

## Lesson 14: Journey to the centre of the earth

### Teachers' notes

#### **Starter**

The starter is a 12 slide PowerPoint showing some early ideas about the centre of our Earth. Many are ridiculous, and yet some weird and wonderful ideas still occur! There is a full commentary below for those interested:

#### **Slide 1**

Posters from the 1959 film of this name based on the novel by Jules Verne. A re-make is proposed but a release date has yet to be announced. Perhaps one of the most well-known books about hollow-earth is Jules Verne's Journey to the Centre of the Earth. The book illustrates a third theory of hollow-earth which is more plausible than the other two. This is that passages from the surface lead to caverns underground in which life thrives. In the book three scientists climb down an inactive Iceland volcano in an attempt to find a path to the centre of the Earth. They don't make it, but they do find an underground sea populated with prehistoric creatures including plesiosaurs. Verne may have been closer to that mark than most expected. For years scientists scoffed at the idea of life thriving underground without light to provide energy. Now explorations have found rock-eating bacteria living as far as a mile below the ground. In Romania a whole ecosystem, including spiders, scorpions, leeches and millipedes has been found in a cave cut off from the surface 5.5 million years ago.

#### **Slide 2**

Perhaps some of the most bizarre scientific theories ever considered were those concerning the possibility that the Earth was hollow. One of the earliest of these was proposed in 1692 by Edmund Halley. Edmund Halley was a brilliant English astronomer whose mathematical calculations pinpointed the return of the comet that bears his name. Halley was fascinated by the earth's magnetic field. He noticed the direction of the field varied slightly over time and the only way he could account for this was that there existed not one, but several, magnetic fields. Halley came to believe that the Earth was hollow and within it was a second sphere with another field. In fact, to account for all the variations in the field, Halley finally proposed that the Earth was composed of some four spheres, each nestled inside another. Halley also suggested that the interior of the Earth was populated with life and lit by a luminous atmosphere. He thought the aurora borealis, or 'northern lights', was caused by the escape of this gas through a thin crust at the poles.

#### **Slide 3**

One of the most ardent supporters of hollow-earth was the American John Symmes. Symmes was an ex-army officer and a business man. He believed that the Earth was hollow and at the north and south poles there were entrances, 4,000 and 6,000 miles wide, respectively, that led to the interior. Symmes dedicated much of his life to advancing his theory and raising money to support an expedition to the North Pole for the purpose of exploring the inner earth. He was never successful, but after his death one of his followers, a newspaper editor named Jeremiah Reynolds, helped influence the U.S.

government to send an expedition to Antarctica in 1838. While the explorers found no hole there, they did bring back convincing evidence that Antarctica was not just a polar ice cap, but the Earth's seventh continent.

### Slide 4

Others picked up Halley's hollow-earth theory, often adding their own twists. In the eighteenth century Leonhard Euler, a Swiss mathematician, replaced the multiple spheres theory with a single hollow sphere which contained a sun 600 miles wide that provided heat and light for an advanced civilization that lived there.

### Slide 5

Later, the Scottish mathematician Sir John Leslie proposed there were two inside suns (which he named Pluto and Proserpine).

### Slide 6

In his 1906 book, *The Phantom of the Poles*, William Reed presents a collection of reports of polar explorers on strange and unexplained phenomena, such as warm winds, deposits of dust, rocks embedded in icebergs, large ice-free areas, fresh water areas in the open polar ocean, and bizarre auroras, all in support of his belief that the polar areas are the vestibule to the interior of the hollow earth. Reed believed that the poles were unreachable because they simply didn't exist. However, three years later, on April 6th, 1909, Peary and Henson reached the North Pole (more or less: it is now thought that they missed it by about 20 nautical miles). Thus Reed's primary assertion, that the poles cannot be reached, was soon invalidated by facts. Today the poles have been reached by land, air and in the case of the North Pole, by submarine; there is a permanent base at the South Pole. The poles are no phantom. John Cleves Symmes used his knowledge to convince James McBride, a Miami Ohio millionaire. Mr. McBride used his political connections to petition congress to finance an expedition to claim the lands inside the earth for the U.S. The petition, by a vote of 56-46 was tabled.

### Slide 7

On February 19th, 1947, Admiral Richard E. Byrd left Base Camp Artic and flew northward. What happened on that flight?

For years rumours have persisted that on his historic flight to the North Pole, Admiral Byrd flew beyond the Pole into an opening leading inside the Earth. Here he met with advanced beings that had a sobering message for him to deliver to Mankind and the Surface World. Upon Byrd's return to Washington, on March 11, 1947 he was interviewed intently by top security forces and a medical team. He was placed under strict control and ordered to remain silent on the behalf of humanity. Being a military man, he felt he had to comply. Here, from Admiral Byrd's secret log and diary, is the message meant to have been heard 45 years ago!

### Excerpt from 'The Hollow Earth'

"During his Arctic flight of 1,700 miles BEYOND the North Pole he reported by radio that he saw below him, not ice and snow, but land areas consisting of mountains, forests, green vegetation, lakes and rivers, and in the underbrush saw a strange animal resembling the mammoth...."

"In January, 1956, Admiral Byrd led another expedition to the Antarctic and there penetrated for 2,300 miles BEYOND the South Pole. The radio announcement at this time (January 13, 1956) said: "On January 13, members of the United States expedition penetrated a land extent of 2,300 miles BEYOND the Pole. The Flight was made by Rear Admiral George Dufek of the United States Navy Air Unit." Byrd said on March 13, 1956, "The present expedition has opened up a vast new land."

Admiral Byrd said in February, 1947 before his North Pole flight, "I'd like to see that land beyond the Pole. That area beyond the Pole is the centre of the great unknown."

### Slide 8

There is a legend that Hitler and many of his Nazi minions escaped Germany in the closing days of World War II and fled to Antarctica where at the South Pole they had discovered an entrance to the Earth's interior. According to the Hollow Earth Research Society in Ontario, Canada, they are still there. After the war, the organization claims, the Allies discovered that more than 2,000 scientists from Germany and Italy had vanished, along with almost a million people, to the land beyond the South Pole. This story gets more complicated with Nazi-designed UFOs, Nazi collaboration with the people who live in the centre of the Earth, and the explanation for "Aryan-looking" UFO pilots. The Fuehrer had long been convinced that Earth was concave and that man lived on the inside of the globe. According to theory advanced by the Nazi scientists, if the Third Reich were to position their most astute radar experts in the proper geometric area, they would be able to determine the position of the British Fleet and the Allied bomber squadrons, because the concave curvature of the globe would enable infrared rays to accomplish long-distance monitoring.

### Slide 9

There are still many people who believe in a hollow earth – try searching for societies on the internet! The most widely accepted idea is that there is a land called Agharta inside the earth, populated by intelligent beings. Some think that UFOs have come from Agharta.

### Slide 10

Dr. Bernard says this is the true home of the flying saucers. The epoch-making significance of Adm. Byrd's flight for 1,700 miles into the North Polar opening leading to the hollow interior of the earth, the home of a Super Race who are the Creators of the flying saucers will startle the world. The author claims that this remarkable book proves that there exists on the inside of the earth's crust, which is about 800 miles thick, a New World, and that Admiral Byrd's polar expeditions penetrated a total distance of 4,000 miles into this Land Beyond the North and South Poles, where there exist immense openings leading to the subterranean world in the hollow interior of the earth, home of a super race and super civilization.

### Slide 11

Japanese scientists are to explore the centre of the Earth. Using a giant drill ship launched in July 2005, the researchers aim to be the first to punch a hole through the rocky crust that covers our planet and to reach the mantle below. The team wants to retrieve samples from the mantle, six miles down, to learn more about what triggers undersea earthquakes, such as the one off Sumatra that caused the Boxing Day tsunami. They hope to study the deep rocks and

mud for records of past climate change and to see if the deepest regions of Earth could harbour life.

Asahiko Taira, director general of the Centre for Deep Earth Exploration in Yokohama, near Tokyo, said: "One of the main purposes of doing this is finding deep bacteria within the ocean crust and upper mantle. We believe there has to be life there. It's the same mission as searching for life on Mars."

### **Main Activity 1**

This involves using evidence cards to come to the realisation that the Earth's core is in fact made of iron.

**Cards 1,2,3 and 4** lead to the deduction that whatever is inside the Earth is much more dense than either the crust or mantle rocks

**Cards 5-10** suggest that the Earth must contain nickel and/or iron

### **Main Activity 2**

Initially this task is introduced by a PowerPoint - 'Seismic Waves' This leads on to a student fact sheet where they must build up a theory using the evidence provided.

Model answers to the questions on the worksheet:

1. Steadily increasing density means steadily increasing speed. The causes waves to refract, bending away from the normal at every point.
2. S-waves cannot travel through liquid.
3. At these depths there is a sudden change of density.

### **Plenary**

The plenary is consolidation of the structure of the Earth structure by analysing a graph of P and S waves through the Earth. A final consideration of earthquakes, always in the news, could lead to a research homework.

Model answers to plenary questions:

1. P-waves travel faster. P-waves have an initial velocity of 7 km/s and S-waves 4 km/s.
2. 2800-2900 km. S-waves cannot travel through the liquid outer core; P-waves are slowed by the sudden change of density.
3. About 2 km/s
4. It increases suddenly, due to a sudden increase in density (the solid inner core).
5. Density increases with depth.
6. The density remains constant.