Disk-Resolved Spectral Characteristics of Saturn's Medium-Sized Satellites

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Voyager-1 and -2 images of six Saturnian satellites have been investigated in the orange, green and violet spectral range (Table 1). The objective of this study is to examine and compare spectral differences of surface features in order to obtain information about compositional trends.

Although Voyager provided spectral information only at five different wavelengths, spectral differences can be identified by comparing color variations. For this purpose violet to green (VI/GR) and orange to green (OR/GR) ratios of a number of points within selected, photogeologically homogeneous regions of six satellites are calculated (Tab. 1). Each of the 50 investigated regions is characterized by its mean ratio value and standard deviation (σ). Within a VI/GR and OR/GR ratio diagram all measured regions fit into a "three-component-system" defined by spectral endmembers (Fig. 1). Two of these endmembers are characterized by specific terrains on Iapetus (CM) and on Dione (GM) while the third endmember (NM) describes spectrally inactive materials. The normalized spectra of the endmembers are shown in Fig.2, their ratios, properties, and possible compositions are given in Table 2.

With respect to the spectral differences as shown in Fig.1 and to previous studies [1,2] the compositional trends can be interpreted as follows (the numbers in parantheses show the OR/GR and the VI/GR ratios of selected points):

- There are at least two different...
spectral active components on the surfaces, one with a "CM characteristic" (OR/GR > 1) and one with a "GM characteristic" (OR/GR < 1).

- All satellites except Dione and Rhea are spectrally different.
- Mimas has the largest NM contribution of all. Thus, it probably has the most icy surface of all six satellites.
- The surface near crater Galahad (1.026;0.953) on Mimas has no GM, while the area near Bors (0.979;0.911) is greener and contains more of this "mixture".
- All parts of Enceladus must be covered with a spectral active material, that means that there is not only ice, but also an additional material with a spectral characteristic of CM.
- The reddish feature on the trailing side of Tethys (1.011;0.780) contains relatively less NM. Therefore, it should have a higher silicate to ice ratio than the other regions of this satellite.
- Dione's "wispy streaks" contain less CM but more NM than the dark, cratered regions. They are not uniform, but differ in their spectral characteristics. A point east of crater Amata (0.863;0.857) contains most of GM on all satellites.
- Most of the wispy streak features on Rhea (0.96;0.83) have a similar spectral characteristic as the cratered terrain, although they are brighter.
- The region near the Iapetus north pole (1.034;0.894) has a similar spectral characteristic as parts of Enceladus.
- The Roncevaux Terra is comparable with some Tethys terrains (but darker).
- All parts of Iapetus contain CM.

In general, the results demonstrate significantly non-uniform spectral characteristics of the Saturnian icy satellites implying that the surfaces are composed of a variety of ice/mineral mixtures. A more detailed discussion is given in [3].

<table>
<thead>
<tr>
<th>endmembers</th>
<th>OR/GR</th>
<th>VI/GR</th>
<th>properties</th>
<th>possible compositions</th>
</tr>
</thead>
<tbody>
<tr>
<td>CM (Cassini Regio material)</td>
<td>1.18</td>
<td>0.69</td>
<td>reddish</td>
<td>carbonaceous (organic) polymers + hydrated silicates + elemental carbon + ice [4]</td>
</tr>
<tr>
<td>NM (spectral neutral material)</td>
<td>1.00</td>
<td>1.00</td>
<td>no spectral activity</td>
<td>ice (bright component); carbon, „shadow“ (dark component)</td>
</tr>
<tr>
<td>GM (greenish material)</td>
<td>0.86</td>
<td>0.86</td>
<td>greenish</td>
<td>ice with siliceous minerals</td>
</tr>
</tbody>
</table>

**Table 2** Characteristics of the endmembers

**References:**


