

## How the Earth Works

Imagine coming upon Earth as a traveler from another galaxy. It wouldn't take you long to discover Earth's fascinating variety. The combination of continents, oceans, and atmosphere makes it unique among all the planets in the solar system, and perhaps in the galaxy. These features also create the conditions for life in all its diversity.

But where did the land, water, and air come from? And how do these systems work together to produce the complex phenomena that are evident everywhere on this beautiful planet? Consider these cases:

- The steady, slow decay of radioactive elements deep inside Earth provides the heat that keeps our planet at a slow boil, moving massive amounts of mantle rock in a cyclic pattern of convection and creating plate tectonics.
- A mid-ocean ridge system snakes around Earth like the seam on a baseball. The slow drift of Earth's tectonic plates—moving at the rate that hair grows—splits the ridges apart, pulling rock up to fill the gap.
- One of the most energetic environments on Earth is where land and ocean meet: the seashore. Waves crashing against the coasts of North America can be heard as background static on seismometers located at the center of the continent.

### An Astonishing Journey

**How the Earth Works** takes you on an astonishing journey through time and space. In 48 half-hour lectures, you will look at what went into making our planet—from the big bang, to the formation of the solar system, to the subsequent evolution of Earth. You will travel to the center of our planet and out again, charting the geologic forces that churn beneath our feet to push the continents and seafloor around like so much froth on the surface of a pot of soup.

Earthquakes, volcanic eruptions, and tsunamis are byproducts of our planet's ceaseless activity, and you will focus on specific examples of each to learn why and when they occur. Volcanic activity has produced the atmosphere as a side effect, and you will learn how this sea of air functions at the global scale. Earth's surface is mostly water, and you will explore the cycling of this vital substance throughout the planet, along with its role in climate, erosion, plate tectonics, and biology.

Not only are humans at the mercy of our planet's natural forces, but we ourselves have also become agents of change. We are altering the Earth's land, water, and air faster than any other geologic process. This will be another theme of your journey: how humans have transformed watersheds, leveled mountains, changed the balance of gases in the atmosphere, and caused the extinction of enough

species to hasten the end of the 65-million-year-old Cenozoic era. It is vitally important that we understand the nature of our geologic powers, if we are to have any hope of controlling them.

### **Your Guide: A Scientific Sherlock Holmes**

Professor Michael E. Wysession is the ideal guide for this expedition. A geophysicist with a specialty in seismology, he has developed techniques for using seismic waves from earthquakes to deduce the three-dimensional structure of the interior of the Earth. Like a scientific Sherlock Holmes, Dr. Wysession uses this approach to “see” into a realm that was previously more mysterious than galaxies billions of light years away.

As a leader in geoscience education, Professor Wysession has wide experience teaching Earth science to students from high school through the advanced graduate level. For this course, he assumes no prior background in science and introduces all the concepts you will need to understand how the Earth works—from basic physics, chemistry, astronomy, and biology to the fundamentals of geology, mineralogy, hydrology, and atmospheric science.

Each lecture builds upon preceding ones to deepen your understanding of key concepts. For example, Professor Wysession spends the first four lectures laying the groundwork for the introduction of plate tectonics in Lecture 5. Almost everything he discusses thereafter relates in some way to this revolutionary theory, which is as instrumental to Earth science as the Copernican theory is to astronomy.

**How the Earth Works** is the perfect complement to The Teaching Company's in-depth geology series, **Nature of Earth: An Introduction to Geology**. Taught by Professor John J. Renton, that course covers Earth's minerals, rocks, soils, and the processes that operate on them through time. **How the Earth Works** also touches on these subjects, but it ranges farther afield to investigate Earth as a system, as one might study a complicated machine.

Such a focus makes this course truly a user's manual to the planet. Whether your interest is geology, cosmology, biology, climate science, or even human history, Professor Wysession shows how these perspectives fit into the comprehensive picture of our planet.

### **Fitting the Pieces Together**

You don't have to travel far to realize that we live in a world of startling contrasts—in landforms, natural resources, flora and fauna, climates, vulnerability to natural disasters, and other characteristics. Professor Wysession shows that these different features are like interlocking puzzle pieces. Learning

how the different pieces fit together gives you insight into some very interesting questions:

- Why is there gold in California and coal in Indiana, and not the other way around?
- What does the tilt of Earth's axis have to do with the evolution of deciduous trees?
- Why are volcanic eruptions predictable, but earthquakes (so far) are not?
- What is the link between the shape of Earth's orbit and the size of mammals?
- How does the movement of Earth's tectonic plates affect climate change?
- What does the mid-ocean ridge environment have to do with the origin of life?

### **Get "Under the Hood" of Earth**

**How the Earth Works** includes many simple activities that make concepts clear. Whether through illustrating the viscosity of magma with day-old oatmeal or showing how a laptop computer can double as a seismometer, Dr. Wysession believes learning works best when you demonstrate and describe basic principles. You will marvel at the lessons he can impart—and that you can do yourself—with a chocolate bar, modeling clay, an orange, and even a piece of Afghan flatbread (which nicely reproduces the complex faulting seen along the mid-ocean ridge system). He also brings in intriguing rock samples with wondrous stories to tell about the history of our planet.

In addition to giving you the pleasure of looking under the hood of Earth and understanding how it is put together and how it works, this course provides a new context for understanding contemporary events and issues such as natural disasters, climate change, resource scarcity, and renewable and nonrenewable energy sources. You may also be surprised to learn the central role that Earth's ceaseless activity has played in historical events, from the origin of civilizations to the fall of Rome and the voyages of Leif Eriksson.

Finally, think back to that traveler from another galaxy. The space voyager's first impression of Earth would doubtless be of its sheer beauty: its intensely blue oceans, brilliant white polar caps, tan deserts, and deep greens of rainforest, overlain by graceful swirls of clouds. How did it all come about? What was it like in the past, and what will it be in the future? What is the role of life in this intricate system? Prepare to investigate the miracle and mystery of the amazing planet that nurtures us all.