

ISOTOPIC ANALYSIS OF SMALL PRESOLAR SiC GRAINS WITH THE NANOSIMS ION MICROPROBE. E. Zinner¹, S. Amari¹, S. Messenger¹, A. Nguyen¹, F. J. Stadermann¹, R. M. Walker¹ and R. S. Lewis², ¹Laboratory for Space Sciences and the Physics Department, Washington University, St. Louis, MO 63130, USA (ekz@howdy.wustl.edu), ²Enrico Fermi Institute, University of Chicago, Chicago IL 60637 USA.

Introduction: SiC is the most studied presolar grain type [1]. A wealth of isotopic compositions has been obtained by ion microprobe analysis of individual grains. Most measurements were made on grains several μm in diameter [e.g., 2,3] and $\sim 0.5\mu\text{m}$ was the lower size limit for which meaningful data could be obtained [4]. However, the isotopic ratios of certain elements were shown to vary with grain size [5,6]. The NanoSIMS with its small primary ion beam, high sensitivity at high mass resolution and multidetection [7] makes it possible to analyze considerably smaller grains (down to $0.1\mu\text{m}$) for their isotopic compositions. Here we report the first NanoSIMS C and N isotopic analyses of presolar SiC grains from the Murchison meteorite.

Experimental: We analyzed 77 grains from Murchison SiC separate KJG (diameters $1.8\text{--}3.7\mu\text{m}$) and 91 grains from separate KJB (diameters $0.25\text{--}0.45\mu\text{m}$). The C and N isotopic ratios were measured simultaneously by counting C^- and CN^- ions produced by a Cs^+ beam of $\sim 0.25\text{pA}$ in four different detectors. A fifth detector was used to count $^{28}\text{Si}^-$ ions in order to ascertain that SiC grains were analyzed. The grains to be measured were selected from raster images of $^{12}\text{C}^-$ and $^{28}\text{Si}^-$ by deflecting the slightly defocused primary beam (the focused beam would have been much smaller than $0.1\mu\text{m}$) onto individual grains for isotopic analysis. In the near future it will be possible to use secondary electron images (which are much more sensitive) to make this selection.

Results: The results are shown in Figs. 1 and 2. KJG grains were measured to obtain a comparison with previous measurements with the Cameca IMS 3f ion probe on grains from the same size fraction [2]. The ranges in the two isotopic ratios are essentially the same as those obtained before. The KJB measurements are the first isotopic analyses made on such small presolar SiC grains. In addition to mainstream grains, the data in Fig. 2 show the presence of the minor grain types Y ($^{12}\text{C}/^{13}\text{C} > 100$), A+B ($^{12}\text{C}/^{13}\text{C} < 10$), and X ($^{14}\text{N}/^{15}\text{N} < 100$). Presolar SiC grains from most other meteorites are much smaller than those from Murchison [e.g., 3,8] and the NanoSIMS

provides the capability to study these grain in detail.

References:

- [1] Zinner E. (1998) *Ann. Rev. Earth Planet. Sci.* 26, 147-188. [2] Hoppe P. et al. (1994) *ApJ* 430, 870-890. [3] Huss G. R. et al. (1997) *GCA* 61, 5117-5148. [4] Hoppe P. et al. (1996) *GCA* 60, 883-907. [5] Prombo C. A. et al. (1993) *ApJ* 410, 393-399. [6] Amari S. et al. (2000) *MAPS* 35, 997-1014. [7] Stadermann F. J. et al. (1999) *LPS XXX*, Abstract #1407. [8] Russell S. S. et al. (1997) *MAPS*. 32, 719-732.

