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8. What Lake on Earth Can No One Reach?

Topics

geology, subglacial lakes

Goal

to describe what is special about Lake Vostok

Context

The continent of Antarctica consists mostly of a massive continental glacier thousands of metres thick. It is surprising, then, to find a large lake in this frozen environment. Even more surprising, this lake exists below the glacial ice.

Teaching Notes

- On a map of Antarctica, locate the Vostok Station, about 1000 kilometres from the South Pole.
- Place tracing paper over Lake Eyre on a map and trace the lake. Then place the tracing over the Vostok area on a map of Antarctica of similar scale. Remind students that Lake Vostok is about a third bigger than Lake Eyre. Students may be surprised that even Australia's largest lake is relatively small amid the vastness of Antarctica.
- Inform students that the idea of Earth's interior heat keeping Lake Vostok from freezing is only one hypothesis as to why the lake exists. There are others. Challenge students to think of other possibilities. Discuss the validity of their ideas.

- After discussing students' ideas, relate other hypotheses that scientists are considering. One suggests that the glacial ice acts as a blanket that insulates the lake and protects it from the cold surface temperatures. Another hypothesis states that pressure from the overlying ice keeps the water in its liquid state, similar to the way pressure forms, and maintains a thin layer of liquid water at the bottom of a valley glacier.

Extension Activity

Encourage students to use the Internet and periodicals to update progress that has been made in the exploration of Lake Vostok. Then report their findings to the class.

Recommended website:

www.ldeo.columbia.edu/~mstuding/vostok.html

Answer Key

1. Antarctica
2. Lake Eyre
3. 4 kilometres
4. satellites, radar and seismic waves
5. Heat from Earth's interior radiates up through the crust and warms the rock on the lake bottom.
6. bacteria, fungi and algae that was 420,000 years old
7. Scientists plan on drilling down to the lake and using robotic equipment to search the lake for signs of life.

8. What Lake on Earth Can No One Reach?

Explanation

How can a lake be unreachable? Does it sit high on a mountainside in Tibet? Is it hidden among the rainforests of the Amazon? No. These places can be reached and explored.

Our mysterious lake lies in Antarctica – the icy continent that surrounds the South Pole. Antarctica is one and a half times the size of the Australia, and ice at least 2 kilometres thick covers nearly all of it. The year-round population of the entire continent is only a few hundred people, mostly scientists living at stations to study the climate, geology and organisms found in this harsh environment.

One of the scientific outposts is Russia's Vostok Station. It has recorded the lowest temperature on Earth: -89.2 degrees Celsius. It is here that scientists discovered Lake Vostok. This lake is 400 metres deep and a third larger than Lake Eyre, Australia's largest lake. However, you won't find Lake Vostok on any map of Antarctica. That's because the lake isn't on the ice – it's under the ice!

Lake Vostok lies nearly 4000 metres below the surface, sandwiched between the glacial ice and the bedrock of the continent. Scientists used satellites, radar and seismic waves to discover and survey Lake Vostok as well as about 70 smaller subglacial lakes.

How a lake can remain liquid water in the coldest place on Earth is somewhat of a mystery. One hypothesis is that heat from Earth's interior radiates up through the crust and warms the bedrock beneath the lake. Another hypothesis suggests that the glacial ice acts as a blanket that insulates the lake and protects it from the cold surface temperatures. Yet another hypothesis suggests that pressure from the overlying ice keeps the water in its liquid state, similar to the way pressure forms and maintains a thin layer of liquid water at the bottom of a valley glacier.

In 1998, scientists drilled an ice core almost to the surface of the lake. The bottom of the core – the deepest ice core ever drilled – contained bacteria, fungi and algae that was 420,000 years old. These organisms probably lived in the lake water that had become frozen. Scientists hope to drill further and use robotic equipment to explore the lake for signs of life. The possibilities are exciting. Ice has sealed Lake Vostok from the outside world for perhaps a million years. Who knows what life forms exist in what may be a living biological museum!

12. When Can You See a Rainbow?

Explanation

Think about the times that you have seen a rainbow. Was it completely cloudy, completely clear or a mix of sun and clouds? Was it raining? Had it recently stopped raining? What time of day was it: early morning, middle of the day or late afternoon?

If you shine light through a triangular piece of glass called a prism, the light separates and spreads out into a spectrum of colours, always in the same order: red, orange, yellow, green, blue, indigo and violet. Raindrops in the sky act as tiny prisms when sunlight shines on them. The light bends as it enters the raindrop. The bending separates the light into its many colours. Each colour of light reflects off the back of the raindrop, then bends again as it leaves the drop. The colours of light leaving the raindrops form a rainbow.

Every raindrop separates light into all of its colours. But when you look at a rainbow, you see only one colour coming from each drop. That's because each colour is bent by a different amount as it reflects off a drop. Red light reflects off the raindrops at 42° . So the light that forms the red band at the top of the rainbow is reaching your eyes at 42° . Violet light reflects off the raindrops at 40° . So the light you see from the 40° position of the rainbow is only violet. The other colours of light reflect off the raindrops between 42° and 40° , forming the other bands of the rainbow.

Now you might be starting to understand the importance of the questions at the beginning of this lesson. In order to see a rainbow, there has to be rain in the sky, but there also has to be sunshine. Plus, the sun has to be fairly low in the sky so that you can see the bands of light when they reflect at angles of 40° to 42° . This means the best time to see a rainbow is in the early morning, late afternoon or early evening when a rain shower has just passed or is about to end and the sun is peeking through the clouds. In most places, these conditions exist several times throughout the year. When they do, look in the sky opposite the sun and enjoy one of nature's most colourful displays.

