

77535 – 578 grams
77536 – 355 grams
Ilmenite Basalt

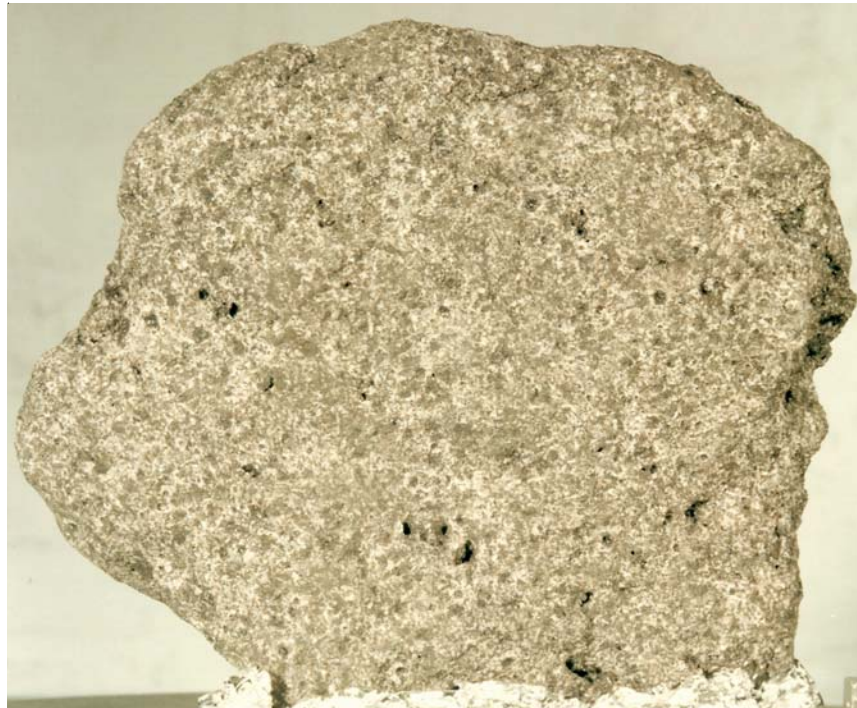


Figure 1: Top view of 77535 showing numerous zap pits from micrometeorite bombardment. Sample is 8 cm across. S73-19122



Figure 2: Side view of 77535 showing rounded surface caused by long term micrometeorite bombardment. Cube is 1 cm. S73-19124.

Introduction

77535 and 77536 are coarse-grained plagioclase-poikilitic ilmenite basalts similar to 71565, 71567 and 71509 (Warner et al. 1978). The average grain size of 77536 is about 2 mm. These samples deserve more study.

Petrography

Plagioclase plates are intergrown with pyroxene (figures 6 and 7). Large pyroxene grains are sector-zoned and enclose ilmenite and resorbed olivine. Minor minerals include zirconolite, tranquillityite, armalcolite



Figure 3a,b: Side and top view of 77536. Sample is 11 cm long. S73-19151 and 31326

and baddeleyite. Pyroxene diagrams show that these two rock have substantial low-Ca pigeonite (figure 5).

Chemistry

Warner et al. (1975) and Rhodes et al. (1976) determined the bulk composition (table 1, figures 8, 9 and 10). They remain unclassified.

Gibson et al. (1976) reported 1865 ppm S.

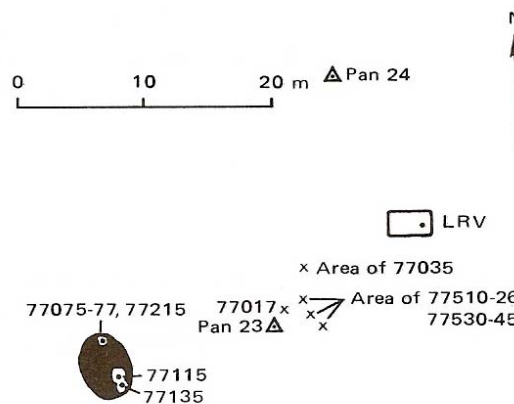


Figure 4: Map of station 7.

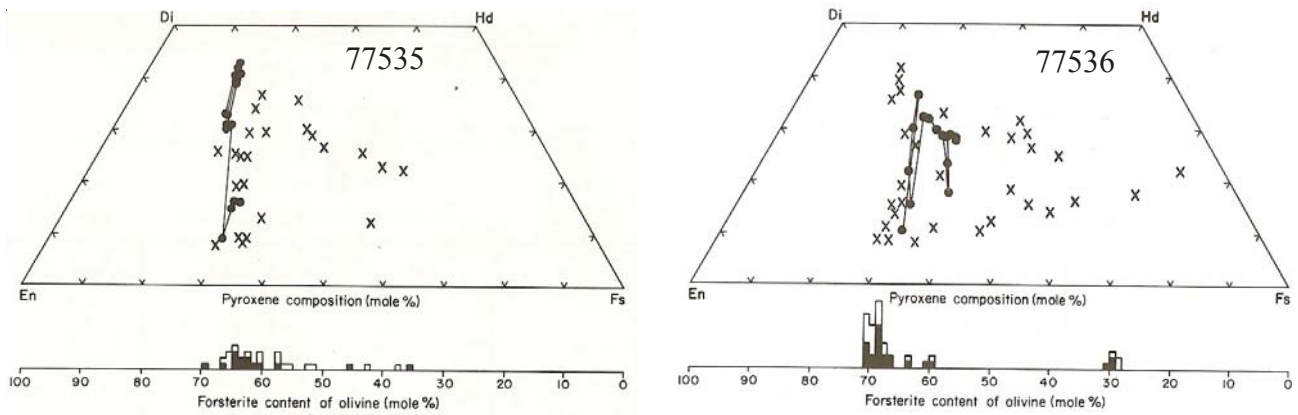


Figure 5a,b: Pyroxene and olivine composition of 77535 and 77536 (Warner et al. 1978).

Radiogenic age dating

Nyquist et al. (1976) determined Rb, Sr and $\text{Sr}^{87/86}$. Although 77535 is coarse-grained, and mineral separation should be easy, they did not determine an internal mineral isochron. The zirconolite in these samples, contains high U (table 3) and should prove easy to date by U-Pb ion probe.

Processing

77535 and 77536 have not been subdivided, nor much allocated. They only have three small thin sections between them.

Mineralogical Mode

| | 77535 | 77536 |
|-------------|-------|-------|
| Olivine | 0.5 | 1.3 |
| Pyroxene | 47.9 | 49.7 |
| Plagioclase | 30.8 | 26.8 |
| Opaques | 16.9 | 19.5 |
| Silica | 2.9 | 1.6 |
| Meostasis | 1 | 1 |

Table 2: Armalcolite for 77535.

(Warner et al. 1976)

| | | | | | |
|--------------------------------|------|------|------|------|------|
| TiO ₂ | 71.8 | 71.6 | 70.5 | 71.4 | 70.6 |
| Al ₂ O ₃ | 1.95 | 2.25 | 1.6 | 1.85 | 2.15 |
| Cr ₂ O ₃ | 1.89 | 1.86 | 1.53 | 1.74 | 1.95 |
| V ₂ O ₃ | 0.19 | 0.17 | 0.25 | 0.23 | 0.21 |
| FeO | 15.3 | 15.3 | 15.5 | 15.5 | 15.9 |
| MgO | 7.5 | 7.3 | 8 | 7.4 | 7.2 |
| CaO | 0.66 | 0.72 | 0.81 | 0.72 | 0.92 |
| ZrO ₂ | 0.17 | 0.23 | 0.11 | 0.06 | 0.1 |

Table 3: Zirconolite in 77536.

(Warner et al. 1976)

| | | |
|--------------------------------|------|------|
| TiO ₂ | 27.9 | 27.6 |
| Al ₂ O ₃ | 1.45 | 1.64 |
| Cr ₂ O ₃ | 0.47 | 0.46 |
| FeO | 8.6 | 9 |
| MgO | 0.34 | 0.42 |
| CaO | 4 | 4.3 |
| ZrO ₂ | 33.6 | 35.8 |
| HfO ₂ | 1.06 | 1.26 |
| Nb ₂ O ₅ | 2.84 | 2.25 |
| Y ₂ O ₃ | 10.8 | 10.8 |
| UO ₂ | 0.31 | 0.18 |

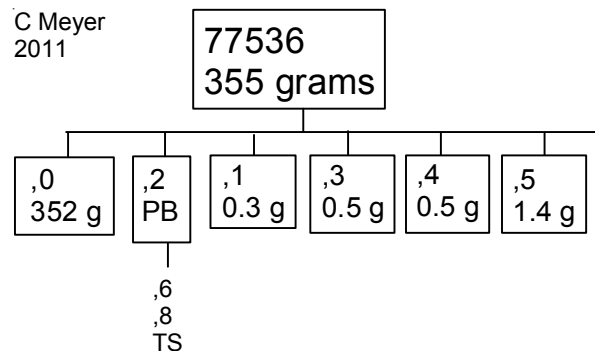
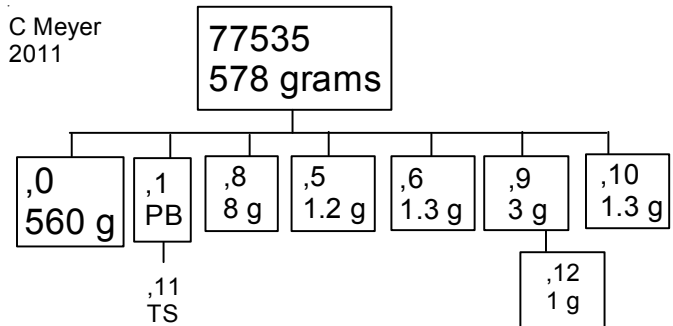
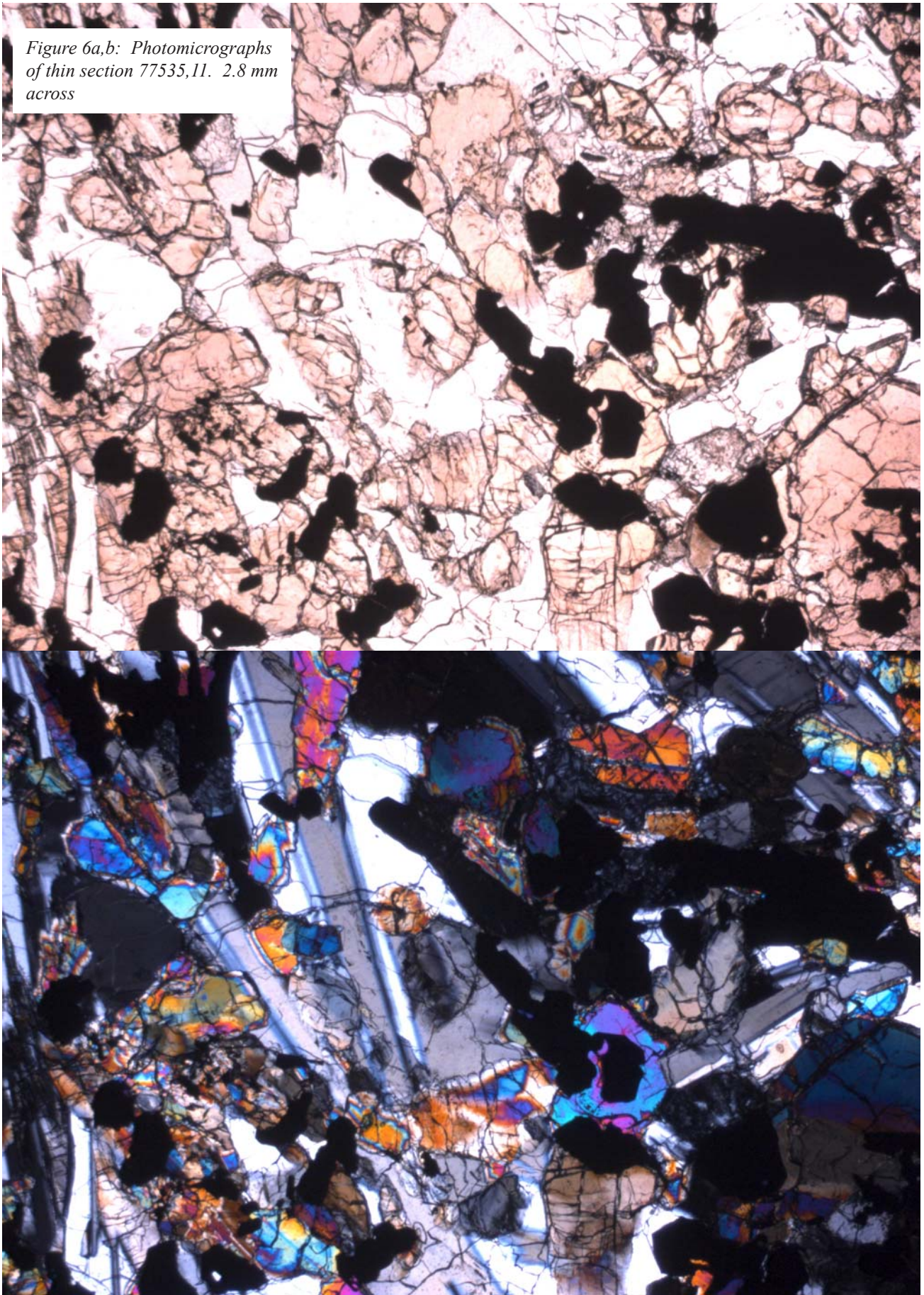


Figure 6a,b: Photomicrographs of thin section 77535,11. 2.8 mm across



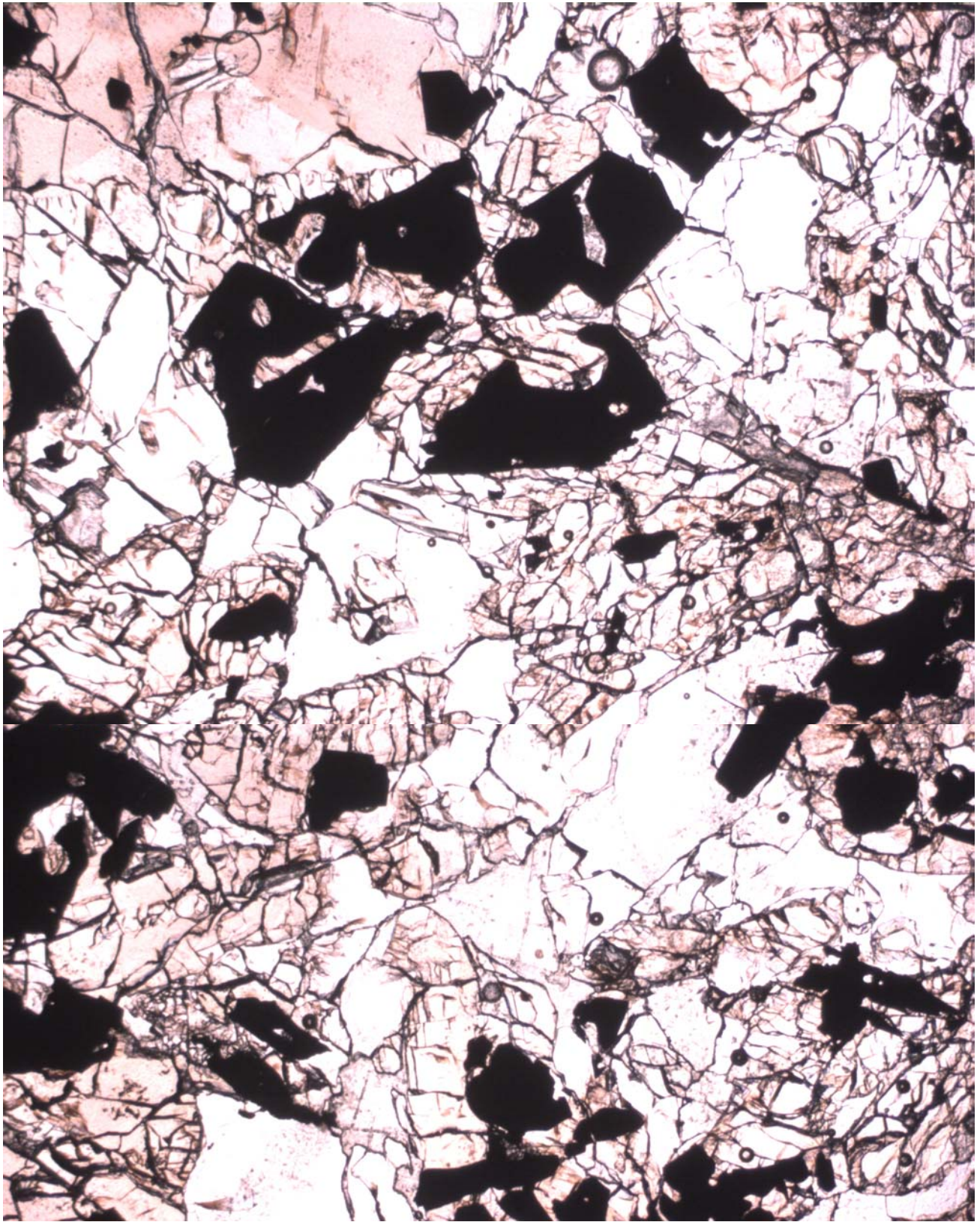


Figure 7a: Photomicrograph of thin section 77536,8. 2.8 mm across

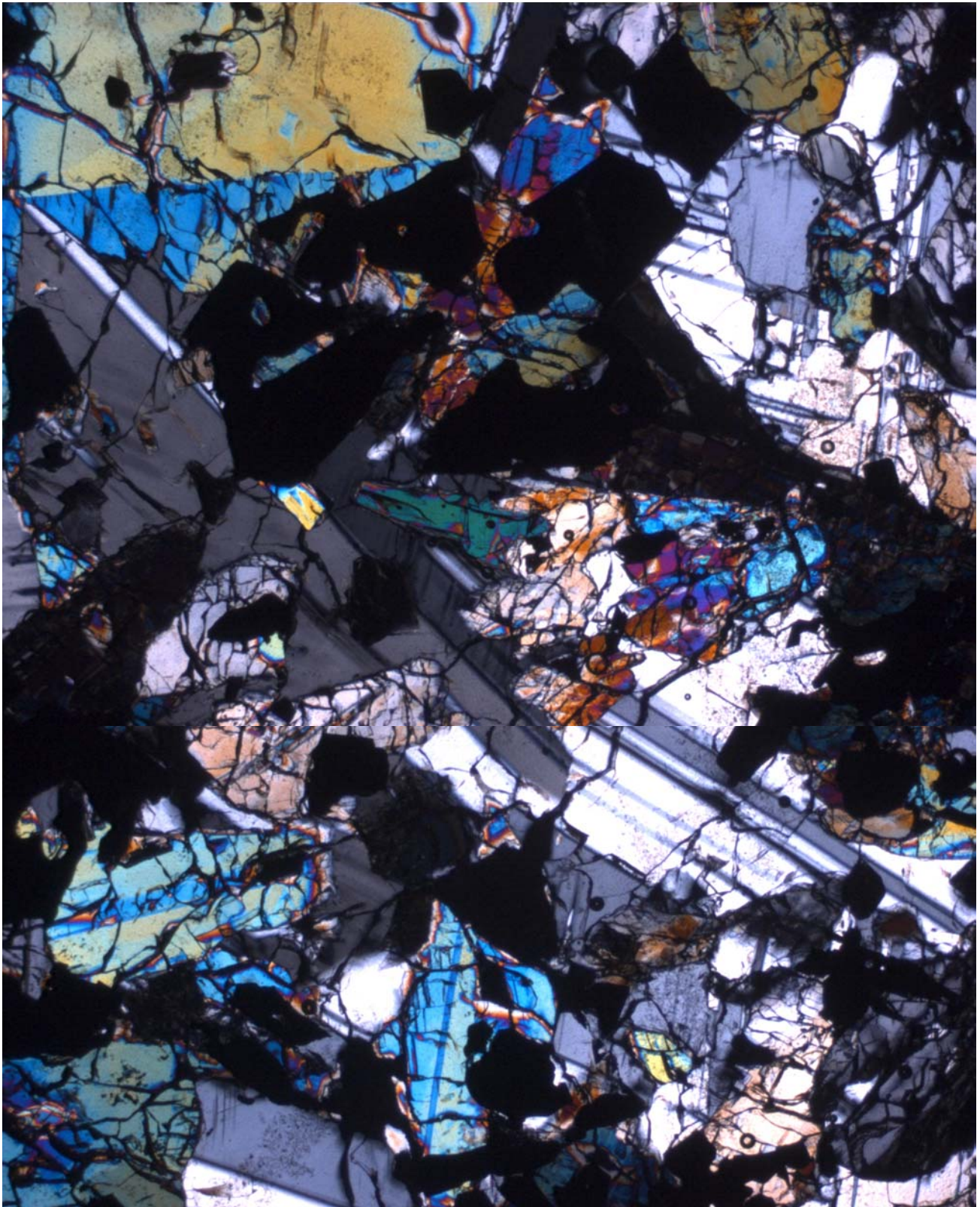


Figure 7b: Crossed nicols for 77536,8.

Table 1. Chemical composition of 77535.

| <i>reference weight</i> | Rhodes76 | | Warner75 | |
|--------------------------------|----------|-----|----------|-----|
| SiO ₂ % | 38.57 | (a) | | |
| TiO ₂ | 12.39 | (a) | 12.1 | (c) |
| Al ₂ O ₃ | 8.95 | (a) | 8.6 | (c) |
| FeO | 18.53 | (a) | 19.5 | (c) |
| MnO | 0.27 | (a) | 0.239 | (c) |
| MgO | 8.85 | (a) | 8.7 | (c) |
| CaO | 10.66 | (a) | 9.8 | (c) |
| Na ₂ O | 0.39 | (a) | 0.36 | (c) |
| K ₂ O | 0.05 | (a) | 0.066 | (c) |
| P ₂ O ₅ | 0.04 | (a) | | |
| S % | 0.16 | (a) | | |
| <i>sum</i> | | | | |
| Sc ppm | 80 | (c) | 79 | (c) |
| V | | | 120 | (c) |
| Cr | 2942 | (a) | 3318 | (c) |
| Co | 20.4 | (c) | 20.5 | (c) |
| Ni | | | | |
| Cu | | | | |
| Zn | | | | |
| Ga | | | | |
| Ge ppb | | | | |
| As | | | | |
| Se | | | | |
| Rb | 0.55 | (b) | | |
| Sr | 184 | (b) | | |
| Y | | | | |
| Zr | | | | |
| Nb | | | | |
| Mo | | | | |
| Ru | | | | |
| Rh | | | | |
| Pd ppb | | | | |
| Ag ppb | | | | |
| Cd ppb | | | | |
| In ppb | | | | |
| Sn ppb | | | | |
| Sb ppb | | | | |
| Te ppb | | | | |
| Cs ppm | | | | |
| Ba | 70.7 | (b) | | |
| La | 5.24 | (b) | 5.7 | (c) |
| Ce | 18.3 | (b) | 23 | (c) |
| Pr | | | | |
| Nd | 20.7 | (b) | 22 | (c) |
| Sm | 8.7 | (b) | 8.8 | (c) |
| Eu | 1.98 | (b) | 1.94 | (c) |
| Gd | 13.6 | (b) | | |
| Tb | | | 2.4 | (c) |
| Dy | 15.8 | (b) | 15 | (c) |
| Ho | | | | |
| Er | 9.84 | (b) | | |
| Tm | | | | |
| Yb | 8.91 | (b) | 8.1 | (c) |
| Lu | 1.29 | (c) | 1.3 | (c) |
| Hf | 8.6 | (c) | 8.6 | (c) |
| Ta | | | 1.6 | (c) |
| W ppb | | | | |
| Re ppb | | | | |
| Os ppb | | | | |
| Ir ppb | | | | |
| Pt ppb | | | | |
| Au ppb | | | | |
| Th ppm | | | | |
| U ppm | | | | |

technique: (a) XRF, (b) IDMS, (c) INAA

Table 2. Chemical composition of 77536.

| <i>reference weight</i> | | | Warner75 | |
|--------------------------------|-------|-----|----------|--|
| SiO ₂ % | | | | |
| TiO ₂ | 14.5 | (a) | | |
| Al ₂ O ₃ | 8 | (a) | | |
| FeO | 18.8 | (a) | | |
| MnO | 0.233 | (a) | | |
| MgO | 9.2 | (a) | | |
| CaO | 10.2 | (a) | | |
| Na ₂ O | 0.33 | (a) | | |
| K ₂ O | 0.07 | (a) | | |
| S % | | | | |
| <i>sum</i> | | | | |
| Sc ppm | 78 | (a) | | |
| V | 140 | (a) | | |
| Cr | 3831 | (a) | | |
| Co | 17.8 | (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 | 6.1 | (a) | | |
| Ce | 20 | (a) | | |
| Pr | | | | |
| Nd | 25 | (a) | | |
| Sm | 8.5 | (a) | | |
| Eu | 1.94 | (a) | | |
| Gd | | | | |
| Tb | 2 | (a) | | |
| Dy | 14 | (a) | | |
| Ho | | | | |
| Er | | | | |
| Tm | | | | |
| Yb | 8.5 | (a) | | |
| Lu | 1.3 | (a) | | |
| Hf | 8.8 | (a) | | |
| Ta | 2 | (a) | | |
| W ppb | | | | |
| Re ppb | | | | |
| Os ppb | | | | |
| Ir ppb | | | | |
| Pt ppb | | | | |
| Au ppb | | | | |
| Th ppm | | | | |
| U ppm | | | | |

technique: (a) INAA

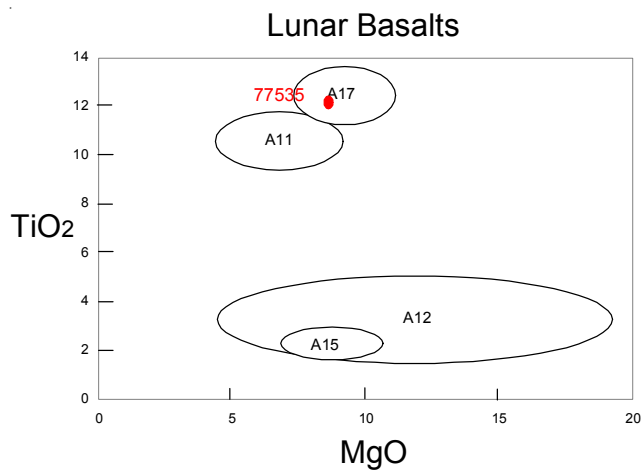


Figure 8: Composition of 77535 and 77536 compared with that of other Apollo basalts.

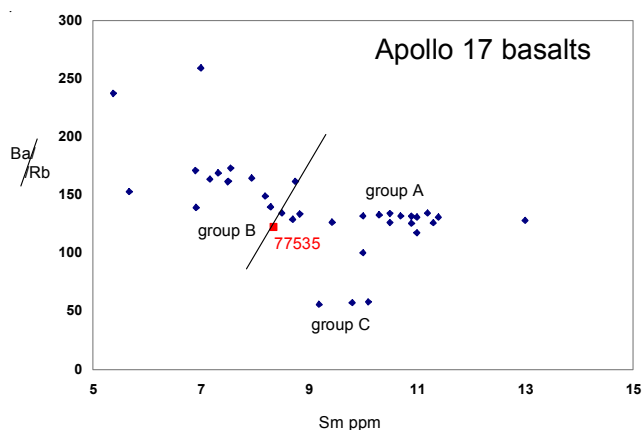


Figure 9: Trace element characteristics of 77535 compared with that of other Apollo 17 basalts.

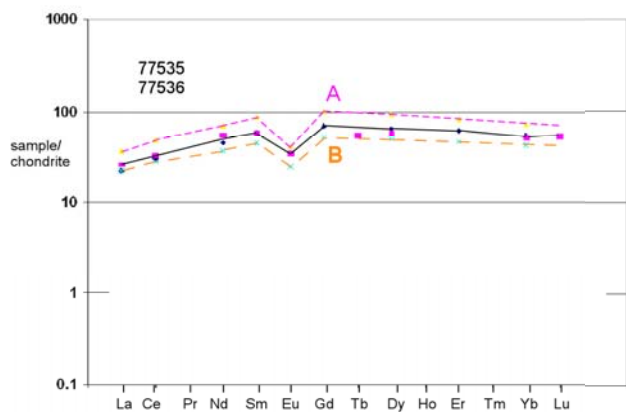


Figure 10: Normalized rare-earth-element diagram for 77535 compared with A and B types of Apollo 17 basalt.

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