Mineral Exploration Targets in British Columbia, Canada, Identified from Regional Stream Geochemical Surveys

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Talk Outline

- The National Geochemical Reconnaissance (NGR) Program
- 2004 BC Regional Geochemical Survey (RGS) Program Highlights
- Survey techniques
- Exploration Targets
So what is the BC Regional Geochemical Survey?

- Part of the National Geochemical Reconnaissance (NGR) program

- Reconnaissance-scale drainage sediment and water surveys since 1976
Objectives?

- Identify areas of high mineral potential
- Produce baseline geochemical data (e.g. for environmental monitoring)
- Possibly identify exploration targets
It’s Extent?

- Over 45,000 drainage sediment & water samples taken over ~ 60% of BC @ an average density of 1 sample/13km²
- Surveys conform to National Geochemical Reconnaissance Program (NGR) standards
Completed 1:250 000 scale stream sediment – water surveys

2004 surveys

2005 surveys
2004 Highlights

- Bowser Lake (NTS 104A) RGS completed (1085 sediment & water samples from 1028 sites)
- Spatsizi Lake (NTS 104H) RGS completed (379 sediment & water samples from 359 sites)
- Multi element data released from aqua regia-ICPMS analysis of archived samples from Iskut River - Telegraph Creek sheets
Ideally RGS Sample sites are:

- Flowing 1 and 2\textsuperscript{nd} order streams that have a drainage basin area of 2.5 – 15 Km\textsuperscript{2}
- Within an active channel
- 60 m upstream from contamination
- 60 m upstream from a confluence
- Upstream from lakes, ponds and marshes
Each RGS site is marked to help follow-up
The ideal RGS sample is ~ 2 kg of fine-textured sediment from the active stream channel.
A more challenging sediment sample site
plus a water sample
## Recording RGS site information

<table>
<thead>
<tr>
<th>NTS SHEET</th>
<th>YEAR</th>
<th>SAMPLE NUMBER</th>
<th>COLLECTORS</th>
<th>SAMPLE TYPE</th>
<th>WIDTH</th>
<th>DEPTH</th>
<th>REP STAT</th>
<th>DAY</th>
<th>MO</th>
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<tr>
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<td>Bank Type</td>
<td>Water Colour</td>
<td>Sample Colour</td>
<td>Bottom PCPT</td>
<td>Stream Physiog</td>
<td>DRNGE PATTN</td>
<td>STRM TYPE</td>
<td>STRM CLASS</td>
<td>STRM SOURCE</td>
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<td>Clear</td>
<td>Rd-Bn</td>
<td>None</td>
<td>Plain</td>
<td>Poor</td>
<td>Undfn</td>
<td>Unknown</td>
<td>Sp'gMelt</td>
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<td>BnTrans</td>
<td>Wh-Bf</td>
<td>Rd-Bn</td>
<td>Swamp</td>
<td>Dendrc</td>
<td>Permit</td>
<td>Ground</td>
<td>RedRain</td>
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<td>Till</td>
<td>WhClidy</td>
<td>Black</td>
<td>Wh-Bf</td>
<td>Penpln</td>
<td>Herrbn</td>
<td>Intermittent</td>
<td>Blue</td>
<td>Glacier</td>
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<td>Outwash</td>
<td>BnClidy</td>
<td>Yellow</td>
<td>Black</td>
<td>Hilly</td>
<td>Rectin</td>
<td>Trellis</td>
<td>Pink</td>
<td>Tertiary</td>
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<td>BareRock</td>
<td>Gy-Blu</td>
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<td>Yellow</td>
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<td>Discont</td>
<td>Secondary</td>
<td>Other</td>
<td>Quaternary</td>
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<td>Pink</td>
<td>Green</td>
<td>Green</td>
<td>Moun/Y</td>
<td>Closed</td>
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Quality Control starts in the Field

Based on blocks of 20 consecutive numbers
- 18 numbers for collecting samples and 2 reserved numbers for analytical Q/C (e.g. 1001, 1014)
- Field duplicate samples collected in every block

93K  1001 AD  1006  1011  1016
1002  1007  1012  1017
1003  1008  1013  1018
1004 FD  1009  1014 S  1019
1005 FD  1010  1015  1020
After addition of Q/C the < 0.177 mm (-80 mesh) fraction is analysed for:

- 33 elements (including Au, U) by instrumental neutron activation (INAA)
- 32 elements (including Cu, Pb, Zn, S) by aqua regia digestion-inductively coupled mass spectrometry
- Loss on ignition, fluorine, tin

Water sampled are analysed for pH, F, U & trace elements
Lake sediments: 1/15 km²

Other RGS Methods – Lake Sampling
Lake Sediment surveys

Focused multimedia surveys
A Recent Success Story - Almanden Minerals Discovery

- Original RGS in 1982. INAA Au data released in 1994
- Au mineralized quartz vein (0.47 g/tonne Au) found in 2003 by prospecting follow-up of low contrast (95 to 98 percentile) RGS Au anomalies
- 2 veins with up to 55.75 g/tonne Au found 3 km SW of discovery zone
- SAM & SAM SOUTH properties cover 6190 hectares
SAM claims area
Spences Bridge
21 ppb Au
19 ppb Au
Au-Quartz Veins
Almanden Minerals SAM Claims, 2004
How can we better identify exploration targets?

- Sample other media
- Reanalyse archived sediment samples for pathfinder elements
Regional Geochemical Surveys using Heavy Mineral Concentrates

- Bulk sediment samples & conventional silts collected from 34 stream sites along a 2,500 km² belt extending north and south of the Eskay Creek mine in NW BC

- Heavy mineral concentrates prepared from bulk samples. Gold content estimated visually, by aqua regia ICPMS analysis & by INAA.
The Eskay Creek Gold-Silver Mine

Hot spring MS deposit in Jurassic mudstone
2.94 m t grading 43.25 g/t Au & 1926 g/t Ag
Sulphides rich in As, Sb & Hg
HM Sampling Process

- Sediment wet sieved to < 1.68 mm (12 mesh) in field.
- Table concentrate made from < 1.68 mm fraction. Au grains counted visually.
- Methylene iodide (SG 3.2) separate made from table concentrate. <0.250 mm fraction analysed by aqua regia-ICPMS & INAA.
- < 0.177 mm & 0.063 mm fractions of routine stream sediments analysed for Au & trace elements by aqua regia-ICPMS & INAA.
Bulk sample collection for heavy minerals
Gold by fire assay – AAS Finish
Au (ppb) in HM concentrate
HM Sampling Results

- Au, As & Hg 1987 NGR anomalies near mine
- 144 ppm Au in HMC from stream east of mine
- ~ 95 ppm HMC Au in streams < 10 km to SW
- ~ 9 ppm HMC Au in creek draining Iskut-Palmiere prospect area (177 HMC Au grains)
- Only background Au & trace element levels detected in silt samples from creek.
- Sediment has 110 ppb in ~ 230 mesh fraction
Archive sample re-analysis using:

- **Neutron activation for Au & trace elements** (As, Ba, Br, Ca, Ce, Cs, Cr, Co, Eu, Hf, Fe, La, Lu, Rb, Sb, Sm, Sc, Na, Ta, Tb, Th, W, U, Yb, Zn)
- **Aqua regia-ICP/MS for pathfinders** (Al, Ag, As, Au, Ba, Bi, Cd, Ca, Cr, Co, Cu, Ga, Fe, La, Pb, Mn, Hg, Mo, Na, Ni, P, K, Sc, Se, Sr, S, Te, Tl, W, U, V, Zn)
Archived RGS Stream Sediment Samples Analysed by INAA & ICPMS
Conclusions

- NGR in BC traditionally uses conventional stream sediment geochemistry to identify areas of high mineral potential.
- HMC’s complement silt sampling to better define exploration targets.
- Eskay Creek mine outlined by HMC & stream sediment Au.
- Iskut-Palmiere has anomalous gold on in HMC’s & < 0.063 mm sediment fraction.
Acknowledgements

- **Sample Collection** – McElhanney Consulting Services, Vancouver, BC
- **HM preparation** – Overburden Drilling Management, Nepean, Ontario
- **Sample Analysis** – Acme Analytical, Vancouver & Becquerel Labs, Mississauga, Ontario
Beating the Bushes for new RGS Targets

http://www.em.gov.bc.ca/Mining/Geolsurv/MapPlace/