The study of whole rock samples from the Abee (E-4) clasts (1) and from other bulk enstatite chondrite samples (2,3) has shown that two trapped components are present. These two components are released at high temperatures and have been partially resolved by temperature stepwise release experiments. One of these components resembles both elementally and isotopically trapped gas released by the Kenna ureilite (4); we have labelled it as "Kenna-type". The other trapped component is characterized by a high $^{36}\text{Ar}/^{132}\text{Xe}$ ratio and has been labelled as "argon-rich". Our bulk data indicate that this component has a $^{36}\text{Ar}/^{132}\text{Xe}$ ratio of at least 1300. Crabb (2) has reported a bulk $^{36}\text{Ar}/^{132}\text{Xe}$ ratio of 2700 for the South Oman (E-4) chondrite; this suggests that we have not fully resolved the argon-rich component in our experiments on bulk samples. The composition of the argon-rich component appears to be distinct from other trapped components or solar-type gas but may resemble the composition of noble gases in the atmosphere of Venus (5,6,7). In addition, the isotopic composition of the argon-rich component seems to resemble typical Kenna-type composition since no significant variation in the Kr and Xe isotopic compositions have been observed in the bulk data. Crabb and Anders (3) have also made the observation that the isotopic composition of the argon-rich component, which they labelled as "sub-solar", is indistinguishable from trapped primordial gas. Additionally, the distribution of the trapped components in Abee is non-uniform as samples from a clast and adjacent matrix show different temperature release profiles for these two components.

To complement our whole rock data, we prepared a series of 7 separates from finely powdered sample 2,2,9, obtained from Abee consortium clast 2,2. Two separation techniques were used. The first involved magnetic separation in acetone of an aliquot of the bulk powder. Two samples were obtained, one more than 95% metal, the other less than 2% metal. The second method involved treating an aliquot of bulk powder with a two-step chemical attack. The first step of this chemical treatment employed an aqueous solution of CuCl$_2$-KCl to selectively dissolve metal (this treatment also removed oldhamite, CaS, and etched niningerite, (Mg-Mn)S). The second step involved the treatment of three aliquants of the CuCl$_2$ treated residue with HNO$_3$, HCl and HF (with a brief HCl rinse) respectively. The HNO$_3$ and HCl effectively removed sulfides whereas the HF treatment removed silicates and, to a lesser degree than either the other two acids, the sulfides. In all, seven samples were prepared, including an aliquot of the bulk powder.

<table>
<thead>
<tr>
<th>TABLE I</th>
<th>LABEL</th>
<th>MASS (mg)</th>
<th>% of BULK</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>WR</td>
<td>101.6</td>
<td>100</td>
<td>whole rock</td>
<td></td>
</tr>
<tr>
<td>ME</td>
<td>112.4</td>
<td>30</td>
<td>magnetic, &gt;95% metal</td>
<td></td>
</tr>
<tr>
<td>NM</td>
<td>76.9</td>
<td>74</td>
<td>non-magnetic, &lt;2% metal</td>
<td></td>
</tr>
<tr>
<td>CU</td>
<td>80.2</td>
<td>60</td>
<td>CuCl$_2$ etch, &lt;2% metal</td>
<td></td>
</tr>
<tr>
<td>NO</td>
<td>34.0</td>
<td>42</td>
<td>sulfide depleted</td>
<td></td>
</tr>
<tr>
<td>HF</td>
<td>38.7</td>
<td>30</td>
<td>silicate</td>
<td></td>
</tr>
<tr>
<td>HC</td>
<td>56.2</td>
<td>41</td>
<td>sulfide</td>
<td></td>
</tr>
</tbody>
</table>

Preliminary results for the separates have already been reported (8).
TRAPPED NOBLE GASES IN ABEE

J.F. Wacker and K. Marti

Most of the trapped gas was contained in non-magnetic phases. The magnetic separate, sample ME, contained less than 4% of the total xenon. The gas in sample ME cannot simply be due to residual gas from the incomplete removal of non-magnetic phases as the $^{36}\text{Ar}/^{132}\text{Xe}$ ratio for this sample was 900, as compared to 450 for bulk sample WR, and the $^{129}\text{Xe}/^{132}\text{Xe}$ ratio was 7 for WR. We are not at present advocating that the metal is the carrier of the argon-rich component. The CuCl$_2$ etched separate, sample CU, released 60% less Xe in the 1100 C step and 20% less Xe in the 1700 C step than did bulk sample WR. The $^{36}\text{Ar}/^{132}\text{Xe}$ and $^{84}\text{Kr}/^{132}\text{Xe}$ ratios for sample CU were 440 and 1.8 respectively. These values were similar to those from sample WR. The isotopic composition was unchanged from the bulk sample except that the $^{129}\text{Xe}/^{132}\text{Xe}$ ratio was slightly elevated compared to sample WR. Data from the HNO$_3$ and HCl treated residues, samples NO and HC respectively, show that these acid treatments removed only a small amount of gas when compared to sample CU. The elemental and isotopic compositions were also similar to samples CU or WR.

The HF treated residue, sample HF, displayed the most interesting results. The Xe remaining after the HF treatment constituted only 15% of the total Xe. Moreover, the $^{36}\text{Ar}/^{132}\text{Xe}$ and $^{84}\text{Kr}/^{132}\text{Xe}$ ratios were 340 and 1.5 respectively which shows that the HF treatment preferentially removed the argon-rich component. Additionally, the $^{129}\text{Xe}/^{132}\text{Xe}$ ratio for sample HF was 1.2 an almost complete removal of radiogenic $^{129}\text{Xe}$. Similar results for a HF/HCl treated residue have been obtained by Srinivasan et al. (9).

The above results allow the following characterizations to be made: 1) the carriers of the trapped and $^{129}\text{Xe}$ components are silicates or the carriers of these components are inclusions of unknown composition hermetically encapsulated within silicate minerals; 2) the argon-rich and Kenna-type components are differentially sited within Abee, and 3) the carriers are either insoluble in or shielded from HNO$_3$ and HCl attack. Our data reveal that it is possible to not only succeed in partially separating the trapped and $^{129}\text{Xe}$ components chemically but that mechanical methods can also yield useful separation of these components. It is therefore likely that more careful mechanical separation techniques employed on finely ground portions of Abee powder may result in better resolution of these components. And, since gases in carbonaceous chondrites are not strongly affected by HF treatment (10,11), our data from the acid treated Abee samples suggest that noble gas carriers in Abee are distinct from those in the carbonaceous chondrites.

The two trapped components may represent samples of two distinct gas reservoirs. It is also possible that the two trapped components represent samples of the same reservoir but obtained via different trapping mechanisms. That this can occur is apparent from our experiments. We have measured significant quantities of both un-fractionated and highly fractionated terrestrial air in our samples; both of these components derived from a single reservoir. Mechanisms for producing fractionated, Kenna-type components have already been discussed (4). Our presentation will focus on mechanisms such as high temperature solubility and chemical trapping of noble gases as means of producing components resembling the argon-rich component observed in Abee.