12042
Soil
255 grams

Figure 1: Photo of location of 12042 (Halo Crater). AS12-48-7072

Figure 2: Location of 12042 on Apollo 12 map.

Introduction
12042 are fines collected in documented bag 12. They were from the outer flank of Surveyor Crater (figure 2).

Petrography
The maturity index for 12042 is I/FeO = 61 (Morris 1987). Frondel et al. (1971) determined the mineral mode, but did not specify agglutinates. The average grain size is 58 or 95 microns, depending on who sieved the sample (figure 5 a,b).


Chemistry
The chemical composition is summarized in figures 3 and 6.
Figure 3: Composition of 12042 compared with that of other Apollo soils samples.

Figure 4: Carbon content and maturity index of 12042 compared with other Apollo soil samples.

The total carbon content of 12042 was reported by Epstein and Taylor (1971) as 125 ppm. Moore et al. (1971) determined 130 ppm C in two splits (figure 4). They also found 130 ppm nitrogen in 12042. Kaplan and Petrowski (1971) found 111 ppm C. Kerridge et al. (1978) found 121 ppm C and 74 ppm N, while

Other Studies
Heymann et al. (1972) reported rare gas content and isotopic rations of 12042.

Arrhenius et al. (1971) studied the frequency of grains with high fossil nuclear tracks in 12042 (and all other Apollo 12 soil and core samples) (see diagram in 12070).

Mineralogical Mode
Frondel et al. 1971
Olivine +
Pyroxene 63.2 %
Plagioclase 11.6
Opales 14.3
Glass, angular 8.2
Glass, rounded 1.6
Silica 1.1

average grain size = 58 microns

Figure 5a: Grain size distribution for 12042 (Graf 1993, from data by McKay et al. 1971).
Table 1. Chemical composition of 12042.

<table>
<thead>
<tr>
<th>reference</th>
<th>Morrison71</th>
<th>Frondel71</th>
<th>Cuttitta71</th>
<th>Haskin71</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SiO₂ %</strong></td>
<td>(a) 46.1</td>
<td>(a) 45.7</td>
<td>(a) 45.7</td>
<td>(a) 45.7</td>
</tr>
<tr>
<td><strong>TiO₂</strong></td>
<td>(d) 2.33</td>
<td>(a) 2.71</td>
<td>(a) 2.71</td>
<td>(a) 2.71</td>
</tr>
<tr>
<td><strong>Al₂O₃</strong></td>
<td>(d) 13.23</td>
<td>(a) 13</td>
<td>(a) 13</td>
<td>(a) 13</td>
</tr>
<tr>
<td><strong>FeO</strong></td>
<td>(d) 17.6</td>
<td>(a) 16.2</td>
<td>(a) 16.2</td>
<td>(a) 16.2</td>
</tr>
<tr>
<td><strong>MnO</strong></td>
<td>(d) 0.22</td>
<td>(a) 0.24</td>
<td>(a) 0.24</td>
<td>(a) 0.24</td>
</tr>
<tr>
<td><strong>MgO</strong></td>
<td>(d) 8.23</td>
<td>(a) 10.4</td>
<td>(a) 10.4</td>
<td>(a) 10.4</td>
</tr>
<tr>
<td><strong>CaO</strong></td>
<td>(d) 12.2</td>
<td>(a) 10.6</td>
<td>(a) 10.6</td>
<td>(a) 10.6</td>
</tr>
<tr>
<td><strong>Na₂O</strong></td>
<td>(d) 0.35</td>
<td>(a) 0.54</td>
<td>(a) 0.54</td>
<td>(a) 0.54</td>
</tr>
<tr>
<td><strong>K₂O</strong></td>
<td>(d) 0.17</td>
<td>(a) 0.25</td>
<td>(a) 0.25</td>
<td>(a) 0.25</td>
</tr>
<tr>
<td><strong>P₂O₅</strong></td>
<td></td>
<td></td>
<td></td>
<td>(a) 0.33</td>
</tr>
<tr>
<td><strong>S %</strong></td>
<td>0.24 (a)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| **Sc ppm** | 34 (d)  | 38 (b)  | 38 (b)    | 38 (b)   |
| **V**      | 150 (d) | 108 (b) | 108 (b)   | 108 (b)  |
| **Cr**     | 2700 (d) | 2258 (a) | 2668 (a) | 2668 (a) |
| **Co**     | 52 (d)  | 52 (b)  | 52 (b)    | 52 (b)   |
| **Ni**     | 10 (d)  | 235 (b) | 235 (b)   | 235 (b)  |
| **Cu**     | 8.5 (d) | 7.5 (b) | 7.5 (b)   | 7.5 (b)  |
| **Zn**     | 4 (d)   | 4.4 (b) | 4.4 (b)   | 4.4 (b)  |
| **Ga**     |         |          |           | 0.03 (d) |
| **As**     | 9.9 (d) | 5.5 (b) | 5.5 (b)   | 5.5 (b)  |
| **Se**     |         |          |           |          |
| **Rb**     | 67 (d)  | 79 (c)  | 79 (c)    | 79 (c)   |
| **Sr**     | 24 (d)  | 19.7 (c) | 19.7 (c) | 19.7 (c) |
| **Y**      | 2.3 (d) | 2.03 (c) | 2.03 (c) | 2.03 (c) |
| **Zr**     | 30 (d)  | 22.5 (c) | 22.5 (c) | 22.5 (c) |
| **Nb**     | 4.7 (d) | 3.87 (c) | 3.87 (c) | 3.87 (c) |
| **Mo**     |         |          |           |          |
| **Ru**     | 1.4 (d) | 1.46 (c) | 1.46 (c) | 1.46 (c) |
| **Rh**     | 6.1 (d) | 14 (c)  | 14 (c)    | 14 (c)   |
| **Pd**     | 35 (d)  |          |           | 35 (d)   |
| **Ag**     | 510 (d) | 445 (b) | 445 (b)   | 445 (b)  |
| **Cd**     | 0.2 (d) |          |           | 0.2 (d)  |
| **In**     | 42 (d)  | 48 (b)  | 48 (b)    | 48 (b)   |
| **Sn**     |         | 111 (c) | 111 (c)   | 111 (c)  |
| **Sb**     | 67 (d)  | 79 (c)  | 79 (c)    | 79 (c)   |
| **Te**     | 24 (d)  | 19.7 (c) | 19.7 (c) | 19.7 (c) |
| **Cs**     | 2.3 (d) | 2.03 (c) | 2.03 (c) | 2.03 (c) |
| **La**     | 30 (d)  | 22.5 (c) | 22.5 (c) | 22.5 (c) |
| **Ce**     | 4.7 (d) | 3.87 (c) | 3.87 (c) | 3.87 (c) |
| **Pr**     |         |          |           | 0.2 (d)  |
| **Nd**     | 61 (d)  | 79 (c)  | 79 (c)    | 79 (c)   |
| **Sm**     | 24 (d)  | 19.7 (c) | 19.7 (c) | 19.7 (c) |
| **Eu**     | 2.3 (d) | 2.03 (c) | 2.03 (c) | 2.03 (c) |
| **Gd**     | 30 (d)  | 22.5 (c) | 22.5 (c) | 22.5 (c) |
| **Tb**     | 4.7 (d) | 3.87 (c) | 3.87 (c) | 3.87 (c) |
| **Dy**     |         | 0.2 (d)  | 0.2 (d)   | 0.2 (d)  |
| **Ho**     | 6.1 (d) | 4.46 (c) | 4.46 (c) | 4.46 (c) |
| **Er**     | 18 (d)  | 13.8 (c) | 13.8 (c) | 13.8 (c) |
| **Tm**     | 2.1 (d) | 2.09 (c) | 2.09 (c) | 2.09 (c) |
| **Yb**     | 11 (d)  | 2.09 (c) | 2.09 (c) | 2.09 (c) |
| **Lu**     | 1.4 (d) | 1.46 (c) | 1.46 (c) | 1.46 (c) |
| **Hf**     | 970 (d) | 970 (d) | 970 (d)   | 970 (d)  |
| **Ta**     | 6.1 (d) | 13.8 (c) | 13.8 (c) | 13.8 (c) |
| **W**      | 1 (d)   |          |           | 1 (d)   |
| **Re**     |         |          |           |          |
| **Os**     | 1 (d)   |          |           | 1 (d)   |
| **Ir**     |         |          |           | 1 (d)   |
| **Pt**     |         |          |           |          |
| **Au**     |         |          |           |          |
| **Th**     | 6.1 (d) |          |           | 6.1 (d) |
| **U**      | 1 (d)   |          |           | 1 (d)   |

**technique:** (a) wet, (b) OES, (c) INAA, (d) various.

Figure 6: Normalized rare-earth-element diagram for 12042 (data by Haskin et al. 1971).

Figure 5b: Grain size distribution for 12042 (Graf 1993, from data by King et al. 1971).

Average grain size = 95 microns
References for 12042


Marvin U.B. (1978) Apollo 12 coarse fines (2-10 mm): Sample locations, description and inventory. Curators Office, JSC#14434


