Katrin Hafner drilling for an installation near Mt. St. Helens

FUN FACT

Dormant since 1857, Mount St. Helens erupted on May 18, 1980 in one of the largest volcanic explosions in North American history.

But in order for EarthScope to work, it needs talented scientists with broad backgrounds. It needs people like Katrin Hafner, one of the chiefs of operations for EarthScope.

Over the years, she has worked in Antarctica, lived near a volcano, and helped polluters clean up their act. Recently, Katrin answered questions about EarthScope and her work from a group of middle school students in Virginia.

Katrin at the Amundsen-Scott South Pole Station

What do you like about being a scientist?

It is a great job. I am always learning something new and I get to work with interesting people and in interesting places. Just when I think I understand things, new questions pop up. I am never bored.

When did you decide to become a scientist?

When I started college, I was a language major. I dreamed of traveling the world, and ultimately being a translator for the United Nations. Then I took a beginning oceanography class at the community college I was attending. The instructor I had was so enthusiastic about the natural world and how science works—I was hooked. I don't exactly know how it happened, but eventually this led me into the study of geology.

What was your favorite class in school?

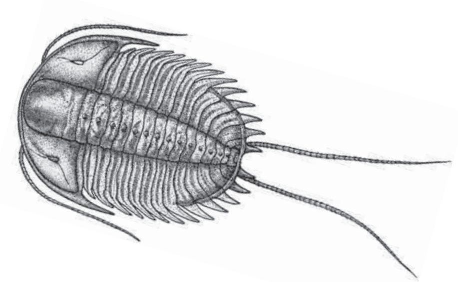
Metamorphic and igneous petrology and summer field class. The field class was for six weeks in the White Mountains of California, and we were able to do geologic mapping over a couple square mile area. We worked in beautiful mountains every day and saw some cool geologic features, faults and folding of rock layers.

Do you have to be good in math to be a scientist?

It is good to have a solid background in math. Honestly for me, math is not my strongest subject, but I made it through my courses. I always learned much better through practical applications and by doing things. So don't give up, even if math doesn't come that easy for you.

What's your favorite rock?

Eclogite. It is made up of red and green minerals, and for some reason it reminds me of Christmas. It is also very easy to identify.



What's your favorite fossil?

A trilobite.

What training did you have to do to live at the South Pole?

The people who work at the South Pole for the winter season need to work together well as a team, and be as self sufficient as possible. Once the station is isolated for the winter season, there is no escaping from each other, and help from the outside world is basically impossible. People have to rely on each other and themselves. Beginning in early September, the winter personnel undergo various tests to ensure they are healthy enough to make it through the winter months. In addition, they are involved in various team building exercises, including a fire training course, a "ropes course" and a wilderness first aid class.

FUN FACT

Three of the ten largest earthquakes of the twentieth century occurred in Alaska, striking in 1957, 1964, and 1965. The strongest of these (magnitude: 9.2) took place on Good Friday in 1964, hitting 80 miles east of Anchorage.

Why did you take fire fighter training?

Fire is one of the biggest hazards of living at the South Pole. If a fire should break out and get out of control, living quarters (and our protection from the harsh environment) could be destroyed. Should a fire break out, there is no "911" number to call. The people who stay there all winter must act as their own emergency response team, and respond to any situation that arises on station.

Katrin at fire fighter training.

EarthScope is going to tell us a lot about how the environment changes over time. Why is the job of an environmental geologist important? What do they do?

Anything that contaminates the surface layer of the earth (e.g., leaking battery acid at a dump, leaking underground storage tanks at gas stations) will eventually travel downward, and intersect a water table. In many areas (e.g., Texas and Nevada), the population's water supply comes primarily from water wells. Groundwater is basically a finite resource, because it takes a very long time to replenish an aquifer. Once it is contaminated, it can no longer be used as a reliable source of water for humans.

I worked on designing and installing remediation systems on a number of groundwater contamination projects. In each case, we already knew that the groundwater had been contaminated. I spent many hours logging the cuttings from drill rigs to determine types of soils, depth to contamination.

FUN FACT

The biggest earthquake of the century struck Chile on May 22, 1960. Its magnitude, the highest ever recorded, was 9.5.

Why did you decide to live near a volcano? Isn't it scary being near a volcano?

Volcanic areas are generally very picturesque, and for a geologist, living near a volcano (especially near an active one) is extra special, because you feel like you can be "part of the geologic process." I was just fortunate that my first job at EarthScope allowed me to live in the Pacific Northwest, and near a number of volcanoes.

An eruption on the Augustine Volcano, Alaska

To me, living near a volcano is less frightening than living where there are hurricanes and tornadoes. I grew up in Southern California, and also experienced the shaking from a number of earthquakes. Learning as much as one can about volcanoes and earthquakes (or anything else) helps one to know what to expect, and understand why things are happening the way they do. Being mentally prepared for such an event can make it easier. As a geologist, my first thought when something happens is usually, "time to go to work…"

EarthScope will use over 2,000 seismometers to learn more about North America. What is a seismometer?

Seismometers are used to record earthquakes, and measure the movement of the ground at a particular site. A group of them located around an earthquake can be used to determine the magnitude and location of the earthquake. I used to work for a group in Southern California that now has over 700 seismometers used to located and to record earthquakes in California.

FUN FACT

The deadliest earthquake of all time is believed to have occurred on Jan. 24, 1556, in Shaanxi (Shensi) Province, China – 830,000 were killed. This quake was detected on the world's first seismometer.

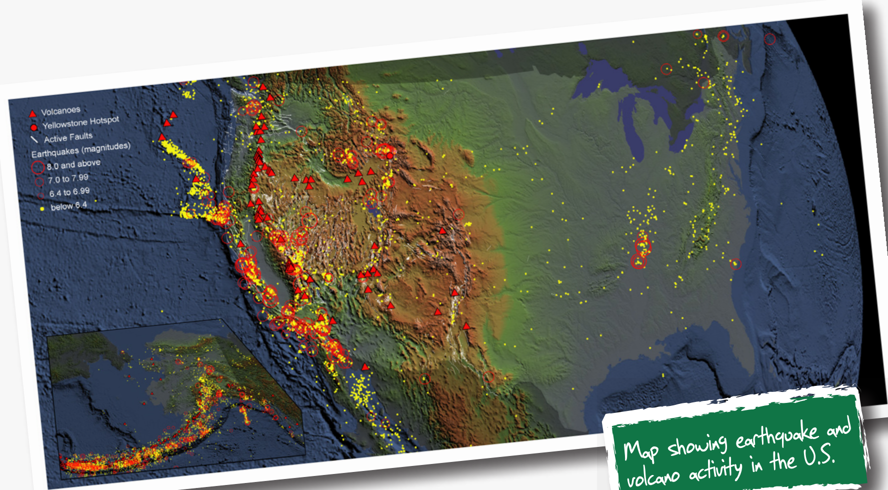
Seismic waves can be used to construct images of the earth's deep interior. EarthScope will use both earthquakes and small explosions to gather information about the earth's crust. What makes an earthquake? How can you tell the difference between an earthquake and a bomb?

FUN FACT
Geologists with 3-5 years experience earned about $75,000/year in a 2004 salary survey.

An earthquake is caused by a sudden slip on a fault. Stress in the earth's outer layer builds up until the rocks suddenly move, releasing energy in the form of seismic waves that travel through the rock. This causes the shaking that we feel as an earthquake. When a nuclear (or any) bomb explodes, it releases its energy in much the same way as an earthquake does (i.e., the earth shakes as the seismic waves travel through and on the surface of the earth). These waves can be identified with a seismometer in the same way as earthquakes are detected. However, the signal produced by an underground nuclear explosion looks very different from that produced by earthquakes occurring throughout the world.

How do we find earthquakes?

Seismic networks have been established all over the world. Knowing how fast seismic waves travel through the earth, seismologists can calculate the time when the earthquake occurred and its location by comparing the times when shaking was recorded at several stations.



Map showing earthquake and volcano activity in the U.S.

Can we predict earthquakes? Can we prevent them?

We can't do either of these things at this time. The goal of earthquake prediction is to warn of potentially damaging earthquakes early enough to allow an appropriate response to the earthquake, enabling people to minimize loss of life and property. The focus these days is more on finding ways to reduce the loss of life and damage.

Earthquakes themselves are not preventable. However, humans can prevent serious damage from earthquakes by developing and enforcing better building codes.

Katrin Hafner is just one of the scientists at EarthScope. There are groups drilling into the San Andreas Fault and groups watching the Pacific Plate slide under Alaska. Some EarthScope scientists are measuring strain in the Rocky Mountains, while others are installing GPS stations over the Yellowstone hotspot. They have listened to the ocean's roar in Colorado, and the movement of magma in Pacific Northwest volcanoes. Katrin is part of a group of EarthScope scientists working to put a seismometer in almost every county in the United States!

All of these data will help us to learn how North America was put together and where the pieces came from. It will also help explain how the glaciers that covered North America about 14,000 years ago interacted with the underlying rocks to form features such as the Channeled Scablands, the Great Plains, and the Great Lakes. By understanding these processes, we can make better choices about where to build, live, and work, and we can have a better idea about where our natural resources are located and what natural hazards exist.

Things to think about!

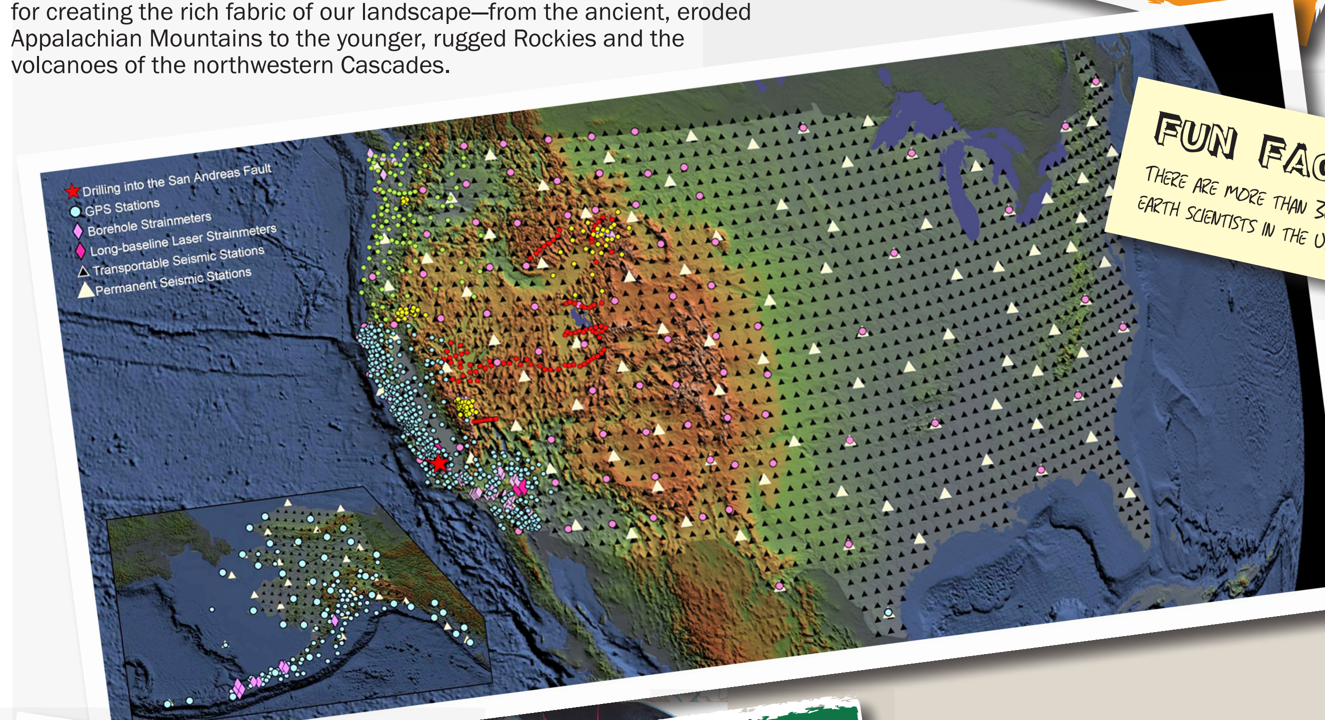
1. **Even though it will gather information from around the world, EarthScope is focused on the North American continent. What part of the Earth would you most like to investigate? Why?**
2. **Dr. Hafner has done many things as a scientist. Which of them would you most like to do, too? Why?**
3. **EarthScope will help us understand natural hazards, such as earthquakes. Which natural hazard is most common where you live? What experiment would you design to learn more about it?**
4. **Because many earth processes are very slow, EarthScope will measure North America for fifteen years. What do you think they might have learned at the end of the experiment? How would you have helped them learn this?**

EarthScope is funded by the National Science Foundation and conducted in partnership with the U.S. Geological Survey. EarthScope is being constructed, operated, and maintained as a collaborative effort with UNAVCO, Inc., the Incorporated Research Institutions for Seismology, and Stanford University, with contributions from NASA and several other national and international organizations.

earthscope Careers in the Earth Sciences

Have you ever thought about the forces that formed the majestic beauty of our national parks or produced our bountiful natural resources? Or wondered what causes the earthquakes that rattle communities or volcanoes that darken the skies?

Today, scientists are running the largest earth science experiment ever to help answer these questions. Called EarthScope, it is inspired by our need to answer questions about the forces that continue to shape our dynamic earth. Over the next 15 years, EarthScope's network of multipurpose geophysical instruments and observatories will allow us to watch the North American continent deform in response to the forces inside the earth. Using modern tools, in over 2,000 observatories across the United States, EarthScope will measure the geological motions responsible for creating the rich fabric of our landscape—from the ancient, eroded Appalachian Mountains to the younger, rugged Rockies and the volcanoes of the northwestern Cascades.



FUN FACT
There are more than 30,000 earth scientists in the U.S. alone!

A GPS station in Alaska

A seismic station being installed underground.

An EarthScope engineer installing equipment

This map shows where EarthScope will have instruments, including seismic stations (triangles), GPS stations (diamonds), and even a drill hole into the San Andreas fault (star). By measuring the changes across North America with these instruments, EarthScope scientists hope to learn more about how continents form. Some instruments are being placed in or near schools like yours! For more information, look on the Web at: **http://www.earthscope.org/**

FUN FACT
EarthScope is the largest systematic survey of the North American continent funded by Congress since the Lewis and Clark expedition 200 years ago.

FUN FACT
The only scientist to ever land on the Moon was a geologist. His name was Harrison Schmitt and he flew on Apollo 17.

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