12012
Olivine Basalt
176.2 grams

Figure 1: Photo of 12012,0, taken in 1991, after subdivision. NASA # S91-38939.

Introduction
Olivine basalt 12012 has not been well studied and no age is available.

Petrography
Rhodes et al. (1977) describe the texture of 12012 as “porphyritic-subophitic” with partially resorbed olivine phenocrysts in a subophitic groundmass (figure 2).

Mineralogy
Olivine: Average Fo$_{67}$ (Baldridge et al. 1979).

Plagioclase: Average An$_{87}$.

Chromite-Ulvöspinel: Figure 4 shows chrome spinel overgrown by ulvöspinel, with metallic iron attached.

Chemistry
The chemical composition of 12012 was determined by LSPET (1970), Rhodes et al. (1977) and Neal et al. (1994).

<table>
<thead>
<tr>
<th>Mineral Mode for 12012</th>
<th>Neal et al. 1994</th>
<th>Baldridge et al. 1979</th>
</tr>
</thead>
<tbody>
<tr>
<td>Olivine</td>
<td>21.6</td>
<td>18</td>
</tr>
<tr>
<td>Pyroxene</td>
<td>53.5</td>
<td>52.7</td>
</tr>
<tr>
<td>Plagioclase</td>
<td>19</td>
<td>25</td>
</tr>
<tr>
<td>Ilmenite</td>
<td>1.9</td>
<td>2</td>
</tr>
<tr>
<td>Chromite +Usp</td>
<td>1.3</td>
<td>0.6</td>
</tr>
<tr>
<td>mesostasis</td>
<td>1.6</td>
<td>0.4</td>
</tr>
<tr>
<td>“silica”</td>
<td>0.2</td>
<td>0.8</td>
</tr>
</tbody>
</table>

Lunar Sample Compendium
C Meyer 2011
Figure 2: Photomicrograph of thin section of 12012. NASA #S69-24220. Length = 2 cm.
Radiogenic age dating
Not dated.

Other Studies
Bogard et al. (1971) reported the content and isotopic composition of rare gases in 12012.

There are 5 thin sections.

List of Photo #s for 12012
S69-63333-63341  B&W
S69-63417-63421
S69-63396-63399
S70-25405  TS
S70-20747  TS
S69-24220  TS
S70-49163-166
S70-49553-554
S91-38939

Figure 3: Photomicrographs of thin section 12012,7 in transmitted and cross-polarizing light showing large, corroded pyroxene in cross section. Field of view is 2.2 mm. NASA #S70-49552 and 553.

Figure 4: Reflected light photomicrograph of thin section 12012,8 showing chromite overgrown by ulvospinel with attached metallic iron grain. Also ilmenite in top corner. NASA #S70-25431. Chromite is 20 microns.

Figure 5: Normalized rare-earth-element diagram for 12012 (data from Rhodes et al. 1977).

Figure 6: Composition of 12012 compared with that of other lunar basalts.
Table 1. Chemical composition of 12012.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Neal 94</th>
<th>Rhodes 77</th>
<th>LSPET 70</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>.0604 g</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SiO2 %</td>
<td>44.17 (c)</td>
<td>35 (c)</td>
<td>35 (c)</td>
</tr>
<tr>
<td>TiO2</td>
<td>2.7 (a)</td>
<td>2.64 (c)</td>
<td>3.1 (c)</td>
</tr>
<tr>
<td>Al2O3</td>
<td>8.1 (a)</td>
<td>7.71 (c)</td>
<td>11 (c)</td>
</tr>
<tr>
<td>FeO</td>
<td>21.4 (a)</td>
<td>20.69 (c)</td>
<td>23 (c)</td>
</tr>
<tr>
<td>MnO</td>
<td>0.262 (a)</td>
<td>0.3 (c)</td>
<td>0.17 (c)</td>
</tr>
<tr>
<td>MgO</td>
<td>16 (a)</td>
<td>14.37 (c)</td>
<td>17.5 (c)</td>
</tr>
<tr>
<td>CaO</td>
<td>8 (a)</td>
<td>8.47 (c)</td>
<td>9.3 (c)</td>
</tr>
<tr>
<td>Na2O</td>
<td>0.207 (a)</td>
<td>0.21 (a)</td>
<td>0.53 (c)</td>
</tr>
<tr>
<td>K2O</td>
<td>0.052 (a)</td>
<td>0.06 (c)</td>
<td>0.055 (c)</td>
</tr>
<tr>
<td>P2O5</td>
<td>0.09 (c)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S %</td>
<td>0.07 (c)</td>
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<td></td>
</tr>
</tbody>
</table>

| Sum       |          |           |          |

Sc ppm | 44 (a) | 41.9 (a) | 38 (a) |
V      | 186 (a) | 65 (a)   |        |
Cr     | 4260 (a) | 4780 (a) | 3900 (a) |
Co     | 57.7 (a) | 56 (a) | 48 (a) |
Ni     | 43 (a) | 60 (a) | 135 (a) |
Cu     |          |          |          |
Zn     |          |          |          |
Ga     |          |          |          |
Ge ppb |          |          |          |
As     |          |          |          |
Se     |          |          |          |
Rb     | 143 (a) | 89 (c) | 110 (c) |
Sr     |          |          |          |
Y      | 33 (c) | 40 (c) |          |
Zr     | 99 (c) | 120 (c) |          |
Nb     | 6.6 (c) |          |          |
Mo     |          |          |          |
Ru     |          |          |          |
Rh     |          |          |          |
Pd ppb |          |          |          |
Ag ppb |          |          |          |
Cd ppb |          |          |          |
in ppb |          |          |          |
Sn ppb |          |          |          |
Sb ppb |          |          |          |
Te ppb |          |          |          |
Cs ppm |          |          |          |
Ba     | 104 (a) | 56 (b) | 38 (b) |
La     | 5.3 (a) |          |          |
Ce     | 15.3 (a) | 13.8 (a) |          |
Pr     | 10.8 (a) |          |          |
Nd     | 3.8 (a) | 4.02 (a) |          |
Sm     | 0.8 (a) | 0.76 (a) |          |
Eu     |          |          |          |
Gd     | 0.86 (a) | 1.17 (a) |          |
Tb     | 4.9 (a) |          |          |
Dy     |          |          |          |
Ho     |          |          |          |
Er     |          |          |          |
Tm     |          |          |          |
Yb     | 3 (a) | 3.4 (a) |          |
Lu     | 0.46 (a) | 0.47 (a) |          |
Hf     | 2.6 (a) | 3.4 (a) |          |
Ta     | 0.37 (a) |          |          |
W ppb  |          |          |          |
Re ppb |          |          |          |
Os ppb |          |          |          |
Ir ppb |          |          |          |
Pt ppb |          |          |          |
Au ppb |          |          |          |
Th ppm | 0.67 (a) |          |          |
U ppm  |          |          |          |

Technique (a) INAA, (b) IDMS, (c) XRF

References for 12012


