Chemistry, Petrology, and Morphology of Some Apollo 12 Materials

James L. Carter

Studies of the lunar fines revealed the presence of breccias, glasses, glass spattered surfaces, glass lined craters, shocked rock and mineral fragments, and complex masses of glass, rock, and mineral fragments. These findings suggest a complex history of impacts similar to those observed in the Apollo 11 materials. These data show further that both the projectiles and targets varied from liquids to solids implying the presence of an impact-produced cloud of gas, liquid, and solid particles. Scanning electron microscopy of glass spheres gives further evidence of the nature of the impact-produced cloud and the general sequence of events as a particle traveled through the cloud. Impact craters down to 0.1 micron, splash glasses, and dimples and mounds down to less than 0.03 microns that may be arranged in geometrical patterns were observed. Interior surfaces of vesicles in glasses are sometimes covered by a fine hummocky network of probably metallic Fe-Ni mounds that vary from less than 0.03 microns to 0.3 microns in longest dimension. Discrete islands in the network range in size from 0.3 to less than 0.03 microns. Probe analyses of the larger mounds and islands showed them to be composed mainly of metallic Fe, Fe-Ni, FeS, or aggregates of metallic Fe-Ni spherules in FeS. The network results from the coalescence of discrete islands which are the surface expression of droplets that formed from vapor deposition onto spheres of volatile-rich liquid silicate. These data suggest that iron is a major component of the vapor phase.

Thin sections of rock 12002,5 (a dolerite with equant phenocrysts of olivine and skeletal crystals of ilmenite), 12022,111 (a porphyritic olivine basalt in which zoning is present in the phases), and rock 12057,27 (an olivine gabbro) have been studied by optical and microprobe techniques. In rock 12057,27 (Cpx, 40.5; Ol, 37.1; Plag, 18.4; Opaques, 4.0) clinopyroxene, olivine, and plagioclase are relatively homogeneous. Olivine is euhedral to subhedral with plagioclase filling the spaces around clinopyroxene and olivine. The texture of rock 12057,27 is similar to cumulate textures in the Stillwater layered complex.