12022
Ilmenite Basalt
1864.3 grams

Introduction
Neal et al. (1994) classify 12022 as an ilmenite basalt while James and Wright (1972) had termed it an ilmenite-bearing olivine basalt. It has been dated at 3.2 b.y. All surfaces, except perhaps the flat end, were apparently covered with micrometeorite craters (Hörz et al. 1971), making this rock less than ideal for cosmic-ray depth profiles.

Petrography
The petrography of 12022 is discussed in Weill et al. (1971), Brett et al. (1971), McGee et al. (1977). McGee et al. describe 12022 as “a medium grained porphyritic basalt characterized by subhedral olivine (0.3 mm) and pyroxene (1-2 mm) phenocrysts. Several olivine phenocrysts are epitaxially overgrown with pyroxene. The matrix consists of feathery intergrowths of parallel feldspar tablets (0.05-1 mm), subrounded ilmenite laths (0.03-0.2 mm), anhedral pyroxene crystals (0.6-0.8 mm) and minor glassy mesostasis”.

Ilmenite in 12022 has an interesting cross-cutting, parallel, skeletal habit.

Mineralogy
Olivine: Butler (1972) determined the minor element content of olivine in 12022.

Pyroxene: Weill et al. (1971) and Brett et al. (1971) determined that the cores of pyroxene phenocrysts in 12022 are Ca-rich, zoning outward to Fe-rich (figure 4). The zonation of minor elements (Al, Ti, Cr ) in pyroxene in 12022 is discussed in Bence and Papike (1972).
Figure 2: Refected light photo of thin section 12022,10 showing alignment of ilmenite, clumps of pyroxene phenocrysts in fine-grained variolitic groundmass. Field of view 1 cm. NASA photo # S70-24742.

Plagioclase: Plagioclase is An$_{91-85}$.

Opales: Ilmenite laths occur in groups, cutting through the matrix but not intersecting the phenocrysts (McGee et al. 1977). Subrounded octahedra of Cr-spinel, with or without rims of Ti-spinel, occur in the matrix and as inclusions in olivine and pyroxene phenocrysts.

Mineralogical Mode of 12022

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Metal: Brett et al. (1971) determined the Ni content of minute metallic iron grains in 12022 (figure 5).

Chemistry


Radiogenic age dating

Alexander et al. (1972) determined an age for 12022 of 3.18 ±0.04 b.y. by the Argon plateau method. Snyder
et al. (1997) reported the isotopic composition of Sr and Nd.

**Cosmogenic isotopes and exposure ages**

Not reported!

**Other Studies**

Bogard et al. (1971) reported the content and isotopic composition of rare gases in 12022. Barber et al. (1971) determined the track density and erosion rate (figure 8).
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| V         | 156 (f)     |          |          |
| Cr        | 3300 (f)    | 3004 (f) |          |
| Co        | 52.6 (f)    |          |          |
| Ni        | 47.4 (f)    | 29.1 (f) |          |
| Cu        | 17.6 (f)    | 15.7 (f) |          |
| Zn        | 2 (e)       | 11.5 (f) | 11.3 (f) |
| Ga        | 3.9 (e)     | 4.24 (f) | 3.64 (f) |
| Ge ppb    |             |          |          |
| As        |             |          |          |
| Se        |             |          |          |
| Rb        | 0.841 (f)   | 0.78 (f) |          |
| Sr        | 142.5 (f)   | 147.5 (f) |          |
| Y         | 64.2 (f)    | 51 (f)   |          |
| Zr        | 160.1 (f)   | 122 (f)  |          |
| Nb        | 7.04 (f)    | 6 (f)    |          |
| Mo        | 0.11 (f)    |          |          |
| Ru        |             |          |          |
| Rh        |             |          |          |
| Pd ppb    |             |          |          |
| Ag ppb    | 105 (f)     |          |          |
| Cd ppb    | 6.4 (e)     |          |          |
| In ppb    | 1.6 (e)     |          |          |
| Sn ppb    |             |          |          |
| Sb ppb    |             |          |          |
| Te ppb    |             |          |          |
| Cs ppm    | 0.058 (f)   | 0.03 (f) |          |
| Ba        | 58.4 (f)    | 57 (f)   |          |
| La        | 6.5 (f)     | 5.59 (f) |          |
| Ce        | 17.9 (f)    | 16.9 (f) |          |
| Pr        | 3.35 (f)    | 2.93 (f) |          |
| Nd        | 19.2 (f)    | 15.3 (f) |          |
| Sm        | 6.58 (f)    | 5.63 (f) |          |
| Eu        | 1.45 (f)    | 1.3 (f)  |          |
| Gd        | 7.94 (f)    | 8.74 (f) |          |
| Tb        | 1.66 (f)    | 1.48 (f) |          |
| Dy        | 10.39 (f)   | 10.2 (f) |          |
| Ho        | 2.1 (f)     | 2.09 (f) |          |
| Er        | 5.81 (f)    | 6.13 (f) |          |
| Tm        | 0.82 (f)    | 0.84 (f) |          |
| Yb        | 5.36 (f)    | 5.51 (f) |          |
| Lu        | 0.78 (f)    | 0.77 (f) |          |
| Hf        |             | 4.25 (f) |          |
| Ta        | 0.381 (f)   | 0.39 (f) |          |
| W ppb     |             | 160 (f)  |          |
| Re ppb    |             |          |          |
| Os ppb    |             |          |          |
| Ir ppb    | 0.09 (e)    |          |          |
| Pt ppb    |             |          |          |
| Au ppb    |             |          |          |
| Th ppm    | 0.987 (f)   | 0.63 (f) |          |
| U ppm     | 0.28 (f)    | 0.19 (f) |          |

*technique: (e) RNAA, (f) ICP-MS*
Helsley (1971) found that 12022 has significant magnetic remanence and Chung et al. (1971) determined the dielectric properties.

Gibson and Hubbard (1972) experimentally studied the volatile depletion for 12022.

**Processing**
A thick slab (B,14) was cut from the middle of 12022 with a circular saw (figure 9) and a column (,17) was cut from the slab with a wire saw (figure 12). End piece (A,13) was also subdivided with a wire saw (figure 10). A large piece of 12022 is on public display in Wales, England (figure 13).

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**List of Photo #s for 12022**
- S69-64083 color mug
- S69-64108 color mug
- S70-16784 – 785 TS color
- S70-20956 TS color
- S70-49560 – 561
- S70-49455 – 460 TS color
- S74-24900 – 902 display
- S79-27121 – 122 TS color
Figure 9: Group photo of 12022,0 after 1.5 mm slab was cut.

Figure 10: Group photo of 12022,13. Scale is in mm.
THE CUTTING AND CHIPPING OF SLICE 'B' NO. 12022,14

DRAWING COMPLETED MAY 25, 1970

Figure 11: End piece of slab 12022, 14.

Figure 12: Column (12022,17) cut from slab (12022,14). Scale in mm.
Figure 13: Display case for 12022,92. NASA S74-24901.

References for 12022


