Evaluation of nucleogenic component in cosmogenic ^{21}Ne surface exposure dating

T. FUJIOKA[1], M. HONDA[1], J. CHAPPELL[1], K. FIFIELD[1], D. FABEL[1] AND K. NISHIIZUMI[2]

[1]Research School of Earth Sciences, and Research School of Physical Sciences and Engineering, Australian National University, Canberra, ACT 0200, Australia toshiyuki.fujioka@anu.edu.au Masahiko.Honda@anu.edu.au John.Chappell@anu.edu.au Keith.Fifield@anu.edu.au Derek.Fabel@anu.edu.au

[2]Space Sciences laboratory, University of California, Grizzly Peak Blvd., Berkeley, California 94720, USA kuni@sunspot.ssl.berkeley.edu

The cosmogenic nuclide ^{21}Ne is produced in rocks near the ground surface by reactions with secondary and tertiary cosmic ray neutrons and muons, and it can be used as a chronometer of various geological events, with important implications for geomorphology. In order to accurately determine the amount of cosmogenic ^{21}Ne (^{21}Ne-c) in a sample it is necessary to correct for nucleogenic ^{21}Ne (^{21}Ne-n) potentially present in a sample, which is produced mainly by $^{18}O(\alpha,n)^{21}Ne$ reaction, where α is generated from U and Th in the crust, and subsequently incorporated into the sample during its crystallisation.

We have analysed four silcrete and two quartzite samples at the surface from the Central Australia for all five noble gases. Most of the samples showed excess ^{136}Xe (fissiogenic), relative to atmospheric. Because of low U content (<0.1 ppb) in these samples, these ^{136}Xe-sf have not been produced in the samples after their crystalisation, but have been incorporated during their formation. The presence of ^{136}Xe-sf in the samples indicates that the corresponding amounts of crustal ^{21}Ne-n are also in the samples. We have calculated ^{21}Ne-n contents from the amounts of ^{136}Xe-sf in the samples using the crustal production ratio. Subtracting ^{21}Ne-n from the non-atmospheric ^{21}Ne yields the amounts of ^{21}Ne-c. Based on this approach, we estimate as high as 30% of the non-atmospheric ^{21}Ne in the samples is nucleogenic.

The amounts of ^{21}Ne-c, after the correction of nucleogenic neon, are compared with cosmogenic ^{10}Be. Most of the samples showed long exposure ages (>1 Ma) and low erosion rates (<1 m/Ma). The exception is the data obtained from a sample from the Davenport Province of the Tennant Creek area in the Central Australia, which lies below the steady-state erosion curve on a ^{21}Ne – ^{10}Be/^{21}Ne plot. This implies that the sample may have been experienced a burial event.

Vp/Vs and mineralogy of the transition layer of the earth's mantle

H. FUJISAWA

Dept. Geosystem Science, nihon University, Sakurajyousui 3-25-40, Setagaya-ku, Tokyo 156-8550, (h-fujisawa@mte.biglobe.ne.jp)

Constituents of the mantle transition layer is discussed based on comparison between the seismic Vp/Vs and those of the mantle-minerals. An olivine-phase change hypothesis has long been a standard model for the earth's mantle.The author measured velocities of olivine and its high-pressure form(spinel-form) and found that the phase change hypothesis can not explain the seismic evidences of the mantle. To explain the seismic evidences he has proposed eclogite model of the transition layer. It means that the layer are constituted by a high-pressure version of eclogite minerals. To judge these two hypotheses we need essentially new method (Vp/Vs comparison) of discussion of the problem. Elastic properties of crystalline solid is determined by its crystal structure, if elements which constitute the solid are similar. Garnet type structure is more rigid compared to that of silicate spinel. Rigidity of solid is directly related to Vs. So the ratio Vp/Vs would reflect essential difference of elastic property among olivine-spinel group minerals and garner-type minerals effectively, and could be a judgement standard. Values of the seismically determine ratio increases steeply in the depth shallower than 410-km discontinuity, and the peridotite (olivine) upper mantle is highly probable. On the contrary, in the transition layer, it does not change with depth. This strongly suggest the eclogite (garnet type materials) transition layer, considering from the experimental data of mantle minerals.