Meteorite Hunting

by Diane Boudreau

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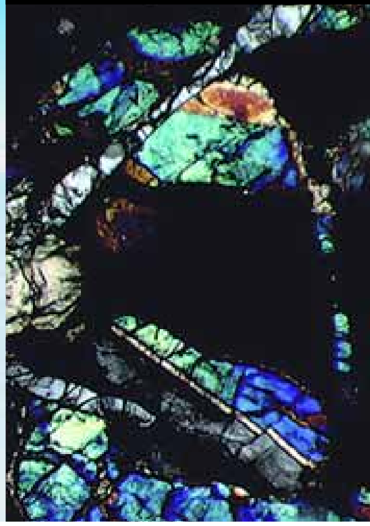

< Optical wavelength thin section of a meteorite reveals its crystal structure

"These meteorites offer a record of the steps leading up to the formation of life."

What on Earth would convince a perfectly sane Arizona native to spend six weeks camping out in one of the coldest, windiest parts of Antarctica? For Laurie Leshin, an Arizona State University geologist, the answer is meteorites.

Meteorites are rocks that fall to the Earth from outer space. They come from asteroids, Mars, and from our own moon. Meteorites fall everywhere on Earth, but Antarctica is the best place to find them. "They are easy to distinguish on the ice. We typically go to places where there aren't Earth rocks for miles. So meteorites are easy to see—black rock on white ice," says Leshin. "The flow of ice also concentrates meteorites in some regions. They get incorporated into the ice like chocolate chips in a cookie," she explains. "The ice flows and sometimes runs into a barrier, like a mountain range. Then the winds erode the ice and expose the meteorites."

During the winter of 1996, Leshin traveled to Antarctica as a member of the Antarctic Search for Meteorites Program (ANSMET), funded by the U.S. National Science Foundation. The program sends a group of scientists to Antarctica every year to retrieve as many meteorites as they can.

Leshin and her team first flew to New Zealand, where they boarded a C-130 military plane for the eight-hour flight to Antarctica. "Its not like a commercial flight," Leshin says. "The seats are uncomfortable, and there's no hot dinner and a movie!"

The plane landed at McMurdo Station, the biggest U.S. base in Antarctica. At McMurdo, the team learned to live and work in Antarctica's frigid environment. They also picked out food for the trip and loaded it on sleds. "You can leave your frozen meat outside and it doesn't go bad!" jokes Leshin.

Next, the group took a smaller, ski-equipped plane to the field site. Before landing, the pilot zoomed over the ground, dragged the skis along at full speed, and then took off again. "It feels like you're crashing," says Leshin. "They do this to test the ice and to make a kind of runway for the landing."

The team camped camped in small tents, using the "warmest down sleeping bags they make," according to Leshin. Team members cooked inside the tents, using stoves that also helped to keep them warm. "The biggest fear in Antarctica among the experienced campers is that with all the wind, the tents will catch fire from the stoves. You keep a knife in the tent in case you have to cut your way out in an emergency," says Leshin.

The average temperature was 5 degrees below zero Fahrenheit. The wind chill factor made it feel like 30 to 40 degrees below zero. "It was really cold and blowing hideously at the camp. They call our program 'the harshest deep field camp on the continent,'" Leshin says. Why? "Because the places where meteorites are found tend to be the windiest, most hideous places. "It's intense, but you know what? I'd love to go back!" she adds.

Leshin's team found 400 meteorites during their stay, which is average for ANSMET trips. Since the program began, the world's collections of meteorites have increased tenfold. Today, about 25,000 meteorites are housed in museums and universities around the globe. The meteorites found through ANSMET belong to the U.S. government. Eventually, they all end up at the Smithsonian Institution in Washington, D.C. But scientists from all over the world can request samples of these meteorites for study.

Leshin often requests these kinds of samples for her research. She also relies on ASU's Center for Meteorite Studies. It is the largest university-based meteorite collection in the world, holding about 1,500 specimens. She studies the chemistry of meteorites to understand environments outside the Earth.

She studies these meteorites using a device called an ion microprobe. The microprobe shoots a beam of electrically charged atoms—ions—at the rock sample. When the ions smash into the rock, tiny particles sputter off of the surface. The probe uses magnetic fields to spread the particles out according to their mass, from light to heavy. The device identifies particles based on their mass, and finds out what the meteorite is made of.

Scientists use meteorite research to better understand how our solar system began, and how life developed. For example, some meteorites contain amino acids, which are the building blocks of proteins. Proteins are an essential part of all living things. "These meteorites offer a record of the steps leading up to the formation of life," says Leshin. "It's really the only record of those steps that we can see. Here on Earth, the record has been wiped out, because the rocks here have undergone so many changes and because existing living things contaminate any historical evidence."

The vast majority of meteorites are tiny pieces of asteroids. Asteroids formed early in the history of the solar system. Asteroid meteorites are the oldest things ever dated, ranging to 4.566 billion years old.

Our solar system began as a cloud of gas and dust. The cloud gradually collapsed under its own gravity. It got smaller, spun faster and flattened out. The colliding matter became very hot. When the solar system began to cool grains of dust could remain stuck together to form asteroids. Over time, these asteroids collided to form planets.

Jupiter was one of those planets. Because Jupiter was so big, its gravity was strong enough to tug asteroids apart and keep them from forming new planets. The result is a belt of thousands of asteroids that now orbit the sun between Mars and Jupiter. "Jupiter also cleans out a lot of debris and protects us from it," says Leshin. "Astrobiologists have lots of questions. One of their big questions: Does a solar system need a big planet like Jupiter in order to form life?"

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