15659 MEDIUM-GRAINED OLIVINE-NORMATIVE MARE BASALT ST. 9A 12.60 g

INTRODUCTION: 15659 is a medium-grained, olivine-bearing, vesicular and vuggy mare basalt (Fig. 1). Small yellow-green olivines are visible macroscopically but are neither conspicuous nor phenocrystic. In chemistry, the sample is a magnesian member of the Apollo 15 olivine-normative mare basalt group. The sample has no zap pits but one surface is somewhat rounded, indicating possible exposure at some time. 15659 was collected as part of the rake sample at Station 9A.

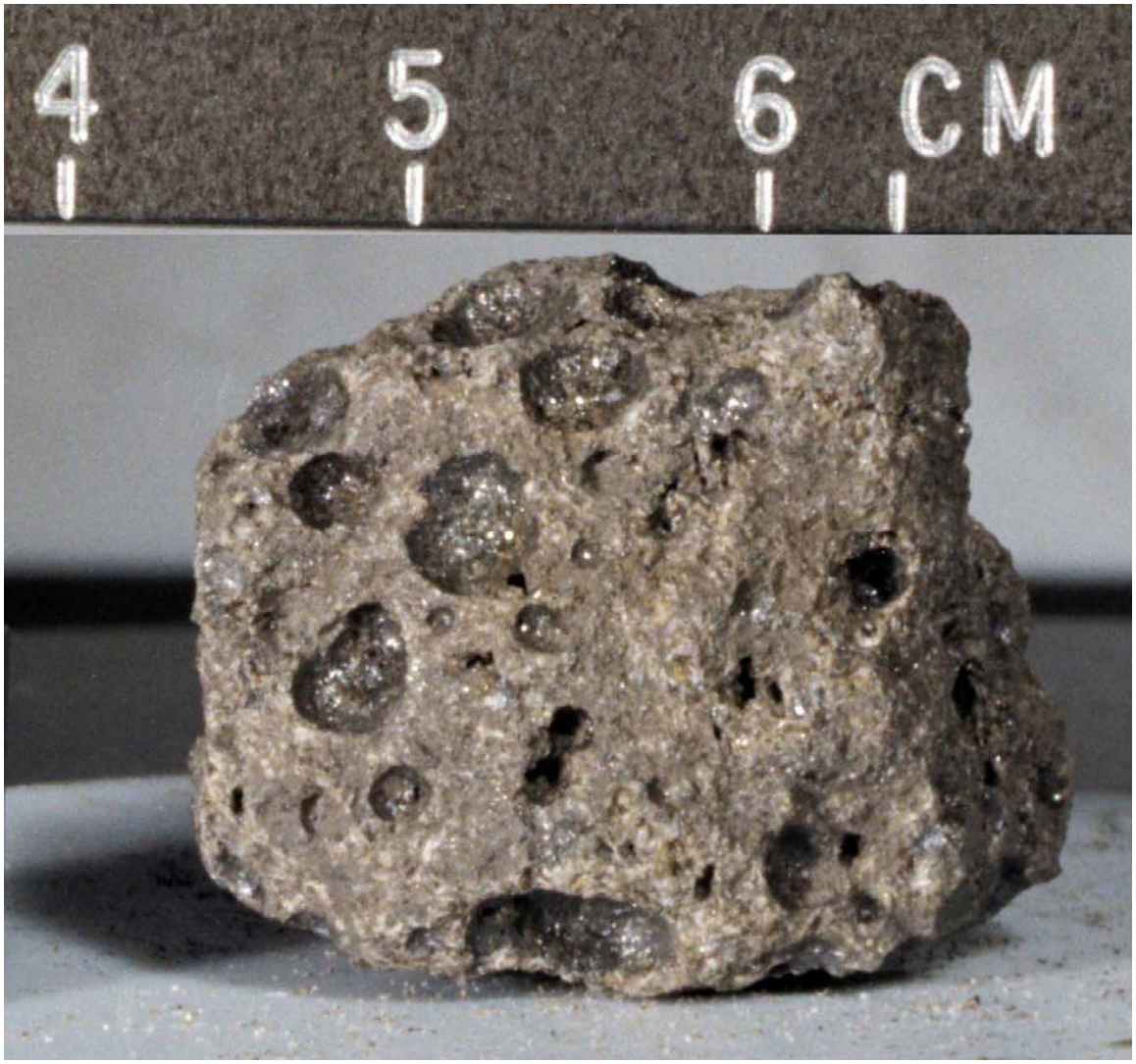

Figure 1. Pre-saw view of 15659. S-71-49756

PETROLOGY: 15659 is a vesicular, medium- to fine-grained, olivine-bearing mare basalt (Fig. 2). The pyroxenes are generally less than 1 mm long; they commonly enclose small olivines. Plagioclases tend to be lathy and interstitial. The small thin section lacks large olivines (all are less than half millimeter). Opaques include chromite, ulvospinel, and ilmenite. The residue occurs in local pockets and consists of glass, cristobalite, fayalite, troilite, ulvospinel, and ilmenite. Steele et al. (1972a) plotted plagioclase compositional data: $An_{93-90}$ with Fe of 0.4 to 0.65 wt%, similar to Apollo 12 and other Apollo 15 mare basalts.

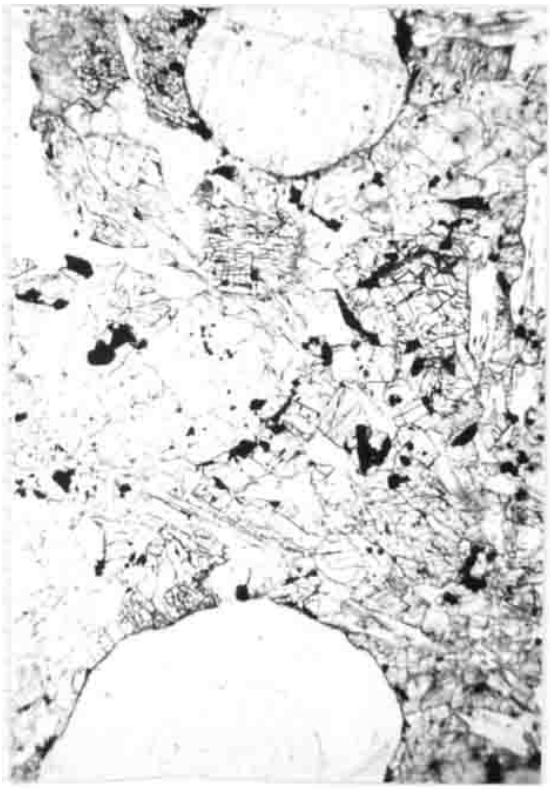

Fig. 2a

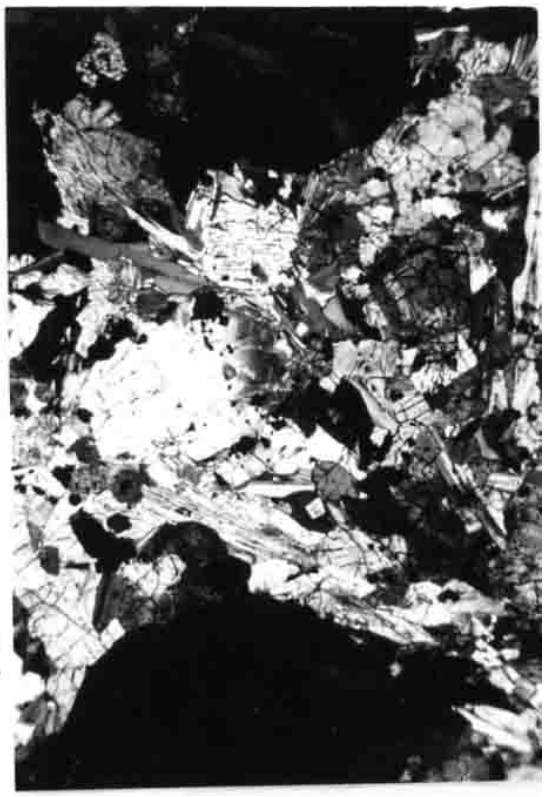

Fig. 2b

Figure 2. Photomicrographs of 15659,10.
Widths about 2 mm. a) transmitted light; b) crossed polarizers.

CHEMISTRY: Bulk rock analyses are shown in Table 1 and the rare earths are plotted in Figure 3. The chemistry is that of a fairly magnesian member of the Apollo 15 olivine-normative mare basalt group (e.g., Laul et al., 1972a). The La abundance of Christian et al. (1972) and Cuttitta et al. (1973) appears to be high and grossly unreliable, the Zr of Laul and Schmitt (1973) too high, and the Ca of Husain (1974) too low, even allowing for sampling errors. Cu was reported erroneously (as 0.32 ppm) in Cuttitta et al. (1973).

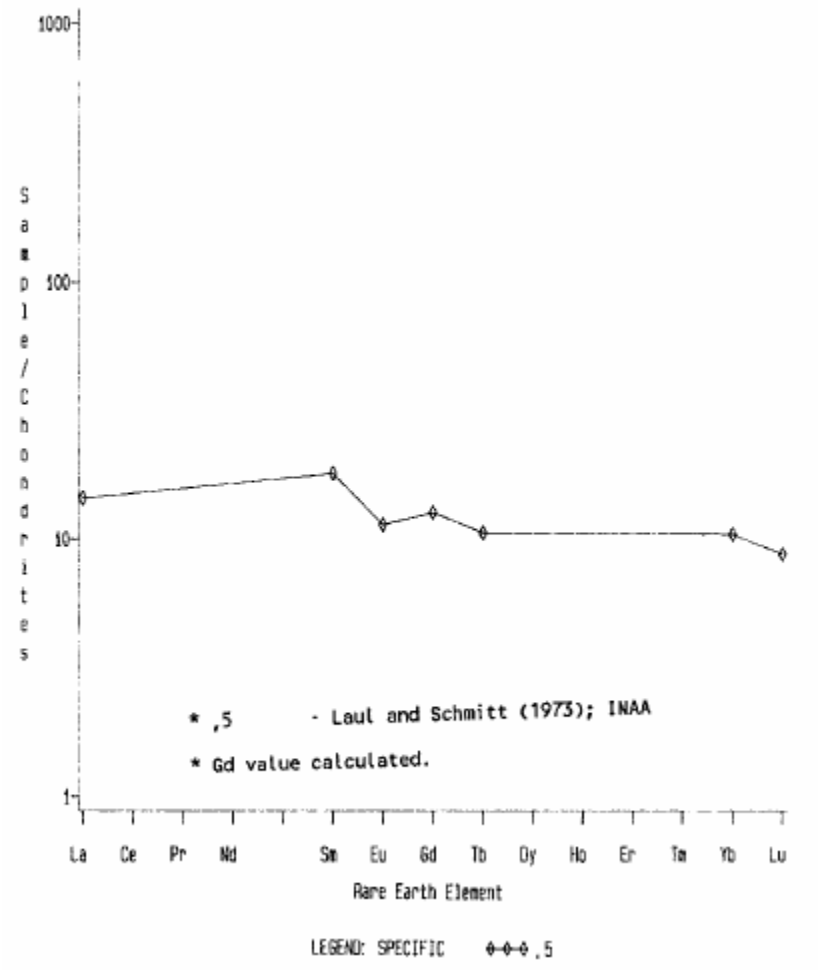


Figure 3. Rare earths in 15659.

TABLE 15659-1. Bulk rock chemical analyses

| | | ,4 | ,5 | ,3 |
|---|---|---|---|---|
| Wt % | SiO2 | 45.33 | | |
| | TiO2 | 2.25 | 2.4 | |
| | Al2O3 | 8.17 | 8.0 | |
| | FeO | 22.17 | 22.0 | |
| | MgO | 12.27 | 13 | |
| | CaO | 8.98 | 9.1 | 7.1 |
| | Na2O | 0.27 | 0.232 | |
| | K2O | 0.06 | 0.042 | 0.038 |
| | P2O5 | 0.12 | | |
| (ppm) | Sc | 37 | 37 | |
| | V | 215 | 260 | |
| | Cr | 3425 | 5820 | |
| | Mn | 2015 | 2170 | |
| | Co | 66 | 55 | |
| | Ni | 87 | | |
| | Rb | 1.0 | | |
| | Sr | 130 | | |
| | Y | 25 | | |
| | Zr | 67 | 200 | |
| | Nb | <10 | | |
| | Hf | | 2.5 | |
| | Ba | 62 | <120 | |
| | Th | | | |
| | U | | | |
| | Pb | | | |
| | La | 38 | 4.8 | |
| | Ce | | | |
| | Pr | | | |
| | Nd | | | |
| | Sm | | 3.3 | |
| | Eu | | 0.79 | |
| | Gd | | | |
| | Tb | | 0.50 | |
| | Dy | | | |
| | Ho | | | |
| | Er | | | |
| | Tm | | | |
| | Yb | 3.7 | 2.1 | |
| | Lu | | 0.30 | |
| | Li | 5.4 | | |
| | Be | | | |
| | B | | | |
| | C | | | |
| | N | | | |
| | S | | | |
| | F | | | |
| | Cl | | | |
| | Br | | | |
| | Cu | 32 | | |
| | Zn | | | |
| (ppb) | I | | | |
| | At | | | |
| | Ga | 3800 | | |
| | Ge | | | |
| | As | | | |
| | Se | | | |
| | Mo | | | |
| | Tc | | | |
| | Ru | | | |
| | Rh | | | |
| | Pd | | | |
| | Ag | | | |
| | Cd | | | |
| | In | | | |
| | Sn | | | |
| | Sb | | | |
| | Te | | | |
| | Cs | | | |
| | Ta | | 400 | |
| | W | | | |
| | Re | | | |
| | Os | | | |
| | Ir | | | |
| | Pt | | | |
| | Au | | | |
| | Hg | | | |
| | Tl | | | |
| | Bi | | | |
| | | (1) | (2) | (3) |

References and methods:

(1) Christian et al. (1972), Cuttitta et al. (1973); XRF, chemical, optical emiss. spec.
(2) Laul and Schmitt (1973): INAA
(3) Husain (1974): Ar isotopes, irradiation

RADIOGENIC ISOTOPES AND GEOCHRONOLOGY: Husain (1974) reported Ar isotopic data for temperature releases and found a $^{40}Ar$-$^{39}Ar$ high temperature (850° to 1400°C releases) plateau age of 3.34 ± 0.04 b.y. (Fig. 4), identical with the crystallization age of other Apollo 15 mare basalts.

RARE GASES AND EXPOSURE: Husain reported Ar isotopic data and an exposure age of 394 ± 20 m.y.

PROCESSING AND SUBDIVISIONS: 15659 was sawn to produce a slab (,2), and a tiny end (,1), leaving ,0 as 9.81 g. ,1 was used to make thin section ,10. ,2 was subdivided and partly used for the chemical and isotopic analyses (,3 to ,5).

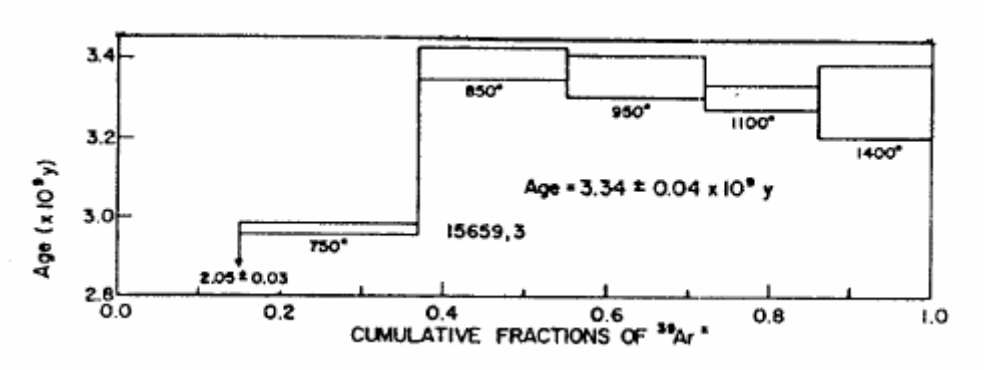


Figure 4. Ar plateau age for 15659 (Husain; 1974).