Geology: From Earth to Planetary Science in the 20th Century

MARVIN, U. B. Harvard-Smithsonian Center for Astrophysics Cambridge, Massachusetts, USA.

Between July, 1969, and December, 1972, twelve Apollo astronauts with geological training landed on the Moon where they collected samples, made instrumental measurements, and recorded field observations. Their activities transformed geology from the earthbound science it had remained since its founding into one that, today, investigates all planetary bodies with rocky or icy surfaces.

The Apollo missions validated stratigraphic maps of the Moon based on the geologic principles of superposition, cross-cutting relationships, and preservation of surface features. The returned samples provided petrologic data and a radiometric time scale for lunar crustal formations. However, even the most ancient lunar rocks proved to be utterly lacking in water, indicating that lunar erosion and deposition has been dominated by meteoroid impact that has saturated the surface with basins and craters and created an abundance of breccias, shocked minerals, and impact glasses among the crustal rocks.

Satellite images have shown that every major and minor planet in the solar system differs from every other, but all display a record of collisions in space. Such events have ejected rocks from the Moon and Mars that have fallen on Earth as meteorites invaluable for research. Images of Mars reveal a complex history of impacts, volcanism, and spectacular erosion by long-vanished floodwaters. Indeed, the visible evidence of catastrophic floods on Mars helped to gain widespread acceptance for a similar flood on the Earth. Whether or not postulated evidence for ancient life on Mars ever is confirmed, the Earth will remain unique in the solar system for being awash with water and burgeoning with life. The emergence of planetary geology in recent decades is one of the most significant advances of this century.