A 2840 year record of nitrate and its stable isotopic composition from the Dome A ice core, East Antarctica

S. JIANG[1]*, J. COLE-DAI[2], Y. LI[1], L. GENG[3], D.G. FERRIS[2], G. SHI[1], C. AN[1] AND H. MA[1]

[1]Key Laboratory for Polar Science of State Oceanic Administration, Polar Research Institute of China, Shanghai 200136 P.R. China (*correspondence: jiangsu@pric.org.cn)

[2]Department of Chemistry and Biochemistry, South Dakota State University, Brookings, SD 57007, USA

[3]Department of Atmospheric Sciences, University of Washington, Seattle, WA 98195, USA

During the 21st Chinese Antarctic Research Expedition in 2004/2005 austral summer, a 109.91 m ice core (hereafter DA2005 core) was recovered at the site about 300 m away from the summit of Dome A. The top 100.42 m was analyzed for major chemical impurities and isotopic composition of nitrate. Dating was based on the volcanic stratigraphy and average annual accumulation rate. Results showed that the analyzed 100.42 m part of the core covers the last 2840 years before present, from 840 BC to AD 1998 [1].

Nitrate concentration in the DA2005 core varies between 2.86 μg kg^{-1} and 30.75 μg kg^{-1} throughout the 2840 years, with the mean concentration of 11.84 μg kg^{-1}. Comparisons with previous Antarctic ice core nitrate records show that the DA2005 core has the lowest mean concentration of nitrate, which is consistent with the lowest accumulation rate at Dome A among these sampling sites. Decreased nitrate concentration during the period of Little Ice Age (AD 1500-1900) is observed in the DA2005 core. The $\delta^{15}N(NO_3^-)$ values vary between 235.4 ‰ and 279.4 ‰, which suggest strong ^{15}N enrichment in the DA2005 core. The sample covering the most recent time period (AD 1695-1838) has the lowest $\delta^{15}N(NO_3^-)$ value. The $\Delta^{17}O(NO_3^-)$ values span from 28.9 ‰ to 31.4 ‰, which is among the range ever observed [2,3]. An increasing trend is seen during the period of AD 1225-1838, which corresponds to the time period when nitrate concentration remains low. The maximum $\Delta^{17}O(NO_3^-)$ value occurs in the period AD 1695-1838, and the minimum value occurs in the period AD 62-166.

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