compared to $540 \pm 60$ (Goles, 1971). The Cu/As ratios are similar in three types of meteorites analysed, indicating the same depletion factors for Cu and As in type 2 and 3 carbonaceous chondrites.


**EVIDENCE OF $^{26}$Mg EXCESS IN HIBONITE FROM MURCHISON**

D.A. Papanastassiou and G.J. Wasserburg, *The Lunatic Asylum, Division of Geological and Planetary Sciences, Caltech, Pasadena, CA 91125*

We report Mg isotopic analyses on a hibonite inclusion from Murchison (CM), named the Blue Angel for its distinct color, and discovered by R.H. Becker. Petrographic, mineralogic, and chemical information is provided in a companion abstract (Armstrong et al., 1980). Hibonite is important as it has the highest estimated condensation temperature for major element oxides (Blander and Fuchs, 1975), may have a high Al/Mg ratio, and may be chemically resistant to alteration. The Mg measurements reported here extend to Murchison the application of high precision mass spectrometric analyses. We list in Table 1 analyses by direct loading of three ~ 50 $\mu$m crystals from the core of the inclusion and the results on a fourth crystal which was fused and the Mg chemically separated. The techniques were described (Lee et al., 1977a; Esat et al., 1979a). Two of the crystals were rinsed in 1N HCl to remove soluble phases (e.g., CaCO$_3$) possibly rich in Mg, so as to enhance effects from hibonite. All crystals yield a uniform, raw $^{25}$Mg/$^{24}$Mg corresponding to unfractonated Mg isotopes relative to terrestrial Mg to within 1% per amu. All directly loaded crystals show a uniform, distinct excess $\delta^{26}$Mg/$^{24}$Mg = 13.6‰. This excess is resolved without the need to normalize for instrumental fractionation and demonstrates the presence of excess $^{26}$Mg in this inclusion. The fused sample yields a lower $^{26}$Mg excess due to contamination during fusion but which confirms the existence of the effect. If we assume that the observed excess is due to $^{26}$Al decay and with an average Al/Mg from Armstrong et al. (1980), and if we assume a normal initial $^{26}$Mg/$^{24}$Mg, we obtain $\Delta^{26}$Al/$^{27}$Al = $5 \times 10^{-6}$ at the time of formation of the Blue Angel. This ratio is similar to that for Allende inclusions BG2-6, WA, Egg-1, Egg-2, and Egg-3 (Lee et al., 1976; Lee et al., 1977b; Esat et al., 1979b), but contrasts with $^{26}$Al/$^{27}$Al < $10^{-5}$ in the HAL hibonite from Allende (Lee et al., 1979) and with reports of $^{26}$Al/$^{27}$Al ~ $10^{-5}$ in hibonite from Leoville using an ion-probe (Lorin and Christophe, 1978). Using an ion-probe, Macdougall and Phinney (1979) found for Murchison that the hibonite crystals (100-500 $\mu$m) they analyzed were normal within their lower precision of 5-10% except for a hint of excess $^{26}$Mg in one hibonite inclusion. They also observed highly fractionated Mg isotopes in another crystal. Tanaka et al. (1980) reported excess $^{26}$Mg in mellilite from Murchison, but the absence of $^{26}$Mg excess in hibonite. We conclude that there is now clear evidence for significant excess of $^{26}$Mg in hibonite in Murchison. The inferred $^{26}$Al/$^{27}$Al for the Blue Angel hibonite (high temperature) does not differ significantly from that commonly found in the anorthite (lower temperature).


**Table 1**

*Murchison: Blue Angel Hibonite*

<table>
<thead>
<tr>
<th>Mean Crystal Dimension</th>
<th>Fractionation* $\delta^{25}$Mg/$^{24}$Mg</th>
<th>$\delta^{26}$Mg*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 70 $\mu$m (blue)</td>
<td>-1 ± 1</td>
<td>13.6 ± 1.2</td>
</tr>
<tr>
<td>2. 50 $\mu$m (grey)</td>
<td>+0.5 ± 1</td>
<td>13.7 ± 0.8</td>
</tr>
<tr>
<td>3. 40 $\mu$m (blue)</td>
<td>-0.5 ± 1</td>
<td>13.6 ± 0.3</td>
</tr>
<tr>
<td>4. Fused hibonite</td>
<td>+1 ± 1</td>
<td>6.3 ± 2.0</td>
</tr>
</tbody>
</table>

With $^{27}$Al/$^{24}$Mg = 42, $\Delta^{26}$Al/$^{27}$Al = $5 \times 10^{-5}$

*Fractional deviation of the raw measured ratio from $^{25}$Mg/$^{24}$Mg = 0.12475 for normal Mg. $\delta^{25}$Mg/$^{24}$Mg is the Mg isotope fractionation.

*Excess $^{26}$Mg relative to normal ($^{26}$Mg/$^{24}$Mg) after correction for fractionation. Errors are 2$\sigma_m$.

© Meteoritical Society • Provided by the NASA Astrophysics Data System