MINERALOGY AND CHEMISTRY OF 61016-215; John C. Drake, Dept. of Geology, Univ. of Vermont, Burlington, Vt., 05401.

Lunar sample 61016 consists of two distinct lithologies, an anorthositic, light grey to white component (Type I,(1)) and a dark grey aphanitic component (Type II,(1)) which has been classified by Warner(2) as a mesostasis rich basalt. The current study describes the textural and chemical characteristics of a polished microprobe section of this sample (61016-215) that is of particular interest because it encompasses both lithologies.

Approximately 1/3 of the section consists of a large anorthositic clast which is highly fractured but does not display the intense brecciation and granulation common to many cataclastic anorthosites. This clast is now predominantly maskelynite($An \approx 96$) although remnants of anisotropism and albite twinning are visible. A general parallelism and continuity of the fracture pattern throughout the clast indicates that it was probably a single feldspar xenocryst approximately 10 mm x 5 mm. This clast is bounded on one side by another anorthositic zone up to 2 mm thick differing from the former in that it lacks the pervasive fracture pattern but contains numerous fragments of pyroxene and occasional olivine. The contact between these two anorthositic zones is sharp and easily discernable, although they are compositionally similar. The pyroxenes in the outer unfractured zone have restricted compositional ranges (figure 1) and are of two distinct types, a pigeonite with Fe/Fe+Mg = 0.40-0.45 and CaO = 1.0-3.0 wt.% and an augite-salite with Fe/Fe+Mg = 0.28-0.32 and CaO = 22.2-22.4 wt.%. Coexisting pyroxene compositions reflect an extensive compositional gap (Figure 1). Two grains of olivine were observed. One, completely enclosed in the outer zone has Fo=63. The other olivine grain occurs on the contact between the two anorthositic zones and is not considered indigenous to the outer anorthositic zone because of its compositional similarity to olivines in the dark lithic component. The fractured anorthositic clast is bounded on the side opposite the unfractured anorthositic zone by the dark lithic component which comprises approximately 2/3 of the section. It consists of a fine grained olivine, maskelynite, mesostasis glass matrix that contains lithic fragments that have been melted and recrystallized to varying degrees and numerous sub-angular to rounded clasts of plagioclase glass up to approximately 1 mm x 0.5 mm. All plagioclase in this portion of the section has been vitrified with little or no evidence of melting (e.g. the original diabasic texture of the matrix has been preserved). The compositions of the matrix constituents are shown in figures 1, 2 and 3. These figures indicate: a) the extremely limited compositional range of the Mg-rich olivine (46 of 72 analyzed grains were within the compositional range Fo=89%-93%)(Figure 1); b) the extreme compositional variability but general Fe en-

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richment, of the matrix glass(Figures 3a,b); c) the negative FeO vs. An correlation in the matrix maskelynite(Figure 2)(An = 97 to 91% FeO = 0.18 to 0.45 wt.%). Also shown in figure 2 are the compositions of the larger maskelynite clasts. They show the same FeO vs. An trend but are consistently more An-rich and Fe-poor (An = 97-95, FeO = 0.05-0.25 wt.%). In general the borders of the larger plagioclase glass clasts are corroded with the matrix constituents encroaching on the clast. The presence of a veinlet of matrix material in the fractured anorthositic clast indicates that at least in this section the dark component was injected into the lighter anorthositic material. The probable sequence of events as interpreted from relationships in section 61016-215 are: the impingement of liquid (or plastic) material having the composition of component II onto and injecting into solid component I (as characterized by the fractured anorthositic clast). Type II liquid contained abundant An-rich clasts and lithic fragments in varying states of disrepair. Subsequent rapid crystallization of type II liquid yielded the quenched olivine, maskelynite, mesostasis matrix material. Following this event the outer portions of the sample were coated with a layer of anorthositic material (liquid or plastic) containing fragments of pyroxene and olivine distinct in composition from those in the type II material. The existence of two distinct anorthositic materials (type I) helps to explain the complex textural relationships between type I and type II material components. The entire sample was then shocked which resulted in the vitrification of the plagioclase constituents. The event causing this shock may have been the impact which resulted in the excavation of this particular sample.

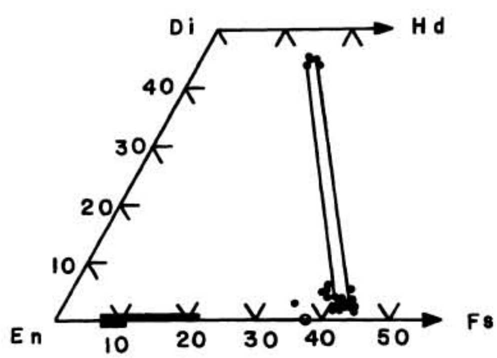

Figure 1

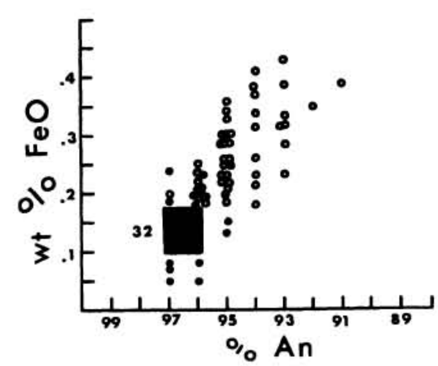

Figure 2

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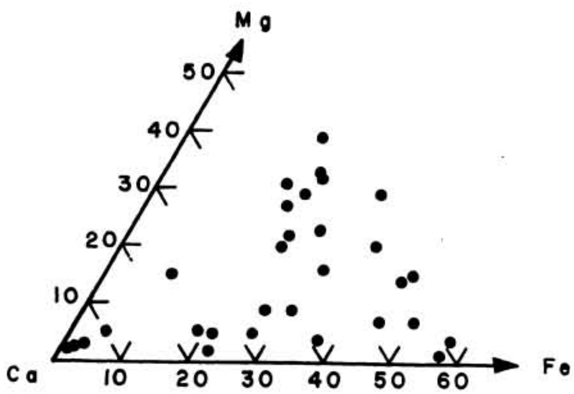

Figure 3A

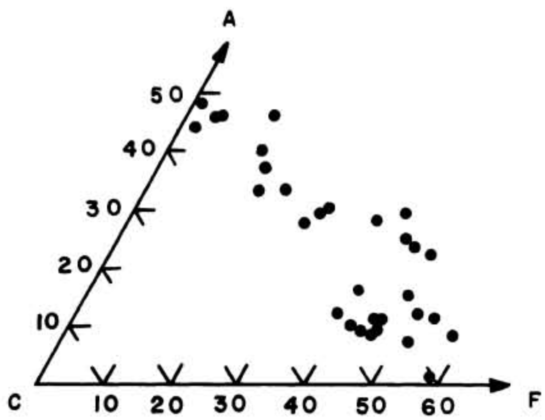

Figure 3B

Figure 1: Pyroxene and olivine compositions in 61016-215. Olivine compositions are plotted on the En-Fs axis as Fe/Fe+Mg ratios. En = $Mg_2Si_2O_6$, Fs = $Fe_2Si_2O_6$, Di = $CaMgSi_2O_6$, Hd = $CaFeSi_2O_6$. • = pyroxenes in outer anorthositic zone, o = olivine in outer anorthositic zone, solid bar represents compositional range of olivine in dark matrix material (the compositional range indicated by the double line thickness contains 46 of 72 analyzed olivines

Figure 2: Weight % FeO vs %An in maskelynite in component II o = acicular to lath shaped matrix maskelynite, • = subangular to rounded maskelynite clasts. The shaded portion contains 32 analyses of subangular to rounded maskelynite clasts.

Figure 3: Compositional range of mesostasis glass in component II (A) relative atomic proportions of Ca, Mg, and Fe (B) ACF diagram (A = Al_2O_3 - Na_2O - K_2O, C = CaO, F = FeO + MgO + MnO)

References:

(1)Bass, M. N., 1972, Lunar Sample 61016, Lunar Sample Information Catalogue, Apollo 16, M.S.C. 03210, pp. 129-134

(2)Warner, J. L., Simonds, C. H.,and Phinney, W. C., 1973, Apollo 16 rocks: Classification and petrogenetic model, Proc. Fourth Lunar Sci. Conf. Geochim. Cosmochim Acta, Suppl.4, Vol. 1 pp. 481 - 504