
Sample 60255, collected at the LM site, is classified by Wilshire, et al (1) as a dark matrix breccia with light clasts more abundant than dark (group B4). Warner, et al (2) describes it as "glassy", categories for other Apollo 16 breccias being "light matrix", "metamorphosed", and "melted matrix". The "glassy" group is equated with the low grade breccias of Apollo 14 (3). Our observations on thin sections 60255,78 and 60255,72 are consistent with these classifications.

Two particular clasts in breccia sample 60255,78 appear to be genetically related although they have markedly different textures: Clast A is a feldspathic basalt with an intersertal texture; clast B, is composed mainly of plagioclase with coarse poikilitic olivine and pyroxene crystals. The matrix of the breccia as a whole has a composition essentially identical to clast A (broad beam microprobe analysis); based on the chemistry, it is intermediate between rocks called "non-mare basaltic KREEP" and "anorthositic" (4). Clast B would be chemically classified as an "anorthosite".

In clast A, plagioclase (70%, up to 0.5 mm) occurs as tabular or blocky subhedral to euhedral crystals. Olivine and pyroxene (23% combined, up to 0.5 mm) occur as euhedral to subhedral grains interstitial to the plagioclase. Glassy Si and K enriched mesostasis areas (3%) and associated troilite and skeletal ilmenite (4% combined) complete the volume of the clast. There are no vugs. One 1,4m grain of rare-earth bearing chlorapatite was identified.

Most microprobe analyses of olivine give a composition of Fo74 with no compositional zoning being detected. The pyroxene is both augite and pigeonite. Pigeonite occurs as discrete grains or at the borders of olivine; it is zoned slightly and normally in seven elements. Subcalcic augite, also slightly zoned in seven elements, occurs at the borders of pigeonite and is typically the pyroxene which is in contact with the mesostasis. The trend in zoning, as in most other lunar igneous rocks with about the same composition, is first towards more calcic pyroxenes and then towards more Fe-rich pyroxene. The most magnesian subcalcic pyroxene (adjacent to olivine Fo74) is En68Wo8Fs24. The most Fe-enriched augite, adjacent to mesostasis glass, is En40Wo37Fs24.

Most of the plagioclase is completely homogeneous at An97+05. However, marked zoning (An97 to An69) occurs at the borders where the plagioclase is in contact with mesostasis. Plagioclase included in olivine is also more sodic (An90-95).

If one assumes a normal igneous paragenesis of plagioclase towards more sodic compositions and olivine and pyroxene towards more Fe-rich compositions, the data indicate that in clast A first a large amount of plagioclase grew with composition of An97, followed by growth and further nucleation of more sodic plagioclase (An95-An90) contemporaneous with olivine (Fo74) followed by successive crystallization of pigeonite and augite with even more sodic plagioclase (An90-An69). Clearly the paragenetic relations, textural and chemical, suggest a sequence of crystallization from an interstitial liquid: olivine to pigeonite to augite to ilmenite to troilite and Si + K enriched
glass. The texture of clast A suggests it cooled more slowly than 14310 but not as slowly as the fine-grained poikilitic rocks with compositions similar to 14310, such as 62235.

Clast B has coarser and more abundant plagioclase (88%, up to 1.0 mm). Compared to the subhedral grains of clast A, olivine and pyroxene occur in large poikilitic grains, with arms 0.1 mm thick. The olivine is only slightly more Fe-rich (Fo73), the bulk of the plagioclase is somewhat more sodic (An95+.05 thin rims to An92), and the most magnesian pyroxene has a composition essentially the same (En68Wo9Fs25). The pyroxene has exsolution lamellae about 1-2 μm in width. Analyses on these lamellae give extremes of composition En70Wo3Fs27 (with optic properties of hypersthene) and En57Wo25Fs18. There is no mesostasis; opaque phases make up only 2% of the rock.

The similar compositions of the minerals in the two clasts, and the fact that the bulk composition of the matrix is essentially the same as the bulk composition of clast A, and of clast B minus some plagioclase, suggests the two clasts share a common origin. The coarse grain size, poikilitic texture of the mafic minerals, and exsolution lamellae of clast B suggest it cooled more slowly than clast A. The slightly more sodic content of the plagioclase suggests clast B is more differentiated than clast A.

A hypothetical genetic link between the two would involve a melt which cooled at varying rates from a chilled, fine grained margin to a coarser, more slowly cooled interior. Thus, the two clasts could be representatives of a suite of rocks ranging from glassy, KREEP-rich rocks to cumulates rich in plagioclase with intercumulate mafic minerals.

A full description of the clasts in breccia sample 60255,78, with microprobe analyses for 8 elements on the silicate minerals documented with respect to positions in the clasts, is contained in a B.A. thesis by Judith Schaeffer (5). It is available through interlibrary loan.