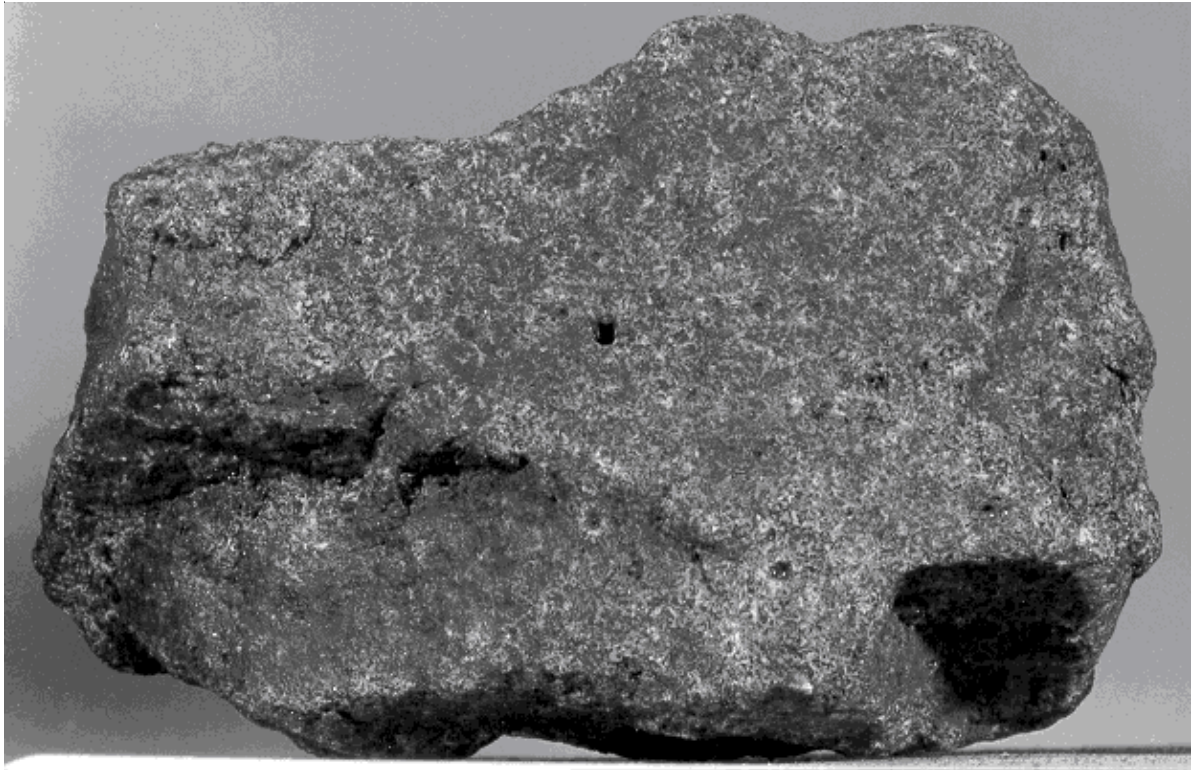


**12046**  
**Ilmenite Basalt**  
 166 grams



*Figure 1: Photo of 12046,0 showing zap pits. Sample is 7 cm across. NASA S70-19036.*

**Introduction**

12046 is an ilmenite basalt with medium-grained ophitic to subophitic texture with a high percentage of pyroxene (figures 1 – 3). It is rounded, with micrometeorite craters on all sides. It has not been dated.

**Petrography**

Dence et al. (1971) termed 12046 a subophitic microgabbro and compared it with 12056. Neal et al. (1994) show a picture of the texture of 12046 and give mineral analyses. In an appendix to their paper, they describe some olivine phenocrysts as cores to pyroxene phenocrysts (<2 mm). Groundmass includes laths of plagioclase (1.5 mm), pyroxene, ilmenite, tridymite, glass with minute anhedral ulvöspinel, troilite and metal.

**Mineralogy**

***Olivine:*** Dence et al. (1971) found olivine was Fo<sub>65</sub>.

***Pyroxene:*** Large grains of pyroxene include corroded olivine and surround plagioclase crystals (figure 4). Dence et al. reported that “pyroxferroite mantles ferroaugite”.

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**Mineralogical Mode for 12046**

|               | Neal et al. 1994 | Dence et al. 1971 |
|---------------|------------------|-------------------|
| Olivine       | 0.8              | 2                 |
| Pyroxene      | 60.1             |                   |
| Plagioclase   | 29.9             |                   |
| Ilmenite      | 3.4              |                   |
| Chromite +Usp | 2                |                   |
| mesostasis    | 2.1              |                   |
| “silica”      | 1.1              |                   |

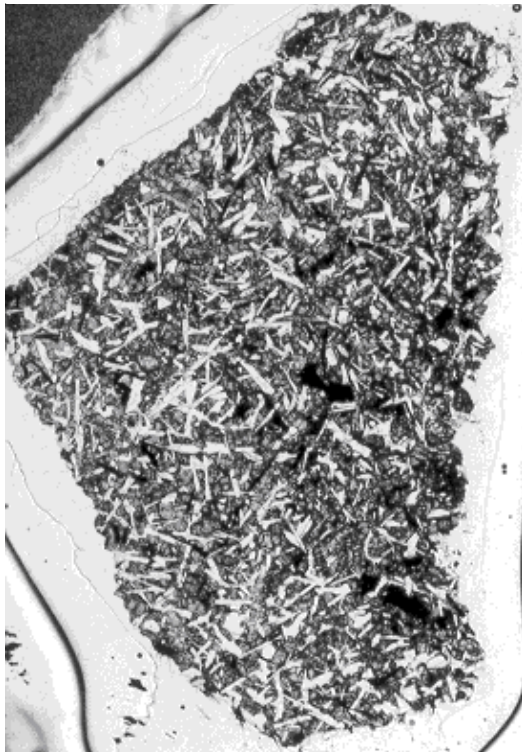


Figure 2: Photomicrograph of whole thin section 12046,5 (2 cm). NASA S70-49389.

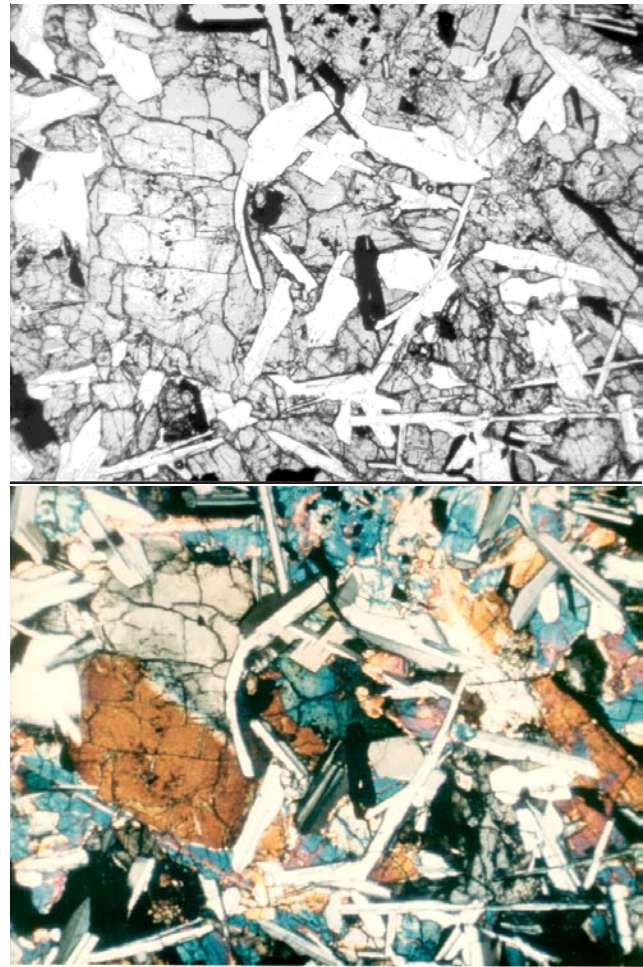


Figure 3: Photomicrographs of thin section 12046,6 (plane-polarized and crossed-nicols). Field of view is 2.6 mm. NASA #S70-49813-814.

**Plagioclase:** Plagioclase laths are  $An_{91-87}$ .

**Metallic iron:** Iron grains are about 2 wt. % Ni. (figure 5).

### Chemistry

The chemical composition was determined by Neal et al. (1994).

### Radiogenic age dating

Not dated.

### Processing

12046 has been used for public display (figure 8). There are 4 thin sections.

### **List of Photo #s for 12046**

|                   |              |
|-------------------|--------------|
| S69-63166 – 63189 | color mug    |
| S69-61883 – 61906 | B & W mug    |
| S70-19027 – 19038 | B & W        |
| S70-48421 – 48430 | color dusted |
| S70-49813 – 49816 | TS color     |
| S70-49258 – 49259 |              |
| S70-50036         |              |
| S70-17296 – 17300 | display      |

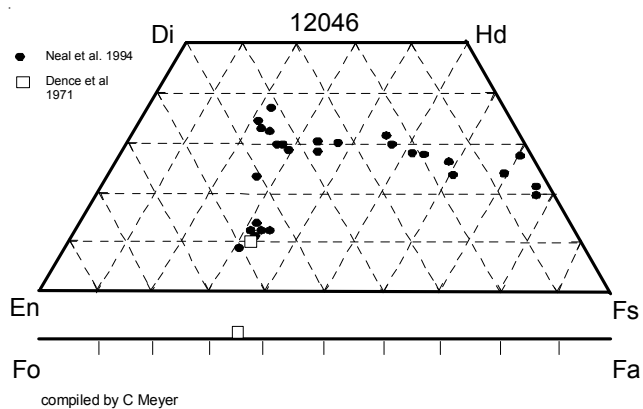


Figure 4: Pyroxene compositions of 12046 as determined by Neal et al. (1994).

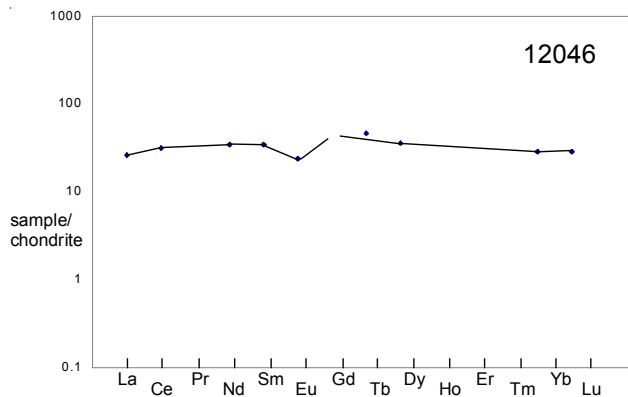


Figure 6: Normalized rare-earth-element composition of 12046 (data by Neal et al. 1994).

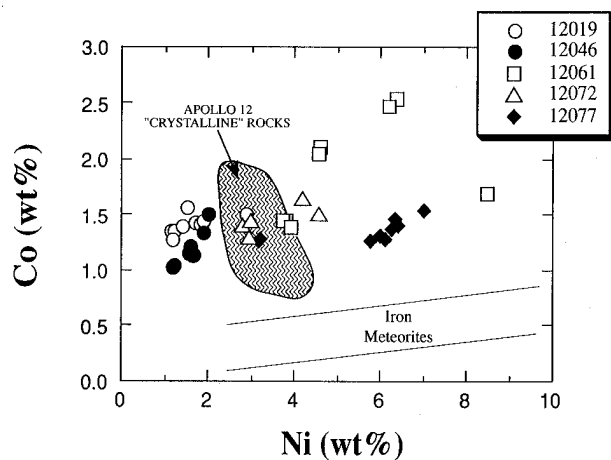


Figure 5: Composition of iron grains in Apollo 12 rock (from Neal et al. 1994).

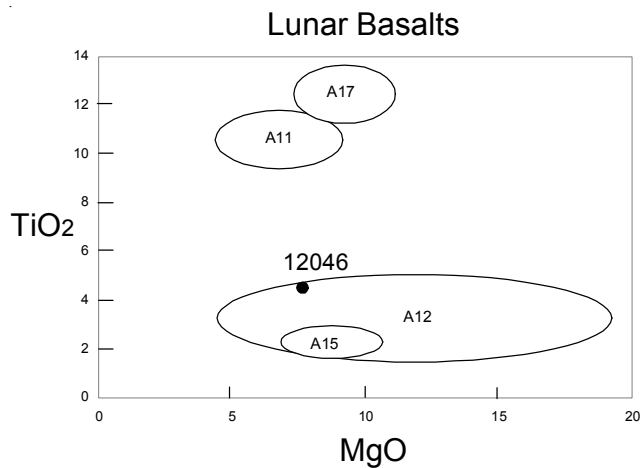


Figure 7: Composition of 12046 compared with other lunar basalts.

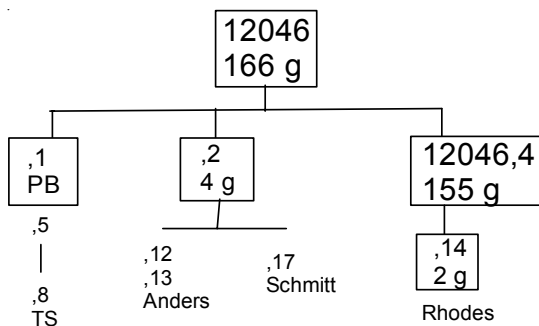


Figure 8. Display for 12046. S70-17297

**Table 1. Chemical composition of 12046.**

|                                |          |     |
|--------------------------------|----------|-----|
| reference                      | Neal94   |     |
| weight                         | .547 g   |     |
| SiO <sub>2</sub> %             |          |     |
| TiO <sub>2</sub>               | 4.6      | (a) |
| Al <sub>2</sub> O <sub>3</sub> | 10.5     | (a) |
| FeO                            | 20.2     | (a) |
| MnO                            | 0.259    | (a) |
| MgO                            | 7.3      | (a) |
| CaO                            | 10.6     | (a) |
| Na <sub>2</sub> O              | 0.293    | (a) |
| K <sub>2</sub> O               | 0.063    | (a) |
| P <sub>2</sub> O <sub>5</sub>  |          |     |
| S %                            |          |     |
| sum                            |          |     |
| Sc ppm                         | 60.2     | (a) |
| V                              | 138      | (a) |
| Cr                             | 2010     | (a) |
| Co                             | 31       | (a) |
| Ni                             |          |     |
| Cu                             |          |     |
| Zn                             |          |     |
| Ga                             |          |     |
| Ge ppb                         |          |     |
| As                             |          |     |
| Se                             |          |     |
| Rb                             |          |     |
| Sr                             | 158      | (a) |
| Y                              |          |     |
| Zr                             |          |     |
| Nb                             |          |     |
| Mo                             |          |     |
| Ru                             |          |     |
| Rh                             |          |     |
| Pd ppb                         |          |     |
| Ag ppb                         |          |     |
| Cd ppb                         |          |     |
| In ppb                         |          |     |
| Sn ppb                         |          |     |
| Sb ppb                         |          |     |
| Te ppb                         |          |     |
| Cs ppm                         |          |     |
| Ba                             | 72       | (a) |
| La                             | 6.2      | (a) |
| Ce                             | 19.3     | (a) |
| Pr                             |          |     |
| Nd                             | 15.8     | (a) |
| Sm                             | 5.2      | (a) |
| Eu                             | 1.32     | (a) |
| Gd                             |          |     |
| Tb                             | 1.7      | (a) |
| Dy                             | 8.8      | (a) |
| Ho                             |          |     |
| Er                             |          |     |
| Tm                             |          |     |
| Yb                             | 4.7      | (a) |
| Lu                             | 0.7      | (a) |
| Hf                             | 3.7      | (a) |
| Ta                             | 0.49     | (a) |
| W ppb                          |          |     |
| Re ppb                         |          |     |
| Os ppb                         |          |     |
| Ir ppb                         |          |     |
| Pt ppb                         |          |     |
| Au ppb                         |          |     |
| Th ppm                         | 0.67     | (a) |
| U ppm                          |          |     |
| technique                      | (a) INAA |     |

**References for 12046**

Dence M.R., Douglas J.A.V., Plant A.G. and Traill R.J. (1971) Mineralogy and peterology of some Apollo 12 samples. *Proc. Second Lunar Sci. Conf.* 285-299.

James O.B. and Wright T.L. (1972) Apollo 11 and 12 mare basalts and gabbros: Classification, compositional variations and possible petrogenetic relations. *Geol. Soc. Am. Bull.* **83**, 2357-2382.

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Neal C.R., Hacker M.D., Snyder G.A., Taylor L.A., Liu Y.-G. and Schmitt R.A. (1994a) Basalt generation at the Apollo 12 site, Part 1: New data, classification and re-evaluation. *Meteoritics* **29**, 334-348.

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