

Precambrian Iron Formations

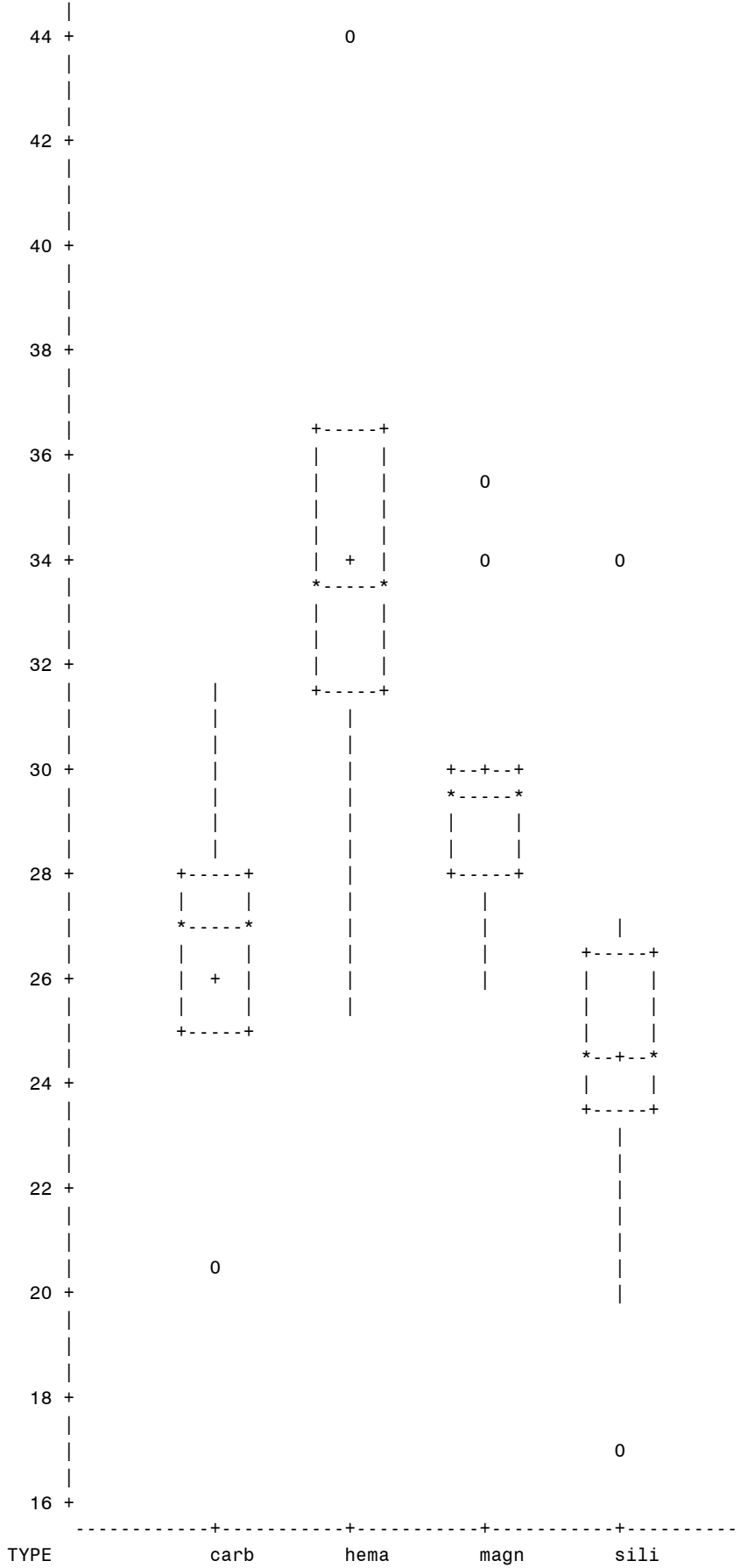
```
1
2
3
4 * exiron;
5 option ls=120 ps=75 nocenter nodate;
6 title 'Precambrian Iron Formations';
7
8 * IRON = FE content (%) in four formation types;
9 * TYPE = formation type (carbonate, silicate, magnetite, hematite);
10 * FE - temporary variable for entering sample data;
11 data IRONDATA; * data step to create dataset;
12     array FE FE1-FE10; * create array;
13     input TYPE $ FE1-FE10; * input type (character) and sample;
14     do over FE; IRON=FE; output; end; * output each observation in sample;
15     drop FE1-FE10; * drop temporary variables;
16 label IRON='FE content' TYPE='Formation Type';
17
18 cards;
19 carb 20.5 28.1 27.8 27.0 28.0 25.2 25.3 27.1 20.5 31.3
20 sili 26.3 24.0 26.2 20.2 23.7 34.0 17.1 26.8 23.7 24.9
21 magn 29.5 34.0 27.5 29.4 27.9 26.2 29.9 29.5 30.0 35.6
22 hema 36.5 44.2 34.1 30.3 31.4 33.1 34.1 32.9 36.3 25.5
23
24 proc print; var TYPE IRON; * print the data;
25
26 PROC SORT;BY TYPE;
27 PROC UNIVARIATE PLOT;VAR IRON; BY TYPE; * SIDE BY SIDE BOX PLOTS;
28
29
30 proc glm; class TYPE; model IRON=TYPE; * one-way analysis of variance;
31     means TYPE/tukey; * Tukey multiple comparison;
32     estimate 'contrast' type -.5 .5 .5 -.5; * estimating a contrast;
33     estimate 'carb vs sili' type 1 0 0 -1; * difference between carb & sili;
34     estimate 'magn vs hemi' type 0 1 -1 0; * difference between magn & hemi;
35     contrast 'contrast' type -.5 .5 .5 -.5; * t-test for a contrast;
36     contrast 'carb vs sili' type 1 0 0 -1; * difference between carb &
37 sili;
38     contrast 'magn vs hemi' type 0 1 -1 0; * difference between magn &
39 hemi;
40     output out=NEW r=RESID; * output residuals;
41
42 proc anova; class type;
43     model iron=type;
44     means hovtest=bf; * test of equality of variances;
45
46 proc nparlway wilcoxon; var IRON; class TYPE; * Kruskal-Wallis test;
47
48
49 proc univariate normal def=5; var RESID; * summary with test for normality;
50
51 proc rank out=IRONDATA normal=blom; * quantiles for normal plot;
52     var RESID; ranks Q_NORM;
53     label Q_NORM='Normal Quantiles';
54 proc plot; plot RESID*Q_NORM; * normal plot of residuals;
55 run;
```

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Obs	TYPE	IRON
1	carb	20.5
2	carb	28.1
3	carb	27.8
4	carb	27.0
5	carb	28.0
6	carb	25.2
7	carb	25.3
8	carb	27.1
9	carb	20.5
10	carb	31.3
11	sili	26.3
12	sili	24.0
13	sili	26.2
14	sili	20.2
15	sili	23.7
16	sili	34.0
17	sili	17.1
18	sili	26.8
19	sili	23.7
20	sili	24.9
21	magn	29.5
22	magn	34.0
23	magn	27.5
24	magn	29.4
25	magn	27.9
26	magn	26.2
27	magn	29.9
28	magn	29.5
29	magn	30.0
30	magn	35.6
31	hema	36.5
32	hema	44.2
33	hema	34.1
34	hema	30.3
35	hema	31.4
36	hema	33.1
37	hema	34.1
38	hema	32.9
39	hema	36.3
40	hema	25.5

The UNIVARIATE Procedure
 Variable: IRON (FE content)
 Schematic Plots



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The GLM Procedure

Class Level Information

Class	Levels	Values
TYPE	4	carb hema magn sili

Number of observations 40

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The GLM Procedure

Dependent Variable: IRON FE content

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	509.122000	169.707333	10.85	<.0001
Error	36	563.134000	15.642611		
Corrected Total	39	1072.256000			

R-Square	Coeff Var	Root MSE	IRON Mean
0.474814	13.80962	3.955074	28.64000

Source	DF	Type I SS	Mean Square	F Value	Pr > F
TYPE	3	509.1220000	169.7073333	10.85	<.0001

Source	DF	Type III SS	Mean Square	F Value	Pr > F
TYPE	3	509.1220000	169.7073333	10.85	<.0001

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The GLM Procedure

Tukey's Studentized Range (HSD) Test for IRON

NOTE: This test controls the Type I experimentwise error rate, but it generally has a higher Type II error rate than REGWQ.

Alpha	0.05
Error Degrees of Freedom	36
Error Mean Square	15.64261
Critical Value of Studentized Range	3.80880
Minimum Significant Difference	4.7637

Means with the same letter are not significantly different.

Tukey Grouping	Mean	N	TYPE
A	33.840	10	hema
A			
B A	29.950	10	magn
B			
B C	26.080	10	carb
C			
C	24.690	10	sili

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The GLM Procedure

Dependent Variable: IRON FE content

Contrast	DF	Contrast SS	Mean Square	F Value	Pr > F
contrast	1	423.8010000	423.8010000	27.09	<.0001
carb vs sili	1	9.6605000	9.6605000	0.62	0.4371
magn vs hemi	1	75.6605000	75.6605000	4.84	0.0344

Parameter	Estimate	Standard Error	t Value	Pr > t
contrast	6.51000000	1.25070425	5.21	<.0001
carb vs sili	1.39000000	1.76876291	0.79	0.4371
magn vs hemi	3.89000000	1.76876291	2.20	0.0344

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The ANOVA Procedure

Class Level Information

Class	Levels	Values
TYPE	4	carb hema magn sili

Number of observations 40

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The ANOVA Procedure

Dependent Variable: IRON FE content

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	509.122000	169.707333	10.85	<.0001
Error	36	563.134000	15.642611		
Corrected Total	39	1072.256000			

R-Square	Coeff Var	Root MSE	IRON Mean
0.474814	13.80962	3.955074	28.64000

Source	DF	Anova SS	Mean Square	F Value	Pr > F
TYPE	3	509.1220000	169.7073333	10.85	<.0001

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The ANOVA Procedure

Brown and Forsythe's Test for Homogeneity of IRON Variance
ANOVA of Absolute Deviations from Group Medians

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
TYPE	3	10.9330	3.6443	0.44	0.7229
Error	36	295.4	8.2063		

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The NPAR1WAY Procedure

Wilcoxon Scores (Rank Sums) for Variable IRON
Classified by Variable TYPE

TYPE	N	Sum of Scores	Expected Under H0	Std Dev Under H0	Mean Score
carb	10	150.0	205.0	32.006610	15.00
hema	10	320.0	205.0	32.006610	32.00
magn	10	246.0	205.0	32.006610	24.60
sili	10	104.0	205.0	32.006610	10.40

Average scores were used for ties.

Kruskal-Wallis Test

Chi-Square 20.5960
DF 3
Pr > Chi-Square 0.0001

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The UNIVARIATE Procedure

Variable: RESID

Moments

N	40	Sum Weights	40
Mean	0	Sum Observations	0
Std Deviation	3.79991228	Variance	14.4393333
Skewness	0.38646664	Kurtosis	1.36976376
Uncorrected SS	563.134	Corrected SS	563.134
Coeff Variation	.	Std Error Mean	0.60081889

Basic Statistical Measures

Location		Variability	
Mean	0.00000	Std Deviation	3.79991
Median	-0.25000	Variance	14.43933
Mode	-5.58000	Range	18.70000
		Interquartile Range	3.34000

NOTE: The mode displayed is the smallest of 4 modes with a count of 2.

Tests for Location: Mu0=0

Test	-Statistic-	-----p Value-----		
Student's t	t	0	Pr > t	1.0000
Sign	M	-1	Pr >= M	0.8746
Signed Rank	S	-9	Pr >= S	0.9055

Tests for Normality

Test	--Statistic--	-----p Value-----		
Shapiro-Wilk	W	0.954059	Pr < W	0.1046
Kolmogorov-Smirnov	D	0.147227	Pr > D	0.0273
Cramer-von Mises	W-Sq	0.134249	Pr > W-Sq	0.0387
Anderson-Darling	A-Sq	0.751778	Pr > A-Sq	0.0469

Quantiles (Definition 5)

Quantile	Estimate
100% Max	10.360
99%	10.360
95%	7.480
90%	4.635
75% Q3	1.820
50% Median	-0.250
25% Q1	-1.520
10%	-5.035
5%	-6.585
1%	-8.340
0% Min	-8.340

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Plot of RESID*Q_NORM. Legend: A = 1 obs, B = 2 obs, etc.

