**Supplementary Information**

**Table 1.** The results of EDX represents the general element compositions analyzed the growth layers and nuclei colonies (Fig.5c). Sp. Refers to EDX spectrum.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Element** | **Nuclei colonies region** | | | | | | | | | | | |
| **Sp.2** | **Sp.3** | **Sp.5** | **Sp.6** | **Sp.16** | **Sp.17** | **Sp.18** | **Sp.19** | **Sp.20** | **Sp.21** | **Sp.22** | **Sp.23** |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| C | 0.0 | 0.0 | 0.0 | 0.0 | 7.1 | 3.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Al | 0.0 | 0.0 | 0.0 | 0.0 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Si | 0.0 | 0.0 | 0.2 | 1.3 | 0.5 | 0.0 | 0.0 | 0.0 | 0.4 | 1.8 | 0.0 | 0.0 |
| Fe | 77.7 | 75.8 | 77.4 | 75.6 | 55.8 | 68.0 | 77.7 | 77.7 | 77.0 | 73.9 | 76.6 | 77.7 |
| O | 22.3 | 22.5 | 22.4 | 23.1 | 36.0 | 28.6 | 22.3 | 22.3 | 22.6 | 23.6 | 22.4 | 22.3 |
| P | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Element** | **Growth layers** | | | | | | | | | | | |
| **Sp.1** | **Sp.4** | **Sp.7** | **Sp.8** | **Sp.9** | **Sp.10** | **Sp.11** | **Sp.12** | **Sp.13** | **Sp.14** | **Sp.15** | **Sp.24** |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| C | 0.0 | 7.5 | 8.7 | 7.5 | 4.4 | 0.0 | 6.9 | 0.0 | 10.7 | 8.0 | 6.6 | 4.2 |
| Al | 0.6 | 0.0 | 0.0 | 0.7 | 0.0 | 0.0 | 5.8 | 0.4 | 0.0 | 0.7 | 0.4 | 0.6 |
| Si | 0.4 | 1.0 | 1.5 | 1.5 | 0.0 | 0.0 | 4.8 | 0.5 | 1.0 | 1.0 | 1.0 | 0.9 |
| Fe | 76.2 | 52.5 | 50.4 | 53.0 | 65.2 | 77.7 | 41.6 | 76.4 | 43.5 | 52.5 | 56.8 | 62.8 |
| O | 22.8 | 37.8 | 39.4 | 37.4 | 30.4 | 22.3 | 40.9 | 22.8 | 43.7 | 37.9 | 35.3 | 30.9 |
| P | 0.0 | 1.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.2 | 0.0 | 0.0 | 0.0 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |

**Table 2.** Table of ICP-MS analysis of soil profile (3rd soil layer), weathered rock, and fresh rock by weight %.

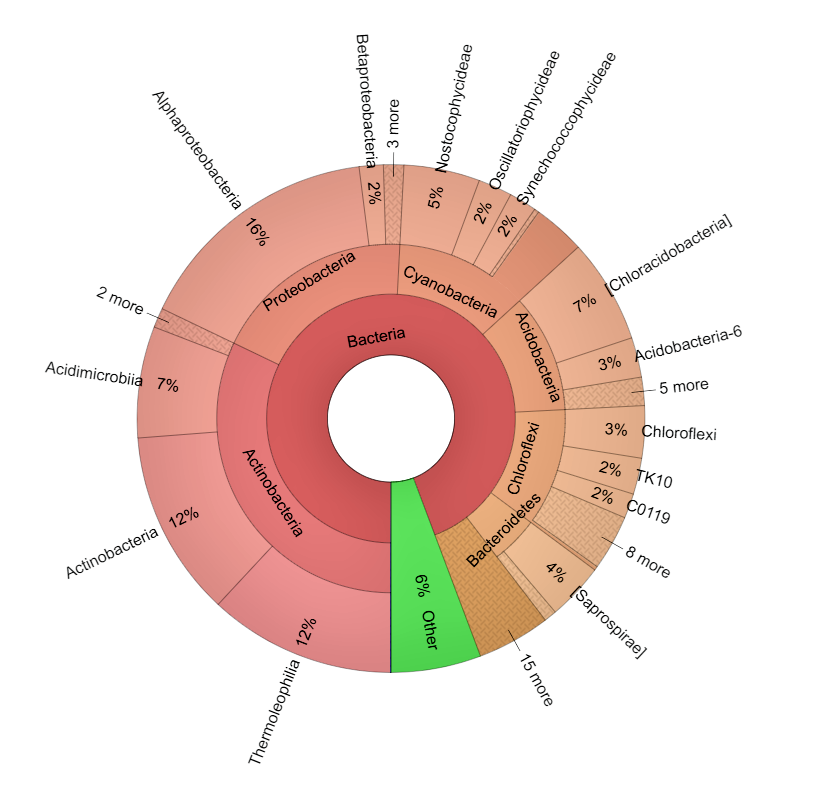
|  |  |  |  |
| --- | --- | --- | --- |
| Element | 3rd soil profile | Weathered rock | Fresh rock |
| Li | 150 | 39 | 8 |
| Be | 18 | 28 | 13 |
| Al | 1609243 | 59521 | 94081 |
| K | 10512 | 8779 | 5380 |
| Ca | 10411 | 7624 | 2938 |
| V | 7807 | 860 | 893 |
| Cr | 6414 | 54 | 506 |
| Mn | 11395 | 738635 | 3715 |
| Fe56 | 2056070 | 2653912 | 2228084 |
| Fe57 | 1832596 | 2534581 | 2188078 |
| Co | 655 | 8254 | 163 |
| Ni | 1797 | 668 | 126 |
| Cu | 3788 | 2059 | 521 |
| Zn | 3431 | 2692 | 314 |
| Ga | 844 | 431 | 76 |
| As | 390 | 82 | 14 |
| 78Se | 92 | 93 | 32 |
| Rb | 47 | 13 | 8 |
| Sr | 200 | 149 | 18 |
| Ba | 1420 | 238743 | 1111 |
| Tl | 0 | 176 | 13 |
| 206Pb | 395 | 371 | 171 |
| 207Pb | 339 | 317 | 146 |
| 208Pb | 363 | 287 | 155 |
| Na | 3654 | 10226 | 4161 |
| Mg | 9702 | 1289 | 610 |

**Table 3.** The results of EDX represent the general element compositions analyzed in the EPS-like structures (Fig.SI 2). Sp. Refers to EDX spectrum.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Element | **Sp1** | **Sp2** | **Sp3** | **Sp4** |
|  |  |  |  |  |
| C | 2.58 | 2.83 | 3.13 | 0.00 |
| Al | 0.00 | 0.00 | 0.00 | 0.78 |
| Si | 0.83 | 1.05 | 1.33 | 1.39 |
| Fe | 67.70 | 66.4 | 65.12 | 73.02 |
| O | 28.16 | 28.86 | 29.58 | 24.11 |
| P | 0.74 | 0.86 | 0.84 | 0.71 |
|  |  |  |  |  |

**Table 4.** The results of EDX represent the general element compositions analyzed in the EPS-like structures (Fig.SI 3). Sp. Refers to EDX spectrum.

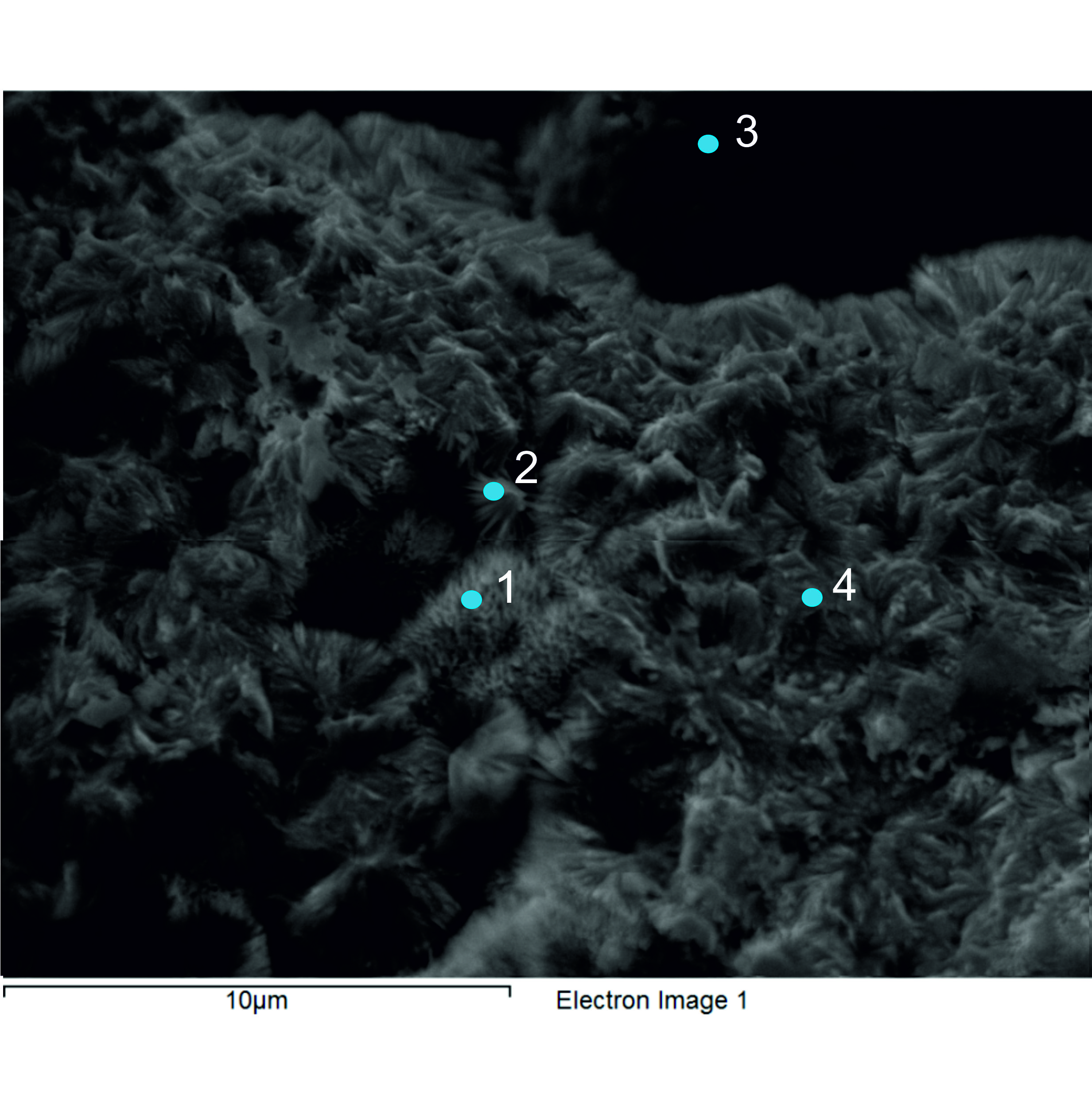
|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Element** | **Sp1** | **Sp2** | **Sp3** | **Sp4** | **Sp5** |
| C | 16.88 | 15.24 | 13.76 | 4.23 | 11.21 |
| Al | 4.48 | 3.80 | 10.91 | 1.68 | 11.19 |
| Si | 3.62 | 8.16 | 10.75 | 1.20 | 10.73 |
| K | 0.14 | 0.14 | 0.07 | 0.00 | 0.13 |
| Ca | 0.26 | 2.78 | 0.01 | 0.15 | 0.02 |
| Fe | 16.64 | 12.00 | 4.56 | 61.09 | 11.38 |
| O | 57.98 | 57.87 | 59.94 | 31.69 | 55.34 |

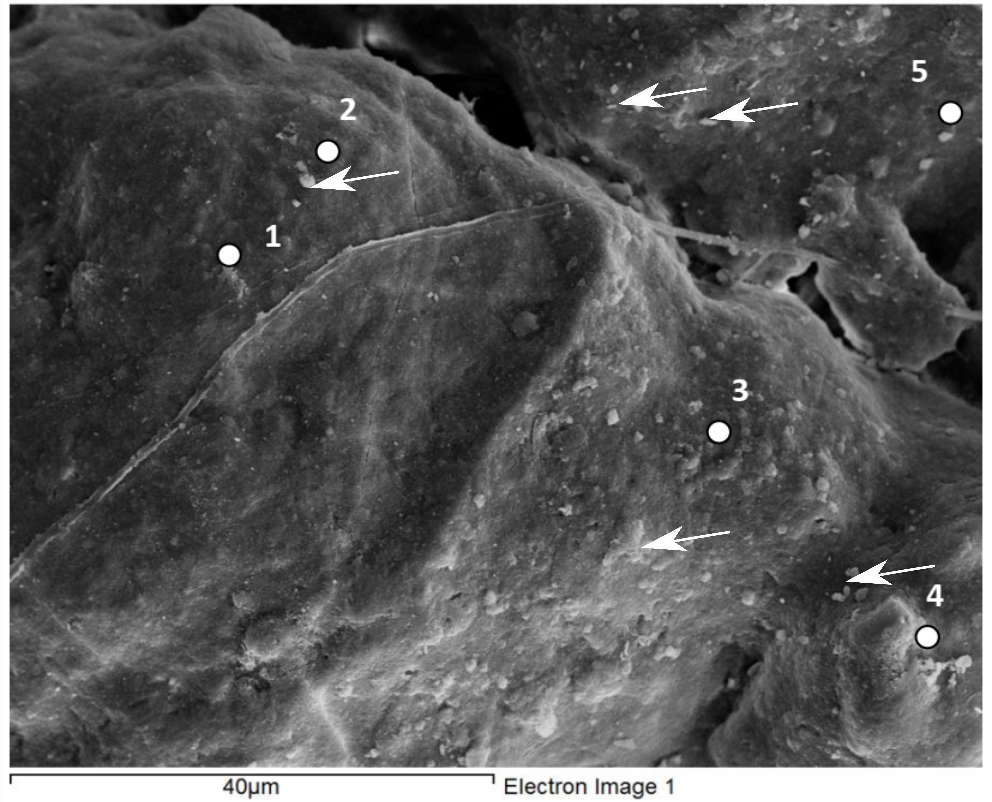


(a)

(b)

**Figure 1.** Krona plot of 16S rRNA Gene Sequencing showing identified bacterial species present in weathered hematite sample. (a) HR fragments soaked in nuclease-free water and (b) crushed HR sample mixed well in nuclease-free water (from 3rd soil profile).



**Figure 2.** The image showing the points of a scanning electron microscope- Energy Dispersive X-Ray (SEM-EDX) focusing on the remnant EPS like structures.

**Figure 3.** Scanning electron microscope- Energy Dispersive X-Ray (SEM-EDX) analysis carried out in the blue-green granular section from a sample collected in 2018. Arrow marks indicate the examples of EPS like structure. The numbered points indicate the locations where SEM-EDX analysis was carried out for the EPS-like structures.