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BC Ministry of Energy, Mines, and Petroleum Resources Mining and Minerals Division Ceasalance EC





# **OVERVIEW**

- What are till geochemistry surveys?
- Till geochemistry survey Tahtsa Lake District.
- Existing till geochemical data.
- Summary.





Geoscience BC Smithers Exploration Group (SEG) Northwest Community College (NWCC) Huckleberry Mine Limited Peter Ogryzlo



# **DRIFT PROSPECTING**

**DRIFT** – general term for sediments created and deposited by, or under the influence of, a glacier.

- glaciofluvial sands and gravels
- glaciolacustrine silts and clays
- till or morainal deposits

**TILL GEOCHEMICAL SURVEY** – use of basal till (first derivative of bedrock) to assess mineral potential by tracing detrital dispersal of bedrock mineralization to bedrock source.

- presence of mineralized clasts or float
- presence of heavy minerals
- relative abundance of major, minor, or trace elements



## **DRIFT PROSPECTING**

Much of Nechako Plateau mantled with drift.

 Majority of drift mantling Nechako Plateau is till, making till geochemistry surveys ideally suited for this physiographic region of the province.



## TILL GEOCHEMICAL SURVEY





# TILL GEOCHEMICAL SURVEYS

#### DISPERSAL TRAIN CHARACTERISTICS

- 1. Elongate parallel to transport direction (length to width ratio of 3:1 to 5:1).
- 2. Highest values occur at head of dispersal train and decrease in down-ice direction.
- 3. Can be up to several kilometres long and typically >1 km wide.
- 4. Bedrock source for elevated till geochemical values is always up ice (~500 m up to 1 km from head of dispersal train).
- 5. Complex glacial histories can produce irregularly shaped dispersal trains.

(Levson, 2001)



# TILL GEOCHEMICAL SURVEY

Dispersal trains can be easy to detect - can be hundreds of times larger in area than their bedrock source.

Basal till samples can be traced to bedrock source - considered a first derivative of bedrock (very closely related to bedrock) and have a relatively simple transport history.

Detrital transport of mineralization - element concentrations in basal till unaffected by pedogenic processes.

Media-specific, basal till must be present in study area property-scale surveys may be restricted by lack, or burial, of basal till.





**1.Collection of basal till samples.** 

2. Determination of study area's ice-flow history.

3.Data interpretation and presentation.



# SAMPLE COLLECTION

#### BASAL TILL

- diamicton (composed of clay, silt, sand, and gravel-sized material).
- overconsolidated.
- massive, matrix supported.
- silt and clay-rich matrix.
- striated clasts.
- strong unimodal clast fabric.
- lower contact usually sharp (erosional).

#### LOCAL TRANSPORT DOWN-ICE





# SAMPLE COLLECTION





# **RECONSTRUCTING ICE-FLOW HISTORY**





# **RECONSTRUCTING ICE-FLOW HISTORY**





# **RECONSTRUCTING ICE-FLOW HISTORY**

FLUTINGS AND DRUMLINS



# CASE STUDY – BELL MINE





## CASE STUDY - HUCKLEBERRY MINE





## TILL GEOCHEMISTRY OF TAHTSA LAKE DISTRICT (2009/2010 – 2010/2011)





## TILL GEOCHEMISTRY OF TAHTSA LAKE DISTRICT (2009/2010 – 2010/2011) Why here?

• Has high potential to host porphyry, polymetallic vein, and perhaps VMS-style mineralization.

 Is an area where mineral exploration is hindered by an extensive till cover and relatively little bedrock out crop.

• Is adjacent to Huckleberry Mine where till geochemical data show a clear association with Cu-Mo mineralization.





## SUMMER 2009 – 93E/15

#### **Progress Report**

 Samples have been collected for major, minor, and trace element analyses and heavy mineral concentrates and Au grain counts.

 Sample targets included mapped intrusives and conductive EM signatures.

 Samples were also collected up and down-ice of known metallic mineral occurrences.

• Future write-ups and data releases.



## Available Data

*Open File* 2008-12

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#### BRITISH COLUMBIA GEOLOGICAL SURVEY

Till Geochemical Surveys main page www.em.gov.bc.ca/Mining/Geolsurv/Geochinv/till/tillgeo.htm

Publications main page www.em.gov.bc.ca/Mining/Geolsurv/Publications/default.htm

#### GEOLOGICAL SURVEY OF CANADA MIRAGE gdr.nrcan.gc.ca/mirage/index\_e.php

GEOSCAN ess.nrcan.gc.ca/esic/geoscan\_e.php





## **METHOD REVIEW**

#### Canadian Cordillera

#### Regional till geochemical surveys in the Canadian Cordillera: sample media, methods and anomaly evaluation

#### VICTOR M. LEVSON

British Columbia Geological Survey, 1810 Blanshard Street, Victoria, British Columbia V8V 1X4, Canada (e-mail: Vic.Levson@gems9.gov.bc.ca)

Abstract: Basal tills have become a widely used regional geochemical sampling medium in recent years in the Canadian Cordillera. They reflect the primary composition of the source bedrock and contrast with B-horizon soil that can be developed on a variety of glacial and non-glacial surficial sediment types. Detailed sedimentological data are critical to collect and they are used to differentiate basal tills from other visually similar sediments including englacial and supraglacial tills, colluvial debris flow deposits, and very poorly sorted, glaciofluvial or glaciolacustrine sediments (e.g. diamictons or gravelly muds). The variable transport and depositional processes that form these different sediments make interpretation of geochemical data difficult. Deep (usually >0.75 m) C-horizon sampling of basal till minimizes the complicating effects of pedogenesis, weathering, surface washing and gravity remobilization of the tills. The latter processes, particularly pronounced in the wet, steep terrain, typical of much of the Canadian Cordillera, lead to depleted concentrations of heavy minerals (notably Au) and hydromorphic dispersion of mobile elements in the near surface sediments. Also, elements that are preferentially concentrated in the fine fraction can be selectively removed by surface waters

Offset sampling lines, oriented perpendicular to the dominant ice-flow direction, are most effective for detecting regional geochemical anomalies which are typically narrow and elongated parallel to ice-flow. Erratios trains and till anomalies are usually a few to several kilometres long and up to one or more kilometres wide. For some metals such as Au, anomalies are generally larger and more readily detected in till than in B-horizon soil. Surface till anomalies reflect up-ice sources and not the immediately underlying bedrock; down-ice displacements of >500 m often occur in areas of thick till. Basal till anomalies usually can be traced to source along linear transport paths reflecting topographically controlled valley-glacier flow in mountainous areas and unidirectional ice-sheet flow in many plateau areas, chiefly representative of the last glacial event. Interpretations of till geochemical data are enhanced with a clear understanding of the surficial and bedrock geology, Quaternary stratigraphy, ice-flow history and down-ice dispersal characteristics around known mineral deposits.

One of the primary objectives of till geochemistry is to identify areas where glaciers eroded mineralized bedrock, transported and dispersed the debris in the direction of glacial flow, and redeposited the mineral-rich sediment over the title 'Evaluation of till geochemical anomarelatively large areas. The resultant deposits, lies'. Since these dispersal trains may be huncontaining elevated levels of elements that were dreds of times larger in area than their original concentrated in the source bedrock, are com- bedrock source, they provide a cost effective monly referred to as till geochemical anomalies target for mineral exploration programs in driftor glacial dispersal trains. Although a specific covered terrains (c.f. Shilts 1976; DiLabio 1990; definition is preferred, 'geochemical anomaly' is Levson & Giles 1995). In addition, tills are 'firstchemical concentrations are elevated above and, having been transported to their present

background values. In this paper, specific definitions are used where possible, but otherwise this general meaning applies. Further discussion on this subject is provided later under commonly used to refer to areas where geo- derivative' products of bedrock (Shilts 1993)

From: MCCLENAGHAN, M. B., BOBROWSKY, P. T., HALL, G. E. M. & COOK, S. J. (eds) 2001. Drift Exploration in Glaclated Terrain. Geological Society, London, Special Publications, 185, 45-68. 0305-8719/01/S15.00 © The Geological Society of London 2001.





# SUMMARY

- Relatively simple transport history, and predictable and relatively short transport distance, are what makes till surveys an effective exploration tool.
- Ideally suited to areas with drift cover and limited bedrock outcrop.
- Till geochemistry investigates the detrital dispersal of bedrock and mineralization; effects of hydromorphic dispersion are minimal.
- Bedrock source is always in the up-ice direction.





# SUMMARY

- Just one of many tools available to mineral exploration industry working in covered areas.
- Combining till geochemistry with known bedrock geology and newly acquired geophysical data is a powerful mineral exploration tool.
- New and existing data available for QUEST-West Project Area.



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#### BRITISH COLUMBIA GEOLOGICAL SURVEY OPEN HOUSE

Friday, 13 November, 2009 8:30 am - 4:30 pm, social to follow St. Anne's Academy Auditorium Victoria, BC

www.empr.gov.bc.ca/Mining/Geoscience/Pages/registration.aspx



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### BRITISH COLUMBIA GEOLOGICAL SURVEY OPEN HOUSE

The British Columbia Geological Survey (BCGS) invites you to attend a full day of oral presentations on the geology and mineral deposits of British Columbia. The Open House is co-sponsored by the Pacific Section of the Geological Association of Canada (PAC-GAC). Presentations will be given by geologists from the BCGS, Resource Development and Geoscience Branch and School of Earth and Ocean Sciences at UVic.

**MORNING SESSION** Exploration Concepts for Mineral Deposits in BC

#### **AFTERNOON SESSION**

Recent Developments in BC Geology and Cordilleran Tectonics

Social to follow, sponsored by PAC-GAC.

