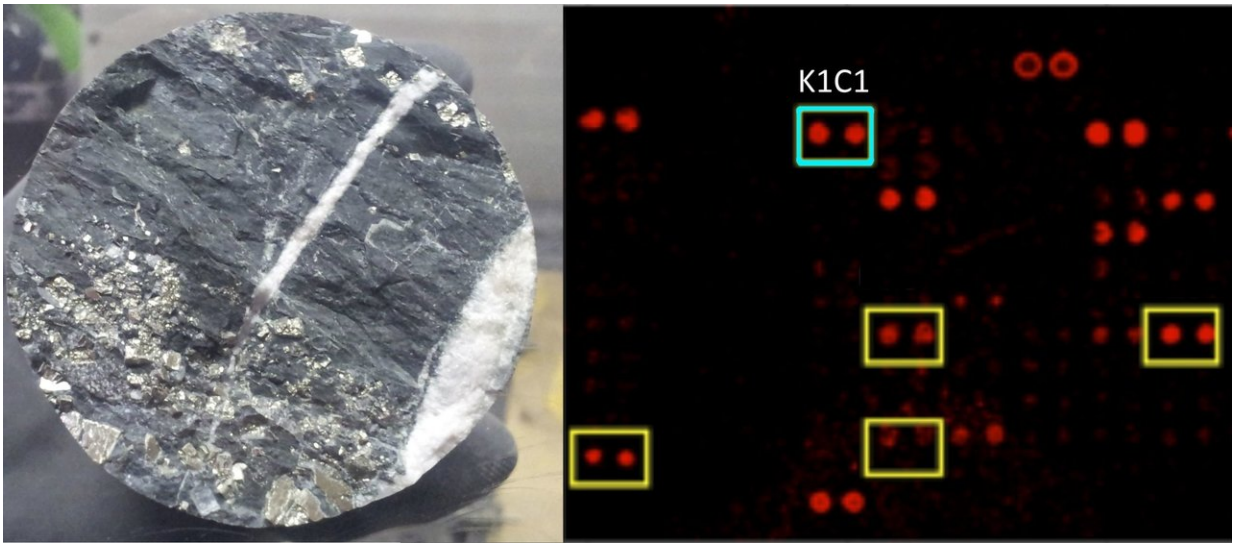
Cyanobacteria found living 600 meters underground without sunlight

October 2 2018, by Bob Yirka



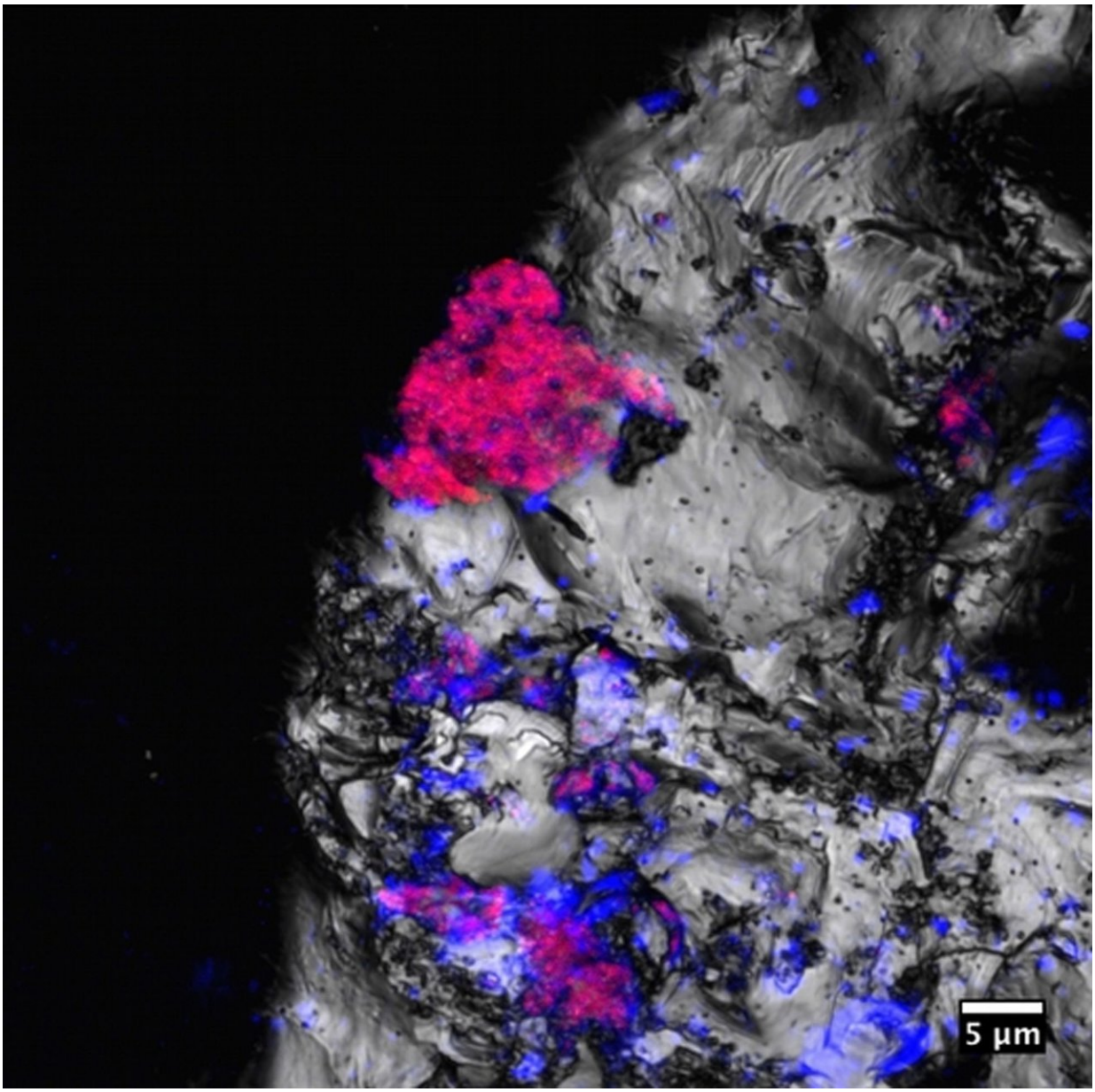
Cyanobacterial markers in deep core samples revealed by a Life Detector Chip immunoassay. Credit: PNAS

A team of researchers from Spain, Germany and the U.S. has found a type of cyanobacteria that is capable of living more than 600 meters underground—in the absence of sunlight. In their paper published in *Proceedings of the National Academy of Sciences*, the group describes their study of the cyanobacteria and what they found.

The Rio Tinto region in Spain has long been a stand-in for Mars—the landscape there is red due to an abundance of iron and sulphur minerals.

Because of its similarities to Mars, researchers have studied rock samples taken from above and underground, looking to better understand what sorts of life can exist in such a barren place. In this new effort, the researchers drilled a 613-meter borehole to study rock samples far below the surface. The team found cyanobacteria living in cracks and crevices within samples. Other bacteria have been found living far below the surface in the area, but cyanobacteria are different. Up until now, scientists believed they needed sunlight to survive.

Cyanobacteria derive energy through photosynthesis—hence the need for sunlight. They are also some of the oldest forms of life on the planet. Prior research has suggested that they were responsible for adding oxygen to the atmosphere, making it possible for other forms of life to evolve.



Viable cyanobacterial cells (red fluorescent signals) attached to rock fragments. Credit: PNAS

Surprised by their find, the researchers went back for more samples using more stringent protocols to ensure that they were not contaminated. They found groups of cyanobacteria living in air pockets

in rocks.

To learn how the cyanobacteria are able to survive without sunlight, the team examined them under a microscope. They found that in most respects, the cyanobacteria were the same as their cousins living on the surface in the surrounding area. When testing the air in the pockets, they discovered that the tiny creatures were consuming hydrogen gas as evidenced by lower hydrogen levels where the cyanobacteria were found. They also found evidence that the subsurface cyanobacteria had one small adaptation to their photosynthetic system that allowed them to use a "safety valve" to produce energy. In other cyanobacteria, the valve is used to release excess energy to prevent overheating when sunlight is abundant.

More information: Fernando Puente-Sánchez et al. Viable cyanobacteria in the deep continental subsurface, *Proceedings of the National Academy of Sciences* (2018). DOI: 10.1073/pnas.1808176115