St. Elias: The History and Culture of the Yakutat Tlingit by de Laguna- Available in the YSD library)
- School van
- Yard Stick

Lesson 4: How long does it take for the land to change? (What are changes we can observe? What are changes we can't observe?)

Days 1-4: How long does it take glaciers to change the land?

- Science A-Z Graphic Organizer: KWL (from previous lesson)
- Student worksheets: *Glacier Information* (1 copy per student)
- Reading A-Z: Web Wheel (1-2 copies per student)
- Snow…er! Iceballs! Activity (p. 137 in 365 Simple Science Experiments
- TeachersPayTeachers: Landforms- Posters and Bingo (p.18)
- Glacier Erosion activity (p. 12 in 75 Easy Earth Science Demonstrations by Thomas Kardos)
- Reading A-Z Leveled Book: Mighty Glaciers (1 copy per student)
- Science A-Z Word Smart (optional)
- Reading A-Z Lesson Plan: Mighty Glaciers (optional)
- *Glacier Ice* lesson material
- *Glacier Moraine* lesson material
- *Glacier Valley* lesson material
- Medium rocks
- Foil tray
- Sand
- Soil
- Shampoo
- Hubbard Landform Model (glacier component)
- Hubbard Landform lesson plan (optional)
- Sand, rocks (small and large), soil
- "KWL" chart from previous lesson
- "Glacier Information" chart made previously
- "Web Wheel" chart made previously
- Science notebooks

Days 5- 7: How long does it take to rivers change the land?

- Science A-Z Graphic Organizer: KWL (1 copy per student)
- Student worksheet: *River Information* (1 copy per student)
- Reading A-Z Graphic Organizer: Web Wheel (1-2 copies per student)
- Science A-Z Investigative File: Wild Rivers (optional)
- Water Erosion (p. 9 of Erosion by Becky Olien)
- Ophir Creek Map lesson material

- "KWL", "River Information" and "Web Wheel" charts (made earlier)
- Water source (faucets)
- Aluminum pans (5)
- Sand, pebbles, gravel (1 lb. each)
- Paper cups (4- each with 4 small holes clumped together in the bottom)
- Potting soil (5 lbs.)
- 4 buckets
- 4 solo cups
- Outdoor gear
- Science notebooks

Days 8-10: How long does it take volcanoes to change the land?
- Science A-Z Graphic Organizer: KWL (1 copy per student)
- Student worksheet: *Volcano Information* (1 copy per student)
- Reading A-Z Graphic Organizer: Web Wheel (1-2 copies per student)
- Earth Science for Children: All about Volcanoes DVD
- DVD player
- AKSCI Volcanoes and Tsunamis lesson plan
- Steam cone activity (p. 135 in 75 Easy Earth Science Demonstrations book)
- Hubbard Landform Model (volcano component)
- Hubbard Landform lesson plan (optional)
- The Best Book of Volcanoes by Simon Adams (pp. 4-5, 6-7, 10-11, 14-15, 18-19, 20-21, 22-23, 24-25)
- "KWL", "Volcano Information" and "Web Wheel" charts (made earlier)
- Science notebooks

Days 11-13: How long does it take for earthquakes to change the land?
- Geological Changes in the Yakutat Area: The Yakutat Earthquake, 1899 (Volume 2 p. 286-288 in "Under Mount St. Elias: The History and Culture of the Yakutat Tlingit" by de Laguna- Available in YSD library)
    - You can substitute have an elder
- Science A-Z Graphic Organizer: KWL (1 copy per student)
- Student worksheet: *Earthquake Information* (1 copy per student)
- Reading A-Z Graphic Organizer: Web Wheel (1 copy per student)
- AKSCI Shake, Rattle and Roll lesson plan
- Earth Science for Children: All about Earthquakes DVD
- "KWL", "Earthquake Information" and "Web Wheel" charts (made earlier)
- Science notebooks

Lesson 5: How can we write a newspaper article?
- TeachersPayTeachers Newspaper Templates
- Reading A-Z: Draw Conclusions Worksheet
- Class charts: Glacier Information/Web Wheel, River Information/Web Wheel, Volcano Information/Web Wheel, Earthquake Information/Web Wheel
- Science Notebooks

Lesson 6: Post-Assessment- What did you learn?
- Post-Assessment: 2-ESS1-1 written component (1 per student)
- Post-Assessment: 2-ESS1-1 oral component (1 per student- optional)
- Glue and/or double sided tape

- Science notebooks

Time frame

- Two Weeks
- 8, forty-minute lessons

Overall Procedure

Investigation 1

Lesson 1: Pre-Assessment- What do you know?
Estimated time: 1, forty-minute lesson.

Teacher Prep: Print and make 1 copy per student of the *Pre-Assessment 2-ESS1-1* worksheet and paste Parts 1-3 into students' science notebooks. Have colored pencils/crayons available for students.

Engage

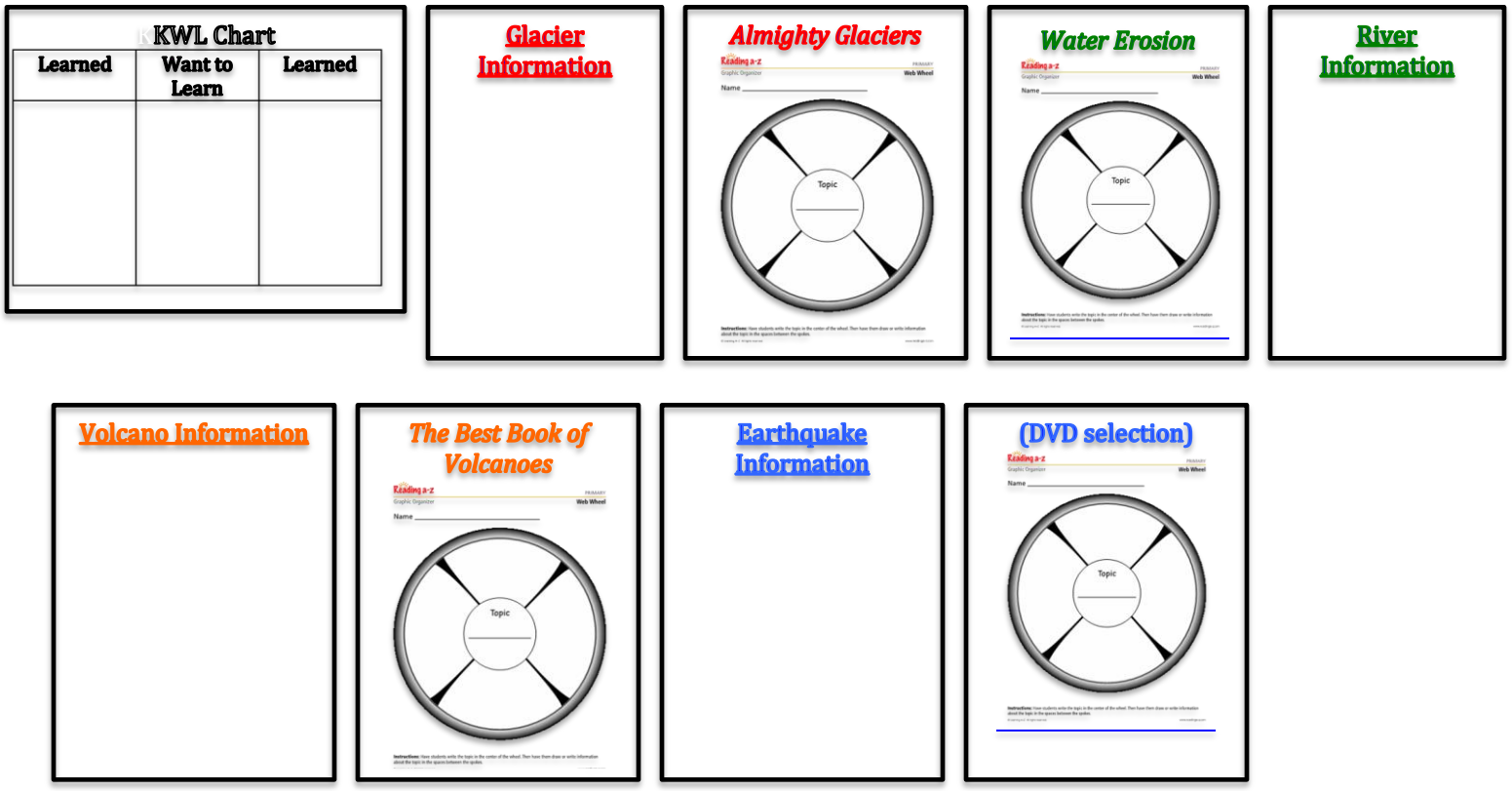
- Tell the class they are about to begin a new investigation today, which means they will have a whole new problem to try and solve as well as a new role to fill that will help you and your teammates solve the problem. For this particular investigation students will assume the role of a volcanologist who works for the United States Geological Survey, or USGS. USGS is a scientific agency with the government. It focuses on studying the land and its natural resources, such as water, wildlife, plants and soil, and then providing information on these topics to communities all around the United States. A very important mission of USGS is preparing communities for natural processes and events that could be harmful to people as well as the natural resources they rely on. David Applegate is the director of the Natural Hazards division at USGS, and your new boss for this investigation. He wants to begin a new program in schools around Alaska, as well as the country, where young scientists learn about various natural process and events that do or will occur in our lifetimes and communicate this information to the communities. Mr. Applegate wants to begin this new program called, Earth Learning, with this team of volcanologists in the Yakutat School District elementary school. The team will learn and work together like professional volcanologists and then communicate their knowledge to the community. Each member of the team will be responsible for writing up a newspaper article for Yakutat's local newspaper, The Driftwood Dispatch, using information they've learned over the course of the investigation.
- Tell the team of meteorologists that they will have three major questions to write about in their newspaper article (write the following on the board):
    - How do natural events and processes change the land?
    - How long does it take for natural events and processes to change the land?

Elicit

- Tell the team that before they can dive into this investigation, Mr. Applegate requires that each team member take an assessment in their notebooks. This is not a test and students do not need to worry if they do not have all the information to answer the questions. The objective of the assessment is to figure out how much students know about certain topics so that the lessons that follow are geared to students' needs.
- Instruct students to open their notebooks and begin will out the pre-assessment to the best of their ability.

Lesson 2: What is a Meteorologist? (What is erosion?)
Estimated time:

Teacher Prep: Copy and glue each of the following worksheets into students' science notebooks: *Career Profile* (1 copy each) and Science A-Z Graphic Organizer: *KWL* (5 copies per student). Before gluing the worksheets into the notebooks, leave a page blank for students to record down the investigation's problems. Make 1 copy per student of the Science A-Z Career File: *Volcanologist* quick read. Only one copy of the book *Erosion* (Becky Olien) is available in the kit, so decide ahead of time if you want to make copies of the reading or if you will be reading it aloud to the class. On five large sheets of chart paper write out the following (refer below for examples of the layout of each sheet): KWL chart, Glacier Information, River Information, Volcano Information, and Earthquake Information.



Engage

- Begin the lesson by asking the class to recall their mission and role for the new investigation as well as the name and mission of the agency they will be working for. (Reiterate any details of the investigation that students have a hard time recalling on their own.) Write the following questions to the investigation on the board and instruct the team of meteorologists to open to a blank page in their notebooks and record *Problem* at the top of the page and the questions below it:
  - How do natural events and processes change the land?
  - How long does it take for natural events and processes to change the land?

Elicit

- Since students will be assuming the role of a volcanologist it is important they learn a bit more about the tasks these particular scientists do on a regular basis. Ask students to volunteer ideas about the role of a volcanologist and record their ideas on the board.

Explore/Explain

- Pass out 1 copy of the Science A-Z Career Profile: *Volcanologist* quick read to each student then read it over and discuss the major characteristics of a volcanologist as a class. Pose the following questions to engage the team in a discussion:
    - What is the center of the Earth (the core) like?
    - How might volcanoes form?
    - What do volcanologists study?
    - What do you have to study in school in order to study volcanoes?
    - What are some interesting facts about volcanoes or the scientists that study them?

Extend

- Instruct the team of meteorologists to open their science notebooks and complete the *Career Files* worksheet.

Elicit

- Post the KWL chart in the center of the room and instruct students to open to the first KWL chart that has been glued into their notebooks and label it, What is Erosion? The volcanologists should be aware that there are 5 different *KWL* worksheets in their notebooks but they should only be focused on the first one for today's lesson.
- Ask the team the following questions and record their responses under the "K" column of the KWL chart posted in front of the room:
    - Does Earth's surface change?
    - What can cause the surface of the Earth to change?
    - What are natural events that can cause changes to the Earth's surface but are also dangerous?
- Remind the team that their mission for this investigation as volcanologists working for USGS is to figure out which natural events and processes change the land, how fast these changes occur, and what people can do to prepare and keep safe during any dangerous events. The team already has some experience with part of this topic already. Team members will collect information from different resources, such as books, scientific models, demonstrations, and then write a newspaper article on this topic for the Driftwood Dispatch. Ask the team why members of the community would be interested in this type of information and what other information they will need to learn in order to successfully complete this investigation. Write the young scientists' responses under the "W" column of the chart.
- Tell the team they will review and go a little more in depth about a natural process caused by the movement of water (liquid and ice) as well as learn about two different but very powerful and dangerous Earth events during this investigation. Explain that during the first half of the investigation the team will review and learn new information about erosion caused by glaciers and rivers. The second half of the investigation will focus on volcanoes and earthquakes, two concepts that have not been discussed in class before.
- Instruct team members to refer to the first *KWL* chart in their notebooks and answer the following question under the "K" column of the chart: What is Erosion?
- Discuss the volcanologists'' responses as a group and record information under the "K" column of the chart.

Explore

- Tell students that before jumping into the investigation, the team will take time to review the very important concept of erosion with a short reading. Together as a team read over *What is Erosion? (p. 5 of* Erosion by Becky Olien).

Explain

- Review the text as a class by posing the following questions to the young scientists:

- What forces cause erosion?
- How do these forces change the surface of the Earth?
- How long does it usually take erosion happen naturally?
- Can people speed up the process of erosion? How?

Evaluate

- Instruct the members of the team to turn to the KWL worksheet they were working on earlier. Post the following questions to the volcanologists and have then record their responses under the "L" column of the chart:
  - What is erosion?
  - What new information did you learn about erosion from the reading?

Lesson 3: Traditional Knowledge

Estimated Time: 2, forty-fifty minute lessons

Teacher Prep Day 1 (Option 1): Invite an Elder or guest speaker from the YTT Cultural Center or community into the classroom to speak on themes related to the Overarching Question and/or Cultural Perspectives (heat/substances) stated below. It is important to note that the 'heritage cultural perspectives' were adopted from the Sealaska Heritage Institute Curriculum in order to provide an overall context as well as connections to the science investigation and should be adapted accordingly to reflect the culture of Yakutat.

Overarching Investigative Question: How long did it take for some of Earth's events to occur?

- **Heritage Cultural Perspective (on Earthquakes)**

Earthquakes have always been a natural phenomenon in Southeast Alaska. They are reflected in Native music and song.

- **Heritage Cultural Perspective (on Tsunamis)**

The old Native village in Lituya Bay was wiped out by a tsunami in the late 1950s. As a result of the 1964 Alaska earthquake, many coastal communities felt the impact of tsunamis.

- **Heritage Cultural Perspective (on Volcanos)**

Mt. Edgecumbe near Sitka is a well-known volcano. In the story, "How Raven Brought Fire to The People," the hawk is directed to go to a volcano to get the fire to bring it to the people. As a result, the hawk's long beak burned off. Raven gave the hawk a short, stubby beak as a replacement.

Print and digital recording versions of the story, "How Raven Brought Fire" can be found online on the Chugach Alaska Corporation at the following website: http://www.chugach-ak.com/who-we-are/history-culture/how-raven-brought-fire.

- **Heritage Cultural Perspective (on Floods)**

Like most cultures in the world, the Native people of Southeast Alaska have a "big flood" story. The story tells that the great flood unified the people of Southeast Alaska and that they survived by waiting out the flood in the Wrangell Mountains.

Teacher Prep Day 1 (Option 2): Read over and familiarize yourself with the following excerpt from Volume Two of de Laguna's "Under Mount St. Elias: The History and Culture of the Yakutat Tlingit": *Geological Changes in the Yakutat Area: Russell Fiord* (p. 286-288), *Glaciers* **and** *Rocks* (pp. 818-820). All three volumes of de Laguna's work can be found in the Yakutat School District Library while scanned copies of the excerpts are included with this investigation. This lesson is divided into a classroom (day 1) as well as an outdoor (day 2) component, which will take place at Russell Fjord. Coordinate accordingly for transportation out to the head of the Russell Fjord trail as well as proper protection (i.e. bear spray) and attire for the 0.8 mile hike down to the shore of the Fjord (water bottles, sturdy shoes and rain gear

are musts for this hike). If you are unaccustomed to the trail it is highly recommended that you traverse it at least once before hiking it with students since it can be somewhat steep, rocky and wet in certain areas. One of the activities during this lesson is structured to help the class conceptualize time in years by comparing their age (or amount of time taken to reach their current height) with the time it took for Nunatak Glaciers to advance during the Little Ice Age (around 2,000 years). On a large sheet of paper (approximately 7 ft. long), the class will first draw a picture of themself alongside a photograph of a glacier (note example below) before marking the average age (or time it has taken students' to reach their current height) of the class above the drawings. Markings can be done with a line (indicating one year) or some other design, but the design must be kept consistent. The same will occur above the photograph of the glacier, which is to represent Nunatak Glacier. Since it took 2,000 years for Nunatak Glacier to reach the head of Russell Fjord, the class will have to mark 2,000 lines on the chart. Make an enlarged version of the Map of Hubbard and Nunatak Glaciers as well as 2 copies per student. Have available 1 dark colored marker per student, science notebooks as well as a long sheet of white paper (about 7 feet long) that can be marked on. Refer to a model of its set-up below:

Engagement

- Have the class sit on the floor and set-up the Map of Yakutat so that it is visible to the entire class. Ask students to close their eyes and imagine themselves as a something that can fly, such as an insect, bird, bat or airplane. It is a beautiful sunny day with only big, white puffy clouds in the sky and each of them is flying very high over Yakutat. They can feel the wind blowing in their faces as it pushes them up higher. The air is cool and smells fresh, just like any sunny day after a big rainstorm. The mountains look huge even though you know they are so far away, and the snow on the peaks glitter as if it is covered with tiny mirrors. Suddenly a breeze of air comes up from the ocean below and fills your nose with the scent of salt. You can see very small ripples in the water below and even fishing boats in the Bay. Ask students to share what they feel and see, making sure to keep their eyes closed.

Explore

- Instruct the students to open their eyes before handing out 2 copies of the Hubbard and Nunatak Glacier Map as well as a dark colored marker to each student. Explain that this is an actual photograph of their community taken by a satellite from space. Allow students time to observe the photograph and identify locations on it that they know. Ask the following questions to get students acquainted with the features on the map:
    - What color is the ocean?
    - What color is the fjord?

- What color is the land?
- What color is the snow?
- What color are the glaciers? Where are the glaciers located?
- What color are the mountains?

- Tell students that a very long time ago, the weather in Yakutat was a lot different than it is today. It was a lot colder and over time more and more snow piled up on mountains. Eventually the glaciers, such as Hubbard and Nunatak, began to grow and move down the mountains, taking pieces of it as they moved. [Instruct students to take a moment and locate Hubbard (Orange star) and Nunatak (Red star) glaciers on their maps. They are to trace the movement of the glaciers with a marker as you continue talking. Make sure to indicate the movement of the ice on the enlarged map as well.] As the weather got colder, Hubbard Glacier slowly creped its way down Disenchantment and into Yakutat Bay. At the same time, Nunatak Glacier slowly moved along Nunatak Fjord before making its way down the land towards the ocean. As Nunatak Glacier moved it eroded the land, creating Russell Fjord as it did this. Review the word *erosion* with students. (Erosion is when wind, water and ice carve away or break rock into smaller pieces, carrying it from place to place) It took almost 2,000 years before the two glaciers came to a resting spot from the original positions in the mountains. Hubbard Glacier stopped advancing once it came to the mouth of the Yakutat Bay. Instruct students to draw a line from the tip of Ankau (Ocean Cape) to Point Manby on their maps and then color in all of Yakutat and Disenchantment Bays. This represents the position of Hubbard Glacier a long time ago. [You can mention it was over 1,000 years ago if students can distinguish the time of its position from the amount of time it took to get there.] Nunatak Glacier on the other hand, after 2,000 years of slowly moving down the mountains and land, finally came to rest along to what is now the southern shore of Russell Fjord. [Instruct students to draw a line along the southern shore and then color in the southern arm of Russell Fjord as well as Nunatak Fjord.] Tell students that the two glaciers stayed in those positions for many years before they began to recede (move backward).

Explain

- Take out the long sheet of white paper and tell the class they are going to do an activity that demonstrates how long it took Hubbard and Nunatak Glaciers come make their way down the mountains and onto the land. To do this the class is going to make their own picto-graph, which compares information of two or more things. Today the class will compare the time it took in years for students and the Nunatak Glacier to grow. Instruct students to draw a picture of his or her self next to the photograph of Nunatak Glacier then ask the class how many years it took them to grow to their current height. Write the age of each student on the board before taking an average, explaining that an average is a number that represents all of their ages together.
- Instruct students to line up by the picto-graph and explain that each horizontal line that is drawn represents one year. Reiterate how many years it took the students in the classroom to grow to their current heights. Have students draw with a marker a short, horizontal line on the graph (above the class picture) one at a time until they've recorded the number of years it took the class to grow.
- Ask the class how many years it took Nunatak Glacier to reach the bottom of Russell Fjord. (2,000 years) Since this will take up more time and space, call students up one at a time to draw 20 closely, spaced lines on the graph. Review the results as a class.
- Have students record what they've learned so far about glaciers on the worksheet glued inside their notebooks titled, *How Long Does It Take Glaciers to Change the Land?* Ask the following questions to guide students during the note recording process:
  - When did the Hubbard and Nunatak glaciers begin to grow?
  - What happened as the glaciers moved down the mountains?
  - How many years did it take before the glaciers stopped moving?
  - How was Russell Fjord formed?

Explore

- Post a new and enlarged version of the *Hubbard and Nunatak Glacier Maps* in front of the class and distribute a second copy of the *Hubbard and Nunatak Glacier Map* to students. Tell the class they will continue to follow the movement of the glaciers on their maps.
- Explain that by the time the Kwackqwan had come to Yakutat from Copper River the weather was changing and becoming a lot warmer again. The glaciers had begun to melt. Unlike people, glaciers can shrink and grow depending on the weather. As it melted, many of the rocks that Nunatak Glacier had eroded from the mountain and the land and carried during its journey were dropped. A large hill of rocks, or also known as a terminal moraine, was formed along the shore.[Instruct students to draw a terminal moraine on their maps along the southern shore of the Fjord. Model this if necessary.] Explain that Nunatak Fjord melted a lot faster than the amount of time it took to move down the mountain and over the land. As it melted it began to fill in the land it had craved out with fresh water. For many years the Yakutat Tlingit knew this as Russell Lake. It was called a lake because none of the salt water from Disenchantment Bay could flow through. The ice from the glacier was blocking the seawater! [Instruct students to draw Nunatak Glacier. The ice should extend only slightly into and stretch across the shores of the northern and southern arms of Russell Fiord as well as all the way back into Nunatak Fiord.] But Russell Lake would not last forever. About 160 years many of your great-great-great grandparents were living in Yakutat when the Nunatak Glacier was much larger than it is today. During that time the glacier melted even more but this time away from the shores of Russell Fiord. This released all the water in the lake! Ask students if they have ever put their hand over a running facet and then removed it. What happened? [Using the map as a visual, explain to the class how the ice blocked the water in the lake. As the ice melted there was space for the blocked water to flow through.] Explain to the class that people were by Old Situk River the day this even happened 160 years ago and that story was recorded so that we could read about it today.
- Read the following excerpt entitled *Russell Fiord* (p. 287, de Laguna, 2009):

> *The people were near the (Russell) lake, picking strawberries. Great numbers of wonderful, big strawberries grew all around the lake. There were so many that everybody would go out to them The younger men had the job of just carrying basketful after basketful of the picked berries to load them in the war canoes. That was what my father was doing. Every time he came back to the boat, he found that it was going dry, so he would push it off into deeper water before going back for another load. When this happened a few times he realized that the water was really going down. He reported back to the people: "The river is going down!" Everybody ran and got into the canoes and started down the steam. Suddenly a big wall of salt water rushed down stream. Everybody got away safely. There was still enough water in the stream for the canoes. But after that, (Old) Situk River was just a little one."*

Explain

- Discuss the story as a class, including the following questions:
  - What did the water level in the river tell the man?
  - Where did the flood of water come from? Why did Russell Lake drain into the Old Situk?
  - Would you consider this a dangerous event? Why?

Extend

- Instruct students to open their science notebooks to a new page and answer the following question: Why is it important that we pass down stories like these in our families and in our community?

Teacher Prep Days 2-3 (Option 2): Trip to Russell Fjord! Have the necessary transportation, attire and resources (snacks/water) for the day. Students will bring back one rock each to write about later in their

notebooks so it may be necessary for them to bring along a backpack for easier carrying. Bring along a Yardstick or walking stick that measures out 1 meter in length.

Engagement

- Before heading down the Russell Fiord trail with the class, tell students that at some point during the hike they will come to a very steep and rocky hill. Nunatak Glacier left this hill of rocks, or terminal moraine that was briefly discussed last lesson, when it began to melt. Students are to take care walking down this hill.

Explore

- Once reaching the shore of the Fiord, give students a few minutes to explore on their own before calling them in for an activity. Tell them they are to find a spot and sit by themselves for the next 5 minutes and just observe, using as many senses as they can, the area around them.
- After 5 minutes call students back and discuss anything and everything they observed as well as any questions that came to mind.
- Explain to students that the Yakutat Tlingit believed that there were female and male glaciers. Male glaciers were thought to have the cleaner and whiter bodies and were either advancing or readying themselves to advance. Female glaciers on the other hand were usually melting and moving back towards the mountains and had long, brown streaks running down the center of the ice. These brown streaks, which were pieces of rock and sand that had been eroded from the land, represented a woman's hair that was parted down the middle. Just like glaciers, rocks had spirits and people would speak to rocks that had shapes resembling people or animals. It was believed that many people and animals had turned to rock when Raven opened the Box of Daylight while others had been turned to stone by Raven himself.

Explain

- Instruct the class to look out toward the mounts and point in the direction they think Nunatak Glacier is located. Ask the class how many years it took Nunatak Glacier to move down the mountain and land before it got to exact spot where students are now sitting? (2,000 years) What did the glacier do as it moved over the land? (Eroded the rock and created the lower part of Russell Fiord.) Ask the class to predict how far they think most glaciers move in a day? Listen to students' answer then take out and display the yard/walking stick to the class. Explain that it represents about 3 feet or 1 meter, which is approximately how far most glaciers move in a day. How many meters did the class walk just to get to the shore of Russell Fiord today? (Way more than a meter!)
- Play the Glacier Creep Relay Race. Delineate the **START** and **STOP** points for the race then break the class up into two groups. Groups are to line up at the starting point and then two students at a time will race each other to and from the **STOP** points before tagging the next person in line. The trick to this race is that students are to act like glaciers, which means they can only move one meter at a time.

Extend

- Before leaving the Fiord tell students to find 1 rock of their liking to take back to the classroom. Each student will write a short story about their rock which could be about its journey on the back of Nunatak Glacier as it traveled from the mountains to the shore of Russell Fiord or how it became a rock in the first place. Students can also chose their own story line as long as it involves the rock they chose.

<u>Lesson 4: How long does it take for the land to change?</u>

*What are changes we can observe? *What are changes we can't observe?

Estimated time:

Days 1-4: How long does it take glaciers to change the land?

Teacher Prep: Read over the procedures and arrange any additional materials needed to implement the following demonstrations and lessons: *Snow…er! Iceballs!* (p. 137 in 365 Simple Science Experiments by E.R. Churchill, L.V. Loeschnig and M. Mandell), *Glacier Erosion Activity* (p. 12 in 75 Easy Earth Science Demonstrations by Thomas Kardos) and Reading A-Z: *Mighty Glaciers*. Print and make 1 copy per student of the Reading A-Z Leveled Book: *Mighty Glaciers* and the *Glacier Ice/Glacier Moraine/Glacier Valley* lesson materials. Print 1 copy of the following worksheets for each student and glue into science notebooks: *Glacier Information* and Reading A-Z Graphic Organizer: *Web Wheel.*

Teacher Prep: Lay down a layer of sand on the bottom of the foil tray. Make a gradual incline up one side of the tray with soil and make 2 "mountain peaks" spaced apart at the top, creating a dish like space between the two peaks. Put small pebbles on the soil and sand. Have available the following materials that were used during previous lessons: Glaciers poster (p. 18 in Landforms: Posters and Bingo resource), KWL chart, Hubbard Landform Model and the *Glacier Information* sheet. Write the following questions on the board:

- How do glaciers form?
- How do glaciers change the land?
- Do glaciers change the land slowly or quickly?

Elicit

- Begin lesson by asking the team of volcanologists to state what they will be investigating over the next few lessons. (How glaciers change the land and if these changes happen slowly or quickly.) Tell the group that they have some knowledge about this topic after the last few lessons and will continue to dig a little deeper to learn more about glaciers and how they change the land.
- Ask students to open their notebooks to the second *KWL* worksheet and to write, "Glacial Erosion," at the top of the worksheet. They should spend the next few minutes answering the questions on the board under the "K" column of the worksheet and then take a moment to record any questions they have about the topic that they hope to have answered by the end of the investigation under the "W" column.
- After providing the volcanologists sufficient time to record their ideas hold a team discussion and encourage the young scientists to volunteer what they know so far about the topic as well as any burning questions they want to have answered. Record ideas and questions on the class KWL Chart.

Explore

- Have the team observe the glacier component of the Hubbard Landform Model for a moment then ask them to name the most basic ingredient all glaciers need to have in order to form and grow. (Snow, ice.) Ask if anyone from the team has seen a glacier or glacier ice before and to recall what it looked like.
- Distribute the lesson material, *Glacier Ice.* Ask students to observe the photograph of the glacier on their own before discussing observations with a partner. Ask students the following questions:
  - What does a glacier look like?
  - How is the ice glaciers are made of different from other ice you've seen?
  - How did the ice become this dark blue color?
- Tell the team of volcanologists that they are going to observe a demonstration that displays how this special glacier ice is formed. Implement the *Snow…er! Iceballs!* Activity (p. 137 in 365 Simple Science Experiments by E.R. Churchill, L.V. Loeschnig and M. Mandell).

Explain

- Instruct the team to open their notebooks to the worksheet titled, *Glacier Information.* They are to record what they learned from the demonstration about glacier formation.

- Discuss students' notes as a team.

Explore

- Glacier-Shampoo model: Tell the group of volcanologists that in order to understand how glaciers change the land they must know how and where glaciers form on the Earth's surface. Ask the team to describe where they have seen glaciers around Yakutat.
- Ask the team to gather around the model and make predictions about the types of landforms the model is trying to represent. Instruct the volcanologists to observe what occurs as the snow (shampoo) begins to collect on the mountains. (Begin to pour small amount of shampoo on top of the mountain and allow students to describe their observations) Ask the following questions to get students thinking more about they are observing:
    - What does the shampoo represent?
    - Where is the snow accumulating (building up)?
    - Did the glacier start to move right away? When did it start moving?
    - What does the glacier pick up as it moves?
    - Does the glacier move fast or slow?
- Instruct students' to record their observations on the *Glacier Information* worksheet glued inside their notebooks.

Explain

- After the demonstration, ask the volcanologists to describe what they learned from the model and to pose any questions they want answered about glaciers. Write students' questions on the class *Glacier Information* chart and explain that like any good scientist, the team will begin researching their topic a little further. Distribute the *Almighty Glaciers* to each student and implement the reading lesson.
- Pause and discuss the sections outlined below by posing questions that connect with the overarching understandings for the lesson. Practice note-taking skills with students by asking them to underline, circle or highlight parts of the text that answer each question then having students recall the highlighted text during class discussion. Record students' answers on the *Web Wheel* chart during discussion then have students re-write the class notes onto the *Web Wheel* worksheets glued into their science notebooks. Have students gradually begin recording notes onto this worksheet from text they underlined in the booklets and ask them to discuss these notes with the class.
    - How Do Glaciers Grow? (pp.7-8)
        - What happens when it's cold all year long?
        - What is firn?
        - How does glacial ice form?
    - How Do Glaciers Move? (pp. 9-10)
        - How high do glaciers get before they start to move?
        - What pulls glaciers downhill?
        - What is the movement of glaciers called?
        - How far do glaciers move in a day?
    - Changing the Earth (pp. 12-13)
        - What happens to rocks and soil underneath a glacier?
        - What to the rocks do to the land?
        - How do valley glaciers change mountainsides?

Elicit

- Ask the team to recall from the reading and their trip to Russell Fiord how glaciers are able to change the land.
- Distribute the *Glacier Moraine* and *Glacier Valley* lesson materials to students. Ask students what they observe about the photographs and pose the following questions:

- What is the dark material on top of the glacier?
- How did the rocks and soil get on top of the glacier?
- What does the glacier do to valleys it moves through?
- Could we sit and watch a glacier change a valley? Are these changes slow or fast?

Explore/Explain

- Implement the *Glacier Erosion Activity* (p. 12 in 75 Easy Earth Science Demonstrations by Thomas Kardos). During the activity reiterate that while we can see the changes left behind by glaciers (such as U-Shaped valleys, moraines or erratics) these changes happen very slowly and can take hundreds or even thousands of years.

Extend

- Tell the team of volcanologists that their boss from USGS, Mr. Applegate, is requesting a review of what they have learned so far about glaciers and their impacts on the land. Each scientist is to write a letter to Mr. Applegate in their notebook describing something interesting or surprising they learned about glaciers over the last few lessons.

Evaluate

- Instruct students to turn to the *Glacier Erosion* KWL chart in their notebooks and answer the following questions under the "L" column of the chart:
  - How do glaciers form?
  - How do glaciers change the land?
  - Do glaciers change the land slowly or quickly?

Days 5- 7: How long does it take to rivers change the land?
Estimated Time:

Teacher Prep: Organize the following materials for the lesson's activity: water source (faucet will work), aluminum pans (5), 3-lbs each of sand/pebbles/gravel, 5 lbs. of potting soil, and 4 paper cups. Combine the soil together with the sand distribute the mixture between five buckets. Make a second mixture with the pebbles and gravel and distribute into four separate containers, such as solo cups. With a pencil, poke 5 holes in the bottom of each cup. The holes should be spaced closely to one another. Prep one of the aluminum pans by covering the entire surface with the mixture from one of the buckets and constructing an elevated surface, to represent a hill, on one of the shorter ends of the pan. Move 2 inches of the soil/sand mixture to the side and cover the surface with the pebble/gravel mixture. Spread the soil/sand back over the new layer of pebble/gravel and compact it with your hand. Collect and insert small branches, twigs and leaves into the soil mixture to add a more "wooded" effect to the model.
Teacher Prep: Print 1 copy of the following worksheets per student and glue into science notebooks: *River Information* and Reading A-Z Graphic Organizer: *Web Wheel*. Print and make 1 copy per student of the *Ophir Creek Map* lesson material. The lesson begins with a field excursion to Ophir Creek via the Train Trail, which is accessible across the street from the school. Bring a meter stick out into the field to measure the depth and width of Ophir Creek. Remind students to bring appropriate outdoor attire the day before the excursion, which should include good shoes to hike in and rain gear. Have available throughout the lesson the *KWL* and *River Information* chart as well as the book *Erosion* by Becky Olien. Write the following questions on

- How do rivers change the land?
- Do rivers change the land slowly or quickly?

Elicit

- Begin the lesson by asking the team to identify the next topic of study. (How rivers change the land and how long this process takes.) Tell students that they have already been introduced to this topic during an earlier investigation so some of the information may be review for the class.

Explain that the main objective of the volcanologists throughout this next lesson will be to determine how long it takes for rivers to change the land.

- Instruct scientists to open their notebooks to the *KWL* worksheet and write, River Erosion, at the top of the sheet. They are to answer the questions on the board under the "K" column of the chart as well as any questions they want answered under the "W" column.
- Discuss responses and questions as a team, recording ideas and questions under the appropriate column of the class chart.

Engage/Explore

- Prepare the team for the field excursion out to Ophir Creek. Remind the volcanologists that their research specialty is volcanoes, therefore if they are going to learn about rivers and erosion they must spend some time out in the field observing one. Tell the team that their major purpose in the field today is to use as many senses as they can to observe flowing water. Review the five senses if necessary. (Sight, smell, taste, touch, hearing) Things team members should keep in mind while making their observations:
    - What direction is the water flowing?
    - What is the water carrying?
    - What is the shape of the creek? How is the creek different than the forest floor?
    - How does the water interact with the sides of the creek?
    - Are there animals living in the water? What other life depends on the water?
- Take the team into the field. Once the team has arrived at the creek, instruct the young scientists to find a spot where they can observe the water. During this time you may want to visit students one-on-one and ask them describe what they are observing and redirect their observations if necessary. Spend as much time at the creek that scheduling and student interest allows.
- Before departure, gather the team on the bridge and ask the young scientists to describe how the water in the creek has changed to the shape of the land. Instruct them to compare the area of the creek to the land around it. (Trees such as Sitka Spruce and Hemlock or shrubs such as Devil's Club do not grow inside the creek. The forest floor is covered in moss, is less rocky and has small hills. The creek is a lot rockier, deeper in the ground, and contained within one area). Measure the depth and width of the creek.

Explain

- Back in the classroom discuss and record the teams' observations as well as any questions that came up on the *KWL* chart. Probe the students' thinking with the following questions:
    - Did the water in the creek carry anything in it?
    - How was the area of the creek the team observed different from the floor of the forest?
    - How were we able to measure some of these differences?
    - How wide was the creek?
    - How deep was the creek?
    - How was the creek created?
- Tell the team they will read a short passage about water erosion. Ask them the recall what the term erosion means and write it on the board. (A process in nature caused by wind, water and ice that breaks rock and soil into smaller pieces and carries these pieces from place to place). Introduce the book *Erosion* by Becky Olien and read the *Water Erosion* (p. 9) aloud to the team. Write the following questions on the board and instruct students to answer the questions in their notebook on the *Web Wheel* worksheet. *[*Provide real-life examples of acid for students so they can visualize this as an important material in water that contributes to erosion.]
    - What does acid in rain do to rocks?
    - What does flowing water do to soil and small rocks?
    - How long does it take water to wear away rocks?

- Review the questions as a team and record students' responses on the class *Web Wheel* chart.

Explore

- Ask the team to review the lesson's two essential questions and write them on the board.
- Explain that for the next activity the team will be divided into four small groups with 2-3 scientists in each group. The objective of the activity is for each group to create their own "Ophir Creek" in a pan. Ask the team to volunteer some of ideas of the types of materials they would need to complete this activity.
- Divide the team into four small groups and distribute the *Ophir Creek Map* to each volcanologist. Instruct group member to work together in order to locate Ophir Creek and then outline its shape on the map with a marker. With different colored markers each team member should draw a star indicating where the creek begins and an X indicating where it ends. Pose the following questions:
    - Is the creek long or short?
    - What is the shape of the creek?
    - Where does the creek end>
    - How was the creek created? (Water from rain)
- Distribute 1 aluminum tray, paper cup, and bucket with the soil/rock/sand mixture to each group. Show the team your model of the Earth's surface in Yakutat and instruct each group to work together to create a similar model with the materials that have been provided. Explain that the hill should be constructed on one side of the pan to allow enough space for their water to flow. Ask the team members to avoid using the paper cups just yet. Assist each group with the pebble/gravel layer. As each group completes their model's foundation, allow them to go outside and collect additional materials (such as twigs, small branches and leaves) to incorporate in the model.
- Once all four groups have completed constructing their model demonstrate the next step of the activity. Ask the team if they have a model of Ophir Creek just yet? What other very important material is needed to make the creek? (Rain water) Fill one of the paper cups up with water and let the water drip on top of the hill.
- Let students draw a diagram of their model before introducing the water. Diagrams need to have a descriptive title.
- Go around to each group and fill up the paper cups with water. Begin the activity.
- Provide groups with enough time to rotate through each member at least once before pausing the activity and discussing the students' observations. Pose the following questions:
    - Does your model look like Ophir Creek?
    - Has your creek exposed any rocks yet in the soil? Describe what you see.

  *Note: The objective of the activity is to demonstrate the amount of time it takes for water to erode the land into a small creek. If students tired before the rock in their model is exposed end the activity ahead of time. You can also set the class model under a facet for a day and allow a light stream of water to run during the day until the layer of rocks is exposed.
- Instruct volcanologists to draw a diagram of their model after water has been introduced. Diagrams need to have a descriptive title.

Explain

- Write the following questions on the board and instruct students to respond on the *River Information* worksheets in their notebooks:
    - What did the model look like without the rain?
    - What happened to the model when it started to rain?
    - Is the land shaped fast or slow by water erosion?

Extend

- Tell the team of volcanologists that their boss from USGS, Mr. Applegate, is requesting another review of what they have learned so far about rivers and their impacts on the land. Each scientist

is to write a letter to Mr. Applegate in their notebook describing something interesting or surprising they learned about water erosion over the last few lessons.

Evaluate

- Instruct students to turn to the *River Erosion* KWL chart in their notebooks and answer the following questions under the "L" column of the chart:
  - How do rivers change the land?
  - Do rivers change the land slowly or quickly?

Days 8-10: How long does it take volcanoes to change the land?
Estimated time:

Teacher Prep: Read over the procedure and organize additional materials needed to implement the AKSCI *Volcanoes and Tsunamis* lesson plan as well as the *Steam Cone* activity (p. 135 in 75 Easy Earth Science Demonstrations book), which provides a more in-depth description on how to set-up volcano model. Note if the multimedia files mentioned in the lesson plan are not accessible you can search through and incorporate clips from the *Earth Science for Children: All About Volcanoes* DVD. Look for clips on the DVD that can be shown during the engagement and exploration components of lesson that provide good visuals of volcanic activity, lava flows, crater lakes and calderas. Since the *Volcanoes and Tsunamis* lesson requires the use of a model to display volcanic features such as magma and vents you can use the *Hubbard Landform Model* and *Inside a Volcano (*pp. 6-7 in The Best Book of Volcanoes by Simon Adams) for this component of the lesson. The *Hubbard Lesson Plan* describes these features more in depth as well. Make 1 copy per student of the *Volcano Information* worksheet and glue into science notebooks. Make 1 copy per student of the following excerpts from The Best Book of Volcanoes by Simon Adams: *What is a volcano?* (pp. 4-5), *Inside a volcano (*pp. 6-7), *Where in the world?* (pp. 10-11) and *Underwater volcanoes (*pp. 18-19). *Rivers of fire* (pp. 14-15), *Volcanic lakes* (pp. 20-21) *Major eruptions* (pp. 22-23), and *After the eruption* (pp. 24-25). Have the class *KWL* and *Volcano Information* chart available throughout the lesson. Write the following questions on the board:

- What are volcanoes and how do they form?
- How do volcanoes change the land?
- Do volcanoes change the land slowly or quickly?

Elicit

- Begin the lesson by asking the team to identify the next topic of study. (How volcanoes change the land and how long this process takes.) Tell the volcanologists we have finally entered into their area of expertise in the investigation! Explain that the main objective of the volcanologists throughout this next lesson will be to determine how long it takes for rivers to change the land.
- Instruct scientists to open their notebooks to the *KWL* worksheet and write, Volcanic Changes, at the top of the sheet. They are to answer the questions on the board under the "K" column of the chart as well as any questions they want answered under the "W" column.
- Discuss responses and questions as a team, recording ideas and questions under the appropriate column of the class chart.

Engagement

- Show the team a clip from the *Earth Science for Children: All About Volcanoes* DVD demonstrating volcanic activity.

Explore/Explain

- Tell the team that the first part of the lesson will introduce them to volcanoes and how they form.
- Implement the AKSCI *Volcanoes and Tsunamis* lesson plan. If the multimedia videos are accessible online, this lesson provides a good opportunity to practice researching information using the Ipad.

- Before proceeding with Step 8 of the lesson's procedure, have the team review information that was just discussed by answering questions on the *Volcano Information* worksheet in their science notebooks. Present questions and have a brief discussion on each as a team. Write the following questions on the board:
    - If you cut the Earth in half, what would it look like? Draw a diagram of Earth's layers.
    - What is magma? Where does it form?
    - What is a volcano? (An opening in the Earth where hot, liquid rock, called magma bursts out.)
    - Where can volcanoes form? (Earth's crust it broken up into huge pieces. These pieces move around on top of Earth's mantle. Volcanoes form in areas where parts of the Earth's crust are moving or are weak in it.
- Follow up the group discussion by reading the selected passages from The Best Book of Volcanoes by Simon Adams as a class: *What is a volcano?* (pp. 4-5), *Inside a volcano (*pp. 6-7), *Where in the world?* (pp. 10-11) and *Underwater volcanoes (*pp. 18-19).
- After completing the passages, instruct volcanologists to respond to the questions on the *Web Wheel* worksheet glued inside their science notebooks. Briefly re-discuss questions as a class and record students' responses on the *Web Wheel* chart.

Explore

- Tell the team that they will conclude the lesson on volcanoes by studying how volcanic eruptions change the land and whether these Earth events happen slowly or quickly. Explain that an event is considered to happen quickly if we are able to observe it in a short amount of time. Ask the team to name a natural process they've learned about that happens very slowly. Write the following questions on the board:
    - How do volcanoes change the land?
    - Do volcanoes change the land slowly or quickly?
- Tell the team they are about to view multiple movie clips that demonstrate volcanic activity. The volcanologists are to observe the movie segments very closely because the team will discuss these two essential questions immediately after the movie.
- Show the team clips from the *Earth Science for Children: All About Volcanoes* DVD demonstrating a volcanic eruption, lava flows, crater lakes and caldera, and then discuss students' observations as a team.

Explain

- Reading the following passages as a class from The Best Book of Volcanoes by Simon Adams: *Rivers of fire* (pp. 14-15), *Volcanic lakes* (pp. 20-21) *Major eruptions* (pp. 22-23), and *After the eruption* (pp. 24-25). Record the following questions on the board and instruct the volcanologists to answer each one on the *Web Wheel* worksheet glued inside their notebooks.
    - What is lava? How does it change the surface of the Earth?
    - How are crater lakes formed?
    - How are calderas formed?
    - How can eruptions change people's lives?
    - Do change the Earth's surface quickly or slowly?
- Once the team has responded to the questions in their notebooks have a group discussion and record students' responses on the class *Web Wheel* chart.

Extend

- Tell the team of volcanologists that their boss from USGS, Mr. Applegate, is requesting they write a third review of what they have learned so far about volcanoes and their impacts on the land. Each scientist is to write a letter to Mr. Applegate in their notebook describing something interesting or surprising they learned about volcanoes over the last few lessons.

Evaluate

- Instruct students to turn to the *Volcanic Changes: KWL* worksheet in their notebooks and answer the following questions under the "L" column of the chart:
    - What are volcanoes? How do they form?
    - How do volcanoes change the land?
    - Do volcanoes change the land slowly or quickly?

Days 11-13: How long does it take for earthquakes to change the land?
Estimated Time:

Teacher Prep: Read over the procedure and organize any additional materials needed that are not listed in this investigation to implement the AKSCI *Shake, Rattle and Roll* lesson plan. While AKSCI lesson incorporate the *Forces of Nature DVD* produced by National Geographic (2004) as an engagement tool, you may wish to switch it out with the *Earth Science for Children: All about Earthquakes DVD.* Both DVDs are included in the kit; therefore it is up to the educator's discretion, which would be more appropriate overall for the class. Print 1copy of the following worksheets for each student and glue into science notebooks: *Earthquakes Information* and Reading A-Z Graphic Organizer: *Web Wheel*.
Teacher Prep: This lesson begins with a historical account of the 1899 earthquake in Yakutat from Volume 1 of de Lagunas "Under Mount St. Elias: The History and Culture of the Yakutat Tlingit" (2009). A scanned copy of *Geological Changes in the Yakutat Area: The Yakutat Earthquake, 1899* is attached at the end of this investigation, however can also be found in the YSD high school library. The preferred manner in which to recount this incident for students is to have an elder or member of the community provide a personal or family account of the event in the classroom. Read over the account ahead of time in order to make any necessary grammatical changes that will help make the delivery smoother and therefore more comprehendible for students. A day before the lesson, ask students to go home and ask family members what they know about or have heard about regarding earthquakes in Yakutat. Have available throughout the lesson the class *KWL* and *Earthquake Information* charts. Write the following questions on the board:

Essential Questions

- What are earthquakes?
- How do earthquakes change the land?
- Do earthquakes change the land slowly or quickly?

Elicit

- Begin the lesson by asking the team to identify the next topic of study. (What kinds of changes to the land do earthquakes cause and how quickly are these changes made?) Tell the team of volcanologists that they have come to the final Earth event of the investigation! The team has done a lot of great work as well as learned a lot throughout the entire process, which has made their USGS boss, Mr. Applegate, very happy. Explain that the main objective for the team during the next lesson is to figure out how long it takes for earthquakes to change the land.
- Instruct scientists to open their notebooks to the *KWL* worksheet and write, *Earthquake Changes*, at the top of the sheet. They are to answer the questions on the board under the "K" column of the chart as well as any questions they want answered about earthquakes under the "W" column.
- Discuss responses and questions as a team, recording ideas and questions under the appropriate column of the class KWL chart.

Engage

- Ask the team of volcanologists if they had ever heard family members or friends tell stories about earthquakes that have taken place in Yakutat in the past. Allow time for students to retell or describe stories that they have heard.

- Tell the team that they are going to hear a story that was told by a Yakutat resident almost 70 years ago to an anthropologist called, Frederica de Laguna. Explain that an anthropologist is a type of scientist that studies people. Frederica was a very special anthropologist to the community of Yakutat and to Alaska in general because she was the first person to come and study the native cultures in this part of the world. She spent four years interviewing people in the community in order to learn about the way of life in Yakutat and the traditional stories. Ms. de Laguna also searched for artifacts that would give more information about the ways in which people lived in this area hundreds of years ago. Frederica wrote everything she learned about the Yakutat Tlingit culture down so that years later people, like the second grade science class, would be able to read and continue to learn about the culture of our community today.
- Read the *Geological Changes in the Yakutat Area: The Yakutat Earthquake, 1899* story to the team of volcanologists.

Explore/Explain

- Ask the team to recall the questions they will be investigating about volcanoes over the course of this lesson and write them on the board.
- Implement the AKSCI *Shake, Rattle and Roll* lesson plan. After the team watches either the National Geographic *Forces of Nature* or the *Earth Science for Children: All about Earthquakes* DVD, instruct the young scientists to answer the essential questions of the lesson on the *Web Wheel* worksheet in their science notebooks. Follow this up with a brief team discussion about students' responses and record these on the class *Web Wheel* chart. An application activity at the end of the lesson instructs students to answer questions based on their observations of a demonstration. Students should record their responses on the *Earthquake Information* worksheet glued into their science notebooks and then discuss their answers during a class discussion, which should be recorded on the class *Earthquake Information* chart.

Extend

- Tell the team of volcanologists that their boss from USGS, Mr. Applegate, is requesting a final write-up about what they have learned about earthquakes and their impacts on the land. Each scientist is to write a letter to Mr. Applegate in their notebook describing something interesting or surprising they learned about earthquakes over the course of the lesson.

Evaluate

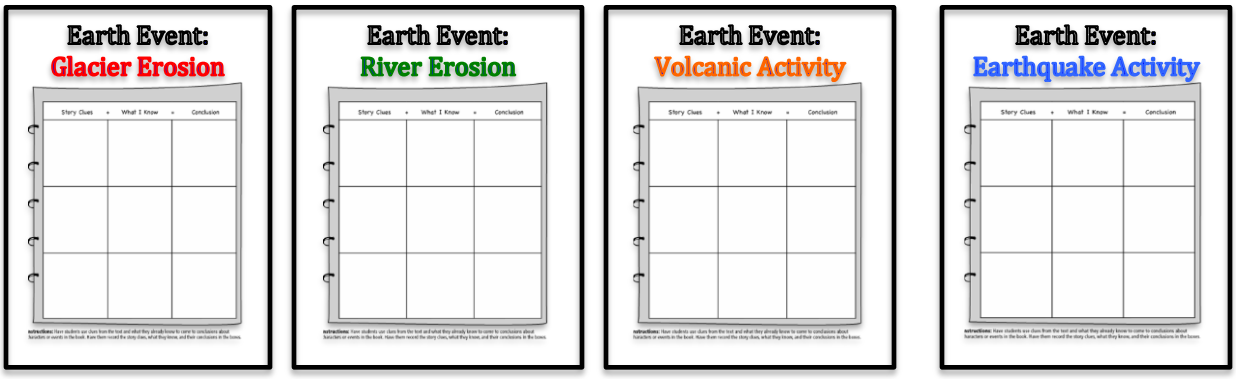
- Instruct students to turn to the *Earthquake Changes: KWL* worksheet in their notebooks and answer the following questions under the "L" column of the chart:
    - What are earthquakes? How do they form?
    - How do earthquakes change the land?
    - Do earthquakes change the land slowly or quickly?

Lesson 5: How can we write a newspaper article?
Estimated time: 1-2, fifty-minute lessons

Teacher Prep: Select a few designs from the TeachersPayTeachers: *Newspaper Templates* resource that students can choose from when they are ready to write their newspaper article and make sufficient copies. Some students may need more than one copy of their chosen template to complete the article. Make four copies per student of the Reading A-Z Graphic organizer: *Draw Conclusions* and glue each set of four into the science notebooks. Have the charts that were filled in as a class (*Glacier Information, River Information, Volcano Information, Earthquake Information)* available during the lesson. Write the following questions on the board:

- How do natural events and processes change the land?
- How long does it take for natural events and processes to change the land?

Teacher Prep: Make enlarged versions of the Reading A-Z: Graphic Organizer on four sheets of chart paper:



Elicit

- Tell the team of volcanologists they have almost completed the investigation. After doing all the hard work of gathering information about different Earth processes and events, the time has come to complete their task for Mr. Applegate. Over the next couple of lessons, the team will look back on the notes that they recorded in their notebooks and write a newspaper article for the Driftwood Dispatch. This is one of the most important jobs of a scientist, learning to communicate their work to the community. The information the team has collected is of value to community members in Yakutat because it can have big impacts on their lives. Ask the team to recall the two questions Mr. Applegate wanted them to answer in their articles.
- Record the prompt on the board under the investigation's essential questions:
    - Choose 2 natural events (1 slow and 1 fast) that change the surface of the Earth. Describe how each event changes the land. Include how long it takes each event to change the land.
- Explain that before the team can begin writing they must go over all the information that was collected throughout the investigation. Instruct team members to open their notebooks to the four *Draw Conclusions* worksheets and to write in the following topics and questions on each sheet. Note: Ask students to cross out and substitute **Book Title** with **Earth Event.**
    - **Earth Event:** Glacier Erosion
        - How do glaciers form?
        - How do glaciers change the land?
        - Do glaciers change the land slowly or quickly?
    - **Earth Event:** River Erosion
        - How do rivers change the land?
        - Do rivers change the land slowly or quickly?
    - **Earth Event:** Volcanic Activity
        - What are volcanoes and how do they form?
        - How do volcanoes change the land?
        - Do volcanoes change the land slowly or quickly?
    - **Earth Event:** Earthquake Activity
        - What are earthquakes?
        - How do earthquakes change the land?
        - Do earthquakes change the land slowly or quickly?
- Review the questions for each topic as a team and record students' responses on the appropriate class chart. As you record individual responses on the chart, students should be filling in the *Draw Conclusions* worksheets in their notebooks.

- Note: **Story Clues** boxes should include any information the team gathered from assigned readings or educational DVDs about the topic, which students should have recorded on their *Web Wheel* worksheets. **What I Know** boxes should include any information the team gathered about a topic from observing demonstrations or participating in lessons' activities and subsequently recorded on the "*Earth Event" Information* worksheets glued into their science notebooks.

Extend

- After the team has filled in all four *Draw Conclusions* worksheets, they are ready to write their articles. Reiterate the prompt for the team.
- Display the various newspaper template designs and allow the volcanologists to choose which they would prefer using to write their article.

Lesson 6: Post-Assessment- What did you learn?

Estimated time: 1, fifty-minute lesson

Teacher Prep: Print and glue 1-copy per student of the Post-Assessment into students' science notebooks. An oral assessment and rubric is available to supplement the written component.

Evaluate

- Tell the team of volcanologists they have done great work. All of the information they have collected is very valuable and useful to the people of Yakutat. Explain that the last step of the investigation is to take an assessment that demonstrates just how much they learned.
- Administer the assessment to the team of outdoor guides.