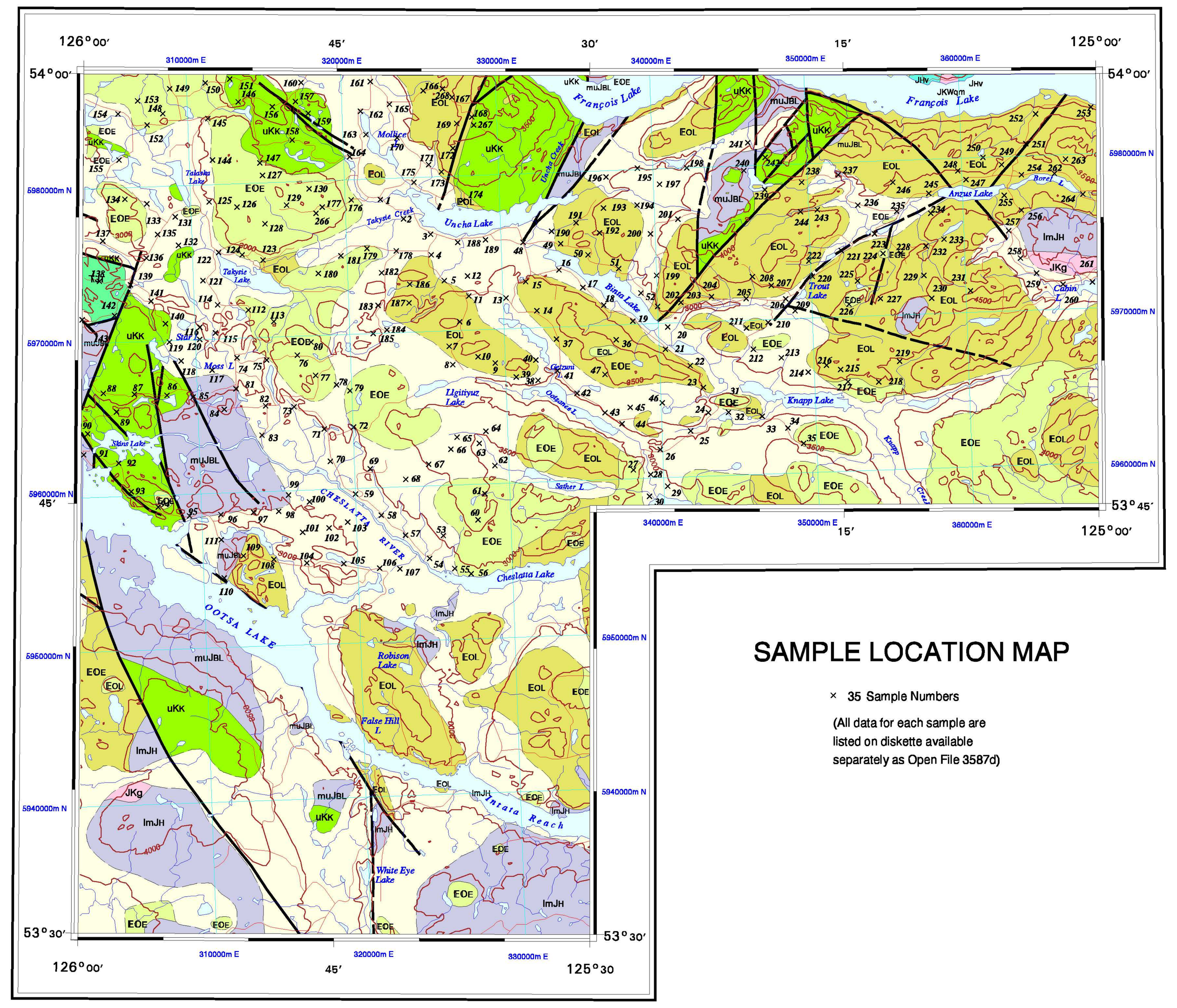
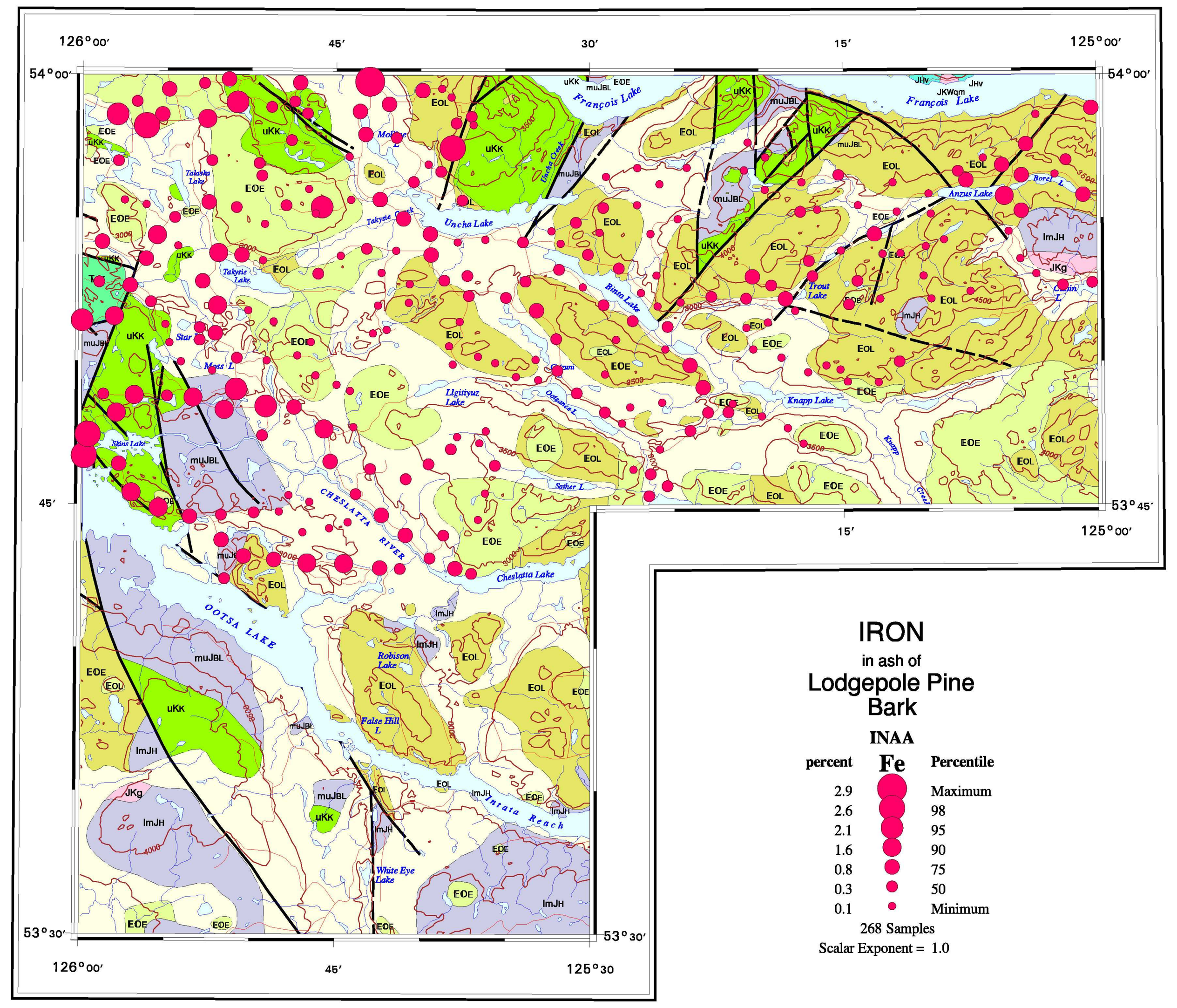


SAMPLE LOCATION MAP

× 35 Sample Numbers

(All data for each sample are listed on diskette available separately as Open File 3587d)

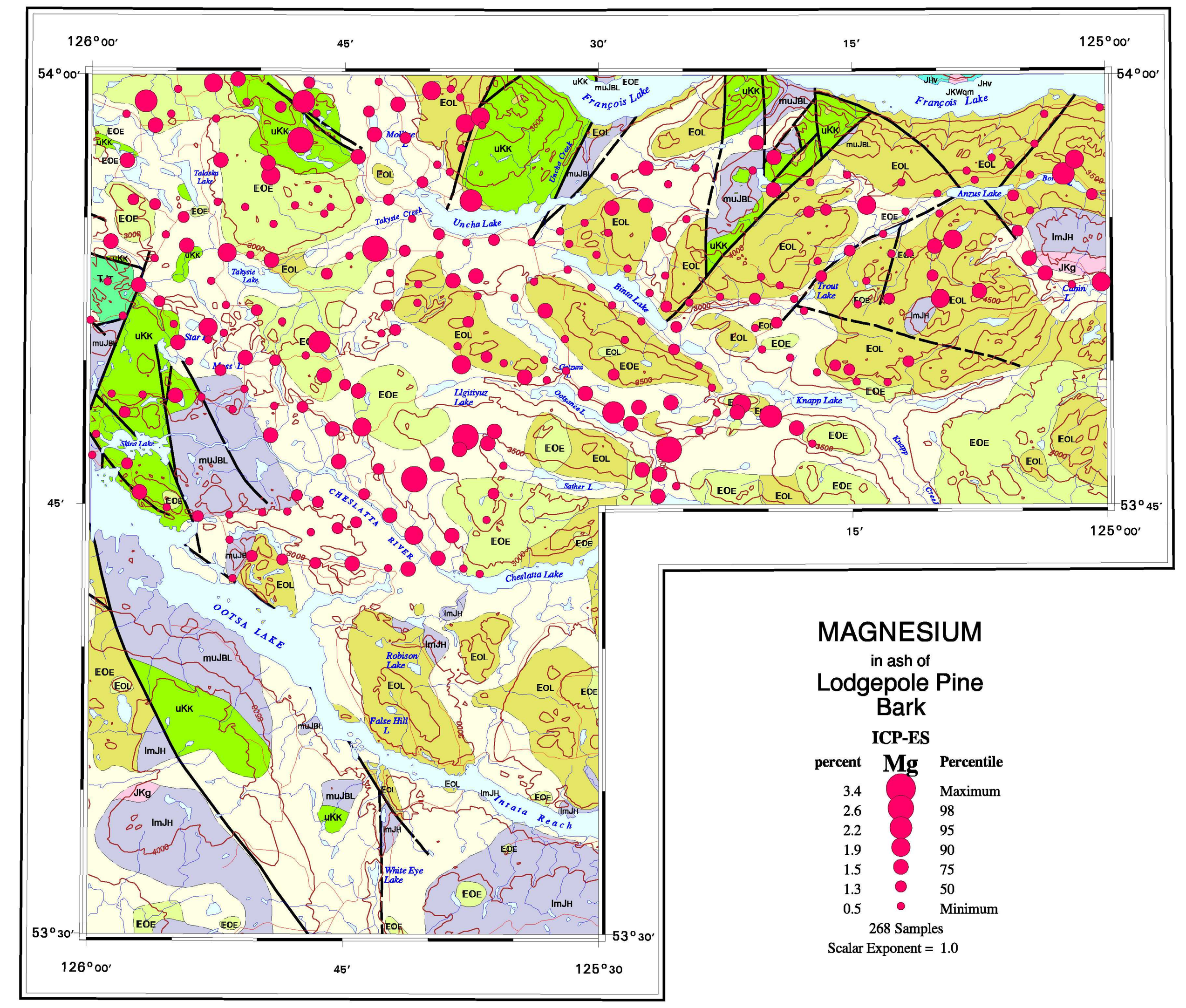


IRON
in ash of
Lodgepole Pine
Bark

INAA

percent	Fe	Percentile
2.9	●	Maximum
2.6	●	98
2.1	●	95
1.6	●	90
0.8	●	75
0.3	●	50
0.1	●	Minimum

268 Samples
Scalar Exponent = 1.0

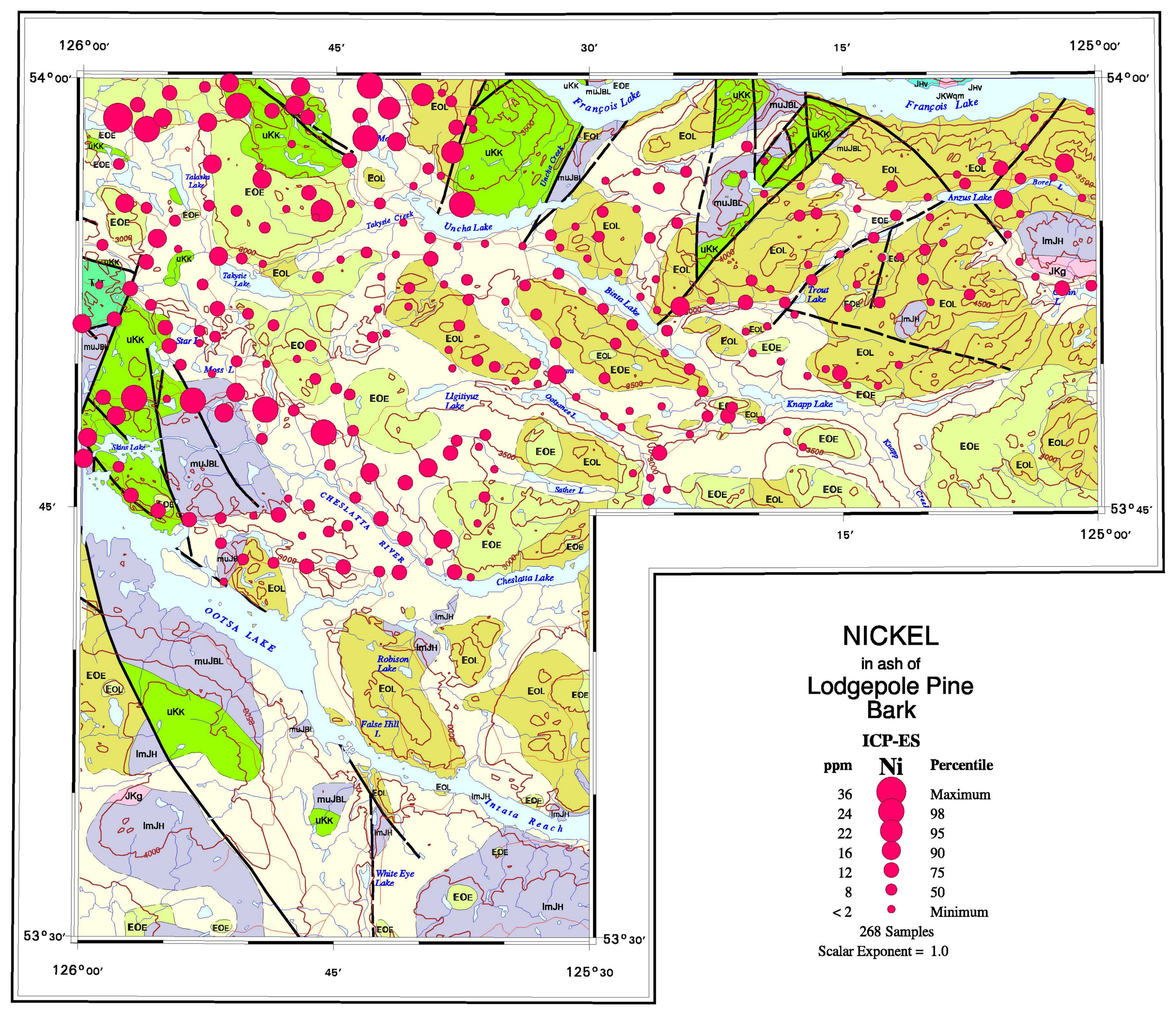


MAGNESIUM
in ash of
Lodgepole Pine
Bark

ICP-ES

percent	Mg	Percentile
3.4	●	Maximum
2.6	●	98
2.2	●	95
1.9	●	90
1.5	●	75
1.3	●	50
0.5	●	Minimum

268 Samples
Scalar Exponent = 1.0

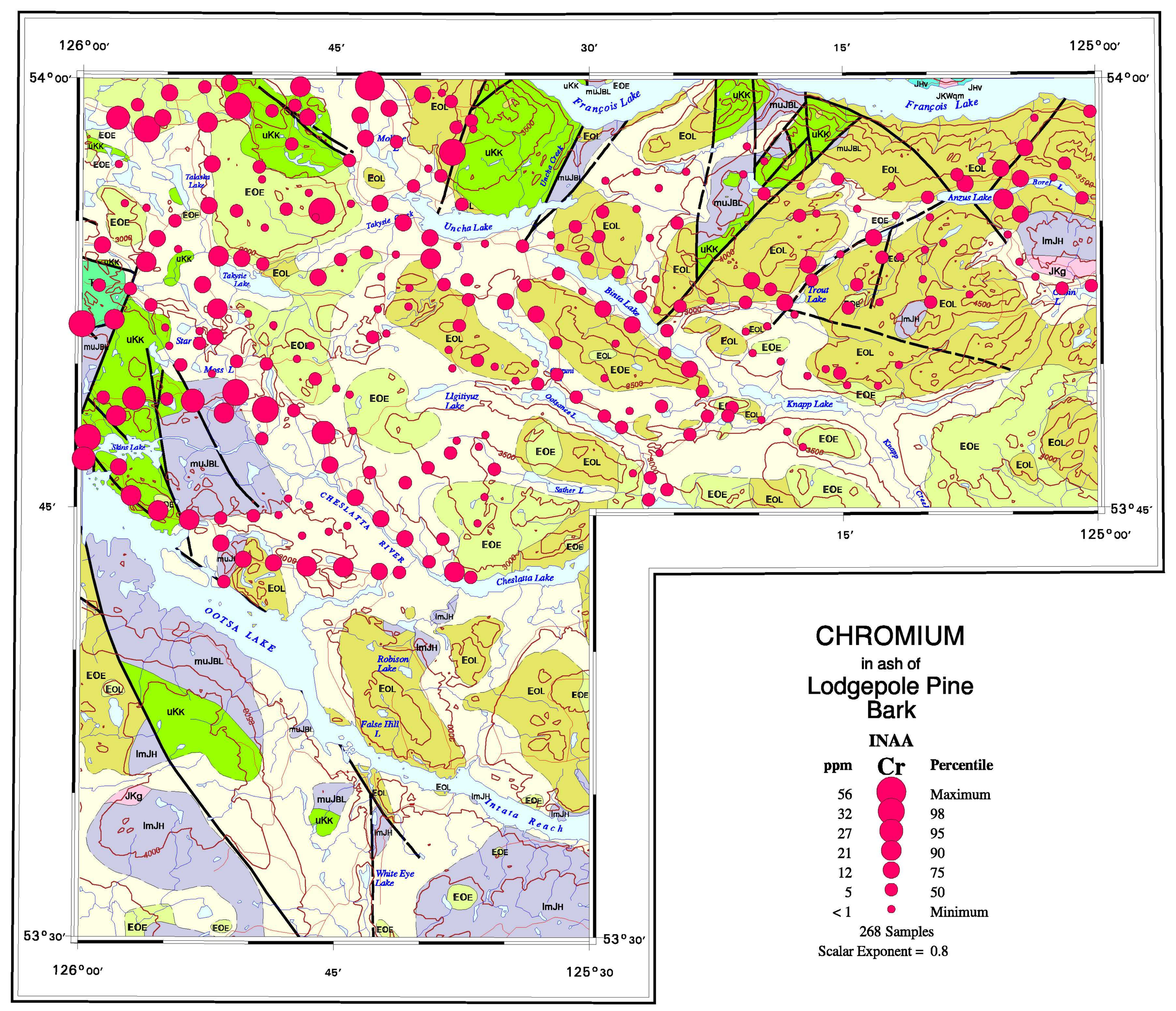


NICKEL
in ash of
Lodgepole Pine
Bark

ICP-ES

ppm	Ni	Percentile
36	●	Maximum
24	●	98
22	●	95
16	●	90
12	●	75
8	●	50
< 2	●	Minimum

268 Samples
Scalar Exponent = 1.0

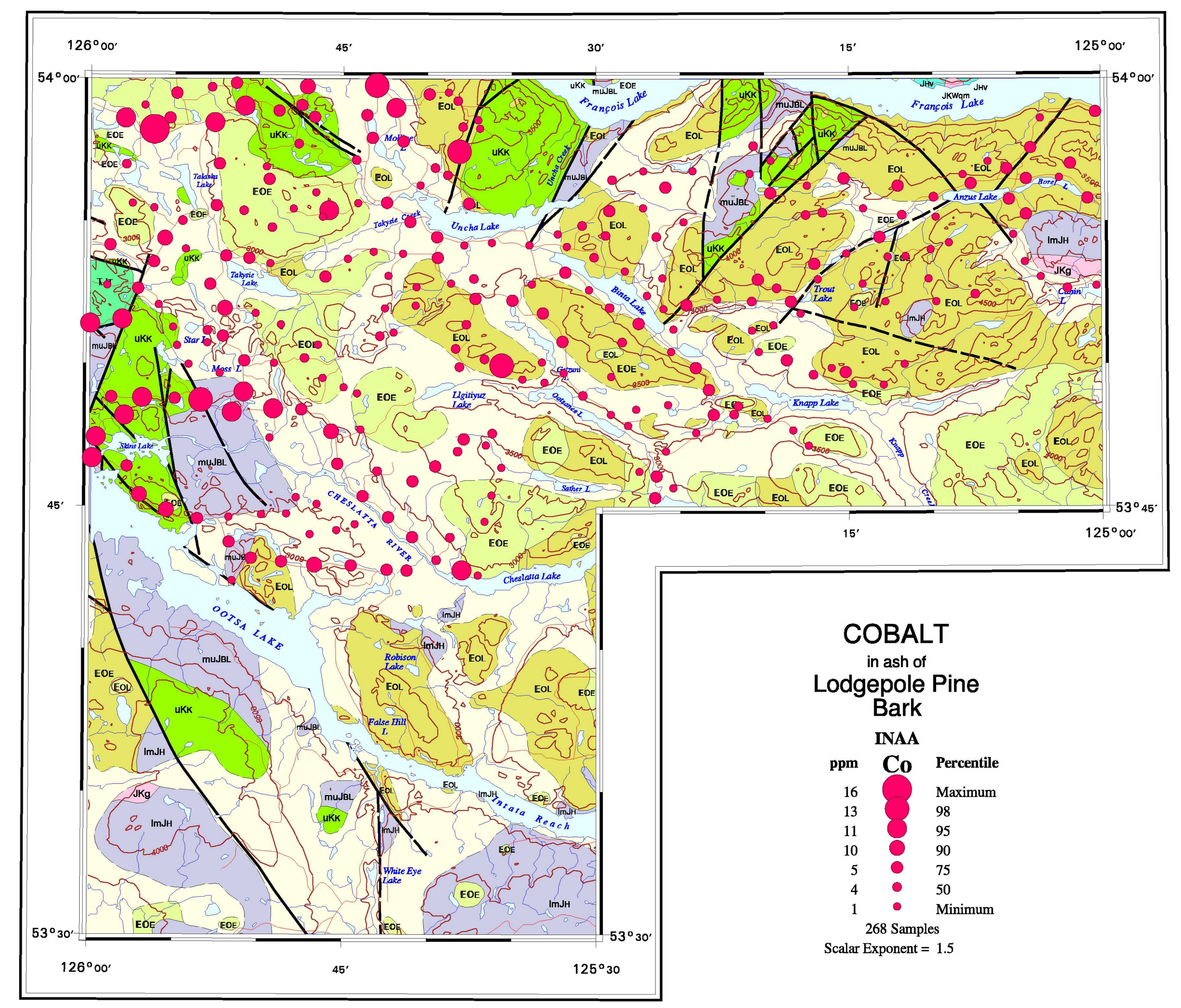


CHROMIUM
in ash of
Lodgepole Pine
Bark

INAA

ppm	Cr	Percentile
56	●	Maximum
32	●	98
27	●	95
21	●	90
12	●	75
5	●	50
< 1	●	Minimum

268 Samples
Scalar Exponent = 0.8

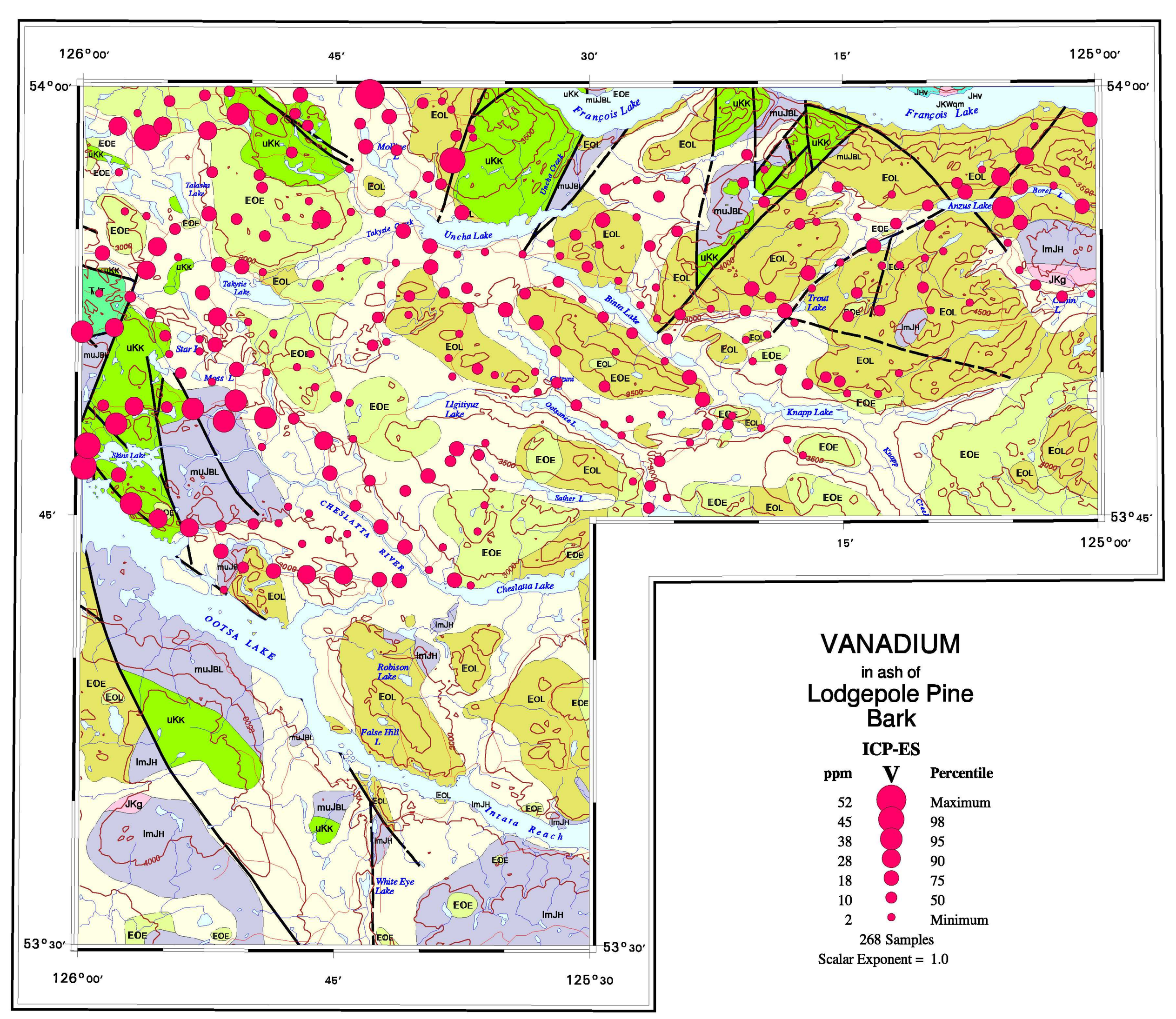


COBALT
in ash of
Lodgepole Pine
Bark

INAA

ppm	Co	Percentile
16	●	Maximum
13	●	98
11	●	95
10	●	90
5	●	75
4	●	50
1	●	Minimum

268 Samples
Scalar Exponent = 1.5

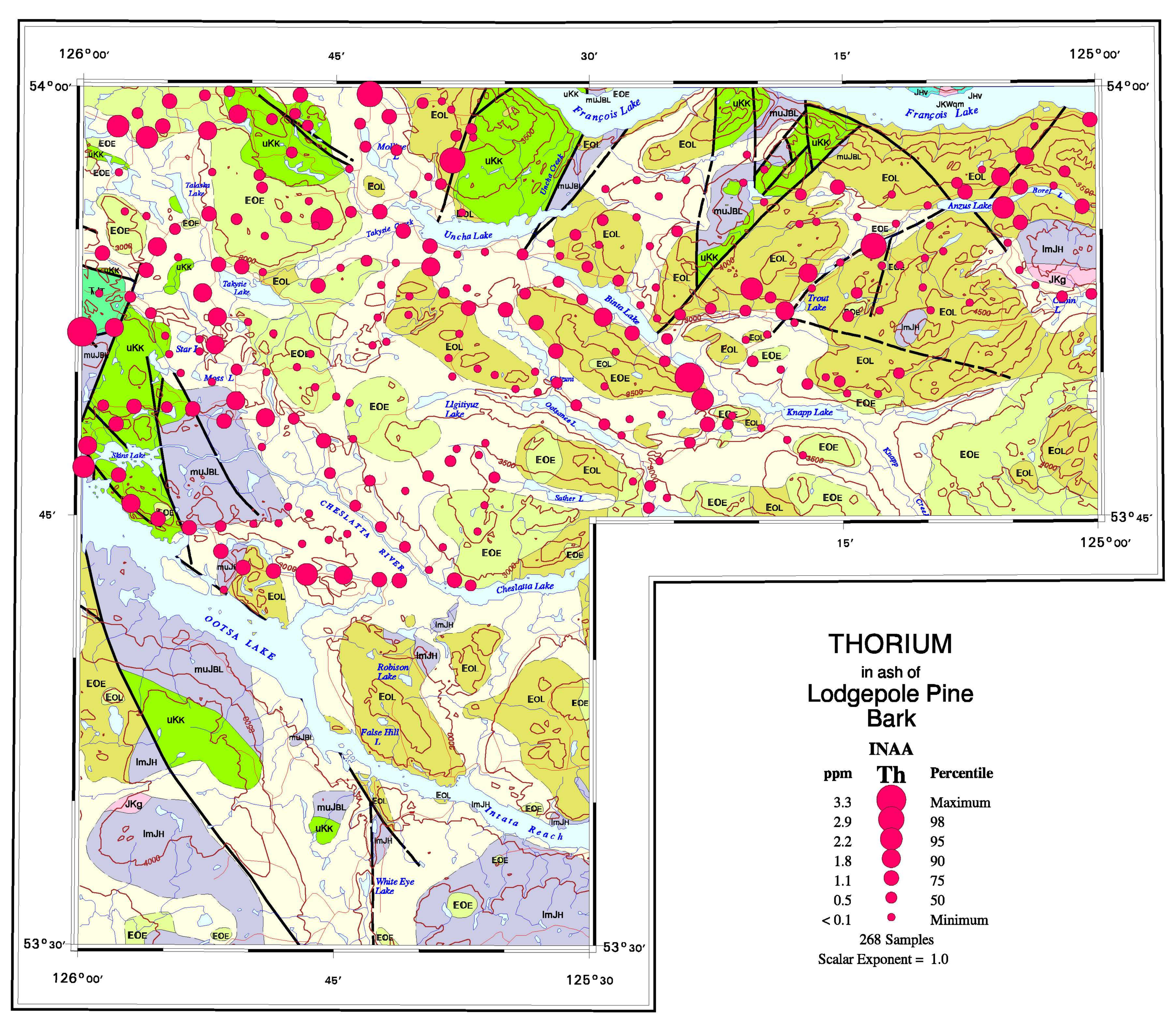


VANADIUM
in ash of
Lodgepole Pine
Bark

ICP-ES

ppm	V	Percentile
52	●	Maximum
45	●	98
38	●	95
28	●	90
18	●	75
10	●	50
2	●	Minimum

268 Samples
Scalar Exponent = 1.0

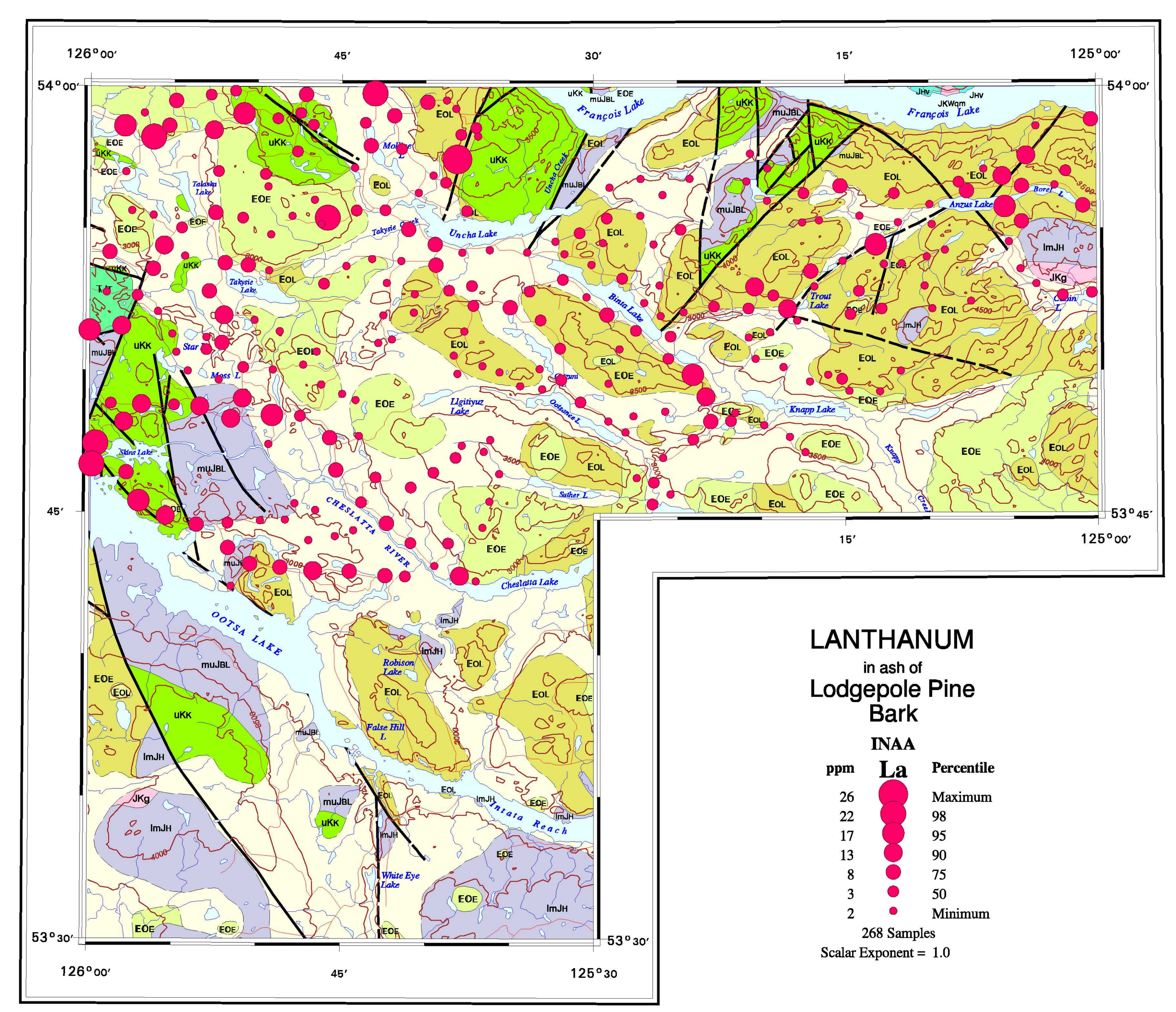


THORIUM
in ash of
Lodgepole Pine
Bark

INAA

ppm	Th	Percentile
3.3	●	Maximum
2.9	●	98
2.2	●	95
1.8	●	90
1.1	●	75
0.5	●	50
< 0.1	●	Minimum

268 Samples
Scalar Exponent = 1.0



LANTHANUM
in ash of
Lodgepole Pine
Bark

INAA

ppm	La	Percentile
26	●	Maximum
22	●	98
17	●	95
13	●	90
8	●	75
3	●	50
2	●	Minimum

268 Samples
Scalar Exponent = 1.0

Natural Resources Canada / Ressources naturelles Canada

Canada

OPEN FILE 3587b

Biogeochemical Survey of the Ootsa-François Lakes Area Using Outer Bark of Lodgepole Pine (NTS 93F/13, 14, and part of 12)

MAFIC SUITE OF ELEMENTS WITH THORIUM AND LANTHANUM

NORTH CENTRAL BRITISH COLUMBIA

Scale 1:250 000 - Échelle 1/250 000

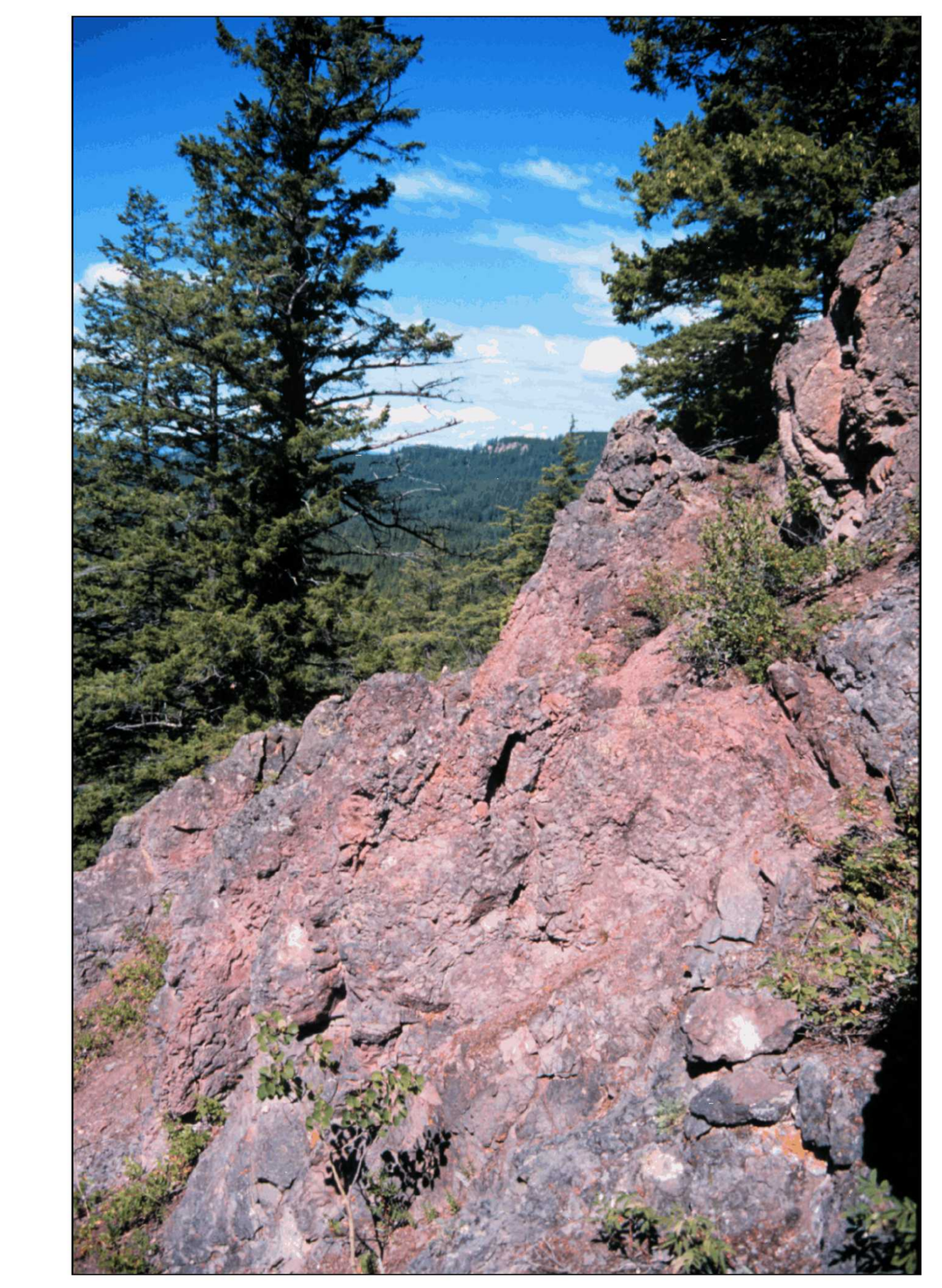
Kilometres 5 0 5 10 15 20 Kilomètres

Transverse Mercator Projection
CM 125°30′, Scale Factor 1.0, NAD27

Projection transverse de Mercator
M.C. 125°30′, facteur d'échelle 1.0, NAD27

GEOLOGICAL SURVEY OF CANADA — COMMISSION GÉOLOGIQUE DU CANADA

Sampling lodgepole pine bark — photo credits N. Hastings



A typical view of the Ootsa-Francois Lakes area — photo credits L. Struik

MARGINAL NOTES

Introduction

This sheet of nine maps is one of three of similar format for the survey area. Grouped together are elements of certain affinities and/or similar distribution patterns. The three sheets are entitled:

1) Base Metals and Pathfinder Elements (Open File 3587a)
2) Mafic Suite of Elements with Thorium and Lanthanum (Open File 3587b)
3) Alkali metals, Alkaline Earths, Manganese and Aluminum (Open File 3587c)

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). Listings of concentrations of these and other elements in each sample are given in the diskette released as Open File 3587d. 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 vegetation is different from that of till. Just as two methods of geophysical survey may provide 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 upward 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 minimise the effects of airborne contamination from roads, samples were collected at least 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 268 sites within a 10-day period in late July 1997. 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 7 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 470°C for 24 hours. A separate split of dry material was ground to a powder and analyzed for mercury. Ash samples were submitted for the analysis of 36 elements by instrumental neutron activation (INAA) and 30 elements by inductively coupled plasma emission spectrometry (ICP-ES) at Activation Laboratories Ltd. (Ancaster, ON). 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. 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 Transverse Mercator projection, with a central meridian of 125°30'. 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 diskette available as Open File 3587d.

LEGEND

Unconsolidated Cover

Tertiary and Quaternary Assemblages

REFERENCE
Williams, S.P. (compiler)
1997: Geological compilation of the Nechako River (93F map area), British Columbia; Geological Survey of Canada, Open File 3429, scale 1:250 000

QUATERNARY
PLEISTOCENE AND HOLOCENE

- **Qal** — *Unconsolidated glacial till, fluvial deposits and poorly sorted alluvium*

Layered Rocks

Tertiary and Quaternary Assemblages

TERTIARY
UPPER EOCENE TO OLIGOCENE
Endako Group

- **EOE** — *Massive, vesicular and amygdaloidal varieties of basalt and andesite; minor breccia, tuff, feeders of gabbro, necks, plugs and dykes, minor dacite, rhyolite, conglomerate, sandstone and shale*

LOWER TO MIDDLE EOCENE
Ootsa Lake Group

- **EOL** — *Buff to white coloured flow banded rhyolite and purplish dacites; quartz, and biotite phyric phases, fine grained rocks with abundant spherulites, medium to dark grey plagioclase-biotite porphyritic andesites, locally with vesicles and amygdules of quartz, calcite and chlorite; basalt, volcanic conglomerates, sediments, breccias and tuffs*

MESOZOIC
LOWER TO UPPER CRETACEOUS
Kasalka Group

- **uKK** — *Predominantly hornblende-feldspar porphyritic andesite flows and related lahars, debris flows, volcanic breccias and epiclastic beds; also includes lesser hornblende-biotite-feldspar phyric dacite to rhyodacite, aphyric to augite-phyric basaltic andesite, flow-banded quartz phyric rhyolite, bladed feldspar porphyry flows, hornblende-biotite-bearing lapilli tuff, crystal tuff and volcanic sandstone and siltstone; overlies older rocks with angular discordance*

MIDDLE JURASSIC
Bowser Lake Group

- **muJBL** — *Chert pebble conglomerate, siltstone, minor argillite*

LOWER TO UPPER JURASSIC
Hazelton Group (lmJH - JHv)

- **lmJH** — *Andesite, basalt and related tuff and breccia; lesser dacitic to rhyolitic tuffs, breccias and flows; conglomerate, greywacke, shale; argillite, tuffaceous argillite, limy argillite; limestone*
- **JHv** — *Green, maroon and purple, marine and sub-aerial basaltic, andesitic and dacitic pyroclastics and flows; feldspar-phyric andesite, augite-phyric basalt; lapilli, crystal and ash tuffs, ignimbrite, lahar, volcanic breccia and agglomerate, epiclastic sediment*

UPPER TRIASSIC AND LOWER JURASSIC
Takla Group

- **TrJT** — *Andesite, basalt, breccia, tuff; minor argillite and limestone*

Intrusive Rocks

MIDDLE JURASSIC TO EARLY CRETACEOUS
François Intrusions

- **JKg** — *Granite and granodiorite*
- **JKwqm** — *Wheeler quartz monzonite; coarse grained leucocratic quartz monzonite with local orthoclase porphyritic varieties; also called Menard stock*

SYMBOLS

Geological boundary (known, approximate, assumed)
faults (exposed/covered by drift)
roads (unclassified)

Copies of this map may be obtained from the Geological Survey of Canada; 601 Booth Street, Ottawa,ON. K1A OE8, or 101-605 Robson Street, Vancouver, B.C.,V6B 5J3

Biogeochemical data by C. Dunn (1998), Mineral Resources Divivsion

Geological compilation based on: (North Half) by K. Bellefontaine, A. Legun, and N. Massey (1994) (south half) P.Schiarizza, A. Panteleyev, R. Gaba, and K.Glover (1995). B.C. Geological Survey

Digital cartography by N.L. Hastings, and H. Zabaneh, Cordilleran 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

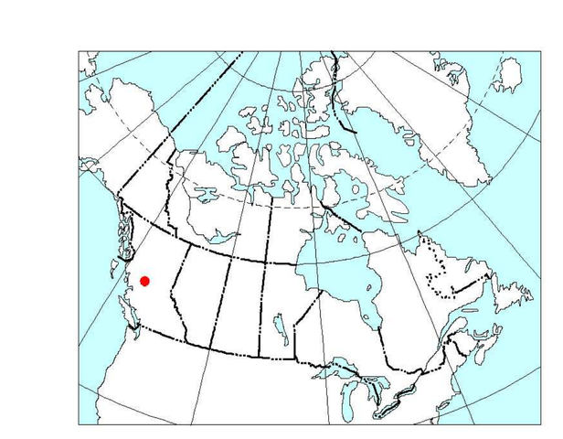
Digital contour data compiled by Geomatics Canada, published 1:250 000, modified by the Geological Survey of Canada

Digital rivers, streams, lakes and roads data (BCGS 93F96, 93F97, 93F98, 93F86, 93F87, 93F88, 93F76, 93F77, 93F78) is available through MAPS-BC. Survey and Resource Mapping Branch, Ministry of Crown Lands, Parliament Buildings, Victoria, B.C., V8V 1X4

Copies of the topographic map for this area may be obtained from the Canada Map Office, Natural Resources Canada, 130 Bentley Ave., Nepean, Ontario, K2E 6P9

Magnetic Declination 1997, 22°45′E decreasing 8.5′ annually. Readings vary from 22°49′E in the NE corner to 22°41′E in the SW corner of the map.

Elevation in feet above mean sea level



LOCATION MAP

93L/1	93K/4	93K/3	93K/2	93K/1
93E/16	93F/13 OF 3587	93F/14 OF 3587	93F/15 OF 3594	93F/16 OF 3594
93E/9	93F/12	93F/11	93F/10	93F/09
93E/8	93F/05	93F/06	93F/07	93F/08
93E/1	93F/4	93F/3	93F/2	93F/1

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

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

OPEN FILE
DOSSIER PUBLIC
3587b
GEOLOGICAL SURVEY OF CANADA
COMMISSION GÉOLOGIQUE DU CANADA
OTTAWA
July 1998

Recommended citation:
Dunn, C.E, and N.L. Hastings
1998: Biogeochemical survey of the Ootsa-François Lakes Area, Using Outer Bark of Lodgepole Pine (NTS 93F13/14, and part of 12), north central British Columbia; Mafic Suite of Elements with Thorium and Lanthanum; Geological Survey of Canada, Open File 3587b, scale 1:250 000