APOLLO 17: COMPARATIVE PETROLOGY OF FINES FROM TAURUS-LITTROW,

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Soil samples 74220 and 74241 were collected on the south rim crest of Shorty Crater located near the edge of the light mantle deposit. The orange soil (74220) forms a band with sharp boundaries between two gray soils (one of which is 74241). A 1/2 cm thick soil layer was reported as mantling the sampling locality. Soil sample 75081 was collected from the regolith surface on the southwest rim of Camelot Crater located on the mare plain and is believed to represent a sample of the dark mantle material [1]. Objectives of this study were to examine the differences in composition of mineral fragments from the various soil samples in an attempt to characterize the nature of the major rock types contributing to the makeup of the soils. Analytical techniques have been described in Taylor and Carter [2].

Comparative chemistry of individual mineral fragments from soil sample 75081 (Figs. 1-6) and the mineralogical constituency of rock fragments from Camelot Crater [3,4,5,6] infer that the dark mantling material deposited on the valley floor merely consists of comminuted mare basalt "subfloor" material. Olivines from dark mantle soil 75081 (Fig. 1) are distinctly different in Fo content from olivines of the STA. 4 orange and gray soils. Olivines from gray soil 74241, however, coincide rather closely in Fo content with the orange soil (74220) olivines (Fig. 1). Such a feature may be caused by 1) mixing of soil components, 2) a genetic relationship or 3) an introduction of olivine fragments from a soil unlike either the gray or orange soils. The first explanation is unlikely because of 1) the relatively ungardened nature of orange soil 74220, 2) the broader range in Fo content of 74220 olivines, 3) the lack of orange glass associated olivines in gray soil 74241,and 4) studies of trapped gas contents of the orange and gray soils [7] which showed that orange soil 74220 is contaminated by material which is not similar to gray soil 74241. The similarity of the CaO vs. Fo content of free olivines from orange soil 74220 and gray soil 74241 (Fig. 2) and the different range in Figure 2 of dark mantle olivines from soil 75081 may require a genetic relationship between the orange and gray soil olivines. Alternatively, if olivines were introduced to the orange and gray soils at Shorty Crater from a source such as the 1/2 cm thick soil layer overlying the sampling area, the olivine chemistry (Figs. 1 and 2) requires the exotic component to be different from the mare-basaltic dark mantle olivines sampled at Camelot Crater and represented here in soil sample 75081.

Most pyroxenes analyzed in soils 74220, 74241, and 75081 are similar (Fig. 3) and greatly resemble those pyroxenes in mare basalt fragments from the Camelot Crater area [3,6,8] which are representative of the subfloor basalts. Dark mantle soil (75081) pyroxenes were found to be characterized by a generally lower Ti-Al enrichment (Fig. 4) than was observed in the pyroxene populations of the orange and gray soils at Shorty Crater. The more Mg-rich pigeonites and the orthopyroxenes in all of these soils (Fig. 3) are not characteristic of the mare-type ilmenite basalts and resemble closely

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pyroxenes of the anorthositic gabbro group (ANT or recrystallized noritic breccias) of rock fragments [5] which is the dominant rock type in samples representative of the South Massif [5,9].

Most plagioclase fragments from dark mantle soil 75081 have chemical characteristics analogous to plagioclase in ilmenite basalts from Camelot Crater [4,6] interpreted as subfloor material. A major mare-basaltic component is represented by plagioclase fragments in dark mantle soil 75081 (Fig. 5) and complemented by olivine and pyroxene chemistry of this study, adds support to the suggestion that the dark mantle deposit is merely comminuted subfloor basaltic material. The orange and gray soils from Shorty Crater contain smaller relative amounts of this mare component as shown by the larger components of Ca-rich plagioclase (Fig. 5). Most plagioclase from 75081 is characterized by a high FeO content (0.27 to 0.69 wt. %) and values of An_{74-89}, relative to plagioclases of the anorthositic gabbro group of highland rocks which rarely exceed 0.35 wt. % FeO and are generally more calcic than An_{90} (Fig. 6). Orange (74220) and gray (74241) soils from Shorty Crater are seen to contain 1) a major component of the anorthositic gabbro group of highland rocks, 2) a minor component of the dark mantle component previously described, 3) a KREEP-like component (characterized by An<90 and FeO<0.3 wt. %), and 4) a component characterized by plagioclases with higher FeO contents (Fig. 6) than those in the 75081 (dark mantle) plagioclases. This fourth component may represent a mare-basaltic material that is of a slightly different bulk chemistry than that represented by plagioclases from dark mantle soil 75081. This fourth component may reflect 1) the bulk chemistry of the mare-type gray soil (74241) at Shorty Crater, or 2) the bulk chemistry of the 1/2 cm soil layer covering the sampling area. The former interpretation supports 1) a genetic relationship between mare-basaltic fragments in the orange and gray soils at Shorty Crater and 2) a mare-basaltic component in gray soil 74241 unlike that of the dark mantle soil (75081) from Camelot Crater. The latter interpretation supports the suggestion of a chemically distinct lithological component acting as a contaminant in both the orange and gray soils; a contaminant possibly induced accidentally (during sampling) from the 1/2 cm soil layer at Shorty Crater but which was not specifically sampled.

References: [1] Apollo Lunar Geology Investigation Team (1973) USGS Interagency Rept.: Astrogeology 71, 322 p. [2] Taylor, H. C. J. and Carter, J. L. (1973) Proc. Fourth Lunar Sci. Conf., Suppl. 4, Geochim. Cosmochim. Acta. Vol. 1, 291-307. [3] Ghose, S., Okamura, F. P., Nelson, J. S., and McCallum, I. S.(1973) EOS 54, 588-589. [4] Kridelbaugh, S. J. and Weill, D. F. (1973) EOS 54, 597-598. [5] Papike, J. J., Bence, A. E., Cameron, K., and Delano, J. (1973) EOS 54, 601-603. [6] Weigand, P. W. (1973) EOS 54, 621-622. [7] Kirsten, T., Horn, P., Heymann, D., Hubner, W., and Storzer, D. (1973) EOS 54, 595-597. [8] Drake, M. J., Taylor, G. J., Marvin, U. B., Wood, J. A., and Hallum, M. (1973) EOS 54, 584-585. [9] Apollo 17 Preliminary Examination Team (1973) Science 182, 659-672.

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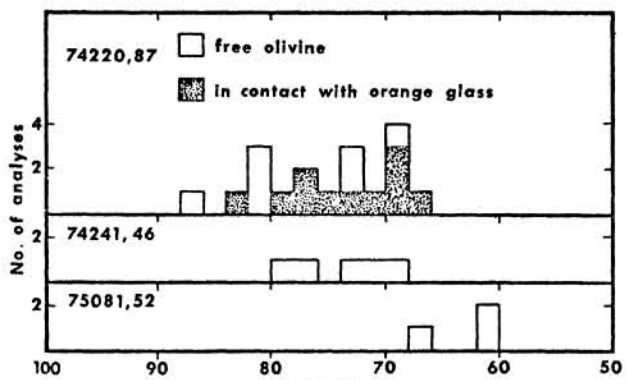

Fig. 1

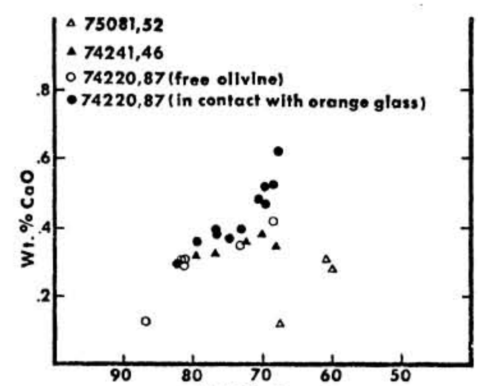

Fig. 2

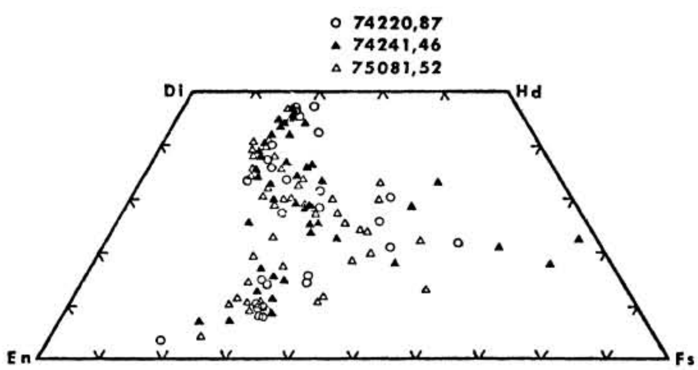

Fig. 3

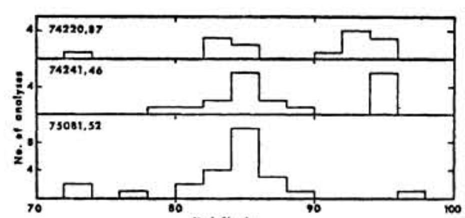

Fig. 5

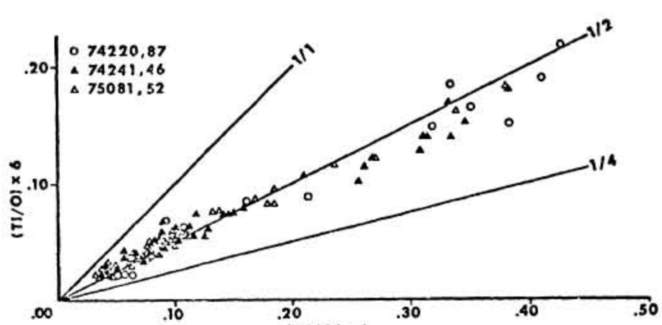

Fig. 4

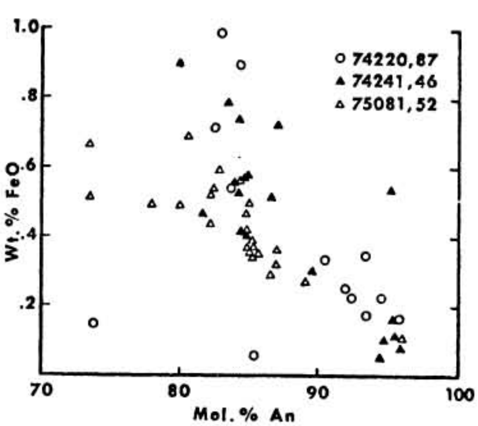

Fig. 6