Markeyite  

\[ \text{Ca}_9(\text{UO}_2)_4(\text{CO}_3)_{13} \cdot 28\text{H}_2\text{O} \]

Crystal Data: Orthorhombic.  
Point Group: 2\(\text{lm}\) 2\(\text{lm}\) 2\(\text{lm}\).  
As blades and tablets, to \(\sim 1\) mm, flattened on \{00\(\text{I}\)\} and elongated along \{0\(\text{I}\)0\} that display \{1\(\text{O}\)0\}, \{0\(\text{I}\)1\}, \{1\(\text{O}\)1\}, \{1\(\text{I}\)1\}, \{01\(\text{I}\)\} and \{11\(\text{I}\)\}.

Physical Properties: Cleavage: Perfect on \{00\(\text{I}\)\}, good on \{10\(\text{O}\)\} and \{0\(\text{I}\)0\}. Fracture: Irregular. Tenacity: Brittle. Hardness = 1.5-2.  
D(meas.) = 2.68  D(calc.) = 2.699  Fluoresces bright bluish white under a 405 nm laser. Dissolves very slowly in H\(\text{2O}\) (minutes) and dissolves immediately with effervescence in dilute HCl.

Optical Properties: Transparent. Color: Pale yellowish green. Streak: White. Luster: Vitreous. Optical Class: Biaxial (-). \(\alpha = 1.538(1)\)  \(\beta = 1.542(1)\)  \(\gamma = 1.545(1)\)  2\(V\)(meas.) = 81(2)\(^\circ\)  2\(V\)(calc.) = 81.6\(^\circ\)  Dispersion: \(r < v\), weak. Pleochroism: \(X = \text{light greenish yellow,}\ Y \approx Z = \text{light yellow.}\) Absorption: \(X > Y \approx Z\). Orientation: \(X = c, Y = b, Z = a\).

Cell Data: Space Group: \(P\text{mmn}\). \(a = 17.9688(13)\)  \(b = 18.4705(6)\)  \(c = 10.1136(4)\)  \(Z = 2\).

X-ray Powder Pattern: Markey mine, Red Canyon, San Juan County, Utah, USA.  
5.43 (100), 6.41 (91), 10.12 (69), 4.104 (37), 3.984 (34), 5.07 (33), 4.618 (25)

Chemistry:

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
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</thead>
<tbody>
<tr>
<td>CaO</td>
<td>18.60</td>
<td>18.52</td>
</tr>
<tr>
<td>UO(_3)</td>
<td>42.90</td>
<td>41.98</td>
</tr>
<tr>
<td>H(_2)O</td>
<td>[18.78]</td>
<td>18.51</td>
</tr>
<tr>
<td>Total</td>
<td>101.58</td>
<td>100.00</td>
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</tbody>
</table>

(1) Markey mine, Red Canyon, San Juan County, Utah, USA; average of 9 EDS analyses supplemented with Raman spectroscopy, H\(_2\)O and CO\(_2\) calculated from stoichiometry; corresponds to Ca\(_9\)(U\(_{1.0}\)O\(_2\)_4(CO\(_3\))\(_{13}\)\(\cdot\)28H\(_2\)O.  
(2) Ca\(_9\)(UO\(_2\)_4(CO\(_3\))\(_{13}\)\(\cdot\)28H\(_2\)O.

Occurrence: As efflorescent crusts on the surfaces of mine walls in a Colorado Plateau-type, roll front uranium deposit.

Association: Asphaltum, calcite, gypsum, natrozippeite.

Distribution: In the Markey mine, Red Canyon, White Canyon District, San Juan County, Utah, USA.

Name: For the locality, the Markey mine.

Type Material: Natural History Museum of Los Angeles County, Los Angeles, California, USA (67091, 67092, 67093, 67094 and 69095) and the A.E. Fersman Mineralogical Museum, Russian Academy of Sciences, Moscow, Russia (4932/1).