

15495

Vuggy Porphyritic Pigeonite Basalt

908.9 grams



Figure 1: Photo of 15495. NASA S71-48602. Sample is about 8 cm across.

Introduction

15495 was collected from the rim of Dune Crater – along with 15475, 15476, 15485 and 15499 (Swann et al. 1971). It is a coarse porphyritic mare basalt with about 10% large vugs (figure 1). It has been studied for its magnetic properties, but has not been dated. The orientation of 15495 was documented by photographs, but there are micrometeorite craters on S, T, B and E surfaces indicating that the rock has rolled.

Petrography

There are no publications dedicated to the petrographic description of 15495, which is surprising considering its rather unusual texture. The texture of 15495 and 15476 appear similar (figure 2, 3, 4a,b). Large pyroxene phenocrysts up to 2.5 cm long separate regions of melt that crystallized as fine-grained radiate masses of plagioclase and pyroxene with a variety of textures. You need several thin sections to get a

complete picture. Mineral compositions have not been reported.

Cooling History

Ryder (1985) writes: “Cooling rate estimates (for A15 basalts) were made by L. Taylor et al. (1973), Lofgren et al. (1975) and Grove and Walker (1977).” In particular, Lofgren et al. (1975) demonstrated experimentally that the porphyritic texture of the Apollo 15 quartz-normative Apollo 15 basalts can be produced

Mineralogical Mode for 15495

| | Sample Catalog Butler 1971 |
|-------------|---------------------------------------|
| Olivine | |
| Pyroxene | 60 |
| Plagioclase | 40 |
| Silica | |
| Opaques | |



Figure 2: Large scale photo of thin section 15495,92 from the data pack. Scale is 1 cm. Large elongate pyroxene crystals separate regions of subophitic matrix.

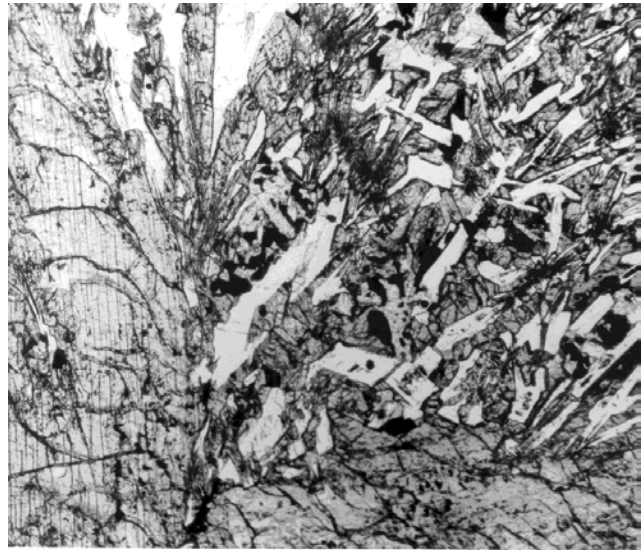


Figure 3: Photomicrograph of thin section 15495,11 showing matrix between large pyroxene phenocrysts. NASA S72-15510. Scale about 3 mm.



Figure 4a: Photomicrographs of thin section 15495,16 by C Meyer @ 30x.

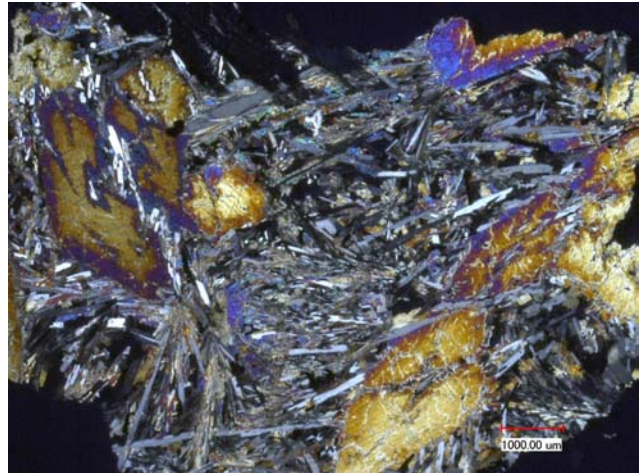


Figure 4b: Photomicrographs of thin section 15495,16 by C Meyer @ 30x (crossed nicols).

with a linear cooling rate. Takeda et al. (1975) studied pyroxene exsolution and concluded cooling rates.

Chemistry

The chemical composition of 15495 was reported by Willis et al. (1972), Carron et al. (1972), Laul and Schmitt (1973) and Wanke et al. (1975) (figures 6 and 7).

Laul and Schmitt (1973) also provided trace element analyses of pyroxene, plagioclase and ilmenite separates.

Radiogenic age dating

Papanastassiou and Wasserburg (1973) dated several Apollo 15 basalts. Barnes et al. (1973) reported K, Pb and Sr isotopic data.

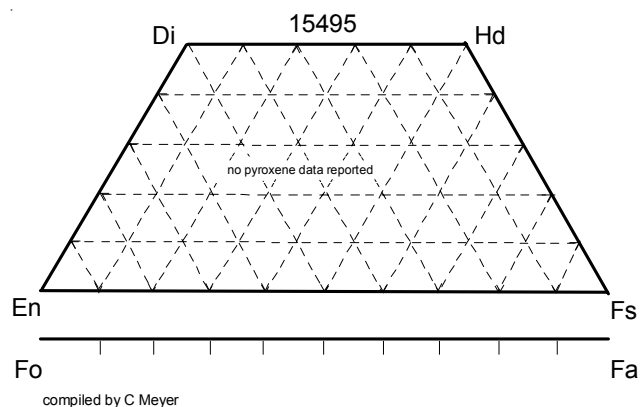


Figure 5: Pyroxene and olivine composition for 15495 not available.

Cosmogenic isotopes and exposure ages

Eldridge et al. (1972) and O'Kelley et al. (1972) determined the cosmic ray induced activity of $^{22}\text{Na} = 29$ dpm/kg., $^{26}\text{Al} = 69$ dpm/kg., $^{46}\text{Sc} = 3$ dpm/kg., $^{54}\text{Mn} = 25$ dpm/kg. and $^{56}\text{Co} = 11$ dpm/kg. for 15495.

Other Studies

Nagata et al. (1973), Collinson et al. (1972) and Banerjee and Mellema (1974) were the first to report magnetic properties.

Huffman et al. (1974) used Mossbauer spectra to discern the Fe distribution among phases.

Becker and Clayton (1975) determined that ^{15}N was produced by spallation reactions caused by cosmic rays.

Thode and Rees (1972) determined sulfur isotopes.

Processing

An end piece (.35) was cut into strips. A second large piece (.61) was cut from the side and is on public display at the US Postal Service. There are 16 thin sections.

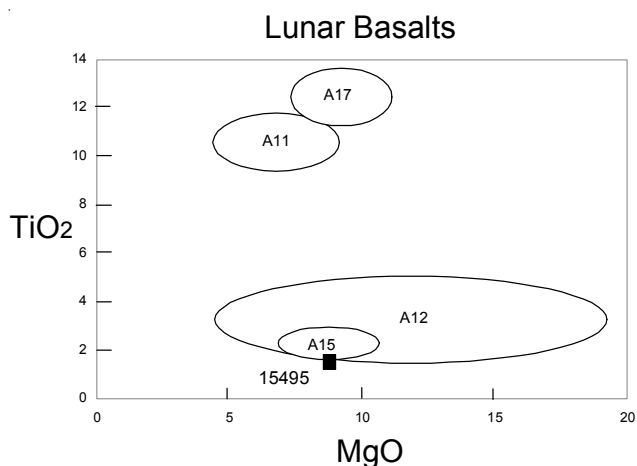


Figure 6: Bulk chemical composition of 15495 compared with other Apollo basalts.

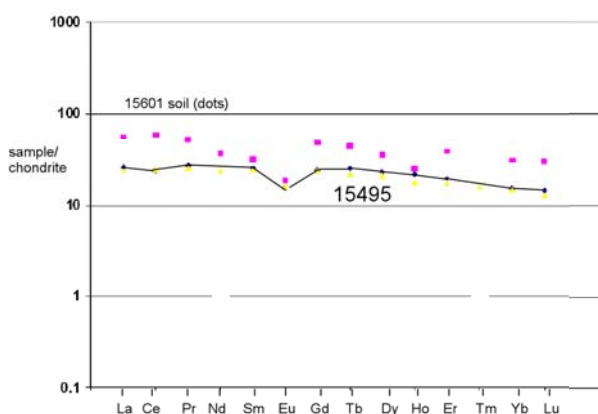


Figure 7: Normalized rare-earth-element diagram for 15495, with 15601 soil for comparison (Wanke et al. 1975).

Table 1. Chemical composition of 15495.

| reference | Cuttitta73 | | Carron72 | | Willis72 | Wanke 75 | |
|-----------|------------|------------|-------------|-----|----------|----------|-----------|
| weight | Laul 73 | O'Kelley72 | Christian72 | | | | |
| | 214 mg | | | | | | |
| SiO2 % | | | 47.98 | (c) | 48 | (d) | 48.99 (e) |
| TiO2 | 1.6 | (b) | 2 | (c) | 1.8 | (d) | 1.52 (e) |
| Al2O3 | 8.4 | (b) | 8.97 | (c) | 9.57 | (d) | 9.28 (e) |
| FeO | 22 | (b) | 20.74 | (c) | 20.07 | (d) | 19.3 (e) |
| MnO | 0.274 | (b) | 0.29 | (c) | 0.261 | (d) | 0.26 (e) |
| MgO | 8 | (b) | 8.96 | (c) | 8.42 | (d) | 9.67 (e) |
| CaO | 10.6 | (b) | 10.26 | (c) | 10.43 | (d) | 10.44 (e) |
| Na2O | 0.27 | (b) | 0.31 | (c) | | (d) | 0.33 (e) |
| K2O | 0.062 | (b) | 0.06 | (a) | 0.07 | (c) | 0.062 (d) |
| P2O5 | | | 0.08 | (c) | 0.09 | (d) | 0.06 (e) |
| S % | | | | | | | 0.065 (e) |
| sum | | | | | | | |
| Sc ppm | 46 | (b) | 36 | (c) | | | 46 (e) |
| V | 240 | (b) | 152 | (c) | | | |
| Cr | 3975 | (b) | 1984 | (c) | 3490 | (d) | 3880 (e) |
| Co | 55 | (b) | 44 | (c) | | | 44.5 (e) |
| Ni | | | 26 | (c) | | | 47 (e) |
| Cu | | | 12 | (c) | | | 27.2 (e) |
| Zn | | | | | | | 1.3 (e) |
| Ga | | | 4.2 | (c) | | | 3.27 (e) |
| Ge ppb | | | | | | | 50 (e) |
| As | | | | | | | 5.5 (e) |
| Se | | | | | | | 0.06 (e) |
| Rb | | | 1.3 | (c) | <2 | (d) | 0.77 (e) |
| Sr | | | 105 | (c) | 114 | (d) | 108 (e) |
| Y | | | 33 | (c) | 32.2 | (d) | 25 (e) |
| Zr | 200 | (b) | 100 | (c) | 126 | (d) | 85 (e) |
| Nb | | | 10 | (c) | 7.7 | (d) | 4.7 (e) |
| Mo | | | | | | | |
| Ru | | | | | | | |
| Rh | | | | | | | |
| Pd ppb | | | | | | | 10 (e) |
| Ag ppb | | | | | | | |
| Cd ppb | | | | | | | |
| In ppb | | | | | | | |
| Sn ppb | | | | | | | |
| Sb ppb | | | | | | | |
| Te ppb | | | | | | | |
| Cs ppm | | | | | | | 0.032 (e) |
| Ba | 70 | (b) | 92 | (c) | | | 68 (e) |
| La | 5.5 | (b) | 10 | (c) | | | 6.03 (e) |
| Ce | | | | | | | 14 (e) |
| Pr | | | | | | | 2.4 (e) |
| Nd | | | | | | | |
| Sm | 3.6 | (b) | | | | | 3.71 (e) |
| Eu | 0.8 | (b) | | | | | 0.87 (e) |
| Gd | | | | | | | 5.1 (e) |
| Tb | 0.59 | (b) | | | | | 0.91 (e) |
| Dy | | | | | | | 5.5 (e) |
| Ho | | | | | | | 1.2 (e) |
| Er | | | | | | | 3.1 (e) |
| Tm | | | | | | | |
| Yb | 2.2 | (b) | 4.6 | (c) | | | 2.46 (e) |
| Lu | 0.35 | (b) | | | | | 0.35 (e) |
| Hf | 2.5 | (b) | | | | | 2.31 (e) |
| Ta | 0.4 | (b) | | | | | 0.31 (e) |
| W ppb | | | | | | | 168 (e) |
| Re ppb | | | | | | | 1.8 (e) |
| Os ppb | | | | | | | |
| Ir ppb | | | | | | | |
| Pt ppb | | | | | | | |
| Au ppb | | | | | | | 0.26 (e) |
| Th ppm | | 0.6 | (a) | | | | 0.43 (e) |
| U ppm | | 0.16 | (a) | | | | 0.136 (e) |

technique: (a) radiation counting, (b) INAA, (c) "microchemical", (d) XRF, (e) mixed

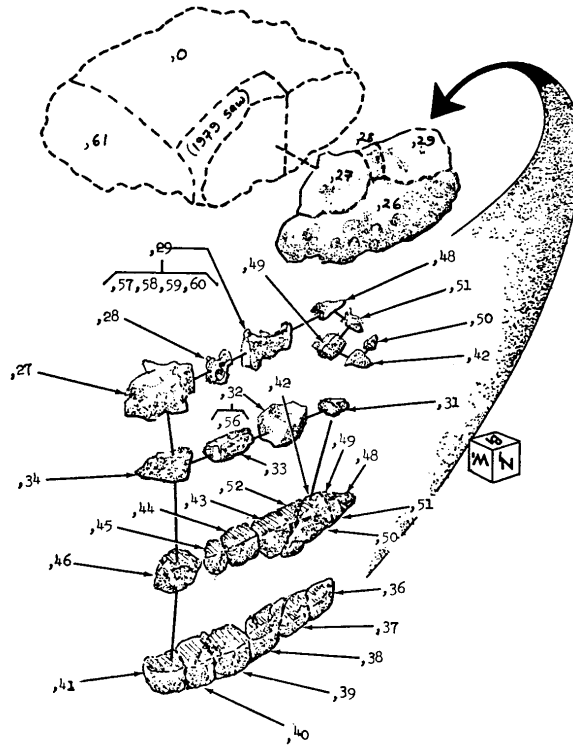
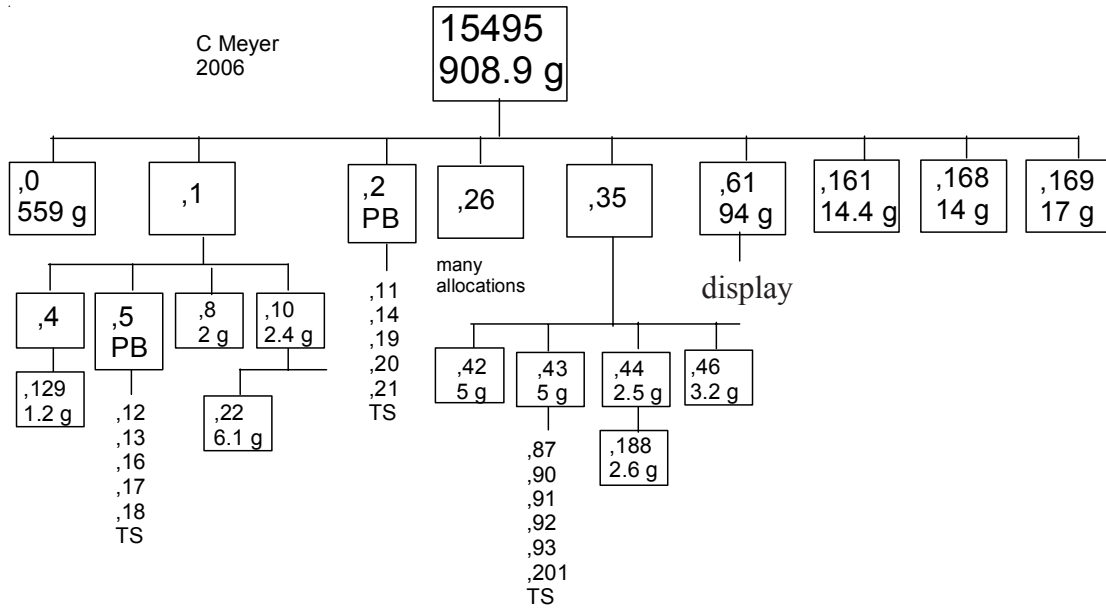


Figure 8: Exploded parts diagram for 15495.



| Table 2 | U ppm | Th ppm | K ppm | Rb ppm | Sr ppm | Nd ppm | Sm ppm | technique |
|----------------------|-------|--------|-------|--------|--------|--------|--------|-----------|
| Barnes et al. 1973 | 0.172 | 0.6331 | | 1.032 | 108.4 | | | IDMS |
| O'Kelley et al. 1972 | 0.16 | 0.6 | 495 | | | | | counting |
| Wanke et al. 1975 | 0.136 | 0.43 | | 0.77 | 108 | | 3.7 | RNAA |

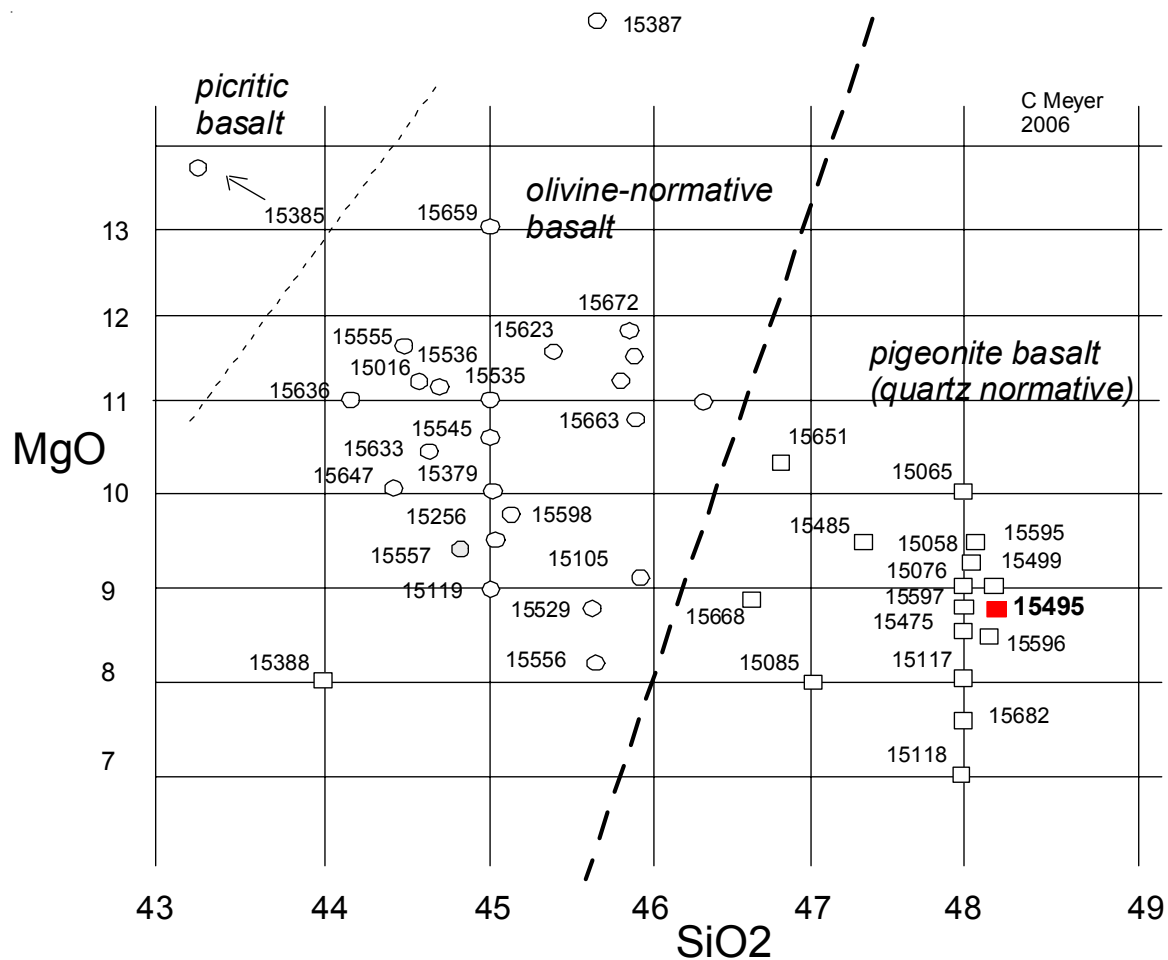


Figure 9: The big picture.

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