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ANIMATION SCRIPT

WHAT LANDSCAPES ARE HIDDEN DEEP WITHIN THE EARTH?

DR PAULA KOELEMEIJER

TO MAKE THE MOST OUT OF THIS SCRIPT, YOU COULD:

- Stick it in your book as a record of watching Paula's animation
- Pause the animation and make notes as you go
- Add your own illustrations to the sheet
- Create your own animation to accompany it
- Add notes from classroom discussions
- Make notes of areas you will investigate further
- Make notes of key words and definitions
- Add questions you would like answered – you can message Paula through the comments box at the bottom of her article: **www.futurumcareers.com/what-landscapes-are-hidden-deep-within-the-earth**

SCRIPT:

The radius of the Earth is 6,371 km, yet the crust on which we live only has an average thickness of 30 km. Below, lie the mantle and core. These layers form 99% of Earth's volume but studying them is no easy task.

Dr Paula Koelemeijer, a seismologist at the University of Oxford, uses seismic waves to 'x-ray' our planet, enabling her to build a picture of the landscapes that exist in the deep Earth and to interpret these in terms of the processes that have shaped our planet.

Earthquakes produce waves of energy that travel through the Earth, typically diminishing in strength with distance. The speed at which these waves travel depends on the material through which they are travelling.

Each wave recorded by a seismometer therefore contains information about the parts of the Earth it travelled through. By combining data from thousands of waves from hundreds of earthquakes, Paula can build a 3D model of the internal structure of the Earth.

Paula is especially interested in vibrations called 'standing waves' in which the wave itself does not move in space but instead the material vibrates with a certain resonance frequency, like a guitar string or a bell when hit. When you hit a bell, it vibrates with a certain frequency and generates a specific sound. If the bell has a crack in it, or is made from a different material, it will produce a different sound.

In the same way, different properties within the Earth will generate standing waves with different frequencies, and Paula can use this information to draw conclusions about the structures deep inside the Earth.

She is using observations of these frequencies to investigate two large 'blobs' deep in the Earth's mantle. Seismic waves travel more slowly through these blobs than through the surrounding the mantle, but scientists still debate why this is. Are these structures just really hot or are they made of a different material? If Paula can constrain the properties of these mysterious blobs in detail, this could change our understanding of how the mantle flows and how the Earth has cooled over time.

Seismic waves are not just caused by earthquakes, but also happen during volcanic eruptions, landslides, hurricanes and other natural hazards, making seismology a very diverse subject. Even animals and humans generate seismic signals! Besides her deep Earth work, Paula has worked on a range of projects looking at different seismic signals, including how elephants produce seismic waves.

To study how different human activities show up on seismometers, Paula has a seismometer in her home that records vibrations from cars, trains and the neighbours' washing machines! She is now planning to put more of these sensors around London to study the geology below the city. What could you achieve as a seismologist?