Is Marscrete the answer to building on Mars?

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Associate Professor Allan Scott is researching basaltic rock and silica to make Marscrete for constructing habitats on Mars. Credit: University of Canterbury

How can we build on Mars? A casual chat with a geologist led a University of Canterbury (UC) engineering academic and his team to spend years researching how to build on Mars. It all started with Associate Professor Allan Scott and Geology Professor Chris Oze

(Occidental College) pondering what materials were available on Mars to make concrete or "Marscrete."

Earthly concrete is made with Portland cement, which is produced by heating limestone to drive off the CO_2. Cement, the main binder, is mixed with sand, stone, and water to create concrete.

But the pressing question is: What is available on Mars to bind the materials of Marscrete together?

"Unfortunately, on Mars there is not a lot of limestone so we are looking at alternative ways to find some sort of binder system," says Associate Professor Allan Scott. "Marscrete can be referred to as a whole range of different materials that could be used on Mars essentially from local ingredients."

The team has been researching the use of basaltic rock which can be found on Earth and on Mars. According to Associate Professor Scott, magnesium oxide and silica can be extracted from the basaltic rock, before recombining the magnesium oxide and silica to make a binder with similar properties to cement.

"We try to use materials, rocks and things, that we know are available on Mars so we can perfect that extraction process here and make concrete which has similar properties as Portland cement."

However, it is not only materials the team is researching. The environments of Earth and Mars are extreme in their differences with much lower pressure and temperatures on Mars. The team are using the testing facilities at the University of Canterbury to allow for temperatures as low as -86 °C while simulating atmospheric conditions by creating a vacuum within the lab.

"All we are trying to do is simulate an environment like Mars without actually being there," he says.

When Associate Professor Scott began his research there were only a few people looking at space materials for construction but interest has grown in the field with the potential reality of a useable product getting closer.

Working with Aerospace Christchurch and the New Zealand Space Agency has helped to open up contacts.

"The whole space community here in Christchurch and New Zealand is really great. It's awesome. The very fact you can go and talk to people at Aerospace Christchurch or Rocket Lab for instance provides a lot of promise and potential."

While the space research is still important what the team has unearthed is that using basaltic rock instead of traditional cement can help reduce the carbon footprint of concrete on Earth, he says.

"Cement is great but it contributes to around 8–10% of global CO_2 emissions. There's a push to reduce that and material has some promise in this area."

According to Associate Professor Scott, the silica extracted from the basaltic rock could be used to partially replace Portland cement reducing almost 30% of CO_2 emissions, while the magnesium hydroxide can be used for carbon removal, making it available for any industry that is producing CO_2 to stop it entering the atmosphere.

Provided by University of Canterbury