APPENDIX 11. STATISTICAL ANALYSIS AND HISTOGRAMS OF VARIOUS PARAMETERS FOR GHN, OTHER QUESTA ROCK PILES, AND ANALOG MATERIALS.

DENSITY FOR GHN, OTHER QUESTA ROCK PILES, AND ANALOG MATERIALS

Descriptive statistics

TABLE A11-1. Descriptive statistics of density (g/cc) by geologic units for GHN and for Questa materials. Histograms are below.

Unit	Mean	Median	Standard deviation	Standard error	Minimum	Maximum	Number of Samples
Traffic	1.88	1.86	0.11	0.03	1.72	2.06	12
Unit C	1.73	1.76	0.12	0.06	1.57	1.85	4
Unit I	2.00						1
Unit J	1.81	1.85	0.12	0.03	1.59	1.94	12
Unit N	1.81	1.81	0.12	0.04	1.63	1.99	9
Unit K	1.77	1.78	0.16	0.04	1.51	1.96	14
Unit O	1.83	1.81	0.11	0.02	1.53	2.48	35
Unit M	1.91	1.97	0.11	0.05	1.61	2.07	9
Unit U	1.82	1.86	0.07	0.03	1.71	1.89	6
Unit V	1.89	1.86	0.08	0.04	1.83	1.99	4
Unit RUB	1.70	1.71	0.04	0.02	1.64	1.75	7
All GHN (including unstable GHN)	1.84	1.83	0.15	0.01	1.51	2.49	118
Middle	2.12						1
SGS	1.75						1
SPR	1.79	1.83	0.26	0.08	1.43	2.19	11
SSS	1.90	1.92	0.12	0.05	1.68	2.09	7
SSW	1.95	1.90	0.27	0.07	1.40	2.43	15
All rock piles	1.85	1.84	0.14	0.01	1.40	2.49	153
Debris Flow	1.87	1.94	0.34	0.11	1.27	2.46	11
Alteration scars	1.90	1.90	0.21	0.06	1.51	2.27	12
Colluvium	2.18						1
Andesites	2.0						1
Rhyolite (Amalia Tuff)	1.8						1
All Questa materials	1.8	1.8	0.18	0.01	1.3	2.4	176

Statistical Analyses

Hypothesis 1. The dry density of the different geologic units in GHN rock pile is different.

Data. Data are results obtained from NMIMT sampling and testing on Questa rock piles 2004-2007 (Appendix 7 and project Access database).

Approach. One Way Analysis of Variance (ANOVA) was selected, which assesses the samples in terms of mean. The tests were calculated using the SigmaStat@ software.

Results. The data are normal (P = 0.180) and have Equal Variance (P = 0.556). The results are in Table A11-2.

TABLE A11-2. Comparisons of dry density (g/cc) in GHN units using standard ANOVA analysis.

Unit	Number	Mean	Standard deviation	SEM
Traffic	12	1.88	0.11	0.032
Unit C-I	5	1.79	0.16	0.070
Unit J	12	1.81	0.12	0.034
Unit K	14	1.77	0.16	0.043
Unit N	9	1.81	0.12	0.038
Unit O	35	1.83	0.16	0.027
Unit M	9	1.92	0.15	0.049
Unit U	6	1.82	0.083	0.034
Unit V	4	1.89	0.077	0.039
Unit RUB (rubble zone)	7	1.70	0.040	0.015

Conclusion

The differences in the mean values among the geologic units are not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference (P = 0.090). The dry density of the geologic units is similar.

Hypothesis 2. The dry density of stable GHN rock pile is different from the dry density in the unstable GHN rock pile.

Data. Data are results obtained from NMIMT sampling and testing on Questa rock piles 2004-2007 (Appendix 7 and project Access database).

Approach. Mann-Whitney Rank Sum Test was selected, which assesses the samples in terms of mean between two groups of data. The tests were calculated using the SigmaStat@ software.

Results. The Normality Test Passed (P = 0.810), but the Equal Variance Test Failed (P < 0.050), so the Mann-Whitney Rank Sum Test was used. The results are in Table A11-3.

TABLE A11-3. Comparisons of dry density (g/cc) between the unstable and stable portions of GHN using the Mann-Whitney Rank Sum Test.

GHN group	N	Missing	Median	25%	75%
stable	113	0	1.83	1.73	1.92
unstable	5	0	2.10	1.87	2.37

Conclusion. The difference in the median values between the two groups is greater than would be expected by chance; there is a statistically significant difference (P = 0.012). Therefore, there is a difference between the median dry density between the unstable and stable portions of GHN rock pile.

Hypothesis 3. The dry density of the density in the Questa rock piles is different from each other.

Data. Data are results obtained from NMIMT sampling and testing on Questa rock piles 2004-2007 (Appendix 7 and project Access database).

Approach. Because the histograms indicate that the data are not approximately normally distributed, the non-parametric test, Kruskal-Wallis One Way Analysis of Variance on ranks, was selected, which assesses the samples in terms of median, not mean. The tests were calculated using the SigmaStat software. The test statistic in Kruskal-Wallis is called H. If the H statistic is small, the average ranks observed for the groups are approximately the same. If the H statistic is large, the variability among the average ranks is larger than expected from random sampling, i.e. the samples are from different distributions. The P value calculated for the test statistic H is the probability of incorrectly rejecting the null hypothesis. Only tests for which the p-value is less than 0.05 (the 5% level of the test; α-0.05) are acceptable evidence that the two samples are drawn from different distributions.

Results. The results are in Table A11-4.

TABLE A11-4. Comparisons of dry density (g/cc) between the GHN, Spring Gulch (SPR), Sugar Shack South (SSS) and Sugar Shack West (SSW) using the Kruskal-Wallis One Way Analysis of Variance analysis. H = 5.526 with 3 degrees of freedom. (P = 0.137).

Group	N	Missing	Median	25%	75%
GHN	118	0	1.83	1.74	1.92
SPR	11	0	1.83	1.58	1.96
SSS	7	0	1.92	1.85	1.94
SSW	15	0	1.90	1.79	2.12

Conclusion. The differences in the median values among the treatment groups are not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference (P = 0.137). Therefore, the dry density of the four rock piles is similar.

Hypothesis 4. The dry density of the density in the Questa rock piles is different from the debris flows and alteration scars (analog sites).

Data. Data are results obtained from NMIMT sampling and testing on Questa rock piles and analog sites 2004-2007 (Appendix 7 and project Access database).

Approach. Because the histograms indicate that the data are not approximately normally distributed, the non-parametric test, Kruskal-Wallis One Way Analysis of Variance on ranks, was selected, which assesses the samples in terms of median, not mean. The tests were calculated using the SigmaStat software. The test statistic in Kruskal-Wallis is called H. If the H statistic is small, the average ranks observed for the groups are approximately the same. If the H statistic is large, the variability among the average ranks is larger than expected from random sampling, i.e. the samples are from different distributions. The P value calculated for the test statistic H is the probability of incorrectly rejecting the null hypothesis. Only tests for which the p-value is less than 0.05 (the 5% level of the test; α-0.05) are acceptable evidence that the two samples are drawn from different distributions.

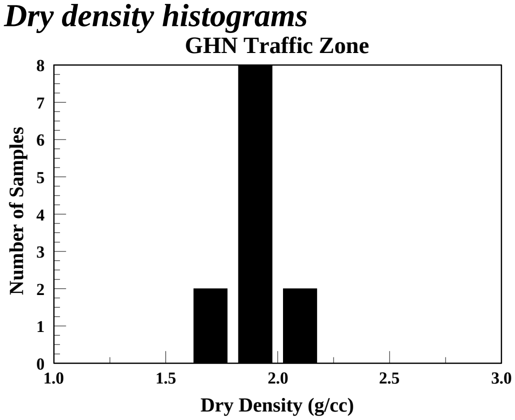
Results. The results are in Table A11-5.

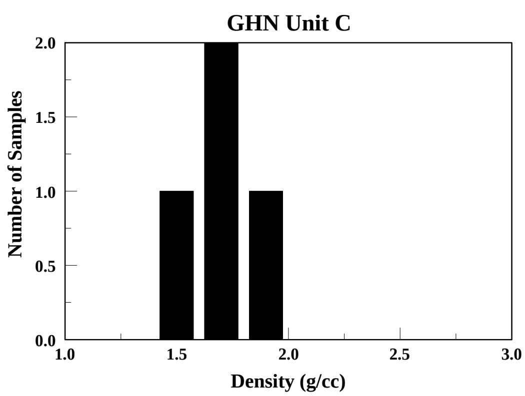
TABLE A11-5. Comparisons of dry density (g/cc) between the Questa rock piles and the analog sites (alteration scars, debris flows) using the Kruskal-Wallis One Way Analysis of Variance analysis. H = 1.827 with 2 degrees of freedom. (P = 0.401).

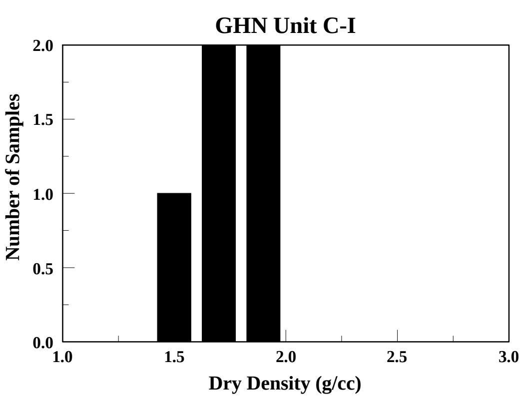
Group	N	Missing	Median	25%	75%
all rock piles	153	0	1.84	1.74	1.94
debris flows	11	0	1.94	1.56	2.14
alteration scar	12	0	1.90	1.77	2.03

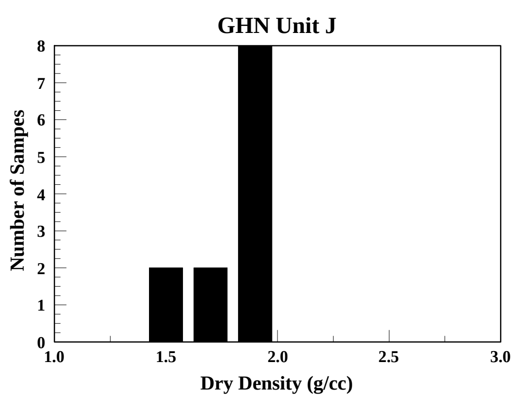
Conclusion. The differences in the median values among the treatment groups are not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference (P = 0.401). Therefore the density is similar for the Questa rock piles and analog sites.

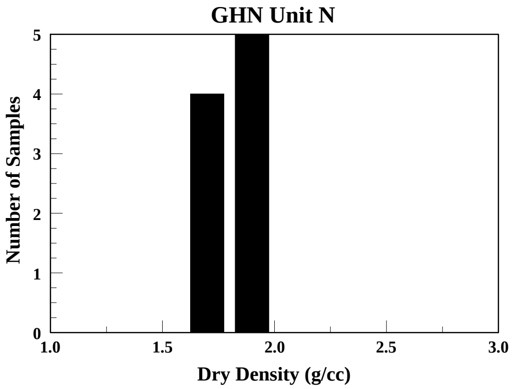
Dry density histograms

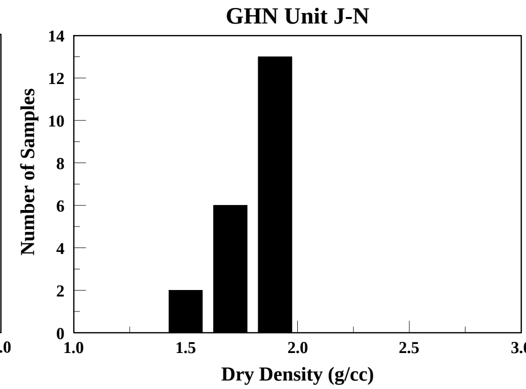


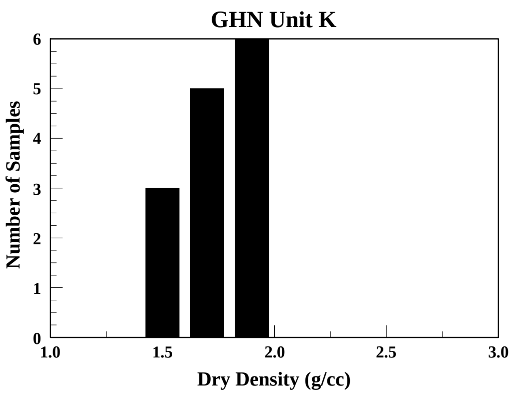


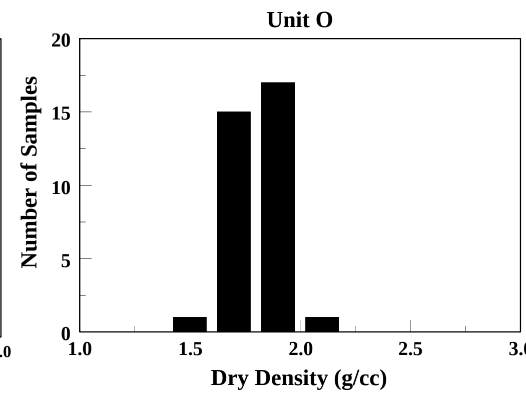


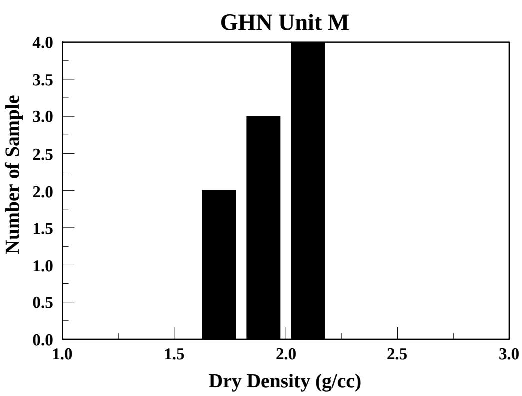


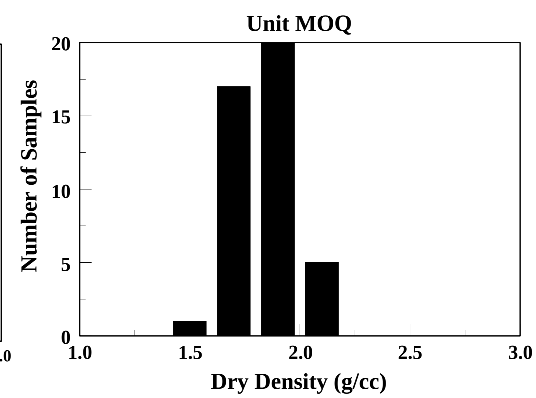

GHN Unit N
Number of Samples
0
1
2
3
4
5
1.0
1.5
2.0
2.5
3.0
Dry Density (g/cc)

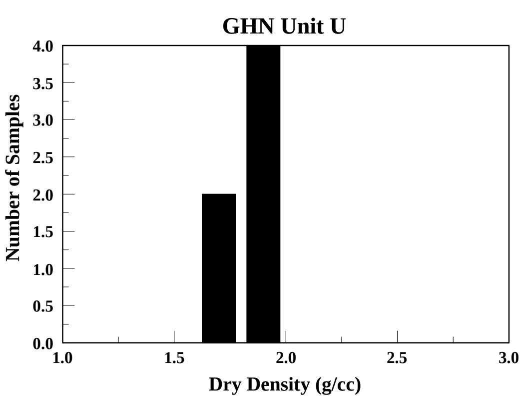

GHN Unit J-N
Number of Samples
0
2
4
6
8
10
12
14
1.0
1.5
2.0
2.5
3.0
Dry Density (g/cc)

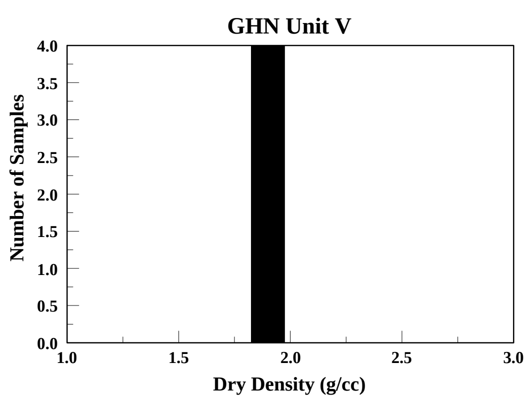

GHN Unit K
Number of Samples
0
1
2
3
4
5
6
1.0
1.5
2.0
2.5
3.0
Dry Density (g/cc)

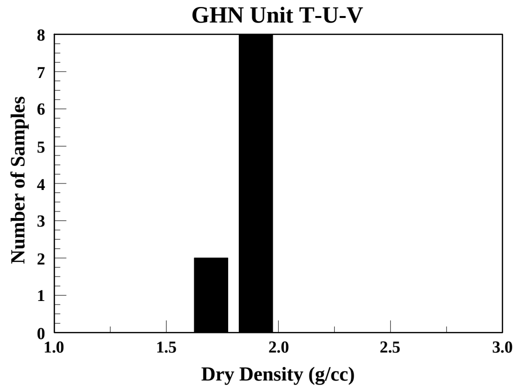

Unit O
Number of Samples
0
5
10
15
20
1.0
1.5
2.0
2.5
3.0
Dry Density (g/cc)

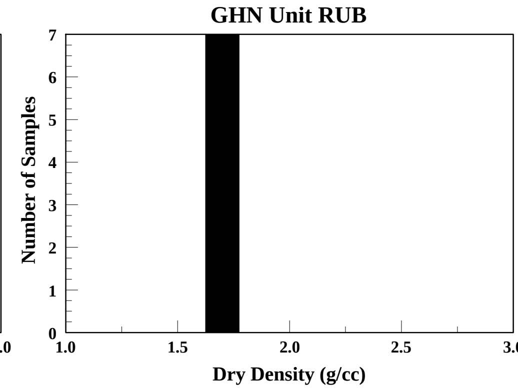

GHN Unit M
Number of Sample
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
1.0
1.5
2.0
2.5
3.0
Dry Density (g/cc)

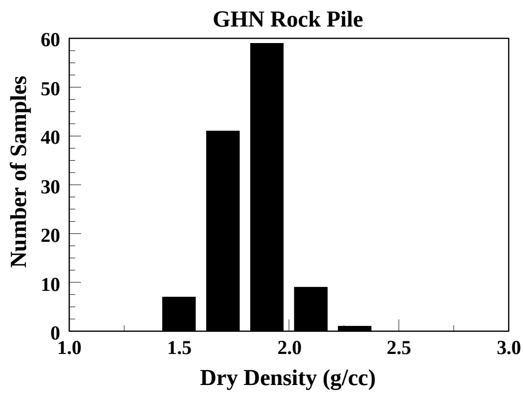

Unit MOQ
Number of Samples
0
5
10
15
20
1.0
1.5
2.0
2.5
3.0
Dry Density (g/cc)

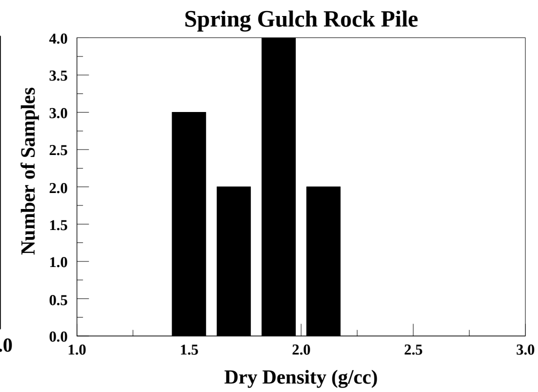

GHN Unit U
Number of Samples
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
1.0
1.5
2.0
2.5
3.0
Dry Density (g/cc)

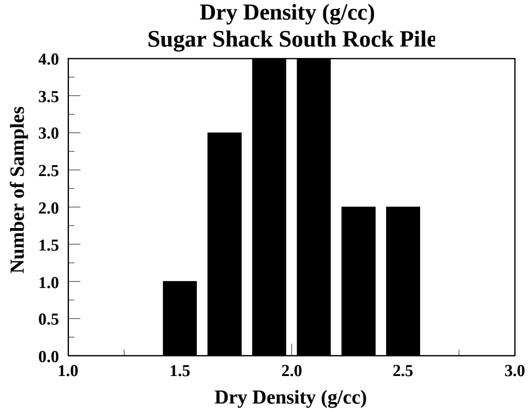

GHN Unit V
Number of Samples
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
1.0
1.5
2.0
2.5
3.0
Dry Density (g/cc)

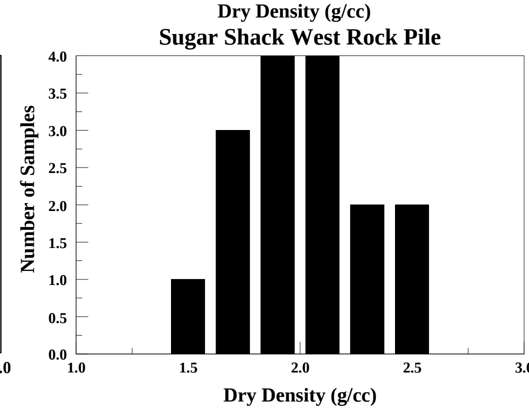

GHN Unit T-U-V
Number of Samples
0 1 2 3 4 5 6 7 8
1.0 1.5 2.0 2.5 3.0
Dry Density (g/cc)

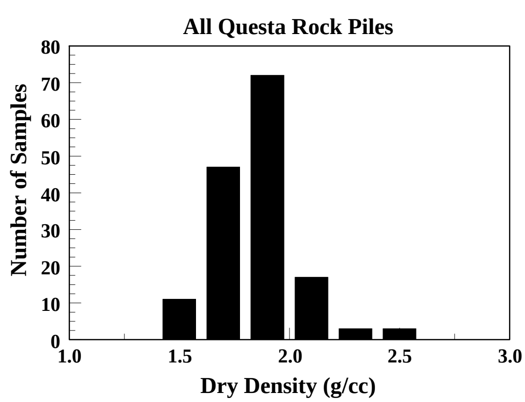

GHN Unit RUB
Number of Samples
0 1 2 3 4 5 6 7
1.0 1.5 2.0 2.5 3.0
Dry Density (g/cc)

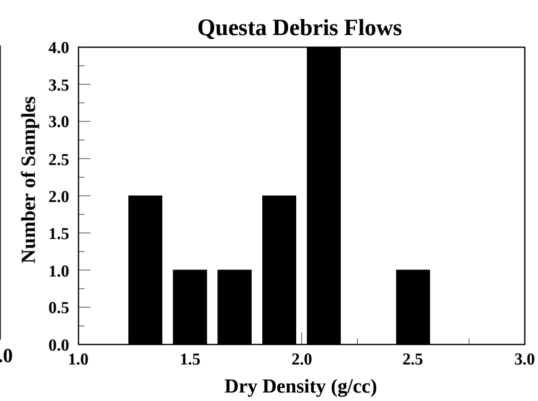

GHN Rock Pile
Number of Samples
0 10 20 30 40 50 60
1.0 1.5 2.0 2.5 3.0
Dry Density (g/cc)

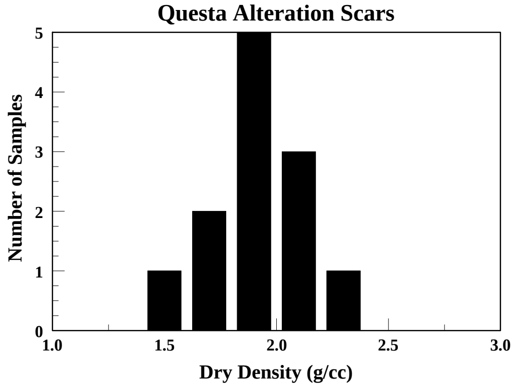

Spring Gulch Rock Pile
Number of Samples
0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0
1.0 1.5 2.0 2.5 3.0
Dry Density (g/cc)

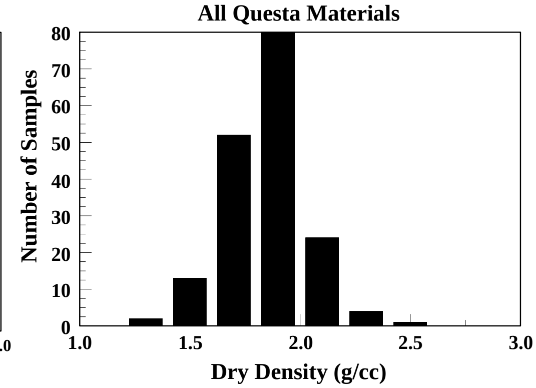

Sugar Shack South Rock Pile
Number of Samples
0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0
1.0 1.5 2.0 2.5 3.0
Dry Density (g/cc)


Sugar Shack West Rock Pile
Number of Samples
0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0
1.0 1.5 2.0 2.5 3.0
Dry Density (g/cc)


All Questa Rock Piles
Number of Samples
0 10 20 30 40 50 60 70 80
1.0 1.5 2.0 2.5 3.0
Dry Density (g/cc)


Questa Debris Flows
Number of Samples
0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0
1.0 1.5 2.0 2.5 3.0
Dry Density (g/cc)





LITHOLOGY FOR GHN, OTHER QUESTA ROCK PILES, AND ANALOG MATERIALS

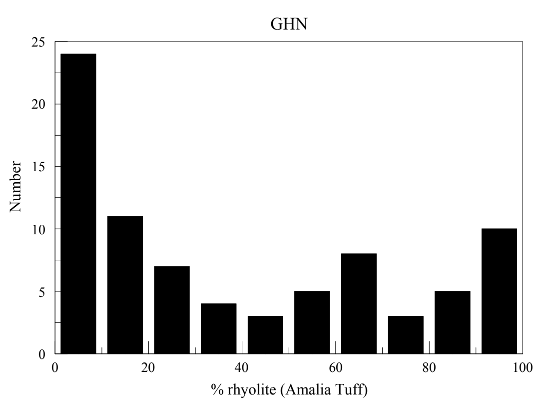
Descriptive statistics

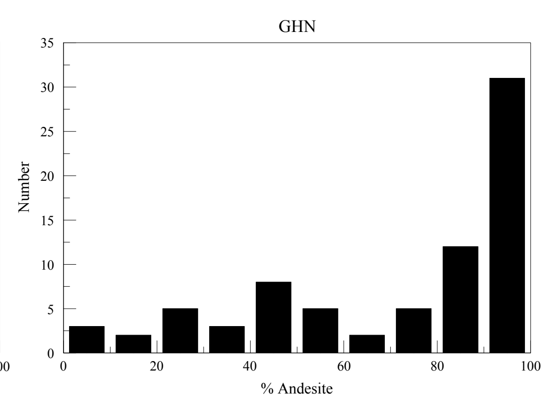
TABLE A11-6. Descriptive statistics for lithology and hydrothermal alteration for GHN. Data are in Appendix 7 and project Access database.

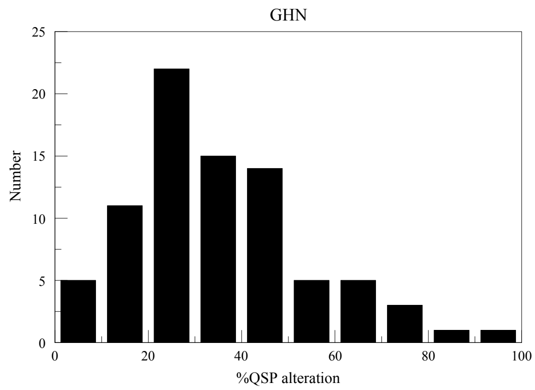
Sample	Description	Rhyolite % (Amalia Tuff)	Andesite %	Intrusive granite/ aplite %	QSP %	Prophylitic %	Argillic %
Average	Unit C	100			40		
No of samples		1			1		
Average	Unit I	55.33333	67		35.375	30.75	
Standard deviation		40.61711	29.05168		24.63411	34.02328	
No of samples		9	6	0	8	4	
Average	Unit J	68.75	49.88889		51.5	4.714286	3.5
Standard deviation		35.93148	42.20617		24.94995	3.039424	2.081666
No of samples		8	9	0	10	7	4
Average	Unit N	38	64.53333	14	31.53333	6.2	4.285714
Standard deviation		25.96151	28.07609	22.72444	15.19806	2.455315	1.603567
No of samples		16	15	6	15	15	7
Average	Unit K	36.66667	63.33333		28.33333	10	4
Standard deviation		46.18802	46.18802		5.773503	9.165151	
No of samples		3	3	0	3	3	1
Average	Unit L	10.5	89.5		11.5	17.5	2
Standard deviation		13.43503	13.43503		4.949747	3.535534	
No of samples		2	2	0	2	2	1

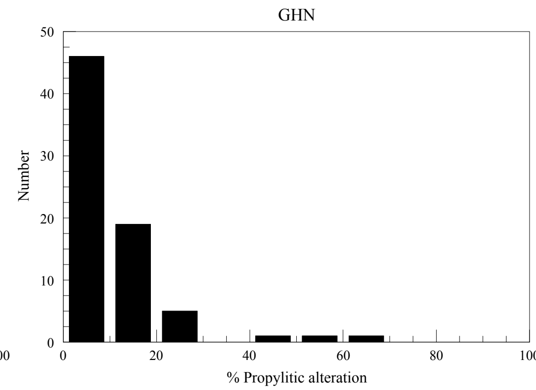
Average	Unit O	18.18182	84.31818	11.25	29	10.54167	3.3
Standard deviation		9.536896	12.34427	9.464847	13.18696	3.705289	0.894427
No of samples		15	15	4	16	16	6
Average	Unit M	63.75	36.25		35	3.666667	2.5
Standard deviation		7.5	7.5		7.071068	3.785939	0.707107
No of samples		4	4	0	4	3	2
GHN-LFG-0090	Unit P	0	100		25	8	3
avg	unit R	18.33333	81.66667		35	10.66667	3
count		3	3		3	3	2
Average	unit S	7.5	92.5		27.5	15	
Standard deviation		10.6066	10.6066		3.535534	7.071068	
No of samples		2	2		2	2	
Average	unit U	40	66.66667		48.33333	9	3
Standard deviation		34.64102	23.09401		12.58306	1.732051	
No of samples		3	3		3	3	1
avg	unit V	56.66667	33.33333		25	7.333333	2
count		3	3		3	3	1
Average	unit rubble	0.333333	99.66667		11	12.33333	
Standard deviation		0.57735	0.57735		3.605551	7.505553	
No of samples		3	3		3	3	

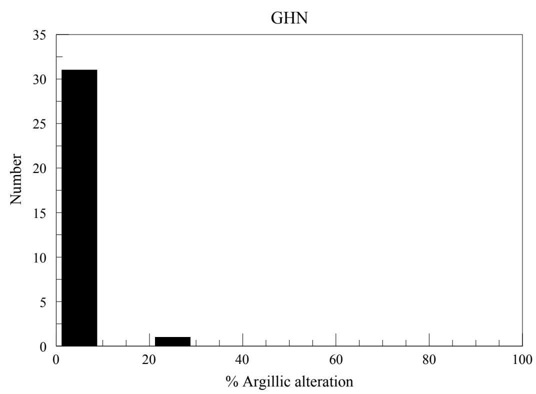
Histograms for lithology and hydrothermal alteration











PASTE pH FOR GHN, OTHER QUESTA ROCK PILES, AND ANALOG MATERIALS

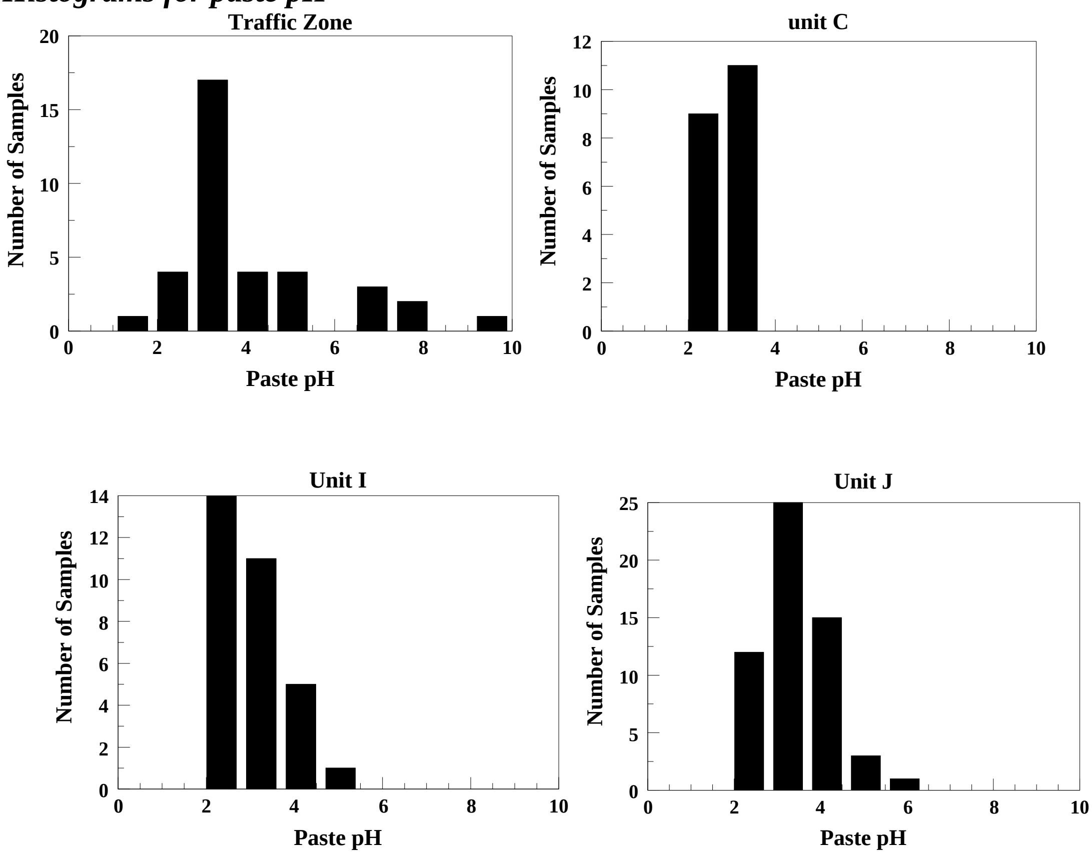
Descriptive statistics

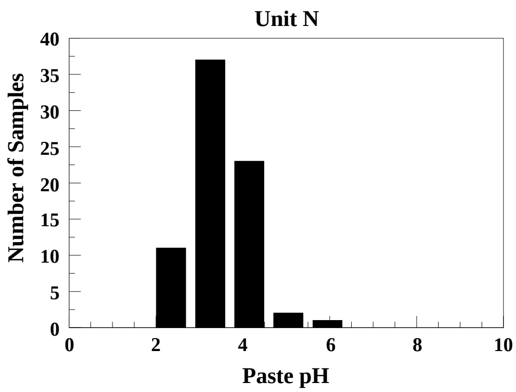
TABLE A11-7. Descriptive statistics of paste pH by geologic unit (updated from McLemore et al., 2005, 2006a,b; Tachie-Menson, 2006). Descriptions of geologic units are in Table 20. Data are in Appendix 7 and project Access database.

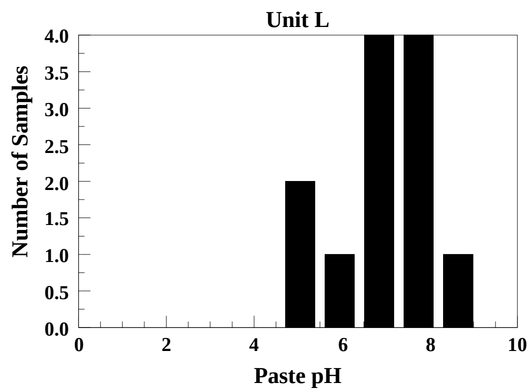
Unit	Mean	Median	Standard Deviation	Standard Error	Minimum	Maximum	Number of Cases
traffic	4.4	4.3	1.0	0.18	2.5	6.1	29
unit C	2.92	2.88	0.36	0.08	2.33	3.50	20
unit I	3.05	2.96	0.70	0.13	2.19	4.77	31
unit J	3.39	3.17	0.75	0.10	2.14	5.75	56
unit N	3.51	3.54	0.64	0.07	2.15	5.53	74
unit K	4.78	4.31	1.54	0.26	2.36	7.20	36
unit L	6.94	7.00	1.22	0.35	4.76	8.74	12
unit M	4.52	4.29	1.47	0.17	2.36	9.56	71
unit O	5.40	5.23	1.70	0.13	2.43	9.37	182
unit Q	5.35	5.64	0.67	0.39	4.	5.83	3
unit P	5.9						1
unit R	6.14	6.68	1.92	0.47	3.17	9.60	17
unit S	6.22	6.36	2.09	0.44	2.48	9.79	22
unit T	4.02	4.08	0.66	0.25	2.68	4.77	7
unit U	3.91	3.91	0.86	0.21	2.45	5.52	17
unit V	4.39	4.38	0.61	0.18	3.37	5.77	11

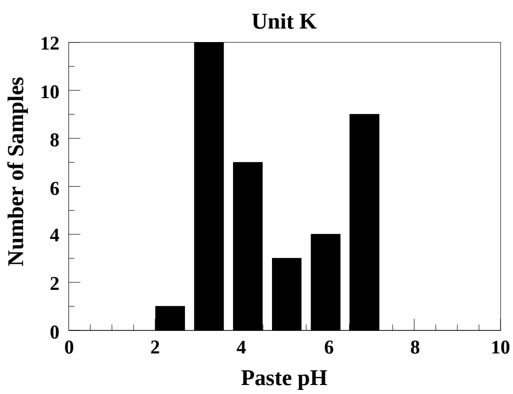
Unit	Mean	Median	Standard Deviation	Standard Error	Minimum	Maximum	Number of Cases
unit W	6.6						2
Unit RUB (rubble zone)	3.73	3.63	1.09	0.17	2.39	8.56	42
colluvium	3.78	3.29	1.30	0.19	2.40	8.60	45
bedrock	4.16	3.34	1.87	0.31	1.86	9.60	36
Entire GHN	4.29	3.89	1.57	0.06	2.14	9.79	804
Blind	7.78	7.90	0.60	0.11	6.40	8.70	28
Capulin	4.29	4.30	1.41	0.28	2.37	7.50	25
Middle	5.63	5.76	2.03	0.20	1.60	9.70	103
Spring Gulch	6.47	7.01	1.78	0.25	2.43	8.80	52
Sugar Shack South	4.80	4.32	1.39	0.14	2.19	8.07	131
Sugar Shack West	3.54	2.79	1.64	0.19	1.78	7.80	76
Sulfur Gulch South	6.23	7.24	1.99	0.16	2.52	9.91	149
Questa rock piles	4.73	4.19	1.84	0.04	1.60	9.91	1714
Alteration scars	4.32	4.14	1.58	0.11	2.05	8.30	215
Debris flow	4.47	3.95	1.28	0.17	2.04	6.85	58

Histograms for paste pH




Unit N
Number of Samples
Paste pH


Unit L
Number of Samples
Paste pH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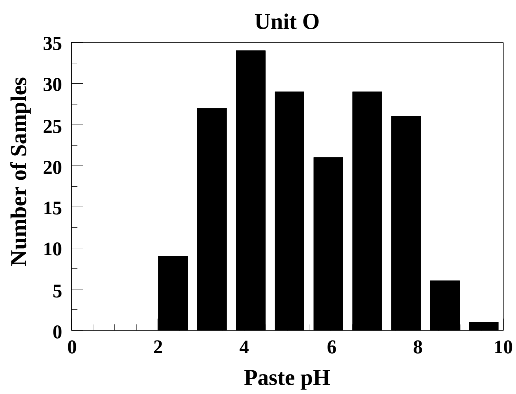
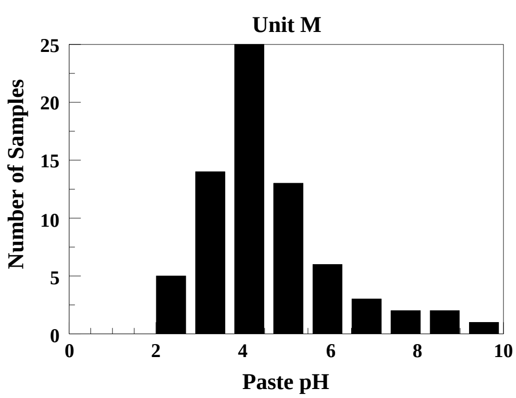
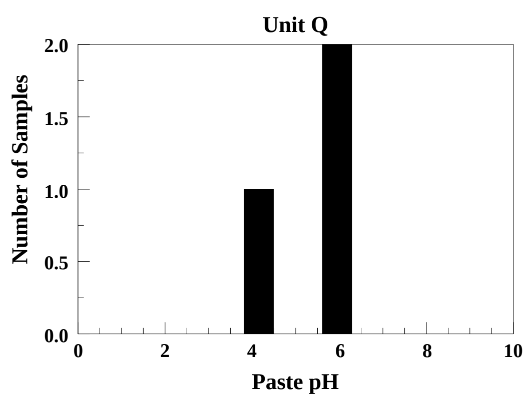
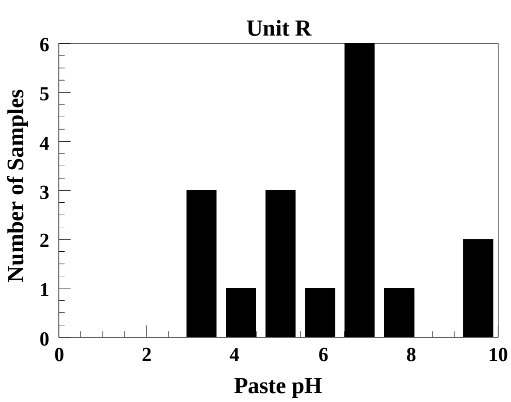
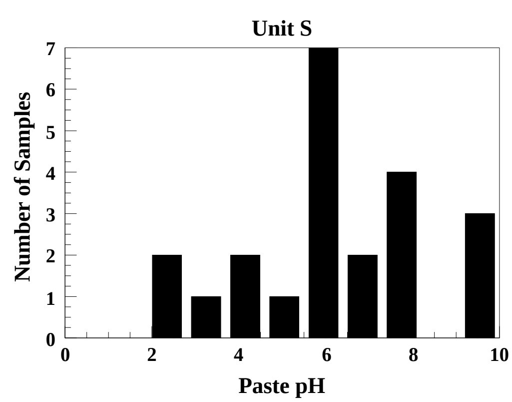
Number of Samples
Paste pH

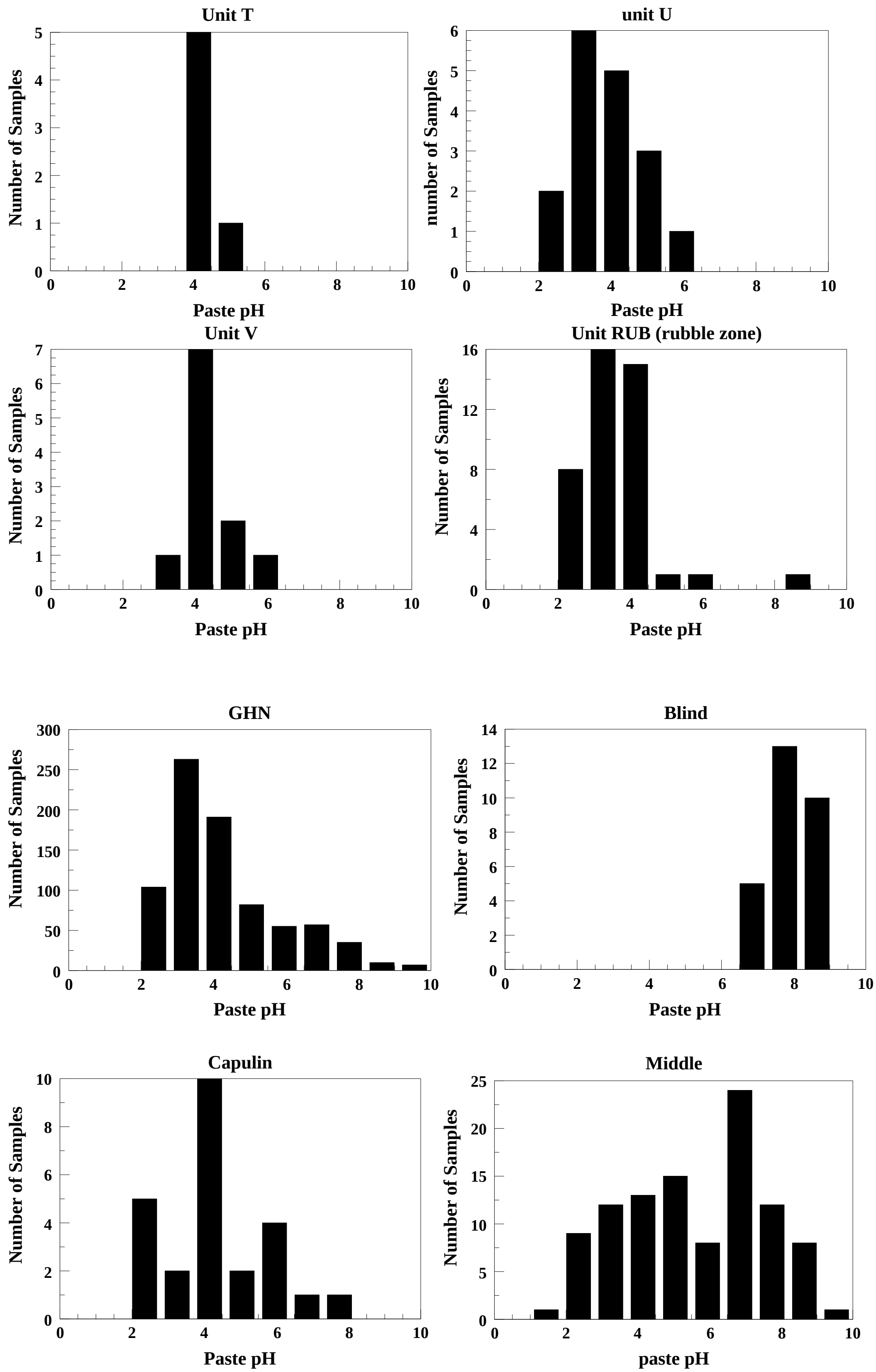

Unit O
Number of Samples
Paste pH

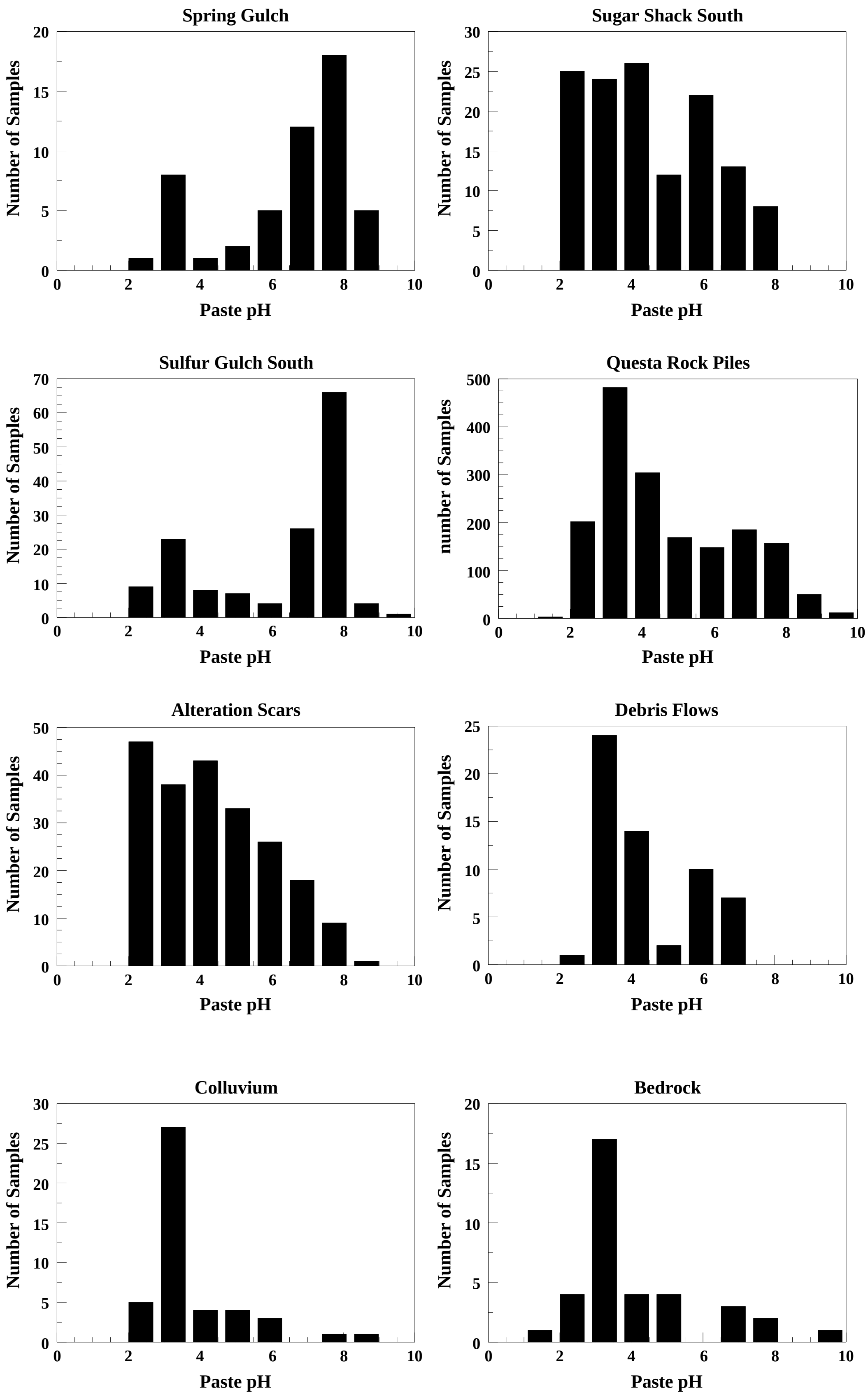

Unit M
Number of Samples
Paste pH


Unit Q
Number of Samples
Paste pH


Unit R
Number of Samples
Paste pH


Unit S
Number of Samples
Paste pH


Unit T
unit U
Unit V
Unit RUB (rubble zone)
GHN
Blind
Capulin
Middle
Number of Samples
number of Samples
Paste pH
paste pH


Spring Gulch
Number of Samples
Paste pH
Sugar Shack South
Number of Samples
Paste pH
Sulfur Gulch South
Number of Samples
Paste pH
Questa Rock Piles
number of Samples
Paste pH
Alteration Scars
Number of Samples
Paste pH
Debris Flows
Number of Samples
Paste pH
Colluvium
Number of Samples
Paste pH
Bedrock
Number of Samples
Paste pH

PYRITE FOR GHN, OTHER QUESTA ROCK PILES, AND ANALOG MATERIALS

Descriptive statistics

TABLE A11-8. Descriptive statistics of % pyrite by geologic unit, other rock piles, and other materials. Histograms are below. Data are in Appendix 7 and project Access database.

Unit	Mean	Median	Standard Deviation	Standard Error	Minimum	Maximum	Number of Cases
traffic	0.6	0.6	0.16	0.04	0.13	0.78	20
Unit C	0.6	0.6	0.24	0.07	0.22	0.55	11
Unit I	1.6	0.9	1.72	0.31	0.22	7.50	30
Unit J	0.8	0.6	0.84	0.17	0.09	3.80	25
Unit N	0.6	0.4	0.62	0.10	0.00	3.00	36
Unit O	0.6	0.5	0.53	0.06	0.00	2.89	75
Unit M	0.5	0.4	0.42	0.06	0.00	1.47	50
Unit Q	0.7				0.69	0.77	2
Unit K	0.7	0.5	0.68	0.15	0.00	2.44	22
Unit L	0.9	0.9	0.21	0.06	0.63	1.4	13
Unit P	0.8						1
Unit R	0.7	0.7	0.31	0.12	0.05	1.03	7
Unit S	0.7	0.8	0.27	0.09	0.05	0.96	9
Unit T	0.5	0.6	0.25	0.11	0.20	0.84	5
Unit U	0.4	0.3	0.33	0.15	0.11	0.34	5
Unit V	0.4	0.4	0.21	0.08	0.11	0.72	7
Unit W	0.7						1
Unit RUB	0.6	0.5	0.49	0.09	0.00	1.91	31
colluvium	0.9	0.5	1.06	0.10	0.00	6.04	113
weathered bedrock	3.6	3.6	3.20	0.49	0.00	3.61	44
Stable GHN	0.6	0.5	0.56	0.03	0	4	380
Unstable GHN	1.5	1.0	1.9	0.12	0	13.5	232
Entire GHN	0. 9	0.6	1.3	0.05	0.0	13.5	617
SGS	1.5	1.5	0.79	0.12	0.3	3.5	40
SSS	1.5	1.1	1.42	0.11	0	6.9	156
SSW	1.0	0.8	0.8	0.15	0.1	3.1	29
Middle	2.2	1.6	1.3	0.14	0.04	5.4	80
Questa rock piles	1.1	0.7	1.3	0.04	0	13.5	943
Alteration scars	1.1	0.2	1.3	0.26	0	11	60
Debris flows	0.2	0.09	0.36	0.07	0.01	1.9	27
colluvium	0.6	0.2	1.1	0.2	0	5.1	27
andesite	1.6	0.5	2.2	0.2	0	9	83
Amalia	0.5	0.05	1.3	0.2	0	6	31
intrusives	1.9	0.5	3.0	0.7	0	11	19
All Questa	1.1	0.7	1.4	0.4	0	13.5	1175

Unit	Mean	Median	Standard Deviation	Standard Error	Minimum	Maximum	Number of Cases
materials							

Hypothesis 1. The pyrite of the different geologic units in GHN rock pile is different.

Data. Data are results obtained from NMIMT sampling and testing on Questa rock piles 2004-2007 (Appendix 7 and project Access database).

Approach. Mann-Whitney rank sum was selected, which assesses the samples in terms of mean. The tests were calculated using the SigmaStat@ software.

Results. The results are in Table A11-9.

TABLE A11-9. Comparison of units with one another using the Mann-Whitney rank sum test.

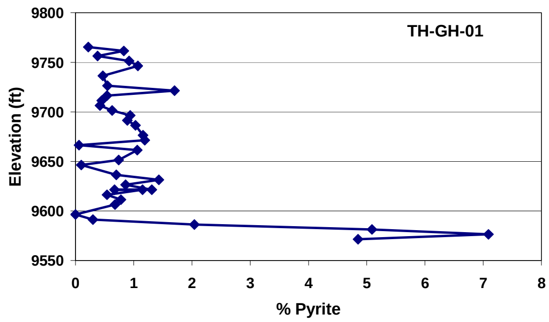
Compare Groups	Type of test	Results	P (probability of being wrong)	Number of samples	Median	25%	75%
Unit C Unit I	Mann-Whitney rank sum	Statistically different	0.005	11 30	0.55 0.87	0.485 0.660	0.658 1.380
Unit I Unit J	Mann-Whitney rank sum	Statistically different	0.008	30 25	0.870 0.573	0.660 0.237	1.38 1.12
Unit C Unit J	Mann-Whitney rank sum	Statistically same population	0.918	11 25	0.55 0.57	0.485 0.237	0.658 1.118
Unit J Unit N	Mann-Whitney rank sum	Statistically same population	0.371	25 36	0.57 0.41	0.237 0.284	1.118 0.885
Unit I Unit JN	Mann-Whitney rank sum	Statistically different	0.001	30 61	0.87 0.45	0.660 0.248	1.380 1.000
Unit C Unit JN	Mann-Whitney rank sum	Statistically same population	0.486	11 61	0.55 0.45	0.485 0.248	0.658 1.000
Unit JN Unit K	Mann-Whitney rank sum	Statistically same population	0.676	61 22	0.45 0.54	0.248 0.220	1.000 0.850
Unit JN Unit O	Mann-Whitney rank sum	Statistically same population	0.562	61 75	0.45 0.51	0.248 0.115	1.000 0.800
Unit JN Unit MOQ	Mann-Whitney rank sum	Statistically same population	0.483	61 127	0.45 0.46	0.248 0.140	1.000 0.810
Unit K Unit O	Mann-Whitney rank sum	Statistically same population	0.319	22 46	0.54 0.62	0.220 0.430	0.850 0.820
Unit M Unit O	Mann-Whitney rank sum	Statistically same population	0.866	50 75	0.43 0.51	0.160 0.115	0.860 0.800

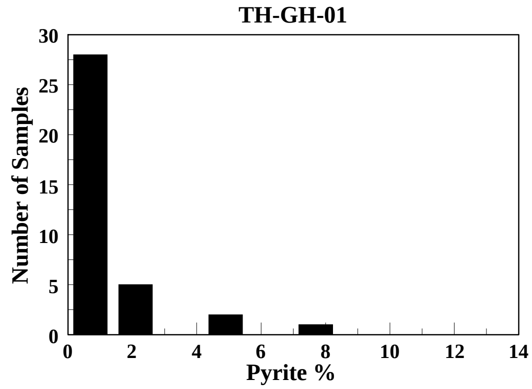
Compare Groups	Type of test	Results	P (probability of being wrong)	Number of samples	Median	25%	75%
Unit MOQ Unit K	Mann-Whitney rank sum	Statistically same population	0.359	127 22	0.46 0.54	0.140 0.220	0.810 0.850
Unit JN Unit MOQ	Mann-Whitney rank sum	Statistically same population	0.483	61 127	0.45 0.46	0.248 0.140	1.000 0.810
Unit K Unit L	Mann-Whitney rank sum	Statistically different	0.029	22 13	0.53 0.89	0.220 0.722	0.850 0.978
Unit RSP Unit MOQ	Mann-Whitney rank sum	Statistically different	0.010	14 127	0.76 0.46	0.670 0.140	0.900 0.810
Unit R Unit S	Mann-Whitney rank sum	Statistically same population	0.751	7 9	0.73 0.76	0.650 0.630	0.858 0.820
Unit T Unit V	T-test	Statistically same population	0.637	5 5	0.526 0.435		
Unit RSP Unit TVU	Mann-Whitney rank sum	Statistically different	0.001	14 19	0.78 0.42	0.670 0.235	0.900 0.591
GHN SGS	Mann-Whitney rank sum	Statistically different	<0.001	616 40	0.60 1.48	0.300 0.955	1.02 1.755
GHN SSS	Mann-Whitney rank sum	Statistically different	<0.001	616 156	0.60 1.085	0.300 0.478	1.02 2.15
GHN SSW	Mann-Whitney rank sum	Statistically same population	0.081	616 31	0.60 0.848	0.300 0.400	1.02 1.1
GHN Middle	Mann-Whitney rank sum	Statistically different	<0.001	616 80	0.60 1.559	0.300 0.828	1.02 2.74
SGS SSS	Mann-Whitney rank sum	Statistically same population	0.331	40 156	1.48 1.085	0.955 0.478	1.755 2.15
SGS SSW	Mann-Whitney rank sum	Statistically different	0.007	40 31	1.48 0.848	0.955 0.400	1.755 1.1
SGS Middle	Mann-Whitney rank sum	Statistically same population	0.042	40 80	1.48 1.559	0.955 0.828	1.755 2.74
SSS SSW	Mann-Whitney rank sum	Statistically same population	0.145	156 31	1.085 0.848	0.478 0.400	2.15 1.1
SSS Middle	Mann-Whitney rank sum	Statistically different	0.039	156 80	1.085 1.559	0.478 0.828	2.15 2.74
SSW Middle	Mann-Whitney rank sum	Statistically different	0.003	31 80	0.848 1.559	0.400 0.828	1.1 2.74

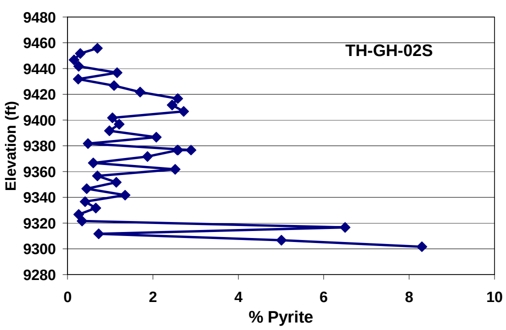
Conclusion. The pyrite distribution varies within different units.

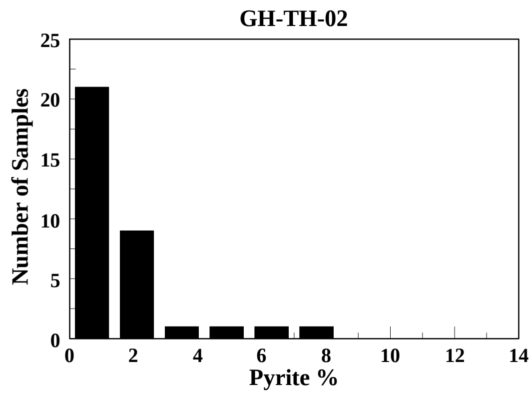
Pyrite with depth. The pyrite distribution differs from rock pile to rock pile (Table A-10-8). The pyrite distributions vary with depth within drill holes in the rock piles, but an increase in pyrite is found in the hot zone of SI-50.

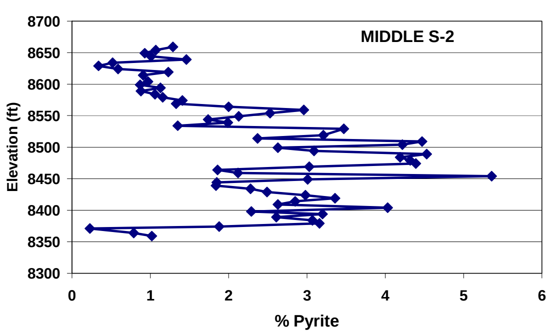
Pyrite concentration with depth

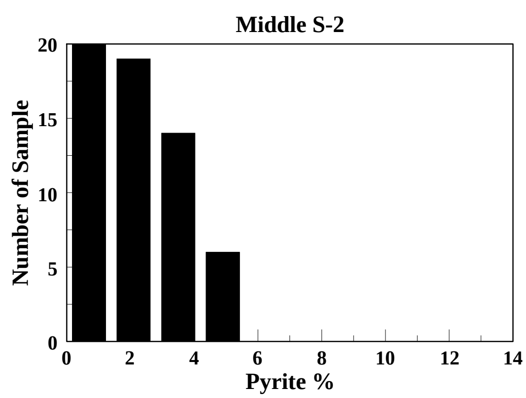


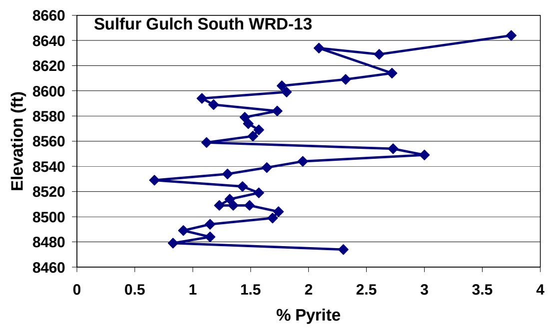


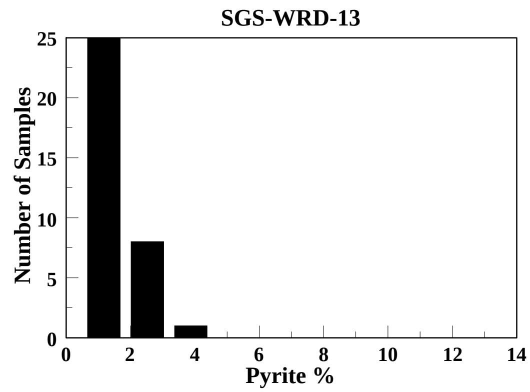




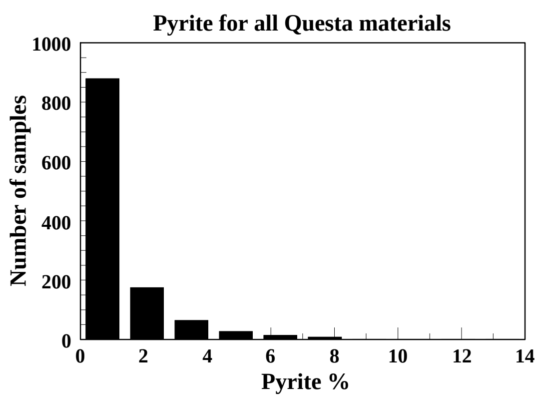


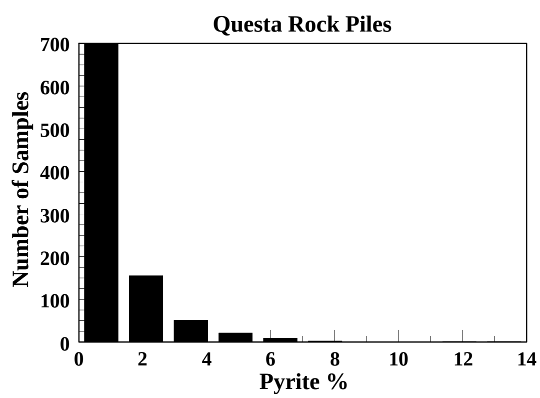


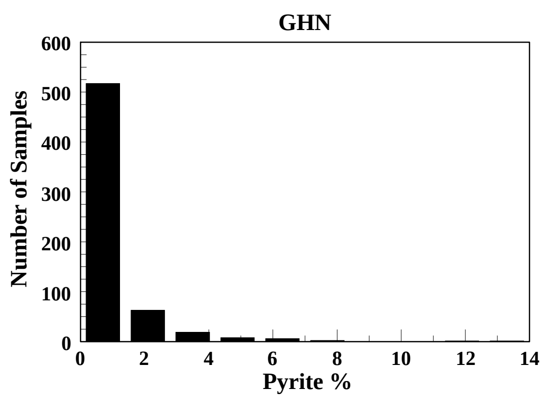


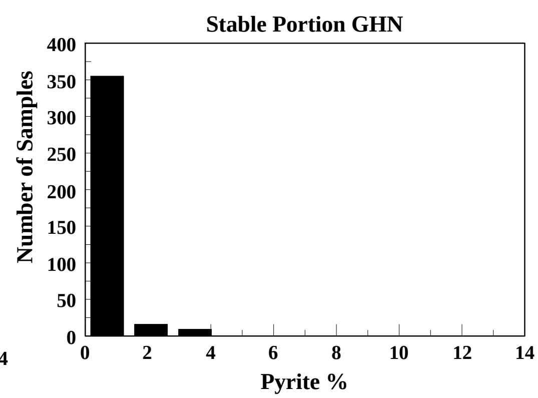


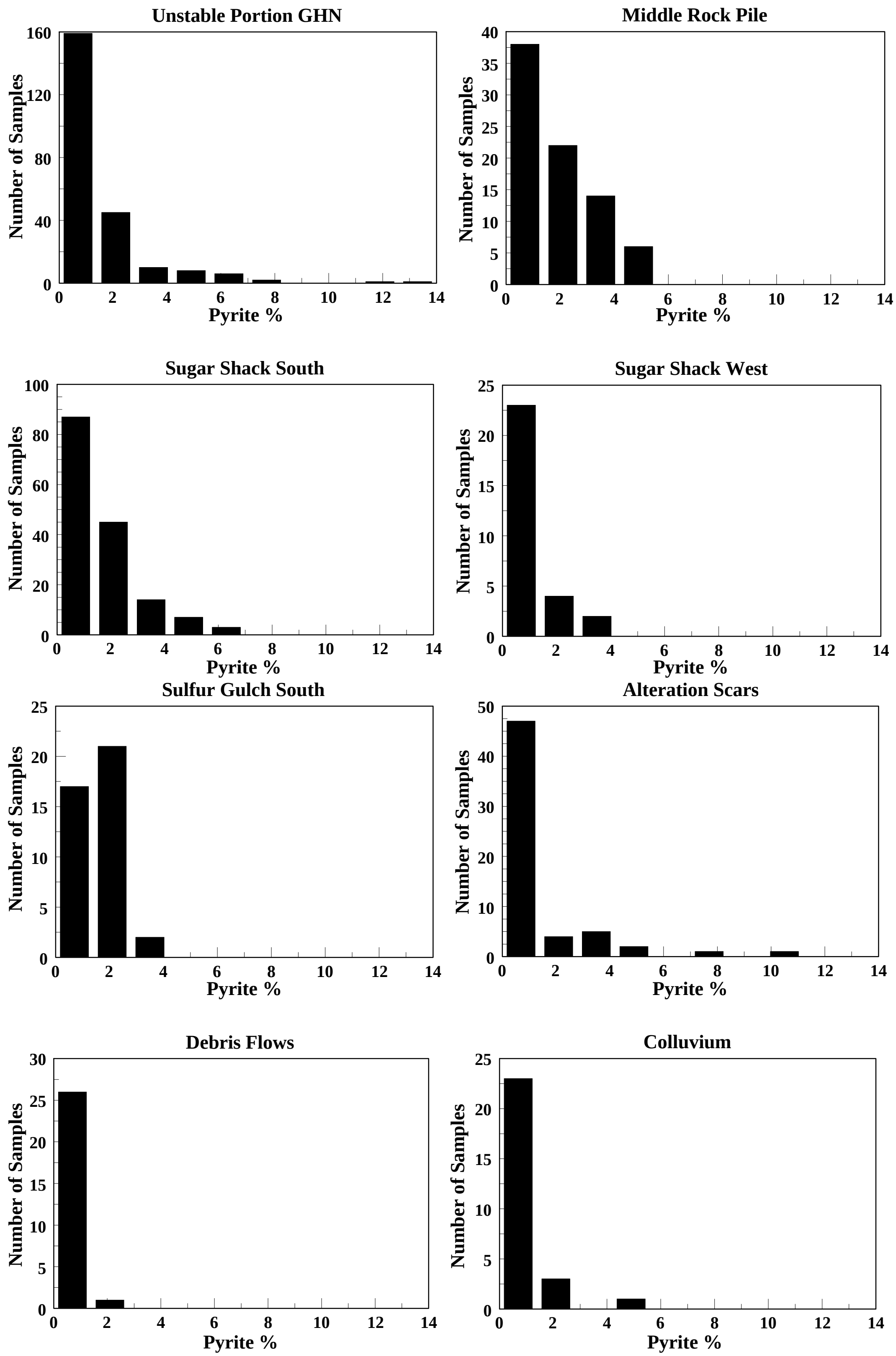
Histograms for pyrite

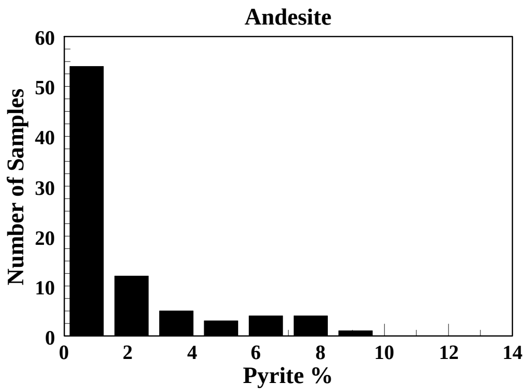


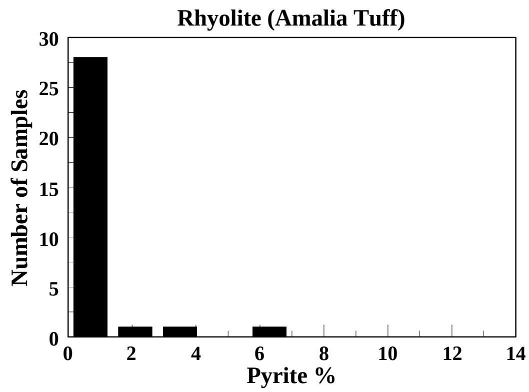


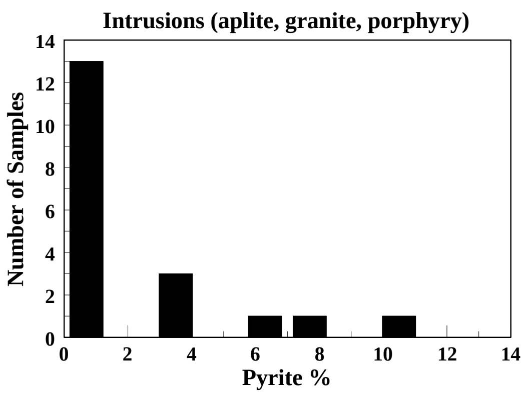





Unstable Portion GHN
Middle Rock Pile
Sugar Shack South
Sugar Shack West
Sulfur Gulch South
Alteration Scars
Debris Flows
Colluvium
Number of Samples
Pyrite %
0
2
4
6
8
10
12
14







GRAVIMETRIC MOISTURE CONTENT

Descriptive statistics

TABLE A11-10. Descriptive statistics of gravimetric moisture content (%) by geologic units and for Questa materials. Histograms are below.

Unit	Mean	Median	Standard deviation	Standard error	Minimum	Maximum	Number of Samples
traffic	10.0	9.5	2.5	0.7	6.9	14.1	11
Unit C	7.0	6.1	2.1	1.2	5.5	9.3	3
Unit I	15.5	14.0	5.0	2.2	10.7	24.0	5
Unit J	10.7	10.3	3.1	0.8	6.6	17.1	17
Unit N	13.1	13.1	2.5	0.6	9.6	17.3	17
Unit L	8.62						1
Unit K	10.2	10.5	1.2	0.4	8.3	11.8	9
Unit O	11.1	11.1	2.3	0.3	6.2	18.1	51
Unit M	10.3	9.8	2.5	0.7	5.5	15.1	14
Unit R	10.5	10.2	0.8	0.5	9.9	11.5	3
Unit S	10.4	10.8	2.0	0.8	7.4	13.4	6
Unit U	10.3	9.6	2.7	1.6	8.0	13.2	3
Unit V	9.0				8.6	9.5	2
Unit W	9.0				8.6	9.5	2
Unit RUB	10.6	10.5	2.7	0.5	6.9	18.5	26
All GHN (including unstable GHN)	10.4	10.3	3.3	0.2	2.4	23.9	229
Capulin	6.4	5.7	3.5	1.0	1.5	13.3	13
Middle	8.1	8.0	1.4	0.7	6.6	10.0	4

Unit	Mean	Median	Standard deviation	Standard error	Minimum	Maximum	Number of Samples
SGS	10.2	9.8	4.4	0.7	4.1	20.2	36
SPR	6.3	6.5	1.8	0.4	3.8	8.9	18
SSS	8.1	7.6	3.3	0.5	2.7	23.1	51
SSW	7.5	7.6	2.2	0.4	2.7	12.1	40
All rock piles	9.5	9.2	3.5	0.2	1.5	23.9	390
Debris Flow	5.2	4.7	4.3	0.7	1.0	28.6	36
Alteration scars	9.2	10.0	3.9	0.6	0.1	19.7	48
Colluvium	14.4	13.8	3.0	0.8	9.2	20.8	13

Statistical Analyses

Hypothesis 1. The gravimetric moisture content of the outer geologic units in GHN rock pile is different from the interior units.

Data. Data are results obtained from NMIMT sampling and testing on Questa rock piles 2004-2007 (Appendix 7 and project Access database).

Approach. The Normality Test failed ($P < 0.050$); therefore the Kruskal-Wallis One Way Analysis of Variance on Ranks was selected. The tests were calculated using the SigmaStat@ software.

Results. The results are in Table A11-11.

TABLE A11-11. Comparisons of gravimetric moisture content (%) in GHN units using Kruskal-Wallis One Way Analysis of Variance on Ranks analysis. Interior units include units K, N, O, M, R, S, T, U, V, and W. H = 1.902 with 3 degrees of freedom (P = 0.593).

Group	N	Median	25%	75%
Traffic zone	11	9.46	7.938	12.145
outer C-I-J	25	10.72	8.267	13.828
Interior units	108	10.57	9.520	12.690
Unit RUB	15	10.75	8.965	12.480

Conclusion. The differences in the median values among the treatment groups are not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference ($P = 0.963$) in gravimetric moisture content between the outer units and interior units of GHN.

Hypothesis 2. The gravimetric moisture content of the Questa rock piles and analog sites (alteration scars, debris flows, colluvium, weathered bedrock) is different.

Data. Data are results obtained from NMIMT sampling and testing on Questa rock piles 2004-2007 (Appendix 7 and project Access database).

Approach. The Normality Test failed ($P < 0.050$); therefore the Kruskal-Wallis One Way Analysis of Variance on Ranks was selected. The tests were calculated using the SigmaStat@ software.

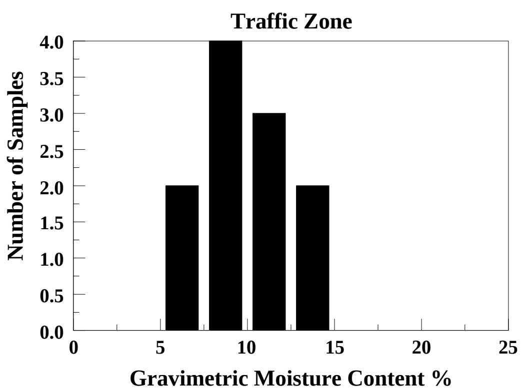
Results. The results are in Table A11-12.

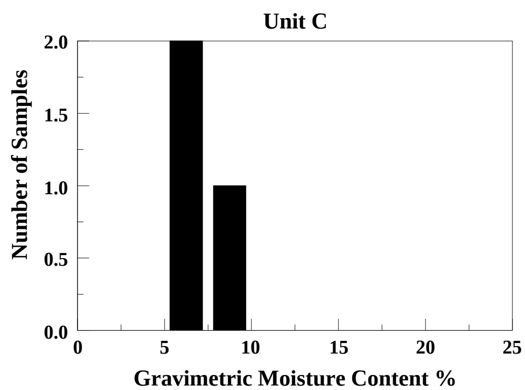
TABLE A11-12. Comparisons of gravimetric moisture content (%) between Questa rock piles and analog sites (colluvium, weathered bedrock, alteration scar, debris flows). H = 90.006 with 4 degrees of freedom (P = <0.001).

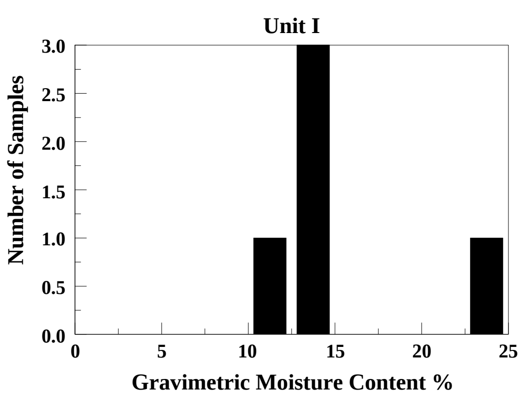
Group	N	Median	25%	75%
Questa rock piles	364	9.200	6.975	11.425
Colluvium	13	13.750	12.192	16.223
Weathered bedrock	9	15.650	13.970	16.725
Alteration scar	48	10.025	7.485	11.285
Debris flows	36	4.700	3.785	5.540

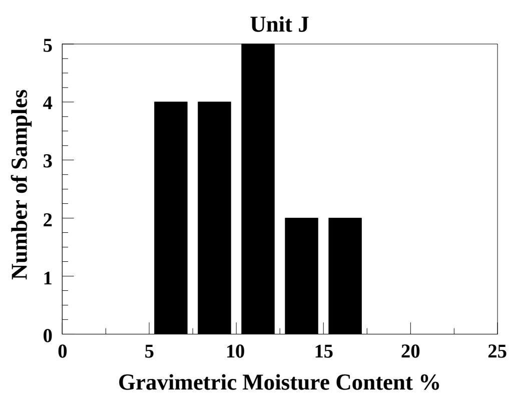
Conclusion. The differences in the median values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = <0.001). The debris flows materials have a lower gravimetric moisture content median than the other samples and the colluvium and weathered bedrock materials have higher median gravimetric water contents than the other samples.

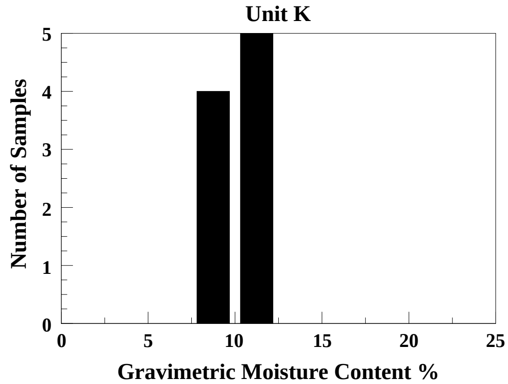
Histograms of gravimetric moisture content

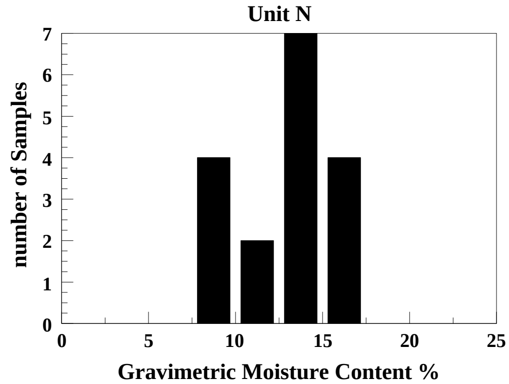


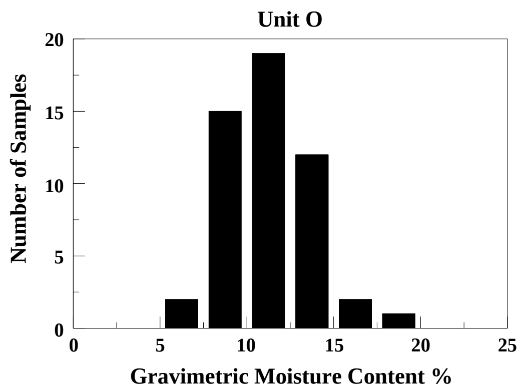


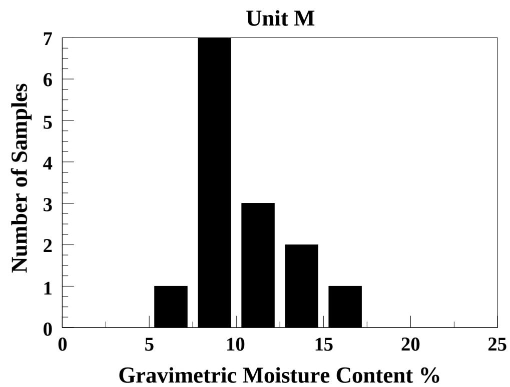


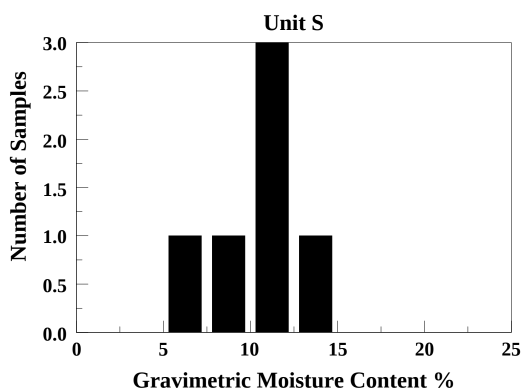


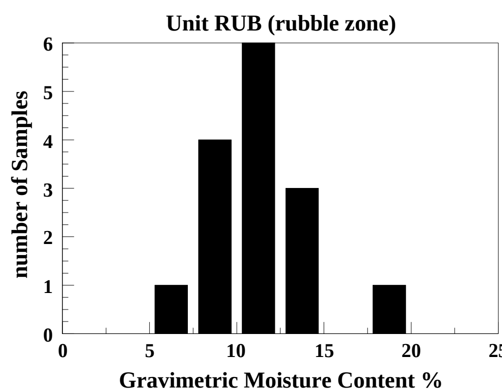

Unit K
Number of Samples
Gravimetric Moisture Content %

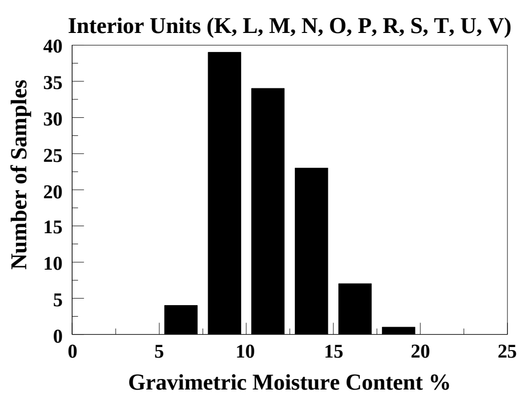

Unit N
number of Samples
Gravimetric Moisture Content %

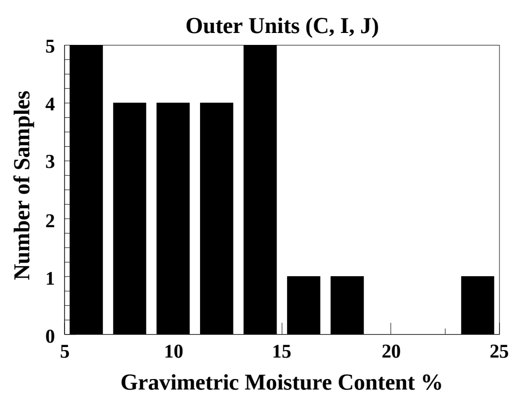

Unit O
Number of Samples
Gravimetric Moisture Content %

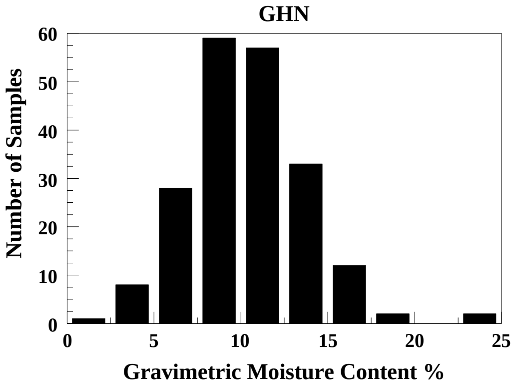

Unit M
Number of Samples
Gravimetric Moisture Content %

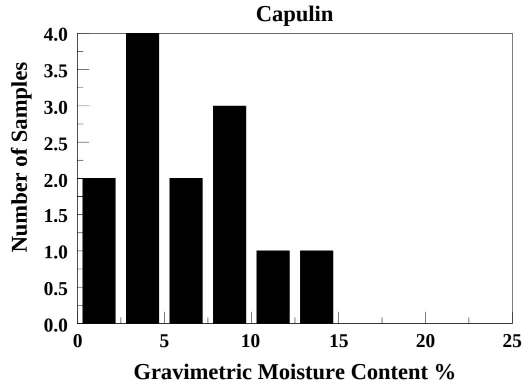

Unit S
Number of Samples
Gravimetric Moisture Content %

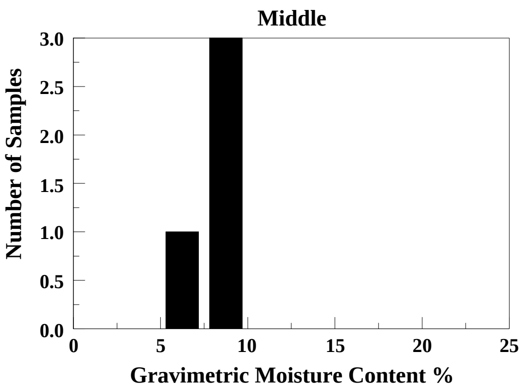

Unit RUB (rubble zone)
number of Samples
Gravimetric Moisture Content %

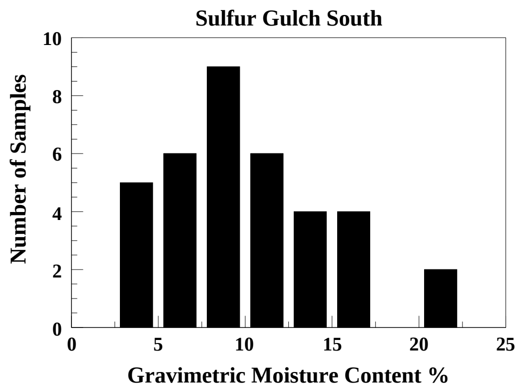

Interior Units (K, L, M, N, O, P, R, S, T, U, V)
Number of Samples
Gravimetric Moisture Content %

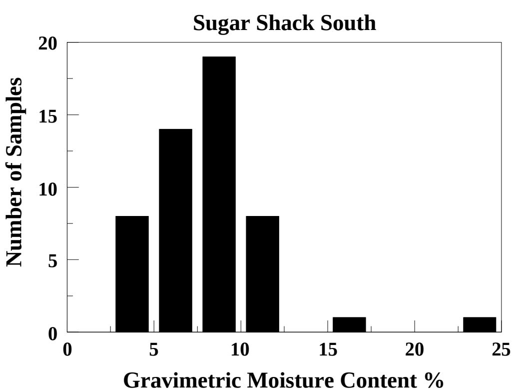

Outer Units (C, I, J)
Number of Samples
Gravimetric Moisture Content %

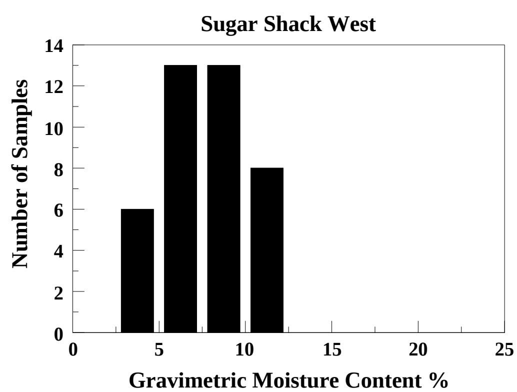

GHN
Number of Samples
Gravimetric Moisture Content %

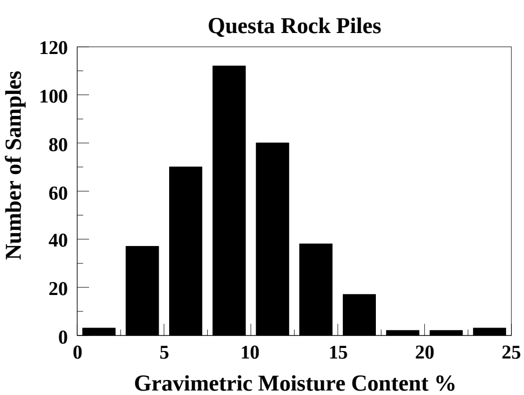

Capulin
Number of Samples
Gravimetric Moisture Content %

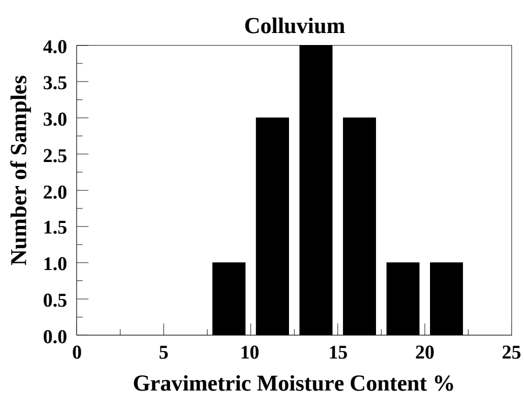

Middle
Number of Samples
Gravimetric Moisture Content %

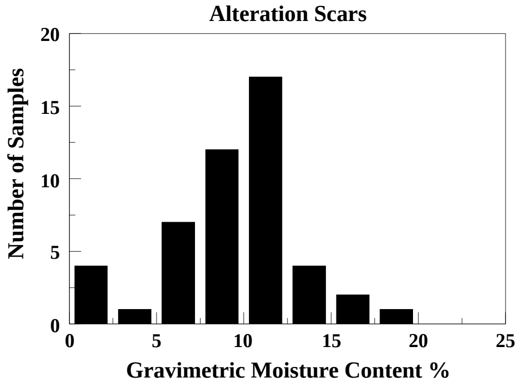

Sulfur Gulch South
Number of Samples
Gravimetric Moisture Content %

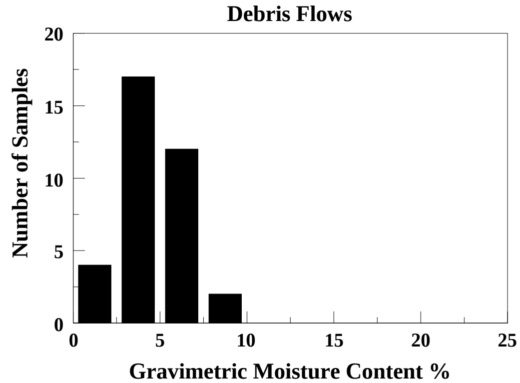

Sugar Shack South
Number of Samples
Gravimetric Moisture Content %

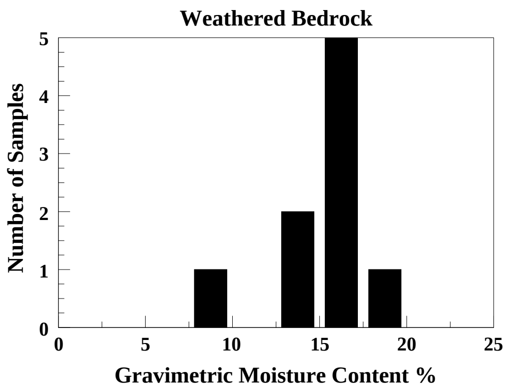

Sugar Shack West
Number of Samples
Gravimetric Moisture Content %


Questa Rock Piles
Number of Samples
Gravimetric Moisture Content %


Colluvium
Number of Samples
Gravimetric Moisture Content %







ATTERBERG LIMITS

TABLE A11-13. Descriptive statistics of Atterberg Limits by geologic unit for stable portion of GHN rock pile. Histograms are below. Data are results obtained from NMIMT sampling and testing on Questa rock piles 2004-2007 (Appendix 7 and project Access database) and from URS Corp. (2003).

Liquid Limit

Unit	Mean	Median	Standard Deviation	Standard Error	Minimum	Maximum	Number of Cases
unit C	32.2						1
unit I	35.0	35.3	4.9	2.8	30.0	39.8	3
unit J	34.9	35.2	3.4	1.3	28.7	38.4	7
unit N	34.7						2
unit K	30.9	31.3	3.4	1.7	26.5	34.7	4
unit M	30.0						1
unit O	35.1	33.8	3.9	1.0	29.6	43.5	16
unit P	36.0						1
unit R	35.3	35.6	2.0	1.2	33.1	37.2	3
unit S	28.1						1
unit U	31.5	31.2	1.1	0.6	30.7	32.7	3
unit V	33.1	34.5	3.1	1.8	29.5	35.3	3
rubble zone	33.0						2

Unit	Mean	Median	Standard Deviation	Standard Error	Minimum	Maximum	Number of Cases
Entire GHN	33.0	33.5	5.5	0.7	3.3	43.5	61
Middle	28.4	28.7	2.5	0.8	22.9	31.7	10
Spring Gulch	23.4	24.0	3.5	0.8	18.6	30.6	18
Sugar Shack South	31.3	31.6	4.0	1.0	2.7	37.0	15
Sugar Shack West	28.8	28.0	3.3	0.5	24.4	39.3	41
Capulin	28.0	22.0	4.5	0.8	22.0	43.0	34
Sulfur Gulch South	32.5	32.1	3.8	1.9	28.7	37.0	4
Questa rock piles	30.4	30.0	5.0	0.2	3.3	46.0	473
colluvium	34.6	33.59	4.3	1.0	29.9	43.9	19
Alteration scars	33.1	32.3	6.3	1.2	20.1	50.5	30
Debris flows	25.1	24.7	2.9	0.7	20.7	30.5	16

Plastic Limit

Unit	Mean	Median	Standard Deviation	Standard Error	Minimum	Maximum	Number of Cases
unit C	17.9						1
unit I	23.9	24.7	1.8	1.0	21.9	25.1	3
unit J	19.6	19.5	2.6	1.0	15.6	23.4	7
unit N	22.7						2
unit K	17.6	18.2	2.2	1.1	14.5	19.6	4
unit M	19.0						1
unit O	20.1	19.8	2.5	0.6	16.6	24.0	16
unit P	22.4						1
unit R	18.3	18.4	1.5	0.9	16.8	19.8	3
unit S	20.9						1
unit U	19.1	18.3	2.0	1.1	17.7	21.4	3
unit V	23.5	25.6	4.5	2.6	18.3	26.5	3
rubble zone	21.6						2
Entire GHN	20.2	19.8	2.7	0.3	14.5	26.5	61
Middle	21.6	20.6	2.8	0.9	17.4	26.3	10
Spring Gulch	18.1	16.9	4.2	1.0	13.1	26.7	18
Sugar Shack South	23.8	22.6	5.0	1.3	17.9	36.0	15
Capulin	17.9	18.0	2.0	0.3	15.0	26.0	34
Sulfur Gulch South	26.0	24.5	7.7	3.8	19.2	36.0	4

Unit	Mean	Median	Standard Deviation	Standard Error	Minimum	Maximum	Number of Cases
Questa rock piles	19.1	19.0	3.0	0.1	11.4	36	473
colluvium	21.7	20.7	3.4	0.8	17.4	30.8	19
Alteration scar	21.2	21.6	3.7	0.7	11.1	28.3	30
Debris flows	18.3	10.2	2.6	0.7	10.2	21.6	16

Plasticity Index

Unit	Mean	Median	Standard Deviation	Standard Error	Minimum	Maximum	Number of Cases
unit C	14.3						1
unit I	11.1	10.2	6.4	3.7	5.3	17.9	3
unit J	15.4	16.4	3.0	1.1	9.3	17.7	7
unit N	12.1						2
unit K	13.3	13.7	3.9	2.0	8.5	17.6	4
unit M	11.0						1
unit O	14.9	14.6	3.7	0.9	6.7	20.4	16
unit P	13.6				13.6		1
unit R	17.0	18.8	3.1	1.8	13.4	18.8	3
unit S	7.1						1
unit U	12.4	13.0	2.4	1.4	9.8	14.4	3
unit V	9.7	8.1	6.7	3.9	3.9	17.0	3
rubble zone	11.3						2
Entire GHN	13.3	13.7	4.1	0.5	3.9	20.7	61
Middle	6.1	6.7	3.4	1.1	1.6	11.1	10
Spring Gulch	5.3	6.2	2.8	0.7	0.2	9.9	18
Sugar Shack South	7.6	7.7	2.3	0.6	1.0	10.5	15
Sugar Shack West	8.8	8.2	3.1	0.5	2.0	15.5	41
Capulin	10.1	10.0	4.1	0.7	5.0	25.0	34
Sulfur Gulch South	6.4	7.6	3.9	2.0	1.0	9.4	4
Questa rock piles	11.3	11.0	4.2	0.2	0.2	25.0	473
colluvium	13.0	13.1	4.4	1.0	5.5	22.5	19
Alteration scar	11.9	10.5	5.3	1.0	5.3	24.8	30
Debris flows	6.8	6.2	3.0	0.8	3.1	13.8	16

Hypothesis 1. The liquid limit of the geologic units in GHN rock pile is different from each other.

Data. Data are results obtained from NMIMT sampling and testing on Questa rock piles 2004-2007 (Appendix 7 and project Access database).

Approach. The Normality Test passed (P = 0.555) and the Equal Variance Test Passed (P = 0.573), therefore the One Way Analysis of Variance was selected. The tests were calculated using the SigmaStat@ software.

Results. The results are in Table A11-14.

TABLE A11-14. Comparisons of liquid limit (%) in GHN units using One Way Analysis of Variance analysis.

Group Name	N	Mean	Std Dev	SEM
LL-Unit C	1	32.170	0.000	0.000
LL-Unit I	3	35.003	4.921	2.841
LL-Unit J	7	34.947	3.408	1.288
LL-Unit K	4	30.935	3.415	1.707
LL-Unit M	1	30.030	0.000	0.000
LL-Unit N	2	34.730	1.202	0.850
LL-Unit O	16	35.037	3.860	0.965
LL-Unit R	3	35.287	2.048	1.182
LL-unit UV	6	32.330	2.273	0.928
LL-Unit RUB (rubble zone)	2	32.950	2.135	1.510

Conclusion. The differences in the mean values among the treatment groups are not great enough to exclude the possibility that the difference is due to random sampling variability; there is not a statistically significant difference (P = 0.413). Therefore, there is no discernable difference in liquid limits between the GHN geologic units.

Hypothesis 2. The liquid limit of the Questa rock piles is different from the analog sites (colluvium, alteration scars, debris flows).

Data. Data are results obtained from NMIMT sampling and testing on Questa rock piles 2004-2007 (Appendix 7 and project Access database).

Approach. The Normality Test failed (P <0.050), therefore the Kruskal-Wallis One Way Analysis of Variance on Ranks was selected. The tests were calculated using the SigmaStat@ software.

Results. The results are in Table A11-15.

TABLE A11-15. Comparisons of liquid limit (%) in GHN units using One Way Analysis of Variance analysis. H = 37.573 with 3 degrees of freedom (P = <0.001).

Group	**N**	**Median**	**25%**	**75%**
LL-rock piles	473	30.000	27.000	34.000
LL-col	18	33.585	30.950	39.280
LL-debris	18	24.740	22.635	27.430
LL-alt	30	32.330	30.490	34.760

Conclusion. The differences in the median values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference ($P = <0.001$). The median liquid limit of the debris flows is lower than the median liquid limit of other Questa materials and the median liquid limit of the colluvium is larger than the other Questa material.