GLOSSARY

Acetylene: A colorless, highly flammable, and explosive gas often used for metal welding and as an illuminant.

Biofilm: A complex structure adhering to surfaces that are regularly in contact with water, consisting of colonies of bacteria and usually other microorganisms such as yeasts, fungi, and protozoa that secrete a mucilaginous protective coating in which they are encased.

Carbide: A chemical compound consisting of carbon and a more electropositive element, such as calcium or tungsten.

Extremophilic: An organism adapted to living in conditions of extreme temperature, pressure, or chemical concentration, as in highly acidic or salty environments.

Hydrogen sulfide: A colorless, poisonous gas that smells like rotten eggs. It is formed naturally by decaying organic matter. It is also emitted by volcanoes and fumaroles.

Snottites: Single celled extremophilic bacteria that hang from caves and are similar in shape to stalactites but have the consistency of mucus.

Sulfur: A pale-yellow, brittle nonmetallic element occurring widely in nature, especially in volcanic deposits, minerals, natural gas, and petroleum.

Sulfuric acid: A clear, colorless to brownish, dense, oily, corrosive, water-miscible liquid, usually produced from sulfur dioxide. Used chiefly in the manufacture of fertilizers, chemicals, explosives, and petroleum refining.

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Show Me Science

Nature's Chemical Wonder - Acid Caves Explored

K4571DVD

***Advanced* Teachers Guide**

SYNOPSIS:

In the remote jungles of southern Mexico there are many cave systems that support unique ecosystems. One specific cave, the Villa Luz, is known for the bacteria in its thermal sulphur springs that produce hydrogen sulfide gas. When the gases form bonds with oxygen, the result is sulfuric acid. The acid eats away at the cave walls, constantly altering the patterns in the cretaceous limestone.

Surprisingly, the caves are home to spiders, bats, and a unique fish species referred to as the Cave Molly. The caves are also well known for their snottites, which are mucous-like formations that resemble stalactites. Descending into the caves is very dangerous as there are potentially lethal levels of hydrogen sulfide gas. Scientists must wear respirators and protective clothing as they enter the cave system in their attempt to document and understand the deadly ecosystem.

CURRICULUM UNITS:

- Chemical Engineering
- Chemistry
- Ecology
- Environmental Science

CAREER OPPORTUNITIES:

- Chemist
- Ecologist
- Genetic Engineer
- Geologist

PROGRAM OVERVIEW:

Scientists are intrigued by the resilient organisms that can endure the harsh environments like the acid caves of Villa Luz. Researchers carefully plan expeditions into the caves to better understand these rare ecosystems. They do not enter the caves without protective clothing, a special breathing apparatus, special lights, and safety devices such as warning sensors that blink when they encounter gases of certain deadly levels. Poisonous gases such as hydrogen sulfide and carbon monoxide are prevalent in the caves and can kill a person in minutes. It is impressive that anything can endure these extreme conditions, but spiders, bats, fish and multiple examples of colonies of microbes flourish. It is these microbes that are responsible for the rapid decay and transformation of the cave walls. The limestone hills, along with water above and below the ground help to create the perfect foundation for the chemical processes that eat huge holes in the earth. The caves have been given the nickname “the Underground Himalayas.” The rapid structural changes are partially due to the microscopic life forms that live on sulfur instead of sunlight. These microbes form colonies of fungi, blue-green algae and bacteria that excrete large quantities of sulfuric acid. In addition there are extremophilic bacteria that are aptly named “snottites”. They hang all over the caves and are similar in shape to stalactites but have the consistency of mucus, or “snot”.

ISSUES & CRITICAL THINKING:

1. Explain how caves are formed.

2. Ask students to research a cave of their choice anywhere in the world. What environmental factors led to its formation? What types of life does it support?

3. Compare and contrast Mammoth Cave in Kentucky and Villa Luz.

4. Explain, using natural selection, how the spiders can survive and prosper in Villa Luz.

5. Outline the chemical reaction that produces the sulfuric acid. Explain what sulfuric acid does to limestone. Explain what sulfuric acid does to our respiratory system.