# The Earth

The deepest hole that we have drilled into the Earth is barely more than 10 km deep, which is tiny compared to the 6400-km radius of the Earth. If it's only possible to drill down so slightly, how do we have such detailed knowledge of the Earth's interior? This is a fascinating detective story, and after studying this unit you'll know a little more about how human ingenuity has given us "X-ray vision" into the interior of the Earth.

We know more about the Earth than any other planet, as we live on it and can therefore study it much more closely. Nevertheless it is interesting to know that we did not have complete maps of the Earth until the 20th century, and we did not have pictures of the entire Earth until late in the 20th century. Our home is a beautiful place, and the more we learn about it, the more we appreciate how much we rely on its special features for our lives.

Despite the fact that we know more about Earth than any other planet, there is still much to learn about Earth, and indeed we learn more about Earth every year. There is so much to know about Earth that nowadays Earth science has been developed into an independent branch of science.

The following questions will guide your reading of this unit. The relevant parts of the textbook are Chapter 6 and Essay 3.

## 1 Overview

- What is the shape of the Earth? Why is it not an exact sphere?
- What are the size and mass of the Earth? How do they compare with other planets in our solar system?
- What is the chemical composition of the Earth? How does it compare with other planets in our solar system?
- What is the Earth's average density? How do we know? How does it compare with other planets in our solar system?

## 2 The Earth's Interior

- What are seismic waves? What are P waves? What are S waves?
- How do seismic waves help us to obtain information about the Earth's interior?
- What is the Earth's overall interior structure?
- What is density differentiation? How has density differentiation affected the Earth's internal structure?
- How hot is Earth's core? What evidence do we have that Earth's interior is hotter than its surface? What has caused the Earth's interior to be hotter than its surface?
- Describe the convective motions of material within the Earth's interior.
- What is rifting? What is subduction? How do these processes affect the Earth's crust?

- What is plate tectonics? What is the theory of continental drift? Who first proposed the theory of continental drift? What evidence did he have for the theory? What evidence do we now have for the theory of continental drift?

## 3 The Age of the Earth

- How is radioactive decay used to measure the ages of rocks?
- What is the concept of half-life of a radioactive element?
- How old are the oldest rocks found on Earth? What is the evidence for this?
- How old is Earth? What is the evidence for this?

## 4 The Earth's Magnetic Field

- What is the shape of Earth's magnetic field?
- What is meant by the polarity of Earth's magnetic field? What is the evidence that the polarity of Earth's magnetic field has switched at some times over Earth's history?
- What causes Earth's magnetic field?
- How does Earth's magnetic field protect life on Earth from dangerous cosmic ray particles?
- What are Earth's aurorae, and what causes them?

## 5 The Earth's Atmosphere

- Describe the structure of Earth's atmosphere. How do the temperature, pressure, and density of the atmosphere change with altitude?
- Where is the ozone layer located within Earth's atmosphere? How does the ozone layer protect us?
- What is the composition of Earth's atmosphere?
- What is the greenhouse effect? How is it operative within Earth's atmosphere?
- How has Earth's surface temperature changed over time?
- How has Earth's atmosphere formed and how has it evolved over time?

## 6 The Earth's Spin

- How fast does the Earth rotate? What is the speed of a point on the Earth's equator, if only the rotation is considered?
- What is the Coriolis effect?
- How does the Earth's spin influence air currents in the atmosphere and water currents in oceans?
- What is the precession in Earth's rotation? What causes it?

## 7 Keeping Track of Time

- How does the number of hours of daylight change with latitude and season?
- What are time zones and what are their purpose?
- What is universal time?
- What is daylight saving time? What is its purpose?
- Describe some calendars that have been used in history.
- What is a leap year? Why are leap years needed?
- What is the Gregorian calendar? Why was it introduced?