

Test Group Summary Report

C17 Metals in Soil

January 2024 PT Round

Issued: March 5, 2024

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1.0 The Proficiency Testing Report

The Proficiency Testing Report consists of two parts.

- *PTC Proficiency Testing Report*: This report contains participant-specific data and other confidential information. This report is emailed to participants at the end of the PT round.
- *Test Group Summary Report*: A Test Group Summary Report is created for each quantified test group at the end of the PT round. These reports contain more detailed information on the round than is found in the participant-specific PTC Proficiency Testing Report. These reports do not contain any confidential information and are made available on the PTC web site.

2.0 Definitions

The participant-specific PTC Proficiency Testing Report contains some terms that new participants may not be familiar with.

<i>Code:</i>	The registration code that is unique to each analyte that a participant is registered for.
<i>App:</i>	If a participant is accredited by CALA, this three-digit number is the appendix number that the accredited method is assigned to.
<i>N:</i>	The number of participants results that were used to calculate the summary statistics. This excludes qualified data (e.g., <) and any results that were flagged as outliers.
<i>Assigned:</i>	The Assigned Value is the robust mean of the reported results, outliers excluded. This is often referred to as the “target” value.
<i>$\pm U$:</i>	The uncertainty of the assigned value.
<i>Reported:</i>	The result reported by the participant.
<i>s:</i>	The Standard Deviation of Proficiency Assessment (SDPA). This value is used to determine the acceptance limits for the PT evaluation.
<i>z-Score:</i>	A value assigned to each reported result that is a measure of the degree to which it deviates from the Assigned Value.
<i>Score:</i>	The composite score of the four results reported for each analyte. It is normalized to a score out of 100.
<i>Bias:</i>	A flag assigned if bias is detected using the re-scaled z-score procedure.

3.0 Scoring System

Participant performance is evaluated for each proficiency testing sample by a quantitative method that is consistent with ISO/IEC 17043 – *Conformity assessment- General requirements for the competence of proficiency testing providers*, the *International Harmonized Protocol for Proficiency Testing of (Chemical) Analytical Laboratories* (2006), and ISO 13528:2015 *Statistical methods for use in proficiency testing by interlaboratory comparisons*.

The following is a brief description of the evaluation procedure used by PTC. The detailed evaluation procedure is described in PROC09 – PT Evaluation *Procedure*, which is available on the PTC website www.PTCanada.org).

3.1 HOMOGENEITY AND STABILITY ASSESSMENT

Homogeneity and stability are assessed using participant data. Regression analysis is performed on reported result against order of sample production (Homogeneity) and reported result against date of analysis (Stability). If the slope is significantly different than zero for either then the Standard Deviation of Proficiency Assessment (s) is increased to minimize the impact.

3.2 THE Z SCORE

A "z-score" is calculated for each reported result as follows:

$$z - Score = \frac{(x - \bar{X})}{SDPA} \quad \text{where: } \begin{array}{l} x = \text{participant result;} \\ \bar{X} = \text{the Assigned Value;} \\ SDPA = \text{the Standard Deviation for Proficiency Assessment.} \end{array}$$

The assigned value \bar{X} is generally estimated from the inter-laboratory Robust mean after outliers due to obvious gross errors (e.g., reported in wrong units) have been removed.

The Standard Deviation for Proficiency Assessment, s, is determined as follows:

- The inter-laboratory Robust standard deviation ($Stdev_{rob}$) is calculated using reported results, obvious outliers removed;
- The regression equation standard deviation ($Stdev_{reg}$) is estimated from regression equations derived from previous studies (see PROC11- *PT Regression Equations* for details);
- The SDPA is the higher of $Stdev_{rob}$ and $Stdev_{reg}$;
- When a laboratory reports its detection limit, s will be estimated using a pooled variance procedure that uses both the inter-laboratory data and the reported detection limit.

3.2 COMPOSITE (PT) SCORE

Since each PT round involves four or two separate samples of distinct concentration for each test, it is necessary to calculate a composite PT score for each test to determine overall performance. The composite score is calculated by first averaging the absolute z-scores for the four results and then calculating a final score as $100 + (-15 \times \text{avg } |z|)$.

Acceptable PT Scores equal or exceed 70.

3.3 IDENTIFYING BIAS

The proficiency testing report provides flags for bias. These are determined using the re-scaled z-score procedure.

$$RSZ = \frac{\sum z}{\sqrt{N}} \quad \text{where } \begin{array}{l} z = \text{the z- score} \\ N = \text{the number of samples} \end{array}$$

Flags are assigned for each test group/parameter combination as follows:

$RSZ \geq -2$ and ≤ 2	no flag assigned
$RSZ > 2$	H (High)
$RSZ > 3$	VH (Very High)
$RSZ < -2$	L (LOW)
$RSZ < -3$	VL (Very Low)

3.4 DEVIATIONS FROM EVALUATION PROCEDURE

Other than changes to the Standard Deviation of Proficiency Assessment due to homogeneity or stability flags, any deviation from the published evaluation procedure is described on the cover page(s) of the final *PTC Proficiency Testing Report*.

4.0 PT Round Specific Data Summary

The following pages provide more detailed information about the PT round indicated in the cover page of this report than is found in the participant-specific PTC Proficiency Testing Report. The graphical representations and the statistical summaries are based upon the data after outliers have been removed.

4.1 SUMMARY STATISTICS

In addition to some of the statistics found in the customer reports, this table includes additional summary statistics such as Median, different measures of dispersion, the number of outliers removed, the number of results in the Questionable range ($|z|$ between 2 and 3) and the Unacceptable range ($z > 3$), and whether a data set was flagged for Homogeneity or Stability. This section also includes sorted scatter plots of the data for each sample.

4.2 z- SCORE PLOTS

The z -scores for each sample are ranked in increasing order and plotted. When the data is normally distributed, the plot should show a slight sigmoidal curve, with an equal number of points above zero as below. Each bar in these plots is colour-coded to indicate the analytical method used by the participant.

4.3 KERNEL DENSITY PLOTS

Kernel density plots are generated for each data set. These plots are a graphical way to represent the overall data distribution and are used to visualize possible deviations from normality and unimodality.

4.4 STABILITY AND HOMOGENEITY PLOTS

Plots of reported result against analysis date, and reported result against order of bottling are displayed, along with the regression line. These regression analyses are used to determine if the SDPA should be adjusted due to homogeneity or stability.

4.5 BOX-AND-WHISKER PLOTS

Box-and-Whisker plots are another way to display the distribution of the data. The box denotes the first and third quartile and the whiskers are the 5th and 95th percentile.

4.6 HISTORIC COMPARISON PLOT

The Historic Comparison Plot is a plot of robust mean against robust standard deviation for the previous ten PT rounds as well as the current PT round. This plot can be used to identify possible changes in the sample formulation.

ALUMINUM

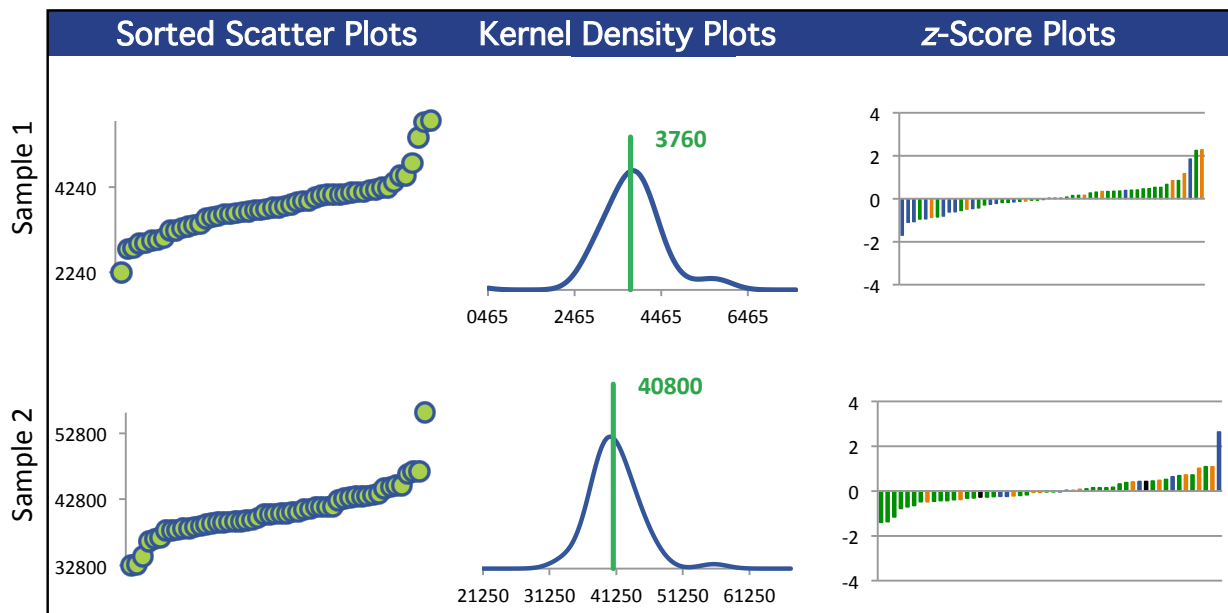
Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	52	52	53	53
Median $\mu\text{g/g}$	3770	40700	46600	27500
Robust Mean $\mu\text{g/g}$	3760	40800	46500	27600
U $\mu\text{g/g}$	100	529	637	383
Robust Standard Deviation $\mu\text{g/g}$	578	3050	3710	2230
Regression Standard Deviation $\mu\text{g/g}$	892	5740	6500	4010
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA) $\mu\text{g/g}$	892	5740	6500	4010
Outliers	2	2	1	1
$ z > 3.0$	0	0	1	0
$2 < z < 3$	2	1	0	2

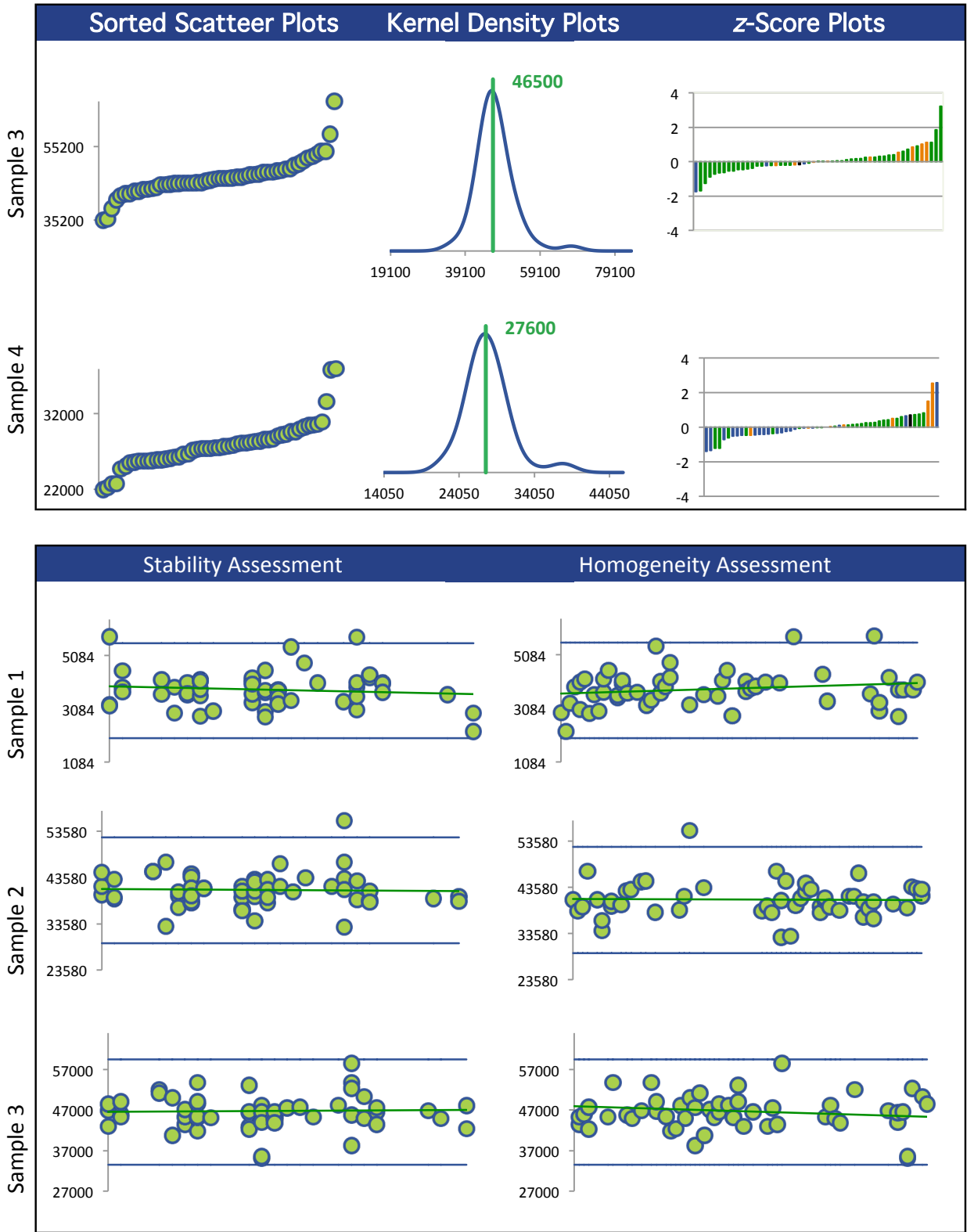
Methods Used

Method	C17-1	C17-2	C17-3	C17-4
ICP/OES (Blue)	20	20	21	21
ICP/MS (Red)	32	32	32	32

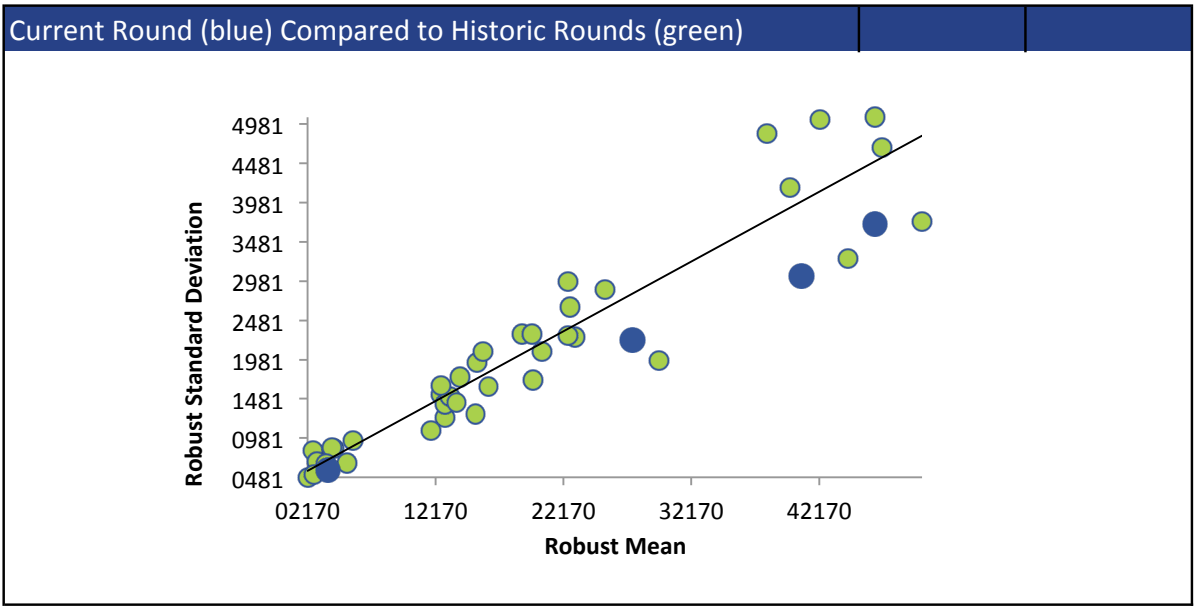
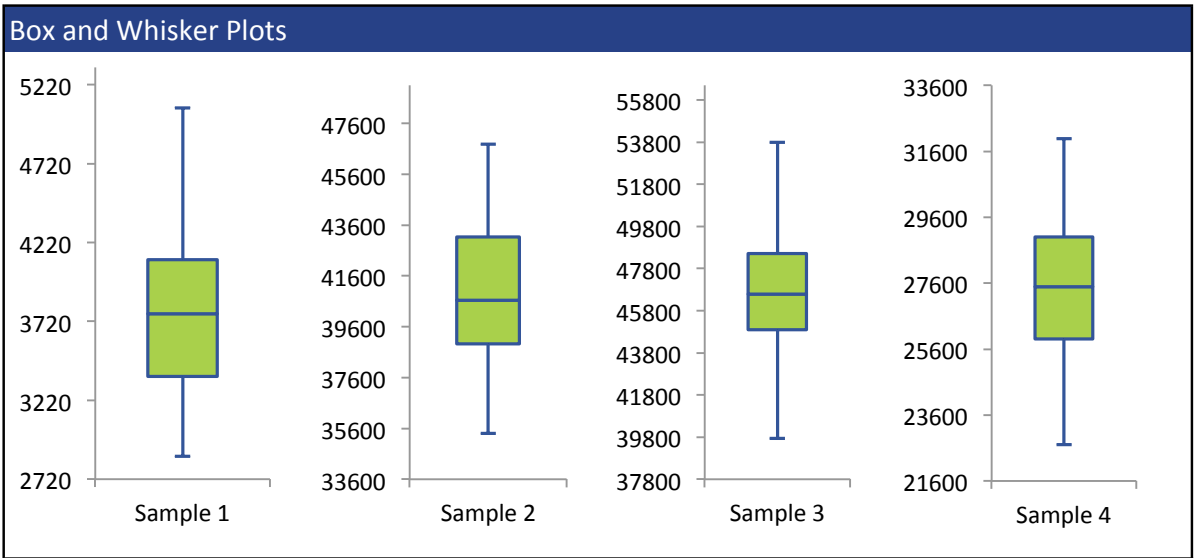
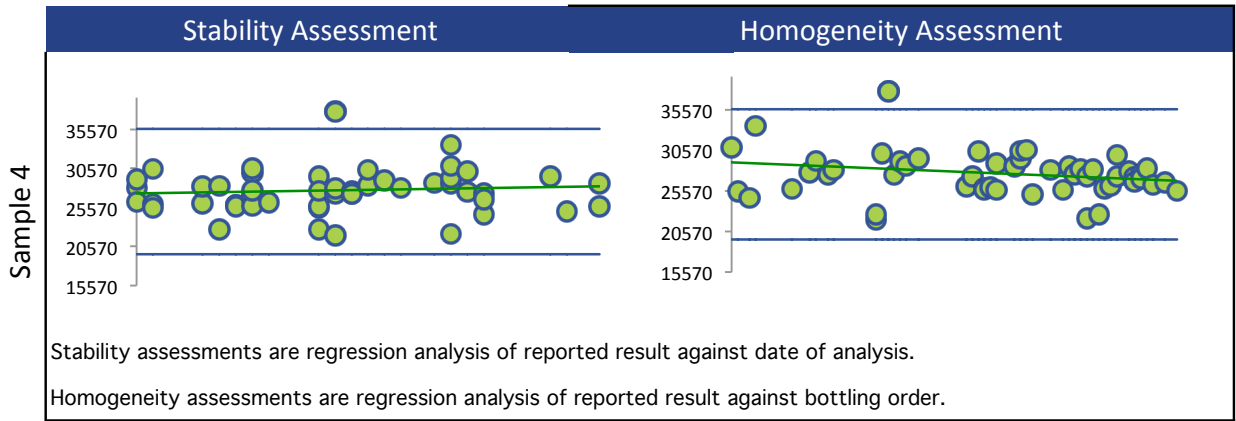
All summary stats and the plots below are based on the data excluding any flagged outliers



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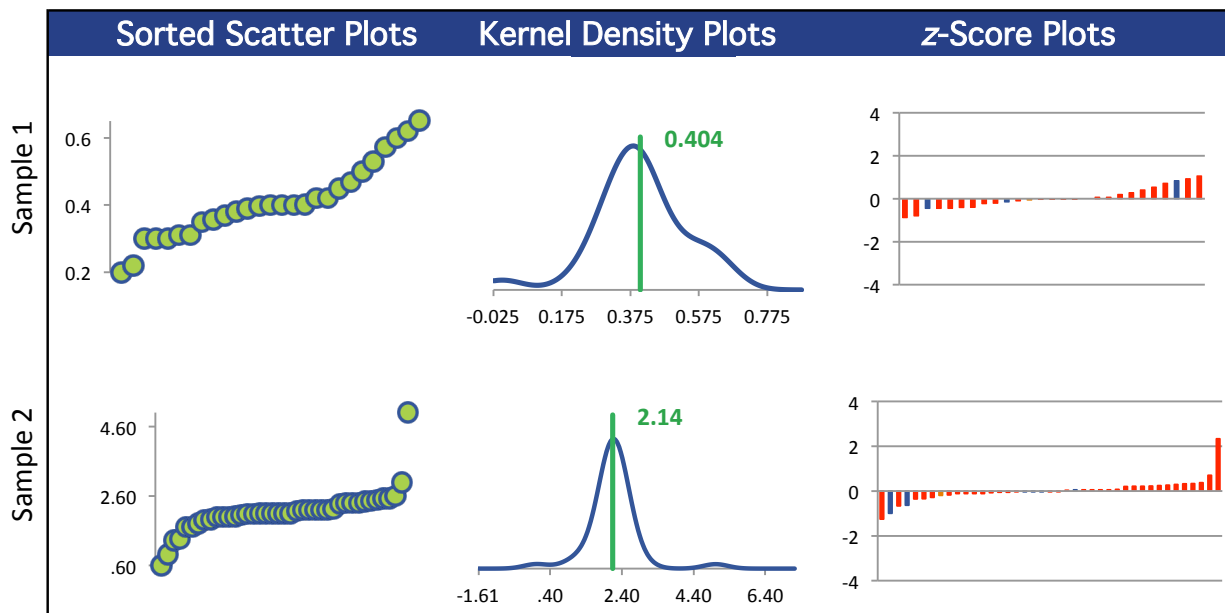
Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	27	41	42	40
Median $\mu\text{g/g}$	0.400	2.10	2.28	1.55
Robust Mean $\mu\text{g/g}$	0.404	2.14	2.29	1.56
U $\mu\text{g/g}$	0.0274	0.0625	0.0816	0.0593
Robust Standard Deviation $\mu\text{g/g}$	0.114	0.320	0.423	0.300
Regression Standard Deviation $\mu\text{g/g}$	0.232	1.23	1.31	0.891
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA) $\mu\text{g/g}$	0.232	1.23	1.31	0.891
Outliers	1	0	0	0
$ z > 3.0$	0	0	0	0
$2 < z < 3$	0	1	0	1

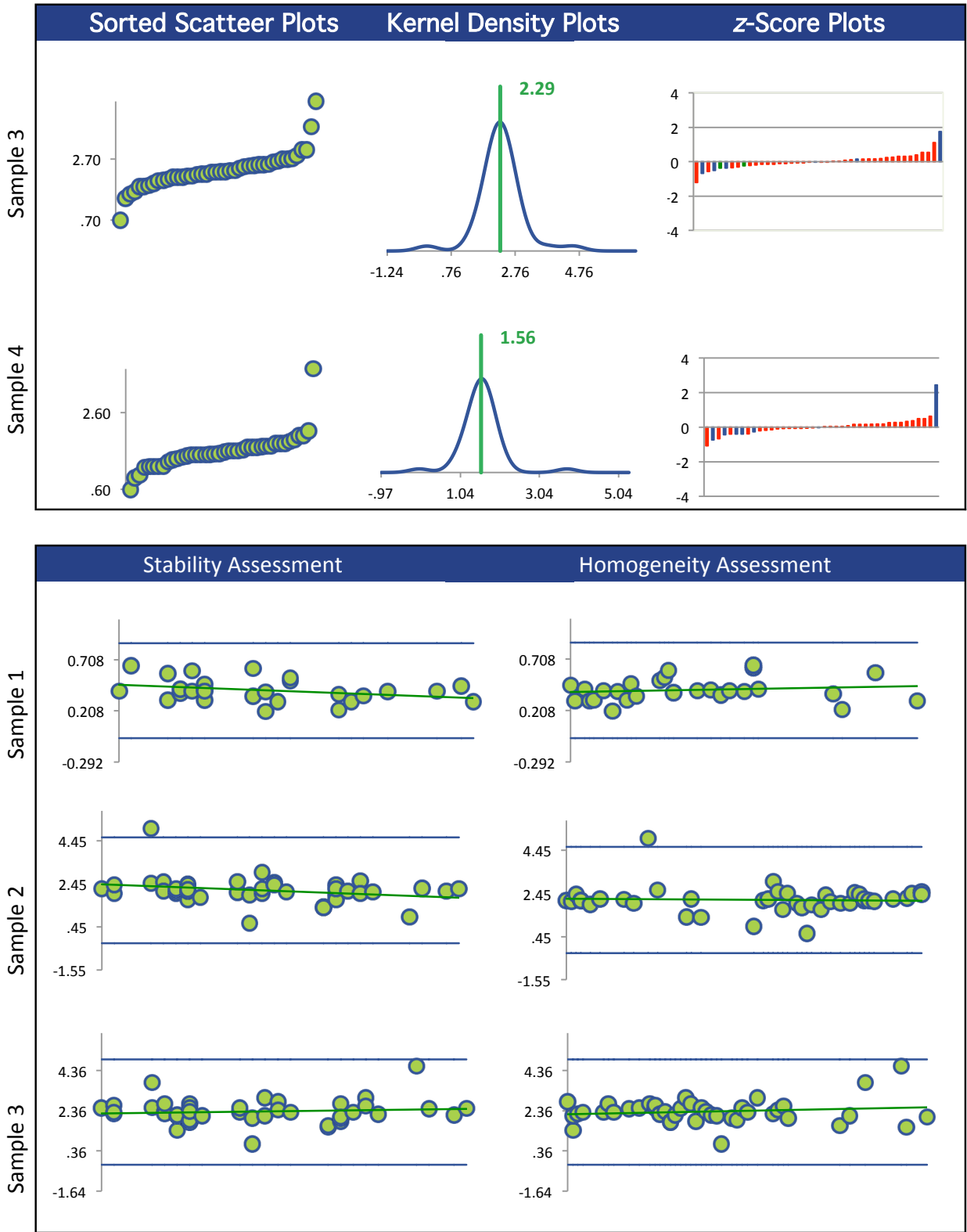
Methods Used

Method	C17-1	C17-2	C17-3	C17-4
ICP/MS (Blue)	23	34	34	33
ICP/OES (Red)	3	5	6	5
HYDRIDE AA (Green)	1	1	1	1
HYDRIDE ICP (Orange)	0	1	1	1

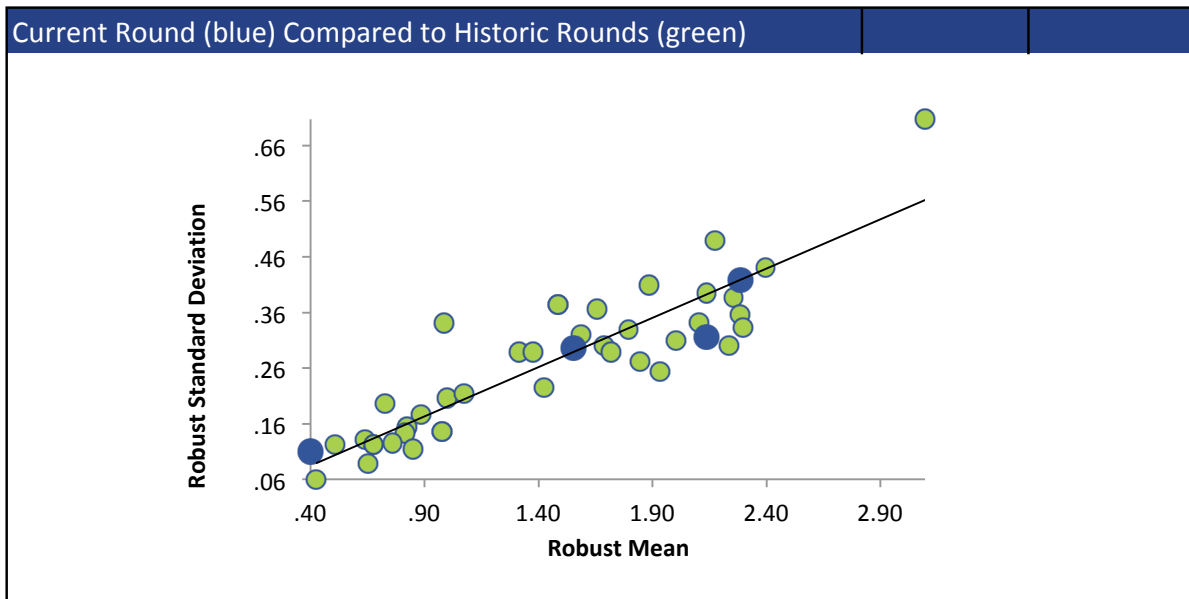
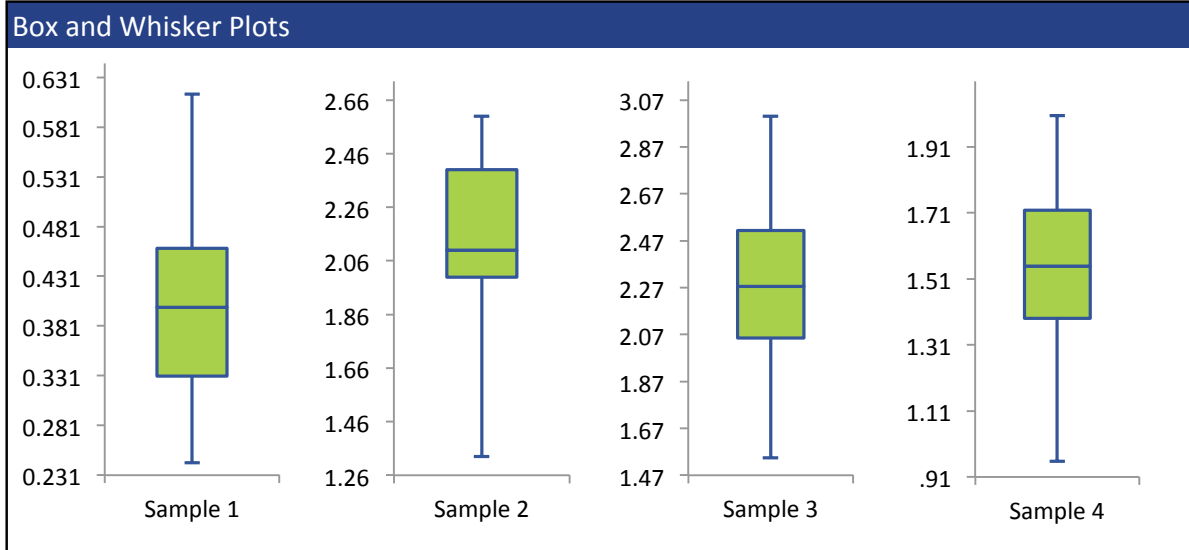
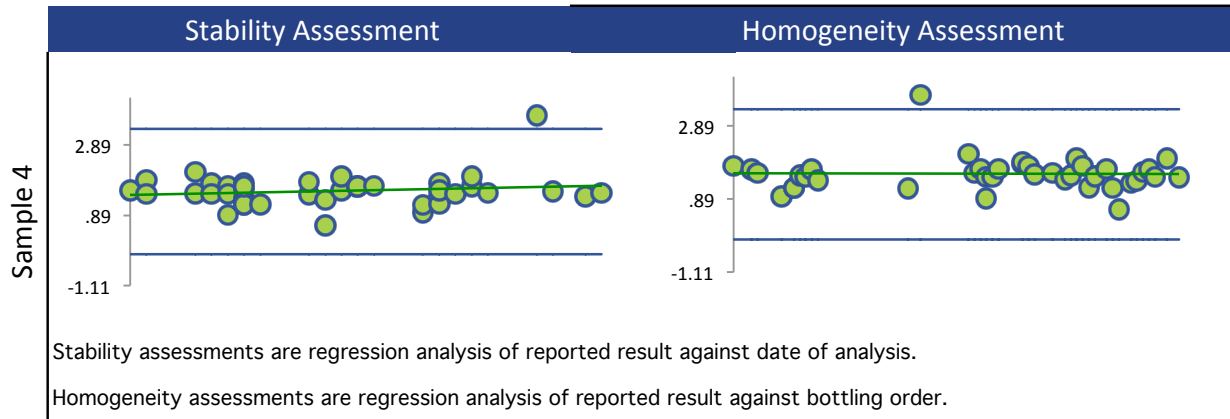
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ARSENIC

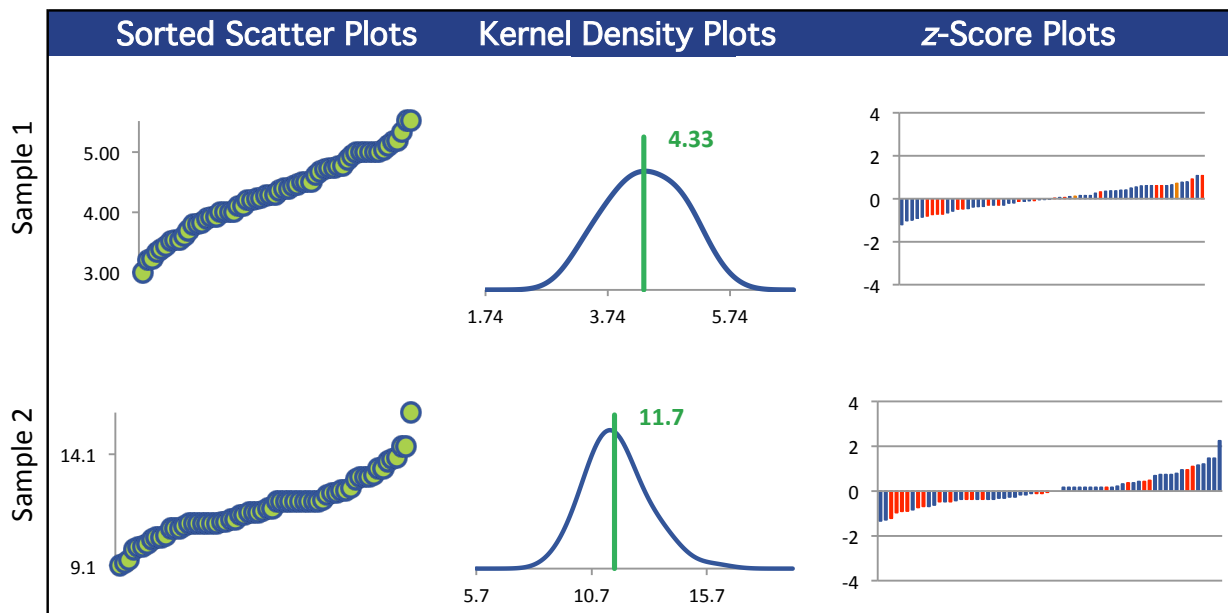
Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	60	64	64	62
Median $\mu\text{g/g}$	4.33	11.7	12.5	6.31
Robust Mean $\mu\text{g/g}$	4.33	11.7	12.7	6.50
U $\mu\text{g/g}$	0.109	0.202	0.275	0.153
Robust Standard Deviation $\mu\text{g/g}$	0.673	1.29	1.76	0.964
Regression Standard Deviation $\mu\text{g/g}$	1.10	1.92	2.03	1.34
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA) $\mu\text{g/g}$	1.10	1.92	2.03	1.34
Outliers	0	0	0	0
$ z > 3.0$	0	0	2	0
$2 < z < 3$	0	1	0	0

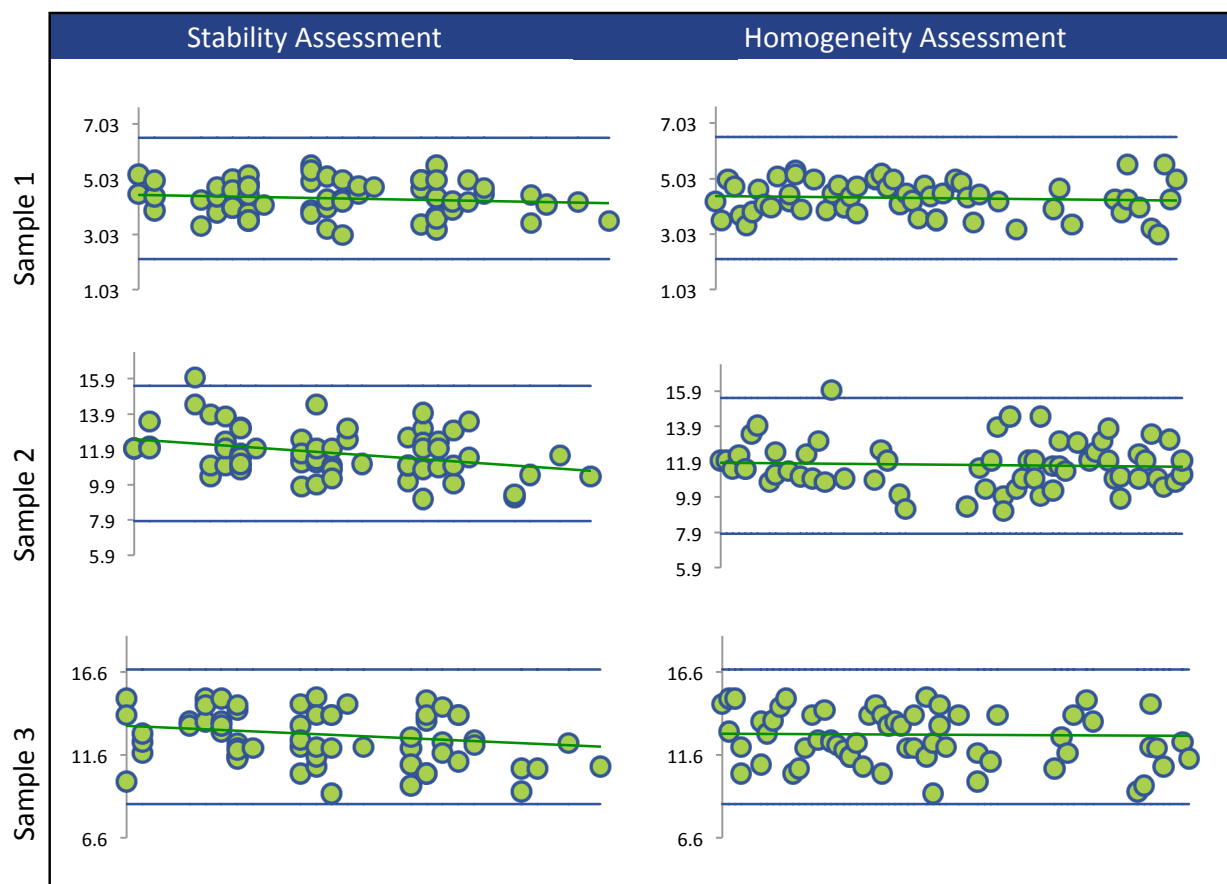
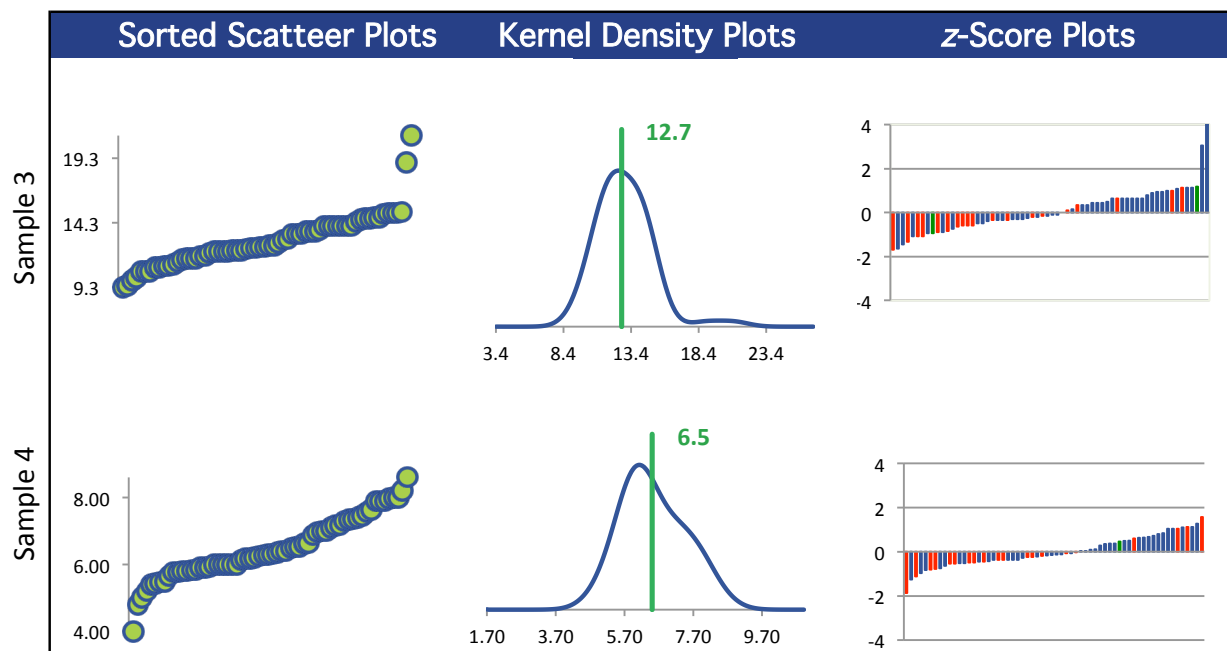
Methods Used

Method	C17-1	C17-2	C17-3	C17-4
ICP/MS (Blue)	41	41	41	41
PYROLYTIC AA (Red)	1	1	1	1
ICP/OES (Green)	15	19	19	17
HYDRIDE ICP (Orange)	1	1	1	1
HYDRIDE AA (Black)	2	2	2	2

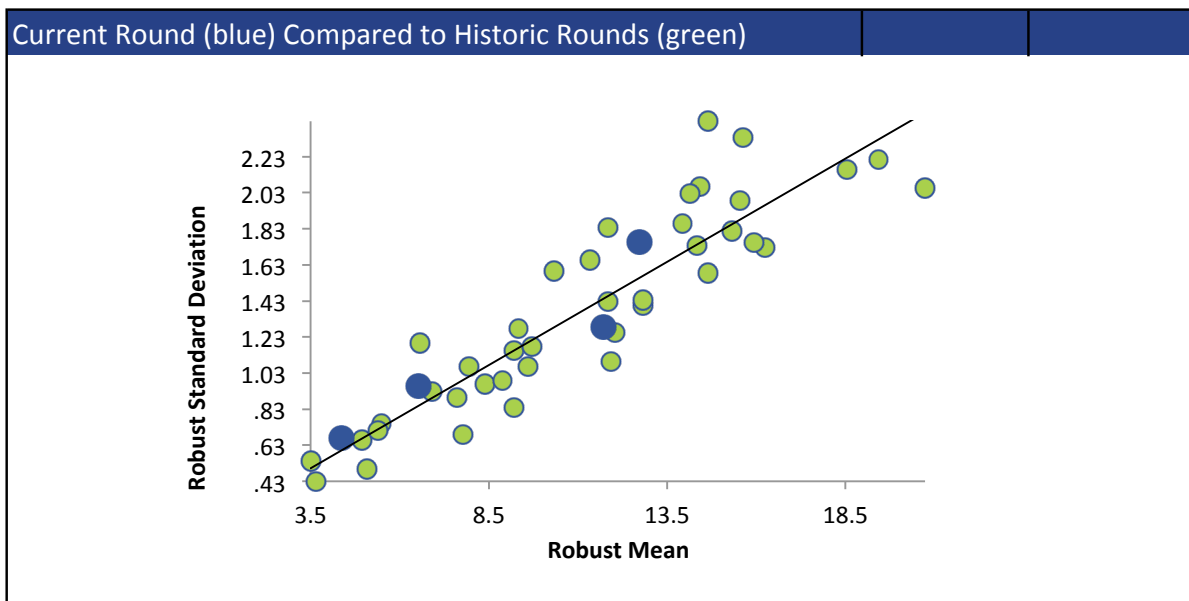
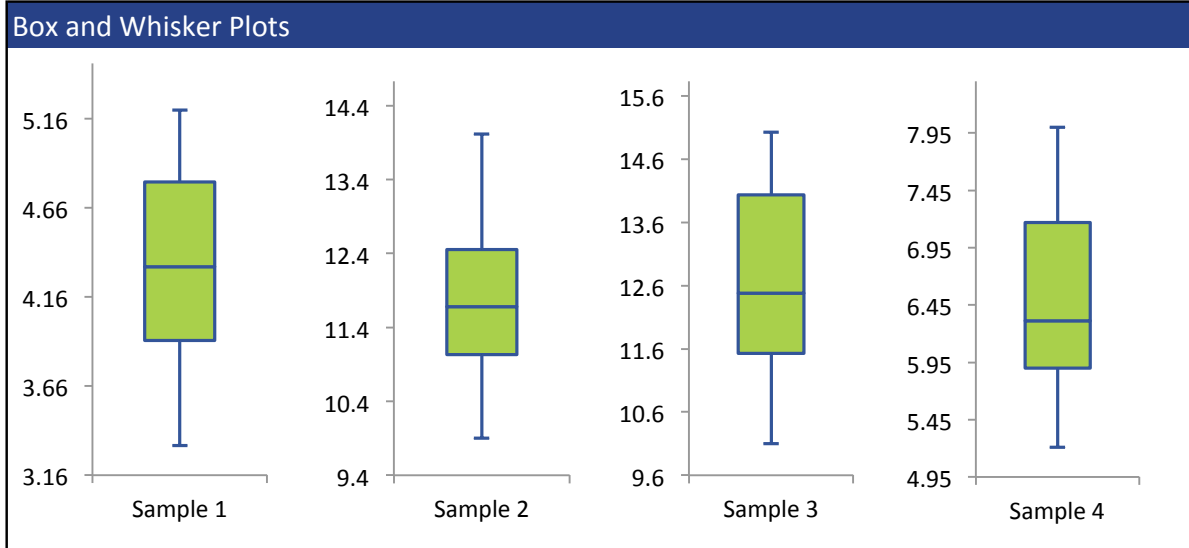
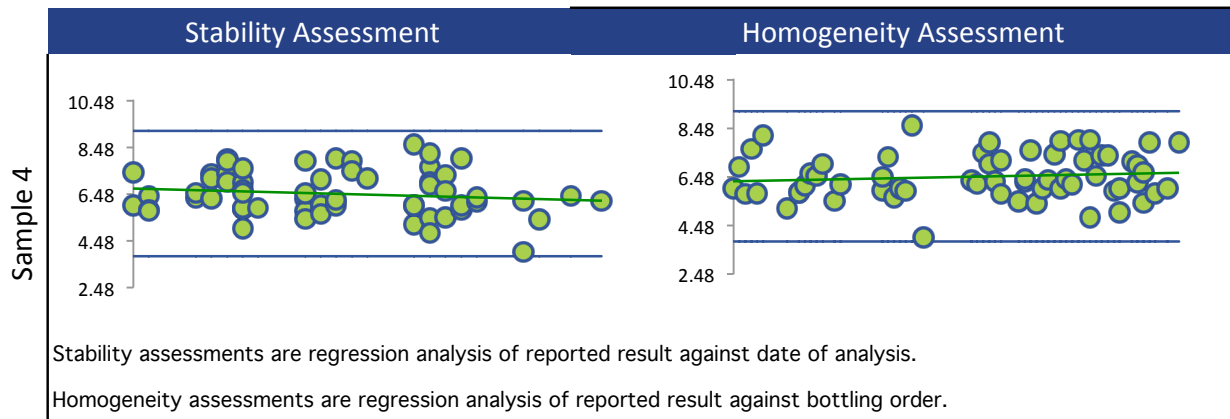
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BARIUM

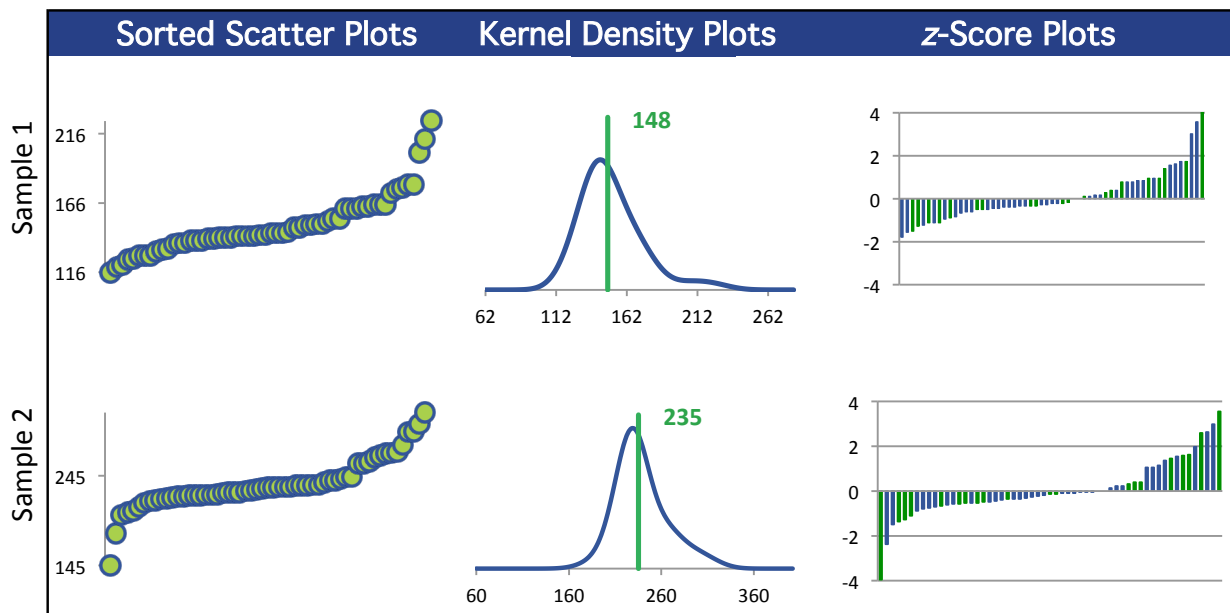
Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	57	57	57	57
Median $\mu\text{g/g}$	144	232	297	227
Robust Mean $\mu\text{g/g}$	148	235	299	225
U $\mu\text{g/g}$	2.96	3.77	3.86	3.28
Robust Standard Deviation $\mu\text{g/g}$	17.9	22.8	23.3	19.8
Regression Standard Deviation $\mu\text{g/g}$	12.3	18.3	22.8	17.7
Stability Flag			Stability	
Homogeneity Flag				
Standard Deviation Used (SDPA) $\mu\text{g/g}$	17.9	22.8	29.6	19.8
Outliers	0	0	0	0
$ z > 3.0$	3	2	0	1
$2 < z < 3$	0	4	2	2

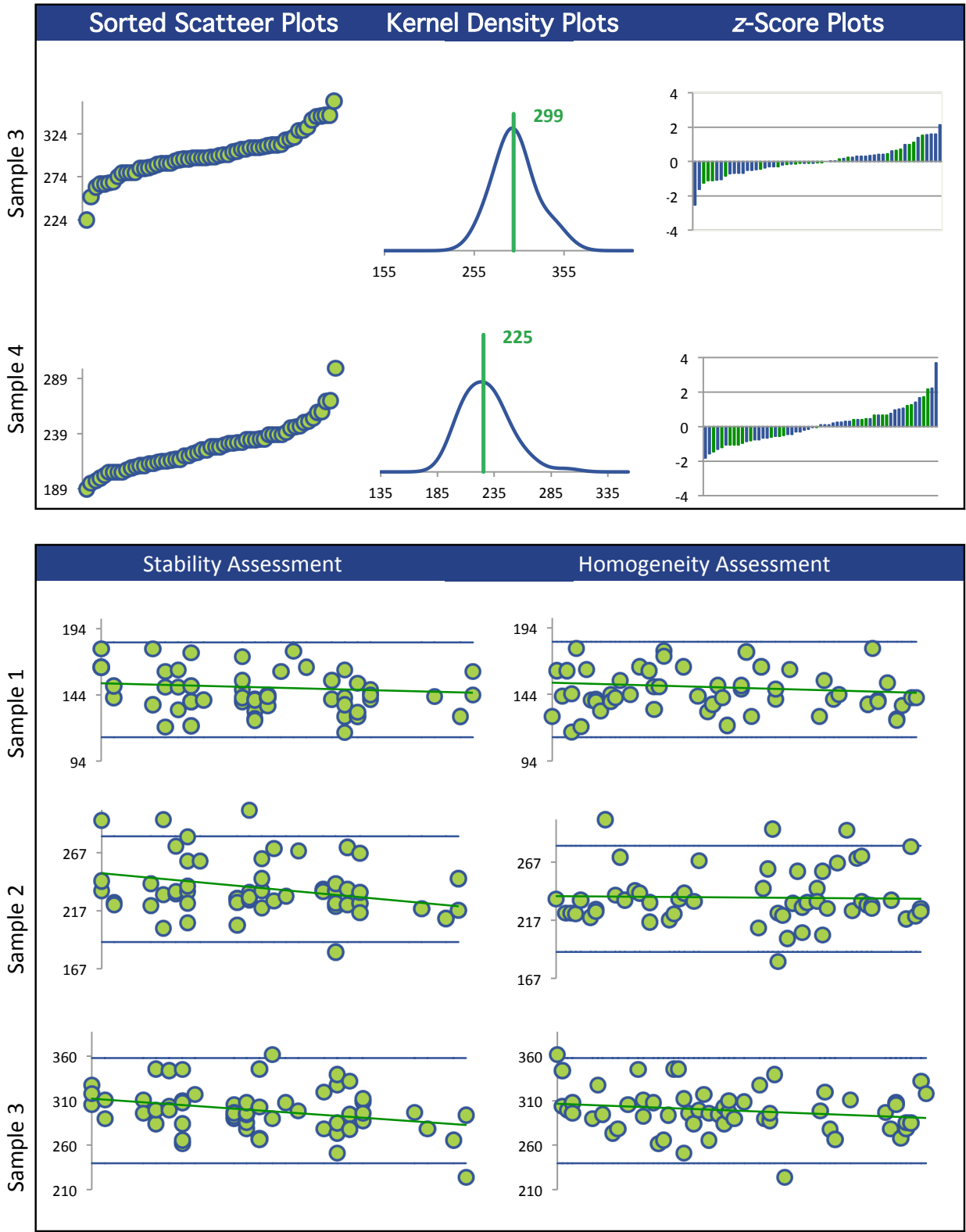
Methods Used

Method	C17-1	C17-2	C17-3	C17-4
ICP/MS (Blue)	36	36	36	36
ICP/OES (Red)	21	21	21	21

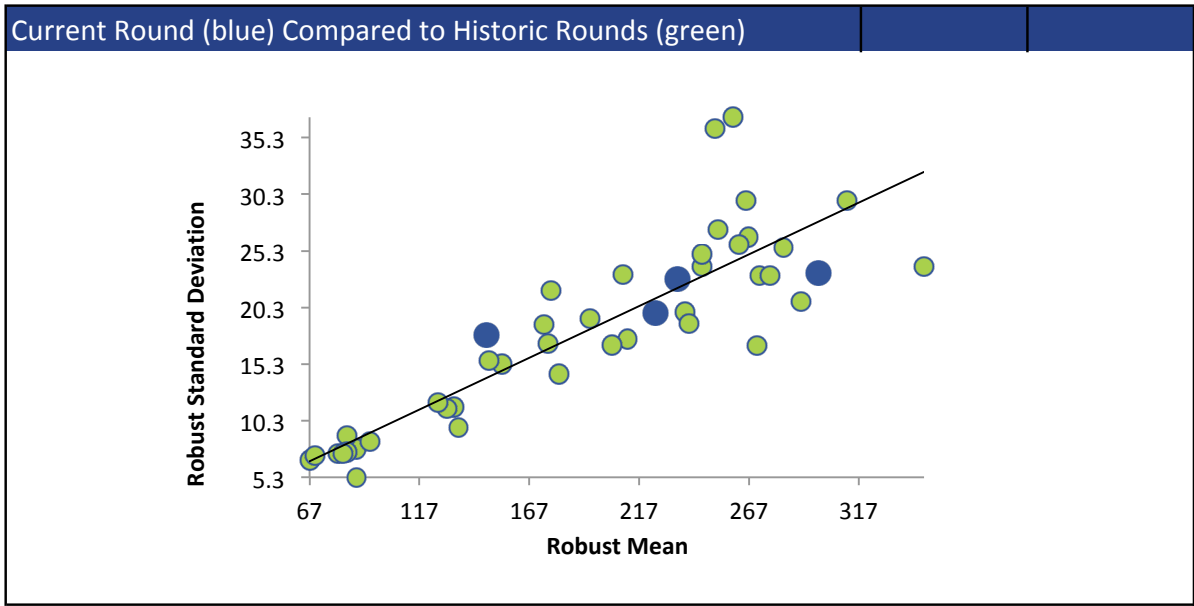
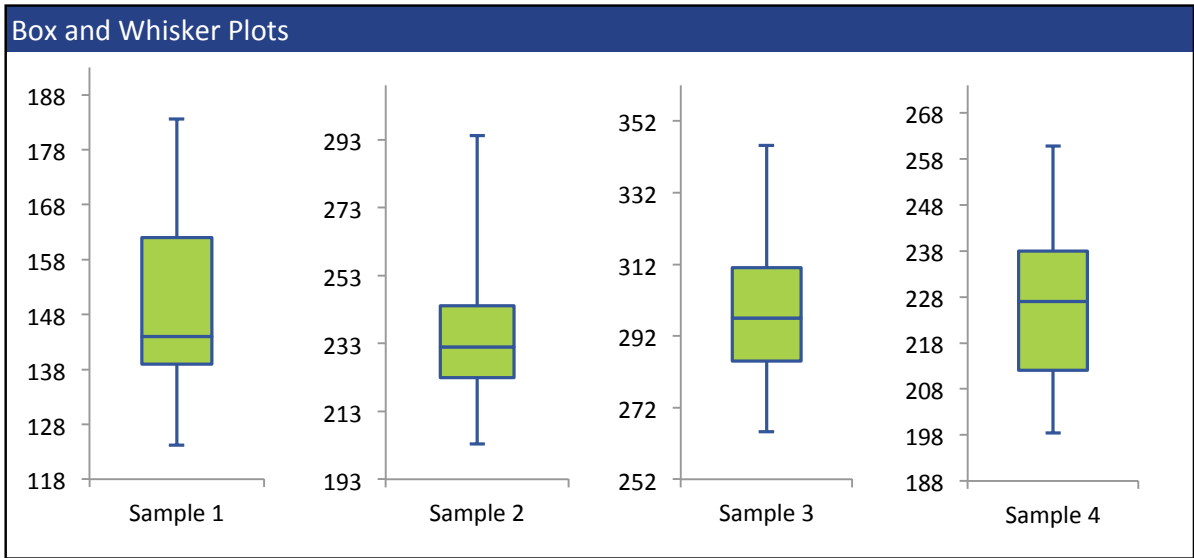
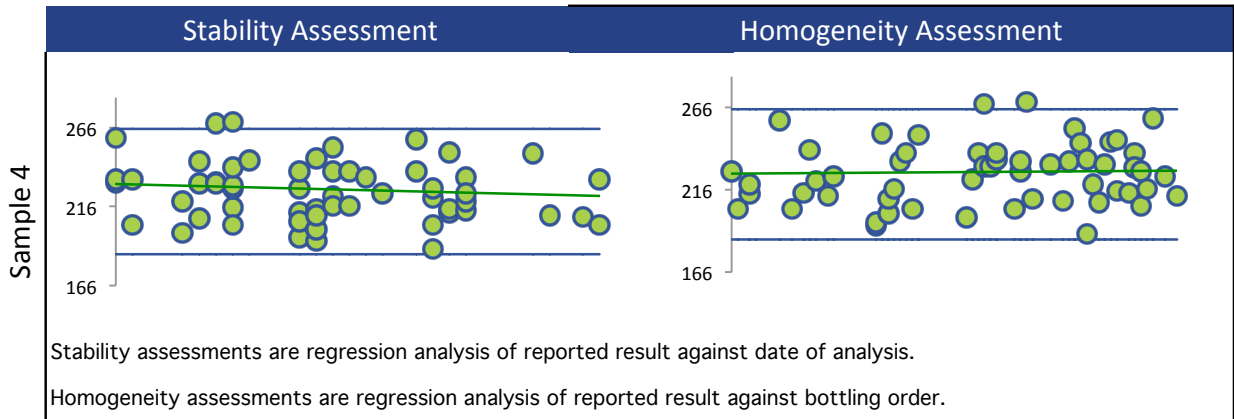
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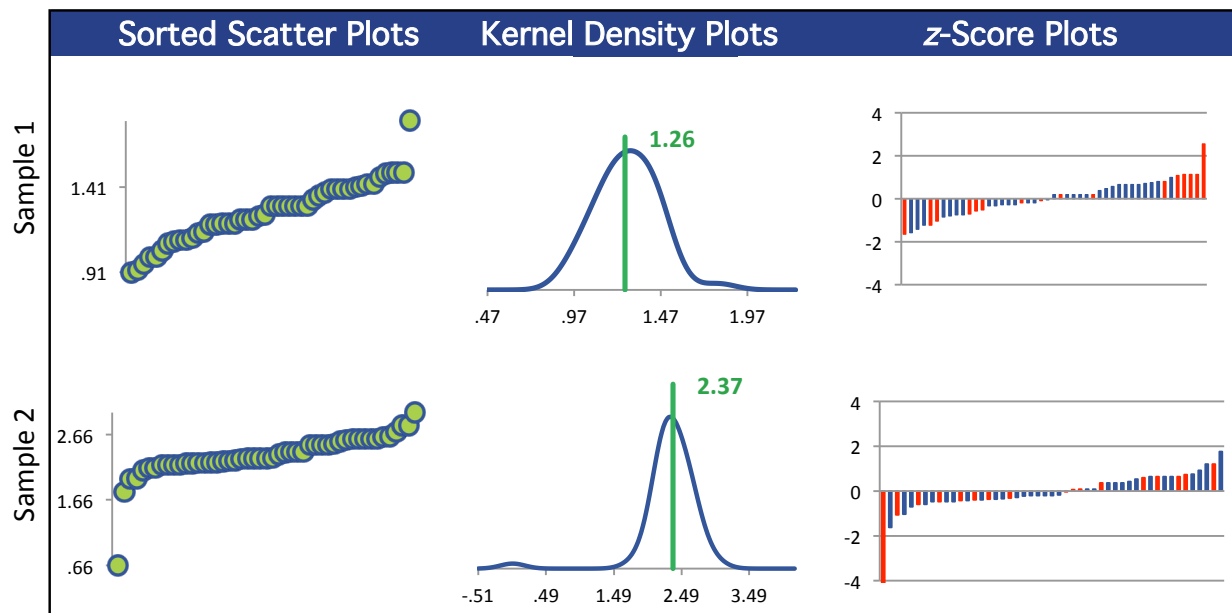
Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	47	49	50	49
Median $\mu\text{g/g}$	1.30	2.30	2.21	1.91
Robust Mean $\mu\text{g/g}$	1.26	2.37	2.24	1.94
U $\mu\text{g/g}$	0.0328	0.0411	0.0417	0.0325
Robust Standard Deviation $\mu\text{g/g}$	0.180	0.230	0.236	0.182
Regression Standard Deviation $\mu\text{g/g}$	0.212	0.358	0.340	0.301
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA) $\mu\text{g/g}$	0.212	0.358	0.340	0.301
Outliers	2	1	0	0
$ z > 3.0$	0	1	0	0
$2 < z < 3$	1	0	4	2

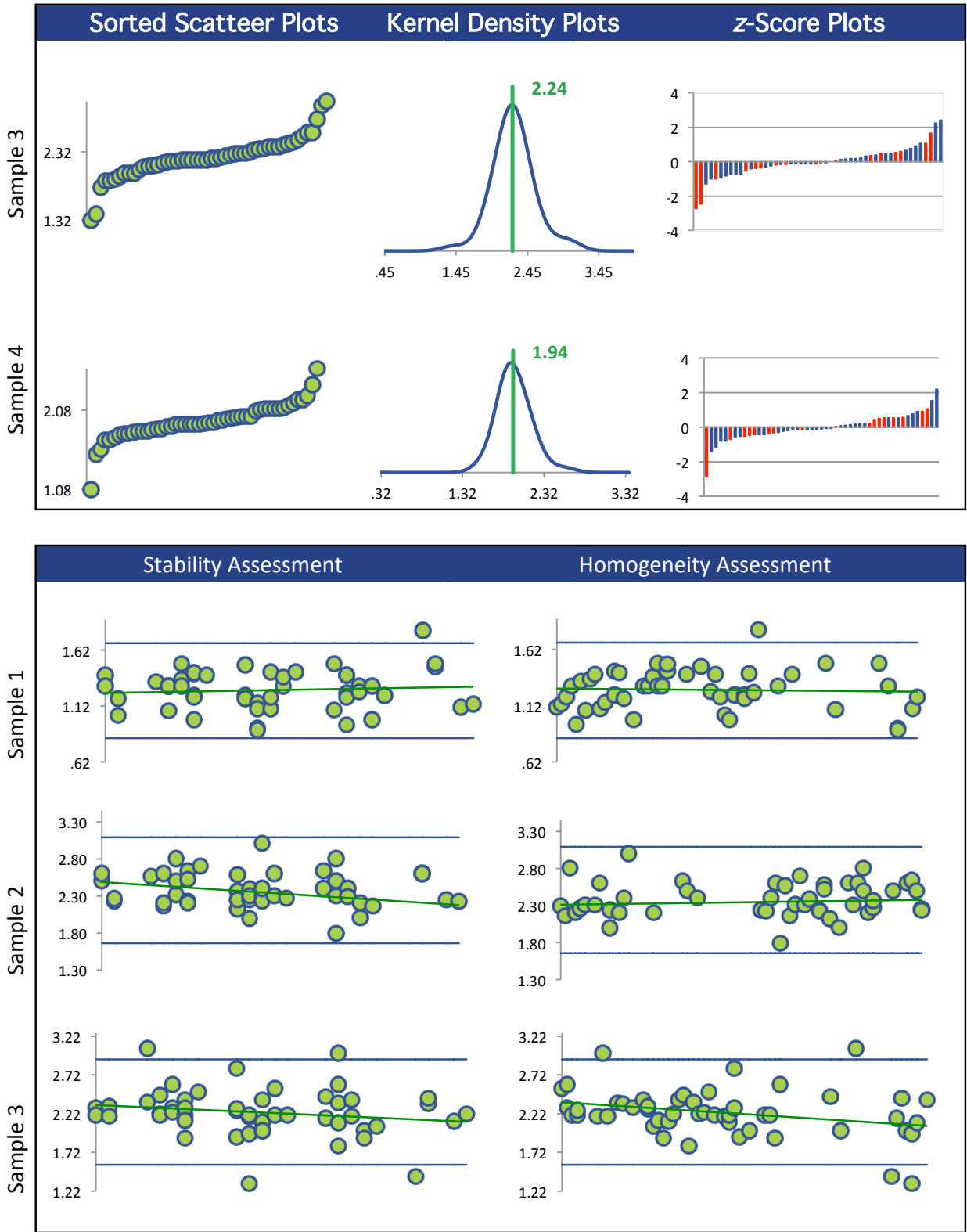
Methods Used

Method	C17-1	C17-2	C17-3	C17-4
ICP/OES (Blue)	16	17	17	17
ICP/MS (Red)	31	32	33	32

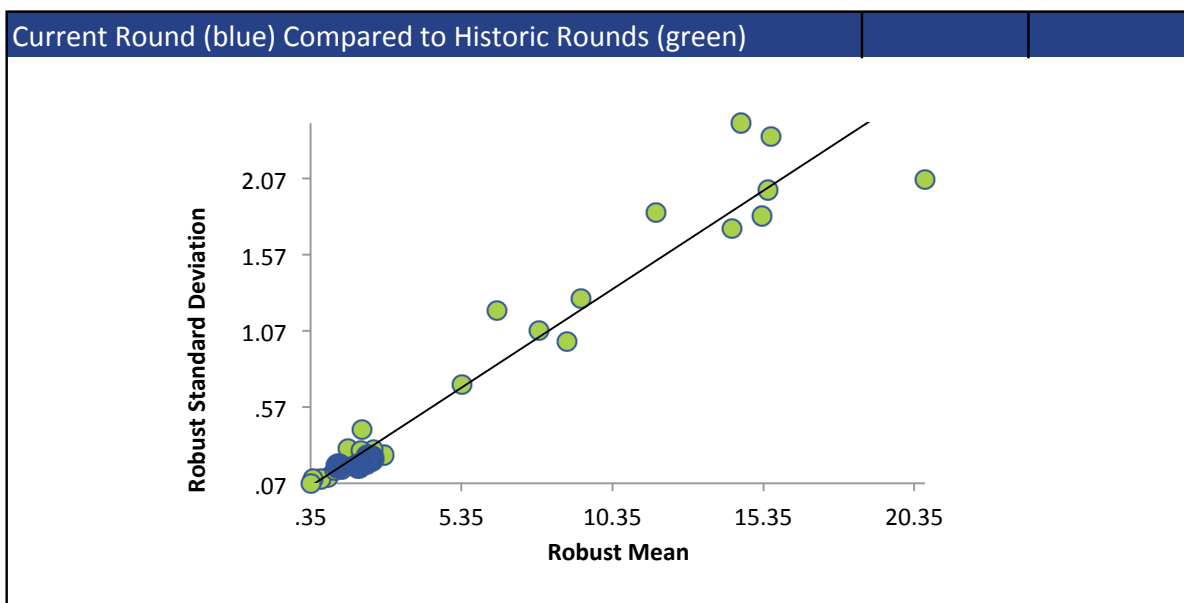
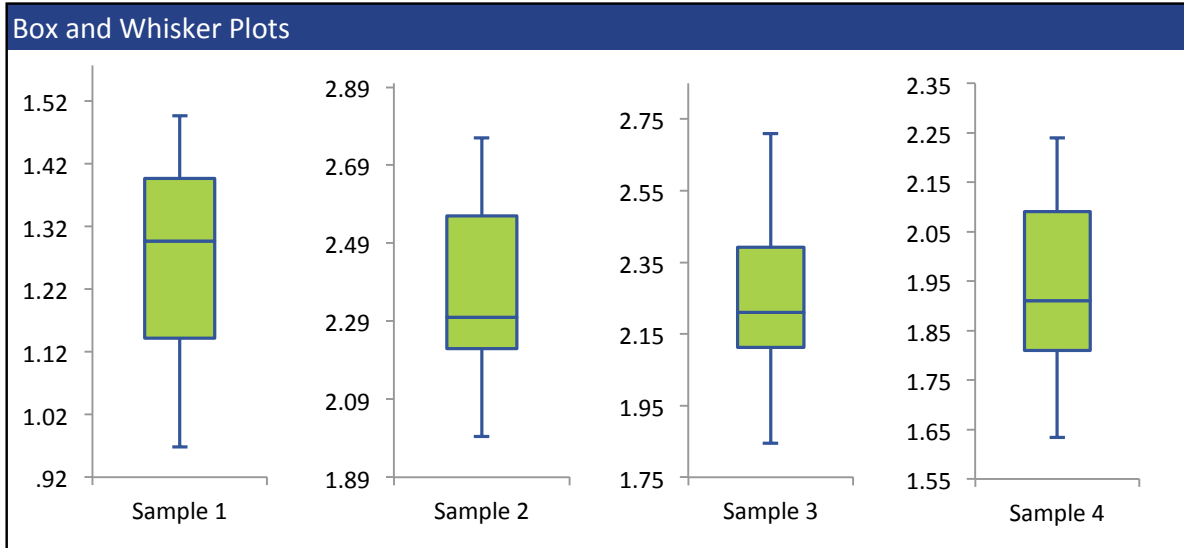
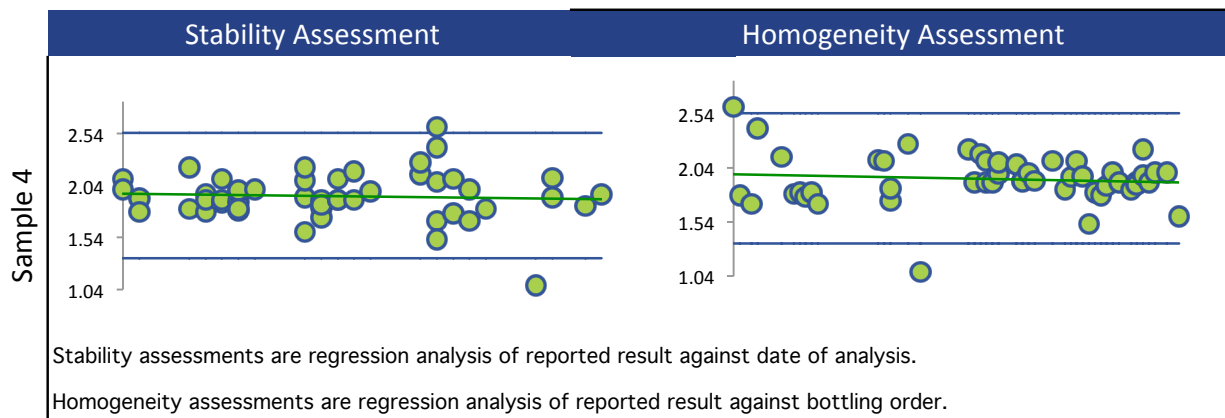
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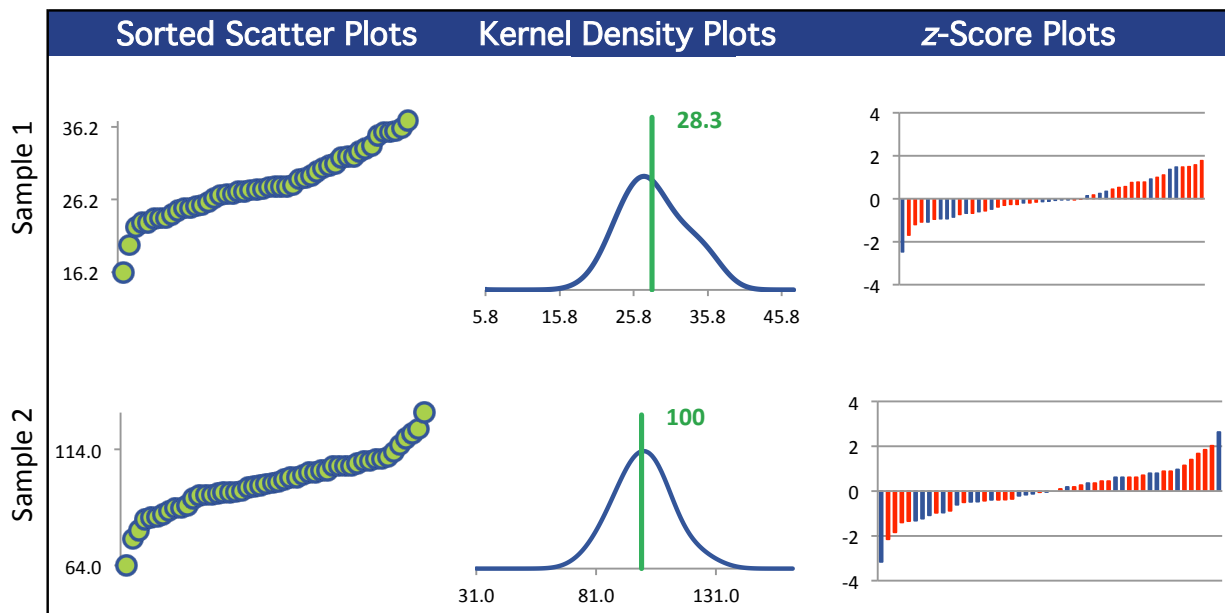
Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	48	50	51	51
Median $\mu\text{g/g}$	27.8	99.8	112	107
Robust Mean $\mu\text{g/g}$	28.3	100	112	106
U $\mu\text{g/g}$	0.821	2.02	2.35	1.84
Robust Standard Deviation $\mu\text{g/g}$	4.55	11.4	13.4	10.5
Regression Standard Deviation $\mu\text{g/g}$	3.78	11.3	12.5	11.9
Stability Flag	Stability			
Homogeneity Flag				
Standard Deviation Used (SDPA) $\mu\text{g/g}$	4.88	11.4	13.4	11.9
Outliers	1	1	0	0
$ z > 3.0$	0	1	1	2
$2 < z < 3$	1	3	3	2

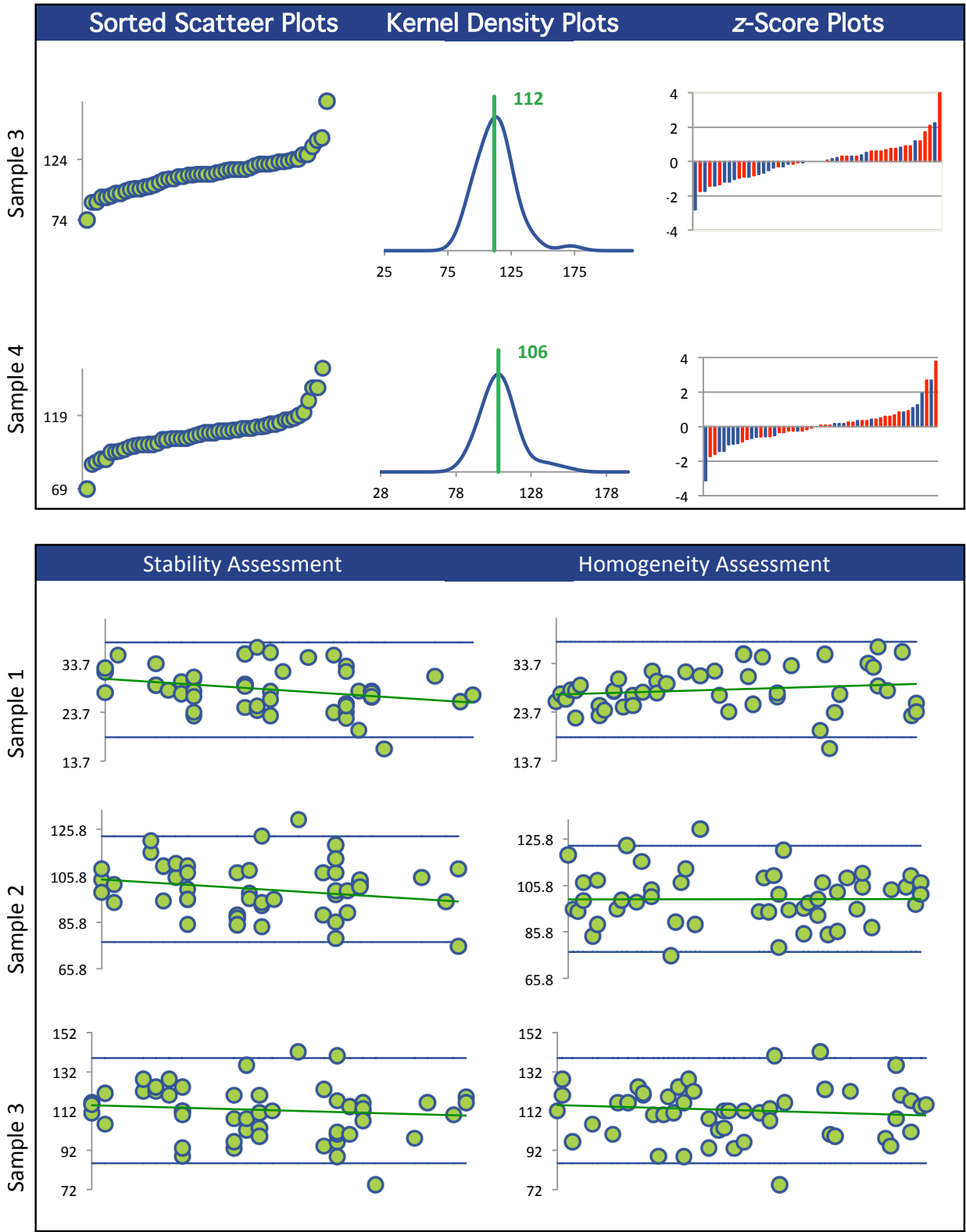
Methods Used

Method	C17-1	C17-2	C17-3	C17-4
ICP/OES (Blue)	20	21	22	22
ICP/MS (Red)	28	29	29	29

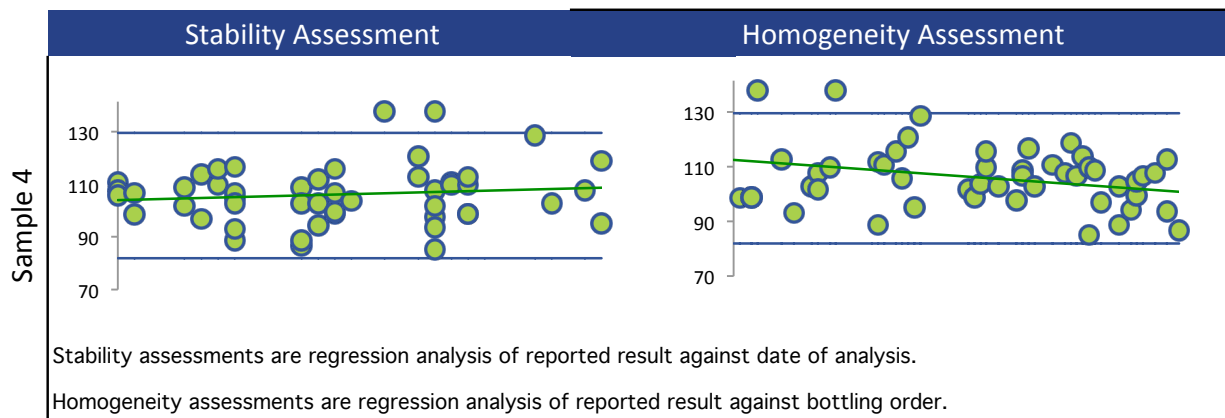
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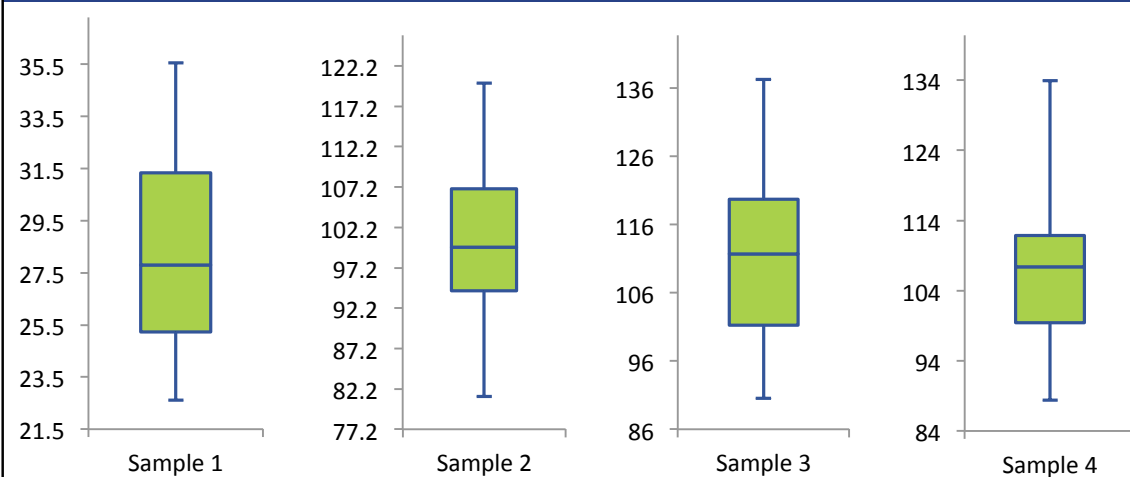
BORON



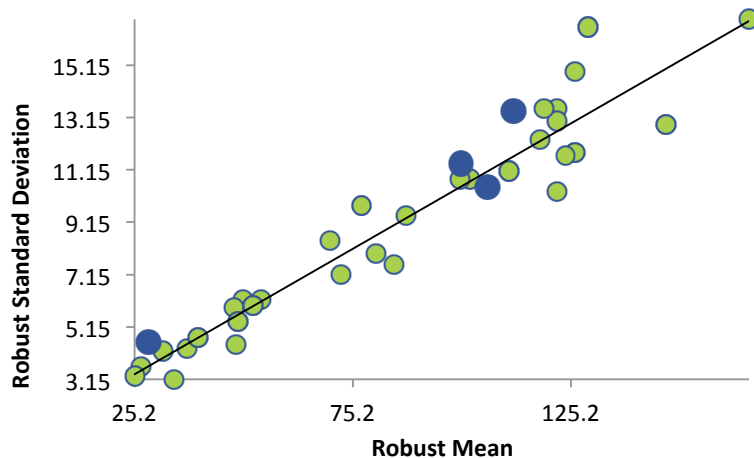
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Box and Whisker Plots



Current Round (blue) Compared to Historic Rounds (green)



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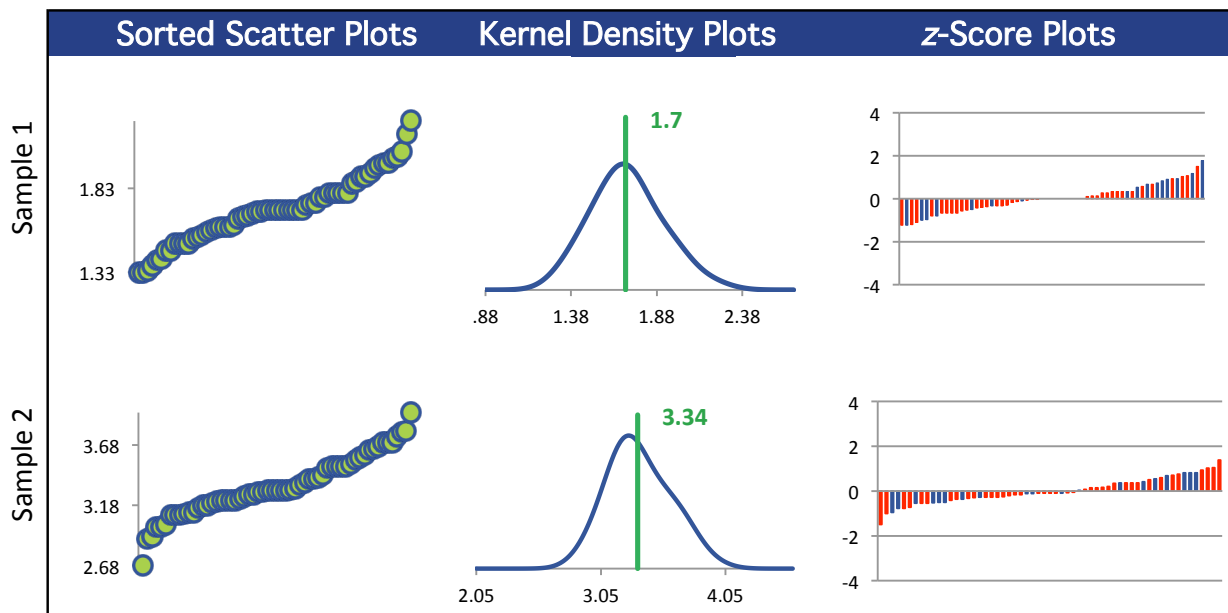
Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	61	59	61	61
Median $\mu\text{g/g}$	1.70	3.30	3.51	1.38
Robust Mean $\mu\text{g/g}$	1.70	3.34	3.56	1.40
U $\mu\text{g/g}$	0.0334	0.0415	0.0538	0.0325
Robust Standard Deviation $\mu\text{g/g}$	0.209	0.255	0.336	0.203
Regression Standard Deviation $\mu\text{g/g}$	0.300	0.442	0.462	0.274
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA) $\mu\text{g/g}$	0.300	0.442	0.462	0.274
Outliers	0	2	0	0
$ z > 3.0$	0	0	0	1
$2 < z < 3$	0	0	1	2

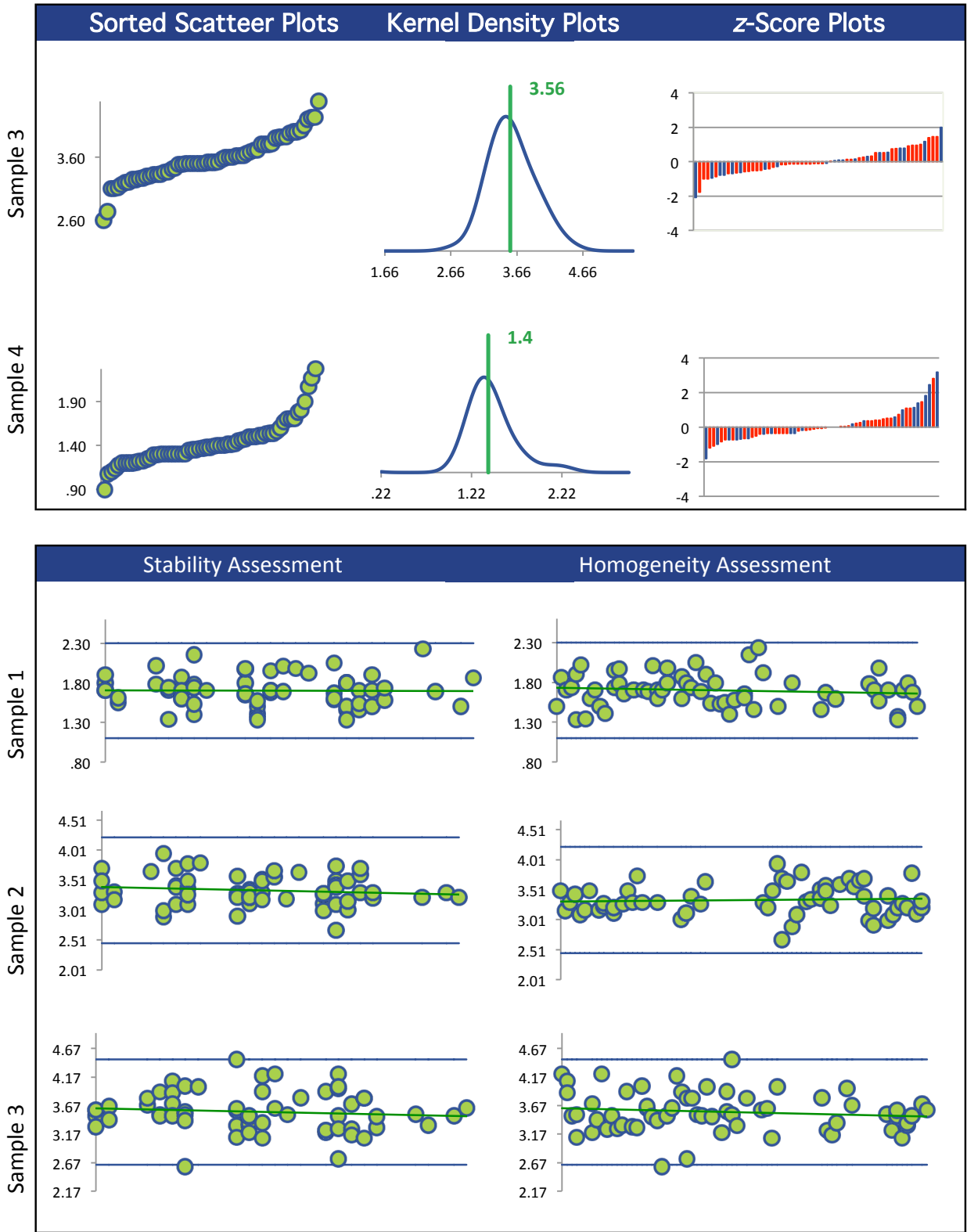
Methods Used

Method	C17-1	C17-2	C17-3	C17-4
ICP/MS (Blue)	41	40	41	41
ICP/OES (Red)	20	19	20	20

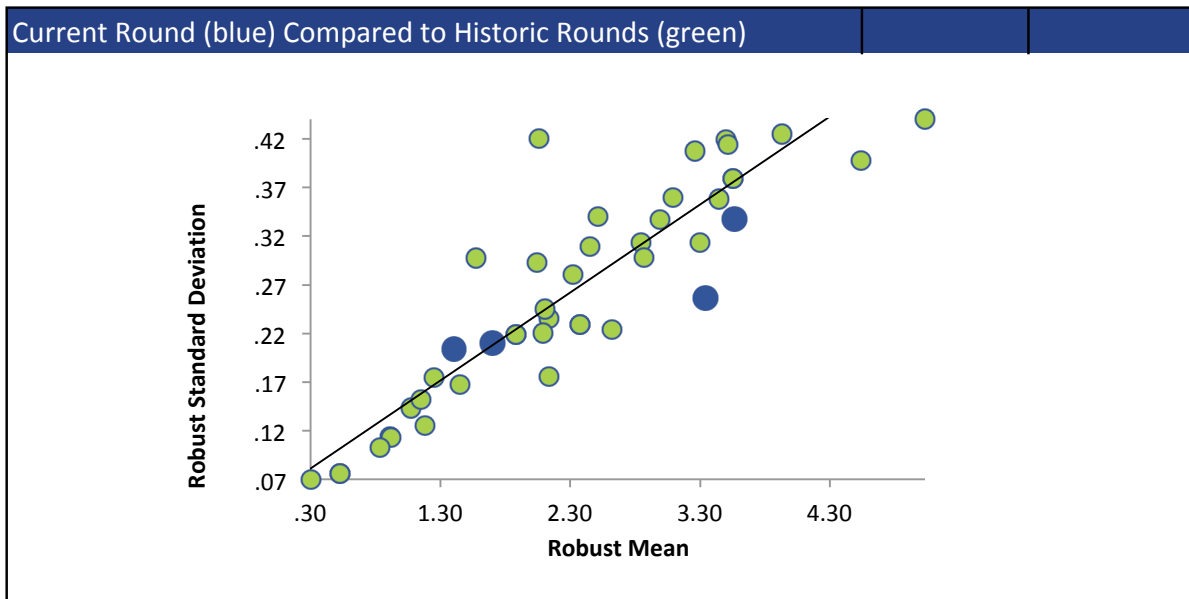
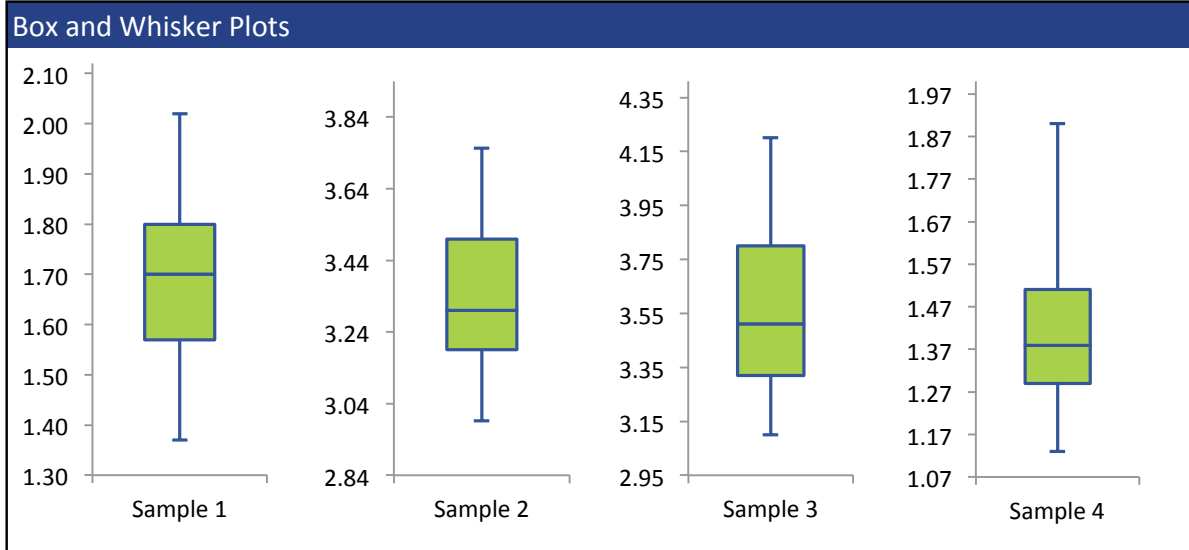
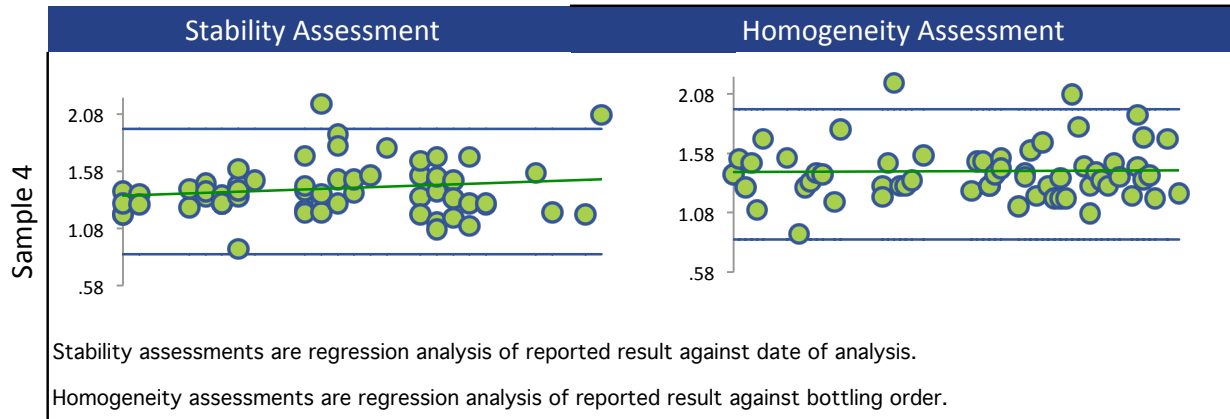
All summary stats and the plots below are based on the data excluding any flagged outliers



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CHROMIUM

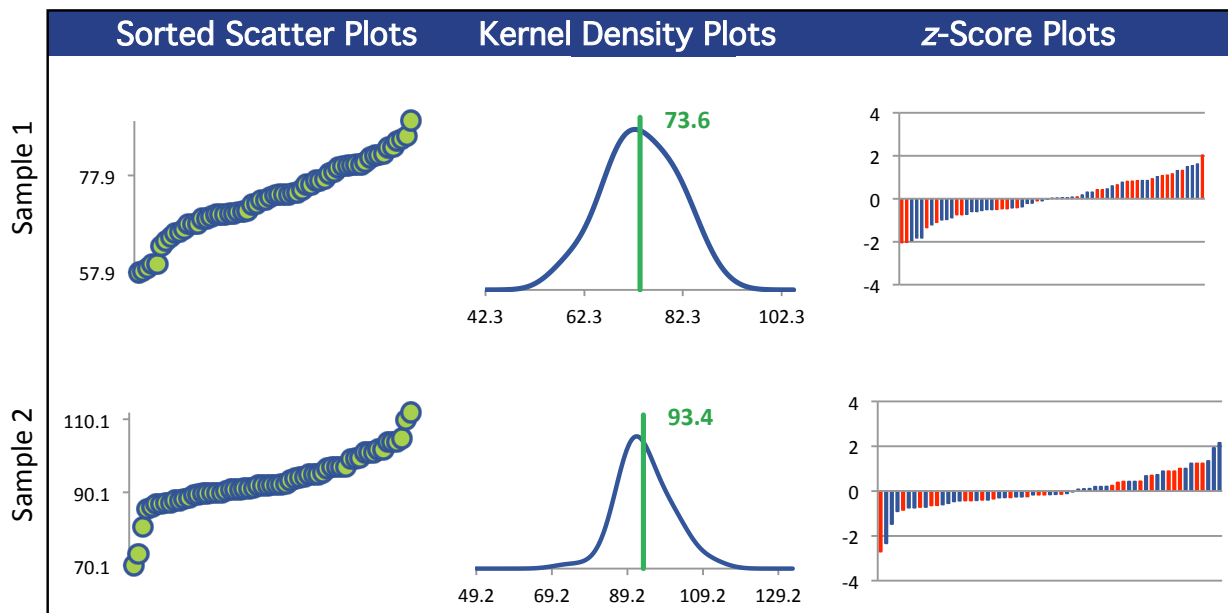
Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	61	61	61	61
Median $\mu\text{g/g}$	73.8	92.1	88.9	76.6
Robust Mean $\mu\text{g/g}$	73.6	93.4	90.0	77.7
U $\mu\text{g/g}$	1.22	0.999	1.11	1.03
Robust Standard Deviation $\mu\text{g/g}$	7.65	6.24	6.94	6.43
Regression Standard Deviation $\mu\text{g/g}$	7.13	8.64	8.38	7.44
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA) $\mu\text{g/g}$	7.65	8.64	8.38	7.44
Outliers	0	0	0	0
$ z > 3.0$	0	0	0	1
$2 < z < 3$	3	3	3	3

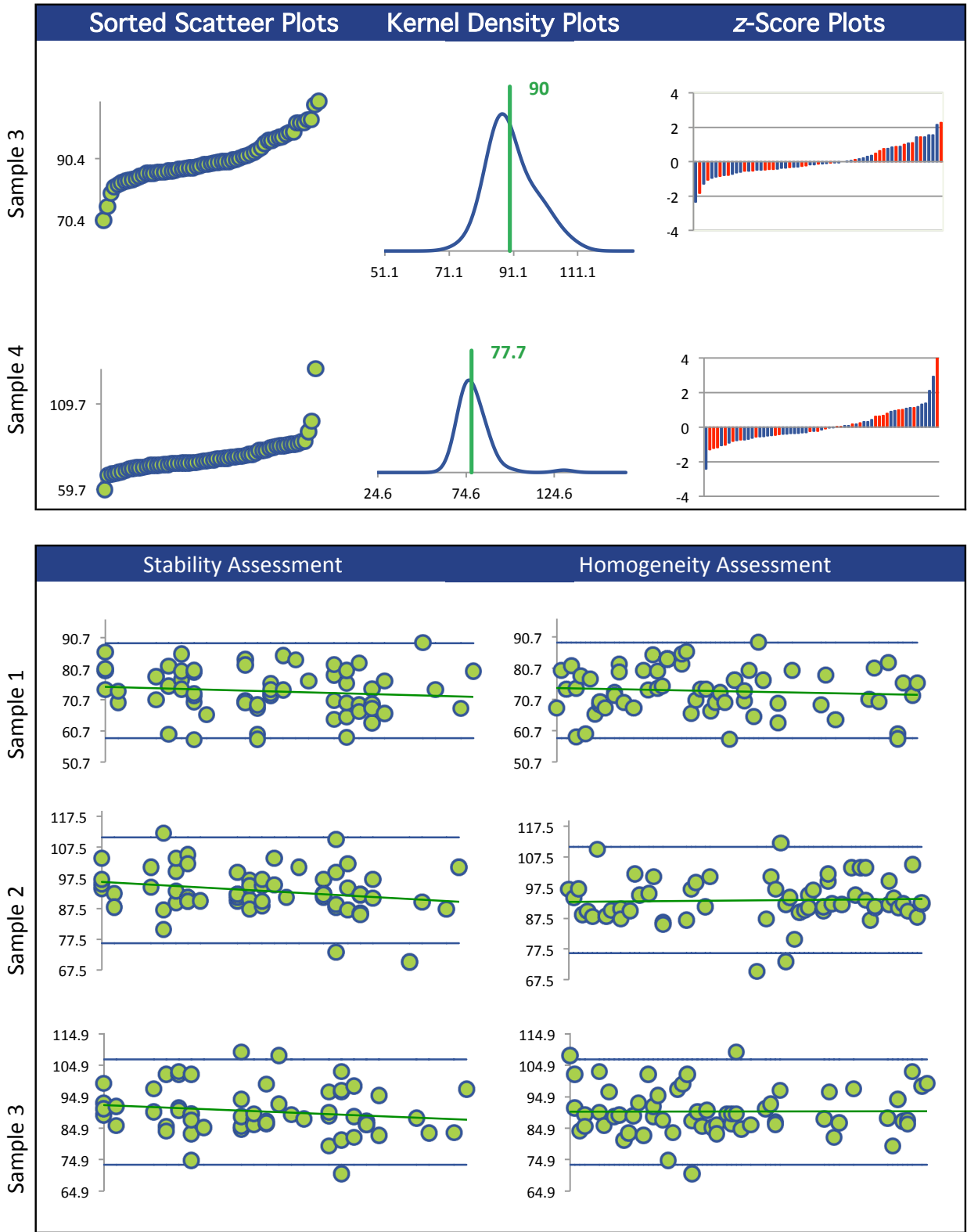
Methods Used

Method	C17-1	C17-2	C17-3	C17-4
ICP/OES (Blue)	24	24	24	24
ICP/MS (Red)	37	37	37	37

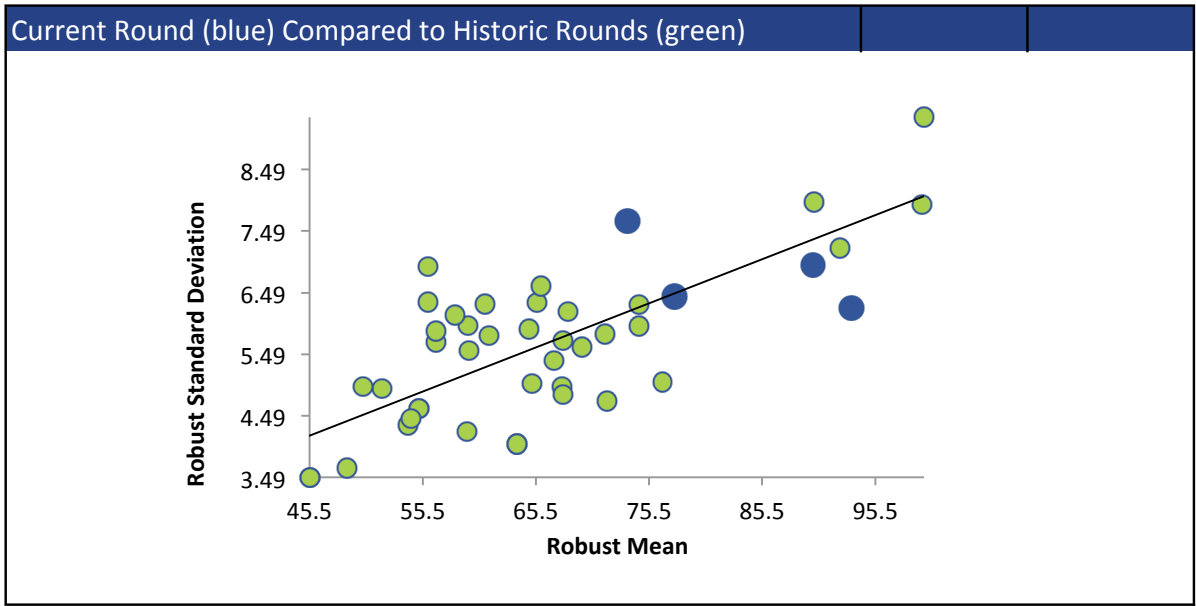
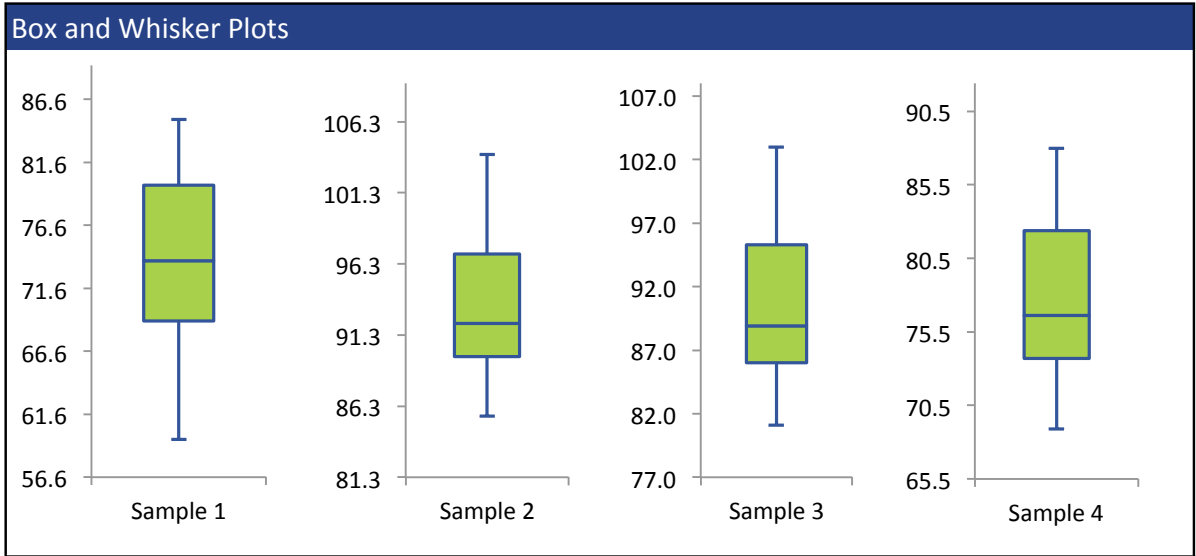
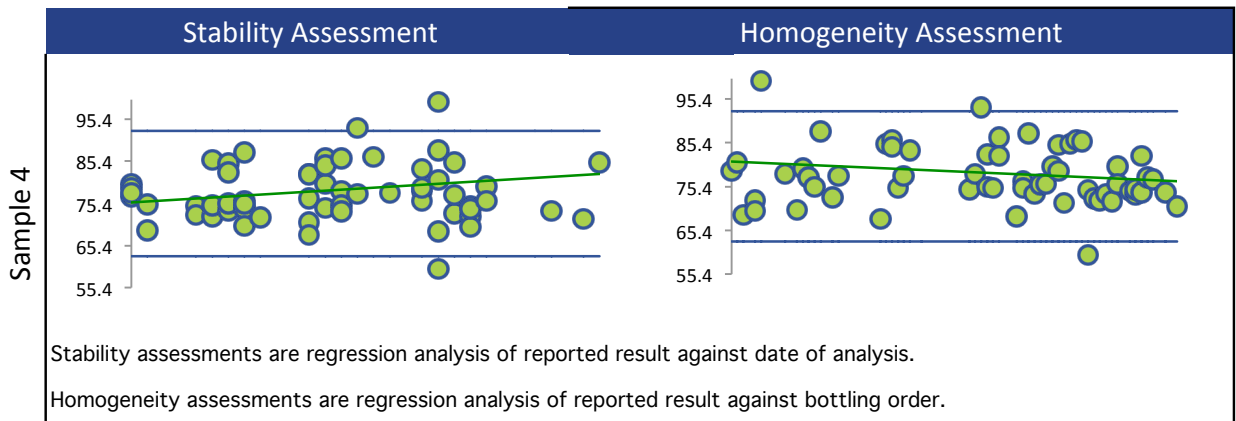
All summary stats and the plots below are based on the data excluding any flagged outliers



CHROMIUM



CHROMIUM



COBALT

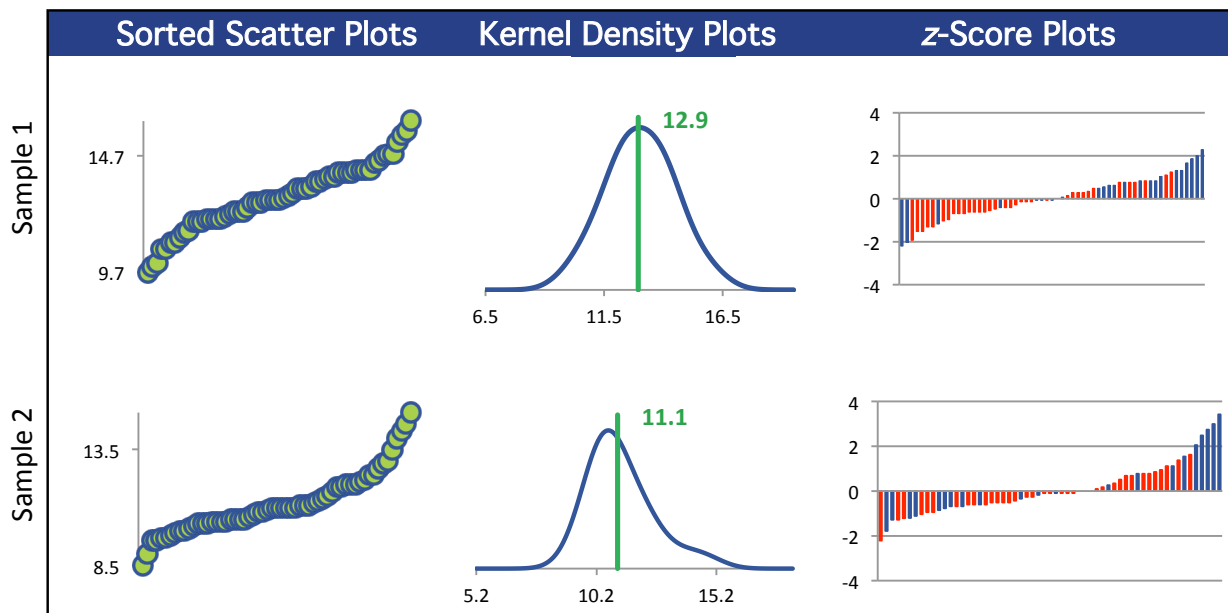
Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	59	59	59	59
Median $\mu\text{g/g}$	12.8	11.0	11.3	9.88
Robust Mean $\mu\text{g/g}$	12.9	11.1	11.5	10.0
U $\mu\text{g/g}$	0.236	0.190	0.179	0.182
Robust Standard Deviation $\mu\text{g/g}$	1.45	1.17	1.10	1.12
Regression Standard Deviation $\mu\text{g/g}$	1.27	1.08	1.12	0.978
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA) $\mu\text{g/g}$	1.45	1.17	1.12	1.12
Outliers	0	0	0	0
$ z > 3.0$	0	1	0	0
$2 < z < 3$	3	5	4	4

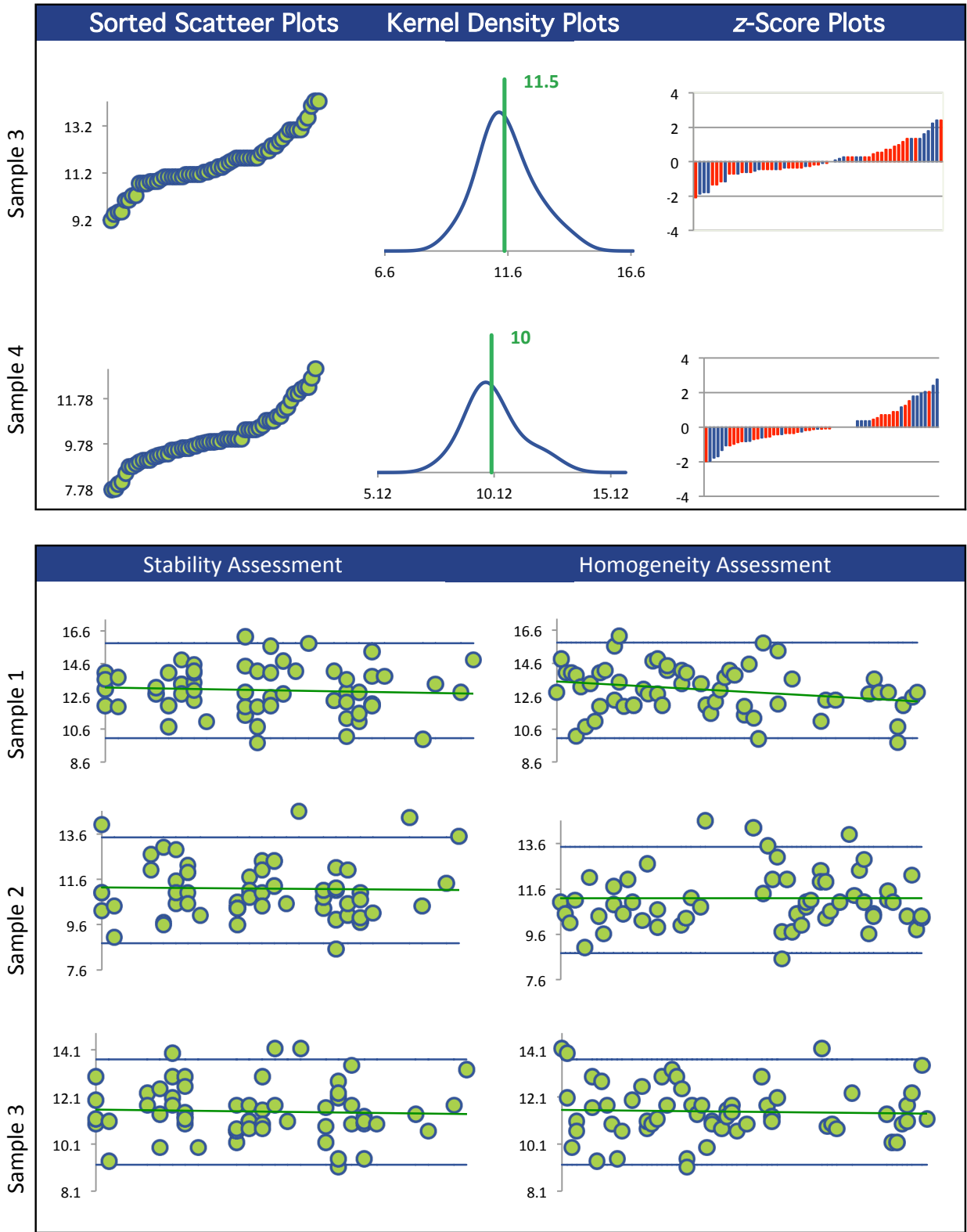
Methods Used

Method	C17-1	C17-2	C17-3	C17-4
ICP/OES (Blue)	23	23	23	23
ICP/MS (Red)	36	36	36	36

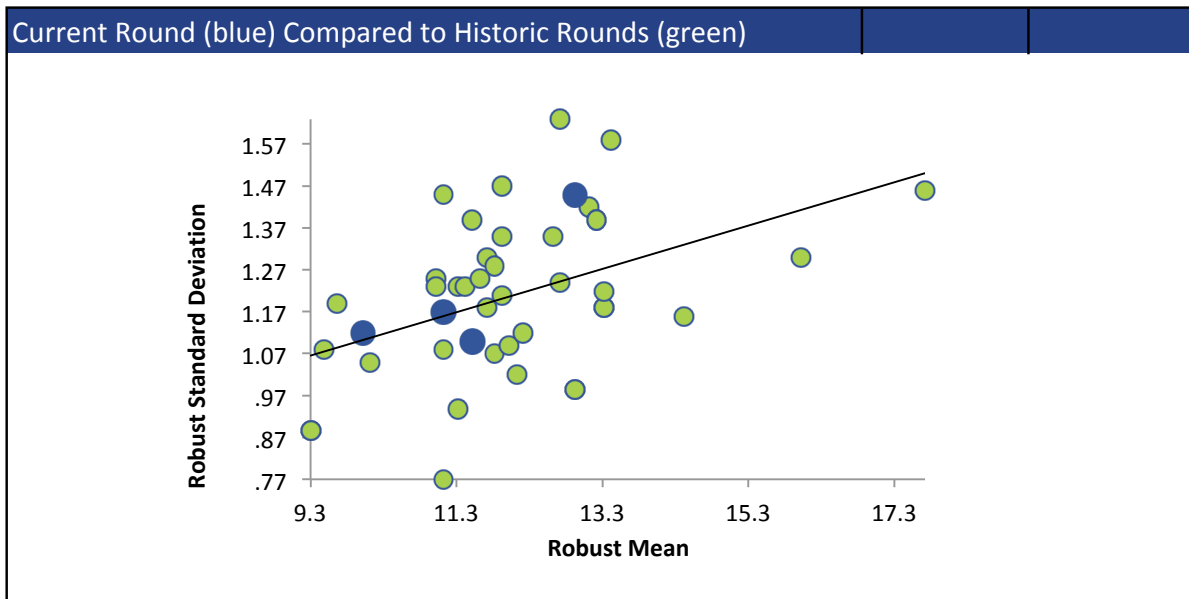
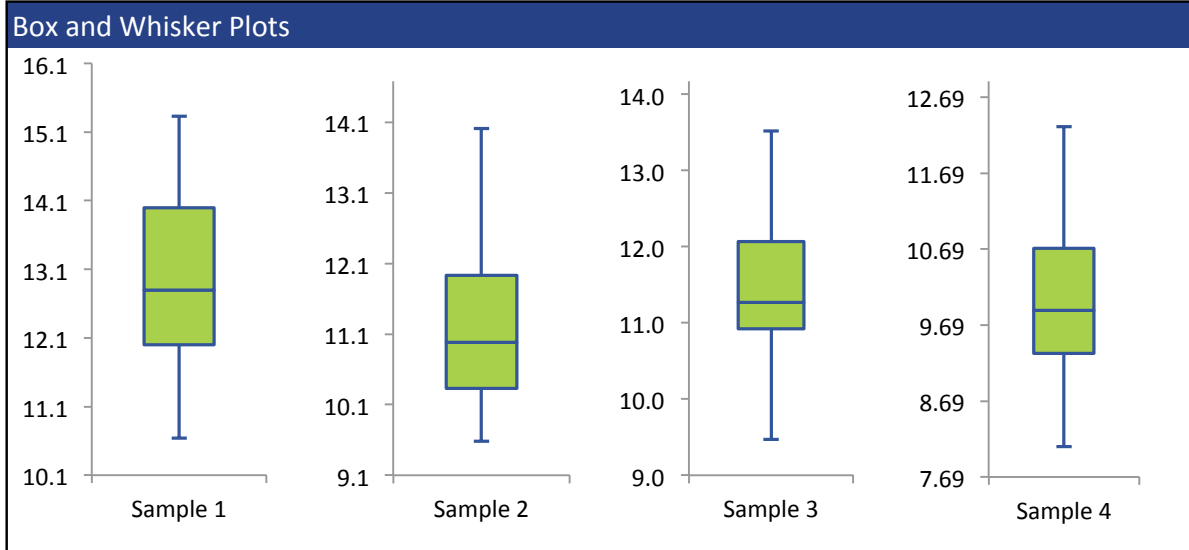
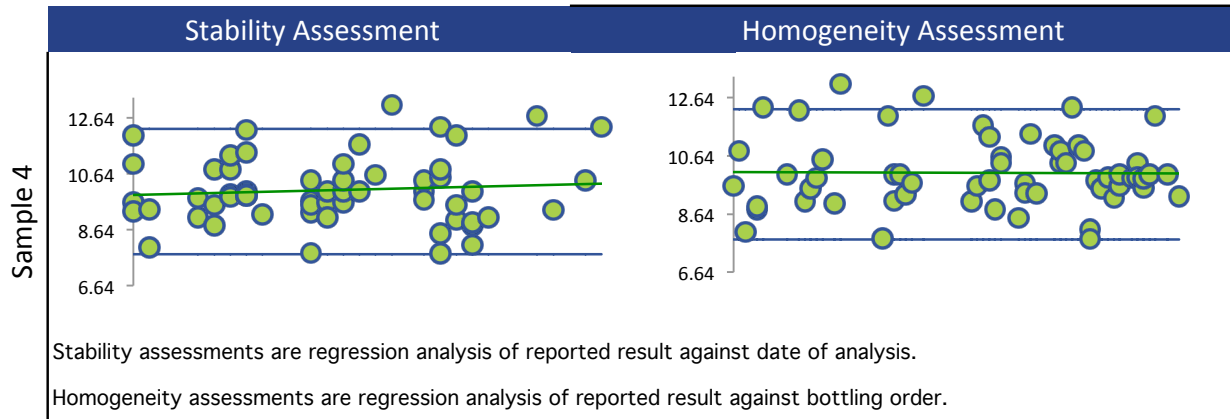
All summary stats and the plots below are based on the data excluding any flagged outliers



COBALT



COBALT



COPPER

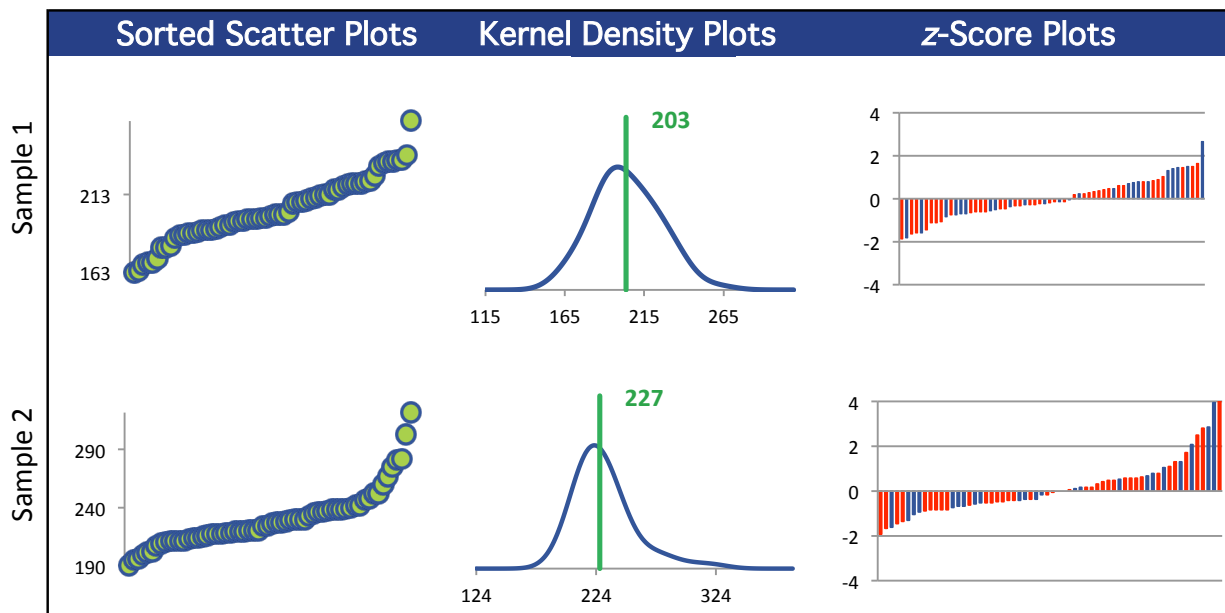
Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	62	62	62	62
Median $\mu\text{g/g}$	200	225	297	240
Robust Mean $\mu\text{g/g}$	203	227	298	241
U $\mu\text{g/g}$	3.40	3.06	3.95	3.10
Robust Standard Deviation $\mu\text{g/g}$	21.4	19.3	24.9	19.5
Regression Standard Deviation $\mu\text{g/g}$	16.9	19.0	24.9	20.2
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA) $\mu\text{g/g}$	21.4	19.3	24.9	20.2
Outliers	1	1	1	1
$ z > 3.0$	0	2	1	2
$2 < z < 3$	1	4	2	2

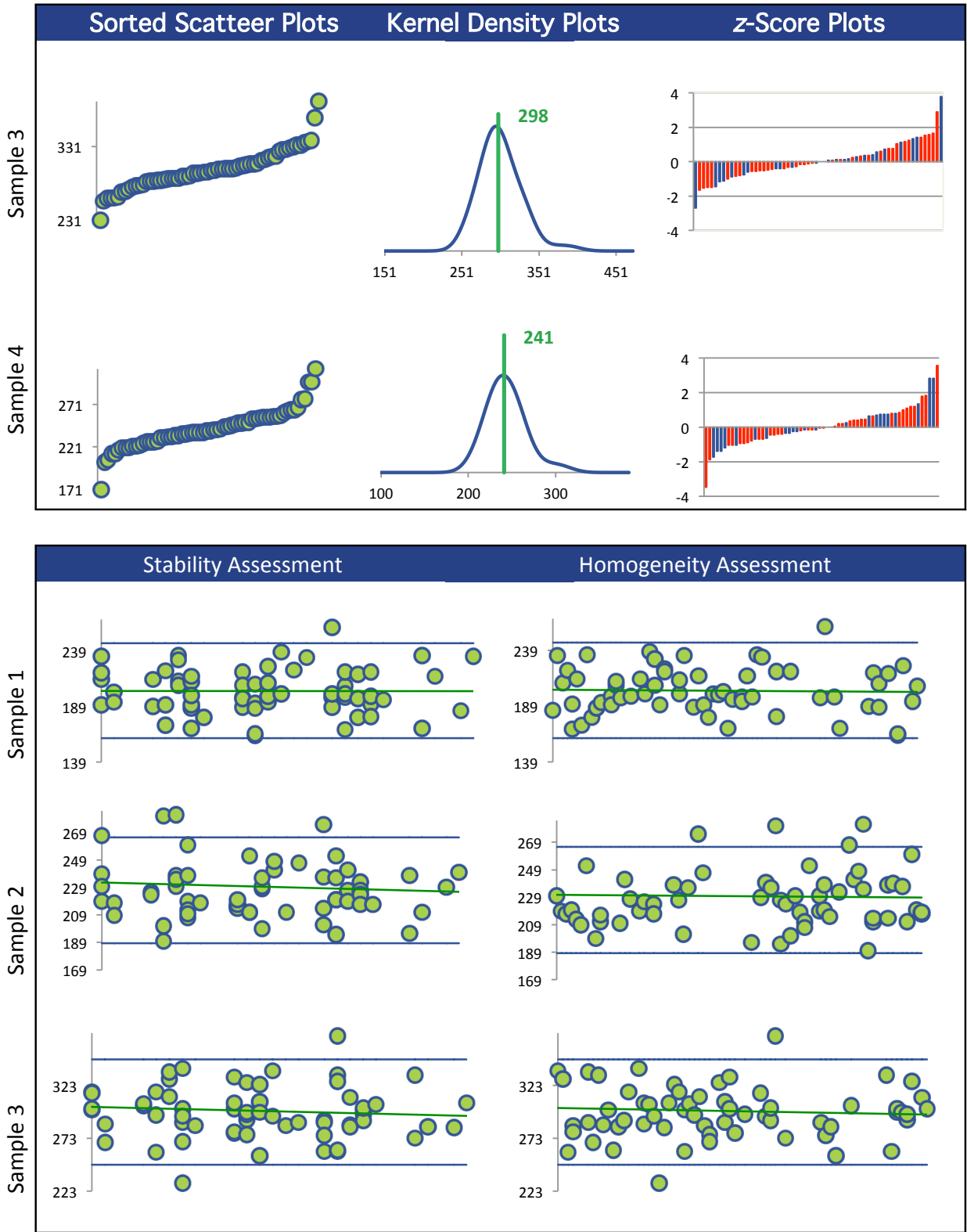
Methods Used

Method	C17-1	C17-2	C17-3	C17-4
ICP/MS (Blue)	38	38	38	38
ICP/OES (Red)	24	24	24	24

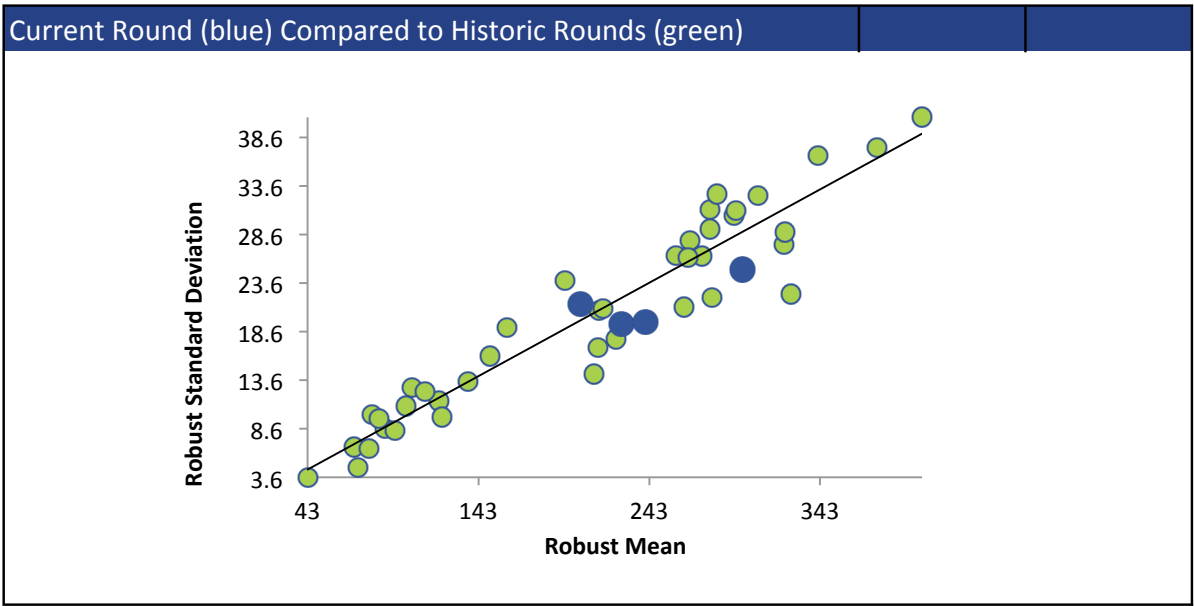
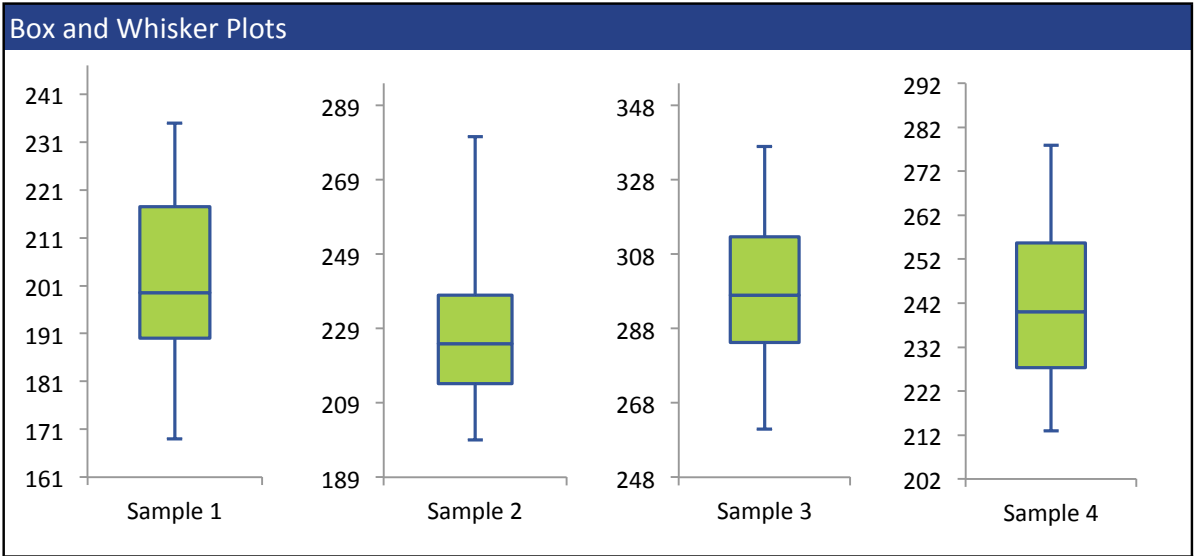
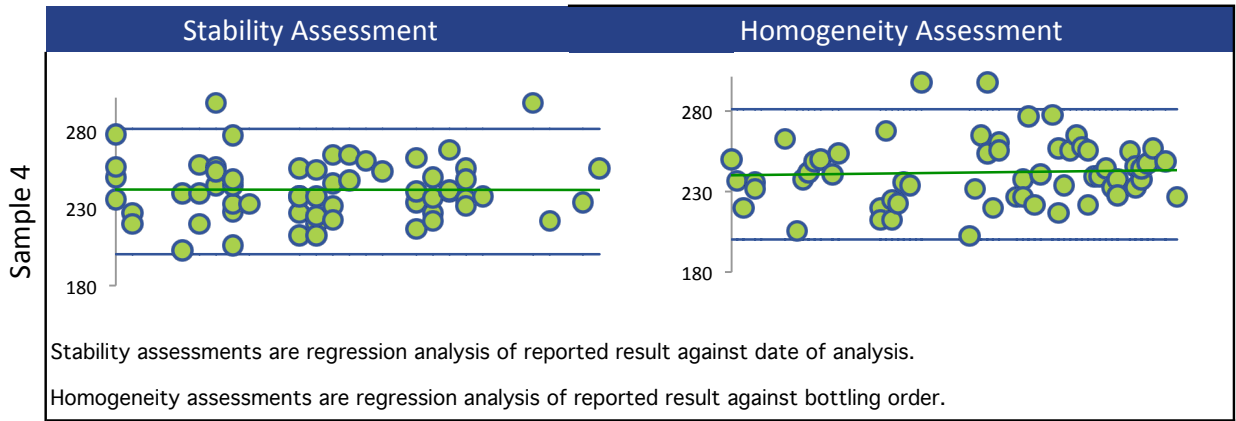
All summary stats and the plots below are based on the data excluding any flagged outliers



COPPER



COPPER



IRON

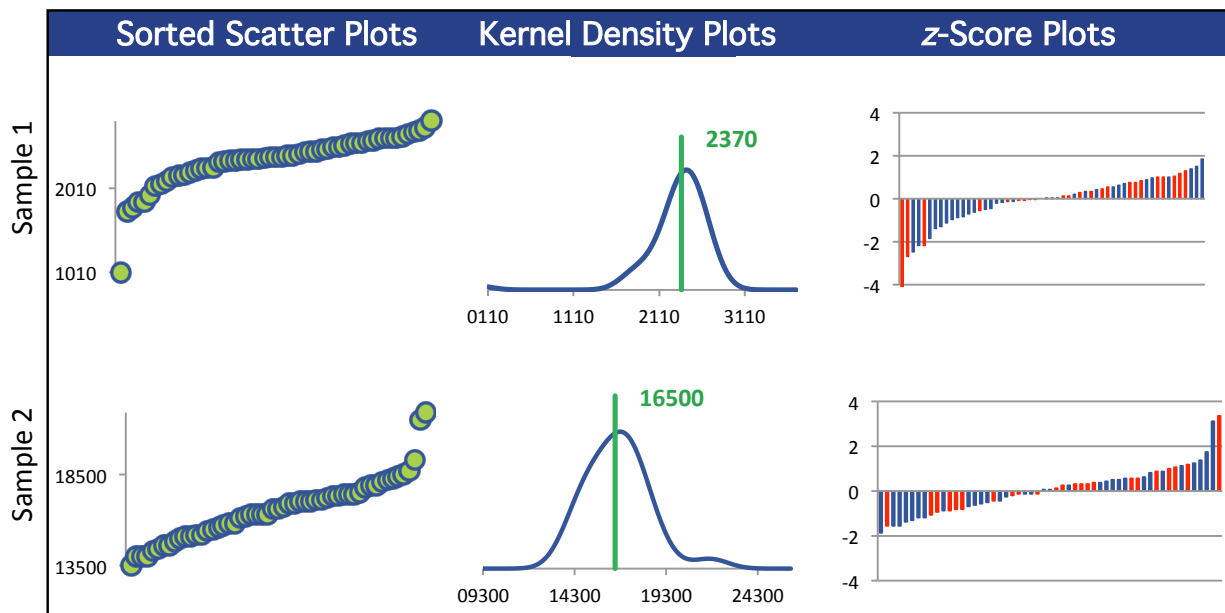
Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	55	55	56	56
Median $\mu\text{g/g}$	2380	16600	28400	23600
Robust Mean $\mu\text{g/g}$	2370	16500	28100	23600
U $\mu\text{g/g}$	40.1	271	403	346
Robust Standard Deviation $\mu\text{g/g}$	238	1610	2410	2070
Regression Standard Deviation $\mu\text{g/g}$	217	1510	2570	2160
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA) $\mu\text{g/g}$	238	1610	2570	2160
Outliers	1	1	0	0
$ z > 3.0$	1	2	1	1
$2 < z < 3$	4	0	4	3

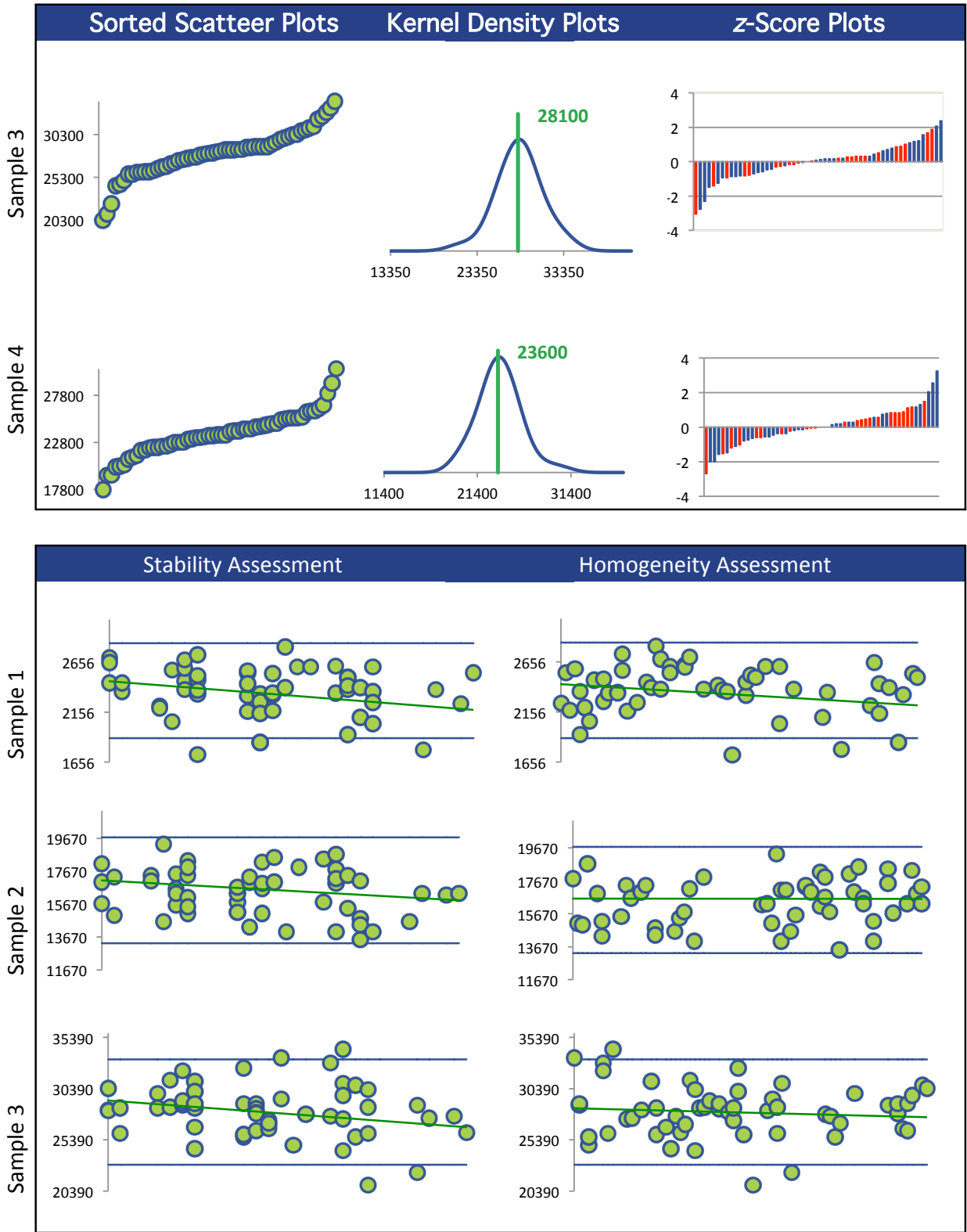
Methods Used

Method	C17-1	C17-2	C17-3	C17-4
ICP/OES (Blue)	23	23	24	24
ICP/MS (Red)	32	32	32	32

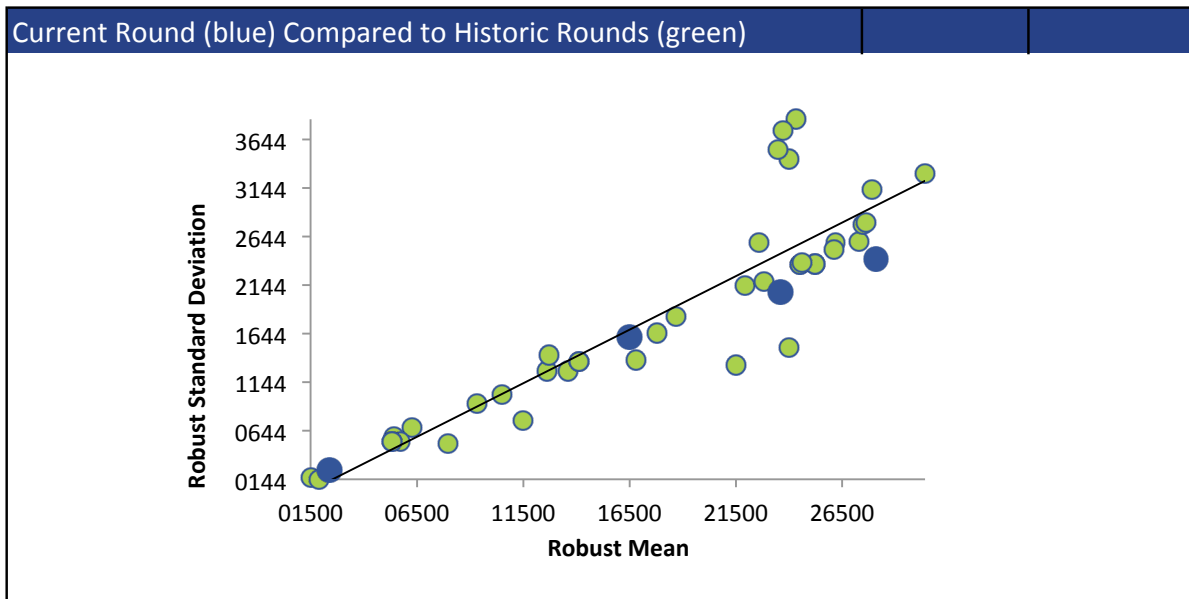
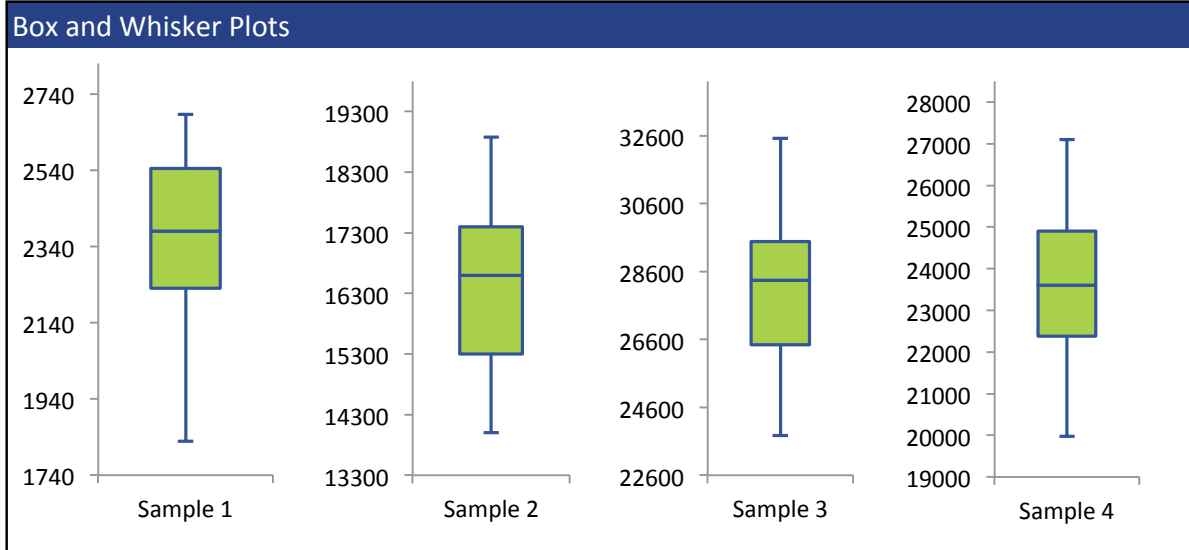
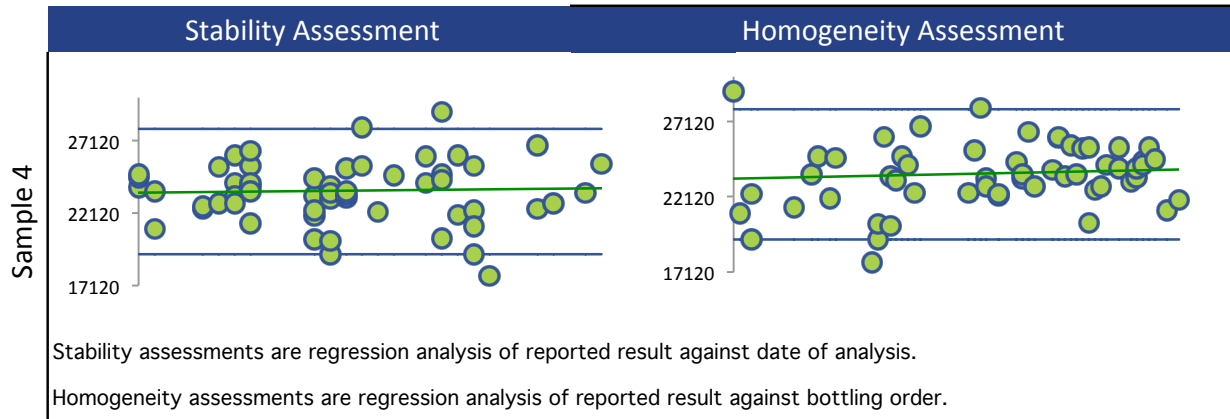
All summary stats and the plots below are based on the data excluding any flagged outliers



IRON



IRON



LEAD

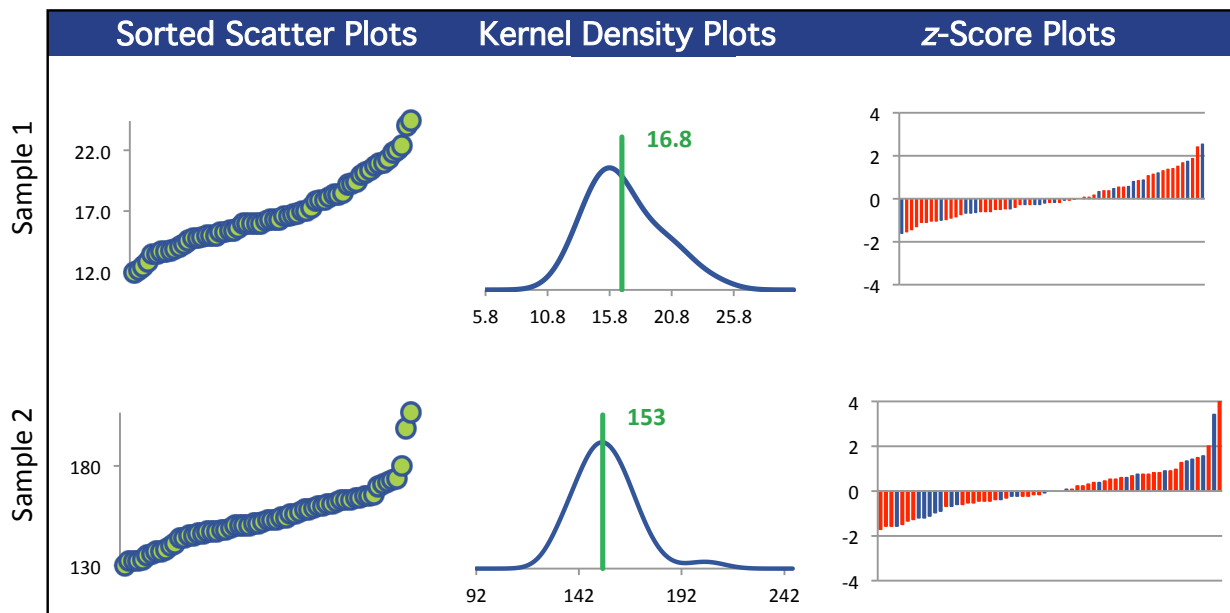
Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	62	63	64	64
Median $\mu\text{g/g}$	16.3	153	234	146
Robust Mean $\mu\text{g/g}$	16.8	153	234	146
U $\mu\text{g/g}$	0.475	2.13	3.03	2.14
Robust Standard Deviation $\mu\text{g/g}$	2.99	13.5	19.4	13.7
Regression Standard Deviation $\mu\text{g/g}$	2.93	13.1	19.1	12.5
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA) $\mu\text{g/g}$	2.99	13.5	19.4	13.7
Outliers	2	1	0	0
$ z > 3.0$	0	2	1	0
$2 < z < 3$	2	0	5	2

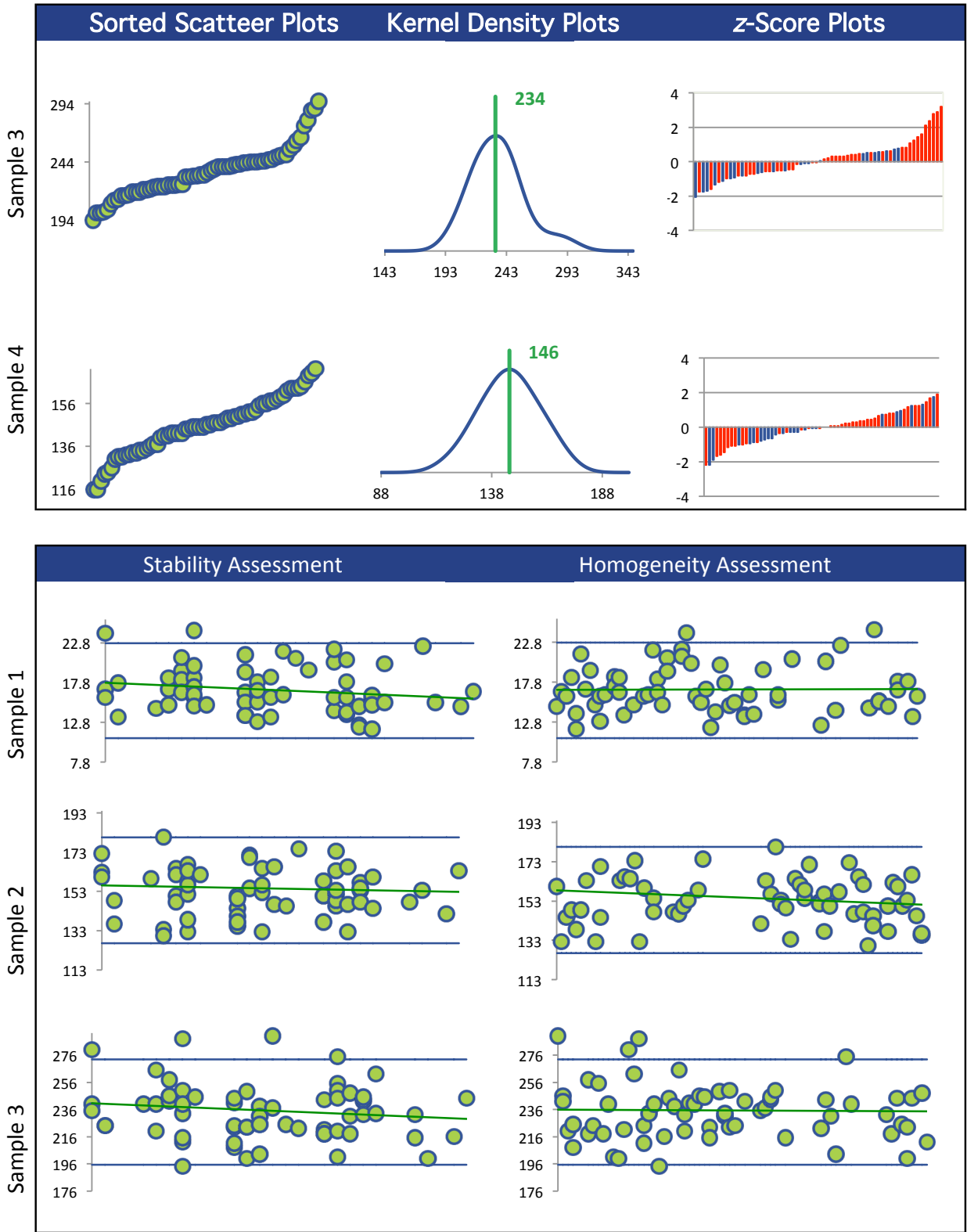
Methods Used

Method	C17-1	C17-2	C17-3	C17-4
ICP/OES (Blue)	22	22	23	23
ICP/MS (Red)	40	41	41	41

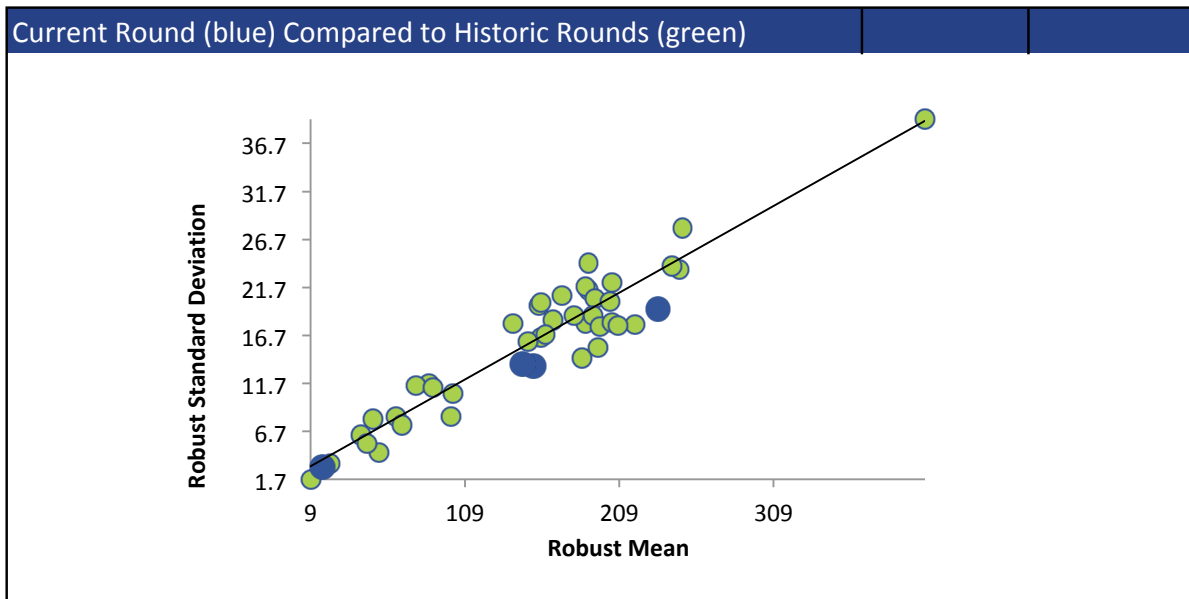
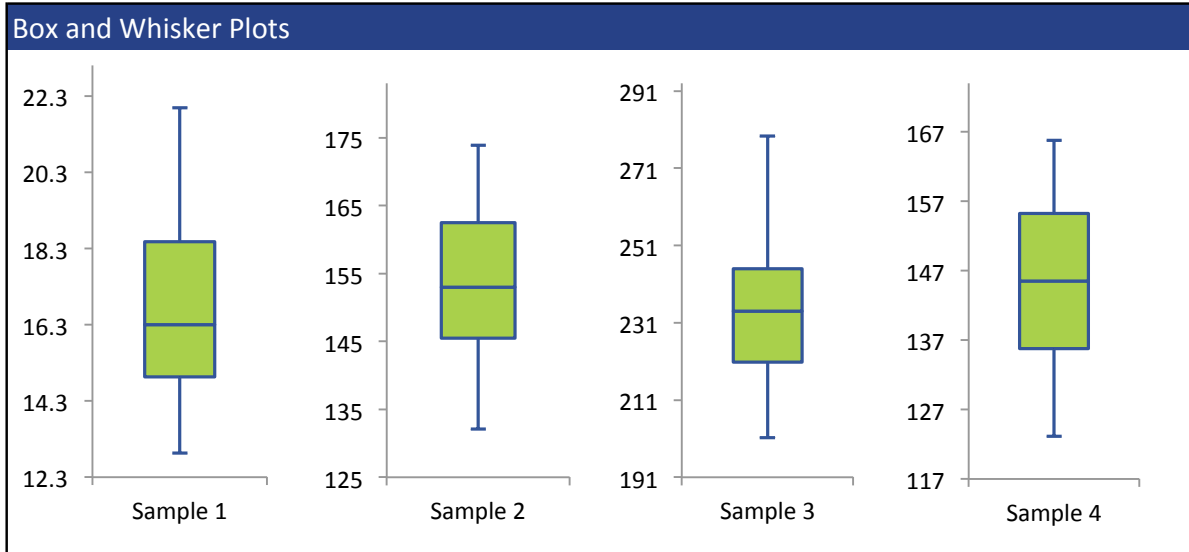
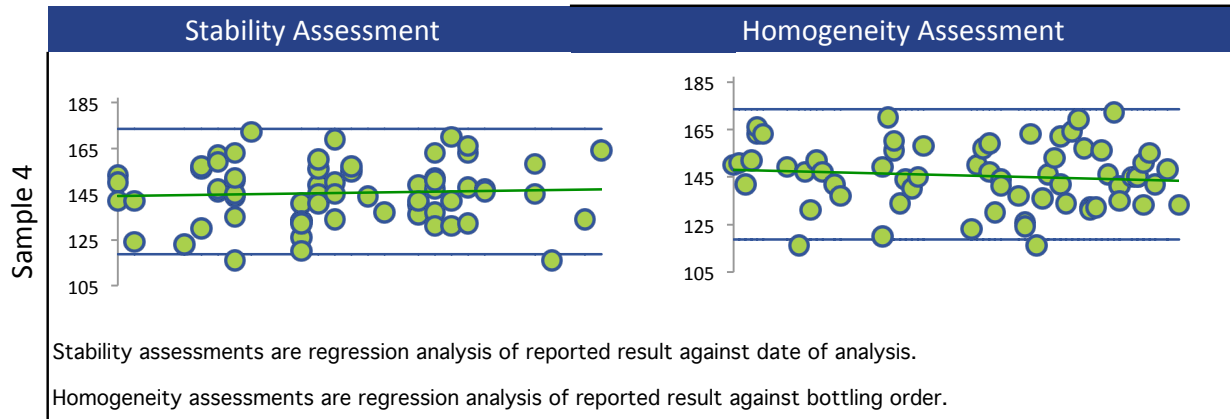
All summary stats and the plots below are based on the data excluding any flagged outliers



LEAD



LEAD



MANGANESE

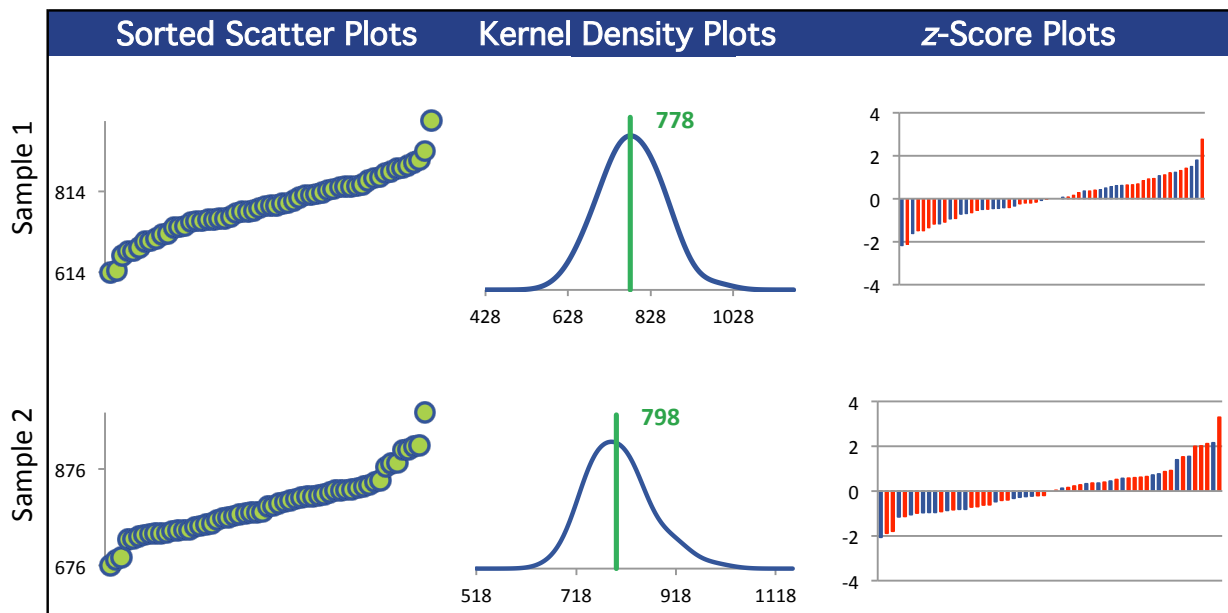
Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	57	57	57	56
Median $\mu\text{g/g}$	778	798	1020	888
Robust Mean $\mu\text{g/g}$	778	798	1030	891
U $\mu\text{g/g}$	12.5	9.80	13.3	12.6
Robust Standard Deviation $\mu\text{g/g}$	75.4	59.2	80.1	75.5
Regression Standard Deviation $\mu\text{g/g}$	57.1	58.5	75.3	65.3
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA) $\mu\text{g/g}$	75.4	59.2	80.1	75.5
Outliers	0	0	0	1
$ z > 3.0$	0	1	0	0
$2 < z < 3$	3	4	4	1

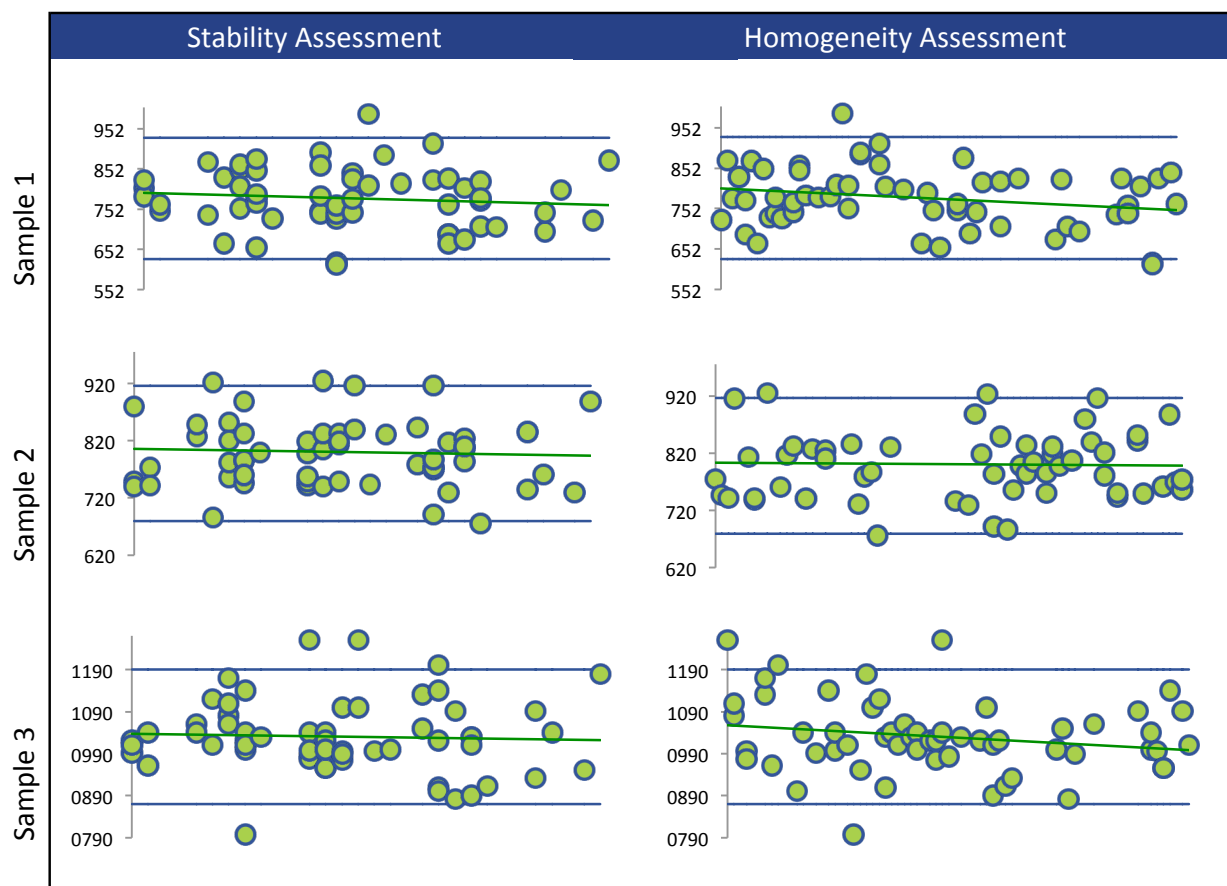
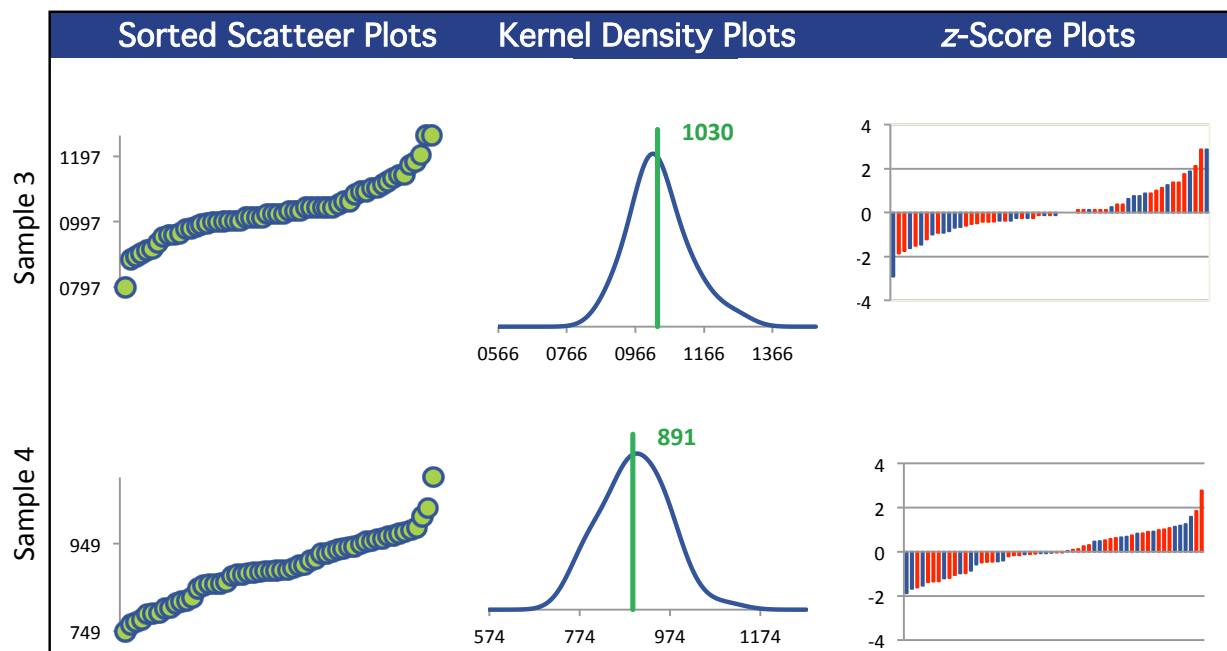
Methods Used

Method	C17-1	C17-2	C17-3	C17-4
ICP/OES (Blue)	24	24	24	24
ICP/MS (Red)	33	33	33	32

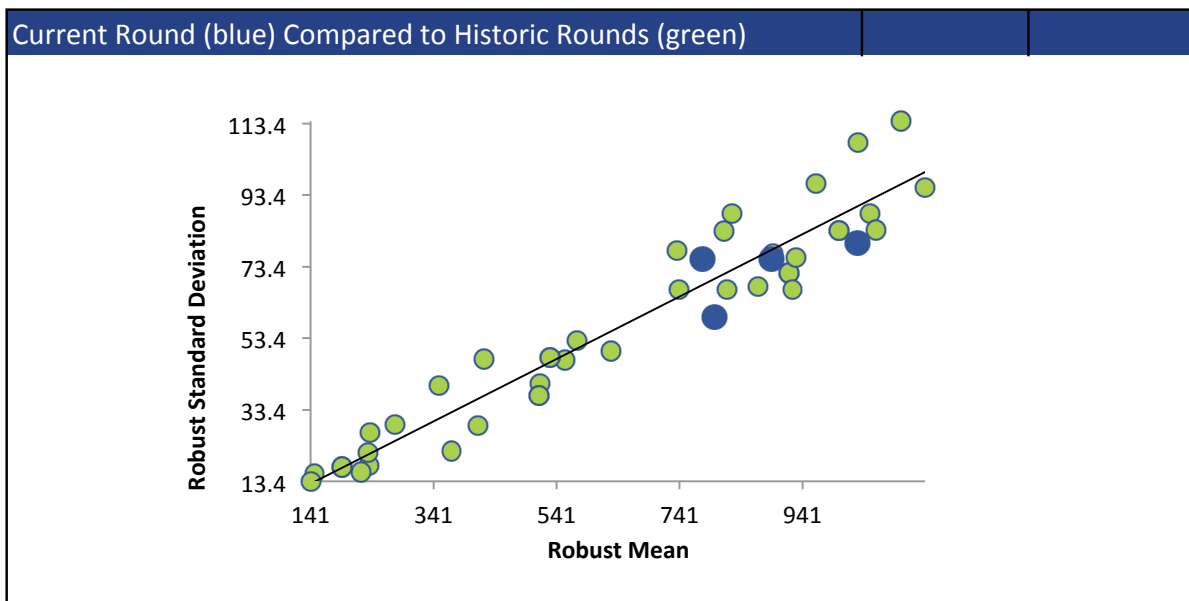
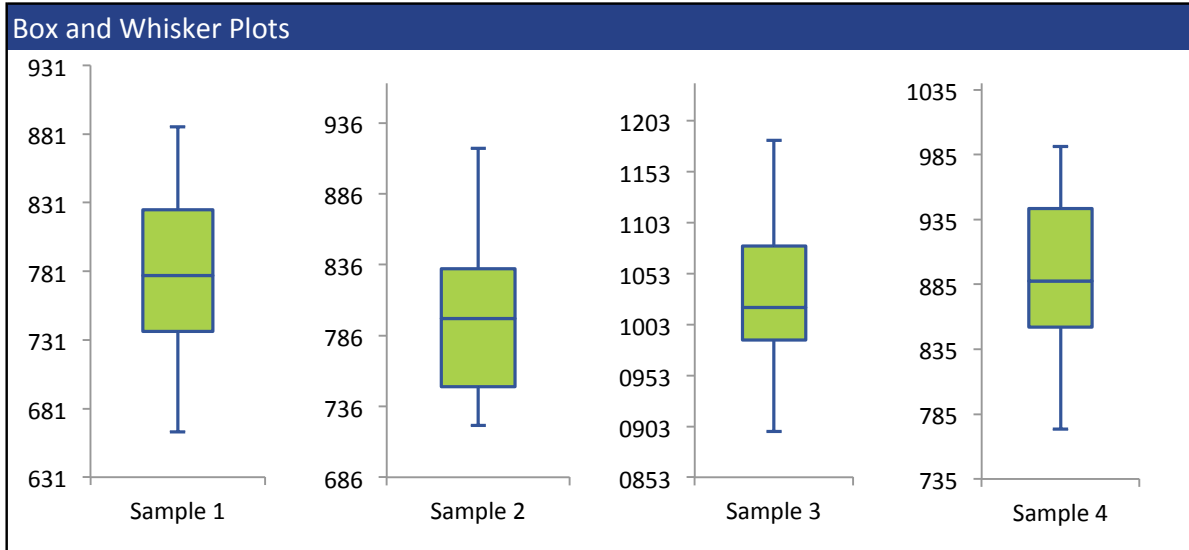
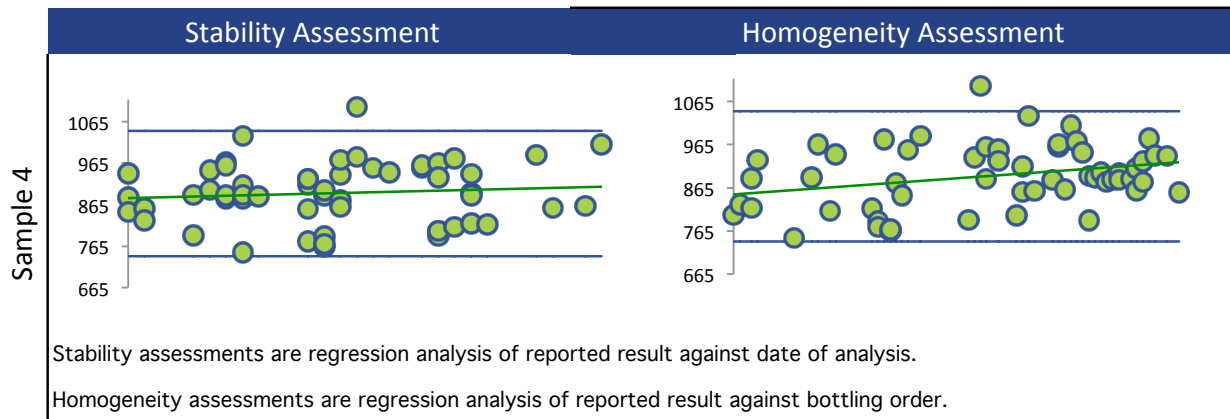
All summary stats and the plots below are based on the data excluding any flagged outliers



MANGANESE



MANGANESE



MERCURY

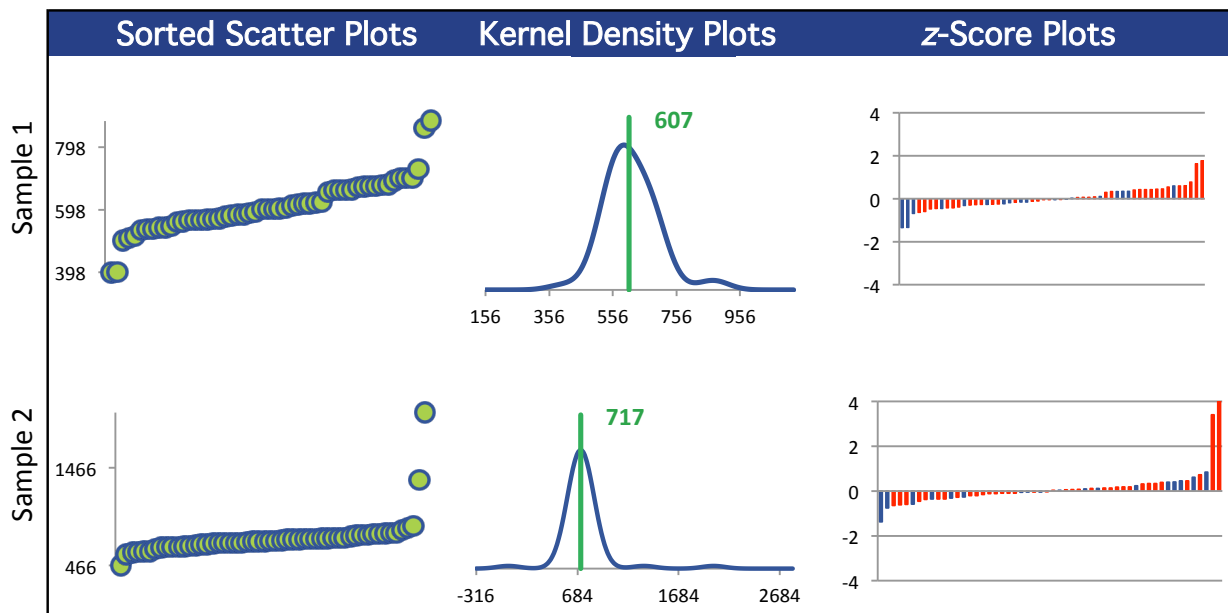
Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	54	54	54	54
Median $\mu\text{g/g}$	600	717	745	829
Robust Mean $\mu\text{g/g}$	607	717	754	826
U $\mu\text{g/g}$	12.1	12.2	15.6	16.3
Robust Standard Deviation $\mu\text{g/g}$	71.2	71.6	91.7	95.9
Regression Standard Deviation $\mu\text{g/g}$	155	183	192	211
Stability Flag			Stability	
Homogeneity Flag				
Standard Deviation Used (SDPA) $\mu\text{g/g}$	155	183	218	211
Outliers	6	6	6	6
$ z > 3.0$	0	2	1	1
$2 < z < 3$	0	0	0	0

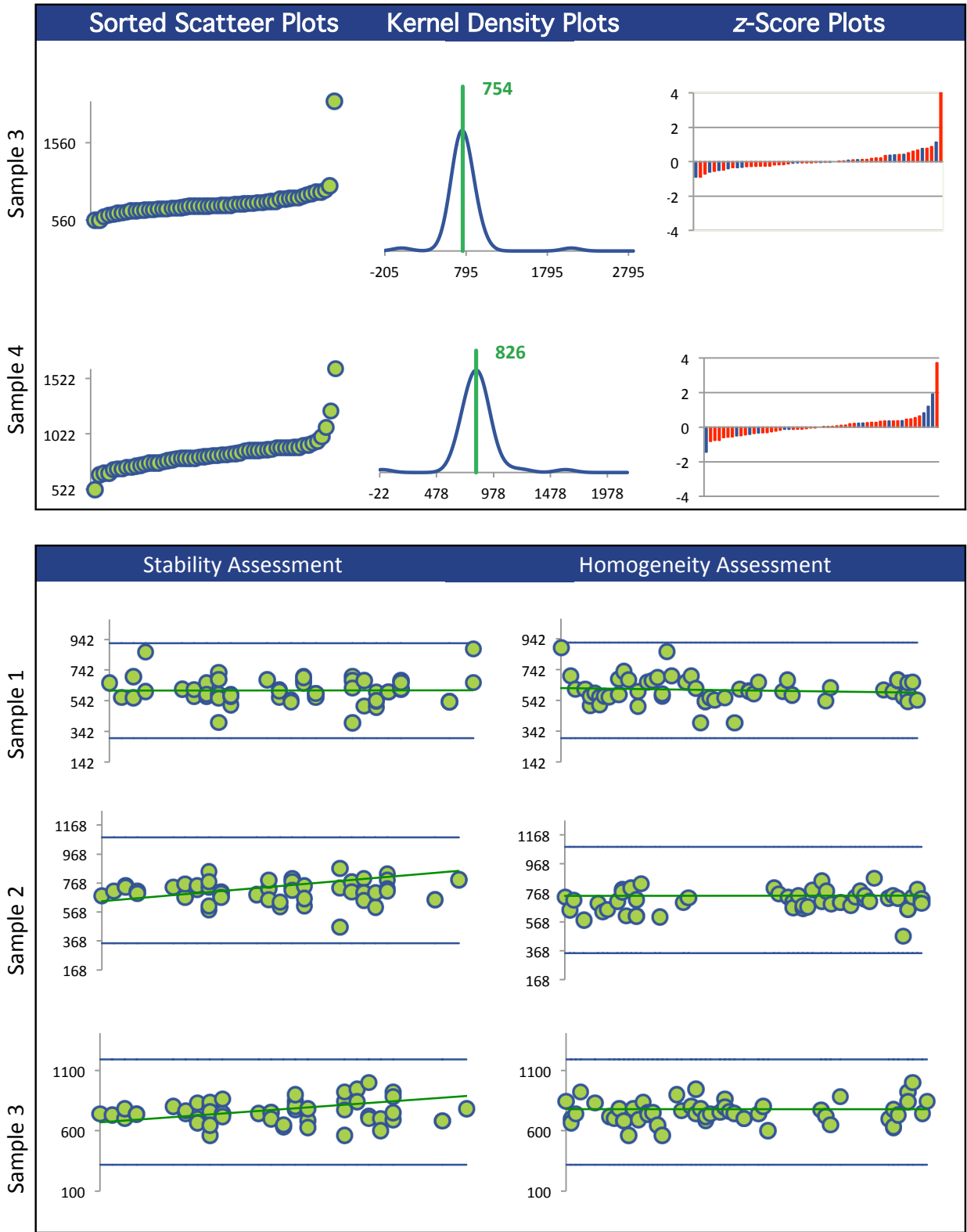
Methods Used

Method	C17-1	C17-2	C17-3	C17-4
COLD VAPOUR AA (Blue)	20	20	20	20
ICP/OES (Red)	4	4	4	4
ICP/MS (Green)	21	21	21	21
ATOMIC FLUORESCENCE (Orange)	7	7	7	7
PYROLYTIC AA (Black)	2	2	2	2

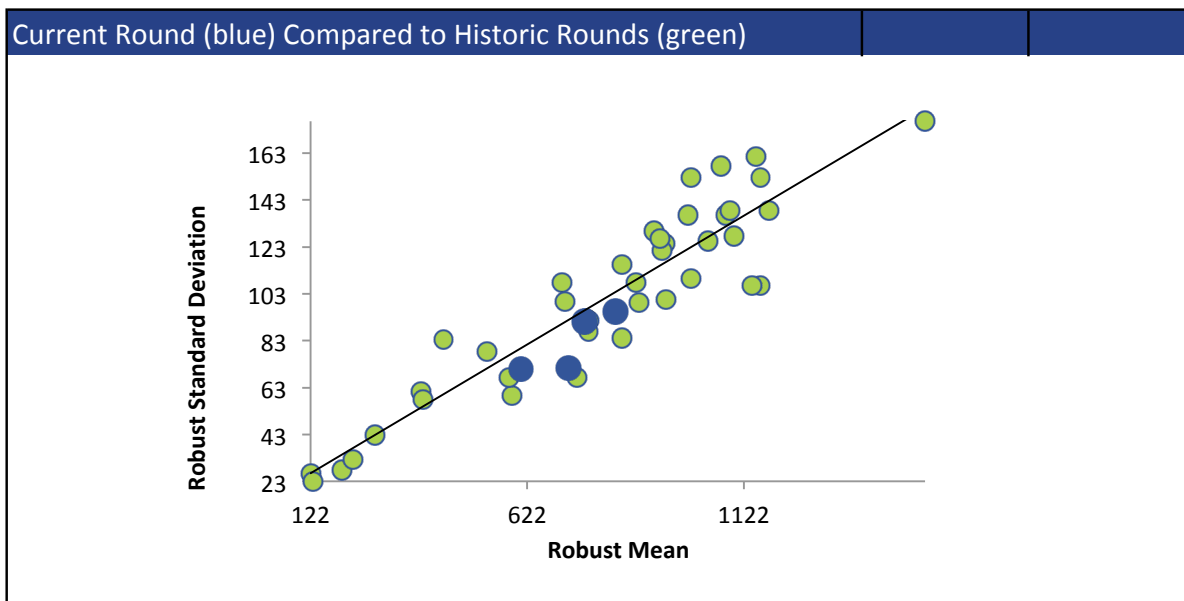
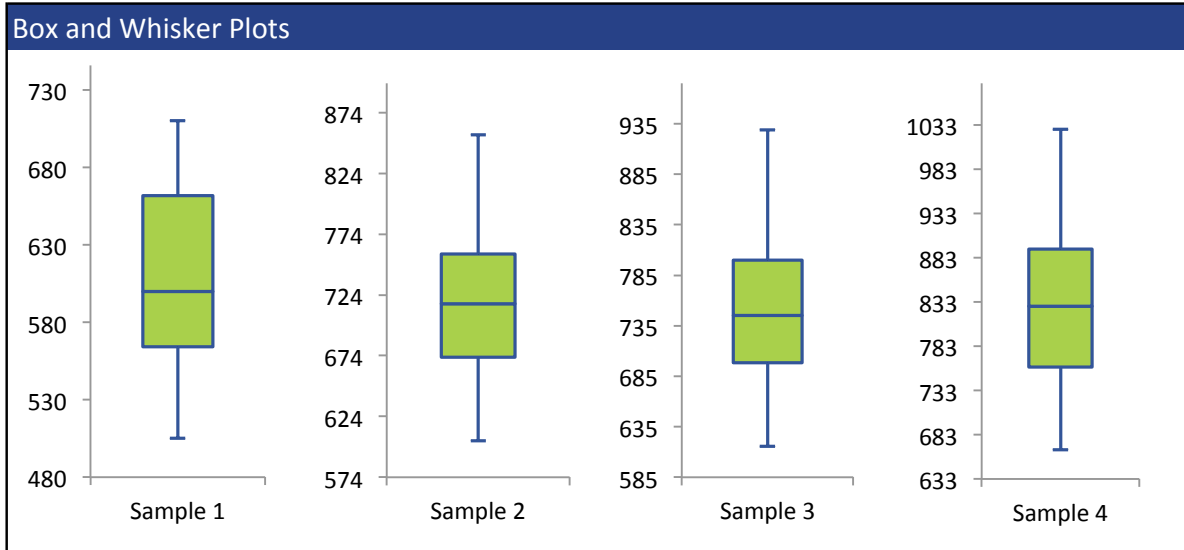
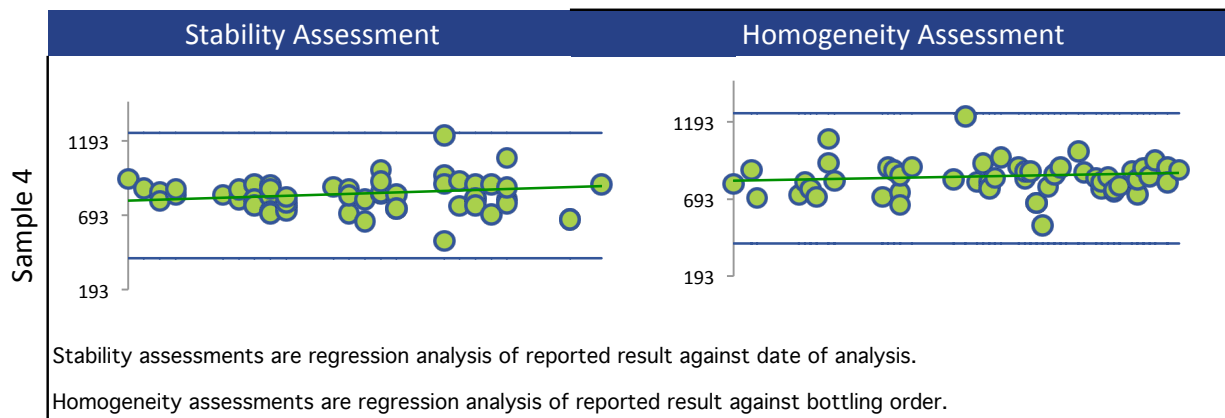
All summary stats and the plots below are based on the data excluding any flagged outliers



MERCURY



MERCURY



NICKEL

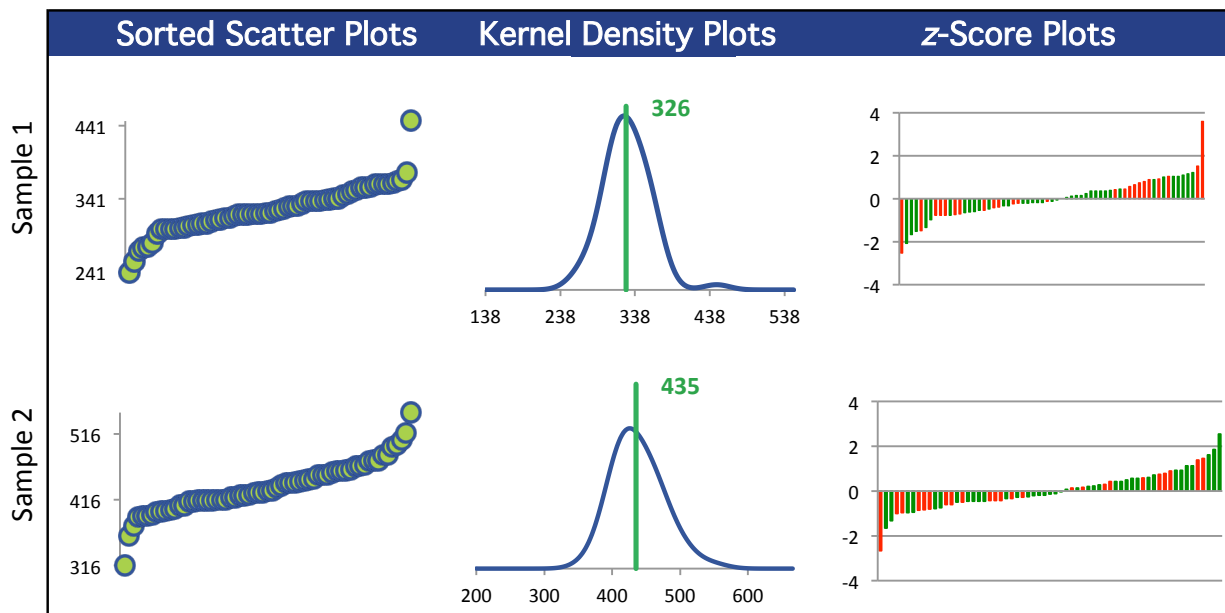
Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	63	63	63	62
Median $\mu\text{g/g}$	322	429	510	474
Robust Mean $\mu\text{g/g}$	326	435	516	476
U $\mu\text{g/g}$	4.44	5.61	6.80	4.62
Robust Standard Deviation $\mu\text{g/g}$	28.2	35.6	43.2	29.1
Regression Standard Deviation $\mu\text{g/g}$	33.6	44.8	53.2	49.1
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA) $\mu\text{g/g}$	33.6	44.8	53.2	49.1
Outliers	0	0	0	1
$ z > 3.0$	1	0	0	0
$2 < z < 3$	2	2	0	1

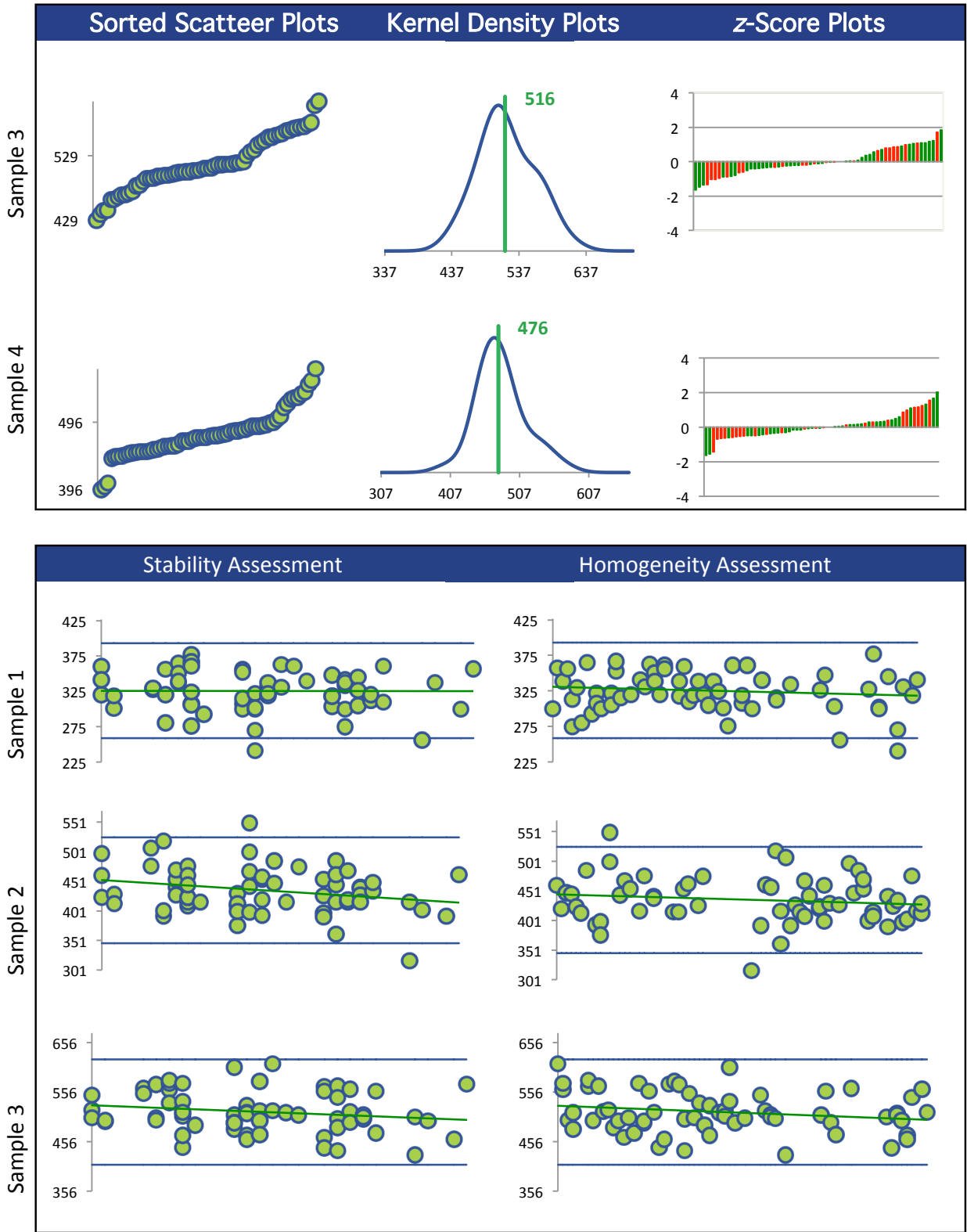
Methods Used

Method	C17-1	C17-2	C17-3	C17-4
ICP/OES (Blue)	24	24	24	24
ICP/MS (Red)	39	39	39	38

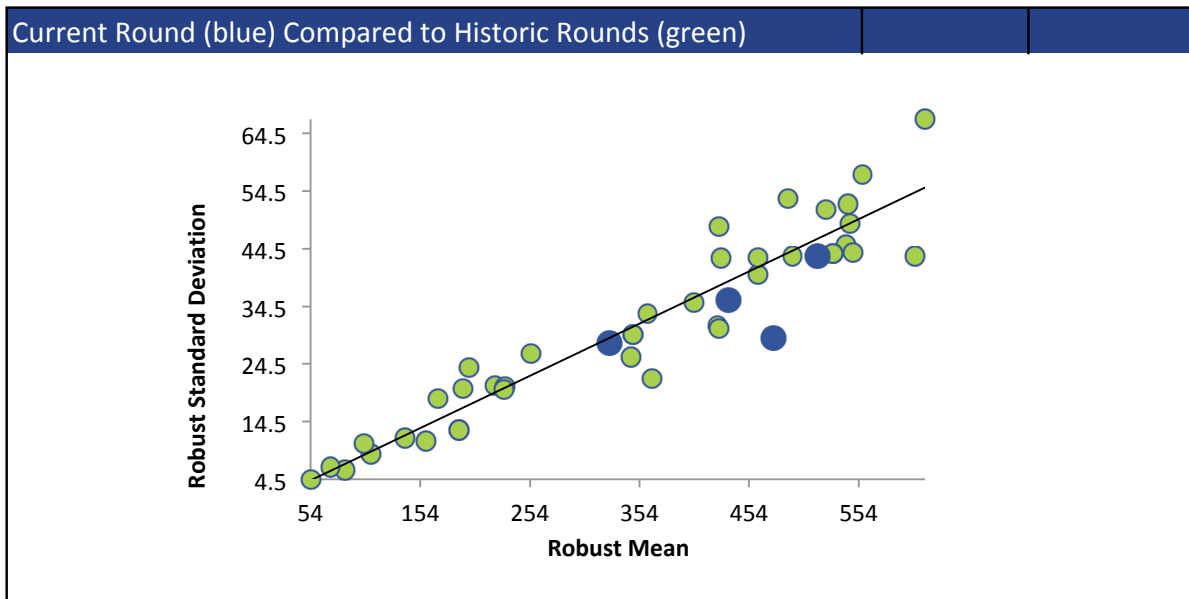
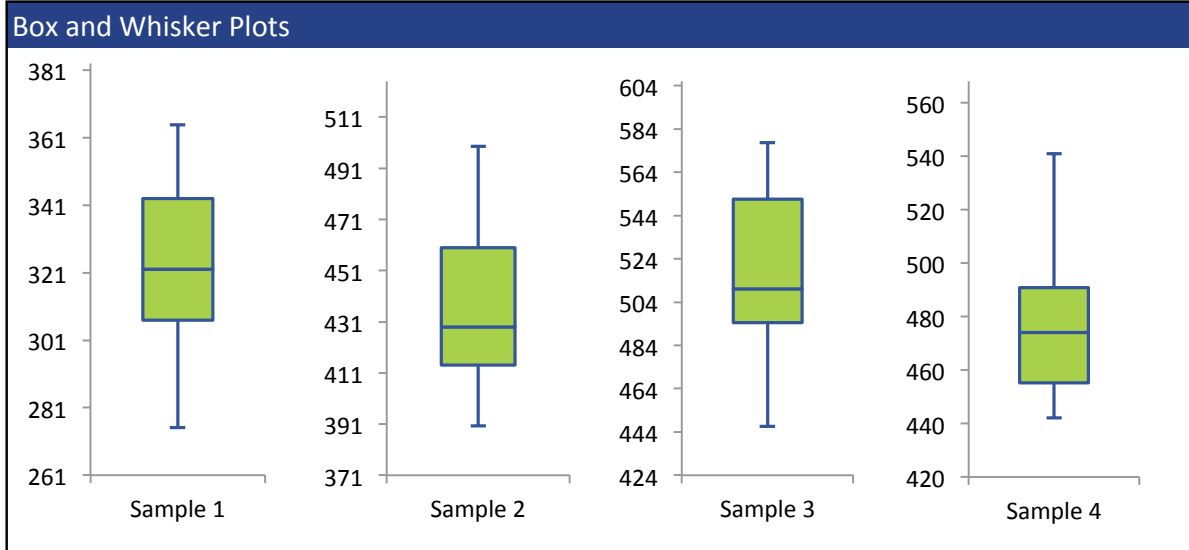
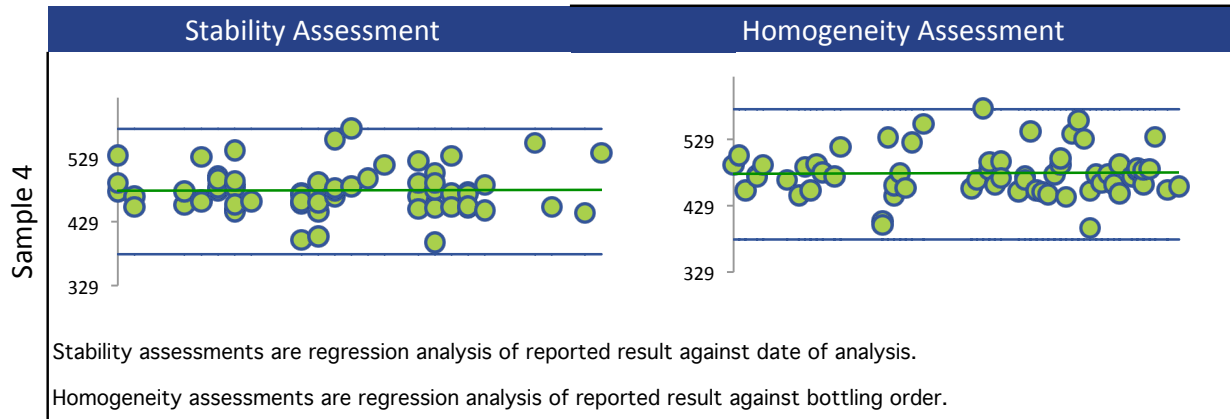
All summary stats and the plots below are based on the data excluding any flagged outliers



NICKEL



NICKEL



STRONTIUM

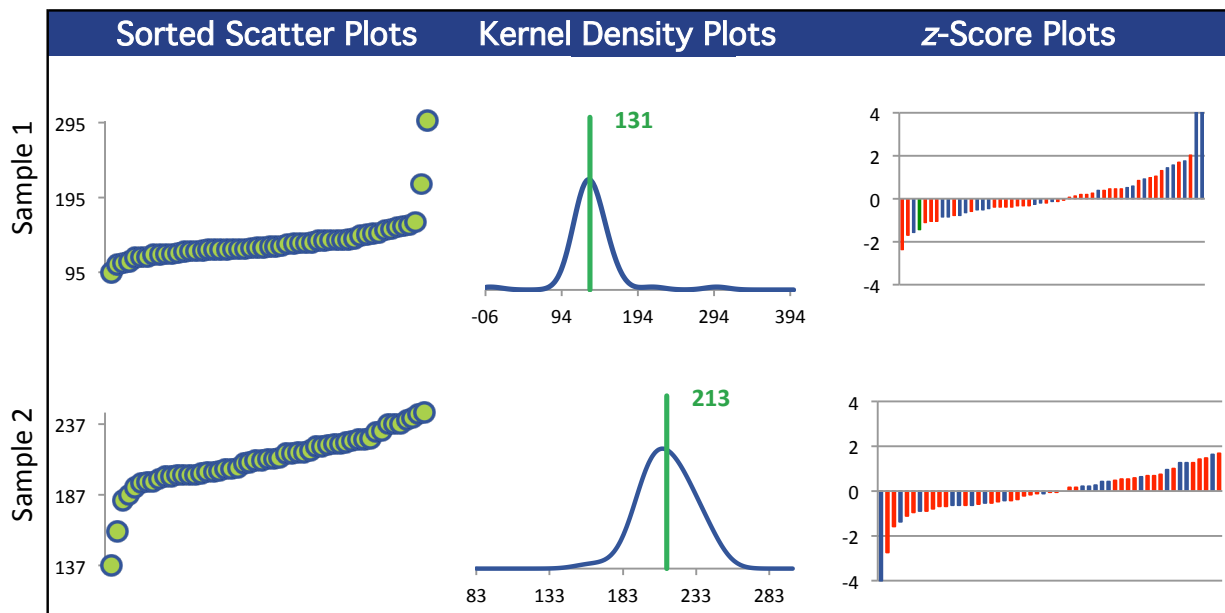
Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	53	53	53	53
Median $\mu\text{g/g}$	129	212	266	284
Robust Mean $\mu\text{g/g}$	131	213	266	285
U $\mu\text{g/g}$	2.63	2.99	3.91	4.81
Robust Standard Deviation $\mu\text{g/g}$	15.3	17.4	22.8	28.0
Regression Standard Deviation $\mu\text{g/g}$	11.9	19.0	23.7	25.3
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA) $\mu\text{g/g}$	15.3	19.0	23.7	28.0
Outliers	0	0	0	0
$ z > 3.0$	2	1	0	0
$2 < z < 3$	2	1	1	4

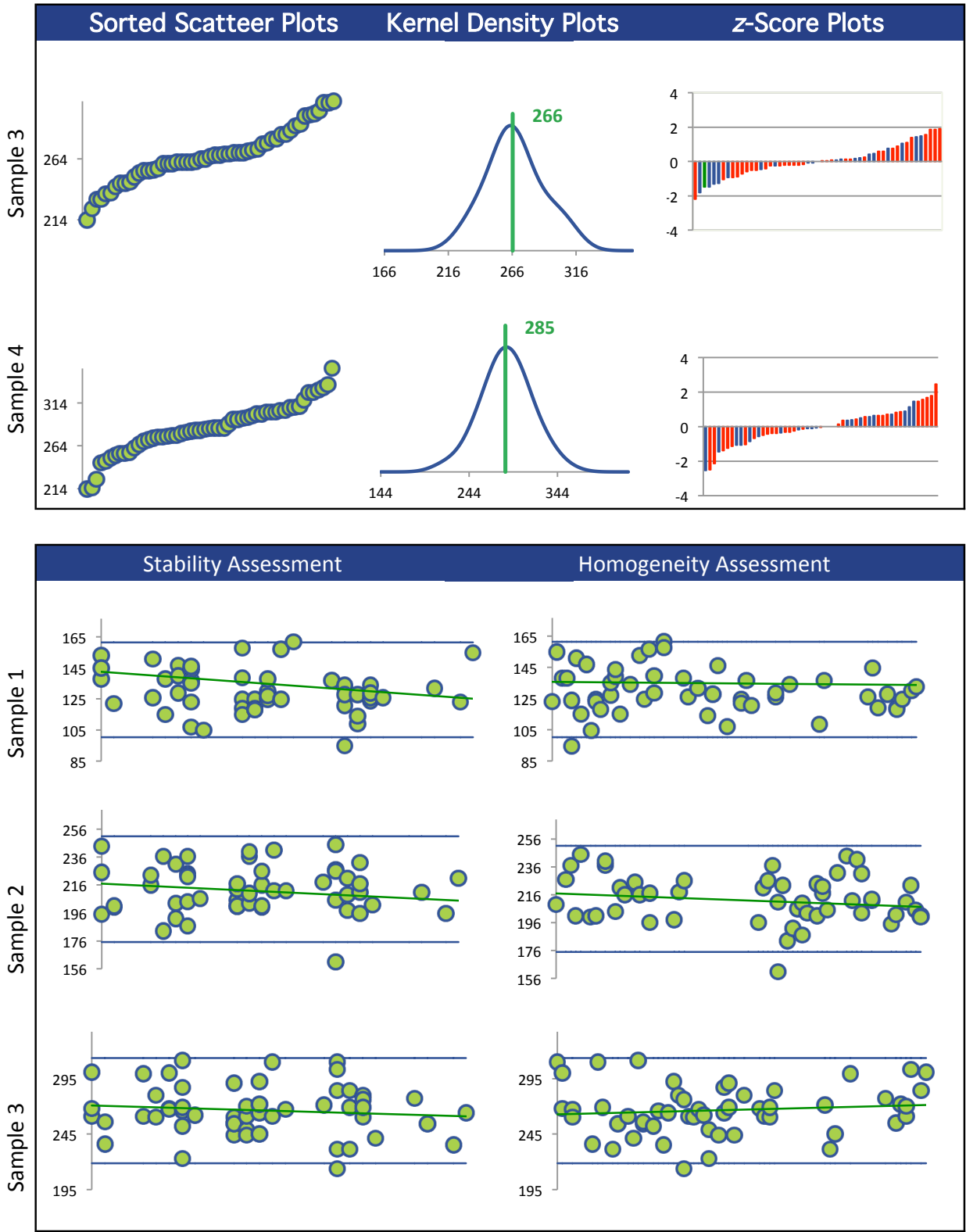
Methods Used

Method	C17-1	C17-2	C17-3	C17-4
ICP/MS (Blue)	32	32	32	32
ICP/OES (Red)	20	20	20	20
AA FLAME (Green)	1	1	1	1

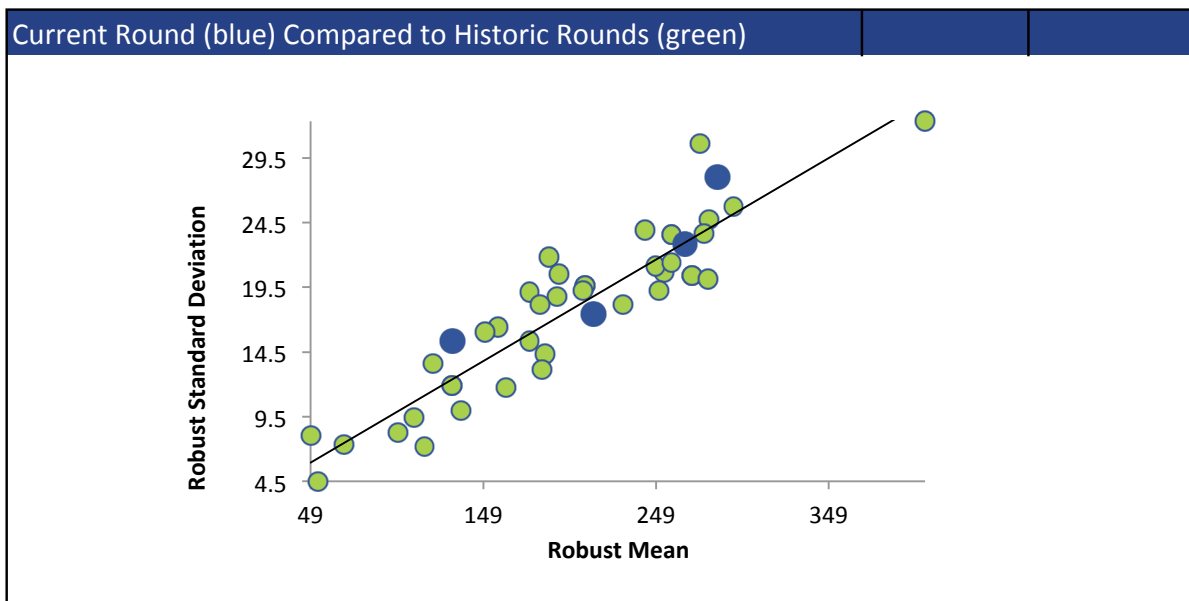
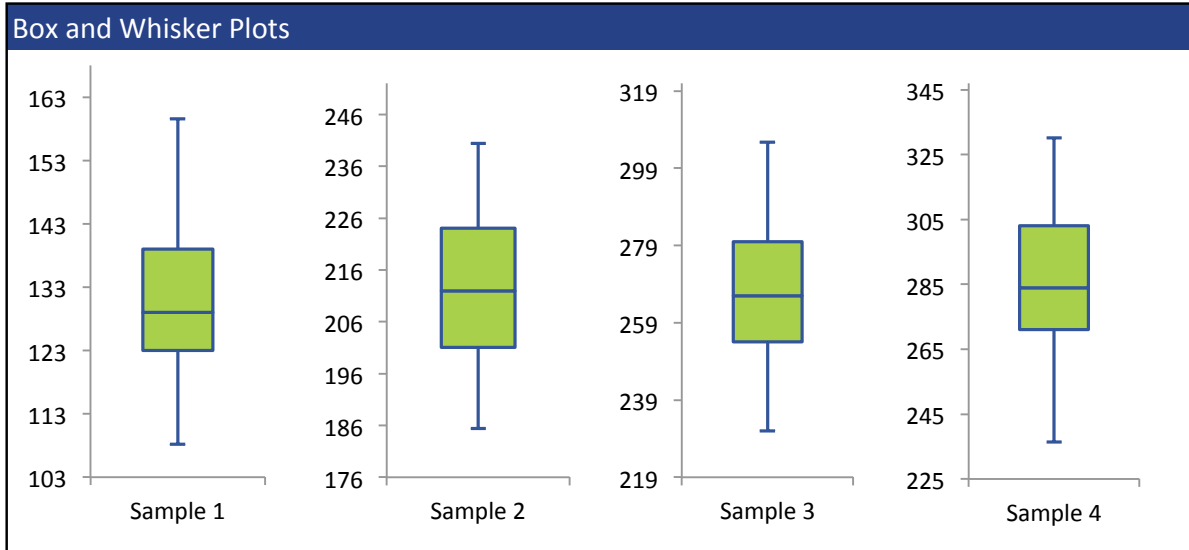
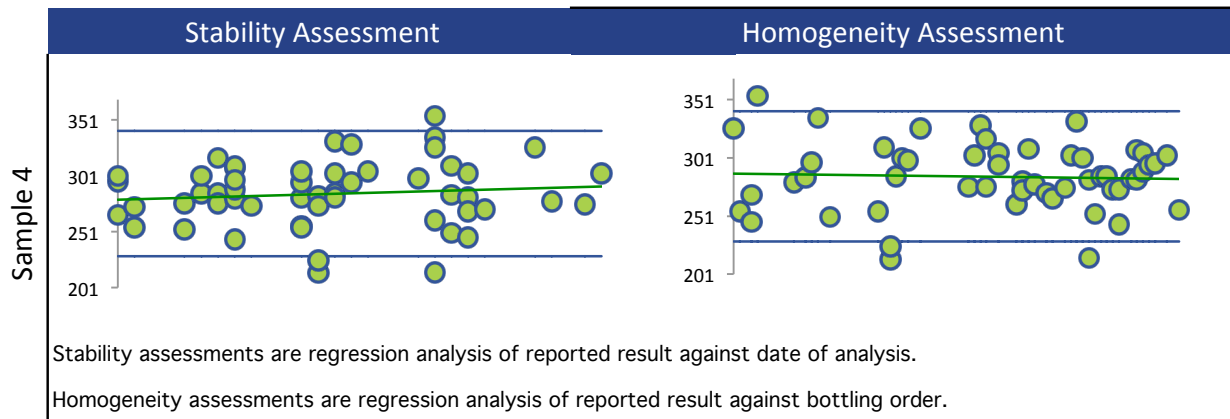
All summary stats and the plots below are based on the data excluding any flagged outliers



STRONTIUM



STRONTIUM



TIN

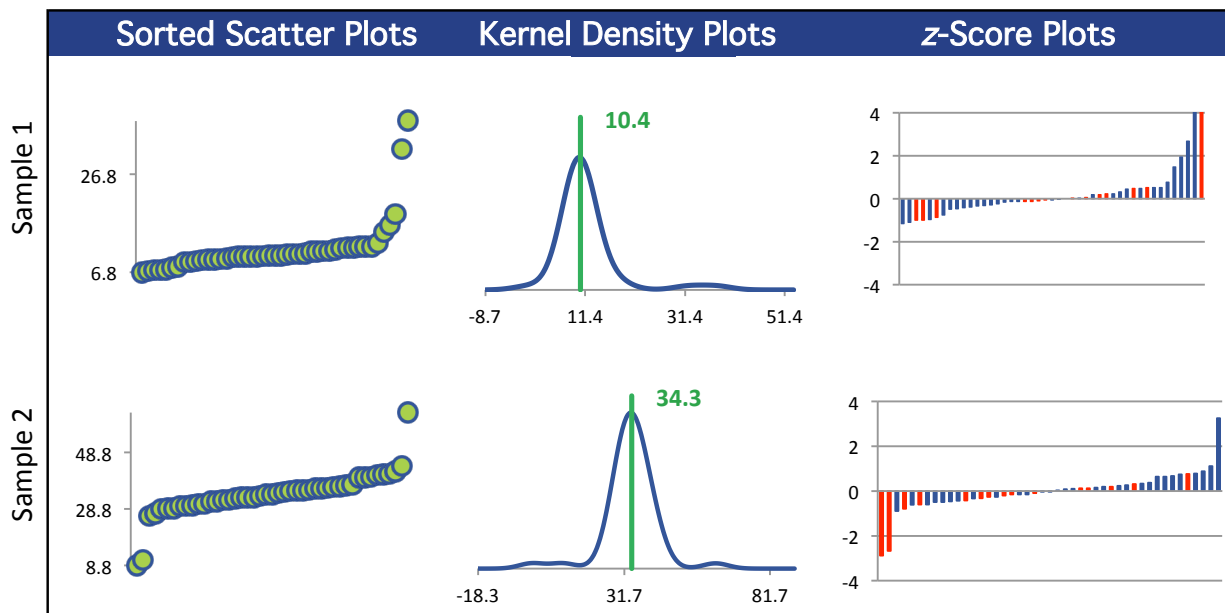
Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	45	45	45	45
Median $\mu\text{g/g}$	10.2	34.0	52.3	46.0
Robust Mean $\mu\text{g/g}$	10.4	34.3	53.6	46.4
U $\mu\text{g/g}$	0.375	0.945	1.39	1.24
Robust Standard Deviation $\mu\text{g/g}$	2.01	5.07	7.45	6.66
Regression Standard Deviation $\mu\text{g/g}$	3.10	8.84	13.5	11.7
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA) $\mu\text{g/g}$	3.10	8.84	13.5	11.7
Outliers	0	0	0	0
$ z > 3.0$	2	1	0	1
$2 < z < 3$	1	2	2	2

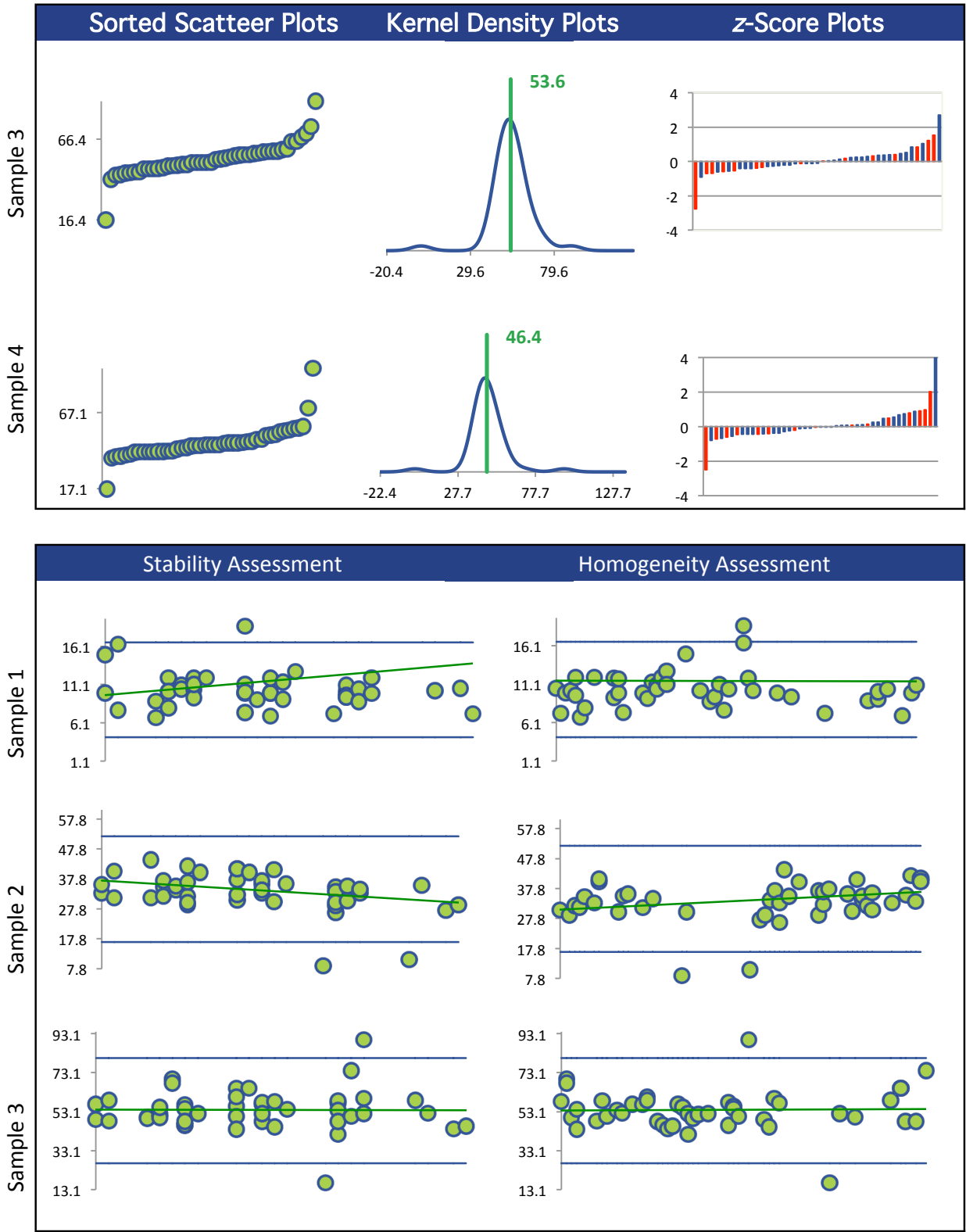
Methods Used

Method	C17-1	C17-2	C17-3	C17-4
ICP/MS (Blue)	30	30	30	30
ICP/OES (Red)	15	15	15	15

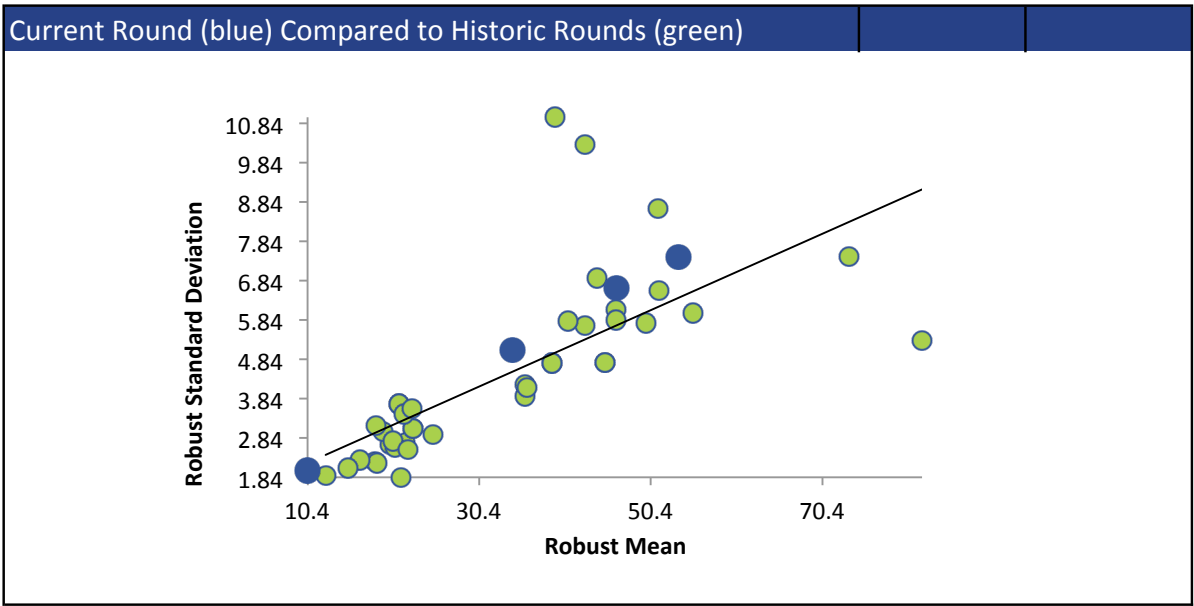
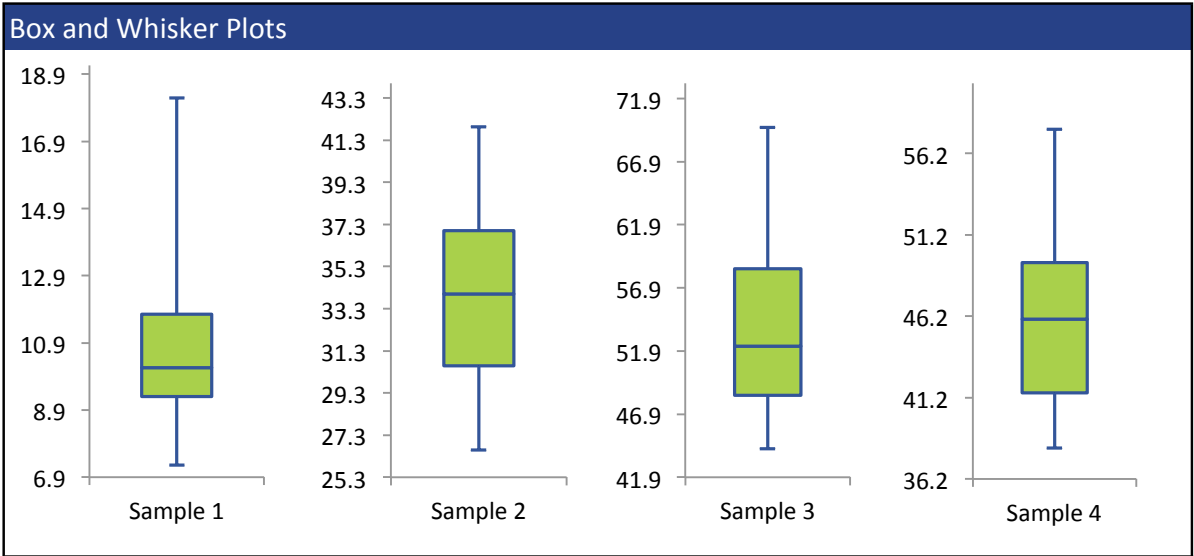
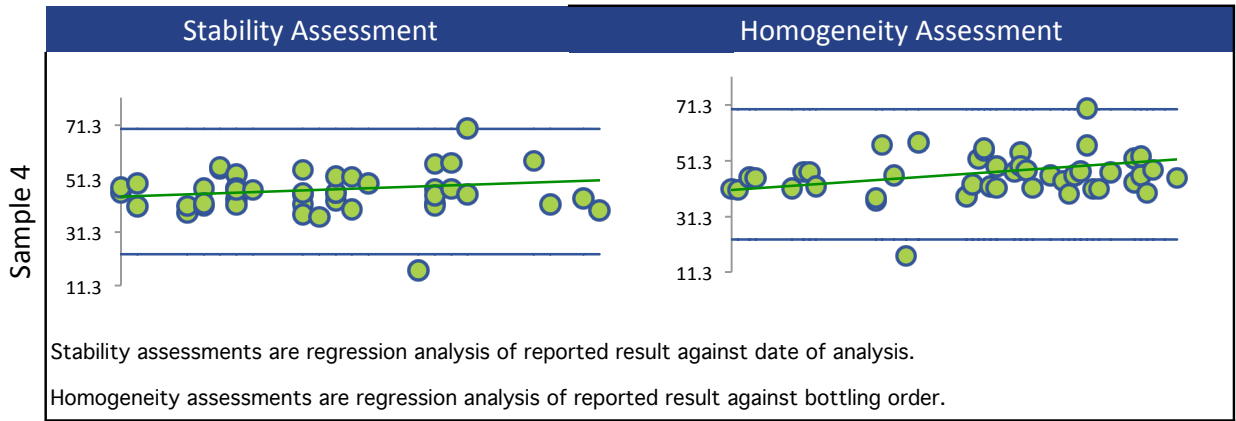
All summary stats and the plots below are based on the data excluding any flagged outliers



TIN



TIN



TITANIUM

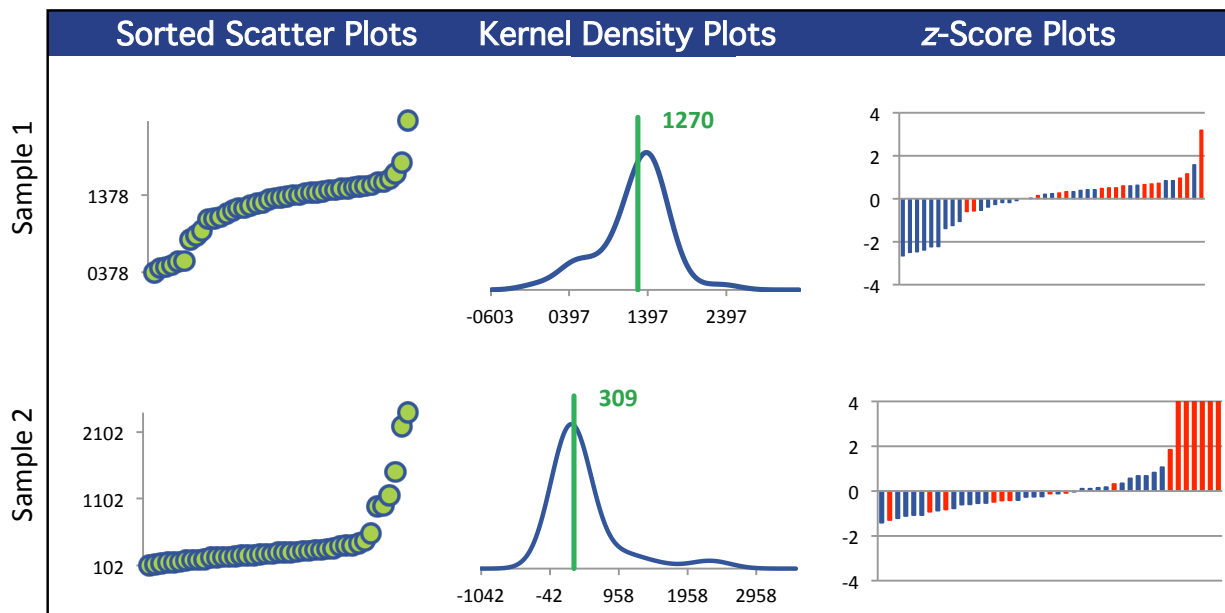
Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	43	43	43	43
Median $\mu\text{g/g}$	1350	293	314	312
Robust Mean $\mu\text{g/g}$	1270	309	345	370
U $\mu\text{g/g}$	62.1	28.0	31.5	48.2
Robust Standard Deviation $\mu\text{g/g}$	326	147	165	253
Regression Standard Deviation $\mu\text{g/g}$	335	92.3	101	108
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA) $\mu\text{g/g}$	335	147	165	253
Outliers	0	0	0	0
$ z > 3.0$	1	6	5	6
$2 < z < 3$	6	0	1	2

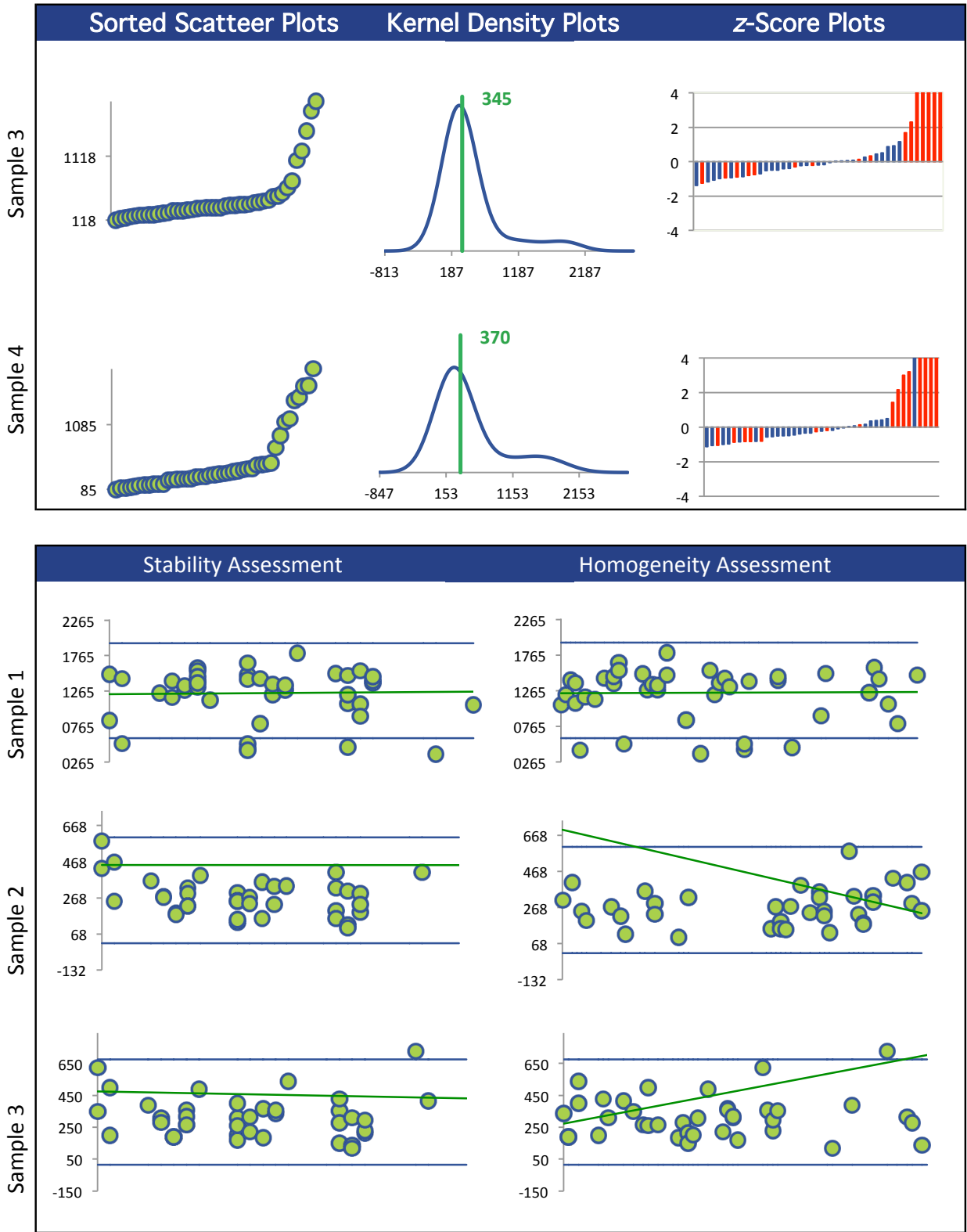
Methods Used

Method	C17-1	C17-2	C17-3	C17-4
ICP/MS (Blue)	27	27	27	27
ICP/OES (Red)	16	16	16	16

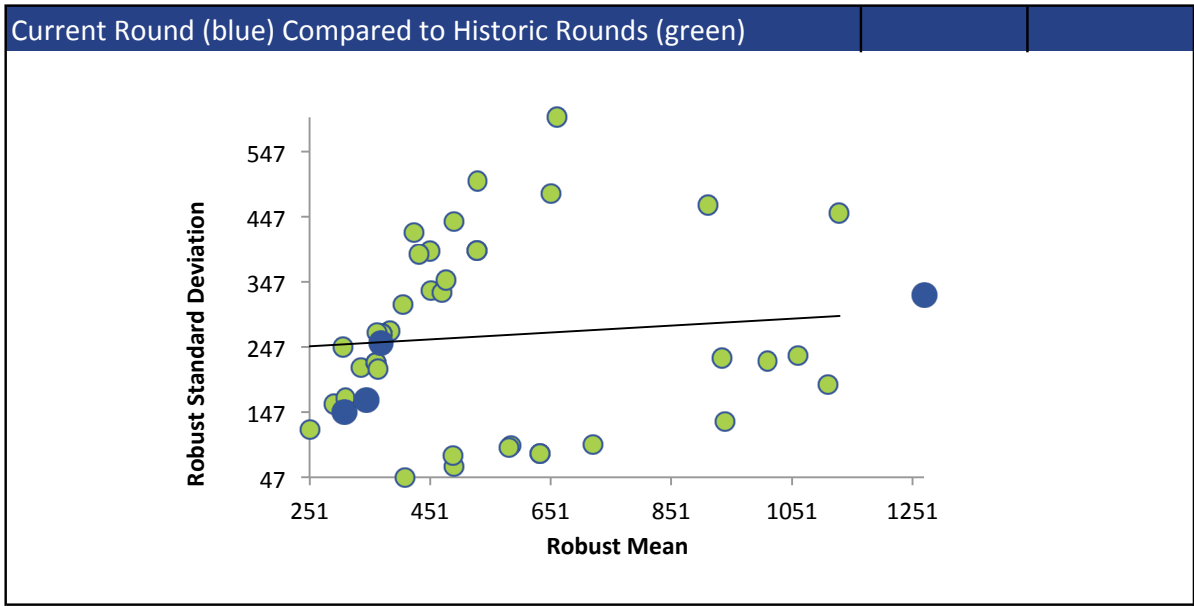
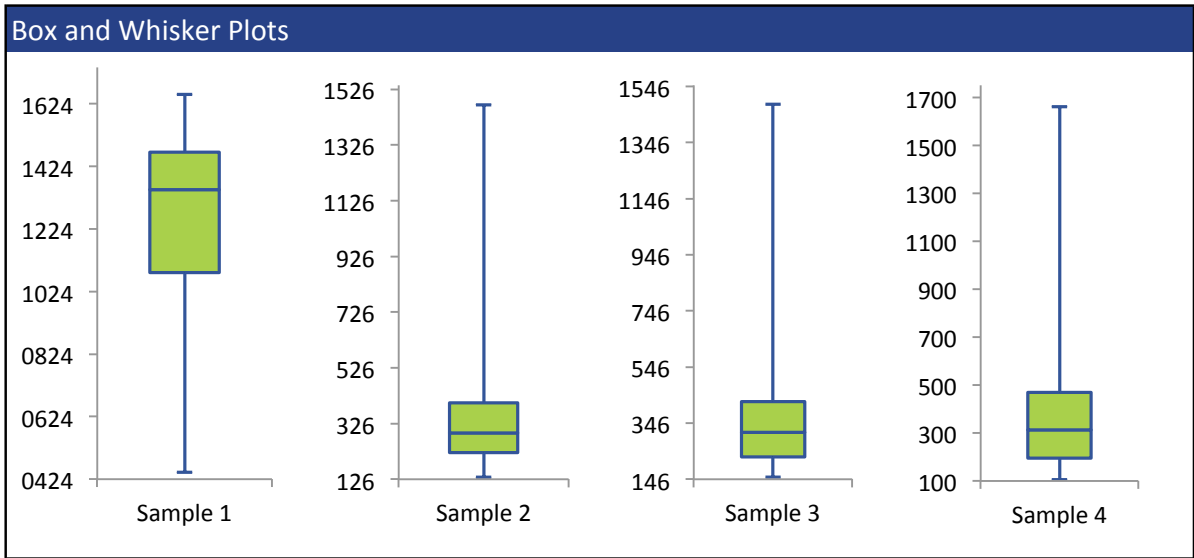
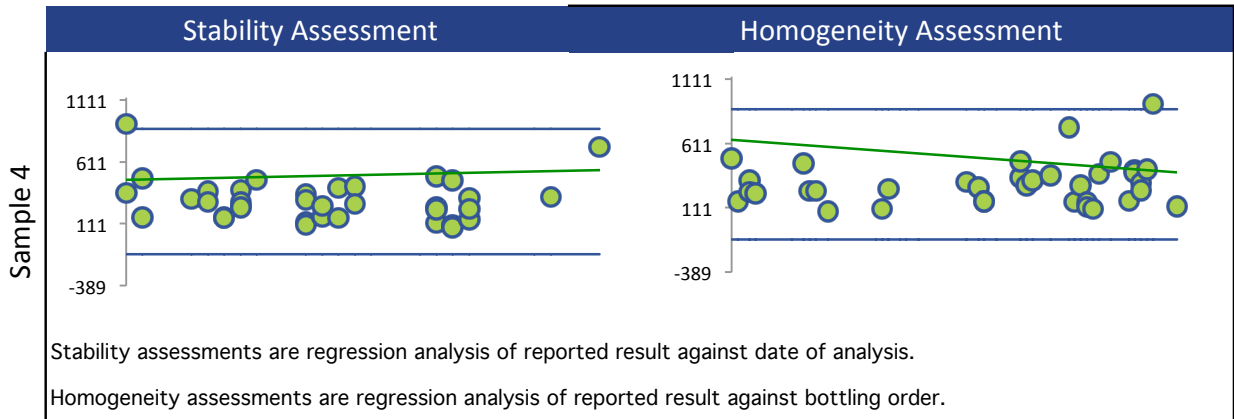
All summary stats and the plots below are based on the data excluding any flagged outliers



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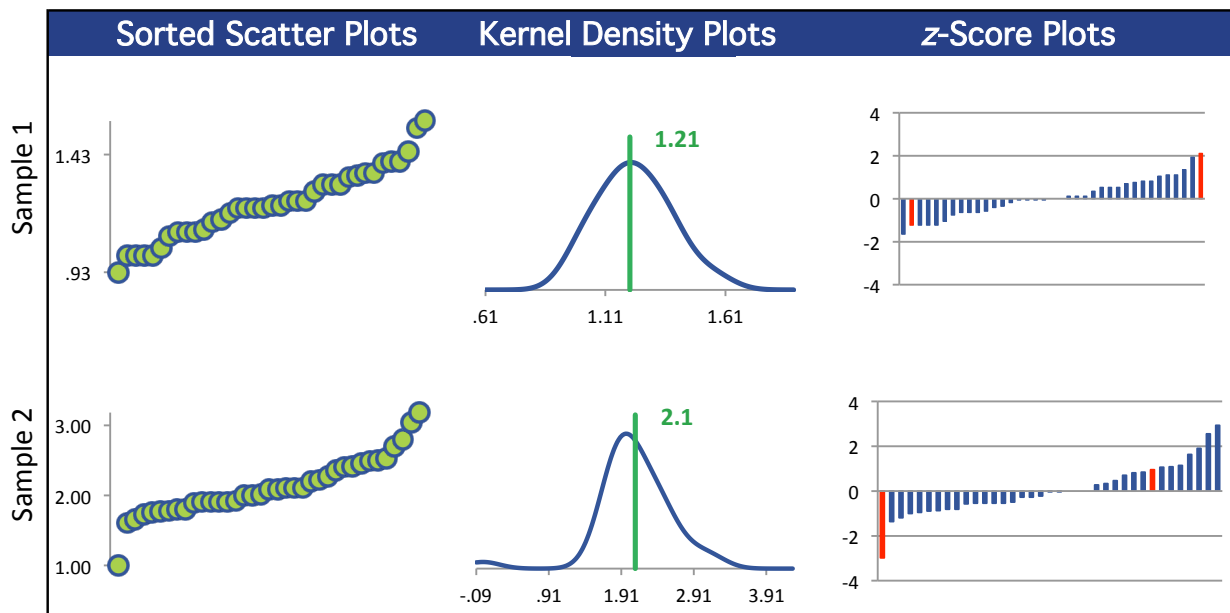
Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	37	37	37	37
Median $\mu\text{g/g}$	1.21	2.09	2.50	1.95
Robust Mean $\mu\text{g/g}$	1.21	2.10	2.53	1.96
U $\mu\text{g/g}$	0.0327	0.0758	0.0824	0.0623
Robust Standard Deviation $\mu\text{g/g}$	0.159	0.369	0.401	0.303
Regression Standard Deviation $\mu\text{g/g}$	0.171	0.248	0.285	0.236
Stability Flag			Stability	
Homogeneity Flag				
Standard Deviation Used (SDPA) $\mu\text{g/g}$	0.171	0.369	0.600	0.303
Outliers	2	2	2	2
$ z > 3.0$	0	0	0	2
$2 < z < 3$	1	3	1	1

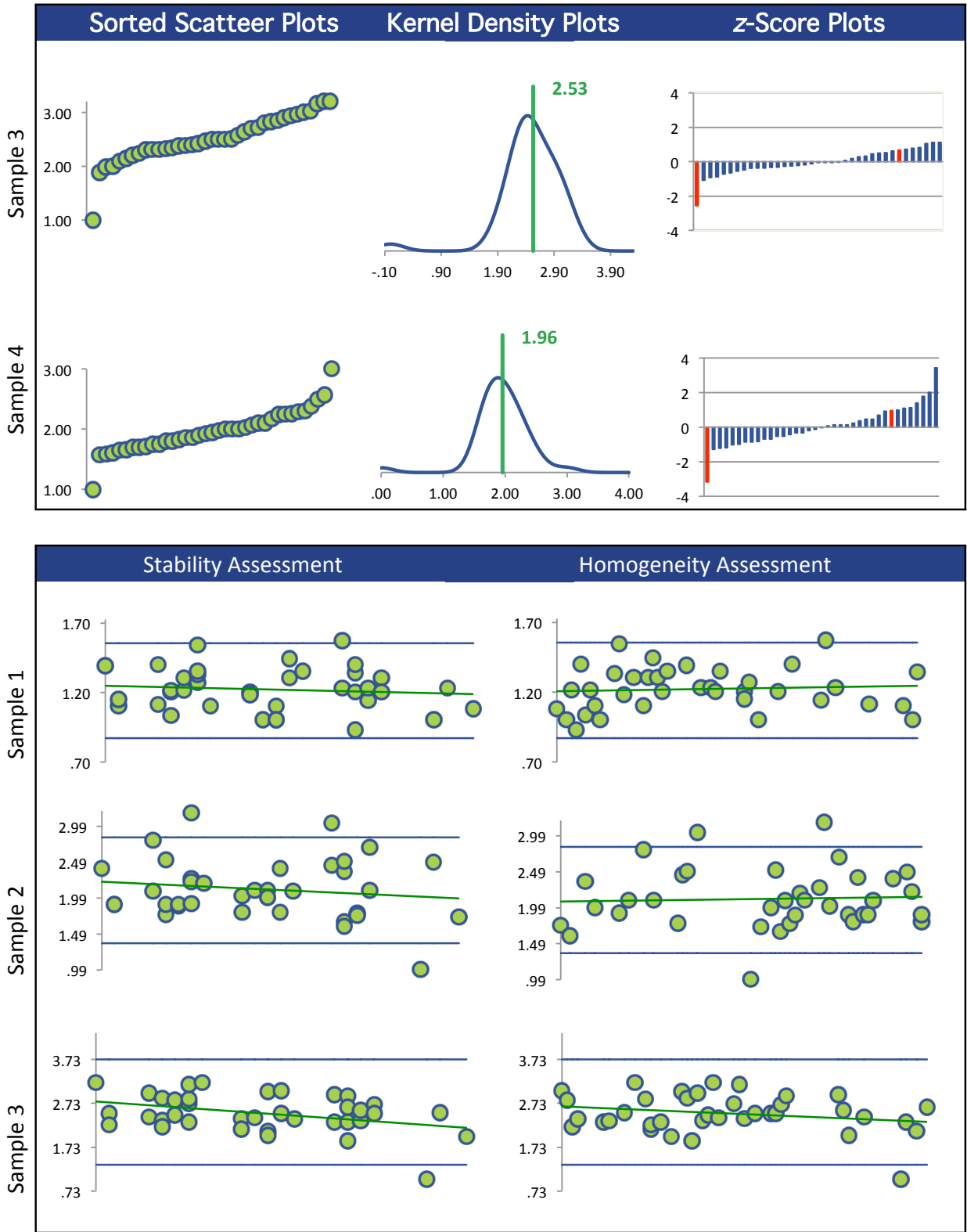
Methods Used

Method	C17-1	C17-2	C17-3	C17-4
ICP/MS (Blue)	35	35	35	35
ICP/OES (Red)	2	2	2	2

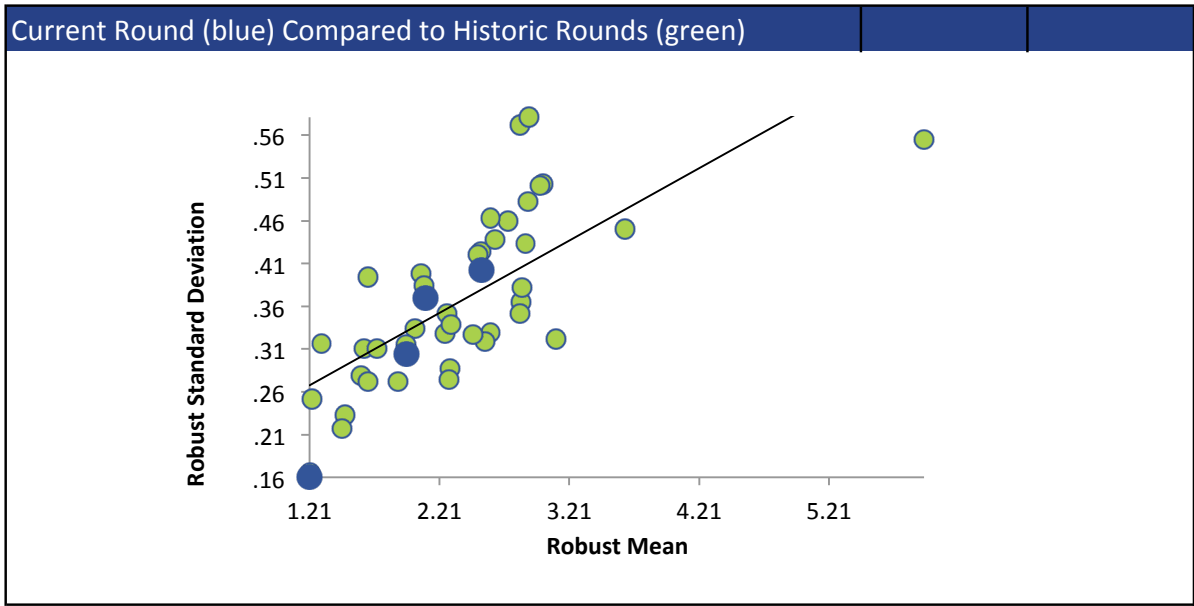
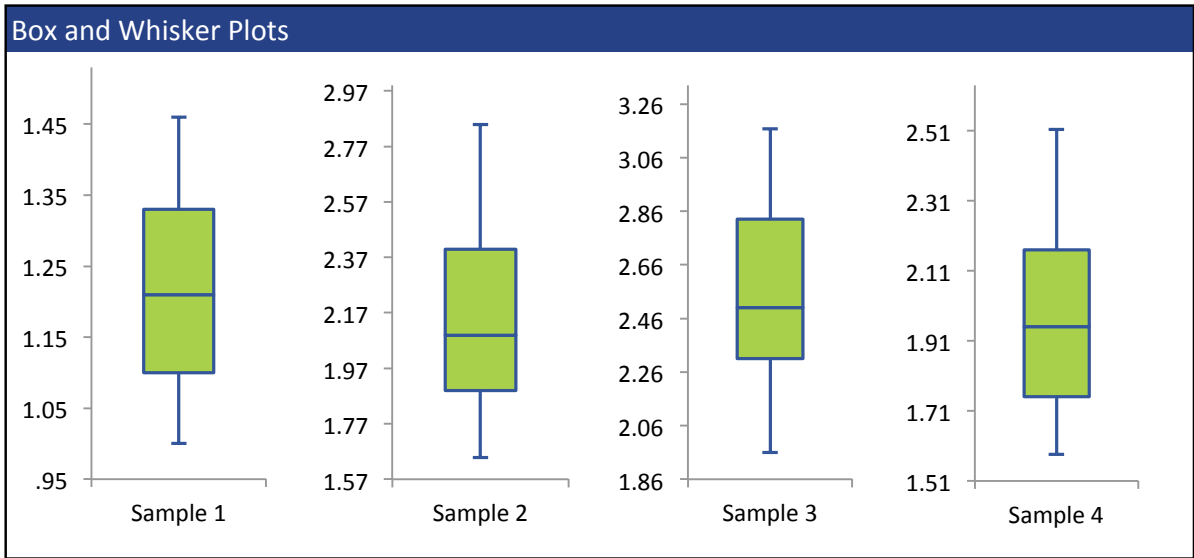
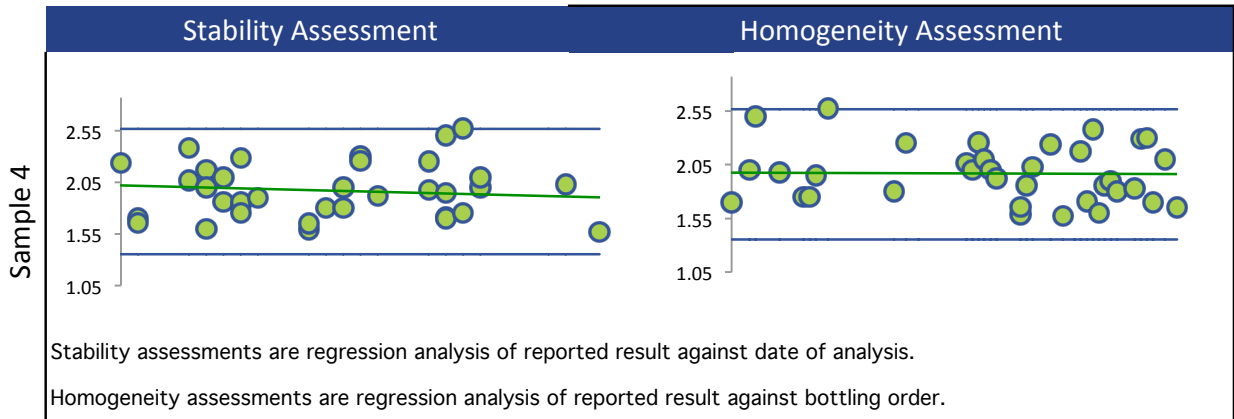
All summary stats and the plots below are based on the data excluding any flagged outliers



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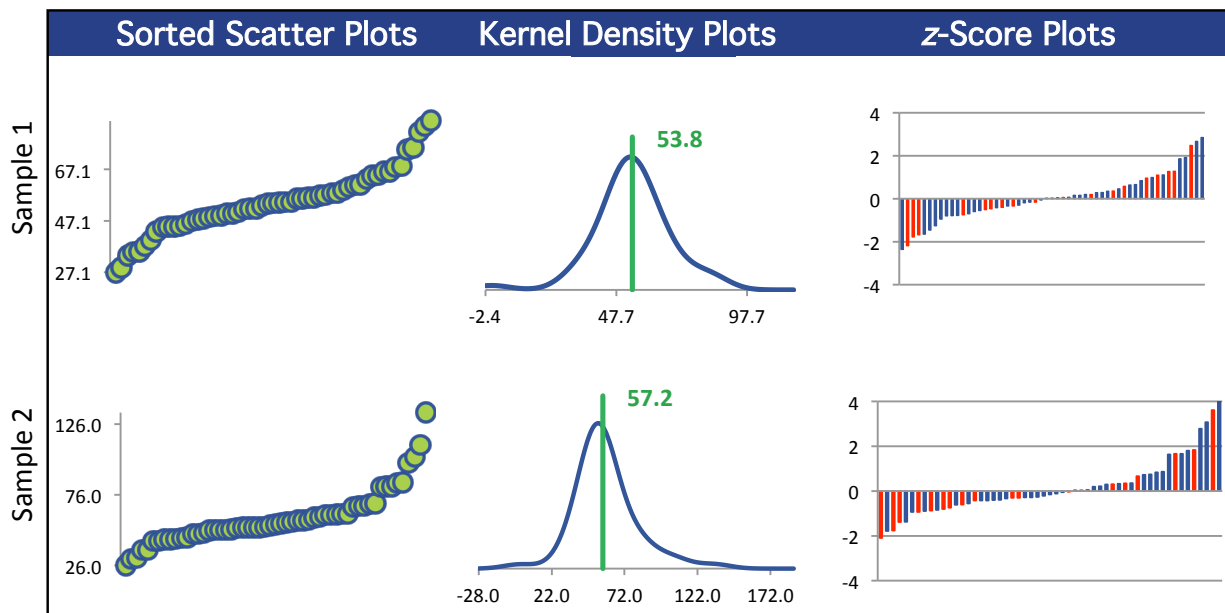
Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	55	55	55	55
Median $\mu\text{g/g}$	54.0	55.0	77.0	76.5
Robust Mean $\mu\text{g/g}$	53.8	57.2	79.0	76.4
U $\mu\text{g/g}$	1.90	2.51	2.48	3.27
Robust Standard Deviation $\mu\text{g/g}$	11.3	14.9	14.7	19.4
Regression Standard Deviation $\mu\text{g/g}$	7.75	8.22	11.3	10.9
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA) $\mu\text{g/g}$	11.3	14.9	14.7	19.4
Outliers	0	0	0	0
$ z > 3.0$	0	3	1	0
$2 < z < 3$	5	2	4	1

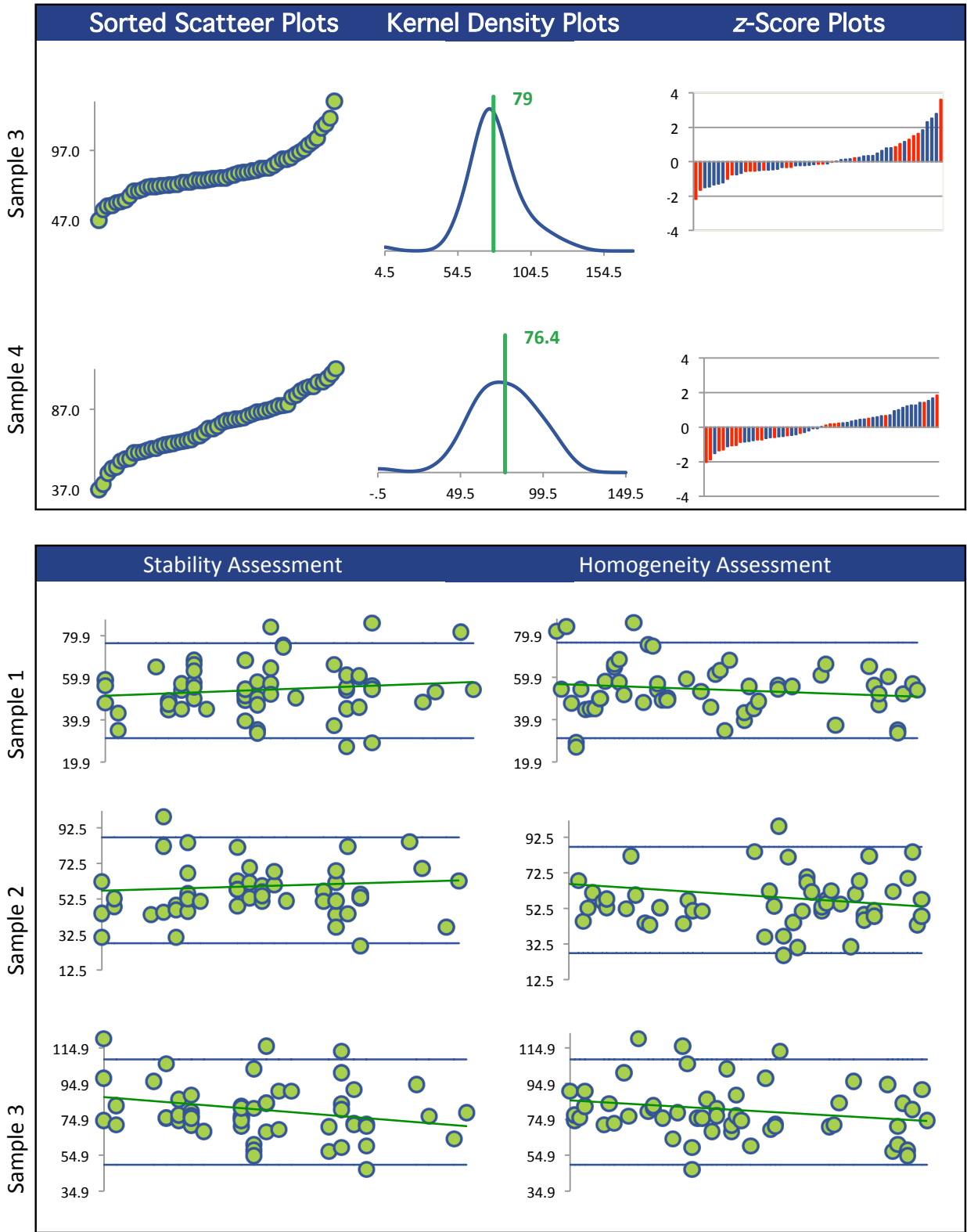
Methods Used

Method	C17-1	C17-2	C17-3	C17-4
ICP/MS (Blue)	35	35	35	35
ICP/OES (Red)	20	20	20	20

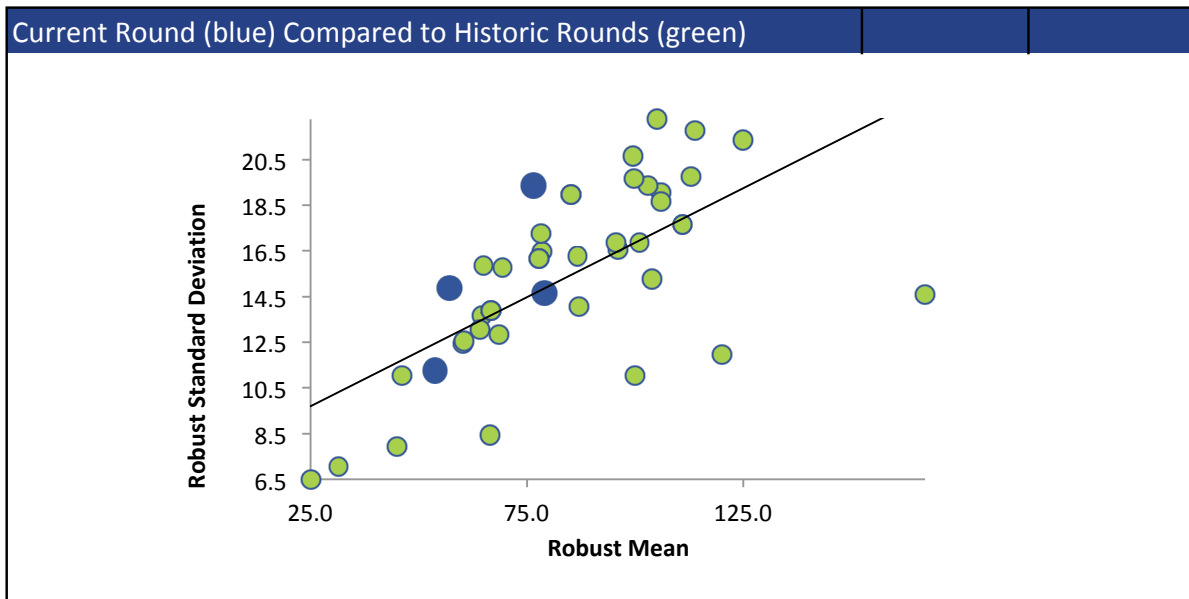
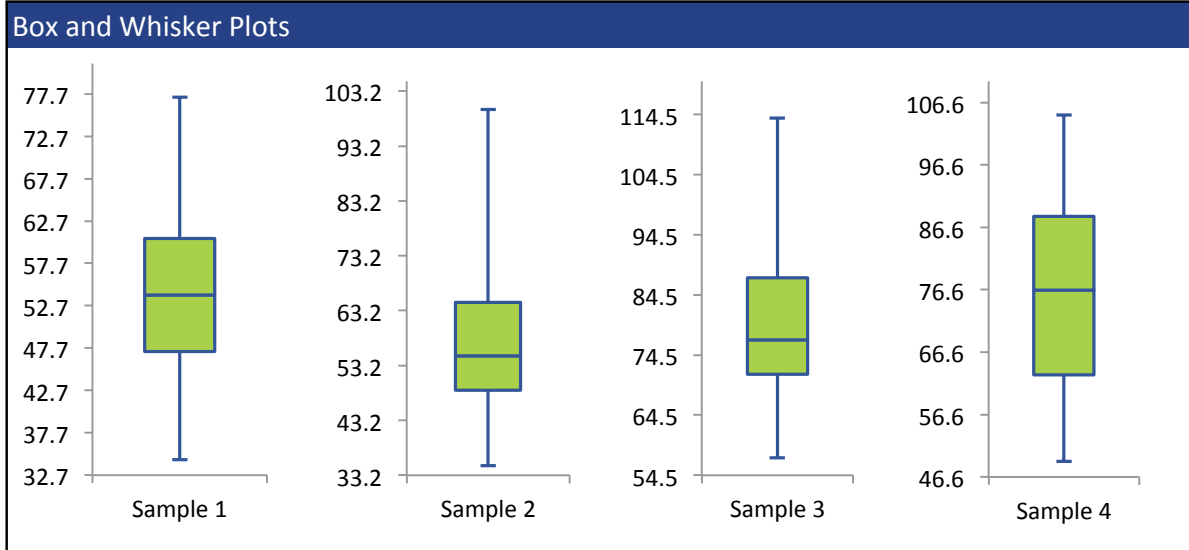
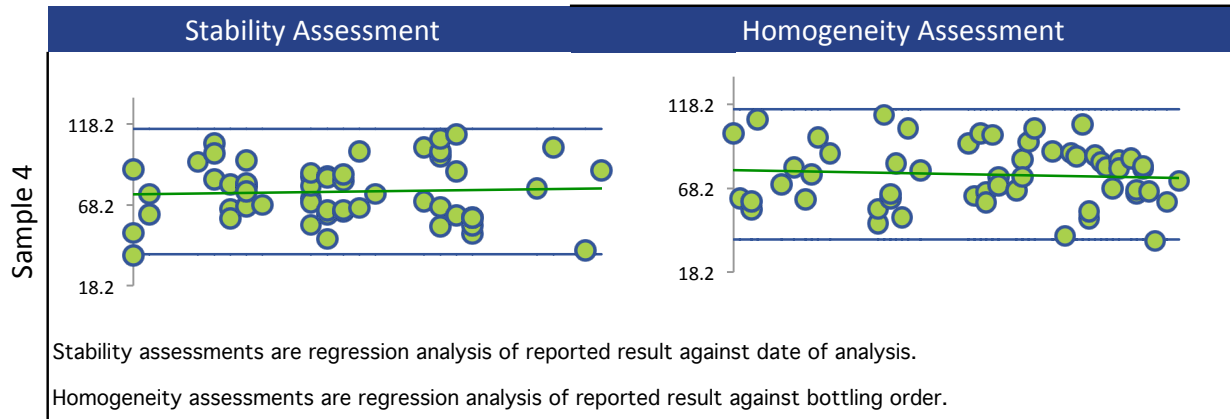
All summary stats and the plots below are based on the data excluding any flagged outliers



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VANADIUM



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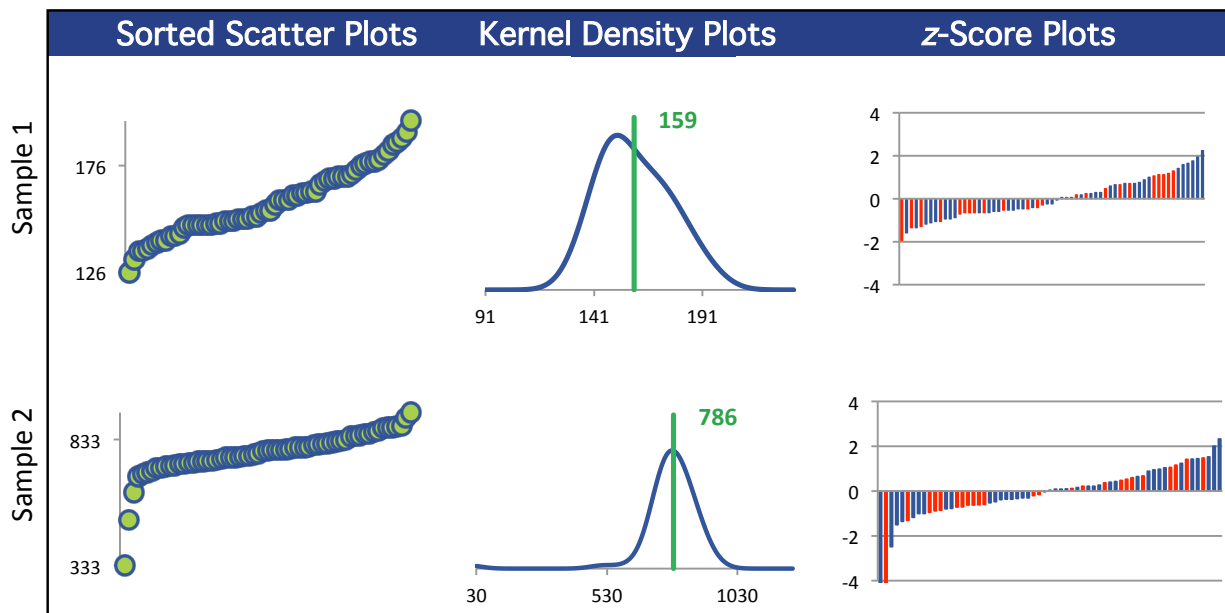
Summary Statistics

Statistic	C17-1	C17-2	C17-3	C17-4
N	63	63	63	63
Median $\mu\text{g/g}$	155	788	828	777
Robust Mean $\mu\text{g/g}$	159	786	828	783
U $\mu\text{g/g}$	2.68	10.4	9.50	9.91
Robust Standard Deviation $\mu\text{g/g}$	17.0	66.0	60.3	62.9
Regression Standard Deviation $\mu\text{g/g}$	13.0	63.1	66.6	63.0
Stability Flag				
Homogeneity Flag				
Standard Deviation Used (SDPA) $\mu\text{g/g}$	17.0	66.0	66.6	63.0
Outliers	1	1	1	1
$ z > 3.0$	0	2	0	0
$2 < z < 3$	1	2	3	3

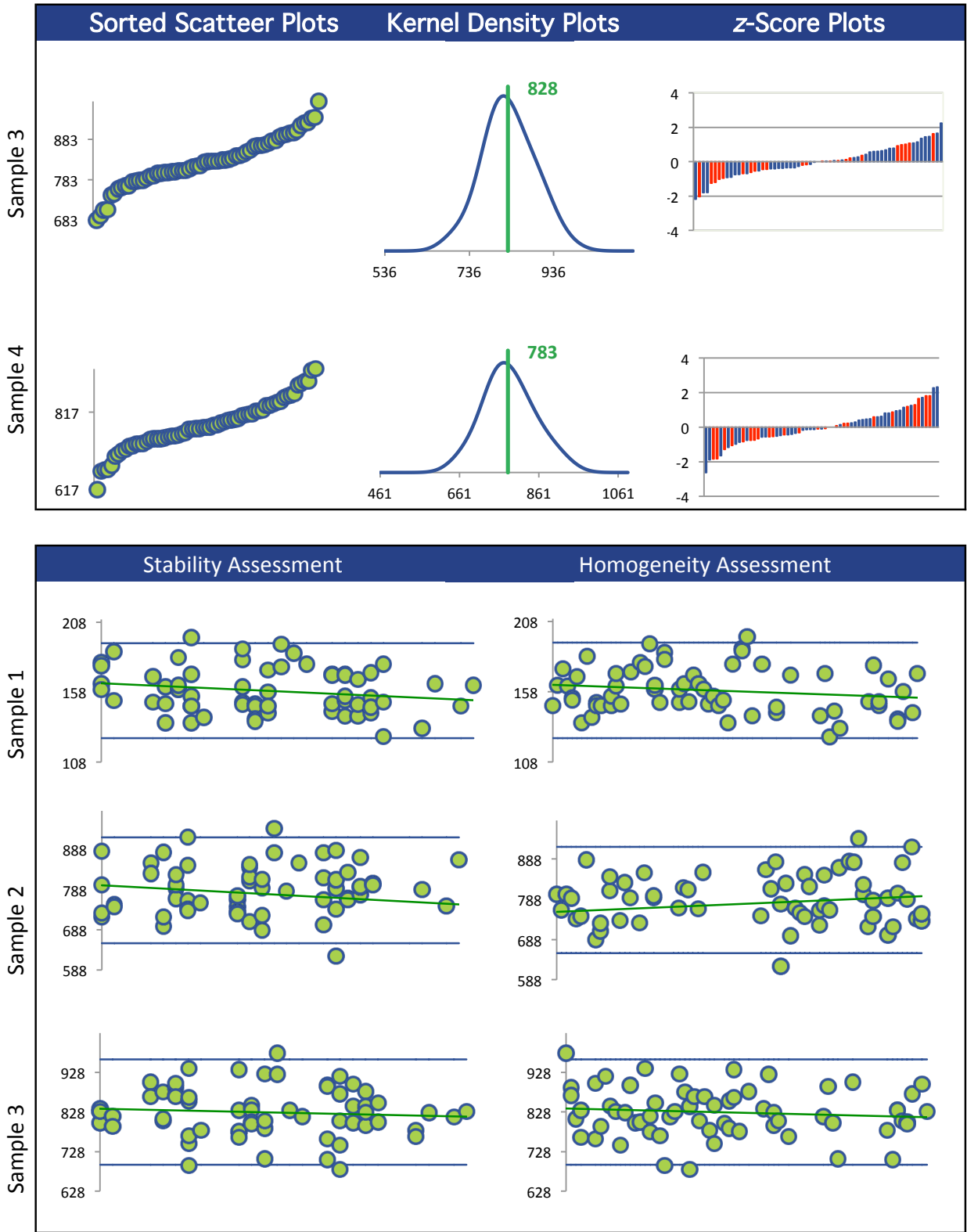
Methods Used

Method	C17-1	C17-2	C17-3	C17-4
ICP/OES (Blue)	24	24	24	24
ICP/MS (Red)	39	39	39	39

All summary stats and the plots below are based on the data excluding any flagged outliers



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