

15651

Olivine-normative Basalt

1.6 grams



Figure 1: Photo of 15651. Cube is 1 cm. S71-49769.

Mineralogical Mode

| | |
|-------------------|-----|
| Olivine | 3 % |
| Pyroxene | 62 |
| Plagioclase | 28 |
| Opaques | 5 |
| Silica | 0.3 |
| Meostasis | 1.7 |
| Dowty et al. 1973 | |

Introduction

The large rake sample from station 9a, Apollo 15 included 15651 (figure 1). It is a medium-grained olivine-bearing mare basalt with microgabbroic texture (figure 2). In places the texture has been somewhat cataclitized by shock.

Petrography

Dowty et al. (1973) reported the mineral mode and determined the composition of the major minerals (figure 3). Pyroxene and olivine are chemically zoned and similar to that of olivine-normative basalts. Opaque minerals occur in clumps (Nehru et al. 1974).

Chemistry

Ryder and Steele (1981) determined the composition, finding that 15651 was an olivine-normative basalt (although silica was a bit high).

Processing

There are three thin section of 15651.

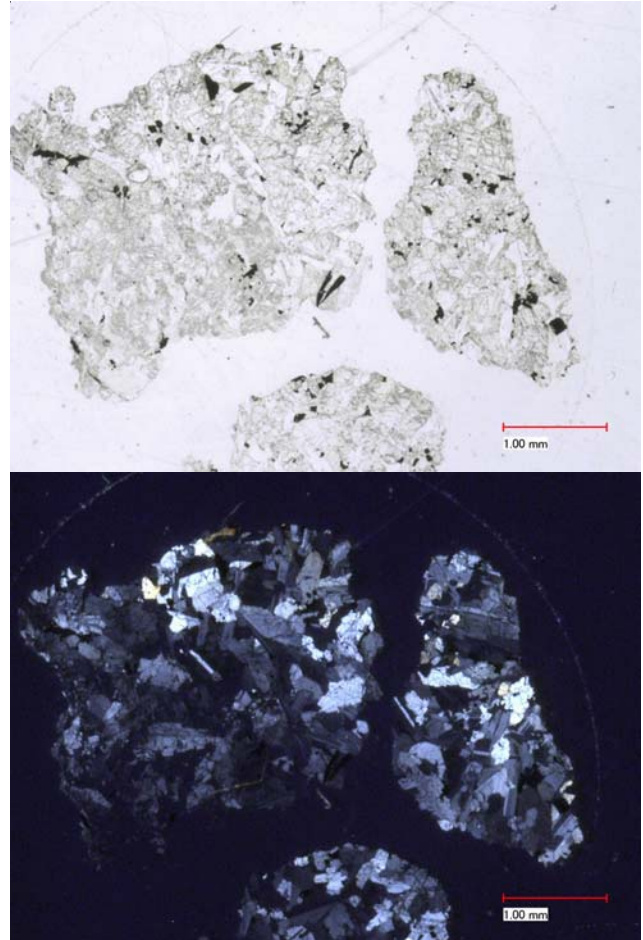


Figure 2: Photomicrograph of thin section 15651,7 by C Meyer @ 50x.

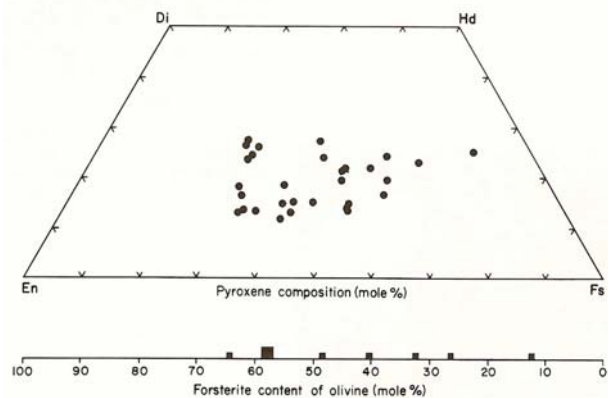


Figure 3: Composition of pyroxene and olivine in 15651 (Dowty et al. (1973)).

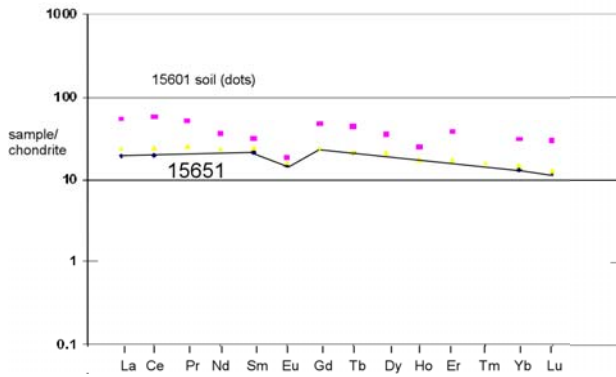


Figure 4: Normalized rare-earth-element diagram for 15651.

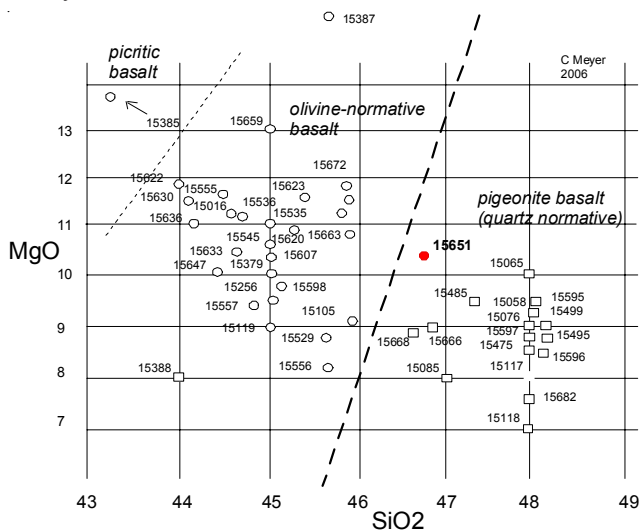


Figure 5: Comparison with other Apollo 15 basalts.

References for 15651.

Butler P. (1971) Lunar Sample Catalog, Apollo 15. Curators' Office, MSC 03209

Dowty E., Conrad G.H., Green J.A., Hlava P.F., Keil K., Moore R.B., Nehru C.E. and Prinz M. (1973a) Catalog of Apollo 15 rake samples from stations 2 (St. George), 7 (Spur Crater) and 9a (Hadley Rille). *Inst. Meteoritics Spec. Publ.* No 11, 51-73. Univ. New Mex. ABQ.

Dowty E., Prinz M. and Keil K. (1973b) Composition, mineralogy, and petrology of 28 mare basalts from Apollo 15 rake samples. *Proc. 4th Lunar Sci. Conf.* 423-444.

Lofgren G.E., Donaldson C.H. and Usselman T.M. (1975) Geology, petrology and crystallization of Apollo 15 quartz-normative basalts. *Proc. 6th Lunar Sci. Conf.* 79-99.

LSPET (1972a) The Apollo 15 lunar samples: A preliminary description. *Science* **175**, 363-375.

LSPET (1972b) Preliminary examination of lunar samples. Apollo 15 Preliminary Science Report. NASA SP-289, 6-1-6-28.

Nehru C.E., Prinz M., Dowty E. and Keil K. (1974) Spinel-group minerals and ilmenite in Apollo 15 rake samples. *Am. Mineral.* **59**, 1220-1235.

Ryder G. (1985) Catalog of Apollo 15 Rocks (three volumes). Curatorial Branch Pub. # 72, JSC#20787

Ryder G. and Steele A. (1988) Chemical dispersion among Apollo 15 olivine-normative mare basalts. *Proc. 18th Lunar Planet. Sci.* 273-282. Lunar Planetary Institute, Houston.

Swann G.A., Hait M.H., Schaber G.C., Freeman V.L., Ulrich G.E., Wolfe E.W., Reed V.S. and Sutton R.L. (1971b) Preliminary description of Apollo 15 sample environments. U.S.G.S. Interagency report: 36. pp219 with maps

Swann G.A., Bailey N.G., Batson R.M., Freeman V.L., Hait M.H., Head J.W., Holt H.E., Howard K.A., Irwin J.B., Larson K.B., Muehlberger W.R., Reed V.S., Rennilson J.J., Schaber G.G., Scott D.R., Silver L.T., Sutton R.L., Ulrich G.E., Wilshire H.G. and Wolfe E.W. (1972) 5. Preliminary Geologic Investigation of the Apollo 15 landing site. In Apollo 15 Preliminary Science Rpt. NASA SP-289. pages 5-1-112.

Table 1. Chemical composition of 15651.

| <i>reference weight</i> | Ryder88 | Dowty73 |
|--------------------------------|---------|--------------|
| SiO ₂ % | 46.8 | (b) 43.7 (c) |
| TiO ₂ | 2.04 | (b) 3.1 (c) |
| Al ₂ O ₃ | 9.9 | (b) 8.9 (c) |
| FeO | 20.3 | (b) 23.9 (c) |
| MnO | 0.37 | (b) 0.25 (c) |
| MgO | 10.3 | (b) 10.9 (c) |
| CaO | 10.3 | (b) 9 (c) |
| Na ₂ O | 0.33 | (b) 0.25 (c) |
| K ₂ O | | |
| P ₂ O ₅ | 0.11 | (b) 0.04 (c) |
| S % | | |
| <i>sum</i> | | |
| Sc ppm | 39.8 | (a) |
| V | | |
| Cr | 3422 | (a) |
| Co | 46.2 | (a) |
| Ni | | |
| Cu | | |
| Zn | | |
| Ga | | |
| Ge ppb | | |
| As | | |
| Se | | |
| Rb | | |
| Sr | | |
| Y | | |
| Zr | | |
| Nb | | |
| Mo | | |
| Ru | | |
| Rh | | |
| Pd ppb | | |
| Ag ppb | | |
| Cd ppb | | |
| In ppb | | |
| Sn ppb | | |
| Sb ppb | | |
| Te ppb | | |
| Cs ppm | | |
| Ba | | |
| La | 4.56 | (a) |
| Ce | 11.8 | (a) |
| Pr | | |
| Nd | | |
| Sm | 3.1 | (a) |
| Eu | 0.821 | (a) |
| Gd | | |
| Tb | 0.77 | (a) |
| Dy | | |
| Ho | | |
| Er | | |
| Tm | | |
| Yb | 2.11 | (a) |
| Lu | 0.293 | (a) |
| Hf | 2.2 | (a) |
| Ta | | |
| W ppb | | |
| Re ppb | | |
| Os ppb | | |
| Ir ppb | | |
| Pt ppb | | |
| Au ppb | | |
| Th ppm | 0.445 | (a) |
| U ppm | | |

technique (a) INAA, (b) fused-bead e-probe, (c) broad-beam e-probe