REDETERMINATION OF PARAMETERS FOR SEMI-EMPIRICAL MODEL FOR SPALLOGENIC 
He AND Ne IN CHONDRITES. L.E. Nyquist, SN4/NASA Johnson Space Center, Houston, 
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The semi-empirical model described previously (1,2) satisfactorily 
reproduced a number of shielding-dependent variations in the relative 
production rates of spallogenic He and Ne in chondrites. However, data for 
cores of the Keyes and St. Severin meteorites (3,4) showed a subsurface 
build-up in $^3$He which was not predicted with the original model parameters and 
the model was not pursued. Renewed interest in the preatmospheric size of 
meteorites, spurred in part by the desirability of understanding the exposure 
history of the SNC meteorites, justifies redetermination of model parameters.

In the semi-empirical model (5) the production rate of nuclide $i$ is

$$P_i = A_i[e^{-\mu_i d} - B_i e^{-\mu_d}]$$

where $\mu_j = \frac{N \sigma_j}{A}$, $j = a,s$. $N$ is Avogadro's number and $A$ and $\rho$ are the average 
atomic weight and the density, respectively, of the meteoritic material. $\sigma_a$ 
and $\sigma_s$ are the interaction cross sections for primary and secondary cosmic 
rays, respectively. Values of $\mu_a$ and $\mu_s$ were obtained by scaling the values 
determined by (5) for the Grant iron meteorite assuming that $\sigma_a$ and $\sigma_s$ are 
proportional to $A^{2/3}$ (1). In principle, these parameters can also be 
independently determined from the Keyes and St. Severin data. However, this 
was not attempted since it was found to be possible to fit those data by 
varying only the $A_i$ and $B_i$.

Values of $A_i$ and $B_i$ obtained from various applications of the model are 
summarized in Table 1. It is possible to obtain good fits to the concentration 
gradients of $^3$He, $^{21}$Ne, and $^{22}$Ne with depth and to reproduce the $^3$He/$^{21}$Ne vs. 
$^{22}$Ne/$^{21}$Ne trends in the Keyes and St. Severin meteorites with the same model 
parameters. It is also possible to reproduce the "Bern line" (6) by varying the 
size of the model meteoroids. However, in this latter case, different model 
parameters are required than those which yield fits to the Keyes and St. 
Severin data. This result is a consequence of the fact that the 
$^3$He/$^{21}$Ne-$^{22}$Ne/$^{21}$Ne trends for the individual meteorites do not parallel the 
"Bern line". It is possible to mimic the general trend of the "Bern 
correlation" by juxtaposition of a family of lines calculated with the same $B_i$ 
as used for Keyes and St. Severin by assuming that all meteoroids are similar 
in size and by varying the values of $A_3/A_{21}$ and $A_{22}/A_{21}$ within the limits given 
in Table 1 for the "Bern family". One possible physical interpretation of this 
result is that the effective cosmic ray flux varies for different meteorites, 
perhaps due to a spatial concentration gradient which affects primarily the 
lower energy particles.

<table>
<thead>
<tr>
<th>TABLE 1. MODEL PARAMETERS</th>
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<tbody>
<tr>
<td>$A_3$</td>
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<tr>
<td>St. Severin</td>
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<td>Keyes</td>
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<td>Bern line</td>
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<td>Bern family</td>
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