

Taylor Volesky
Junior Division Earth & Space Sciences
Acid Rain Effects on Cave Formation

Caves form in limestone when rain seeps into cracks and dissolves away the limestone. Pure water has a pH of 7.0 and does not dissolve limestone. Rain absorbs carbon dioxide from air forming carbonic acid giving rainwater a pH of 5.6 to 6. This slightly acidic solution slowly dissolves the limestone. Limestone caves take about 100,000 years to form. Acid rain can have a pH of 3.0 or lower, approximately 1,000 times more acidic than normal rainwater. Acid rain is mostly caused by human activities, which produce sulfur and nitrogen compounds. These compounds react in the atmosphere to produce stronger acids, which dissolve the limestone more quickly than rainwater. I designed my experiment to determine how much faster limestone dissolves in the stronger acids. First, I set pieces of limestone at about 80 degree angle and setup burettes so they would drip at about 1.5 drops per second. Next, I dripped hydrochloric acid (pH:1, pH:2, pH:3, and pH:7) down on the limestone (150 mL per test). Then, I collected the acid and checked the pH after the acid dripped onto the limestone to see if the pH changed (which it did). Next, I measured the holes in the limestone. By pressing play-doh into the hole, I measured the volume. The results of my experiment showed that the limestone dissolved approximately 1000x faster for acid rain with a pH of 3 than for rain with a pH of 6. When rainwater is too acidic, it can also cause other problems ranging from killing fish and damaging crops, to eroding limestone buildings, monuments and increasing the rate at which caves form.