earth scope PROJECT

EarthScope Education and Outreach Bulletin:

Activity at Augustine Volcano

1.6.2006

AUGUSTINE, ALASKA — Scientists at EarthScope and across the world are excited by recent activity on Augustine Volcano, which reaches a peak height of 1,282 m (4,205 ft) and is the most active volcano in the Cook Inlet region. Local pilots have reported seeing a steam plume that extends at least 75 km (45 mi) SE to the southeast; the plume is also clearly visible by satellite and on images from the Augustine web camera. EarthScope GPS units installed on the volcano just last summer indicate that the volcano appears to be expanding as magma rises through it. Taken as a whole, scientists are interpreting these observations as indications that an eruption is likely in the near future.

Motion of magma within the volcano causes small tremors and earthquakes, which are recorded on nearby seismometers. The magma also causes the chamber to inflate; this tilts the sides of the volcano. The tilt is recorded on the GPS units. When volcanoes erupt, seismometers record a dramatic increase in the number of earthquakes and GPS units record even larger movements away from the center of the island. As part of our efforts to understand plate tectonics and the processes associated with it, such as volcanism and earthquakes, EarthScope has installed GPS units throughout Alaska, including five on Augustine Volcano and two on the nearby mainland.

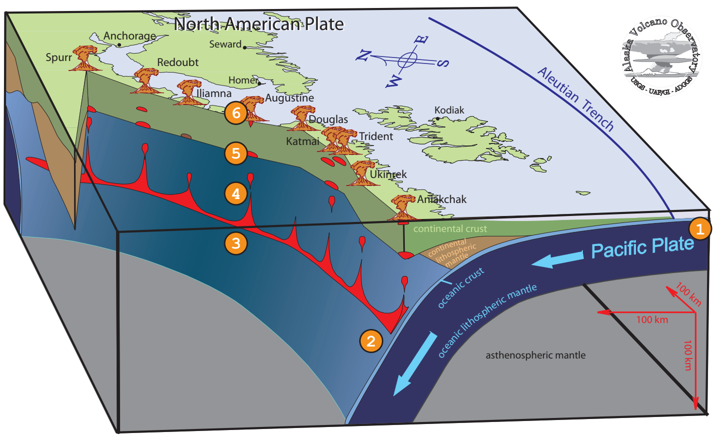
> http://earthscope.org/education/viz/augustine_viz_main.php

Mount St. Augustine Volcano was named by Capt. Cook when he reached the inlet that bears his name on May 26th (St. Augustine's Day) in 1778. Typically referred to as "Augustine Volcano" in scientific literature, the peak is also known as Chernabura, Mt. Chinabora, and Pilon D'Azucar (after the white snow on the slopes). EarthScope has installed GPS units at five sites on Augustine and one at nearby Williamsport, AK. They will stay in place for at least ten years. The data is relayed to our data center by radio and satellite links. This December 12, 2005, image from NASA's MODIS satellite shows a steam plume extending from Augustine Volcano for about 75 km (50 mi) to the SE.

Satellite image courtesy of NASA's MODIS satellite.

Activity at Augustine Volcano

> Formation of Subduction Zone Volcanoes

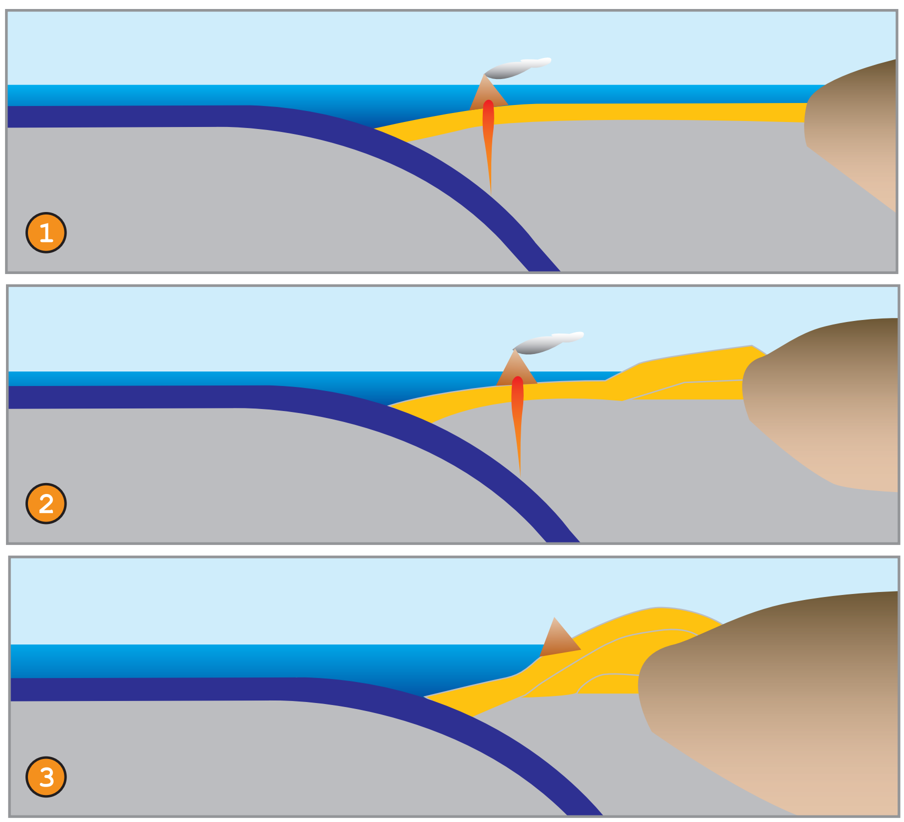


Volcanoes form near subduction zones for a very simple reason – that is where the water is. As an oceanic plate moves, it absorbs water **(1)**. However, once the plate is subducted, the heat and pressure release the water to the surrounding mantle. This makes the mantle material less dense **(2)**. The lighter wet mantle material begins to move upward, which reduces the pressure. The reduced pressure and added water causes local melting in the mantle material, creating magma **(3)**. The hot, buoyant magma rises through the surrounding mantle **(4)**. Eventually, it forms a magma chamber **(5)** where pressure builds until the lava erupts onto the surface **(6)**. Repeated eruptions form cones of lava and ash; these are volcanoes.

> Accretion of Island Arc Volcanoes

Image courtesy of LANDSAT.

Island arcs are long chains of volcanoes that are formed near subduction zones; perhaps the best known examples of these are the Japanese and the Aleutian islands. However, though these island chains form far from continents **(1)**, they don't stay there very long. Over millions of years, the forces of plate tectonics cause the ocean basin behind the island arc to shorten **(2)**. Eventually, the islands are "accreted"; that is, they are added to the continent **(3)**. This is the process that formed the Wallowa Mountains-Seven Devils Mountains in Idaho almost 250 million years ago; it continues today along the Aleutian Island arc.



Just what happens after an island arc is added to a continent is still being debated by geologists. Does subduction continue at the new continental edge? Or does a new subduction zone form much further back? By placing instruments along the Aleutian Islands, EarthScope hopes to answer this and other questions about plate tectonics.

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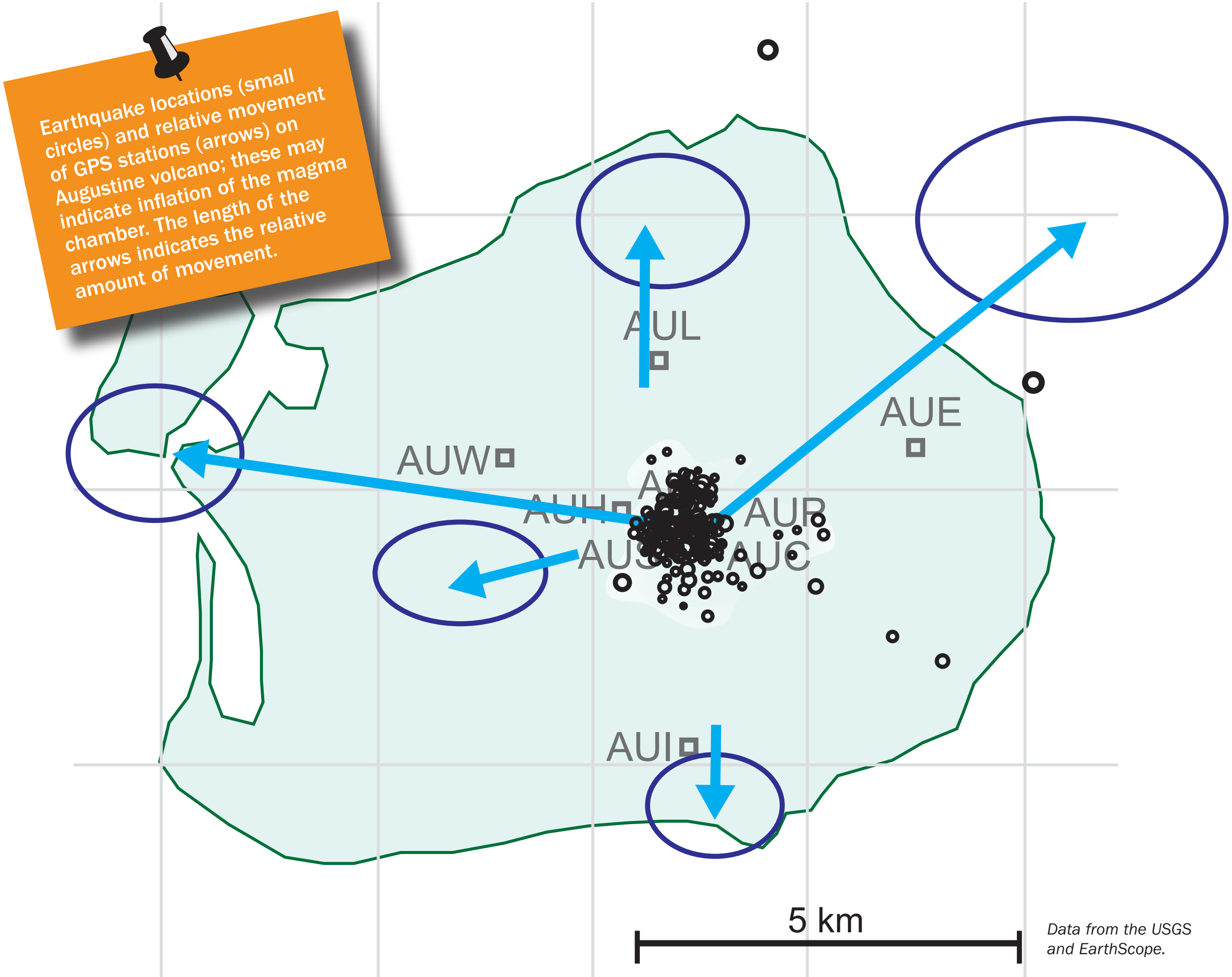
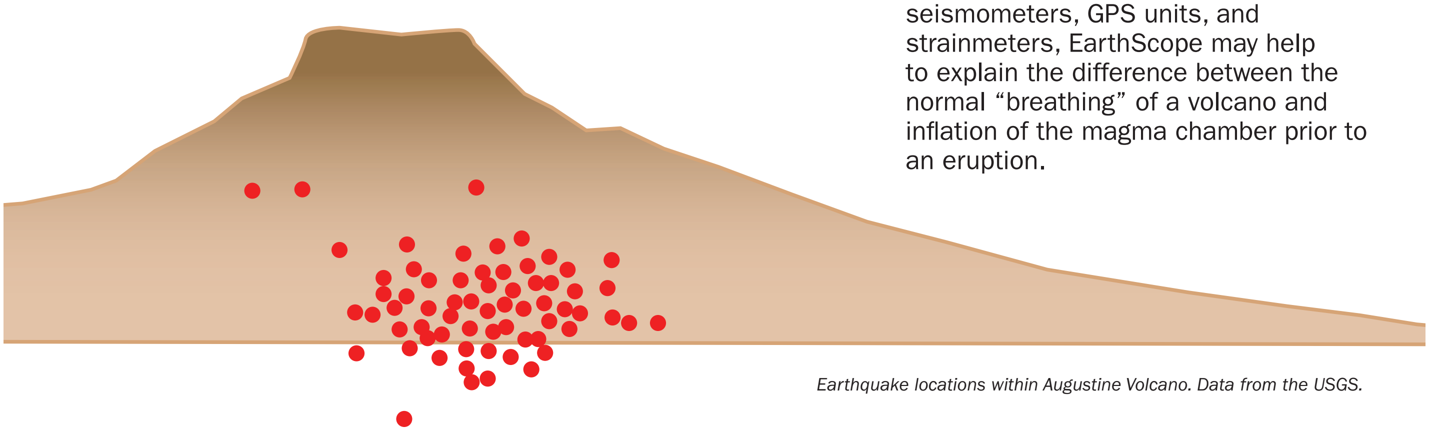


Data from the USGS and EarthScope.

> Why are volcanoes interesting?

Simply put, though plate tectonics has led to great advances in our knowledge of the Earth's workings, there are still many unanswered questions. For example, we do not understand the inner workings of volcanoes, nor what triggers eruptions. Though limited observations have provided views of the short-term changes leading up to eruptions at some volcanoes, little is known about the long-term coupling between plate tectonic motion and volcano life-cycles. By combining seismometers, GPS units, and strainmeters, EarthScope may help to explain the difference between the normal "breathing" of a volcano and inflation of the magma chamber prior to an eruption.



Earthquake locations within Augustine Volcano. Data from the USGS.

Activity at Augustine Volcano

(Left) Two technicians install a GPS unit at McNeil River. Lying in the background, Augustine Volcano is surrounded by clouds. (Right) Steam rises from the ground near EarthScope station AV05, located near the summit of Augustine Volcano.

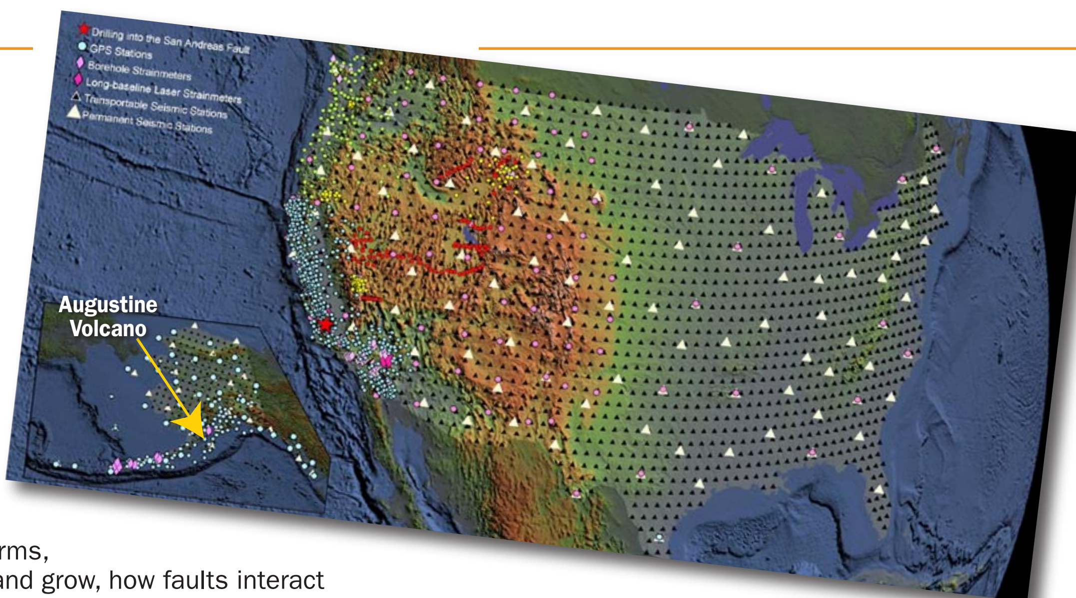
Things to think about:

1) Will Augustine Volcano erupt soon? How can you tell?

2) Are the other volcanoes in Alaska likely to erupt when Augustine does? What makes you think so?

3) What evidence is there that these volcanoes are caused by subduction?

4) What will happen to the Aleutian Islands in a few million years? What will happen to the subduction zone?



What is the EarthScope Project?

Scientists working for EarthScope are examining North America's features and how they change through time. We are investigating how volcanoes grow and change, how the plate boundary deforms, how earthquakes start and grow, how faults interact with each other and with the landscape, and how the structure of the North American continent has developed. To do this, we will have over a thousand instruments placed across North America, including:

- 3.2 km (2 mi) borehole into the San Andreas Fault holding instruments to detect earthquake changes
- Hundreds of permanent GPS stations that can measure movements of less than an inch
- Almost two hundred borehole strainmeter stations that can discover changes of less than a half-inch
- About one hundred permanent seismic stations capable of detecting hundreds of earthquakes a day
- Several hundred transportable seismic stations that will be moved to more than two thousand sites

Visit us on the web at www.earthscope.org to find out more.