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Geochemical Background in Soil and Till - An Evaluation of Additional Elements from Geochemical Surveys of Soils and Tills: Addendum to GSC Open File 5084

E.C. Grunsky, A.N. Rencz and S.W. Adcock

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Geochemical Background in Soil and Till
- An Evaluation of Additional Elements from Geochemical Surveys of Soils and Tills:
Addendum to GSC Open File 5084

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Introduction

This report is an addendum to GSC Open File 5084 (Rencz et al., 2006), which provided background values for a limited range of elements: As, Cr, Co, Cu, Pb, Ni, Th, U, Zn., Ag, Cd, Hg, Mn, Mo, Sb and Se). The elements included in this report are: Au, Ba, Br, Ca, Ce, Cs, Eu, Fe, Ga, Hf, Ho, La, Lu, Na, Nb, Nd, Rb, Sc, Sm, Ta, Tb, V, W, Y, Yb and Zr. These additional elements can be used in conjunction with the previously published results to establish backgrounds, based on multivariate studies, that can assist in the discrimination of geochemical values that are the result of anthropogenic activities from natural background.

This report also provides background variability based on two major types of geochemical analyses: those samples prepared using partial digestion techniques and those prepared using total/near-total digestion techniques.

The data have been described using an extension of statistical methods developed by Garrett and Chen, which is a library of data summary and description routines in the R statistical language (R Development Core Team, 2004). For each element, summary statistics are produced in graphical and table summary form.

This report follows the same principles and guidelines established in GSC Open File 5084. The summary statistics described herein differ slightly from the statistics for elements listed in OFR 5084. This is due to an increase in the number of observations that were added to the database subsequent to the release of the earlier report.

Till/Soil Geochemical Data

The data used in this report were derived by the data extraction procedures described by Adcock (Rencz et. al., 2006, Part 2: Till Geochemistry Data Compilation), and are for elements determined in the < 63µm size fraction using both total/near-total and partial digestion methods.

Samples digested by Aqua-Regia (partial digestion by HCl and HNO_3) were analyzed using AAS (Atomic Absorption Spectroscopy) or Inductively-Coupled Plasma Optical Emission Spectroscopy (ICP-OES) or Mass Spectroscopy (ICP-MS) methods.

Data for total/near-total determinations were derived by two procedures:
a) Direct analysis of the material by instrumental neutron activation analysis (INAA); and
b) a strong 4-acid digestion (HF, HCl, $HClO_4$ and HNO_3), which is a "near-total", and analysis

using AAS (Atomic Absorption Spectroscopy) or Inductively-Coupled Plasma Optical Emission Spectroscopy (ICP-OES) or Mass Spectroscopy (ICP-MS) methods.

Table 2 (Rencz et al, 2006) provides list of the elements analyzed by each/both of these procedures. Analytical results for the same element derived from partial or total extractions are, generally, not from the same survey data. Thus, comparison between two elements based solely on the graphical description of their distributions is not valid.

The geochemical values from analyses derived from the partial and total digestion methods cannot be mixed. Partial digestion does not dissolve all of the minerals present in a sample, thus the geochemical data generated by the two procedures are not compatible; each needs to be studied in their own context.

Survey Coverage

The areas that the surveys cover are shown in Figure 1, they include parts of Newfoundland/Labrador, New Brunswick, Quebec, Nunavut, Northwest Territories, Manitoba, Saskatchewan, Alberta and British Columbia. The large area of coverage in the prairies represents a soil survey (Garrett and Thorliefson, 1993). The remaining sites are till surveys. Table 3 (Rencz et al. ,2006) provides a list of sources from which the data were derived.

The previous study compared the statistics of the survey areas with the regional geology. The results of this comparison were not significant due to the lack of resolution and the variability of the regional geology. As a result, summary statistics have not been compiled on the basis of the regional geology in this report.

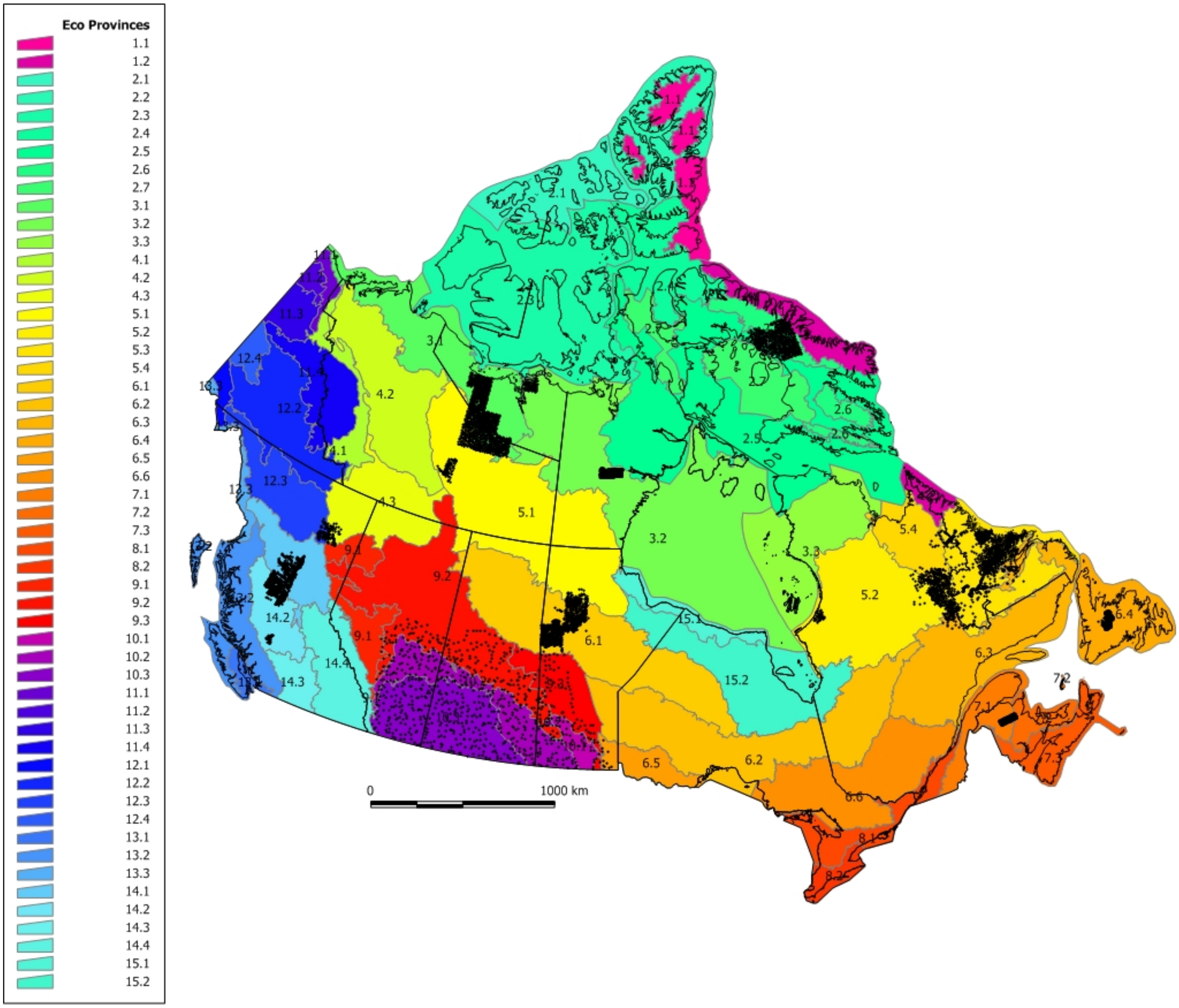

Figure 1. Locations of Soil/Till Surveys over EcoZones in Canada. Ecozone numbers are shown with corresponding colours in the legend. Sample location sites are shown as black dots.

Summary Graphics

The graphics have been prepared as outlined in OFR 5084. In addition to those graphics, this report includes the addition of the quantile-quantile plot along with the histogram, Tukey Boxplot, empirical cumulative distribution function (ECDF), percent cumulative percentage probability (CCP) plot, and a summary table of basic statistical measures.

Initial summaries of the data were carried out by generating boxplots for each of the elements for the partial-digestion and total/near-total digestion analyses over all of the areas.
These plots are shown in Figures 2 and 3. A comparison of the range of some of the elements

shows that the analytical response is dependent upon the completeness of the digestion. Elements that exhibit differences include: Ba., Cr, La, Na, Nb, Rb, Sc. V and Zr. These differences are primarily the result of the presence of mineral phases that were not digested during the partial, Aqua-Regia, procedure.

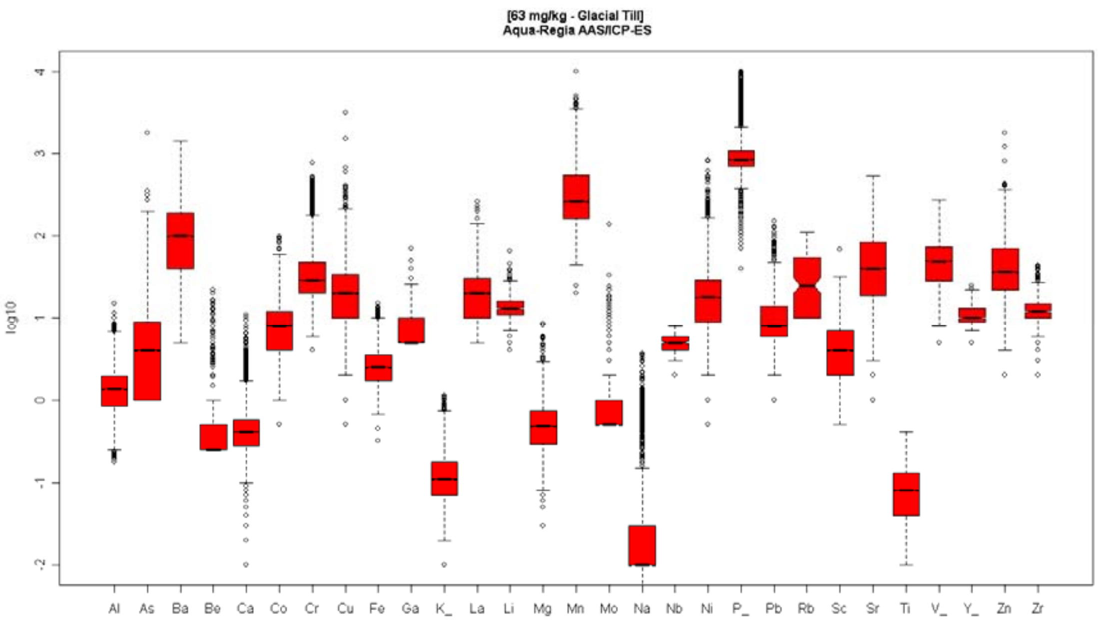

Figure 2. Boxplots of the partial digestion data. The y axis units are log base 10.

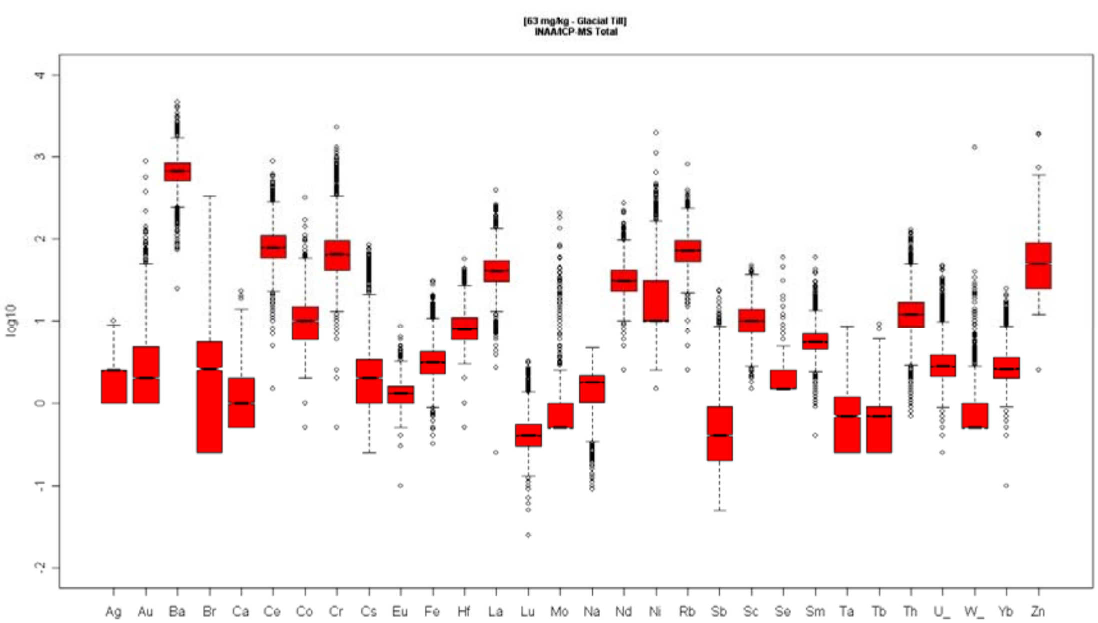

Figure 3. Boxplots of the total/near-total digestion data. The y-axis units are log base 10.

Element by element analysis - entire data set

Many of the distributions and summary statistics that are described below have effects that can influence basic statistical measures For many of the elements, variable proportions of the analytical values are less than the detection limit. As a result, the distributions are left truncated (left censored) which makes the interpretation of measures such as the mean, difficult. Robust measures such as the median more accurately reflect the background value as a substitute for the mean. Generally, when an analytical value is close to the detection limit, the precision of the measurement is reduced. Additionally, results may be rounded up or down to a value such as 1, 2 or 5 mg/kg. This can result in a "quantization" effect, which can also influence the calculation of the average (mean) and other statistics.

Not all data were used for the evaluation. Elements for which there are less than 5000 observations, were not evaluated since they did not provide enough information in a regional context. Exceptions to this were Cd and W, which were included in the elements analyzed in the "totals" group. The number of observations that was used to compute the summary statistics and figures is posted in the summary graphics.

Partial Digestion Variability

Aluminum (Partial Digestion) (Figure 4)

Aluminum shows two populations. The largest population has a median value about about 1.8 %, whereas the second, smaller population has a median of approximately 7 mg/kg. Higher Al values are associated with tills collected in Labrador and the Lake Athabasca areas. A total of 6,415 observations are available.

Arsenic (Partial Digestion) (Figure 5)

Arsenic displays a skewed distribution that is a function of mixtures of source material and selective extraction from the partial digestion. More than 25% of the data (8873 total) are at less than the detection limit of 1 mg/kg. There are distinct populations at 3-4 mg/kg, 5-7 mg/kg, 10-12 mg/kg and 20-30 mg/kg. This is clearly a poly-modal population based on regional geological differences

Barium (Partial Digestion) (Figure 6)

Barium displays a polymodal population, which is probably based on regional geological/mineralogical differences. Barium may replace K in many minerals and is present in the Aqua-Regia insoluble mineral barite ($Ba\ SO_4$). The distribution is roughly symmetrical but not log-normal. The median is 100 mg/kg with 50% of the values ranging from 40 to 190 mg/kg.

Beryllium (Partial Digestion) (Figure 7)

Approximately 75% of the Be analyses are less than the detection limit. The median is less than 1 mg/kg. Areas of higher Be occur in the Lake Athabasca region of Alberta.

Calcium (Partial Digestion) (Figure 8)

Calcium shows a symmetrical but not a log-normal distribution. The population is approximately tri-modal, as shown in the cumulative probability q-q plots This mixture of populations may reflect differences in regional geology and mineralogy (e.g. silicates, carbonates, sulphates). The median is 0.41%.

Cobalt (Partial Digestion) (Figure 9)

Cobalt distribution is approximately symmetrical with a slight positive skewness, which represents large Co values. These values are do not appear to have any particular spatial pattern and probably represent natural background variability due to the presence of varying amounts of Co-bearing Fe-sulphide minerals in the geological environments. The median is 8 mg/kg with an inter-quartile range of 4 to 12 mg/kg.

Chromium (Partial Digestion) (Figure 10)

Chromium shows a positively skewed distribution, which indicates that the overall distribution is likely a mix of several populations. The range of values from 200- > 500 mg/kg is likely derived from source material that is ultramafic in composition. From the evaluation of the histogram and the q-q plots, there appear to be modes at ~22, 50, 90 and 400 mg/kg, reflecting different source environments. These values reflect Cr that is available in minerals that are easily decomposed using Aqua-Regia digestion.

Copper (Partial Digestion) (Figure 11)

Cu displays a near-log-normal distribution, with a group of observations of large values in Labrador and central Newfoundland. Cu has a median of 20 mg/kg, with 50% of the observations with values between 10 and 35 mg/kg.

Iron (Partial Digestion) (Figure 12)

Iron shows a distribution that is likely the mixture of at least two large populations, with modal maxima at 2 and 4.8 % The median is 2.49 % with 50% of the observations in the range of 1.73 and 3.5 %. The q-q plot shows that there are at least 5 inflection points on the curve, suggesting a mix of at least 5 populations. There is a clear geospatial association in Western Labrador with high Fe values related to the Fe-enriched lithologies and ore deposits in the Labrador Trough.

Gallium (Partial Digestion) (Figure 13)

Ga values are censored to the level of almost 75%. The figures show that there are likely at least 5 detection limits at 5, 10, 20, 30, 40 and 50 mg/kg. Alternatively, the precision of Ga determinations is low and this is reflected in the quantization in the figures. It is impossible to provide a median or any other meaningful statistical summary of the data.

Postassium (Partial Digestion) (Figure 14)

Potassium appears to be reflecting the presence of several populations as shown in the histogram and q-q plots. The distribution is also affected by poor precision at the lower measures as shown by the quantization effects in the plots. Higher values of K occur in the Lake Athabasca area and lower K occurs in the central Newfoundland area. The median is 0.11% with 50% of the observations between 0.07 and 0.18%.

Lanthanum (Partial Digestion) (Figure 15)

Lanthanum values are highly quantized, reflecting poor precision near to the detection limit. It is difficult to draw any conclusion on the nature of the distribution of this element, except that it is not log-normal and positively skewed.

Magnesium (Figure 16)

Magnesium appears as a near log-normal distribution with a median of 0.48% with 50% of the values ranging from 0.20% to 0.74%.The distribution is most probably a mixture of at least 2 or three populations associated with regional geological and mineralogical differences (e.g. silicates, carbonates) Higher values of Mg occur in the Labrador Trough region of eastern Quebec.

Manganese (Partial Distribution) (Figure 17)

Manganese appears as at least two major populations; one with a mode of approximately 200 mg/kg and the other with a mode of 600 mg/kg. Additional frequency maxima occur at approximately 1200 and 1700 mg/kg. The median value is 260 mg/kg with 50% of the values occurring between 160 and 550 mg/kg. The lowest values occur in the Amunsden Lowlands in the Mackenzie River delta. The highest values occur in Labrador.

Molybdenum (Partial Digestion) (Figure 18)

The distribution of Mo is highly censored, with almost 75% of the value at less than the detection limit of 0.5 mg/kg. The resulting summary statistics are unreliable for Mo carried out by Aqua-Regia digestion. The maximum value of Mo is 137 mg/kg.

Sodium (Partial Digestion) (Figure 19)

About 10% of the Na values are censored and values greater than the detection limit of 0.1% are quantized up to values of 0.4%. The median is 0.01 with 50% of the data ranging from 0.01 to 0.03%. Sodium (Na) levels are highest in the Lake Athabasca area and north of Great Slave Lake.

Nickel (Partial Digestion) (Figure 20)

The distribution of Ni is polymodal and positively skewed. Maxima occur at 10, 25 and 60 mg/kg. Lower values of Ni tend to be quantized. The median is 18 μg/kg with 50% of the values between 9 and 29 mg/kg. Ni values are highest in Labrador.

Phosphorus (Partial Digestion) (Figure 21)

The distribution of P is distinctively bi-modal with a clear break between populations at a value of 2500 mg/kg. This distinction between populations more likely represents a definitive difference between source materials.

Lead (Partial Digestion) (Figure 22)

The distribution of lead is not log-normal and shows the effects of quantization in the data reporting at lower levels. The cumulative probability and q-q plots indicate that there are at least three populations represented in the distribution. The median is 8 mg/kg with 50% of the data ranging from 6 to 14 mg/kg. Higher values of Pb could be due to the effects of Pb mineral occurrences.

Scandium (Partial Digestion) (Figure 23)

Scandium values are highly quantized below 10 mg/kg. The median is 2 mg/kg with 50% of the data occurring between 2 and 7 mg/kg. The population appears to be bi-modal. Higher values occur in central Newfoundland and the Lake Athabasca region of Alberta.

Strontium (Partial Digestion) (Figure 24)

The distribution of Sr appears to have at least 3 modes at 10, 25 and 100 mg/kg. These differences probably reflect the solubility of Sr in various mineral phases. High values of Sr are likely derived from sedimentary rocks containing limestone, whereas lower Sr values are associated with less easily soluble minerals in the Aqua-Regia digestion process. The median for Sr is 40 mg/kg, with 50% of the values ranging from 19 to 84 mg/kg. Values exceeding 100 mg/kg occur in the Keewatin Lowlands in Nunavut and the central Cordillera of British Columbia.

Titanium (Partial Digestion) (Figure 25)

Titanium is not normally present in mineral phases that are easily dissolved in Aqua-Regia. Values range from 0.01 to 0.41% (100 to 4100 mg/kg). At the lower levels of detection, the analytical values are quantized. About 1% of the data are left censored and the overall nature of the distribution, above the detection limit of 0.01% is close to log-normal. The median is 0.08% with 50% of the data ranging from 0.04 to 0.13%. Higher values of Ti occur in the Labrador Trough and central Newfoundland areas.

Vanadium (Partial Digestion) (Figure 26)

Vanadium occurs as several distinct populations, with modes at 20, 30, 80 and 150 mg/kg. These distinct populations reflect regional geological differences and associated solubility differences within the mineralogy unique to the regional geological patterns. V is highest in the prairie soils of Alberta, Saskatchewan and Manitoba where it has been derived from weathered shales in the Western Canada Sedimentary Basin.

Zinc (Partial Digestion) (Figure 27)

Zinc abundance is dominated by at least two distinct populations with modes at approximately 20 and 100 mg/kg. There are at least 3 outliers that exceed 500 mg/kg, most likely representing Zn from mineralized areas. The median for Zn is 36 mg/kg with 50% of the values ranging from 22 to 70 mg/kg. Values of Zn above 80 mg/kg can be found in the intermontane area of British Columbia, the prairie soils of Alberta, Saskatchewan and Manitoba, the Lake Athabasca area of Alberta, the Labrador Trough and central Newfoundland.

Total Digestion Variability

Silver (Total Digestion) (Figure 28)

More than 99% of the silver analytical results are less than the detection limits of 2 and 5 mg/kg. Any statistical summary is not meaningful.

Gold (Total Digestion) (Figure 29)

More than 50% of the analytical values for Au are at less than the detection limit of 2 ppb. A statistical interpretation of these data is not possible. Gold is known occur very sporadically within soils and tills. This sporadic occurrence is known as the nugget effect. Thus, it is difficult to place any statistical interpretation with these data.

Barium (Total Digestion) (Figure 30)

The distribution of Ba values is not log-normal and is negatively skewed. The median is 670 mg/kg with 50% of the values ranging from 510 to 840 mg/kg. These values are about 5 times greater than for Ba determined by partial extraction. Barium distribution is nearly uniform across all of the survey areas. However, Ba values tend to increase in the southwest part of the prairie soil data survey.

Bromine (Total Digestion) (Figure 31)

Approximately 25% of the Br values are less than the detection limit of 0.5 mg/kg. For those values above the detection limit, there appear to be to modal maxima, one at 2 and one at 5µg/kg. Other maxima possibly exist but are obscured by outliers. The median is 2.6 mg/kg with 50% of the values ranging from 0.5 to 5.5 mg/kg . Areas near the coast of Labrador show the highest values of Br, reflecting the effect of sea-spray driven inland.

Calcium (Total Digestion) (Figure 32)

More than 50% of Ca values are at the detection limit of 1% and the values are quantized at 1, 2, 3 and 5% levels. Less than 95% of the values exceed 5%.

Cadmium (Total Digestion) (Figure 33)

There are a limited number of Cd observations, primarily derived from the prairie soil survey. Less than 2% of the values do not exceeded 3 mg/kg. The data are also highly quantized.

Cerium (Total Digestion) (Figure 34)

The distribution of Ce values is symmetrical but not log-normal. About 2% of the values are less than detection limit, with breaks in the populations at 300 and 400 mg/kg. The median is approximately 80 mg/kg with 50% of values ranging from 58 to 110 mg/kg. Ce shows greater enrichment in the central Baffin Island area.

Cobalt (Total Digestion) (Figure 35)

The median value of Co is 10 mg/kg with 50% of the values ranging from 6 to 15 mg/kg. The histogram indicates at least 3 modes to the right of the median. High Co values occur in central British Columbia and the western part of the till survey in Labrador, which covers the Labrador trough.

Cr (Total Digestion) (Figure 36)

The distribution of Cr is not log-normal and is a mixture of several populations. Modal maxima can be seen at 50, 100, approximately200 mg/kg and 550 mg/kg, reflecting several different underlying lithologies. The median is 65 mg/kg with 50% of the data ranging from 42 to 96 mg/kg. The largest concentration of elevated values of Cr (> 200 mg/kg) occurs in the Labrador Trough region.

Cesium (Total Digestion) (Figure 37)

More than 50% of the Cs values are close to the detection limit and are quantized at 0.5, 1, 2, 3 and 5 mg/kg. The population is clearly not log-normal and about 25% of the values exceed 5 mg/kg. Most of the high Cs values are in the survey area in central British Columbia

Europium (Total Digestion) (Figure 38)

Europium values do not exceed 8.6 mg/kg. Over 75% of the values are quantized at values less than 2 mg/kg. From the histogram and q-q plots, there appears to be at least two populations, although there does not appear to be any spatial patterns in the Eu values.

Iron (Total Digestion) (Figure 39)

Iron is comprised of at least two populations, with the majority of Fe values exceeding 10% occur in the Labrador Trough area. The overall median of Fe is 3.13 % with 50% of the values ranging from 2.24 to 4.2%.

Hafnium (Total Digestion) (Figure 40)

Hafnium shows an approximate log-normal distribution and appears polymodal. The median is 8 mg/kg and ranges from 6 to 11 mg/kg from the first to third quartile. Elevated Hf values occur along the coast of Labrador.

Lanthanum (Total Digestion) (Figure 41)

Lanthanum values form a negatively skewed polymodal log-normal distribution, with a few extreme values exceeding 200 mg/kg. The median is 41 mg/kg and ranges from 30-55 mg/kg between the first and third quartiles. High La values occur in the central Baffin Island and northern Manitoba survey areas.

Lutetium (Total Digestion) (Figure 42)

Lutetium ranges from 0.1 to a maximum of 3.2 mg/kg. The distribution is negatively skewed log-normal with several outliers at both ends of the distribution. Approximately 5% of the values are less than the detection limit. The median is 0.4 mg/kg and 50% of the values range from 0.3 to 0.55 mg/kg. Elevated Lu values occur along the coast of Labrador and in central Newfoundland.

Molybdenum (Total Digestion) (Figure 43)

The Mo data is highly censored. More than 50% are less than the detection limit of 1 mg/kg. The values range from < 1 mg/kg to 206 mg/kg. Elevated Mo values occur in the central British Columbia, central Baffin Island and New Brunswick survey areas.

Sodium (Total Digestion) (Figure 44)

Sodium displays a clear bi-modal distribution with maxima at approximately 1% and 2%. The overall range of Na between the first and third quartiles is 1.02 to 2.15 %. Low Na values occur throughout the prairie soil survey area. The highest Na values occur along the coast of Labrador.

Neodymium (Total Digestion) (Figure 45)

Neodymium exhibits a near log-normal distribution with modal maxima at approximately 30 and 40 mg/kg. The distribution shows a positive skew with a population of elevated values that varies from 100 to 275 mg/kg. The median is 31.1 mg/kg with a range of 23 to 41.15 mg/kg between the first and third quartiles. Elevated Nd values occur in the central Baffin Island, Labrador coast and central New Brunswick surveys.

Nickel (Total Digestion) (Figure 46)

The distribution of Ni is highly censored, with nearly 75% of the values less than 10 mg/kg. The graphs show that the data are highly quantized representing low precision of varying levels of detection. The summary statistics are difficult to interpret. High Ni values occur in the central British Columba and central Baffin Island survey areas.

Rubidium (Total Digestion) (Figure 47)

Rubidium exhibits a lognormal-like distribution with a median of 72 mg/kg with 50% of the values ranging between 53 and 97 mg/kg. The survey area in central Baffin Island shows the highest values of Rb.

Antimony (Total Digestion) (Figure 48)

The distribution of Sb exhibits a significant amount of quantization with many of the values close to the detection limit. The median is 0.4 mg/kg with a range of 0.2 to 0.9 mg/kg between the first and third quartiles. Elevated levels of Sb are found in the central British Columbia, central Baffin Island, Labrador Trough and the Bathurst Camp of New Brunswick survey areas.

Scandium (Total Digestion) (Figure 49)

Scandium exhibits a polymodal population with maxima at approximately 10, 15 and 20 mg/kg. The median is 10 mg/kg with a range of 7.3 to 14 mg/kg between the first and third quartiles. Elevated levels of Sc occur in the central British Columbia, central Baffin Island, central Newfoundland and New Brunswick survey areas. High values of Sc are noted in the Labrador Trough area.

Selenium (Total Digestion) (Figure 50)

More than 98% of the Se values are less than the detection limits of 2 and 5 mg/kg Only a small number of values exceed 5 mg/kg. It is difficult to infer much about the variability with the exception of those observations that exceed 10 mg/kg, which are located in the survey over central Baffin Island.

Samarium (Total Digestion) (Figure 51)

Samurium values exhibit a near log-normal distribution. The histogram suggests that the distribution is composed of several populations, most probably related to source lithologies. The median is 5.5 mg/kg with a range of 4.5 to 7 mg/kg between the first and third quartiles. Higher values of Sm (>15 mg/kg) are noted in the central Baffin and New Brunswick survey areas.

Tantalum (Total Digestion) (Figure 52)

Almost 50% of Ta values are less than the detection limit, making it difficult to summarize the variability of this element. The overall variability is from 0.5 mg/kg to a maximum of 8.6 mg/kg. Ta values are elevated (3 mg/kg) in the surveys of central Baffin Island, the coast of Labrador and New Brunswick.

Terbium (Total Digestion) (Figure 53)

Terbium values are mostly at the detection limit of 0.5 mg/kg. As well, the quantization of the values makes it difficult to summarize the data in a meaningful way. Significant elevated values (> 3 mg/kg) of Tb occur only in the New Brunswick till survey data.

Thorium (Total Digestion) (Figure 54)

The distribution of Th is symmetrical and near log-normal and is composed of several different populations. The median is 12 mg/kg with a range of 8.3 to 17 mg/kg between the first and third quartiles. From the histogram and q-q plots, there are appears to be at least two major populations comprising the data distribution; one with a mode at about 8 mg/kg and the other with a mode at about 20 mg/kg. Elevated values of Th occur in Manitoba, north of Great Slave Lake, central Baffin Island, the Labrador Trough, and New Brunswick. The prairie soil data is relatively lower in Th.

Uranium (Total Digestion) (Figure 55)

Uranium exhibits a near symmetrical log-normal distribution. About 2% of the analytical values are less than the detection limit of 0.5 mg/kg. The median is 2.8 mg/kg with 50% of the values ranging between 2.1 and 3.9 mg/kg. Values of U are uniform across the survey areas with the exception of central Baffin Island where there are values >10 mg/kg.

Tungsten (W) (Figure 56)

More than 75% of W values are less then the detection limits of 1 mg/kg, thus the summary statistics are not meaningful. A few values exceed 10 mg/kg in the area of the New Brunswick till survey.

Ytterbium (Total Digestion) (Figure 57)

The distribution of Yb shows quantization and analytical values are close to the detection limit of 1 mg/kg. The median is 2.6 mg/kg with a range of 2 to 3.6 mg/kg between the first and third quartiles. Elevated values of Yb (>6 mg/kg) occur on the coast of Labrador and central New Brunswick and Newfoundland.

Zinc (Total Digestion) (Figure 58)

Approximately 50% of the analytical values for zinc at less than the detection limit, which creates difficulty in characterizing the data. It appears that there may be two significant populations, one less than 50 μg/kg and another with a mode of 100 mg/kg. Zinc values in the range of 50-100 μg/kg exist throughout the survey areas, whereas Zn values that exceed 150 μg/kg occur in the survey areas of central British Columbia, Baffin Island, Labrador and Newfoundland. For those data analyzed by INAA, the detection limit of 100 mg/kg make it difficult to characterize and compare with other data that have a much lower detection limit.

Summary

This addendum has provided additional information on a range of elements that are routinely determined in geochemical surveys across Canada. It can be seen that the distribution for many elements show a significant amount of censoring, that is, analytical values that are less than the detection limit. Nonetheless, for most elements, the data summaries provide a view on the range of values that can be expected across the country. In addition, a brief summary on how the analytical values are distributed spatially will provide some insight into the geospatial aspect of geochemical data. Future work will integrate both the statistical features and the geospatial features of the data.

Acknowledgements

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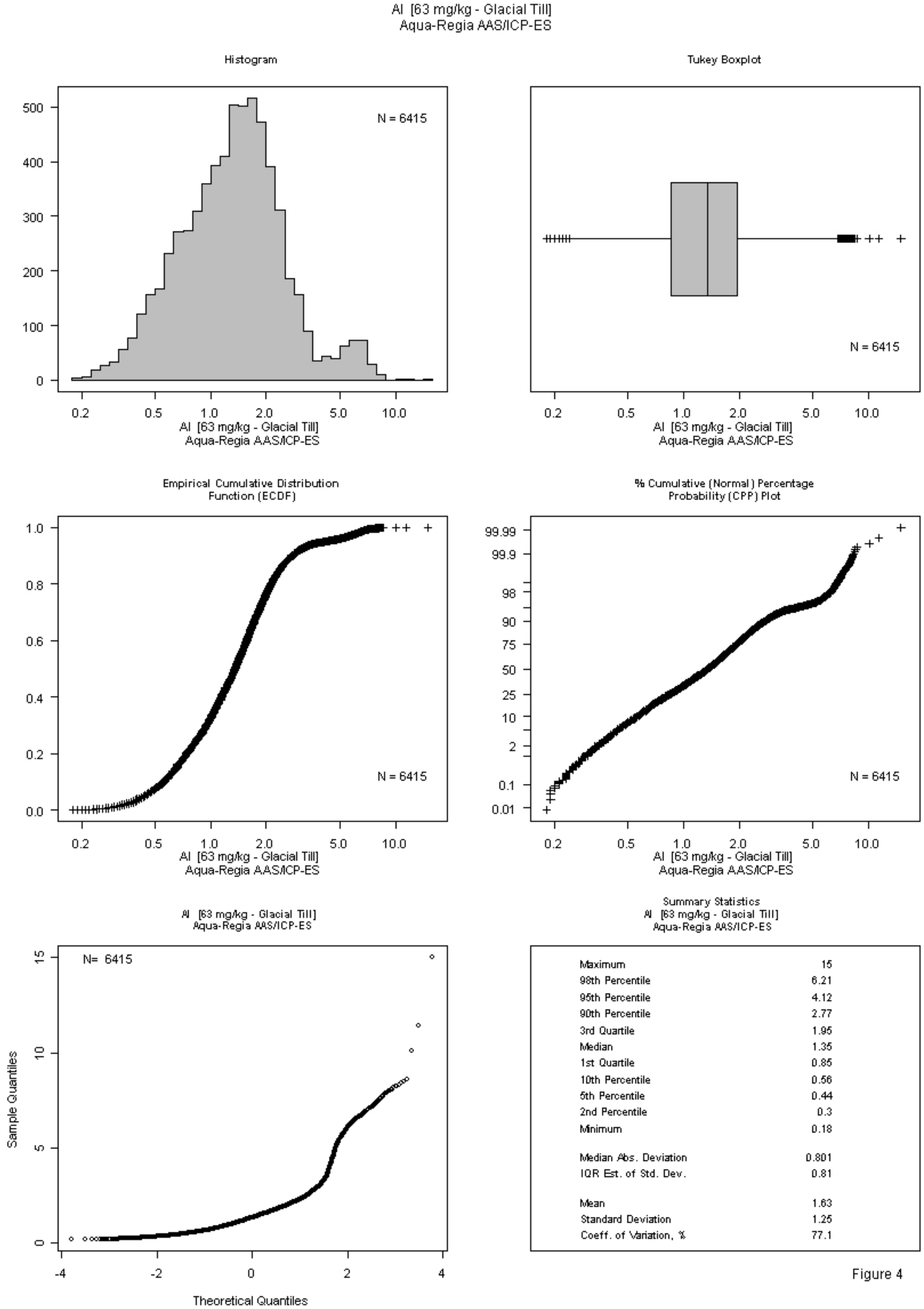
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Histogram
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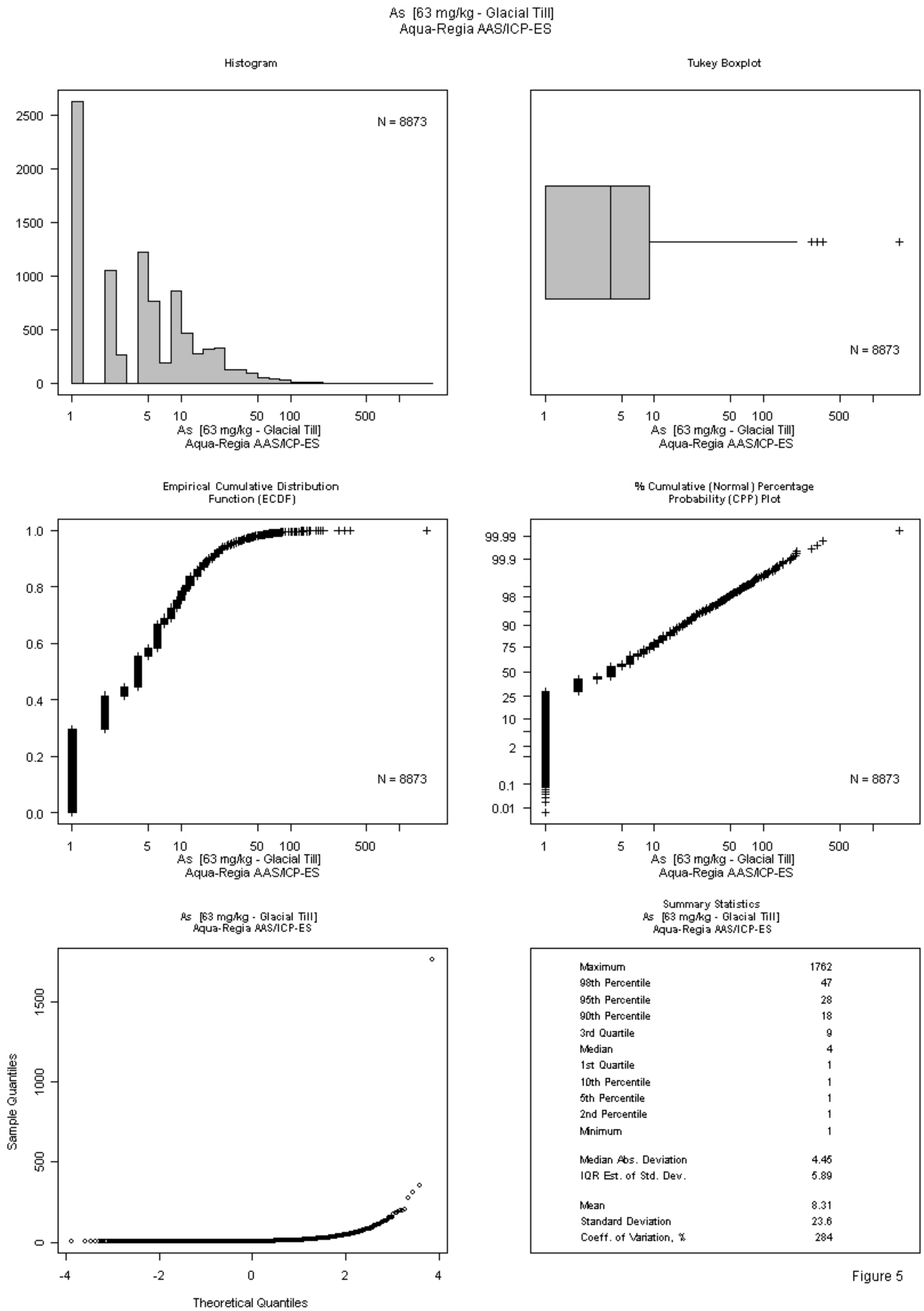
Tukey Boxplot
N = 6415
Empirical Cumulative Distribution Function (ECDF)
N = 6415
% Cumulative (Normal) Percentage Probability (CPP) Plot
N = 6415
N= 6415
Sample Quantiles
Theoretical Quantiles
Summary Statistics
Maximum 15
98th Percentile 6.21
95th Percentile 4.12
90th Percentile 2.77
3rd Quartile 1.95
Median 1.35
1st Quartile 0.85
10th Percentile 0.56
5th Percentile 0.44
2nd Percentile 0.3
Minimum 0.18
Median Abs. Deviation 0.801
IQR Est. of Std. Dev. 0.81
Mean 1.63
Standard Deviation 1.25
Coeff. of Variation, % 77.1

Figure 4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Histogram
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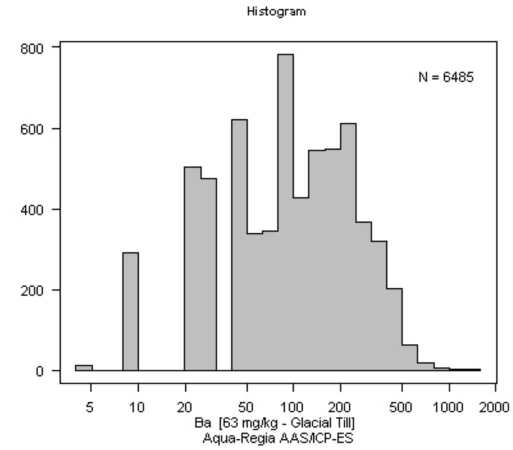
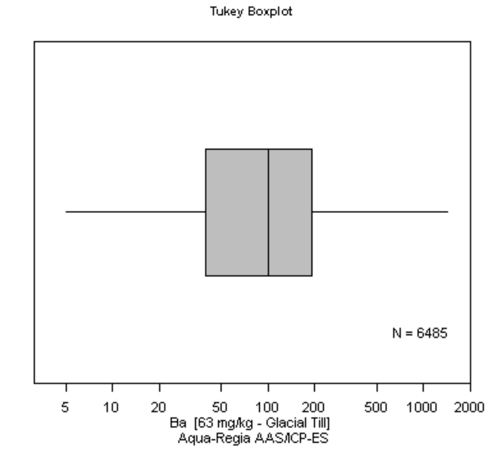
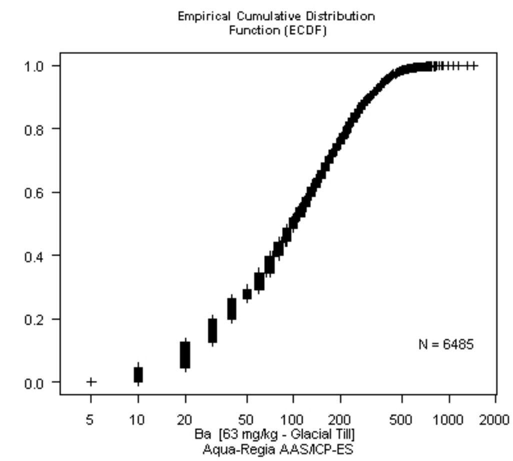
Aqua-Regia AAS/ICP-ES
Tukey Boxplot
N = 8873
Empirical Cumulative Distribution
Function (ECDF)
N = 8873
% Cumulative (Normal) Percentage
Probability (CPP) Plot
N = 8873
As [63 mg/kg - Glacial Till]
Aqua-Regia AAS/ICP-ES
Sample Quantiles
Theoretical Quantiles
Summary Statistics
As [63 mg/kg - Glacial Till]
Aqua-Regia AAS/ICP-ES
Maximum 1762
98th Percentile 47
95th Percentile 28
90th Percentile 18
3rd Quartile 9
Median 4
1st Quartile 1
10th Percentile 1
5th Percentile 1
2nd Percentile 1
Minimum 1
Median Abs. Deviation 4.45
IQR Est. of Std. Dev. 5.89
Mean 8.31
Standard Deviation 23.6
Coeff. of Variation, % 284

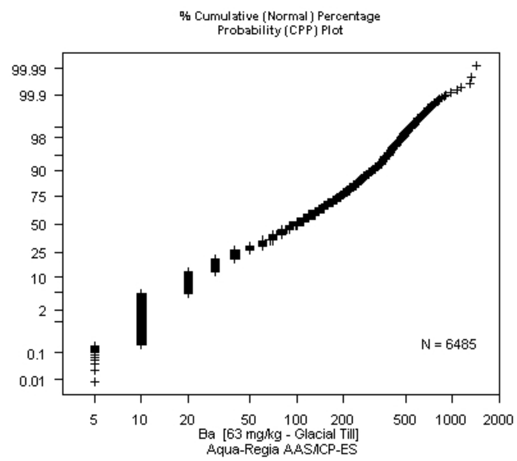
Figure 5

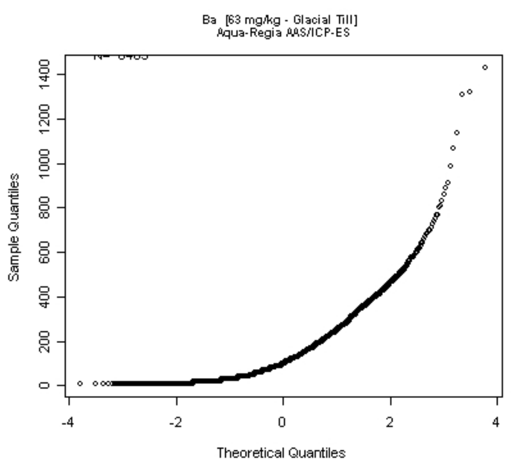
Ba [63 mg/kg - Glacial Till]
Aqua-Regia AAS/ICP-ES









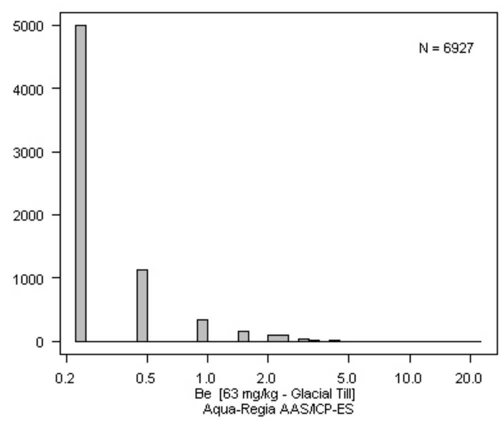


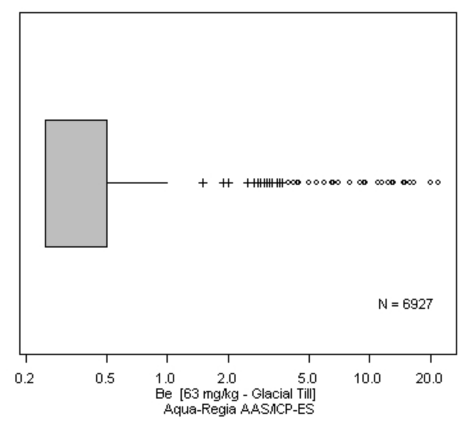
Summary Statistics
Ba [63 mg/kg - Glacial Till]
Aqua-Regia AAS/ICP-ES

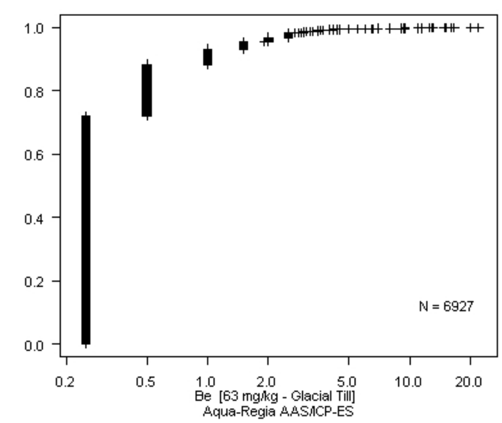
Maximum	1430
98th Percentile	470
95th Percentile	380
90th Percentile	310
3rd Quartile	190
Median	100
1st Quartile	40
10th Percentile	20
5th Percentile	20
2nd Percentile	10
Minimum	5
Median Abs. Deviation	104
IQR Est. of Std. Dev.	110
Mean	137
Standard Deviation	126
Coeff. of Variation, %	91.4

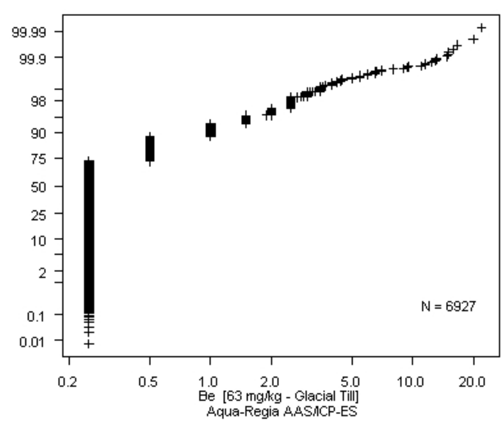
Figure 6

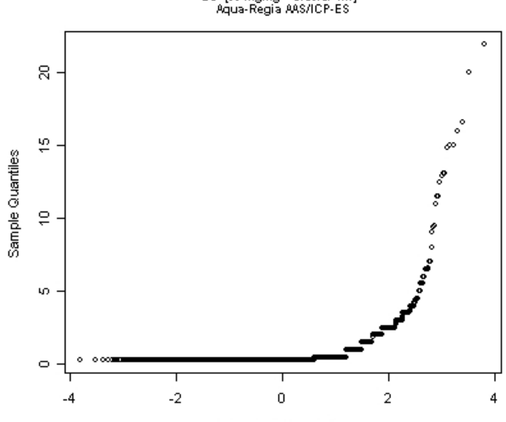
Be [63 mg/kg - Glacial Till]
Aqua-Regia AAS/ICP-ES









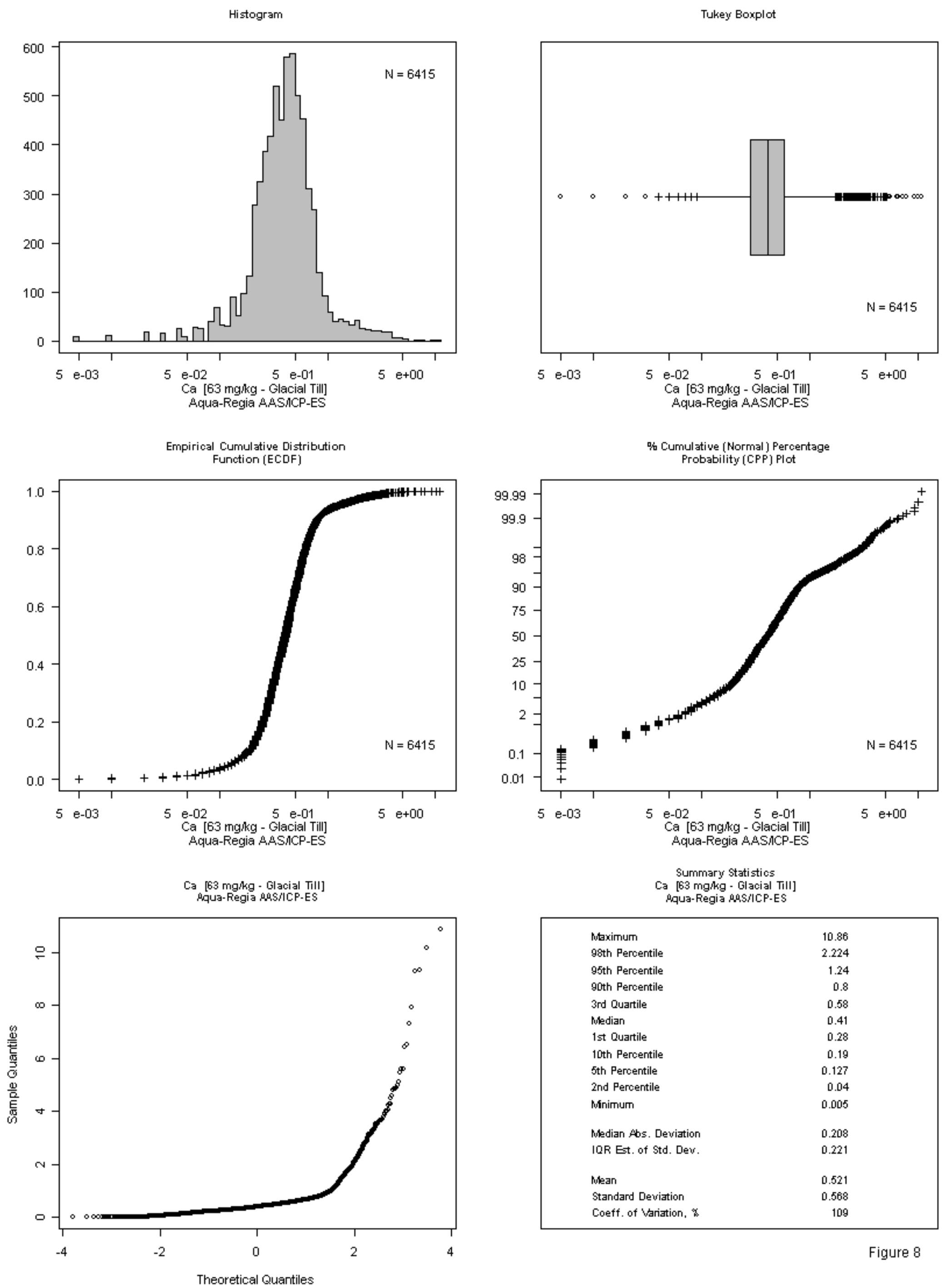


Summary Statistics
Be [63 mg/kg - Glacial Till]
Aqua-Regia AAS/ICP-ES

Maximum	21.9
98th Percentile	2.5
95th Percentile	1.5
90th Percentile	1
3rd Quartile	0.5
Median	0.25
1st Quartile	0.25
10th Percentile	0.25
5th Percentile	0.25
2nd Percentile	0.25
Minimum	0.25
Median Abs. Deviation	0
IQR Est. of Std. Dev.	0.184
Mean	0.497
Standard Deviation	0.902
Coeff. of Variation, %	181

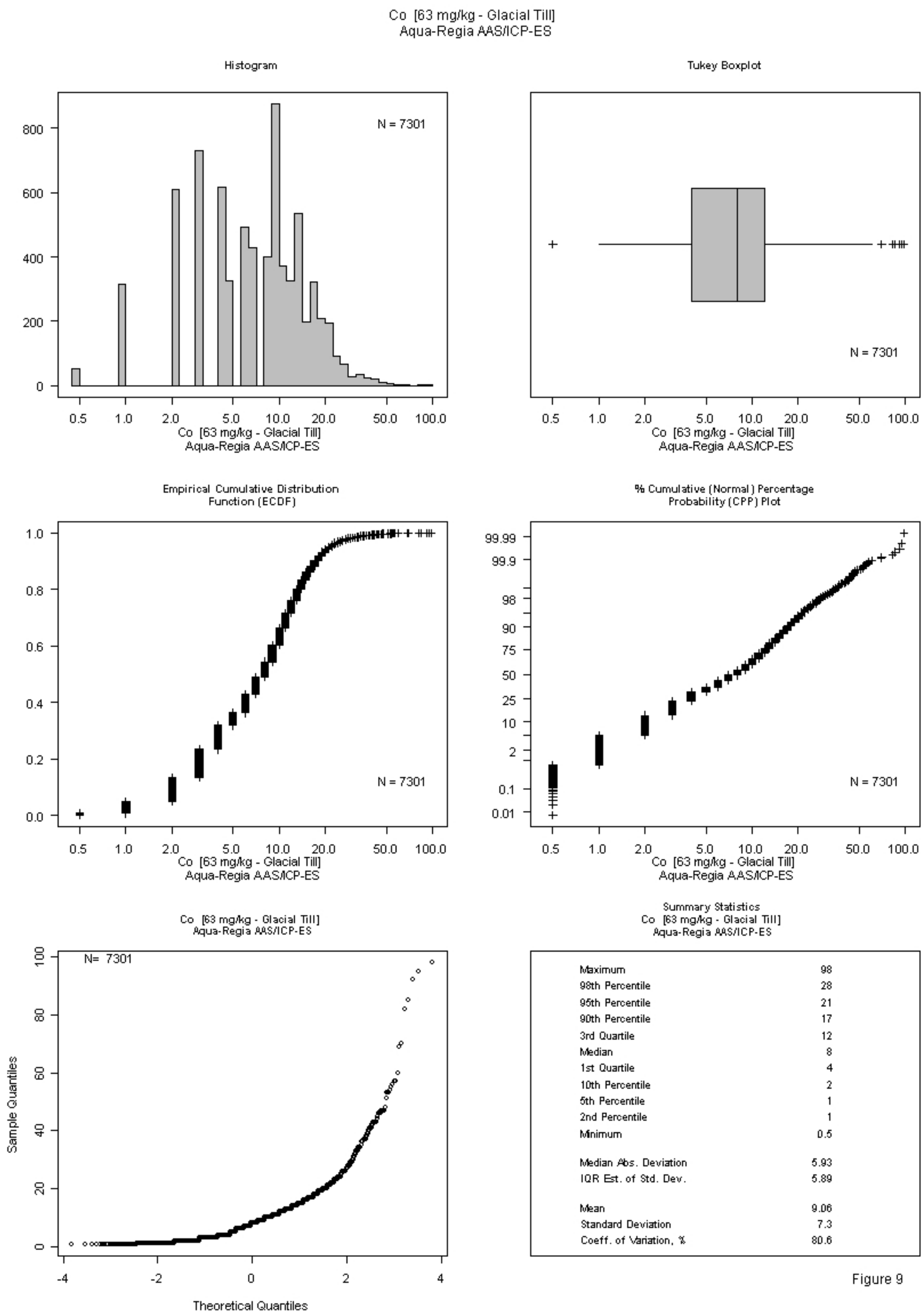
Figure 7

Ca [63 mg/kg - Glacial Till]
Aqua-Regia AAS/ICP-ES



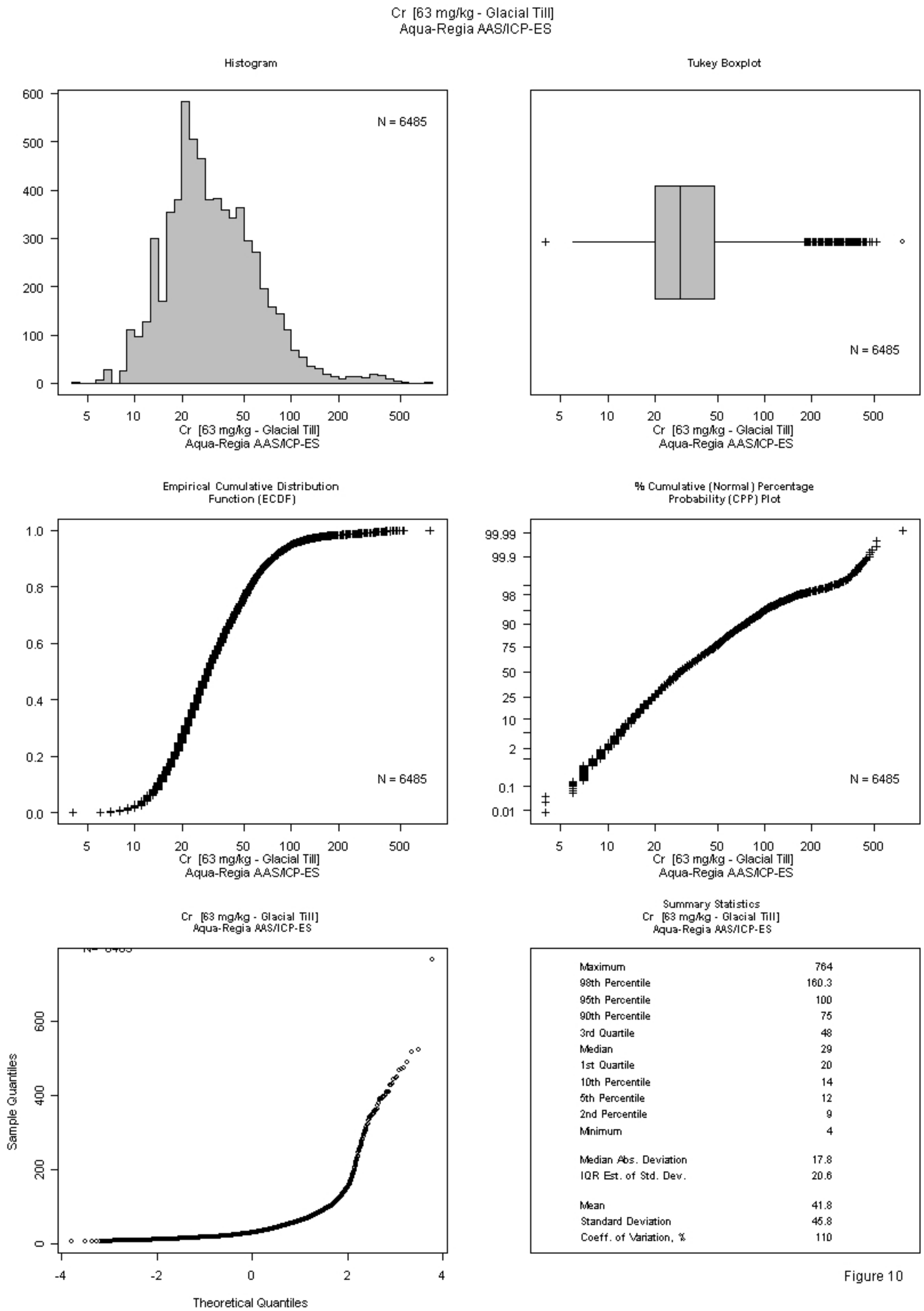
Maximum	10.86
98th Percentile	2.224
95th Percentile	1.24
90th Percentile	0.8
3rd Quartile	0.58
Median	0.41
1st Quartile	0.28
10th Percentile	0.19
5th Percentile	0.127
2nd Percentile	0.04
Minimum	0.005
Median Abs. Deviation	0.208
IQR Est. of Std. Dev.	0.221
Mean	0.521
Standard Deviation	0.568
Coeff. of Variation, %	109

Figure 8



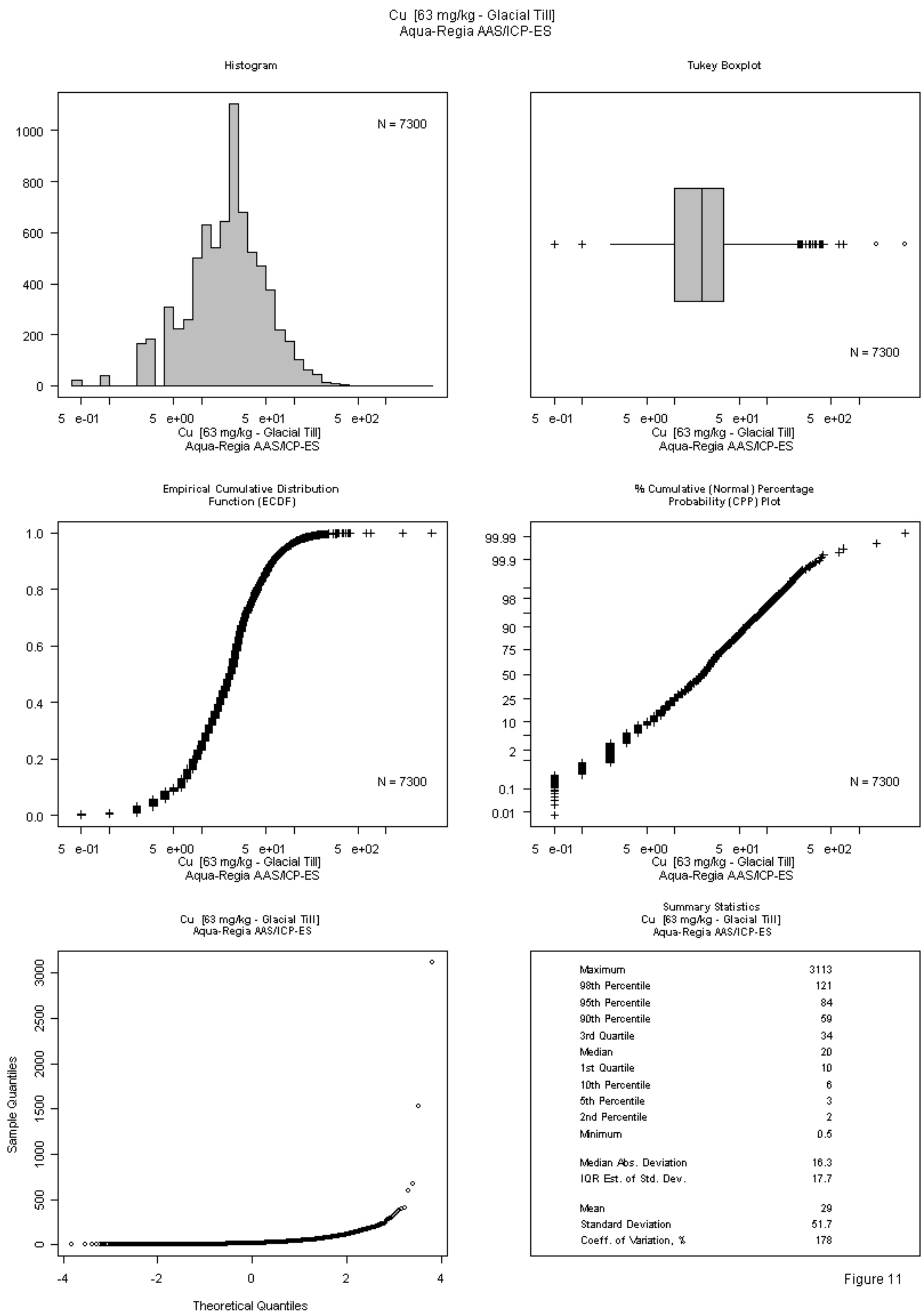
Maximum	98
98th Percentile	28
95th Percentile	21
90th Percentile	17
3rd Quartile	12
Median	8
1st Quartile	4
10th Percentile	2
5th Percentile	1
2nd Percentile	1
Minimum	0.5
Median Abs. Deviation	5.93
IQR Est. of Std. Dev.	5.89
Mean	9.06
Standard Deviation	7.3
Coeff. of Variation, %	80.6

Figure 9



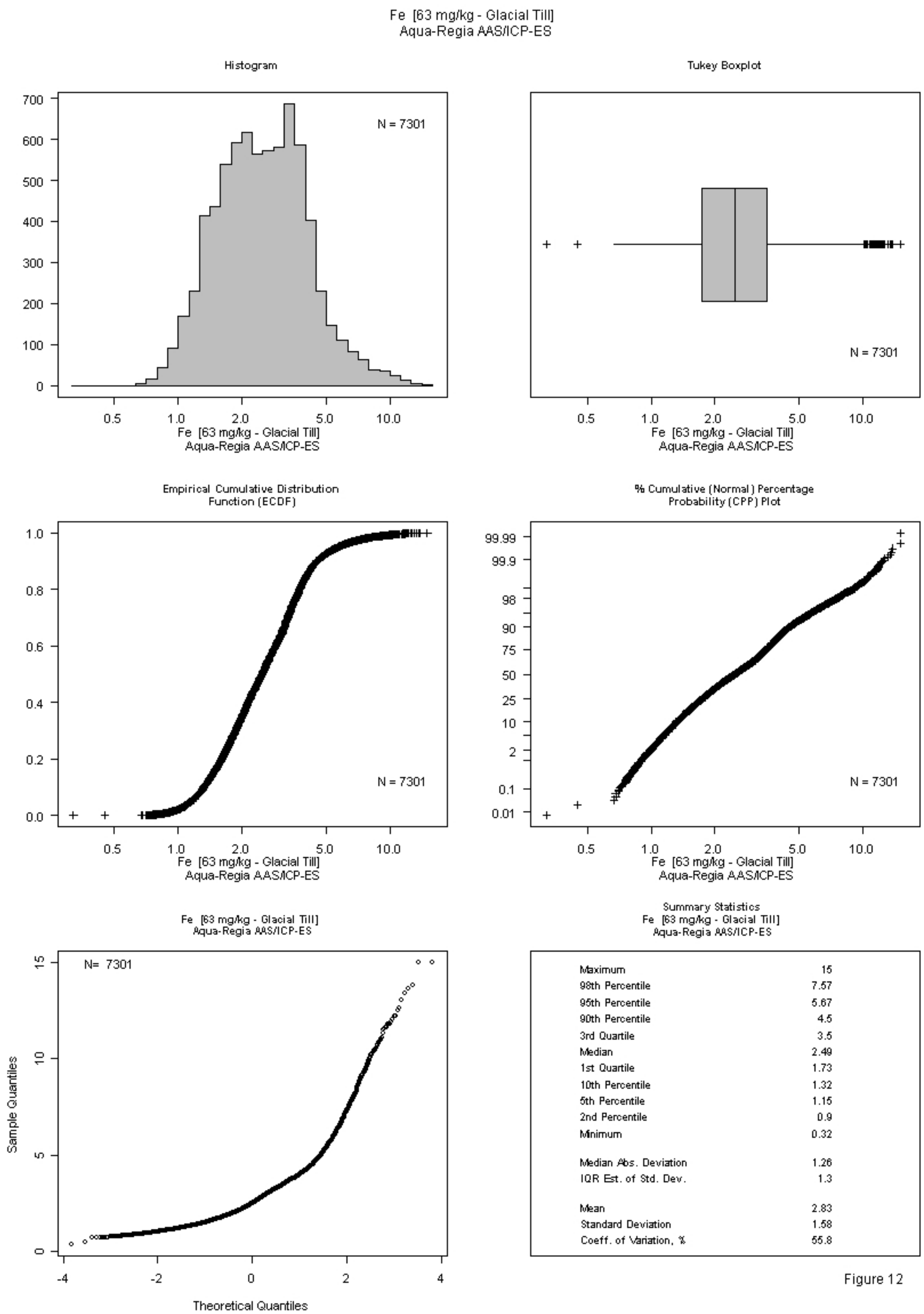
Maximum	764
98th Percentile	160.3
95th Percentile	100
90th Percentile	75
3rd Quartile	48
Median	29
1st Quartile	20
10th Percentile	14
5th Percentile	12
2nd Percentile	9
Minimum	4
Median Abs. Deviation	17.8
IQR Est. of Std. Dev.	20.6
Mean	41.8
Standard Deviation	45.8
Coeff. of Variation, %	110

Figure 10



Maximum	3113
98th Percentile	121
95th Percentile	84
90th Percentile	59
3rd Quartile	34
Median	20
1st Quartile	10
10th Percentile	6
5th Percentile	3
2nd Percentile	2
Minimum	0.5
Median Abs. Deviation	16.3
IQR Est. of Std. Dev.	17.7
Mean	29
Standard Deviation	51.7
Coeff. of Variation, %	178

Figure 11



Maximum	15
98th Percentile	7.57
95th Percentile	5.67
90th Percentile	4.5
3rd Quartile	3.5
Median	2.49
1st Quartile	1.73
10th Percentile	1.32
5th Percentile	1.15
2nd Percentile	0.9
Minimum	0.32
Median Abs. Deviation	1.26
IQR Est. of Std. Dev.	1.3
Mean	2.83
Standard Deviation	1.58
Coeff. of Variation, %	55.8

Figure 12

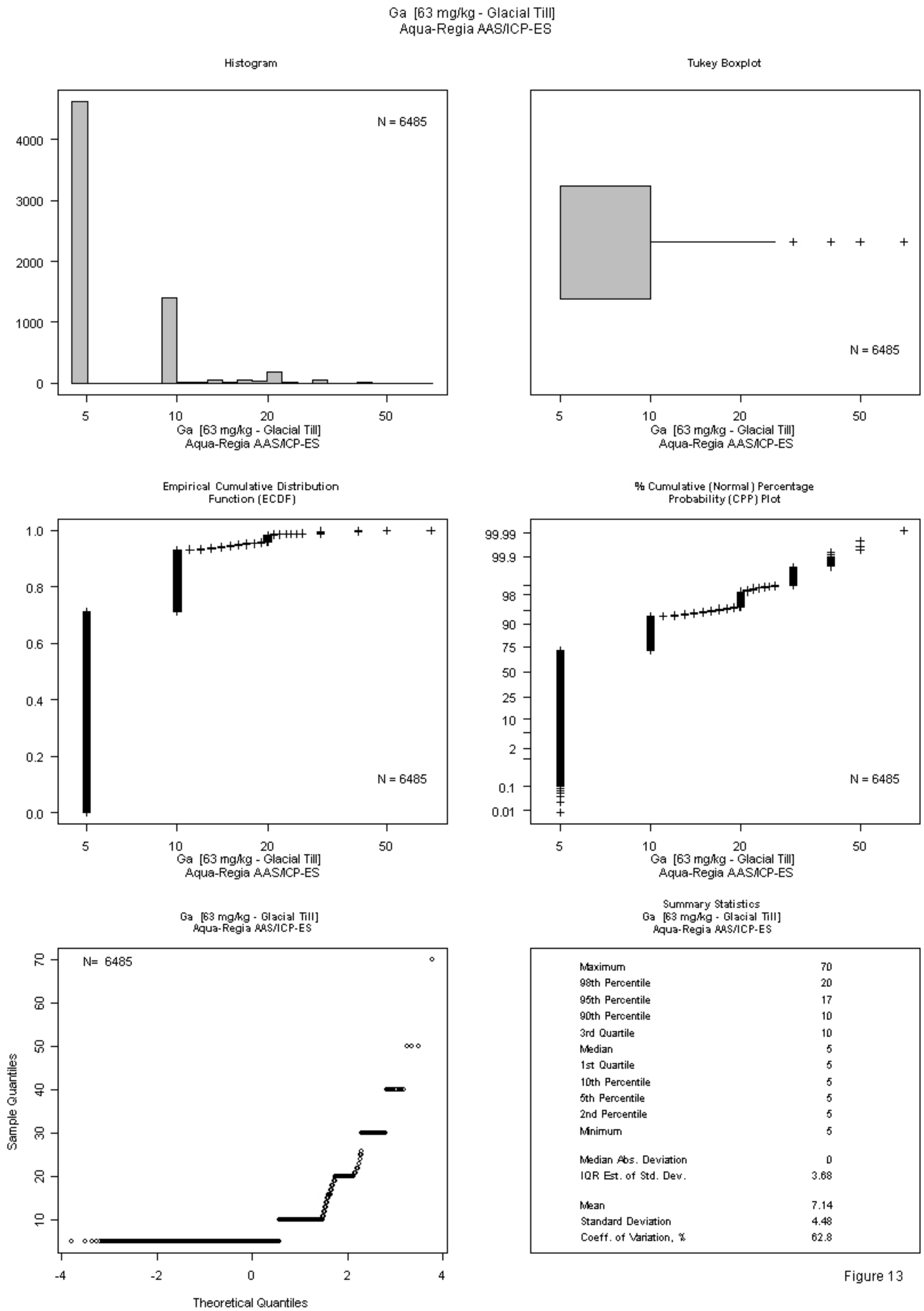
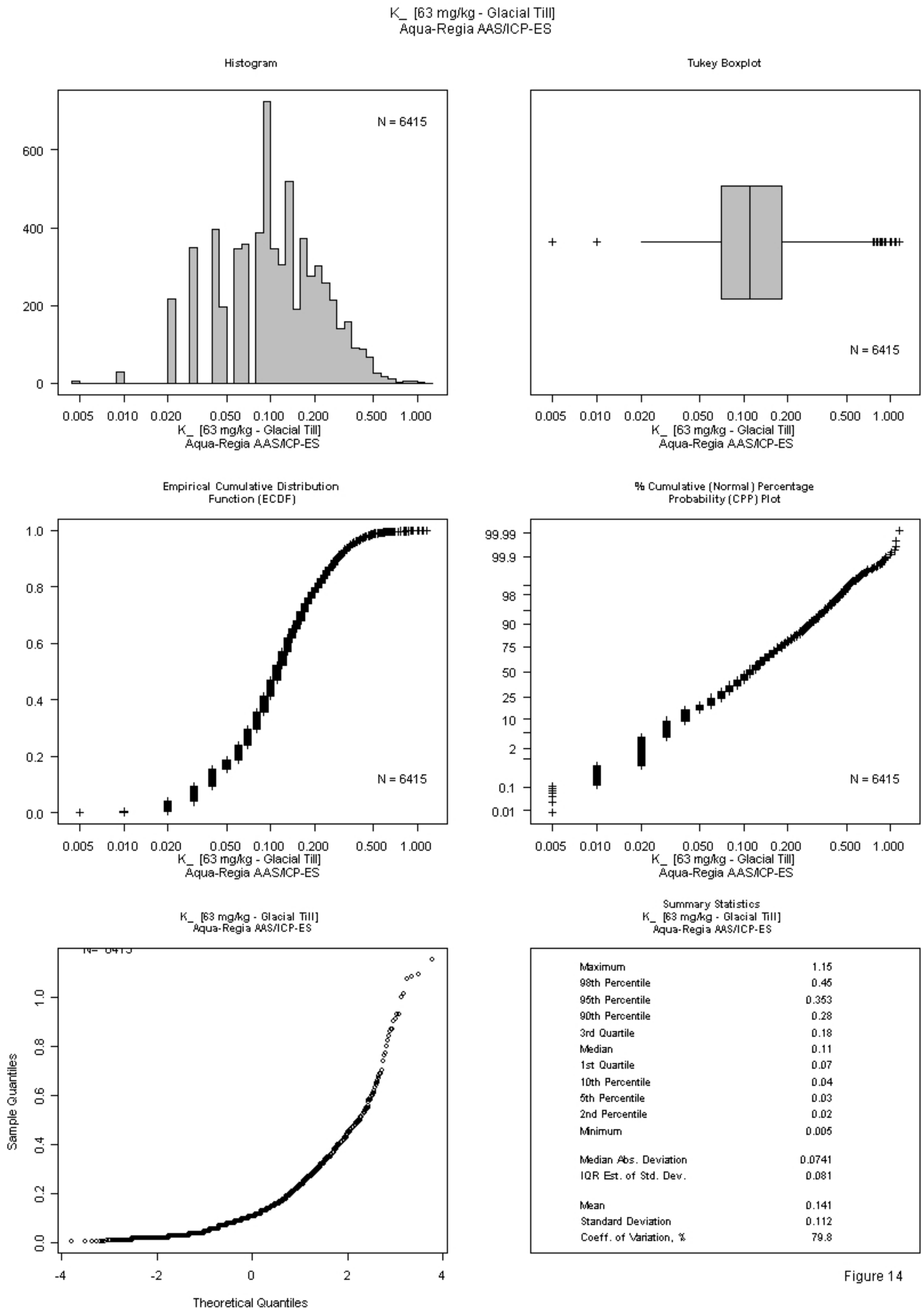

Ga [63 mg/kg - Glacial Till]
Aqua-Regia AAS/ICP-ES
Histogram
N = 6485
Ga [63 mg/kg - Glacial Till]
Aqua-Regia AAS/ICP-ES
Tukey Boxplot
N = 6485
Ga [63 mg/kg - Glacial Till]
Aqua-Regia AAS/ICP-ES
Empirical Cumulative Distribution
Function (ECDF)
N = 6485
Ga [63 mg/kg - Glacial Till]
Aqua-Regia AAS/ICP-ES
% Cumulative (Normal) Percentage
Probability (CPP) Plot
N = 6485
Ga [63 mg/kg - Glacial Till]
Aqua-Regia AAS/ICP-ES
Ga [63 mg/kg - Glacial Till]
Aqua-Regia AAS/ICP-ES
N= 6485
Sample Quantiles
Theoretical Quantiles
Summary Statistics
Ga [63 mg/kg - Glacial Till]
Aqua-Regia AAS/ICP-ES
Maximum 70
98th Percentile 20
95th Percentile 17
90th Percentile 10
3rd Quartile 10
Median 5
1st Quartile 5
10th Percentile 5
5th Percentile 5
2nd Percentile 5
Minimum 5
Median Abs. Deviation 0
IQR Est. of Std. Dev. 3.68
Mean 7.14
Standard Deviation 4.48
Coeff. of Variation, % 62.8

Figure 13



Maximum	1.15
98th Percentile	0.45
95th Percentile	0.353
90th Percentile	0.28
3rd Quartile	0.18
Median	0.11
1st Quartile	0.07
10th Percentile	0.04
5th Percentile	0.03
2nd Percentile	0.02
Minimum	0.005
Median Abs. Deviation	0.0741
IQR Est. of Std. Dev.	0.081
Mean	0.141
Standard Deviation	0.112
Coeff. of Variation, %	79.8

Figure 14

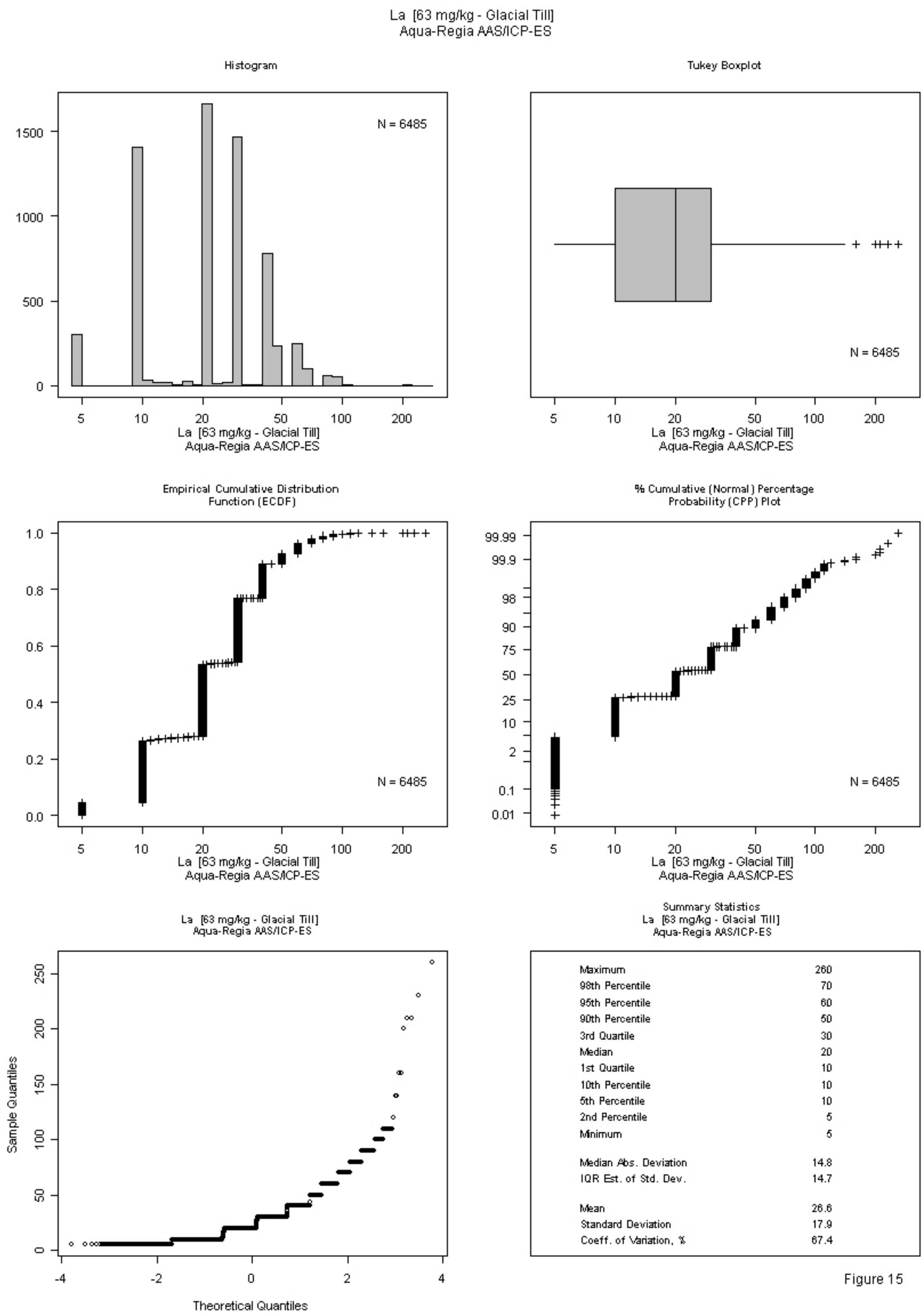
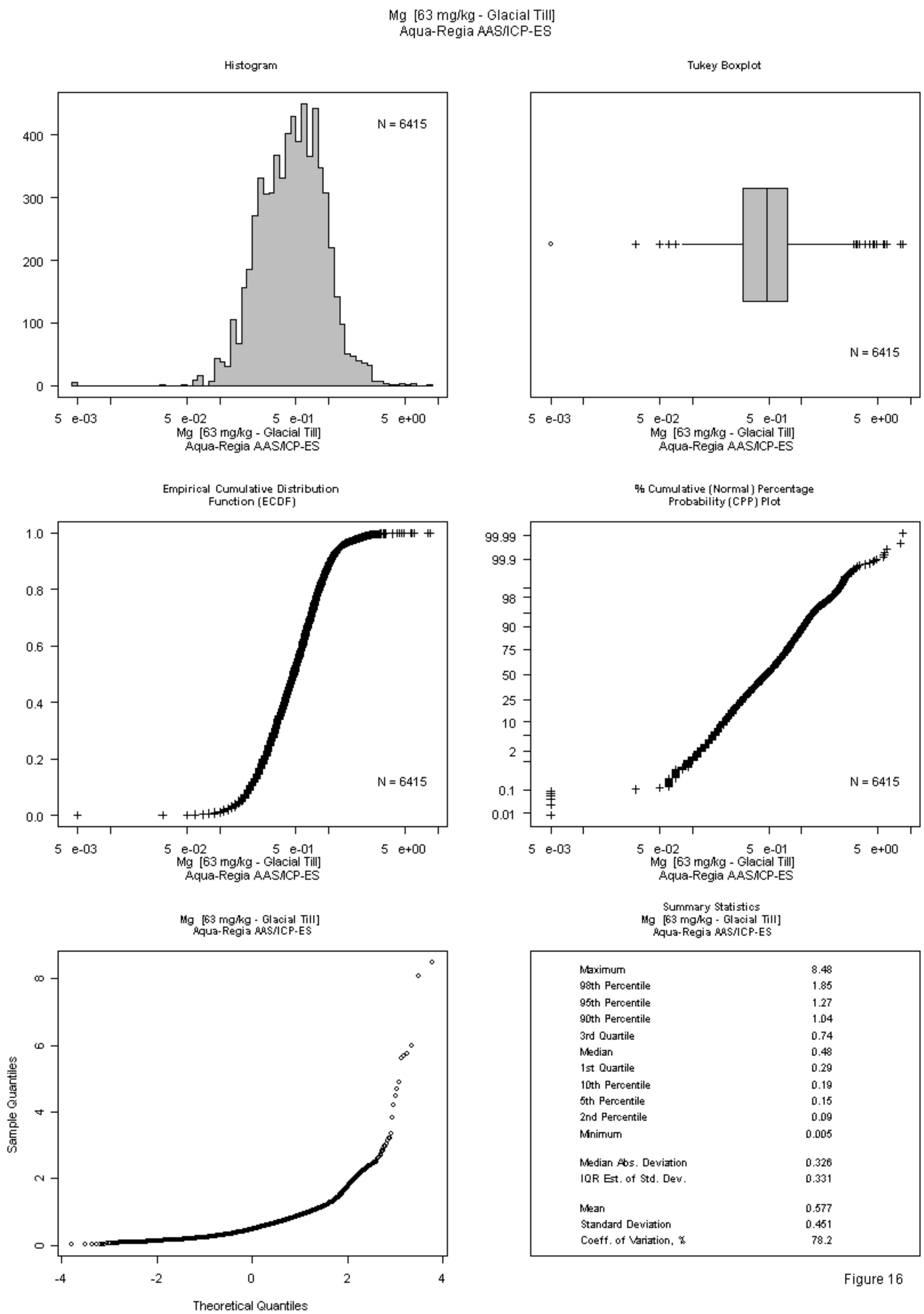

La [63 mg/kg - Glacial Till]
Aqua-Regia AAS/ICP-ES
Histogram
N = 6485
Tukey Boxplot
N = 6485
La [63 mg/kg - Glacial Till]
Aqua-Regia AAS/ICP-ES
Empirical Cumulative Distribution Function (ECDF)
N = 6485
% Cumulative (Normal) Percentage Probability (CPP) Plot
N = 6485
Sample Quantiles
Theoretical Quantiles
Summary Statistics
La [63 mg/kg - Glacial Till]
Aqua-Regia AAS/ICP-ES
Maximum 260
98th Percentile 70
95th Percentile 60
90th Percentile 50
3rd Quartile 30
Median 20
1st Quartile 10
10th Percentile 10
5th Percentile 10
2nd Percentile 5
Minimum 5
Median Abs. Deviation 14.8
IQR Est. of Std. Dev. 14.7
Mean 26.6
Standard Deviation 17.9
Coeff. of Variation, % 67.4

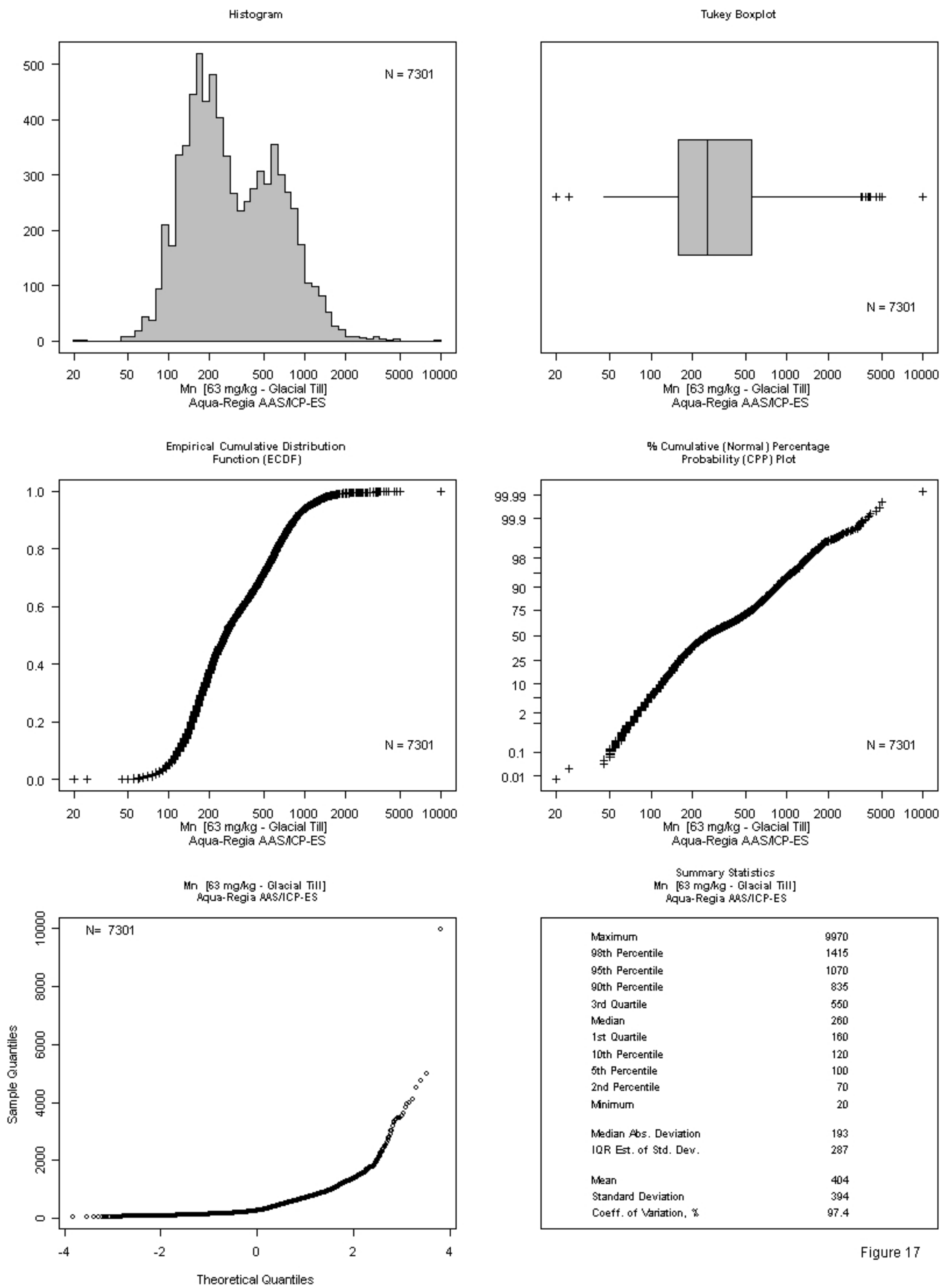
Figure 15



Maximum	8.48
98th Percentile	1.85
95th Percentile	1.27
90th Percentile	1.04
3rd Quartile	0.74
Median	0.48
1st Quartile	0.29
10th Percentile	0.19
5th Percentile	0.15
2nd Percentile	0.09
Minimum	0.005
Median Abs. Deviation	0.326
IQR Est. of Std. Dev.	0.331
Mean	0.577
Standard Deviation	0.451
Coeff. of Variation, %	78.2

Figure 16

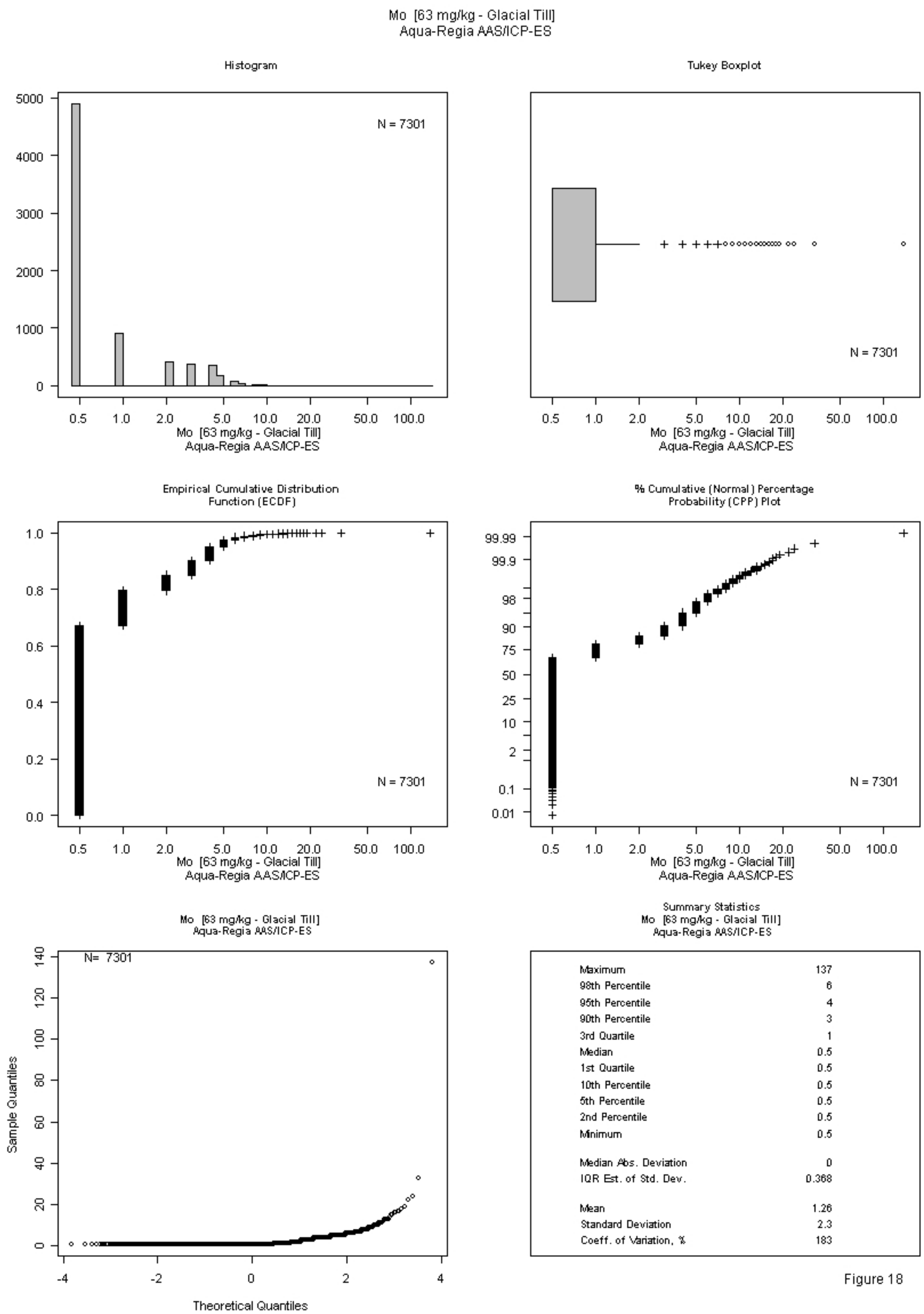
Mn [63 mg/kg - Glacial Till]
Aqua-Regia AAS/ICP-ES



Summary Statistics
Mn [63 mg/kg - Glacial Till]
Aqua-Regia AAS/ICP-ES

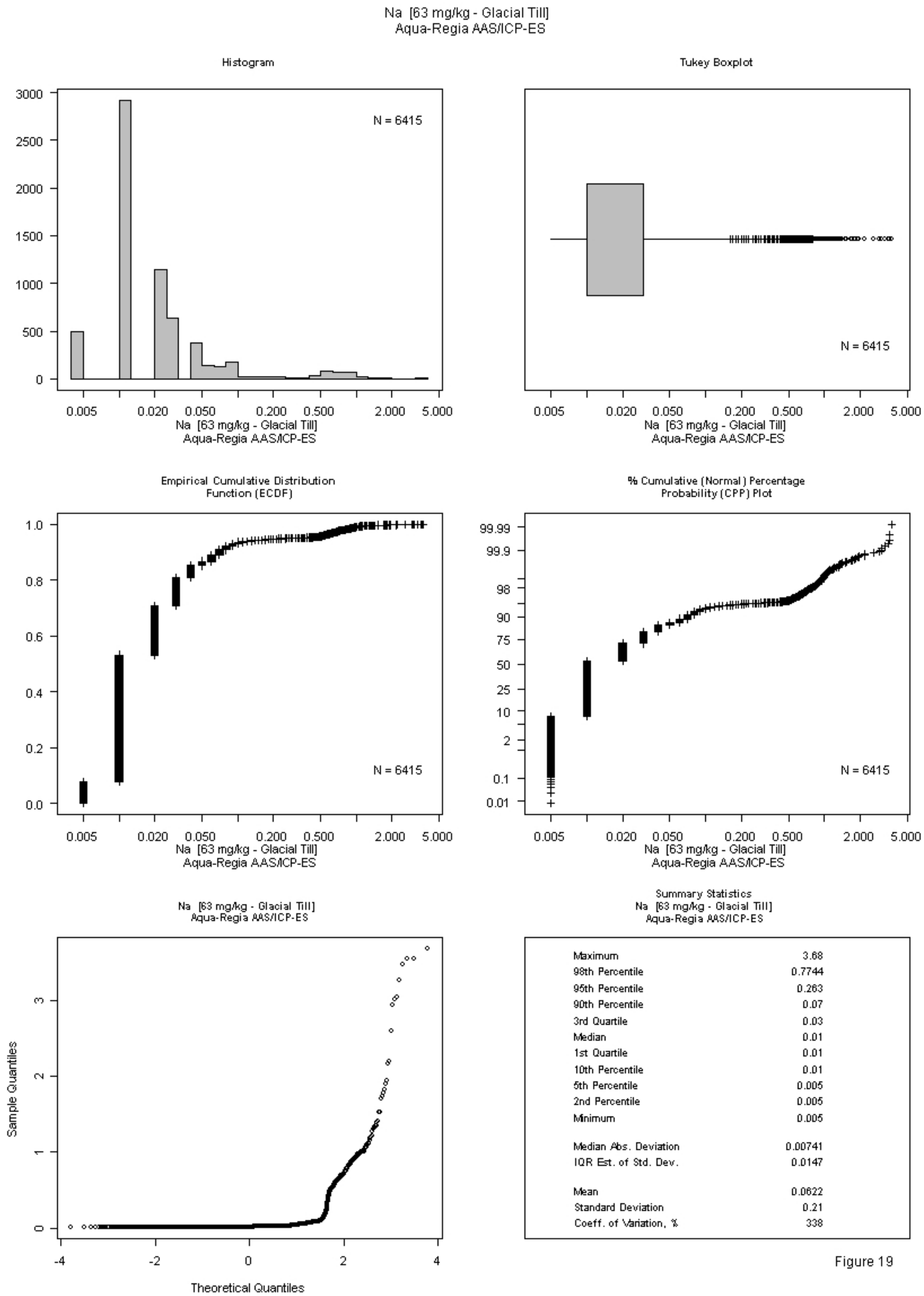
Maximum	9970
98th Percentile	1415
95th Percentile	1070
90th Percentile	835
3rd Quartile	550
Median	260
1st Quartile	160
10th Percentile	120
5th Percentile	100
2nd Percentile	70
Minimum	20
Median Abs. Deviation	193
IQR Est. of Std. Dev.	287
Mean	404
Standard Deviation	394
Coeff. of Variation, %	97.4

Figure 17



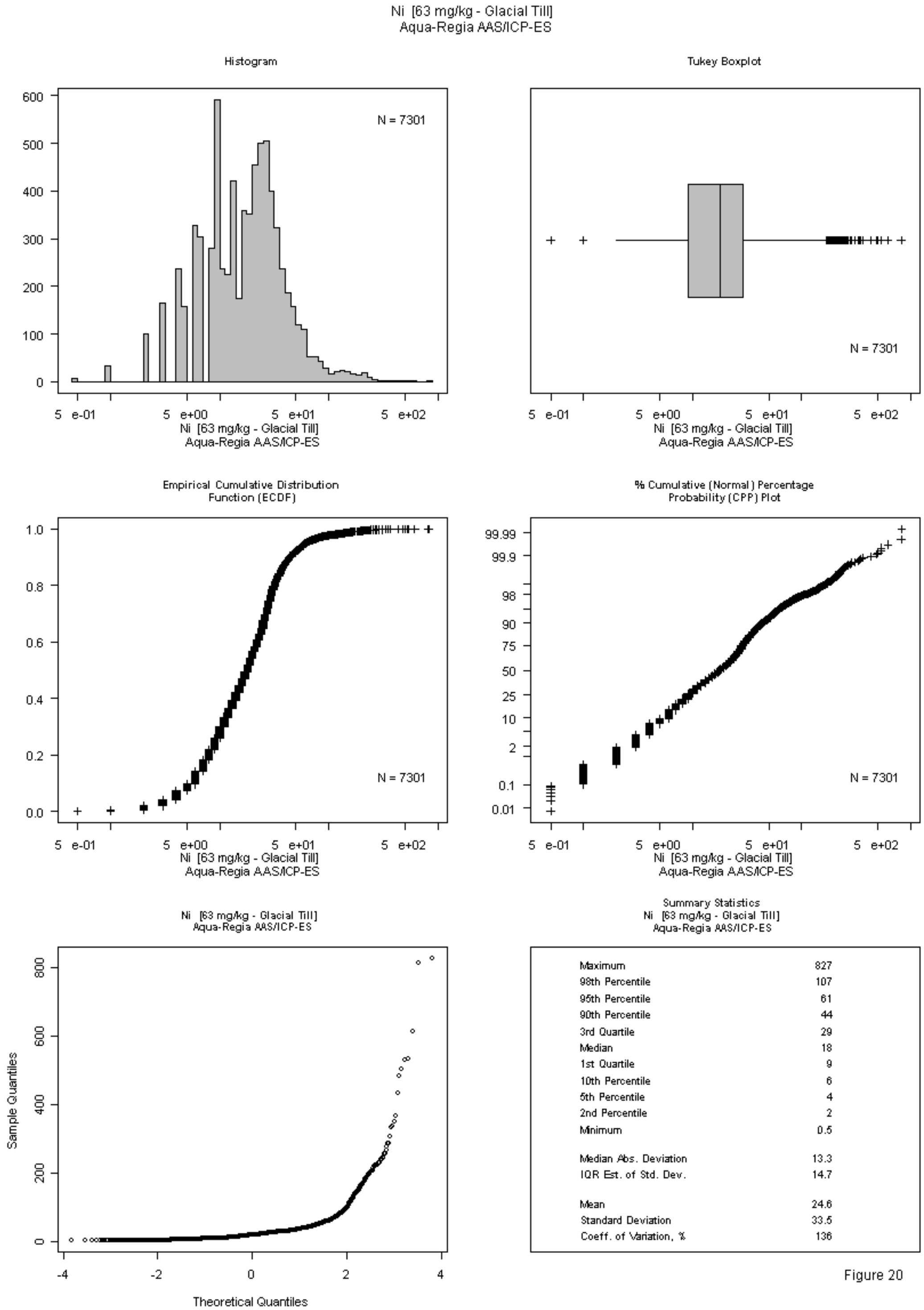
Maximum	137
98th Percentile	6
95th Percentile	4
90th Percentile	3
3rd Quartile	1
Median	0.5
1st Quartile	0.5
10th Percentile	0.5
5th Percentile	0.5
2nd Percentile	0.5
Minimum	0.5
Median Abs. Deviation	0
IQR Est. of Std. Dev.	0.368
Mean	1.26
Standard Deviation	2.3
Coeff. of Variation, %	183

Figure 18



Maximum	3.68
98th Percentile	0.7744
95th Percentile	0.263
90th Percentile	0.07
3rd Quartile	0.03
Median	0.01
1st Quartile	0.01
10th Percentile	0.01
5th Percentile	0.005
2nd Percentile	0.005
Minimum	0.005
Median Abs. Deviation	0.00741
IQR Est. of Std. Dev.	0.0147
Mean	0.0622
Standard Deviation	0.21
Coeff. of Variation, %	338

Figure 19



Maximum	827
98th Percentile	107
95th Percentile	61
90th Percentile	44
3rd Quartile	29
Median	18
1st Quartile	9
10th Percentile	6
5th Percentile	4
2nd Percentile	2
Minimum	0.5
Median Abs. Deviation	13.3
IQR Est. of Std. Dev.	14.7
Mean	24.6
Standard Deviation	33.5
Coeff. of Variation, %	136

Figure 20

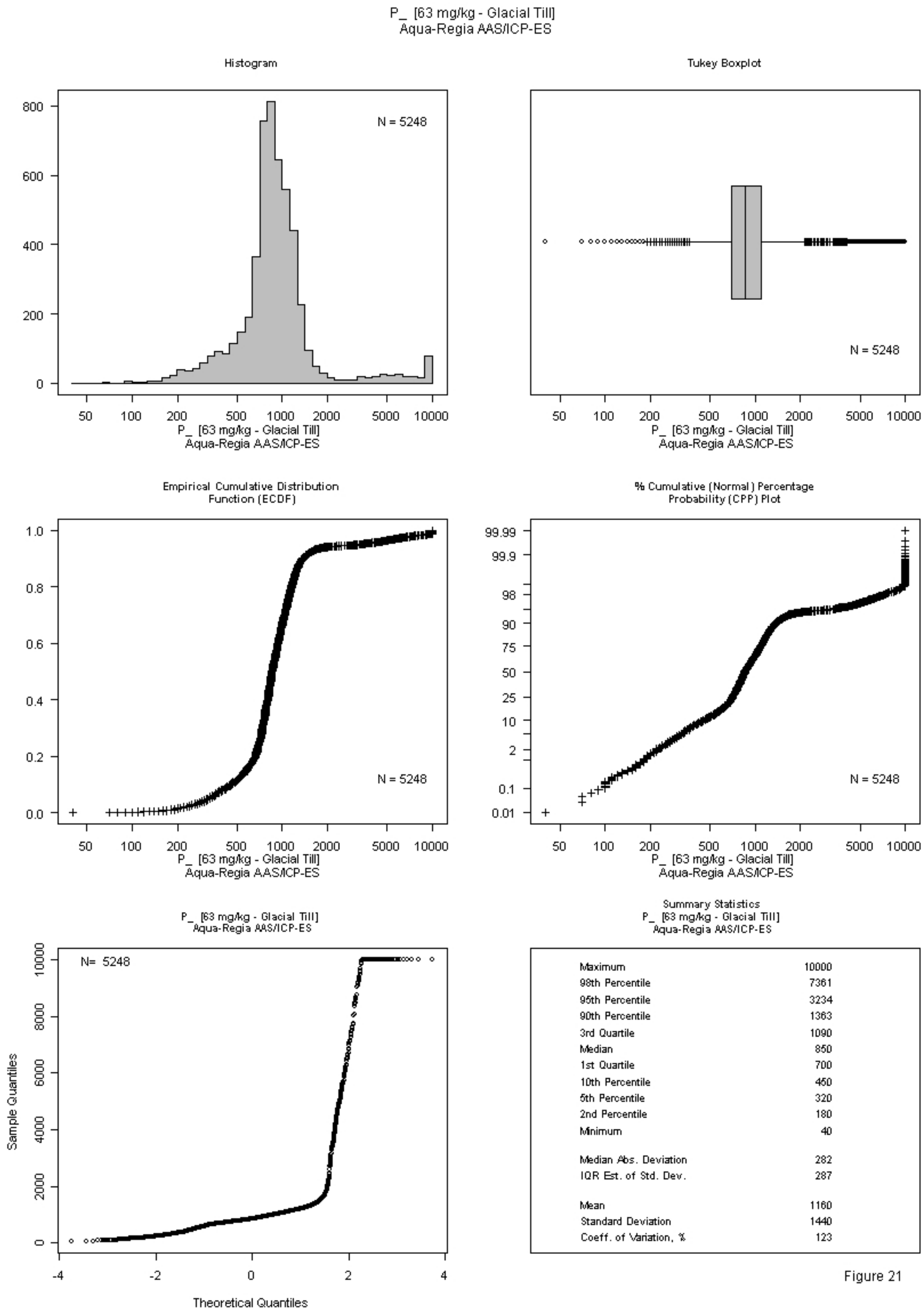
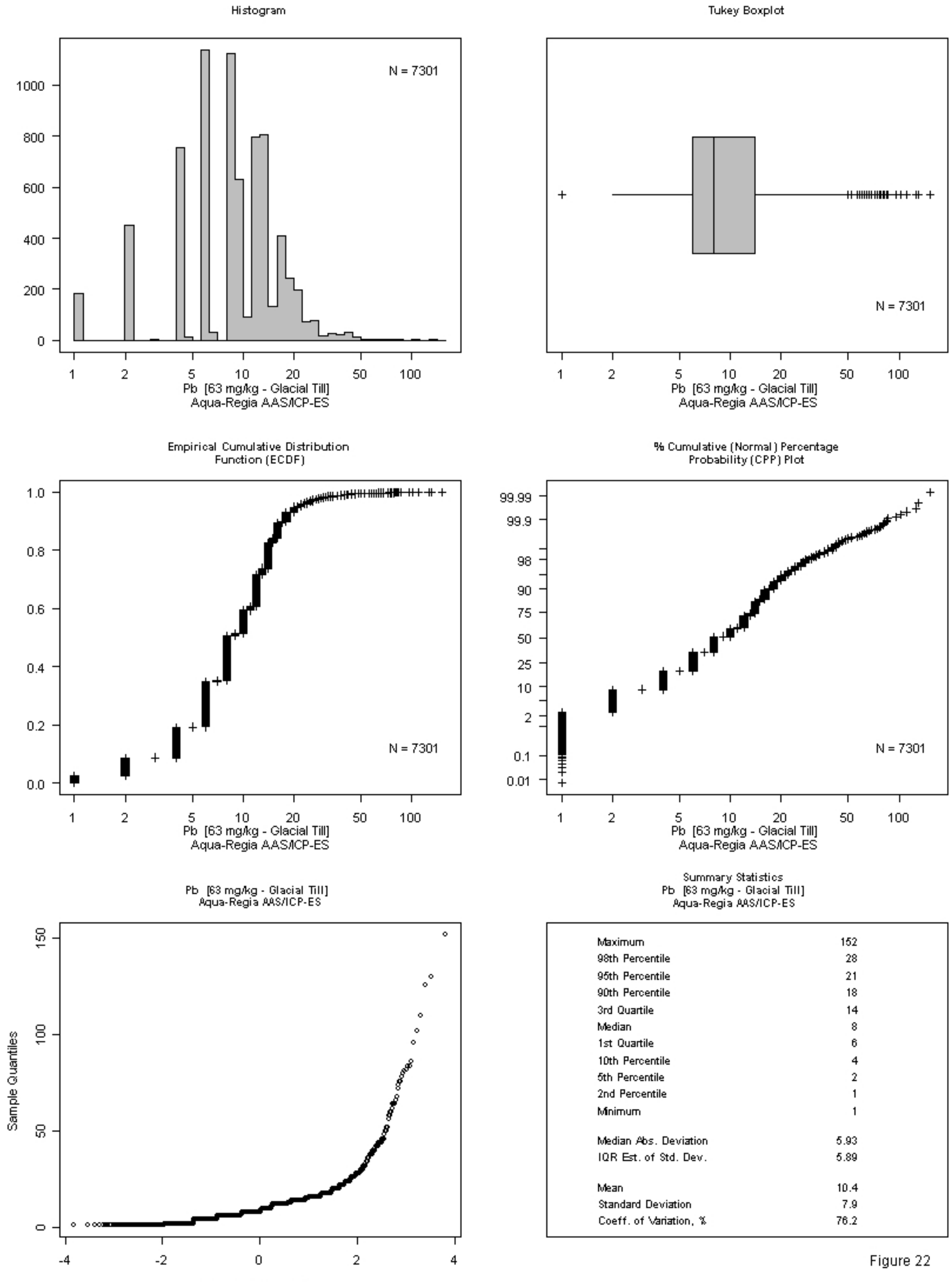

P_ [63 mg/kg - Glacial Till]
Aqua-Regia AAS/ICP-ES
Histogram
N = 5248
Tukey Boxplot
N = 5248
Empirical Cumulative Distribution
Function (ECDF)
N = 5248
% Cumulative (Normal) Percentage
Probability (CPP) Plot
N = 5248
N= 5248
Sample Quantiles
Theoretical Quantiles
Summary Statistics
P_ [63 mg/kg - Glacial Till]
Aqua-Regia AAS/ICP-ES
Maximum 10000
98th Percentile 7361
95th Percentile 3234
90th Percentile 1363
3rd Quartile 1090
Median 850
1st Quartile 700
10th Percentile 460
5th Percentile 320
2nd Percentile 180
Minimum 40
Median Abs. Deviation 282
IQR Est. of Std. Dev. 287
Mean 1160
Standard Deviation 1440
Coeff. of Variation, % 123

Figure 21

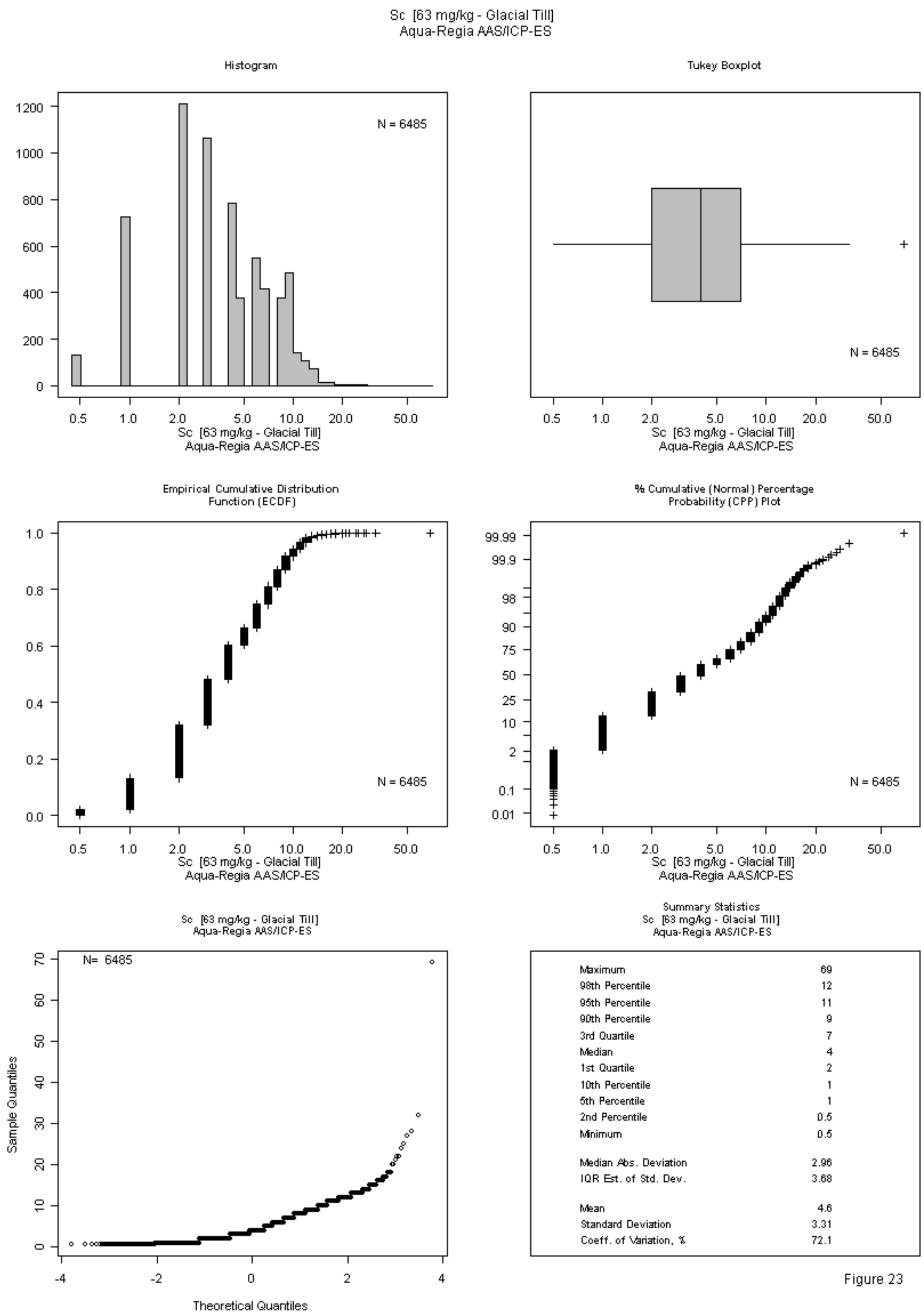
Pb [63 mg/kg - Glacial Till]
Aqua-Regia AAS/ICP-ES



Summary Statistics
Pb [63 mg/kg - Glacial Till]
Aqua-Regia AAS/ICP-ES

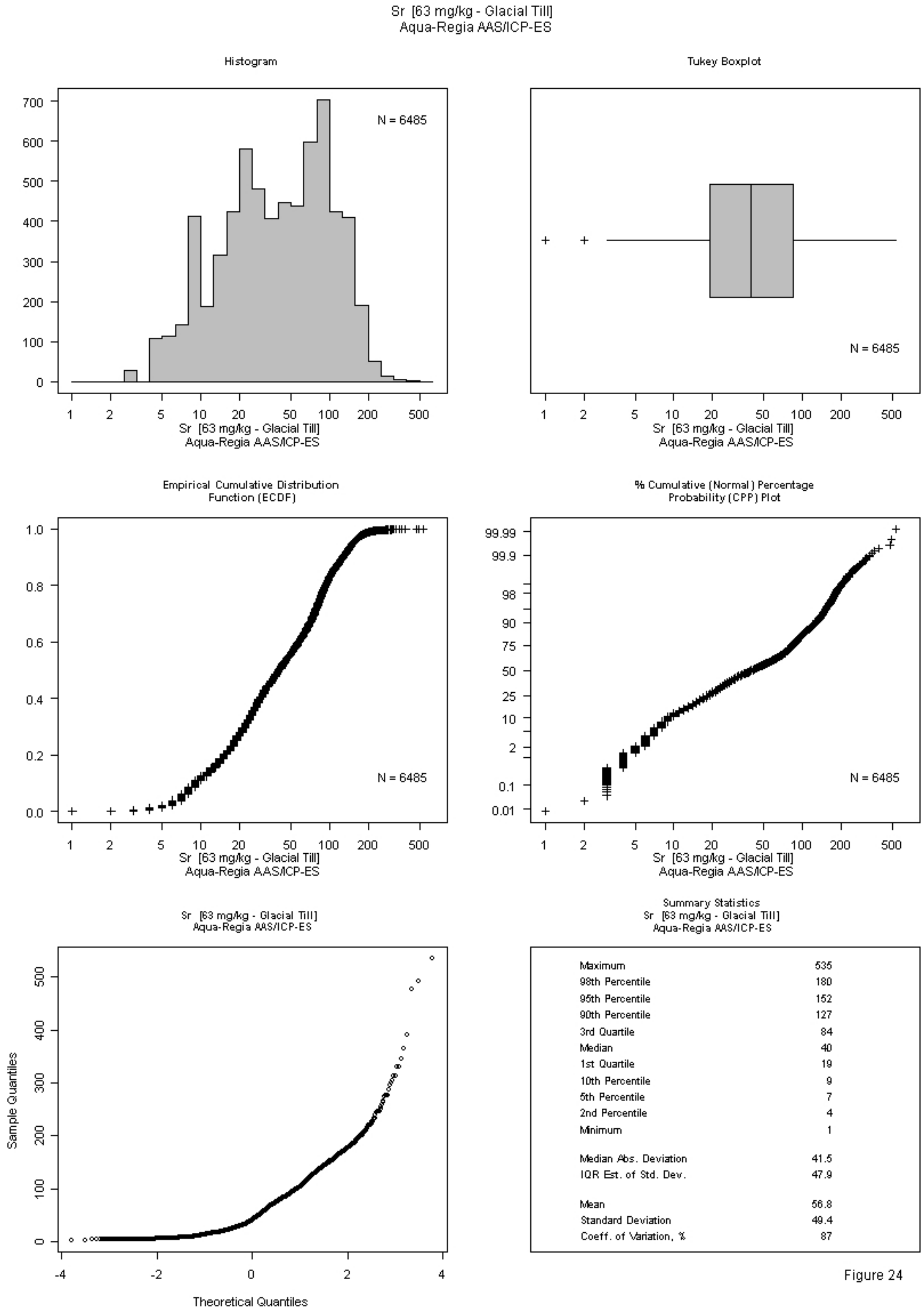
Maximum	152
98th Percentile	28
95th Percentile	21
90th Percentile	18
3rd Quartile	14
Median	8
1st Quartile	6
10th Percentile	4
5th Percentile	2
2nd Percentile	1
Minimum	1
Median Abs. Deviation	5.93
IQR Est. of Std. Dev.	5.89
Mean	10.4
Standard Deviation	7.9
Coeff. of Variation, %	76.2

Figure 22



Maximum	69
98th Percentile	12
95th Percentile	11
90th Percentile	9
3rd Quartile	7
Median	4
1st Quartile	2
10th Percentile	1
5th Percentile	1
2nd Percentile	0.5
Minimum	0.5
Median Abs. Deviation	2.96
IQR Est. of Std. Dev.	3.68
Mean	4.6
Standard Deviation	3.31
Coeff. of Variation, %	72.1

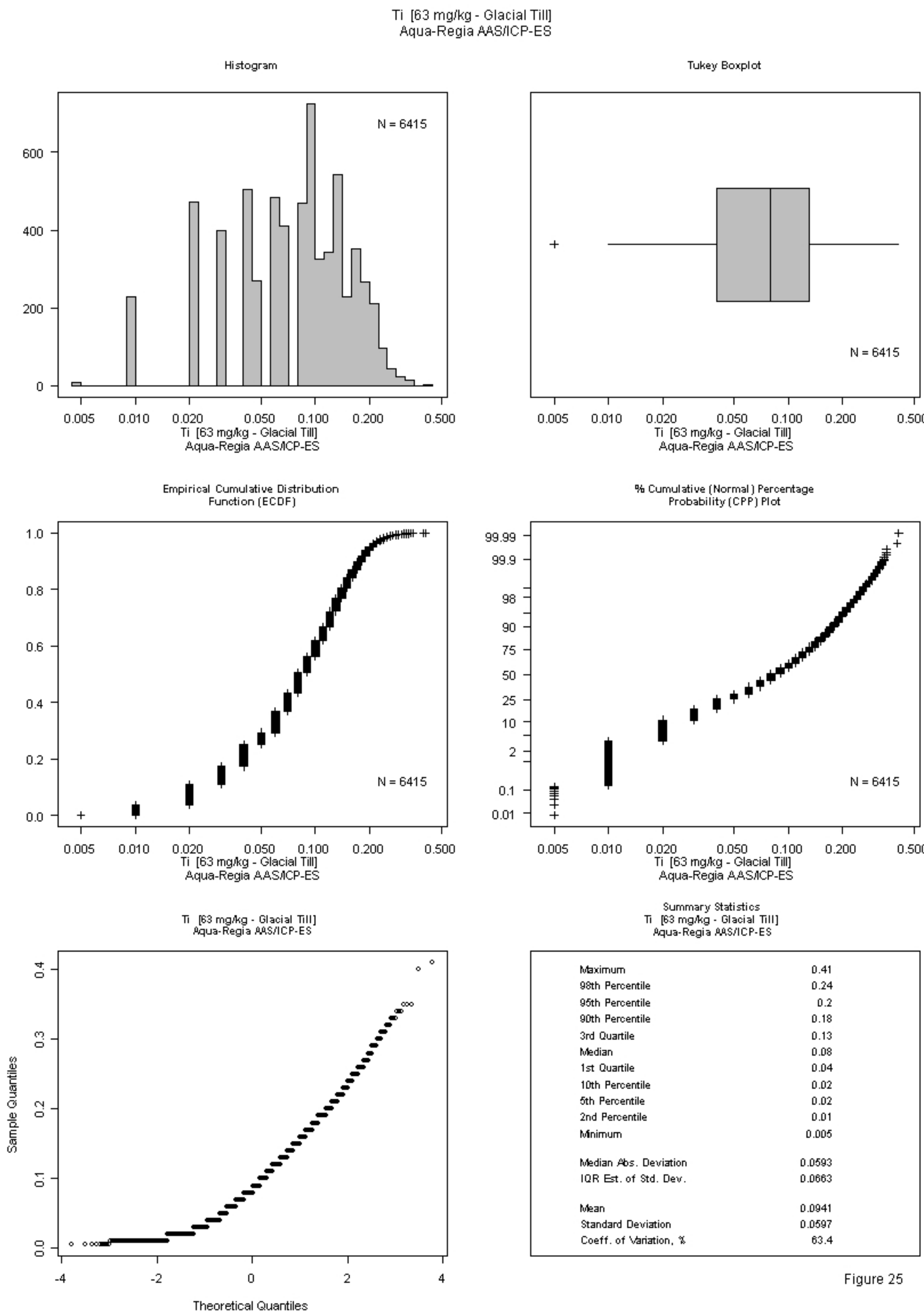
Figure 23



Summary Statistics
Sr [63 mg/kg - Glacial Till]
Aqua-Regia AAS/ICP-ES

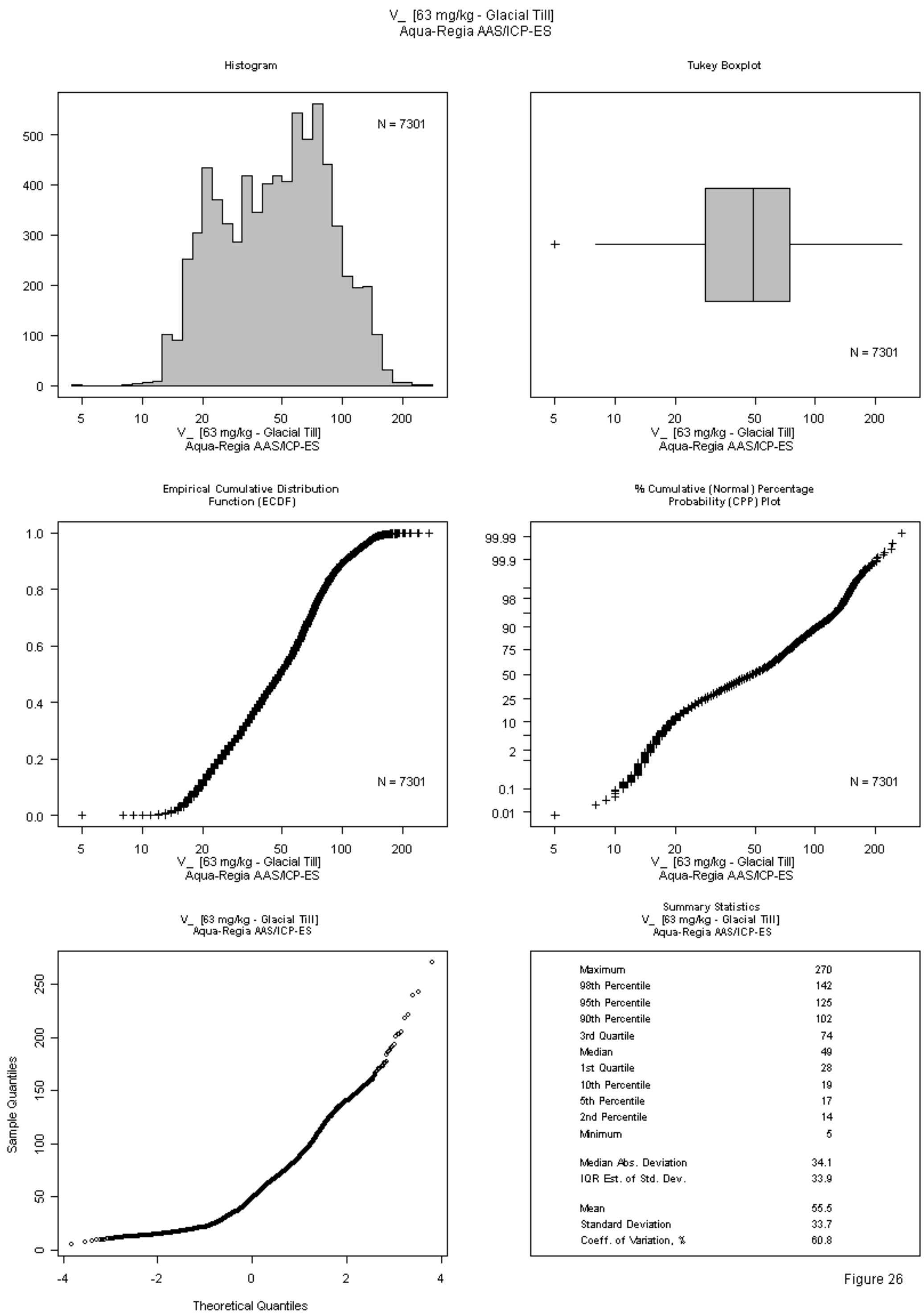
Maximum	535
98th Percentile	180
95th Percentile	152
90th Percentile	127
3rd Quartile	84
Median	40
1st Quartile	19
10th Percentile	9
5th Percentile	7
2nd Percentile	4
Minimum	1
Median Abs. Deviation	41.5
IQR Est. of Std. Dev.	47.9
Mean	56.8
Standard Deviation	49.4
Coeff. of Variation, %	87

Figure 24



Maximum	0.41
98th Percentile	0.24
95th Percentile	0.2
90th Percentile	0.18
3rd Quartile	0.13
Median	0.08
1st Quartile	0.04
10th Percentile	0.02
5th Percentile	0.02
2nd Percentile	0.01
Minimum	0.005
Median Abs. Deviation	0.0593
IQR Est. of Std. Dev.	0.0663
Mean	0.0941
Standard Deviation	0.0597
Coeff. of Variation, %	63.4

Figure 25



V_ [63 mg/kg - Glacial Till]
Aqua-Regia AAS/ICP-ES
Histogram
N = 7301
Tukey Boxplot
N = 7301
Empirical Cumulative Distribution Function (ECDF)
N = 7301
% Cumulative (Normal) Percentage Probability (CPP) Plot
N = 7301
V_ [63 mg/kg - Glacial Till] Aqua-Regia AAS/ICP-ES
Sample Quantiles
Theoretical Quantiles
Summary Statistics
V_ [63 mg/kg - Glacial Till]
Aqua-Regia AAS/ICP-ES
Maximum 270
98th Percentile 142
95th Percentile 125
90th Percentile 102
3rd Quartile 74
Median 49
1st Quartile 28
10th Percentile 19
5th Percentile 17
2nd Percentile 14
Minimum 5
Median Abs. Deviation 34.1
IQR Est. of Std. Dev. 33.9
Mean 55.5
Standard Deviation 33.7
Coeff. of Variation, % 60.8

Figure 26

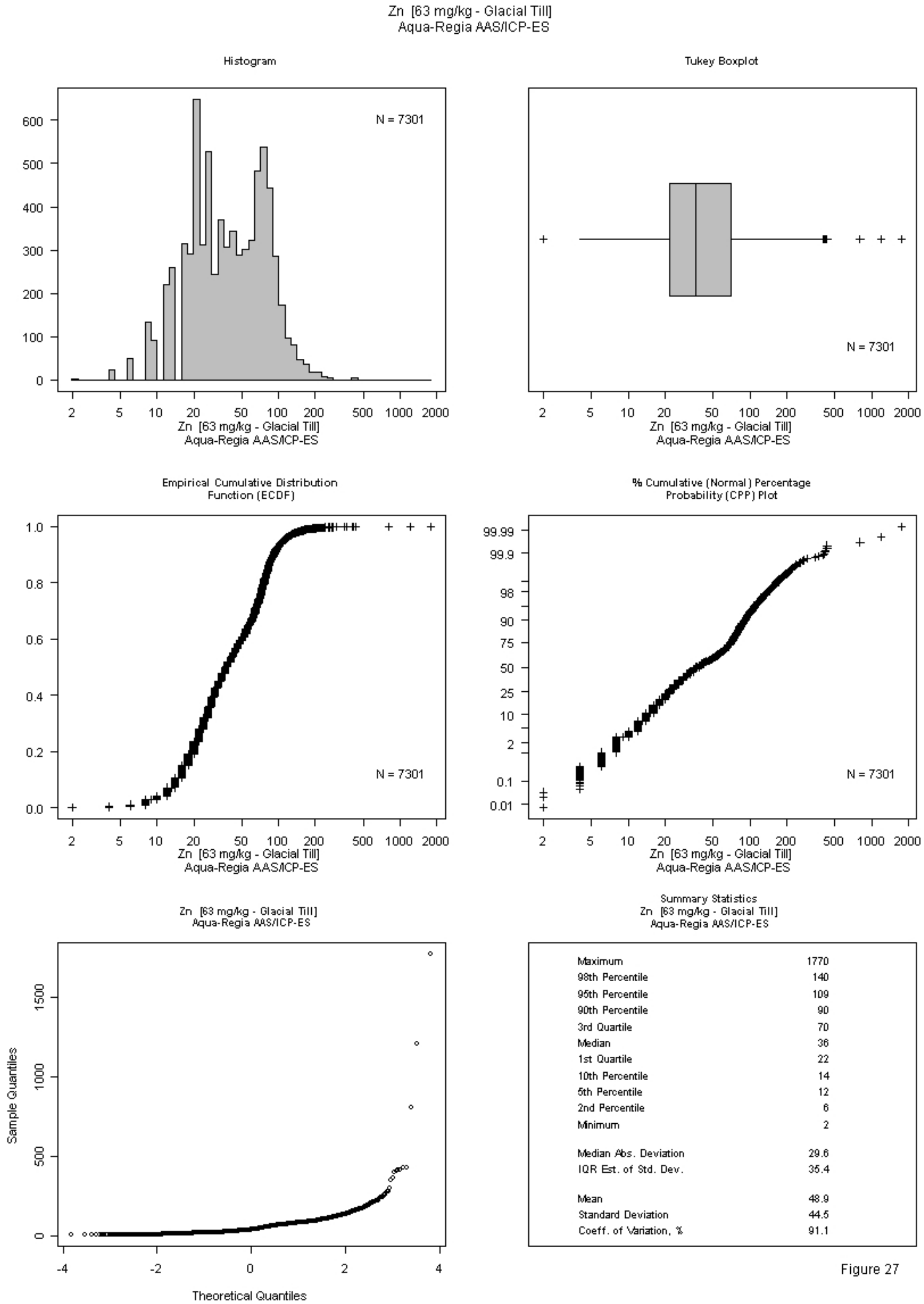

Zn [63 mg/kg - Glacial Till]
Aqua-Regia AAS/ICP-ES
Histogram
N = 7301
Zn [63 mg/kg - Glacial Till]
Aqua-Regia AAS/ICP-ES
Tukey Boxplot
N = 7301
Zn [63 mg/kg - Glacial Till]
Aqua-Regia AAS/ICP-ES
Empirical Cumulative Distribution Function (ECDF)
N = 7301
Zn [63 mg/kg - Glacial Till]
Aqua-Regia AAS/ICP-ES
% Cumulative (Normal) Percentage Probability (CPP) Plot
N = 7301
Zn [63 mg/kg - Glacial Till]
Aqua-Regia AAS/ICP-ES
Zn [63 mg/kg - Glacial Till]
Aqua-Regia AAS/ICP-ES
Sample Quantiles
Theoretical Quantiles
Summary Statistics
Zn [63 mg/kg - Glacial Till]
Aqua-Regia AAS/ICP-ES
Maximum 1770
98th Percentile 140
95th Percentile 109
90th Percentile 90
3rd Quartile 70
Median 36
1st Quartile 22
10th Percentile 14
5th Percentile 12
2nd Percentile 6
Minimum 2
Median Abs. Deviation 29.6
IQR Est. of Std. Dev. 35.4
Mean 48.9
Standard Deviation 44.5
Coeff. of Variation, % 91.1

Figure 27

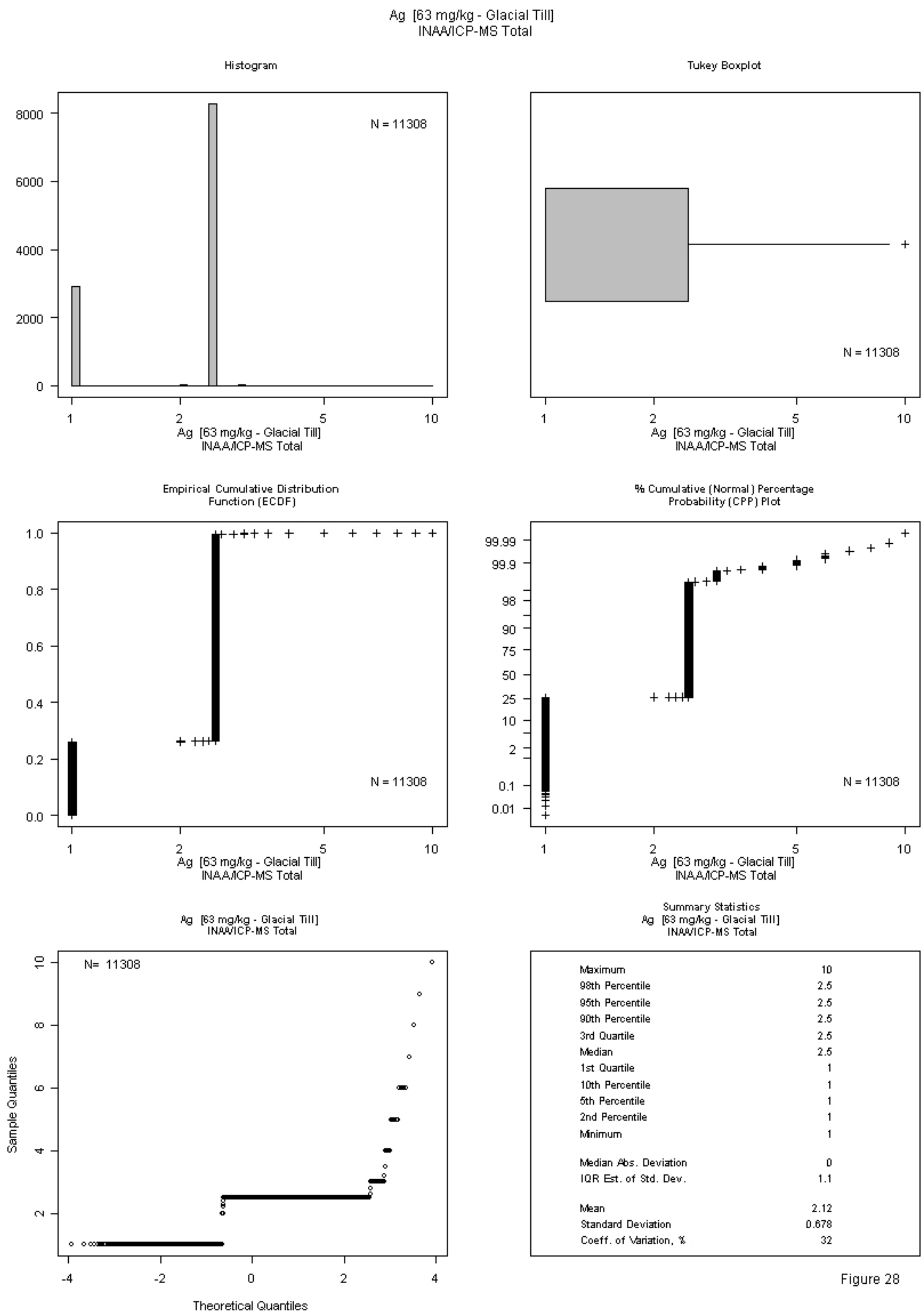

Ag [63 mg/kg - Glacial Till]
INAA/ICP-MS Total
Histogram
N = 11308
Tukey Boxplot
N = 11308
Empirical Cumulative Distribution Function (ECDF)
N = 11308
% Cumulative (Normal) Percentage Probability (CPP) Plot
N = 11308
Ag [63 mg/kg - Glacial Till] INAA/ICP-MS Total
N= 11308
Sample Quantiles
Theoretical Quantiles
Summary Statistics
Ag [63 mg/kg - Glacial Till] INAA/ICP-MS Total
Maximum 10
98th Percentile 2.5
95th Percentile 2.5
90th Percentile 2.5
3rd Quartile 2.5
Median 2.5
1st Quartile 1
10th Percentile 1
5th Percentile 1
2nd Percentile 1
Minimum 1
Median Abs. Deviation 0
IQR Est. of Std. Dev. 1.1
Mean 2.12
Standard Deviation 0.678
Coeff. of Variation, % 32

Figure 28

Au [63 mg/kg - Glacial Till]
INAA/ICP-MS Total

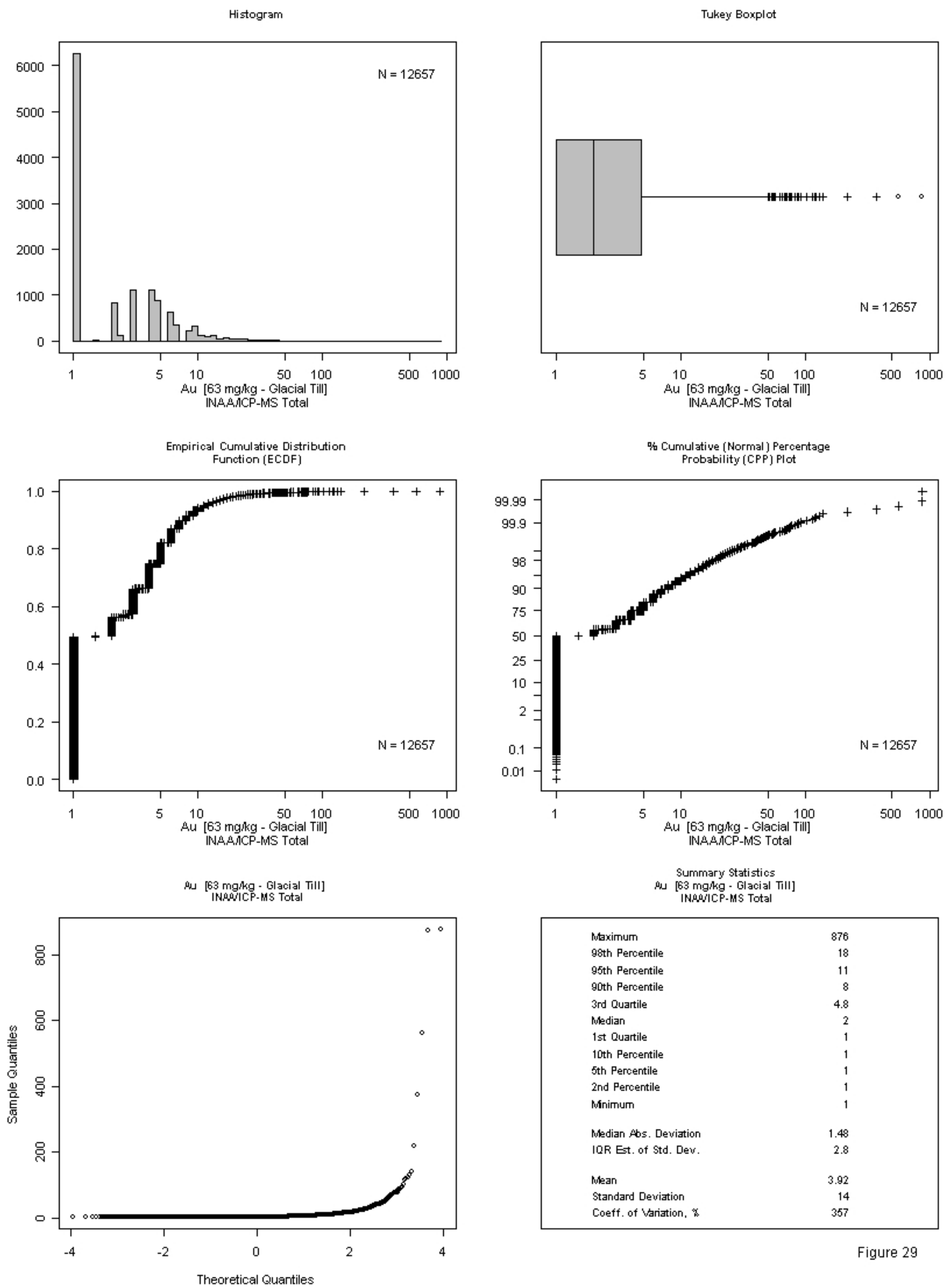
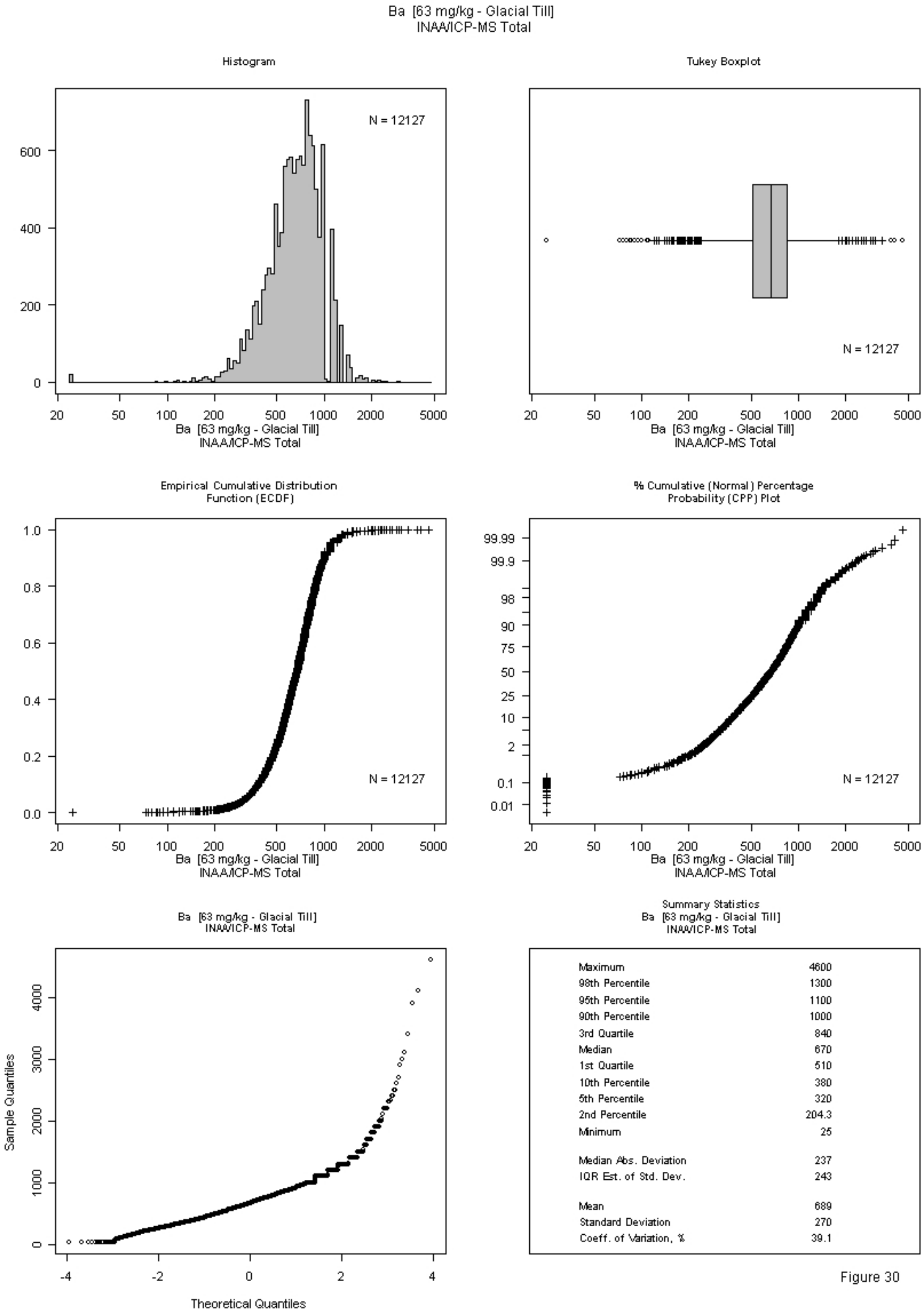


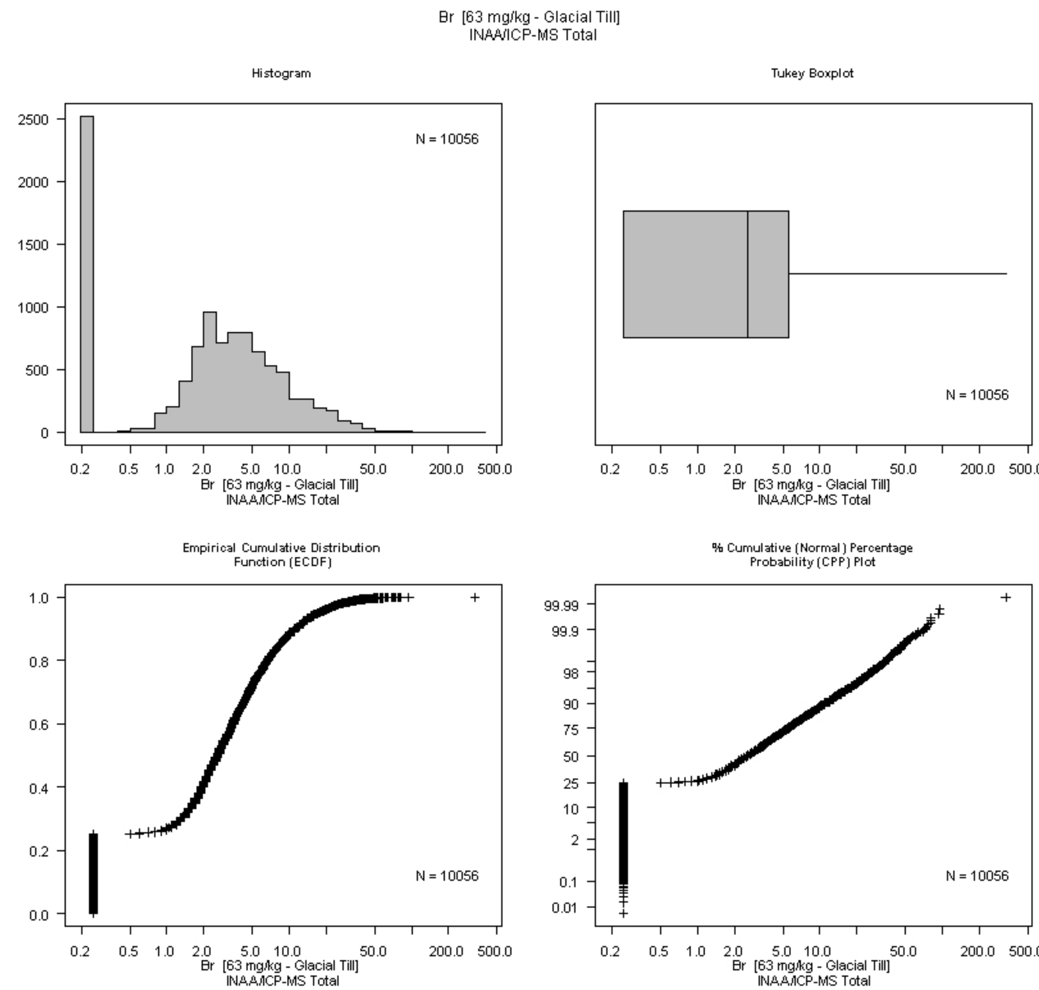
Figure 29

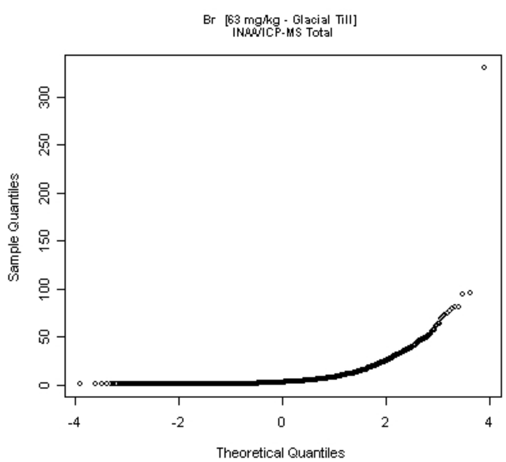


Summary Statistics
Ba [63 mg/kg - Glacial Till]
INAA/ICP-MS Total

Maximum	4600
98th Percentile	1300
95th Percentile	1100
90th Percentile	1000
3rd Quartile	840
Median	670
1st Quartile	510
10th Percentile	380
5th Percentile	320
2nd Percentile	204.3
Minimum	25
Median Abs. Deviation	237
IQR Est. of Std. Dev.	243
Mean	689
Standard Deviation	270
Coeff. of Variation, %	39.1

Figure 30

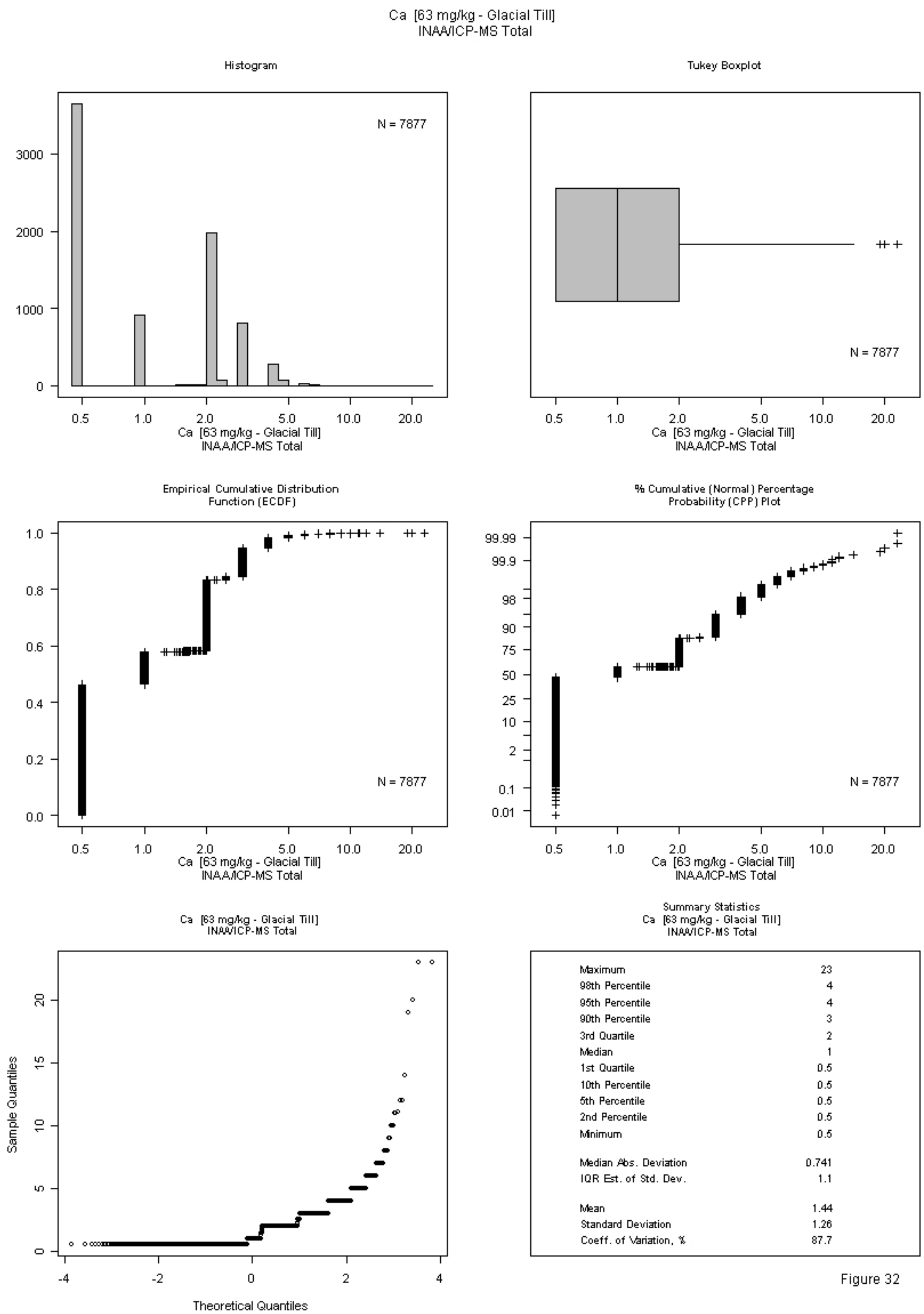




Summary Statistics
Br [63 mg/kg - Glacial Till]
INAA/ICP-MS Total

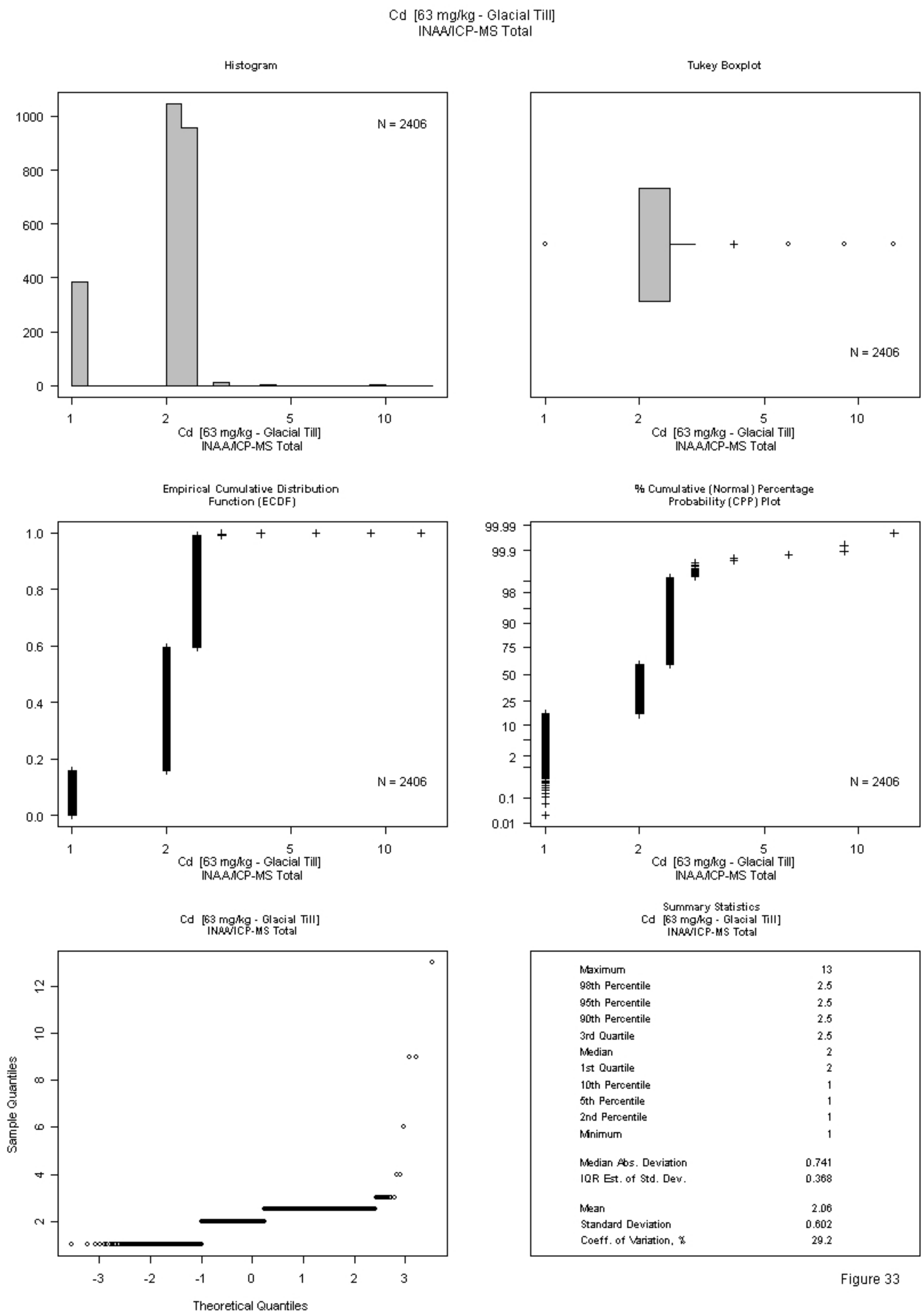
Maximum	330.3
98th Percentile	26.39
95th Percentile	17
90th Percentile	11
3rd Quartile	5.5
Median	2.6
1st Quartile	0.25
10th Percentile	0.25
5th Percentile	0.25
2nd Percentile	0.25
Minimum	0.25
Median Abs. Deviation	3.48
IQR Est. of Std. Dev.	3.87
Mean	4.72
Standard Deviation	7.62
Coeff. of Variation, %	161

Figure 31



Maximum	23
98th Percentile	4
95th Percentile	4
90th Percentile	3
3rd Quartile	2
Median	1
1st Quartile	0.5
10th Percentile	0.5
5th Percentile	0.5
2nd Percentile	0.5
Minimum	0.5
Median Abs. Deviation	0.741
IQR Est. of Std. Dev.	1.1
Mean	1.44
Standard Deviation	1.26
Coeff. of Variation, %	87.7

Figure 32

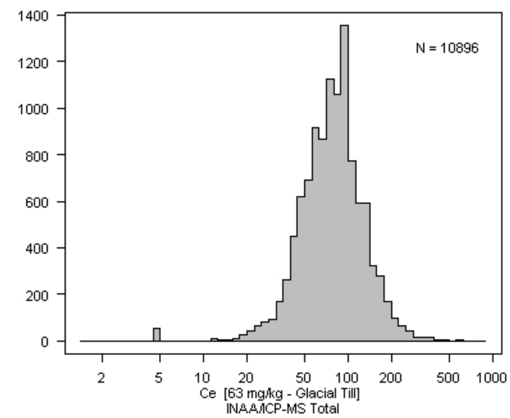


Maximum	13
98th Percentile	2.5
95th Percentile	2.5
90th Percentile	2.5
3rd Quartile	2.5
Median	2
1st Quartile	2
10th Percentile	1
5th Percentile	1
2nd Percentile	1
Minimum	1
Median Abs. Deviation	0.741
IQR Est. of Std. Dev.	0.368
Mean	2.06
Standard Deviation	0.602
Coeff. of Variation, %	29.2

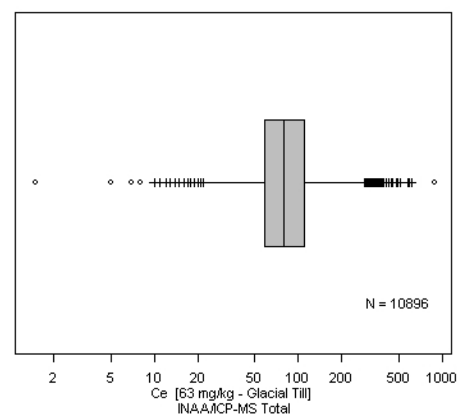
Figure 33

Ce [63 mg/kg - Glacial Till]
INAA/ICP-MS Total

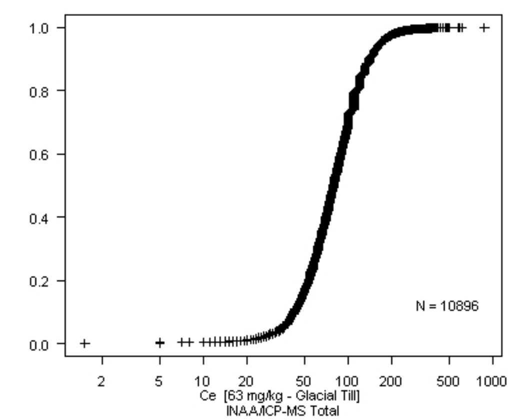
Histogram



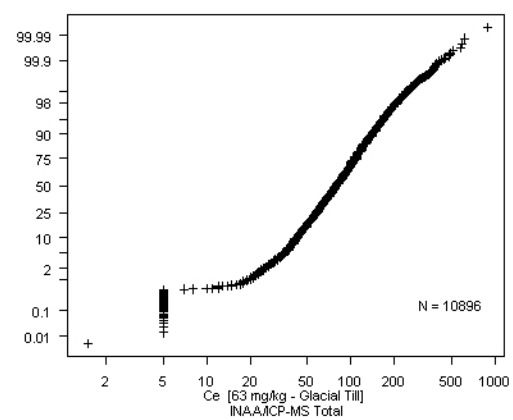
Tukey Boxplot



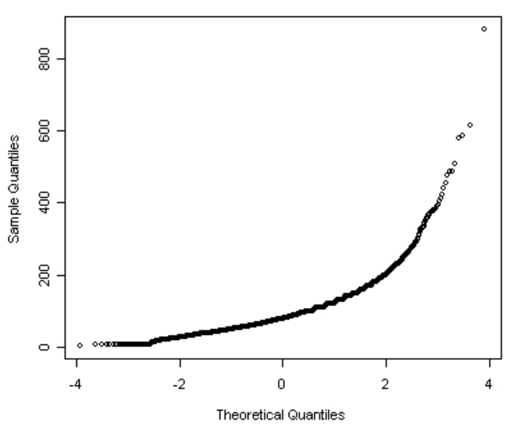
Empirical Cumulative Distribution
Function (ECDF)



% Cumulative (Normal) Percentage
Probability (CPP) Plot



Ce [63 mg/kg - Glacial Till]
INAA/ICP-MS Total



Summary Statistics
Ce [63 mg/kg - Glacial Till]
INAA/ICP-MS Total

Maximum	881.8
98th Percentile	207
95th Percentile	169
90th Percentile	140
3rd Quartile	110
Median	79
1st Quartile	58
10th Percentile	42
5th Percentile	35
2nd Percentile	19.95
Minimum	1.5
Median Abs. Deviation	34.1
IQR Est. of Std. Dev.	38.3
Mean	87.7
Standard Deviation	46.4
Coeff. of Variation, %	53

Figure 34

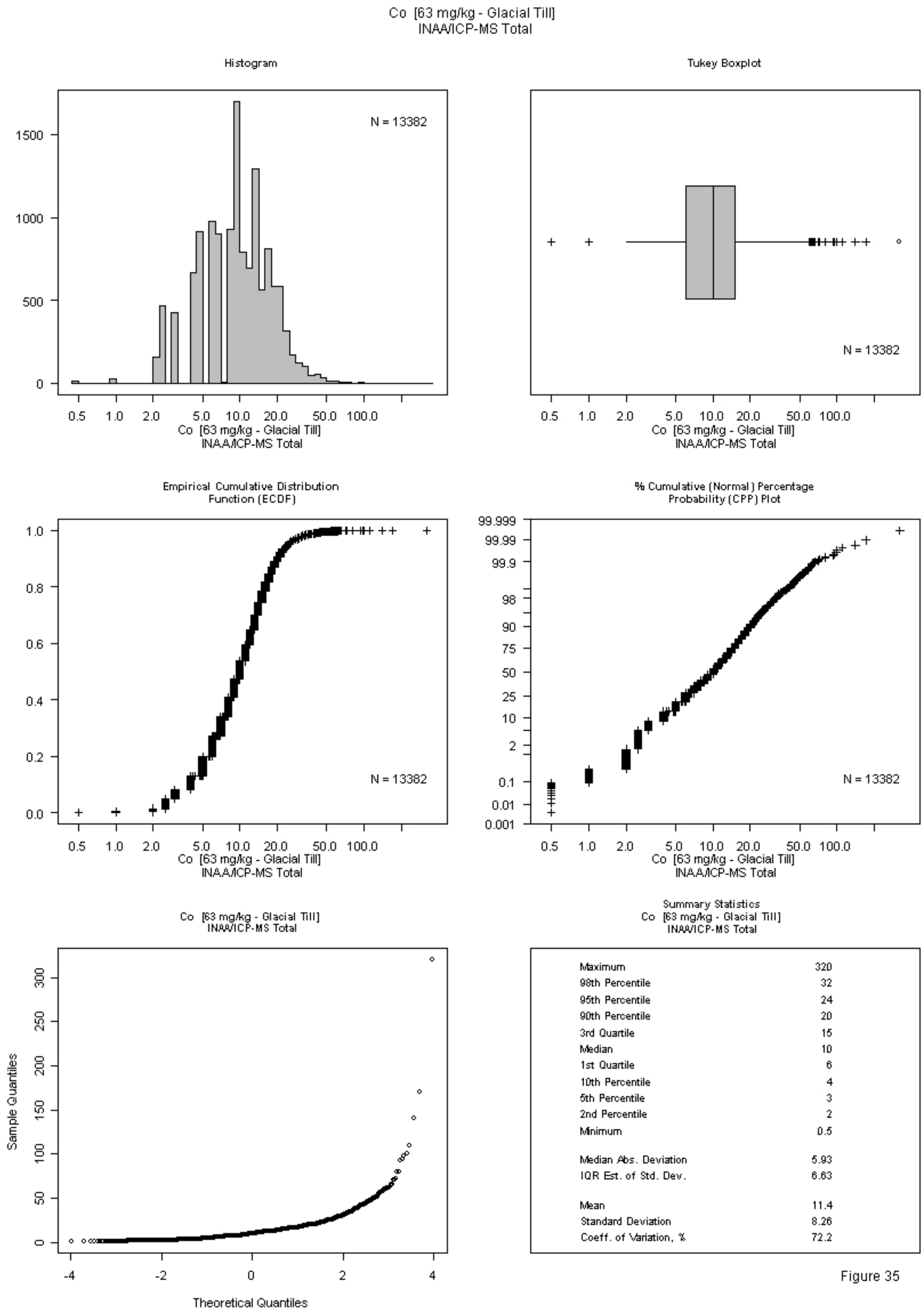
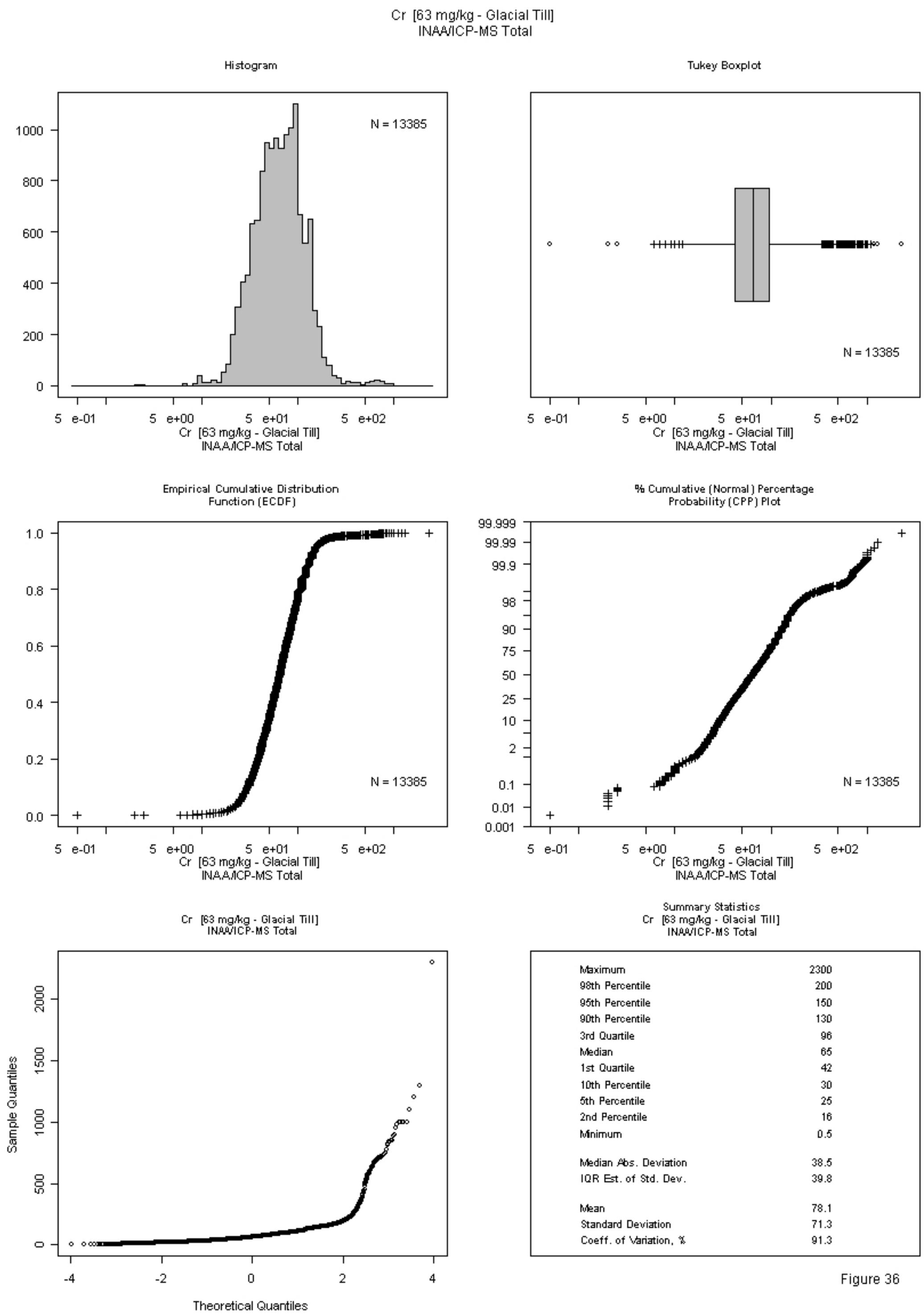

Co [63 mg/kg - Glacial Till]
INAA/ICP-MS Total
Histogram
N = 13382
Tukey Boxplot
N = 13382
Empirical Cumulative Distribution Function (ECDF)
N = 13382
% Cumulative (Normal) Percentage Probability (CPP) Plot
N = 13382
Sample Quantiles
Theoretical Quantiles
Summary Statistics
Co [63 mg/kg - Glacial Till]
INAA/ICP-MS Total
Maximum 320
98th Percentile 32
95th Percentile 24
90th Percentile 20
3rd Quartile 15
Median 10
1st Quartile 6
10th Percentile 4
5th Percentile 3
2nd Percentile 2
Minimum 0.5
Median Abs. Deviation 5.93
IQR Est. of Std. Dev. 6.63
Mean 11.4
Standard Deviation 8.26
Coeff. of Variation, % 72.2

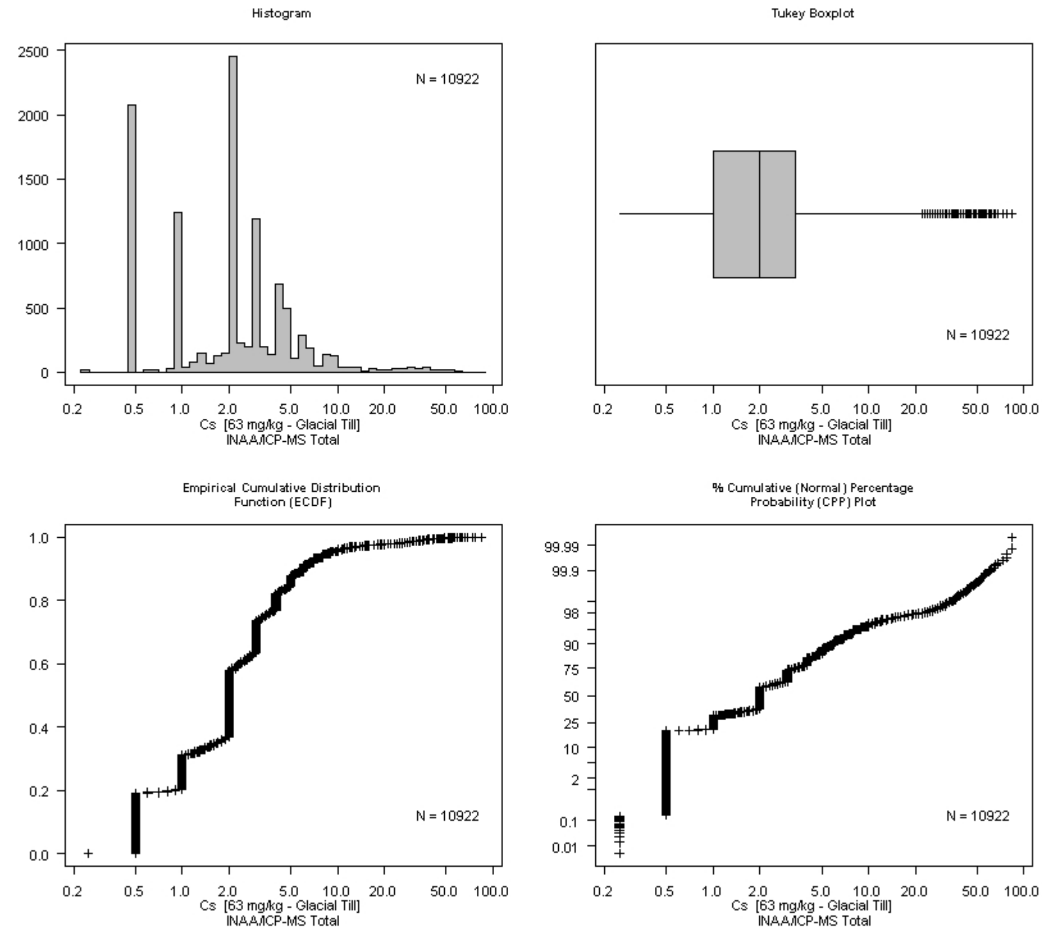
Figure 35

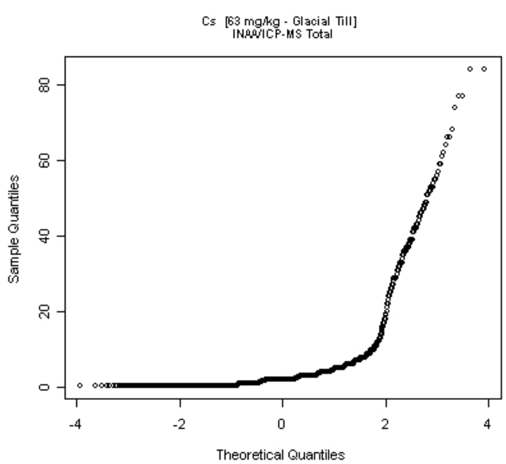


Maximum	2300
98th Percentile	200
95th Percentile	150
90th Percentile	130
3rd Quartile	96
Median	65
1st Quartile	42
10th Percentile	30
5th Percentile	25
2nd Percentile	16
Minimum	0.5
Median Abs. Deviation	38.5
IQR Est. of Std. Dev.	39.8
Mean	78.1
Standard Deviation	71.3
Coeff. of Variation, %	91.3

Figure 36

Cs [63 mg/kg - Glacial Till]
INAA/ICP-MS Total





Summary Statistics
Cs [63 mg/kg - Glacial Till]
INAA/ICP-MS Total

Maximum	84
98th Percentile	23
95th Percentile	8.9
90th Percentile	6
3rd Quartile	3.4
Median	2
1st Quartile	1
10th Percentile	0.5
5th Percentile	0.5
2nd Percentile	0.5
Minimum	0.25
Median Abs. Deviation	1.48
IQR Est. of Std. Dev.	1.77
Mean	3.35
Standard Deviation	5.66
Coeff. of Variation, %	169

Figure 37

Eu [63 mg/kg - Glacial Till]
INAA/ICP-MS Total

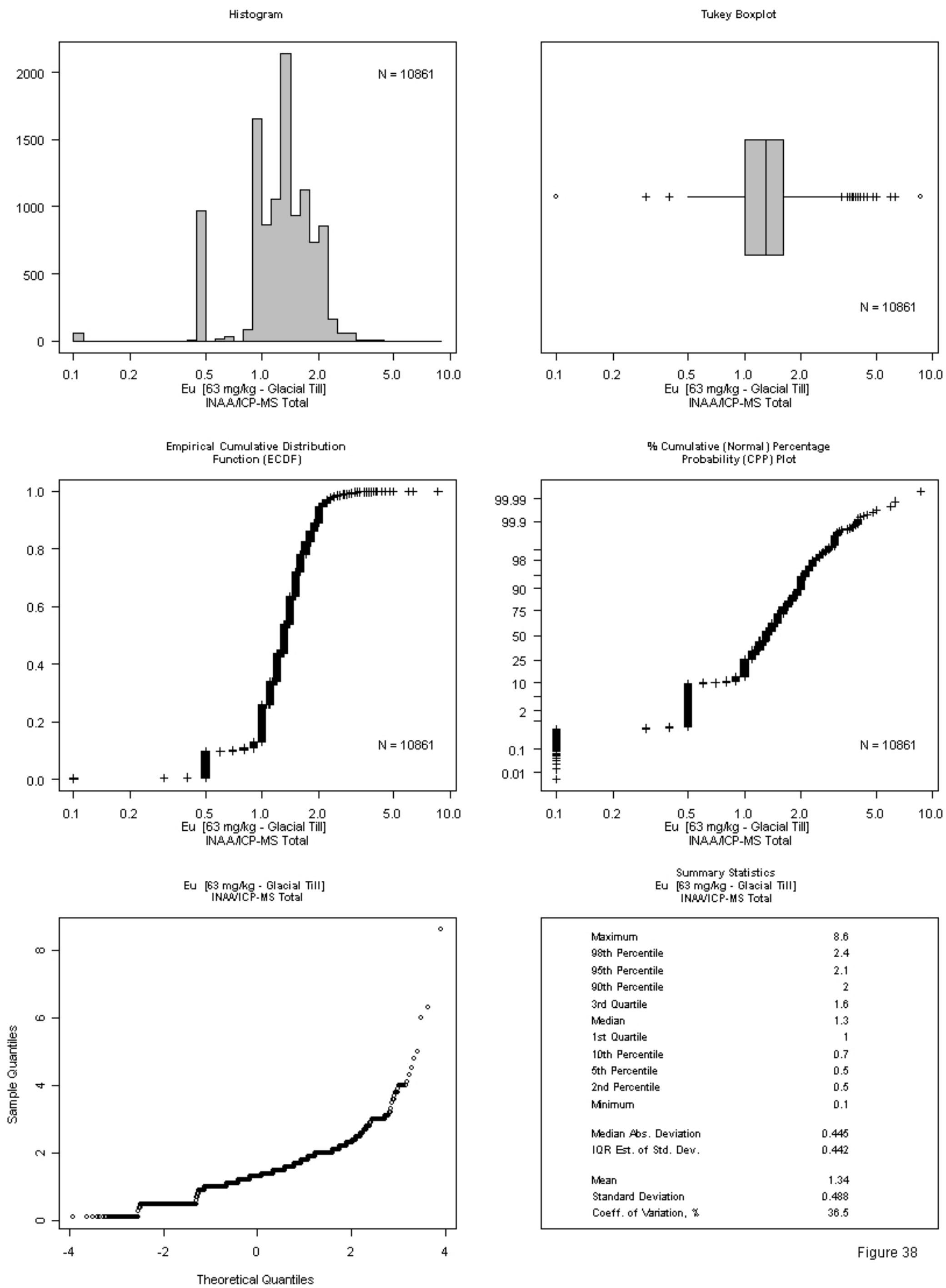
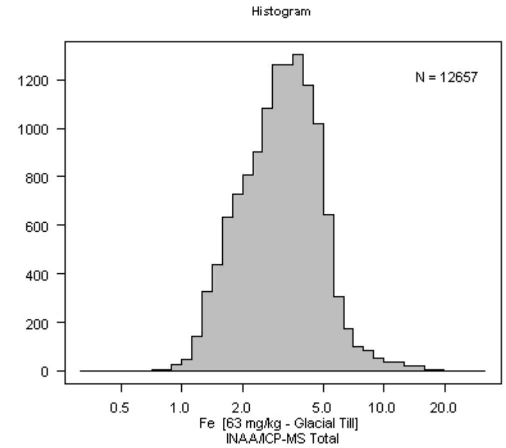
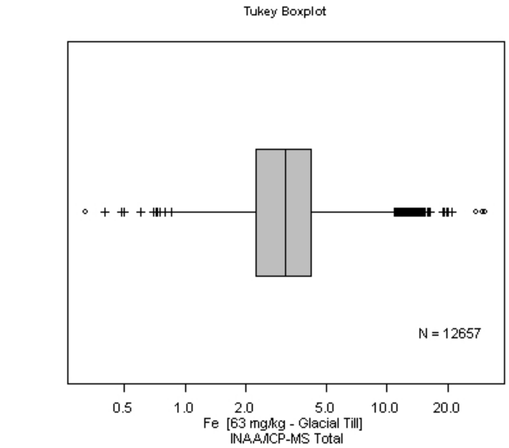
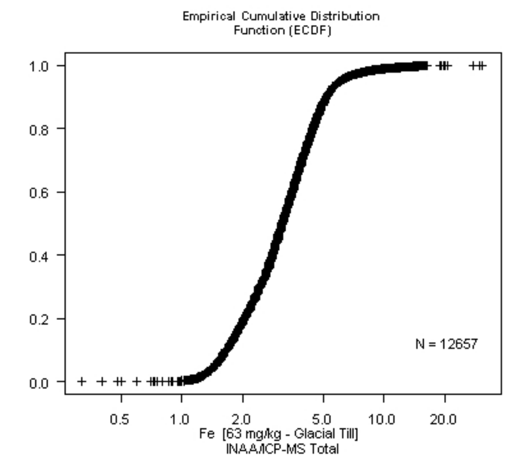


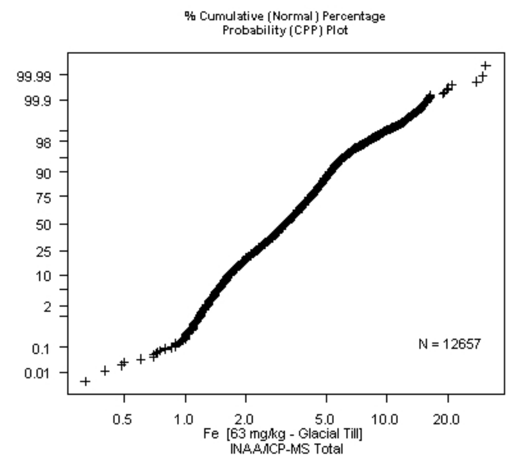
Figure 38

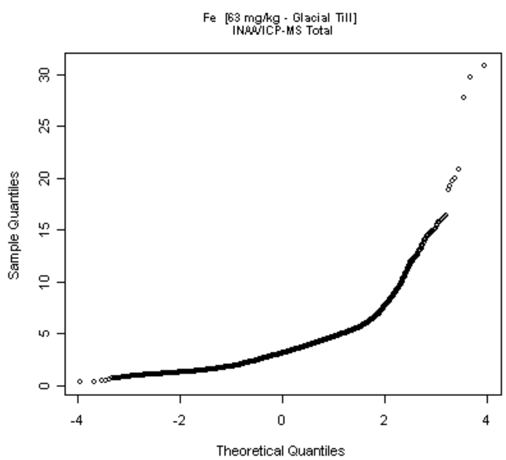
Fe [63 mg/kg - Glacial Till]
INAA/ICP-MS Total











Summary Statistics
Fe [63 mg/kg - Glacial Till]
INAA/ICP-MS Total

Maximum	30.8
98th Percentile	7.97
95th Percentile	6.05
90th Percentile	5.2
3rd Quartile	4.2
Median	3.13
1st Quartile	2.24
10th Percentile	1.65
5th Percentile	1.46
2nd Percentile	1.186
Minimum	0.32
Median Abs. Deviation	1.42
IQR Est. of Std. Dev.	1.44
Mean	3.41
Standard Deviation	1.75
Coeff. of Variation, %	51.3

Figure 39

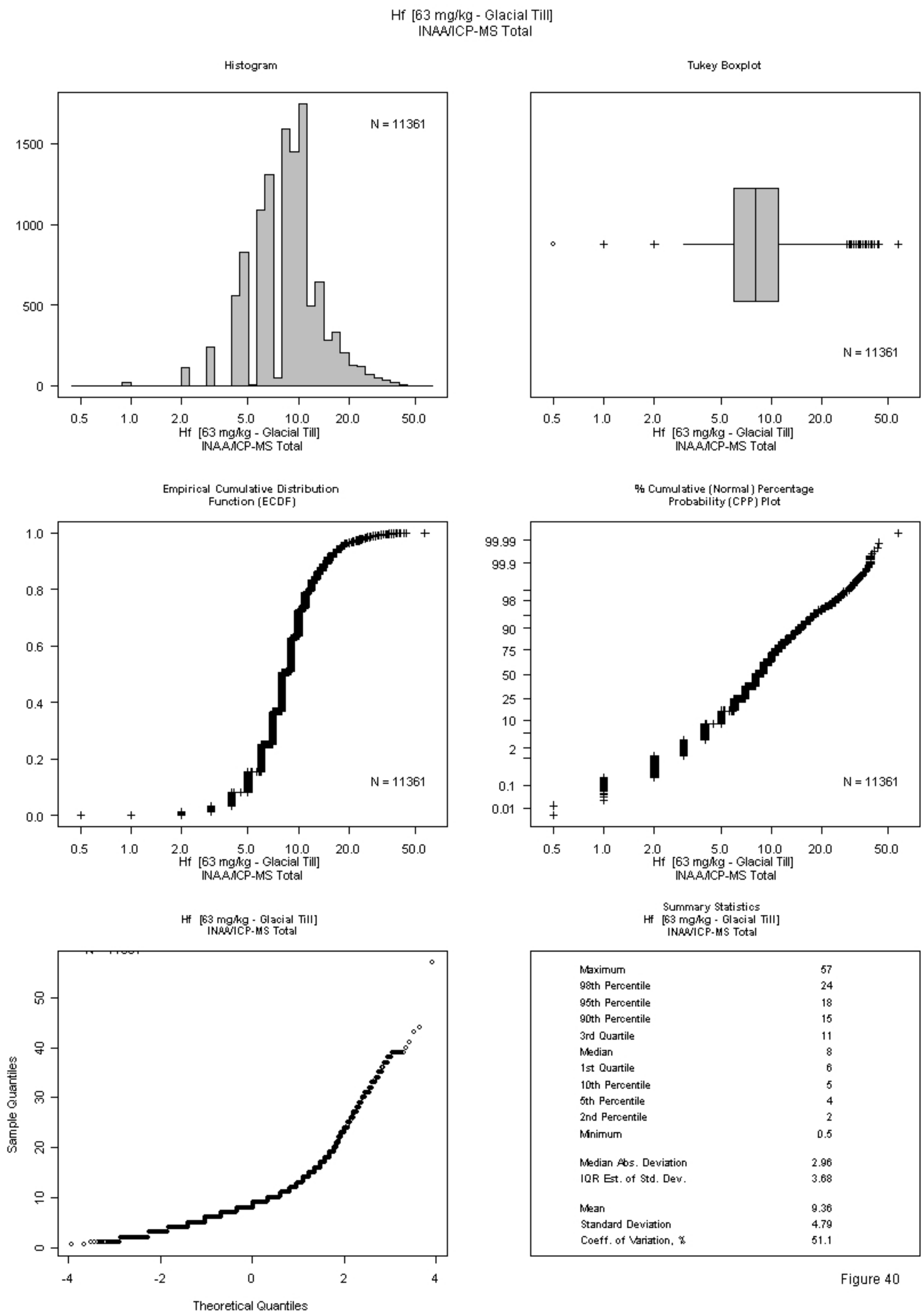
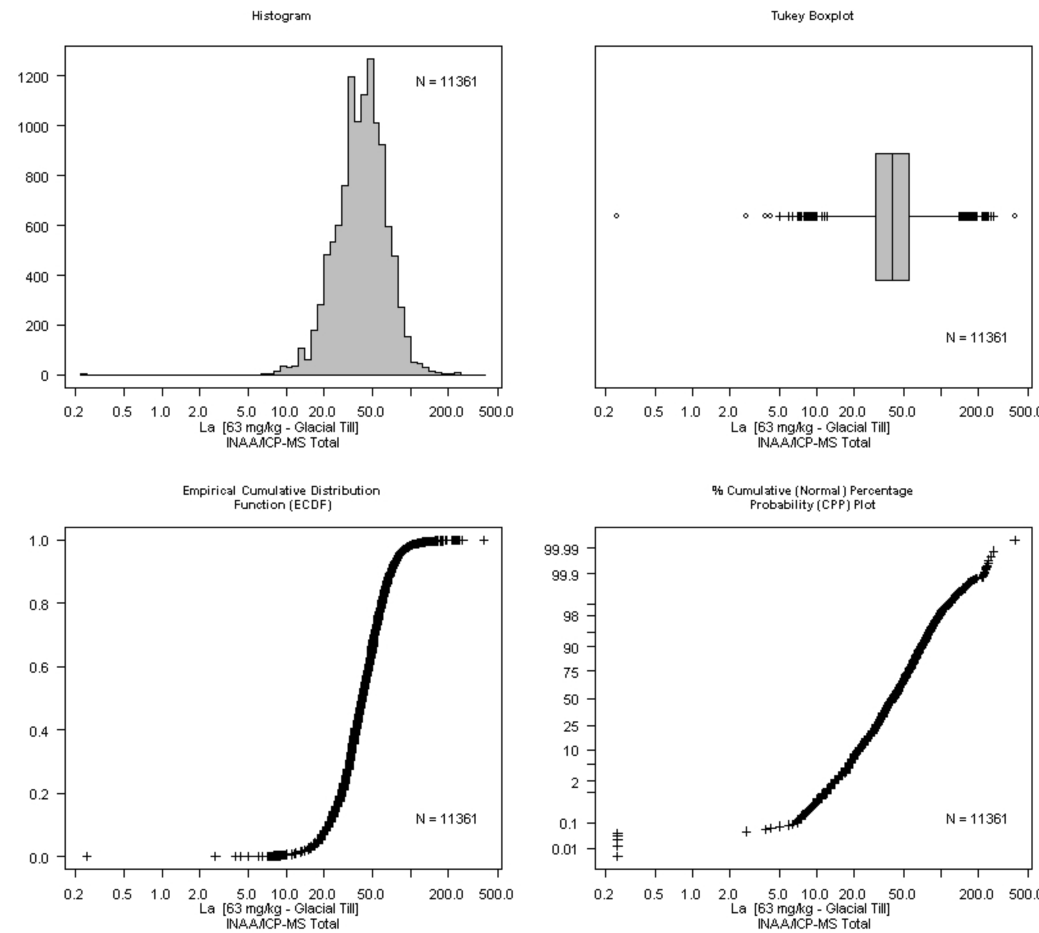
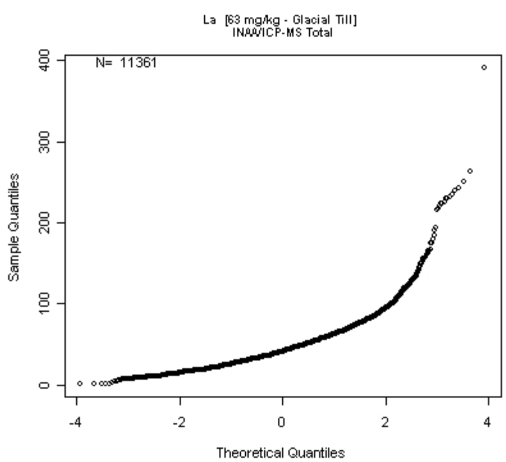

Hf [63 mg/kg - Glacial Till]
INAA/ICP-MS Total
Histogram
N = 11361
Tukey Boxplot
N = 11361
Empirical Cumulative Distribution Function (ECDF)
N = 11361
% Cumulative (Normal) Percentage Probability (CPP) Plot
N = 11361
Hf [63 mg/kg - Glacial Till] INAA/ICP-MS Total
Sample Quantiles
Theoretical Quantiles
Summary Statistics
Hf [63 mg/kg - Glacial Till]
INAA/ICP-MS Total
Maximum 57
98th Percentile 24
95th Percentile 18
90th Percentile 15
3rd Quartile 11
Median 8
1st Quartile 6
10th Percentile 5
5th Percentile 4
2nd Percentile 2
Minimum 0.5
Median Abs. Deviation 2.96
IQR Est. of Std. Dev. 3.68
Mean 9.36
Standard Deviation 4.79
Coeff. of Variation, % 51.1

Figure 40

La [63 mg/kg - Glacial Till]
INAA/ICP-MS Total

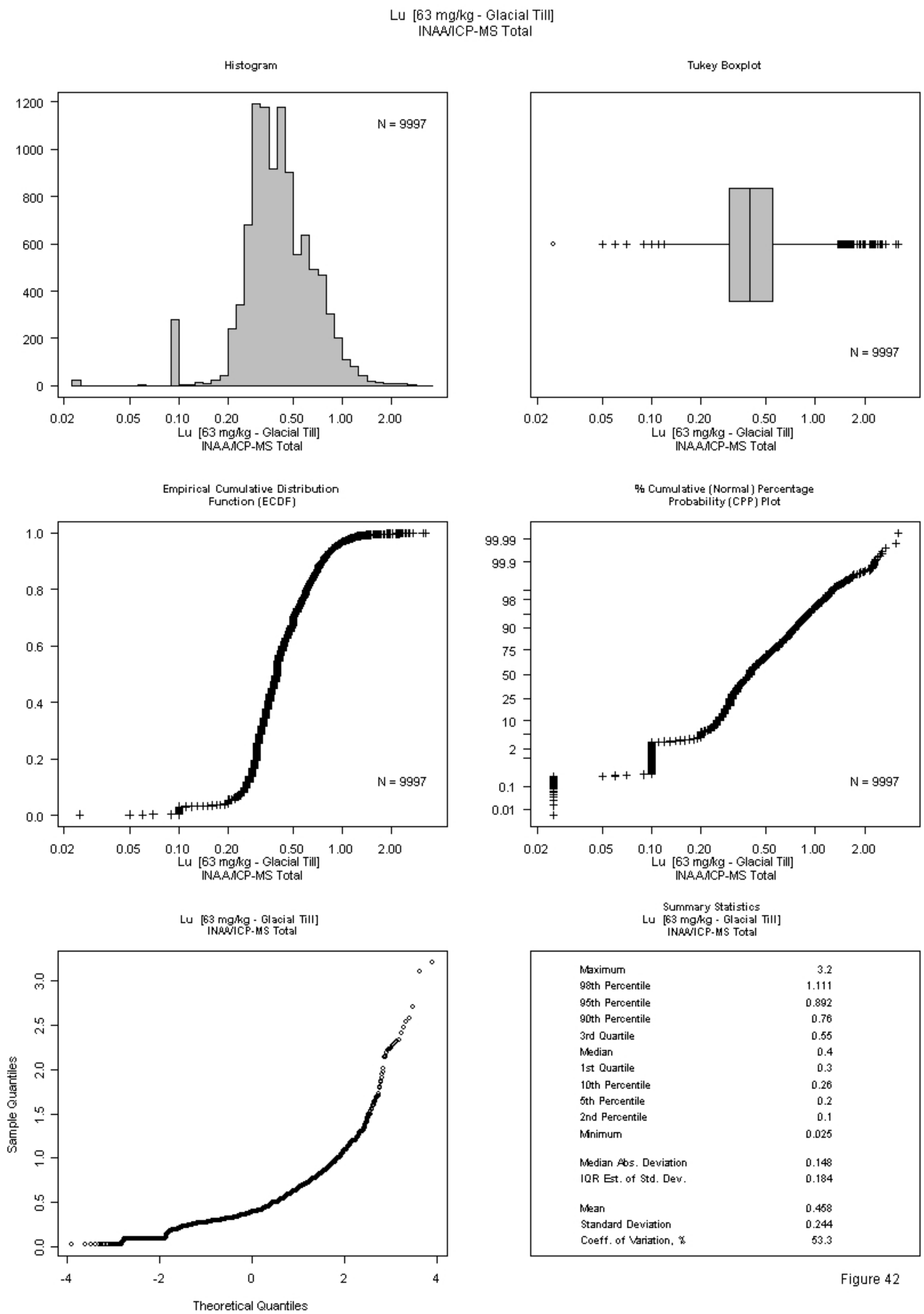




Summary Statistics
La [63 mg/kg - Glacial Till]
INAA/ICP-MS Total

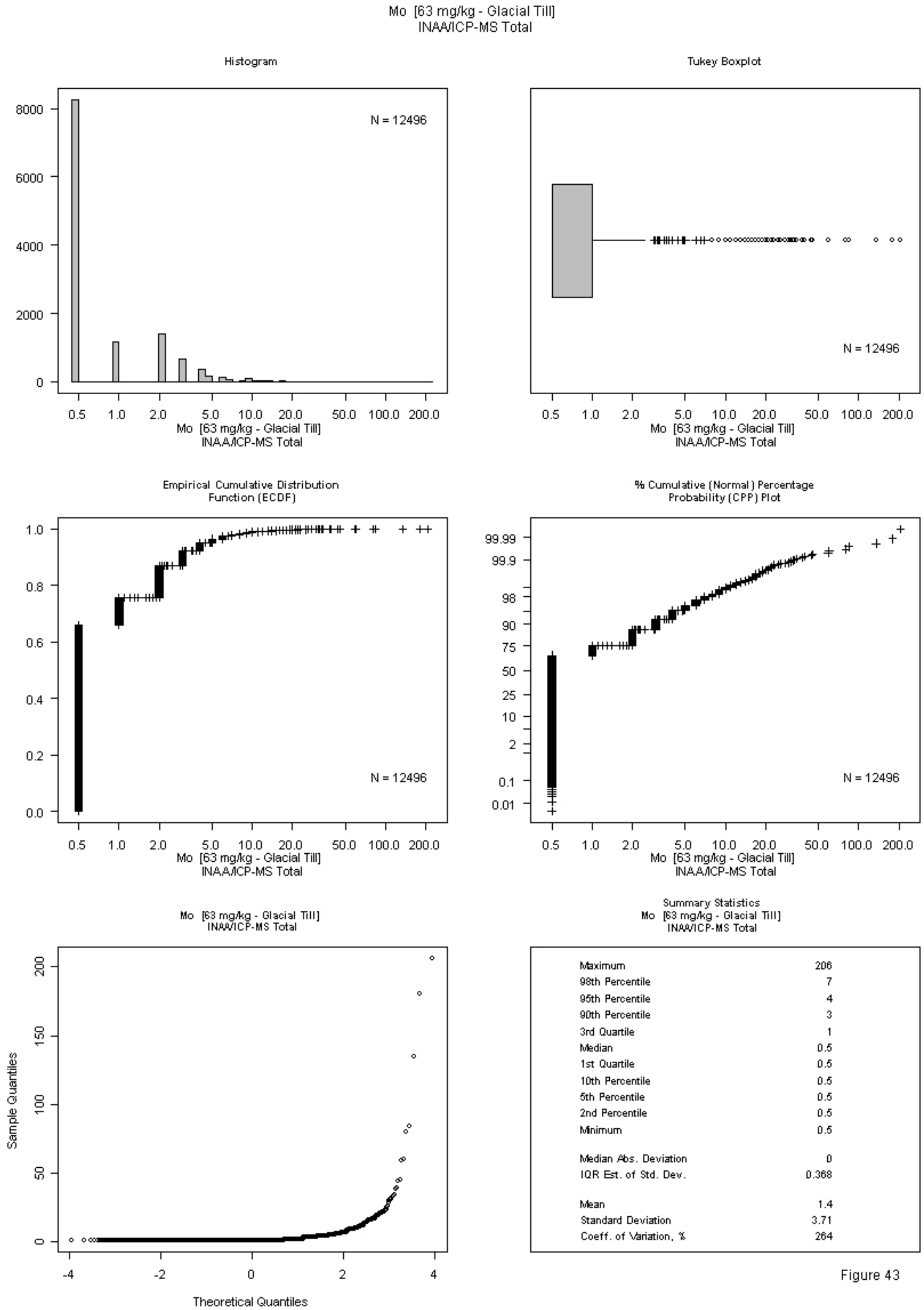
Maximum	390.8
98th Percentile	96.74
95th Percentile	80.2
90th Percentile	69.6
3rd Quartile	55
Median	41
1st Quartile	30
10th Percentile	22
5th Percentile	18
2nd Percentile	12
Minimum	0.25
Median Abs. Deviation	17.8
IQR Est. of Std. Dev.	18.4
Mean	44.4
Standard Deviation	21.6
Coeff. of Variation, %	48.5

Figure 41



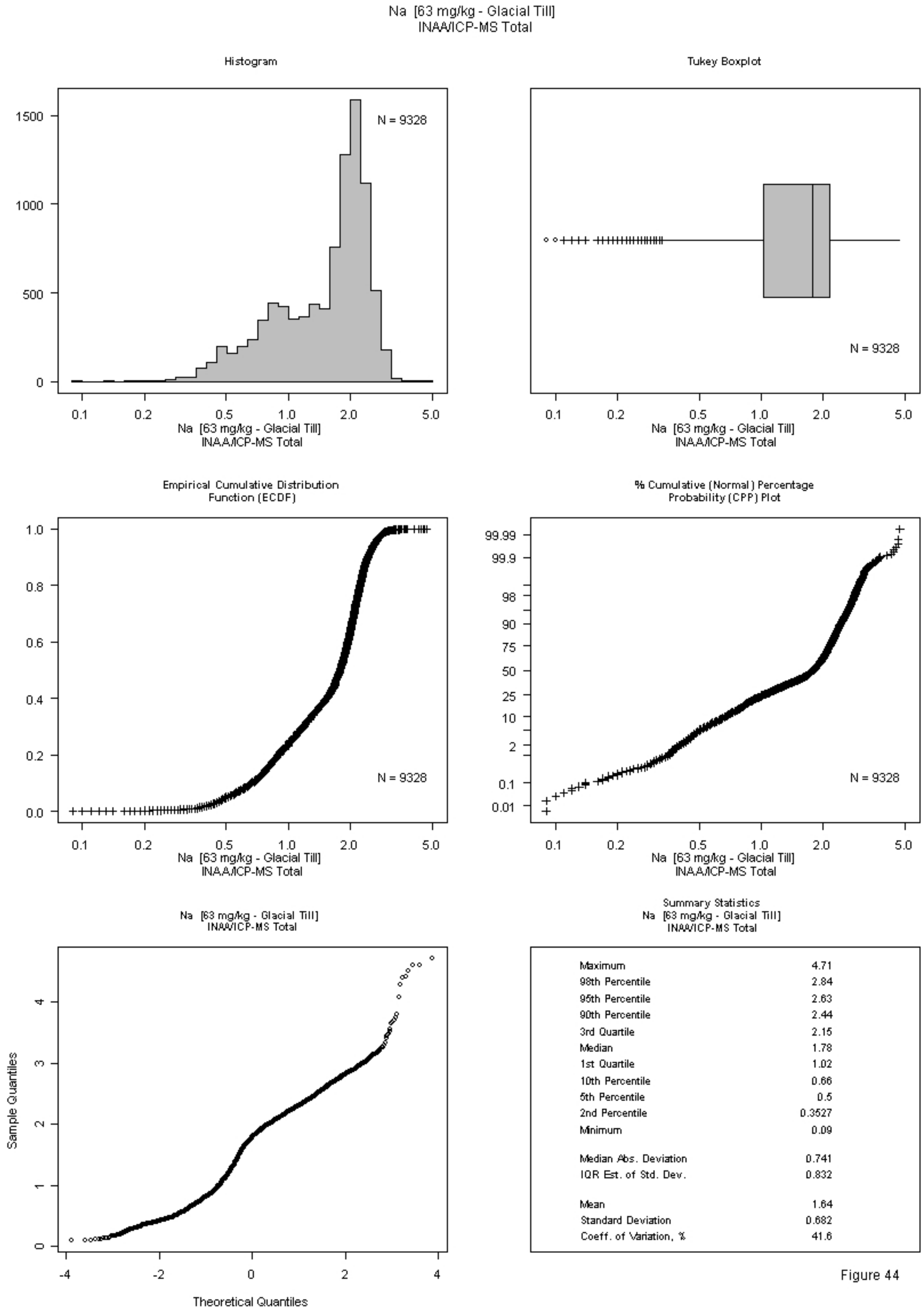
Maximum	3.2
98th Percentile	1.111
95th Percentile	0.892
90th Percentile	0.76
3rd Quartile	0.55
Median	0.4
1st Quartile	0.3
10th Percentile	0.26
5th Percentile	0.2
2nd Percentile	0.1
Minimum	0.025
Median Abs. Deviation	0.148
IQR Est. of Std. Dev.	0.184
Mean	0.458
Standard Deviation	0.244
Coeff. of Variation, %	53.3

Figure 42



Maximum	206
98th Percentile	7
95th Percentile	4
90th Percentile	3
3rd Quartile	1
Median	0.5
1st Quartile	0.5
10th Percentile	0.5
5th Percentile	0.5
2nd Percentile	0.5
Minimum	0.5
Median Abs. Deviation	0
IQR Est. of Std. Dev.	0.368
Mean	1.4
Standard Deviation	3.71
Coeff. of Variation, %	264

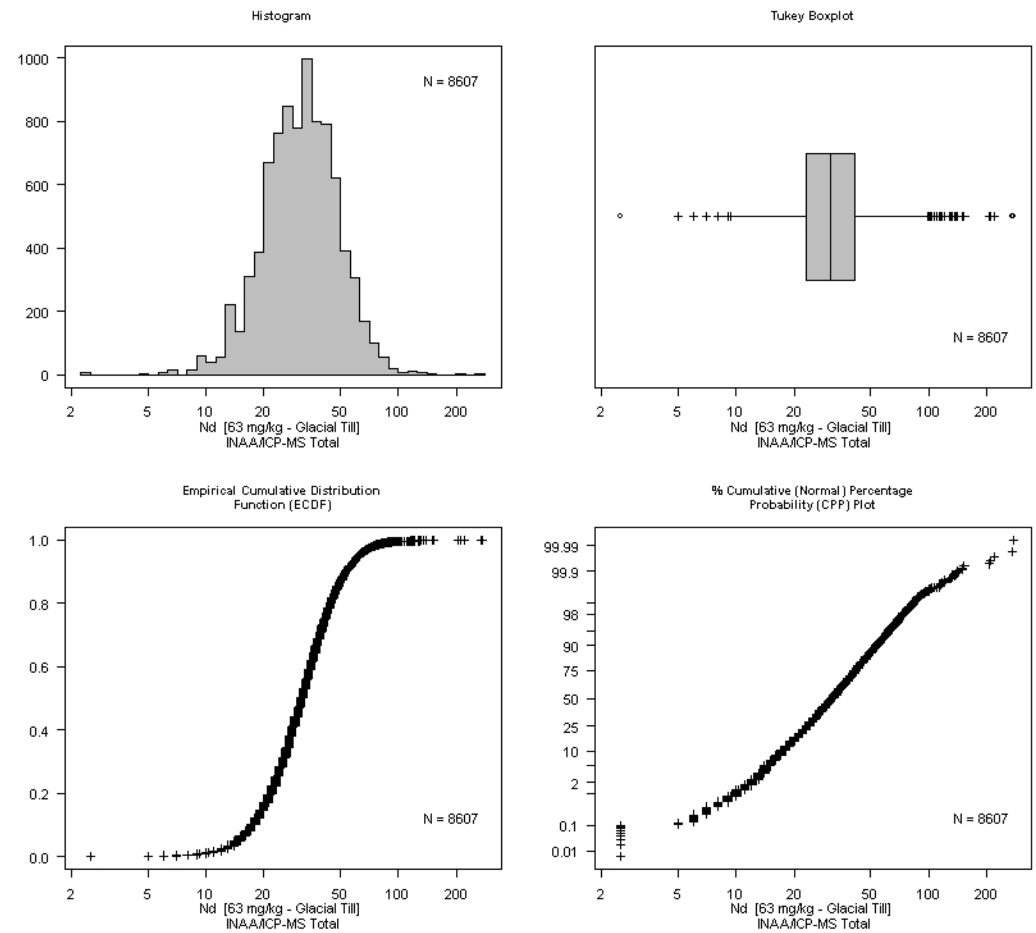
Figure 43

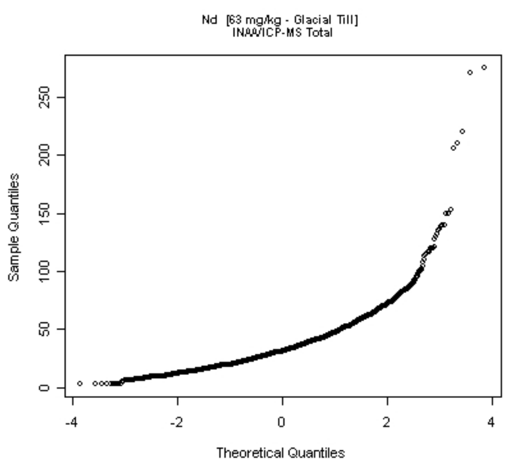


Maximum	4.71
98th Percentile	2.84
95th Percentile	2.63
90th Percentile	2.44
3rd Quartile	2.15
Median	1.78
1st Quartile	1.02
10th Percentile	0.66
5th Percentile	0.5
2nd Percentile	0.3527
Minimum	0.09
Median Abs. Deviation	0.741
IQR Est. of Std. Dev.	0.832
Mean	1.64
Standard Deviation	0.682
Coeff. of Variation, %	41.6

Figure 44

Nd [63 mg/kg - Glacial Till]
INAA/ICP-MS Total



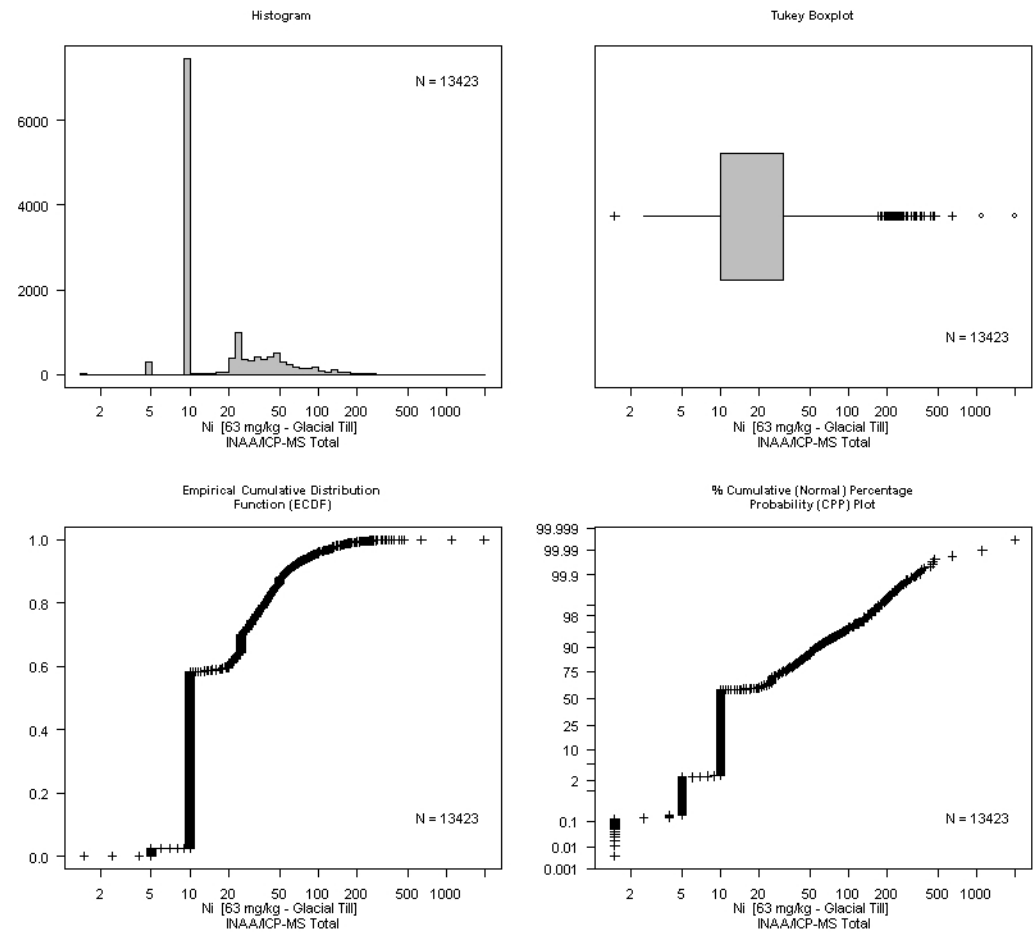


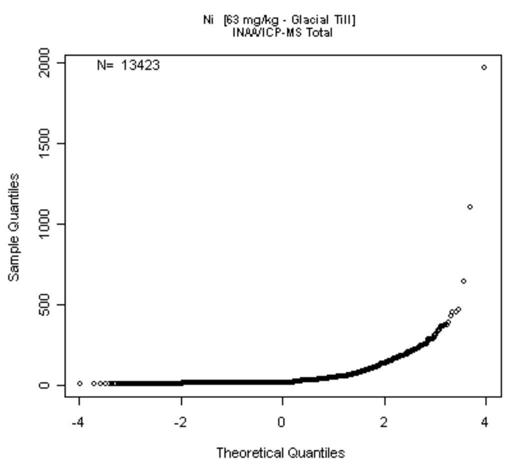
Summary Statistics
Nd [63 mg/kg - Glacial Till]
INAA/ICP-MS Total

Maximum	275
98th Percentile	73
95th Percentile	62
90th Percentile	53
3rd Quartile	41.15
Median	31.1
1st Quartile	23
10th Percentile	17
5th Percentile	15
2nd Percentile	10
Minimum	2.5
Median Abs. Deviation	13.2
IQR Est. of Std. Dev.	13.4
Mean	34.1
Standard Deviation	16.1
Coeff. of Variation, %	47.3

Figure 45

Ni [63 mg/kg - Glacial Till]
INAA/ICP-MS Total



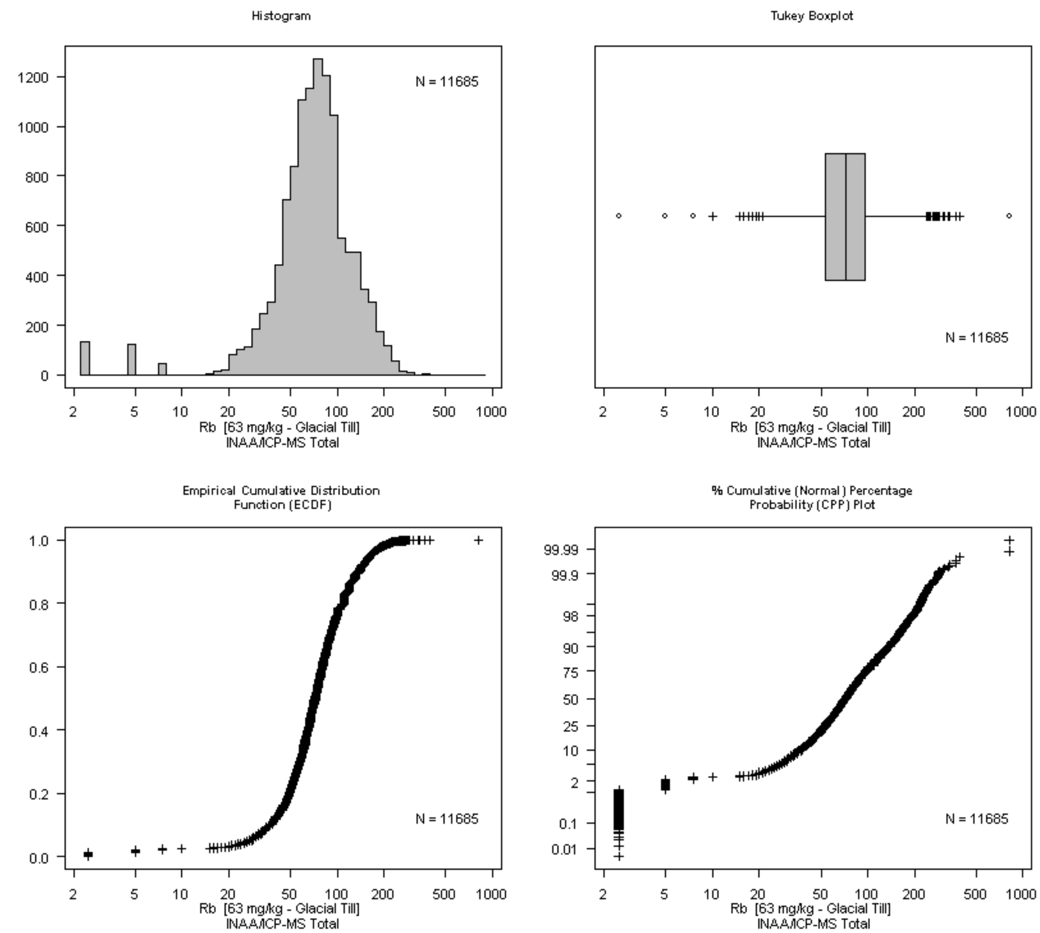


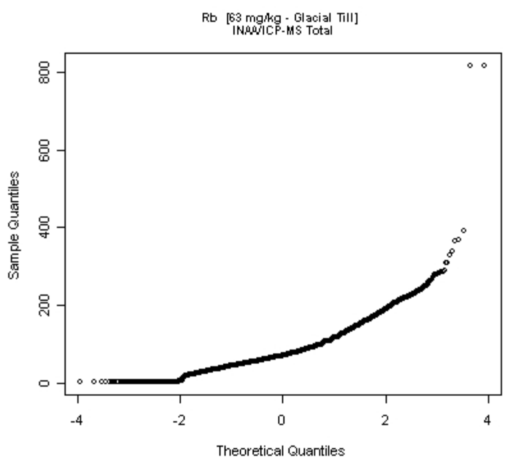
Summary Statistics
Ni [63 mg/kg - Glacial Till]
INAA/ICP-MS Total

Maximum	1970
98th Percentile	140
95th Percentile	90
90th Percentile	57
3rd Quartile	31
Median	10
1st Quartile	10
10th Percentile	10
5th Percentile	10
2nd Percentile	5
Minimum	1.5
Median Abs. Deviation	0
IQR Est. of Std. Dev.	15.5
Mean	27.1
Standard Deviation	39.4
Coeff. of Variation, %	145

Figure 46

Rb [63 mg/kg - Glacial Till]
INAA/ICP-MS Total





Summary Statistics
Rb [63 mg/kg - Glacial Till]
INAA/ICP-MS Total

Maximum	815
98th Percentile	194.3
95th Percentile	162
90th Percentile	137
3rd Quartile	97
Median	72
1st Quartile	53
10th Percentile	37
5th Percentile	27
2nd Percentile	2.5
Minimum	2.5
Median Abs. Deviation	31.1
IQR Est. of Std. Dev.	32.4
Mean	80.1
Standard Deviation	42.9
Coeff. of Variation, %	53.6

Figure 47

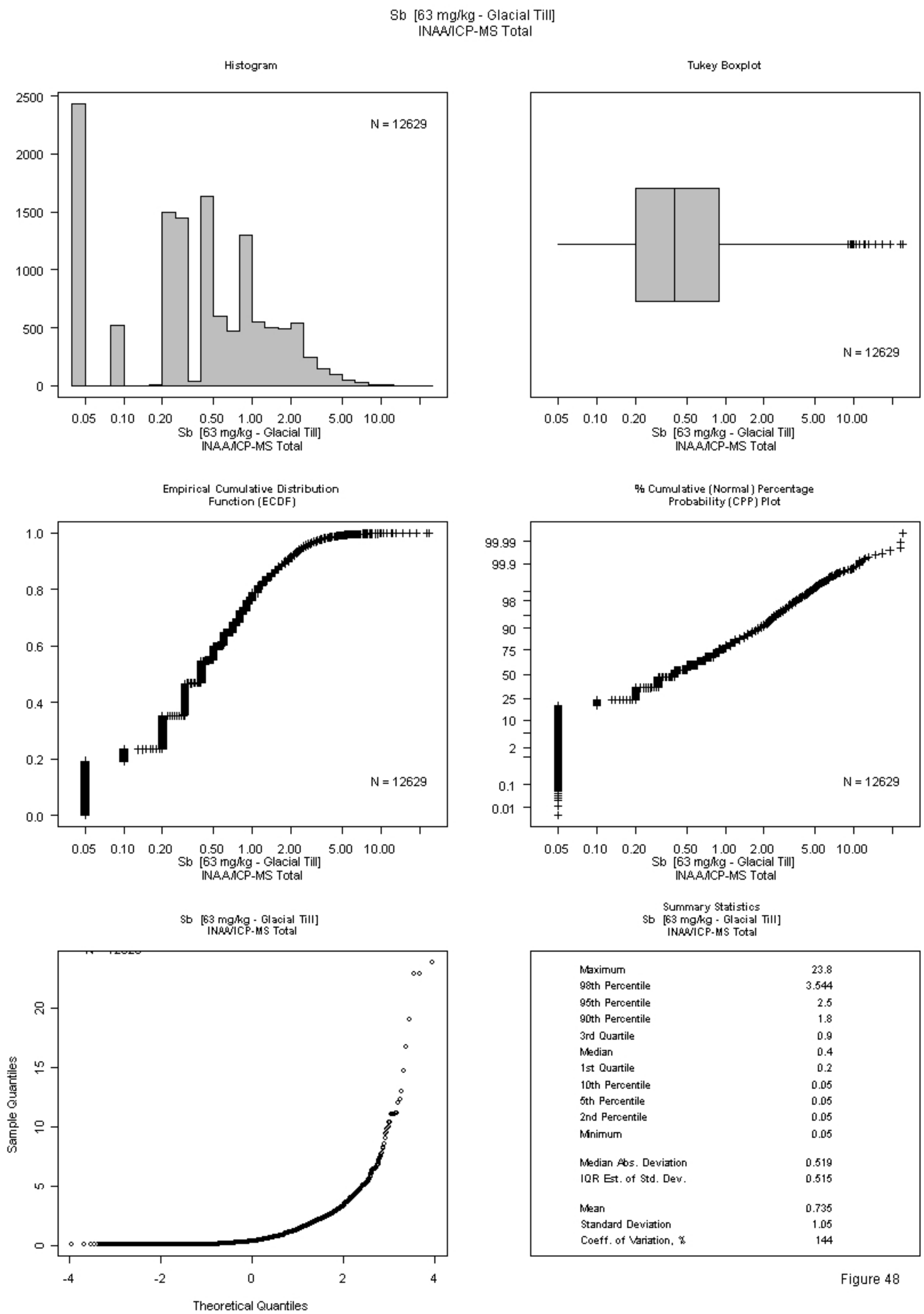
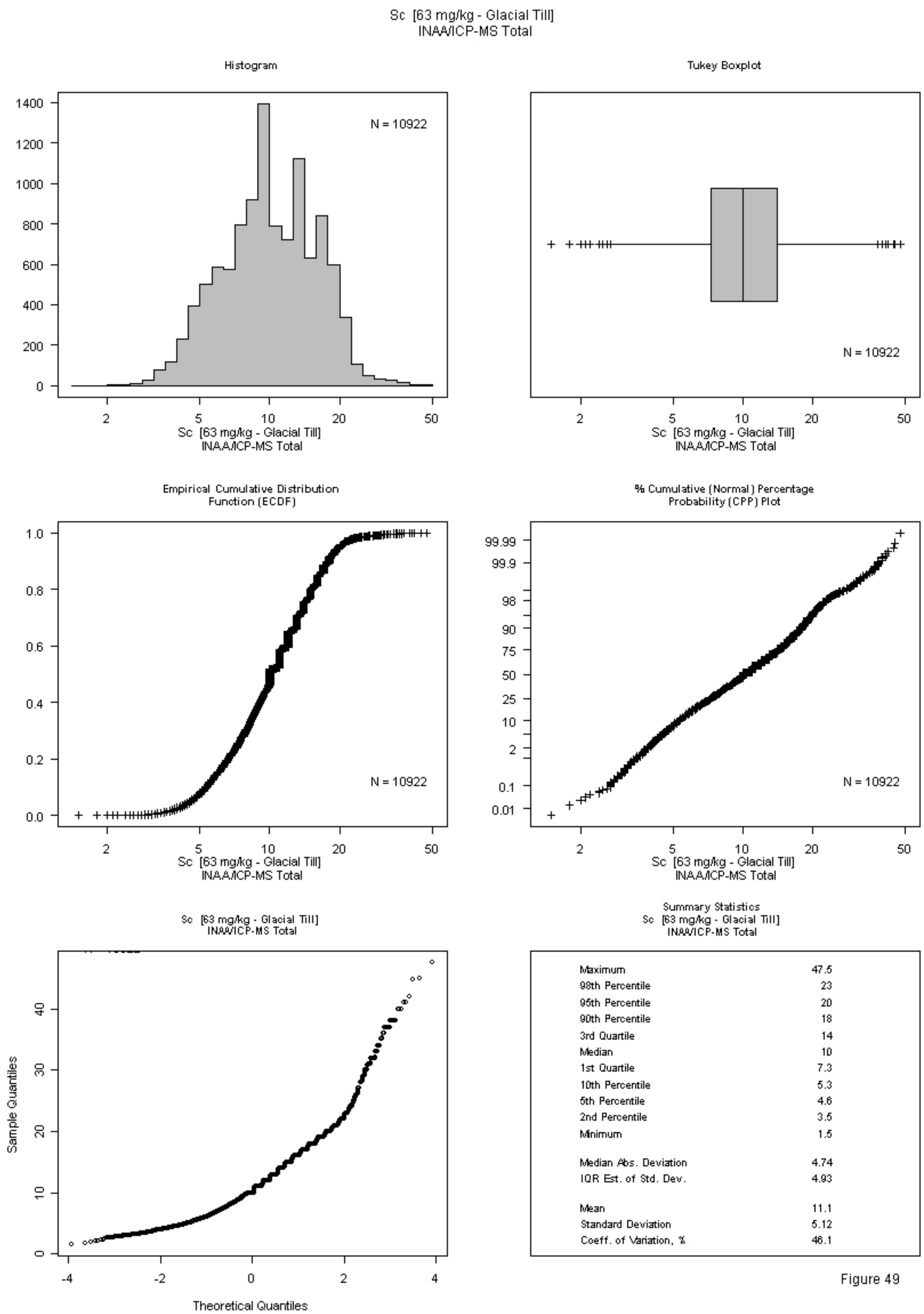
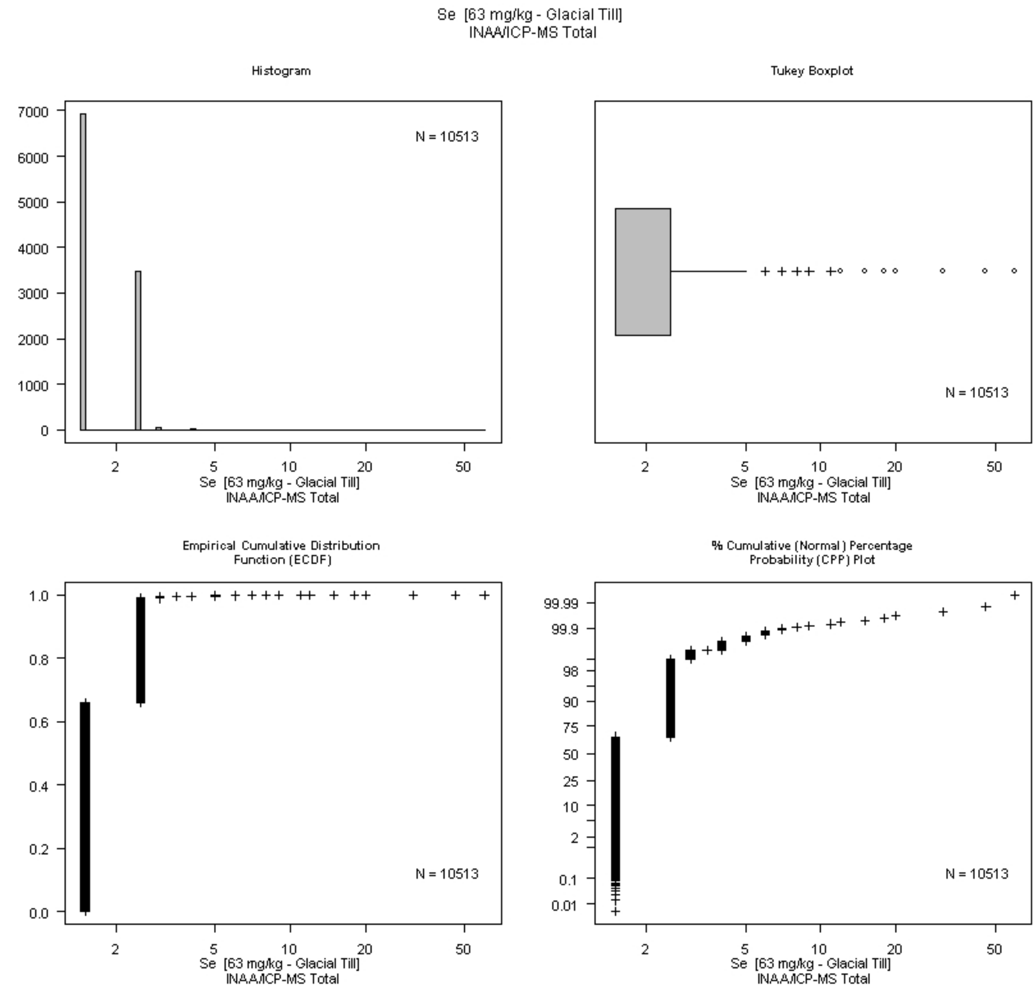

Sb [63 mg/kg - Glacial Till]
INAA/ICP-MS Total
Histogram
N = 12629
Sb [63 mg/kg - Glacial Till]
INAA/ICP-MS Total
Tukey Boxplot
N = 12629
Empirical Cumulative Distribution Function (ECDF)
N = 12629
% Cumulative (Normal) Percentage Probability (CPP) Plot
N = 12629
Sample Quantiles
Theoretical Quantiles
Summary Statistics
Sb [63 mg/kg - Glacial Till]
INAA/ICP-MS Total
Maximum 23.8
98th Percentile 3.544
95th Percentile 2.5
90th Percentile 1.8
3rd Quartile 0.9
Median 0.4
1st Quartile 0.2
10th Percentile 0.05
5th Percentile 0.05
2nd Percentile 0.05
Minimum 0.05
Median Abs. Deviation 0.519
IQR Est. of Std. Dev. 0.515
Mean 0.735
Standard Deviation 1.05
Coeff. of Variation, % 144

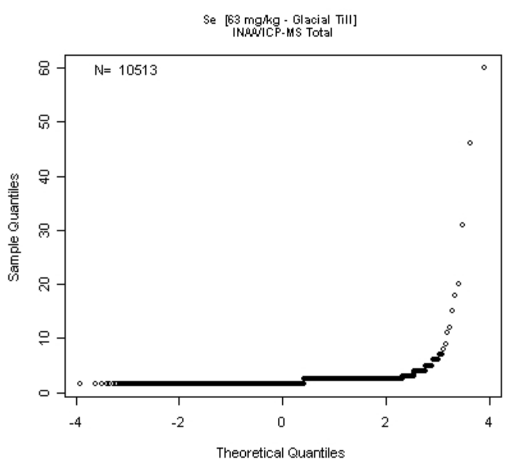
Figure 48



Maximum	47.5
98th Percentile	23
95th Percentile	20
90th Percentile	18
3rd Quartile	14
Median	10
1st Quartile	7.3
10th Percentile	5.3
5th Percentile	4.6
2nd Percentile	3.5
Minimum	1.5
Median Abs. Deviation	4.74
IQR Est. of Std. Dev.	4.93
Mean	11.1
Standard Deviation	5.12
Coeff. of Variation, %	46.1

Figure 49

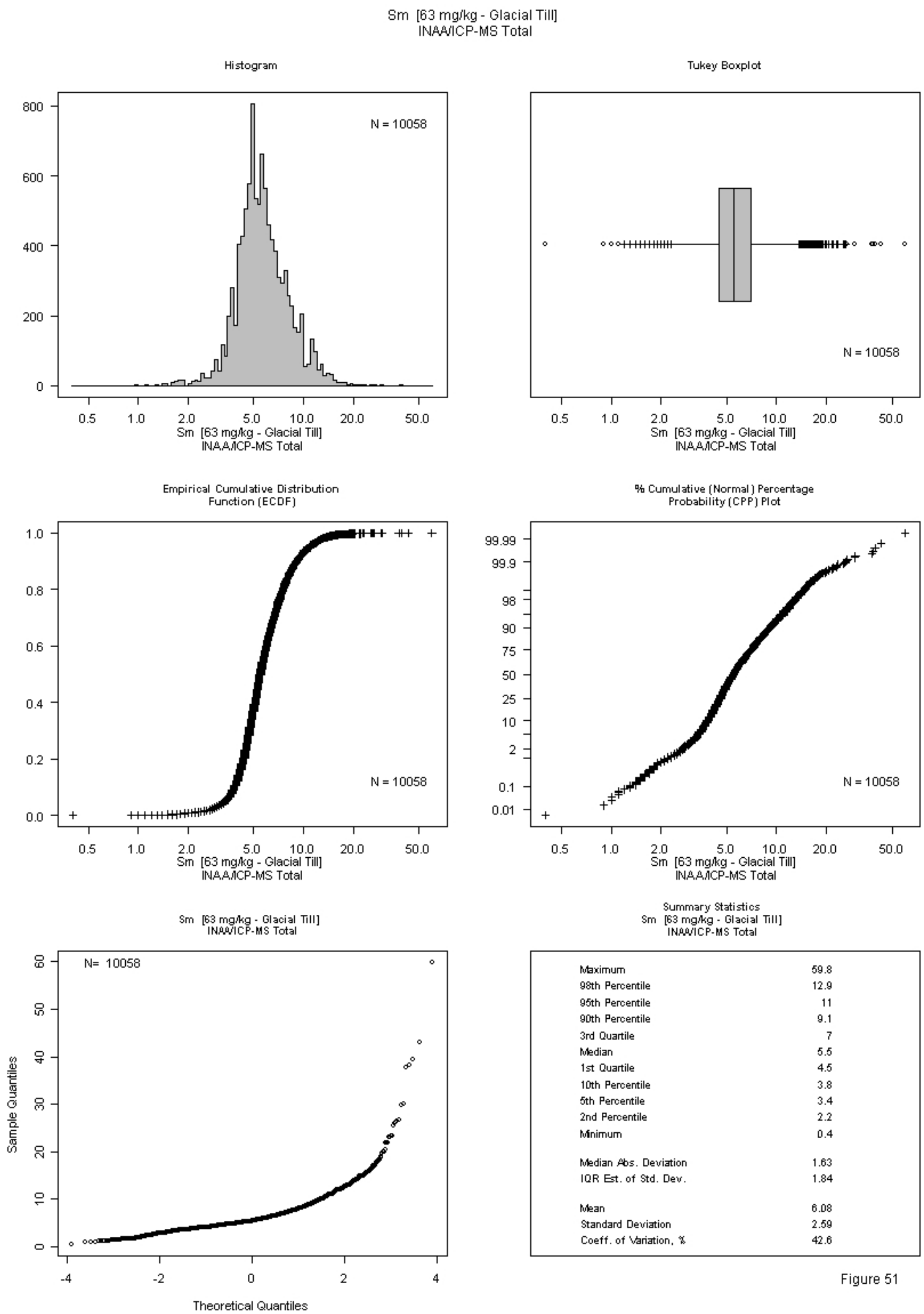




Summary Statistics
Se [63 mg/kg - Glacial Till]
INAA/ICP-MS Total

Maximum	60
98th Percentile	2.5
95th Percentile	2.5
90th Percentile	2.5
3rd Quartile	2.5
Median	1.5
1st Quartile	1.5
10th Percentile	1.5
5th Percentile	1.5
2nd Percentile	1.5
Minimum	1.5
Median Abs. Deviation	0
IQR Est. of Std. Dev.	0.736
Mean	1.87
Standard Deviation	0.976
Coeff. of Variation, %	52.1

Figure 50



Maximum	59.8
98th Percentile	12.9
95th Percentile	11
90th Percentile	9.1
3rd Quartile	7
Median	5.5
1st Quartile	4.5
10th Percentile	3.8
5th Percentile	3.4
2nd Percentile	2.2
Minimum	0.4
Median Abs. Deviation	1.63
IQR Est. of Std. Dev.	1.84
Mean	6.08
Standard Deviation	2.59
Coeff. of Variation, %	42.6

Figure 51

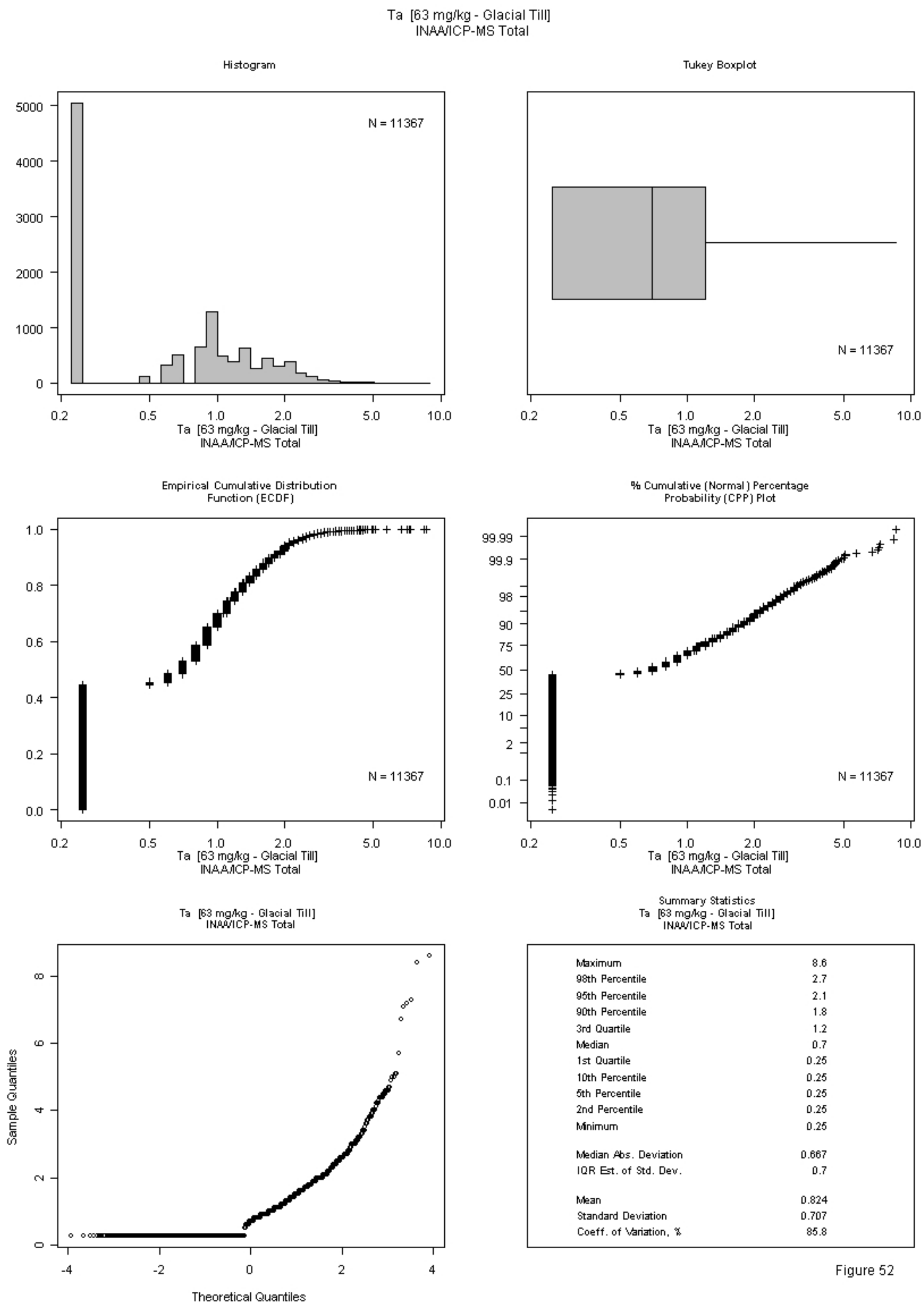
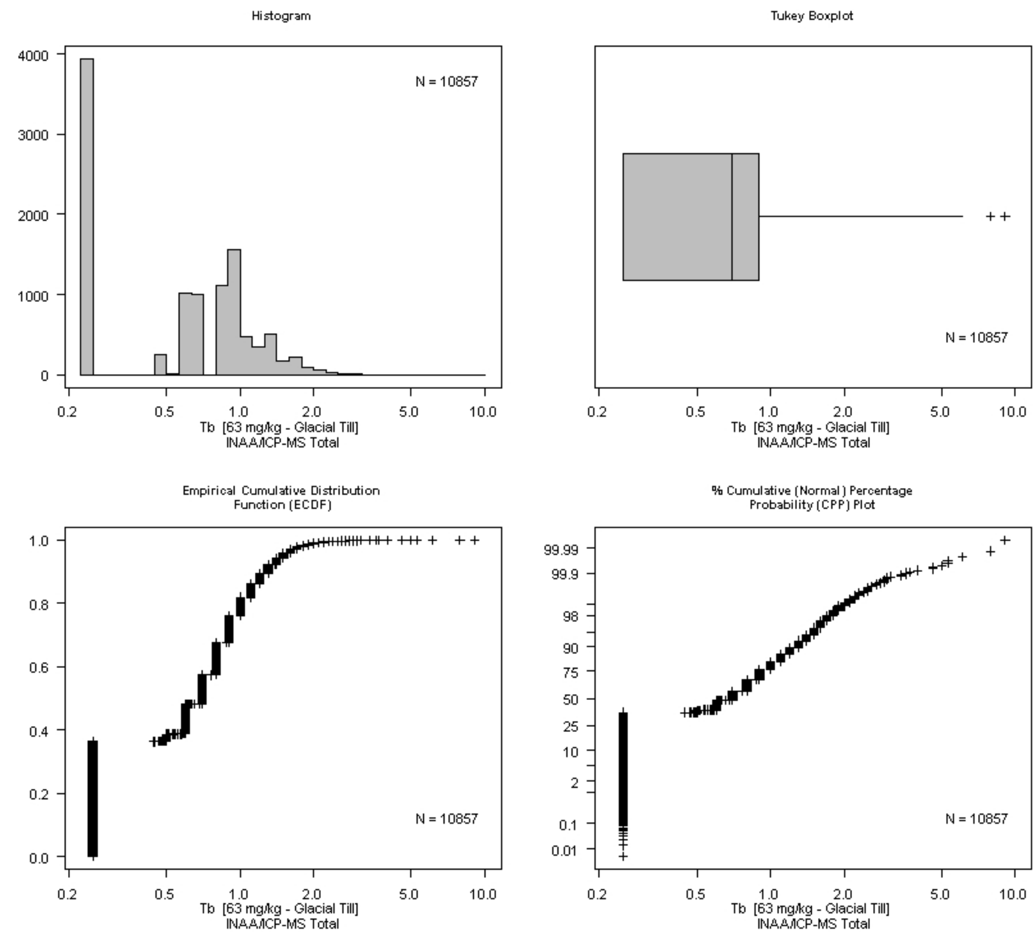
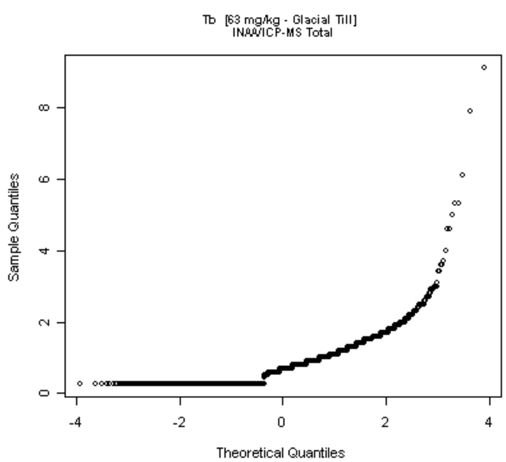

Ta [63 mg/kg - Glacial Till]
INAA/ICP-MS Total
Histogram
N = 11367
Tukey Boxplot
N = 11367
Empirical Cumulative Distribution Function (ECDF)
N = 11367
% Cumulative (Normal) Percentage Probability (CPP) Plot
N = 11367
Ta [63 mg/kg - Glacial Till] INAA/ICP-MS Total
Sample Quantiles
Theoretical Quantiles
Summary Statistics
Ta [63 mg/kg - Glacial Till]
INAA/ICP-MS Total
Maximum 8.6
98th Percentile 2.7
95th Percentile 2.1
90th Percentile 1.8
3rd Quartile 1.2
Median 0.7
1st Quartile 0.25
10th Percentile 0.25
5th Percentile 0.25
2nd Percentile 0.25
Minimum 0.25
Median Abs. Deviation 0.667
IQR Est. of Std. Dev. 0.7
Mean 0.824
Standard Deviation 0.707
Coeff. of Variation, % 85.8

Figure 52

Tb [63 mg/kg - Glacial Till]
INAA/ICP-MS Total





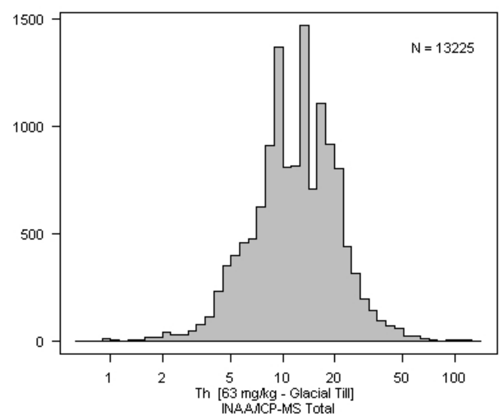
Summary Statistics
Tb [63 mg/kg - Glacial Till]
INAA/ICP-MS Total

Maximum	9.1
98th Percentile	1.8
95th Percentile	1.5
90th Percentile	1.3
3rd Quartile	0.9
Median	0.7
1st Quartile	0.25
10th Percentile	0.25
5th Percentile	0.25
2nd Percentile	0.25
Minimum	0.25
Median Abs. Deviation	0.593
IQR Est. of Std. Dev.	0.479
Mean	0.695
Standard Deviation	0.462
Coeff. of Variation, %	66.4

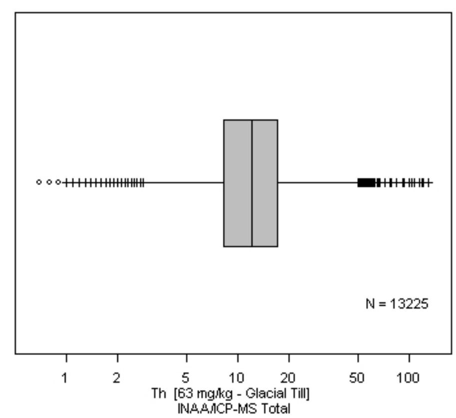
Figure 53

Th [63 mg/kg - Glacial Till]
INAA/ICP-MS Total

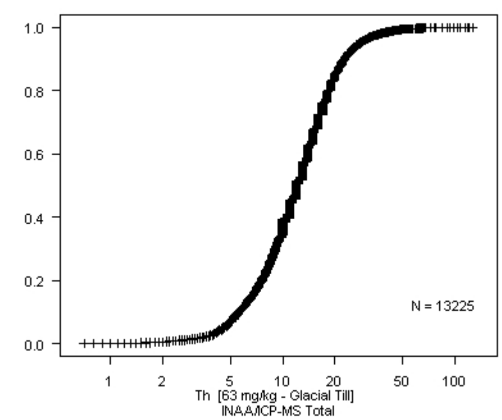
Histogram



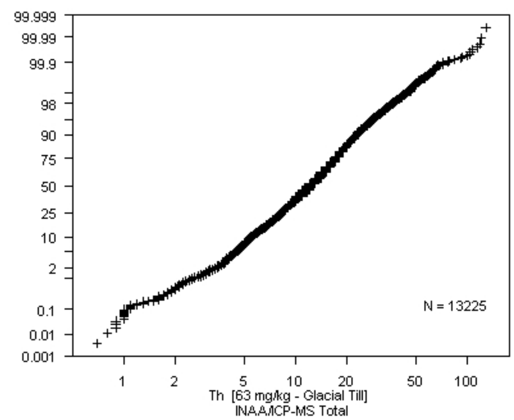
Tukey Boxplot



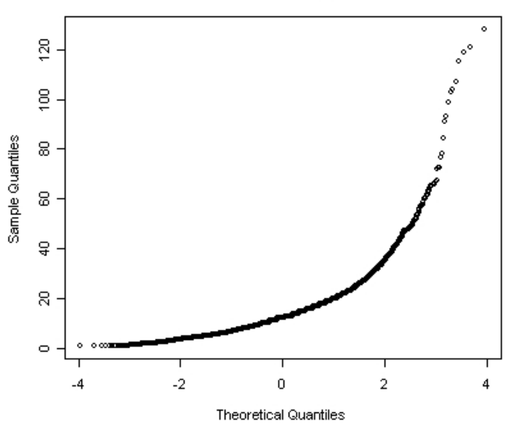
Empirical Cumulative Distribution
Function (ECDF)



% Cumulative (Normal) Percentage
Probability (CPP) Plot



Th [63 mg/kg - Glacial Till]
INAA/ICP-MS Total

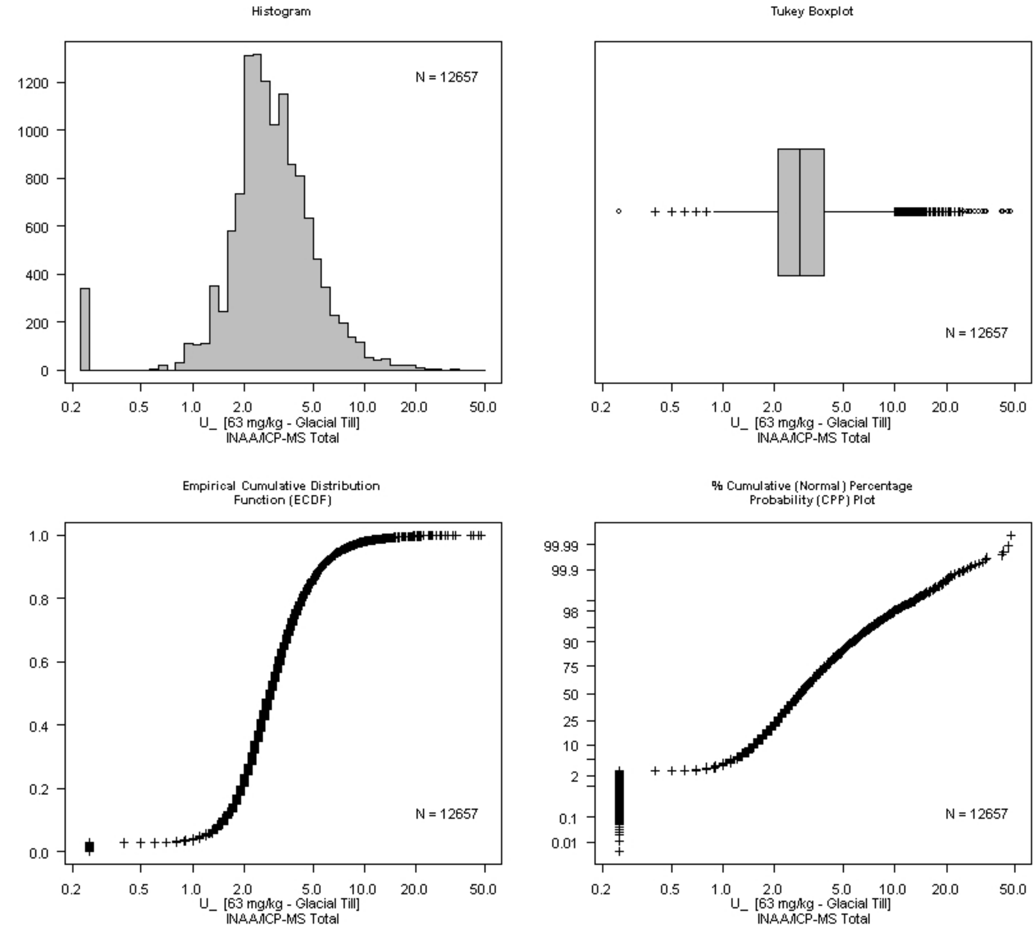


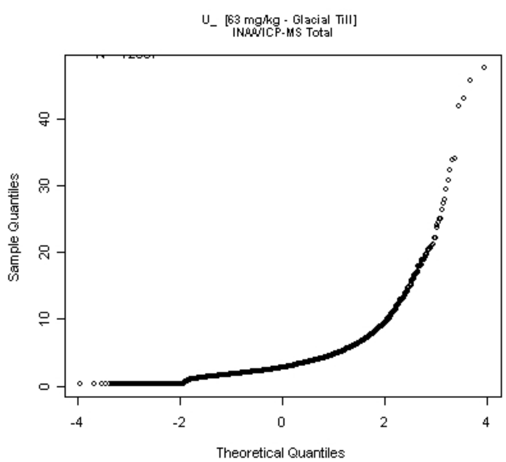
Summary Statistics
Th [63 mg/kg - Glacial Till]
INAA/ICP-MS Total

Maximum	128
98th Percentile	36.5
95th Percentile	28
90th Percentile	22.8
3rd Quartile	17
Median	12
1st Quartile	8.3
10th Percentile	5.5
5th Percentile	4.5
2nd Percentile	2.5
Minimum	0.7
Median Abs. Deviation	5.93
IQR Est. of Std. Dev.	6.41
Mean	13.7
Standard Deviation	8.37
Coeff. of Variation, %	60.9

Figure 54

U_ [63 mg/kg - Glacial Till]
INAA/ICP-MS Total

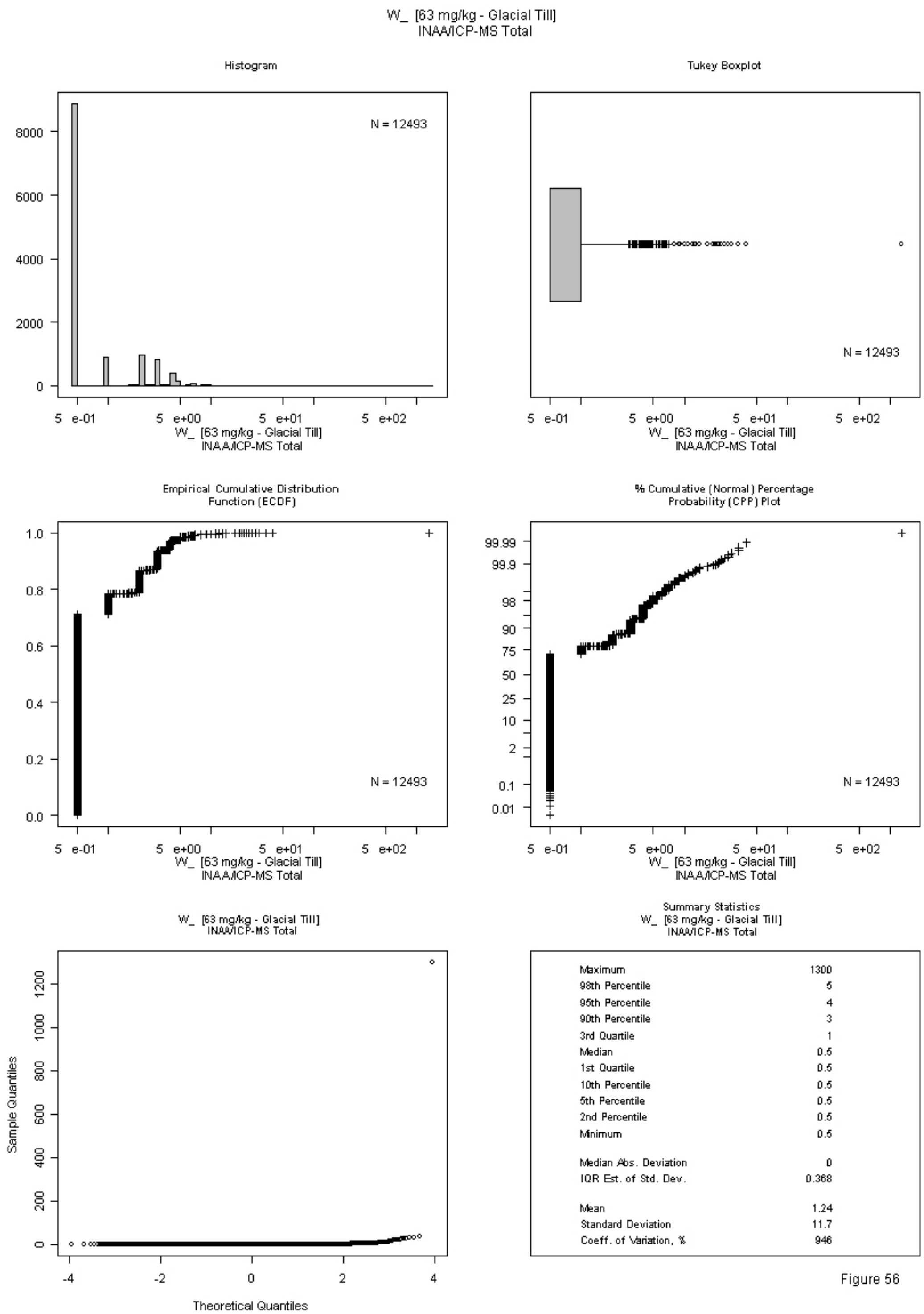




Summary Statistics
U_ [63 mg/kg - Glacial Till]
INAA/ICP-MS Total

Maximum	47.6
98th Percentile	9.9
95th Percentile	7.2
90th Percentile	5.6
3rd Quartile	3.9
Median	2.8
1st Quartile	2.1
10th Percentile	1.5
5th Percentile	1.2
2nd Percentile	0.25
Minimum	0.25
Median Abs. Deviation	1.33
IQR Est. of Std. Dev.	1.33
Mean	3.37
Standard Deviation	2.44
Coeff. of Variation, %	72.6

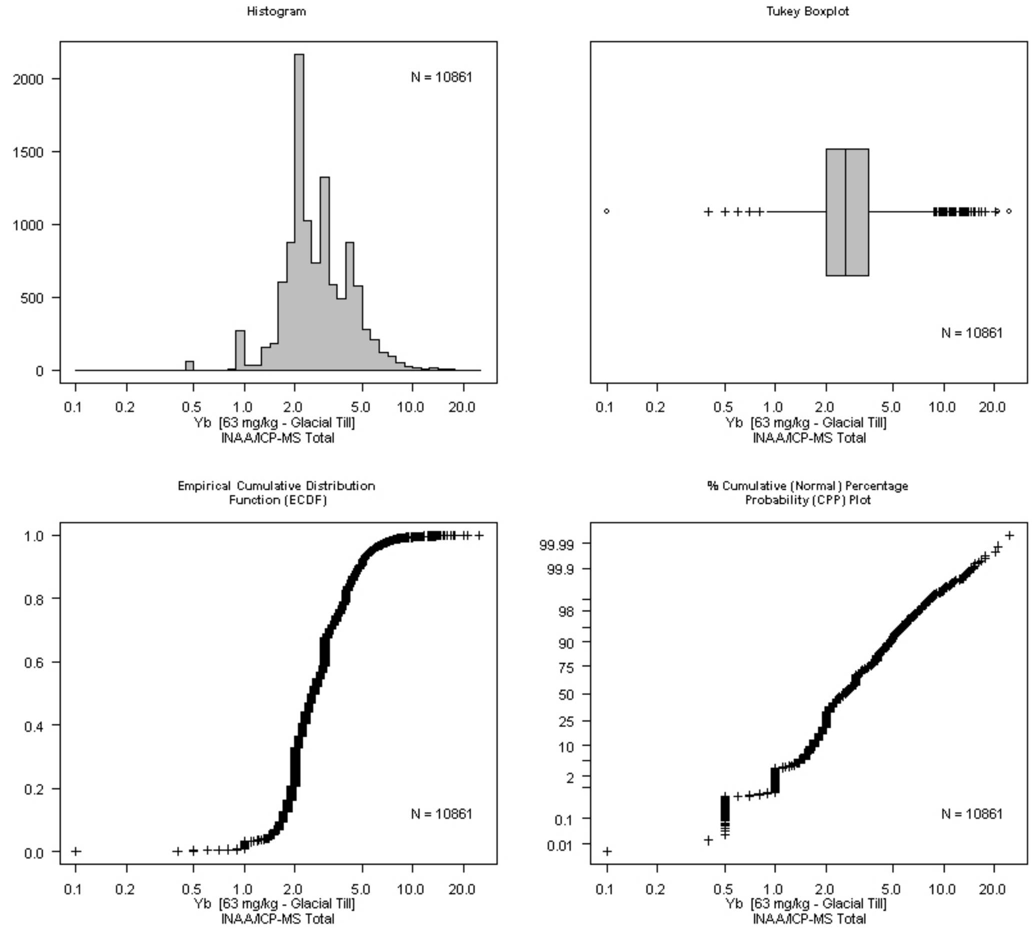
Figure 55

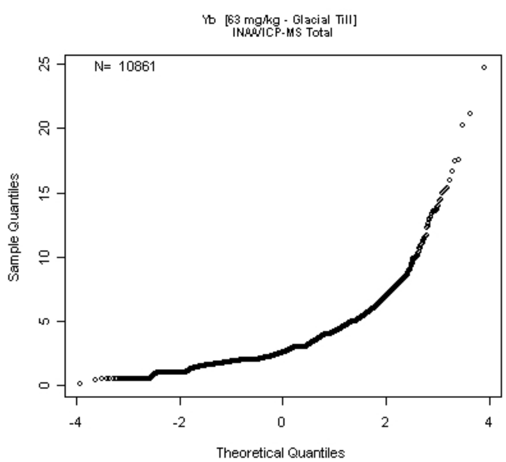


Maximum	1300
98th Percentile	5
95th Percentile	4
90th Percentile	3
3rd Quartile	1
Median	0.5
1st Quartile	0.5
10th Percentile	0.5
5th Percentile	0.5
2nd Percentile	0.5
Minimum	0.5
Median Abs. Deviation	0
IQR Est. of Std. Dev.	0.368
Mean	1.24
Standard Deviation	11.7
Coeff. of Variation, %	946

Figure 56

Yb [63 mg/kg - Glacial Till]
INAA/ICP-MS Total





Summary Statistics
Yb [63 mg/kg - Glacial Till]
INAA/ICP-MS Total

Maximum	24.7
98th Percentile	7.1
95th Percentile	5.7
90th Percentile	4.8
3rd Quartile	3.6
Median	2.6
1st Quartile	2
10th Percentile	1.7
5th Percentile	1.4
2nd Percentile	1
Minimum	0.1
Median Abs. Deviation	1.04
IQR Est. of Std. Dev.	1.18
Mean	2.96
Standard Deviation	1.54
Coeff. of Variation, %	52

Figure 57

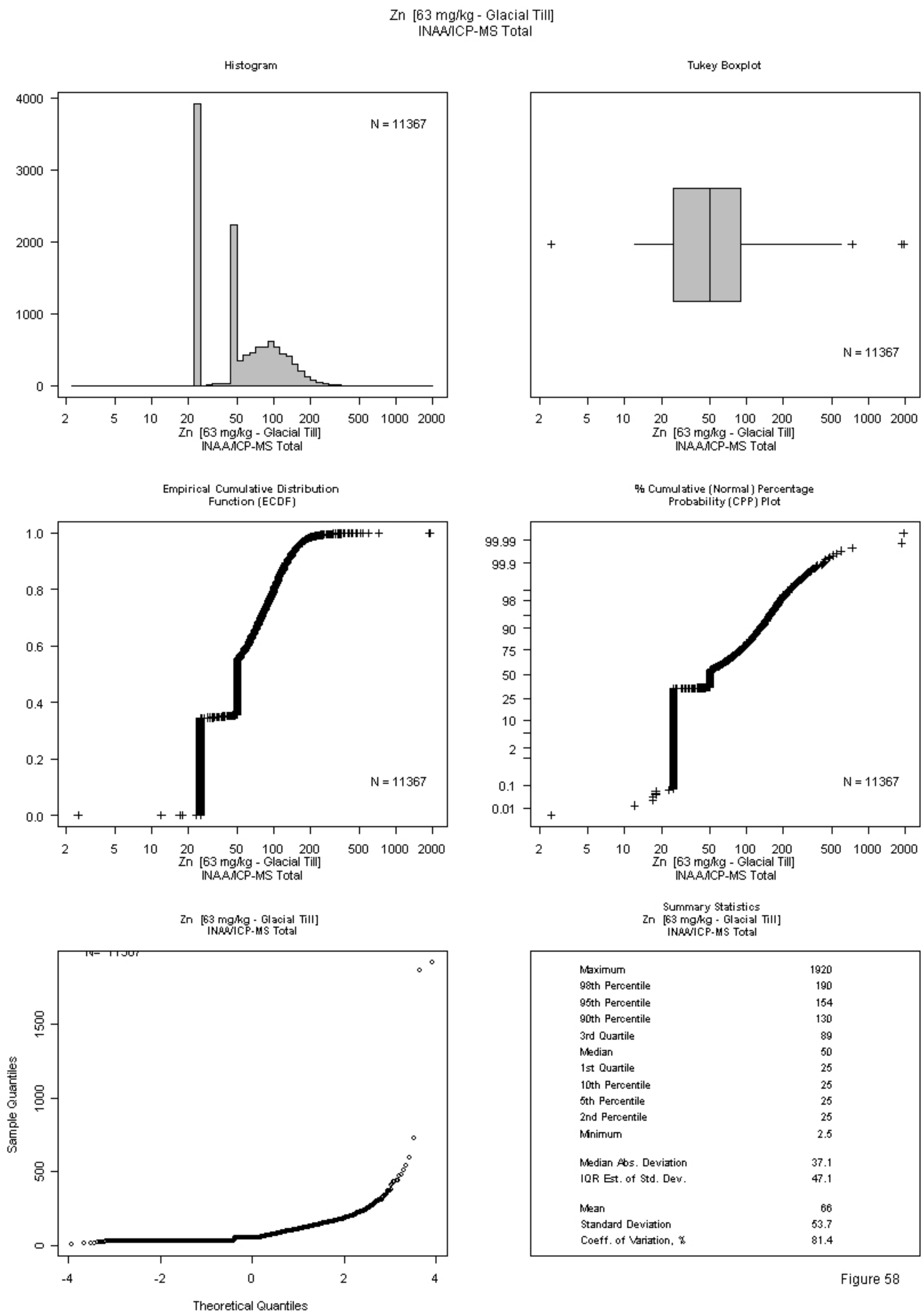

Zn [63 mg/kg - Glacial Till]
INAA/ICP-MS Total
Histogram
N = 11367
Zn [63 mg/kg - Glacial Till]
INAA/ICP-MS Total
Tukey Boxplot
N = 11367
Zn [63 mg/kg - Glacial Till]
INAA/ICP-MS Total
Empirical Cumulative Distribution
Function (ECDF)
N = 11367
Zn [63 mg/kg - Glacial Till]
INAA/ICP-MS Total
% Cumulative (Normal) Percentage
Probability (CPP) Plot
N = 11367
Zn [63 mg/kg - Glacial Till]
INAA/ICP-MS Total
Zn [63 mg/kg - Glacial Till]
INAA/ICP-MS Total
Sample Quantiles
Theoretical Quantiles
Summary Statistics
Zn [63 mg/kg - Glacial Till]
INAA/ICP-MS Total
Maximum 1920
98th Percentile 190
95th Percentile 154
90th Percentile 130
3rd Quartile 89
Median 50
1st Quartile 25
10th Percentile 25
5th Percentile 25
2nd Percentile 25
Minimum 2.5
Median Abs. Deviation 37.1
IQR Est. of Std. Dev. 47.1
Mean 66
Standard Deviation 53.7
Coeff. of Variation, % 81.4

Figure 58