THE APOLLO 16 MISSION

The Apollo 16 mission (April 1972) to the Descartes landing site in the central lunar highlands was the only Apollo mission restricted to highlands terrain (Figures 1, 2). Hence, samples from the site are of fundamental importance in the understanding of lunar crustal evolution. Approximately 95 kg of rocks, mainly feldspathic breccias, and soils were collected during three periods of extravehicular activity. Using the Lunar Roving Vehicle, astronauts John W. Young and Charles M. Duke covered over 20 km of traverses, and samples were collected from 10 different stations (Figure 3).

The mission had two prime sampling objectives: the Cayley Formation, an example of highland plains; and the Descartes Formation, a rugged, hilly, and furrowed terrain. The consensus of pre-mission photogeological interpretation was that both units were of probable volcanic origin; however, it became apparent even during the mission that the samples were not volcanic but predominantly impact-produced feldspathic breccias. The landing site included a portion of the Cayley Plain and two areas of mountainous terrain: Stone Mountain to the south and Smokey Mountain to the north. Traverses were selected to sample 1) the Cayley Plains around the Lunar Module, 2) Descartes material on Stone Mountain, 3) blocky debris around the rim of North Ray Crater, a 1 km wide, 230 m deep crater which lies on the boundary between Smokey Mountain and the Plains, and 4) blocky material from a ray of the younger South Ray Crater, an almost 1 km wide crater in the Cayley Plains. The exploration strategy was to use impact craters of various diameters as stratigraphic probes.

The great majority of samples collected are feldspathic breccias of varied characteristics. They include specimens chipped from boulders up to tens of meters in size, individually collected hand samples, samples raked from the regolith, and samples picked from regolith samples in the laboratory. In all, more than 500 rocks have been individually numbered in addition to the many regolith samples collected. The largest rock collected (61016) is 11,729 g; the smallest include many samples less than 1 g. The samples include friable breccias, coherent breccias, and varied impact melts; many of the latter have clast-free or near clast-free ophitic textures and were almost completely molten during their formation. Glass, glassy breccias, and glass coatings on breccias are common. A significant group are the cataclastic anorthosites, nearly pure plagioclase and certainly shocked igneous cumulates from the early lunar crust.

The Apollo 16 samples confirm that the highlands crust is feldspathic and formed by a process involving plagioclase accumulation. The details of variation between sampling sites have not yet been fully worked out; the most obvious distinction is that samples, including soils, from the North Ray Crater area are more aluminous (~28-30 wt% $A1_2O_3$) than those from other areas (26-28 wt% $A1_2O_3$), and include more friable, fragmental, light-colored breccias. North Ray Crater and South Ray Crater are about 50 m.y. and 2 m.y. old respectively.

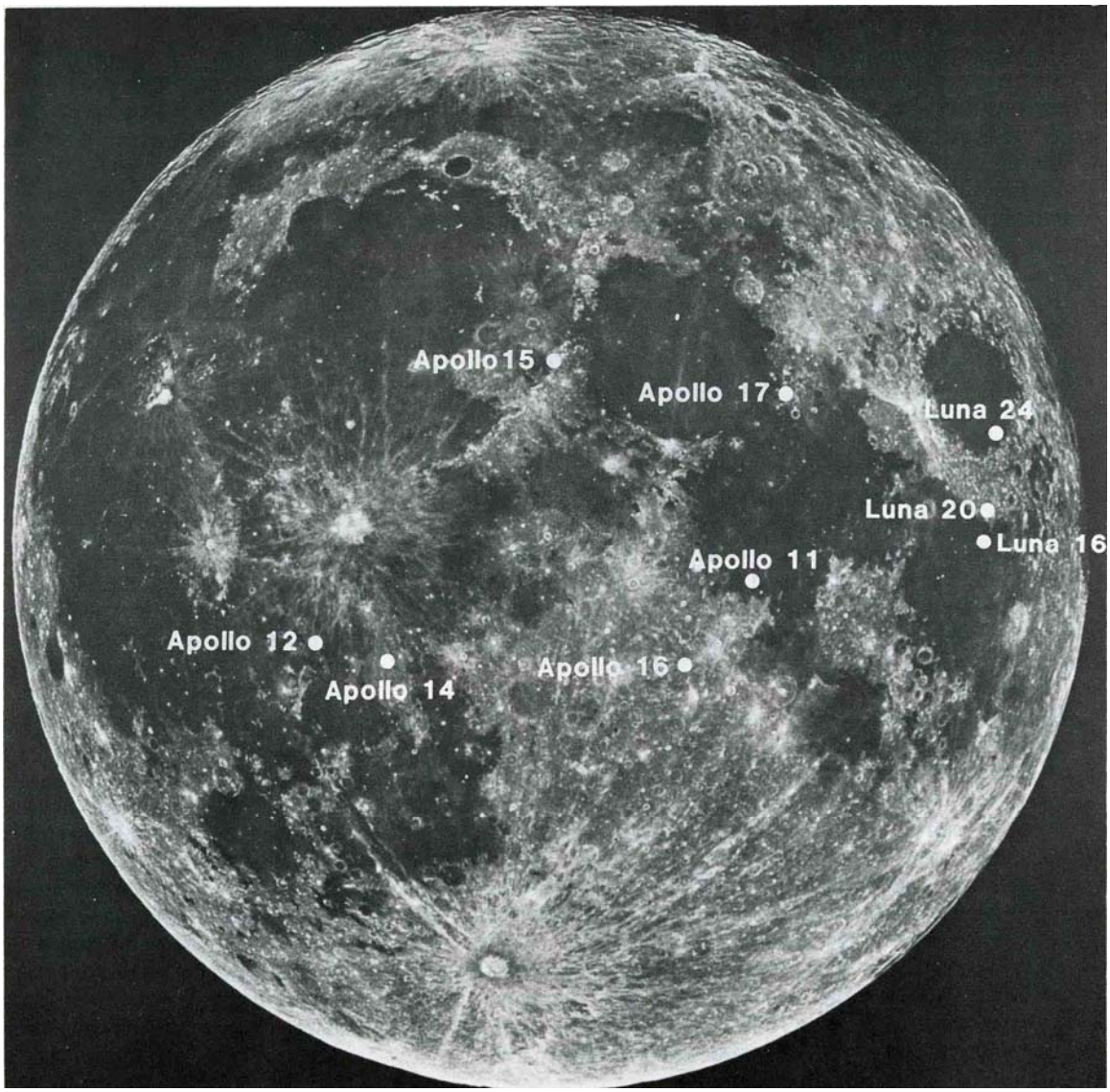

FIGURE 1. Apollo and Luna sampling locations.

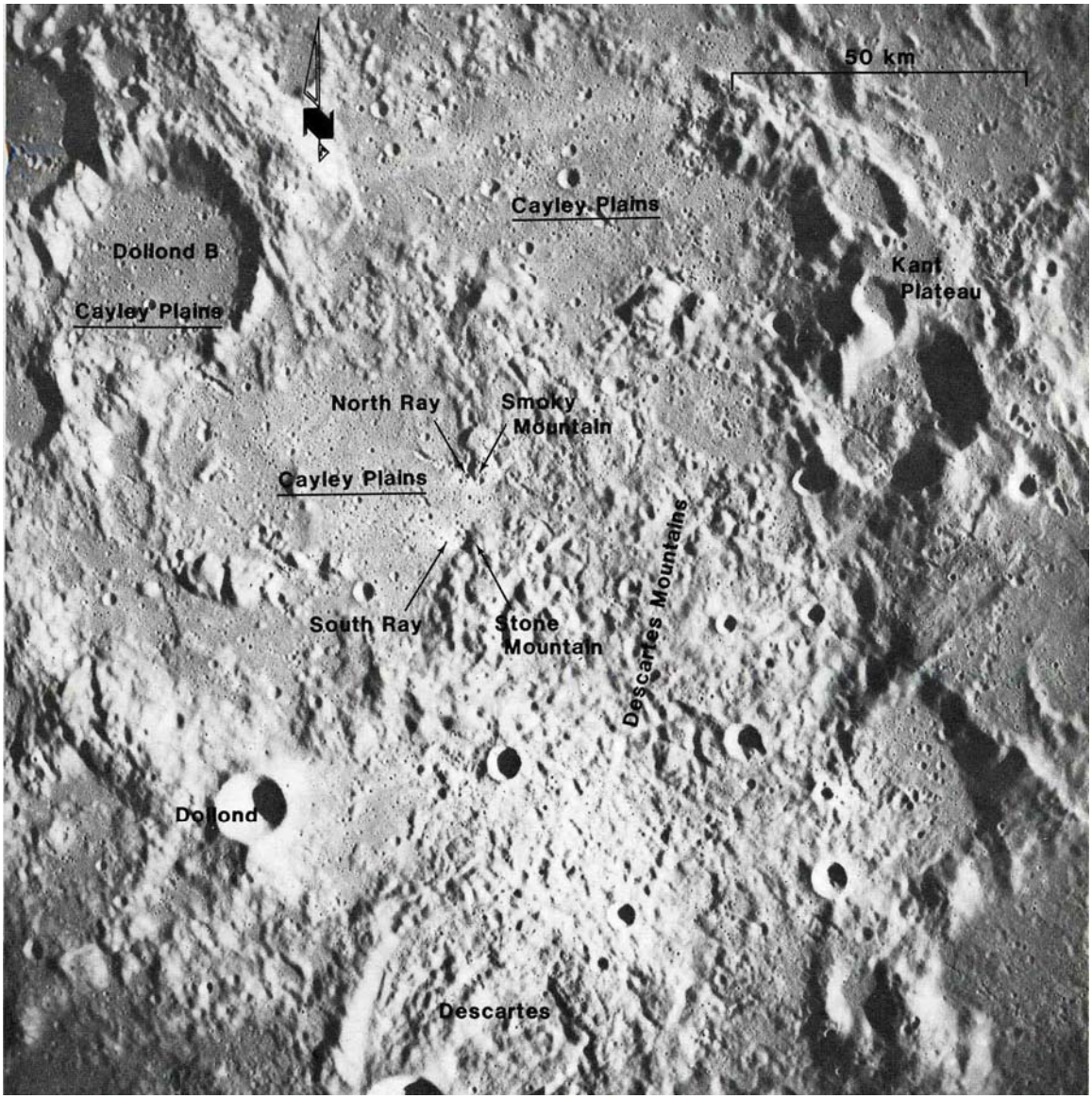

FIGURE 2. Apollo 16 landing site area (Apollo 16 metric camera frame 439).

FIGURE 3. Apollo 16 traverses and sampling stations
(Apollo 16 pan camera frame 4618).

References to detailed studies on the Apollo 16 samples are cited in the individual rock descriptions. The following list is a more general selected bibliography pertaining to the geological interpretation, and rock samples of the Apollo 16 landing site. The Proceeding of the Lunar Science Conferences, in particular the 4th, contain many other relevant papers.

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