# 15241 and 15251

Soils

348 and 601 grams

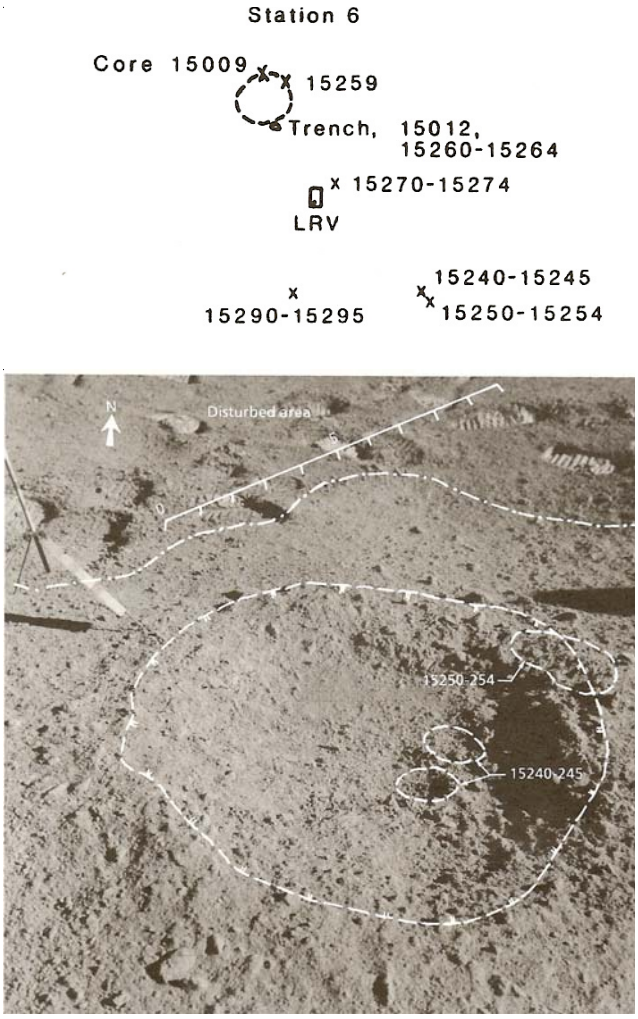



*Figure 1: Location of soil samples 15241 and 15251 from bottom and rim of approx. 1 m crater at station 6 (Apennine Front). AS15-86-11610.*

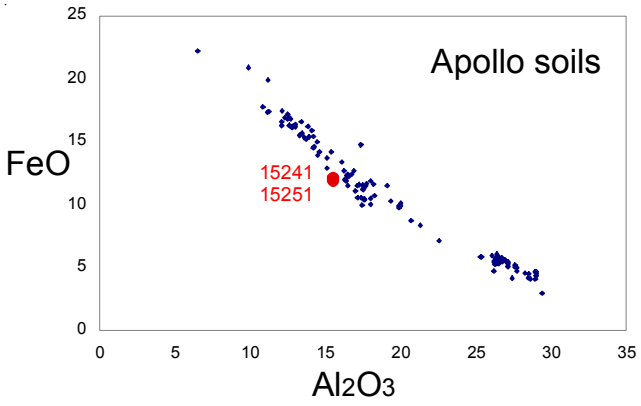



*Figure 2: Composition of 15241 and 15251 compared with other Apollo soil samples.*

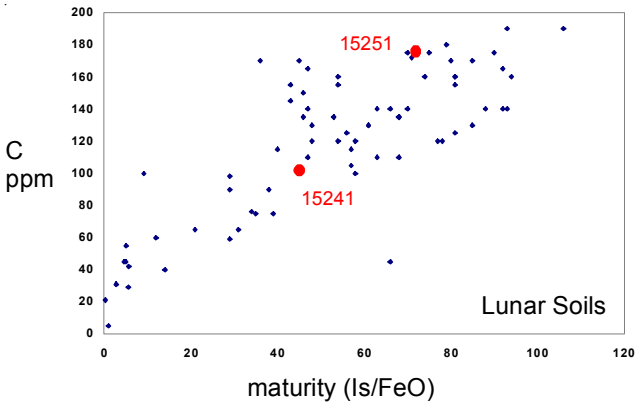



*Figure 3: Carbon content and maturity of 15241 and 15251 (Moore et al. 1973; Morris 1978).*

## Introduction

Sample 15250 was collected from the rim of a 1 meter crater at station 6, Apollo 15, on the lower slopes of the Apennine Front. The lunar surface in the vicinity of the crater had numerous small rocks exposed (figure 1) indicating the crater was "fresh". 15240 was collected from the bottom of the crater and included numerous fragments of soil breccia with glass coating, both in the coarse-fines and in the >1cm fraction (labeled 15245).

## Petrography

The maturity index ($I_s$/FeO) for 15241 is 45 (submature); and for 15251 is 75 (mature). The average grain size is 42 microns for 15251 and 103 microns for 15241. 15241 does not have normal grain size distribution, with too many coarse particles (figure 5a).

Powell (1972) and Ryder and Sherman (1989) cataloged the coarse-fine particles.

Ryder et al. (1987) studied some of the coarse-fine particles from 15243, finding 9 KREEP basalt, 20 regolith breccia, ~13 impact melt rocks and only one cataclastic anorthosite.

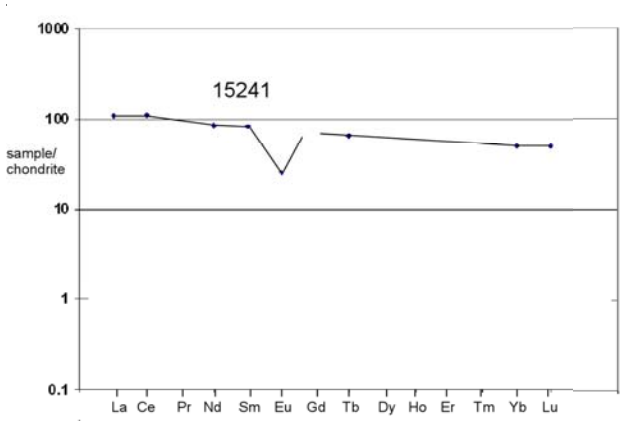



*Figure 4: Normalized rare-earth-element diagram for 15241.*

## Chemistry

Palme et al. (1978), Korotev (1987), Cuttitta et al. (1973) and other determined the chemical composition (figures 2 and 4).

Moore et al. (1973) determined 100 ppm and 175 ppm C for 15240 and 15250 respectively (figure ). Reed et al. (1972) also determined the halogens, Li, Hg Te, Ru and Os in 15251.

Walker and Papike (1981) used chemical mixing model techniques to calculate that 15251 was 30 % KREEP, 31 % mare basalt and 33 % LKFM.

## Radiogenic age dating

The age of this (young) carter has not been determined.

## Other Studies

Bogard and Nyquist (1973) determined the rare gas content and isotopic ratios of 15251.

## Processing

15240 and 15250 were returned in a sealed ALSRC (#1) and have only been exposed to dry $GN_2$ in the curation cabinets.

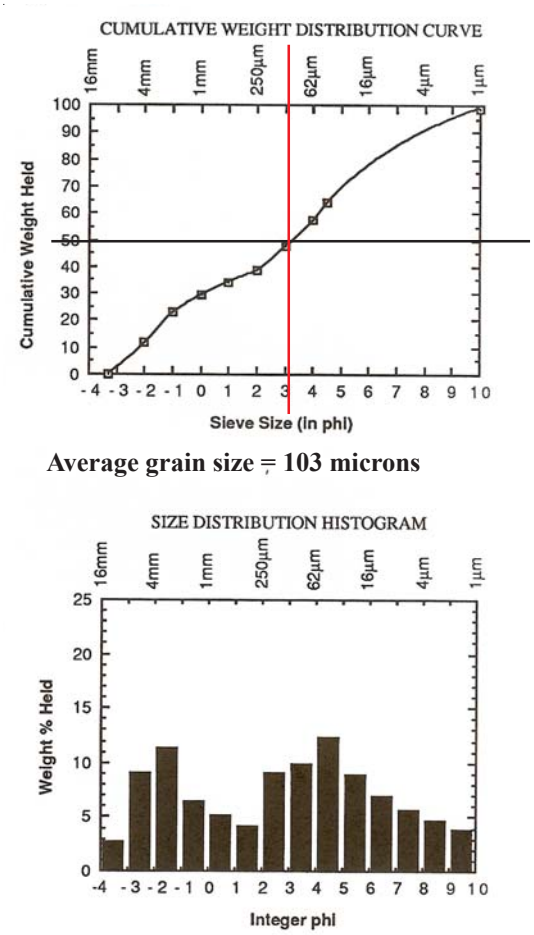



*Figure 5a: Grain size distribution for 15240 (Graf 1993).*

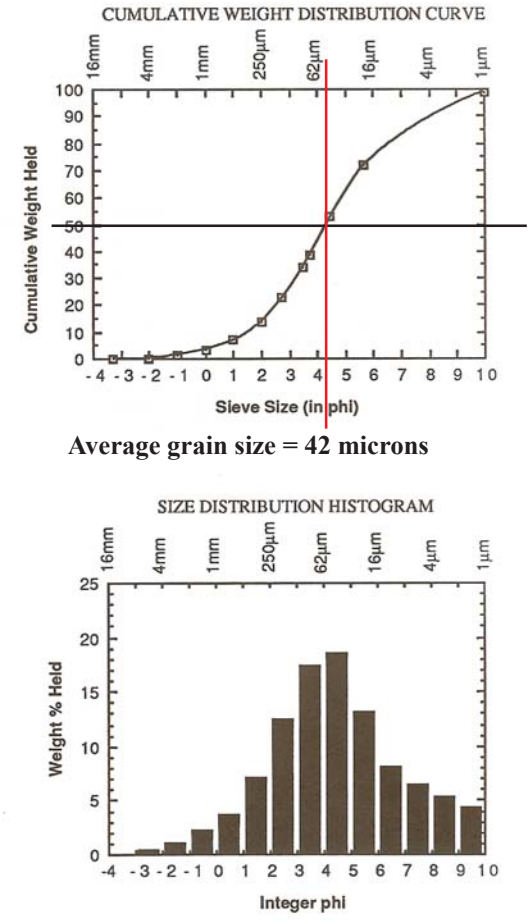



*Figure 5b: Grain size distribution for 15250 (Graf 1993).*

## Table 1. Chemical composition of 15241.

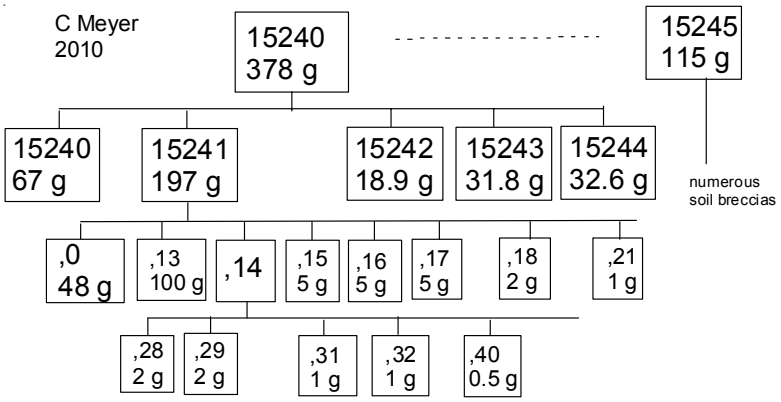
| | | | | | 15245 | |
|---|---|---|---|---|---|---|
| *reference* | Palme78 | | Korotev87 | | Brunfelt72 | |
| *weight* | | | | | | |
| SiO2 % | 46.7 | (a) | | | | |
| TiO2 | 1.55 | | 1.55 | (a) | 1.23 | (a) |
| Al2O3 | 16.5 | | 16.5 | (a) | 15.8 | (a) |
| FeO | 12 | | 12.4 | (a) | 12 | (a) |
| MnO | 0.16 | | | | 0.17 | (a) |
| MgO | 10.4 | | 10.4 | (a) | 9.9 | (a) |
| CaO | 11 | | 11.3 | (a) | 9.8 | (a) |
| Na2O | 0.48 | | 0.46 | (a) | 0.46 | (a) |
| K2O | 0.2 | | | | | |
| P2O5 | 0.22 | | | | | |
| S % | 0.074 | | | | | |
| *sum* | | | | | | |
| | | | | | | |
| Sc ppm | 24.7 | (a) | 25.4 | (a) | 21.9 | (a) |
| V | | | | | 76 | (a) |
| Cr | 2335 | (a) | 2410 | (a) | 2250 | (a) |
| Co | 39.6 | (a) | 38.8 | (a) | 38.8 | (a) |
| Ni | 270 | (a) | 212 | (a) | 180 | (a) |
| Cu | | | | | | |
| Zn | | | | | | |
| Ga | 4.3 | (a) | | | | |
| Ge ppb | | | | | | |
| As | | | | | | |
| Se | | | | | | |
| Rb | | | | | 6.3 | (a) |
| Sr | 140 | (a) | 155 | (a) | 115 | (a) |
| Y | 86 | (a) | | | | |
| Zr | 360 | (a) | 390 | (a) | | |
| Nb | 25 | (a) | | | | |
| Mo | | | | | | |
| Ru | | | | | | |
| Rh | | | | | | |
| Pd ppb | | | | | | |
| Ag ppb | | | | | | |
| Cd ppb | | | | | | |
| In ppb | | | | | | |
| Sn ppb | | | | | | |
| Sb ppb | | | | | | |
| Te ppb | | | | | | |
| Cs ppm | 0.23 | (a) | 0.27 | (a) | | |
| Ba | 274 | (a) | 262 | (a) | 210 | (a) |
| La | 27.2 | (a) | 25.5 | (a) | 25 | (a) |
| Ce | 71.8 | (a) | 67 | (a) | | |
| Pr | | | | | | |
| Nd | 45 | (a) | 38 | (a) | | |
| Sm | 11.65 | (a) | 12.2 | (a) | 12.1 | (a) |
| Eu | 1.43 | (a) | 1.41 | (a) | 1.8 | (a) |
| Gd | 12.6 | (a) | | | | |
| Tb | 2.43 | (a) | 2.38 | (a) | 2.71 | (a) |
| Dy | 15.6 | (a) | | | 10 | (a) |
| Ho | 3.56 | (a) | | | | |
| Er | | | | | | |
| Tm | 1.61 | (a) | | | | |
| Yb | 9.23 | (a) | 8.1 | (a) | 10.7 | (a) |
| Lu | 1.26 | (a) | 1.23 | (a) | | |
| Hf | 9.34 | (a) | 9.6 | (a) | 10.5 | (a) |
| Ta | 1.25 | (a) | 1.16 | (a) | 1.25 | (a) |
| W ppb | | | | | | |
| Re ppb | | | | | | |
| Os ppb | | | | | | |
| Ir ppb | 10 | (b) | 8.1 | (a) | | |
| Pt ppb | | | | | | |
| Au ppb | 8 | (b) | 2.7 | (a) | | |
| Th ppm | 3.84 | (a) | 4.2 | (a) | 3.98 | (a) |
| U ppm | 0.96 | (a) | 1.02 | (a) | 1.02 | (a) |
| *technique:* | *(a) INAA, (b) RNAA* | | | | | |

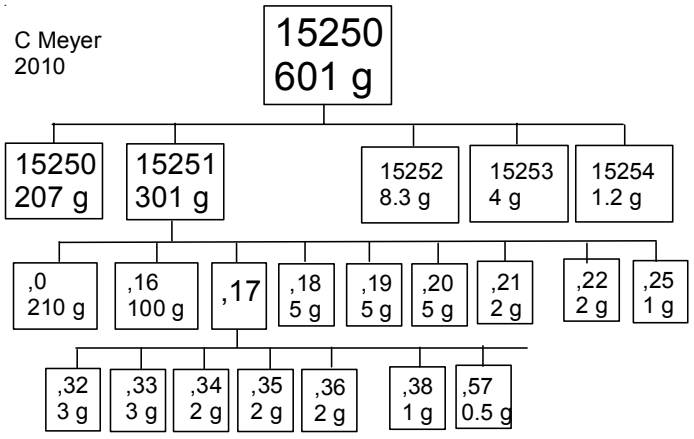
## Table 2. Composition of 15251.

| | | | | |
|---|---|---|---|---|
| *reference* | Cuttitta73 | | Brunfelt72 | |
| *weight* | | | | |
| SiO2 % | 47.02 | (a) | | |
| TiO2 | 1.49 | (a) | 1.4 | (b) |
| Al2O3 | 16.28 | (a) | 16.1 | (b) |
| FeO | 12 | (a) | 11.96 | (b) |
| MnO | 0.16 | (a) | 0.16 | (b) |
| MgO | 10.31 | (a) | | |
| CaO | 11.25 | (a) | 11.9 | (b) |
| Na2O | 0.54 | (a) | 0.46 | (b) |
| K2O | 0.22 | (a) | | |
| P2O5 | 0.24 | (a) | | |
| S % | | | | |
| *sum* | | | | |
| | | | | |
| Sc ppm | 24 | (a) | 23 | (b) |
| V | 85 | (a) | 111 | (b) |
| Cr | 2053 | (a) | 2430 | (b) |
| Co | 46 | (a) | 43.6 | (b) |
| Ni | 405 | (a) | 320 | (b) |
| Cu | 12 | (a) | 7.4 | (b) |
| Zn | 24 | (a) | 16 | (b) |
| Ga | 3.7 | (a) | 4.3 | (b) |
| Ge ppb | | | | |
| As | | | 60 | (b) |
| Se | | | 300 | (b) |
| Rb | 5.4 | (a) | 6.1 | (b) |
| Sr | 160 | (a) | 108 | (b) |
| Y | 96 | (a) | | |
| Zr | 350 | (a) | | |
| Nb | 23 | (a) | | |
| Mo | | | | |
| Ru | | | | |
| Rh | | | | |
| Pd ppb | | | | |
| Ag ppb | | | 21 | (b) |
| Cd ppb | | | | |
| In ppb | | | 8 | (b) |
| Sn ppb | | | | |
| Sb ppb | | | | |
| Te ppb | | | | |
| Cs ppm | | | 0.26 | (b) |
| Ba | 340 | (a) | 236 | (b) |
| La | 40 | (a) | 22 | (b) |
| Ce | | | 84 | (b) |
| Pr | | | | |
| Nd | | | | |
| Sm | | | 11.9 | (b) |
| Eu | | | 1.69 | (b) |
| Gd | | | | |
| Tb | | | 2.28 | (b) |
| Dy | | | 12.6 | (b) |
| Ho | | | 3.1 | (b) |
| Er | | | 10 | (b) |
| Tm | | | | |
| Yb | 11 | (a) | 7.4 | (b) |
| Lu | | | 0.87 | (b) |
| Hf | | | 13 | (b) |
| Ta | | | 1.13 | (b) |
| W ppb | | | 1 | (b) |
| Re ppb | | | | |
| Os ppb | | | | |
| Ir ppb | | | 7.1 | (b) |
| Pt ppb | | | | |
| Au ppb | | | 4.8 | (b) |
| Th ppm | | | 3.7 | (b) |
| U ppm | | | 1.16 | (b) |
| *technique:* | *(a)"microchemical", (b) INAA* | | | |

## Table 3. Composition of KREEP.

| **15243** | KREEP | Impact Melt | |
|---|---|---|---|
| *reference* | Ryder88 | | |
| *weight* | ,19 | ,21 | |
| SiO2 % | | | |
| TiO2 | | | |
| Al2O3 | | | |
| FeO | 10.3 | 8.6 | (a) |
| MnO | | | |
| MgO | | | |
| CaO | 10.4 | 12.6 | (a) |
| Na2O | 0.82 | 0.702 | (a) |
| K2O | | 0.098 | |
| P2O5 | | | |
| S % | | | |
| *sum* | | | |
| | | | |
| Sc ppm | 21.9 | 18.3 | (a) |
| V | | | |
| Cr | 2240 | 1100 | (a) |
| Co | 21 | 21.4 | (a) |
| Ni | | 58 | |
| Cu | | | |
| Zn | | | |
| Ga | | | |
| Ge ppb | | | |
| As | | | |
| Se | | | |
| Rb | 17 | | (a) |
| Sr | 225 | | (a) |
| Y | | | |
| Zr | 840 | | (a) |
| Nb | | | |
| Mo | | | |
| Ru | | | |
| Rh | | | |
| Pd ppb | | | |
| Ag ppb | | | |
| Cd ppb | | | |
| In ppb | | | |
| Sn ppb | | | |
| Sb ppb | | | |
| Te ppb | | | |
| Cs ppm | 0.6 | | (a) |
| Ba | 740 | 140 | (a) |
| La | 73.3 | 8.4 | (a) |
| Ce | 192 | 23.1 | (a) |
| Pr | | | |
| Nd | 116 | 10.5 | (a) |
| Sm | 33.1 | 4.25 | (a) |
| Eu | 2.69 | 1.58 | (a) |
| Gd | | | |
| Tb | 6.64 | 0.96 | (a) |
| Dy | | | |
| Ho | | | |
| Er | | | |
| Tm | | | |
| Yb | 22.3 | 4.1 | (a) |
| Lu | 2.99 | 0.57 | (a) |
| Hf | 26.7 | 3.68 | (a) |
| Ta | 2.81 | 0.55 | (a) |
| W ppb | | | |
| Re ppb | | | |
| Os ppb | | | |
| Ir ppb | | | |
| Pt ppb | | | |
| Au ppb | < 4 | < 6 | (a) |
| Th ppm | 11.4 | 1.37 | (a) |
| U ppm | 3 | 0.42 | (a) |
| *technique:* | *(a) INAA* | | |



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