



## Jurassic starfish discovery in south-central Montana wows researchers



15 HOURS AGO • BY [BRETT FRENCH](#)

It took five years for Jay Gunderson to find a scientist willing to investigate the fossilized [starfish](#) — also called sea stars — that he discovered in crumbling rock along the base of the Pryor Mountains. It was worth the wait.

“What you found is an extraordinary occurrence,” Tom Guensburg, interim dean of the Physical Science Division at Rock Valley College in Rockford, Ill., wrote to Gunderson after investigating the site last month. “It could be the most diverse starfish fauna known from the Jurassic, a time when modern starfish orders

make their earliest known appearances. This is good stuff.”

Fossilized starfish are rare, especially whole ones, said Guensburg, who has long researched ancient sea stars. Often, only bits and pieces are found. That’s because when they die, starfish are eaten by scavengers or quickly disintegrate as the dual action of sand and surf grinds them down.

It’s also because of their body composition. The external shell of the animals is made of thousands of spongelike plates held together by soft tissue.

“Modern ones are a handful of sand in a matter of days,” Guensburg said.

All of these factors taken together make starfish fossils a rare find, especially whole ones.

### Fateful hike

Gunderson, who works as a geologist for the Montana Bureau of Mines and Geology in Billings, said he likes to get out of the office occasionally to explore the rock exposures strewn about south-central Montana.

In 2010 he was hiking with his 9-year-old son, Robert, when they chanced upon two small starfish — only about 6 inches across — embedded in the surface of a 150-foot layer of chalky marine sandstone known as the Swift formation. The formation dates back 150 million to 160 million years ago to the late Jurassic age — the time of dinosaurs. Back then, this area of Montana was an inland sea. The Swift formation represents the last “major regression of the Sundance Sea,” Gunderson wrote in a paper about his discovery.

“I’m just surprised it hadn’t been seen before,” Gunderson said. “I kept it secret for years. I know that starfish are pretty rare fossils.”

After taking photographs of the fossil find, Gunderson sent the pictures out to try to encourage someone with knowledge about starfish to investigate further. No one responded.

“We went out again and found more and more,” Gunderson said. “Finally I sent the photos to the BLM.”

### **Expert connection**

The Bureau of Land Management is responsible for the land where the fossils were discovered. It was BLM’s Greg Liggett, a paleontologist for the Montana-Dakotas office, who encouraged an investigation of the site.

“I am not a starfish expert, so I contacted Dan (Blake) to see if he was interested in coming out from Illinois to take a look, and that resulted in his trip,” Liggett wrote in an email.

Blake is recognized as one of the world’s experts on fossilized starfish. He is now professor emeritus at the University of Illinois, Urbana-Champaign. He noted that the only other site in the world with similar fauna of a similar age to that found in the Pryors is in Switzerland, “and that’s it.”

“One of the interesting things about it is it looks like it will have some parallel with Switzerland,” Blake said, possibly the same massive extinction that affected all life in that time period.

In Montana, a large ancient flood or influx of sediment washed over the starfish all at once, entombing them in time, Guensburg said. Other starfish fossils have been found in only a handful of locations in North America, including Wyoming. And those discoveries have typically revealed only one kind of starfish, not several.

“So this is way outside the normal,” Guensburg said. “So we’re pretty excited about this occurrence.”

What’s more, the Pryor starfish fossils were mixed in with fossilized clams and oysters, their traditional prey.

### **Quick excavation**

Finally arriving at the site last month, Blake, Guensburg, Liggett and a crew of volunteers were able to use masonry saws to cut the surrounding rock and remove the starfish fossils over the course of six days working 12 to 14 hours a day.

“I was elated because they are so rare, and here they are,” Blake said of finally arriving at the site. “For those of us doing this kind of thing, it’s fun to see them in the field.”

“I was sort of overwhelmed,” Guensburg said. “When you work all of your life and find only one or two of them and suddenly they are all over the place.”

Whole portions of the rocks had to be removed because trying to chisel out just the fossil would be impossible given the crumbly nature of the stone. Blake said it would be more likely that the fossils would be embedded in a cementlike material to keep them intact. Because they were exposed to the weather, some have been etched and damaged.

“What’s interesting is that it’s four to six different kinds of starfish all on one surface in a small area — 22 examples,” Guensburg said. “It’s interesting because they are the oldest examples

of starfish that aren't too different from modern ones.”

In all, the crew collected so many fossils that they had to be shipped to Blake for study in four separate boxes — one of which was late to arrive and caused the researchers a bit of anxiety.

“This is a great example of how the system can work to benefit the public,” Liggett said in his email. “Someone finds something on public land and brings it to our attention; we connect with a leading expert on the subject and help them get the clearance needed to excavate; Dan, as the expert, will spend time studying the new fossils and see what we can determine about them and the history of the rocks and perhaps publish his findings in a scientific journal; and everyone enjoys the benefits of public fossils and the information about the past that they provide.”

### **Sifting evidence**

Blake has begun slowly going through the boxes to more closely examine each fossil and take notes.

“It's not a fast process,” Blake said. “It takes a fair amount of thought.”

But he admits to feeling a bit like a child under the Christmas tree, a surprise in each box he opens.

One of the fossils doesn't look like anything modern, having thin pencil-like arms.

“There's nothing quite like that in the modern fauna,” Blake said. “I don't know yet quite what to make of it.”

He's discussed the fossil with a Smithsonian colleague who wants to see photographs.

“Some of the others, it's difficult to determine what the diversity is because they look different under a hand lens in the field than when viewed under a microscope,” Blake said.

Once he's finished researching them, most of the fossils will be turned over to Chicago's [Field Museum](#) for display and so that other researchers can examine them, although they will remain the property of the public and government.

“Up until now, the Field Museum had zero starfish fossils, now they have 22,” Guensburg said.

After waiting five frustrating years for someone to take an interest in his starfish fossil find, Gunderson is now anxiously awaiting the results of Blake's findings. He will keep his son, who is now 14 and has different priorities than rocks, apprised of the results, as well. And he'll keep taking the occasional hike in search of other interesting rocks.

“That's an area that we kind of frequent,” he said, although admitting it's going to be tough to top the last discovery.

“It's pretty spectacular.”

### **Starfish facts**

Starfish aren't really fish. Although they live underwater — only in saltwater — that's where

their similarity to fish ends.

Starfish, also known as sea stars, use the seawater to pump nutrients through their bodies because they don't have blood. They come in a variety of species. So far about 2,000 have been counted.

To move, they have tiny tube feet on the underside of their bodies. Adult sunflower sea stars have 15,000 tube feet, yet can only move one yard a minute, which is pretty fast for a starfish. Those tube feet also help sea stars hold their prey, which includes shellfish.

Sea stars are related to sand dollars, sea urchins and sea cucumbers, all of which are echinoderms, meaning that they have five-point radial symmetry. However, this does not mean that all sea stars have five arms. There are species with 10, 20 and even 40 arms. If one of these arms is lost, a sea star has the ability to regrow it.

— *National Oceanic Atmospheric Administration*