STELLAR ORIGINS OF 13C- AND 15N-ENRICHED PRESOLAR SiC GRAINS

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Extreme excesses of $^{13}$C ($^{12}$C/$^{13}$C<10) and $^{15}$N ($^{14}$N/$^{15}$N<20) in rare presolar SiC grains have been considered diagnostic of an origin in classical novae [1], though an origin in core-collapse supernovae (CCSNe) has also been proposed [2]. We report multi-element isotopic data for 19 $^{13}$C- and $^{15}$N-enriched presolar SiC grains ($^{12}$C/$^{13}$C<16 and $^{14}$N/$^{15}$N<~150) from an acid-resistant residue of the Murchison meteorite. These grains are enriched in $^{13}$C and $^{15}$N, but with quite diverse Si isotopic signatures. Four grains with $^{29,30}$Si excesses similar to those of type C SiC grains likely came from CCSNe that experienced explosive H burning occurred during their explosions [3]. The independent coexistence of proton- and neutron-capture isotopic signatures in these grains strongly supports heterogeneous H ingestion into the He shell in at least some pre-supernova massive stars. Also, we found that seven $^{15}$N-enriched AB grains (~25<$^{14}$N/$^{15}$N<~150) have distinctive isotopic signatures compared to eight putative nova grains with $^{30}$Si excesses and $^{28}$Si depletions, such as higher $^{14}$N/$^{15}$N, lower $^{26}$Al/$^{27}$Al, and lack of $^{30}$Si excess, indicating weaker proton-capture nucleosynthetic environments. Interestingly, two of the eight putative nova grains and four of the seven $^{14}$N-enriched AB grains show lower-than-solar $^{34}$S/$^{32}$S ratios that cannot be explained by classical nova nucleosynthetic models. We discuss these signatures within the CCSN scenario.