Soil Geochemical and Indicator Mineral Reconnaissance Survey of Till in Minnesota - Infill and Follow-up Sampling

Antimony
Analytical Method
Material
Fraction Analyzed
INAA
Non-Ferromagnetic Fraction
> 3.2 Specific Gravity
< 250 μ

2006 In-fill Samples (78)
Percentile Range
0-25% Below Detection - 0.1 ppm
25-50% 0.4 - 1.7 ppm
50-75% 1.8 - 3.3 ppm
75-90% 3.4 - 4.9 ppm
90-95% 5.0 - 6.1 ppm
95-98% 6.4 - 8.6 ppm
98-99% 9.8 - 10.3 ppm
99-100% 12.8 - 13.3 ppm

2007 Follow-up Samples (52)

2004 Statewide survey Samples (250)
Minnesota Geological Survey
Open File Report 07-01
Multiple samples from drill holes or outcrops

Mesabi Iron Range

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Arsenic

Analytical Method
INAA

Material
Non-Ferromagnetic Fraction
> 3.2 Specific Gravity

Fraction Analyzed
< 250 μ

2006 In-fill Samples (78)

Percentile
0-25%
25-50%
50-75%
75-90%
90-95%
95-98%
98-99%
99-100%

Range
Below Detection
3 - 8 ppm
9 - 14 ppm
15 - 21 ppm
22 - 38 ppm
40 - 59 ppm
60 - 91 ppm
104 - 630 ppm

2007 Follow-up Samples (52)

2004 Statewide survey Samples (250)

Minnesota Geological Survey
Open File Report 07-01

Multiple samples from drill holes or outcrops

Mesabi iron Range
Soil Geochemical and Indicator Mineral Reconnaissance Survey of Till in Minnesota - Infill and Follow-up Sampling

Barium

Analytical Method
INAA

Material
Non-Ferromagnetic Fraction

Fraction Analyzed
> 3.2 Specific Gravity
< 250 μ

2006 In-fill Samples (78)
Percentile
Range
0-25%
Below Detection
75-90%
290 - 2100 ppm
90-95%
2200 - 3800 ppm
95-98%
4300 - 6000 ppm
98-99%
6100 - 6800 ppm
99-100%
8400 - 12000 ppm

2007 Follow-up Samples (52)

2004 Statewide survey Samples (250)
Minnesota Geological Survey
Open File Report 07-01

Multiple samples from drill holes or outcrops

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Bromine

Analytical Method INAA
Material Non-Ferromagnetic Fraction
Fraction Analyzed

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Calcium

Analytical Method
Material
Fraction Analyzed

INAA
Non-Ferromagnetic Fraction
> 3.2 Specific Gravity
< 250 µ

2006 In-fill Samples (78)
2007 Follow-up Samples (52)
2004 Statewide survey Samples (250)

Percentile Range

- 0-25% Below Detection
- 50-75% 3 - 6 ppm
- 75-90% 7 - 9 ppm
- 90-95% 10 - 11 ppm
- 95-98% 12 - 14 ppm
- 98-99% 15 ppm
- 99-100% 16 - 19 ppm

Multiple samples from drill holes or outcrops

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Chromium

Analytical Method: INAA

Material: Non-Ferromagnetic Fraction

Fraction Analyzed:

- > 3.2 Specific Gravity
- < 250 μ

2006 In-fill Samples (78)

- Percentile Range
- 0-25% 113 - 325 ppm
- 25-50% 326 - 499 ppm
- 50-75% 500 - 780 ppm
- 75-90% 783 - 1140 ppm
- 90-95% 1160 - 1470 ppm
- 95-98% 1480 - 1810 ppm
- 98-99% 1850 - 2040 ppm
- 99-100% 2080 - 3610 ppm

2007 Follow-up Samples (52)

2004 Statewide survey Samples (250)

Multiple samples from drill holes or outcrops

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Cerium

Analytical Method: INAA
Material: Non-Ferromagnetic Fraction
Fraction Analyzed: > 3.2 Specific Gravity, < 250 μ

2006 In-fill Samples (78)
- Percentile Range
  - 0-25% 32 - 260 ppm
  - 25-50% 263 - 480 ppm
  - 50-75% 481 - 683 ppm
  - 75-90% 684 - 856 ppm
  - 90-95% 857 - 1050 ppm
  - 95-98% 1070 - 1240 ppm
  - 98-99% 1330 - 1570 ppm
  - 99-100% 1600 - 1900 ppm

2007 Follow-up Samples (52)

2004 Statewide survey Samples (250)

Multiple samples from drill holes or outcrops

Mesabi Iron Range

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Cesium

Analytical Method:
INAA

Material:
Non-Ferromagnetic Fraction

Fraction Analyzed:
> 3.2 Specific Gravity
< 250 μ

2006 In-fill Samples (78)

Percentile Range

0-25% Below Detection
95-98% 2 - 4 ppm
98-99% 5 ppm
99-100% 6 - 9 ppm

2007 Follow-up Samples (52)

2004 Statewide survey Samples (250)

Minnesota Geological Survey
Open File Report 07-01

Multiple samples from drill holes or outcrops

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Cobalt

Analytical Method: INAA
Material: Non-Ferromagnetic Fraction
Fraction Analyzed: > 3.2 Specific Gravity, < 250 µ

2006 In-fill Samples (78)
- 0-25%: 12 - 28 ppm
- 25-50%: 29 - 33 ppm
- 50-75%: 34 - 39 ppm
- 75-90%: 40 - 47 ppm
- 90-95%: 48 - 54 ppm
- 95-98%: 56 - 69 ppm
- 98-99%: 74 - 81 ppm
- 99-100%: 82 - 121 ppm

2007 Follow-up Samples (52)

2004 Statewide survey Samples (250)
- Minnesota Geological Survey
- Open File Report 07-01
- Multiple samples from drill holes or outcrops

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Europium

Analytical Method
Material

INAA
Non-Ferromagnetic Fraction
> 3.2 Specific Gravity
< 250 μ

Fraction Analyzed

2006 In-fill Samples (78)
Percentile  Range
0-25%  0.1 - 3.8 ppm
25-50%  3.9 - 6.0 ppm
50-75%  6.1 - 8.2 ppm
75-90%  8.3 - 9.9 ppm
90-95%  10.0 - 11.5 ppm
95-98%  11.6 - 13.1 ppm
98-99%  13.2 - 14.9 ppm
99-100% 15.7 - 18.3 ppm

2007 Follow-up Samples (52)

2004 Statewide survey Samples (250)
Minnesota Geological Survey
Open File Report 07-01
Multiple samples from drill holes or outcrops

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Gold

Analytical Method: INAA
Material: Non-Ferromagnetic Fraction
Fraction Analyzed: > 3.2 Specific Gravity, < 250 μ

2006 In-fill Samples (78)
2007 Follow-up Samples (52)
2004 Statewide survey Samples (250)

Percentile Range
0-25% Below Detection
25-50% 6 - 34 ppb
50-75% 35 - 101 ppb
75-90% 102 - 213 ppb
90-95% 224 - 377 ppb
95-98% 378 - 678 ppb
98-99% 743 - 893 ppb
99-100% 931 - 13700 ppb

Multiple samples from drill holes or outcrops

Mesabi Iron Range

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Hafnium

Analytical Method: INAA
Material: Non-Ferromagnetic Fraction
Fraction Analyzed: > 3.2 Specific Gravity, < 250 μ

2006 In-fill Samples (78)
Percentile Range
0-25% 11 - 67 ppm
25-50% 68 - 153 ppm
50-75% 154 - 243 ppm
75-90% 244 - 316 ppm
90-95% 320 - 378 ppm
95-98% 379 - 439 ppm
98-99% 466 - 516 ppm
99-100% 735 - 1050 ppm

2007 Follow-up Samples (52)

2004 Statewide survey Samples (250)
- Minnesota Geological Survey
  Open File Report 87-91
- Multiple samples from drill holes or outcrops
- Mesabi Iron Range

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Iridium

Analytical Method: INAA
Material: Non-Ferromagnetic Fraction
Fraction Analyzed: > 3.2 Specific Gravity, < 250 µm

2006 In-fill Samples (78)
- Percentile Range
  - 0-25% Below Detection
  - 99-100% 50 - 70 ppm

2007 Follow-up Samples (52)
2004 Statewide survey Samples (250)
- Minnesota Geological Survey Open File Report 07-01
- Multiple samples from drill holes or outcrops
- Mesabi Iron Range

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Iron

Analytical Method: INAA
Material: Non-Ferromagnetic Fraction
Fraction Analyzed: > 3.2 Specific Gravity, < 250 μ

2006 In-fill Samples (78)
- Percentile Range
  - 0-25% 7.3 - 13.0%
  - 25-50% 13.1 - 15.7%
  - 50-75% 15.8 - 19.2%
  - 75-90% 19.3 - 22.5%
  - 90-95% 22.6 - 26.1%
  - 95-98% 26.1 - 27.8%
  - 98-99% 28.7 - 30.0%
  - 99-100% 30.2 - 33.6%

2007 Follow-up Samples (52)

2004 Statewide survey Samples (250)
- Minnesota Geological Survey
  - Open File Report 07-01

Multiple samples from drill holes or outcrops

Mesabi Iron Range

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NRRI Report of Investigation NRRI/RI-2007/06
Lanthanum

Analytical Method: INAA
Material: Non-Ferromagnetic Fraction
Fraction Analyzed: > 3.2 Specific Gravity, < 250 μ

2006 In-fill Samples (78)
Percentile: Range
0-25%: 13 - 150 ppm
25-50%: 152 - 269 ppm
50-75%: 270 - 372 ppm
75-90%: 375 - 466 ppm
90-95%: 471 - 580 ppm
95-98%: 581 - 739 ppm
98-99%: 742 - 848 ppm
99-100%: 945 - 1100 ppm

2007 Follow-up Samples (52)

2004 Statewide survey Samples (250)
- Minnesota Geological Survey
  - Open File Report 07-01
- Multiple samples from drill holes or outcrops

Mesabi Iron Range

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NRRI Report of Investigation NRRI/RI-2007/06
Lutetium

Analytical Method
INAA

Material
Non-Ferromagnetic Fraction
> 3.2 Specific Gravity

Fraction Analyzed
< 250 μ

2006 In-fill Samples (78)

<table>
<thead>
<tr>
<th>Percentile</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-25%</td>
<td>0.55 - 1.78 ppm</td>
</tr>
<tr>
<td>25-50%</td>
<td>1.80 - 3.06 ppm</td>
</tr>
<tr>
<td>50-75%</td>
<td>3.07 - 4.39 ppm</td>
</tr>
<tr>
<td>75-90%</td>
<td>4.40 - 5.56 ppm</td>
</tr>
<tr>
<td>90-95%</td>
<td>5.58 - 6.15 ppm</td>
</tr>
<tr>
<td>95-98%</td>
<td>6.17 - 6.94 ppm</td>
</tr>
<tr>
<td>98-99%</td>
<td>7.00 - 8.29 ppm</td>
</tr>
<tr>
<td>99-100%</td>
<td>8.93 - 15.80 ppm</td>
</tr>
</tbody>
</table>

2007 Follow-up Samples (52)

2004 Statewide survey Samples (250)

Multiple samples from drill holes or outcrops

Mesabi Iron Range

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Mercury

Analytical Method  INAA
Material
Non-Ferromagnetic Fraction
> 3.2 Specific Gravity
< 250 μ

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2006 In-fill Samples (78)
Percentile Range
0-25% Below Detection
99-100% 5 ppm

2007 Follow-up Samples (52)

2004 Statewide survey Samples (250)
Minnesota Geological Survey Open File Report 04-01
Multiple samples from drill holes or outcrops
Mesabi Iron Range

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Molybdenum

Analytical Method: INAA
Material: Non-Ferromagnetic Fraction
> 3.2 Specific Gravity
< 250 μ

2006 In-fill Samples (78)
Percentile Range
0-25% Below Detection
98-99% 20 - 30 ppm
99-100% 31 - 40 ppm
2007 Follow-up Samples (52)
2004 Statewide survey Samples (250)
Minnesota Geological Survey
Open File Report 07-01
Multiple samples from drill holes or outcrops
Mesabi Iron Range

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Neodymium

Analytical Method
INAA
Non-Ferromagnetic Fraction
> 3.2 Specific Gravity
Fraction Analyzed
< 250 μ

2006 In-fill Samples (78)
Percentile Range
0-25% Below Detection - 10 ppm
25-50% 91 - 170 ppm
50-75% 172 - 257 ppm
75-90% 258 - 340 ppm
90-95% 342 - 386 ppm
95-98% 399 - 478 ppm
98-99% 483 - 620 ppm
99-100% 640 - 642 ppm

2007 Follow-up Samples (52)

2004 Statewide survey Samples (250)
Minnesota Geological Survey Open File Report 07-01
Multiple samples from drill holes or outcrops

Mesabi Iron Range

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Nickel

Analytical Method: INAA
Material: Non-Ferromagnetic Fraction
> 3.2 Specific Gravity
Fraction Analyzed: < 250 μ

2006 In-fill Samples (78)
Percentile Range
- 0-25% Below Detection - 100 ppm
- 90-95% 206 ppm
- 95-99% 220 - 565 ppm
- 99-99% 620 - 764 ppm
- 99-100% 771 - 1500 ppm

2007 Follow-up Samples (52)

2004 Statewide survey Samples (250)
Minnesota Geological Survey
Open File Report 07-01

Multiple samples from drill holes or outcrops

Mesabi Iron Range

Kilometers
Miles
Soil Geochemical and Indicator Mineral Reconnaissance Survey of Till in Minnesota - Infill and Follow-up Sampling

Rubidium

Analytical Method: INAA
Material: Non-Ferromagnetic Fraction
Fraction Analyzed: > 3.2 Specific Gravity
< 250 μ

2006 In-fill Samples (78)
- 0-25% Below Detection
- 25 ppm
- 55-70 ppm
- 95-98%
- 96 - 100 ppm
- 98-99%
- 99 - 100% 113 - 159 ppm
2007 Follow-up Samples (52)
2004 Statewide survey Samples (250)
Minnesota Geological Survey
Open File Report 07-01
Multiple samples from drill holes or outcrops
Mesabi Iron Range

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Samarium

Analytical Method: INAA
Material: Non-Ferromagnetic Fraction
Fraction Analyzed: > 3.2 Specific Gravity, < 250 μ

2006 In-fill Samples (78)
Percentile Range
0-25% 3.3 - 18.9 ppm
25-50% 19.0 - 34.4 ppm
50-75% 34.5 - 47.7 ppm
75-90% 48.0 - 60.1 ppm
90-95% 60.2 - 68.9 ppm
95-98% 69.2 - 87.0 ppm
98-99% 87.9 - 97.8 ppm
99-100% 98.1 - 139.0 ppm

2007 Follow-up Samples (52)

2004 Statewide survey Samples (250)
- Minnesota Geological Survey
  Open File Report 07-01
- Multiple samples from drill holes or outcrops

Mesabi Iron Range

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Scandium

Analytical Method: INAA
Material: Non-Ferromagnetic Fraction
> 3.2 Specific Gravity
Fraction Analyzed: < 250 μ

2006 In-fill Samples (78)
Percentile
0-25% 18.4 - 41.7 ppm
25-50% 41.8 - 56.4 ppm
50-75% 56.5 - 71.2 ppm
75-90% 71.3 - 81.7 ppm
90-95% 81.9 - 87.9 ppm
95-98% 88.5 - 92.3 ppm
98-99% 94.1 - 100.0 ppm
99-100% 101.6 - 104.0 ppm

2007 Follow-up Samples (52)

2004 Statewide survey Samples (250)
Minneapolis Geological Survey
Open File Report 07-01

Multiple samples from drill holes or outcrops

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Selenium

Analytical Method: INAA
Material: Non-Ferromagnetic Fraction
Fraction Analyzed: > 3.2 Specific Gravity, < 250 μ

2006 In-fill Samples (78)
Percentile Range
0-25% Below Detection
98-99% 21 - 23 ppm
99-100% 25 - 70 ppm

2007 Follow-up Samples (52)

2004 Statewide survey Samples (250)

Multiple samples from drill holes or outcrops

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Silver

Analytical Method: INAA
Material: Non-Ferromagnetic Fraction
Fraction Analyzed: > 3.2 Specific Gravity, < 250 μm

- 2006 In-fill Samples (78)
  - Percentile Range
  - 0-25% Below Detection
  - 99-100% 7 - 35 ppm

- 2007 Follow-up Samples (52)

- 2004 Statewide survey Samples (250)

Minnesota Geological Survey
Open File Report 07-01

Multiple samples from drill holes or outcrops

Mesabi Iron Range
Soil Geochemical and Indicator Mineral Reconnaissance Survey of Till in Minnesota - Infill and Follow-up Sampling

Sodium
Analytical Method: INAA
Material: Non-Ferromagnetic Fraction
> 3.2 Specific Gravity
Fraction Analyzed: < 250 μ

2006 In-fill Samples (78)
2007 Follow-up Samples (52)
2004 Statewide survey Samples (250)

Minnesota Geological Survey
Open File Report 07-01

Multiple samples from drill holes or outcrops

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Strontium

Analytical Method: INAA
Material: Non-Ferromagnetic Fraction
Fraction Analyzed: > 3.2 Specific Gravity
< 250 μ

2006 In-fill Samples (78)
2007 Follow-up Samples (52)
2004 Statewide survey Samples (250)

Minnesota Geological Survey
Open File Report 07-01

Multiple samples from drill holes or outcrops
Mesabi Iron Range

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Tantalum

Analytical Method
INAA

Material
Non-Ferromagnetic Fraction
> 3.2 Specific Gravity
< 250 μm

Fraction Analyzed

2004 Statewide survey Samples (250)
Minnesota Geological Survey
Open File Report 07-01

2006 In-fill Samples (78)

Percentile
0-25%
25-50%
50-75%
75-90%
90-95%
95-98%
98-99%
99-100%

Range
Below Detection - 5 ppm
6 - 9 ppm
10 - 13 ppm
14 - 16 ppm
17 ppm
18 - 22 ppm
23 ppm
24 - 27 ppm

2007 Follow-up Samples (52)

Multiple samples from drill holes or outcrops

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Terbium

Analytical Method
INAA
Material
Non-Ferromagnetic Fraction
> 3.2 Specific Gravity
Fraction Analyzed
< 250 μ

2006 In-fill Samples (78)
Percentile Range
0-25% Below Detection
25-50% 2 - 3 ppm
50-75% 4 - 6 ppm
75-90% 7 - 8 ppm
90-95% 9 ppm
95-98% 10 ppm
98-99% 11 - 12 ppm
99-100% 13 - 19 ppm

2007 Follow-up Samples (52)

2004 Statewide survey Samples (250)
Minnesota Geological Survey
Open File Report 07-01

Multiple samples from drill holes or outcrops
Mesabi Iron Range

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Thorium

Analytical Method: INAA
Material: Non-Ferromagnetic Fraction
Fraction Analyzed: > 3.2 Specific Gravity
< 250 μ

2006 In-fill Samples (78)
- Percentile Range
  - 0-25% 2.2 - 54.9 ppm
  - 25-50% 55.3 - 111.0 ppm
  - 50-75% 112.0 - 150.0 ppm
  - 75-90% 151.0 - 189.0 ppm
  - 90-95% 190.0 - 249.0 ppm
  - 95-98% 250.0 - 307.0 ppm
  - 98-99% 331.0 - 339.0 ppm
  - 99-100% 376.0 - 498.0 ppm

2007 Follow-up Samples (52)

2004 Statewide survey Samples (250)
- Minnesota Geological Survey
  Open File Report 07-01
- Multiple samples from drill holes or outcrops

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Tungsten

Analytical Method

INAA

Material

Non-Ferromagnetic Fraction

Fraction Analyzed

> 3.2 Specific Gravity

< 250 μ

2006 In-fill Samples (78)

Percentile

0-25%

95-98%

98-99%

99-100%

Range

Below Detection

8 - 9 ppm

11 - 26 ppm

27 - 70 ppm

2007 Follow-up Samples (52)

2004 Statewide survey Samples (250)

Multiple samples from drill holes or outcrops

Mosabi Iron Range

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Soil Geochemical and Indicator Mineral Reconnaissance Survey of Till in Minnesota - Infill and Follow-up Sampling

Ytterbium

Analytical Method: INAA

Material: Non-Ferromagnetic Fraction

Fraction Analyzed: > 3.2 Specific Gravity, < 250 μ

2006 In-fill Samples (78)

Percentile Range

0-25% 2.8 - 10.7 ppm
25-50% 11.0 - 18.8 ppm
50-75% 18.9 - 28.1 ppm
75-90% 28.2 - 35.2 ppm
90-95% 35.5 - 39.8 ppm
95-98% 39.9 - 45.7 ppm
98-99% 47.5 - 53.9 ppm
99-100% 56.3 - 107.0 ppm

2007 Follow-up Samples (52)

2004 Statewide survey Samples (250)

Multiple samples from drill holes or outcrops

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Zinc
Analytical Method INAA
Material Non-Ferromagnetic Fraction
Fraction Analyzed > 3.2 Specific Gravity < 250 µ

2006 In-fill Samples (78)
Percentile Range
0-25% Below Detection
75-90% 200-249 ppm
90-95% 251-321 ppm
96-98% 322-391 ppm
98-99% 400-475 ppm
99-100% 524-2290 ppm

2007 Follow-up Samples (52)

2004 Statewide survey Samples (250)
Minnesota Geological Survey
Open File Report 97-01
Multiple samples from drill holes or outcrops

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