Mono Lake thinolite ages and their implications for the regional $\delta^{18}O$ chronology


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Thinolite

- Thinolite, made of CaCO$_3$, is a pseudo-morph of ikaite.
- Ikaite forms only at low temperatures and under specific water chemistry.

E.S. Dana
Research Questions

- How old are thinolite samples collected from Mono Basin?
- Do the dates of our samples correlate with colder time periods described in the GISP2 ice core?
- Does the correlation between GISP2 and thinolite ages reveal controls on the Mono Lake $\delta^{18}O$ curve?
Methods

- 80% pretreatment leach
- Sample dissolved using phosphoric acid, evolved gas reduced to graphite
- Graphite analyzed by accelerator mass spectrometer
### $^{14}$C Results: thinolite and non-thinolite ages

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>$^{14}$C Age (BP)</th>
<th>Cal. Age (BP)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Thinolites</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MV2-1</td>
<td>15650 ±160</td>
<td>18671 - 18948</td>
</tr>
<tr>
<td>MV2-9</td>
<td>15620 ±160</td>
<td>18662 - 18918</td>
</tr>
<tr>
<td>M09 GR 6</td>
<td>13000 ±110</td>
<td>15247 - 15873</td>
</tr>
<tr>
<td><strong>Non-Thinolites</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MV2-3</td>
<td>20550 ±310</td>
<td>24193 - 24930</td>
</tr>
<tr>
<td>MV2-10</td>
<td>30060 ±1040</td>
<td>33260 - 35535</td>
</tr>
</tbody>
</table>
GISP2 $\delta^{18}$O

Mono Lake Tufa/Ikaite

Thinolite

Non-thinolite

Warmer

Colder
Observations: GISP2 $\delta ^{18}O$

- Based on Greenland ice core
- Provides temperature proxy
- Thinolite ages correlate with colder periods described by GISP2 $\delta ^{18}O$ curve
Mono Lake $\delta^{18}O$
Observations: Mono Lake $\delta^{18}O$

- Based on bulk sediment carbonates
- Thinolites correlate with less positive $\delta^{18}O$ values
- During Last Glacial Maximum $\delta^{18}O$ values vary by $\sim 7\%$, suggesting control of Mono $\delta^{18}O$ is more than temperature
## Discussion: parameters of Mono Lake $\delta^{18}O$ values

<table>
<thead>
<tr>
<th>More positive value may indicate:</th>
<th>More negative value may indicate:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Colder</td>
<td>• Warmer</td>
</tr>
<tr>
<td>• More evaporation</td>
<td>• Less evaporation</td>
</tr>
<tr>
<td>• Precipitation source mostly Gulf of Mexico</td>
<td>• Precipitation source mostly Pacific</td>
</tr>
<tr>
<td>• Less runoff from glaciers</td>
<td>• More runoff from glaciers</td>
</tr>
</tbody>
</table>
Discussion & Conclusion

• GISP2 and Mono Lake $\delta^{18}O$ behave similarly during the last 30,000 years

• Thinolite ages correlate to Younger Dryas and Last Glacial Maximum

• Thinolite ages represent minimum number of cold periods
Acknowledgments

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Discussion: thinolite dating dilemma

• Reservoir effect of lake and spring water