Mineral chemistry, x-ray and IR characteristics of vermiculites from ancient Sargur supracrustals, Karnataka craton, South India

PRAKASH NARASIMHA KIKKERI, NARASIMHA SASTRY AND KRISHNA VENI

Department of Geology, University of Mysore, Manasagangotri, MYSORE-570 006, INDIA. (prakashnarasimha@yahoo.com)

Karnataka craton is one of the oldest Precambrian terrain's of the world preserving within it's limits the geological history of one of the earliest formed continental crust in south India. Within the southern part of the Karnataka craton , the oldest recognizable supracrustal rocks occurring as dismembered remnants lacking distinct stratigraphy and set in a sea of gneisses are well exposed and are widely recognized as ancient Sargur supracrustal enclaves. It is possible they belong to different ages and depositional settings prevailing over a protracted period of time prior to 3000 m.y ago. Within these Sargur sulpracrustals enclaves, Vermiculites occur at the contact of ultramafic rocks and acid intrusion. Vermiculites are the alteration products of either pyroxenes or biotite in this part of the terrain. Optical studies indicate, Vermiculites are light golden yellow in colour in hand specimen and colourless under polarized light. Grains are highly deformed, which is indicated by the presence of deformation lamellae and kink bands.

Micro probe analysis were carried out on Vermiculite show SiO_2 -36.00% ; Al_2O_3 -12.80%; TiO_2 -2.61%; MgO -17.59%; FeO -11.15 % ; K_2O -0.35 %; Na_2O -0.17% ; CaO -0.97%; NiO -0.15% ; Cr_2O_3- 0.17 %. Unexfoliated samples have H_2O up to 18% and on exfoliation reduced to 16%. X-ray diffraction patterns show the presence of both dehydrated and hydroxyl inter layers. IR spectra were obtained in the range of 4400cm-^{1} to 410 cm-^{1}. IR spectra shows peaks due to presence of water and shift in the peak is seen between exfoliated and unexfoliated samples. Percentage of transmittance increases towards the exfoliated samples which is indicated by the shift in corresponding wave numbers (3419.29 $^{cm-1}$, 1644.96^{cm-1}, 1383.94^{cm-1}, 1007.00^{cm-1}, 670.01^{cm-1} in unexfoliated samples to 1651.45^{cm-1}, 1383.96^{cm-1}, 1013.79^{cm-1}, 668.75^{cm-1}in exfoliated samples respectively.

Numerical simulations of cosmogenic nuclide production rates in the Apollo 15 deep drill core

K. J. KIM[1] AND R. C. REEDY[1]

[1]Institute of Meteoritics, Univ. of New Mexico, Albuquerque, NM 87131, USA, kkim@unm.edu rreedy@unm.edu

Introduction

The production rates of spallogenic ^{10}Be, ^{14}C, ^{26}Al, and ^{53}Mn and neutron capture-induced ^{41}Ca in the Apollo 15 drill core were investigated using the MCNPX code. The concentrations of these cosmogenic nuclides in the Apollo 15 deep drill core have been well studied [1-6]. These measured data allow us to test the numerical simulations by the MCNPX code for rates of cosmic-ray-induced reactions.

Results

The MCNPX (Monte Carlo N Particle eXtended) code combines the latest versions of the LAHET code for high-energy particle transport and the neutron code MCNP that were used by Masarik and co-workers [3,7,8]. Using version 2.4.b of the MCNPX code with its default parameters, fluxes of protons and secondary neutrons were calculated for a series of 86 concentric spherical shells near the lunar surface. Each shell is spaced by 3 cm, and a density of 1.71 g/cm^3 was used. An incident flux of 1 p/s/cm^2 of galactic-cosmic-ray protons [7] was used. Production rates of cosmogenic nuclides were then calculated using these calculated neutron and proton fluxes, compositions of the Apollo 15 drill core samples, and our most-recent sets of neutron and proton cross sections for all target-product combinations.

Discussion

The profiles of our calculated production rates agreed well with the measured concentrations [1-6] and previous calculations [3,8]. The effective proton flux needed to match the measurements for each nuclide was determined. These fluxes varied among these radionuclides. For each nuclide, the effective primary proton flux is slightly less than that in meteorites. The average effective proton flux will be an important parameter in our future calculations. Numerical simulations with MCNPX of both neutron-capture and spallation reactions will also be used to calculate gamma-ray and neutrons fluxes for the elemental mapping of planetary surfaces, such as now being done by Mars Odyssey and soon will be done by the Japanese SELENE mission to the Moon.

Acknowledgments NASA's Cosmochemistry Program supported this work. We thank D. Drake, J. Masarik, T. Prettyman, and G. McKinney for their help with MCNPX.

References

[1] Nishiizumi K. et al., (1984), *Earth Planet. Sci. Lett.* **70**, 157-163. [2] Nishiizumi K. et al., (1984), *Earth Planet. Sci. Lett.* **70**, 164-168. [3] Nishiizumi K. et al., (1997), *Earth Planet. Sci. Lett.* **148**, 545-552. [4] Rancitelli L.A. et al., (1975), *Proc. Lunar Sci. Conf. 6th*, 1891-1899. [5] Imamura M. et al., (1973), *Earth Planet. Sci. Lett.* **20**, 107-112. [6] Imamura M. et al., (1974), *Proc. Lunar Sci. Conf. 5th*, 2093-2103. [7] Masarik J. and Reedy R.C., (1994), *Geochim. Cosmochim. Acta* **58**, 5307-5317. [8] Reedy R.C. and Masarik J. (1994), *Lunar Planet. Sci.* **25**, 1119-1120.