REANALYSIS OF LAKE-BOTTOM SEDIMENTS IN NORTHEASTERN QUÉBEC (ASHUANIPI SUBPROVINCE, NEW QUÉBEC OROGEN, SOUTHEAST CHURCHILL PROVINCE)

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PRO 2009-10

Québec

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Introduction

The Ministère des Ressources naturelles et de la Faune du Québec announces the publication of new lake-bottom sediment geochemistry data derived from new analyses of archived samples from northeastern Québec. These data cover part of the Ashuanipi Subprovince and the Southeast Churchill Province, including the south part of the New Québec Orogen (Figure 1). They are available in SIGÉOM since September 15, 2009, under the tab "Geochemistry – Sediment sample" (http://sigeom.mrnf.gouv.qc.ca/signet/classes/I1102_indexAccueil?l=e).

More than 21,000 samples were reanalyzed, covering a surface area of more than 200,000 km^2 to the north and west of the border with Newfoundland-and-Labrador, between the municipality of Schefferville and Ungava Bay (Figure 1). These samples were initially collected during many different surveys in 1982, 1983, 1984, and 1997; work conducted in 2009 was designed to harmonize analytical data acquired over many years (1982, 1983, 1984, 1996, 1997, 2006) and using many different analytical methods. The new data set not only provides new analytical data for chemical elements that had not been previously analyzed, it also makes it possible to standardize the data using a single analytical method (inductively coupled plasma mass spectrometry) with very low detection limits and improved accuracy for several elements. The new data set will help the mineral exploration industry develop new exploration models, but will also be useful for future mapping surveys by Géologie Québec in the Southeast Churchill Province, where it intends in the coming years to complete the mapping coverage at a scale of 1/250,000.

Methodology

Some 21,000 samples were reanalyzed in the winter of 2009 at AcmeLabs facilities in Vancouver. Concentrations for 53 chemical elements were determined by inductively coupled plasma mass spectrometry (ICP-MS), following aqua regia digestion. The samples were initially collected during earlier surveys conducted from 1982 to 1984 in the south part of the region, and in 1997 in the north part (Figure 1). Surveys in the Lac Otelnuk and Schefferville areas (New Québec Orogen) showed a sample density of about one sample per 3 km^2, whereas surveys in the Rivière Caniapiscau, Rivière à la Baleine, Rivière George areas and the Far North survey had a density of about one sample per 12 km^2. Despite the fact that the Lac Otelnuk and Schefferville surveys had a higher sample density, their analytical data for gold, among others, were practically unusable since the only results available were fire assay results dating back to the early 1980s. The new analytical data for gold are thus the first to be published for this area covering the New Québec Orogen south of latitude 57°30'N (Figure 1).

No detailed statistical studies have been performed on the new data set. However, we have included in this report a few geochemical anomaly maps likely to be of interest for mineral exploration. The various isocontour maps were generated using the "Spatial Analyst" tool in ArcGIS. These maps were calculated using the inverse distance method, with a search radius taking into account 12 points and a cell size of 250 m by 250 m. The samples analyzed cover distinct geological entities (Superior Province, New Québec Orogen, east part of the Southeast Churchill Province), consequently the data were processed in three distinct blocks to avoid masking potential anomalies by using non-representative background thresholds. For example, the average value for arsenic in the New Québec Orogen is 6.0 ppm (standard deviation = 10.8 ppm), whereas average values in the Superior and Southeast Churchill provinces are only 1.1 and 1.2 ppm (standard deviation = 2.5 and 2.4 ppm) respectively. Moreover, the sample density is higher for most of the New Québec Orogen (Lac Otelnuk and Schefferville surveys), which makes it all the more relevant to process these data separately.

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Dépôt légal – Bibliothèque et Archives nationales du Québec, 2009

For each chemical element analyzed, grades were converted into percentile values prior to generating the maps. Combinations of elements shown on the same map were achieved by adding the percentile values for each element. The maps show the new percentile rankings calculated in this fashion and are designed to visually emphasize higher percentile values (0.90 and more). All the maps in this report use the same graphic legend, expressed in percentiles.

Geochemistry Maps

In this report, we chose to present only a few geochemical maps that showcase the newly acquired data. These data provide lower detection limits for gold, and for the Lac Otelnuk and Schefferville surveys (Figure 1), completely new coverage for this element. Lower detection limits and improved accuracy were also obtained for several elements (namely Ce, La, Li, Y), whereas analyses were obtained for certain elements that had not been analyzed in the past (Nb, Pd, Pt, Sn, W, Zr), or for which previous results were only semi-quantitative (Bi, Be, Cs, Sb, Se). Eleven regional exploration targets not covered by active or pending mining titles as at October 19, 2009, are suggested herein, discussed sequentially in the text and shown in the figures.

Superior Province

Most of the samples reanalyzed in the Superior Province (Figure 2) are located within the Ashuanipi Subprovince (Simard *et al.*, 2009a; Simard *et al.*, 2009b). The south part of this zone (NTS sheets 23K and 23J) was already covered by recent ICP-MS analyses and the extensive gold and arsenic anomaly in the eastern part corresponds to a series of known occurrences (Figure 2a). No deposits are known however near targets #1 and #2, which correspond to anomalies of similar intensity to those occurring near gold showings recently discovered in the Lac Pau Deformation Zone, north of the Caniapiscau Reservoir. The Beausac 2 showing was discovered in this area by the MRNF (Simard *et al.*, 2009b), whereas the Jedi, Obiwan and Tricorne showings were discovered by Virginia (http://www.virginia.qc.ca/en/Projet/Lac-Pau/index.asp).

North of latitude 55ºN, the only analytical results available for gold were derived from neutron activation analyses or fire assay, with detection limits of 5 ppb. The new data outlines target #3, which includes several samples with values above the 90th percentile. According to Simard *et al.* (2009a), this zone is underlain by rocks of the La Grande Subprovince rather than the Ashuanipi Subprovince.

Figure 2b shows a map combining uranium, cerium, and yttrium values. This combination typically highlights disseminated U-Th-REE mineralization associated with granitic pegmatites occurring in Neoarchean migmatitic terrains (Cuney and Kyser, 2009). Target #4 is located south of the Caniapiscau Reservoir, and target #5 occurs north of the Sable Fault, which follows the trace of a metamorphic gradient separating granulite-grade rocks to the south (Ashuanipi Subprovince) from amphibolite-grade rocks to the north (La Grande Subprovince; Simard *et al.*, 2009a). Target #6 is located about ten kilometres south of one of the Paleoproterozoic basins of the Sakami Formation; the anomaly is in fact elongated parallel to the latter. This anomaly may represent a potential target for Paleoproterozoic mineralization, particularly given its strong intensity and the extensive surface area it covers when only uranium is considered (not shown in this report).

New Québec Orogen

The new analytical data set covers a large part of the New Québec Orogen, where no analytical data for gold was available south of latitude 57º30'N. Figure 3a shows the distribution of gold and uranium in lake-bottom sediments, as well as the location of known mineral occurrences for the two elements combined. These occurrences are located northwest of Lac Romanet, in sedimentary units of the Wheeler lithotectonic zone (Clark and Wares, 2006), where a northwest-trending geochemical anomaly some 25 km long is delineated. Target #7 is located east of Lac Lemoyne, over an anomaly of similar intensity where the bedrock is mapped as a mixed unit of Paleoproterozoic paraschists, paragneisses and amphibolites (Clark and Wares, 2006).

Figure 3b shows the distribution of copper and nickel, as well as the location of platinum group element (PGE) occurrences grading more than 500 ppb palladium or platinum. The new lake-bottom sediment data includes analytical results for these two elements (platinum and palladium, Pt and Pd respectively). About 96% of samples in the New Québec Orogen yielded values below the detection limit for palladium (10 ppb Pd), and 73% were below the detection limit for platinum (2 ppb Pt). Nevertheless, Figure 3b shows the location of sediment samples that yielded higher values (black squares), from 7 to 22 ppb Pt and from 11 to 26 ppb Pd. The strong copper and nickel anomaly located northeast of Schefferville corresponds to volcano-sedimentary units of the Doublet Group (Clark and Wares, 2006). The south part of this anomaly overlaps with a few known PGE occurrences, which are also associated with stronger values for platinum and palladium in lake-bottom sediments. The north part of the anomaly constitutes target #8; it exhibits an anomalous geochemical signature and stronger values in platinum and palladium, but no PGE occurrences are known in this area at this time.

Southeast Churchill Province

Figure 4a shows the distribution map for beryllium and yttrium in the Southeast Churchill Province. This combination of elements is typical of rare metal deposits such as the one hosted in the Mesoproterozoic Strange Lake peralkaline complex (Zajac *et al.*, 1984; Miller *et al.*, 1997), which also contains rare earth elements (REE), zirconium and niobium. The Strange Lake deposit is located at the northeast end of a major beryllium and yttrium anomaly around Lac Napeu Kainiut. Another important anomaly is visible southeast of Lac aux Goélands, which partially corresponds to the recent REE, yttrium and phosphorus discovery by Quest on the Misery Lake project (http://www.questuranium.com/miserylakeproject.php). This area is currently almost entirely covered by active or pending claims. However, target #9 covers an anomaly that is nearly as intense and that is only partially covered by 47 mining titles. Although the bedrock near target #9 is mapped as the Paleoproterozoic De Pas Batholith (Van der Leedan, 1994), it may in fact also host anorogenic alkaline intrusions of Mesoproterozoic age similar to the Strange Lake intrusion.

Finally, Figure 4b shows the combined distribution of bismuth and tin, which may be used to target various metallic occurrences occurring in greisen or skarn environments. Target #10 covers a vast anomaly located south of Rivière Koroc, in an area where several sediment samples yielded silver values above 400 ppb, i.e. above the 99th percentile for all samples collected in the Southeast Churchill Province (not shown in this report). This anomaly occurs in metasedimentary units of the Lake Harbour Group (Verpaelst *et al.*, 2001), where a few units of marble and calc-silicate rocks may potentially host skarn-type mineralization. Target #11 is smaller in scope, with two sediment samples also showing silver values above the 99th percentile. The anomaly is located south of Rivière Falcoz, where the nature of the bedrock is poorly defined; it is currently mapped as a migmatitic unit with quartzite layers.

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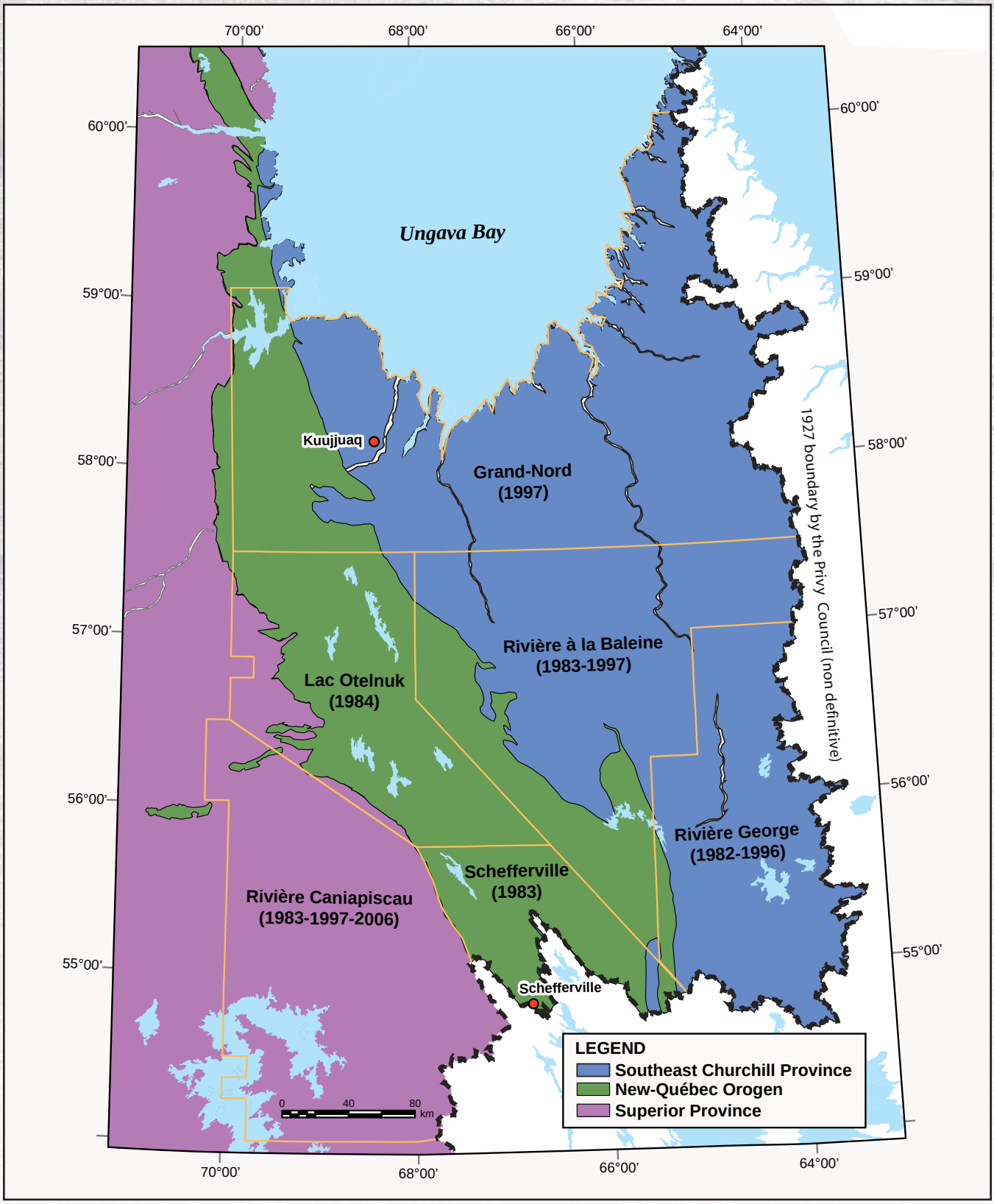

Figure 1 - Location of geological provinces and lake-bottom sediment surveys that were re-analyzed in 2009. Years in parentheses indicate the year when the samples were initially analyzed.

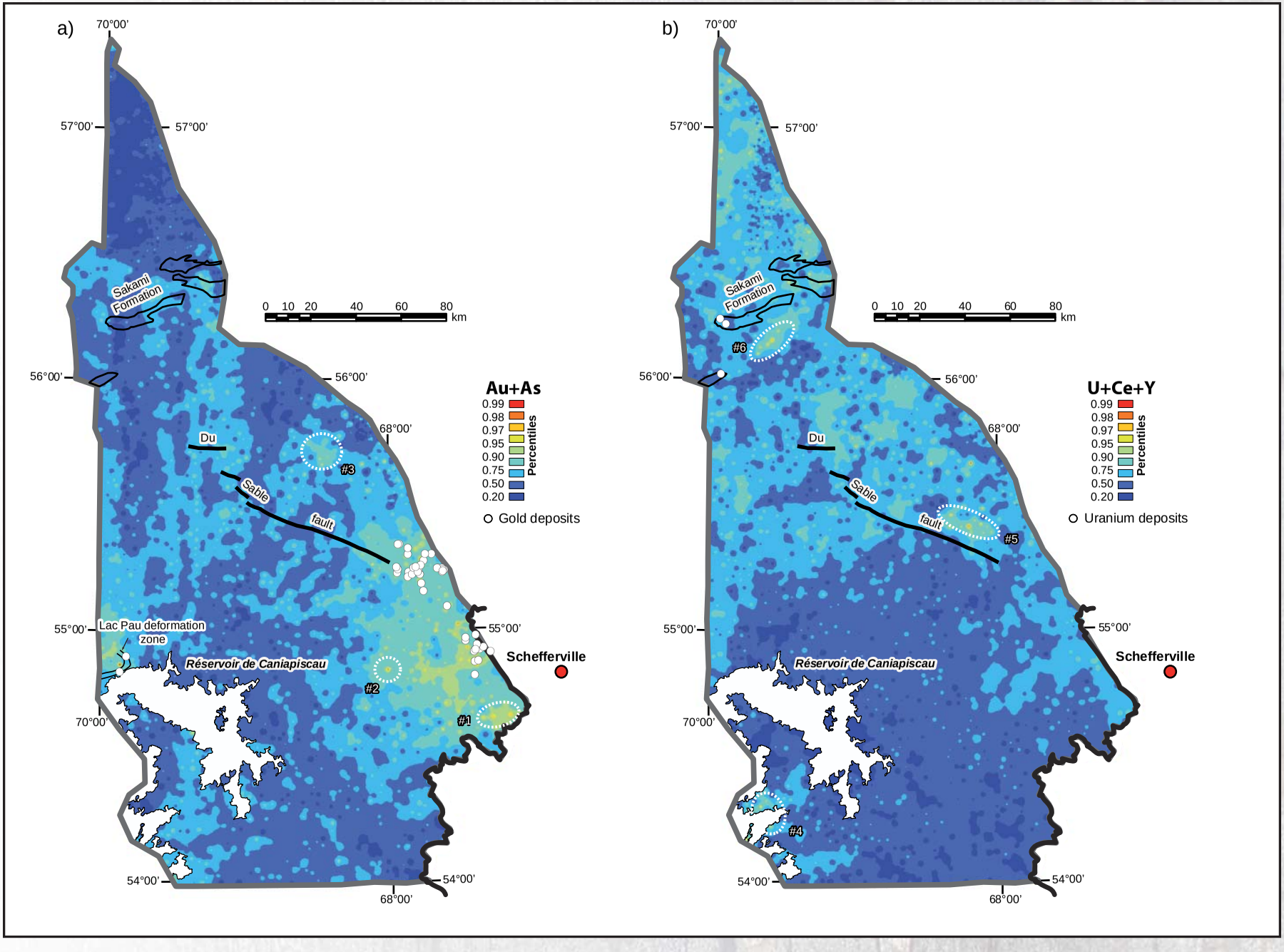

Figure 2 - Map showing lake-bottom sediment anomalies and mineral occurrences in the Superior Province: **a**) gold and arsenic anomalies and gold occurrences; **b**) uranium, cerium and yttrium anomalies and uranium occurrences.

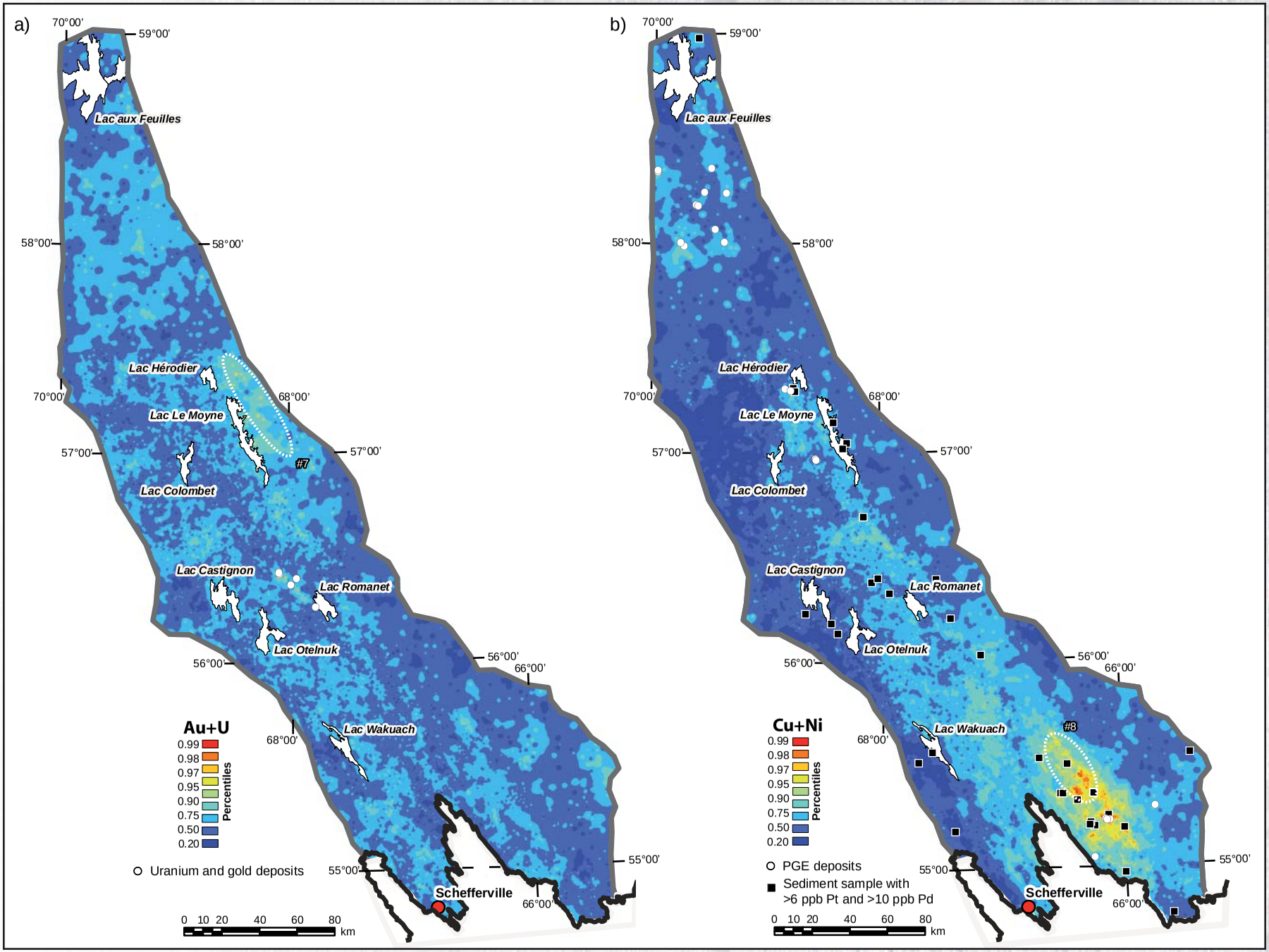

Figure 3 - Map showing lake-bottom sediment anomalies and mineral occurrences in the New Québec Orogen: **a**) gold and uranium anomalies and mineral occurrences; **b**) copper and nickel anomalies and PGE occurrences.

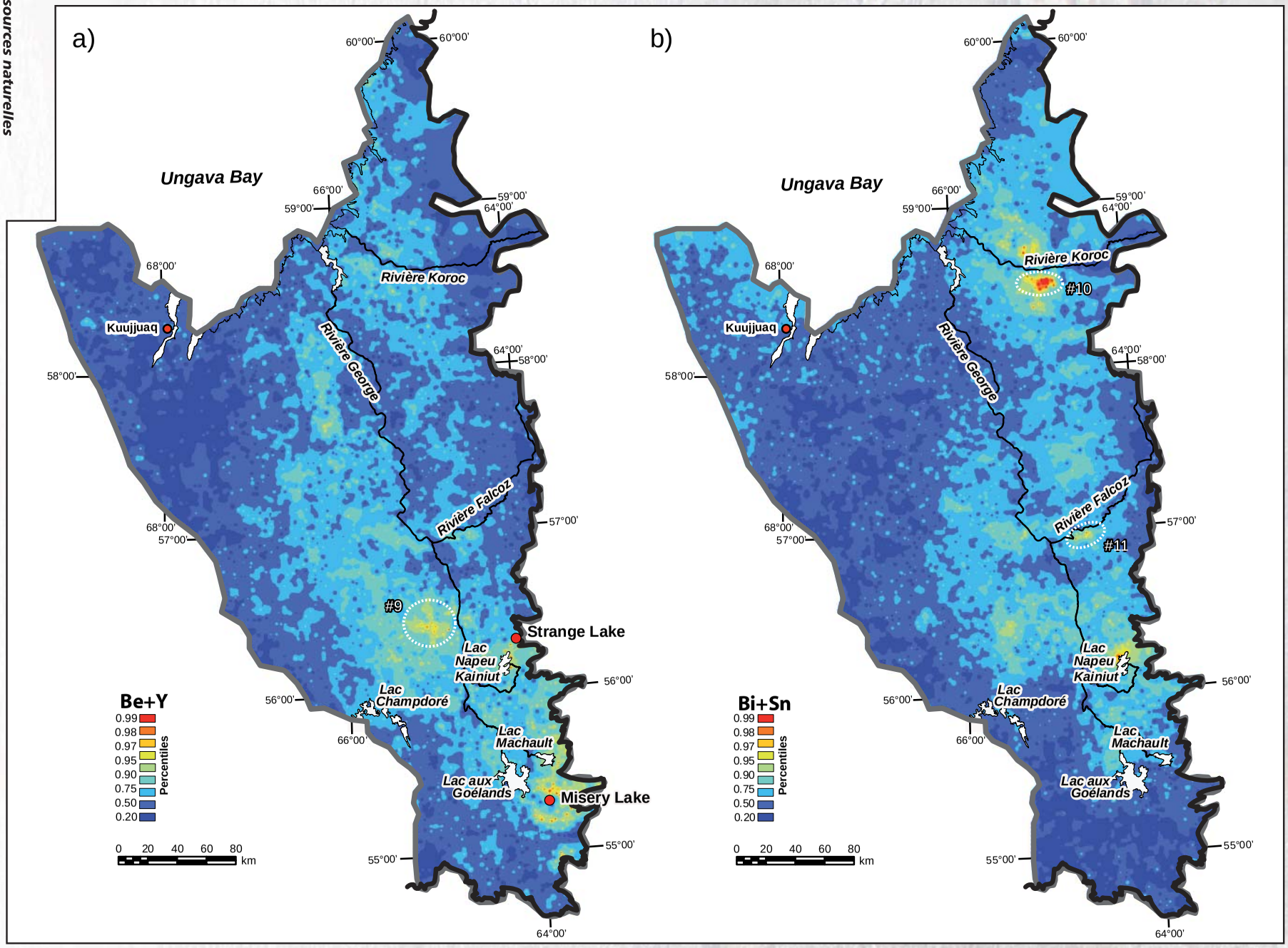

Figure 4 - Map showing lake-bottom sediment anomalies in the Southeast Churchill Province: **a**) beryllium and yttrium anomalies; **b**) bismuth and tin anomalies.