Apollo moon rocks yield more insights on evolution of solar system

January 19, 1989

Contact: Yvonne Baskin, (619) 534-3120 or AAAS Newsroom For Release THURSDAY PMS

APOLLO MOON ROCKS STILL YIELDING INSIGHTS ON EVOLUTION OF SOLAR SYSTEM, UCSD CHEMIST SAYS

SAN FRANCISCO--Footprints left in the talcum-like dust of the moon by Apollo 11 astronauts two decades ago should be visible for another half a million years, calculates cosmochemist James R. Arnold of the University of California, San Diego.

Through extensive and ongoing isotopic studies of moon rocks brought back by six Apollo missions, Arnold and his colleagues have developed techniques to measure the rate of erosion and turnover of rocks and soil on the lunar surface.

"The moon is a quiet place, lacking an atmosphere and therefore free of wind and rain," notes Arnold, who holds the Harold Clayton Urey professorship in chemistry and serves as director of the California Space Institute at UCSD.

The absence of an atmosphere, however, also leaves the moon unprotected from bombardment by meteorites and cosmic rays. These hits have scarred its rugged surface over 4.5 billion years and will eventually obliterate the footprints, too.

Long before that happens, however, Arnold hopes to see a more permanent human presence on the moon.

He talked about the role of "The Moon as a Space Probe" Thursday morning, January 19, at a session on Apollo Plus 20: The New Moon, the Earth, and the Universe at the annual meeting of the American Association for the Advancement of Science at the San Francisco Hilton.

"We've learned a lot about the history of the sun and moon and both solar and galactic cosmic rays from Apollo," Arnold says. "But we've barely scratched the surface in our understanding of the formation and evolution of the sun and moon."

He hopes to see future moon missions land near relatively "fresh" meteorite craters--only 100 million years old--such as Copernicus, near the equator, and Tycho, near the south pole.

"With the techniques we've worked out from Apollo, we think we can measure how long it will take these fresh craters to degrade and disappear," he says. "And that information bears directly on many questions about the evolution of our solar system, including the Earth."

The meteorite bombardment rates he has found on the moon, for instance, lend credence to the theory that asteroids--such as the one believed to have struck the Earth at the Cretaceous-Tertiary boundary--do impact our planet every 100 million years or so. (Whether such an impact led to the extinction of the dinosaurs is a separate question, he notes.)

The record of bombardment of the lunar surface by high energy solar flare particles provides clues to the history of the sun and perhaps to resultant climate variations on Earth.

These solar flare particles smash the atomic structures in rock and soil, creating new isotopes that serve as a fossil record of both the particles that made them and the solar storm activity that generated the flares and the resulting particles.

Arnold and his co-workers have pioneered techniques for measuring the concentration of various radioactive isotopes in layers of rock. The longer the decay time or half-life of the radioisotope, the farther back in the fossil record researchers can see. Arnold's studies have ranged from cobalt-56, with a half-life of only months, and carbon-14, which takes thousands of years to decay, to manganese-53, with a half-life of 3.7 million years.

His lab is now working on precise and sensitive techniques needed to count atoms of rare, longer-lived radioisotopes such as iodine-129, which could extend knowledge of solar activity and moon history back 17 million years.

"Even after 20 years, we have no real theory of solar evolution and stability that fits the data," Arnold says. "Useful models for time variation of solar activity are a challenge for the future."

(January 19, 1989)