SOLAR AND GALACTIC COSMIC RAY STUDIES IN MOON AND METEORITE SAMPLES USING NOBLE GAS MASS SPECTROMETRIC METHODS

BY

CHANDRA MOHAN NAUTIYAL

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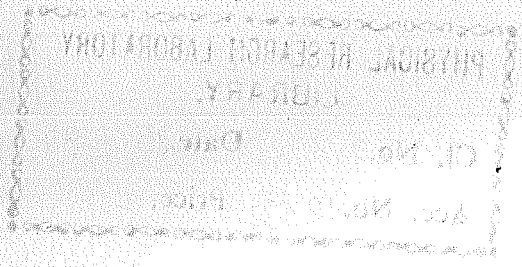
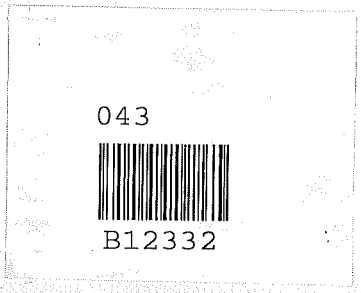


PHYSICAL RESEARCH LABORATORY

AHMEDABAD - 380 009 (INDIA)



CERTIFICATE

I hereby declare that the work presented in this thesis is original and has not formed basis for the award of any degree or diploma by any university or institution.

C M Nautiyal

CHANDRA MOHAN NAUTIYAL
(AUTHOR)

Certified by:

Rao M.N.

Prof. M. N. Rao

Oct., 1983

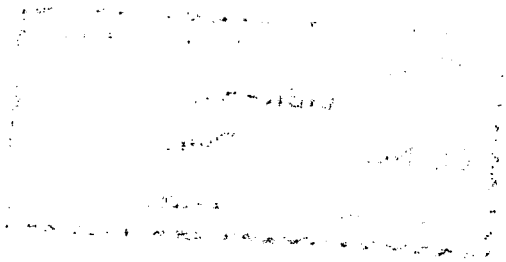


TABLE OF CONTENTS

ABSTRACT

The main problems addressed to in this thesis are centered around the identification and characterization of the implanted component of the noble gases due to solar energetic particles (SEP); the solar cosmic ray (SCR) proton-induced neon composition in lunar and meteoritic samples and the resolution of the cosmogenic effects of the SCR and GCR protons in them. Several interrelated problems have been dealt with in the thesis though all pertain to the irradiation effects of solar and galactic cosmic rays.

In this study, a systematic analysis of lunar soils which accumulate solar flare gases over several millions of years has been carried out. The results based on etched feldspars and etched pyroxene mineral residues suggest that the Ne isotopic composition of the solar flares is not planetary and is different from but closer to the solar wind value. The conclusion is further strengthened by the fact that noble gas elemental composition in these etched samples compares well with the solar composition rather than with the planetary composition.

A procedure making use of the characteristic Ne-isotopic compositions of different reservoirs has been developed. This procedure allows an estimation of the surface exposure ages (integrated residence time in top one cm of the regolith) for the soil samples.

An attempt has been made to understand the observed trend of Ne isotopic compositions of the gas-rich meteorites in the frame-work of the known reservoirs viz. implanted SEP and SW as well as spallation (SCR-and GCR-proton produced) components. The results suggest necessity for invoking a higher proton flux with a pulse-like spectral shape during the early history of the Sun. A qualitative explanation is offered for this observation considering possible physical conditions in the early solar system when interplanetary medium was denser and (young) Sun was presumably much more active than at present.

During the course of this study, two meteorites were found to be interesting viz. Isna (C3-O) and AH 77216, 18 (L-3) as they showed the presence of Ne of planetary and solar compositions respectively in appreciable quantities which is not common for their respective groups. Results of noble gas study of these meteorites have also been presented.

Further, some relevant experimental studies are proposed to improve the findings of this study in future.