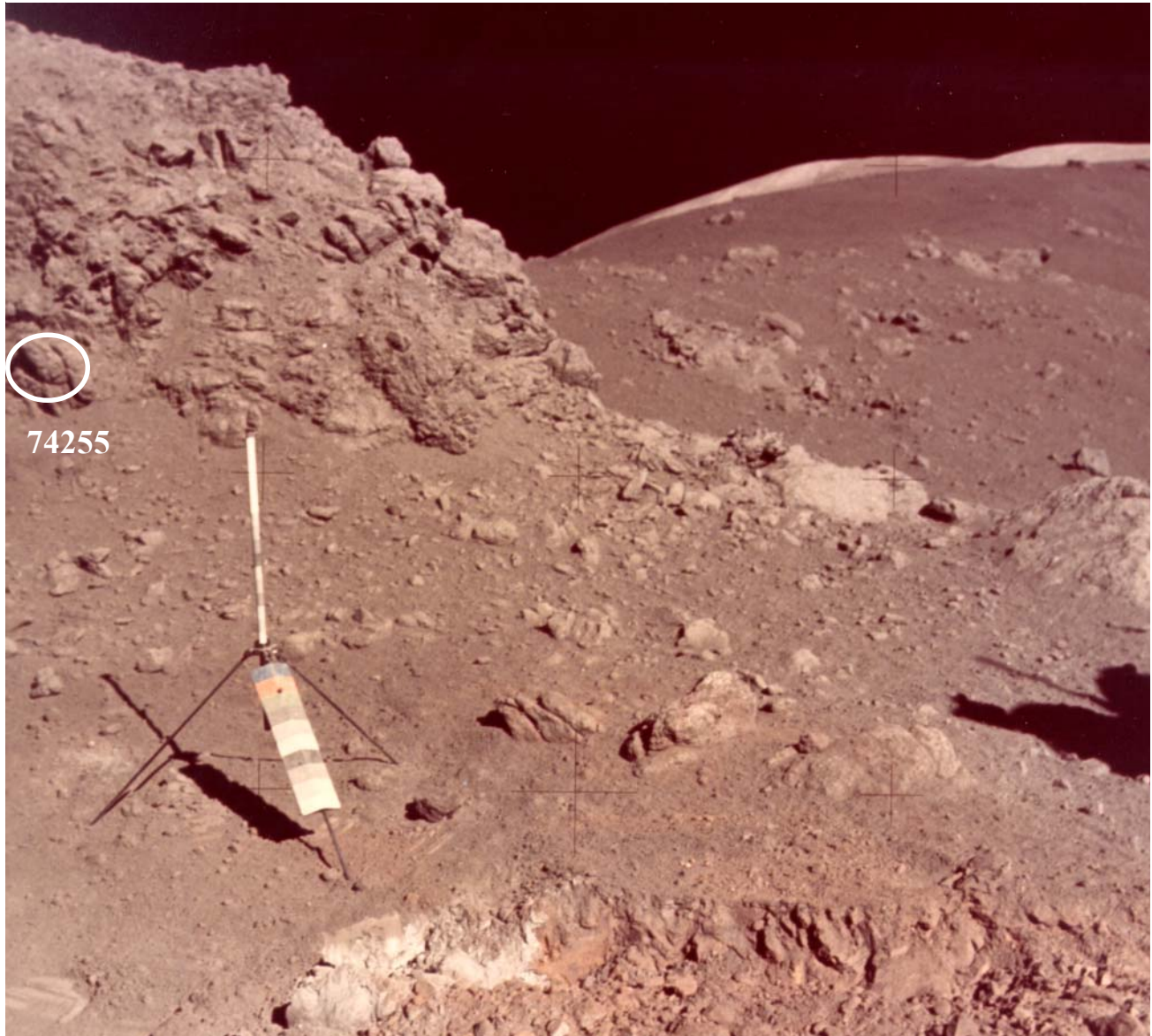


**74255**  
Ilmenite Basalt  
737.6 grams



*Figure 1: Picure of 5 meter boulder on rim of Shorty Crater showing where 74255 was collected. Trench in foreground is location of orange soil sample 74220. Photo number AS17-137-20990*

- CC We'd like to get a quick sample of the basalt up there on the rim, and Gene's stereo pan, and then press on.
- LMP OK, Bob, I'll get a sample. I'll sample it by hand. But, it'll be documented. And I'll get it in a bag in a minute since I don't have any. Basalt (74255) is in bag 512.
- CDR From where I am, about 100 meters around the west side of the rim of this crater, the mantle on the inside of the rim runs from this gray material we've been

- sampling in here – to a very dark gray material. And there's a lot of . . . stuff that goes down – radially down into the pit of the crater. I got to take a couple more pictures at that contact slope over there. I know you can't see it from where you are jack, but I guess we got to leave. Otherwise it would be nice to sample that dark stuff up on top.
- LMP Bag 461 has another sample of basalt (74275) that I picked up right near where we dug the trench.



Figure 2: Photo of 74255 (B1 surface). NASA S73-16905. Cube edge is 1 cm.

### **Introduction**

74255 was chipped from a large boulder on the rim of Shorty Crater (figure 1). It is a vesicular porphyritic, coarse-grained basalt with abundant ilmenite (high-Ti, type C) and is apparently identical to 74275. It is rounded with micrometeorite pits on one side and has one prominent fracture (figure 2). The crystallisation age of 74255 is about 3.8 b.y. with an exposure age of about 17 m.y. (age of Shorty Crater ~ 19 m.y.).

### **Petrography**

Dymek et al. (1975) carefully described the texture of 74255 and determined the chemical composition of all the phases. The crystallization sequence for 74255 starts with armalcolite and Cr-spinel, which are found as unreacted inclusions in both olivine and pyroxene cores. Olivine crystallized next, reacting with the melt to form augite before armalcolite ceased crystallization. Ilmenite was next and is included in the augite phenocrysts as they zone to become more Fe-rich, followed by plagioclase and pigeonite which coprecipitated forming bundles of minerals defining

the basaltic texture. Fe-rich pyroxene, silica, Na-plagioclase and potassic mesostasis formed last (figure 3).

### **Mineralogy**

**Olivine:** Small olivine grains ( $\text{Fo}_{70}$ ) are found as cores of larger pyroxene phenocrysts (Dymek et al. 1975).

**Plagioclase:** Plagioclase ranges in composition from  $\text{An}_{86}$  to  $\text{An}_{76}$  with an average about  $\text{An}_{82}\text{Ab}_{14}\text{Or}_{0.5}$

**Pyroxene:** The cores of the pyroxene grains in 74255 are subcalcic augite ( $\sim\text{Wo}_{33}\text{En}_{52}\text{Fs}_{15}$ ), figure 4) with rims that are Fe-rich. Large pyroxene grains (4 mm) are often composite with complex zoning including hourglass structures. Some pigeonite coprecipitated.

**Ilmenite:** There is an abundance of ilmenite (figure 3).

### **Mineralogical Mode for 74255**

|             | Agrell<br>PET | Brown et<br>al. 1975 | Dymek et<br>al. 1975 |
|-------------|---------------|----------------------|----------------------|
| Olivine     | 5 %           | 3.2 %                | 3.2                  |
| Plagioclase | 33            | 18                   | 27.6                 |
| Pyroxene    | 46            | 48.6                 | 50.7                 |
| Opakes      | 16            | 38.6                 | 15.1                 |
| Mesostasis  | 1             | 1.8                  | 1.7                  |



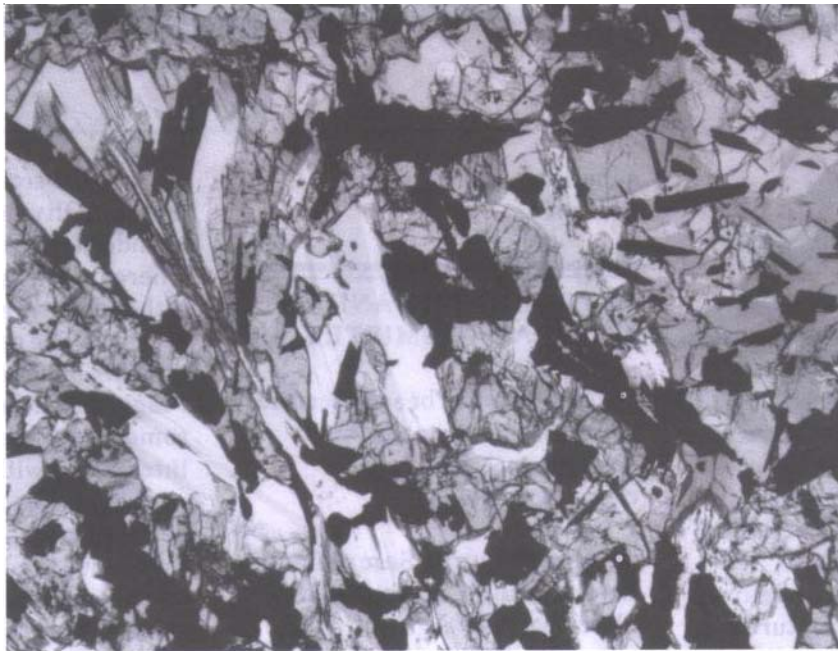


Figure 3: Photomicrograph of thin section of 74255 (from Neal and Taylor 1993). Field of view is 2.5 mm.

**Armalcolite:** Dymek et al. (1975) found rare grains of unmantled armalcolite in olivine and augite cores (table), but often rimmed by ilmenite within outer zones of pyroxene.

### Chemistry

The chemical composition of 74255 has been determined by Rhodes et al. (1976), Rose et al. (1975) and Dymek et al. (1975) (table 1). Trace element analyses are found in papers by Shih et al. (1975), Nunes et al. (1974) and Hughes and Schmitt (1985) (figure 6). The Ba/Rb vs. Sm discriminator groups it with type C, Apollo 17 basalts (figure 6). Hey, it's identical to 74275!

### Radiogenic age dating

Nyquist et al. (1976) and Murthy and Coscio (1976) dated 74255 by Rb/Sr (figures 7 and 8), consistent with the old age determined for 74275. Paces et al. (1991) give additional whole rock data for Sr and Sm isotopes.

**Table 2: Analysis of armalcolite.**

|                                |        |
|--------------------------------|--------|
| SiO <sub>2</sub>               | 0.07   |
| Al <sub>2</sub> O <sub>3</sub> | 2.12   |
| TiO <sub>2</sub>               | 73.15  |
| Cr <sub>2</sub> O <sub>3</sub> | 1.59   |
| FeO                            | 17.35  |
| MnO                            | 0.16   |
| MgO                            | 6.2    |
| ZrO <sub>2</sub>               | 0.09   |
| total                          | 100.73 |
| Dymek et al. 1975              |        |

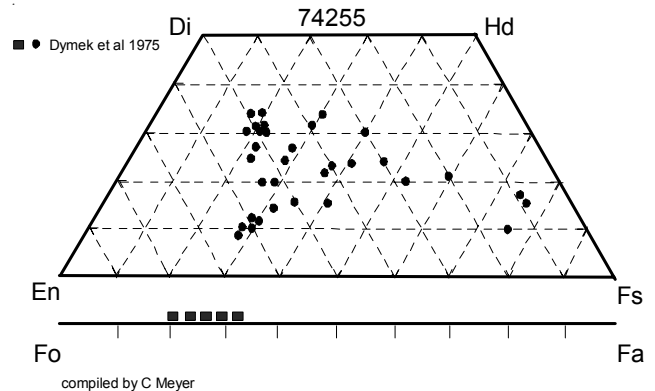


Figure 4: Pyroxene and olivine composition of 74255 (copied as best I can, from Dymek et al. 1975, with apologies).

### Cosmogenic isotopes and exposure ages

Eugster et al. (1977) and Morgelli et al. (1977) determined the cosmic-ray exposure age 17.3 m.y. by <sup>81</sup>Kr method. Considering partial shielding from the boulder, this is consistent with other exposure age determinations and it is concluded from these studies that the age of Shorty Crater is ~19 m.y.

### Other Studies

Usselman et al. (1975) determined the cooling rate of 74255 to be ~ 1 – 3 deg/hr.

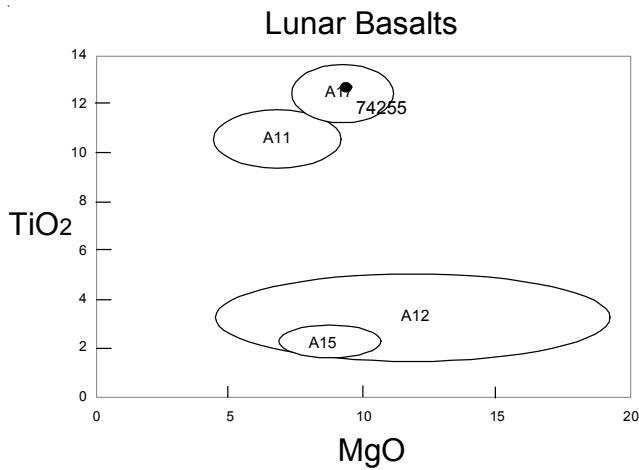


Figure 5: Chemical composition of 74255 compared with other Apollo basalts.

### Processing

A small slab was cut from 74255 in 1976 (figure 9).

There are two PAO display samples, one at the Onizuka Space Center, Kailua-Kona, Hawaii (figure 11). There are 12 thin sections.

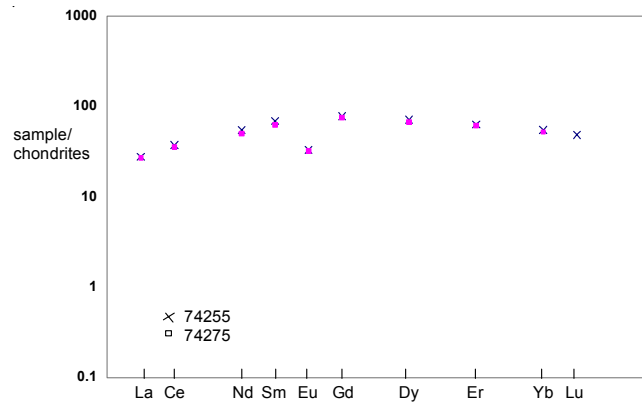
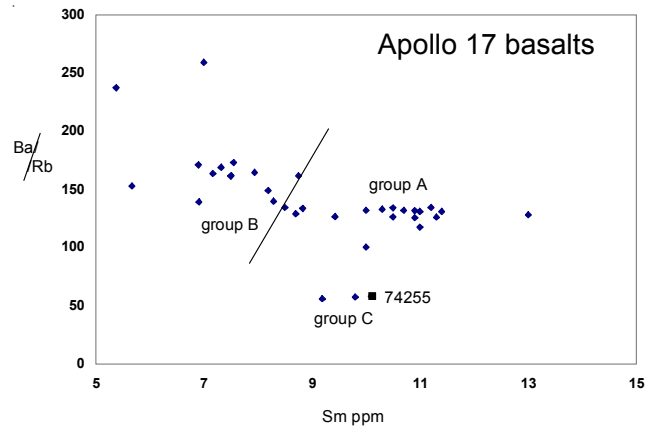


Figure 6: Trace element composition of 74255 showing that it is type C, A17 basalt.

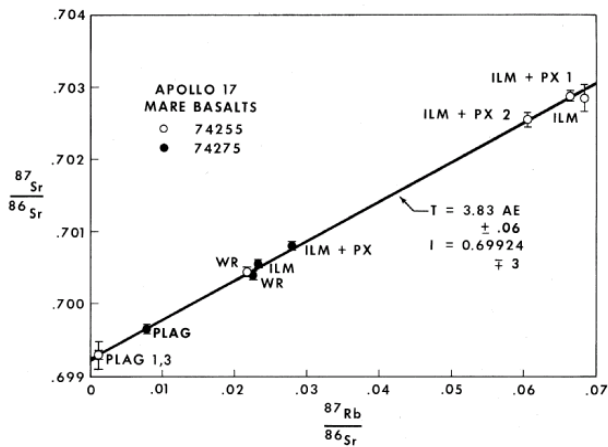


Figure 7: Internal Rb-Sr isochron for 74255 (Nyquist et al. 1976).

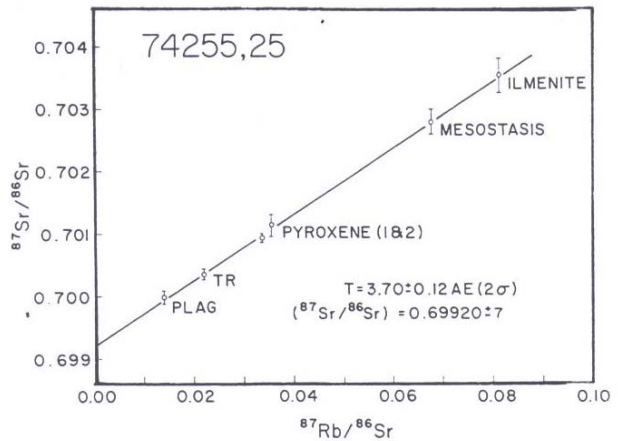


Figure 8: Internal Rb-Sr isochron for 74255 (Murthy and Coscio 1976).

### Summary of Age Data for 74255

|                        | Rb/Sr            |
|------------------------|------------------|
| Nyquist et al. 1976    | 3.83 ± 0.06 b.y. |
| Murthy and Coscio 1976 | 3.7 ± 0.12       |

Caution: Decay constant?

**Table 1. Chemical composition of 74255.**

| <i>reference weight</i>        | Wiesmann75<br>Shih 1975 | Nunes74<br>Hughes85 | Rhodes76  | Rose75    | Dymek75  | Gibson75<br>Murthy76 | Paces91  | Neal2001 |
|--------------------------------|-------------------------|---------------------|-----------|-----------|----------|----------------------|----------|----------|
| SiO <sub>2</sub> %             |                         |                     | 37.96 (c) | 38.4 (d)  | 38.7 (e) |                      |          |          |
| TiO <sub>2</sub>               |                         |                     | 12.17 (c) | 12.76 (d) | 12.6 (e) |                      |          |          |
| Al <sub>2</sub> O <sub>3</sub> |                         |                     | 8.55 (c)  | 8.84 (d)  | 9 (e)    |                      |          |          |
| FeO                            |                         |                     | 18.11 (c) | 17.98 (d) | 17.6 (e) |                      |          |          |
| MnO                            |                         |                     | 0.27 (c)  | 0.28 (d)  | 0.23 (e) |                      |          |          |
| MgO                            |                         |                     | 10.5 (c)  | 10.72 (d) | 10.7 (e) |                      |          |          |
| CaO                            |                         |                     | 10.35 (c) | 10.2 (d)  | 10.2 (e) |                      |          |          |
| Na <sub>2</sub> O              |                         |                     | 0.36 (c)  | 0.37 (d)  | 0.39 (e) |                      |          |          |
| K <sub>2</sub> O               | 0.081                   | (a)                 | 0.08 (c)  | 0.1 (d)   | 0.05 (e) | 0.087                | (a)      |          |
| P <sub>2</sub> O <sub>5</sub>  |                         |                     | 0.05 (c)  | 0.06 (d)  | 0.03 (e) |                      |          |          |
| S %                            |                         |                     | 0.11 (c)  |           | 0.08 (e) | 0.1625               |          |          |
| <i>sum</i>                     |                         |                     |           |           |          |                      |          |          |
| Sc ppm                         | 74                      | (b)                 |           | 62 (d)    |          |                      |          | 75 (f)   |
| V                              |                         |                     |           | 65 (d)    |          |                      |          | 103 (f)  |
| Cr                             |                         |                     | 4884 (c)  |           |          |                      |          | 4147 (f) |
| Co                             | 22                      | (b)                 |           | 34 (d)    |          |                      |          | 25 (f)   |
| Ni                             |                         |                     |           | 17 (d)    |          |                      |          | 5.55 (f) |
| Cu                             |                         |                     |           | 36 (d)    |          |                      |          | 36 (f)   |
| Zn                             |                         |                     |           | 5.4 (d)   |          |                      |          | 84.3 (f) |
| Ga                             |                         |                     |           | 6.1 (d)   |          |                      |          | 3.6 (f)  |
| Ge ppb                         |                         |                     |           |           |          |                      |          |          |
| As                             |                         |                     |           |           |          |                      |          |          |
| Se                             |                         |                     |           |           |          |                      |          |          |
| Rb                             | 1.22                    | (a)                 |           | 1.5 (d)   |          | 1.2 (a)              | 1.19 (a) | 1.21 (f) |
| Sr                             | 163                     | (a)                 |           | 165 (d)   |          | 158 (a)              | 160 (a)  | 169 (f)  |
| Y                              |                         |                     |           | 126 (d)   |          |                      |          | 111 (f)  |
| Zr                             | 238                     | (a)                 | 307 (b)   | 310 (d)   |          |                      |          | 276 (f)  |
| Nb                             |                         |                     |           |           |          |                      |          | 25 (f)   |
| Mo                             |                         |                     |           |           |          |                      |          | 0.03 (f) |
| Ru                             |                         |                     |           |           |          |                      |          |          |
| Rh                             |                         |                     |           |           |          |                      |          |          |
| Pd ppb                         |                         |                     |           |           |          |                      |          |          |
| Ag ppb                         |                         |                     |           |           |          |                      |          |          |
| Cd ppb                         |                         |                     |           |           |          |                      |          |          |
| In ppb                         |                         |                     |           |           |          |                      |          |          |
| Sn ppb                         |                         |                     |           |           |          |                      |          |          |
| Sb ppb                         |                         |                     |           |           |          |                      |          |          |
| Te ppb                         |                         |                     |           |           |          |                      |          |          |
| Cs ppm                         |                         |                     |           |           |          |                      |          | 0.03 (f) |
| Ba                             | 71.1                    | (a)                 |           | 288 (d)   |          |                      |          | 72 (f)   |
| La                             | 6.5                     | (a)                 |           |           |          |                      |          | 6.47 (f) |
| Ce                             | 22.5                    | (a)                 |           |           |          |                      |          | 24.8 (f) |
| Pr                             |                         |                     |           |           |          |                      |          | 4.08 (f) |
| Nd                             | 24.7                    | (a)                 |           |           |          |                      | 23.9 (a) | 26.4 (f) |
| Sm                             | 10.1                    | (a)                 |           |           |          |                      | 9.79 (a) | 12.1 (f) |
| Eu                             | 1.85                    | (a)                 |           |           |          |                      |          | 1.9 (f)  |
| Gd                             | 15.3                    | (a)                 |           |           |          |                      |          | 16.9 (f) |
| Tb                             |                         |                     |           |           |          |                      |          | 2.8 (f)  |
| Dy                             | 17.3                    | (a)                 |           |           |          |                      |          | 17.8 (f) |
| Ho                             |                         |                     |           |           |          |                      |          | 3.53 (f) |
| Er                             | 10                      | (a)                 |           |           |          |                      |          | 9.54 (f) |
| Tm                             |                         |                     |           |           |          |                      |          | 1.4 (f)  |
| Yb                             | 8.93                    | (a)                 |           | 11 (d)    |          |                      |          | 10 (f)   |
| Lu                             | 1.18                    | (a)                 |           |           |          |                      |          | 1.31 (f) |
| Hf                             |                         |                     | 10 (b)    |           |          |                      |          | 8.58 (f) |
| Ta                             |                         |                     |           |           |          |                      |          | 1.55 (f) |
| W ppb                          |                         |                     |           |           |          |                      |          | 150 (f)  |
| Re ppb                         |                         |                     |           |           |          |                      |          |          |
| Os ppb                         |                         |                     |           |           |          |                      |          |          |
| Ir ppb                         |                         |                     |           |           |          |                      |          |          |
| Pt ppb                         |                         |                     |           |           |          |                      |          |          |
| Au ppb                         |                         |                     |           |           |          |                      |          |          |
| Th ppm                         |                         |                     | 0.445 (a) |           |          |                      |          | 0.42 (f) |
| U ppm                          | 0.14                    | (a)                 | 0.132 (a) |           |          |                      |          | 0.16 (f) |

*technique: (a) IDMS, (b) INAA, (c) XRF, (d) microchem., (e) calculated, (f) ICP-MS*

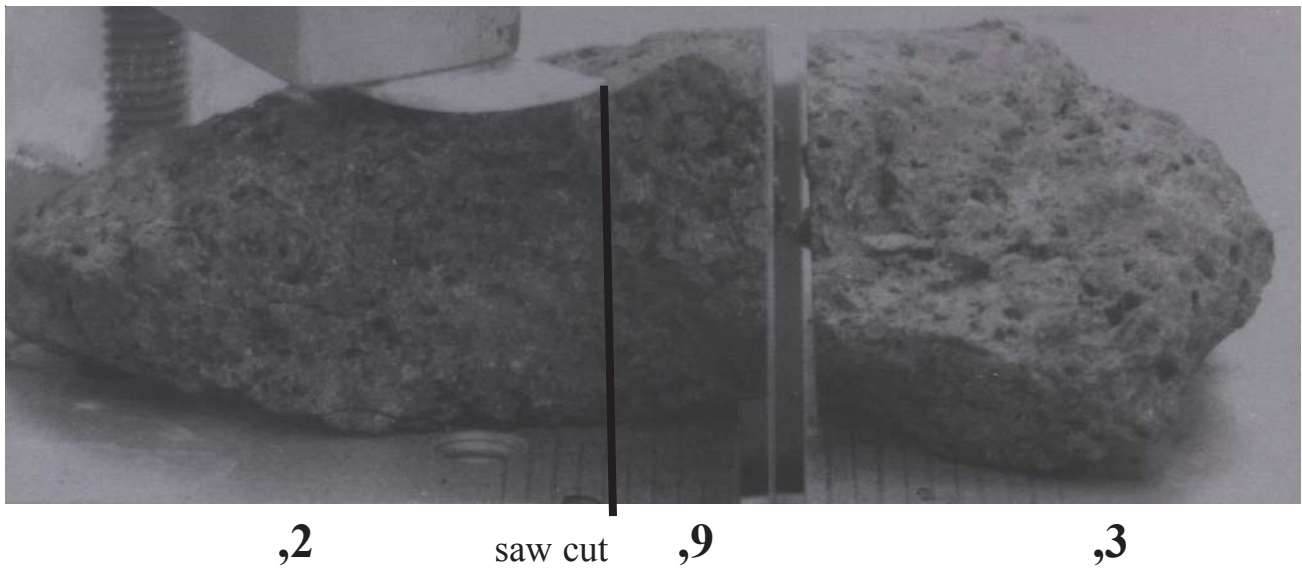


Figure 9: Cutting plan for 74255,2. Photo from data pack. Slab is 1 cm thick.

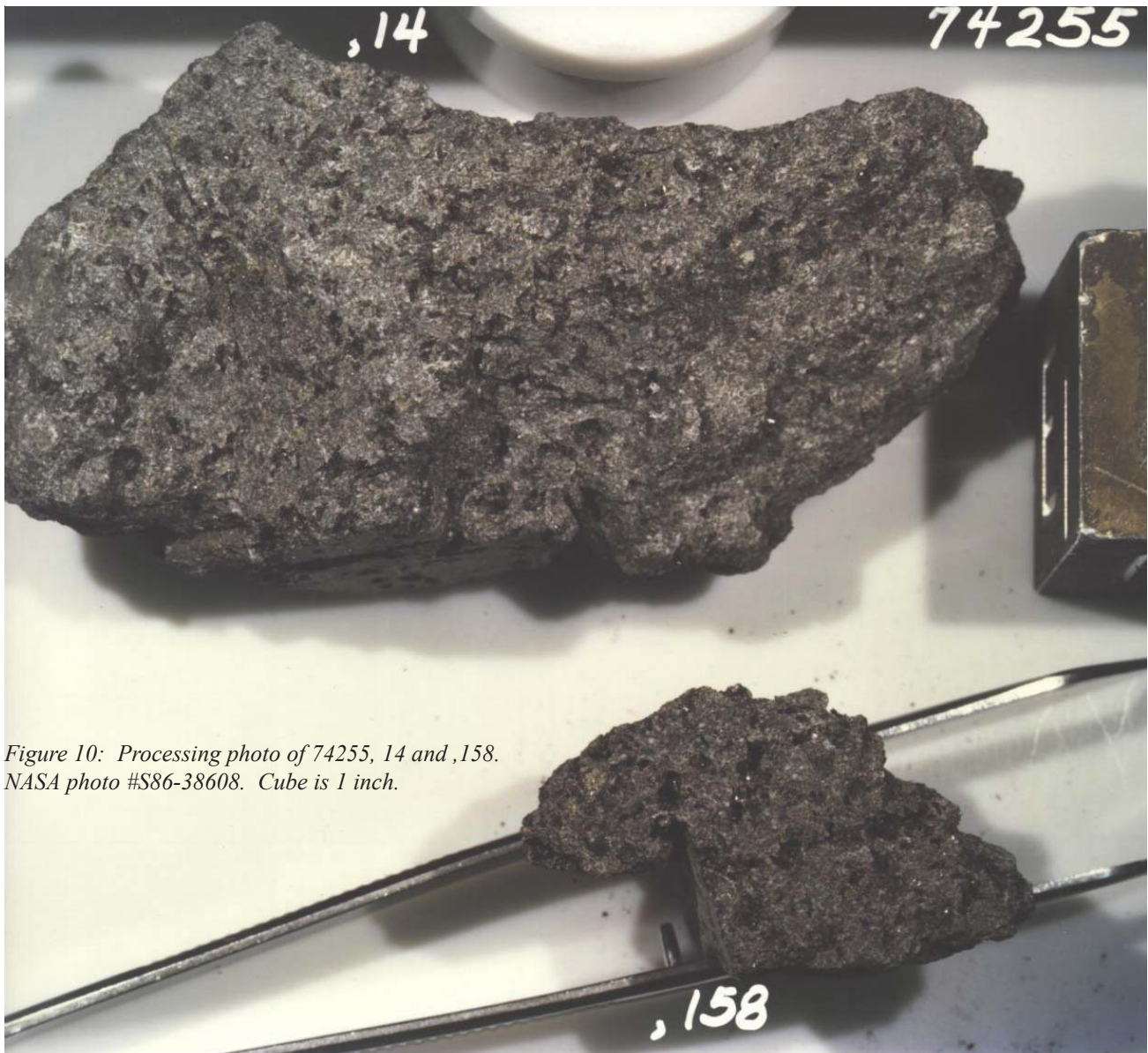


Figure 10: Processing photo of 74255, 14 and ,158.  
NASA photo #S86-38608. Cube is 1 inch.



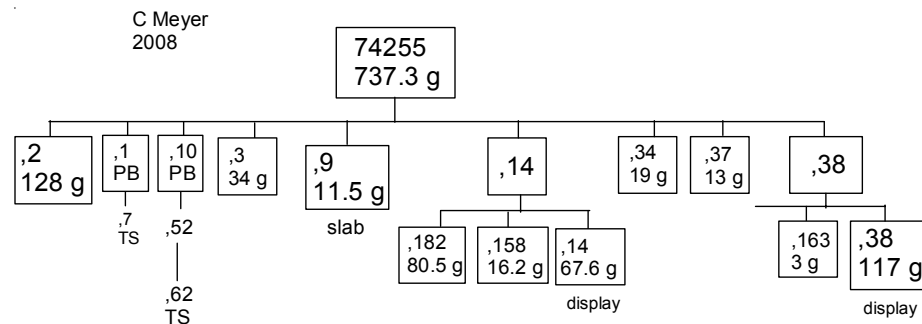


Figure 11: Display sample 74255.38.

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