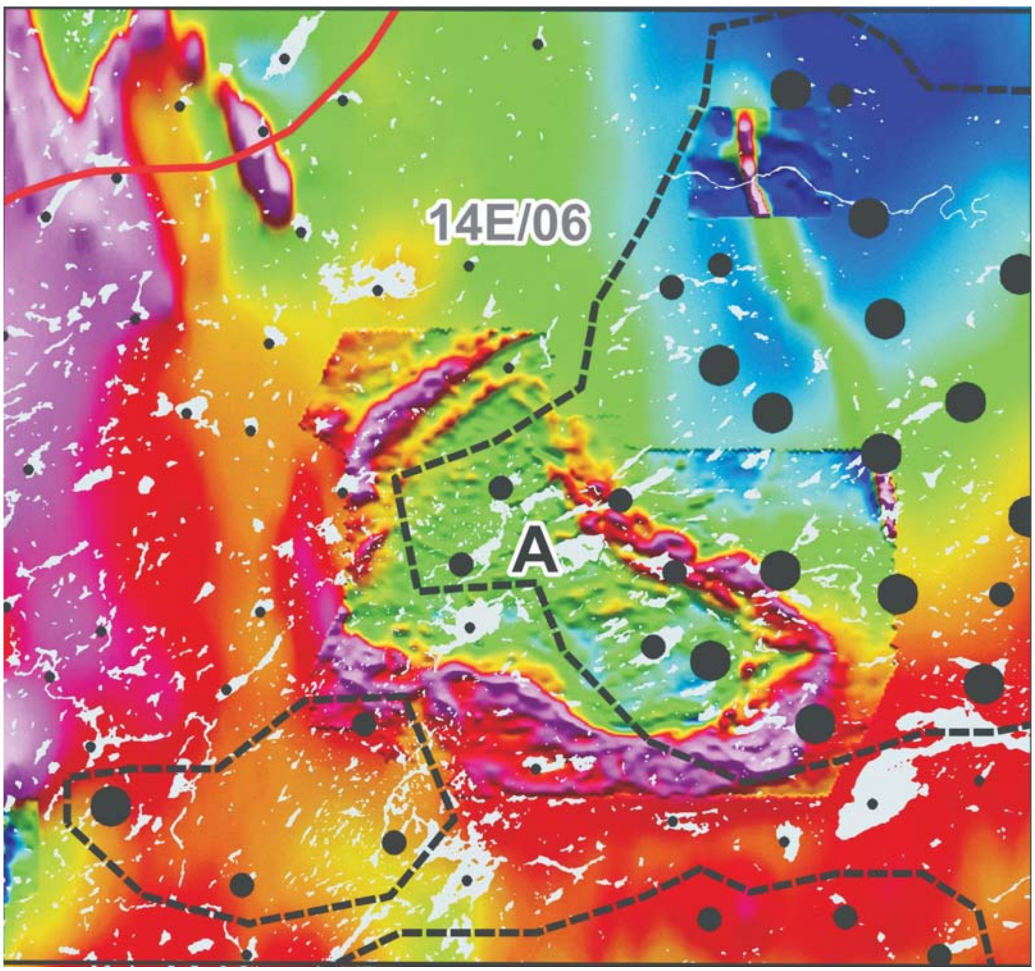
Newfoundland Labrador

Natural Resources

Mines

AN UNTESTED RARE-EARTH ELEMENT TARGET IN NORTHERN LABRADOR



S.D. Amor

Open File 014E/0229

St. John's, Newfoundland
August, 2011

NOTE

DISCLAIMER

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Cover: North River fluoride anomaly. Fluoride in lake water superimposed on merged regional and detailed magnetics.

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ABSTRACT

A regional lake-sediment rare-earth element (REE) anomaly occurs within the Umiakovik Lake batholith in northern Labrador. This anomaly contains within its bounds two distinctive ring-shaped features, one 14 km in diameter and the other 2.25 km in diameter. The ring-shaped features are defined by total-field magnetics data gathered by exploration companies in 1995 and 1996, during a search for Voisey's Bay-type magmatic sulphide deposits. A similar ring-shaped magnetic pattern is present at Quest Rare Minerals' Misery Lake prospect in Québec, and concentric compositional zoning is also present at the Lovozero and Khibina peralkaline complexes in Russia. Three localized anomalies of fluoride in lake water (the North River, Kingurutik River North and Kingurutik River South (fluoride) anomalies) are located within the bounds of the lake-sediment REE anomaly, and may represent glacial dispersion from loci of rare-earth concentration.

Detailed magnetic data are not available for the westerly Kingurutik River North and Kingurutik River South (fluoride) anomalies, respectively 23 km southeast and 28 km south-southeast from the centre of the North River Anomaly, although regional magnetic data indicate two local maxima within the bounds of the Kingurutik River South (fluoride) anomaly.

The circular Sikkoyavik Brook magnetic feature, centred on 57.31ºN, 62.88ºW, south of Umiakovik Lake is much smaller (diameter 2.25 km) and is also defined by detailed exploration company aeromagnetic data. This feature falls within the bounds of the larger REE lake-sediment anomaly but is not associated with anomalous fluoride in lake water.

The identification of these targets resulted from examination of publicly available geochemical data and a limited number of assessment files, which predate the current interest in REE from the mining industry. It is probable that other targets will be found by similar means, elsewhere in the province.

INTRODUCTION

This open file report describes surficial geochemical and geophysical characteristics of an area of northern Labrador, about 50 km west of Ukak Bay and 120 km west-northwest of Nain, within NTS map areas 14E/03, 14E/06 and 14E/07 (Figure 1). These characteristics suggest the presence of hitherto-undiscovered rare-earth element (REE) mineralization.

The report contains a brief overview of the bedrock and surficial geology, and a review of previous exploration work in the area. Anomalies defined by various REE in lake sediment, and fluoride ion in lake water, from the Geoscience Atlas of Newfoundland and Labrador are described and discussed in association with regional and detailed aeromagnetic data, which suggest the presence of zoned peralkaline intrusions. The geophysical and geochemical characteristics of the anomalies are compared to those of other rare earth deposits and prospects in Labrador and Québec.

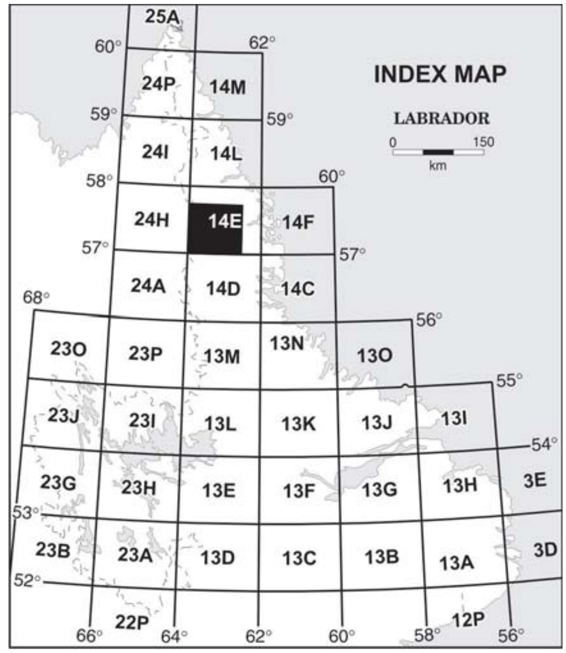

Figure 1. *Location of survey area.*

BEDROCK GEOLOGY

The anomalies described in this report occur in an area underlain by the Umiakovik Lake batholith, a unit of the Nain Plutonic Suite; the latter comprises numerous individual intrusions, including granitic, iron-rich gabbroic-dioritic, troctolitic and anorthositic units (Ryan, 1990). Granitic units of the suite are described in general as "predominantly hornblende ± biotite ± fayalite ± clinopyroxene ± fluorite-bearing granite and quartz monzonite", also including "monzonite, syenite, monzodiorite and quartz monzodiorite". The suite also includes iron-rich gabbroic-dioritic, troctolitic and anorthositic units (Ryan, 1990).

The Umiakovik Lake batholith is centred on 57.32ºN, 63.15ºW, having a kite-shaped surface expression with axes striking north south (75 km) and east west (60 km), although a linear 'tail' extends about 30 km to the south-southeast to 56.64ºN, north of Tasisuak Lake where it is only about 1 km wide (Figure 2). Emslie and Stirling (1993) subdivided the batholith into biotite–hornblende granite, reported to be fluorite-bearing by Emslie and Russell (1988), and dated at 1315.4 ± 1.9 Ma and 1316.0 ± 1.7 Ma by Emslie and Loveridge (1993); hornblende granite (occupying all of the western half of the batholith), fayalite–pyroxene quartz monzonite and granite (1319 ± 2 Ma, *ibid.*), ferrodiorite and monzodiorite (Figure 3). Emslie and Loveridge (*ibid.*) described the batholith as a whole as "relatively fractionated and fluorite-bearing" although the mode of occurrence of the fluorite is not described. They observed that trace interstitial carbonate grains are

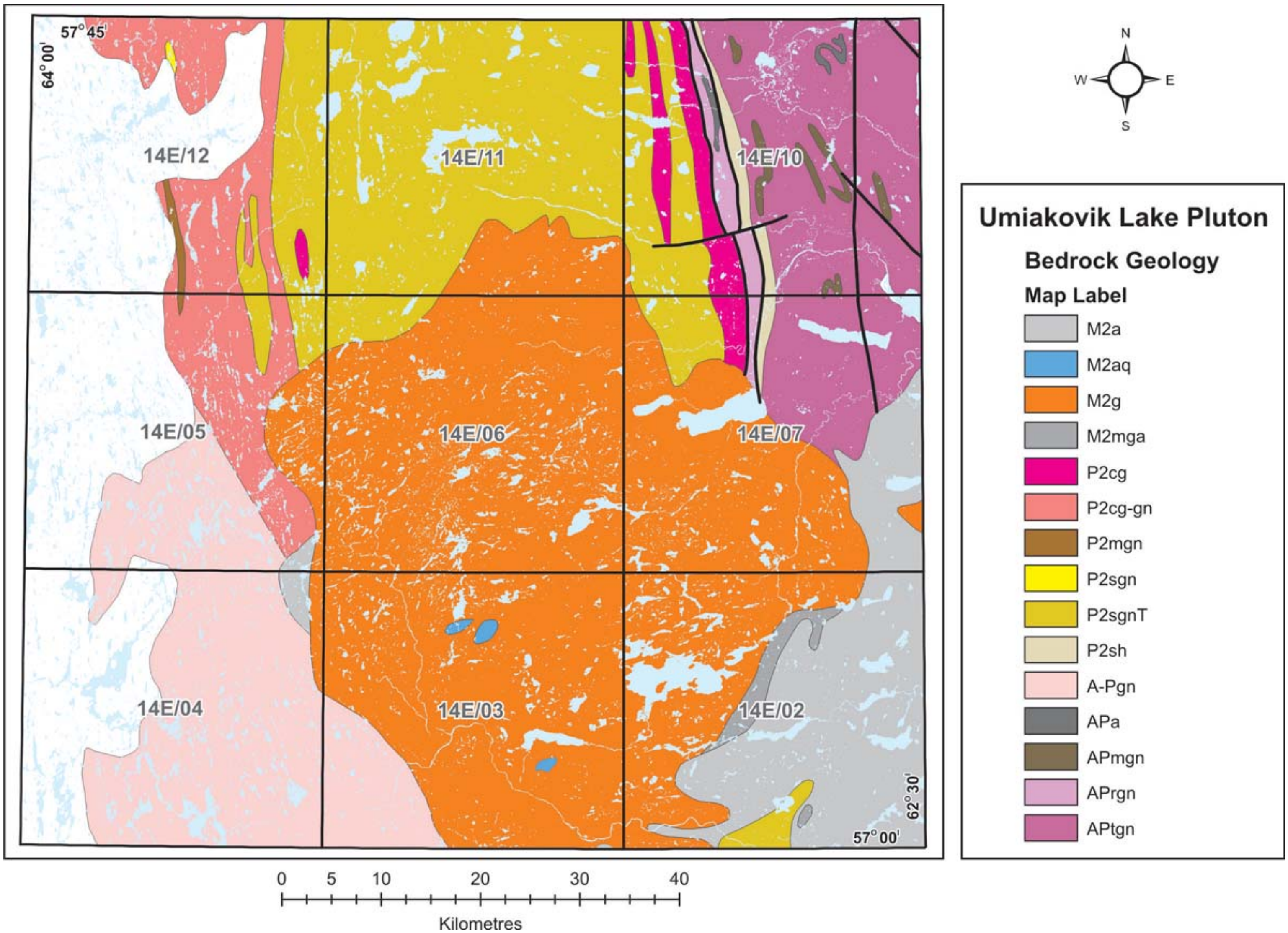

Figure 2. *Regional geology.* ***APtgn****=Tonalite gneiss, quartz diorite gneiss, granodiorite gneiss, amphibolite, mafic granulite (eo-Archean);* ***APrgn****=Tonalite gneiss, granitoid gneiss (Eo-Paleoarchean);* ***APmgn****=Amphibolite, mafic granulite (Eo-Paleoarchean);* ***APa****=Anorthosite, leucogabbro (Eo-Paleoarchean);* ***A-Pgn****=Gneiss (Archean and/or Paleoproterozoic);* ***P2sh****=Shale, siltstone, sandstone (Mid Paleoproterozoic);* ***P2sgn****=Pelitic gneiss (Mid Paleoproterozoic);* ***P2sgnT****=Metasedimentary gneiss (Mid Paleoproterozoic);* ***P2mgn****-Amphibolite, mafic granulite (Mid Paleoproterozoic);* ***P2cg-gn****=Granite, tonalite, tonalite gneiss (Mid Paleoproterozoic);* ***P2cg****=Tonalite, quartz diorite, granodiorite, granite (Mid Paleoproterozoic);* ***M2mga****=Ferrodiorite (Mid Mesoproterozoic);* ***M2g****=Granite, monzonite, charnockite (Mid Mesoproterozoic);* ***M2aq****=Arkose, quartzite (Mid Mesoproterozoic);* ***M2a****=Leuconorite, leucogabbro, leucotroctolite, anorthosite (Mid Mesoproterozoic).*

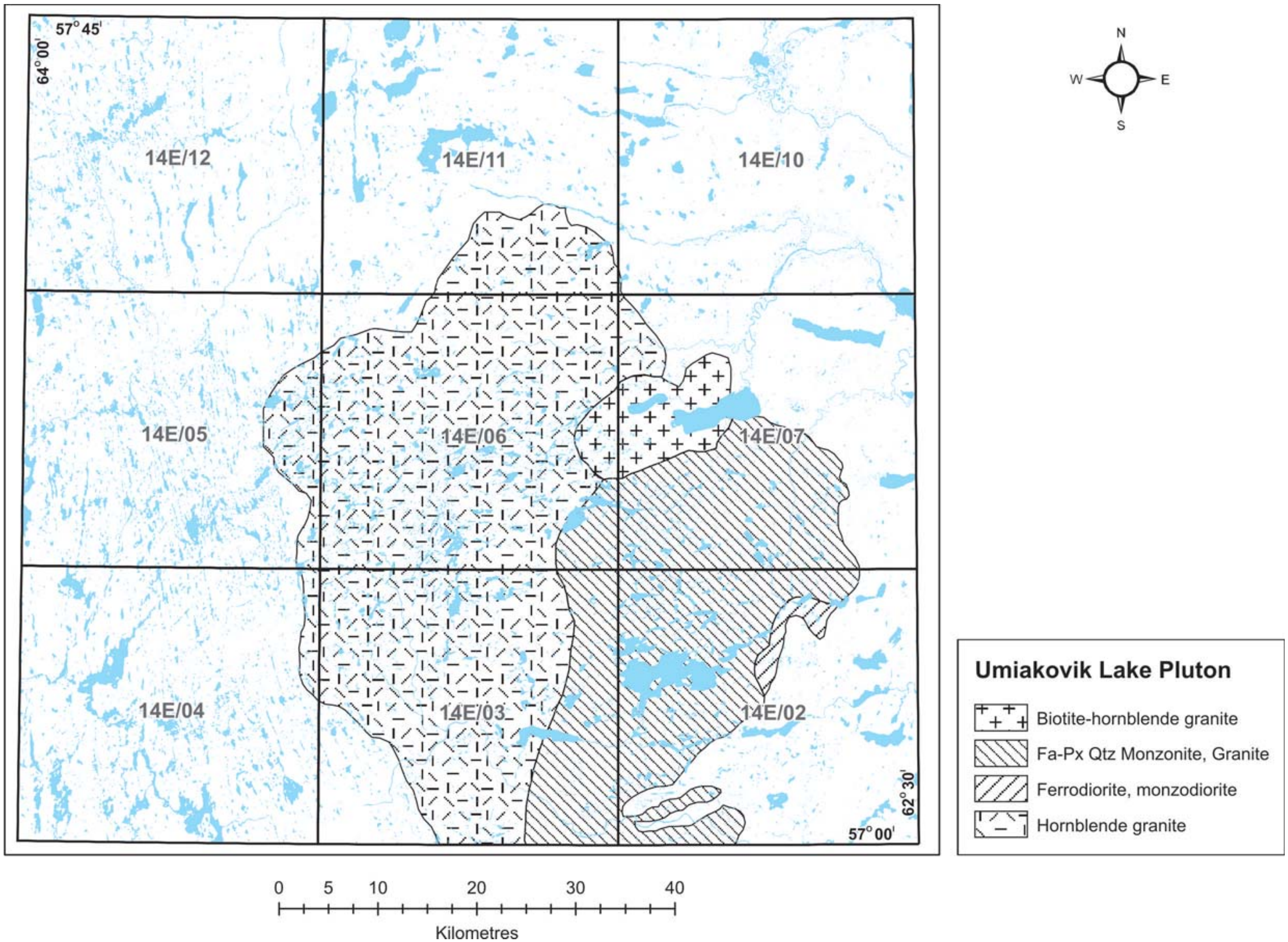

Figure 3. *Rock types of the Umiakovik Pluton (from Emslie and Stirling, 1993).*

present in fresh rock samples of all types. The batholith is also reported to be locally intruded by pegmatites (Luffman, 1996).

The batholith intrudes Archean to mid-Paleoproterozoic granites and gneisses of the Torngat Orogen and Southeastern Churchill Tectonic Province in the west and north, and Archean gneisses of the Nain Province in the northeast; the latter having interleaved, deformed and metamorphosed Paleoproterozoic sedimentary rocks of the Ramah Group. Along its northern contact with the Tasiyuak gneiss (map unit P2sgnT), contact metamorphism and migmatization have affected the country rock to a distance of 1 to 2 km (Taylor, 1979; Ermanovics and van Kranendonk, 1996). To the east and southeast the batholith is intruded into leuoconoritic rocks of the Pyramid Pass intrusion, another component of the Nain Plutonic Suite (Ryan *et al.*, 1998).

MINERALIZATION

Minor occurrences of copper, nickel and iron sulphides were reported in drillcore from Sikkoyavik Brook, south of Umiakovik Lake, during a program to test a circular magnetic anomaly centred on 57.31ºN, 62.88ºW (French and Syberg, 1997; French *et al.*, 1998; French and Woods, 1999). This work is described in more detail in a later section.

SURFICIAL GEOLOGY

Data concerning the surficial geology of the area are sparse. The nearest documented striation directions are from the Strange Lake area, almost 100 km to the south, and indicate that ice movement was to the east-northeast. Klassen *et al.* (1992) describe the surficial geology in the vicinity of the anomalies as “drift poor” (*i.e.*, consisting of greater than 80% exposed bedrock, but with discontinuous areas of till and other surficial materials generally less than 1 m thick). There are also minor occurrences of undifferentiated till, ablation drift and glaciofluvial material (Klassen *et al.*, 1992).

PREVIOUS WORK

GOVERNMENT AND ACADEMIA

Initial reconnaissance geological work in the study area was carried out by Wheeler (1942, 1960), Christie (1952) and Taylor (1979), and their work was incorporated into the map of Ryan (1990). Studies of the geology of the Umiakovik Lake batholith were reported by Emslie and Russsell (1988), Emslie and Loveridge (1992) and Emslie and Stirling (1993). Emslie and Stirling (*ibid.*) collected 49 samples for whole-rock and trace-element geochemical analysis, whose rock types are known (*see* below). The analyses included F, Y and the REE La, Ce, Nd, Sm, Eu, Gd, Dy and Yb; these will be described later.

Results of a regional-scale aeromagnetic survey NTS 1:250 000-scale area 14E (Geological Survey of Canada, 1983) were incorporated into the online Geoscience Atlas of the Newfoundland and Labrador Department of Natural Resources (Davenport *et al.*, 1999).

The Geological Survey of Canada's National Geochemical Reconnaissance (NGR) lake-sampling program was carried out at a density of approximately one sample per 16 km^2 south of latitude 58.5º (Geological Survey of Canada, 1985; Friske *et al.,* 1993). The Labrador data comprise analyses of about 18 600 lake-sediment samples, for about 40 elements, and of about the same number of lake-water samples, for fluoride ion, uranium and pH. The data are available, without cost, for download from the Geoscience Atlas (*gis.geosurv.gov.nl.ca/resourceatlas/viewer.htm*) and also from the online database of Natural Resources Canada at *gdrdap.agg.nrcan.gc.ca/geodap*. The latter database includes analyses of more than 60 000 lake sediment and water samples from areas underlain by the Canadian Shield in the Northwest Territories, Nunavut, Alberta, Saskatchewan, Manitoba, Ontario and Labrador. The coverage of Labrador is exceptionally thorough, both in terms of the total area sampled and the large suite of elements for which the samples were analyzed.

INDUSTRY

Work carried out on the 3 NTS 1:50 000-scale areas occupied by the targets described herein, and filed for assessment, is summarized in Table 1. The more relevant results are as follows:

In 1996, a detailed helicopter-borne electromagnetic (EM) and magnetic survey was conducted over part of NTS map area 14E/06 by SIAL Géosciences Inc. on behalf of Southern Arizona Mining and Smelting Corp. (St-Hilaire, 1996). The work was filed for assessment by Rainbow Petroleum Group, which held a block of claims in the centre of 14E/06. In common with almost every company exploring in Labrador at that time, the target of the work was magmatic Cu–Ni–Co mineralization of the Voisey's Bay type. It is not known whether any fieldwork was carried out, but the claims were allowed to lapse in November 1997.

An airborne magnetic and EM survey was flown for Gallery Resources Ltd. over part of NTS map area 14E/07 in May 1996 (French *et al.*, 1996) and this was followed by prospecting, ground geophysics and diamond-drilling in 1997 (French and Syberg, 1997; French *et al.*, 1998) and 1999 (French and Woods, 1999). The claims have now lapsed.

Alterra Resources held a single claim block in the centre of NTS map area 14E/06 whose orientation follows that of part of the large semicircular magnetic anomaly (*see* below). No work was filed for assessment.

Vulcan Minerals held a block of claims (the North Dyke Property) over a dyke-like feature (as defined by the regional magnetic data, and more strongly by Southern Arizona's survey described above) northeast of the centre of NTS map area 14E/06 (Luffman, 1996). Their search for Cu–Ni–Co mineralization was unsuccessful, although the presence of pegmatites and rarer aplites, albeit without 'exotic minerals', was noted.

ROCK GEOCHEMISTRY

Figure 4 shows average F contents from four rock types of the Umiakovik Lake batholith, plotted against the sum of Y and all the analyzed REE (ΣREE). Data are from Emslie and Stirling

Table 1. Summary of field exploration work in study area

Company*	Year	Assessment File No.	Author(s)	Relevant NTS Sheets	Mapping	Prospecting	Stream Geochemistry	Lake Geochemistry	Soil Geochemistry	Till Geochemistry	Ground Magnetics	Ground EM	Aeromagnetic	Airborne EM	Drilling
First Choice Industries	1995	014E/0032	Gaudreault, D.	14E/02, 14E/07		X									
Consolidated Samarkand Resources	1996	014E/0036	Cheng, C.X.	14E05, 14E/06	X	X	X								
Mango Resources Ltd.	1996	014E/0046	St.-Hilaire, C.	14E/02, 14E/07									X	X	
Golden Trump Resources	1996	014E/0047	Mitchell, B. and Tallman, P.	14E/07		X	X						X	X	
Gallery Resources Ltd.	1996	014E/0054	French, V.A.. et al.	14E/07									X		
Birchwood Ventures Ltd.	1996	014E/0060	Burns T.E. et al.	14E/02		X							X	X	
Columbia Yukon Resources	1996	014E/0075	Lo, B.B.H.	14E/02									X	X	
Consolidated Viscount Resources Ltd.	1996	014E/0077	Brewer, K. and van Nostrand, T.	14E/02,14E/03	X	X					X	X			
Golden Trump Resources	1997	014E/0087	Emon, K. et al.	14E/07		X	X								
Castle Rock Exploration Corp.	1996	014E/0096	O'Sullivan, J.	14E/07		X									
Cartaway Resources Corp.	1995	014E/0098	Beesley, T.J.	14E/07		X									
Cartaway Container Corporation	1996	014E/0099	Woolham, R.W.	14E/02, 14E/07									X	X	
Essex Resource Corporation	1996	014E/0110	Barbour, D. et al.	14E/03, 14E/04, 14E/05, 14E/06		X									
Copper Hill Resources Inc.	1998	014E/0114	Wilton, D. and Lombardo, S	14E/07									X	X	
NDT Ventures Ltd.	1996	014E/0116	Burns, T.E. et al.	14E/03, 14E/04, 14E/05, 14E/06	X	X									
Gallery Resources Ltd.	1997	014E/0117	French, V.A. and Syberg, F.J.R	14E/07		X					X	X			X
Vulcan Minerals Inc.	1996	014E/0149	Luffman, G.	14E/06	X	X									
New Island Resources Ltd.	1999	014E/0159	French, V.A. and Hussey, A.	14E/07	X	X									
New Island Resources Ltd.	1999	014E/0160	French, V.A. and Hussey, A.	14E/07	X	X									
Gallery Resources Ltd.	1998	014E/0192	French, V.A. et al.	14E/07								X			X
Gallery Resources Ltd.	1998	014E/0195	French, V.A. and Hodge, R.	14E/07	X	X									
Castle Rock Exploration Corp.	1996	014E/0199	O'Sullivan, J.	14E/07		X							X	X	
Castle Rock Exploration Corp.	1996	014E/0201	O'Sullivan, J.	14E/07		X							X	X	
Gallery Resources Ltd.	1999	014E/0215	French, V. A. and Woods, D.V.	14E/07								X			X
Gallery Resources Ltd.	1999	014E/0216	French, V.A.	14E/07											X
Vulcan Minerals Inc.	2009	014E/0223	Walsh, D.	14E/05		X									
First Choice Industries	1995	LAB/1149	Woolham, R.W.	14E/07									X	X	
Southern Arizona Mining and Smelting Corp.	1996	LAB/1197	St.-Hilaire, C	14E/02, 14E/3, 14E/06									X	X	
Topper Gold Corporation	1996	LAB/1198	St.-Hilaire, C	14E/02									X	X	
Columbia Yukon Resources	1996	LAB/1199	Anderson, W.J. et al.	14E/02	X	X		X					X	X	
Copper Hill Resources Inc.	1997	LAB/1206	Wilton, D.	14E/07									X	X	
NDT Ventures Ltd.	1997	LAB/1208	Miller, R. et al.	14E/02	X	X					X	X			
Donner Resources	1996	LAB/1259	von Einsiedel, C.	14E/03			X						X	X	
Consolidated Magna Resources	1996	LAB/1292	Reeves, J.	14E/02		X	X								
Columbia Yukon Resources	1996	LAB/1332	Coates, H.J. et al.	14E/02		X					X	X			X
First Western Minerals	1997	LAB/1350	Duess, R.	14E/02	X	X									
Castle Rock Exploration Corp.	1996	LAB/1353	Fiset, N.	14E/02, 14E/07									X	X	

* Denotes first company listed on report cover

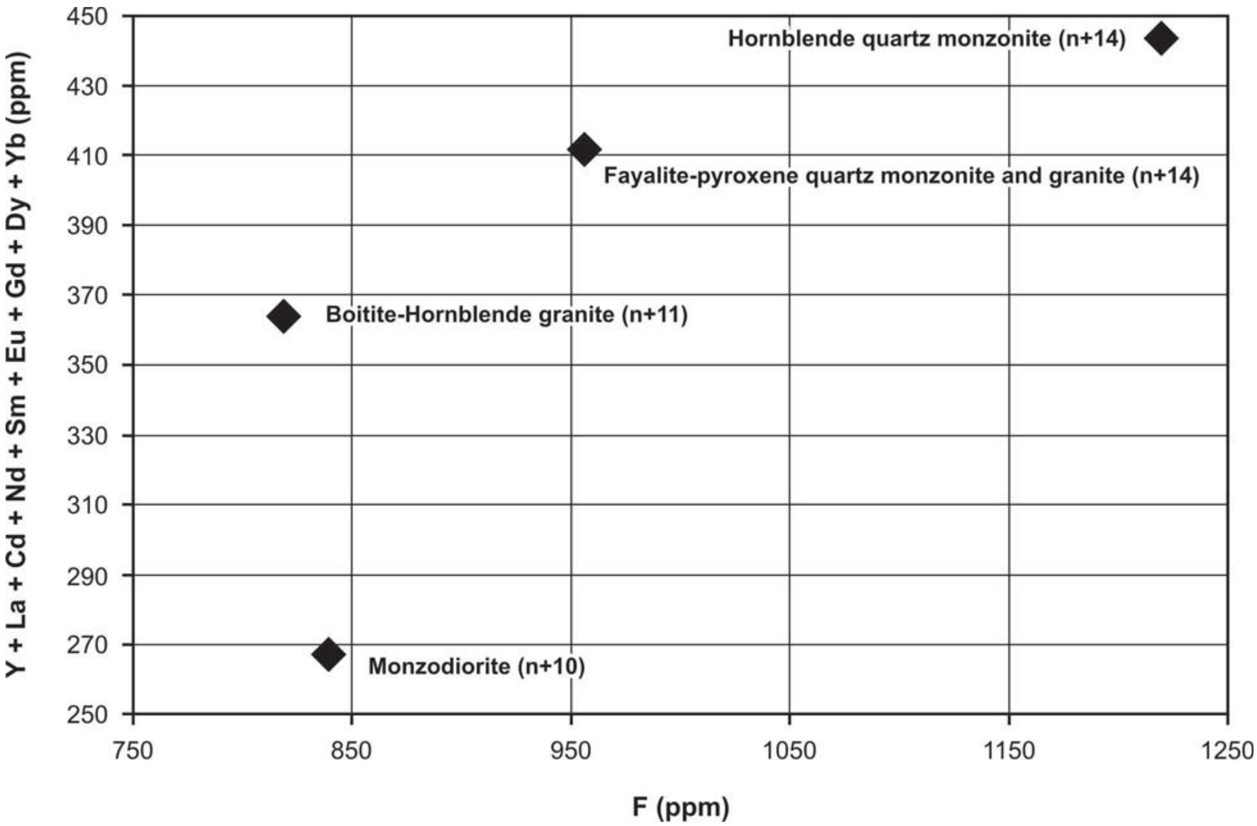

Figure 4. *Mean F and REE contents of rock types of the Umiakovik Lake pluton (data from Emslie and Stirling, 1993).*

(1993). The hornblende quartz monzonite rock type, which comprises most of the western half of the batholith (and underlies most of the anomalies of fluoride in lake water described below), is characterized by both the highest F (1220 ppm) and ΣREE (444 ppm) contents. Biotite–hornblende granite, which has restricted surface expression in the northeast of the batholith, has the lowest mean F content of 819 ppm (and ΣREE of 364 ppm), although monzodiorite (very limited exposure on the southeast contact) has a comparable F content at 839 ppm and much lower ΣREE (267 ppm).

LAKE SEDIMENT GEOCHEMISTRY

REGIONAL

Figures 5 and 6 show the regional distribution of fluoride in lake water (F_w) and lutetium (Lu) in lake sediment, as plotted from the NGR data. In contrast to the local maps described below, the bounds of the concentration class intervals have been determined by the application of Jenks' optimization (Slocum *et al.*, 2005), an option within ArcGIS 9.2, after a series of cross-validation tests to determine the optimum number of class intervals for each element.

Although all the analyzed REE show similar patterns, Lu is shown because it is generally present in much lower concentration levels than, for example, Ce and La, with the result that a signif-

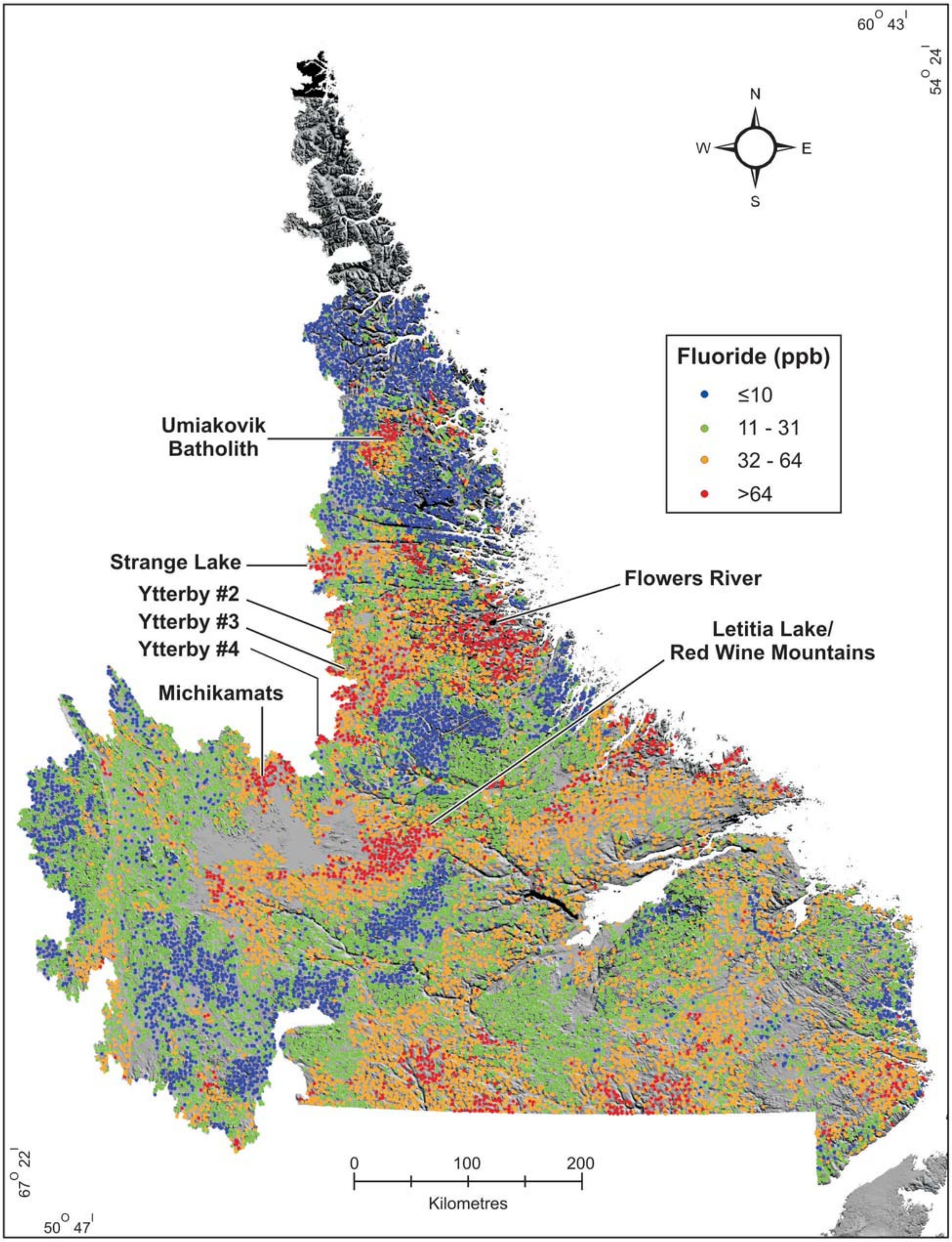

Figure 5. *Distribution of fluoride in water (F_w) in lake sediment, Labrador. Data class intervals are based on Jenks' Optimization (Slocum* et al.*, 2005).*

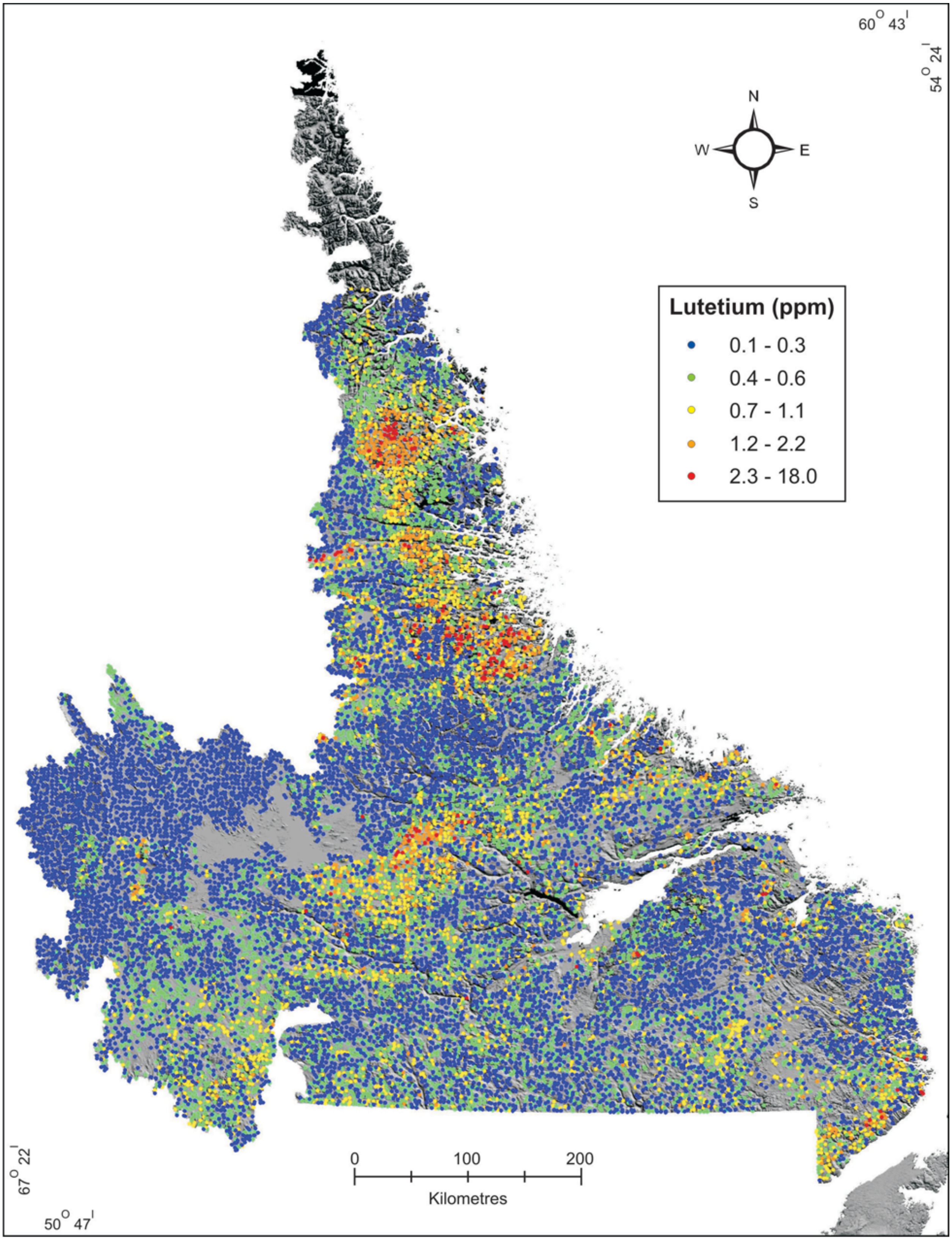

Figure 6. *Distribution of lutetium (Lu) in lake sediment, Labrador. Data class intervals are based on Jenks' Optimization (Slocum* et al.*, 2005).*

icant proportion of the values fall within the lowermost class interval, *i.e.*, less than the detection limit. This results in the emphasis of those areas where Lu (and the other REE) are present in higher concentrations. Both Lu and F_w highlight the Flowers River and Letitia Lake/Red Wine Mountains regions, as well as delineating the well-documented (*e.g.*, Batterson, 1989) dispersion train from the Strange Lake deposit. There is also a conspicuous concentration of values in the higher ranges of both parameters over the Umiakovik Lake batholith.

DETAILED

The class intervals representing analytical values in the more detailed maps are based on percentiles of the entire Labrador dataset, and make use of the terms 'anomalous', 'elevated' and 'background'. These terms are defined in Table 2.

Table 2. Definition of terms used to describe geochemical anomalies

Anomalous	indicates that the sample's content exceeds the 97.5-percentile, in a particular population of samples, of the element in question.
Elevated	indicates that the sample's content is less than or equal to the 97.5-percentile, but exceeds the 90-percentile, in a particular population of samples, of the element in question.
Background	refers to all values less than or equal to the 90-percentile, in a particular population of samples, of the element in question.

In any geochemical population where frequency distribution approximates some permutation of the Gaussian or 'normal' distribution, there will always be values that are defined as anomalous or elevated, according to the criteria described in Table 2. This is the case whether or not the values are either statistically or geochemically anomalous, and whether or not they have any spatial or genetic relationship with enrichment in bedrock of the element in question. Nevertheless, this method of anomaly identification has the advantage of allowing rapid first-pass plotting, and the significance of the anomalous and elevated samples can be assessed by examining their relationship to known geology, to the behaviour of other elements, or to each other.

The cut-off values for defining anomalous and elevated values, so defined, of the elements under consideration in this report are summarized in Tables 3a-c.

Table 3a. Cut-off values for defining elevated and anomalous values in lake waters

Element	Background	Elevated	Anomalous
F^-_w9	≤ 60	> 60 ≤ 110	> 110

Note: Values are derived from 90- and 97.5-percentiles of Labrador NGR dataset and expressed in ppb. Numeric suffix '9' indicates Ion-Specific Electrode (ISE) analysis

Table 3b. Cut-off values for defining elevated and anomalous values of REE and related elements in lake sediments

Element	Background	Elevated	Anomalous
Ce1	≤ 220	> 220 ≤ 400	> 400
Eu1	≤ 3	> 3 ≤ 4	> 4
La1	≤ 110	> 110 ≤ 190	> 190
Lu1	≤ 1.0	> 1.0 ≤ 1.5	> 1.5
Mo1	≤ 7	> 7 ≤ 19	> 19
Mo5	≤ 8	> 8 ≤ 19	> 19
Sm1	≤ 14.0	> 14.0 ≤ 24.9	> 24.9
Tb1	≤ 2.0	> 2.0 ≤ 3.1	> 3.1
Th1	≤ 11	> 11 ≤ 16	> 16
U1	≤ 7	> 7 ≤ 19	> 19
U8	≤ 7	> 7 ≤ 19	> 19
Yb1	≤ 4	> 4 ≤ 8	> 8

Note: Values are derived from 90- and 97.5-percentiles of Labrador NGR dataset and expressed in ppm. Numeric suffix '1' indicates analysis by Instrumental Neutron Activation Analysis (INAA); '5' indicates Atomic-Absorption Spectrometry (AAS) after HNO3 digestion; and '8' indicates Delayed Neutron Counting (DNC) analysis

Table 3c. Cut-off values for defining elevated and anomalous values of other elements in lake sediments

Element	Background	Elevated	Anomalous
Au1 (ppb)	≤3	>3 ≤ 5	> 5
Cd3	≤ 0.3	>0.3 ≤ 0.6	> 0.6
Co3	≤ 22	>22 ≤ 41	> 41
F9	≤ 400	>400 ≤ 560	> 560
Fe1 (%)	≤ 8.0	>8.0 ≤ 13.0	> 13.0
Hf1	≤ 8	> 8 ≤ 13	> 13
Mn3	≤ 905	>905 ≤ 3117	> 3117
Na1 (%)	≤ 2.00	> 2.00 ≤ 2.89	> 2.89
Rb1	≤ 68	>68 ≤ 95	> 95
Sc1	≤ 15	>15 ≤ 18	> 18

Note: Values are derived from 90- and 97.5-percentiles of Labrador NGR dataset and expressed in ppm unless otherwise stated. Numeric suffix '1' indicates analysis by Instrumental Neutron Activation Analysis (INAA); '3' indicates Atomic-Absorption Spectrometry (AAS) after aqua-regia digestion; and '9' indicates Ion-Specific Electrode (ISE) analysis

Figure 7 shows the distribution of fluoride in water, superimposed on bedrock geology, on the quadrangle made up of NTS map areas 14E/02 to 14E/07, and 14E/10 to 14E/12. Three spatial concentrations of anomalous or elevated values, as defined above, are present; the analyses of their component samples are summarized in Tables 4-6.

NORTH RIVER (NR) ANOMALY

The North River Anomaly, centred on 57.4ºN, 63.1ºW, is the largest and most significant of the three anomalies, comprising 28 samples that are anomalous or elevated in fluoride in water (maximum value 300 ppb; Tables 4a and 4b, Figure 7) and REE (Figures 8–12). Most of the anomaly is situated over hornblende granite (Emslie and Stirling, 1993), although its southeastern corner overlies biotite–hornblende granite. However, anomalous or elevated values of the REE, especially Lu (Figure 10; *cf.* Figure 6) extend over most of the Umiakovik Lake batholith to the southeast (but not to the west and south) and are not restricted to the bounds of the North River, Kingurutik River, South or Kingurutik River, North anomalies (*see* below).

Other elements are present in lake sediments to anomalous or elevated levels within the NR anomaly only, and not outside it, notably Mo (Figure 13) and U (Figure 14); whereas Th defines an anomaly in lake sediment similar to that of the REE, extending outside the bounds of the anomalies and over most of the Umiakovik Lake batholith (Figure 15). The association of enriched Mo and U with REE mineralization has also been noted down-ice of REE deposits at Strange Lake in Labrador (in NGR data) and at Misery Lake (*in* Québec Government data; C. Maurice, personal communication, 2010).

Other elements displaying anomalous or elevated values in samples within the bounds of the anomaly include fluorine (in lake sediment), Hf, Sc and Na, although the high values are not confined exclusively within the anomaly's bounds.

KINGURUTIK RIVER, SOUTH (KRS) ANOMALY

The Kingurutik River, South (KRS) anomaly (Tables 5a and 5b) is separated from both the North River and Kingurutik River, North (*see* below) anomalies by samples that returned background values of fluoride in lake water. However, anomalous or elevated values of REE and Th in lake sediments overlap all three anomalies and the areas between them. Unlike the almost equidimensional North River Anomaly, the KRS Anomaly is arcuate, with two arms trending east-northeast and south-southeast, and their apex at 57.2ºN, 63.5ºW is 25 km southwest of the centre of the North River Anomaly.

The KRS anomaly comprises 20 samples; besides fluoride in water, the REE lake-sediment characteristics are similar to those of the North River Anomaly with the strongest responses in Lu, Sm and Th. Anomalous and elevated Mo values are concentrated in the southerly-trending arm. Other elements displaying anomalous or (mainly) elevated values in sediments are Cd, F, Na, Hf, Sc and Au.

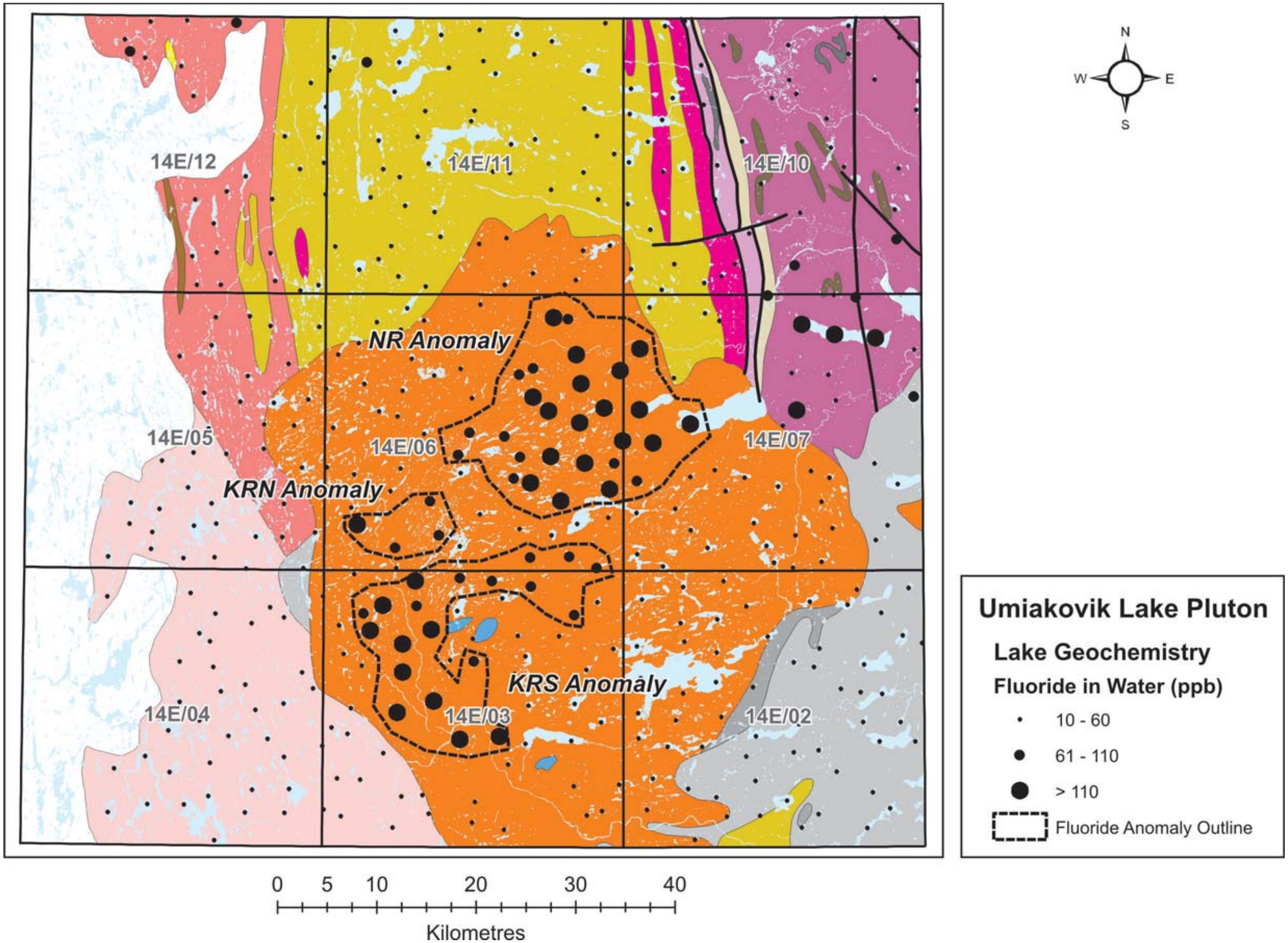

Figure 7. *Anomalous and elevated values of fluoride ion in water, Umiakovik Lake batholith and surrounds, superimposed on regional geology, with outlines of NR, KRN and KRS (fluoride) anomalies.* See *Figure 2 for explanation of geological units.*

Table 4a. Component samples of North River Anomaly, with analyses of REE and related elements

SAMPLE_ID	NTS	Latitude NAD27	Longitude NAD27	Fw9 ppb	Ce1 ppm	Eu1 ppm	La1 ppm	Lu1 ppm	Sm1 ppm	Tb1 ppm	Yb1 ppm	Mo1 ppm	Mo5 ppm	Th1 ppm	U1 ppm	U8 ppm
851114	14E	57.4779	-63.0929	110	527	4	307	2.2	31.1	3.7	7	1	4	37.9	7.2	8.5
851115	14E	57.4790	-63.1176	120	400	4	254	2.4	27.4	3.3	8	1	8	32.2	6.5	7.1
851148	14E	57.4072	-63.1519	150	470	1	249	2.0	20.9	2.6	6	4	14	20.0	7.4	7.2
851149	14E	57.4277	-63.1748	100	230	2	140	1.5	14.5	1.8	5	14	18	15.0	5.4	6.0
851150	14E	57.4334	-63.1512	90	400	2	234	2.0	20.2	2.6	7	29	34	24.0	5.6	6.2
851151	14E	57.4457	-63.0797	140	260	3	130	1.0	14.2	1.4	3	1	2	15.0	3.8	4.0
851413	14E	57.4510	-62.9729	130	543	6	325	4.5	33.6	4.7	14	1	8	35.0	6.9	6.9
851414	14E	57.4311	-63.0062	230	818	6	431	4.1	32.4	4.3	14	1	22	29.8	11.0	12.0
851415	14E	57.4192	-63.0716	210	595	1	312	2.3	25.9	3.3	7	1	18	36.9	10.0	12.7
851416	14E	57.3947	-63.1260	200	609	3	310	2.4	30.9	3.7	8	2	18	34.9	14.0	13.5
851417	14E	57.3718	-63.1992	100	380	7	238	1.6	20.6	2.3	6	4	14	18.0	5.6	6.3
851418	14E	57.3750	-63.2572	100	230	3	120	1.3	14.6	1.9	4	1	2	13.0	4.6	4.9
851450	14E	57.3548	-63.2763	110	210	3	120	1.3	16.4	2.0	5	1	8	14.0	5.0	4.8
851452	14E	57.3529	-63.1727	82	230	3	120	1.4	13.5	1.6	4	1	6	12.0	3.3	3.4
851454	14E	57.3534	-63.1222	140	490	2	222	2.6	22.8	3.0	8	1	12	23.3	12.0	11.5
851455	14E	57.3840	-63.0732	130	636	4	340	4.5	30.4	4.4	13	1	18	30.0	16.0	14.7
851456	14E	57.3474	-63.0654	140	400	3	235	3.2	24.0	3.1	10	1	8	20.7	11.0	10.1
851457	14E	57.3473	-63.0149	68	290	2	170	1.9	16.9	2.4	6	1	4	14.0	5.6	4.4
851458	14E	57.3677	-63.0021	150	430	4	248	3.3	26.5	3.6	10	1	12	26.1	12.0	11.7
851459	14E	57.3974	-63.0327	130	460	4	281	5.0	27.0	4.2	17	1	12	22.3	16.0	15.4
851460	14E	57.3957	-62.9738	300	748	4	314	4.4	36.2	5.1	14	1	16	31.9	14.0	12.0
851462	14E	57.3830	-62.8882	220	210	1	95	0.6	12.9	1.6	2	1	2	18.0	2.6	2.4
851529	14E	57.3336	-63.1829	76	270	3	110	1.2	16.0	1.7	7	5	4	14.0	4.1	3.9
851530	14E	57.3296	-63.1558	200	240	3	100	1.2	15.2	1.6	7	3	2	11.0	3.6	3.0
851531	14E	57.3133	-63.1051	120	350	2	130	1.8	21.4	2.4	9	4	4	21.0	3.1	2.6
851532	14E	57.3238	-63.0238	120	898	4	342	4.4	42.5	5.3	28	17	16	33.6	16.0	14.2
851533	14E	57.3314	-62.9768	68	509	2	227	2.6	31.4	3.7	17	8	8	31.7	7.7	6.7
851534	14E	57.3658	-62.9513	260	591	3	339	11.0	77.6	13.0	70	15	18	33.5	85.7	81.6

Note: Red text indicates 'anomalous' values exceeding 97.5-percentile for samples collected throughout Labrador; blue text indicates 'elevated' values exceeding 90-percentile for the same population. Numeric suffix '1' indicates analysis by Instrumental Neutron Activation Analysis (INAA); '5' indicates Atomic-Absorption Spectrometry (AAS) after HNO3 digestion; '8' indicates Delayed Neutron Counting (DNC) analysis; and '9' indicates ion-specific electrode (ISE) analysis.

Table 4b. Component samples of North River Anomaly, with other anomalous and elevated elements

SAMPLE_ID	NTS	Latitude NAD27	Longitude NAD27	F9 ppm	Hf1 ppm	Sc1 ppm	Na1 %	Fe1 %	Mn3 ppm	Co3 ppm	Rb1 ppm
851114	14E	57.4779	-63.0929	600	8	12.0	1.2	4.1	165	4	54
851115	14E	57.4790	-63.1176	620	12	15.0	1.5	5.2	210	5	83
851148	14E	57.4072	-63.1519	350	6	12.0	1.2	7.5	3300	52	23
851149	14E	57.4277	-63.1748	400	6	11.0	1.3	11.0	145	12	28
851150	14E	57.4334	-63.1512	200	8	10.0	1.0	20.5	100	5	49
851151	14E	57.4457	-63.0797	320	4	6.9	0.8	2.8	280	7	22
851413	14E	57.4510	-62.9729	780	19	20.5	1.7	9.1	440	9	81
851414	14E	57.4311	-63.0062	960	7	15.0	1.1	12.0	17500	50	35
851415	14E	57.4192	-63.0716	640	8	9.3	1.0	7.2	540	7	52
851416	14E	57.3947	-63.1260	640	11	15.0	1.7	9.3	210	7	51
851417	14E	57.3718	-63.1992	550	5	12.0	1.0	6.7	160	6	11
851418	14E	57.3750	-63.2572	480	14	18.0	2.3	4.4	90	5	56
851450	14E	57.3548	-63.2763	520	8	13.0	1.4	4.6	110	5	31
851452	14E	57.3529	-63.1727	440	8	13.0	1.8	6.0	100	5	30
851454	14E	57.3534	-63.1222	480	8	17.0	2.2	5.7	180	11	64
851455	14E	57.3840	-63.0732	680	10	17.0	1.7	8.6	720	24	61
851456	14E	57.3474	-63.0654	650	16	16.0	2.0	5.0	95	3	60
851457	14E	57.3473	-63.0149	560	13	16.0	2.2	5.2	90	4	55
851458	14E	57.3677	-63.0021	780	14	15.0	1.6	5.3	95	4	44
851459	14E	57.3974	-63.0327	680	9	14.0	1.5	4.3	175	5	59
851460	14E	57.3957	-62.9738	1000	14	18.0	2.1	10.0	3100	19	89
851462	14E	57.3830	-62.8882	880	6	18.0	2.2	7.7	1150	18	130
851529	14E	57.3336	-63.1829	290	7	16.0	2.0	7.9	110	6	39
851530	14E	57.3296	-63.1558	380	14	16.0	2.9	3.6	50	3	45
851531	14E	57.3133	-63.1051	540	13	16.0	2.3	6.2	180	8	68
851532	14E	57.3238	-63.0238	380	10	19.0	1.8	12.0	3800	32	42
851533	14E	57.3314	-62.9768	640	19	20.0	2.3	6.2	135	35	79
851534	14E	57.3658	-62.9513	620	13	16.0	1.7	3.2	95	5	43

Note: Red text indicates 'anomalous' values exceeding 97.5-percentile for samples collected throughout Labrador; blue text indicates 'elevated' values exceeding 90-percentile for the same population. Numeric suffix '1' indicates analysis by Instrumental Neutron Activation Analysis (INAA); '3' indicates Atomic-Absorption Spectrometry (AAS) after aqua-regia digestion; and '9' indicates Ion-Specific Electrode (ISE) analysis.

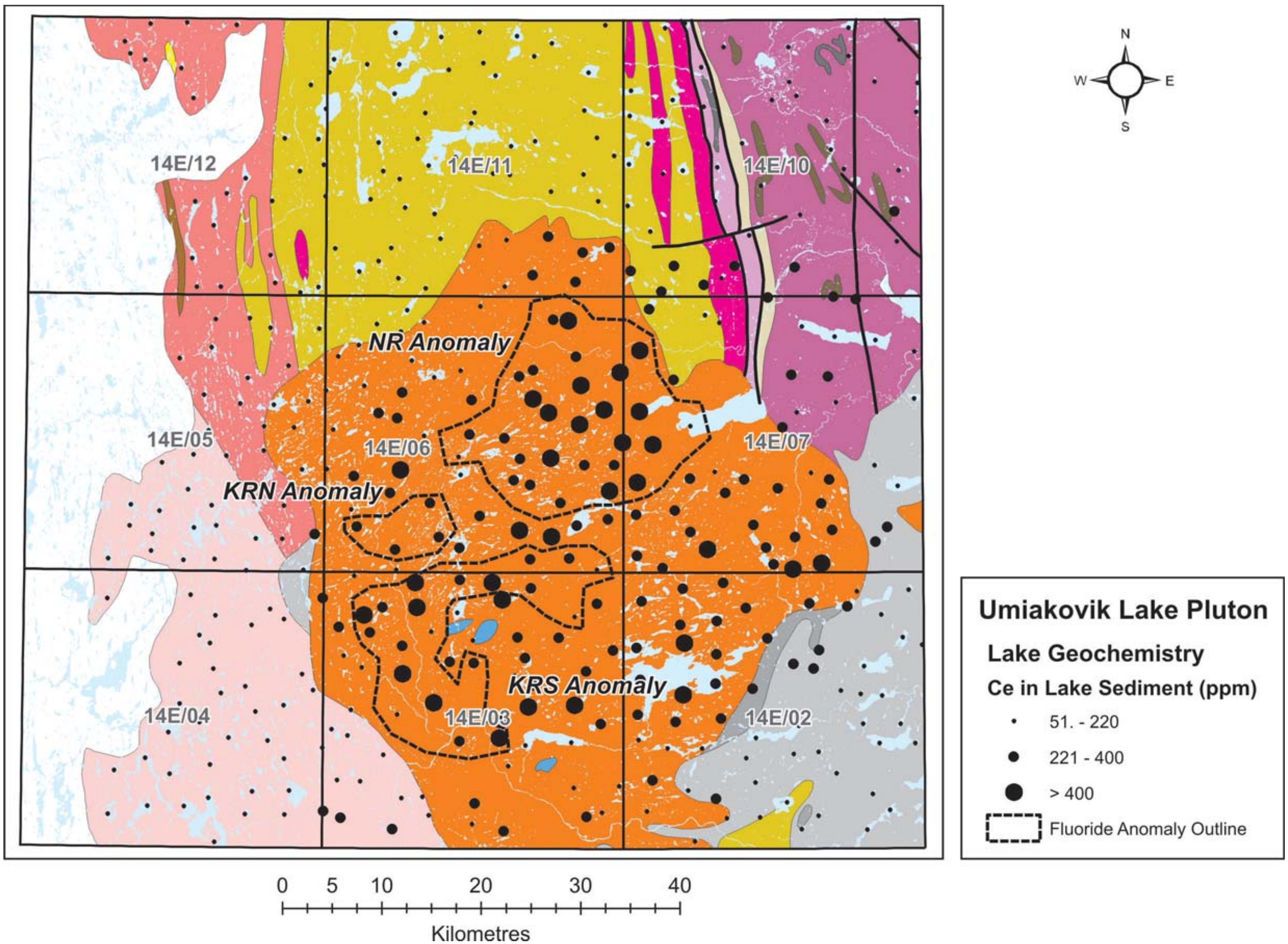

Figure 8. *Anomalous and elevated values of Ce in lake sediment, Umiakovik Lake batholith and surrounds, superimposed on regional geology, with outlines of NR, KRN and KRS (fluoride) anomalies.* See *Figure 2 for explanation of geological units.*

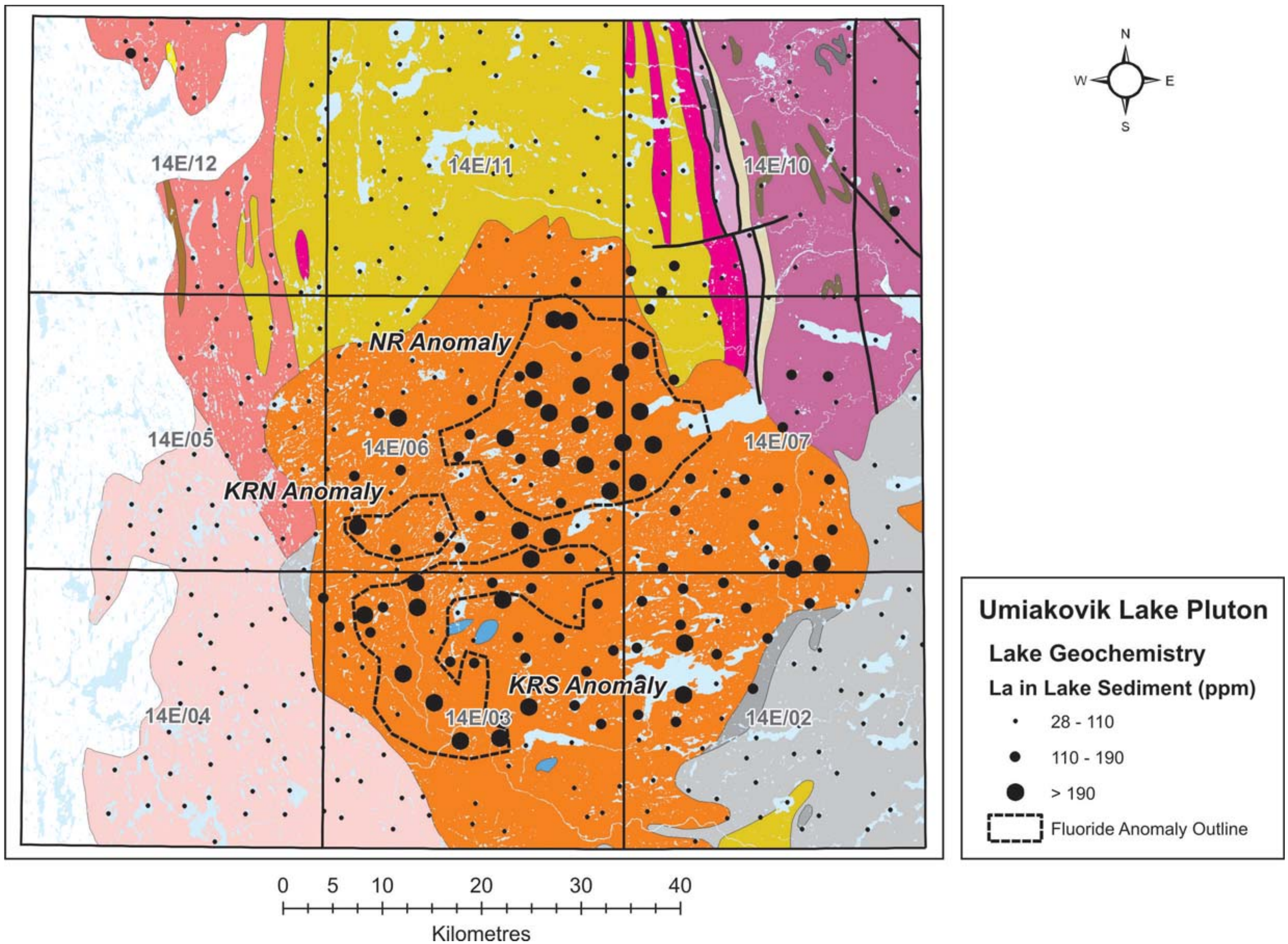

Figure 9. *Anomalous and elevated values of La in lake sediment, Umiakovik Lake batholith and surrounds, superimposed on regional geology, with outlines of NR, KRN and KRS (fluoride) anomalies.* See *Figure 2 for explanation of geological units.*

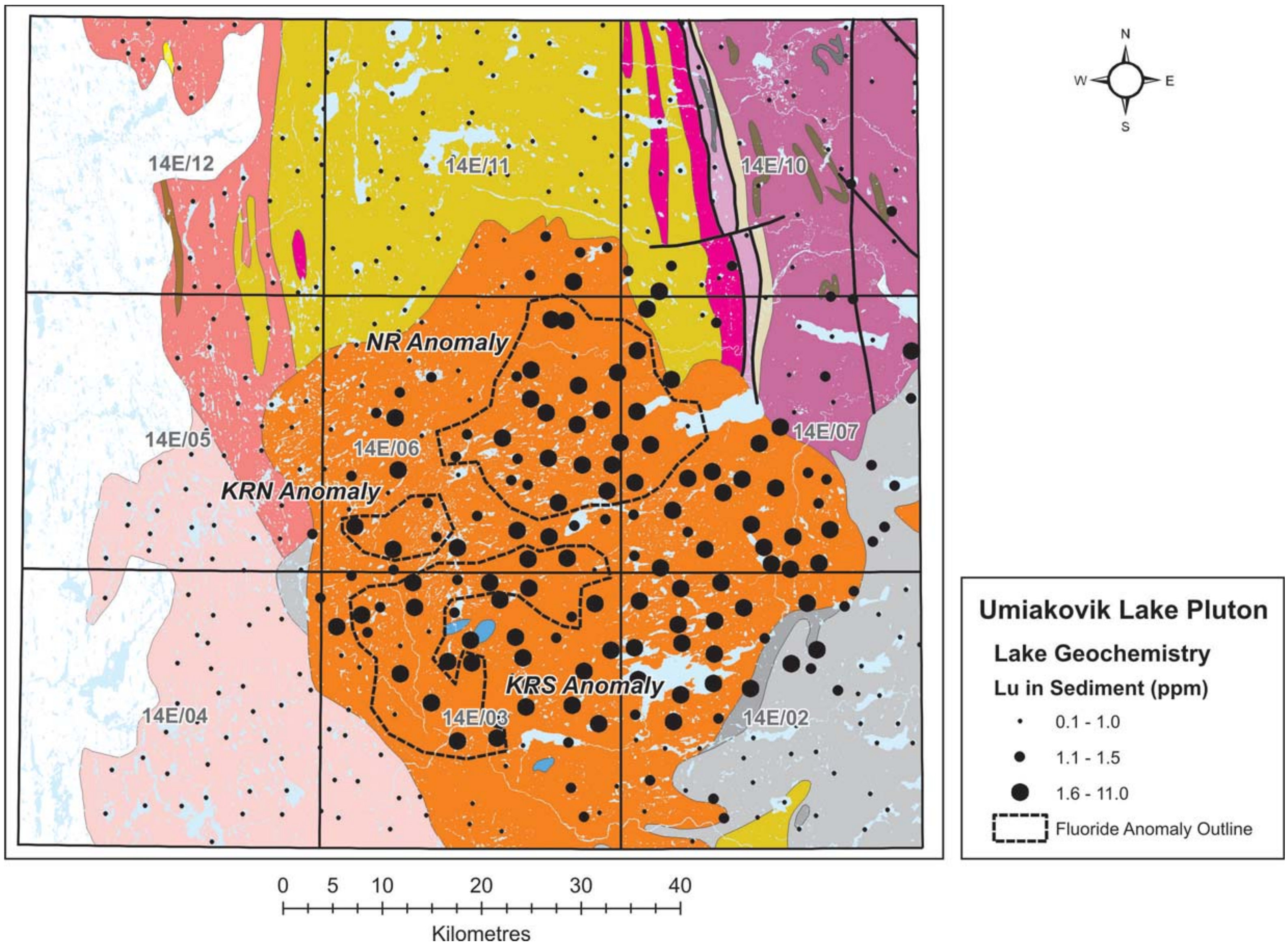

Figure 10. *Anomalous and elevated values of Lu in lake sediment, Umiakovik Lake batholith and surrounds, superimposed on regional geology, with outlines of NR, KRN and KRS (fluoride) anomalies.* See *Figure 2 for explanation of geological units.*

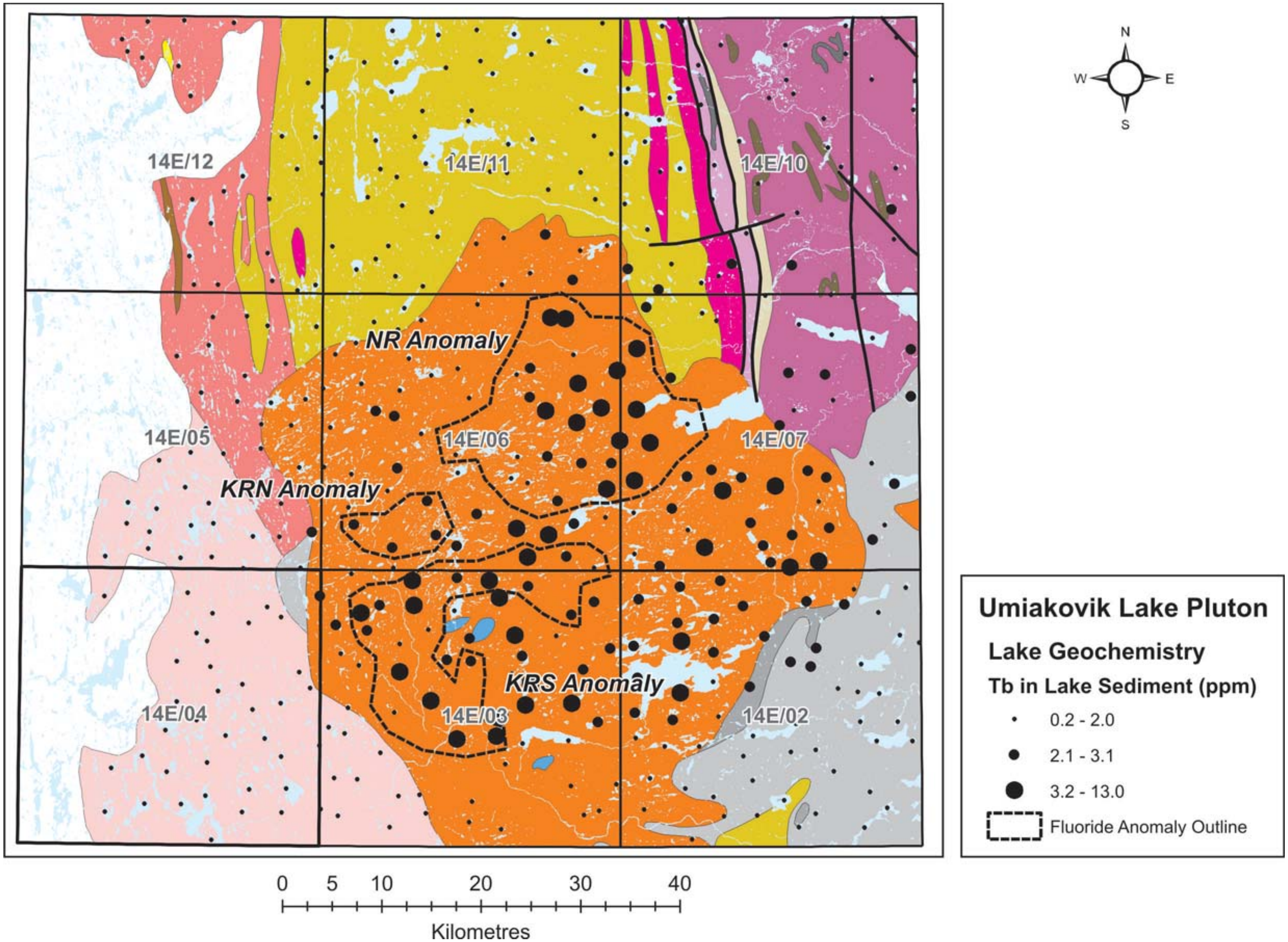

Figure 11. *Anomalous and elevated values of Tb in lake sediment, Umiakovik Lake batholith and surrounds, superimposed on regional geology, with outlines of NR, KRN and KRS (fluoride) anomalies.* See *Figure 2 for explanation of geological units.*

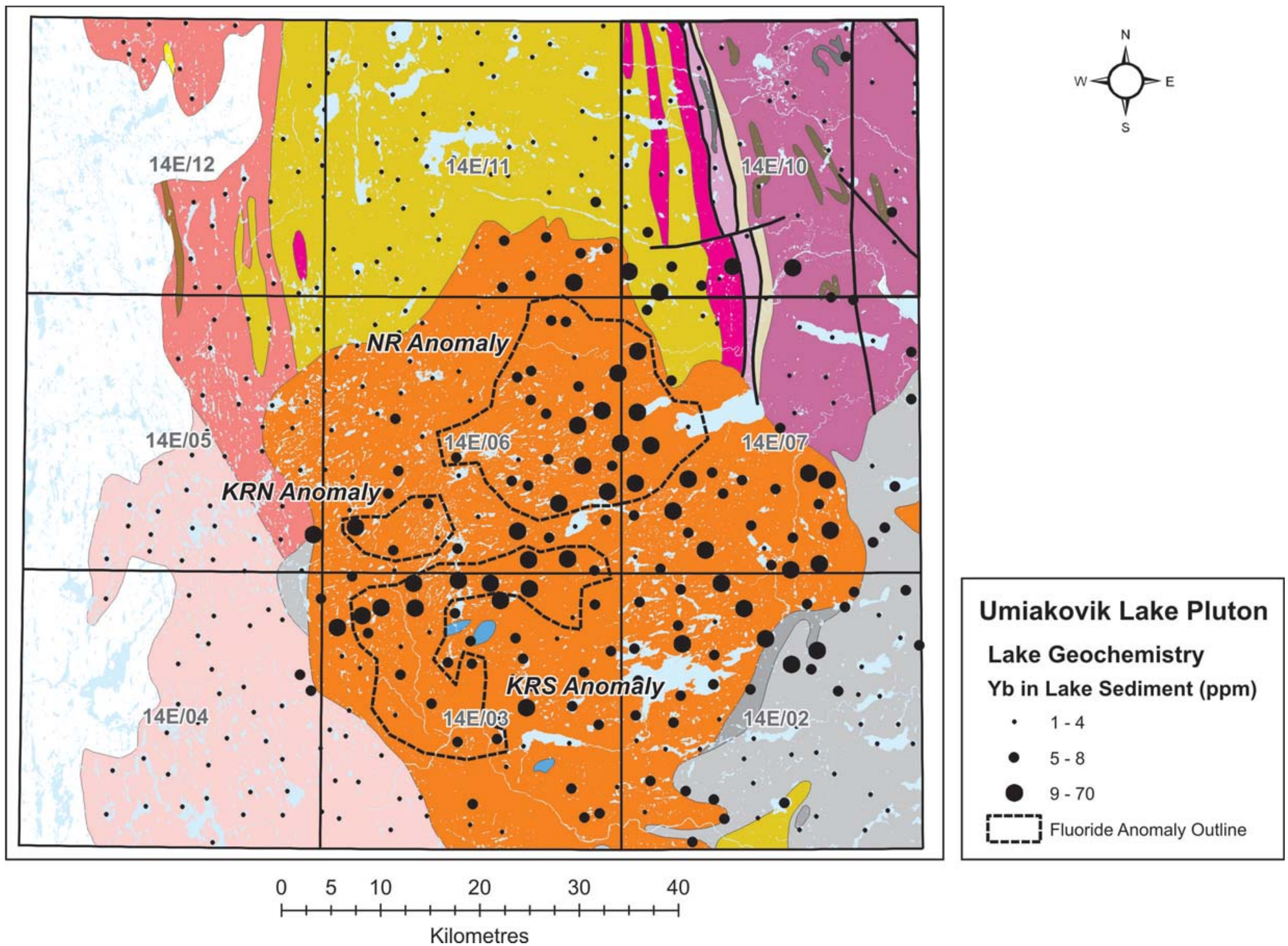

Figure 12. *Anomalous and elevated values of Yb in lake sediment, Umiakovik Lake batholith and surrounds, superimposed on regional geology, with outlines of NR, KRN and KRS (fluoride) anomalies.* See *Figure 2 for explanation of geological units.*

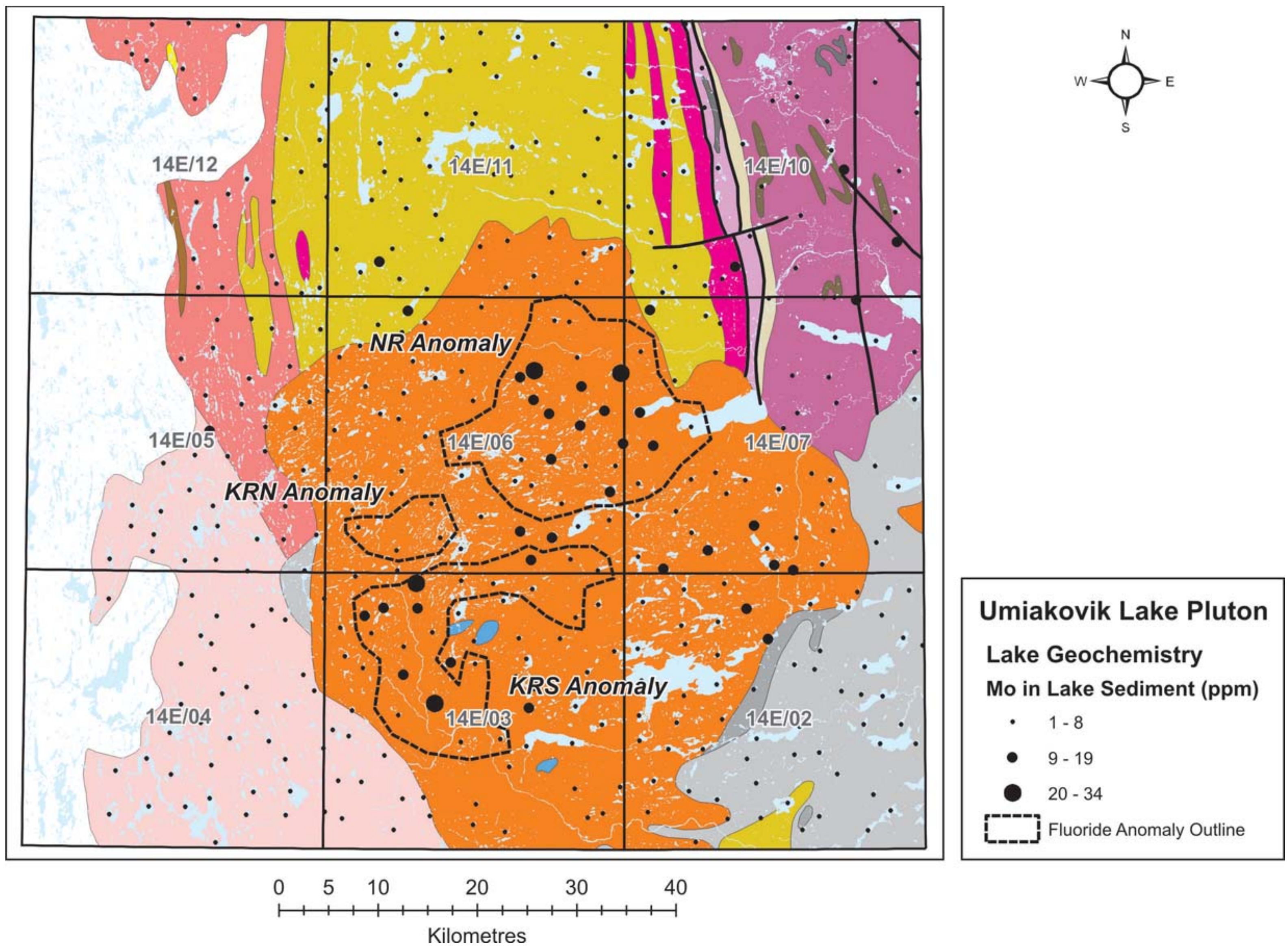

Figure 13. *Anomalous and elevated values of Mo in lake sediment, Umiakovik Lake batholith and surrounds, superimposed on regional geology, with outlines of NR, KRN and KRS (fluoride) anomalies.* See *Figure 2 for explanation of geological units.*

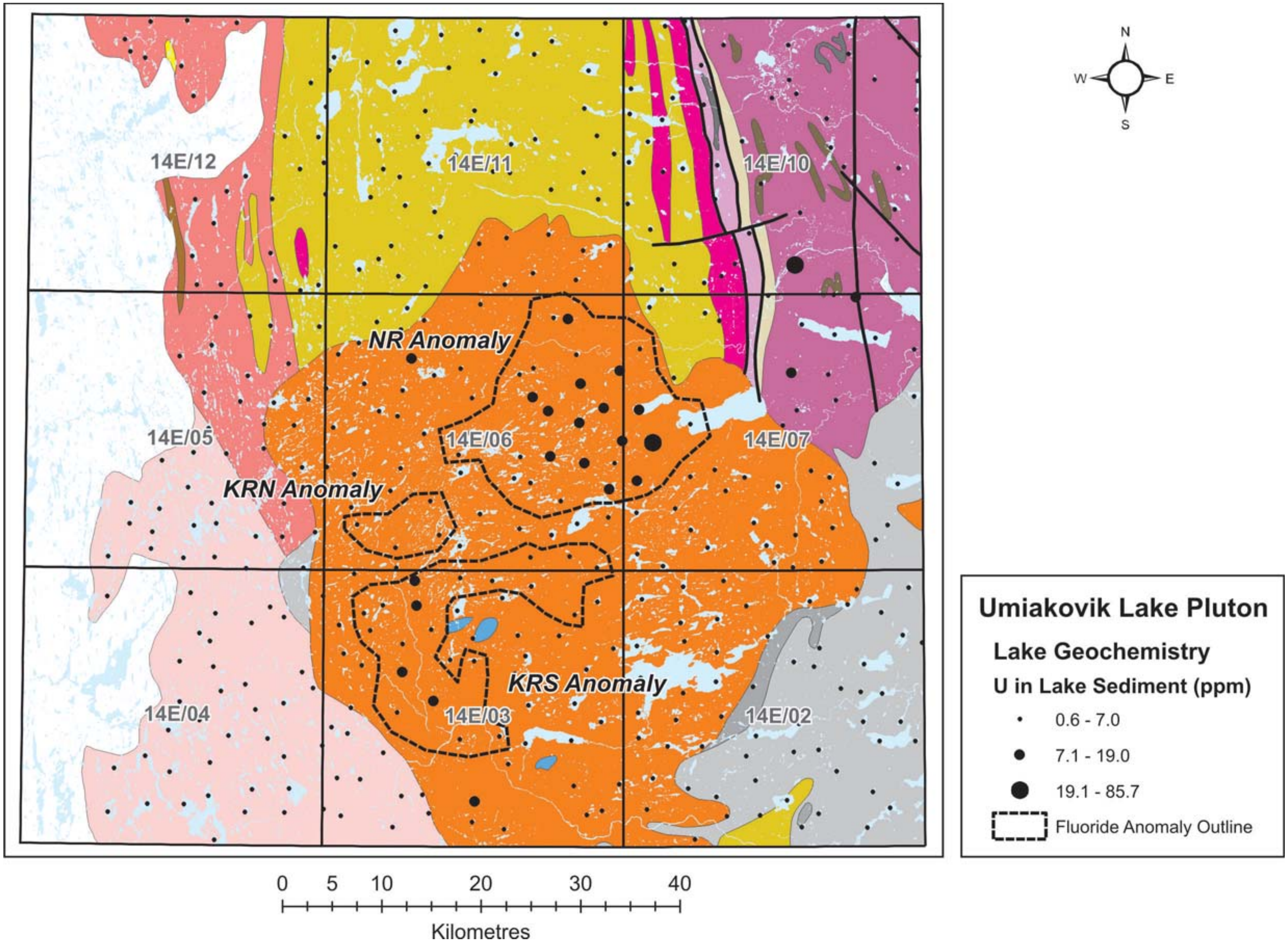

Figure 14. *Anomalous and elevated values of U in lake sediment, Umiakovik Lake batholith and surrounds, superimposed on regional geology, with outlines of NR, KRN and KRS (fluoride) anomalies.* See *Figure 2 for explanation of geological units.*

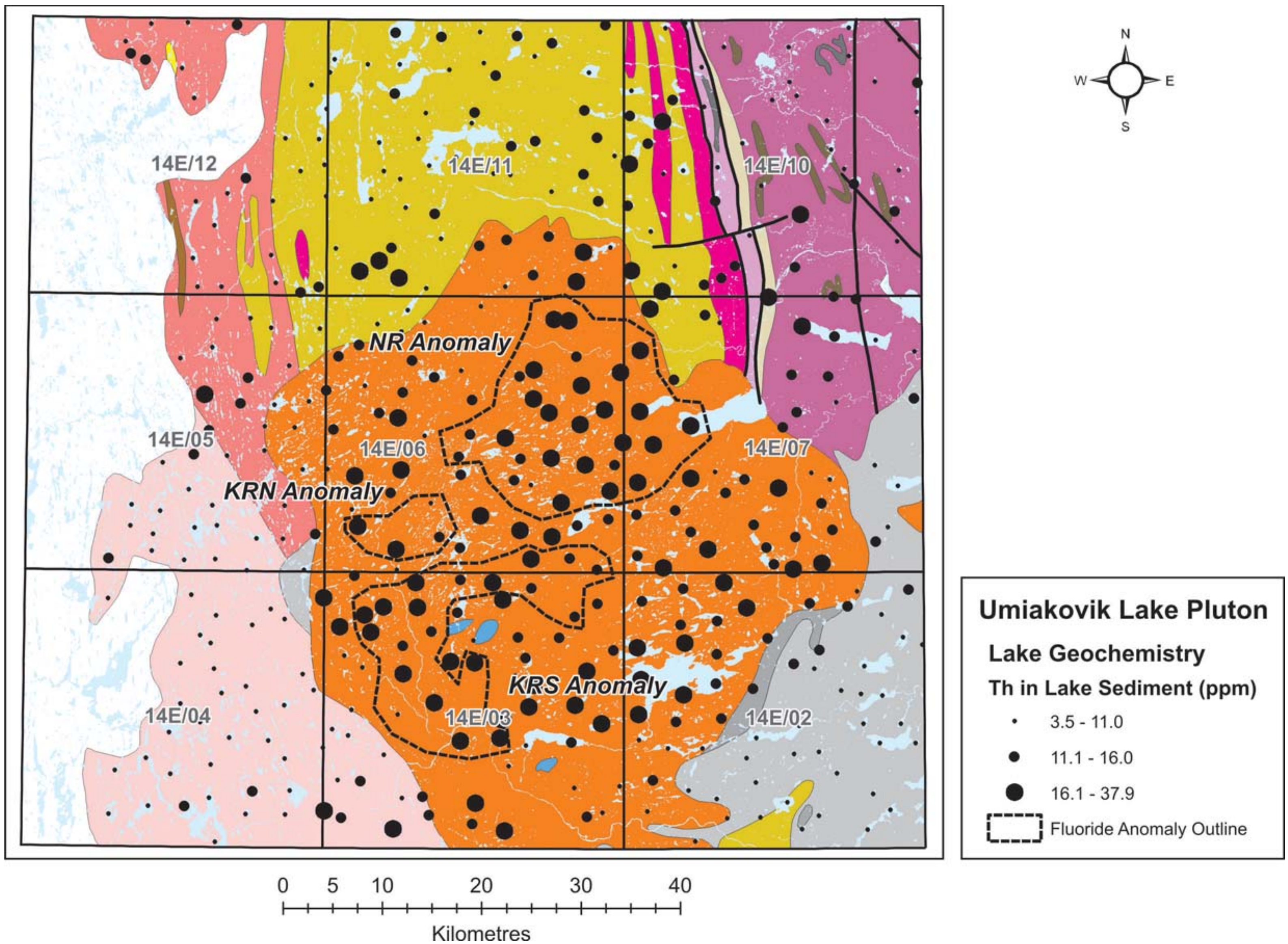

Figure 15. *Anomalous and elevated values of Th in lake sediment, Umiakovik Lake batholith and surrounds, superimposed on regional geology, with outlines of NR, KRN and KRS (fluoride) anomalies.* See *Figure 2 for explanation of geological units.*

Table 5a. Component samples of Kingurutik River, South Anomaly, with analyses of REE and related elements

SAMPLE_ID	NTS	Latitude NAD27	Longitude NAD27	Fw9 ppb	Ce1 ppm	Eu1 ppm	La1 ppm	Lu1 ppm	Sm1 ppm	Tb1 ppm	Yb1 ppm	Mo1 ppm	Mo5 ppm	Th1 ppm	U1 ppm	U8 ppm
851670	14E	57.1002	-63.2063	140	430	7	230	2.3	25.3	3.4	7	1	4	25.1	5.0	4.5
851671	14E	57.0971	-63.2719	250	360	2	208	2.2	25.3	3.2	7	1	4	26.7	5.6	5.6
851688	14E	57.1955	-63.4221	150	360	2	180	1.4	27.2	2.6	7	3	2	24.0	6.2	5.9
851690	14E	57.2181	-63.3448	110	576	4	284	2.5	36.6	4.0	17	15	14	34.4	7.5	8.6
851693	14E	57.2359	-63.1542	78	300	4	150	2.0	27.4	3.1	12	4	2	15.0	2.6	2.7
851694	14E	57.2528	-63.0448	70	220	3	93	1.0	15.3	1.7	7	1	1	12.0	1.6	1.7
851695	14E	57.2629	-63.0901	64	360	2	160	1.9	24.8	2.9	12	4	4	16.0	2.5	2.3
851696	14E	57.2623	-63.1556	100	390	4	216	2.1	32.2	3.5	14	12	14	17.0	4.1	4.9
851697	14E	57.2408	-63.2189	76	490	3	190	1.9	29.2	3.3	12	6	6	18.0	3.4	3.8
851698	14E	57.2432	-63.2722	70	230	3	100	1.5	20.3	2.3	10	2	2	12.0	2.2	2.5
851699	14E	57.2406	-63.3474	200	450	4	227	2.0	32.1	3.6	14	21	22	26.3	8.9	9.7
851700	14E	57.2183	-63.4014	160	330	1	180	1.2	25.4	2.6	9	16	16	21.8	5.9	6.6
851702	14E	57.2111	-63.4327	110	518	2	240	2.0	28.1	3.3	12	14	16	27.2	5.5	5.2
851839	14E	57.2103	-63.0817	92	220	3	100	1.5	16.3	2.2	4	1	1	12.0	2.2	3.1
851845	14E	57.1965	-63.3209	120	200	1	110	1.0	12.2	1.3	3	1	7	13.0	2.7	2.7
851846	14E	57.1833	-63.3680	220	230	2	82	1.0	11.5	1.4	3	1	7	13.0	3.7	3.3
851847	14E	57.1579	-63.3676	430	490	5	288	1.9	31.8	3.4	7	1	12	20.8	9.4	10.3
851848	14E	57.1215	-63.3766	170	160	2	83	0.6	10.7	1.1	2	1	7	9.5	2.6	2.9
851849	14E	57.1317	-63.3160	190	501	4	272	1.6	33.6	3.6	6	11	28	19.0	10.0	9.5
851851	14E	57.1681	-63.2490	72	280	3	130	1.8	19.3	2.3	5	1	5	17.0	2.5	1.9

Note: Red text indicates 'anomalous' values exceeding 97.5-percentile for samples collected throughout Labrador; blue text indicates 'elevated' values exceeding 90-percentile for the same population. Numeric suffix '1' indicates analysis by Instrumental Neutron Activation Analysis (INAA); '5' indicates Atomic-Absorption Spectrometry (AAS) after HNO3 digestion; '8' indicates Delayed Neutron Counting (DNC) analysis; and '9' indicates ion-specific electrode (ISE) analysis.

Table 5b. Component samples of Kingurutik River, South Anomaly, with other anomalous and elevated elements

SAMPLE_ID	NTS	Latitude NAD27	Longitude NAD27	Cd3 ppm	F9 ppm	Na1 %	Hf1 ppm	Sc1 ppm	Au1 ppb	Mn3 ppm
851670	14E	57.1002	-63.2063	0.8	420	1.8	5	16.0	1	1600
851671	14E	57.0971	-63.2719	0.2	640	1.8	9	19.0	1	350
851688	14E	57.1955	-63.4221	0.4	360	2.0	8	10.0	7	70
851690	14E	57.2181	-63.3448	0.4	440	1.6	5	14.0	1	730
851693	14E	57.2359	-63.1542	0.1	400	1.9	10	14.0	1	105
851694	14E	57.2528	-63.0448	0.1	350	2.4	9	14.0	1	120
851695	14E	57.2629	-63.0901	0.2	340	1.4	9	12.0	1	80
851696	14E	57.2623	-63.1556	0.2	440	1.4	5	11.0	1	80
851697	14E	57.2408	-63.2189	0.6	320	2.1	8	14.0	1	1150
851698	14E	57.2432	-63.2722	0.4	300	1.7	7	12.0	1	95
851699	14E	57.2406	-63.3474	0.6	520	1.0	3	9.2	6	140
851700	14E	57.2183	-63.4014	0.2	300	1.2	3	8.1	5	100
851702	14E	57.2111	-63.4327	0.4	300	1.7	6	13.0	1	9300
851839	14E	57.2103	-63.0817	0.1	370	2.6	13	17.0	1	95
851845	14E	57.1965	-63.3209	0.1	330	2.2	7	12.0	1	100
851846	14E	57.1833	-63.3680	0.1	460	2.9	8	14.0	1	980
851847	14E	57.1579	-63.3676	0.6	550	0.9	3	7.2	1	50
851848	14E	57.1215	-63.3766	0.4	370	1.9	5	11.0	1	325
851849	14E	57.1317	-63.3160	0.4	560	0.9	2	8.9	1	210
851851	14E	57.1681	-63.2490	0.1	500	2.6	11	20.0	1	135

Note: Red text indicates 'anomalous' values exceeding 97.5-percentile for samples collected throughout Labrador; blue text indicates 'elevated' values exceeding 90-percentile for the same population. Numeric suffix '1' indicates analysis by Instrumental Neutron Activation Analysis (INAA); '3' indicates Atomic-Absorption Spectrometry (AAS) after aqua-regia digestion; and '9' indicates Ion-Specific Electrode (ISE) analysis.

NORTH KINGURUTIK RIVER (KRN) ANOMALY

This anomaly (Tables 6a and 6b) is irregular and comprises just four samples centred on a point 21 km southwest of the centre of the North River anomaly at 57.29ºN, 63.37ºW. As well as the paucity of component samples, the element responses are weaker than in the other two anomalies; the strongest are in fluoride in lake water and Lu and Th in lake sediment. Other elements displaying anomalous and (mainly) elevated values are Cd, F, Na, Hf, Sc and Au; *i.e.*, the same as at KRS.

Table 6a. Component samples of Kingurutik River North Anomaly, with analyses of REE and related elements

SAMPLE_ID	NTS	Latitude NAD27	Longitude NAD27	Fw9 ppm	Ce1 ppm	Eu1 ppm	La1 ppm	Lu1 ppm	Sm1 ppm	Tb1 ppm	Yb1 ppm	Mo1 ppm	Mo5 ppm	Th1 ppm	U1 ppm	U8 ppm
851523	14E	57.2910	-63.4453	150	390	2	200	1.8	23.7	2.4	11	6	8	31.3	6.1	6.3
851527	14E	57.3129	-63.3227	62	250	3	87	1.4	21.2	2.3	8	5	2	10.0	2.5	2.3
851580	14E	57.2707	-63.3811	70	350	3	190	1.7	20.4	2.4	6	1	8	21.7	4.9	5.2
851582	14E	57.2819	-63.3079	62	280	5	140	1.2	16.4	2.1	4	5	6	14.0	3.4	3.4

Note: Red text indicates 'anomalous' values exceeding 97.5-percentile for samples collected throughout Labrador; blue text indicates 'elevated' values exceeding 90-percentile for the same population. Numeric suffix '1' indicates analysis by Instrumental Neutron Activation Analysis (INAA); '5' indicates Atomic-Absorption Spectrometry (AAS) after HNO3 digestion; '8' indicates Delayed Neutron Counting (DNC) analysis; and '9' indicates ion-specific electrode (ISE) analysis.

Table 6b. Component samples of Kingurutik River North Anomaly, with other anomalous and elevated elements

SAMPLE_ID	NTS	Latitude NAD27	Longitude NAD27	Au1 ppb	Cd3 ppm	F9 ppm	Hf1 ppm	Na1 %	Sc1 ppm
851523	14E	57.2910	-63.4453	1	0.2	460	8	2.3	17.0
851527	14E	57.3129	-63.3227	1	0.1	380	30	2.2	18.0
851580	14E	57.2707	-63.3811	1	0.4	480	5	1.4	12.0
851582	14E	57.2819	-63.3079	7	0.4	320	6	2.0	14.0

Note: Red text indicates 'anomalous' values exceeding 97.5-percentile for samples collected throughout Labrador; blue text indicates 'elevated' values exceeding 90-percentile for the same population. Numeric suffix '1' indicates analysis by Instrumental Neutron Activation Analysis (INAA); '3' indicates Atomic-Absorption Spectrometry (AAS) after aqua-regia digestion; and '9' indicates Ion-Specific Electrode (ISE) analysis.

GEOPHYSICAL EXPRESSION

REGIONAL DATA

Figure 16 shows fluoride in water superimposed on regional aeromagnetic data (Geological Survey of Canada, 1983). The magnetic susceptibility of the Umiakovik Lake batholith is generally low compared to the rocks that surround it. Within its bounds (indicated by a red line), the most prominent aeromagnetic features comprise a linear, dyke-like feature trending south-southeast in the northeast corner of NTS map area 14E/06, and a horseshoe-shaped feature in the northwest of NTS map area 14E/06.

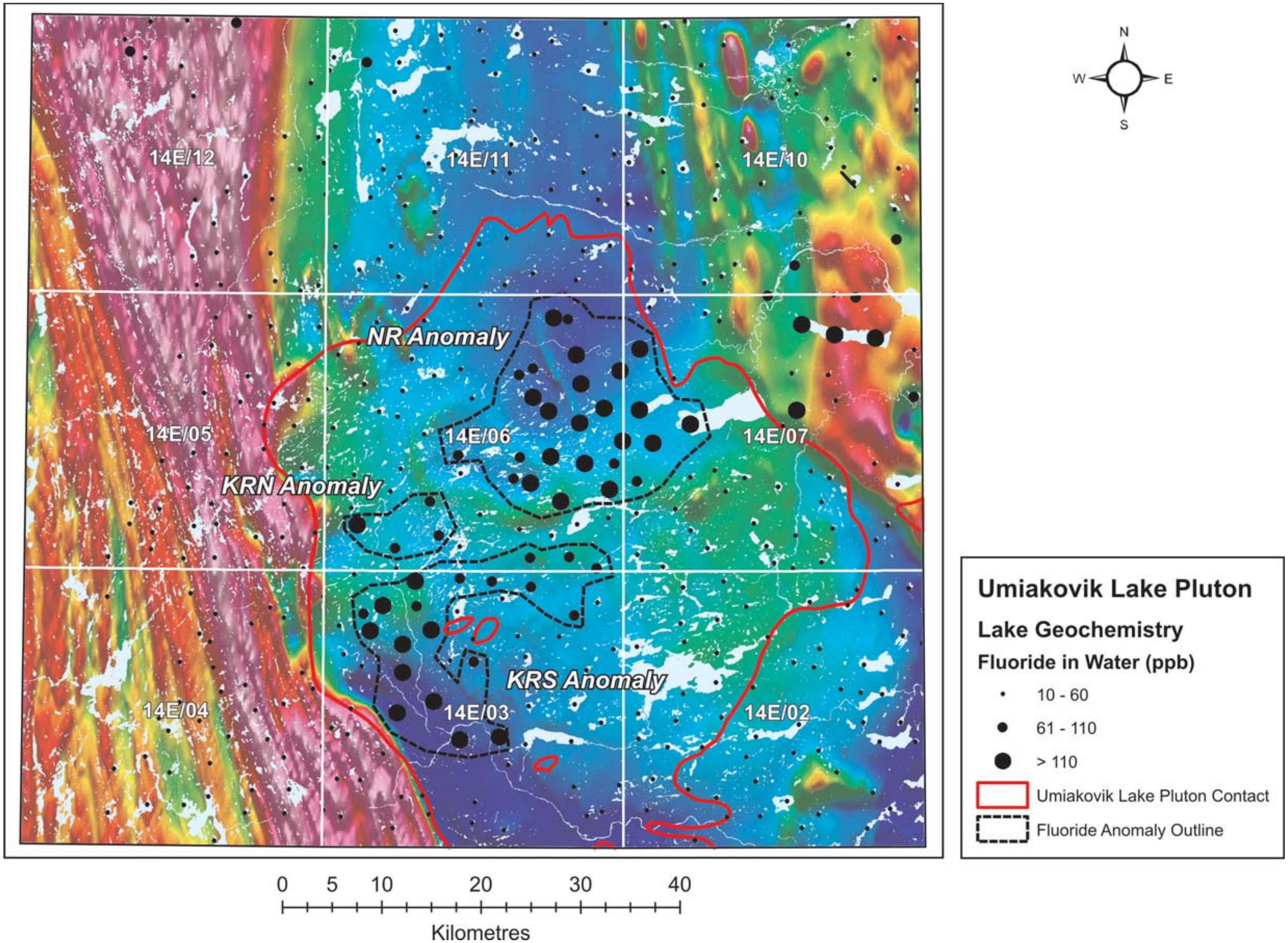

Figure 16. *Fluoride in lake water, superimposed on regional magnetics (GSC, 1983).*

There are also local maxima in the northwest of NTS map area 14E/03 (coincident with the apex of the Kingurutik Lake South Anomaly), as well as two point features along the boundary between NTS map areas 14E/06 and 14E/03, within the northern arm of the Kingurutik Lake South Anomaly; and two maxima not associated with lake-water fluoride anomalies within the western (on the boundary between 14E/05 and 14E/06) and eastern (southwestern corner of 14E/07) embayments of the batholith. The latter feature is about 20 km long and corresponds to Emslie and Stirling's (1993) fayalite–pyroxene quartz monzonite and granite, and although not associated with anomalous fluoride in lake water, it is associated with elevated or anomalous Ce (Figure 17) and other REE in lake sediments.

DETAILED DATA

Two other features, having subtle manifestations in the regional aeromagnetic data, are much more strongly defined in the data compiled from exploration company studies (Kilfoil, 2002; Figures 18 and 19). The first (designated A in Figure 18) consists of an almost semicircular ring structure whose centre is at 57.4ºN, 63.1ºW, south of the centre of NTS map area 14E/06, as shown in figures 18 (Kilfoil, 2002) and 19 (St-Hilaire, 1996). The feature is convex to the north, with the flat side trending southeast, and with a diameter of about 14 km. The North River lake-water fluoride anomaly is mainly disposed to the northeast of this feature, with only one anomalous and five elevated lake-water samples collected within the ring structure itself.

The detailed aeromagnetic data also provide greater emphasis to the dyke-like and arcuate features in the north of NTS map area 14E/06 that are also apparent in the regional data.

French *et al.* (1996) described a 'large' circular feature 1.6 km in diameter, centred on Sikkoyavik Brook, south of Umiakovik Lake, at 57.31ºN, 62.88ºW (feature B in Figure 20); the dimension refers only to the inner magnetic high and if the outer annulus of low magnetic susceptibility is included, the diameter of the feature is about 2.25 km. There is also a second, vague magnetic high, of about the same size and shape, centred on 57.33ºN, 62.85ºW about 2.4 km to the northeast (feature C in Figure 20). Both features are underlain by fayalite–pyroxene quartz monzonite and granite (Emslie and Stirling, 1993). Figure 21 shows the anomaly as depicted in the original assessment file. The possibility that these features might represent a kimberlite was raised during an initial discussion of their significance (French *et al.*, *ibid.*), although subsequently interest was focussed exclusively on magmatic Cu–Ni sulphide of the Voisey's Bay type. In 1997, ground geophysical work confirmed the presence of the both features and from 1997 to 1999 the company drilled 13 diamond-drillholes, totalling 6980 m (French and Syberg, 1997; French *et al.*, 1998; French and Woods, 1999). With only one exception, the drillholes were concentrated in the centre of the southwesterly high-susceptibility feature and the outer annulus was not tested. Only minor sulphides of iron, nickel and copper were intersected.

DISCUSSION

SIMILARITY TO OTHER ANOMALIES AND DEPOSITS

The Misery Lake property of Quest Rare Minerals Inc., located in southeastern Nouveau-Québec about 120 km south of Strange Lake and 200 km north of Churchill Falls, is associated

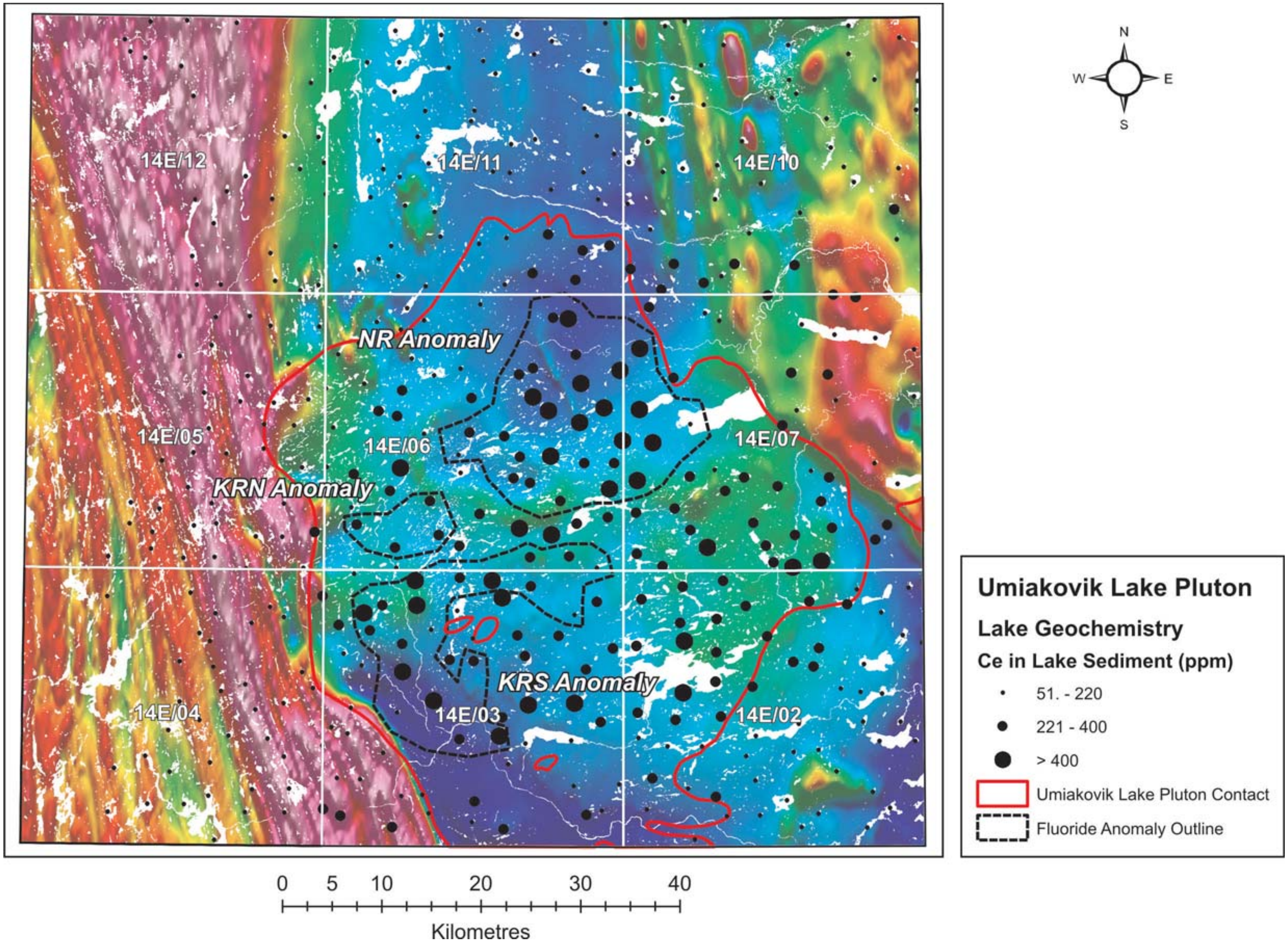

Figure 17. *Cerium in lake sediment, superimposed on regional magnetics (GSC, 1983).*

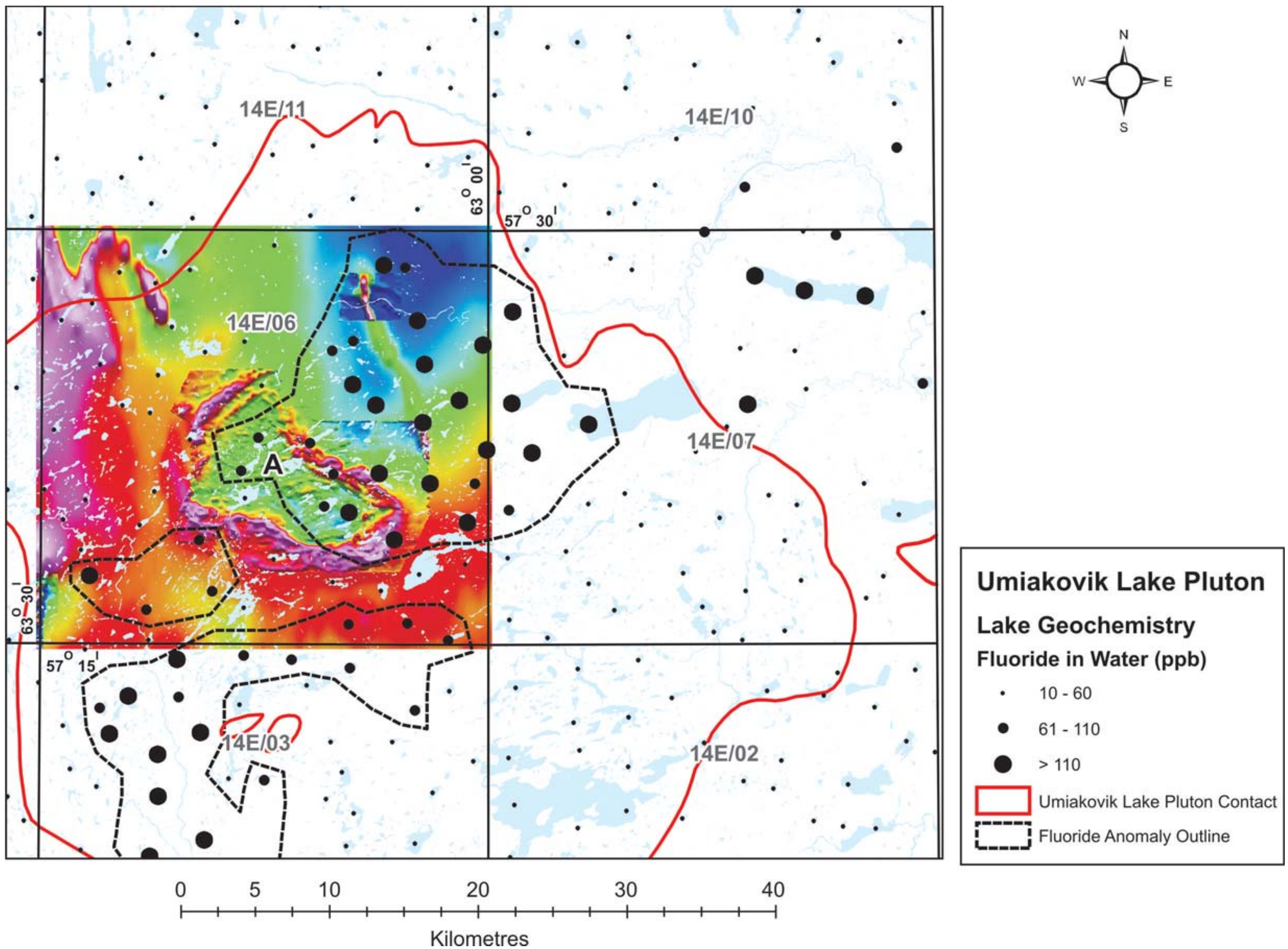

Figure 18. *North River fluoride anomaly: fluoride in lake water, superimposed on merged regional and detailed magnetics (Kilfoil, 2002), showing ring-shaped magnetic feature A.*

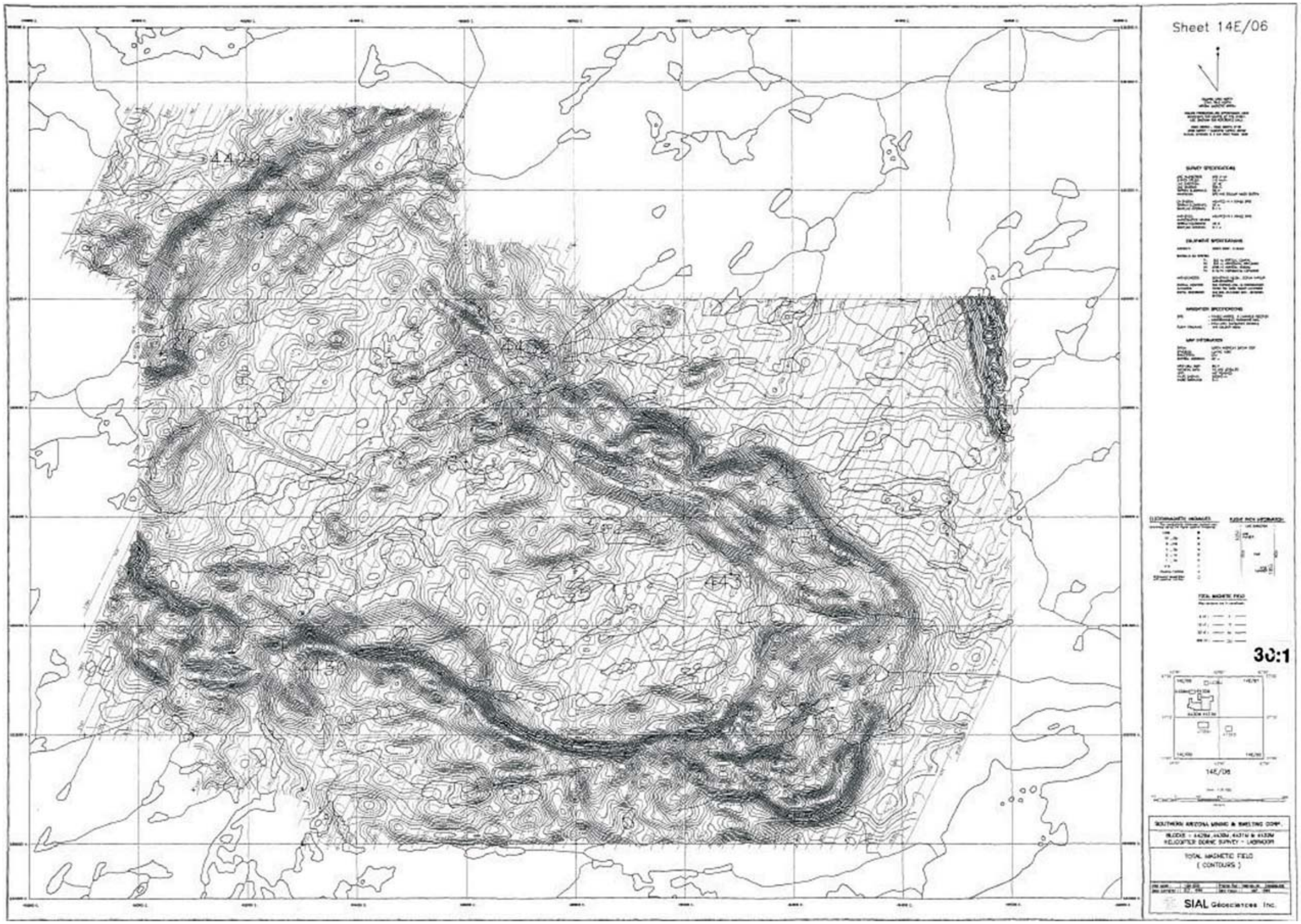

Figure 19. *Magnetic contours associated with the North River fluoride anomaly, as shown in the original assessment file (St-Hilaire, 1996). Map grid lines are 2 km apart.*

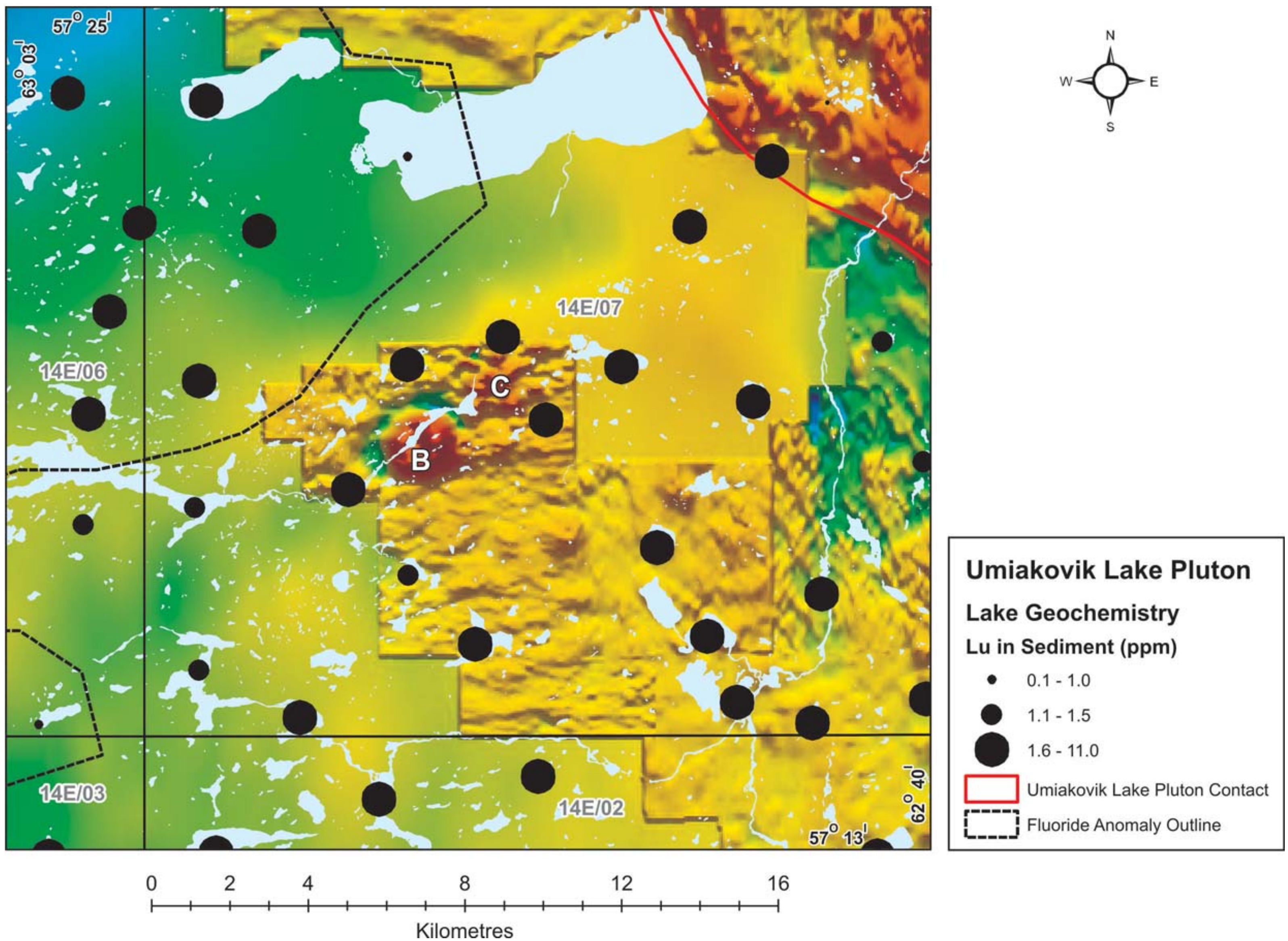

Figure 20. *Sikkoyavik Brook magnetic feature: lutetium in lake water, superimposed on merged regional and detailed magnetics (Kilfoil, 2002), showing circular magnetic features B and C.*

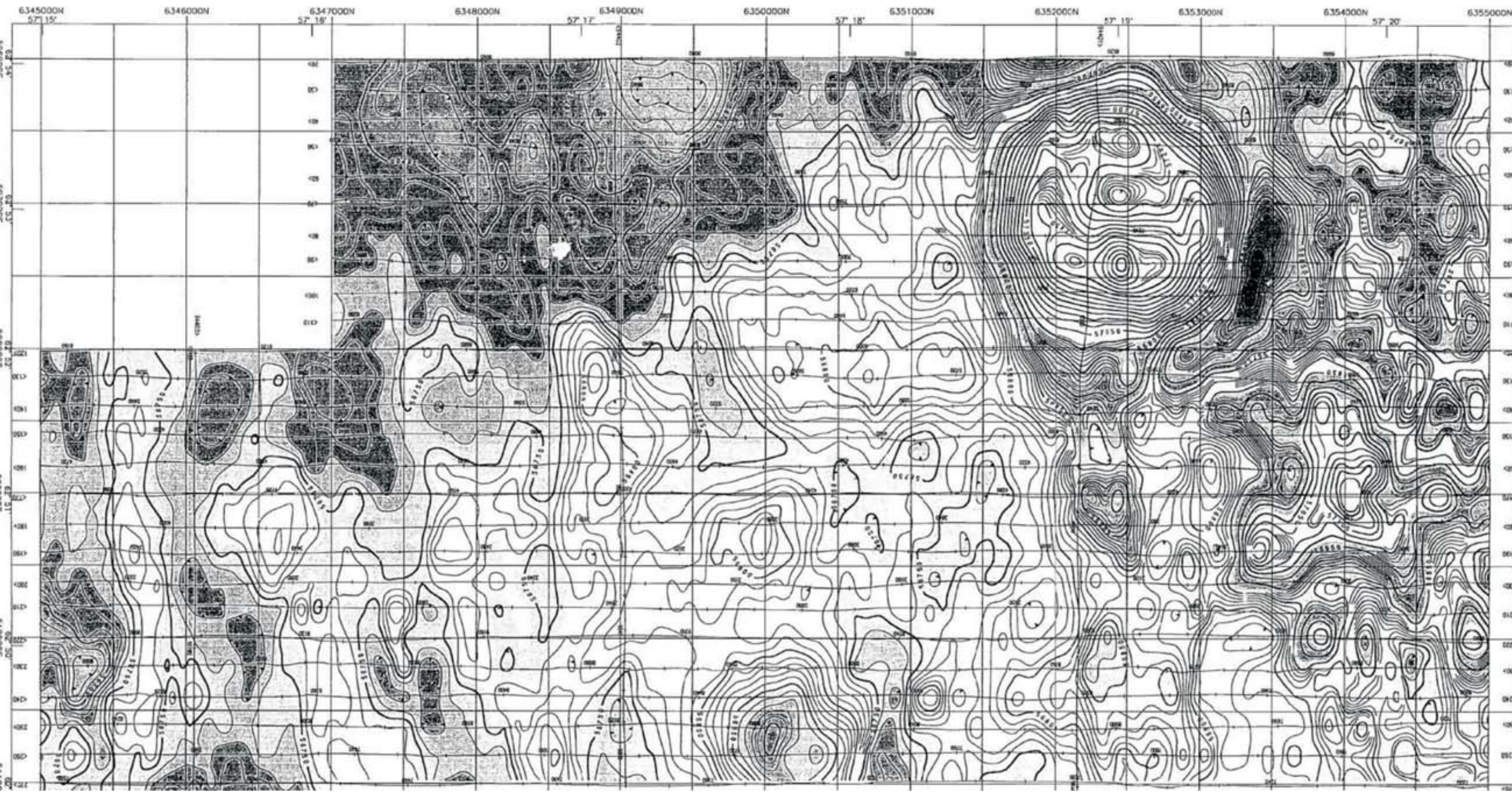

Figure 21. *Magnetic contours associated with the Sikkoyavik Brook magnetic feature, as shown in the original assessment file (French* et al.*, 1996). Map grid lines are 500-m apart.*

with two adjacent circular magnetic features, within an outer annulus of low magnetic relief that is transgressive to the regional foliation. The deposit and its host rocks have been compared (Quest Minerals, press release, November 23, 2009) to the very large Lovozero and Khibina alkalic complexes of the Kola Peninsula in northwestern Russia (Arzamastsev *et al.*, 2008).

EFFECTS OF GLACIATION ON RELATIVE POSITIONS OF GEOCHEMICAL ANOMALY AND RING STRUCTURE

As stated above, information regarding ice-movement directions over the Umiakovik Lake batholith is lacking. The nearest striation measurements, located at Strange Lake, about 120 km to the south, indicate a consistent east-northeastward direction, while landform data at Strange Lake suggest a northeastward flow (Klassen *et al.*, 1992).

Figure 22 shows the distribution of fluoride in water down-ice of the very large, REE-hosting Strange Lake (peralkaline) complex, along with measured striation directions. The same criteria are used to classify the samples as anomalous or elevated, as in maps of the North River area. Anomalous values (exceeding 110 ppb) persist down ice for about 28 km; the dispersion train becomes diluted by background samples beyond this point, but some elevated values persist for at least another 40 km.

In the case of the North River ring structure, anomalous F_w values persist in a northeastward direction for about 20 km, and values drop directly to background beyond this distance (Figure 17). It seems reasonable to postulate that the North River Anomaly represents a glacial dispersion train from a source within the ring-shaped structure giving rise to the North River magnetic feature. Its similarity to the dispersion train from the Strange Lake complex suggests that it, too, is associated with bedrock enrichment not only in fluorine but also in REE. Unlike Strange Lake, the most westerly samples (*i.e.*, at the head of the dispersion train within the ring structure) are only elevated, and not anomalous, in fluoride; this may be a direct reflection of variable fluorine content in bedrock.

OTHER GEOCHEMICAL ANOMALIES

The north and south Kingurutik River anomalies, particularly the latter, have geochemical characteristics similar to the North River Anomaly, although unlike it, no detailed company aeromagnetic surveys were carried out. With the exception of the Sikkoyavik Brook feature (*see* below), the concentration of anomalous and elevated REE values in sediment (unaccompanied by high fluoride values in lake water) in the eastern part of the Umiakovik Lake batholith also lacks detailed aeromagnetic data. Unlike the NR, KRN and KRS anomalies, this feature is underlain by fayalite–pyroxene quartz monzonite and granite (Emslie and Stirling, 1993), although the elevated or anomalous REE values are probably not merely a manifestation of higher background associated with these rock types, for they do not persist over the UL batholith's extension to the south, where the same quartz monzonite and granite also occur. The extensive REE anomaly, in the absence of anomalous fluoride in lake water, does not merit target status at present but would benefit from reconnaissance prospecting.

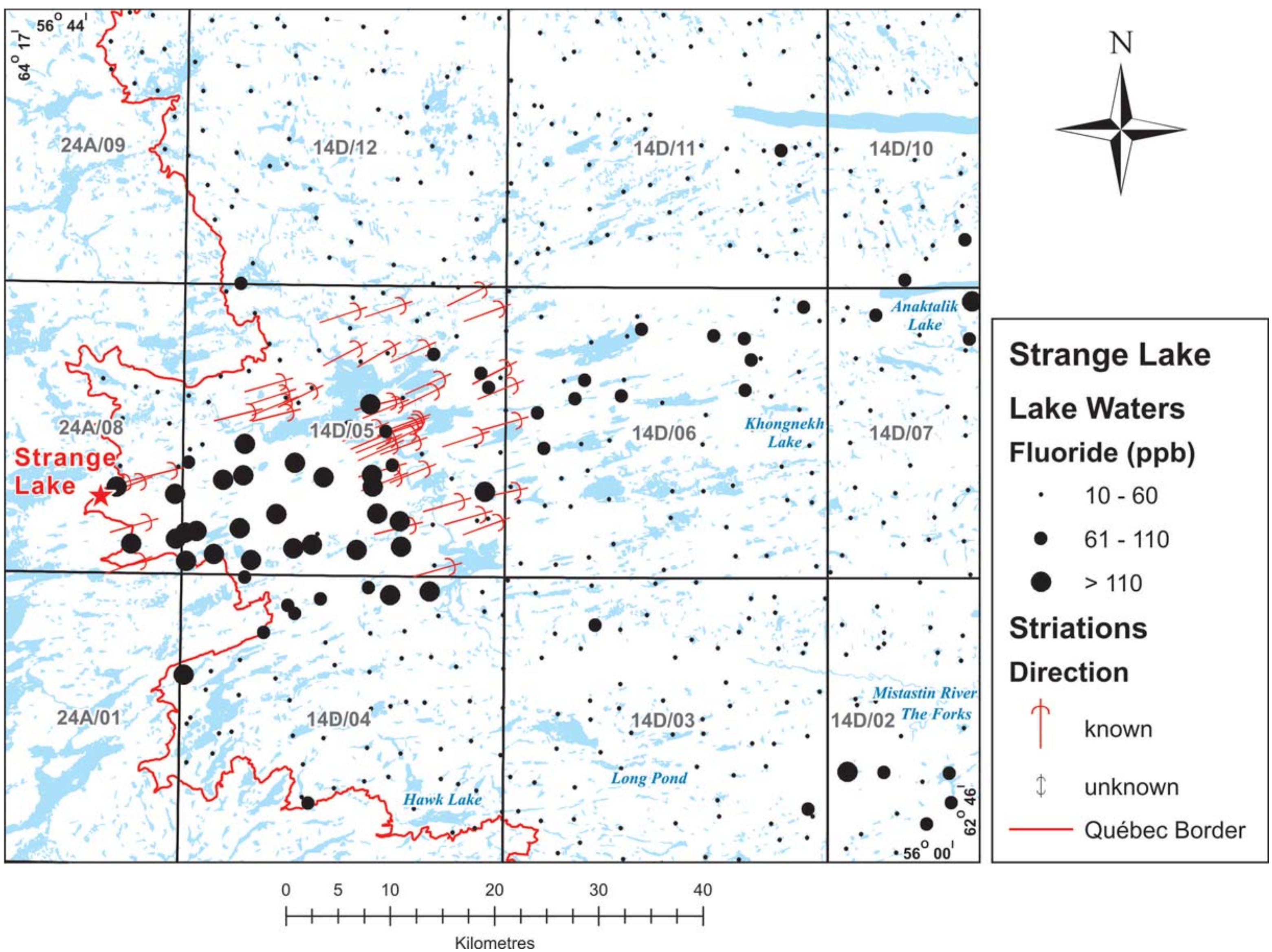

Figure 22. *Distribution of F_w in lake water down ice of Strange Lake complex, showing measured striation directions (from Taylor, 2001)*

RESIDUAL POTENTIAL OF THE SIKKOYAVIK BROOK FEATURE

As was the case with the North River Anomaly, the possibility that the circular Sikkoyavik Brook magnetic feature might represent a REE target appears not to have been considered during the period of its exploration in the 1990s. The possible presence of a kimberlite was proposed at the outset but not addressed subsequently. The analytical package to which at least some of the drillcore samples were subjected included La and Y; neither element shows significant enrichment, although the analytical results in the assessment files are incomplete. Regardless, where adequate geochemical data were filed it is clear that sampling of the core was guided by the presence of mafic rock, and sulphide tenor. The core is believed to have been left on site, or near to it (A. Kerr, Geological Survey, personal communication, 2011) and is unlikely at this stage to provide much useful information.

CHANGING PRIORITIES

It has been possible to construct REE exploration targets over the Umiakovik Lake batholith from a combination of detailed aeromagnetic data gathered by the industry sector and retrieved from government assessment files, and regional lake-sediment and lake-water data downloaded from the Geoscience Atlas of the Department of Natural Resources (Davenport *et al.*, 1999). The quantity of assessment data, although not as even in its coverage as the geochemical sampling, is large and much of the data are of high quality and utility.

Prospecting trends tend to be commodity-focused. The intense activity on the part of mining companies, large and small, in acquiring and prospecting ground almost anywhere in Labrador, in the wake of the discovery of the Voisey's Bay magmatic Ni–Cu–Co deposit in 1993, has been a major contributor to the assessment database. St-Hilaire (1996, p. 17) provides an example of what are probably many campaigns from that period in which the significance of any feature that did not suggest the presence of a sulphide-bearing mafic intrusive rock (in this case, the North River ring structure) was noted in passing without further consideration of its significance.

An implication of the foregoing is that there are probably many other exploration targets waiting to be identified through judicious research of existing government-gathered and government-stored data. It is also likely that data gathered during the current (May, 2011) period of interest in REE, even if they do not lead to new REE discoveries, will undergo additional scrutiny at some point in the future when the priorities of mining companies, and their investors, have changed once again.

CONCLUSION

Geophysical and surficial geochemical data retrieved from the assessment files and Geoscience Atlas of the Department of Natural Resources indicate the presence of a semicircular, fluorine-enriched ring structure underlain by the Umiakovik Lake batholith in northern Labrador, similar to that at the Misery Lake REE prospect in Québec. The structure is associated with a fluoride anomaly in lake water extending in a northeastward direction and suggestive of glacial dispersion of fluorine-rich material from the structure's core. The dispersion pattern is similar to that from the large Strange Lake deposit 120 km to the south.

A smaller annular magnetic feature, also underlain by the Umiakovik Lake batholith, is located within an extensive anomaly of REE in lake sediment, without an associated fluoride anomaly in lake water. It was the target of sustained exploration in the mid- to late-1990s, including almost 7000 m of diamond drilling, although the target, and focus of the sampling, was magmatic Ni–Cu mineralization (of which only traces were found).

The entire Umiakovik Lake batholith has been prospected in the past for magmatic Ni–Cu–Co deposits of the Voisey's Bay type, but its potential as an economic REE host remains untested. The exploration target identified in this report is an example of the kind of information that can be generated by re-examination of historical data with a different exploration model in mind, and it is likely that more targets of this type are waiting to be identified in government files.

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