PRESOLAR SIC X GRAINS WITH LOW $^{29}Si/^{30}Si$ RATIOS: IMPLICATIONS FOR SUPERNOVA MODELS.

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Introduction: A rare subgroup of presolar grains are SiC grains from supernovae (SNe), the C and X grains [1]. Important characteristics of X grains are enhanced isotope abundances of ^{12}C (mostly), ^{15}N, and ^{28}Si. First attempts to explain these signatures (and others) in the context of SNII models considered selective mixing of matter from the inner Si- and S-rich zone (^{28}Si-rich) with matter from the C-rich outer zone (^{12}C-rich). More recently, Pignatari et al. [2] presented an alternative scenario in which a C- and Si-rich (C/Si) zone forms by explosive He burning at the bottom of the He shell, from which SiC might condense without the need for selective, large-scale mixing.

Here, we focus on rare X grains with low $^{29}Si/^{30}Si$ ratios (<0.5x the solar ratio). Data from the literature (2 grains for which C, N, and Si isotope data exist) [3,4] and from a NanoSIMS ion imaging survey of presolar SiC grains (2 grains, this work) are compared with predictions from two SN models [5].

Experimental and Results: About 1200 SiC grains from Murchison separate KJA [6] were screened for X grains by C and Si ion imaging with the NanoSIMS at MPI for Chemistry. 13 X grains were identified, two of which showed low solar-normalized $^{29}Si/^{30}Si$ ratios of 0.47 and 0.51, similar to the values of the two previously found grains [3,4]. Alltogether, these grains have $\delta^{29}Si$ from -658 to -530‰, $\delta^{30}Si$ from -234 to -52‰, $^{12}C/^{13}C$ from 137 to 2100, and $^{14}N/^{15}N$ from 44 to 175.

Discussion: Two SNII models are explored, the 25 $M_\odot$ models 25T-H and 25T-H10 of [5]. These models consider ingestion of H (1 % and 0.1 % H, respectively) into the He shell before the explosion and artificially increase temperature and density at the bottom of the He shell during explosion. In both models the C/Si zone extends over <0.05 $M_\odot$ at about 6.82 $M_\odot$. This layer has mostly low $^{29}Si/^{30}Si$ and integration over a subzone can reproduce the Si-isotopic ratios of the X grains considered here reasonably well (Table). However, $^{12}C/^{13}C$ and N/C don't agree at all with those of the X grains. If we expand the integration by ~0.2 $M_\odot$ to the overlaying O/nova zone then the $^{12}C/^{13}C$ and N/C ratios of X grains can be roughly matched (models marked by * in the Table). However, these mixtures cannot reproduce the Si-isotopic ratios and C/O is <1. In a next step we will explore the constraints from X grains with low $^{29}Si/^{30}Si$ ratios on the SN models of [5], which may provide crucial observational indications for H-ingestion events in massive star SN progenitors.

Model	$^{12}C/^{13}C$	$^{14}N/^{15}N$	$\delta^{29}Si$ (‰)	$\delta^{30}Si$ (‰)	[C] (wt%)	[Si] (wt%)	N/C
25T-H	~10^8	1.7	-580	60	22	18	~10^{-8}
25T-H10	~10^8	1.7	-570	60	23	18	~10^{-8}
25T-H*	350	3.3	1470	690	1.4	2.3	0.9
25T-H10*	280	13.8	-20	170	5.2	2.7	0.1

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