Hydrochlorborite \( \text{Ca}_2\text{B}_4\text{O}_4\text{Cl(OH)}_7 \cdot 7\text{H}_2\text{O} \)

**Crystal Data:** Monoclinic. \( \text{Point Group:} \ 2/m \). As well-formed tabular \( \{001\} \) crystals, with wedgelike terminations, to 13 mm; \( \{001\}, \{110\}, \{211\} \) define the typical habit, with four other forms reported; in dense masses.

**Physical Properties:** Cleavage: On \( \{001\} \), good. Fracture: Conchoidal. Tenacity: Brittle. Hardness = 2.5 \( \text{D(meas.)} = 1.83–1.85 \) \( \text{D(calc.)} = 1.84 \) Soluble in \( \text{H}_2\text{O} \).

**Optical Properties:** Transparent. Color: Colorless. Luster: Vitreous to dull. Optical Class: Biaxial (+). Orientation: \( Y = b, X \wedge c = 25^\circ \). Dispersion: \( r < v \).

\( \alpha = 1.499–1.501 \) \( \beta = 1.502–1.504 \) \( \gamma = 1.520–1.521 \) \( 2V(\text{meas.}) = 45^\circ–45.8^\circ \)

**Cell Data:** Space Group: \( \text{I2/a} \). \( a = 22.783(3) \) \( b = 8.745(1) \) \( c = 17.066(1) \) \( \beta = 96.705(1)^\circ \) \( Z = 8 \)

**X-ray Powder Pattern:** Salar Carcote, Chile. 8.48 (100), 6.01 (24), 3.604 (9), 2.798 (8), 2.825 (7), 2.186 (7), 8.18 (6)

**Chemistry:**

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SO(_3)</td>
<td>trace</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B(_2)O(_5)</td>
<td>29.50</td>
<td>29.2</td>
<td>29.75</td>
</tr>
<tr>
<td>FeO</td>
<td>0.04</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MgO</td>
<td>0.00</td>
<td>0.01</td>
<td></td>
</tr>
<tr>
<td>CaO</td>
<td>23.31</td>
<td>24.0</td>
<td>23.96</td>
</tr>
<tr>
<td>Na(_2)O</td>
<td>trace</td>
<td></td>
<td></td>
</tr>
<tr>
<td>K(_2)O</td>
<td>0.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cl</td>
<td>7.62</td>
<td>7.2</td>
<td>7.58</td>
</tr>
<tr>
<td>H(_2)O</td>
<td>41.91</td>
<td>41.5</td>
<td>40.42</td>
</tr>
<tr>
<td>−(\bar{O}) = Cl(_2)</td>
<td>1.72</td>
<td>1.62</td>
<td>1.71</td>
</tr>
<tr>
<td>Total</td>
<td>100.62</td>
<td>100.33</td>
<td>100.00</td>
</tr>
</tbody>
</table>

(1) China; corresponds to \( \text{Ca}_{1.94}\text{B}_{3.94}\text{O}_4\text{Cl(OH)}_7 \cdot 7\text{H}_2\text{O} \). (2) Salar Carote, Chile; corresponds to \( \text{Ca}_{2.04}\text{B}_4\text{O}_4\text{Cl}_{0.97}(\text{OH})_7 \cdot 7\text{H}_2\text{O} \). (3) \( \text{Ca}_2\text{B}_4\text{O}_4\text{Cl(OH)}_7 \cdot 7\text{H}_2\text{O} \) established by crystal-structure analysis.

**Occurrence:** A rare dry-season evaporite mineral in playa sediment (Salar Carcote, Chile).

**Association:** Ulexite, halite, gypsum (China).

**Distribution:** From China, at an unspecified locality [the Qinghai-Xizang Plateau, Tibet]. From Salar Carote, Antofagasta, Chile.

**Name:** In allusion to the essential chemical components, water, chlorine and borate.

**Type Material:** National Museum of Natural History, Washington, D.C., USA, 131036.