Report on the Mineralogy of Five Samples by X-Ray Powder Diffraction (XRPD)

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Job and Sample Information:

<table>
<thead>
<tr>
<th>Lab Code</th>
<th>Client Code</th>
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<tbody>
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<td>3FB-2</td>
</tr>
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Introduction

Five samples were forwarded for whole rock and <2 micron clay fraction mineralogical analysis by X-ray powder diffraction (XRPD).

Methods

<table>
<thead>
<tr>
<th>Methods</th>
<th>Accreditation Reference</th>
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</thead>
<tbody>
<tr>
<td>Identification and Quantification of Polycrystalline Material by XRPD</td>
<td>GM003 and GM004</td>
</tr>
<tr>
<td>Identification and Semi-Quantification of Clay Minerals</td>
<td>GM001 and GM002</td>
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</table>

XRPD

The bulk samples were wet ground (in ethanol) in a McCrone mill and spray dried to produce random powders. The X-ray powder diffraction (XRPD) patterns were recorded from 2-75°2θ using Cobalt Kα radiation. Quantitative analysis was done by a normalised full pattern reference intensity ratio (RIR) method. Unless stated otherwise, expanded uncertainty using a coverage factor of 2, i.e. 95% confidence, is given by ±X0.35, where X = concentration in wt.%, e.g. 30 wt.% ±3.3. Note also that for phases present at the trace level (<1%) there may also be uncertainty as to whether or not the phase is truly present in the sample. This is both phase and sample dependent. It arises because at trace concentrations identification is often based on the presence of a single peak and the judgement of the analyst in assigning that peak to a likely mineral.

The clay fractions of <2μm were obtained by timed sedimentation, prepared as an oriented mount using the filter peel transfer technique and scanned from 2-45°2θ in the air-dried state, after glycolation, and after heating to 300°C for one hour. Clay minerals identified were quantified using a mineral intensity factor approach based on calculated XRPD patterns. Unless otherwise stated, for clay minerals present in amounts >10wt.% uncertainty is estimated as better than ±5wt.% at the 95% confidence level.

The XRPD patterns are identified by a labcode and by a name based on customer supplied identifiers, plus the suffix ‘A’ for air-dried, ‘G’ for glycolated, ‘H3’ for heated to 300°C and ‘B’ for bulk sample.
Results
The bulk XRPD results are presented in Table 1 and <2 micron clay fraction are in Table 2. The XRPD patterns, with the main non-clay phases identified in the bulk sample by reference to patterns from the International Centre for Diffraction Database (ICDD), are provided for reference.

Comments and opinions
The whole rock samples are mixtures of quartz, plagioclase, K-feldspar, calcite, dolomite, undifferentiated illite plus illite/smectite, amphibole, kaolinite, chlorite, halite and possible traces of siderite, pyrite and anatase.

The <2 micron clay fractions are dominated by mixed-layer illite/smectite with smaller amounts of illite, chlorite and kaolinite. In all samples the mixed-layer illite/smectite has an expandability estimated as 75%.

Note:
Samples will be stored for a period of eight weeks following completion of analysis and acceptance of analytical report(s) at no extra cost after which samples will be disposed of unless a specific instruction is given (with the sample analysis request/order) to store the sample beyond this period. Extended storage charges will apply.
Table 1: XRPD Bulk Mineralogy (weight %) RIR Method

<table>
<thead>
<tr>
<th>Labcode</th>
<th>Sample ID</th>
<th>Quartz</th>
<th>Plagioclase</th>
<th>K-feldspar</th>
<th>Amphibole</th>
<th>Calcite</th>
<th>Dolomite</th>
<th>Siderite</th>
<th>Pyrite</th>
<th>Anatase</th>
<th>Halite</th>
<th>I+I/S-ML</th>
<th>Chlorite(Tri)</th>
<th>Kaolinite</th>
<th>Total</th>
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<tr>
<td>1282528</td>
<td>1FB-3-B</td>
<td>20.0</td>
<td>15.9</td>
<td>8.4</td>
<td>1.8</td>
<td>11.7</td>
<td>8.4</td>
<td>0.8</td>
<td>0.4</td>
<td>0.0</td>
<td>0.7</td>
<td>26.9</td>
<td>2.9</td>
<td>2.1</td>
<td>100.0</td>
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<td>34.4</td>
<td>18.7</td>
<td>7.4</td>
<td>1.3</td>
<td>8.4</td>
<td>10.7</td>
<td>0.5</td>
<td>0.3</td>
<td>0.0</td>
<td>0.2</td>
<td>2.0</td>
<td>2.0</td>
<td>0.8</td>
<td>0.3</td>
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<td>3FB-3-1-B</td>
<td>47.6</td>
<td>20.9</td>
<td>8.4</td>
<td>1.3</td>
<td>8.4</td>
<td>9.7</td>
<td>0.2</td>
<td>0.0</td>
<td>0.0</td>
<td>0.1</td>
<td>5.9</td>
<td>0.0</td>
<td>0.0</td>
<td>100.0</td>
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<td>4FB-2-B</td>
<td>46.7</td>
<td>22.3</td>
<td>8.0</td>
<td>1.0</td>
<td>6.1</td>
<td>9.7</td>
<td>0.2</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>6.0</td>
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<td>trace</td>
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<td>1282532</td>
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<td>25.6</td>
<td>15.0</td>
<td>6.5</td>
<td>1.4</td>
<td>9.7</td>
<td>9.3</td>
<td>0.9</td>
<td>0.2</td>
<td>0.1</td>
<td>0.9</td>
<td>25.8</td>
<td>1.2</td>
<td>3.4</td>
<td>100.0</td>
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I+I/S © = Undifferentiated Illite + Illite/Smectite – Mixed Layered

Table 2: Relative percentage of clay minerals in the <2μm clay size fraction

<table>
<thead>
<tr>
<th>Labcode</th>
<th>Sample ID</th>
<th>XRD pattern name</th>
<th>Chlorite(Tri)©</th>
<th>Kaolinite©</th>
<th>Illite©</th>
<th>I/S-ML©</th>
<th>%Exp©</th>
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<tr>
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<td>1FB-3</td>
<td>1FB-3-A,-G,-H3</td>
<td>10</td>
<td>4</td>
<td>14</td>
<td>72</td>
<td>75</td>
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<td>1282529</td>
<td>3FB-2</td>
<td>3FB-2-A,-G,-H3</td>
<td>5</td>
<td>3</td>
<td>15</td>
<td>77</td>
<td>75</td>
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<tr>
<td>1282530</td>
<td>3FB-3</td>
<td>3FB-3-1-A,-G,-H3</td>
<td>3</td>
<td>2</td>
<td>10</td>
<td>85</td>
<td>75</td>
</tr>
<tr>
<td>1282531</td>
<td>4FB-2</td>
<td>4FB-2-A,-G,-H3</td>
<td>3</td>
<td>2</td>
<td>9</td>
<td>86</td>
<td>75</td>
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<tr>
<td>1282532</td>
<td>4FB-3-1</td>
<td>4FB-3-1-A,-G,-H3</td>
<td>6</td>
<td>4</td>
<td>13</td>
<td>77</td>
<td>75</td>
</tr>
</tbody>
</table>

I+I/S © = Undifferentiated Illite + Illite/Smectite – Mixed Layered
Exp% © = Percent Expandability of Illite/Smectite – Mixed Layered
99-090-0023 (U) - Hornblende - Na.9K.4Ca1.6Mg2.9Fe1.4Ti.5Al2.4Si6O

99-090-0014 (U) - Pyrite - FeS2

99-090-0018 (U) - Halite, syn - NaCl

99-090-0009 (U) - Siderite, FeCO3

99-090-0005 (U) - Calcite, syn - CaCO3

99-090-0003 (U) - Microcline - from Pike's Peak batholith, Colorado, US

99-090-0002 (U) - Albite low - Na(AlSi3O8)

99-090-0067 (U) - Quartz - SiO2

99-090-0001 (U) - Microcline - from Pike's Peak batholith, Colorado, US

99-090-0074 (U) - Dolomite - CaMg(CO3)2

1282528 - File: 1282528-1FB-3-B.RAW
99-090-0023 (U) - Hornblende - Na.9K.4Ca1.6Mg2.9Fe1.4Ti.5Al2.4Si6O
99-090-0014 (U) - Pyrite - FeS2
99-090-0018 (U) - Halite, syn - NaCl
99-090-0074 (U) - Dolomite - CaMg(CO3)2
99-090-0009 (U) - Siderite - FeCO3
99-090-0018 (U) - Halite, syn - NaCl
99-090-0014 (U) - Pyrite - FeS2
99-090-0018 (U) - Halite, syn - NaCl
99-090-0023 (U) - Hornblende - Na.9K.4Ca1.6Mg2.9Fe1.4Ti.5Al2.4Si6O24
99-090-0009 (U) - Siderite - FeCO3
99-090-0074 (U) - Dolomite - CaMg(CO3)2
99-090-0002 (U) - Albite low - Na(AlSi3O8)
99-090-0005 (U) - Calcite, syn - CaCO3
99-090-0003 (U) - Microcline - from Pike's Peak batholith, Colorado, USA - - KAlSi3O8
99-090-0067 (U) - Quartz - SiO2
1282530 - File: 1282530-3FB-3-1-B.RAW

Counts

0 1000 2000 3000 4000 5000 6000 7000

2Ø Cobalt K-alpha

0 2 10 20 30 40 50 60 70
99-090-0023 (U) - Hornblende - Na.9K.4Ca1.6Mg2.9Fe1.4Ti.5Al2.4Si6O24
99-090-0009 (U) - Siderite - FeCO3
99-090-0074 (U) - Dolomite - CaMg(CO3)2
99-090-0009 (U) - Siderite - FeCO3
99-090-0023 (U) - Hornblende - Na.9K.4Ca1.6Mg2.9Fe1.4Ti.5Al2.4Si6O24
Counts

2° Cobalt K-alpha

0 1000 2000 3000

2° Cobalt K-alpha

1282532 - File: 1282532-4FB-3-1-B.RAW
99-090-0067 (U) - Quartz - SiO2
99-090-0002 (U) - Albite low - Na(AlSi3O8)
99-090-0003 (U) - Microcline - from Pike's Peak batholith, Colorado, US
99-090-0005 (U) - Calcite, syn - CaCO3
99-090-0074 (U) - Dolomite - CaMg(CO3)2
99-090-0009 (U) - Siderite - FeCO3
99-090-0018 (U) - Halite, syn - NaCl
99-090-0014 (U) - Pyrite - FeS2
99-090-0023 (U) - Hornblende - Na.9K.4Ca1.6Mg2.9Fe1.4Ti2.4Si6O
99-090-0016 (U) - Anatase - synthetic - TiO2
99-090-0009 (U) - Siderite - FeCO3
99-090-0005 (U) - Calcite, syn - CaCO3
99-090-0003 (U) - Microcline - from Pike's Peak batholith, Colorado, US
99-090-0002 (U) - Albite low - Na(AlSi3O8)
99-090-0067 (U) - Quartz - SiO2
1282532 - File: 1282532-4FB-3-1-B.RAW