
**On the Relationship Between the Apollo 16 Ancient Regolith Breccias and Feldspathic Fragmental Breccias, and the Composition of the Prebasin Crust in the Central Highlands of the Moon**

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**Abstract** - Two types of texturally and compositionally similar breccias consisting largely of fragmental debris from meteorite impacts occur at the Apollo 16 lunar site, feldspathic fragmental breccias (FFBs) and ancient regolith breccias (ARBs). Both types of breccia are composed of a suite of mostly feldspathic components derived from the early crust of the Moon and mafic impact-melt breccias produced during the time of basin formation. The ARBs also contain components such as agglutinates and glass spherules indicating that the material of which they are composed occurred at the surface of the Moon as fine-grained regolith prior to lithification of the breccias. These components are absent from the FFBs, suggesting that the FFBs might be the protolith of the ARBs. However, several compositional differences exist between the two types of breccia, making any simple genetic relationship implausible. First, clasts of mafic impact-melt breccia occurring in the FFBs are of a different composition than those in the ARBs. Also, the feldspathic, “prebasin” components of the FFBs have a lower average Mg/Fe ratio than the corresponding components of the ARBs, the average composition of the plagioclase in the FFBs is more sodic than that of the ARBs, and there are differences in relative abundances of rare earth elements. The two breccia types also have different provenance: the FFBs occur primarily in ejecta from North Ray crater and presumably derive from the Descartes Formation while the ARBs are restricted to the Cayley plains. Together these observations suggest that although some type of fragmental breccia may have been precursor to the ARBs, the FFBs of North Ray crater are not a significant component of the ARBs and, by inference, the Cayley plains. The average compositions of the prebasin components of the two types of fragmental breccia are generally similar to the composition of the feldspathic lunar meteorites. With 30–31% Al$_2$O$_3$, however, they are slightly richer in plagioclase than the most feldspathic lunar meteorites (~29% Al$_2$O$_3$), implying that the crust of the early central nearside of the Moon contained a higher abundance of highly feldspathic anorthosite than typical lunar highlands, as inferred from the lunar meteorites. The ancient regolith breccias, as well as the current surface regolith of the Cayley plains, are more mafic than (1) prebasin regoliths in the Central Highlands and (2) regions of highlands presently distant from nearside basins because they contain a high abundance (~30%) of mafic impact-melt breccias produced during the time of basin formation that are absent from other regoliths.