Exploration Report EX2003-1

Enzyme Leach^{SM} and Mobile Metal Ion$^{®}$ B-Horizon-Based Soil Geochemical Surveys over the Thorne Gold Zone and Adjacent Areas, Snow Lake, Manitoba

by M.A.F. Fedikow

Winnipeg, 2003

Manitoba

When using information from this publication in other publications or presentations, due acknowledgment should be given to the Manitoba Geological Survey. The following reference format is recommended:

Fedikow, M.A.F. 2003: Enzyme Leach^{SM} and Mobile Metal Ion® B-horizon–based soil geochemical surveys over the Thorne gold zone and adjacent areas, Snow Lake, Manitoba; Manitoba Industry, Trade and Mines, Manitoba Geological Survey, Exploration Report EX2003-1, 30 p. + 6 appendices.

NTS grid: 63K16

Keywords: Enzyme Leach, enzymes, geochemical methods, geochemical surveys, gold ores, ions, leaching, Manitoba, Mobile Metal Ion, mineral exploration, New Britannia Deposit, soils, soil profiles, Snow Lake, Thorne gold zone

Author address:
Mark Fedikow
Current Affiliation
Mount Morgan Resources Ltd.
34 Wellesley Court
Winnipeg, Manitoba R3P 1X8
(204) 487-9627
E-mail: mfedikow@attcanada.ca or mfedikow@mts.net

Published by:
Manitoba Industry, Trade and Mines
Manitoba Geological Survey
360–1395 Ellice Avenue
Winnipeg, Manitoba
R3G 3P2 Canada

Telephone: (800) 223-5215 (General Enquiry)
(204) 945-4154 (Publication Sales)
Fax: (204) 945-8427
E-mail: minesinfo@gov.mb.ca

Website: http://www.gov.mb.ca/itm/mrd

FOREWORD

This report is the first in an effort to complete publication of outstanding databases and studies begun while the author was an employee of Manitoba Industry, Trade and Mines, Manitoba Geological Survey. A series of publications based on these data and entitled 'Exploration Reports' will be released via the ministry website. These reports represent data generated from co-operative projects between the Manitoba Geological Survey and its industry partners. This particular report is one product resulting from a joint venture between the Manitoba Geological Survey and TVX Gold Inc. in the Snow Lake area.

ABSTRACT

Fifty-five B-horizon soil samples were collected from two transects over the Thorne Au zone and forty-three samples were collected from a baseline to serve as an ‘exploration’ sample suite. Samples were analyzed by inductively coupled plasma–mass spectrometry (ICP-MS) following dissolution using the Enzyme Leach^{SM} and Mobile Metal Ion (MMI) ® techniques.

Results based on these analytical methods indicate the presence of reproducible, multi-element, multisample, high- to low-contrast geochemical anomalies over the Thorne gold zone and other mineralized zones in the general area of the New Britannia gold deposit. The anomalies extend over 70 m in surface width and laterally between two sampling transects 30 m apart. Arsenic, manganese and cobalt are common halo-forming elements and are diagnostic of buried mineralized zones.

Both digestions are similarly priced and provide valuable exploration information. The ability to map subsurface mineralized structures with the Enzyme Leach^{SM} data makes this a particularly useful exploration tool. Enzyme Leach^{SM} and MMI® process analytical data are demonstrated to have application to gold exploration in the area of the New Britannia deposit, and elsewhere in the Snow Lake area where highly prospective rocks are concealed beneath overburden. The MMI® approach to soil-geochemical exploration offers the advantage of being able to measure gold in soils, whereas the standard grade of Enzyme Leach^{SM} is incapable of achieving this.

CONTENTS

Figures

Table

Appendices

All analytical data in Appendices 1 to 6 are also provided as Microsoft® Excel® spreadsheets.

INTRODUCTION

Overburden cover, such as till, lacustrine sand, silt, clay, peat and swamp, represents a serious impediment to exploration. Although the analysis of various size fractions of glacial till and, to some degree, boulder tracing have been successful in delineating gold-enriched heavy-metal dispersion fans, the explorationist is still required to search ‘up ice’ or within the area covered by the dispersion fan for the source of these anomalies. In some instances, the till dispersion fans can attain considerable areal dimensions (cf. Kaszycki, 1989). The recent development of geochemical techniques based on sequential, phase-specific and partial digestions, coupled with analytical technological advances that permit routine parts-per-billion analysis, has provided an opportunity to ‘see through’ transported and other types of overburden. Anomalies defined in this manner generally occur directly over, or in the immediate vicinity of, the mineralized source.

The Enzyme Leach^{SM} and Mobile Metal Ion (MMI)$^{®}$ approaches to geochemical exploration represent two commercially available techniques that have application to blind and/or buried mineralization. These methods have been tested to some degree in what would normally be considered ‘hostile’ geochemical environments, such as the Assean Lake area, where tens of metres of clay-rich overburden mantle highly prospective gold- and base-metal–bearing rocks. Surveys using both the Enzyme Leach^{SM} and MMI$^{®}$ approaches successfully delineated gold-bearing quartz veins and differentiated between prospective and nonprospective ground-electromagnetic conductors at Assean Lake (Fedikow and Ziehlke, 1996, 1998). The diamond-drill testing of an MMI gold anomaly at Assean Lake has led to the discovery of a previously unknown gold deposit. International Curator and Rare Earth Metals Corp. are currently drilling this zone of gold mineralization. An additional claim made by the developers of the MMI$^{®}$ approach is that a geochemically anomalous response is only obtained over a mineralized zone where ‘significant’ amounts of metals are present. Accordingly, this may permit ranking or prioritization of geophysical conductors for follow-up drill testing, thereby helping to avoid expensive assessment of ‘barren’ sulphide-facies iron formation. These two analytical techniques form the basis for the orientation survey conducted over the Thorne gold zone.

The analytical data for Mobile Metal Ion$^{®}$ surveys are presented in Figures 6, 7 and 8 as response ratios (suffix ‘RR’) rather than concentrations. The response ratio is defined as the arithmetic mean of the lower quartile of the data for any particular element. Analyses are normalized against this figure to give response ratios. There is a one-to-one correlation between a response ratio and the concentration of any particular element. As such, an anomalous concentration will be reflected by a high response ratio.

GEOLOGICAL SETTING OF THE MINERALIZED ZONE

The host rocks to the Thorne gold zone are part of the Snow Lake portion of the Flin Flon greenstone belt (Fig. 1). This Paleoproterozoic metavolcanic belt is a collage of 1.92–1.83 Ga tectonostratigraphic assemblages juxtaposed during a period of 1.88–1.87 Ga intra-oceanic accretion and subsequent 1.84–1.78 Ga terminal collision of bounding Archean cratons.

Outcrop in the area of the Thorne gold zone is not abundant and is generally moss and lichen covered. Detailed property-scale mapping by TVX Gold Inc. has identified massive basalt flows as the probable host rocks to the mineralized quartz veins. Basalt flow breccia and minor mafic tuff have also been mapped in the general area. Locally, these basalt units are rusty weathered and crosscut by quartz-carbonate veinlets.

Mineralization in the Thorne gold zone consists of quartz-filled tension gashes with disseminated iron sulphide and arsenopyrite. Typical gold grades associated with the zone are quoted from TVX Gold Inc. diamond-drill logs as 0.36 oz./ton over 1 foot from a core sample described as altered basalt with quartz and quartz-carbonate veins and disseminated arsenopyrite. Gold values range between <5 ppb and 0.36 oz./ton in the mineralized zone, with occasional zones of 0.09 oz./ton over 3 feet.

OVERBURDEN CHARACTERISTICS

The study area is characterized by undulating, low-relief topography with outcrop ridges mantled by a shallow (<1 m) B horizon consisting of fine to coarse sand with pebbles and cobbles of granitic rocks, and fine- to medium-grained mafic volcanic and intrusive rocks. Nonmineralized quartz-vein fragments (1 cm) are locally present in the B horizon. Typically, the B horizon is limonitic and locally hematitic, resulting in a bright orange to brick red colour in the soil. Between the outcrop ridges, the depth of overburden is greater than 1 m but indeterminate. These areas are weakly oxidized, clay-rich sediment with local gley textures. The B horizon, as developed on the outcrop ridges, is generally topped by a white to grey leached zone (Ae horizon) that is overlain by several centimetres of brown, poorly decomposed humus with root mat or fine-grained, well-decomposed black humus. The upper or active layer is characterized by lichen, and an assortment of grasses (*Salix* sp.), blueberry (*Vaccinium augustifolium*) and labrador tea (*Ledum groenlandicum*).

SAMPLE COLLECTION

Thorne gold zone

Samples of B-horizon soil were collected from lines 105E and 106E, proceeding northward for 183 m and 168 m, respectively. Sample sites were established every 25 feet along these grid lines (Fig. 2). In this way, 30 samples (including 3 duplicate samples) were obtained from L105E and 25 samples (including 2 duplicate samples) were collected from 106E. A total of 43 B-horizon samples (including 4 duplicates) was collected along baseline TL-180 at 50 and 100 foot intervals from a depth of between 10 and 20 cm. All duplicate samples were collected from a second, hand-dug pit at every tenth site for an assessment of sampling error and analytical reproducibility. Sample descriptions are provided in Appendix 1.

SAMPLE PREPARATION

Samples consisted of approximately 2 kg of B-horizon material stored in medium-sized Ziploc® freezer bags. Sample temperature was maintained at approximately 20ºC to avoid possible volatilization of metal-bearing compounds and transported to the laboratories of the Manitoba Geological Survey in Winnipeg. Samples were air dried on plastic, disposable plates and split into two equal portions, with one portion sieved to obtain –60 mesh. The –60 mesh fraction was forwarded to Activation Laboratories Ltd. (Ancaster, Ontario) for multi-element ICP-MS analysis following the standard grade of Enzyme Leach℠. The second sample split was forwarded to SGS Minerals Services (Toronto)[1] for analysis using the MMI Technique®.

SAMPLE ANALYSIS

Enzyme Leach℠

This dissolution is a phase-specific leach that preferentially attacks amorphous manganese dioxide coatings on mineral grains, thereby liberating trace metals that are trapped in this material. Amorphous manganese dioxide is an efficient chemical sieve or trap for cations, anions and polar molecules because of its large surface area and the random distribution of positive and negative charges on this surface. Mineral grains within the B soil horizon tend to be coated with a film of amorphous manganese dioxide and, as such, represent the target for dissolution with the Enzyme Leach®.

[1] formerly XRAL Laboratories – A Division of SGS Canada Inc.

The metals that are trapped, sieved or complexed with the amorphous manganese dioxide are interpreted to represent the chemical signatures of oxidizing, bedrock-hosted mineralization at depth. Notwithstanding this observation, buried mineralized boulders resident in a dispersion train may also contribute trace metals to the B horizon. These signatures, in the form of metal-enriched volatiles (Hg vapour, halides, halogens) move upward through fracture systems or induced zones of permeability in bedrock and overburden under the influence of electrochemical cells, groundwater flow, capillary flow, evapotranspiration pumping or, as in the case of Hg vapour, the partial pressure of the gaseous compounds generated by oxidation.

Of some concern is the potential for the subtle additions of oxidizing mineralization to the B horizon to be concealed or swamped by the downward movement of metal-enriched compounds derived from the weathering of till and/or organometallic humate or fulvate compounds derived from the A soil horizon (eluviation/illuviation). Despite these concerns, the anomalies delineated by Enzyme Leach^{SM} generally occur directly over the mineralized target in the form of high contrast 'oxidation' or lower contrast 'apical' anomalies, each with their own unique element associations. The oxidation anomalies are developed for elements such as Cl, Br, I, As, Sb, Mo, W, Re, Se, Te, V, U and Th in the form of double-peak or 'rabbit-ear' anomalies, with low concentrations of metals directly over the deposit and peak concentrations on either side of the mineralization. Apical anomalies result from diffusion of commodity elements along an electrochemical gradient, from an area of high concentration to one of lower concentration, and are characterized by a series of high concentrations directly over the target zone. In this type of anomaly, the metals present are representative of the mineralized source. The apical anomalies are relatively lower in contrast than the oxidation anomalies. Variability in the morphology of the anomalies can be attributed to the depth of burial of the source.

The leachate from the B-horizon soil was analyzed by ICP-MS for 59 elements at detection limits in the parts-per-billion range. Enzyme Leach^{SM} will not detect elemental Au or Hg in the B horizon. Details of the Enzyme Leach^{SM} technique are provided in Clark et al. (1993).

Mobile Metal Ion (MMI) Technique®

The MMI Technique® was developed in Western Australia by Wamtech Pty. Ltd. and a consortium of exploration companies seeking tools to geochemically 'see through' residual overburden. In this study, a partial-extraction scheme was used on a 100 g sample of soil. Separate dissolutions or extractants are used and provide a leachate for Cu, Pb, Zn, and Cd (MMI-A), and for Co, Au, Ag, Pd and Ni (MMI-B). This leachate is then analyzed by ICP-MS in the parts-per-billion concentration range.

The exact chemistry of the multicomponent dissolutions is unknown, owing to the proprietary nature of the technique. Available literature citations indicate that MMI anomalies are well defined and usually overlie the mineralized zone, thereby defining the surface projection of the mineralization. Numerous case studies have been undertaken in a variety of geological environments, and both technical and commercial exploration successes document the effectiveness of the technique. These case histories can be accessed on the MMI Technology website (www.mmigeochem.com). A recent description of the MMI Technique® is provided by Birrell (1996).

RESULTS

Data presentation

Enzyme Leach^{SM} and Mobile Metal Ion® analyses are plotted as profiles (x-y plots) for each sampling transect (lines LI05E and Ll06E, and baseline TL-180), with distance along the sampling transect on the x-axis and concentration on the y-axis. The location of the target (the Thorne gold zone) is plotted on the x-axis so that geochemical flux in the analyses can be compared with proximity to mineralization. A broad zone of peat is plotted at the appropriate location on transect TL-180 so that the geochemical response attributed to these distinctly different samples can be reviewed. Peat samples were not analyzed by the MMI Technique®. The locations of a trenched, rusty-weathered quartz vein and a zone of quartz-tourmaline-pyrite rubble are plotted on the profiles to aid interpretation.

Analytical data for the Enzyme Leach℠ and the MMI Technique® are given in Appendices 2 and 3, respectively. Descriptive statistics for the two techniques can be found in Appendix 4. The geochemical profiles for the Enzyme Leach℠ technique are given in Figures 3, 4 and 5, and those for the MMI Technique® in Figures 6, 7 and 8. Results for Enzyme Leach℠ analytical and field duplicate pairs are given in Appendix 5, and for MMI Technique® analytical duplicates in Appendix 6. Analytical results that are less than the lower limit of detection (LLD) are replaced with half of the LLD for the calculation of MMI response ratios. 'Between line' geochemical responses are compared. Elements determined using the Enzyme Leach℠ and prefixed by 'SQ' were determined semiquantitatively.

Data reproducibility

Field duplicate samples were collected from seven locations during the sampling program in the area of the Thorne gold zone. Duplicate B-horizon samples were collected from sample pits approximately 1 m apart and prepared in exactly the same manner. The reproducibility of analyses at most concentration ranges is generally within ±25%. Occasionally Cu and, in some instances, Mn are not reproducible within ±25% in one or two duplicate pairs.

Analytical duplicates from the Mobile Metal Ion Technique® are reproducible over a wide concentration range, although concentrations below 10 ppb are subject to slight sample inhomogeneities (sampling error) and are therefore more likely to be less reproducible than those containing hundreds of parts per billion. Field duplicates show a wider range in concentrations for some elements in duplicate samples. Copper, in five of eight duplicate pairs, is not reproducible. Four of eight duplicate pairs are not reproducible (greater than ±25%) for Zn. Sub–parts per billion results for Au and Pb are not reproducible. The elements Pb and Cd both have six of eight duplicate pairs below the lower limits of determination and, accordingly, cannot be assessed for reproducibility. Based on reproducibility of analyses from field duplicates, the elements Co, Ni and Ag appear to be particularly useful for interpretation purposes.

Enzyme Leach℠

Geochemical responses are plotted in Figures 3 to 8 and are discussed below with respect to the variation in concentration of a particular element along a given transect.

Line 105E transect

The elements Ag, Au, Bi, Er, Eu, Hf, Ho, Ir, La, Os, Pd, Pt, Re, Rh, Ru, Sn, SQBe, SQHg, SQSc, SQTi, Ta, Tl, Tm and Zr are below their individual limits of determination and are therefore not considered further. The Thorne gold zone is marked by relatively high contrast responses for the elements As, Ba, Co, Ga, Mn and Rb, with possible diagnostic but lower contrast anomalies for the elements Y, W, Zn, Cu, SQCl and selected rare earth elements (REE). Individual responses for As, Ba, Co, Ga, Mn and Rb form single and multiple sample highs directly over the Thorne zone. Arsenic forms the highest contrast anomaly on line 105E, a double-peak response extending for a distance of 70 m and varying from greater than 150 ppb to almost 900 ppb directly over the gold-bearing quartz vein; background variation for As is 20–30 ppb. The Co and Ba enrichments tend to be erratic but marked by moderate contrast. Cobalt contents reach 170 ppb directly over the target and >1300 ppb Ba occurs in B-horizon soils immediately adjacent to mineralization. A single-sample Ga anomaly (23 ppb) occurs over the deposit, relative to background of generally less than 5 ppb. A very high double-peak Mn anomaly is developed for 70 to 80 m along the line, including the deposit, and coincides exactly with the double-peak As response. Manganese exceeds 22 000 ppb over the mineralized target. The area of the Thorne gold zone is also marked by a 300 m wide zone of Rb enrichment in the B-horizon soils; Rb contents up to 190 ppb characterize the anomaly, against a background of 60 ppb.

Less diagnostic responses to the Thorne gold zone are noted for Ce, Dy, Sm Tb and Yb; for Cu and Zn; and for Y, W and SQCl. The REE response, as characterized by Dy, is very low contrast and reflected by three widely spaced individual peaks, none of which corresponds to the location of the Au zone along the line. In this regard, the Yb (and Tb) anomaly is shifted northward from the Thorne zone along line 105E and, like Dy, is a low contrast response with 1–2 ppb defining the anomaly against background of <LLD. Tungsten forms an eight-sample anomaly of 1–3 ppb (background <LLD) over a distance of approximately 70 m along the sampling transect. The SQCl response forms a broad (90 m) 11-sample response along line 105E, with >300 ppb defining the anomaly against a background that is <LLD. This zone encompasses the Thorne mineralized zone.

Copper and zinc responses approximate rabbit-ear anomalies, with the Thorne zone situated adjacent to or within a trough of low values flanked by peaks or high concentrations both north and south along line 105E.

Line 106E transect

The elements Au, Bi, Ho, Ir, Os, Pd, Pt, Re, Rh, Ru, Sn, SQBe, SQHg, SQTi, Ta, Tl and Tm are all below the lower limits of determination and are excluded from further consideration. Many elements along line 106E form high-contrast single-sample apical anomalies directly over the Thorne gold zone, including As (3735 ppb), Mn (8328 ppb), Sc (14 ppb), Th (14 ppb), Y (20 ppb) and Zr (42 ppb). Concentrations of Zr and Sc in samples collected away from the mineralization are <LLD.

The geochemical coherence of the REE is reflected in similarities in the responses of Ce, Dy, Eu, Er, Gd, La, Lu, Nd, Pr, Tb and Yb over the Thorne zone. Collectively, REE form one- to four-sample, high-contrast anomalies with concentration levels generally <20 ppb (e.g., 1–4 ppb Dy, 2 ppb Er, 2 ppb Eu, 2–6 ppb Gd, 17 ppb La, 1–6 ppb Lu, 8–17 ppb Pr, 2–8 ppb Sm, 1–9 ppb Tb and 1–8 ppb Yb). The concentrations of Ce and Nd, however, range from 3 to 55 ppb and from 10 to 32 ppb, respectively, over the target. Most samples not collected close to the mineralization have REE concentrations <LLD. The REE anomalous response extends for a maximum of 25–30 m north and south of the mineralization, for an anomaly width of approximately 50 m.

Multisample anomalies are present for Ba (two samples with 1113 and 1197 ppb over 15–20 m), Ni (two samples with 107 and 201 ppb over 20 m) and Mo (two samples with 15 and 20 ppb and four samples with 3–6 ppb over approximately 50 m). As with the REE profiles, all elements that do not define the anomaly have concentrations <LLD.

Numerous other elements in the line 106E dataset form single- and multiple-sample anomalies with concentration ranges of <10 ppb over the gold zone. These include Ag, Hf, In, Nb, Pb, Sb, Te, U and W. Possible anomalous responses are obtained for I and Rb, albeit with erratic profiles and low concentration ranges.

The line 106E profiles indicate a 50–60 m wide zone of high- and low-contrast anomalies for the REE, Ba, Ni and Mo. Within this broad zone are some very high single-sample anomalies for As and Mn that occur directly over the Thorne zone.

The elements As and Mn are common anomaly-forming pathfinders on lines 105E and 106E, with the REE and Ba as subsidiary elements.

Baseline TL-180 transect

This transect was sampled for a distance of approximately 600 m as an exploratory line across the area east of the Thorne gold zone. Three obvious features were observed along the line during sampling, each of which is marked by anomalous concentrations of metals in one or more samples. The three features, which are plotted on the TVX Gold Inc. geology map (Fig. 2), are a pit exposing a rusty-weathered quartz vein; a quartz rubble zone with tourmaline and pyrite; and a broad, approximately 100 m wide, peat-filled linear depression that was transected at right angles by the sample line. The quartz-tourmaline-pyrite rubble zone occurs at the western edge of this linear, so the geochemical response of this zone is often difficult to separate from that obtained over the linear. It should be noted that samples of inorganic B-horizon soil could not be obtained from the linear, so fine-grained, black, sooty peat was substituted. This complicates interpretation because the peat is a drastically different sample medium with distinctive geochemical characteristics. The three features and the geochemical flux in the samples collected over each of them are described in turn.

Trenched rusty-weathered quartz vein

A two-sample Co anomaly occurs in the vicinity of this trenched occurrence, which is located a few metres south of the sampling transect. These two samples contain 103 and 168 ppb Co and define a 15 m wide anomalous zone; background Co concentrations are approximately 30 ppb. It is noteworthy that a single high Co value of 70 ppb was obtained from a site 100 m west of this trenched quartz vein.

Three other elements form single-sample anomalous geochemical responses at the trenched site: 1196 ppb As, 12 136 ppb Mn and 147 ppb Ni.

Quartz-tourmaline-pyrite rubble zone

Although trenches were not observed during sampling in the vicinity of this zone, the mineralized rubble is considered to be potentially significant because it occurs at the western edge of the peat-filled north-trending lineament.

A four-sample, 65 m wide zone of anomalous Co values, ranging from 99 to 115 ppb, occurs over this mineralized rubble. This anomaly is truncated at the point on the transect where peat samples were collected. This rubble zone is also marked by a two-sample (2668 and 4495 ppb) As anomaly that, unlike Co, continues into the linear peat-filled depression, with much higher As contents observed in the peat samples (*see* below).

Single-sample anomalies for Mn (4326 ppb), Rb (273 ppb), Se (37 ppb), Sc (31 ppb), and lesser responses of 2 ppb Ge and 3 ppb Te, also occur over this zone. The Ge and Te responses are developed against a background of <LLD.

Peat-filled linear depression

The seven samples collected over this 100 m wide linear depression are characterized by greatly elevated metal contents. The elements As (779–10 626 ppb), Mn (6036–8332 ppb), V (270–8016 ppb), SQCl (8325–36 522 ppb), Sr (447–1787 ppb) and Mo (45–121 ppb) all show significant enrichment in these samples relative to inorganic B-horizon samples elsewhere on the three transects. Other enrichments in some or all of the peat samples include Br (80–855 ppb), I (16–241 ppb), SQSc (20–91 ppb), Sb (7–84 ppb), Ge (1–7 ppb) and U (5–55 ppb). The only two samples to contain detectable Ag, albeit at very low levels (0.3 ppb), are peat.

Mobile Metal Ion (MMI) Technique®

Line L105E transect

The variation in both MMI-A and MMI-B elements along a sampling transect is plotted as response ratios on Figures 6, 7 and 8, and discussed in terms of concentration here. Both data display methods provide the same information.

There is a multisample, high-contrast anomaly developed over the Thorne gold zone for the elements Ag, Zn, Cd, Ni, Co and Pd. A six-sample anomaly of >6 ppb Ag is developed over the zone for a total distance of approximately 70 m. Results for Au comprise low level (0.5–0.7 ppb) responses without a recognizable pattern developed in proximity to the mineralization.

A double-peak Zn and Cd anomaly is developed over and somewhat north of the zone, with Zn concentrations of up to 1300 ppb Cd values of up to 25 ppb. The last sample collected on line 105E contains 1110 ppb Zn and 17 ppb Cd. Background concentrations for Cd are <LLD of 10 ppb. Nickel and cobalt also form coincident anomalies over the gold zone. A four-sample Ni anomaly (98–174 ppb) and a three-sample Co anomaly (55–95 ppb) are well developed with moderately good contrast over the target. A potential rabbit-ear or double-peak negative anomaly exists for Cu, with values of 100–300 ppb directly over the mineralization and values of >400 ppb on either side. A low-contrast Pd anomaly (1–1.5 ppb) is developed over the target, with a trough of 0.6–0.7ppb occurring just north of the gold zone.

Line L106E transect

Geochemical response to the Thorne gold zone on this line is more weakly developed, and fewer elements seem to be indicative of mineralization. A single-sample Ag (14 ppb), Au (2.7 ppb) and Ni (290 ppb) anomaly occurs over mineralization, as well as a Pd response of 2.1 ppb. The elements Zn, Cu, Co and Cd give ‘saw-tooth’–type responses without clear relationship to mineralization. All Pb analyses were <LLD.

Baseline TL-180 transect

The geochemical profiles for this sample line are incomplete due to the lack of inorganic B-horizon samples caused by the linear peat-filled depression. Nevertheless, there are recognizable responses to the trenched rusty-weathered quartz vein and the quartz-tourmaline-pyrite rubble developed at the western edge of the peat-filled depression transected by TL-180. The trenched quartz vein is marked by a two-sample Co anomaly (63 and 96 ppb), a bilobate, two-sample Cu anomaly (438 and 770 ppb) and a low-contrast Au response of 1–3 ppb in two samples. Similarly, the quartz-tourmaline-pyrite rubble is marked by a four-sample Co anomaly (47–82 ppb) and a single-sample Cu response of 448 ppb. Interestingly, some very high Zn responses were obtained from the last six samples collected over the final 300 m of the transect. Values of 257–1040 ppb Zn were obtained in this area. The first sample collected on the eastern edge of the linear depression contained 550 ppb Ni.

MORPHOLOGY OF ANOMALIES

A variety of anomaly morphologies is observed in these profiles. Oxidative or bilobate anomalies are developed for As and Mn, and possibly for Cu, Zn and SQCl, on line 105E. Manganese approximates an oxidative-type response on line 106E. Arsenic on line 106E forms an apical response. The majority of halo-forming elements on both lines form apical anomalies, defined by one or more samples, that are usually directly over the mineralized target. The oxidation anomalies are developed as a result of metal-enriched halogen or halide gases dispersing from the mineralized source along fractures through to the

B horizon. Dispersion along electrochemical gradients or other mechanisms of dispersal, other than those of glacial origin, explain the preponderance of apical anomalies.

DISCUSSION

The Thorne gold zone is a mineralized, fracture-filling quartz vein containing gold. It is exposed by trenches and pits on lines 105E and 106E. Despite the apparently low grade of gold mineralization associated with the zone, multisample high-contrast geochemical responses have been obtained from Enzyme Leach^{SM} and MMI Technique® analytical approaches.

Enzyme Leach^{SM}

Typical of the geochemical response are the multisample, high-contrast As and Mn anomalies that persist for approximately 70 m along line 105E. Within these broad anomalous zones are single-sample anomalies for Ga, Co and Ba.

The majority of responses are apical in nature but 'rabbit-ear' responses for Mn, As, Cu and Zn (and, to some extent, Y) are present although somewhat erratic and poorly defined; the Zn double-peak profile appears to be well constrained.

Unlike line 105E, line 106E is characterized by very high contrast, single-sample As and Mn anomalies, as well as anomalies for Sc, Y, Zr and Th. Anomalous responses for Sc, Y and Zr, as well as the REE, are interpreted to represent fault zones. The coherent, multisample, 50 m wide REE response on line 106E would seem to establish the fault-related nature of the mineralization in the Thorne gold zone. The elements Ni, Mo and Ba, in conjunction with As and Mn, serve as pathfinders along line 106E.

Three obvious features identified during sampling along baseline TL-180 are reflected by multisample, high-contrast anomalies: Co, As, Mn and Ni at the trenched quartz vein; Co, As, Mn, Se and Sc at the quartz-tourmaline-pyrite rubble zone; and extraordinary enrichments of As, Mn, V, Sr, Mo and Cl over the peat-filled, north-trending linear depression. Enrichments in Br, I, Sc, Sb, Ge and U are also observed from the seven samples collected over this depression. It is difficult to assess these anomalous responses with respect to samples collected elsewhere during this survey because the samples collected over the linear depression are all peat, with dramatically different background metal concentrations and therefore different anomaly:background ratios. Rabbit-ear bilobate anomalies are developed for As, Ge and Sb within the depression. These anomalies, plus the extraordinary 10 609 ppb As anomaly, suggest that the depression could be of economic interest, since arsenopyrite is an abundant mineralogical associate of gold in other gold zones in the area, including the New Britannia deposit.

Structural breaks, covered by overburden, may be recognized by REE, Y, Zr and Sc anomalies. This is demonstrated by responses on line 106E near the Thorne gold zone.

Mobile Metal Ion (MMI) Technique®

Analytical results based on this dissolution provide valuable exploration information. Multisample, high-contrast anomalies for Au, Zn, Cd, Ni, Co and Pd are developed along line 105E over the Thorne zone. The Au response is very low and generally not indicative of mineralization. Low-contrast responses for elements such as Pd need to be interpreted with caution because of concern for reproducibility at these concentration levels. The very low mobility of Pd in the secondary environment makes any MMI® Pd response worthy of inspection. A double-peak response for Zn and Cu was documented. Weaker geochemical responses were obtained for Ni, Ag and Au from samples collected along line 106E.

The trenched quartz vein and quartz-tourmaline-pyrite rubble zone are delineated by multisample, high-contrast Co and Cu anomalies.

Other MMI® anomalous responses

High metal concentrations were observed at sites along the sampling lines other than those identified prior to or during sample collection.

The MMI® results documented three distinctive zones of metal enrichment. The most significant is considered to be a zone of Zn enrichment reflected by values of 257–1040 ppb in six samples collected at the eastern end of baseline TL-180. Additionally, a single-sample response of 550 ppb Ni was obtained just east of the north-trending, peat-filled linear depression along baseline TL-180. The third anomaly, at the north end of line 105E, consists of a single sample containing 1110 ppb Zn and 17 ppb Cd.

An anomaly with 70 ppb Co was identified in the Enzyme Leach℠ data from a single sample collected 100 m west of the trenched, rusty-weathered, quartz-vein occurrence. This may be important, since Co is an element present in high concentrations in samples collected adjacent to or over many of the known mineralized zones in the survey area and may be reflecting the presence of iron-sulphide mineralization.

CONCLUSIONS

Results from the Enzyme Leach℠ and Mobile Metal Ion® analysis of B-horizon soils and peats in this exploration-oriented survey indicate the following:

- The Thorne gold zone and other vein-type mineral occurrences in the survey area have distinctive, multisample, multi-element, high-contrast, soil geochemical signatures. This is true for both Enzyme Leach℠ and Mobile Metal Ion (MMI) Technique® analytical results.
- Elements forming anomalies over the Thorne gold zone, the trenched rusty-weathered quartz vein and the quartz-tourmaline-pyrite rubble zone include As, Mn and Co for Enzyme Leach℠ and Co for MMI®.
- The individual mineralized zones have additional pathfinder elements associated with them (Table 1).

Table 1: Pathfinder elements associated with mineralized zones in the study area.

Analytical technique	Thorne gold zone	Trenched rusty quartz vein	Quartz-tourmaline-pyrite rubble
Enzyme Leach℠	As, Ba, Co, Ni, Mn, Rb, Ga, REE, Y, Zr, Sc, Cu, Zn	Co, As, Mn, Ni	Co, As, Mn, Rb, Se, Sc
Mobile Metal Ion (MMI)®	Ag, Zn, Cd, Ni Co, Cu, Co, Pd	Co, Cu	Co, Cu

- The peat-filled north-trending linear is marked by enrichments in As, Mn, V, Cl, Sr and Mo, with lesser but distinctive Br, I, Sc, Sb, Ge and U peaks for Enzyme Leach℠ data.
- Overlap between the geochemical signatures of the quartz-tourmaline-pyrite zone and the linear depression occurs for As Enzyme Leach℠ data.

- The peat-filled, north-south linear is bracketed by the quartz-tourmaline-pyrite zone on its west boundary and a single-sample, high Ni analysis of 550 ppb at its eastern limit. Both areas adjacent to the linear have anomalous concentrations of metals, whether determined by the Enzyme Leach^{SM} or MMI® process.

RECOMMENDATIONS

The following recommendations are based on the observations made in this orientation program:

- Enzyme Leach^{SM}–based B-horizon soil geochemical surveys should be undertaken on grid sampling programs to identify overburden-covered mineralized structures. Structures with anomalous precious- and base-metal associations can be used to prioritize geophysically indicated diamond-drill targets. If the delineation of Au and Ag anomalies is given priority over geochemical anomalies based on 'associated pathfinder elements' (e.g., As), then it is recommended that the Mobile Metal Ion (MMI) Technique® be used in place of the Enzyme Leach^{SM}.

  If structures have been identified by geophysical methods, mapping or historical exploration (including diamond-drilling), then their prospectivity for gold can be assessed using either technique. In this scenario, the MMI Technique® would probably be superior to Enzyme Leach^{SM}, since the real strength of the latter is to geochemically map buried structures by determining anomalous concentrations of 'structure-related' elements, such as REE, Zr, Se and Y. The MMI Technique® provides analyses of nine base and precious metals or commodity elements that represent mineral deposits and their associated alteration. In this regard, the inability of the Enzyme Leach^{SM} to detect metallic Au (or Hg) in overburden samples is a drawback. The recent development of an enhanced Enzyme Leach^{SM} may address this shortcoming.

- Despite the marked difference between the the sooty peat samples collected from the peat-filled depression on baseline TL-180 transect and the inorganic B-horizon soil samples collected throughout the rest of the study area, the enrichment of both As and Mn in the peat samples and the associated geochemical anomalies and mineral occurrences of its western and western edges all indicate that this linear depression deserves further consideration. A review of past exploration activity over and adjacent to this feature is warranted, with the aim of determining whether the exceptional As enrichments are related to mineralization or simply a reflection of different sample types.

- Sample collection for either Enzyme Leach^{SM} or the MMI Technique® should be restricted to inorganic soils where possible. If organic material is sampled, then it must be interpreted separately as a discrete sample population. For 100% sample coverage and absolute consistency, it may be necessary to employ a Winkie™ or packsack drill to obtain inorganic sediment samples from beneath peat organic layers. Due to the significant differences in metal concentrations stripped from inorganic soils and organic peat samples, it is strongly recommended that organic and inorganic material not be mixed during sample collection.

- Most of the geochemical anomalies identified in this survey are of the apical variety, forming peaks directly over the mineralized zone. The areal extent of the observed geochemical anomalies indicates that a sample spacing of 25–50 m would be appropriate along grid lines spaced 100 m apart. These specifications can be modified to address the size of the expected mineralization target.

- Duplicate samples must be collected so as to represent 20% of the total sample population and to allow interpretation of data quality. In this way, geochemical responses, particularly at low concentrations (<10–20 ppb), can be identified as real or as artifacts of sampling error, analytical error (including instrument instability) or incomplete/inconsistent dissolution. Samples should probably be randomized to avoid possible instrument 'memory' effects.

ACKNOWLEDGMENTS

John Danko, formerly Senior Exploration Geologist for TVX Gold Inc., is thanked for help during sample collection and for discussions regarding the exploration of the survey area. Gerald Trembath, former Exploration Geologist for TVX Gold Inc., is acknowledged for logistical help and for informative discussions regarding the geology of the area. TVX Gold Inc. permitted access to confidential information and provided funding for analyses. Leah Chudy and Kelly Proutt are thanked for typing the manuscript. Bob Davie of RnD Technical edited the manuscript.

REFERENCES

Birrell, R. 1996: MMI geochemistry: mapping the depths; Mining Magazine, May 1996, p. 306–307.

Clark, J.R., Meier, A.L. and Riddle, G. 1993: Enzyme leaching of surficial geochemical samples for detecting hydromorphic trace-element anomalies associated with precious-metal mineralized bedrock buried beneath glacial overburden in northern Minnesota; Transactions of the Institution of Mining and Metallurgy, Section B, p. B19–B29.

Fedikow, M.A.F. and Ziehlke, D.V. 1996: Enzyme Leach℠ and Mobile Metal Ion® B-horizon geochemical signatures of buried geophysical conductors, Assean Lake area, northeastern Manitoba (poster); Manitoba Mining and Minerals Conference, Winnipeg, November 1996.

Fedikow, M.A.F. and Ziehlke, D.V. 1998: Enzyme Leach℠ and Mobile Metal Ion® B-horizon soil geochemical signatures of buried geophysical conductors, Assean Lake area, northeast Manitoba; Manitoba Department of Energy and Mines, Geological Services, Open File Report OF98-3, 36 p.

Kaszycki, C.A. 1989: Surficial geology and till composition, northwestern Manitoba; Geological Survey of Canada, Open File 2118, 48 p.

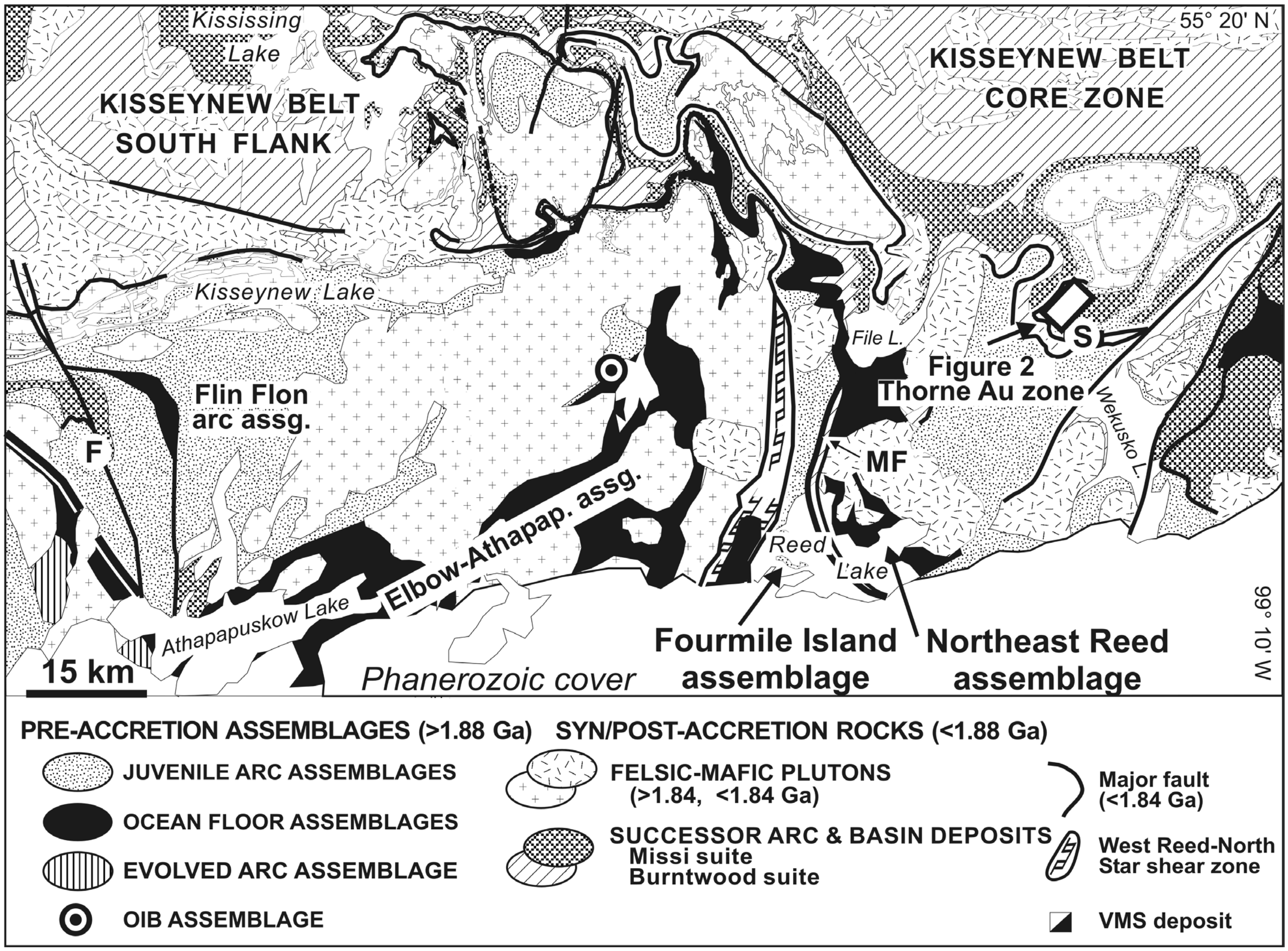

Figure 1: Location of the survey area in the Flin Flon greenstone belt.

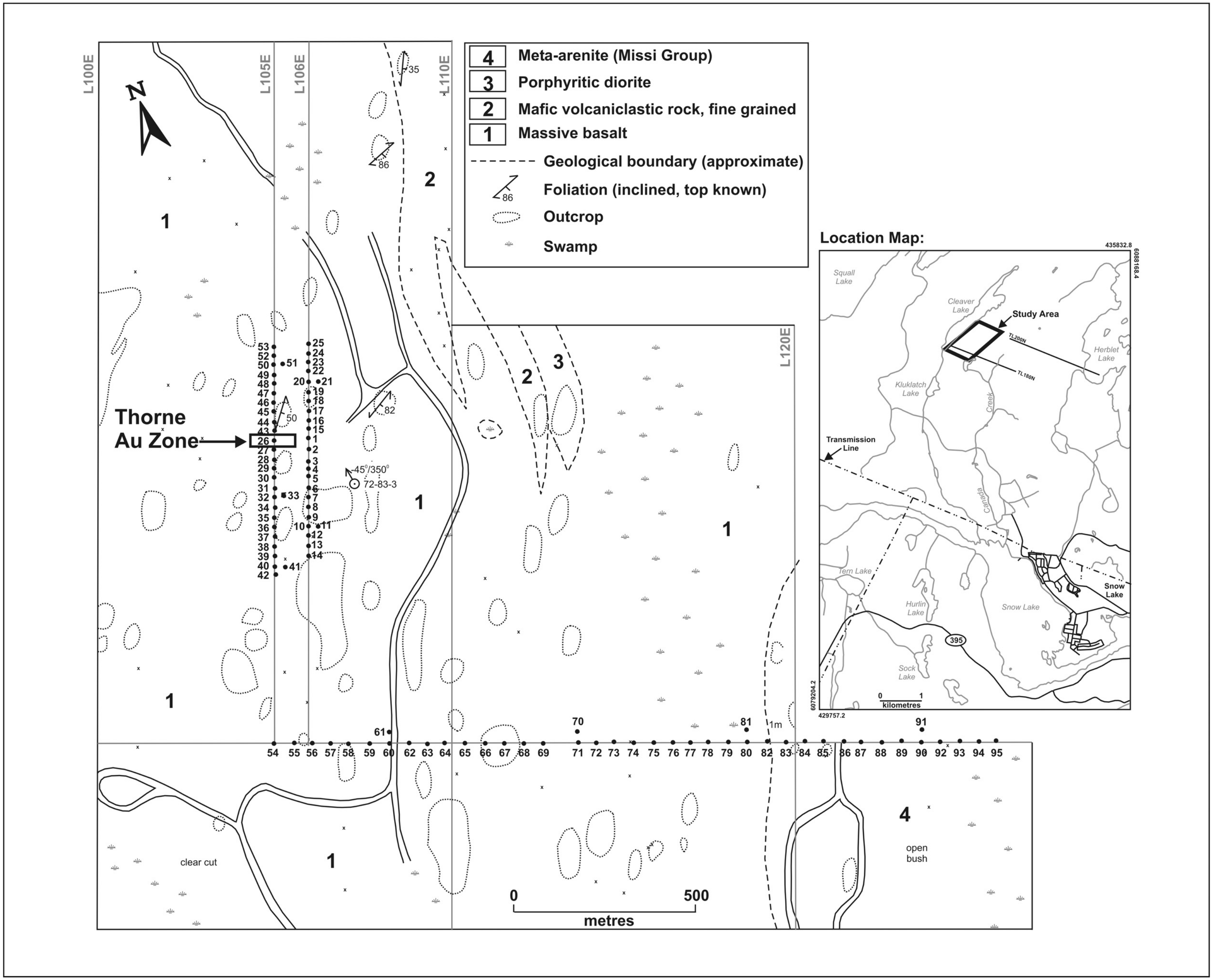

Figure 2: Locations of Enzyme LeachSM and Mobil Metal Ion (MMI Technique®) samples, Thorne gold zone, Snow Lake area.

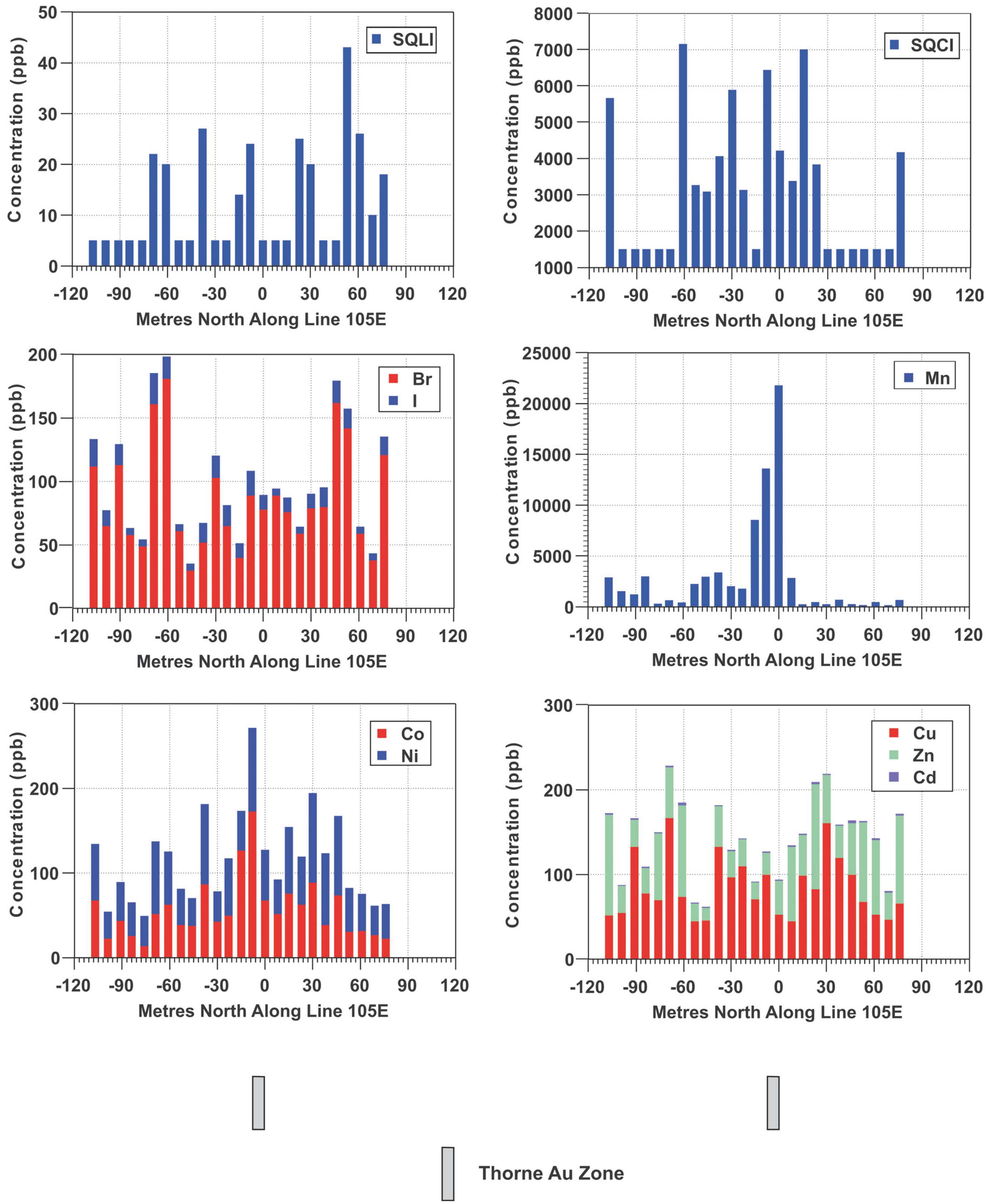

Figure 3: Plots of Enzyme LeachSM analytical results versus distance along line 105E, Thorne gold zone, Snow Lake area.

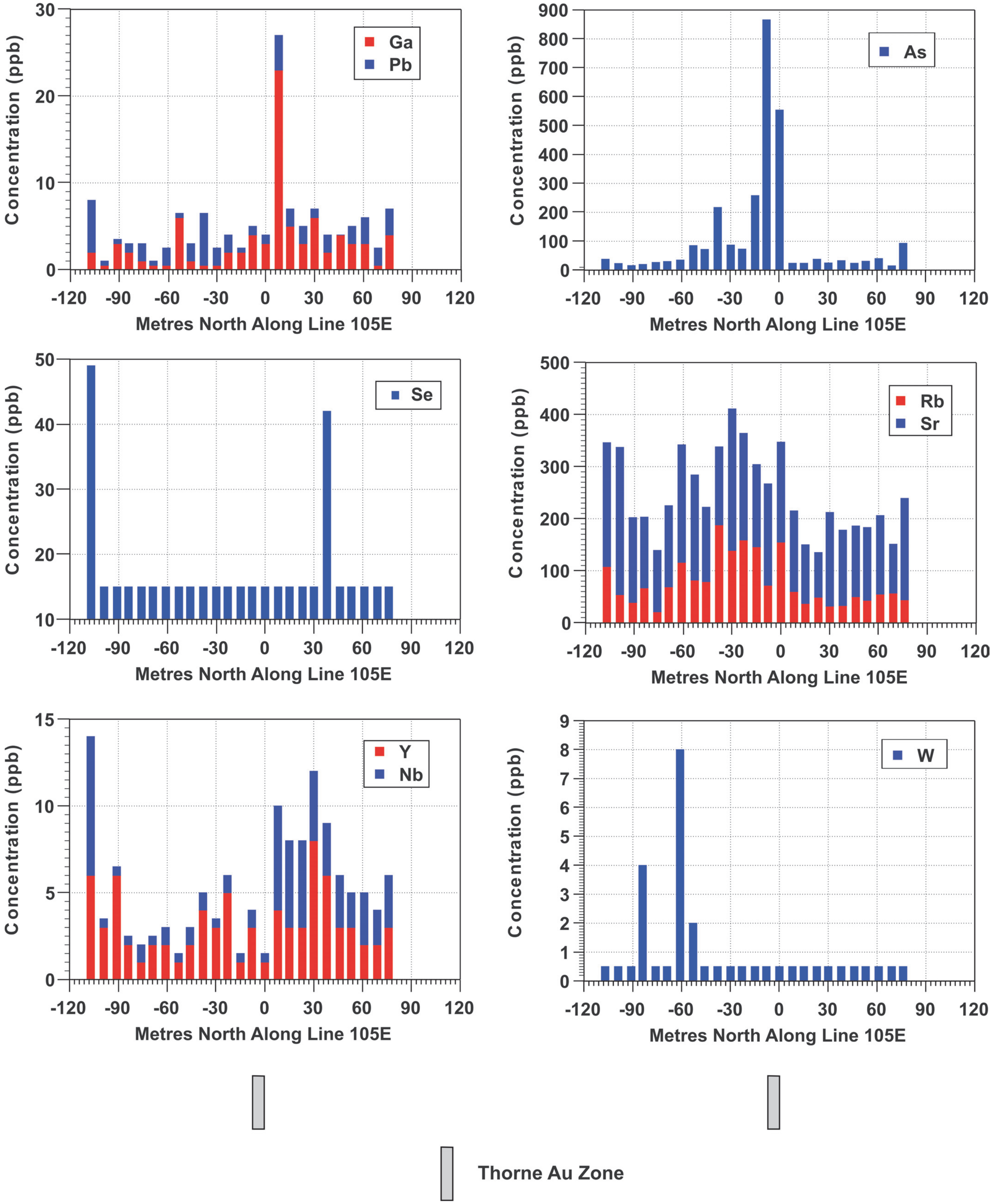

Figure 3: Plots of Enzyme LeachSM analytical results versus distance along line 105E, Thorne gold zone, Snow Lake area. (continued)

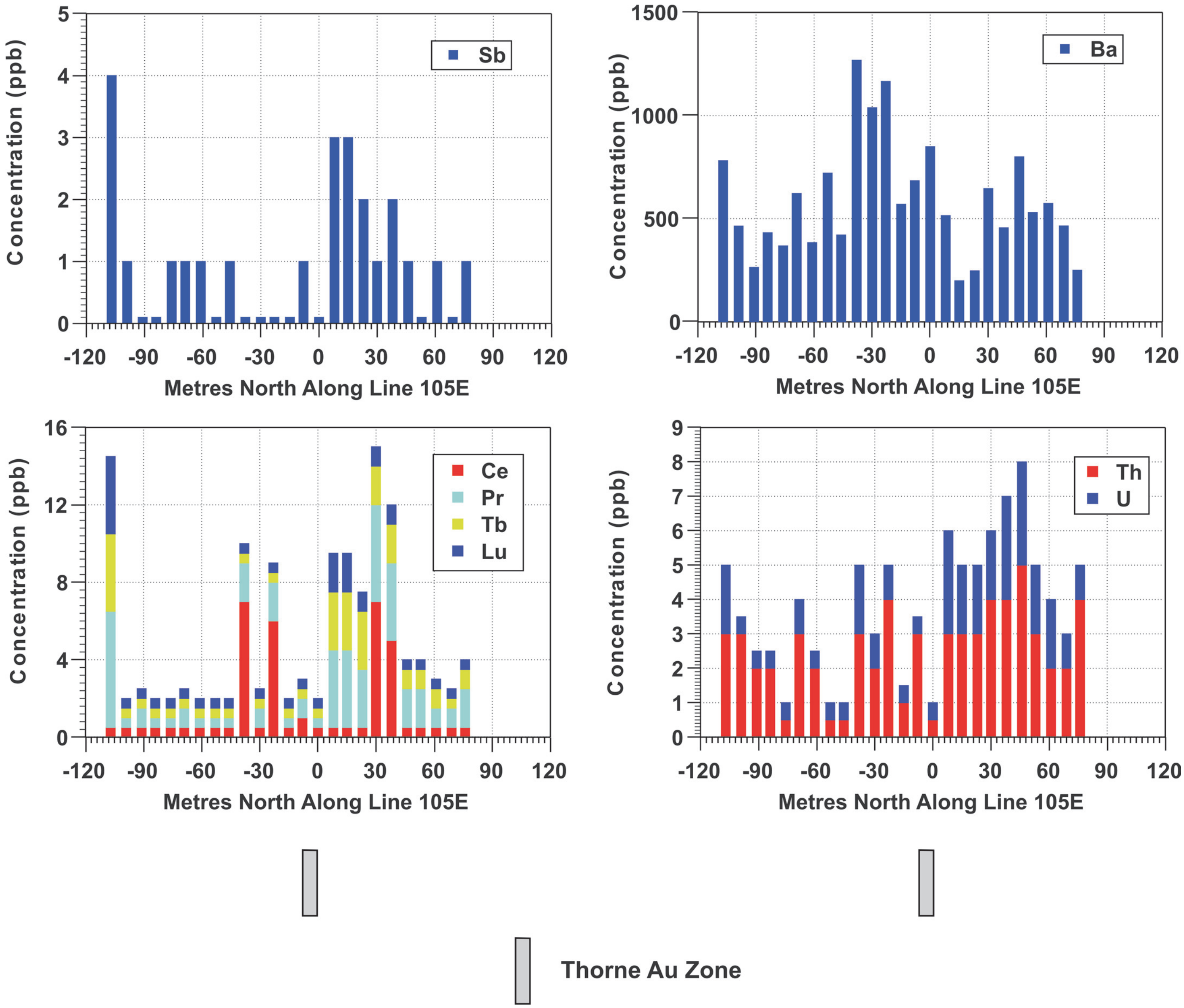

Figure 3: Plots of Enzyme LeachSM analytical results versus distance along line 105E, Thorne gold zone, Snow Lake area. (continued)

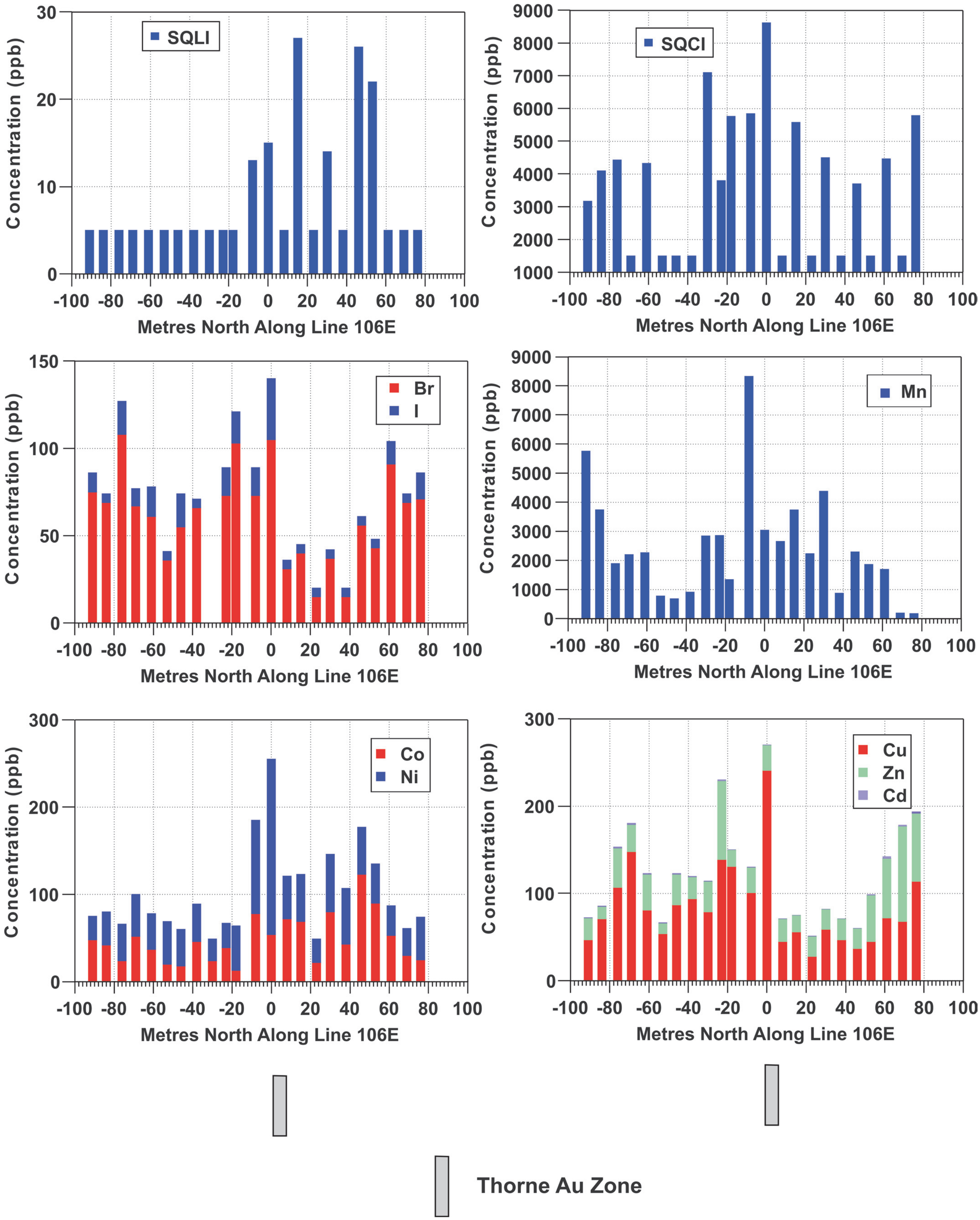

Figure 4: Plots of Mobile Metal Ion (MMI) Technique® analytical results versus distance along line 106E, Thorne gold zone, Snow Lake area.

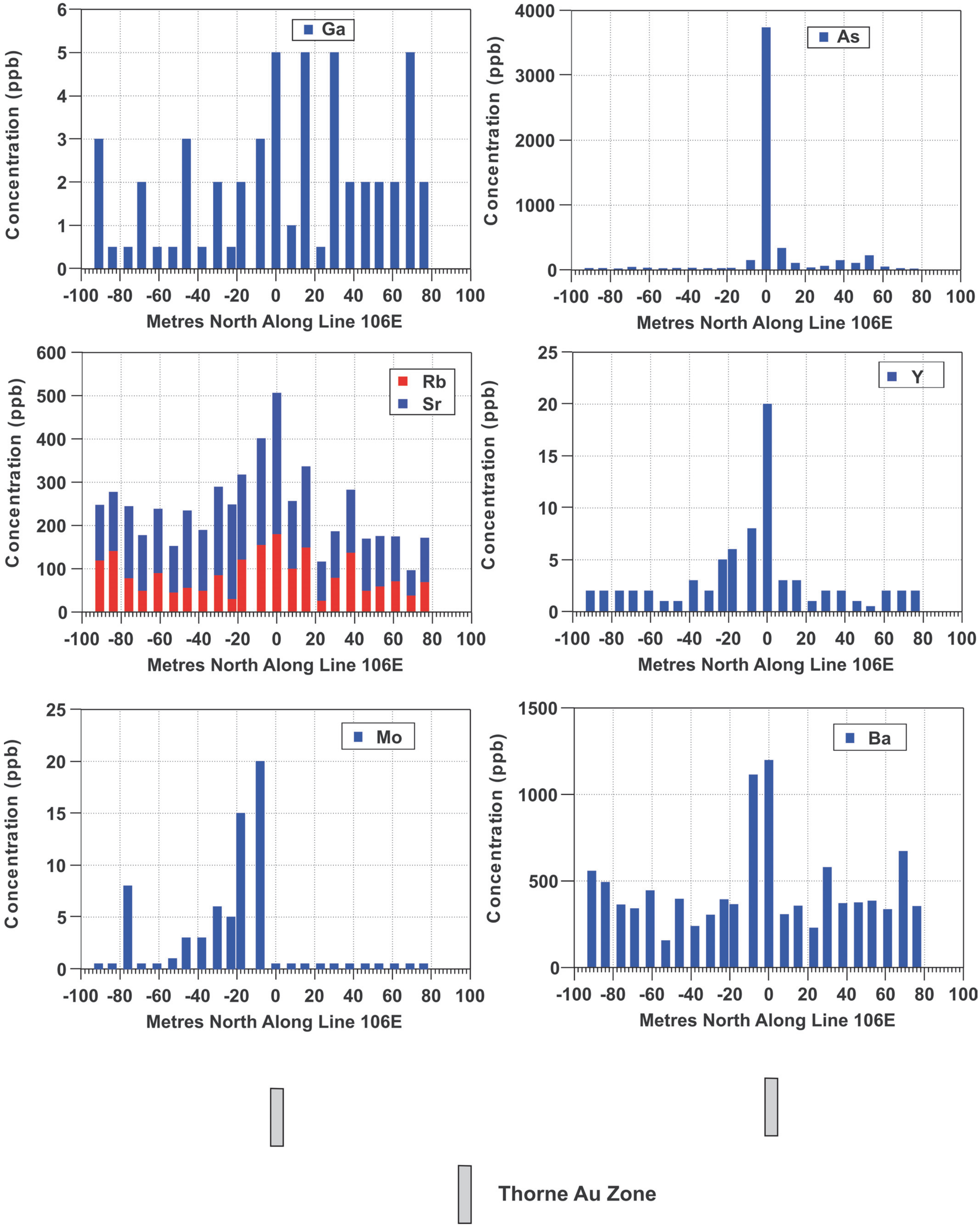

Figure 4: Plots of Mobile Metal Ion (MMI) Technique® analytical results versus distance along line 106E, Thorne gold zone, Snow Lake area. (continued)

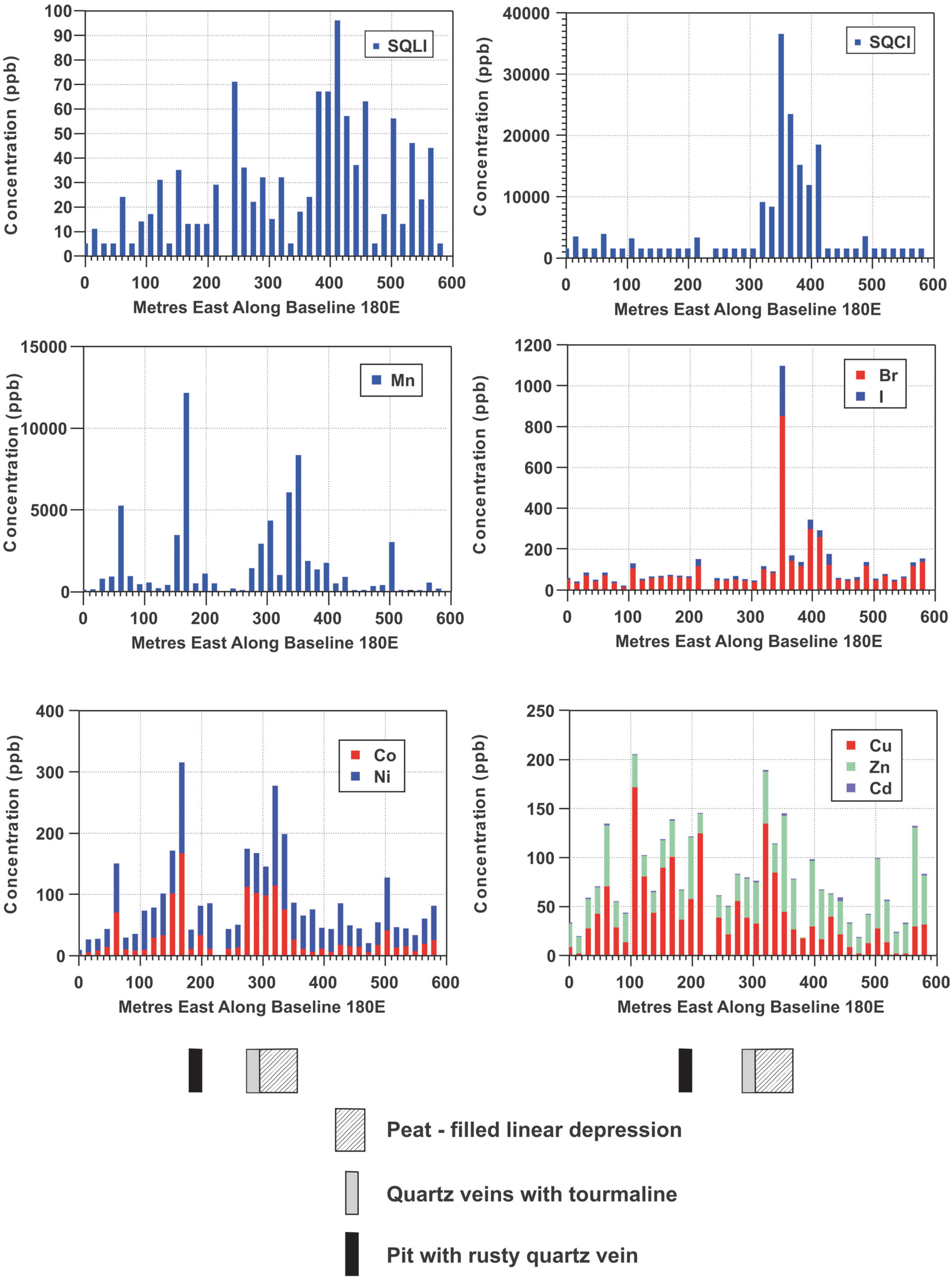

Figure 5: Plots of Mobile Metal Ion (MMI) Technique® analytical results versus distance along baseline TL-180, Thorne gold zone, Snow Lake area.

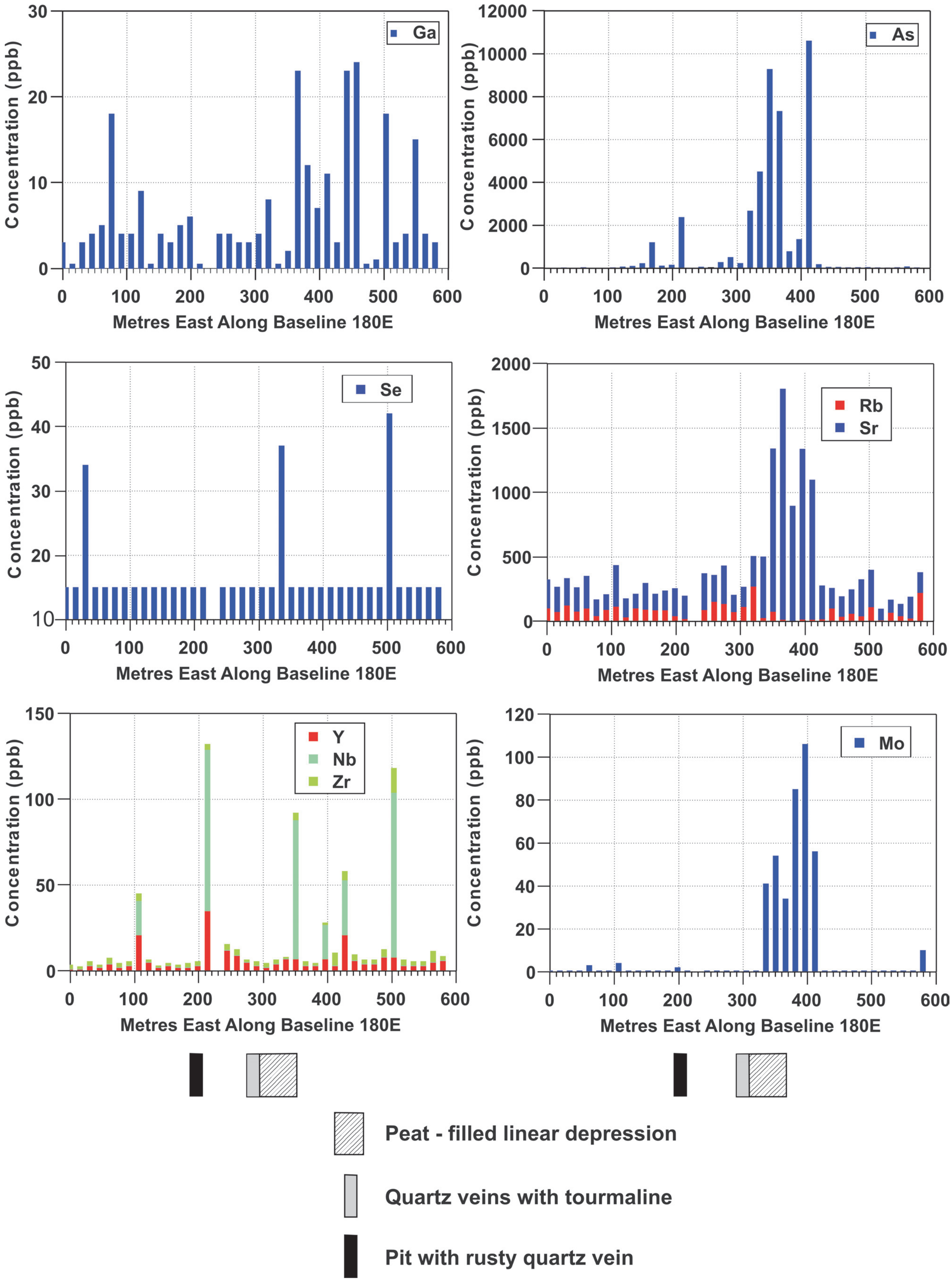

Figure 5: Plots of Mobile Metal Ion (MMI) Technique® analytical results versus distance along baseline TL-180, Thorne gold zone, Snow Lake area. (continued)

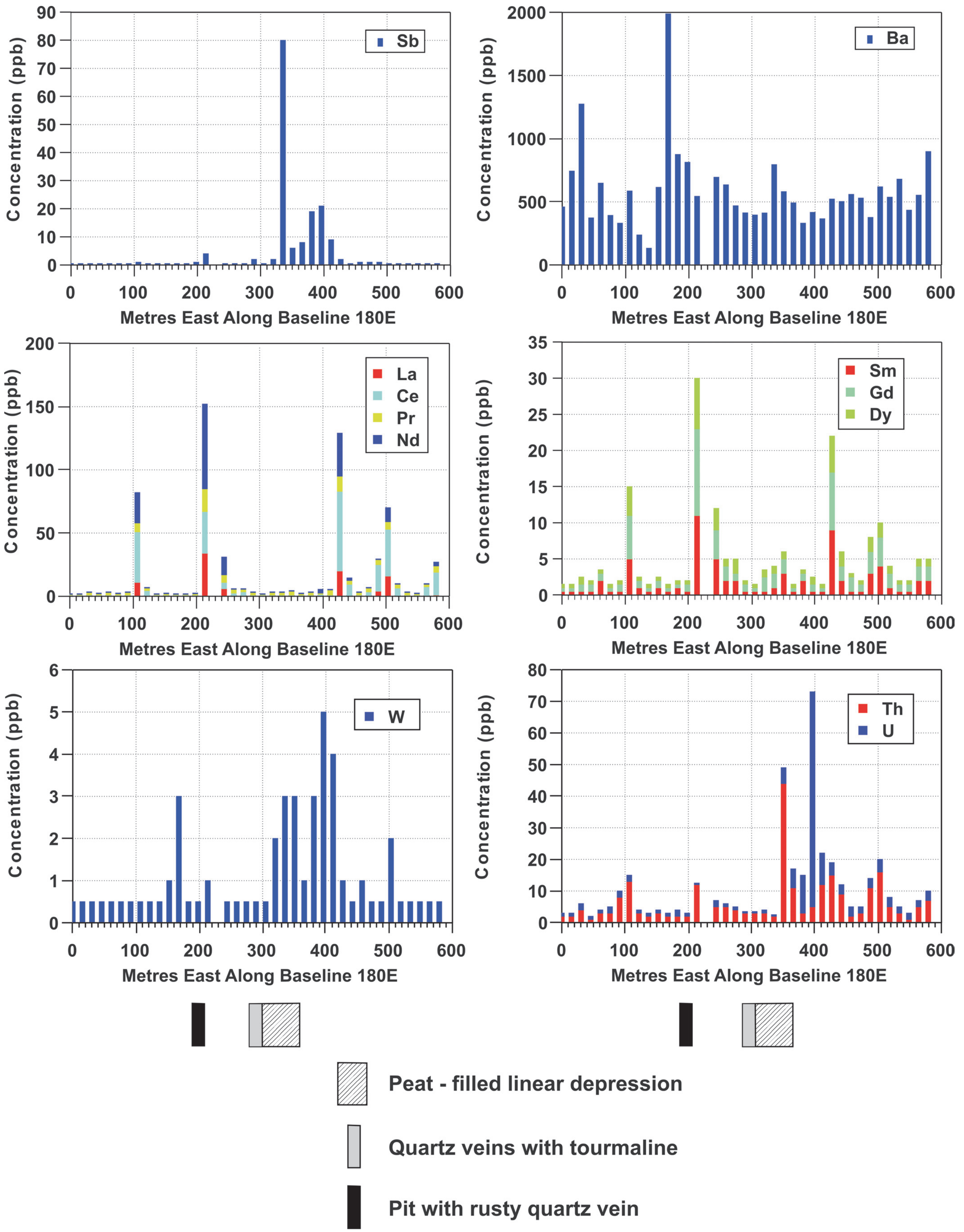

Figure 5: Plots of Mobile Metal Ion (MMI) Technique® analytical results versus distance along baseline TL-180, Thorne gold zone, Snow Lake area. (continued)

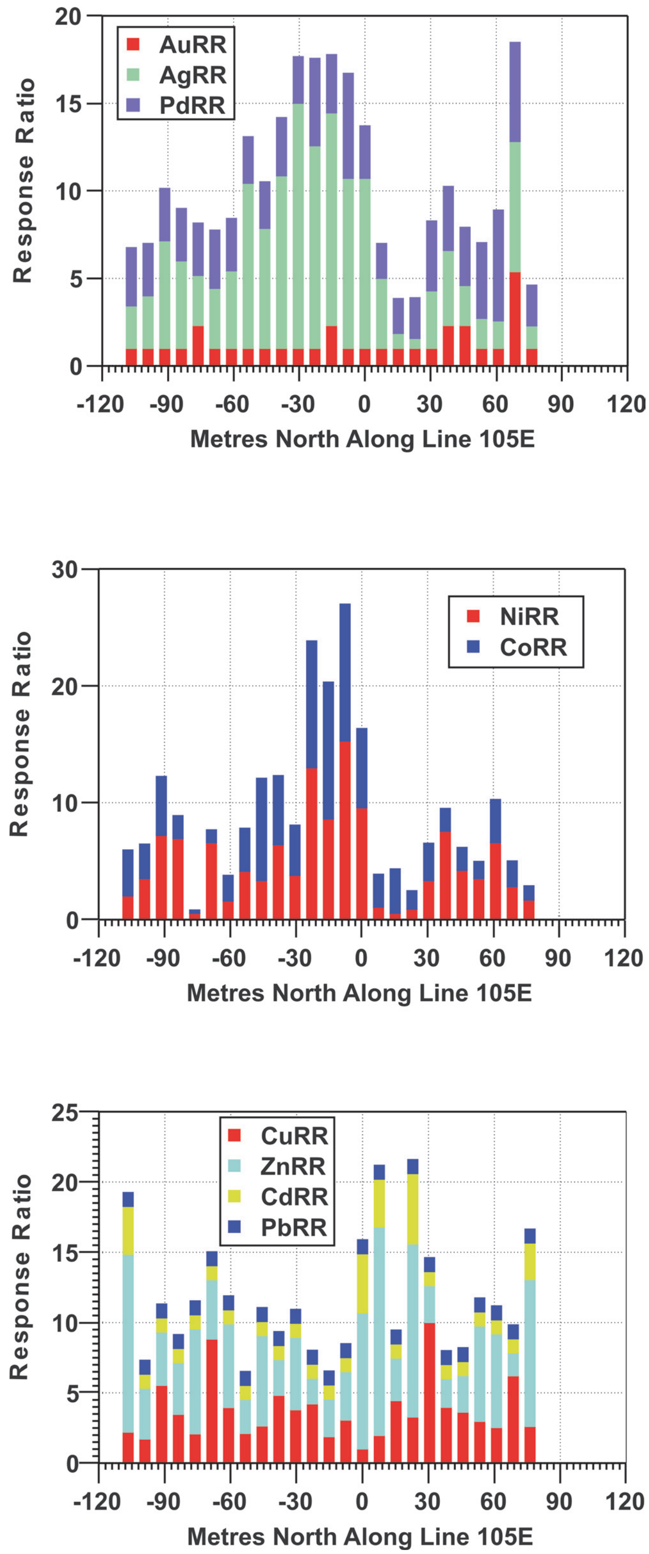

Figure 6: Plots of Mobile Metal Ion (MMI) Technique® analytical results versus distance along line 105E, Thorne gold zone, Snow Lake area.

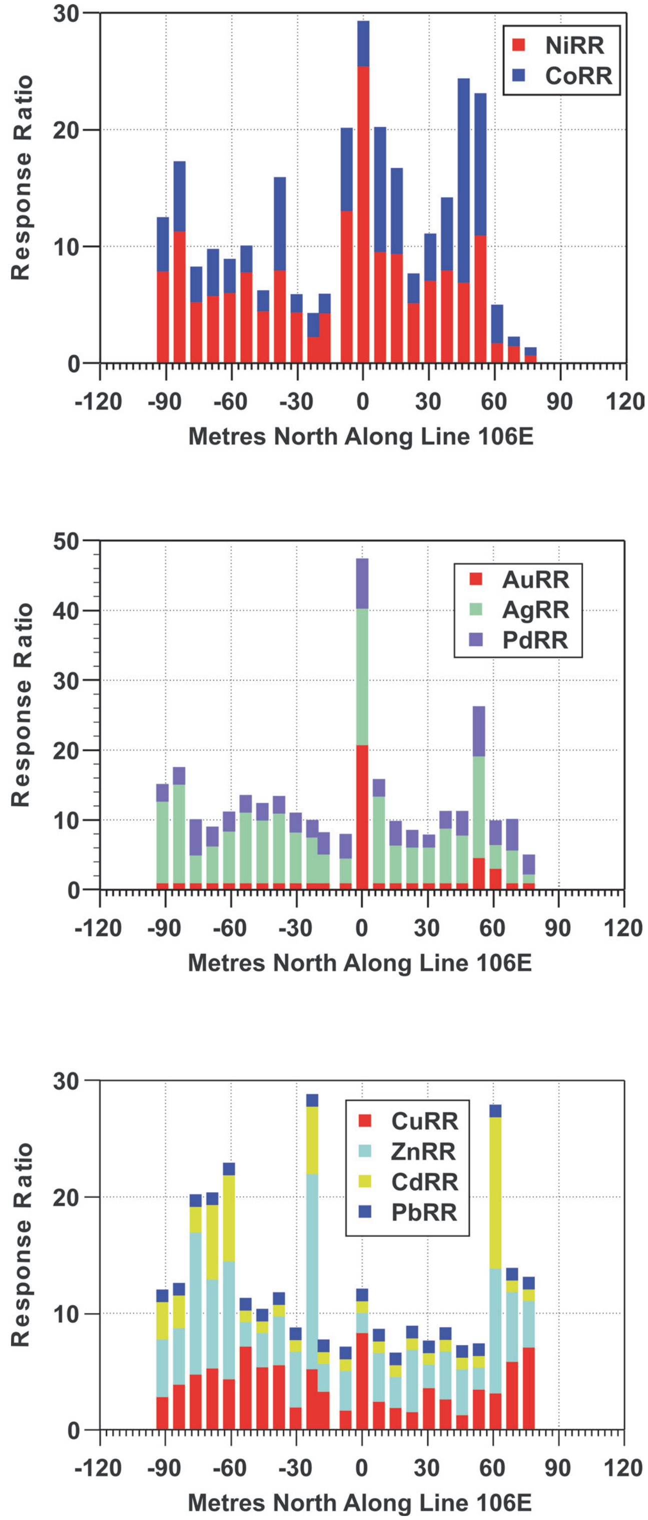

Figure 7: Plots of Mobile Metal Ion (MMI) Technique® analytical results versus distance along line 106E, Thorne gold zone, Snow Lake area.

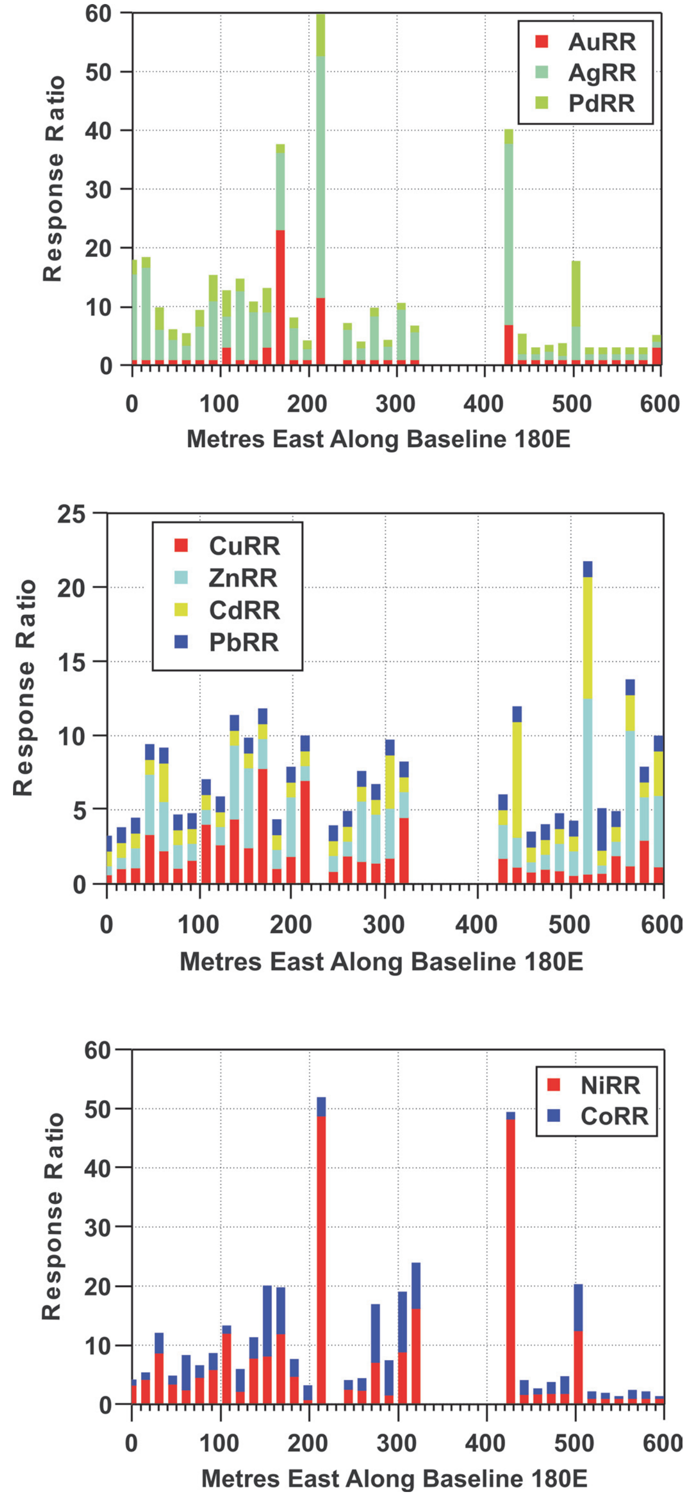

Figure 8: Plots of Mobile Metal Ion (MMI) Technique® analytical results versus distance along baseline TL-180, Thorne gold zone, Snow Lake area.

Appendix 1: Descriptions of B-horizon soil samples collected along lines 105E and 106E and baseline TL-180, Thorne gold zone, Snow Lake area.

Sample No.	Location	Description
Target: Thorne gold zone, line 106E		
TZ-1	188N	chocolate brown, silty B horizon underlain by grey clay
TZ-2	188N+25'S	hematitic-chocolate brown, silty, rootlets
TZ-3	188N+58'S	hematitic-chocolate brown, silty, rootlets
TZ-4	188N+75'S	hematitic-chocolate brown, silty, rootlets
TZ-5	188N+100'S	hematitic-chocolate brown, silty, rootlets, angular basalt cobbles
TZ-6	188N+100'S	hematitic-limonitic, silty, rootlets
TZ-7	188N+125'S	strongly hematitic, silty
TZ-8	188N+150'S	hematitic-limonitic, silty
TZ-9	188N+175'S	hematitic-limonitic, silty
TZ-10	188N+200'S	hematitic-limonitic, silty
TZ-11	188N+225'S	hematitic-limonitic, silty
TZ-12	188N+250'S	light chocolate brown, silty
TZ-13	188N+275'S	light-medium chocolate brown, loamy, basalt pebbles and cobbles
TZ-14	188N+300'S	hematitic, loamy
TZ-15	188N+25'N	hematitic, dark chocolate brown, loamy
TZ-16	188N+50'N	hematitic, loamy, fine grained basaltic pebbles
TZ-17	188N+75'N	hematitic, loamy abundant rootlets
TZ-18	188N+100'N	hematitic, loamy, abundant rootlets
TZ-19	188N+125'N	dark chocolate brown, locally hematitic
TZ-20	188N+150'N	dark chocolate brown, locally hematitic
TZ-21	188N+150'N	dark chocolate brown, locally hematitic
TZ-22	188N+175'N	dark chocolate brown, locally hematitic, quartz vein pebbles
TZ-23	188N+200'N	dark chocolate brown, locally hematitic
TZ-24	188N+225'N	dark brown-black, increased clay content
TZ-25	188N+250'N	dark brown-black, increased clay content, hematitic patches and streaks
Target: Thorne gold zone, line105E		
TZ-26	188N	dark brown, weak limonitic patches, possible mixing with humus
TZ-27	188N+25'S	light chocolate brown, abundant quartz pebbles
TZ-28	188N+50'S	light reddish brown, quartz pebbles
TZ-29	188N+75'S	light-medium reddish brown, angular basalt pebbles
TZ-30	188N+100'S	light-medium reddish brown, rootlets, cobble with quartz vein
TZ-31	188N+125'S	light greyish brown, locally hematitic
TZ-32	188N+150'S	dark brown, collected between roots, basalt pebbles to cobbles
TZ-33	188N+150'S	light limonitic brown, weakly hematitic
TZ-34	188N+175'S	light chocolate brown, collected between outcrop fractures
TZ-35	188N+200'S	dark chocolate brown, locally hematitic
TZ-36	188N+225'S	limonitic-hematitic silts, collected between cobbles and boulders
TZ-37	188N+250'S	hematitic, resting directly on outcrop
TZ-38	188N+275'S	limonitic-hematitic, fine loamy/silty
TZ-39	188N+300'S	hematitic dark chocolate brown, pebbly, rootlets
TZ-40	188N+325'S	limonitic, pebbly, rootlets, loamy
TZ-41	188N+325'S	limonitic, pebbly, rootlets, loamy
TZ-42	188N+350'S	limonitic, rootlets, pebbles-cobbles of carbonate altered basalt
TZ-43	188N+25'N	dark reddish brown, pebbly, rootlets
TZ-44	188N+50'N	dark reddish brown, pebbly, rootlets

TZ-45	188N+75'N	dark reddish brown, pebbly, rootlets
TZ-46	188N+100'N	medium hematitic brown, rootlets, basaltic pebbles to cobbles
TZ-47	188N+125'N	medium hematitic brown, rootlets, basaltic pebbles to cobbles
TZ-48	188N+150'N	reddish brown, rootlets
TZ-49	188N+175'N	reddish brown, rootlets, pebbly
TZ-50	188N+200'N	medium limonitic brown, roots
TZ-51	188N+200'N	medium limonitic brown, roots
TZ-52	188N+225'N	medium light brown, locally hematitic, rootlets
TZ-53	188N+250'N	dark brown, pebbles to cobbles, abundant roots
Target: Baseline TL-180		
TZ-54	105E	limonitic fine sand, 6 cm leached zone
TZ-55	105+50'E	limonitic pebbly sand
TZ-56	106E	yellow-beige limonitic fine sand, abundant poplars
TZ-57	106+50'E	hematitic, pebbly
TZ-58	107E	hematitic, pebbly
TZ-59	107+50'E	oxidized fine sand
TZ-60	108E	visibly unoxidized fine sand
TZ-61	108E	sand-clay, gleysol
TZ-62	108+50'E	gleysol
TZ-63	109E	reddish-yellowish brown, pebbly, rootlets
TZ-64	109+50'E	strongly limonitic to hematitic, rootlets
TZ-65	110E	yellow-beige, locally hematitic, basaltic pebbles
TZ-66	110+50'E	dark reddish brown
TZ-67	111E	limonitic-hematitic fine sand, rootlets, east slope
TZ-68	111+50'E	dark red-brown, rootlets, east slope
TZ-69	112E	pebbly grey clay, beneath 0.4 m peat
TZ-70	113E	limonitic yellow sand
TZ-71	113E	limonitic yellow sand

Appendix 2: Enzyme Leach[SM] analytical data, lines 105E and 106E and baseline TL-180, Thorne gold zone, Snow Lake area.

Sample no.	Line	SQLi	SQBe	SQCl	SQSc	SQTi	V	Mn	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Rb	Sr	Y	Zr	Nb	Mo	Ru	Rh	Pd
TZ-1	106E	15	-20	8622	14	-100	75	3042	54	201	241	29	5	3	3735	-30	105	181	325	20	42	3	-1	-1	-1	-1
TZ-2	106E	13	-20	5847	-10	-100	75	8328	78	107	101	29	3	-1	148	-30	73	156	245	8	-1	-1	20	-1	-1	-1
TZ-3	106E	-10	-20	5764	-10	-100	29	1344	13	51	131	19	2	-1	28	-30	103	122	195	6	-1	-1	15	-1	-1	-1
TZ-4	106E	-10	-20	3801	-10	-100	26	2860	39	28	139	90	-1	-1	23	-30	73	31	217	5	-1	-1	5	-1	-1	-1
TZ-5	106E	-10	-20	7102	-10	-100	25	2845	24	25	79	35	2	-1	23	-30	-30	86	203	2	-1	-1	6	-1	-1	-1
TZ-6	106E	-10	-20	-3000	-10	-100	57	913	46	43	94	25	-1	2	29	-30	66	50	139	3	-1	-1	3	-1	-1	-1
TZ-7	106E	-10	-20	-3000	-10	-100	39	685	18	42	87	35	3	-1	27	34	55	57	177	1	-1	-1	3	-1	-1	-1
TZ-8	106E	-10	-20	-3000	-10	-100	43	779	20	49	54	12	-1	2	22	-30	36	46	106	1	-1	1	1	-1	-1	-1
TZ-9	106E	-10	-20	4328	-10	-100	83	2269	37	41	81	41	-1	2	30	-30	61	91	147	2	-1	1	-1	-1	-1	-1
TZ-10	106E	-10	-20	-3000	-10	-100	76	2014	48	34	69	31	2	-1	36	-30	36	77	147	1	-1	-1	-1	-1	-1	-1
TZ-11	106E	-10	-20	-3000	-10	-100	75	2202	52	48	148	31	2	-1	43	-30	67	50	127	2	-1	1	-1	-1	-1	-1
TZ-12	106E	-10	-20	4431	-10	-100	30	1894	24	42	107	45	-1	-1	18	-30	108	79	165	2	-1	1	8	-1	-1	-1
TZ-13	106E	-10	-20	4099	-10	-100	59	3742	42	38	71	14	-1	-1	25	-30	69	142	135	2	-1	1	-1	-1	-1	-1
TZ-14	106E	-10	-20	3173	-10	-100	68	5757	48	27	47	25	3	-1	25	-30	75	120	127	2	-1	1	-1	-1	-1	-1
TZ-15	106E	-10	-20	-3000	-10	-100	66	2657	72	49	45	26	1	-1	335	-30	31	101	155	3	-1	1	-1	-1	-1	-1
TZ-16	106E	27	-20	5580	-10	-100	58	3738	69	54	56	19	5	-1	105	-30	40	150	186	3	-1	1	-1	-1	-1	-1
TZ-17	106E	-10	-20	-3000	-10	-100	74	2235	22	27	28	23	-1	-1	35	-30	-30	27	89	1	-1	-1	-1	-1	-1	-1
TZ-18	106E	14	-20	4502	-10	-100	37	4381	80	66	59	23	5	-1	59	-30	37	80	106	2	-1	1	-1	-1	-1	-1
TZ-19	106E	-10	-20	-3000	-10	-100	39	877	43	64	47	24	2	-1	147	-30	-30	138	144	2	-1	1	-1	-1	-1	-1
TZ-20	106E	26	-20	3704	-10	-100	48	2295	123	54	37	23	2	-1	105	-30	56	50	119	1	-1	1	-1	-1	-1	-1
TZ-21	106E	33	-20	-3000	-10	-100	41	1544	81	77	68	22	-1	-1	137	-30	51	135	158	1	-1	1	-1	-1	-1	-1
TZ-22	106E	22	-20	-3000	-10	-100	53	1864	90	45	45	53	2	-1	222	-30	43	60	115	-1	-1	-1	-1	-1	-1	-1
TZ-23	106E	-10	-20	4467	-10	-100	20	1696	53	34	72	68	2	-1	48	-30	91	72	102	2	-1	-1	-1	-1	-1	-1
TZ-24	106E	-10	-20	-3000	-10	-100	47	194	30	31	68	109	5	-1	23	-30	69	39	57	2	-1	1	-1	-1	-1	-1
TZ-25	106E	-10	-20	5789	-10	-100	35	176	25	49	114	78	2	-1	16	-30	71	70	101	2	-1	-1	-1	-1	-1	-1
TZ-26	105E	-10	-20	4213	-10	-100	68	21761	68	59	53	40	3	-1	554	-30	78	155	192	1	-1	-1	-1	-1	-1	-1
TZ-27	105E	24	-20	6436	-10	-100	47	13580	173	98	100	26	4	-1	866	-30	89	72	195	3	-1	1	-1	-1	-1	-1
TZ-28	105E	14	-20	-3000	-10	-100	44	8526	127	46	71	20	2	-1	258	-30	40	146	158	1	-1	-1	-1	-1	-1	-1
TZ-29	105E	-10	-20	3130	-10	-100	28	1765	50	67	110	32	2	-1	73	-30	65	159	205	5	-1	1	-1	-1	-1	-1
TZ-30	105E	-10	-20	5886	-10	-100	34	2003	43	35	97	31	-1	-1	87	-30	103	139	272	3	-1	-1	-1	-1	-1	-1
TZ-31	105E	27	-20	4061	-10	-100	30	3355	87	94	133	48	-1	-1	217	-30	52	188	150	4	-1	1	-1	-1	-1	-1
TZ-32	105E	-10	-20	3084	-10	-100	32	2939	38	32	46	15	1	-1	72	-30	30	79	143	2	-1	1	-1	-1	-1	-1
TZ-33-1	105E	21	-20	4025	-10	-100	34	9100	158	66	70	65	2	-1	426	-30	83	102	135	2	-1	-1	-1	-1	-1	-1
TZ-33-2	105E	22	-20	-3000	-10	-100	35	8054	133	68	66	56	1	-1	422	-30	56	93	129	2	-1	-1	-1	-1	-1	-1
TZ-34	105E	-10	-20	3264	-10	-100	36	2224	39	42	45	21	6	-1	85	-30	61	82	202	1	-1	-1	2	-1	-1	-1
TZ-35	105E	20	-20	7150	-10	-100	43	404	63	62	74	108	-1	-1	35	-30	181	116	226	2	-1	1	8	-1	-1	-1
TZ-36	105E	22	-20	-3000	-10	-100	30	625	52	85	167	60	-1	-1	30	-30	161	69	156	2	-1	-1	-1	-1	-1	-1
TZ-37-1	105E	-10	-20	-3000	-10	-100	62	284	14	35	70	79	1	-1	27	-30	49	21	118	1	-1	1	-1	-1	-1	-1
TZ-37-2	105E	-10	-20	-3000	-10	-100	60	283	14	41	42	78	2	-1	29	-30	-30	19	112	1	-1	-1	-1	-1	-1	-1
TZ-38	105E	-10	-20	-3000	-10	-100	57	2969	26	39	78	30	2	-1	20	-30	58	67	136	2	-1	-1	4	-1	-1	-1
TZ-39	105E	-10	-20	-3000	-10	-100	35	1198	44	45	133	32	3	-1	16	-30	113	39	163	6	-1	-1	-1	-1	-1	-1
TZ-40	105E	-10	-20	-3000	-10	-100	37	1515	23	31	55	32	-1	-1	23	-30	65	54	283	3	-1	-1	-1	-1	-1	-1
TZ-41	105E	-10	-20	-3000	-10	-100	62	3196	30	25	50	36	-1	-1	21	-30	59	44	271	2	-1	1	-1	-1	-1	-1
TZ-42	105E	-10	-20	5661	-10	-100	27	2876	68	66	52	119	2	-1	38	49	112	108	238	6	-1	8	-1	-1	-1	-1
TZ-43	105E	-10	-20	3377	-10	-100	33	2816	52	40	45	88	23	-1	24	-30	89	60	155	4	-1	6	-1	-1	-1	-1
TZ-44	105E	-10	-20	7001	-10	-100	32	228	76	78	99	48	5	-1	24	-30	76	37	113	3	-1	5	-1	-1	-1	-1
TZ-45	105E	25	-20	3833	-10	-100	53	444	63	56	83	124	3	-1	38	-30	59	49	86	3	-1	5	-1	-1	-1	-1
TZ-46	105E	20	-20	-3000	-10	-100	71	231	89	105	161	57	6	4	25	-30	79	32	180	8	-1	4	-1	-1	-1	-1
TZ-47	105E	-10	-20	-3000	-10	-100	41	676	39	84	120	38	2	-1	33	42	80	33	145	6	-1	3	-1	-1	-1	-1
TZ-48	105E	-10	-20	-3000	-10	-100	25	239	74	93	100	61	4	-1	24	-30	162	50	136	3	-1	3	-1	-1	-1	-1
TZ-49	105E	43	-20	-3000	-10	-100	34	151	31	51	68	94	3	-1	31	-30	142	43	140	3	-1	2	-1	-1	-1	-1
TZ-50	105E	26	-20	-3000	-10	-100	59	442	32	43	53	88	3	-1	40	-30	59	55	151	2	-1	3	-1	-1	-1	-1
TZ-51	105E	19	-20	-3000	-10	-100	28	440	40	57	36	66	7	-1	20	-30	56	64	148	2	-1	2	-1	-1	-1	-1
TZ-52	105E	10	-20	-3000	-10	-100	20	139	27	34	47	32	-1	-1	15	-30	38	57	94	2	-1	2	-1	-1	-1	-1
TZ-53	105E	18	-20	4169	-10	-100	84	651	23	40	66	104	4	-1	93	-30	121	44	195	3	-1	3	-1	-1	-1	-1
TZ-54	TL-180	-10	-20	-3000	-10	-100	36	99	3	6	9	24	3	-1	12	-30	53	104	219	1	-1	2	-1	-1	-1	-1
TZ-55-1	TL-180	11	-20	3462	-10	-100	21	124	6	20	-5	17	-1	-1	10	-30	36	76	190	1	-1	1	-1	-1	-1	-1
TZ-55-2	TL-180	11	-20	-3000	-10	-100	24	165	8	18	8	14	2	-1	12	-30	71	83	201	1	-1	1	-1	-1	-1	-1
TZ-56	TL-180	10	-20	-3000	-10	-100	28	766	9	18	28	30	3	-1	22	34	73	126	207	3	-1	2	-1	-1	-1	-1
TZ-57	TL-180	-10	-20	-3000	-10	-100	22	903	15	28	43	27	4	-1	10	-30	44	79	183	2	-1	1	-1	-1	-1	-1
TZ-58	TL-180	24	-20	3887	-10	-100	46	5240	71	79	71	62	5	-1	32	-30	74	103	248	4	-1	3	3	-1	-1	-1
TZ-59	TL-180	-10	-20	-3000	-10	-100	31	929	11	18	29	26	18	-1	12	-30	36	44	124	2	-1	2	-1	-1	-1	-1
TZ-60	TL-180	14	-20	-3000	-10	-100	26	432	9	26	14	29	4	-1	9	-30	-30	92	116	3	-1	2	-1	-1	-1	-1
TZ-61	TL-180	17	-20	-3000	-10	-100	28	494	13	37	70	32	3	-1	11	-30	-30	125	160	5	-1	3	-1	-1	-1	-1
TZ-62	TL-180	17	-20	3158	-10	103	69	534	10	63	172	33	4	-1	25	-30	108	117	317	21	20	4	4	-1	-1	-1
TZ-63	TL-180	31	-20	-3000	-10	-100	108	189	30	48	81	21	9	-1	63	-30	49	34	142	5	-1	1	-1	-1	-1	-1
TZ-64	TL-180	-10	-20	-3000	-10	-100	74	388	34	67	44	21	-1	-1	95	-30	60	104	108	2	-1	-1	-1	-1	-1	-1
TZ-65	TL-180	35	-20	-3000	-10	-100	85	3441	102	69	90	28	4	-1	222	-30	63	94	202	3	-1	1	-1	-1	-1	-1
TZ-66	TL-180	13	-20	-3000	-10	-100	49	12136	168	147	101	37	3	-1	1196	-30	68	89	123	2	-1	1	-1	-1	-1	-1
TZ-67	TL-180	13	-20	-3000	-10	-100	45	485	12	30	37	30	5	-1	107	-30	64	89	148	2	-1	2	-1	-1	-1	-1
TZ-68	TL-180	13	-20	-3000	-10	-100	65	1085	34	47	58	63	6	-1	151	-30	61	43	212	3	-1	2	2	-1	-1	-1
TZ-69	TL-180	29	-20	3298	-10	-100	271	484	12	73	125	20	-1	2	2370	-30	118	21	176	35	94	3	-1	-1	-1	-1
TZ-70	TL-180	71	-20	-3000	-10	-100	54	170	12	31	39	22	4	-1	56	-30	47	91	280	12	-1	3	-1	-1	-1	-1
TZ-71	TL-180	79	-20	-3000	-10	-100	43	432	15	58	27	48	4	-1	42	-30	32	76	326	7	-1	4	-1	-1	-1	-1
TZ-72	TL-180	36	-20	-3000	-10	-100	29	73	14	36	22	28	4	-1	23	-30	49	155	203	9	-1	3	-1	-1	-1	-1
TZ-73	TL-180	22	-20	-3000	-10	-100	66	1414	113	61	56	27	3	-1	272	-30	53	138	293	5	-1	1	-1	-1	-1	-1
TZ-74	TL-180	32	-20	-3000	-10	-100	155	2910	103	64	39	40	3	-1	505	-30	47	75	129	3	-1	2	-1	-1	-1	-1
TZ-75	TL-180	15	-20	-3000	-10	-100	54	4326	99	46	33	42	4	-1	225	-30	40	115	151	2	-1	2	-1	-1	-1	-1
TZ-76	TL-180	32	-20	9088	31	-100	157	996	115	162	135	53	8	2	2668	-30	103	273	232	4	-1	2	-1	-1	-1	-1
TZ-77	TL-180	-10	-20	8325	-10	-100	8016	6052	76	122	85	29	-1	6	4495	37	85	29	472	7	-1	-1	41	-1	-1	-1
TZ-77-2	TL-180	19	-20	-3000	-10	-100	8012	6017	69	113	99	12	-1	7	4503	39	74	33	421	3	-1	1	49	-1	-1	-1
TZ-78	TL-180	18	-20	36522	66	-100	491	8332	27	59	45	98	2	3	9271	-30	855	78	1261	7	81	4	54	-1	-1	-1
TZ-79	TL-180	24	-20	23444	72	-100	1201	1858	12	53	27	51	23	2	7312	-30	145	16	1787	3	-1	2	34	-1	-1	-1
TZ-80	TL-180	67	-20	15146	51	-100	2347	1334	7	68	18	-10	12	1	779	-30	119	4	891	3	-1	1	85	-1	-1	-1
TZ-80-2	TL-180	65	-20	14059	30	-100	2334	1396	7	52	21	-10	14	1	831	-30	145	3	911	3	-1	2	84	-1	-1	-1
TZ-81	TL-180	48	-20	8572	17	-100	2271	1072	5	44	23	15	4	2	1128	-30	260	9	1013	9	39	2	121	-1	-1	-1
TZ-81-2	TL-180	55	-20	7281	23	-100	2232	901	7	36	20	22	4	1	1132	-30	195	8	852	10	32	2	107	-1	-1	-1
TZ-82	TL-180	67	-20	11866	68	-100	1595	1740	12	33	30	67	7	3	1343	-30	300	17	1320	7	20	1	106	-1	-1	-1
TZ-82-2	TL-180	55	-20	15805	91	-100	1535	1186	8	49	25	46	6	-1	1189	-30	217	12	1343	4	17	1	98	-1	-1	-1
TZ-83	TL-180	96	-20	18458	52	-100	286	483	7	36	17	50	11	2	10593	-30	261	16	1081	3	-1	7	56	-1	-1	-1
TZ-83-2	TL-180	92	-20	20122	57	-100	253	512	6	36	16	59	5	2	10626	-30	266	13	1081	2	-1	4	48	-1	-1	-1
TZ-84	TL-180	57	-20	-3000	24	-100	257	881	18	67	40	23	3	-1	175	-30	125	19	257	21	32	5	-1	-1	-1	-1
TZ-85	TL-180	37	-20	-3000	-10	-100	49	74	16	33	22	34	23	-1	49	-30	53	103	154	6	-1	3	-1	-1	-1	-1
TZ-86	TL-180	63	-20	-3000	-10	-100	46	85	15	29	9	24	24	-1	47	-30	47	39	153	4	-1	2	-1	-1	-1	-1
TZ-87	TL-180	-10	-20	-3000	-10	-100	33	321	6	14	-5	16	-1	-1	30	-30	50	62	184	4	-1	2	-1	-1	-1	-1
TZ-88	TL-180	17	-20	3509	-10	-100	53	380	18	36	13	29	1	-1	37	-30	120	42	282	8	-1	4	-1	-1	-1	-1
TZ-89	TL-180	56	-20	-3000	56	260	100	3012	42	85	28	71	18	-1	40	42	49	113	285	8	96	14	-1	-1	-1	-1
TZ-90	TL-180	13	-20	-3000	-10	-100	53	82	14	32	14	42	3	-1	25	-30	72	11	85	3	-1	3	-1	-1	-1	-1
TZ-91	TL-180	23	-20	-3000	-10	-100	77	458	19	21	5	63	4	-1	34	-30	74	-1	199	3	-1	2	-1	-1	-1	-1
TZ-92	TL-180	46	-20	-3000	-10	-100	22	57	16	28	-5	21	4	-1	19	-30	44	70	96	3	-1	2	-1	-1	-1	-1
TZ-93	TL-180	23	-20	-3000	-10	-100	26	71	8	25	-5	30	15	-1	32	-30	60	43	90	3	-1	2	-1	-1	-1	-1
TZ-94	TL-180	44	-20	-3000	-10	131	137	532	20	40	30	101	4	-1	70	-30	119	25	164	5	-1	6	-1	-1	-1	-1
TZ-95	TL-180	-10	-20	-3000	-10	-100	49	163	26	55	32	50	3	-1	26	-30	139	224	155	6	-1	2	10	-1	-1	-1

NOTE: All data in parts per billion. A negative number denotes an analysis <LLD.

Ag	Cd	In	Sn	Sb	Te	I	Cs	Ba	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Hf	Ta	W	Re	Os	Ir
0.3	0.4	1	-1	5	2	35	1	1197	17	55	17	32	8	2	6	9	4	-1	2	-1	8	6	1	-1	2	-0.1	-1	-1
-0.2	0.4	1	-1	3	1	16	-1	1113	1	15	8	10	2	-1	2	5	2	-1	-1	-1	4	3	-1	-1	1	-0.1	-1	-1
-0.2	0.4	0.5	-1	2	1	18	-1	364	-1	5	4	-1	2	-1	2	3	1	-1	-1	-1	1	2	-1	-1	2	-0.1	-1	-1
-0.2	1.5	0.5	-1	2	-1	16	-1	392	-1	3	4	-1	-1	-1	2	2	-1	-1	-1	-1	2	1	-1	-1	-1	-0.1	-1	-1
-0.2	0.4	0.5	-1	2	-1	-10	-1	303	-1	-1	2	-1	-1	-1	-1	1	-1	-1	-1	-1	-1	1	-1	-1	-1	-0.1	-1	-1
-0.2	0.7	-0.2	-1	1	-1	-10	2	238	-1	-1	2	-1	-1	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	1	-0.2	-1	-1	-1	19	-1	395	-1	-1	2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	0.7	-0.2	-1	-1	-1	-10	-1	155	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	1	-0.2	-1	1	-1	17	-1	444	-1	-1	2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	1	-0.2	-1	-1	-1	-10	-1	207	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	1.5	-0.2	-1	-1	-1	10	-1	340	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	1.3	-0.2	-1	1	-1	19	2	362	-1	-1	2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	0.7	-0.2	-1	-1	-1	-10	1	492	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	0.4	-0.2	-1	-1	-1	11	2	557	-1	-1	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	-0.2	-0.2	-1	-1	-1	-10	-1	306	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	-0.2	-0.2	-1	1	-1	-10	-1	355	-1	-1	1	-1	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	0.4	-0.2	-1	-1	-1	-10	-1	228	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	-0.2	-0.2	-1	1	1	-10	-1	578	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	-0.2	-0.2	-1	1	1	-10	2	370	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1	-0.1	-1	-1
-0.2	0.4	-0.2	-1	-1	-1	-10	-1	374	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	0.4	-0.2	-1	-1	-1	-10	-1	591	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	1	-0.2	-1	-1	-1	-10	-1	384	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1	-0.1	-1	-1
-0.2	2.4	-0.2	-1	-1	-1	13	-1	335	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	1.5	-0.2	-1	-1	-1	-10	-1	671	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	1.5	-0.2	-1	-1	-1	15	-1	353	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	0.4	-0.2	-1	-1	-1	11	1	849	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	3	-0.1	-1	-1
-0.2	0.7	-0.2	-1	1	-1	19	-1	684	-1	1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1	-0.1	-1	-1
-0.2	-0.2	-0.2	-1	-1	1	11	-1	570	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	2	-0.1	-1	-1
-0.2	-0.2	-0.2	-1	-1	-1	16	-1	1165	-1	6	2	-1	2	-1	1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	0.7	-0.2	-1	-1	-1	17	-1	1038	-1	-1	1	-1	1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	0.4	-0.2	-1	-1	-1	15	1	1268	-1	7	2	-1	2	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	0.4	-0.2	-1	1	-1	-10	-1	421	-1	-1	-1	-1	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	0.4	-0.2	-1	-1	1	-10	-1	712	-1	-1	1	-1	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	1	-0.2	-1	-1	-1	-10	-1	644	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	0.4	-0.2	-1	-1	-1	-10	3	721	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	2.4	-0.2	-1	1	-1	17	1	384	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	1	-0.2	-1	1	-1	24	-1	622	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	0.4	-0.2	-1	1	-1	-10	-1	368	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	0.4	-0.2	-1	1	-1	-10	-1	352	-1	-1	2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	0.7	-0.2	-1	-1	2	-10	1	432	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	1	-0.2	-1	-1	2	16	-1	264	-1	-1	1	-1	2	-1	1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	-0.2	-0.2	-1	1	-1	12	-1	464	-1	-1	-1	-1	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	1	-0.2	-1	-1	1	15	-1	341	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	1	1	-1	4	2	21	1	781	-1	-1	6	-1	-1	-1	1	4	-1	-1	-1	-1	3	4	-1	-1	2	-0.1	-1	-1
-0.2	1	0.5	-1	3	-1	-10	-1	515	-1	-1	4	-1	-1	-1	1	3	-1	-1	-1	-1	2	2	-1	-1	2	-0.1	-1	-1
-0.2	0.7	0.5	-1	3	-1	11	-1	199	-1	-1	4	-1	-1	-1	-1	3	-1	-1	-1	-1	1	2	-1	-1	2	-0.1	-1	-1
-0.2	1.8	-0.2	-1	2	-1	-10	-1	247	-1	-1	3	-1	-1	-1	-1	3	-1	-1	-1	-1	1	1	-1	-1	1	-0.1	-1	-1
-0.2	0.4	0.5	-1	1	-1	11	-1	646	-1	7	5	1	1	-1	3	2	1	-1	-1	-1	2	1	-1	-1	1	-0.1	-1	-1
-0.2	0.4	0.5	-1	2	-1	15	-1	456	-1	5	4	-1	2	-1	2	2	1	-1	-1	-1	1	1	-1	-1	1	-0.1	-1	-1
-0.2	2.4	-0.2	-1	1	-1	17	-1	800	-1	-1	2	-1	-1	-1	1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	0.7	-0.2	-1	-1	-1	15	-1	530	-1	-1	2	-1	-1	-1	1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	1.3	-0.2	-1	1	-1	-10	-1	574	-1	-1	1	-1	-1	-1	-1	1	-1	-1	-1	-1	1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	1	-0.2	-1	1	-1	-10	-1	586	-1	-1	2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	1	-0.2	-1	-1	2	-10	-1	465	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	1.3	-0.2	-1	1	-1	14	-1	250	-1	-1	2	-1	-1	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	2	-0.1	-1	-1
-0.2	0.4	-0.2	-1	-1	-1	-10	-1	460	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	-0.2	-0.2	-1	-1	-1	-10	-1	744	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	-0.2	-0.2	-1	-1	-1	-10	-1	804	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	0.7	-0.2	-1	-1	1	11	-1	1274	-1	-1	2	-1	-1	-1	1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	0.4	-0.2	-1	-1	-1	-10	-1	373	-1	-1	1	-1	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	1.3	-0.2	-1	-1	2	10	1	648	-1	-1	2	-1	2	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	-0.2	-0.2	-1	-1	-1	-10	-1	393	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	0.4	-0.2	-1	-1	-1	-10	-1	331	-1	-1	2	-1	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	0.4	-0.2	-1	-1	1	-10	-1	448	-1	13	3	1	2	-1	2	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	-0.2	-0.2	-1	1	-1	21	-1	586	11	40	7	24	5	2	6	1	4	-1	2	-1	2	-1	3	-1	-1	-0.1	-1	-1
-0.2	-0.2	-0.2	-1	-1	-1	-10	-1	238	-1	4	2	-1	1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	0.7	-0.2	-1	-1	-1	-10	-1	133	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	0.4	-0.2	-1	-1	-1	-10	-1	615	-1	-1	1	-1	1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1	-0.1	-1	-1
-0.2	0.7	-0.2	-1	-1	-1	-10	2	1988	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	3	-0.1	-1	-1
-0.2	-0.2	-0.2	-1	-1	-1	-10	-1	875	-1	-1	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	-0.2	-0.2	-1	1	-1	-10	-1	813	-1	-1	1	-1	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	-0.2	-0.2	-1	4	-1	32	-1	544	34	33	18	67	11	2	12	1	7	1	2	-1	4	-1	1	-1	1	-0.1	-1	-1
-0.2	-0.2	-0.2	-1	-1	-1	10	-1	695	6	5	6	14	5	-1	4	-1	3	-1	1	-1	1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	0.4	-0.2	-1	-1	-1	10	-1	673	-1	-1	4	5	4	-1	3	-1	2	-1	-1	-1	1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	0.4	-0.2	-1	-1	-1	-10	-1	635	-1	2	3	-1	2	-1	2	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	-0.2	-0.2	-1	-1	-1	14	-1	469	-1	3	2	-1	2	-1	1	-1	2	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	0.4	-0.2	-1	2	-1	-10	-1	413	-1	-1	2	-1	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	1	-0.2	-1	-1	3	-10	1	396	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	1	-0.2	-1	2	-1	12	-1	412	-1	-1	2	-1	-1	-1	2	-1	1	-1	-1	-1	1	-1	-1	-1	2	-0.1	-1	-1
-0.2	-0.2	-0.2	-1	80	-1	-10	-1	795	-1	-1	2	-1	1	-1	2	-1	1	-1	-1	-1	-1	-1	-1	-1	3	-0.1	-1	-1
-0.2	-0.2	-0.2	-1	87	-1	-10	-1	716	-1	-1	2	-1	1	1	2	-1	1	-1	-1	-1	1	-1	-1	-1	3	-0.1	-1	-1
0.3	1.8	-0.2	-1	6	6	241	-1	581	-1	-1	3	-1	3	-1	2	1	1	-1	-1	-1	-1	-1	4	-1	3	0.2	-1	-1
-0.2	-0.2	-0.2	-1	8	2	23	-1	492	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1	-0.1	-1	-1
-0.2	-0.2	-0.2	-1	19	2	17	-1	331	-1	-1	2	-1	2	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	3	-0.1	-1	-1
-0.2	1	-0.2	-1	17	-1	14	-1	343	-1	-1	2	-1	-1	-1	1	-1	1	-1	-1	-1	-1	-1	-1	-1	3	0.2	-1	-1
-0.2	0.7	-0.2	-1	16	1	36	1	307	6	10	2	8	-1	-1	3	-1	-1	-1	-1	-1	-1	-1	2	-1	4	0.2	-1	-1
-0.2	0.4	-0.2	-1	21	1	39	-1	297	5	11	2	8	1	-1	2	-1	-1	-1	-1	-1	-1	-1	-1	-1	5	0.2	-1	-1
0.3	1	-0.2	-1	21	2	43	-1	417	-1	1	1	3	-1	-1	1	-1	1	-1	-1	-1	-1	-1	-1	-1	5	0.2	-1	-1
-0.2	0.7	-0.2	-1	19	-1	32	-1	381	-1	-1	-1	1	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	4	0.2	-1	-1
-0.2	-0.2	-0.2	-1	9	1	30	-1	366	-1	-1	4	-1	-1	-1	-1	3	-1	-1	-1	-1	2	2	-1	-1	4	0.2	-1	-1
-0.2	-0.2	-0.2	-1	10	-1	31	-1	364	-1	-1	3	-1	-1	-1	-1	2	-1	-1	-1	-1	1	2	-1	-1	2	-0.1	-1	-1
-0.2	-0.2	-0.2	-1	2	-1	50	-1	522	20	63	12	34	9	2	8	2	5	1	3	-1	3	1	3	-1	1	-0.1	-1	-1
-0.2	3	-0.2	-1	-1	-1	-10	-1	503	-1	9	3	2	2	-1	2	-1	2	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	0.4	-0.2	-1	1	-1	-10	-1	559	-1	-1	2	-1	-1	-1	2	-1	-1	-1	-1	-1	-1	-1	-1	-1	1	-0.1	-1	-1
-0.2	-0.2	-0.2	-1	1	1	12	-1	530	-1	3	3	-1	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	-0.2	-0.2	-1	1	-1	16	-1	377	4	21	4	-1	3	-1	3	1	2	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	-0.2	-0.2	-1	-1	2	-10	3	619	16	37	6	11	4	-1	4	1	2	-1	1	-1	1	-1	3	1	2	-0.1	-1	-1
-0.2	0.7	-0.2	-1	-1	-1	-10	-1	537	-1	6	3	-1	1	-1	2	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	2.1	-0.2	-1	-1	-1	-10	-1	174	-1	3	2	-1	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	0.4	-0.2	-1	-1	-1	-10	-1	680	-1	-1	2	-1	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	0.7	-0.2	-1	-1	-1	-10	-1	434	-1	-1	1	-1	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	1	-0.2	-1	-1	1	15	-1	553	-1	7	2	-1	2	-1	2	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1
-0.2	1	-0.2	-1	-1	1	14	-1	898	1	18	5	3	2	-1	2	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1

Pt	Au	SQHg	Tl	Pb	Bi	Th	U
-1	-0.1	-1	-1	5	-1	14	4
-1	-0.1	-1	-1	2	-1	4	2
-1	-0.1	-1	-1	3	-1	4	3
-1	-0.1	-1	-1	2	-1	3	2
-1	-0.1	-1	-1	2	-1	2	3
-1	-0.1	-1	-1	-1	-1	2	2
-1	-0.1	-1	-1	-1	-1	1	1
-1	-0.1	-1	-1	-1	-1	-1	-1
-1	-0.1	-1	-1	-1	-1	2	1
-1	-0.1	-1	-1	-1	-1	-1	1
-1	-0.1	-1	-1	-1	-1	1	-1
-1	-0.1	-1	-1	-1	-1	2	2
-1	-0.1	-1	-1	-1	-1	1	-1
-1	-0.1	-1	-1	-1	-1	-1	-1
-1	-0.1	-1	-1	-1	-1	-1	-1
-1	-0.1	-1	-1	-1	-1	2	1
-1	-0.1	-1	-1	-1	-1	-1	-1
-1	-0.1	-1	-1	1	-1	1	-1
-1	-0.1	-1	-1	-1	-1	-1	-1
-1	-0.1	-1	-1	-1	-1	-1	-1
-1	-0.1	-1	-1	-1	-1	-1	-1
-1	-0.1	-1	-1	-1	-1	-1	-1
-1	-0.1	-1	-1	1	-1	2	-1
-1	-0.1	-1	-1	1	-1	2	1
-1	-0.1	-1	-1	-1	-1	2	-1
-1	-0.1	-1	-1	1	-1	-1	-1
-1	-0.1	-1	-1	1	-1	3	-1
-1	-0.1	-1	-1	-1	-1	1	-1
-1	-0.1	-1	-1	2	-1	4	1
-1	-0.1	-1	-1	2	-1	2	1
-1	-0.1	-1	-1	6	-1	3	2
-1	-0.1	-1	-1	2	-1	-1	-1
-1	-0.1	-1	-1	2	-1	-1	-1
-1	-0.1	-1	-1	2	-1	1	1
-1	-0.1	-1	-1	-1	-1	-1	-1
-1	-0.1	-1	-1	2	-1	2	-1
-1	-0.1	-1	-1	-1	-1	3	1
-1	-0.1	-1	-1	2	-1	-1	-1
-1	-0.1	-1	-1	-1	-1	-1	-1
-1	-0.1	-1	-1	1	-1	2	-1
-1	-0.1	-1	-1	-1	-1	2	-1
-1	-0.1	-1	-1	-1	-1	3	-1
-1	-0.1	-1	-1	1	-1	3	1
-1	-0.1	-1	-1	6	-1	3	2
-1	-0.1	-1	-1	4	-1	3	3
-1	-0.1	-1	-1	2	-1	3	2
-1	-0.1	-1	-1	2	-1	3	2
-1	-0.1	-1	-1	1	-1	4	2
-1	-0.1	-1	-1	2	-1	4	3
-1	-0.1	-1	-1	-1	-1	5	3
-1	-0.1	-1	-1	2	-1	3	2
-1	-0.1	-1	-1	3	-1	2	2
-1	-0.1	-1	-1	3	-1	3	2
-1	-0.1	-1	-1	2	-1	2	1
-1	-0.1	-1	-1	3	-1	4	1
-1	-0.1	-1	-1	1	-1	2	1
-1	-0.1	-1	-1	-1	-1	2	1
-1	-0.1	-1	-1	-1	-1	3	1
-1	-0.1	-1	-1	-1	-1	4	2
-1	-0.1	-1	-1	-1	-1	1	1
-1	-0.1	-1	-1	2	-1	3	1
-1	-0.1	-1	-1	2	-1	3	2
-1	-0.1	-1	-1	2	-1	8	2
-1	-0.1	-1	-1	2	-1	9	2
-1	-0.1	-1	-1	2	-1	13	2
-1	-0.1	-1	-1	2	-1	3	1
-1	-0.1	-1	-1	1	-1	2	1
-1	-0.1	-1	-1	2	-1	3	1
-1	-0.1	-1	-1	-1	-1	2	1
-1	-0.1	-1	-1	2	-1	2	2
-1	-0.1	-1	-1	1	-1	2	1
-1	-0.1	-1	-1	4	-1	12	-1
-1	-0.1	-1	-1	2	-1	5	2
-1	-0.1	-1	-1	2	-1	2	1
-1	-0.1	-1	-1	2	-1	5	1
-1	-0.1	-1	-1	2	-1	4	1
-1	-0.1	-1	-1	1	-1	3	-1
-1	-0.1	-1	-1	2	-1	3	-1
-1	-0.1	-1	-1	1	-1	3	1
-1	-0.1	-1	2	-1	-1	2	-1
-1	-0.1	-1	3	-1	-1	2	-1
-1	-0.1	-1	-1	2	-1	44	5
-1	-0.1	-1	-1	-1	-1	11	6
-1	-0.1	-1	-1	-1	-1	3	12
-1	-0.1	-1	-1	-1	-1	2	15
-1	-0.1	-1	-1	-1	-1	5	15
-1	-0.1	-1	-1	-1	-1	6	16
-1	-0.1	-1	-1	-1	-1	5	68
-1	-0.1	-1	-1	-1	-1	6	41
-1	-0.1	-1	-1	-1	-1	12	10
-1	-0.1	-1	-1	1	-1	11	8
-1	-0.1	-1	-1	2	-1	15	4
-1	-0.1	-1	-1	2	-1	9	3
-1	-0.1	-1	-1	1	-1	2	3
-1	-0.1	-1	-1	3	-1	3	2
-1	-0.1	-1	-1	2	-1	11	3
-1	-0.1	-1	-1	9	-1	16	4
-1	-0.1	-1	-1	2	-1	5	3
-1	-0.1	-1	-1	2	-1	2	2
-1	-0.1	-1	-1	-1	-1	3	2
-1	-0.1	-1	-1	-1	-1	1	2
-1	-0.1	-1	-1	3	-1	5	2
-1	-0.1	-1	-1	1	-1	7	3

Appendix 3: Mobile Metal Ion (MMI) Technique® analytical data, lines 105E and 106E and baseline TL-180, Thorne gold zone, Snow Lake area.

Sample no.	Au	Co	Ni	Cu	Zn	Pd	Ag	Cd	Pb
Line 105E:									
TZ-26	-0.25	55.00	109.00	101.00	849.00	0.90	6.80	21.00	-20.00
TZ-27	-0.25	95.00	174.00	306.00	302.00	1.80	6.80	-10.00	-20.00
TZ-28	0.30	95.00	98.00	188.00	235.00	1.00	8.50	-10.00	-20.00
TZ-29	-0.25	88.00	148.00	421.00	160.00	1.50	8.10	-10.00	-20.00
TZ-30	-0.25	35.00	43.00	379.00	452.00	0.80	9.80	-10.00	-20.00
TZ-31	-0.25	48.00	73.00	482.00	223.00	1.00	6.90	-10.00	-20.00
TZ-32	-0.25	47.00	49.00	160.00	326.00	0.90	4.50	-10.00	31.00
TZ-33	-0.25	71.00	38.00	264.00	564.00	0.80	4.80	-10.00	-20.00
TZ-34	-0.25	30.00	47.00	211.00	212.00	0.80	6.60	-10.00	-20.00
TZ-35	-0.25	18.00	18.00	395.00	522.00	0.90	3.10	-10.00	-20.00
TZ-36	-0.25	9.00	75.00	882.00	370.00	1.00	2.40	-10.00	-20.00
TZ-37	0.30	-5.00	6.00	208.00	655.00	0.90	2.00	-10.00	-20.00
TZ-38	-0.25	16.00	79.00	347.00	323.00	0.90	3.50	-10.00	-20.00
TZ-39	-0.25	41.00	82.00	553.00	333.00	0.90	4.30	-10.00	-20.00
TZ-40	-0.25	24.00	40.00	171.00	317.00	0.90	2.10	-10.00	-20.00
TZ-41	-0.25	31.00	53.00	360.00	343.00	0.60	2.50	-10.00	-20.00
TZ-42	-0.25	32.00	23.00	220.00	1110.00	1.00	1.70	17.00	-20.00
TZ-43	-0.25	23.00	12.00	197.00	1300.00	0.60	2.80	17.00	-20.00
TZ-44	-0.25	31.00	6.00	444.00	266.00	0.60	0.60	-10.00	-20.00
TZ-45	-0.25	13.00	10.00	328.00	1080.00	0.70	0.40	25.00	-20.00
TZ-46	-0.25	26.00	38.00	1000.00	230.00	1.20	2.30	-10.00	-20.00
TZ-47	0.30	16.00	86.00	397.00	179.00	1.10	3.00	-10.00	-20.00
TZ-48	0.30	16.00	48.00	362.00	228.00	1.00	1.60	-10.00	-20.00
TZ-49	-0.25	12.00	40.00	297.00	595.00	1.30	1.20	-10.00	-20.00
TZ-50	-0.25	30.00	75.00	253.00	584.00	1.90	1.10	-10.00	-20.00
TZ-51	-0.25	17.00	26.00	290.00	370.00	0.80	0.60	-10.00	-20.00
TZ-52	0.70	18.00	32.00	621.00	143.00	1.70	5.20	-10.00	-20.00
TZ-53	-0.25	10.00	19.00	261.00	916.00	0.70	0.90	13.00	-20.00
Line 106E:									
TZ-1	2.70	31	290	834	152	2.10	13.70	-10	-20
TZ-2	-0.25	57	149	168	299	1.00	2.50	-10	-20
TZ-3	-0.25	13	49	330	211	0.90	2.90	-10	-20
TZ-4	-0.25	16	26	523	1470	0.70	4.60	29	-20
TZ-5	-0.25	12	50	195	420	0.80	5.10	-10	-20
TZ-6	-0.25	64	91	558	367	0.70	7.00	-10	-20
TZ-7	-0.25	14	51	540	258	0.70	6.30	-10	-20
TZ-8	-0.25	18	89	718	184	0.70	7.10	-10	-20
TZ-9	-0.25	23	69	437	888	0.80	5.20	37	-20
TZ-10	-0.25	32	66	530	670	0.80	3.70	32	-20
TZ-11	-0.25	35	82	669	456	0.70	4.40	30	-20
TZ-12	-0.25	24	60	478	1070	1.50	2.80	11	-20
TZ-13	-0.25	48	129	391	426	0.70	9.90	14	-20
TZ-14	-0.25	37	90	284	435	0.70	8.20	16	-20
TZ-15	-0.25	86	109	244	367	0.70	8.70	-10	-20
TZ-16	-0.25	59	107	191	234	1.00	3.80	-10	-20
TZ-17	-0.25	20	59	155	468	0.70	3.60	-10	-20
TZ-18	-0.25	32	81	361	176	0.50	3.60	-10	-20
TZ-19	-0.25	50	91	264	361	0.70	5.50	-10	-20
TZ-20	-0.25	141	79	129	345	1.00	4.80	-10	-20
TZ-21	0.60	98	125	348	166	2.10	10.20	-10	-20
TZ-22	-0.25	43	34	196	709	1.00	3.00	21	-20
TZ-23	0.40	26	20	316	940	1.00	2.40	65	-20
TZ-24	-0.25	6	17	587	525	1.30	3.30	-10	-20
TZ-25	-0.25	5	8	710	350	0.80	0.90	-10	-20

Baseline TL-180:

TZ-54	-0.25	7.00	37.00	62.00	53.00	0.70	10.20	-10.00	-20.00
TZ-55	-0.25	9.00	48.00	104.00	66.00	0.50	11.00	-10.00	-20.00
TZ-56	-0.25	27.00	99.00	109.00	118.00	1.10	3.60	-10.00	-20.00
TZ-57	-0.25	11.00	39.00	334.00	356.00	0.50	2.40	-10.00	-20.00
TZ-58	-0.25	47.00	28.00	224.00	291.00	0.60	1.70	13.00	-20.00
TZ-59	-0.25	16.00	52.00	106.00	140.00	0.80	4.00	-10.00	-20.00
TZ-60	-0.25	23.00	64.00	79.00	80.00	0.70	4.00	-10.00	37.00
TZ-61	-0.25	22.00	67.00	160.00	100.00	1.30	7.00	-10.00	-20.00
TZ-62	0.40	10.00	137.00	403.00	24.00	1.30	3.70	-10.00	-20.00
TZ-63	-0.25	30.00	25.00	264.00	108.00	0.60	8.20	-10.00	-20.00
TZ-64	-0.25	28.00	89.00	438.00	437.00	0.50	5.70	-10.00	-20.00
TZ-65	0.40	96.00	93.00	244.00	473.00	1.20	4.20	-10.00	-20.00
TZ-66	3.00	63.00	136.00	779.00	177.00	0.40	9.20	-10.00	-20.00
TZ-67	-0.25	23.00	54.00	105.00	112.00	0.50	3.80	-10.00	-20.00
TZ-68	-0.25	19.00	9.00	186.00	352.00	0.40	1.30	-10.00	-20.00
TZ-69	1.50	25.00	556.00	698.00	-5.00	2.10	28.80	-10.00	-20.00
TZ-70	-0.25	12.00	29.00	85.00	94.00	0.30	3.60	-10.00	-20.00
TZ-71	-0.25	17.00	39.00	79.00	88.00	0.30	2.70	-10.00	-20.00
TZ-72	-0.25	16.00	27.00	189.00	28.00	-0.25	1.40	-10.00	-20.00
TZ-73	-0.25	79.00	81.00	152.00	357.00	0.40	5.20	-10.00	-20.00
TZ-74	-0.25	47.00	18.00	141.00	289.00	-0.25	1.60	-10.00	-20.00
TZ-75	-0.25	82.00	101.00	174.00	295.00	-0.25	6.00	18.00	-20.00
TZ-76	-0.25	62.00	185.00	448.00	153.00	0.30	3.30	-10.00	-20.00
TZ-77	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TZ-78	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TZ-79	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TZ-80	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TZ-81	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TZ-82	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TZ-83	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
TZ-84	0.90	9.00	550.00	173.00	200.00	0.70	21.60	-10.00	-20.00
TZ-85	-0.25	19.00	19.00	114.00	176.00	1.00	-0.25	39.00	-20.00
TZ-86	-0.25	7.00		81.00	60.00	-0.25	-0.25	-10.00	-20.00
TZ-87	-0.25	15.00	21.00	47.00	25.00	-0.25	1.00	-10.00	-20.00
TZ-88	-0.25	23.00	21.00	89.00	162.00	0.60	0.50	-10.00	-20.00
TZ-89	-0.25	63.00	142.00	58.00	145.00	3.30	4.00	-10.00	-20.00
TZ-90	-0.25	-5.00	-5.00	217.00	311.00	-0.25	-0.25	-10.00	-20.00
TZ-91	-0.25	9.00	-5.00	67.00	1040.00	-0.25	-0.25	41.00	-20.00
TZ-92	-0.25	7.00	-5.00	72.00	49.00	-0.25	-0.25	-10.00	28.00
TZ-93	-0.25	-5.00	-5.00	191.00	85.00	-0.25	-0.25	-10.00	-20.00
TZ-94	-0.25	11.00	-5.00	122.00	802.00	0.30	-0.25	12.00	-20.00
TZ-95	-0.25	9.00	-5.00	295.00	257.00	-0.25	0.30	-10.00	-20.00
TZ-96	0.40	-5.00	-5.00	116.00	422.00	-0.25	-0.25	15.00	-20.00

All analyses in parts per billion. A negative number denotes an analysis below the lower limit of determination.

Appendix 4: Descriptive statistics for Enzyme Leach SM and Mobile Metal Ion (MMI®) techniques, lines 105E and 106E and baseline TL-180, Thorne gold zone, Snow Lake area.

TVX L105E
ENZYME LEACH

ELEMENT	N	RANGE	ARITH. MEAN	MEDIAN	STANDARD DEVIATION
As	25	15-866	119	33	199
Ba	25	199-1268	593	570	278
Br	25	38-181	87	78	40
Cd	23	0.4-2.4	0.9	0.7	0.6
Ce	5	1-7	5.2	6	2.5
Co	25	14-173	60	52	36
Cs	6	1-3	1.3	1	0.8
Cu	25	45-167	85	74	36
Ga	19	1-23	4.3	3	4.8
Gd	12	1-3	1.3	1	0.6
I	17	11-24	15.5	15	3.6
Lu	6	1-4	1.8	1.5	1.2
Mn	25	139-21761	3066	1198	4992
Mo	3	2-8	4.6	4	3
Nb	17	1-8	2.9	3	2
Ni	25	28-105	60	55	23
Pb	19	1-6	2.4	2	1.4
Pr	17	1-6	2.5	2	1.5
Rb	25	20-188	79	60	47
Sb	15	1-4	1.6	1	1
Se	2	42-49	45.5	45.5	5
Sm	6	1-2	1.7	2	0.5
SQCL	13	3130-7150	4749	4169	1468
SQLi	12	10-43	22-3	22	8
Sr	25	86-277	169	156	49
Tb	10	1-4	2.1	2	1
Te	5	1-2	1.8	2	0.4
Th	21	1-5	2-9	3	0.9
U	15	1-3	1-9	2	0.7
V	25	20-84	42	36	16
W	10	1-3	1.7	2	0.7
Y	25	1-8	3.2	3	1.8
Yb	7	1-3	1.6	1	0.8
Zn	25	20-124	58	48	32

TVX L106E
ENZYME LEACH

ELEMENT	N	RANGE	ARITH. MEAN	MEDIAN	STANDARD DEVIATION
As	23	16-3735	230	30	768
Ba	23	155-1197	442	364	256
Br	20	31-108	66	68	23
Cd	19	0.4-2.4	0.9	0.7	0.5
Ce	4	3-55	20	10	24
Co	23	13-102	47	43	25
Cs	6	1-2	1.7	2	0.5
Cu	23	28-241	84	72	45
Dy	3	1-4	2.3	2	1.5
Gd	5	1-6	2.6	2	1.9
Ge	4	2-3	2.3	2	0.5
I	10	11-35	18	17	7
La	2	1-17	9	9	11
Lu	5	1-6	2.6	2	2
Mn	23	176-8328	2448	2108	1873
Mo	8	1-20	7.6	5.5	6.5
Nb	12	1-3	1.1	1	0.6
Nd	2	10-32	21	21	16
Ni	23	25-201	53	43	37
Pb	8	1-5	2.1	2	1.4
Pr	13	1-17	3.6	2	4.5
Rb	23	27-181	89	80	43
Sb	11	1-5	1.8	1	1.3
Sm	4	1-8	3.3	2	3.2
SQCL	14	3173-8622	5086	4484	1475
SQLi	6	13-30	20	19	7
Sr	23	57-325	153	139	58
Tb	6	1-9	3.5	2.5	3
Te	5	1-2	1.2	1	0.4
Th	15	1-14	2.9	2	3.1
U	13				
V	23	20-83	50	47	19
W	4	1-2	1.5	1.5	0.6
Y	22	1-20	3.3	2	4
Yb	5				
Zn	23	12-109	38	29	25

TVX TL-180
ENZYME LEACH

ELEMENT	N	RANGE	ARITH. MEAN	MEDIAN	STANDARD DEVIATION
As	39	10-10609	1116	63	2523
Ba	39	133-1988	574	522	312
Br	38	36-855	109	64	138
Cd	22	0.4-3	0.9	0.7	0.6
Ce	16	1-63	16	8	18
Co	39	3-168	34	16	40
Cs	6	1-399	68	1.5	162
Cu	36	5-172	47	33	38
Dy	17	1-7	2.1	1	1.7
Er	5	1-3	1.8	2	0.8
Ga	35	1-24	7.1	4	7
Gd	30	1-12	2.4	2	2.4
Ge	9	1-6	2.6	2	1.4
Hf	6	1-4	2.7	3	1
I	18	10-241	33	16	53
La	8	1-34	12	9	11
Mn	39	7-12136	1623	534	2533
Mo	11	2-121	47	45	42
Nb	37	1-14	2.7	2	2
Nd	9	2-67	18	10	21
Ni	39	6-162	51	45	33
Pb	27	1-9	2.1	2	1.5
Pr	33	1-18	3.3	2	3.4
Rb	39	4-273	77	78	58
Sb	16	1-84	11	3	21
Se	3	34-42	38	38	4
Sm	19	1-11	3.1	2	2.7
SQCL	13	3158-36522	11357	8572	10104
SQLi	33	10-94	34	29	21
SQSc	9	17-80	49	55	22
SQTi	4	103-270	191	196	86
Sr	39	90-1787	355	202	401
Tb	7	1-3	1.4	1	0.8
Te	13	1-6	1.9	2	1.4
Th	39	1-44	6.2	3	7
U	35	1-68	4.9	2	11
V	39	22-8014	480	65	1363
W	14	1-5	2.3	2.5	1.2
Y	39	1-35	5.9	4	6
Yb	7	1-4	2	2	1.1
Zn	38	15-101	38	30	21
Zr	7	19-96	54	39	35

TVX L105E
MOBILE METAL ION PROCESS

ELEMENT	N	RANGE	ARITH. MEAN	MEDIAN	STANDARD DEVIATION
Ag	25	0.4-9.8	3.8	3	2.8
Au	5	0.3-0.7	0.4	0.3	0.2
Cd	5	13-25	19	17	5
Co	24	9-95	35	27	26
Cu	25	101-1000	374	328	210
Ni	25	6-174	56	47	43
Pb	1	22			
Pd	25	0.6-1.8	1	0.9	0.3
Zn	25	143-1300	477	333	329

TVX L106E
MOBILE METAL ION PROCESS

ELEMENT	N	RANGE	ARITH. MEAN	MEDIAN	STANDARD DEVIATION
Ag	23	0.9-13.7	5.2	4.6	3
Au	3	0.4-2.7	1.1	0.4	1.3
Cd	8	11-65	28	25	17
Co	23	5-120	36	31	28
Cu	23	155-834	405	361	198
Ni	23	8-290	80	74	58
Pd	23	0.5-2.1	0.9	0.8	0.4
Zn	23	152-1470	484	367	329

TVX TL-180
MOBILE METAL ION PROCESS

ELEMENT	N	RANGE	ARITH. MEAN	MEDIAN	STANDARD DEVIATION
Ag	26	0.3-28.8	5.8	3.9	6.4
Au	6	0.4-3	1.1	0.7	1
Cd	6	12-39	20	17	10
Co	31	6-96	29	19	25
Cu	33	47-779	208	142	174
Ni	26	9-556	103	53	140
Pb	2	25-28	26.5	26.5	2
Pd	23	0.3-3.3	0.8	0.6	0.7
Zn	31	24-802	222	153	191

Appendix 5: Descriptive statistics for Enzyme Leach[SM] field and analytical duplicate pairs, Thorne gold zone, Snow Lake area.

Sample no.	SQLi	SQBe	SQCl	SQSc	SQTi	V	Mn	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Rb	Sr	Y	Zr
Field duplicates:																				
F1	-10	-20	-3000	-10	-100	76	2014	48	34	69	31	2	-1	36	-30	36	77	147	1	-1
F2	-10	-20	-3000	-10	-100	75	2202	52	48	148	31	2	-1	43	-30	67	50	127	2	-1
F3	26	-20	3704	-10	-100	48	2295	123	54	37	23	2	-1	105	-30	56	50	119	1	-1
F4	33	-20	-3000	-10	-100	41	1544	81	77	68	22	-1	-1	137	-30	51	135	158	1	-1
F5	-10	-20	-3000	-10	-100	37	1515	23	31	55	32	-1	-1	23	-30	65	54	283	3	-1
F6	-10	-20	-3000	-10	-100	62	3196	30	25	50	36	-1	-1	21	-30	59	44	271	2	-1
F7	26	-20	-3000	-10	-100	59	442	32	43	53	88	3	-1	40	-30	59	55	151	2	-1
F8	19	-20	-3000	-10	-100	28	440	40	57	36	66	7	-1	20	-30	56	64	148	2	-1
F9	14	-20	-3000	-10	-100	26	432	9	26	14	29	4	-1	9	-30	-30	92	116	3	-1
F10	17	-20	-3000	-10	-100	28	494	13	37	70	32	3	-1	11	-30	-30	125	160	5	-1
F11	71	-20	-3000	-10	-100	54	170	12	31	39	22	4	-1	56	-30	47	91	280	12	-1
F12	79	-20	-3000	-10	-100	43	432	15	58	27	48	4	-1	42	-30	32	76	326	7	-1
F13	67	-20	15146	51	-100	2347	1334	7	68	18	-10	12	1	779	-30	119	4	891	3	-1
F14	65	-20	14059	30	-100	2334	1396	7	52	21	-10	14	1	831	-30	145	3	911	3	-1
F15	23	-20	-3000	-10	-100	77	458	19	21	5	63	4	-1	34	-30	74	-1	199	3	-1
F16	46	-20	-3000	-10	-100	22	57	16	28	-5	21	4	-1	19	-30	44	70	96	3	-1
Analytical duplicates:																				
TZ-10	-10		-3000	-10	-100	76	2014	48	34	69	31	2		36	-30	36	77	147	1	
TZ-11	-10		-3000	-10	-100	75	2202	52	48	148	31	2		43	-30	67	50	127	2	
TZ-20	26		3704	-10	-100	48	2295	123	54	37	23	2		105	-30	56	50	119	1	
TZ-21	33		-3000	-10	-100	41	1544	81	77	68	22	-1		137	-30	51	135	158	1	
TZ-40	-10		-3000	-10	-100	37	1515	23	31	55	32	-1		23	-30	65	54	283	3	
TZ-41	-10		-3000	-10	-100	62	3196	30	25	50	36	-1		21	-30	59	44	271	2	
TZ-50	26		-3000	-10	-100	59	442	32	43	53	88	3		40	-30	59	55	151	2	
TZ-51	19		-3000	-10	-100	28	440	40	57	36	66	7		20	-30	56	64	148	2	
TZ-60	14		-3000	-10	-100	26	432	9	26	14	29	4		9	-30	-30	92	116	3	
TZ-61	17		-3000	-10	-100	28	494	13	37	70	32	3		11	-30	-30	125	160	5	
TZ-70	71		-3000	-10	-100	54	170	12	31	39	22	4		56	-30	47	91	280	12	
TZ-71	79		-3000	-10	-100	43	432	15	58	27	48	4		42	-30	32	76	326	7	
TZ-90	67		15146	51	-100	2347	1334	7	68	18	-10	12		779	-30	119	4	891	3	
TZ-91	65		14059	30	-100	2334	1396	7	52	21	-10	14		831	-30	145	3	911	3	

All analyses in parts per billion. A negative number denotes an analysis below the limits of determination.

Nb	Mo	Ru	Rh	Pd	Ag	Cd	Sb	I	Ba	Ce	Pr	Nd	Sm	Gd	Dy	W	Pb	Th	U	Sn	In	Te
-1	-1	-1	-1	-1	-0.2	1	-1	-10	207	-1	-1	-1	-1	-1	-1	-1	-1	-1	1	-1	-0.2	-1
1	-1	-1	-1	-1	-0.2	1.5	-1	10	340	-1	-1	-1	-1	-1	-1	-1	-1	1	-1	-1	-0.2	-1
1	-1	-1	-1	-1	-0.2	0.4	-1	-10	374	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.2	-1
1	-1	-1	-1	-1	-0.2	0.4	-1	-10	591	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.2	-1
-1	-1	-1	-1	-1	-0.2	-0.2	1	12	464	-1	-1	-1	-1	1	-1	-1	-1	3	-1	-1	-0.2	-1
1	-1	-1	-1	-1	-0.2	1	-1	15	341	-1	-1	-1	-1	-1	-1	-1	1	3	1	-1	-0.2	1
3	-1	-1	-1	-1	-0.2	1.3	1	-10	574	-1	1	-1	-1	-1	-1	-1	3	2	2	-1	-0.2	-1
2	-1	-1	-1	-1	-0.2	1	1	-10	586	-1	2	-1	-1	-1	-1	-1	3	3	2	-1	-0.2	-1
2	-1	-1	-1	-1	-0.2	0.4	-1	-10	331	-1	2	-1	-1	1	-1	-1	2	8	2	-1	-0.2	-1
3	-1	-1	-1	-1	-0.2	0.4	-1	-10	448	13	3	1	2	2	1	-1	2	9	2	-1	-0.2	1
3	-1	-1	-1	-1	-0.2	-0.2	-1	10	695	5	6	14	5	4	3	-1	2	5	2	-1	-0.2	-1
4	-1	-1	-1	-1	-0.2	0.4	-1	10	673	-1	4	5	4	3	2	-1	2	2	1	-1	-0.2	-1
1	85	-1	-1	-1	-0.2	-0.2	19	17	331	-1	2	-1	2	1	-1	3	-1	3	12	-1	-0.2	2
2	84	-1	-1	-1	-0.2	1	17	14	343	-1	2	-1	-1	1	1	3	-1	2	15	-1	-0.2	-1
2	-1	-1	-1	-1	-0.2	2.1	-1	-10	174	3	2	-1	-1	1	-1	-1	2	2	2	-1	-0.2	-1
2	-1	-1	-1	-1	-0.2	0.4	-1	-10	680	-1	2	-1	-1	1	-1	-1	-1	3	2	-1	-0.2	-1

-1	-1				-0.2	1	-1	-10	207	-1	-1	-1	-1	-1	-1	-1	-1	-1	1
1	-1				-0.2	1.5	-1	10	340	-1	-1	-1	-1	-1	-1	-1	-1	1	-1
1	-1				-0.2	0.4	-1	-10	374	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
1	-1				-0.2	0.4	-1	-10	591	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
-1	-1				-0.2	-0.2	1	12	464	-1	-1	-1	-1	1	-1	-1	-1	3	-1
1	-1				-0.2	1	-1	15	341	-1	-1	-1	-1	-1	-1	-1	1	3	1
3	-1				-0.2	1.3	1	-10	574	-1	1	-1	-1	-1	-1	-1	3	2	2
2	-1				-0.2	1	1	-10	586	-1	2	-1	-1	-1	-1	-1	3	3	2
2	-1				-0.2	0.4	-1	-10	331	-1	2	-1	-1	1	-1	-1	2	8	2
3	-1				-0.2	0.4	-1	-10	448	13	3	1	2	2	1	-1	2	9	2
3	-1				-0.2	-0.2	-1	10	695	5	6	14	5	4	3	-1	2	5	2
4	-1				-0.2	0.4	-1	10	673	-1	4	5	4	3	2	-1	2	2	1
1	85				-0.2	-0.2	19	17	331	-1	2	-1	2	1	-1	3	-1	3	12
2	84				-0.2	1	17	14	343	-1	2	-1	-1	1	1	3	-1	2	15

Cs	La	Eu	Tb	Ho	Er	Tm	Yb	Lu	Hf	Ta	Re	Os	Ir	Pt	Au	SQHg	Tl	Bi
-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1	-1	-0.1	-1	-1	-1
-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1	-1	-0.1	-1	-1	-1
-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1	-1	-0.1	-1	-1	-1
-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1	-1	-0.1	-1	-1	-1
-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1	-1	-0.1	-1	-1	-1
-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1	-1	-0.1	-1	-1	-1
-1	-1	-1	1	-1	-1	-1	1	-1	-1	-1	-0.1	-1	-1	-1	-0.1	-1	-1	-1
-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1	-1	-0.1	-1	-1	-1
-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1	-1	-0.1	-1	-1	-1
-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1	-1	-0.1	-1	-1	-1
-1	6	-1	-1	-1	1	-1	1	-1	-1	-1	-0.1	-1	-1	-1	-0.1	-1	-1	-1
-1	-1	-1	-1	-1	-1	-1	1	-1	-1	-1	-0.1	-1	-1	-1	-0.1	-1	-1	-1
-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1	-1	-0.1	-1	-1	-1
-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0.2	-1	-1	-1	-0.1	-1	-1	-1
-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1	-1	-0.1	-1	-1	-1
-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-0.1	-1	-1	-1	-0.1	-1	-1	-1

Appendix 6: Analytical duplicate data for the Mobile Metal Ion (MMI) Technique®, Thorne gold zone, Snow Lake area.

Duplicate pair	Sample no.	Au (1)	Au (2)	Co (1)	Co (2)	Ni(1)	Ni (2)	Cu (1)	Cu (2)	Zn (1)	Zn (2)	Pd (1)	Pd (2)	Ag (1)	Ag (2)	Cd (1)	Cd (2)	Pb (1)	Pb (2)
Field duplicates:																			
#1	TZ-10	-0.25		32		66		530		670		0.8		3.7		32		-20	
	TZ-11		-0.25		35		82		669		456		0.7		4.4		30		-20
#2	TZ-20	-0.25		141		79		129		345		1		4.8		-10		-20	
	TZ-21		0.6		98		125		348		166		2.1		10.2		-10		-20
#3	TZ-32	-0.25		47		49		160		326		0.9		4.5		-10		31	
	TZ-33		-0.25		71		38		264		564		0.8		4.8		-10		-20
#4	TZ-40	-0.25		24		40		171		317		0.9		2.1		-10		-20	
	TZ-41		-0.25		31		53		360		343		0.6		2.5		-10		-20
#5	TZ-50	-0.25		30		75		253		584		1.9		1.1		-10		-20	
	TZ-51		-0.25		17		26		290		370		0.8		0.6		-10		-20
#6	TZ-60	-0.25		23		64		79		80		0.7		4		-10		37	
	TZ-61		-0.25		22		67		160		100		1.3		7		-10		-20
#7	TZ-70	-0.25		12		29		85		94		0.3		3.6		-10		-20	
	TZ-71		-0.25		17		39		79		88		0.3		2.7		-10		-20
#8	TZ-90	-0.25		-5		-5		217		311		-0.25		-0.25		-10		-20	
	TZ-91		-0.25		9		-5		67		1040		-0.25		-0.25		41		-20
Analytical duplicates:																			
#1	TZ-1	2.1	2.7	28	31	254	290	820	834	141	152	1.7	2.1	13.3	13.7	-10	-10	-20	-20
#2	TZ-13	-0.25	-0.25	47	48	110	129	365	391	391	426	-0.25	0.7	9.1	9.9	-10	14	-20	-20
#3	TZ-25	-0.25	-0.25	-5	5	7	8	512	710	416	350	0.3	0.8	-0.25	0.9	14	-10	-20	-20
#4	TZ-37	-0.25	-0.25	-5	-5	-5	6	222	208	704	655	-0.25	0.9	1.3	2	-10	-10	-20	-20
#5	TZ-47	-0.25	0.3	15	16	64	86	445	397	177	179	0.25	1.1	2.2	3	-10	-10	-20	-20
#6	TZ-59	-0.25	-0.25	12	16	43	52	116	106	188	140	-0.25	0.8	3	4	-10	-10	-20	-20
#7	TZ-71	-0.25	-0.25	20	17	34	39	77	79	63	88	-0.25	0.3	2.4	2.7	-10	-10	-20	-20
#8	TZ-93	-0.25	-0.25	10	-5	-5	-5	179	191	84	85	-0.25	-0.25	-0.25	-0.25	-10	-10	-20	-20

All analyses in parts per billion. A negative number denotes an analysis below the limits of determination.