Ruby Grading System

The Gem and Jewelry Institute of Thailand in cooperation with the Thai Gem and Jewelry Traders Association (TGJTA) considered that Thailand as the world's largest exporter of rubies should have an efficient and internationally recognized grading system that satisfied both the traders and the Tourism Authority of Thailand and set up a proper pricing standard. Thus a working committee of academicians from GIT and gem traders from the TGJTA was established. This committee then created a Ruby Grading System.

One of the most important challenges facing gem dealers is how to grade rubies into various categories. The most important problems found in trying to develop an effective ruby grading language are the lack of understanding among gem dealers about color terminology as used by color scientists. As a matter of fact, the principal difference between a fine ruby and a lower graded stone is the color saturation or chroma and intensity of the hue (dominant color) rather than a color or hue shift. (Plate 1)

Plate 1

The beauty of rubies is a combination of their attractive color, brilliance and transparency. These factors were the fundamental criteria used to select standard ruby sets. Two sets each of Thai, Mogok, Mong Hsu and Madagascar rubies were obtained. Each set was carefully selected so that each had 5 red color levels varying from dark to light. These were now considered standard sets. Each stone has a color code based on the Munsell system (Hue Value/Chroma) including a specific color name.

An extensive research effort regarding the subjective ruby color preferences of Thais, Japanese, Americans, Europeans and Indians was conducted. The result was that people from different countries expressed different preferences regarding hue, tone and color saturation. In order to effectively evaluate the most important factors (Color, Brilliance and Transparency) that contribute to the beauty of rubies a quantitative approach under the heading quality was used. The quality grading of a ruby depends on 4 independent criteria, namely, color grading, clarity grading, cut grading and carat weight. Color notations used in color grading are dark red (5R 2/8), deep red (5R 3/10), vivid red (2.5R 4/14), strong red (5R 4/12), pinkish red (8.75R 4/12) and purplish red (7.5RP 5/8). Clarity gradings are excellent (minute inclusions), fine (minor inclusions), very good (noticeable inclusions), good (moderate inclusions) and fair (significant inclusions). The cutting gradings are excellent, fine, very good, good, and fair.
METHODS USED FOR RUBY GRADING AND RESULTS

In general there are three factors governing the assessment of a ruby. It's **beauty**, **quality** and **value** (natural or synthetic origin). (See a flowchart showing criteria used to assess a ruby's grading)

3.1 **Beauty**: this is the most important easily seen aspect of a gemstone and a strong factor in determining it's value. Beauty is a subjective word. It is in fact, a collective term combining color, brilliance and transparency when assessing a ruby or, for that matter any gemstone.

3.1.1 **The attractive color** of a ruby usually depends on personal taste. The key to its attractive color is not merely the gemstones simple two-dimensional color, but the balance of light and dark tones in a mosaic-like pattern that gives the gem a wonderful three-dimensional appearance. This is the effect of reflection and refraction caused by good and proper faceting.
3.1.2 The brilliance of a ruby is caused by light refracted and reflected from a properly faceted gem. As the brilliance increases rubies become more valuable.

3.1.3 Transparency and the lack of inclusions and blemishes combined with its brilliance are what make a ruby so beautiful.

Three criteria, attractive color, brilliance, and transparency were used by the GIT to select eight sets of standard rubies weighing from 0.75 to 1 carats from four different geographic regions. Included were two sets of Thai, Mogok, Mong Hsu and Madagascar rubies. Each set has 5 tone levels ranging from dark to light.

These standard ruby sets were used to conduct the color preference survey. The participants in this study were buyers and gemmologists from various countries who attended the 28th Gem and Jewelry Fair in Bangkok between the 13th and 16th of September, 2001. The participants were divided into 6 groups and numbered by
geographic origin, (Thais 191, American 49, European 76, Japanese 55, Indian 64, and other Asian countries 47). The results of the Color Preference Survey are shown in the following tables. (Plate 5 - Plate 8)

**Plate 5:**

While researching the color preferences of Rubies from various regions, it was found that **Thais** prefer rubies of **Thai** origin more than other types from a sample test of 191 people.

- **Thai Ruby** (43%)
- Mong Hsu Ruby (29%)
- Mogok Ruby (36%)
- Madagascar Ruby (40%)

**Plate 6:**

**Americans** prefer Mogok Rubies (56%) from a sample test of 49 persons.

- Thai Ruby (41%)
Mong Hsu Ruby (33%)

Mogok Ruby (56%)

Madagascar Ruby (37%)

Plate 7:

Europeans prefer Thai Rubies (45%) from a sample test of 76 persons.

Thai Ruby (45%)

Mong Hsu Ruby (28%)

Mogok Ruby (43%)

Madagascar Ruby (30%)

Plate 8: Japanese prefer Burmese Rubies (49%) from a sample test of 55 persons.
Thai Ruby (40%)

Mong Hsu Ruby (27%)

Mogok Ruby (49%)

Madagascar Ruby (27%)

In order to evaluate three of the important factors contributing to the beauty of a ruby more precisely we used quantitative methods grouped under the heading 'Quality'.

3.2 Quality: The quality of a ruby is based on 4 independent criteria; color, clarity, cut grading and carat weight.

3.2.1 Color Grading

The color of a ruby determines at least 50% of its final market value. The color grading of rubies is very difficult and more subjective than when grading diamonds. The GIT method has been designed to provide a meaningful grading system that is easily understood and used. This system can be directly related to market price.

The color grading of a ruby becomes complicated because we must consider three separate components that are both independent and interrelated, namely hue, tone, and saturation (color intensity.)

**Hue** describes the dominant and additional colors in a gemstone that are visible to the naked eye. In our example, a purplish/red (PR) ruby has red as the dominant color and purple as the secondary color. **Value or Tone** - This is the lightness or darkness of Saturation or Chroma is best described as the strength or intensity of the hue sensation. The GIT Color Grading System is based on the Munsell Color Chart.

Each ruby was matched to the appropriate Munsell color chip and viewed under a standard 5,000 Degree Kelvin light source. (Plate 9, 10)

**Plate 9 : Color matching between a ruby and a Munsell color chip**
Plate 10: Munsell color charts

Each stone in the standard sets was assigned a Munsell color code and name. The results were compared with the ISCC-NBS of the ASTM color chart. Additionally the Munsell Color Code can be converted into the color coordinates of the L*U* V* and L*a*b* system.

The following picture is an example of one of these master ruby sets.

![Munsell Color Charts](image)

### 3.2.2 Clarity Grading

Clarity is the second most important factor when evaluating rubies. The clarity of the stone is the second most important factor when determining value and is worth between 20 and 30% in the grading system. The clarity of a ruby is first determined with naked eyes and then under 10x magnification. The clarity of a ruby can be determined by a point system that takes into account the following factors.

<table>
<thead>
<tr>
<th>Points</th>
<th>Position</th>
<th>Amount</th>
<th>Relat. Size</th>
<th>Aggregation</th>
<th>Contrast</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Table</td>
<td>Numerous</td>
<td>Large</td>
<td>Dense all over</td>
<td>Very High</td>
</tr>
<tr>
<td>3</td>
<td>Crown</td>
<td>Moderate</td>
<td>Medium</td>
<td>Locally dense</td>
<td>High</td>
</tr>
<tr>
<td>2</td>
<td>Girdle</td>
<td>Few</td>
<td>Small</td>
<td>Disperse</td>
<td>Moderate</td>
</tr>
<tr>
<td>1</td>
<td>Pavilion</td>
<td>Very Few</td>
<td>Very Small</td>
<td>Isolate</td>
<td>Low</td>
</tr>
</tbody>
</table>

**Table 1: The point system for clarity grading of rubies**

Inclusions (including the location of inclusions in the ruby), number of inclusions, the size aggregation and contrast of any inclusions.
<table>
<thead>
<tr>
<th>Points</th>
<th>Clarity Grade</th>
</tr>
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<tbody>
<tr>
<td>&lt; 9</td>
<td>Excellent Clarity</td>
</tr>
<tr>
<td>10 - 12</td>
<td>Fine Clarity</td>
</tr>
<tr>
<td>13 - 16</td>
<td>Very Good Clarity</td>
</tr>
<tr>
<td>17 - 19</td>
<td>Good Clarity</td>
</tr>
<tr>
<td>20</td>
<td>Fair Clarity</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Clarity Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minute Inclusion (MiI)</td>
</tr>
<tr>
<td>Minor Inclusion (MrI)</td>
</tr>
<tr>
<td>Noticeable Inclusion (NI)</td>
</tr>
<tr>
<td>Moderate Inclusion (MoI)</td>
</tr>
<tr>
<td>Significant Inclusion (SI)</td>
</tr>
</tbody>
</table>

Table 2: Then, the total score will be used to assign the final clarity grade:

- **≤ 9**: Minute Inclusion (MiI) or Excellent Clarity
- **10 - 12**: Minor Inclusion (MrI) or Fine Clarity
- **13 - 16**: Noticeable Inclusion (NI) or Very Good Clarity
- **17 - 19**: Moderate Inclusion (MoI) or Good Clarity
- **20**: Significant Inclusion (SI) or Fair Clarity

MrI

<table>
<thead>
<tr>
<th>Position</th>
<th>Amount</th>
<th>Relat. Size</th>
<th>Aggregation</th>
<th>Contrast</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crown</td>
<td>Few</td>
<td>Medium</td>
<td>Disperse</td>
<td>Low</td>
</tr>
<tr>
<td>3</td>
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<td>3</td>
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<td>1</td>
</tr>
<tr>
<td>Total = 11</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clarity Grade: Minor Inclusion (MrI)</td>
<td></td>
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</table>

MoI

<table>
<thead>
<tr>
<th>Position</th>
<th>Amount</th>
<th>Relat. Size</th>
<th>Aggregation</th>
<th>Contrast</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table</td>
<td>Moderate</td>
<td>Large</td>
<td>Dense all over</td>
<td>Moderate</td>
</tr>
<tr>
<td>4</td>
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<td>4</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Total = 17</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clarity Grade: Moderate Inclusion (MoI)</td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3-4: Samples of clarity grading
Minute Inclusion (MiI): Visible with 10x magnification, very difficult to see with naked eyes.

Minor Inclusion (MrI): Visible with 10x magnification, difficult to see with naked eyes.

Noticeable Inclusion (NI): Easily visible with 10x magnification, just able to see with naked eyes.

Moderate Inclusion (MoI): Very easily seen with 10x magnification, easy to see with naked eyes.

Significant Inclusion (SI): Very easily seen with 10x magnification, very easy to see with naked eyes.

3.2.3 Cut Grading

Cutting is the third important factor when evaluating rubies. The cut component is worth 10% to 20% of the value in a grading system.

Plate 12, 13

Criteria for cut grading are the proportion and finish of a ruby.

**Proportion:** There are 3 criteria used to assess proportion

1-Face-up balance

When viewed in the face-up position, the opposite parts of the faceted stone should be exactly the same size and well shaped. The overall effect should be appealing to our eyes.
Plate 14

2-Profile balance

When viewed from the side of the table, the culet should be exactly centered, the girdle not wavy, and the pavilion bulge should be even. Total depth percentage (the height of a ruby measured from table to culet, divided by the width and multiplied by 100) should normally be between 60 and 65%. The crown height measuring from table to girdle should fall between $\frac{1}{4}$ to $\frac{1}{3}$ of the total depth. The pavilion depth measuring from girdle to culet should vary between $\frac{2}{3}$ to $\frac{3}{4}$ of the total depth. (Plate 12, 13, 14)

Plate 15

3-Brilliance

The light returned to the eye is known as brilliance. As the brilliance increases rubies become more valuable. When light leakage occurs it is known as windowing. When dark areas are visible. It is know as extinction.

Finish: There are three criteria used to assess finish

1-Polish: consider the surface characteristics

2-Symmetry: consider shape, position, and arrangement of facets

3-Facet survey: consider the number of facets. Facet positions should be suitable to the cutting style.
3.2.4 Weight (in carats) will also determine the price of the stone.

A large-sized ruby should have a higher price per carat than that of a smaller-sized ruby of the same quality. This is because the smaller stone is easier to find than the larger one.

3.3 Value

The word 'value' in our context means its authenticity. A natural ruby without any treatment and originating from a world famous origin such as Mogok is considered, by the trade, to be a premium gemstone. Therefore, the first priority in the grading process must be to determine whether any forms of treatment or enhancement have been used. Only then can we logically proceed to the analysis of the gemstones color, clarity, cut, and weight (carats).