As part of the Lunar Highlands Initiative, Breccia 67015 from the rim of North Ray Crater was selected for a systematic study correlating the petrology of matrix samples and individual clasts with their major, minor, and trace element compositions and their \(^{40}\text{Ar}/^{39}\text{Ar}\) ages. Sm/Nd ages and additional types of determinations will be made on any portions of the breccia that prove sufficiently interesting. The initial phases of the study will be carried out by U.B. Marvin, L.A. Haskin, and C.M. Hohenberg. The breccia has been mapped, a Guidebook issued, and the first round of allocations made. Results of the chemical analyses and Ar/Ar dating are not yet available. Preliminary petrological studies and electron microprobe analyses have been made on 10 thin sections. The purpose of this study will be not only to fully characterize the breccia itself but to compare and contrast its component parts to those of other Apollo 16 rocks and to materials from other sites in the hope of building a credible petrologic history of the highlands crust.

67015 is a feldspathic fragmental breccia with a gray-white, friable matrix and five main types of lithic clasts. In bulk composition the matrix and most of the clasts are equivalent to ferroan anorthosites with \(\text{Mg}/(\text{Mg}+\text{Fe})\) ranging from 0.25 to 0.51. Much of the matrix is porous with no obvious binding material. It consists chiefly of minute angular mineral fragments in the approximate proportions: 95% plagioclase, 4% mafics, traces of ilmenite, troilite, metallic iron, and pink spinel. The breccia is polymict but contains no glassy regolith products. The lithic clasts include anorthosites of at least four textural varieties, dark gray aphanitic-appearing melt rocks, sugary grayish or yellowish fine-grained crystallines, and coarse igneous-looking "basaltic" crystallines. To date no mare basalts, coarse pristine cumulates, or other lithologic types of special interest have been noted among the clasts.

The anorthositic clasts range from cataclastic breccias of essentially pure plagioclase to gabbroic anorthosites with granulitic textures. One rather common variety, which appears translucent in hand specimens, consists of coarse plagioclase that retains perceptible grain boundaries although the fabric has been largely randomized by shock. The plagioclase \((\text{An}_{98}\text{Ab}_2\text{Or}_0)\) contains lenses and veinlets of dark ferroan-anorthosite glass with \(\text{MgO} = 3.3-6.3\) and \(\text{FeO} = 4.6-4.8\) wt %.

The most conspicuous clasts in this light-colored breccia are dark gray, finely vesicular, aphanitic materials that range in size and shape from angular fragments of less than 1 mm to lobate masses over 6 cm long. Thin sections show that these are microbreccias with dark melt-rock matrixes laden with minute clasts. Dark materials that look much like these, both in hand
specimens and thin sections, occur in numerous other highland breccias. However, comparisons with apparently similar dark material from Boulder 1 at Apollo 17 Station 2 show compositions so markedly different as to rule out any petrologic affinity.

Most of the sugary fine-grained clasts are anorthosites or gabbroic anorthosites with granoblastic textures. Occasional large plagioclase crystals or clots with coarse granulitic texture occur within a fine-grained granulitic groundmass.

The coarse "basaltic" clasts, which are the only igneous-looking materials in 67015, are poikilitic assemblages of plagioclase and olivine in low-Ca pyroxene. Detailed work on these clasts is only beginning. However, despite their coarse crystallinity a magmatic origin for these materials always seemed unlikely because they are too rich in plagioclase and most, if not all, of them are rimmed and invaded along cracks by chalky white anorthosite.

Breccia 67015 appears, on initial examination, to be an assemblage of consanguinous anorthosites, impact melt rocks, and recrystallized gabbroic anorthosites within a matrix of crushed ferroan anorthosite. The youngest material in the breccia is a chesnut-colored glass that has invaded some portions of the friable matrix. This glass is itself a melted ferroan anorthosite rich in fragments of plagioclase. Until further analyses reveal significant differences in composition or age between the components of this breccia it seems likely that it represents local Apollo 16 site materials that have been through varying degrees of crushing, shock, melting, and recrystallization.