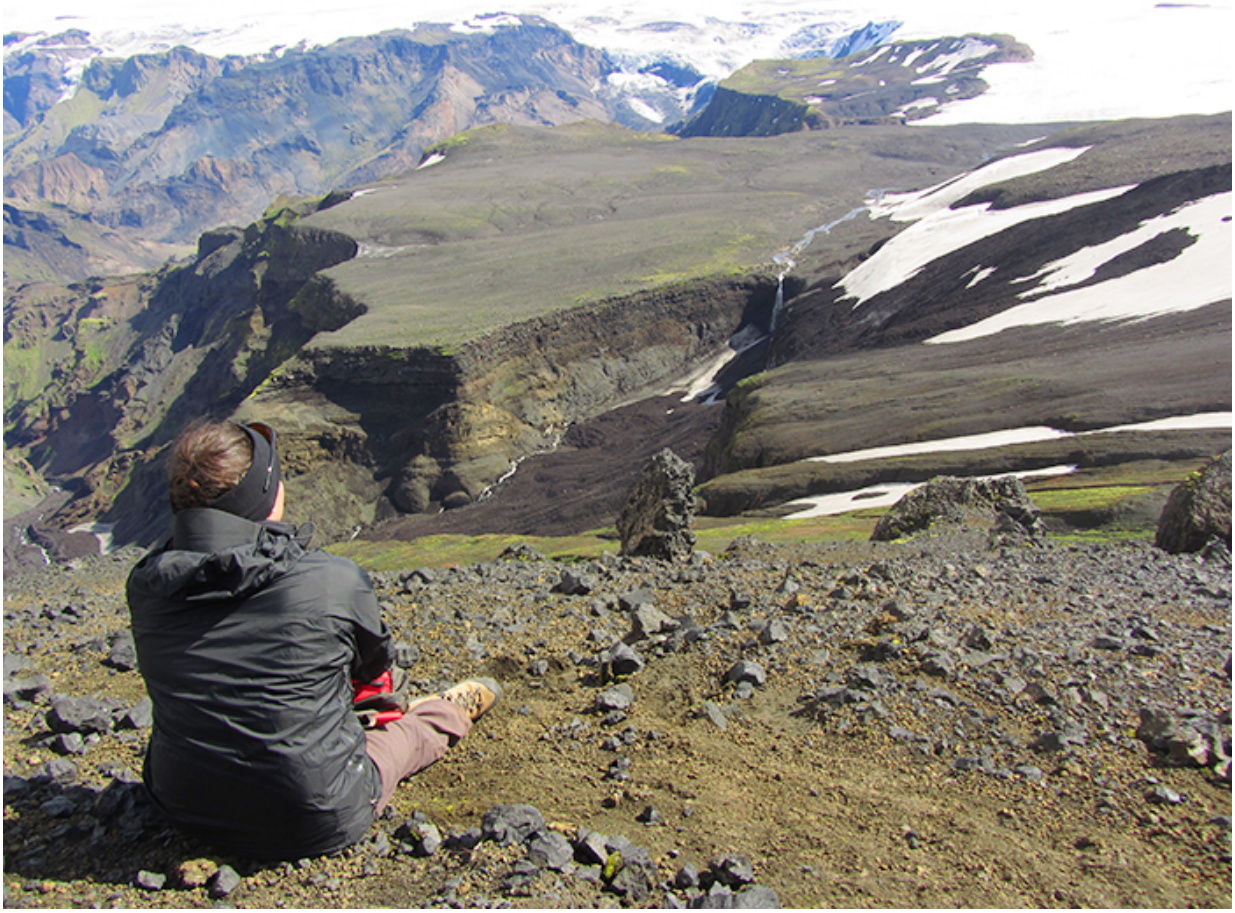
Researcher hunts DNA on Mars

January 13 2017, by Adela Talbot



Astrobiologist alumna Alexandra Pontefract, PhD'13 (Geology), is a postdoctoral associate at the Massachusetts Institute for Technology (MIT), where she is part of a team working on a life-detection instrument – a DNA sequencer for Mars. The project is funded by NASA. Credit: University of Western Ontario

Astrobiologist alumna Alexandra Pontefract, PhD'13 (Geology), knows finding DNA on the Red Planet will be no easy feat. But it is possible. What's more, if DNA is found, it's not far-fetched to think it would be proof of shared ancestry between Earth and Mars.

"There is a really good argument for the fact that if there was life on Mars, it would have shared ancestry with Earth. That's because back towards the origins of the solar system, between 4.1 and 3.8 billion years ago, Earth and Mars had formed, and there is evidence they were both habitable at that point in time," said Pontefract.

"At the time, there was something going on called the Late Heavy Bombardment, and meant the inner solar system was being hit with lots and lots of meteorites. There was a big exchange of rocks between Mars and Earth. There have been studies that have shown biology can survive being ejected from a planet and survive in space. We know it's possible; it's really amazing."

This is what Pontefract is working on now. With a background in microbiology and geology, she is a postdoctoral associate at the Massachusetts Institute for Technology (MIT), where she is part of a team working on a life detection instrument – a DNA sequencer for Mars. The project is funded by NASA.

Looking for DNA on Mars is not an oddity at all, Pontefract noted, and she is arguably among the best prepared to work on a project such as this.

Her interest in impact cratering, biology and the intersection between the two – particularly impact craters and their potential to create habitats for life – was what brought Pontefract to Western, to work with Gordon Osinski in the Centre for Planetary Science and Exploration (CPSX). With CPSX, through a Mars analog mission in Utah, she gained

knowledge and training into mission design and what is needed for flight readiness of an instrument.

"I've been very interested in life detection, and I've done a little bit of work in something called Raman spectroscopy, which looks at rational modes of molecules. Basically, it's a fingerprinting technique for molecules, it has a very high resolution and it is going to be used as a life detection instrument on Mars 2020 and ExoMars – the two rovers," Pontefract said.

"When I saw this job at MIT advertised and that they are building a life-detection instrument for Mars, a portable DNA sequencer, that was really intriguing to me. The problem with looking for life on other planets is, you need to make sure you have an unambiguous signal. You think you find life. But what do you need to find, to say definitively, that you have found life? It's really difficult to do here on Earth, with all of the complex instruments available to us. It's even harder to do remotely with the instruments available to you on a rover," she continued.

Building a life-detection instrument with NASA also appealed to Pontefract from a medical point of view, she added.

"I want to be able to give back to the community, and the instrument they are developing is a portable DNA sequencer. You could bring it into the field, anywhere in the world – some small village in the middle of nowhere. If there's an outbreak and you need to know what it is, lots of times we take samples, send them out and it takes a couple of weeks to get it back. With the instrument we have, you could find out in a matter of hours what you're dealing with. I love that it has multiple applications aside from planetary science," Pontefract explained.

NASA instrument development programs are gauged on something called a Technical Readiness Level (TRL). There are two sets of

programs: 'Picasso' funds an early stage idea (TRL 1-2) and 'Matisse' funds mid-stage ideas (TRL 3-6). TRL 7 means the instrument is ready for flight.

The life-detection instrument Pontefract is working on is currently at TRL 4.

"We are going to be taking the instrument into the field in January in Argentina to test it at a site that is a Mars analog environment," she noted.

"Finding DNA on the surface of Mars is definitely going to be difficult because it only has a residence time of 1 million to 2 million years and you need something fresh. We would prefer to go to places we're not currently allowed to go – to 'special regions on Mars.'"

'Special regions' on Mars are areas designated in the Committee on Space Research planetary protection policy as areas that may support Earth microbes inadvertently introduced to Mars, or may have a high probability of supporting indigenous martian life.

"We're working on trying to determine how to make that a reality within planetary protection, being able to access these regions that may host life, without contaminating Mars," Pontefract continued. "Being able to potentially sequence a living organism on the planet would be incredible."

Provided by University of Western Ontario