Table 1. Average values for the major mineral of clays and associated minerals examined in Pine County, Minnesota.

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Average Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quartz</td>
<td>65.2</td>
</tr>
<tr>
<td>Kaolinite</td>
<td>12.3</td>
</tr>
<tr>
<td>Illite</td>
<td>14.8</td>
</tr>
<tr>
<td>Chlorite</td>
<td>6.5</td>
</tr>
<tr>
<td>Fuchsitite</td>
<td>1.4</td>
</tr>
<tr>
<td>Mica</td>
<td>2.1</td>
</tr>
<tr>
<td>Siderite</td>
<td>0.7</td>
</tr>
<tr>
<td>Pyrite</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Figure 1. Physical relief on the land surface in Pine County. Elevations shown by color, and a false color illumination from the ortorad provides another view and challenge to assess details of landforms. The map was created using the USGS DLMQ Digital Elevation Model. The contour is at 100 feet (30 meters) of hill. The land surface rises in the central southern part of the county along the St. Croix River valley (750 feet, or 230 meters, above sea level); the highest elevations not visible are at Cass Lake (1,300 feet, or 390 meters, above sea level). No data are available for this inland section due to geographic inaccessibility.

QHOTENTIAL STRATIGRAPHY

By
Alan R. Knabe, Carrie J. Patterson, and Gary N. Meyer
2001

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REFERENCES


List of Quaternary Stratigraphic Units

The following units are defined in this report:

1. **Shallow Drift Complex**
2. **Lowland Drift Complex**
3. **Highland Drift Complex**
4. **Proglacial Lake Sediment**
5. **Black Earth Formation**
6. **Hickory Ridge Formation**
7. **Sandstone Formation**
8. **Glacial Till Formation**
9. **Glacial Lake Deposits**
10. **Lake Mendota Deposits**
11. **Lake Pepin Deposits**
12. **Lake Ontario Deposits**
13. **Lake Michigan Deposits**
14. **Lake Huron Deposits**
15. **Lake Superior Deposits**
16. **Lake Erie Deposits**
17. **Lake Iroquois Deposits**
18. **Lake Algonquin Deposits**
19. **Lake Agassiz Deposits**
20. **Lake Outwash Deposits**

**Shallow Drift Complex**

- **A. Shallow Drift Complex**
- **B. Lowland Drift Complex**
- **C. Highland Drift Complex**

**Proglacial Lake Sediment**

- **D. Proglacial Lake Sediment**

**Black Earth Formation**

- **E. Black Earth Formation**

**Hickory Ridge Formation**

- **F. Hickory Ridge Formation**

**Sandstone Formation**

- **G. Sandstone Formation**

**Glacial Till Formation**

- **H. Glacial Till Formation**

**Glacial Lake Deposits**

- **I. Glacial Lake Deposits**

**Lake Mendota Deposits**

- **J. Lake Mendota Deposits**

**Lake Pepin Deposits**

- **K. Lake Pepin Deposits**

**Lake Ontario Deposits**

- **L. Lake Ontario Deposits**

**Lake Michigan Deposits**

- **M. Lake Michigan Deposits**

**Lake Huron Deposits**

- **N. Lake Huron Deposits**

**Lake Superior Deposits**

- **O. Lake Superior Deposits**

**Lake Erie Deposits**

- **P. Lake Erie Deposits**

**Lake Iroquois Deposits**

- **Q. Lake Iroquois Deposits**

**Lake Agassiz Deposits**

- **R. Lake Agassiz Deposits**

**Lake Outwash Deposits**

- **S. Lake Outwash Deposits**

**Quaternary Stratigraphy**

- **T. Quaternary Stratigraphy**

**Quaternary Cross Sections**

- **U. Quaternary Cross Sections**

**GEOLOGIC ATLAS OF PINE COUNTY, MINNESOTA**