

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?

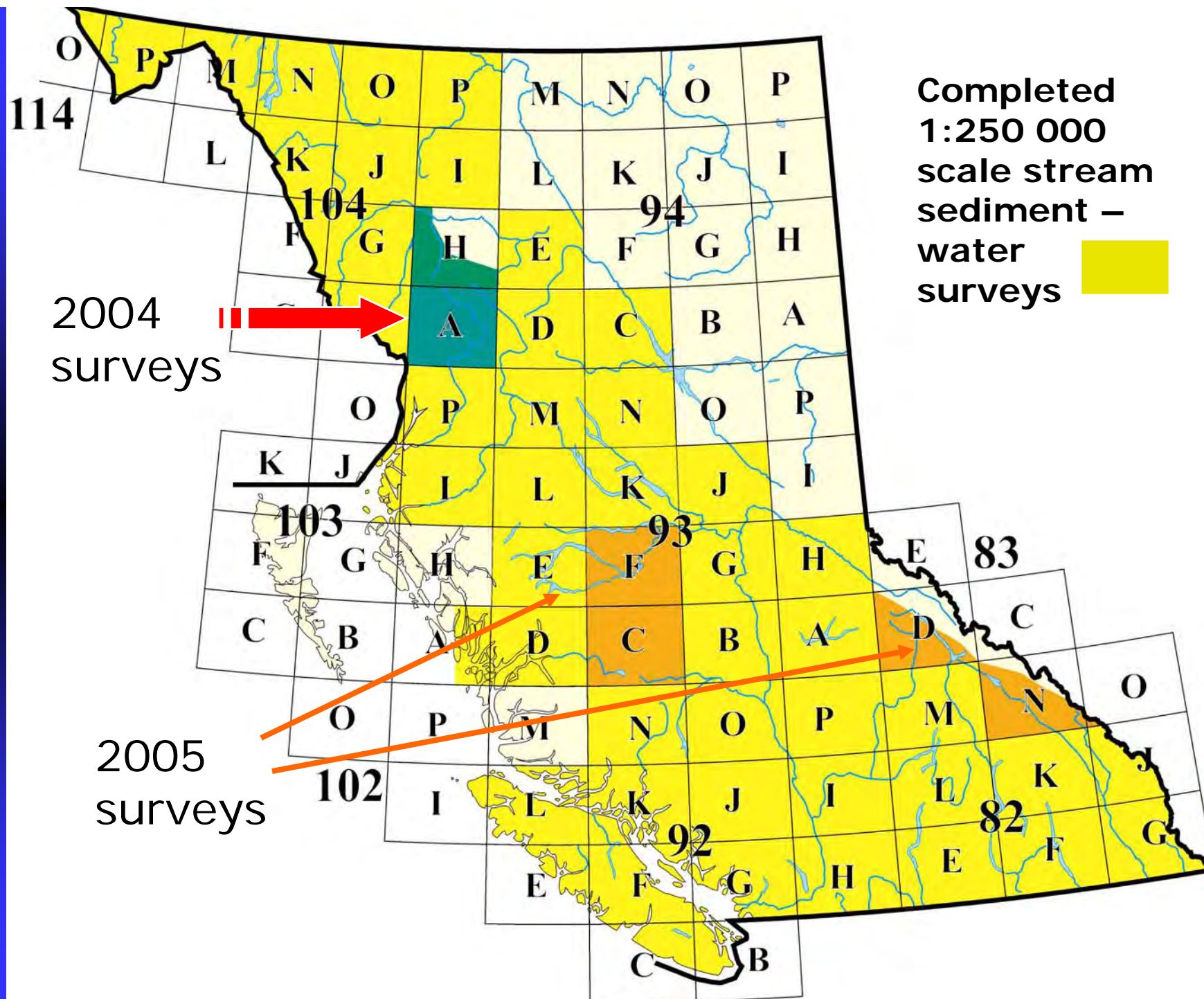
- Part of the National Geochemical Reconnaissance (NGR) program
- Reconnaissance-scale drainage sediment and water surveys since 1976

Objectives?

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

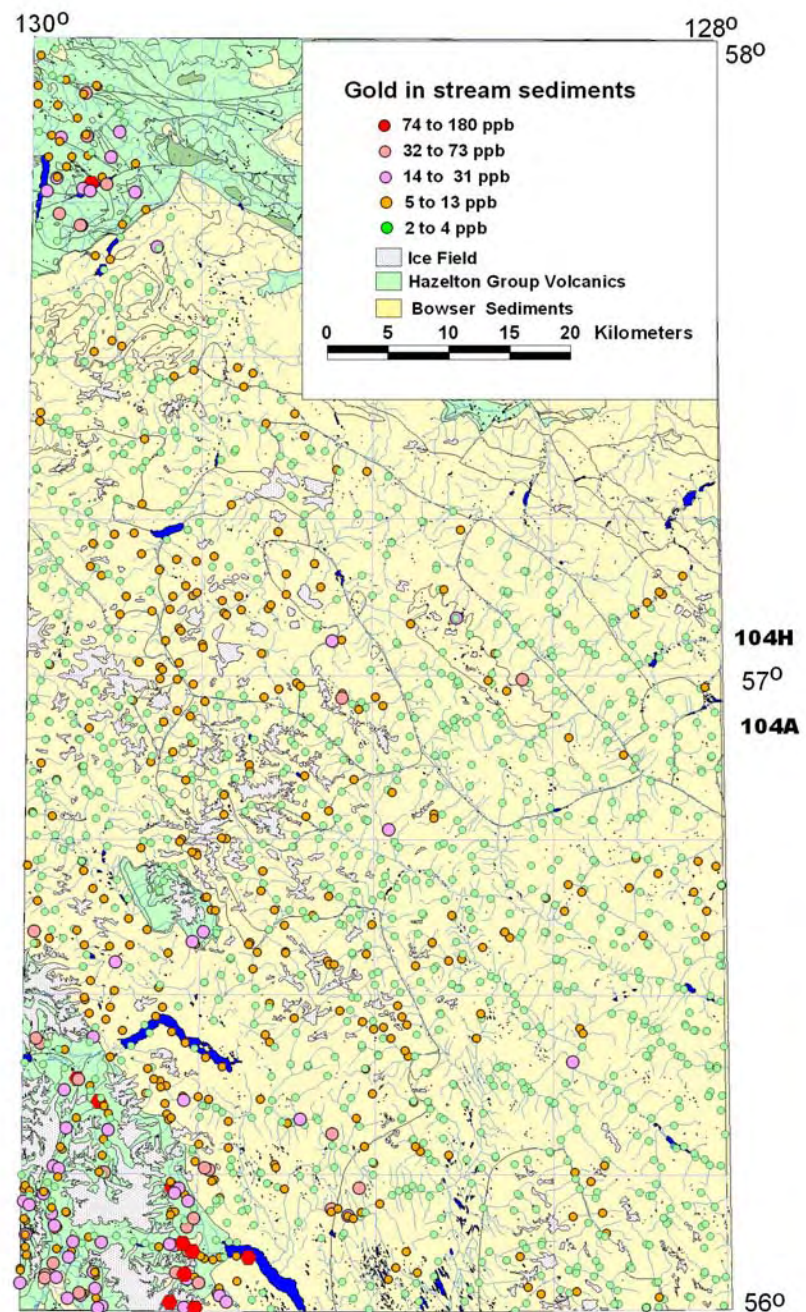
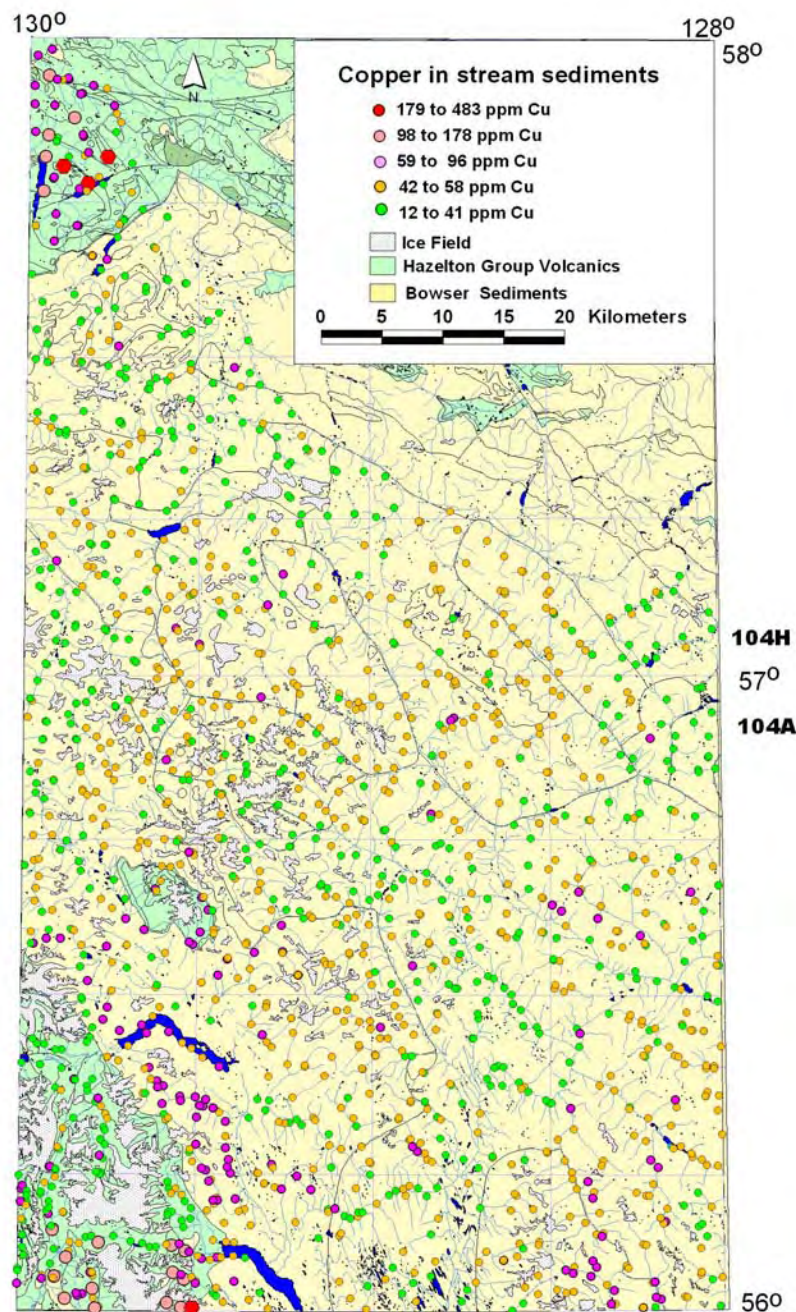
It's Extent?

- 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



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 2nd order streams that have a drainage basin area of 2.5 – 15 Km²
- 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

NTS SHEET		YEAR	SAMPLE NUMBER	COLLECTORS		SAMPLE TYPE	WIDTH	DEPTH	REP STAT	DAY	MO
CONTAMINATION <input type="checkbox"/> None <input type="checkbox"/> Possible <input type="checkbox"/> Probable <input type="checkbox"/> Definite <input type="checkbox"/> Mining <input type="checkbox"/> Industry <input type="checkbox"/> Agricult <input type="checkbox"/> Domestic <input type="checkbox"/> Forestry <input type="checkbox"/> Burn <input type="checkbox"/> Other		BANK TYPE <input type="checkbox"/> Alluv <input type="checkbox"/> Colluv <input type="checkbox"/> Till <input type="checkbox"/> Outwash <input type="checkbox"/> BareRock <input type="checkbox"/> TalScr <input type="checkbox"/> Organic <input type="checkbox"/> Other	WATER COLOUR <input type="checkbox"/> Clear <input type="checkbox"/> BnTrans <input type="checkbox"/> WhCldy <input type="checkbox"/> BnCldy <input type="checkbox"/> Other STREAM FLOW <input type="checkbox"/> Stagnt <input type="checkbox"/> Slow <input type="checkbox"/> Modert <input type="checkbox"/> Fast <input type="checkbox"/> Torrt	SAMPLE COLOUR <input type="checkbox"/> Rd-Bn <input type="checkbox"/> Wh-Bf <input type="checkbox"/> Black <input type="checkbox"/> Yellow <input type="checkbox"/> Green <input type="checkbox"/> Gy-Blu <input type="checkbox"/> Pink <input type="checkbox"/> Bf-Bn <input type="checkbox"/> Brown <input type="checkbox"/> DkBrown <input type="checkbox"/> Other SED COMP <input type="checkbox"/> S <input type="checkbox"/> F <input type="checkbox"/> O	BOTTOM PCPT <input type="checkbox"/> None <input type="checkbox"/> Rd-Bn <input type="checkbox"/> Wh-Bf <input type="checkbox"/> Black <input type="checkbox"/> Yellow <input type="checkbox"/> Green <input type="checkbox"/> Grey <input type="checkbox"/> Pink <input type="checkbox"/> Bf-Bn <input type="checkbox"/> Other <input type="text" value="PH"/> <input type="text" value="COND"/>	<input type="checkbox"/> SedOnly <input type="checkbox"/> SedWat <input type="checkbox"/> SedWatAcid BANK PCPT <input type="checkbox"/> None <input type="checkbox"/> Rd-Bn <input type="checkbox"/> Wh-Bf <input type="checkbox"/> Black <input type="checkbox"/> Yellow <input type="checkbox"/> Green <input type="checkbox"/> Blue <input type="checkbox"/> Pink <input type="checkbox"/> Other	STRM PHYSIOG <input type="checkbox"/> Plain <input type="checkbox"/> Swamp <input type="checkbox"/> Penpln <input type="checkbox"/> Hilly <input type="checkbox"/> Moun/M <input type="checkbox"/> Moun/Y STRM SOURCE <input type="checkbox"/> Unknown <input type="checkbox"/> Ground <input type="checkbox"/> Sp'gMelt		DRNGE PATRN <input type="checkbox"/> Poor <input type="checkbox"/> Dendrc <input type="checkbox"/> Herrbn <input type="checkbox"/> Rectin <input type="checkbox"/> Trellis <input type="checkbox"/> Discnt <input type="checkbox"/> Closed <input type="checkbox"/> RecRain <input type="checkbox"/> Glacier	STRM TYPE <input type="checkbox"/> Undfnd <input type="checkbox"/> Permnt <input type="checkbox"/> Intermit <input type="checkbox"/> Re-emerg STRM CLASS <input type="checkbox"/> Undefined <input type="checkbox"/> Primary <input type="checkbox"/> Secondary <input type="checkbox"/> Tertiary <input type="checkbox"/> Quaternary	
COMMENTS							POSITION				

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

Sample Analysis

After addition of Q/C the < 0.177 mm (-80 mesh) fraction is analysed for:

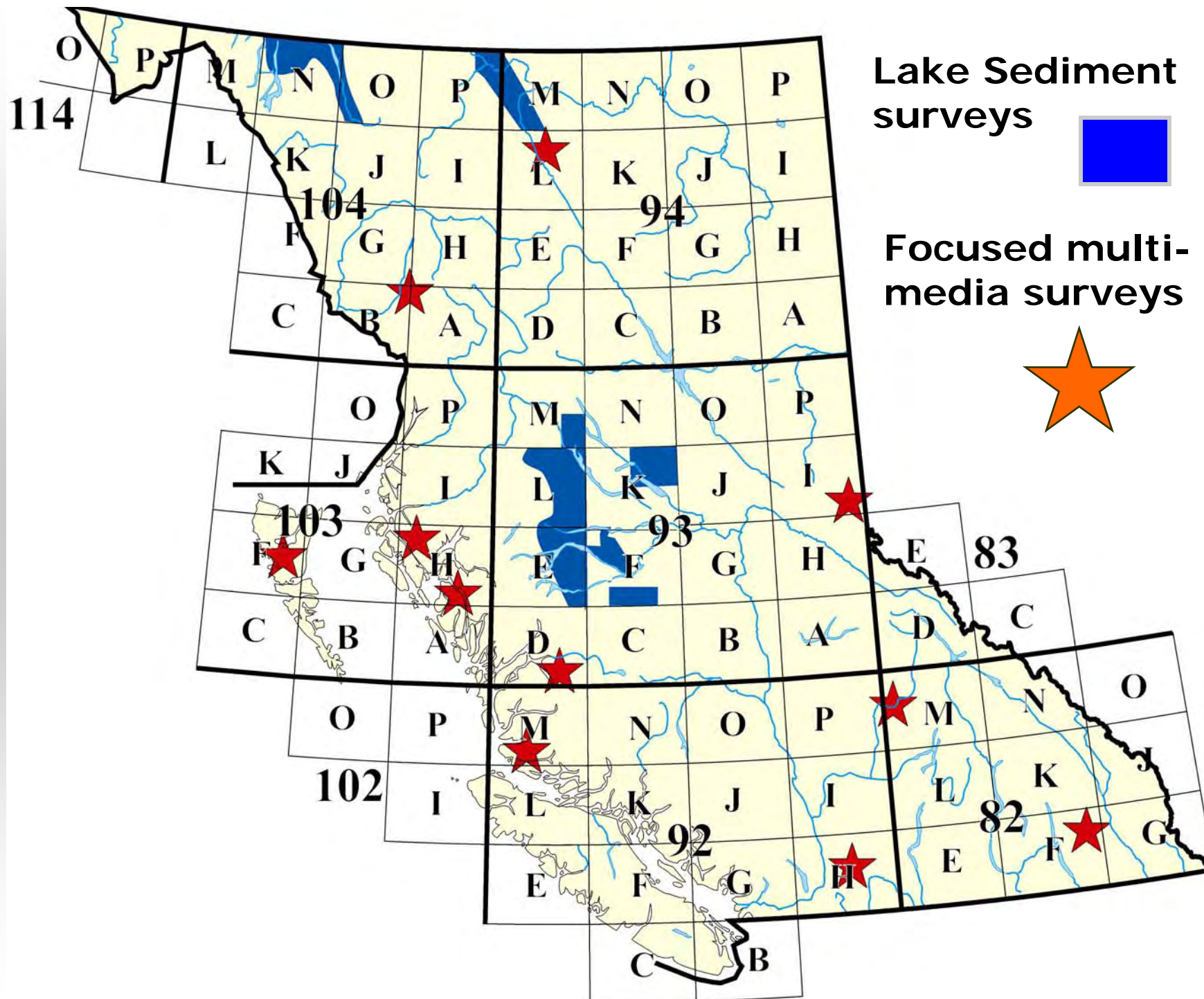
- 33 elements (including Au, U) by instrumental neutron activation (INAA)
- 32 elements (including Cu, Pb, Zn, S) by aqua regia digestion-inductively coupled mass spectrometry
- Loss on ignition, fluorine, tin

Water sampled are analysed for pH, F, U & trace elements



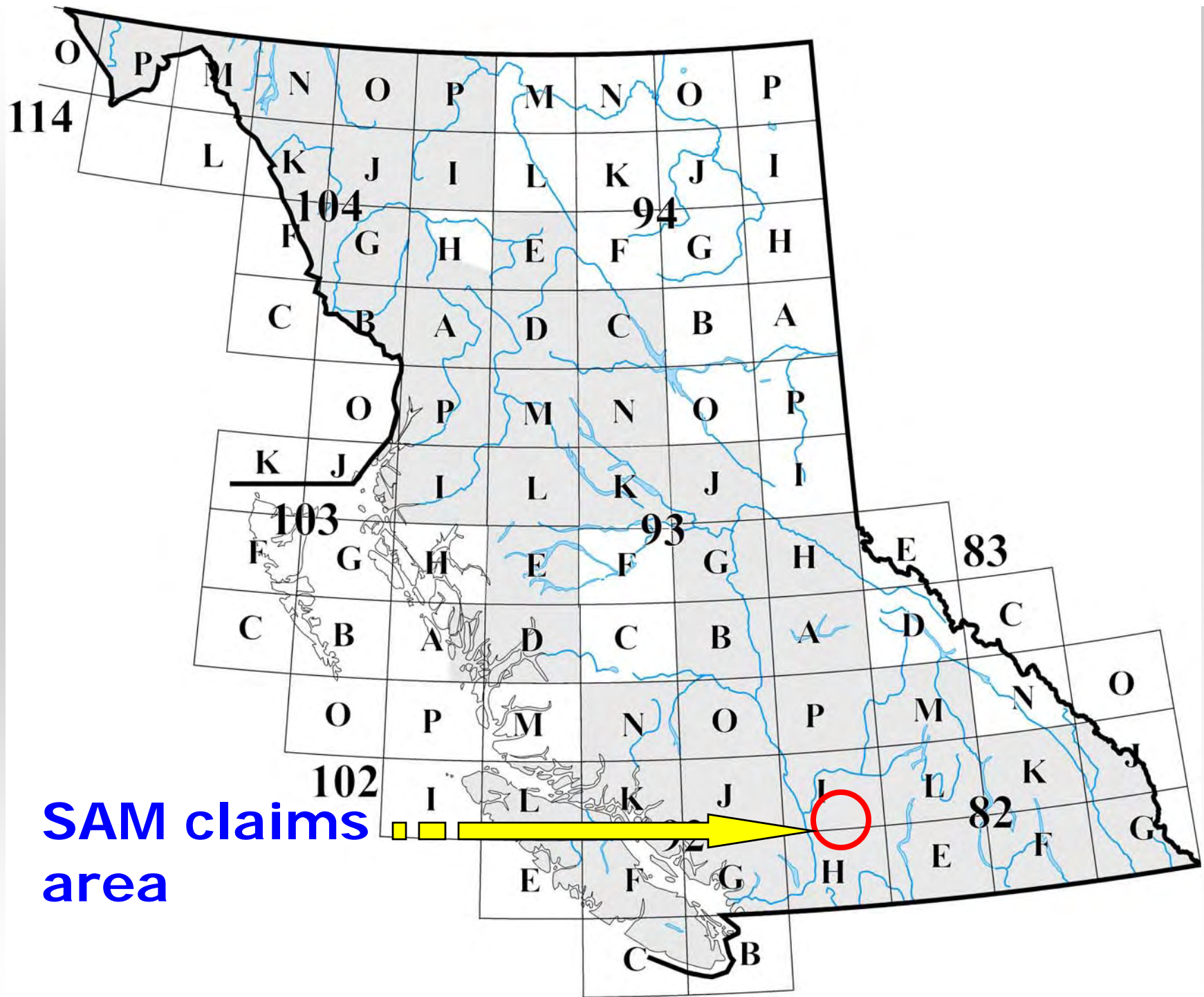
Lake
sediments:
 $1 / 15 \text{ km}^2$

Other RGS Methods –Lake Sampling

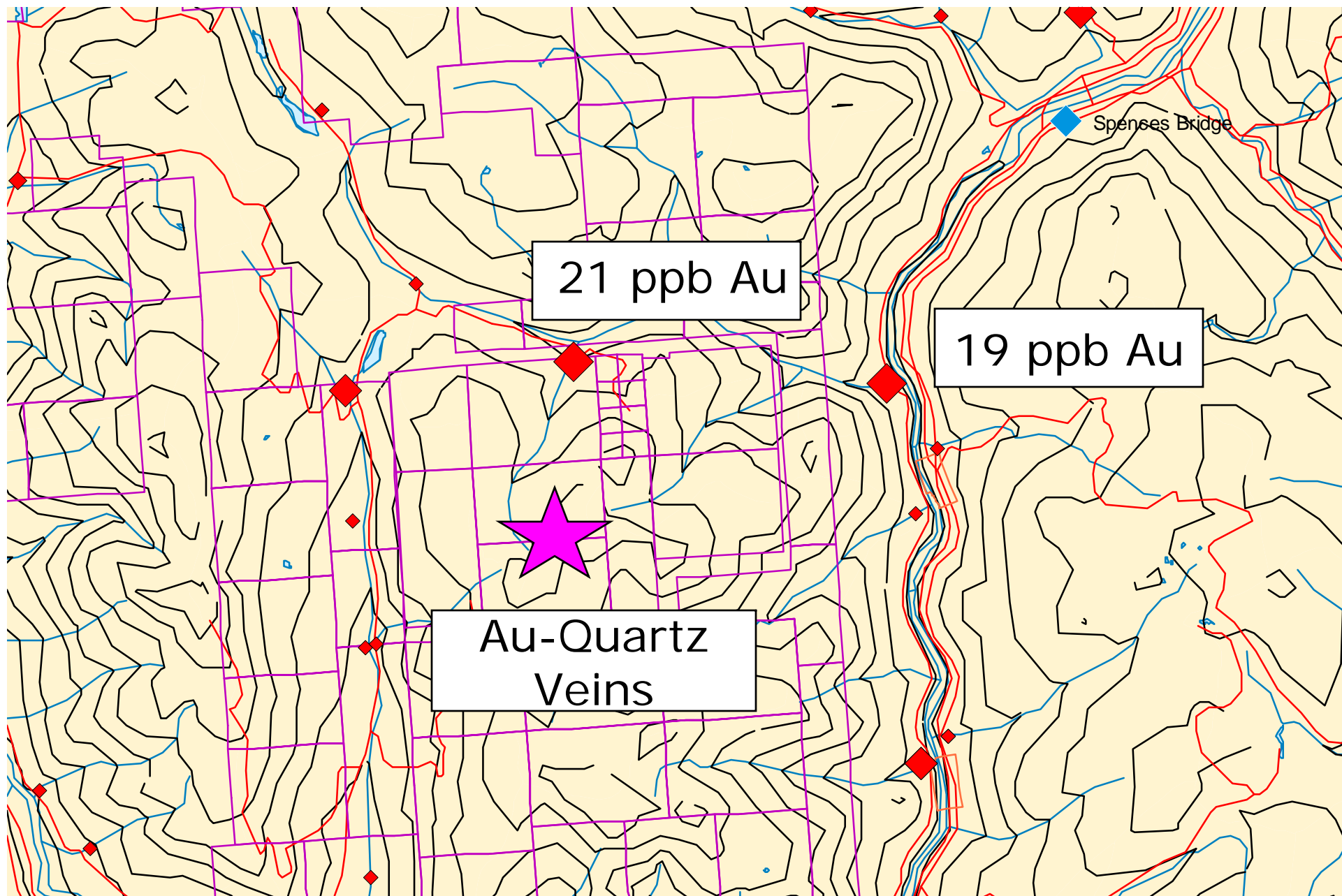


A Recent Success Story - Almanden Minerals Discovery

- 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







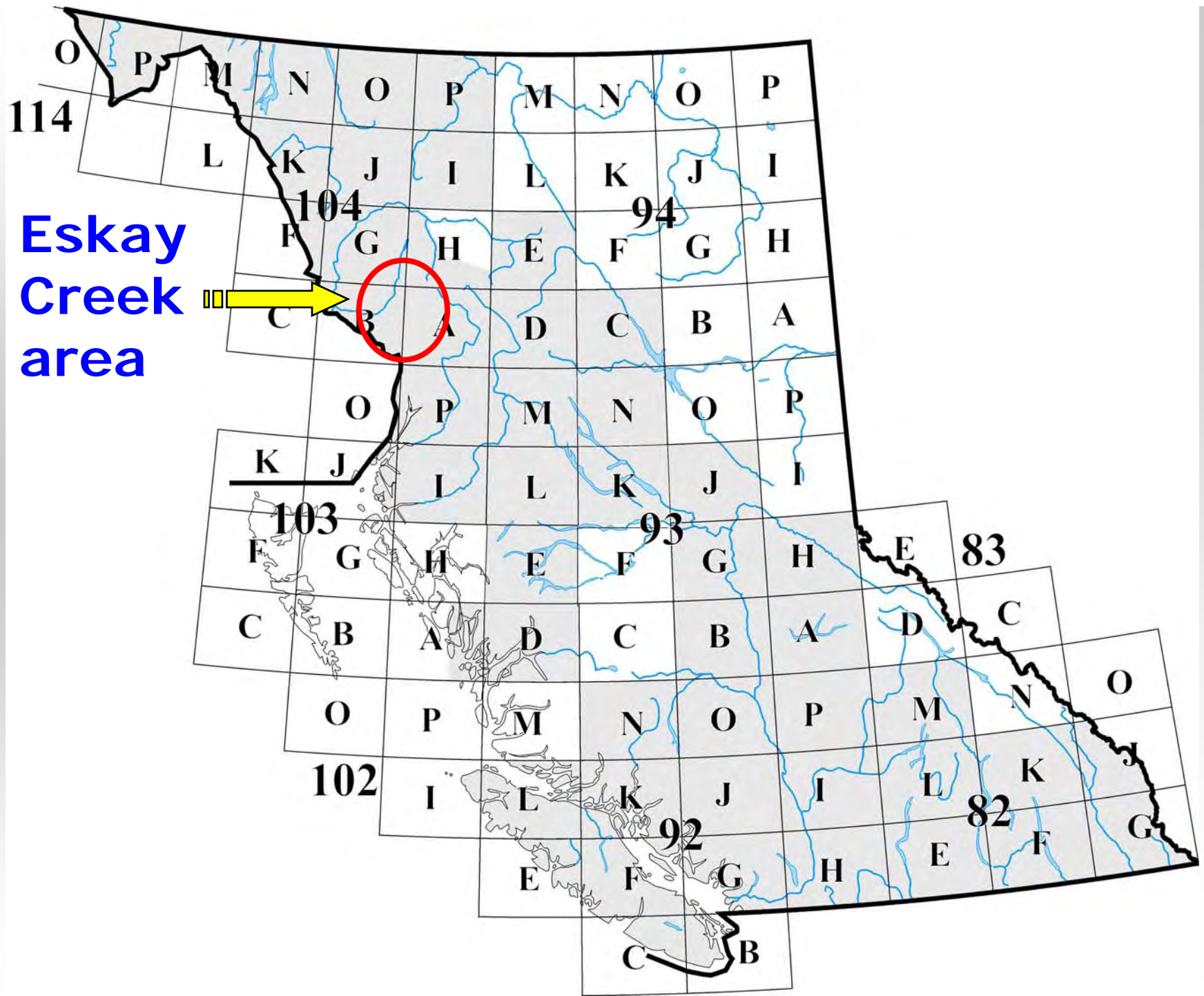
Almanden Minerals SAM Claims, 2004

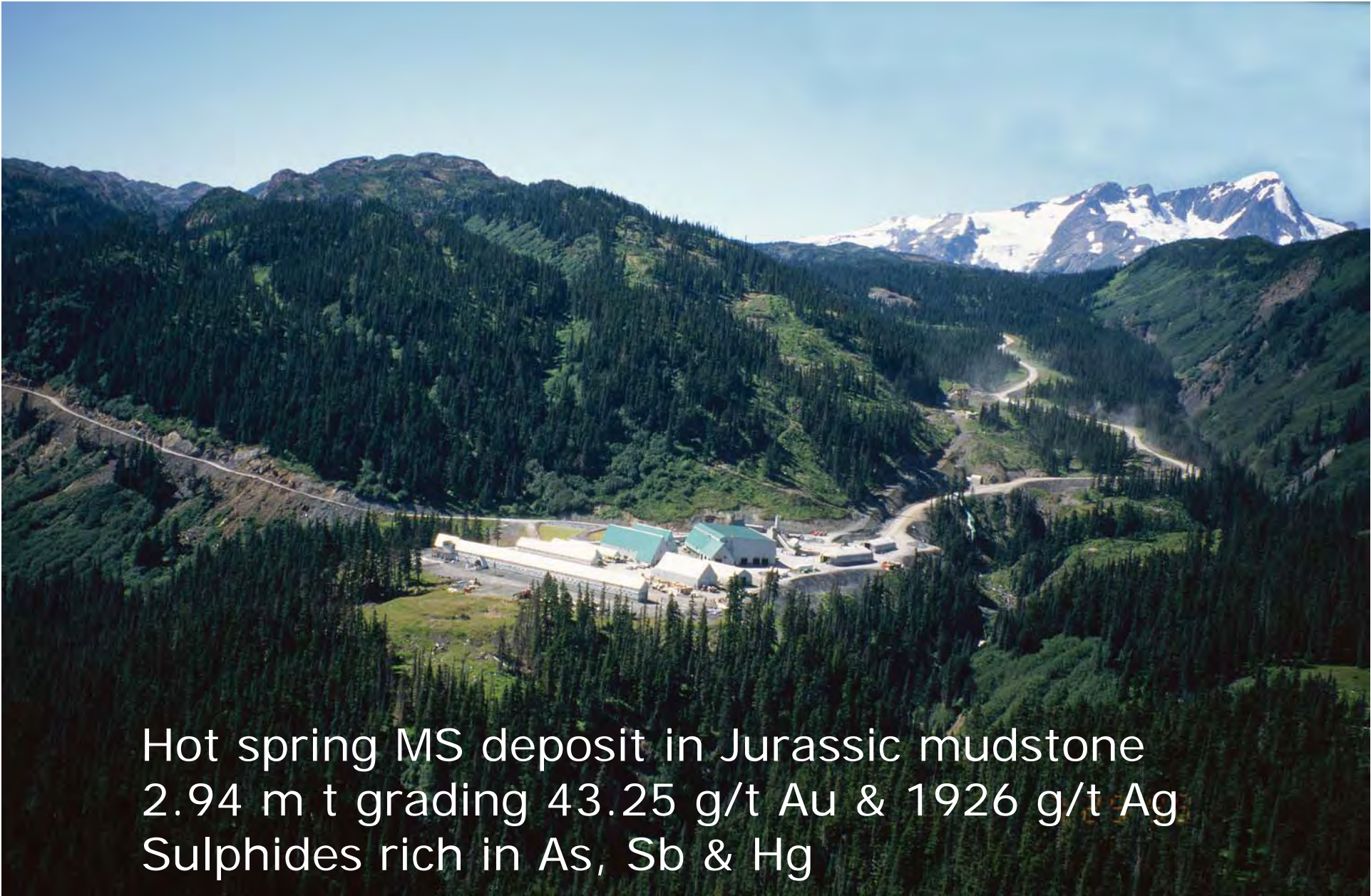
How can we better identify exploration targets?

- 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.





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

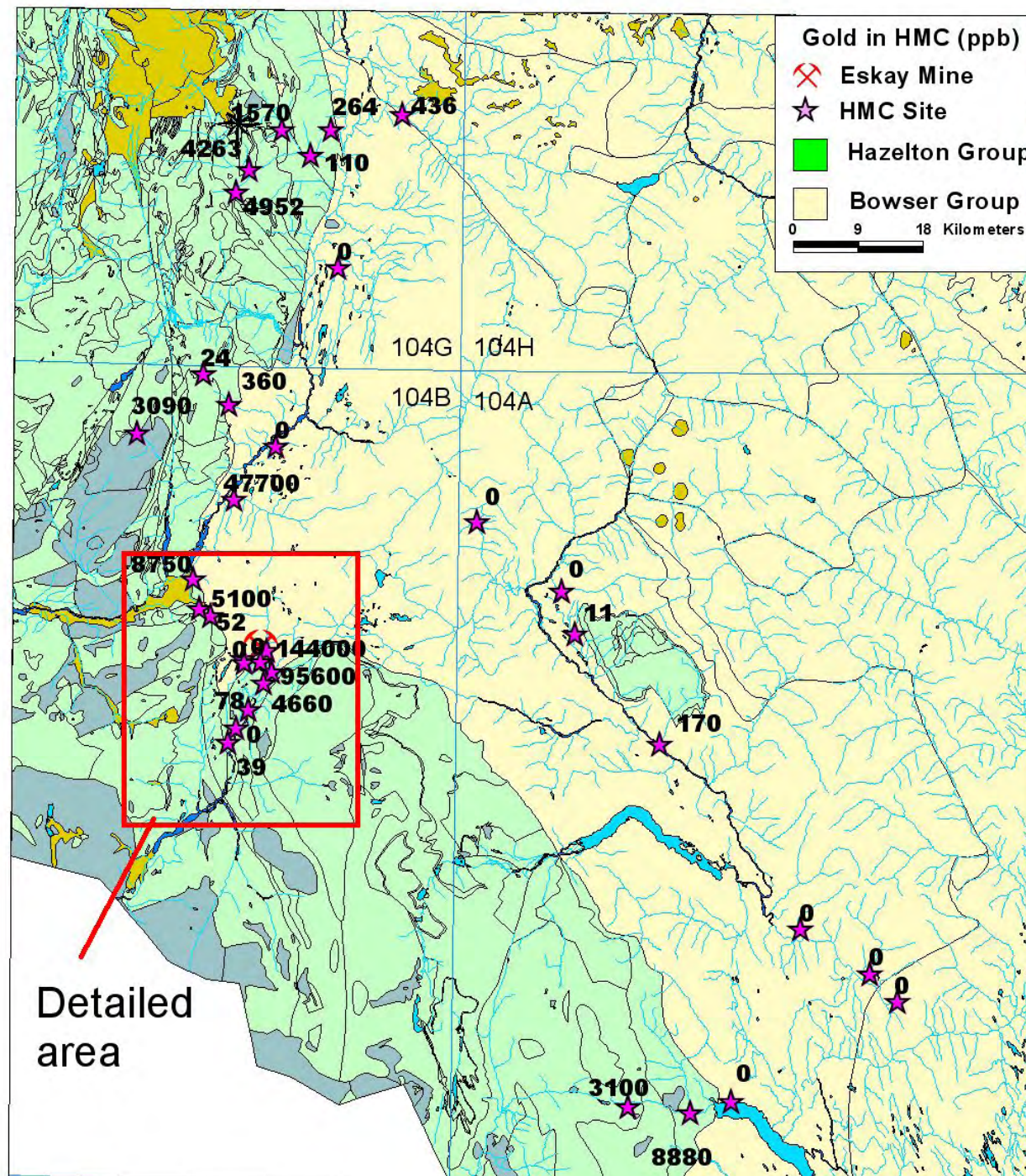
The Eskay Creek Gold-Silver Mine

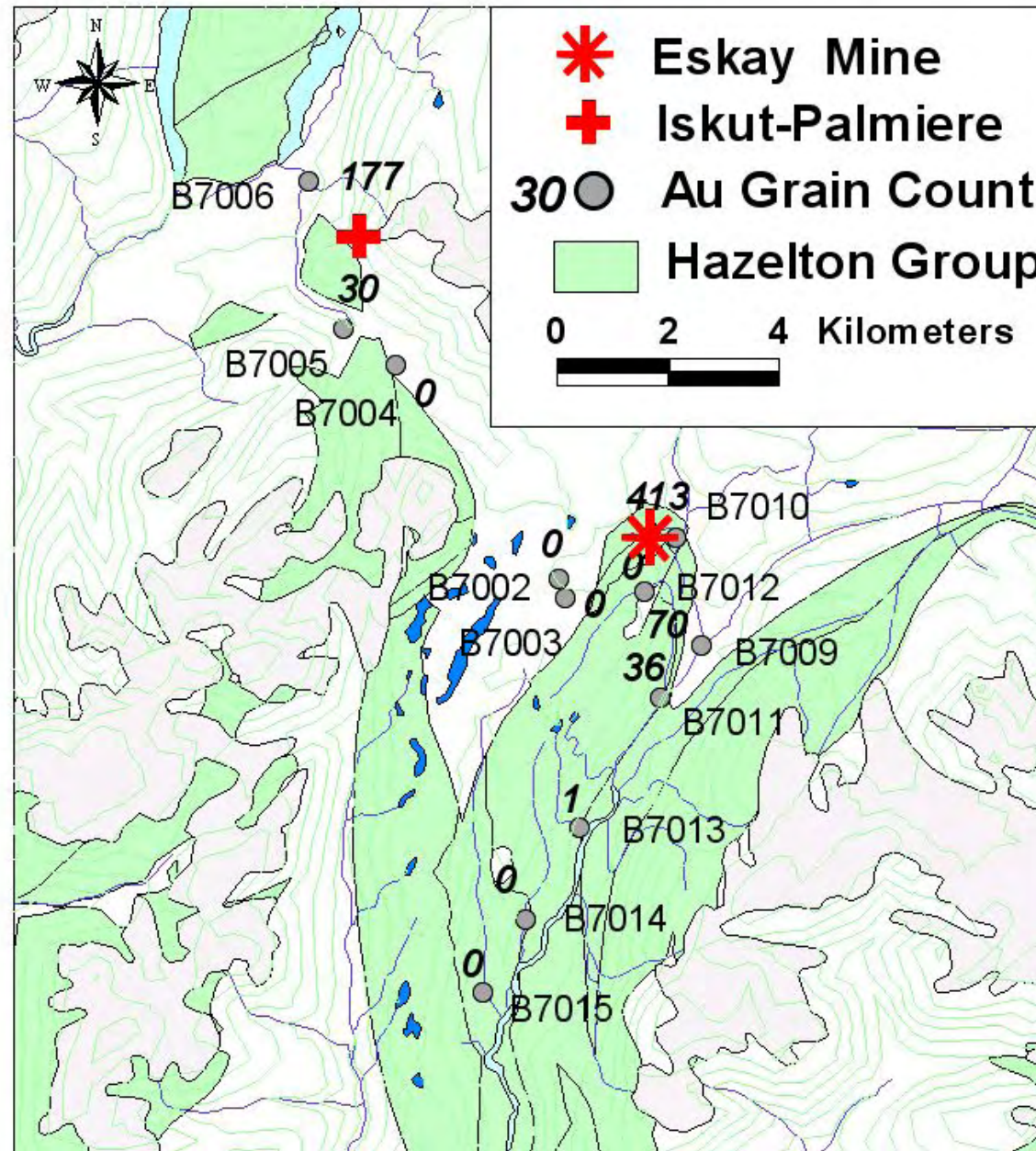
HM Sampling Process

- 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

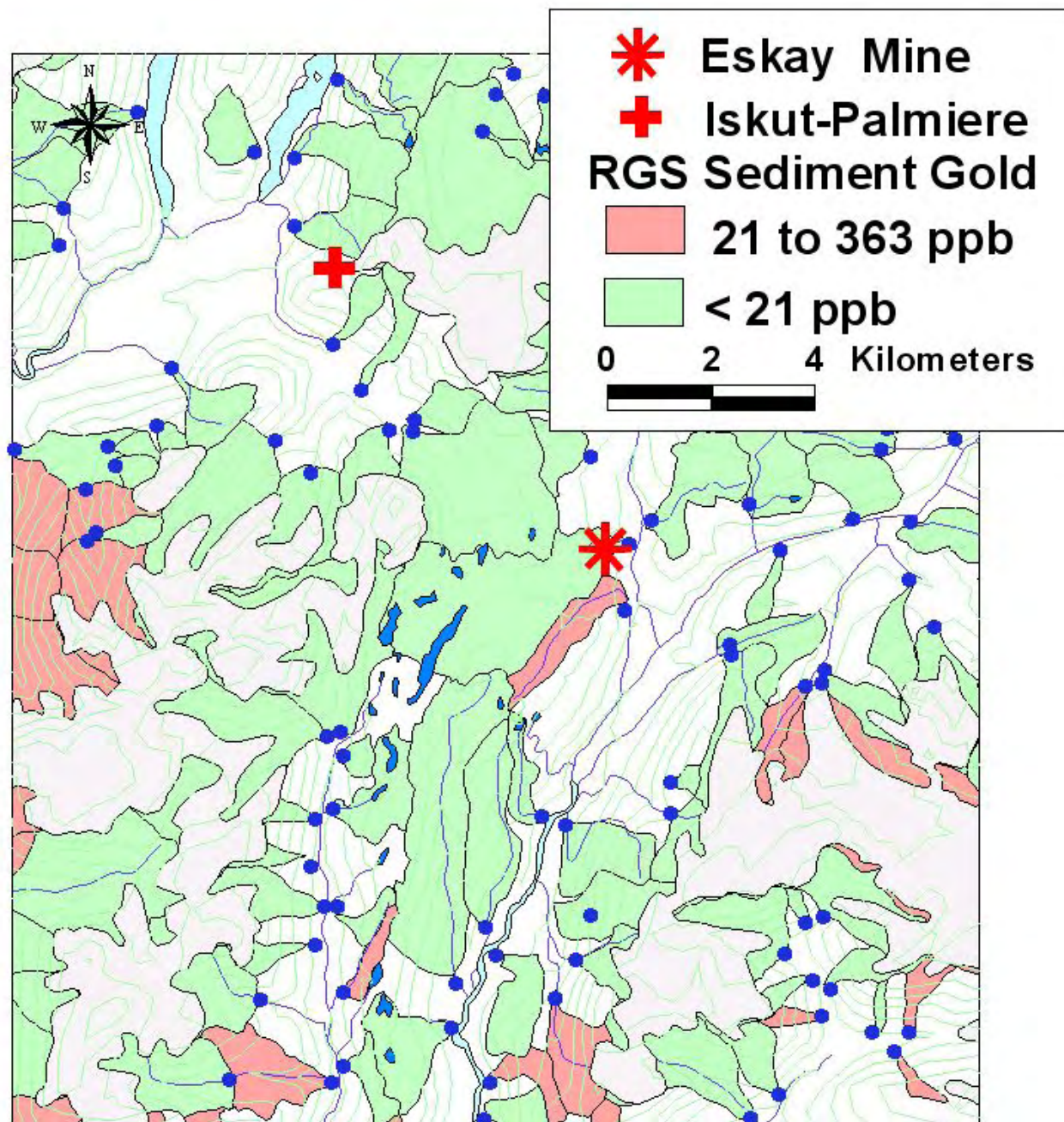
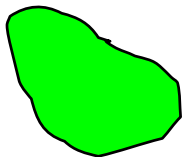




Gold Grain Counts

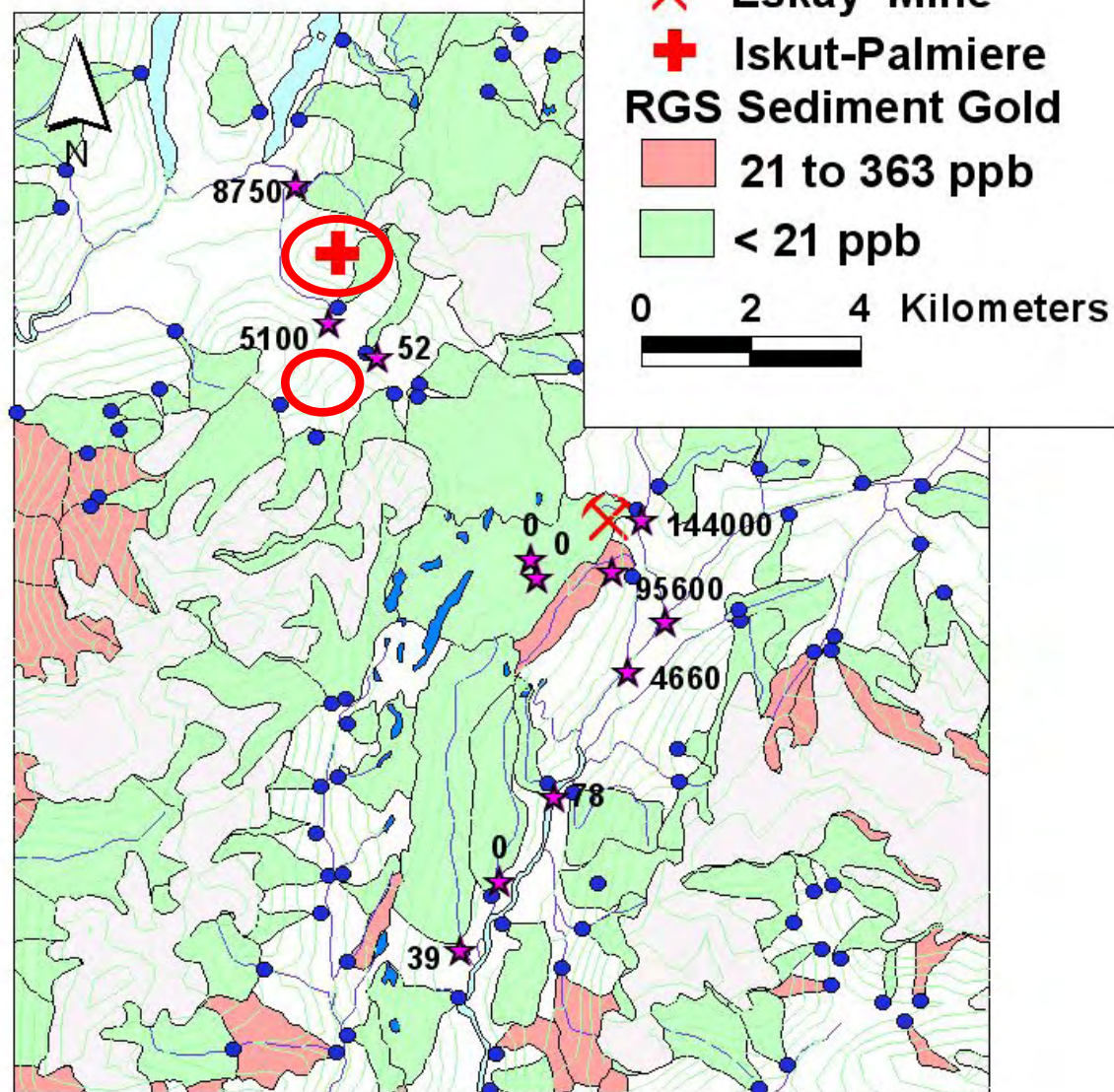
● RGS
Site

Drainage
basin



Gold by fire assay – AAS Finish

Au (ppb) in HM concentrate

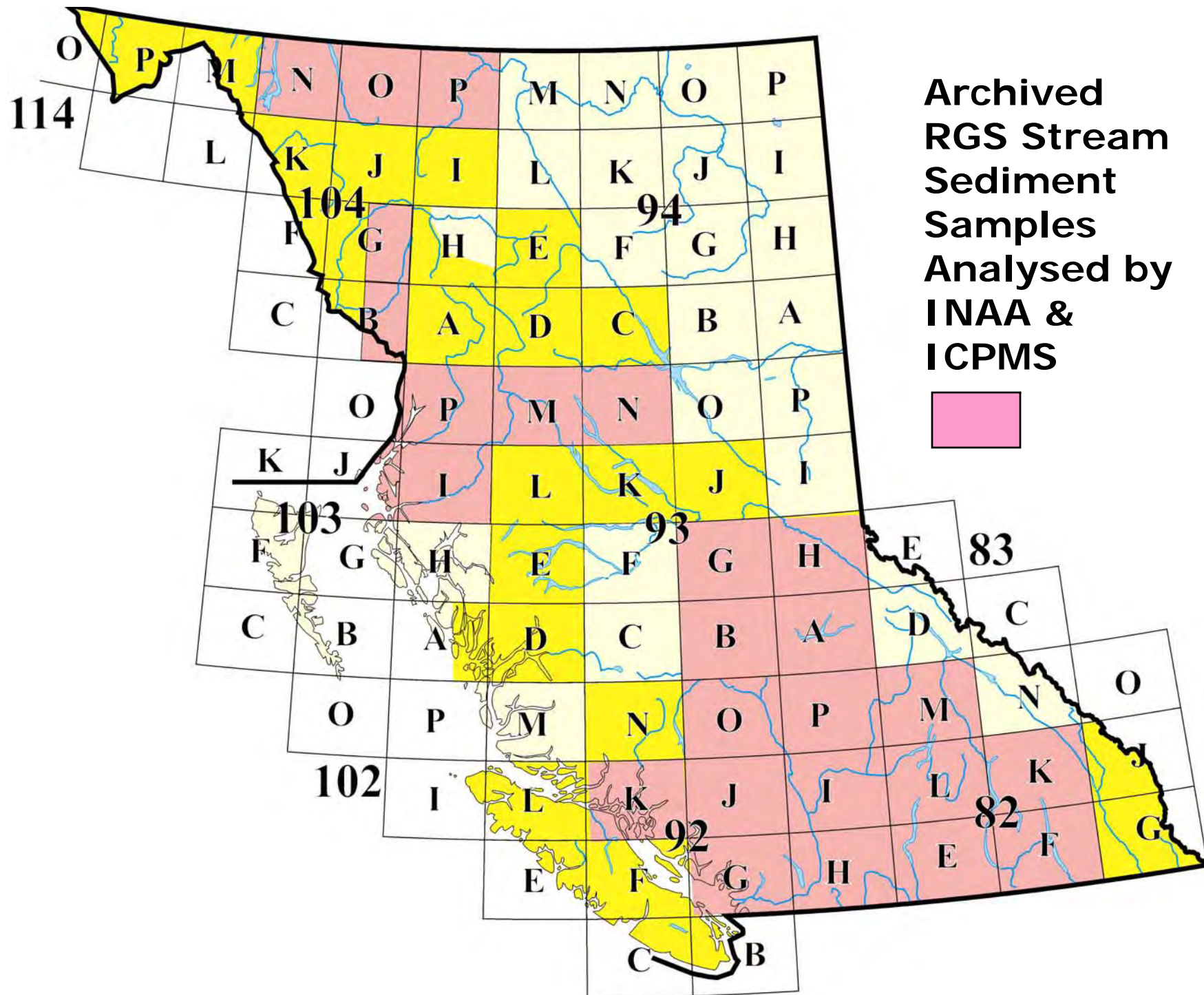


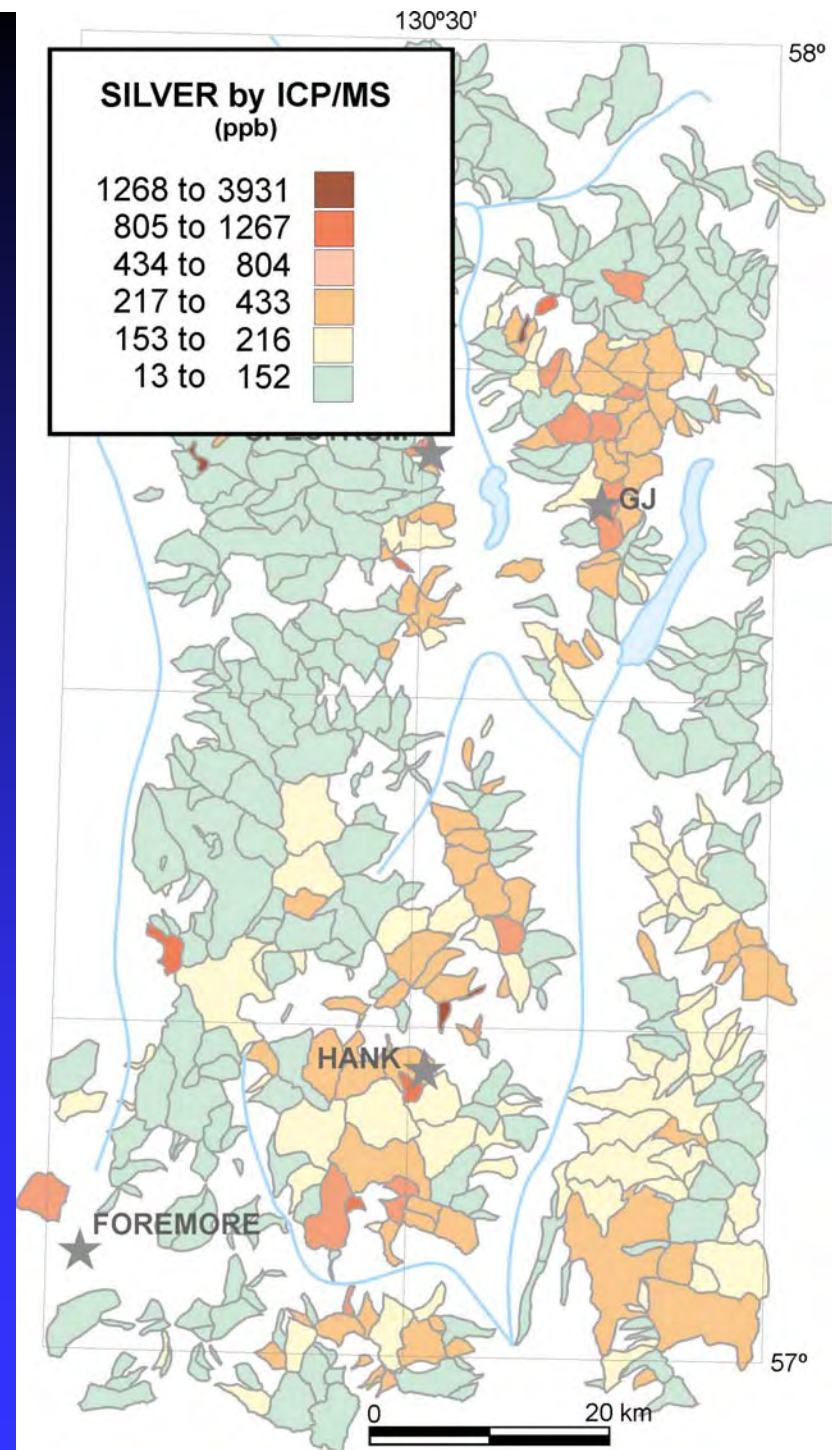
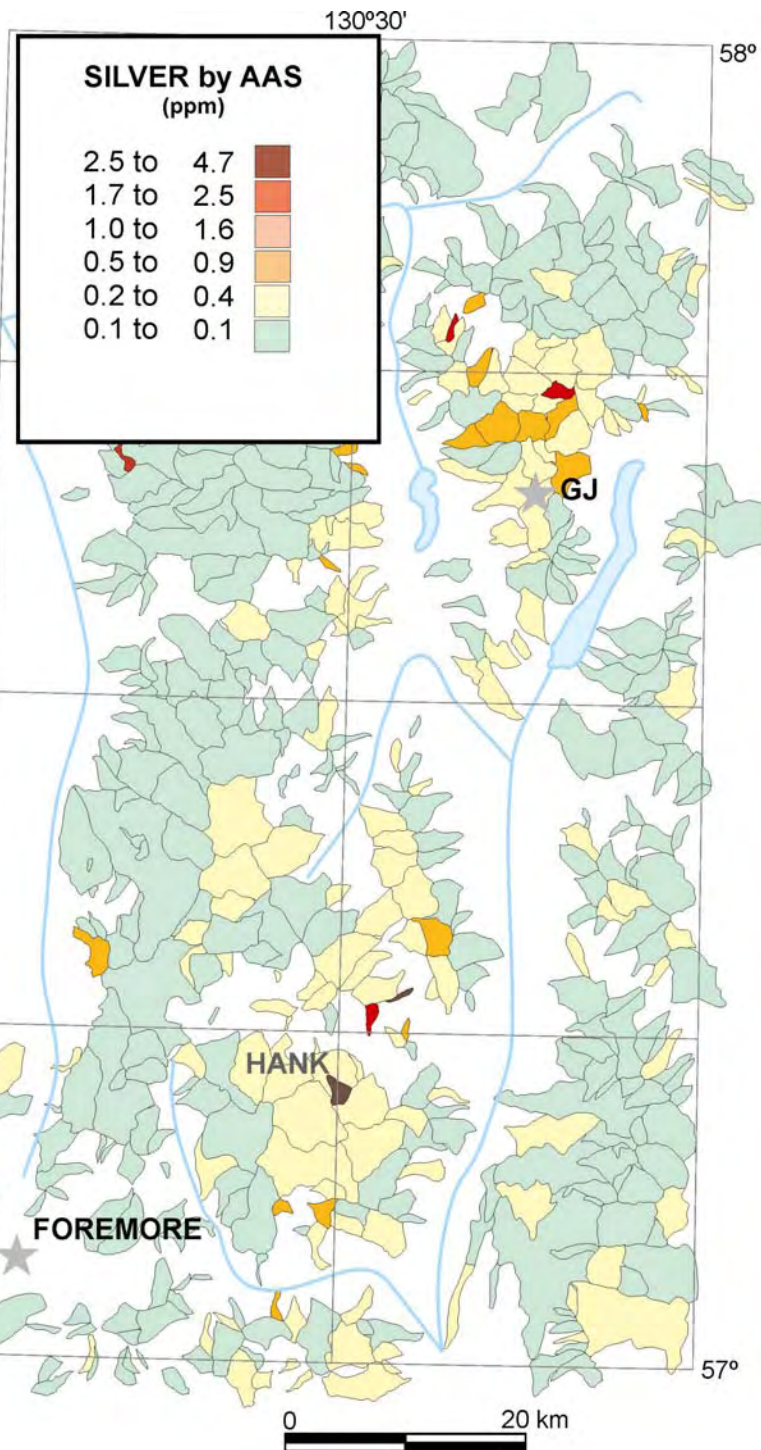
HM Sampling Results

- 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)





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

A man with a mustache, wearing a bright yellow raincoat and a yellow cap, stands in a lush, green forest. He is holding a branch with a red and white striped flag attached to it. The forest is dense with various types of trees and foliage, including large green leaves and ferns. The scene is well-lit, suggesting a sunny day.

Beating the Bushes for new RGS Targets

[http://www.em.gov.bc.ca/
Mining/Geolsurv/MapPlace/](http://www.em.gov.bc.ca/Mining/Geolsurv/MapPlace/)