C, N, Si, Fe, Sr, Zr, Mo AND Ba ISOTOPIC ANALYSES OF TYPE X MURCHISON SiC GRAINS: EXPERIMENTAL EVIDENCE FOR A NEW TYPE OF STELLAR NUCLEOSYNTHESIS IN SUPERNOVAE.* M. J. Pellin[1], M. R. Savina[1], E. Tripa[1,2], W. F. Calaway[1], A. M. Davis[2,3], R. S. Lewis[2], S. Amari[5] and R. N. Clayton[2,3,4], [1]Materials Science and Chemistry Divisions, Argonne National Laboratory, Argonne, IL 60439, [2]Enrico Fermi Institute, [3]Department of the Geophysical Sciences, [4]Department of Chemistry, University of Chicago, Chicago, IL 60637 USA, [5]McDonnell Center for the Space Sciences, Washington University, St. Louis, MO 63130, USA..

Introduction: Silicon carbide grains isolated from the Murchison meteorite are thought, based on their isotopic compositions, to have formed in stellar outflows prior to the formation of the solar system.[1] A fraction of these grains (2%), identified by high $^{12}C/^{13}C$, and low $^{29}Si/^{28}Si$ and $^{30}Si/^{28}Si$ ratios are thought to have formed from supernovae ejecta.[2,3] This view is reinforced by the observation many of these grains contain excess ^{26}Mg from the in situ decay of ^{26}Al ($t_{1/2}$ = 716,000 yr) and excess ^{44}Ca from the in situ decay of ^{44}Ti ($t_{1/2}$ = 59 yr) indicating grain condensation shortly after neutron exposure. Here we expand on our previous work [4-6] detailing the heavy element isotopic compositions of ten SiC grains of Type X.

Results: In each grain measured, the C, N, and Si isotopic compositions along with the isotopic composition of at least one heavy element isotopic composition have been determined. Remarkably, two of the grains contained sufficiently high trace element abundances to allow determination of all five heavy elements (Sr, Zr, Mo, Fe, and Ba). Although supernovae are thought to be the major site for *r*-process nucleosynthesis in the universe, it is clear from an examination of the Mo isotopic enhancements in several X-grains measured that the heavy elements measured here are not consistent with production in a canonical *r*-process. Major enhancements relative to the pure s-process isotope ^{96}Mo are found for ^{95}Mo and ^{97}Mo with ^{100}Mo being enhanced to a much smaller extent if at all. Other results of interest include significant $^{96}Zr/^{94}Zr$, $^{138}Ba/^{136}Ba$, $^{88}Sr/^{86}Sr$, $^{57}Fe/^{56}Fe$ and $^{58}Fe/^{56}Fe$ enhancements relative to solar. Each of the heavy elements measured appear to be consistent with an intense neutron dose of limited exposure. This limited neutron exposure has been proposed to result from the supernova explosion shock wave passing through helium-rich stellar zones [7,8]. Recent detailed calculations of Type II supernova explosions show large enhancements of ^{57}Fe, ^{58}Fe, ^{88}Sr, ^{96}Zr, ^{95}Mo, ^{97}Mo and ^{138}Ba in an oxygen rich zone below the helium-rich zone [9].

Conclusion: The heavy element isotopic signatures (Sr, Zr, Mo, Fe, and Ba) of 10 presolar SiC grains of Type X have been measured for the first time. These signatures are consistent with a new type of nucleosynthesis – a neutron burst nucleosynthesis.

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