SILICON AND TITANIUM ISOTOPES IN SiC FROM AGB STARS;
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We are modelling the abundances in both the He-burning shells of asymptotic-giant-branch (AGB) stars and in its envelope as shell material is dredged up and mixed into it. The envelope mass is declining owing to mass loss (prescribed at a standard but uncertain rate), and it is becoming more carbon-rich as newly synthesized C is dredged up along with the neutron-irradiated material. In this report we compare the calculated Si isotopes in SiC particles with the anomalous compositions of those particles as measured [1,2]. We take all nuclei in the He shell to receive the same neutron fluence in each AGB pulse, probably in the range $\Delta\tau$ =0.05-0.2 n/mb. The fraction *r* of shell matter remaining for the next irradiation probably lies in the range r=0.5-0.9 [3], and is sometimes taken to have a constant value that can be varied as a parameter but which we determine for each pulse by an astrophysical model of the AGB envelope and its mass loss and shell mass primarily from published analytic models by Renzini and Voli [4]. If these stars are also the dominant site of *s*-process nucleosynthesis, then their composite must average an exponential distribution $\exp(-\tau/\tau_0)$, where $\tau_0 = -\Delta\tau/\ln(r)$; but we do not at this time require that constraint because it cannot be asserted that the SiC particles have sampled the average s process. For the Si isotopes we take neutron cross sections advocated by the Karlsruhe team [5], namely 2.9mb, 7.8mb, and 6.3mb for $^{28,29,30}Si$ respectively.

Figure 1a shows the calculated evolution of the Si isotopes within the He shell in a 3-isotope plot as the pulses proceed in a $5M_\odot$ star in which it is assumed that $\Delta\tau$=0.071 n/mb per pulse; and Fig.1b shows the envelope composition with our mixing prescription. That specific pulse and dredgeup that first turns the atmosphere C-rich is shown as an asterisk along the dotted evolution path. The line of unit slope is shown solid as an aid to the eye. In Fig. 1a one sees that the initial slope in the shell is greater than unity, similar to measurements [1,2], but only for those first few pulses while the star is still O-rich. The star becomes C-rich only near the end of this path in the 3-isotope plot, and the large number of subsequent pulses move it very little more. We do not find the very ^{30}Si-rich composition calculated by Gallino *et al.*[3]. Of more relevance to the SiC particles, which must form in the envelope in order that its carbon not be too ^{12}C-rich, is the evolution of that envelope. Fig.1b reveals that the dilution of the dredged up Si by envelope Si greatly reduces the size of the anomalies and lies near slope 1. The largest envelope anomalies occur after the transition to C star, with $^{30}\delta$ =100-250 ppm. Such magnitudes are similar to those measured [1,2] in SiC, but fall near the slope 1 line rather than a slope 1.4

line that is suggested by the measurements [1,2]. We continue to seek the sensitivity of this result to uncertainties in the model: $\Delta\tau$, *r*, mass, mass loss rate, *etc.*

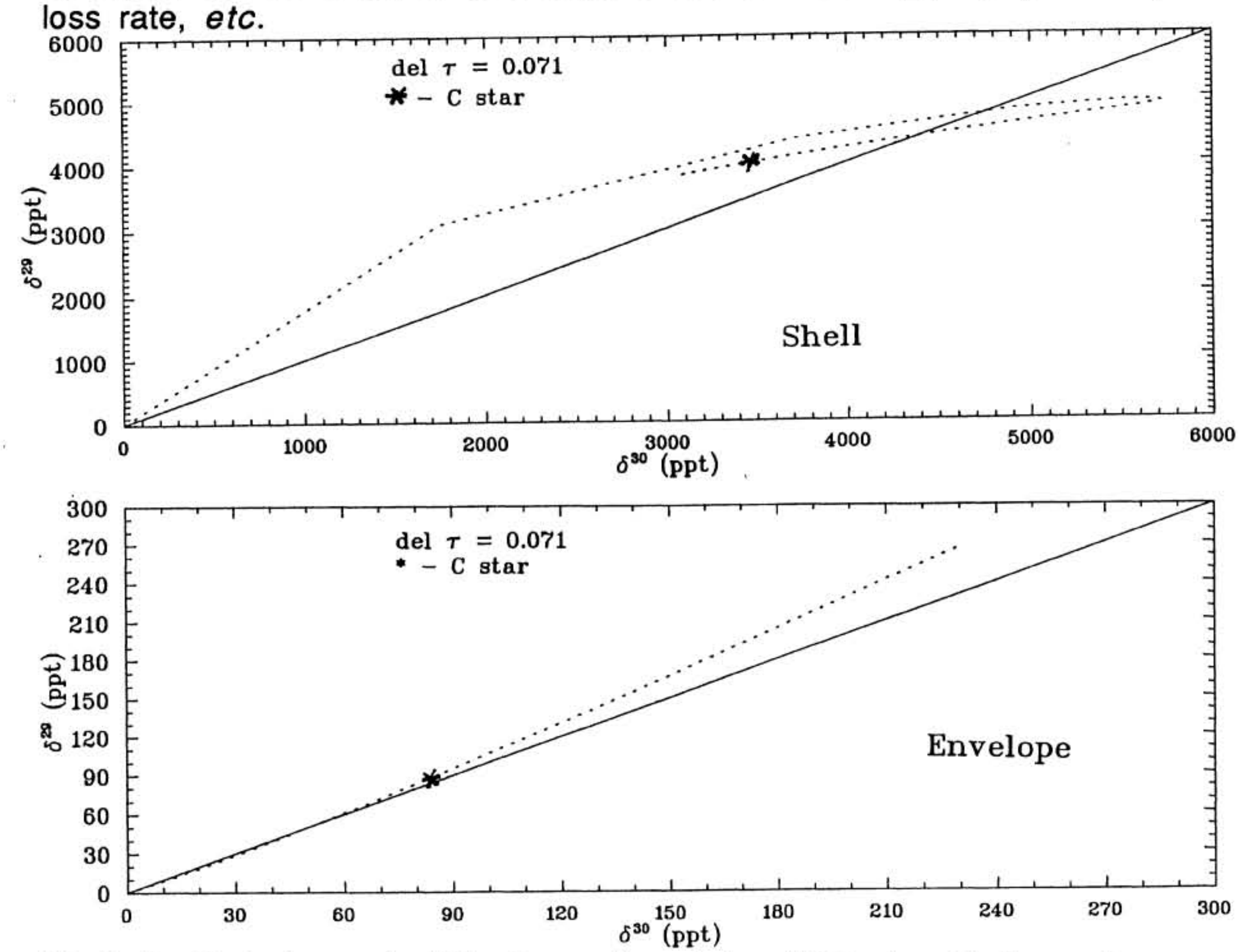

Fig.1a,b. Si isotopes in $5M_{\odot}$ thermally pulsing AGB star. Both overlap *r* and mass loss are prescribed by astrophysical model [4]; $\Delta\tau$ =0.071 is chosen.

A promising *s*-diagnostic of SiC may be sought in the isotopes of Ti, initially predicted [6] to be huge $^{50}\delta$, big $^{49}\delta$, large negative $^{48}\delta$,moderate negative $^{47}\delta$, and moderate $^{46}\delta$. This pattern seems to be now be discovered [7], after renormalizing the ^{48}Ti deficiency to normal.

This research supported by NASA grants NAG-9-4140 and by "Origins".

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