6. FIELD STAINING TECHNIQUES FOR DETERMINING CALCITE, DOLOMITE AND PHOSPHATE

6.1. INTRODUCTION

Quick and simple field techniques are described for determining and distinguishing the carbonate mineral's calcite and dolomite. A further procedure for determining the presence of phosphate is also described. All of these field staining procedures can be modified for, or have been adapted from techniques used in the laboratory. A review of the field applications of geological techniques employing stains and dyes can be found in Green (1993). The methods are described below:

6.2. CARBONATE (CALCITE AND DOLOMITE) DETERMINATION

6.2.1. Dolomite (Mann 1955)

1. On a clean rock surface add a few drops of dilute (10%) hydrochloric acid HCl to etch the surface. This releases the Ca and Mg ions into solution. Continue with the procedure even if no reaction is visible (i.e. high Mg content). The etching stage may help separate a pure dolomite from a limestone (but not a low Mg limestone, MgO <10%).

2. When any vigorous reaction has ceased, add a drop of alkaline solution (0.002g p-Nitrobenzene-azoresourcinol in 100ml of 2N sodium hydroxide).

3. Within the first minute of adding the solution observe the results of any reaction.

RESULTS

<table>
<thead>
<tr>
<th>Carbonate Type</th>
<th>Result Description</th>
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<tbody>
<tr>
<td>HIGH-Mg CALCITE</td>
<td>Blue precipitate is evident (indicates a carbonate high in available MgO). The intensity of the blue colour will decrease with MgO content.</td>
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<tr>
<td>LOW-Mg CALCITE</td>
<td>Violet colour indicates a carbonate with no MgO.</td>
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<tr>
<td>DOLOMITE</td>
<td>Yellow colour (seen when no reaction occurs after etching and alkali solution is applied).</td>
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As a blue coloration will be evident on evaporation of the alkali solution, observations must be noted within the first minute of application. Shield the test area from direct sunlight while undertaking this technique to avoid the loss of staining solution through evaporation, and detect light colour hues of the precipitates.
Following three month's field and laboratory testing, Mann (1955) was able to semi-quantify the presence of magnesium into one of four categories:

(i) >30% MgO
(ii) 10-30% MgO
(iii) 1-10% MgO
(iv) <1% MgO

However, it is unfortunate that the intensity of the blue coloration is not indicated for each category. This technique is of particular use in areas where contacts between formations are poorly exposed, or where lithologic boundaries are not visible (Mann 1955).

6.2.2. Calcite from dolomite (Warne 1962)

Warne (1962) modified the staining scheme of Friedman (1959) for field and laboratory use. However, the scheme requires the use of seven solutions to determine Calcite, Dolomite and High-Mg Calcite. Three of the stages require boiling - facilities that may not be readily available at every field station. Initial determination is achieved by etching the specimen, followed by immersion in Alizarin Red-S, an acidic solution (dye + HCl), and then boiled in an alkali solution (dye + NaOH). Warne's staining scheme, like those suggested by Friedman (1959), are best performed in the laboratory (see section 22 PREPARATION OF STAINED ACETATE PEELS AND SECTIONS).

A simple procedure, although non-quantitative, which can be undertaken in adverse weather, uses Alizarin Red-S to differentiate calcite (and aragonite) from dolomite.

1. Etch a clean rock surface with 10% HCl.
2. Place a few drops of Alizarin Red-S (0.1g dye in 50ml 1.5% HCl) on the area. Calcite will stain within 2-3 minutes.

RESULTS

<table>
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<tr>
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<th>Calcite (aragonite)</th>
<th>Dolomite</th>
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</thead>
<tbody>
<tr>
<td><strong>Pink or red</strong></td>
<td>(depending on crystal orientation)</td>
<td><strong>Unstained.</strong></td>
</tr>
</tbody>
</table>

The tests for determining iron in carbonate, using Potassium Ferricyanide either by itself, or in combination with Alizarin Red-S, and the determination of Mg-calcite using Titan Yellow, is not readily adaptable for field use. This is mainly due to the unstable nature of the freshly mixed stains. Potassium Ferricyanide is light sensitive, and must be used within a few hours of being mixed. Titan Yellow is non-permanent unless correctly "fixed" within a strong alkali solution, a procedure suitable for laboratory staining schemes only (for details see section 22 PREPARATION OF CARBONATE STAINED ACETATE PEELS AND THIN SECTIONS).