**7th Grade Article: Unlocking Secrets of the Grand Canyon's Age.** *Rocks from the iconic gorge provide the clues.* Sid Perkins for [National Geographic](http://news.nationalgeographic.com/) PUBLISHED JANUARY 26, 2014

To the untrained eye, the [Grand Canyon](http://travel.nationalgeographic.com/travel/national-parks/grand-canyon-national-park/) might just look like one big hole in the ground. But to some scientists, the American Southwest's iconic gorge is increasingly looking like several ancient canyons of different ages, stitched together by [erosion](http://science.nationalgeographic.com/science/earth/the-dynamic-earth/weathering-erosion-article/) that occurred about six million years ago, and subsequently sculpted into its modern form.

**Share:** A [new study](http://www.nature.com/doifinder/10.1038/ngeo2065) published in the journal *Nature Geoscience*, added to more than a century's worth of fieldwork, is helping researchers decipher a geological tale that began unfolding when dinosaurs roamed the landscape.For nearly 150 years, scientists have been debating how and when the Grand Canyon formed, says [Karl Karlstrom](http://epswww.unm.edu/facstaff/kek1/), a geologist at the University of New Mexico in Albuquerque. In recent decades they've mostly split into two camps: those proposing a "young canyon" model in which the [Colorado River](http://environment.nationalgeographic.com/environment/freshwater/colorado-river-zoomifier/)alone carved much of the gorge in the past five million years or so, and those suggesting an "old canyon" model in which a series of ancient rivers carved ancestral canyons along more or less the same route. New research by Karlstrom and his colleagues bolster the notion that what actually happened lies between these two extremes. To help estimate ancient erosion rates, the team turned to [thermochronology](http://www2.le.ac.uk/research/festival/meet/geosciences/szameitat/thermochronology)—the study of how a rock's temperature has changed through its history. Because temperature rises as depth in the Earth's crust increases, a rock's thermal history provides insight into when, and how quickly, terrain above it eroded away.

**Analyzing the Rocks:** In the new study, the researchers used a variety of techniques to analyze samples of phosphate-bearing rocks taken from four of the five major sections of the canyon, both from river level and from the canyon rim, which typically lies almost a mile (1.5 kilometers) above the river.One technique, called apatite fission-track dating, involves counting the number of paths carved through apatite crystals by high-speed alpha particles (helium nuclei) emitted during radioactive decay. Because the atoms in these crystals tend to shift and heal such defects at temperatures above 230°F (110°C), the number of paths remaining in minerals today gives researchers a sense of how long ago the rocks cooled below that threshold.Similarly, by analyzing the amount of radiogenic helium trapped in apatite crystals, the researchers could estimate how long ago the rocks cooled to below 86°F (30°C).Finally, by measuring the length of fission tracks remaining in apatite crystals, the team got an idea of how long those minerals remained at intermediate temperatures.

**So How Old Is It?:** Like several previous researchers, Karlstrom and his colleagues found that different parts of the canyon formed at different times. One of the oldest segments, named the Hurricane segment after a famed geological fault, lies in the western portion of the canyon. Data suggest that this stretch of the gorge had been carved to about half its current depth between 70 million and 55 million years ago.But the researchers posit that erosion hadn't started etching a section that geologists have dubbed "Eastern Grand Canyon," immediately downstream of where the Little Colorado River joins the Colorado, until some 25 million years ago. And the team's analyses suggest that the westernmost and easternmost segments of the canyon were largely carved in the past five million or six million years.

Karlstrom and his colleagues argue that while the Hurricane and Eastern Grand Canyon segments were originally sculpted by different rivers, the Colorado took over the job in the past six million years, joining the disparate canyons and carving them wider and deeper.