SN EDUCATOR GUIDE

February 2, 2019

Kilauea Curiosities

Cross-Curricular Connections, Q and Resources

Directions: Each of the questions below relates to one of the sections of "Kilauea curiosities." Review the section summary and key terms and then answer the questions based on your teacher's instructions.

Section 1

Summary: The recent eruption at Kilauea was particularly explosive because the molten rock was andesite, which isn't usually found in Hawaii. Andesite contains more silica and gas bubbles than basalt, which added to the eruption's explosive power.

Key terms:

Andesite — A gray to black type of volcanic rock with about half the density of silica. Andesite lava commonly erupts from volcanoes in thick flows. They may travel great distances before hardening. Andesite magma can also trigger explosive eruptions characterized by pyroclastic flows.

Basalt — A type of black volcanic rock that tends to be very dense (unless volcanic eruptions seeded it with lots of air pockets).

Tectonic plates — The gigantic slabs, some spanning thousands of kilometers across, that make up Earth's outer layer.

Hot spot — In this context, regions of the Earth's mantle where rocks melt to generate magma. Geological hot spots are typically associated with volcanic activity.

Question:

Section 1 of the article states that the type of lava affected the explosiveness, or magnitude, of Kilauea's eruption. Why would the amount of silica or gas bubbles in basalt lava, as compared with andesite lava, affect the magnitude of the eruption? What other factors would likely affect the magnitude of a volcanic eruption? Explain how a change in magnitude of a factor might affect the explosiveness of the eruption.

Section 2

Summary: The eruption revealed how connected the volcano's internal plumbing is. Researchers tracking collapses at the summit could warn colleagues monitoring the lava flows elsewhere in the field.

Key terms:

Caldera — A crater that forms from a volcanic eruption and subsequent collapse.

Piston — A closed cylinder that moves up and down within a closely fitted larger cylindrical chamber by or against the pressure of a fluid. Pistons are the moving components used in engines, pumps and other similar mechanisms.

Pressure — Force applied uniformly over a surface, measured as force per unit of area.

Force — Some outside influence that can change the motion of a body, hold bodies close to one another or produce motion or stress in a stationary body.

Question:

Thanks to data collected and an understanding of the volcano's internal plumbing, scientists were able to warn colleagues elsewhere about a possible eruption. Name and describe an instrument scientists use to predict and study potential volcanic activity. Imagine you were a scientist witnessing the collapse near the summit, write the warning message you would send your colleagues. What specific information about the volcano might you provide? If you were addressing local residents about a volcanic threat, what information would you provide and why?

Section 3

Summary: Dozens of small collapses at Kilauea, occurring at regular intervals, spurred earthquakes and caused the caldera to sink more than 500 meters — more than the height of the Empire State Building.

Key terms:

Summit crater — A large, bowl-shaped cavity in the uppermost part of a mountain or hill.

Fissure — A long, narrow opening that emerges in ice or rock. A fissure starts when pressure causes the material to crack and eventually split open.

Tiltmeter — A device that measures small changes in the tilt, or slope, of the ground or another surface. Tiltmeters are often used to monitor volcanoes, tracking land that swells or deflates because of moving magma below.

Volcanic Explosivity Index (VEI) — A numeric scale that measures the explosiveness of volcanic eruptions. According to the U.S. Geological Survey, volume of ejected rock and particles, the height of the eruption cloud and other observations are used to determine an explosivity value. The scale is logarithmic, meaning that each interval represents a tenfold increase in the observed criteria.

Question:

Kilauea's caldera collapse is described as a "piston-style" collapse. Based on the definition of a piston and the article's description of the collapse, how is the collapse like a piston and how is it unlike a piston? Draw a diagram to represent the progressive cycle of the collapse at Kilauea. Within your diagram, show the forces that explain each small collapse within the larger progression. Try to incorporate the quantitative data mentioned in Section 3 of the article into your diagram.

Section 4

Summary: Once the eruption made it to the ocean, marine life sprouted up in the lava flows surprisingly fast. For instance, microbes set up homes along the edges of the flows by about 100 days after lava first entered the ocean.

Key terms:

Microbes — Short for microorganisms. A living thing that is too small to see with the unaided eye, including bacteria, some fungi and many other organisms such as amoebas. Most consist of a single cell.

Hydrothermal activity — The movement of heated water beneath Earth's surface. In some volcanic systems, hydrothermal activity is fueled by magma chambers that heat rocks. Those heated rocks then heat the surrounding water, causing the water to rise to the surface.

Species — A group of similar organisms capable of producing offspring that can survive and reproduce.

Ecosystem — A group of interacting living organisms, including microorganisms, plants and animals, and their physical environment within a particular climate. Examples include tropical reefs, rainforests, alpine meadows and polar tundra.

Question:

How do you think the volcanic lava flow affected the marine ecosystem? Give a specific example of a complex interaction that exists among common plants and animals in a marine ecosystem. How would the ecosystem change over a period of time after the volcanic lava enters the ecosystem: What would change right after the lava event? What about in the weeks, months, decades and centuries that follow? Think about ecological succession, the stages of regrowth and the primary factors of evolution.

Section 5

Summary: Kilauea's recent eruption spouted some of the highest levels of toxic sulfur dioxide ever recorded at the volcano. At its most active, Kilauea released as much as 100 to 200 kilotons of the gas per day.

Key terms:

Sulfur dioxide — A compound made of sulfur and oxygen. It is one of the pollutants that can form when a fossil fuel is burned. It's also a gas naturally emitted during volcanic eruptions. Its scientific symbol is SO_2.

Vog — Volcanic smog that forms when sulfur dioxide and other gases and particles seep out of a volcanic fissure then react with oxygen, water vapor and sunlight.

Ash (in geology) — Small, lightweight fragments of rock and glass spewed by volcanic eruptions.

Lahar — A thick flow of mud, ash, soil and rocks. It can develop when rains mix with the materials being spewed during a volcanic eruption. This viscous mix can have the consistency of wet, newly mixed concrete. As it slides down a volcano's slopes, it can destroy nearly everything in its path.

Question:

Section 5 of the article discusses the high levels of sulfur dioxide produced by Kilauea. Why is volcanic smog, or vog, a threat to local residents? What other threats might exist for local residents during an eruption, and how might these threats impact daily life? How does an active volcano affect its local environment more generally? What about the global environment? How would you go about creating a plan to mitigate one of the negative effects?