Communities of organisms found around deep-sea hydrothermal vents are arguably some of the most interesting forms of life on the planet. Down at the bottom of the ocean, there is no light or oxygen and the pressure is tremendous, but heat and chemicals from under the crust, deep inside the Earth, vent out into the water.

Surrounding these vents are whole communities of all kinds of life—bacteria, archaea, even strange animals like tube worms seen nowhere else—that survive by extracting energy from the chemicals spewed out of the vents. They are capable of withstanding extreme pressure from all the water pressing in, and even temperatures of 120 degrees Celsius—the temperature normally used to sterilize lab supplies.

The microbes involved are essential to the entire outfit: they are the ones deriving energy from the chemicals that all the other life forms use to grow. But strangely, though there are many chemicals from which prokaryotes could derive energy, scientists have only found multicellular organisms pairing with ones that use sulfur or methane, even though something like hydrogen could provide 7-18 times more energy.

But now, scientists publishing this past August in Nature have found mussels in deep-sea vents pairing with bacteria that DO use hydrogen.

The scientists used PCR on mussel gill tissues, where the mussels housed their symbiotic bacteria, to discover that at least some of those bacteria possessed enzymes called hydrogenases, which are the ones that use the hydrogen gas. Even mussels from vents with low hydrogen outputs contained the enzymes.

But simply possessing an enzyme doesn't mean that an organism is actually using that enzyme, at least not all the time or for its predicted purpose. So the researchers tested the mussels to see if they actually were using hydrogen. So they put samples of mussel gill in an atmosphere containing a known amount of hydrogen and measured how much hydrogen was consumed. They found that the bacteria-containing samples did consume a lot more hydrogen than sterile samples or seawater alone.

To make sure the hydrogen consumption is used for energy and making food out of carbon dioxide, they added radioactive carbon and watched to see if the samples became radioactive from taking it up. Both samples kept in environments with hydrogen and those with a sulfur compound became radioactive, at about the same amount, so hydrogen might be as good for CO_2 fixation as sulfur.

They also tested the low-hydrogen vent bacteria in the same way, and found that they too take up hydrogen, but 20-30 times less.

The scientists even went to the hydrogen-emitting vent and measured hydrogen around the mussel fields, and found that liquid close to the mussels had much less hydrogen than the liquid coming right out of the vent, probably because the mussel bacteria were consuming most of it.

For us this story has more relevance as fossil fuels become less appealing, since hydrogen-based energy is looking more attractive. This story shows that use of hydrogen for energy is more widespread than we thought, and might be even more than this study shows, for other deep-sea organisms contain bacteria possessing the enzymes needed to use hydrogen. It's possible that by studying these organisms, we may learn something that we can use in our own attempts to extract energy from hydrogen.

This story is also interesting because it shows that there is more potential for carbon fixation than we thought, removing carbon dioxide from the atmosphere, though it may not be an amount large enough to make much difference in terms of climate change.

But even apart from potential applications of this knowledge, I find this kind of thing very interesting. Almost all life on Earth, at least most of what we see, depends on energy from sunlight. Plants absorb it and turn it into food, which animals eat and take the energy, then sometimes other animals eat those animals and take the energy from them. But in these deep-sea vents, there is no light, so energy for life has to come from somewhere else: the minerals inside the Earth. It's a very cool—or should I say hot—topic!