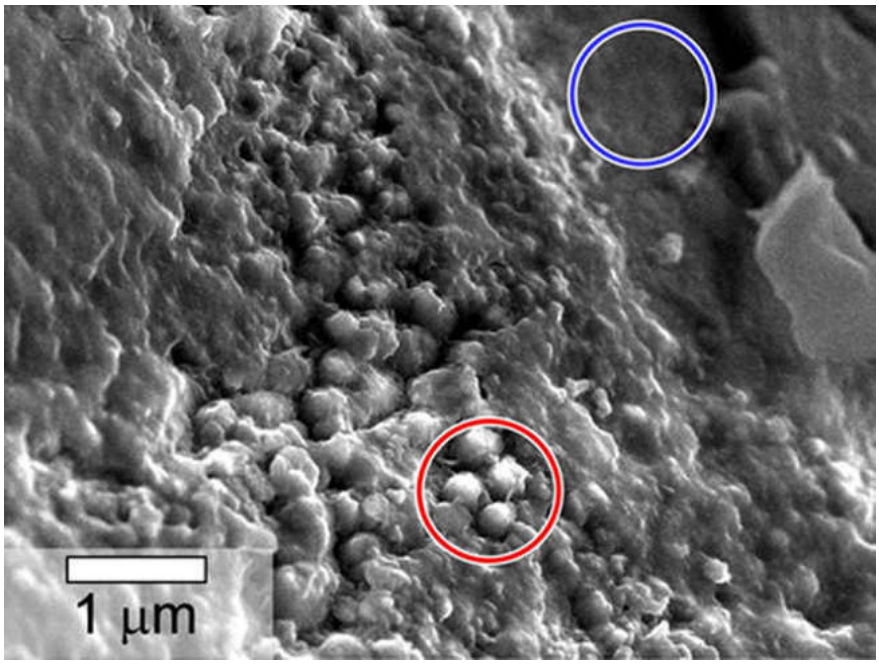
Space scientists will use 'scanning electron microscopes' to find biological samples on the Red planet

The study of scanning electron microscope instruments to search for biological samples on Red planet is being conducted by space scientists.

One of the ultimate goals of the Mars exploration was to bring **samples** from the **Martian** surface to Earth, especially those specimens that could be tested as proof of existence. **Red planet** .

To accomplish such a task would be **costly** and the samples were at risk of **contamination** during the journey back to Earth. Therefore, scientists choose to analyze samples in their natural habitat on Mars, before bringing them back to Earth for further research. **The Mars Laboratory** (*Mars Science Lab - MSL*) and other **Mars Mars** are studying samples right on Mars with a series of basic imaging tools and basic chemical evaluations of different samples on Mars. However, only a few technical technologies can clearly determine whether life exists on the Red planet.



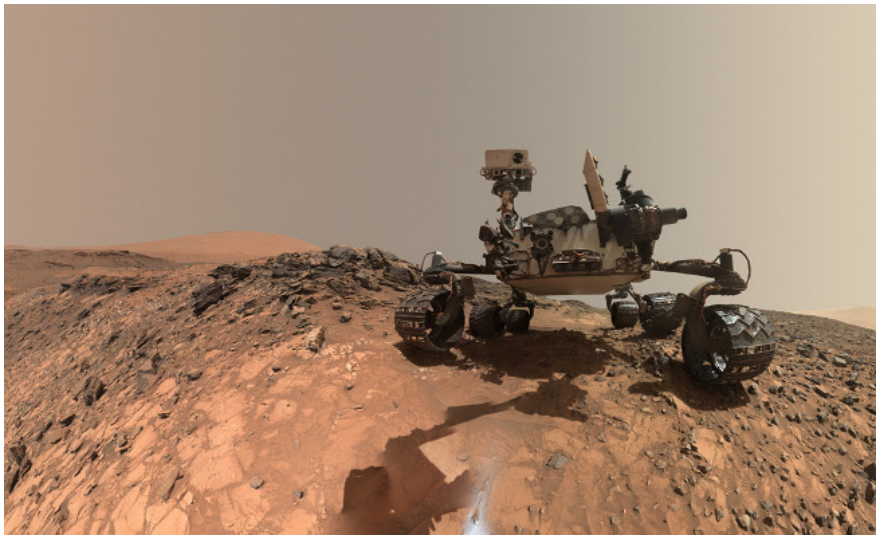
This is an image of a scanning electron microscope showing a spherical feature (circle) on **Yamato 000,593** - a meteorite found on Earth originating from Mars. Features found in a layer of iddingsite - a mineral created in water. Researchers hope to bring high-resolution scanning **electron** microscopes to the surface of Mars.Photo source: NASA

On planet Earth, scientists used a device to examine life and other biological samples, an **atmospheric scanning atmosphere or the environment** (*ASEM or ESEM)* . The **ESEM** is capable of taking pictures with higher resolution than 10 nanometers, or about one-thousandth of a width on human hair, and is also capable of identifying the components of the same sample. In contrast, the commercials of ESEM are often very large and "crave power". However, a research team took on the challenge with a sub-ESEM, making it suitable for activities conducted right on Mars.

A NASA team tested techniques that could be used for astronauts on Mars.The task of bringing the sample back to Earth will help determine the locations on Mars that can be safely explored.Photo source: NASA
Miniaturized Variable Pressure Scanning Electron Microscope (MVP-SEM) is a NASA-funded project based on concepts that can be used on **the International Space Station** and the Face moon. The next goal is to create a type of device - this ESEM will allow scientists to study the geology of Mars and find bacteria on the surface of Mars, in some unspecified tasks.

" *Implementing this ability with a rover or amphibious vehicle not only helps us to select better models to bring back to the earth, but also can capture high quality images. and analyzing right on Mars - there is no risk of contamination from a sample brought to Earth for research* , "said **Jessica Gaskin** , the principal researcher on the project.

This project was presented at **the Planet and Moon Science Conference** in early 2016. It is funded by NASA's Planetary Concept Program for progress in observing the solar system (PICASSO).



Curiosity rover robot is working in Gale Crater area on Mars.The main goal in NASA's Mars program is to find areas of life in the past and present.Photo source: NASA / JPL-Caltech / MSSS

The development of tools

The electron or atmospheric scanning microscope transformer is used in laboratories to study in many fields, from medicine to geology. Special equipment funded by NASA will help to study geological documents in a way - keep samples intact. Because this process does not destroy the samples, it can then be analyzed by other tools and thus, to have a more complete picture formed from the origin of the specimens and can grow.

These tools will capture high resolution images (better than 50 nanometers) and Energy Dispersive Spectroscopy (EDS), or chemical mapping to clearly identify chemical components . SEMs have a large depth of field with the ability to observe a large sample material and do not require samples to be prepared in advance during the test, which simplifies operations for a remote work rover. people.

" *The main part of this particular technology will use the Martian atmosphere as a gas in our image. This helps us to see the material (conductive and non-conductive) of" bare "specimens. in their natural environment,* "Gaskin said.

The criticism of cosmology is the familiar carbon-based life search trend that will flourish in the presence of water. A strategy to expand life search is to find some kind of imbalance in the surrounding environment, which cannot be easily explained by physics or chemistry. For example, if a large amount of silicon is found in a specific environment, that explanation may be the presence of life. The **spectrum** will be able to detect an imbalance in the environment.

"The device will also provide high-resolution images to identify vital signs ," said Jennifer Edmunson, scientist participating in the MVP-SEM project.

An example is the search for protein from bacteria, such as **Pyrobaculum aerophilum** , a bacterium that thrives in boiling water. " *The goal of our device development is to be able to distinguish compounds like calcium oxalate (potential living organism) from calcium carbonate* ," Edmunson said.

Bacteria that survive in harsh environments on Earth often use in microbiological theoretical models that they can exist in cold, salty waters of the planet Mars. In addition, in the case of any life form that can be exposed on

some sample surfaces, such as dry spores - like life forms, our devices can capture images to explain how clarity and research.

MVP-SEM will use a secondary electronic detector to help scientists learn about specific features on a microscope surface, as well as a backscattered electronic detector that provides information about the wall. part and structure of a sample object. EDS detectors are also used to study chemical components.

Currently, the team is looking to optimize the activities in Mars's **carbon dioxide-** rich atmosphere, after which a prototype will be developed and tested in a room with the same atmosphere on Mars. JPL. The main participants in this study are different from MSFC, including Jet Propulsiom Laboratory (JPL), Creare, Applied Physical Technologies (Applied Physics Technologies), Case Western Reserve University and adviser Dr. G. Danilatos (pioneer of air or environmental SEM).

After the **PICASSO** study was completed, the team plans to continue developing other instruments through NASA-funded progressive devices in the Solar System probe (MatlSSe), which is part of the research agency. Save on opportunities in the space program and Earth science.