

## BACKGROUND

- Geodermatophilaceae* is a family of bacteria which includes several extremophile species isolated from rocks in arid deserts and Antarctic soils<sup>1</sup>.

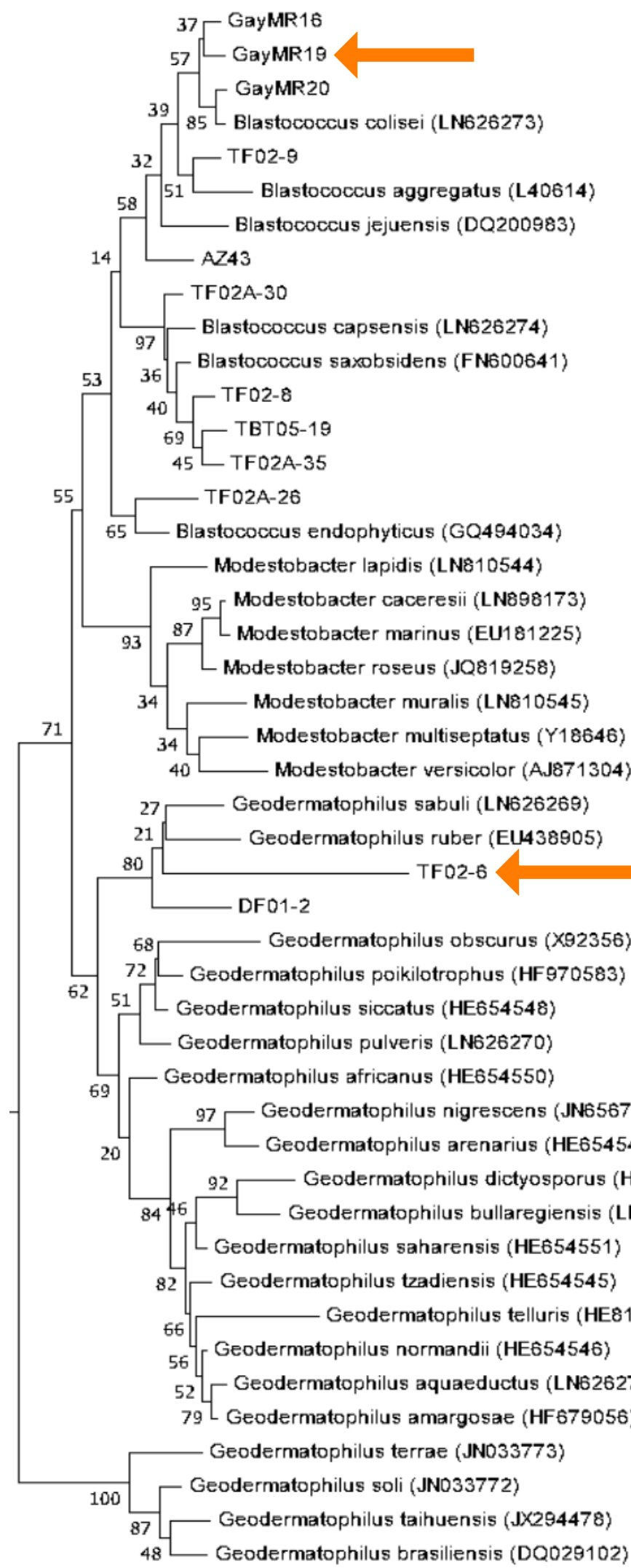


Figure 1: Phylogenetic tree of the family *Geodermatophilaceae* based on 16S rRNA sequencing data.<sup>2</sup> Isolates used in this study are indicated with an arrow.

- These bacteria surround themselves with a slime-like coating of extracellular polymeric substance (EPS) which adheres them to surfaces and provides protection against harsh conditions<sup>4,5,6</sup>.
- Scanning Electron Microscopy (SEM) is a common tool for imaging biofilms on rock surfaces and allows for visualization of the intricate structures found within the EPS<sup>7</sup>.
- While commonly used, imaging biofilm EPS structures on rocks is difficult and expensive, as the EPS is fragile, especially under vacuum conditions<sup>7</sup>.

## PROJECT GOALS

- Apply** a modified SEM preparation protocol to preserve biofilm EPS for SEM imaging<sup>7</sup>.
- Image** *Geodermatophilaceae* biofilms on rock surfaces using SEM at 2 weeks, 1 month, and 2 months to compare development and structures if observed.
- Create** a library of images for future researchers to use in projects and publications on the *Geodermatophilaceae* family.

## PROJECT WORKFLOW

### 1 PREPARING ROCK SURFACES



Rock samples were cut into smaller pieces using a diamond rotary blade.



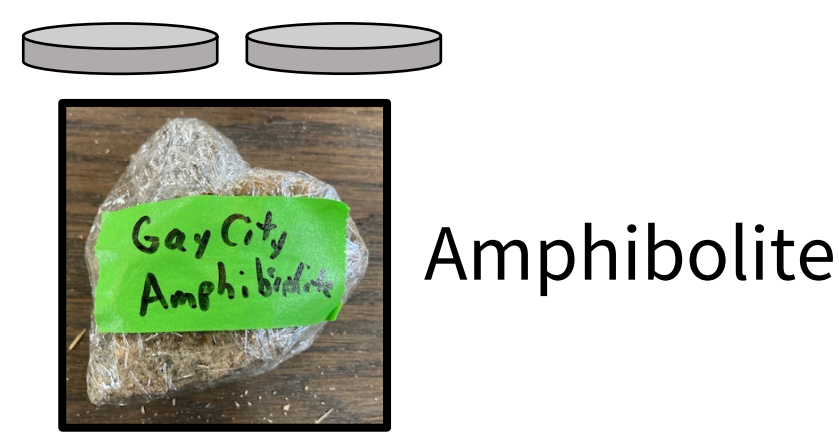
Simulated Mars regolith was adhered to the surface of resin beads and the resin was cured using UV light.

### 2 PUTTING MICROBES ON THE ROCKS

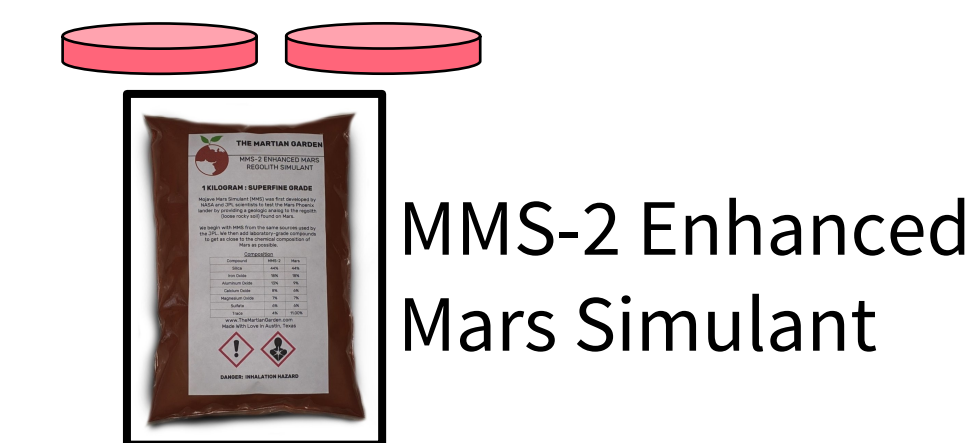


*Geodermatophilus* isolate TF02-6

*Blastococcus* sp. isolate GayMR19

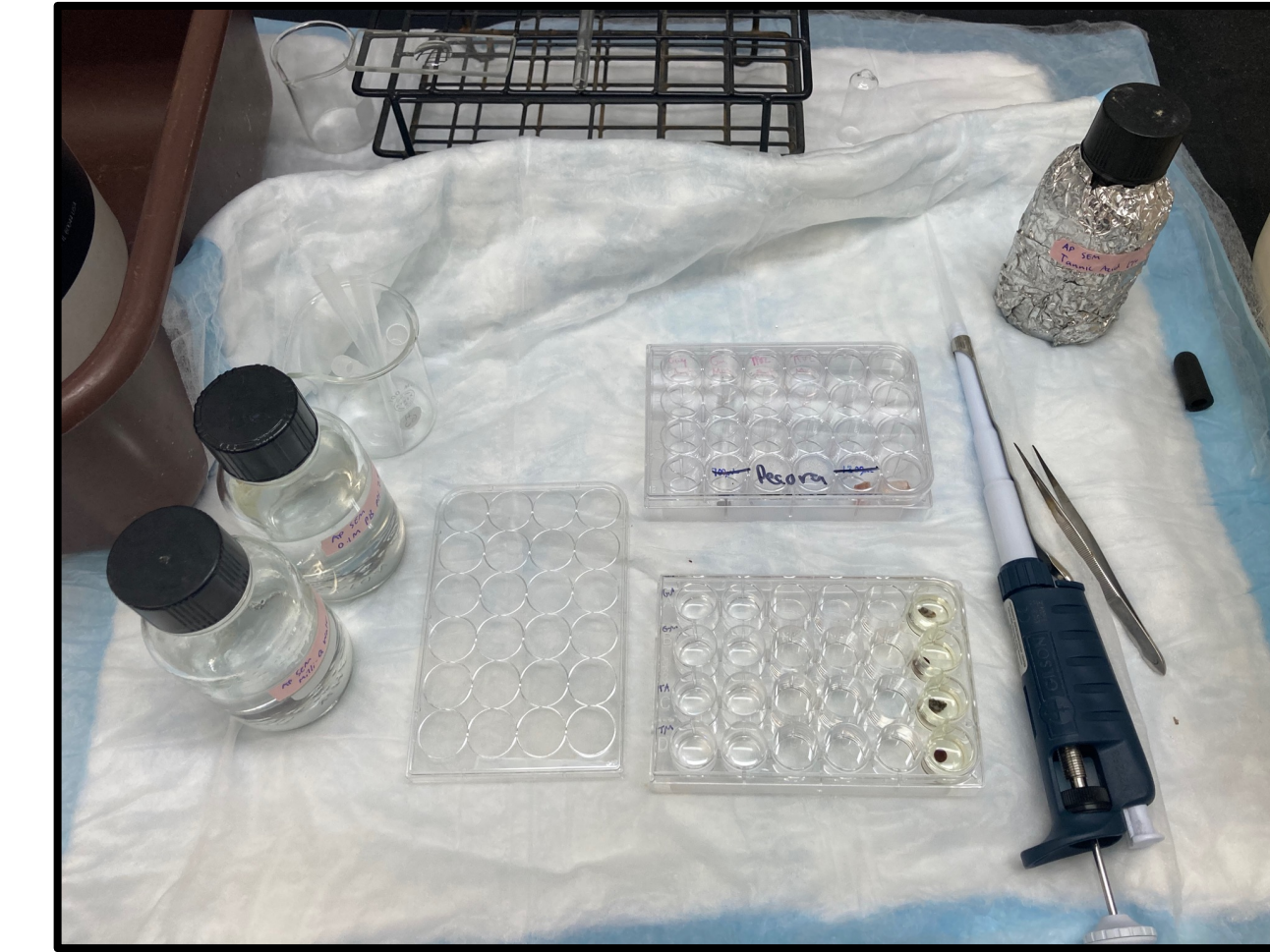


Amphibolite



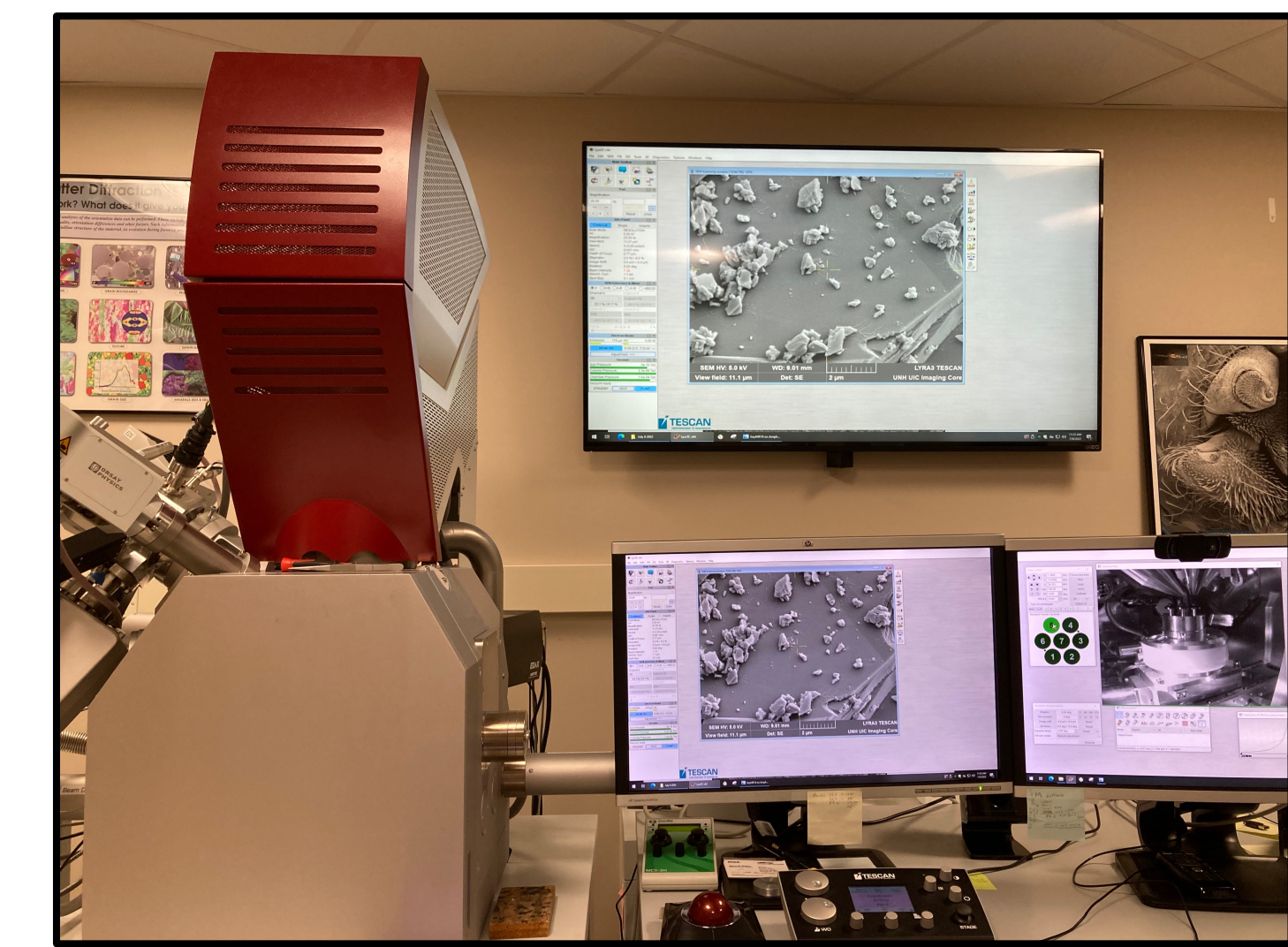
MMS-2 Enhanced Mars Simulant

### 3 SEM PREPARATIONS



A modified preparation protocol from Relucenti et. al. 2021 was used to preserve and image these fragile biofilm structures.

### 4 SEM IMAGING



Tescan Lyra3 GMU FIB-SEM at the UNH University Instrumentation Center.

## SEM IMAGES

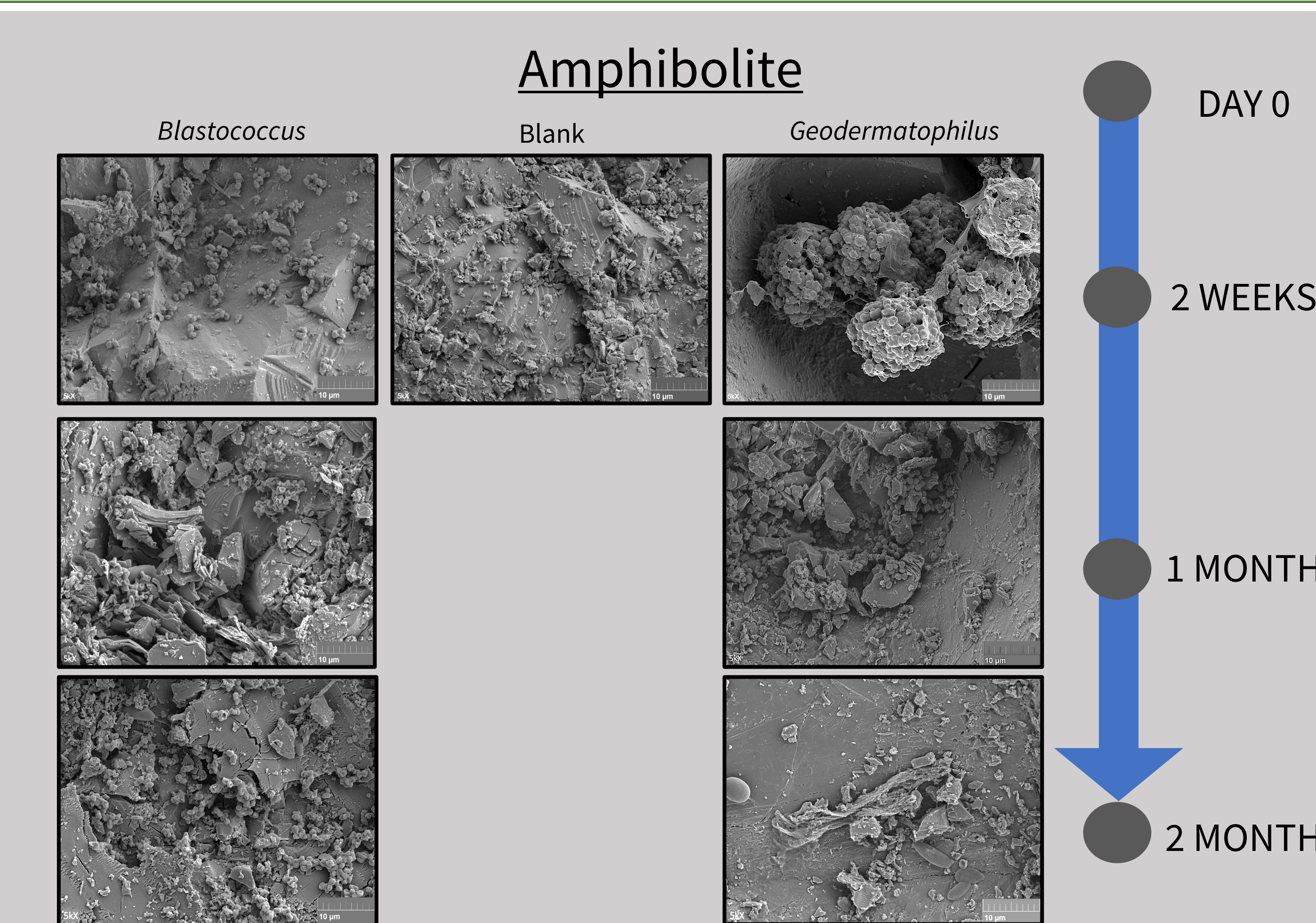


Figure 2: Scanning electron microscope images of *Geodermatophilaceae* species on the amphibolite rock surface. The left column shows *Blastococcus* isolate GayMR19 on the regolith, the center column contains the blank comparison image of the regolith, and the right column shows *Geodermatophilus* isolate TF02-6 on the amphibolite rock surface.

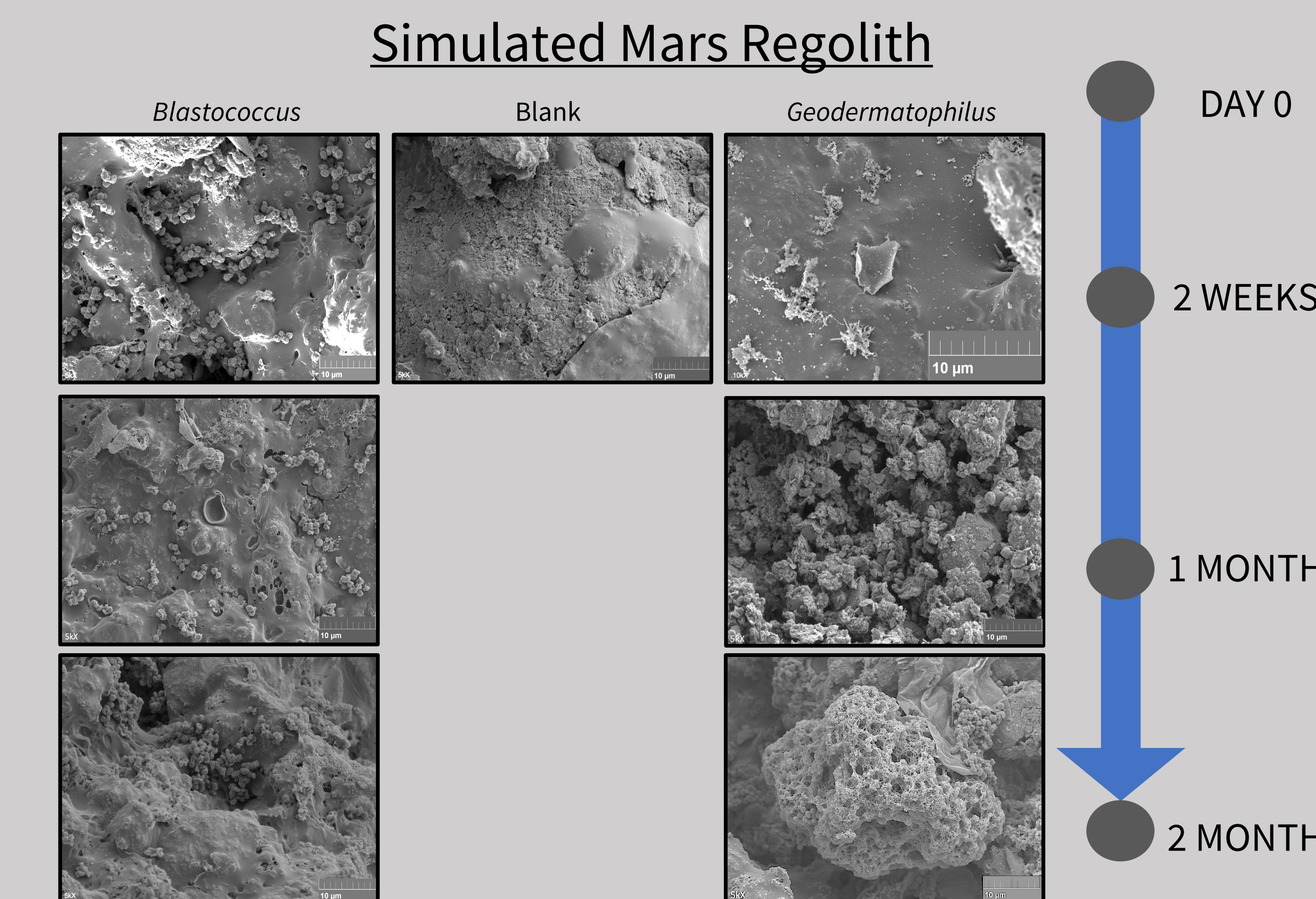


Figure 3: Scanning electron microscope images of *Geodermatophilaceae* species on the MMS-2 Enhanced Mars Simulant regolith. The left column shows *Blastococcus* isolate GayMR19 on the regolith, the center column contains the blank comparison image of the regolith, and the right column shows *Geodermatophilus* isolate TF02-6 on the MMS-2 Enhanced Mars Simulant regolith surface.

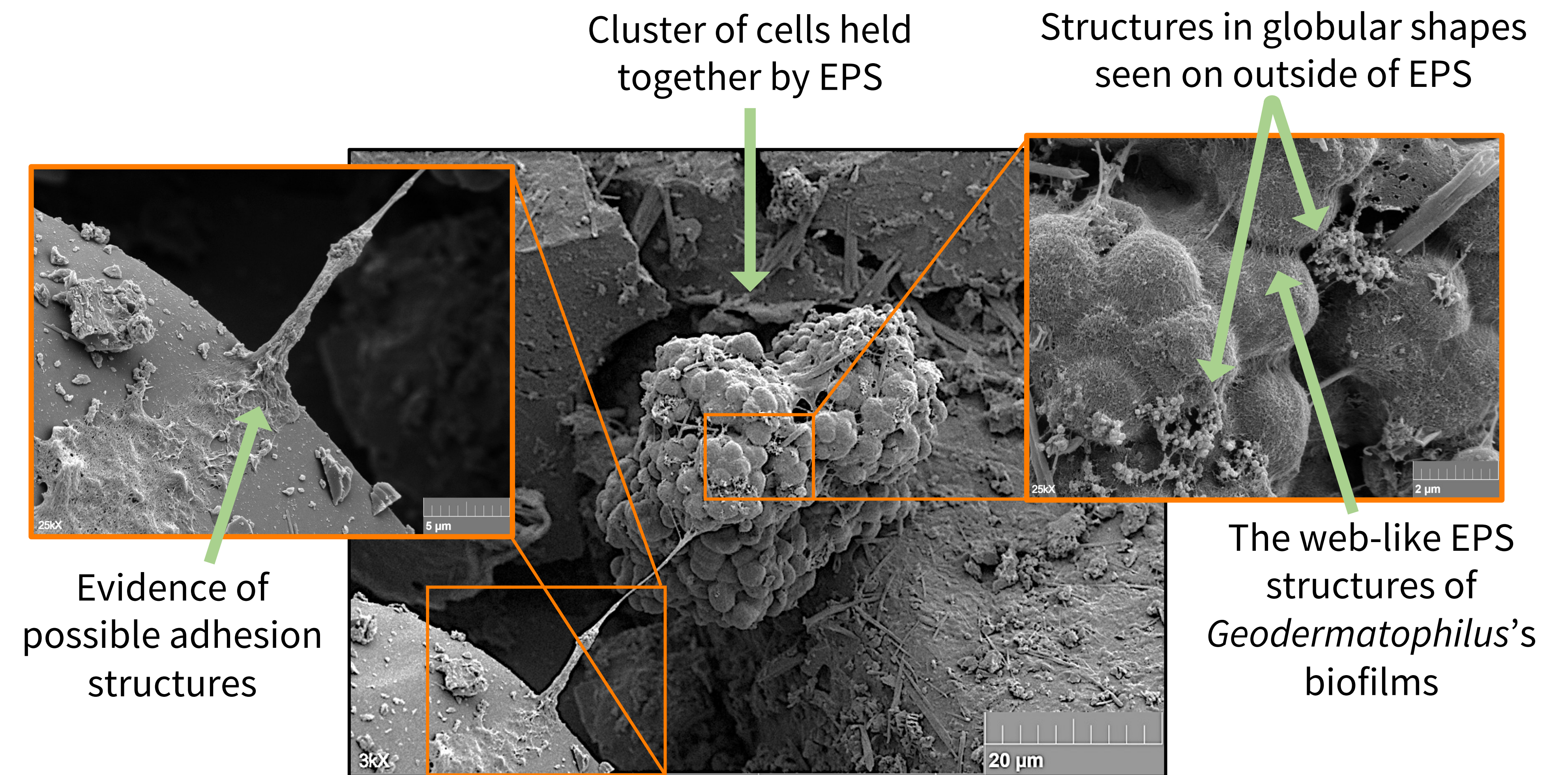


Figure 4: Image of *Geodermatophilus* cells on MMS-2 Enhanced Mars Simulant 2 weeks after introduction to the surface. Higher magnification photos from certain parts of this structure are shown with arrows highlighting notable observations.

## CONCLUSIONS

- The EPS of *Geodermatophilus* was successfully preserved using this SEM preparation protocol.
- Possible *Geodermatophilus* adhesion structures were seen 2 weeks after the bacteria were introduced to the substrate.
- Glob-like structures on the outside of *Geodermatophilus* EPS was observed.
- Library of images was uploaded to UNH OneDrive for future use in publications on *Geodermatophilaceae*.

## ACKNOWLEDGEMENTS

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## FUTURE WORK

- Analyze the chemical makeup of the glob-like structures seen outside the EPS.
- Conduct metabolism assays of these isolates on the rock substrates used here.

## REFERENCES

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