BASALTS FROM THE TAURUS-LITTROW REGION OF THE MOON. J. J. Papike and A. E. Bence, Dept. of Earth and Space Sciences, State Univ. of N. Y., Stony Brook, N. Y. 11790

Interstation Distributions

Thin sections of (2-4 mm) soil fragments from nine sampling stations (1, 2, 2a, 3, 4, 5, 6, 8, 9) show that these fragment populations contain at least three distinct basalt types (1): Type 1--Apollo 11 intersertal ilmenite basalts (large rock equivalent 75055); Type 2--olivine porphyritic ilmenite basalts (large rock equivalent 70215); Type 3--plagioclase poikilitic ilmenite basalt (large rock equivalent 70035). Type 1 basalts are virtually identical chemically to the Apollo 11 low-K basalts. Type 2 and Type 3 basalts, although texturally distinct, have essentially identical chemistry (2) and could represent different cooling histories in the same basalt flow. Figure 1 and Table 1 illustrate the interstation distribution of these basalts. The height of the bar indicates the total fragment population at each station ($\approx$ 30 fragments) and the different patterns indicate the following from top to bottom: solid = non-basalt fragments, stipled pattern = Type 1 basalts, light colored pattern = Type 2 basalts, horizontally ruled pattern = Type 3 basalts. Type 2 basalts, which show a complete textural spectrum from olivine vitrophyres to medium-grained intersertal, are most abundant at Station 4 (Shorty) and 8 (base of Sculptured Hills) and appear to represent a near-surface component of the subfloor basalts. Type 3 basalts are most abundant at Station 5 (Camelot Crater) and decrease in abundance with distance from Camelot. This type appears to be from the deeper levels of the subfloor basalts. Apparently Type 1 basalts are a relatively minor component of the basalt suite at Apollo 17 (3). A schematic cross section across the valley of Taurus-Littrow illustrating this interpretation is given in Fig. 2.

Petrography

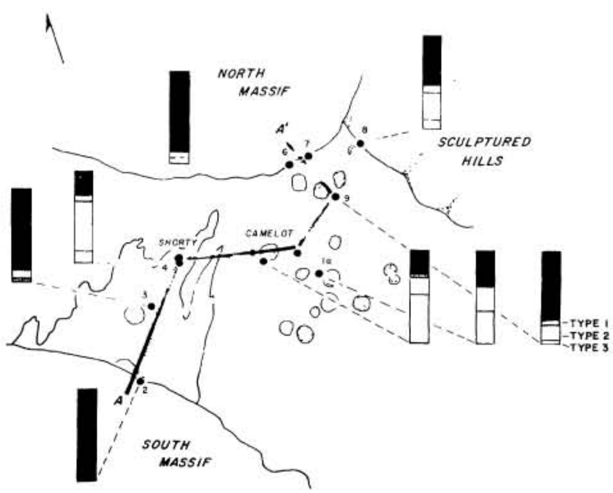
Type 1 basalts are characterized by abundant subcalcic titanaugite, Fe-Ti oxides and plagioclase. Interstitial glass is present in moderate amounts and olivine is rare. Pyroxene compositions follow the Apollo 11 trend to pyroxferroite (right arrow Fig. 3). The Ti/Al ratios in the pyroxenes (Fig. 4, lower Ti and Al concentrations) indicate that Ti and Al are present in the component $R^{2+}TiAl_2O_6$, suggesting that plagioclase and pyroxene coprecipitated.

Type 2 basalts are characterized by a distinctive epitaxial relationship of augite on olivine. Textures range from skeletal elongate olivine phenocrysts with very thin augite overgrowths set in a vitrophyric groundmass to subequant olivines with very thick augite overgrowths set in a medium-grained groundmass having an intersertal texture. Microprobe analyses of the pyroxenes and olivines from the extremes of this group are remarkably similar. The olivines are slightly zoned with respect to Fe/Mg (Fo_{70}-Fo_{60}) whereas the pyroxenes are uniform in Fe/Mg (Fig. 3, enclosed area). These pyroxenes have very high Ca and Ti contents (CaO $\approx$ 20%; TiO_2 $\approx$ 9%) and are thus distinct from most pyroxenes reported from the Apollo basalts. The Ti/Al ratios range from 1/2 to 1/4 (Fig. 4) reflecting the presence of octahedral aluminum (Fig. 5). This is interpreted to mean that plagioclase commenced crystallizing after pyroxene, as also indicated by the textures of these rocks. Armalcolites mantled by ilmenite are extremely common. A microprobe scan across one such grain (Fig. 6) shows: an Fe/Mg ratio of 1:1 at the core of the armalcolite, an increase in this ratio just before the incoming of ilmenite, and a higher Al/Cr ratio in the armalcolite than in the mantling ilmenite. We tentatively interpret that the magnesium depletion near the edges of the armalcolite was caused by the incoming of olivine and served to destabilize armalcolite relative to ilmenite.

Type 3 basalts are characterized by poikilitic calcic plagioclase enclosing euhedral grains of olivine, augite and pigeonite. Composite pyroxene phenocrysts contain augite cores and discontinuous rims of pigeonite or sometimes the reverse. Pronounced sectoral compositional control is observed. A large percentage of these phenocrysts show only very little iron enrichment and the trend is primarily one of decreasing calcium content (Fig. 3, left arrow). It is only in the last few percent of pyroxene growth that extreme iron enrichment is observed. This appears to be due to the very high TiO_2 content [$\approx$ 13% TiO_2, (2)] of this basalt type. Iron apparently was preferentially incorporated in the Fe-Ti oxides which coprecipitated with the pyroxenes.

References

(1) J. J. Papike *et al.* (1973) EOS Vol. 54, No. 6, pp. 601-603.
(2) Apollo 17 PET Report (1973) Science Vol. 182, No. 4113, pp. 659-672.
(3) A. E. Bence and J. J. Papike (1973) EOS Vol. 54, No. 11, p. 1217.



Stat.	Total Frags.	Non-crystalline Basalt Contrib.	Mare Basalts I	II	III	Other Mare
1a	30	11 (37)	0 (0)	8 (26)	11 (37)	0
3	24	21 (88)	0 (0)	2 (8)	1 (4)	0
4	21	4 (19)	2 (10)	12 (57)	3 (14)	0
5	36	7 (19)	1 (3)	7 (19)	20 (56)	1 (3)
6	32	27 (84)	0 (0)	2 (16)	3 (10)	0
8	27	13 (48)	2 (7)	9 (33)	3 (11)	0
9	31	22 (71)	2 (6)	6 (19)	1 (3)	0

Table 1

Fig. 1

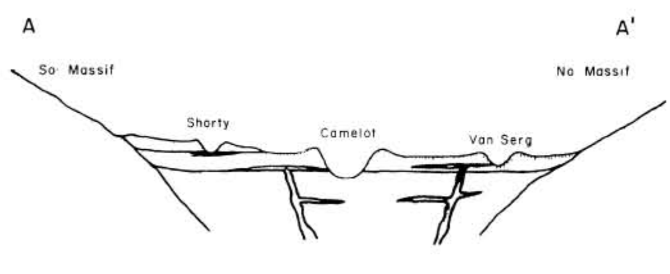


Fig. 2

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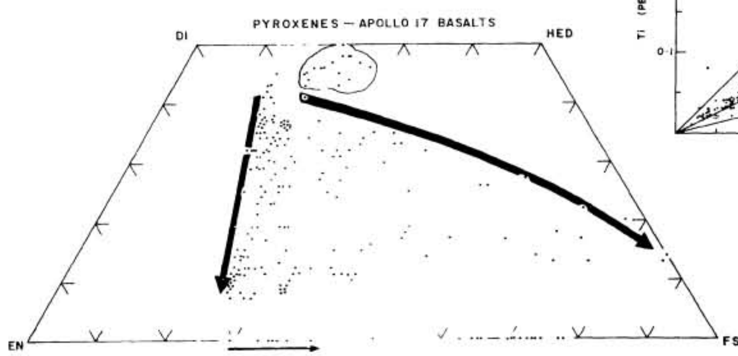

Fig. 3

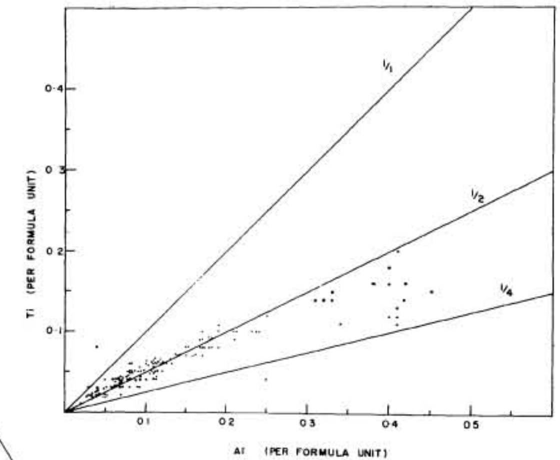

Fig. 4

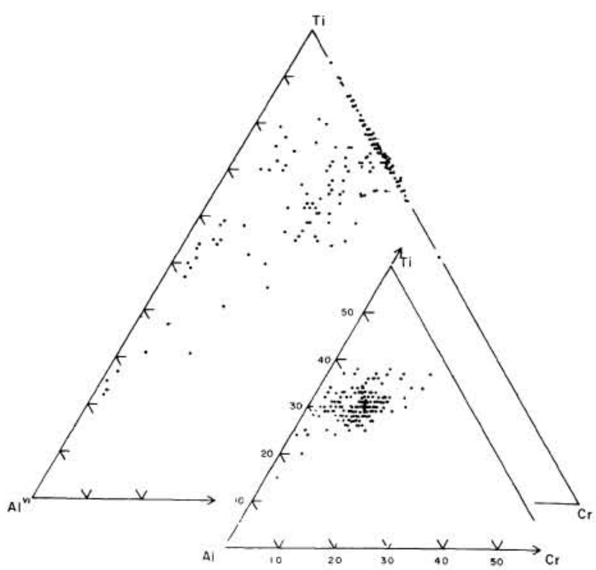

Fig. 5

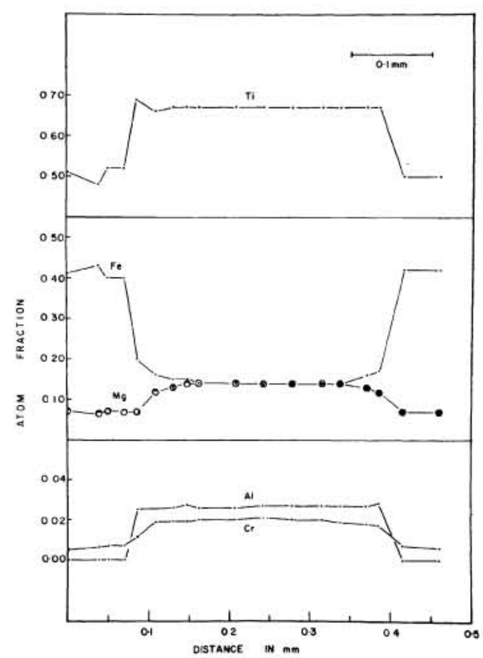

Fig. 6