

Sand Spikes



How a Strange Desert Curiosity Helped Solve a Century-Old Geological Mystery

Photos by the author unless otherwise noted.

What on earth is that?

Every rock collector has experienced that moment of discovery—spotting something so unusual that you stop in your tracks and wonder, *What on earth is that?*

Mine came in 2024 at the annual gem and mineral show hosted by the Anaheim Searchers Gem and Mineral Society in Anaheim, California. As a longtime member, I never miss the show, and one of my favorite stops is the silent auction. The tables are always filled with everything from common minerals to museum-quality specimens, each waiting for the highest bidder.

That year, one item caught my eye.

The handwritten label identified it simply as **"Sand Spike."**



At first glance it wasn't especially impressive. It looked like a lump of hardened sand someone had squeezed together by hand. I glanced at it, shrugged, and continued down the table.

Then I noticed another. And another.

Some were only a few inches long. Others approached eight inches, while several consisted of multiple spikes fused together into a cluster. One even reminded me of an artichoke. None resembled the smooth, rounded concretions I had seen before.

What surprised me even more was the bidding.

Collectors were competing enthusiastically for what appeared to be nothing more than oddly shaped sand.

Curiosity finally got the better of me.

I asked another bidder why everyone seemed so interested. "Oh," he replied casually, "they're just sand concretions." Then he promptly outbid me.

His answer explained almost nothing.

If they were "just concretions," why were collectors willing to pay so much for them?

That simple question launched me into months of research and introduced me to one of geology's most fascinating stories—a mystery that puzzled scientists for more than a century before a convincing explanation finally emerged.

A Geological Mystery That Lasted More Than a Century

Sand spikes had puzzled geologists for well over a hundred years.

Unlike ordinary concretions, sand spikes have a distinctive shape. Most possess a rounded or bulbous head that tapers into a long, pointed tail. Some occur as solitary specimens, while others form spectacular clusters of parallel spikes fused together.



Photo courtesy of the Spirit Rock Shop

Just as unusual is their internal structure. Rather than displaying the concentric growth expected of ordinary concretions, sand spikes appear to have formed by an entirely different process. Even more puzzling, they lack the concentric internal structure expected of ordinary concretions.

The discovery sites are equally mysterious.

What do an earthquake fault and an asteroid strike 6,000 miles apart have to do with each other? And why do sand spikes in nature always point in the same direction?

Naturally occurring sand spikes have been documented from only two locations in the world: near Mount Signal in Imperial County, California, and near Ochsenhausen in southern Germany, close to the Ries impact crater. Although separated by thousands of miles, specimens from both localities are remarkably similar in shape, composition, and size.



Map created in Chat GBT

Perhaps the strangest observation was that specimens at each locality were consistently aligned in the same direction.

For generations, no one could explain why.

Early explanations proposed a remarkable variety of explanations for sand spikes. Some believed they could be casts of ancient plant roots or seaweed. Others suggested they formed in animal burrows or resulted from ground water movement or some magnetic force. My favorite explanation was unknown alien forces!

Each idea explained part of the evidence, but none explained all the evidence.

The mystery remained unsolved for more than 100 years.

Following the Trail

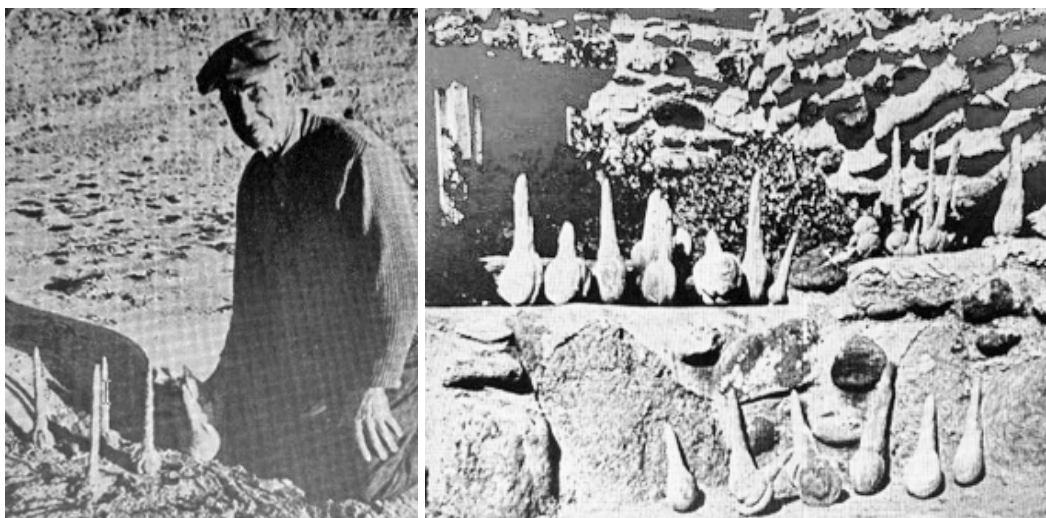


Mount Signal 2026

When I asked other members of the club where these spikes had come from, I was told they were a donation from the estate of long time club member Gwen Smale of Laguna Beach, CA. I was unable to contact any of the descendants, but “club lore” suggests that Gwen may have known Mr. H. W. Pierce (also of Laguna Beach, CA). Mr. Pierce had done extensive research and collecting on the Mount Signal site (which sits in Imperial County, California on the US/Mexican Border) in the early 1970’s.

As I continued researching sand spikes, one name appeared repeatedly: **Howard W Pierce**.

Pierce was an amateur geologist whose fascination with these unusual formations led him to spend years exploring the Mount Signal area in southeastern California. According to a 1939 article in *Desert Magazine*, he collected hundreds of specimens from both the surface and buried in sand deposits, carefully documenting their location, orientation, and remarkable diversity.



Photos excerpted from "Mystery Rock of the Desert" by McDonald White published in Desert Magazine, Oct 1939 Pg 21

Some measured only a few inches, while others measured up to 30 inches. All pointed in the same direction.

His work preserved an extraordinary record of locality that has since disappeared under decades of mining, agriculture, and development.

Pierce wasn't the first person to find sand spikes – other geologists had documented them near Mount Signal as early as 1902 – but he played an essential role in introducing them to collectors, museums, and researchers. Without his efforts, much of what we now know about the original California occurrence might have been lost.

A photograph from another researcher from 1936, Kenneth Garner, became especially significant, as it documented sand spikes embedded in a stream bank all pointing the same way.

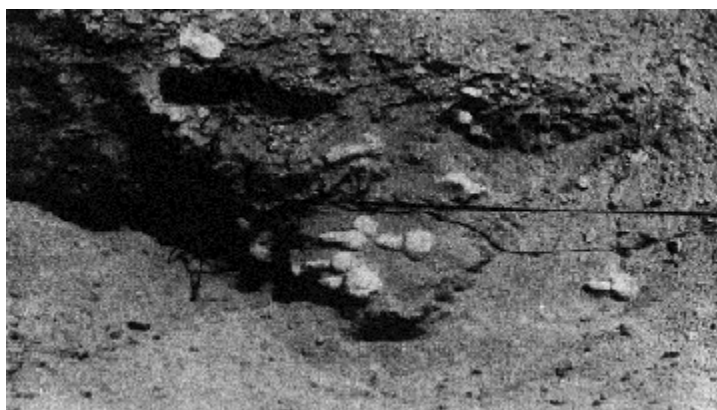


Photo excerpted from "Concretions Near Mount Signal, Lower California" published in the American Journal of Science, 5th Series Vol 31 #84 April 1936

This orientation remained an intriguing curiosity for decades. Today it is recognized as one of the strongest pieces of evidence leading to the true origin of sand spikes.

The Breakthrough

If correct, the new theory tells us that every sand spike is more than a geological specimen – it is a small record of a catastrophic seismic event from the past.”

The breakthrough finally came more than a century later. In 2021, German geologist Dr. Elmar Buchner and his colleagues compared the scientific evidence from both the California and German occurrences. Although the two locations are separated by thousands of miles and formed under very different geological conditions, the researchers found striking similarities in their mineralogy, internal structure, orientation, and mode of occurrence.

Their conclusions were unexpected. Sand spikes from both locations appear to have formed during violent seismic events that rapidly deformed water-saturated sediment.

For the Mount Signal specimens, the likely seismic trigger was a powerful earthquake along the nearby San Andreas fault system. In Germany the seismic trigger was a massive asteroid strike that created the Ries crater approximately 15 million years ago.

Because of the seismic connection sand spikes have now earned their own sub-category among concretions - Seismites. Sand spikes are the only member of this new category.

Two seeming unrelated localities. One remarkably similar geological process.

A Violent Geological Snapshot

“A quartz crystal may require millions of years to grow. A sand spike forms in only a few seconds!”

According to Buchner and his colleagues, sand spikes form in a way that is both dramatic and very quick.

Their model begins with a layer of loose “water saturated” sand containing groundwater rich in calcium carbonate (calcite).

When violent seismic waves pass through this sediment, the intense shaking causes the sand to liquify. For a brief moment the sediment behaves more like a liquid than a solid. This temporary change creates the conditions necessary for something extraordinary to occur.

The new theory is that powerful successive seismic waves compress pockets of the liquified sand, producing small pressure bursts that instantly vaporize the liquid into a gas (steam) to create an elongated cavity in the sand.

Those cavities determine the future shape of the sand spike.

The former water pocket becomes the bulbous head and the channel of escaping gas forms the tapering tail.

Almost immediately the cavities refill with liquified sand suspended in calcium carbonate rich groundwater. As the pressure changes, calcium precipitates between the sand grains, cementing the former pocket into a sand spike. A sand spike is a natural cast of a cavity that existed only for a few moments during a catastrophic geological event.

Every step requires a nearly perfect combination of sediment, groundwater chemistry, and exceptionally strong seismic activity. Remove any one of these ingredients and a sand spike doesn't form.

Why They All Point The Same Way

Perhaps the most intriguing aspect of Buchner's model is that it finally explains the question that had puzzled geologists for generations – why they all point in the same direction. According to researchers this orientation preserves the direction in which the seismic energy passed through the sediment.

The rounded head faces the source of incoming energy. The tapering spike points away from the source of energy.

Buchner's findings changed the way I look at sand spikes.

When I first saw them on the auction table they appeared to be little more than odd lumps of sand.

Now I see something entirely different. I see unique objects that record a snap shot of the Earth's amazing geological history.

Preserving The Evidence of Earth's Geological History

“Today, surviving specimens represent far more than unusual collectibles. They are irreplaceable records of geological phenomena that can no longer be observed in the field. They are snap shots of some of Earth's past cataclysmic events.”

Sadly, both of the sites where today's existing sand spikes were found have been lost to development.

When I visited Mount Signal in 2026, I found it difficult to believe that this quiet desert location had once been a productive source of one of the world's rarest geological oddities.

In a 1934 paper, geologist S. C Edwards described collecting dozens of sand spikes from an area only a few square yards in size. Eva May Hyde wrote in the 1937 article titled Mount Signal Concretions "They were so numerous that we thought little of their scientific value".

This abundance is no longer so. Unless a new discovery occurs, the number of sand spikes present today is finite, and will inevitably decline. These realities underscore the necessity of preserving them for their fascinating history and importance.

For decades they were often labeled as ordinary concretions and overlooked in favor of more colorful or eye catching minerals. Many collectors regarded them as little more than curiosities. Now they are recognized as among the rarest sedimentary specimens available to collectors, and one of the few examples where recent research has fundamentally changed our understanding of them over the last 100 years.

That growing appreciation is becoming increasingly evident in the marketplace. Dealers that once struggled to explain what sand spikes were now find knowledgeable collectors seeking them out. Long forgotten examples occasionally reappear from estate collections, where they had rested unnoticed for decades. Others are simply disposed of by the unknowing heirs of a previous generation of rockhounds.

Today, surviving specimens represent far more than unusual collectibles. They are irreplaceable records of geological phenomena that can no longer be observed in the field. They are snap shots of some of Earth's past cataclysmic events.

The next time you're sorting through a dusty old rock collection, browsing an estate sale, or wandering past a table at a local gem and mineral show, don't overlook that strange lump of cemented sand.

It just might be one of geology's rarest eyewitnesses to an ancient catastrophe.

And if another asteroid ever strikes Earth? Well... you might want to grab a shovel—but only after the dust settles.

About the Author

Steve Millbern is a lifelong Southern Californian and a graduate of California State University, Long Beach, where he earned a Bachelor of Science degree in Biology. After a 45-year career as a residential real estate appraiser, he retired in 2021 and immersed himself in the world of rocks, minerals, and geology. He is a member of the Anaheim Searchers Gem & Mineral Society and the South Orange County Gem & Mineral Society.

Collector's Note: Beware of Replicas

If this article inspires you to begin searching for a sand spike of your own, there's one more important thing you should know.

Not every sand spike on the market is the real thing.

In 2000, artist Allan McCollum created approximately 400 replica sand spikes as part of a commissioned art project for the Imperial Valley Historical Society & Pioneer Museum in Imperial, California. Using molds taken from an authentic Mount Signal specimen, he produced convincing reproductions from a mixture of sand and adhesive.



Photo excerpted from “Signs of the Imperial Valley: Sand Spikes from Mount Signal” 2020.

The replicas were never intended to deceive collectors—they were created as educational art and commemorative pieces—but many have since found their way into private hands. Fortunately, they're usually easy to identify. Genuine sand spikes formed naturally and therefore have no mold seams. McCollum's replicas typically display a faint mold line running along both sides of the specimen. If you see matching seam lines, you're almost certainly looking at a replica rather than a naturally formed sand spike. The museum also commissioned McCollum to create a monumental outdoor sculpture inspired by a sand spike. Measuring roughly 25 feet in length, it's an impressive tribute to these remarkable geological oddities. By comparison, the largest authentic Mount Signal sand spike ever reported measured only about 30 inches long.



Photo by the author at the Imperial Valley Historical Society & Pioneer Museum in Imperial, California. 2026

For collectors, a replica can make an interesting conversation piece, but it should never be mistaken for one of nature's originals.