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A NEW LOOK AT THE CEMENT GRADE LIMESTONE IN THE BETAMCHERLA AND BANAGANAPALLE MANDALS OF KURNOOL DISTRICT

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And
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Professor of Geology

Introduction

The Narji Limestone of the Kurnool Group forms the back bone of cement industry in Andhra Pradesh. There are certain pockets in the limestone that are generally used as a building material, especially for flooring. This is popularly known as 'Betamcherla Marble'. Depending upon the color and black steaks, the limestone is called by different names like, Joy, Techno White etc. These are extensively mined in these two said mandals. These are polished and marketed at Betamcherla. The moot point is that all the varieties of that are used as polishing stones are of good quality of cement grade limestone.

Fig. 1. Pink & Marble of Betamcherla used for flooring
**Brief Geology**

The Narji Limestone is divisible into three sub units, viz, the upper flaggy limestone, the middle massive limestone and the lower flaggy limestone. It is the middle massive limestone that forms the treasure house of cement grade limestone. The cement grade limestone is generally divided into upper dark grey limestone, middle light grey limestone and the lower pink limestone. This division is purely based on color. In majority of the cement plant areas the said division of limestone is well established.

**Grade of the limestone**

The dark grey limestone generally yields + 84% of TCO₃, i.e., 47.04 CaO%. The light grey limestone gives 79% to + 84% of TCO₃, i.e., 44.24% to 47.04% of CaO. The top horizon of pink is basically of cement grade and the lower units are of sub-grade nature. NCB has suggested the following broad specifications of the Run - of Mine cement grade limestone.

<table>
<thead>
<tr>
<th>Oxide</th>
<th>Acceptable range for manufacture of ordinary Components Portland cement</th>
</tr>
</thead>
<tbody>
<tr>
<td>CaO%</td>
<td>44 – 52</td>
</tr>
<tr>
<td>MgO%</td>
<td>3 – 5 (Max)</td>
</tr>
<tr>
<td>SiO₂</td>
<td>}</td>
</tr>
<tr>
<td>Al₂O₃</td>
<td>} to satisfy the LSF and SM of the raw mix</td>
</tr>
<tr>
<td>Fe₂O₃</td>
<td>}</td>
</tr>
<tr>
<td>K₂O% + Na₂O</td>
<td>&lt; 0.5</td>
</tr>
<tr>
<td>P₂O₅ %</td>
<td>&lt; 0.5</td>
</tr>
<tr>
<td>Cl%</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>SO₂</td>
<td>&lt; 0.6</td>
</tr>
</tbody>
</table>
Furthermore, Indian Bureau of Mines stipulated the following threshold values for the limestone:

- CaO \( \geq 35\% \) (Min)
- MgO \( \leq 4\% \) (Max)
- SiO\(_2\) \( \leq 18\% \) (Max)
- Alkalies \( \leq 0.5\% \) (Max)

Limestone or shaly limestone having CaO less than 35%, MgO more than 4% and SiO\(_2\) more than 18% can be considered as reject. The samples from the traders of the ‘Betamcherla Marble’ have been collected and analysed. The details of the chemical analysis are documented below in the form of a table.

Table reflecting the chemical analysis of the ‘Betamcherla Marble’

<table>
<thead>
<tr>
<th>S/no.</th>
<th>Commercial Name of the Limestone</th>
<th>TC</th>
<th>LOI</th>
<th>SiO(_2)</th>
<th>Al(_2)O(_3)</th>
<th>Fe(_2)O(_3)</th>
<th>CaO</th>
<th>MgO</th>
<th>MgCO(_3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PT_Marble</td>
<td>85.27%</td>
<td>37.57%</td>
<td>10.02%</td>
<td>1.35%</td>
<td>0.65%</td>
<td>47.76%</td>
<td>1.43%</td>
<td>1.37%</td>
</tr>
<tr>
<td>2</td>
<td>Violet</td>
<td>81.19%</td>
<td>35.66%</td>
<td>15.24%</td>
<td>1.43%</td>
<td>0.97%</td>
<td>45.18%</td>
<td>1.81%</td>
<td>1.04%</td>
</tr>
<tr>
<td>3</td>
<td>Pink</td>
<td>84.40%</td>
<td>37.65%</td>
<td>11.26%</td>
<td>0.56%</td>
<td>0.89%</td>
<td>47.47%</td>
<td>1.23%</td>
<td>1.37%</td>
</tr>
<tr>
<td>4</td>
<td>Golden_Buff</td>
<td>68.28%</td>
<td>30.30%</td>
<td>26.03%</td>
<td>1.93%</td>
<td>0.97%</td>
<td>38.33%</td>
<td>1.03%</td>
<td>1.04%</td>
</tr>
<tr>
<td>5</td>
<td>Joy</td>
<td>83.07%</td>
<td>38.12%</td>
<td>13.70%</td>
<td>1.25%</td>
<td>0.40%</td>
<td>46.33%</td>
<td>1.23%</td>
<td>0.77%</td>
</tr>
<tr>
<td>6</td>
<td>Techno_White</td>
<td>78.55%</td>
<td>34.39%</td>
<td>18.32%</td>
<td>0.32%</td>
<td>0.48%</td>
<td>43.75%</td>
<td>1.23%</td>
<td>0.77%</td>
</tr>
<tr>
<td>7</td>
<td>Plain_White</td>
<td>88.99%</td>
<td>38.51%</td>
<td>9.54%</td>
<td>0.53%</td>
<td>0.32%</td>
<td>49.47%</td>
<td>0.61%</td>
<td>1.37%</td>
</tr>
</tbody>
</table>

The scrutiny of the above table points to the fact that except the ‘Golden Buff’, all other varieties are of good quality cement grade limestones. This study should be extended to the other areas to establish the extension of this grade in the so called marbles of Betamcherla.
The study in this area has brought to light another interesting feature in the limestone terrain. In the lower flaggy limestone area, the top horizon below soil is basically milk white and powdery. Locals mine this and send it to different places. This white powder occurs as beds and grade laterally into the limestone as noticed in the canal section near Yanakandla.

This has been chemically analysed and it was surprising to note that it has yielded 92% to 96% of TCO₃ accounting to 51.52% to 53.76% of CaO. The thickness of this unit grades from 4m to 8m. This beyond 8m grades in to flaggy limestone. Further, in respect of chemistry, this is depleted in silica, alumina and iron, suggesting the possible residual nature of formation of the deposit. The process of removal of the said elements could have been initiated by the water action, both connate and ground water. Fluctuations of water table also might have played its role. The term calc - tuffa is used as senso lato. Tuffa is related to volcanic origin and in some cases it is related to the precipitation of material around a spring. As the present set up is not supporting the said nature, the term is used as senso lato.

The higher percentage of TCO₃ qualifies this unit as a ‘Sweetener’ for the marginal grade limestones in the cement industry. A few companies are acquiring lands of flaggy limestone area only for the calc-tuffa.
Conclusions

- The variants of the so-called 'Betamcherla Marble' are of good quality cement grade limestone.
- If planned properly in the conservation and utilization of the limestone, the reserves of the cement grade limestone may increase many fold.
- Extensive and intensive work using the remote sensing technology can be utilized to demarcate these zones.
- The area in the lower flaggy limestone, where calc-tuffa is present have to be delineated and the tuffa can be best used as a 'sweetener' for the sub-grade limestone. This will enhance the grade of the limestone.

Likely to be presented in the National Seminar, Department of Geology in connection with Golden Jubilee Celebration of the Department of Geology, S. V. University, Tirupati, to be held in the month of March 2009.
Camp Yanakandla,  
04/07/2008.

From
Y. Prabhakar Reddy,  
Geologist,  
C/o Dr. B.K. Nagaraja Rao,  
Consultant Geologist,  
Hyderabad.

To
The Director,  
M/s Jayajyothi Cements Ltd.,  
Chennai.

Sir,

Sub: - Requesting for permission to use the field and chemical data for my doctoral degree in S.V. University, Tirupathi - Reg.

I request you to permit me to use the field and chemical data that I will be studying while doing the work in the Yanakandla block along with Dr. B.K. Nagaraja Rao. It will be helpful for me in my career. I will be grateful to you for ever for the help.

Thanking you sir,

Yours faithfully,

(Y. Prabhakar Reddy)