

**12045**  
Ilmenite Basalt  
63 grams



*Figure 1: Photo of 12045 showing rounded surface with many zap pits due to micrometeorite bombardment. NASA #S70-19002. Sample is 4.5 cm across.*

**Introduction**

12045 is a small flat rock with lots of micrometeorite craters.

of thin platelets. Thus 12045 appears to be a more crystalline, less glassy version of 12008.

**Petrography**

Dungan and Brown (1977) compare 12045 with olivine vitrophyre 12008. Like 12008, 12045 has glomerophytic aggregates of early-formed olivine phenocrysts, spinel grains and rare metal droplets. It also has elongate non-skeletal phenocrysts of titanomagnetite. These phenocryst assemblages are set in a variolitic groundmass of acicular pyroxene, plagioclase, silica, ilmenite, troilite and metal. The ilmenite is highly skeletal and occurs as parallel sets

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**Mineralogical Mode for 12045**

|               |                  |
|---------------|------------------|
|               | Neal et al. 1994 |
| Olivine       | 8.8              |
| Pyroxene      | 57               |
| Plagioclase   | 20.6             |
| Ilmenite      |                  |
| Chromite +Usp |                  |
| mesostasis    | 5.7              |
| “silica”      | 0.6              |



*Figure 2: Faded photomicrograph of thin section 12045,6 showing olivine pheocrysts in groundmass cut by fine, parallel needles of ilmenite. NASA S70-50032. Plane polarized light. Scale about 3 mm.*

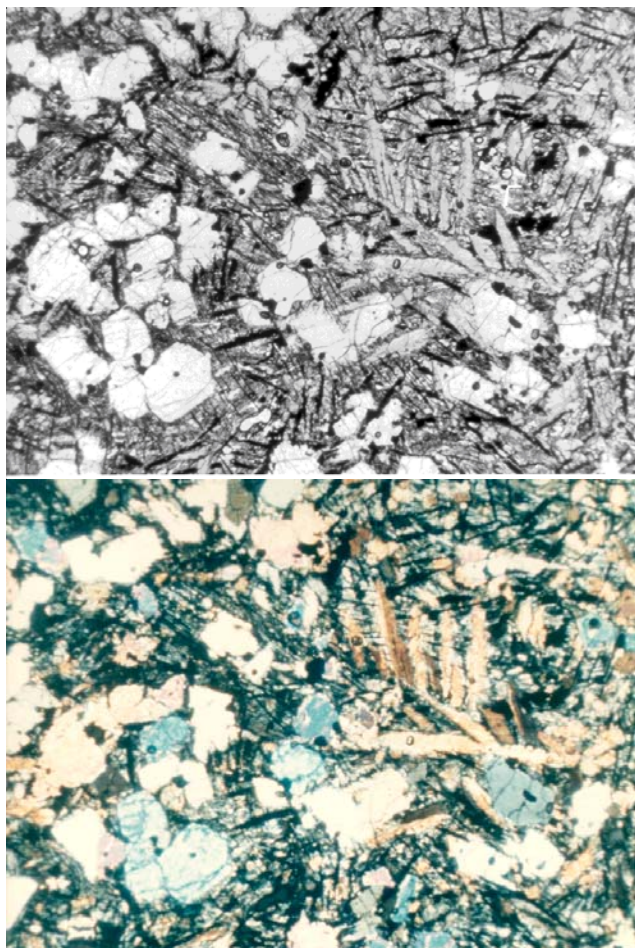


Figure 3: Photomicrograph of thin section 12045,7 (plane-polarized and cross-nicols). Note feathery pyroxene. NASA#S70-17968-969. 2.7 mm across.

### Mineralogy

**Olivine:** Dungan and Brown (1977) report that Fo<sub>74</sub> is the most magnesian olivine in 12045.

**Pyroxene:** Dungan and Brown (1977) present pyroxene compositions in 12045 in figure 3.

**Ilmenite:** The groundmass of 12045 is riddled with fine ilmenite needles in odd parallel alignment (figure 2).

### Chemistry

The chemical composition of 12045 has been determined by Rhodes et al. (1977), Nyquist et al. (1979) and Snyder et al. (1997).

### Radiogenic age dating

Snyder et al. (1997) reported the isotopic composition of Sr and Nd.

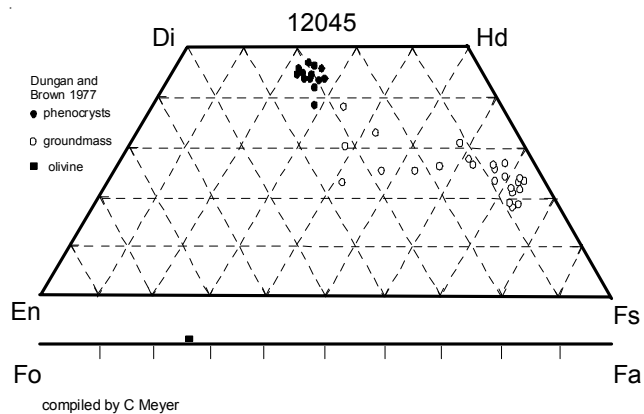


Figure 4: Pyroxene composition of 12045 (adapted from Dungan and Brown 1977).

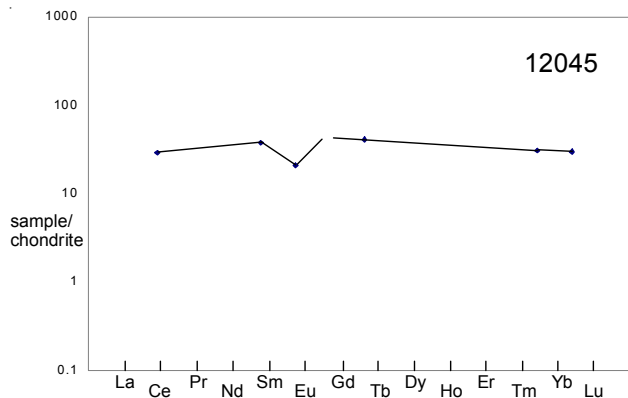


Figure 5: Normalized rare-earth-element diagram for 12045 (data from Nyquist et al. 1979).

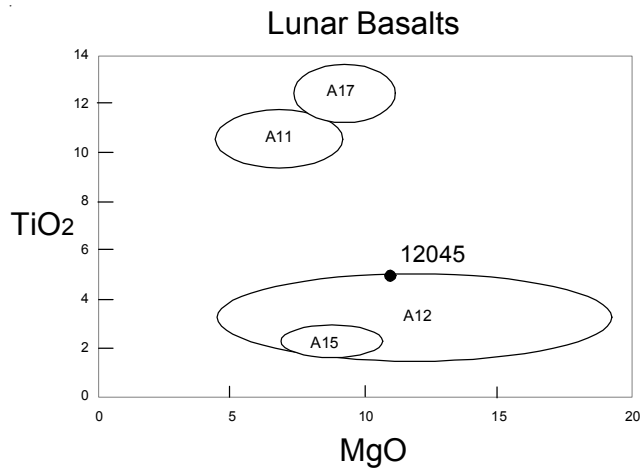


Figure 6: Composition of 12045 compared with other lunar basalts.

### List of Photo #s for 12045

- |                   |                 |
|-------------------|-----------------|
| S70-17966 – 17971 | TS              |
| S70-19002 – 19026 | B & W mug color |
| S70-48255 – 48264 | TS              |
| S70-50032 – 50035 |                 |

**Table 1. Chemical composition of 12045.**

| reference weight               | Rhodes77  | Nyquist79<br>50 mg | Snyder97      | Neal2001   |
|--------------------------------|-----------|--------------------|---------------|------------|
| SiO <sub>2</sub> %             | 42.3      | (c)                | 42.3          |            |
| TiO <sub>2</sub>               | 4.78      | (c)                | 4.78          |            |
| Al <sub>2</sub> O <sub>3</sub> | 8.06      | (c)                | 8.06          |            |
| FeO                            | 22.09     | (c)                | 22.09         |            |
| MnO                            | 0.29      | (c)                | 0.29          |            |
| MgO                            | 11.63     | (c)                | 11.63         |            |
| CaO                            | 9.09      | (c)                | 9.09          |            |
| Na <sub>2</sub> O              | 0.26      | (a)                | 0.26          |            |
| K <sub>2</sub> O               | 0.07      | (c) 0.062          | (b) 0.07      |            |
| P <sub>2</sub> O <sub>5</sub>  | 0.09      | (c)                | 0.09          |            |
| S %                            | 0.09      | (c)                |               |            |
| sum                            |           |                    |               |            |
| Sc ppm                         | 54        | (a)                |               | 60 (d)     |
| V                              |           |                    |               | 162 (d)    |
| Cr                             | 4060      | (a)                | 3800 (d)      | 3757 (d)   |
| Co                             | 52        | (a)                | 55.9 (d)      | 53 (d)     |
| Ni                             | 40        | (a)                | 56.1 (d)      | 51 (d)     |
| Cu                             |           |                    | 16.4 (d)      | 20 (d)     |
| Zn                             |           |                    | 9.98 (d)      | 29 (d)     |
| Ga                             |           |                    | 3.83 (d)      | 3.37 (d)   |
| Ge ppb                         |           |                    |               |            |
| As                             |           |                    |               |            |
| Se                             |           |                    |               |            |
| Rb                             |           | 0.717              | (b) 0.709 (d) | 0.88 (d)   |
| Sr                             | 136       | (c) 143            | (b) 132.1 (d) | 151 (d)    |
| Y                              | 50        | (c)                | 49.7 (d)      | 57 (d)     |
| Zr                             | 112       | (c)                | 109.9 (d)     | 125 (d)    |
| Nb                             | 5.3       | (c)                | 5.17 (d)      | 6.8 (d)    |
| Mo                             |           |                    |               |            |
| Ru                             |           |                    |               |            |
| Rh                             |           |                    |               |            |
| Pd ppb                         |           |                    |               |            |
| Ag ppb                         |           |                    | 398 (d)       |            |
| Cd ppb                         |           |                    |               |            |
| In ppb                         |           |                    |               |            |
| Sn ppb                         |           |                    |               |            |
| Sb ppb                         |           |                    |               |            |
| Te ppb                         |           |                    |               |            |
| Cs ppm                         |           |                    | 0.038 (d)     | 0.02 (d)   |
| Ba                             | 52        | (b) 52.7           | (b) 52.9 (d)  | 57 (d)     |
| La                             |           |                    | 6.65 (d)      | 5.6 (d)    |
| Ce                             | 17.4      | (a) 16.2           | (b) 17.3 (d)  | 17 (d)     |
| Pr                             |           |                    | 2.83 (d)      | 2.93 (d)   |
| Nd                             |           | 14.8               | (b) 15.1 (d)  | 14.8 (d)   |
| Sm                             | 5.6       | (a) 5.48           | (b) 5.64 (d)  | 5.54 (d)   |
| Eu                             | 1.19      | (a) 1.28           | (b) 1.06 (d)  | 1.27 (d)   |
| Gd                             |           | 7.69               | (b) 6.04 (d)  | 7.97 (d)   |
| Tb                             | 1.51      | (a)                | 1.26 (d)      | 1.45 (d)   |
| Dy                             |           | 9.57               | (b) 7.74 (d)  | 9.79 (d)   |
| Ho                             |           |                    | 1.6 (d)       | 1.98 (d)   |
| Er                             |           | 5.66               | (b) 4.41 (d)  | 5.74 (d)   |
| Tm                             |           |                    | 0.63 (d)      | 0.8 (d)    |
| Yb                             | 5.1       | (a) 4.94           | (b) 4.25 (d)  | 5.44 (d)   |
| Lu                             | 0.73      | (a) 0.721          | (b) 0.58 (d)  | 0.68 (d)   |
| Hf                             | 4.5       | (a)                |               | 4.17 (d)   |
| Ta                             |           |                    | 0.274 (d)     | 0.38 (d)   |
| W ppb                          |           |                    |               | 90 (d)     |
| Re ppb                         |           |                    |               |            |
| Os ppb                         |           |                    |               |            |
| Ir ppb                         |           |                    |               |            |
| Pt ppb                         |           |                    |               |            |
| Au ppb                         |           |                    |               |            |
| Th ppm                         |           |                    | 0.679 (d)     | 0.64 (d)   |
| U ppm                          |           |                    | 0.176 (d)     | 0.17 (d)   |
| technique                      | (a) INAA, | (b) IDMS,          | (c) XRF,      | (d) ICP-MS |

**References for 12045**

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