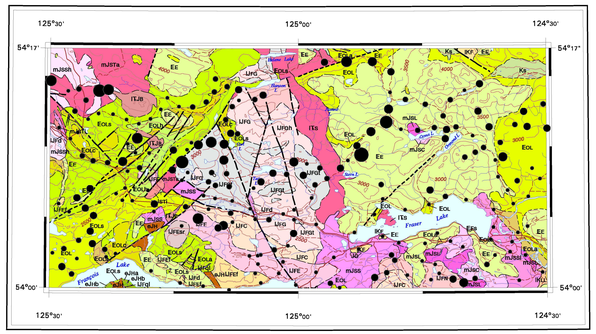
Natural Resources Canada | Ressources naturelles Canada

GEOLOGICAL SURVEY OF CANADA | COMMISSION GÉOLOGIQUE DU CANADA

NATMAP
CARTNAT
Canada's National Geoscience Mapping Program
La Programme national de cartographie géoscientifique du Canada

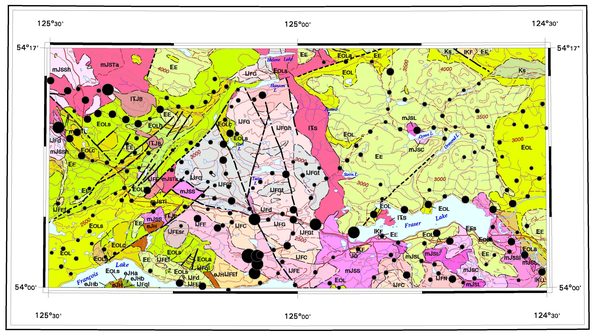


MANGANESE

ICP-ES

ppm	Mn	Percentile
14914		Maximum
11726		98
9857		95
8681		90
6543		75
4200		50
812		Minimum

217 Samples
Scalar Exponent = 1.0

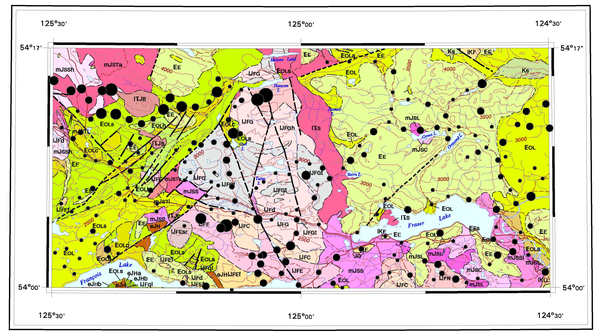


CESIUM

INAA

ppm	Cs	Percentile
3.7		Maximum
2.8		98
2.2		95
1.8		90
1.4		75
0.9		50
<0.5		Minimum

217 Samples
Scalar Exponent = 1.5

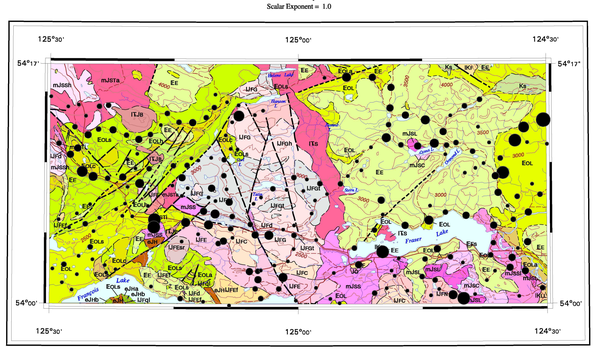


RUBIDIUM

INAA

ppm	Rb	Percentile
170		Maximum
116		98
92		95
70		90
54		75
40		50
2.5		Minimum

217 Samples
Scalar Exponent = 1.0

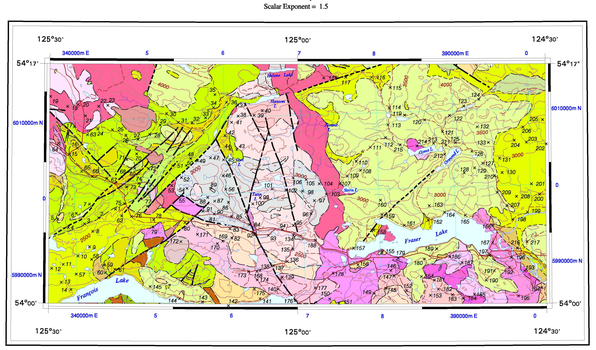


BARIUM

INAA

ppm	Ba	Percentile
1400		Maximum
1200		98
1010		95
970		90
810		75
640		50
240		Minimum

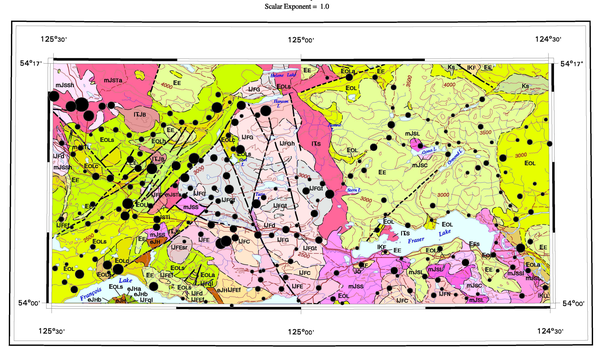
217 Samples
Scalar Exponent = 1.0



SAMPLE LOCATION MAP

× 35 Sample Numbers

(All data for each sample are listed on diskette available separately as Open File D3696d)

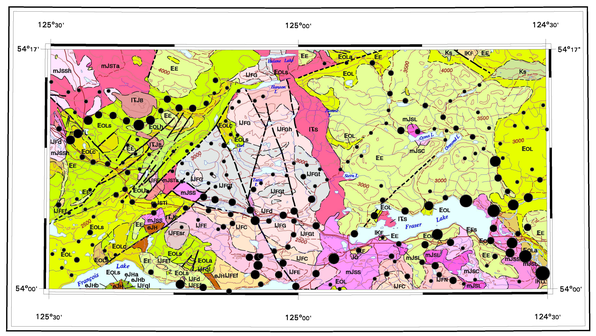


POTASSIUM

INAA

percent	K	Percentile
11		Maximum
9.1		98
7.6		95
6.7		90
5.4		75
4.0		50
1.12		Minimum

217 Samples
Scalar Exponent = 1.0

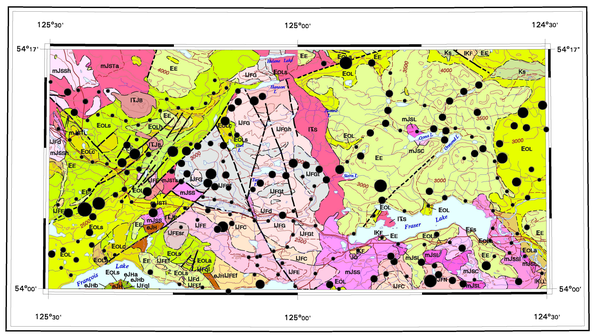


SODIUM

INAA

ppm	Na	Percentile
29200		Maximum
24956		98
23610		95
20560		90
15800		75
6610		50
733		Minimum

217 Samples
Scalar Exponent = 1.0

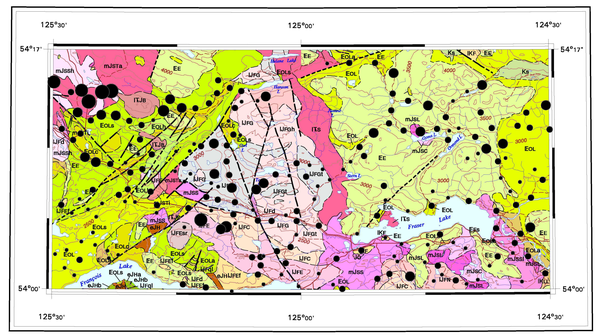


STRONTIUM

INAA

ppm	Sr	Percentile
2900		Maximum
2000		98
1800		95
1600		90
1300		75
1200		50
< 150		Minimum

217 Samples
Scalar Exponent = 1.0



ALUMINIUM

ICP-ES

percent	Al	Percentile
5.7		Maximum
4.9		98
3.3		95
2.8		90
2.2		75
1.6		50
0.4		Minimum

217 Samples
Scalar Exponent = 0.8

LOCATION MAP

Canada

Biogeochemical data by C. Dunn (1996), Mineral Resources Division

Geological compilation based on: 93K/3 L.C. Struik (1998), 93K/3 I.C. Struik & J. Whalen (1998)

Digital cartography by N.L. Hastings, Pacific Division

Electrostatic plot produced by the Geoscience Information Division

Any revisions or additional geological information known to the user would be welcomed by the Geological Survey of Canada

Digital contour data compiled by Geomatics Canada, published 1:250 000, modified by the Geological Survey of Canada

Digital rivers, streams, lakes and roads data is available through MAYNE-BC, Survey and Resource Mapping Branch, Ministry of Crown Lands, Parliament Buildings, Victoria, B.C., V8V 1X4

Magnetic Declination 1999, 22°45'E decreasing 8.7 annually. Readings vary from 22°00'E in the NW corner to 23°30'E in the SE corner of the map.

Elevation in feet above mean sea level

OPEN FILE 3696c

Biogeochemical Survey of the Fraser Lake Area Using Outer Bark of Lodgepole Pine (NTS 93K02/03)

ALKALI METALS, ALKALINE EARTHS, MANGANESE AND ALUMINUM

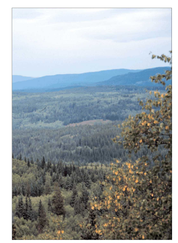
CENTRAL BRITISH COLUMBIA

Scale 1:400 000 - Échelle 1/400 000

Kilometres 10 0 10 20 30 40 Kilometres

Transverse Mercator Projection
CM 125°00', *Scale Factor* 1.0, NAD27
© Her Majesty the Queen in Right of Canada, 1999

Projection transverse de Mercator
M.C. 125°00', *facteur d'échelle* 1.0, NAD27
© Sa Majesté la Reine du chef du Canada, 1999



Scenic view of the Fort Fraser Area — Photo credit C. Dunn

Collection of outer bark — Photo credit C. Dunn

Bark samples after reduction to ash — Photo credit C. Dunn

NOTES

This sheet of nine maps is one of three of similar format provided in this Open File. Grouped together are elements of certain affinities and/or similar distribution patterns. The three sheets are entitled:

1) Base Metals, Gold and Pathfinder Elements (Open File 3696a)
2) Mafic Suite of Elements with Thorium and Lanthanum (Open File 3696b)
3) Alkali metals, Alkaline Earths, Manganese and Aluminum (Open File 3696c).

The elements depicted on these sheets are either those which show moderate geochemical data relief in the survey area, or they are representative of a closely associated suite of elements (e.g. of the rare-earth elements, only La is shown because the distribution patterns of the other 7 determined [Ce, Eu, Lu, Nd, Sm, Tb, Yb] are almost identical). Full data listings of concentrations of these and other elements in each sample are given in the accompanying diskette. The diskette includes, also, a more detailed description of the methodology, analytical methods and analytical quality control.

Rationale for Biogeochemical Surveys

The roots of a single large tree extract elements from many cubic metres of soil, overburden, groundwater and sometimes bedrock. These elements are then transferred to aerial parts of the tree where they may become locally concentrated. In a multi-disciplinary survey program, data derived from the analysis of an appropriate vegetation sample medium permits geochemical mapping, with enhanced background to anomaly contrast of certain elements, which may assist both in mapping bedrock and in the search for concealed zones of mineralization.

Because each species of plant has a different requirement for, and tolerance to, a range of chemical elements, some partitioning of elements takes place and there is selective absorption and transference into the plants. For biogeochemical exploration, conifers provide suitable and effective sample media because they are primitive plants that have a wide tolerance to many trace elements. The outer bark is a repository for many elements that are not required for the metabolic function of the tree.

The geochemical information supplied by the vegetation is different from that of the till. Just as two methods of geophysical survey may provide totally different information, so may two methods of geochemical survey. A high correlation between distribution patterns of two geochemical sample media is the exception rather than the rule. In geological environments where there is sufficient concentration of metals to form a mineral deposit, such a 'critical mass' of elements may be sufficient to generate biogeochemical anomalies above the mineral source (e.g. by upward diffusion) or close to it (e.g. by groundwater movement or movement in electrochemical cells). Tills, however, usually have geochemical anomalies displaced down-ice from the mineralised source. Such factors need to be taken into consideration when interpreting geochemical results.

Reconnaissance Survey

Lodgepole pine is the most common tree species in the Nechako area, and many metals concentrate in its outer bark. Hence, pine bark was selected as the sample medium for a reconnaissance-level biogeochemical survey in the Nechako project area. Samples were obtained by scraping approximately 100 g of outer bark from around the circumference of mature trees. The preferred sample interval was 2 km along roads, trails, and tracks. To minimize the effects of airborne contamination from roads, samples were collected a minimum distance of 100 m into the forest. Along lesser used trails and tracks this distance was reduced to approximately 50 m. Within the survey area a two-person crew sampled trees at 217 sites within a 10-day period in early August 1998. Because of the lack of roads and trails in some areas, the sampling grid is not even. However, on average the sample coverage is approximately 1 site per 8 km^2.

Bark samples were returned to the GSC laboratories in Ottawa where they were air-dried then reduced to ash by controlled ignition at 475°C for 24 hours. Ash samples were submitted for the analysis of 36 elements by instrumental neutron activation (INAA) at Activation Laboratories Ltd. (Ancaster, ON), and 30 elements by inductively coupled plasma emission spectrometry (ICP-ES) at Acme Laboratories, Vancouver. The INAA analysis reports the total concentration of elements in the sample. The ICP-ES is performed on an aqua regia digest of the ashes, and provides data on the total or near total concentrations of most elements that were determined. Data for some elements are obtained by both methods, but after review of the data from a quality control standpoint only the more accurate and precise set of values is recorded in the data listings.

Map Production and Data Presentation

The proportional dot maps are plotted using the Universal Transverse Mercator projection (NAD27 datum), with a central meridian of 125° (Zone 10). They were generated using AML (ARC/INFO Macro Language). The macro, with its corresponding input menu, prompts the user to input percentile break points and an appropriate scaling exponent for each element to be mapped. Proportional dots are then generated, using the ARC/INFO SPOTSIZE, POINTSPOT and SPOT commands, with the user specifying an appropriate minimum and maximum dot size. Exponents for individual elements were chosen to provide the best view of the analytical data. Accordingly, care should be exercised when attempting to compare different elements plotted with different exponents. Comments on distribution patterns are given in the digital file on the accompanying diskette.

LEGEND

TERTIARY
Eocene
Endako Group
- EE — *andesite, basalt; flows, breccia, vesicular, amygdaloidal, tuff, hyaloclastite, lahar*
- EEs — *siltstone, sandstone, coal, tuff*

Ootsa Lake Group (EOL - EOLh)
- EOL — *undifferentiated* EOLa - EOLh
- EOLa — *rhyodacite, rhyolite, flows, breccia, tuff, locally flow banded; includes some felsic subvolcanic intrusives*
- EOLc — *andesite, basalt, dacite; includes some undifferentiated Ootsa Lake Group units*
- EOLs — *Savory Phase: dacite, rhyodacite and minor andesite and rhyolite*
- EOLh — *Hicks Hill Phase: dacite with phenocrystic biotite, hornblende, plagioclase*

MESOZOIC
Cretaceous
Kasalka Formation
- uKK — *olive-green hornblende, plagioclase phyric dacite to dacitic andesite; generally the phenocrysts have altered cores*
- Ks — *andesite plagioclase porphyry*

Fraser Lake Suite (IKF - IKLL)
- IKF — *Fraser Phase: granodiorite, K-feldspar megacrystic*
- IKLL — *Leg Lake Phase: granite and granodiorite, pink, fine to medium grained*

Late Jurassic
François Lake Suite (IJFgl - IJFgh)
- IJFgl — *quartz latite porphyry*
- IJFh — *Nithi Phase: biotite granite to granodiorite, K-feldspar megacrystic*
- IJFd — *leucocratic porphyritic granite dykes*
- IJFC — *Casey Phase: granite, granodiorite*
- IJFE — *Endako Phase: biotite ± hornblende granite to granodiorite*
- IJFEf — *François Subphase: biotite granite to granodiorite*
- IJFEsr — *Sam Ross Creek Subphase: miarolitic granite*
- IJFG — *Glenannan Phase: biotite granite and granodiorite, porphyritic*
- IJFGt — *Tatin Lake Subphase: biotite granite, hornblende granodiorite*
- IJFGh — *Hanson Lake Subphase: biotite granodiorite to quartz monzonite*

Middle - Late Jurassic
Stag Lake Suite (mJSSh - mJSS)
- lJSSs — *Slug Lake Phase: hornblende- biotite diorite to quartz diorite; medium grey to chalky weathering fine- to medium-grained equigranular*
- mJSSh — *Sheraton Phase: biotite-hornblende granodiorite to quartz diorite; subporphyritic*
- mJSC — *Caledonia Phase: quartz monzonite, k-feldspar megacrystic*
- mJSTa — *Tahtsph Phase: hornblende-biotite diorite to quartz diorite*
- mJSTi — *Tintagel Phase: granite, chloritized*
- mJSS — *Stellako Phase: biotite-hornblende quartz diorite to granodiorite*
- JO — *Overlander Phase: hornblende biotite diorite to quartz diorite*
- mJSL — *Slag Lake Phase: gabbro and diorite*

Late Triassic-Middle Jurassic
Hazelton Group (eJH - eJHb)
- eJH — *feldspar porphyry andesite, greywacke*
- eJHa — *dacitic, andesitic and basaltic flows and breccias; minor rhyolite*
- eJHb — *conglomerate, greywacke conglomerate, shale and argillite with minor interbedded andesite or basalt flows*

Boer Plutonic Suite (ITS - ITJb)
- ITs — *Stem Creek Phase: diorite, granodiorite gneiss*
- ITJB — *Boer Phase: hornblende diorite to quartz diorite*
- TCCm — *hornblende diorite, biotite-hornblende quartz diorite, biotite granodiorite, minor amphibolite*

PALEOZOIC - MESOZOIC
Permian - Triassic
- PTt — *undifferentiated amphibolite, biotite amphibolite and marble, calc-silicate*

SYMBOLS

geological boundary (known, approximate, assumed)
faults (exposed/covered by drift)
roads (primary, secondary)
railroad

93K/5	93K/6	93K/7	93K/8
93K/4	93K/3 OF3696 a/b/c/d	93K/2 OF3696 a/b/c/d	93K/1
93F/13 OF3587	93F/14 OF3587	93F/15	93F/16
93F/12 OF3587	93F/11	93F/10	93F/09

NATIONAL TOPOGRAPHIC SYSTEM REFERENCE AND INDEX TO ACCOMPANYING GEOLOGICAL SURVEY OF CANADA MAPS

OPEN FILE
DOSSIER PUBLIC
3696c
GEOLOGICAL SURVEY OF CANADA
COMMISSION GÉOLOGIQUE DU CANADA
OTTAWA
04/1999

Recommended citation:
Dunn, C.E. and N.L. Hastings
1999: Biogeochemical survey of the Fraser Lake Area, Using Outer Bark of Lodgepole Pine (NTS 93K02/03), central British Columbia; Alkali Metals, Alkaline Earths, Manganese and Aluminum, Geological Survey of Canada, Open File 3696c, scale 1:400 000