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Canada's meteorite research may soon be on the rocks; Homegrown ingenuity the bedrock of cutting-edge scientists

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Illustrations: Chris Mikula, The Ottawa Citizen / Chris Fry, a student of earth sciences professor Claire Samson, holds a section of the Toluca, a nickel and iron meteorite at the Carleton University Herzberg Laboratories.;

One of Claire Samson's favourite objects is a thumb-sized lump of (mostly) iron from a distant part of the solar system, its surface pitted and scoured by its super-hot fall through Earth's atmosphere.

Rocks do fall from the sky, and Canada's meteorite experts have built themselves into a world power in the specialized field of studying them.

Samson is one of these people, a professor of earth sciences at Carleton University. She and others are preparing for the time, coming soon, when major space powers will send robot probes to asteroids or Mars and return with samples of rocks.

When that happens, Canada is positioned to be at the forefront of analysing these relics of the early solar system, based on homegrown techniques and ingenuity.

"We sort of have a little club going. Meteorite research in Canada is not well funded. (But) we are innovative and creative and we do it anyway," Samson says. "It's a lot through personal contact."

One innovation lies in finding new uses for old equipment. Samson and her students use a medical CT scanner to look inside meteorites without cutting into them.

"It's the same exact technology" as a medical CT scan, "except that now you are not imaging human tissues; you are imaging a piece of rock."

Space rocks, like those on earth, vary enormously.

Some are nickel and iron heavy-weights, formed inside a planet or large asteroid. Others, known as chondrites, are a mix of dust from the early solar system - droplets of metal, fine grains of rock, tiny spheres of silica - all pressed together.

Some carry amino acids, the building blocks of protein in our bodies.

"What we want to do is study as much as we can without destroying the samples," Samson says. Eventually, someone will cut into some space rocks. They will slice across them, re-move chunks, grind the pieces into powder and do chemical analysis.

But if they know in advance what's inside, they can aim at the right spot the first time and do a lot less cutting. It's a twist on the carpenter's maxim, "Measure twice, cut once."

She credits Richard Herd of the Geological Survey of Canada with the idea of trying

this on meteorites.

And another part of the meteorite club, Western University in London, supplied the CT scanner, and also the biomedical researchers who are its main users.

Another new Canadian trick: calculating the density of a space rock. That means measuring the weight (easy) and exact volume (harder. Samson's students, Jason Mah, Chris Fry and Maxim Ral-chenko, scan the surface with a laser that makes precise images).

An engineering student, bit of a smart aleck, recently asked: Why not dunk the meteorite in your coffee?

That's good engineering - Archimedes himself worked out volume from the amount of water an object displaces - but a lousy way to keep the meteorite pure. Samson is also an engineer and shrugs off the kid's approach as "a bit rough around the edges," but well-meaning.

Her lab leans heavily on her former employer, Neptec Design Group, a space engineering company in Ottawa. They borrow equipment from Neptec sometimes; the technology dates back to the lasers Neptec sup-plied for NASA to inspect the outside of the space shuttles for damage after Columbia was lost in 2003.

The hunt for Martian rocks is intriguing partly because primitive life may have come to Earth aboard rocks knocked free from Mars in ancient collisions, when Mars was warmer and Earth was lifeless.

At the University of New Brunswick, John Spray is part of a science team advising NASA on its latest probe to Mars, due to land there in August and look for ancient life.

Spray's expertise lies in what hap-pens when space objects slam together very, very fast, leaving craters like those on the moon.

"Probably, ultimately, Canada will be a partner" with NASA, the European Space Agency and others "in a collaborative effort to bring material back from Mars," he said.

And in Edmonton, a new lab holds Canada's most famous meteorite. It has a story behind it.

A five-metre-wide rock that drifted for millions of years in a lazy, egg-shaped orbit reaching past Mars landed on a frozen Canadian lake in 2000.

Rushing into our atmosphere at 72,000 kilometres an hour, it screamed southeast over the Yukon town of Carcross just before dawn, and exploded in mid-air with the force of up to 3,000 tonnes of TNT.

U.S. military satellites designed to track nuclear missiles saw the green-white fireball. Seismic instruments in Canada and Alaska, designed to measure earthquakes, felt the sound waves from the explosion, and the pressure waves from the sonic boom.

And at her home in Carcross, Jacqueline Foster saw "a great, rolling, greenish-yellow, fiery mass, as big as my fist at arm's length."

The fragments are named for the spot where they landed, on frozen Tagish Lake, British Columbia. A resident had the good

sense to keep big chunks sealed in a plastic bag in his home freezer, still frozen in the lake ice.

The Tagish Lake meteorite has never thawed. As such, it holds organic substances that would have evaporated quickly at room temperature, such as naphthalene, the chemical in mothballs.

Blackened, sulphury and fragile, part of the Tagish Lake find is now in a lab at the University of Alberta. A small "glove box" filled with argon gas holds the rock, because argon is inert: It doesn't react with anything. And the box is in a freezer.

"It has these organic molecules from space, and we found that all that trouble was worth it," says Chris Herd, the University of Alberta professor who runs the meteorite lab. (He's Richard Herd's son.)

"The entire environment is a cold environment: -20C. This has not been done before, anywhere." And NASA is interested in keeping future samples from Mars or asteroids under frozen conditions.

But the meteorite illustrates more connections in Canada's meteorite club. The Royal Ontario Museum owns part of it, and also owns a "wire saw" used for cutting meteorites with the least possible destruction - like a scalpel for rocks. As well, Canadian-owned fragments have been on loan to NASA.

"If you take collectively the nation-al meteorite collection (on Booth Street), the Royal Ontario Museum and the University of Alberta collection (and) count those as one, it's one of the best collections of meteorites in the world," Herd said.

What's next for the meteorite experts is uncertain. Funding for re-search tools and instruments from the Natural Sciences and Engineering Council of Canada (NSERC) will end next fall, a victim of budget cuts.

And Richard Herd worries that support for this work is failing just as Canadian expertise reaches its peak.

"There is a lack of integrated vision," says Carleton's Claire Sam-son. "For the longest time a lot of us would look to the Canadian Space Agency to bring such integrated vision, but it's not happening."

The space agency's budget is being cut, and it is operating without a long-range plan that was promised four years ago, but never made it past the federal cabinet.

"We are the people in the trenches - doing the work - 'we' meaning the professors and students. At one point fatigue cuts in a bit," he said.

"In this country, everything is very decentralized. People go and do work anyway. We have a very positive, in-formal network that we all talk to each other and so forth, but some-how that reaches a limit. We will not go beyond without more leadership and funding."

It's worth studying meteorites, she says, "because nature has delivered them to Earth for free."

HEAVY DAY FOR CANADIAN ASTRONAUT HADFIELD

Canadian astronaut Chris Hadfield had a tough exam in Russia Friday: Proving he could fly the Soyuz during re-entry.

All exams have pressure, but this one had 8G - eight times the force of gravity as a centrifuge whirled him around in a simulated cockpit.

He had to maintain manual control of the spacecraft as the artificial gravity shoved him back into his seat.

He passed "with flying colours" and announced the fact on his popular Twitter account (@cmdr_hadfield), with links to a couple of YouTube videos.

Hadfield is due to launch in December to spend six months on the Inter-national Space Station. He'll be the mission commander for the second half of his stay.

Since American space shuttles no longer fly, the only way up or down is by Russian Soyuz, and Hadfield has been training intensively for years.

His recent Twitter posts show a great respect for the machines he will fly. Asked by a reader about Russian technology, he replied: "I've been studying it and training on it for 18 years. I helped build Mir. I trust it with my life."

As for the 8G maximum pressure, he wrote simply: "That gets heavy." It will be Hadfield's third space flight.