Fossil Track Studies in Lunar Materials - I : High Resolution Time Averaged (Millions of Years) Data on Chemical Composition and Energy Spectrum of Cosmic Ray Nuclei of Z = 22-28 at 1-3 A.U.

By

N. Bhandari, S. Bhat, D. Lal, G. Rajagopalan, A.S. Tamhane and V.S. Venkatavaradan

Tata Institute of Fundamental Research
Homi Bhabha Road, Colaba, Bombay-5, India

Abstract

Experimental data are presented on the number and "recordable" ranges of fossil tracks in silicate minerals in spot samples and thin sections from Apollo 12 rocks. Some of the rocks are documented and the thin sections have a known orientation. These data are analysed in the light of new model calculations of track densities expected for rocks exposed to cosmic rays on the lunar surface. A range of cosmic ray V-H nuclei spectra is considered encompassing contemporary near earth balloon/satellite data and fossil track meteoritic data. The experimental and theoretical analyses make it possible to deduce the orientation of the rocks during their exposure history on the moon and to identify several regions of the rocks that have not

suffered any appreciable erosion/attrition*. The track density data therefore allow us to establish the energy spectrum of iron group nuclei in the 1-500 MeV/n kinetic energy interval and we conclude :

(a) For the kinetic energy interval, $E > 200$ MeV/n the "lunar cosmic ray data" appear to be identical with recent observational data based on Cerenkov-scintillator/solid state dE/dx detectors, but very different from meteoritic data.

(b) For the interval $1 < E < 200$ MeV/n, "lunar cosmic ray data" provide the only information available so far for Z 22 elements because these data have not yet been acquired with modern particle detectors.

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* A notation due to J.R. Arnold to specifically denote losses of surface due to artificial physical means, e.g., during transport from moon to the earth or from M.S.C., Houston to P.I's laboratory.