An Island is Born

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Waihe`e School (Maui)

Grade Level: K–3

Project Time Span: 1–2 weeks

To the Teacher:

This lesson forms part of a larger unit that aims to help students learn about the area they live in. Designed for Maui students, it can be adapted to the island where you live. This lesson is most effective when taught by someone knowledgeable about Hawaiian language, culture and a sense of place. If you do not feel comfortable with your knowledge level in these areas, please consider asking a kupuna or people in your community to help. Most schools have a resource person such as a kupuna who can help. For deeper science knowledge, some excellent resources are listed below.

Goals of the Lesson:

- To understand the stages of how the island of Maui formed
- To understand how Hawaiian culture and science interact and reinforce one another
- To become accustomed to hearing the Hawaiian language, and to learn a typical greeting

Student Learning Objectives (Benchmarks):

This lesson addresses Grade K–3 benchmarks for HCPS Science Standards:

1.2 Living the Values, Attitudes, and Commitments of the Inquiring Mind.

Students apply the values, attitudes, and commitments characteristic of an inquiring mind.

- Ask “wondering” questions.
- Ask questions and describe the wonderings about the world around us.

1.3 Using Unifying Concepts and Themes. Students use concepts and themes such as system, change, scale to help them understand and explain the natural world.

- Observe and describe changes that occur in nature.
2.6 Cycle of Matter and Energy Flow. Students trace the cycling of matter and the flow of energy through systems of living things.
   • Give examples of matter or energy being recycled in the environment.

2.12 Learning and Human Behavior. Students explain what influences learning and human behavior.
   • Explain how people can learn from each other by telling and listening, showing and watching, and imitating what others do.

2.19 Forces that Shape the Earth. Students analyze the scientific view of how the Earth’s surface is formed.
   • Classify chunks of rocks by size and shape.

Resources and Materials:

Resources
   • Maps and Legends
     o Appendix 1: Map of the Island of Maui
       (http://www.bestofhawaii.com/maps/images/maui.jpg)
     o Appendix 2: Legend Explaining the Formation of the Hawaiian Islands by Maui the Demigod
       (http://www.huna.org/html/patience_sk.html)

   • Scientific Resources about the Stages of Formation of Hawaiian Volcanoes
     o http://www.oceanexplorer.noaa.gov/explorations/02hawaii/background/education/media/nwhi_hot.pdf (basic level)
     o http://emedia.leeward.hawaii.edu/millen/bot130/learning_objectives/lo17/17.html (intermediate level)
     o http://www.volcanolive.com/hawaiian.html (advanced level)

   • Hawaii Volcano Observatory website (information on Maui Nui)

Materials
   • Rock samples (a`a and pahoehoe lava, lava with olivine crystals, coral)
   • Magnifying glasses
   • Magnets
   • Hammer (to crush lava sample)
   • Videocamera (if available)
Instructional Procedures:
A. Opening (Hawaiian protocol)

- Teacher: *Hui. Aloha kakahiaka na haumana* (Good morning students)
  *(or if p.m.)*
  *Hui. Aloha awakea na haumana* (Good afternoon students)

- Teacher: *Pehea kakou i keia la?* (How are all of you today?)

- Students: *Aloha kakahiaka maika'i no makou. Mahalo a o 'oe?*  
  (Good morning we are fine. Thank you for asking and how are you?)

B. Review previous lesson, and tie in today’s topic to what the students have already learned. Then ask students some wondering questions, such as:

- How did Maui form?
- What is the island made of?

[Students may share: volcano, lava, coral, Maui broke off from other islands, God of Maui made the island]

Tying in what the students contributed, ask focused questions, such as:

- What is lava?
- What is a volcano?
- What is a volcano made of?
- What is coral?

Have the children touch and describe various rock samples (*pahoehoe* and *a`a* lava, coral, lava with olivine crystals). If possible, crush a piece of lava with the hammer and have students use magnets to see if there are magnetic minerals in the lava. Explain to the students that in the next lesson they will learn more about coral.

C. What are the stages of formation of an island volcano? (For reference, refer to websites listed under “Scientific Resources about the Stages of Formation of Hawaiian Volcanoes” in Resources and Materials.)

1) *Initial Stage.* The volcano starts to form from lava that erupts through an opening in the ocean floor. As eruptions continue, the volcano builds up and gets closer to the ocean surface. At this stage, it is an underwater volcano or seamount (e.g., Loihi).

2) *Caldera Stage.* Should eruptions continue, the underwater volcano will eventually break the ocean surface and become an island. Eruptions then continue on land, and eventually the highest point (summit) of the volcano will collapse to form a big crater (caldera). Plants begin to grow on
(colonize) the part of the volcano that is above the ocean surface (e.g., Mauna Loa and Kīlauea).

Note: the 'crater' or 'caldera' on top of Haleakalā was not formed this way. Instead, it was formed by erosion, as the heads of two large valleys merged together.

3) **Post-Caldera Stage.** Continued eruptions fill up the caldera and cause a dome-shaped mountain. Eruptions become explosive (e.g., Haleakalā).

4) **Erosional Stage.** From now on, the island gets smaller due to erosion by streams and waves and sinking (subsidence). Canyons, valleys and seacliffs form. Corals grow in shallow water around the island (e.g., parts of all major Hawaiian islands are in this stage).

5) **Rejuvenation Stage.** After a period of quiet lasting hundreds of thousands or millions of years, renewed volcanic activity may occur. Erosion and reef building continue (e.g., portions of West Maui volcano).

6) **Atoll Stage.** The volcano continues to erodes, and most of the island is below sea level. Only the coral reef can be seen at the surface. The island is now small, circular and very low; it is called an atoll.

7) **Late Seamount.** Erosion dominates over reef building, so the island sinks below the ocean surface and once again becomes a seamount. (This will eventually happen to all of the Hawaiian islands, including Maui).

**Note to Teacher:** Before discussing the above stages, talk about the Hawaiian hotspot. Explain that Stage 1 happens when an island is over the hotspot. Then, as the islands travel northwest, they progress through the above stages. Eventually, after stage 7, the islands get recycled into the Earth (at the convergent plate boundary). Encourage the students to ask wondering questions (e.g., How far do the islands travel? How hot is it inside the Earth?).

**D. Mini ‘field trip’**
- Take students outside to view volcanic mountains and erosional processes. From Waihe‘e school, students can view Kalepa ridge of Pu‘u ēke (West Maui volcano) where they can see waterfalls, which are fed by streams carved into the side of the mountain. Students at other schools will see different mountains, in different stages.

**E. How did Maui form?**
- Return to classroom and view a map of Maui (Appendix 1). Ask students first to describe the shape of Maui (e.g., as a head and body), and then to come up with a theory of how Maui formed (why does it have this shape?). Lead them to the conclusion that Maui formed from two volcanoes.
Now, discuss traditional legends of how Maui formed (Appendices 2 & 3); also see Colum (1937).

Draw connections between the culture and science. For example, one legend tells us Maui (the demigod) fished out all of the Hawaiian islands from the northwest (Kaua`i was first; Hawai`i was last). Another legend tells us how Pele formed the islands (Kaua`i was first; Hawai`i was last). Both of these examples connect to the hot spot theory. Kaua`i formed first (it was once over the hotspot and then traveled northwest). Next, Oahu formed over the hotspot, then it too traveled northwest. Then Moloka`i, Lana`i, Kaho`olawe and Maui formed. They too traveled off the hotspot. Now Hawaii and Lo`ihi are over the hotspot, and they too will eventually travel northwest and a new volcano will form. So, the legends show that the Hawaiians had a very clear understanding of the relative ages of the islands.

Share that the volcanoes of Maui, Lana`i, Kaho`olawe and Moloka`i were once all part of the same island (Maui Nui). Like all of the Hawaiian Islands, Maui Nui started sinking (subsiding) into the ocean floor. The valleys between the volcanoes got flooded by the sea, forming separate islands. If Maui continues to subside at present-day rates, Haleakala and West Maui will become separate islands in about 15,000 years! (http://hvo.wr.usgs.gov/volcanowatch/1995/95_09_22.html)

F. Sharing with their families

For homework, students will be asked to share their drawings with their families, and to discuss what they learned in class today. Their parents will sign their drawings and share what they know about volcanoes.

G. Closing (Hawaiian protocol)

Teacher: Mahalo. Aloha a hui hou e na haumana.
(Thank you. Good bye until we meet again, students)

Students: Mahalo. Aloha a hui hou e ke Kupuna.
(Thank you. Good bye until we meet again, teacher)

Assessment:

Students will draw the stages of development of the island of Maui, and label each stage.

Students will draw how the Hawaiian Islands formed (from both a cultural and scientific perspective), and explain their drawings to the class. If a videocamera is available, students will be videotaped.

Students' knowledge of Hawaiian will be assessed through participation in the opening protocol, knowledge of vocabulary words in the Maui legend and in their drawing of the volcano stages.
Extension:

- If the teacher wishes to add a multi-cultural component, consider reading legends from the South Pacific cultures (e.g., New Zealand, Tonga, Samoa), which all tell a story of the demigod Maui (although the name and story may vary slightly).
- If the teacher wants to go into more details about Hawaiian rocks, collection kits are available through Bishop Museum on O‘ahu and the Haleakala observatory on Maui.
- If volcanoes and waterfalls can not be seen from your school yard, you may wish to take a field trip.
- It’s always fun to do a volcano demonstration (e.g., the gelatin volcano model discussed in “Shield Volcanoes vs. Tuff Cones” by H. Rodrigues in this volume).

Evaluation of Lesson:

- I will view the videotape of student presentations to gauge students’ level of understanding and enthusiasm.
- At the next class, I will ask students what they shared with their families about this lesson and how their parents responded. This will tell me if the lesson was successful.
Appendix 1: Map of the Island of Maui

(http://www.bestofhawaii.com/maps/images/maui.jpg)
Appendix 2: Legend Explaining the Formation of the Hawaiian Island by Maui the Demigod

(http://www.huna.org/html/patience_sk.html)

Once a upon a time, long before Captain Cook, Maui Kupua, who was born on Kauai, of course, was coming back from O'ahu in his canoe when he thought to himself, "Why are the islands so far apart? They should all be closer together." So after he landed he went to his mother, Hina, in Wailua, and asked for her advice. Hina stopped her tapa beating and said, "If you want to bring the islands together you will have to catch the giant whale Luehu with your magic fishhook, Manai-a-ka-lani, and you will have to hold on fast for a long time. If you can do this, Luehu will circle the islands and you will be able to pull them together. Take your brothers with you to help with the canoe, but warn them to always face forward no matter what happens, or you will fail."

So Maui gathered his four brothers, Maui, Maui, Maui, and Maui, and told them what he was going to do. They were excited about such an adventure, and when he warned them about facing forward no matter what, they promised that they would. At last the canoe was ready, the fishhook was ready, and the brothers were ready. During a break in the surf they paddled out into the Kaieiewaho Channel and began their search for the great whale. For days and days they searched, until at last they found the great whale Luehu swimming beside Nihoa, the island to the northwest of Kauai. Maui threw his magical fishhook, Luehu caught it in his mouth, and immediately the whale began pulling the canoe through the ocean at high speed. For many more long days the Maui brothers held on with determination as the whale pulled them onward, but by carefully tugging on the fishing line in just the right way, and by cleverly paddling in just the right way at just the right time, they caused the whale to circle all the islands, until one day they found themselves again off the coast of Wailua, facing toward O'ahu.

Luehu was tired now, so while Maui Kupua pulled on the fishing line with all his might his brothers back-paddled furiously, and slowly, slowly the islands began to pull together. Just then, a canoe bailer, Kaliu, floated past the canoe. The eldest Maui, in the steersman position, quickly grabbed it and tossed it behind him in case they should need it. Unknown to him, the bailer was really a mischievous spirit, an e`epa, who turned into a very beautiful woman. All the people gathered on the Wailua shoreline exclaimed about her beauty. At first, none of the Maui brothers paid attention, but finally the praises got so loud that Maui's four brothers turned around to see who this beautiful woman was that everyone was shouting about. In that moment, Luehu felt the weakening of the pull against him and gave one last desperate leap to escape. Without his brothers to help him, Maui Kupua pulled too hard, the fishing line broke, Luehu got away, and the islands drifted apart again. And we know the story is true because the islands are still far apart today.
Appendix 3: Legend Explaining the Formation of the Hawaiian Islands by Pele, and the Correlation with the Geological Ages of the Islands

"Pele was born of the female spirit Haumea, or Hina, who, like all other important Hawai'i gods and goddesses, descended from the supreme beings, Papa, or Earth Mother, and Wakea, Sky Father. Pele was among the first voyagers to sail to Hawai'i, pursued, legends say, by her angry older sister, Na-maka-o-kaha'i because Pele had seduced her husband. Pele landed first on Kaua'i, but every time she thrust her o' o (digging stick) into the earth to dig a pit for her home, Na-maka-o-kaha'i, goddess of water and the sea, would flood the pits. Pele moved down the chain of islands in order of their geological formation, eventually landing on the Big Island's Mauna Loa, which is considered the tallest mountain on earth when measured from its base at the bottom of the ocean." (http://www.coffeetimes.com/pele.htm)

"The possibility that the Hawaiian Islands become younger to the southeast was suspected by the ancient Hawaiians, long before any scientific studies were done. During their voyages, sea-faring Hawaiians noticed the differences in erosion, soil formation, and vegetation and recognized that the islands to the northwest (Niihau and Kauai) were older than those to the southeast (Maui and Hawaii). This idea was handed down from generation to generation in the legends of Pele, the fiery Goddess of Volcanoes. Pele originally lived on Kauai. When her older sister Namakaokahai, the Goddess of the Sea, attacked her, Pele fled to the Island of Oahu. When she was forced by Namakaokahai to flee again, Pele moved southeast to Maui and finally to Hawaii, where she now lives in the Halemaumau Crater at the summit of Kilauea Volcano. The mythical flight of Pele from Kauai to Hawaii, which alludes to the eternal struggle between the growth of volcanic islands from eruptions and their later erosion by ocean waves, is consistent with geologic evidence obtained centuries later that clearly shows the islands becoming younger from northwest to southeast." (http://pubs.usgs.gov/publications/text/hotspots.html)