

Investigation of Glass Recovered from Apollo 12
Sample No. 12057

By B. P. Glass

Sample No. 12057 consists of fines and chips from the bottom of the documented Apollo Lunar Sample Return Container (ALSRC). A 0.51 gram sample of <1mm fines was disaggregated with a sonic vibrator and sieved into five size fractions (580-1000 μ m, 147-580 μ m, 74-147 μ m, 44-74 μ m and <44 μ m). Each fraction contained approximately 30% glassy particules. Except for the 580-1000 μ m fraction, each fraction contained approximately 1% glass spherules with some indication of an increase in percentage of spherules with decrease in size fraction. Most of the spherules are spherical in shape, but a small percentage (~10%) are dumbbell, teardrop or some other shape. Scanning electron microscope studies show "splash" features, impact pits and metallic beads on the surface of many of the spherules. Nearly all of the opaque spherules and about 1/3 of the non-opaque spherules contain crystalline inclusions and/or metallic spherules. X-ray and microprobe analyses indicate that the most abundant crystalline inclusions are pyroxene and feldspar with some olivine and illmenite. The metallic spherules are quite variable in composition (Ni/Fe ratio varies from 0.017 to 2.67). The Si, Ti, Al, Fe, Mn, Mg, Ca, Na and K contents of 130 glass particles were determined by electron microprobe analysis. In addition, the Cr and P contents of forty of the glass particles and the refractive indices of 87 of the glass particles were determined. Like the Apollo 11 glasses, these glasses show a strong correlation between composition, color and refractive index. However, no correlation was observed between composition and size. Two types of glasses can be distinguished: 1) pale green glass fragments ($n = 1.595$) without crystalline inclusions, bubble cavities or metallic spherules (this glass is essentially anorthositic in composition); 2) and the remainder of the glass particles (~95%) which are varied in color and have compositions similar to the published analyses for Apollo 12 crystalline rocks except for their apparently higher average SiO₂, Al₂O₃, CaO and lower average TiO₂, FeO and MgO contents. None of the glass particles have compositions similar to the high silica (~61%) Apollo 12 rock sample No. 12013. The glasses from sample 12057 differ from the Apollo 11 glasses in that they generally have higher SiO₂ and lower TiO₂ contents. Otherwise, they are similar in composition.