

**APPENDIX B**  
**SAMPLE ADEQUACY EVALUATION FOR**  
**ROSEMONT GEOLOGIC MATERIALS**

## B1.0 INTRODUCTION

An open pit copper mine and ore processing operation are planned for the Rosemont Copper Project (Rosemont) site, located approximately 30 miles southeast of Tucson, Arizona. Processing of approximately 546 million tons (Mt) of sulfide ore and 69 Mt of oxide ore is expected to generate up to 1,232 Mt of waste rock during the anticipated 20-25 year mine life. Consequently, a baseline geochemical characterization was prepared which focused on the potential water quality impacts from the various mine facilities (e.g., waste rock and dry stack tailings storage areas). One of the primary goals of the baseline characterization study was to test a representative number of samples in order to adequately characterize the geochemical behavior of the rock that would be developed from mining (Tetra Tech, 2007). The results from this geochemical testing can also be used to estimate the geochemistry of non-ore rocks in the final walls of the pit.

The exposed pit wall lithology will be dominated by arkosic rocks of the Willow Canyon Formation, the Horquilla Limestone, and Bolsa Quartzite, with less exposure of additional limestone, quartz monzonite porphyry, and andesite (Table B1). Most of the primary sulfide mineralization is hosted by the Horquilla, Colina, and Epitaph Limestones, although the total sulfide content of these Paleozoics is generally low compared to other southwest porphyry copper systems (Tetra Tech, 2007). In fact, the total sulfur content of the overlying arkosic and andesitic lithologies is generally higher than the remainder of the deposit. A total of 226 applicable samples were subsequently submitted for standard static testing procedures.

The most commonly-used static test is known as acid-base accounting (ABA), which measures the balance between the acid-producing potential (AP) and the acid-neutralizing potential (NP) (White and others, 1999). The AP is determined by sulfur analysis and determines the sulfur content associated with pyritic sulfur. The NP is determined by acid-titration and generally represents the carbonate content of the sample. The net-neutralizing potential (NNP) is the difference between these values ( $NNP = NP - AP$ ) and is typically expressed in units of kilograms of calcium carbonate ( $CaCO_3$ ) per ton of rock ( $kg CaCO_3/t$  rock, or  $kg/t$ ). The NNP, together with the NP ratio ( $NP/AP$ ), is an important parameter used to classify a material as either potentially-acid generating (PAG) or inert with respect to acid generation. Because the ABA characteristics for a given sample reflect the dominant mineralogic properties of the material (i.e., carbonate and sulfur mineral content), ABA results can be used to evaluate if a material has been adequately characterized with respect to its potential effects on water quality.

## **B2.0 TECHNICAL OBJECTIVE**

The objective of this sample adequacy evaluation is to assess the degree to which results from geochemical testing represent the overall geochemical tendencies of various rock types at Rosemont.

### **B3.0 TECHNICAL EVALUATION**

Numerous criteria for determining an adequate sample population have been suggested as a means of obtaining representative samples of waste rock (USEPA, 1983; USEPA, 1994; Maest and Kuipers, 2005; Runnells and others, 1997). However, because it is impossible to confidently predict the degree of heterogeneity of a material, it is impossible to predict in advance how many samples will be required to representatively characterize it. In concept, a perfectly homogeneous material requires only one sample. Because the degree of variability in geochemical properties of rock is unique to each site, a reasonable approach is to determine the sample requirement based upon site-specific variability.

Samples may be taken from over a reasonable volume of the rock unit under consideration and continuously characterized until no further significant variability is observed. Such a process explicitly determines the heterogeneity of geochemical characteristics and demonstrates an adequate level of characterization.

The evaluation of sample adequacy presented herein was conducted using the approach outlined by Runnells and others (1997), which utilizes statistical measures of central tendency (mean) and dispersion (standard deviation) (USEPA, 2000) to evaluate sample representation. The method uses a stepwise evaluation to evaluate the degree to which additional sample analysis improves the level of confidence for a given parameter. Once the naturally-occurring variability of a rock unit is established, specific samples may be selected for detailed characterization of water quality that results from contact with that material.

During the baseline geochemical characterization (Tetra Tech, 2007), samples of geologic materials were submitted for ABA testing in proportion to their expected occurrence in the waste rock. The previous baseline testing results can be found in Appendix A of the Geochemical Characterization Addendum 1 Report (Tetra Tech, 2007). A subsequent evaluation of these data using the approaches described above indicated that insufficient information existed for several of the rock types, and therefore additional geochemical analysis was conducted in 2008. This additional data was composited with data from Tetra Tech (2007) for subsequent analysis.

Illustration B1 shows the spatial extent of sampling of rock within the projected pit. In this illustration, the traces of the boreholes are shown as lines and the individual sample locations are shown as a colored segment of the line. Samples were collected from a relatively large volume in the area most proximal to mineralization, where variability of the unit would be expected to be greatest. Samples were also collected, although fewer in number, at more distal positions, where less variability was anticipated.

The final composite ABA data for the rock types analyzed (Table B2) were first listed in random order, and then a moving average and standard deviation were calculated for NNP. The resulting data were graphed. This analysis evaluates potential increasing convergence toward the population mean (average), and decreasing variability about the population mean, with increasing sample size. A given rock type was considered to be adequately characterized when increasing the sample size produces a change of <10% in the average NNP, and if the slope of the standard deviation approaches zero.

## **B4.0 RESULTS AND DISCUSSION**

The statistical results (from the Geochemical Characterization Addendum 1 [Tetra Tech, 2007] and subsequent additional analyses) for NNP within each rock type evaluated are presented on Illustrations B2 through B14. Each illustration depicts the moving average and standard deviation of the NNP for a given rock type. Based on these results, the rock types which will be exposed on the pit walls have been adequately characterized. Increasing the number of samples associated with these materials for analysis would yield limited or no increased definition of their chemical characteristics, and consequently no further sampling was deemed necessary.

For example, Illustration B2 shows the variation in the moving average and standard deviation for the Willow Canyon Formation arkose NNP values. For the first few samples, the running average changes by more than 10% as the sample number increases, but with increasing sample size, very little change is seen for both the moving average and the standard deviation (Illustration B2). Therefore, increasing the number of arkose samples will not change the level of confidence in the average value, indicating that an adequate number of arkose samples have been analyzed. Similar trends are apparent for the remaining rock types, which includes the rock types that are expected to dominate the final pit wall exposure.

## **B5.0 CONCLUSIONS**

Statistical evaluation of ABA data collected from the Rosemont geologic materials provides a method for evaluating sample adequacy using site-specific geochemical parameters, rather than relying on arbitrary literature criteria developed for mine materials in general. Application of a statistical technique to the Rosemont Project site indicates that an adequate number of samples have been analyzed to characterize their central geochemical tendency.

## B6.0 REFERENCES

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## **TABLES**



**Table B1 Projected Exposed Areas and ABA Summary for Various Rock Types in the Rosemont Pit**

| Rock Type                         | % of Exposed Area | No. Samples Analyzed for ABA |
|-----------------------------------|-------------------|------------------------------|
| Willow Canyon Formation, Arkose   | 29.3              | 55                           |
| Horquilla Limestone               | 16                | 26                           |
| Bolsa Quartzite                   | 8.1               | 13                           |
| Abrigo Formation                  | 7.5               | 6                            |
| Epitaph Formation                 | 7.4               | 16                           |
| Tertiary Gravel                   | 6.4               | 5                            |
| Colina Limestone                  | 4.8               | 11                           |
| Earp Formation                    | 4.0               | 14                           |
| Glance Conglomerate               | 3.8               | 4                            |
| Escabrosa Limestone               | 3.8               | 10                           |
| Concha                            | 2.9               | 6                            |
| Martin Formation                  | 2.5               | 7                            |
| Precambrian Granodiorite          | 1.0               | 0                            |
| Willow Canyon Formation, Andesite | 0.89              | 38                           |
| Scherrer                          | 0.62              | 0                            |
| Quartz Monzonite Porphyry         | 0.53              | 9                            |
| Overburden                        | 0.15              | 6                            |
| TOTAL                             | 100               | 226                          |

**Table B2 Summary of ABA Data Used to Evaluate Sampling Adequacy**

| Sample ID   | Rock Type | # Samples | AP   | NP   | NNP   | NNP - Mean | NNP - Std. Dev. |
|-------------|-----------|-----------|------|------|-------|------------|-----------------|
| 1561-03     | Abrigo    | 1         | 0.3  | 665  | 665.0 | 665.0      |                 |
| 1561-01     | Abrigo    | 2         | 0.3  | 439  | 439.0 | 552.0      | 159.8           |
| 1916-02     | Abrigo    | 3         | 0.3  | 630  | 630.0 | 578.0      | 121.6           |
| A818-01     | Abrigo    | 4         | 0.3  | 693  | 693.0 | 606.8      | 114.8           |
| 1926-02     | Abrigo    | 5         | 0.3  | 550  | 550.0 | 595.4      | 102.6           |
| A780-01     | Abrigo    | 6         | 0.3  | 501  | 501   | 579.7      | 99.5            |
|             |           |           |      |      |       |            |                 |
| AR2019-02   | Andesite  | 1         | 0.3  | 44.2 | 44.2  | 44.2       |                 |
| AR2021-01   | Andesite  | 2         | 35.3 | 47.3 | 12.0  | 28.1       | 22.8            |
| AR2030-06   | Andesite  | 3         | 0.3  | 33.9 | 33.9  | 30.0       | 16.4            |
| AR2010-03   | Andesite  | 4         | 52.2 | 26.6 | -25.6 | 16.1       | 30.9            |
| AR2017-06   | Andesite  | 5         | 0.3  | 39.6 | 39.6  | 20.8       | 28.7            |
| A-820 245.5 | Andesite  | 6         | 18.2 | 87.7 | 69.5  | 28.9       | 32.5            |
| AR2009-03   | Andesite  | 7         | 64.1 | 99.1 | 35.0  | 29.8       | 29.7            |
| AR2014-03   | Andesite  | 8         | 29.7 | 71.7 | 42.0  | 31.3       | 27.9            |
| AR2017-01   | Andesite  | 9         | 0.3  | 45.3 | 45.3  | 32.9       | 26.5            |
| A-816 569   | Andesite  | 10        | 28.9 | 121  | 92.1  | 38.8       | 31.2            |
| AR2028B-01  | Andesite  | 11        | 29.4 | 75.7 | 46.3  | 39.5       | 29.7            |
| AR2043-01   | Andesite  | 12        | 47.5 | 103  | 55.5  | 40.8       | 28.7            |
| AR2013-01   | Andesite  | 13        | 48.4 | 59.7 | 11.3  | 38.5       | 28.7            |
| AR2013-02   | Andesite  | 14        | 33.1 | 70.2 | 37.1  | 38.4       | 27.5            |

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| Sample ID   | Rock Type | # Samples | AP   | NP   | NNP   | NNP - Mean | NNP - Std. Dev. |
|-------------|-----------|-----------|------|------|-------|------------|-----------------|
| AR2030-05   | Andesite  | 15        | 5.3  | 47.7 | 42.4  | 38.7       | 26.6            |
| AR2011-03   | Andesite  | 16        | 68.8 | 54.2 | -14.6 | 35.4       | 28.9            |
| AR2032-01   | Andesite  | 17        | 0.3  | 39.8 | 39.8  | 35.6       | 28.0            |
| AR2026-01   | Andesite  | 18        | 14.4 | 48.3 | 33.9  | 35.5       | 27.2            |
| AR2038-04   | Andesite  | 19        | 0.3  | 6.2  | 6.2   | 34.0       | 27.3            |
| AR2029-01   | Andesite  | 20        | 0.3  | 105  | 105.0 | 37.5       | 30.9            |
| A-882 109   | Andesite  | 21        | 12   | 71.6 | 59.6  | 38.6       | 30.5            |
| AR2020-02   | Andesite  | 22        | 5.3  | 50.1 | 44.8  | 38.9       | 29.8            |
| AR2038-01   | Andesite  | 23        | 0.3  | 13.7 | 13.4  | 37.8       | 29.6            |
| AR2030-03   | Andesite  | 24        | 11.9 | 68.5 | 56.6  | 38.6       | 29.2            |
| 1535-01     | Andesite  | 25        | 34.1 | 41   | 6.9   | 37.3       | 29.3            |
| AR2022-01   | Andesite  | 26        | 34.1 | 88.5 | 54.4  | 37.9       | 28.9            |
| AR2014-02   | Andesite  | 27        | 123  | 105  | -18.0 | 35.9       | 30.3            |
| A808-01     | Andesite  | 28        | 36.9 | 19   | -17.9 | 34.0       | 31.4            |
| AR2038-06   | Andesite  | 29        | 0.3  | 38.9 | 38.9  | 34.1       | 30.9            |
| A817-01     | Andesite  | 30        | 45   | 46.8 | 1.8   | 33.0       | 30.9            |
| A-886 888   | Andesite  | 31        | 27.6 | 156  | 128.4 | 36.1       | 34.9            |
| AR2016-01   | Andesite  | 32        | 0.3  | 26.2 | 26.2  | 35.8       | 34.4            |
| AR2037-01   | Andesite  | 33        | 36.3 | 80.4 | 44.1  | 36.1       | 33.9            |
| AR2038-03   | Andesite  | 34        | 0.3  | 43.5 | 43.5  | 36.3       | 33.4            |
| AR2017-05   | Andesite  | 35        | 0.6  | 25.7 | 25.1  | 36.0       | 32.9            |
| AR2013-03   | Andesite  | 36        | 31.9 | 79   | 47.1  | 36.3       | 32.5            |
| AR2025-03   | Andesite  | 37        | 0.3  | 39.1 | 39.1  | 36.3       | 32.0            |
| AR2025-01   | Andesite  | 38        | 30.3 | 37.8 | 7.5   | 35.6       | 32.0            |
|             |           |           |      |      |       |            |                 |
| AR2037-02   | Arkose    | 1         | 0.3  | 48.9 | 48.9  | 48.9       |                 |
| AR2011-01   | Arkose    | 2         | 0.3  | 10.5 | 10.2  | 29.6       | 27.4            |
| A873-01     | Arkose    | 3         | 0.3  | 78.9 | 78.9  | 46.0       | 34.4            |
| 1596-01     | Arkose    | 4         | 0.3  | 65.6 | 65.6  | 50.9       | 29.8            |
| AR2035-01   | Arkose    | 5         | 0.3  | 44.8 | 44.5  | 49.6       | 25.9            |
| VABH0609-01 | Arkose    | 6         | 0.3  | 4.3  | 4.3   | 42.1       | 29.7            |
| AR2009-02   | Arkose    | 7         | 0.3  | 19.6 | 19.6  | 38.9       | 28.4            |
| AR2004-01   | Arkose    | 8         | 0.3  | 56.2 | 56.2  | 41.0       | 27.0            |
| AR2036-01   | Arkose    | 9         | 7.2  | 103  | 95.8  | 47.1       | 31.2            |
| AR2020-01   | Arkose    | 10        | 0.3  | 13.9 | 13.9  | 43.8       | 31.2            |
| AR2005-01   | Arkose    | 11        | 0.3  | 35.6 | 35.6  | 43.0       | 29.7            |
| AR2002-01   | Arkose    | 12        | 1.6  | 27.1 | 25.5  | 41.6       | 28.8            |
| AR2011-02   | Arkose    | 13        | 0.3  | 21.6 | 21.6  | 40.0       | 28.1            |
| AR2026-02   | Arkose    | 14        | 0.3  | 108  | 108.0 | 44.9       | 32.5            |
| AR2017-07   | Arkose    | 15        | 41.6 | 74.6 | 33.0  | 44.1       | 31.5            |
| AR2013-05   | Arkose    | 16        | 9.1  | 82.8 | 73.7  | 46.0       | 31.3            |
| AR2003-01   | Arkose    | 17        | 0.3  | 37.6 | 37.6  | 45.5       | 30.4            |
| AR2009-01   | Arkose    | 18        | 0.3  | 52.7 | 52.7  | 45.9       | 29.5            |
| A857-01     | Arkose    | 19        | 0.3  | 91.6 | 91.6  | 48.3       | 30.6            |
| AR2040-01   | Arkose    | 20        | 0.3  | 7.7  | 7.4   | 46.2       | 31.1            |
| AR2025-01   | Arkose    | 21        | 30.3 | 37.8 | 7.5   | 44.4       | 31.5            |

**Table B2 Summary of ABA Data Used to Evaluate Sampling Adequacy**

| Sample ID       | Rock Type | # Samples | AP   | NP   | NNP   | NNP - Mean | NNP - Std. Dev. |
|-----------------|-----------|-----------|------|------|-------|------------|-----------------|
| AR2001-02       | Arkose    | 22        | 0.3  | 26.1 | 25.8  | 43.5       | 31.0            |
| AR2005-02       | Arkose    | 23        | 29.4 | 34.1 | 4.7   | 41.9       | 31.3            |
| AR2041-01       | Arkose    | 24        | 13.1 | 44.3 | 31.2  | 41.4       | 30.7            |
| AR2030-04       | Arkose    | 25        | 0.3  | 63.5 | 63.5  | 42.3       | 30.4            |
| AR2014-01       | Arkose    | 26        | 0.3  | 31.1 | 31.1  | 41.9       | 29.9            |
| AR2039-03       | Arkose    | 27        | 20.3 | 24.8 | 4.5   | 40.5       | 30.2            |
| AR2007-01       | Arkose    | 28        | 0.3  | 74   | 74.0  | 41.7       | 30.3            |
| AR2017-03       | Arkose    | 29        | 40.9 | 73.2 | 32.3  | 41.4       | 29.8            |
| AR2003-03       | Arkose    | 30        | 20.6 | 31.1 | 10.5  | 40.3       | 29.8            |
| AR2038-05       | Arkose    | 31        | 0.3  | 16.6 | 16.6  | 39.6       | 29.6            |
| AR2019-01       | Arkose    | 32        | 0.3  | 11.8 | 11.8  | 38.7       | 29.5            |
| AR2013-04       | Arkose    | 33        | 6.9  | 70.2 | 63.3  | 39.4       | 29.4            |
| AR2036-03       | Arkose    | 34        | 5    | 75.2 | 70.2  | 40.3       | 29.4            |
| AR2030-02       | Arkose    | 35        | 0.3  | 97.2 | 97.2  | 42.0       | 30.5            |
| AR2010-01       | Arkose    | 36        | 0.3  | 19.6 | 19.6  | 41.3       | 30.3            |
| AH4-01          | Arkose    | 37        | 0.3  | 43.2 | 43.2  | 41.4       | 29.9            |
| AR2042-02       | Arkose    | 38        | 0.3  | 134  | 134.0 | 43.8       | 33.1            |
| AR2003-02       | Arkose    | 39        | 0.3  | 24.1 | 24.1  | 43.3       | 32.8            |
| 1920-01         | Arkose    | 40        | 0.3  | 45.3 | 45.3  | 43.4       | 32.4            |
| AR2039-06       | Arkose    | 41        | 23.1 | 19.7 | -3.4  | 42.2       | 32.8            |
| AR2010-02       | Arkose    | 42        | 13.8 | 17.6 | 3.8   | 41.3       | 32.9            |
| AR2043-02       | Arkose    | 43        | 32.2 | 175  | 142.8 | 43.7       | 36.0            |
| AR2038-02       | Arkose    | 44        | 0.3  | 100  | 100.0 | 45.0       | 36.6            |
| A886-01         | Arkose    | 45        | 1.9  | 9.1  | 7.2   | 44.1       | 36.6            |
| AR2025-02       | Arkose    | 46        | 15.9 | 71.9 | 56.0  | 44.4       | 36.3            |
| A830-03         | Arkose    | 47        | 0.3  | 17.6 | 17.6  | 43.8       | 36.1            |
| Arkose (AR2054) | Arkose    | 48        | 0.3  | 8.3  | 8.3   | 43.1       | 36.1            |
| A814-01         | Arkose    | 49        | 0.3  | 90   | 90.0  | 44.0       | 36.3            |
| AR2001-01       | Arkose    | 50        | 0.3  | 27.1 | 27.1  | 43.7       | 36.0            |
| AR2025-04       | Arkose    | 51        | 6.3  | 31.1 | 24.8  | 43.3       | 35.7            |
| AR2032-02       | Arkose    | 52        | 0.3  | 36.5 | 36.5  | 43.2       | 35.4            |
| A831-01         | Arkose    | 53        | 0.3  | 29   | 28.7  | 42.9       | 35.1            |
| AR2015-01       | Arkose    | 54        | 0.3  | 73.3 | 73.3  | 43.5       | 35.0            |
| AR2000-01       | Arkose    | 55        | 0.3  | 42.7 | 42.7  | 43.5       | 34.7            |
| AR2042-04       | Arkose    | 56        | 0.3  | 111  | 111.0 | 44.7       | 35.6            |
|                 |           |           |      |      |       |            |                 |
| AR2067-01       | Bolsa     | 1         | 0.3  | 7.3  | 7.3   | 7.3        |                 |
| AR2033-01       | Bolsa     | 2         | 0.55 | 13.5 | 13.0  | 10.1       | 4.0             |
| AR2059-01       | Bolsa     | 3         | 2.74 | 2.7  | 0.0   | 6.7        | 6.5             |
| VABH0608-01     | Bolsa     | 4         | 0.3  | 2.6  | 2.6   | 5.7        | 5.7             |
| AR2023-01       | Bolsa     | 5         | 21.5 | 8.3  | -13.2 | 1.9        | 9.8             |
| A780-02         | Bolsa     | 6         | 9.69 | 3.5  | -6.2  | 0.6        | 9.4             |
| A780-03         | Bolsa     | 7         | 39.7 | 0.3  | -39.7 | -5.2       | 17.5            |
| AR2066-01       | Bolsa     | 8         | 15.4 | 38.1 | 22.7  | -1.7       | 18.9            |
| 1561-02         | Bolsa     | 9         | 6.03 | 1.5  | -4.5  | -2.0       | 17.7            |
| AR2073-01       | Bolsa     | 10        | 0.3  | 9.9  | 9.9   | -0.8       | 17.1            |

**Table B2 Summary of ABA Data Used to Evaluate Sampling Adequacy**

| Sample ID  | Rock Type | # Samples | AP   | NP   | NNP   | NNP - Mean | NNP - Std. Dev. |
|------------|-----------|-----------|------|------|-------|------------|-----------------|
| 1561-04    | Bolsa     | 11        | 0.54 | 4.2  | 3.7   | -0.4       | 16.3            |
| AR2072-01  | Bolsa     | 12        | 5.47 | 10.4 | 4.9   | 0.0        | 15.6            |
| AR2060-01  | Bolsa     | 13        | 0.3  | 3.2  | 3.2   | 0.3        | 15.0            |
|            |           |           |      |      |       |            |                 |
| A852-01    | Colina    | 1         | 74.8 | 203  | 128.2 | 128.2      |                 |
| A840-01    | Colina    | 2         | 0.3  | 492  | 492.0 | 310.1      | 257.2           |
| A815-01    | Colina    | 3         | 0.3  | 453  | 453.0 | 357.7      | 199.7           |
| A865-01    | Colina    | 4         | 3.4  | 129  | 125.6 | 299.7      | 200.2           |
| AR2011-04  | Colina    | 5         | 1.6  | 299  | 297.4 | 299.2      | 173.4           |
| 1914-01    | Colina    | 6         | 18.1 | 403  | 384.9 | 313.5      | 158.9           |
| 1528-02    | Colina    | 7         | 11.9 | 337  | 325.1 | 315.2      | 145.2           |
| A860-01    | Colina    | 8         | 2.2  | 354  | 351.8 | 319.8      | 135.0           |
| AR 2010-04 | Colina    | 9         | 0.3  | 930  | 930.0 | 387.6      | 239.4           |
| AR2002-02  | Colina    | 10        | 0.6  | 617  | 616   | 410.4      | 237.0           |
| AR2041-02  | Colina    | 11        | 1.6  | 221  | 220   | 393.1      | 232.1           |
|            |           |           |      |      |       |            |                 |
| AR2042-01  | Concha    | 1         | 0.3  | 432  | 432.0 | 432.0      |                 |
| AR2042-05  | Concha    | 5         | 0.3  | 570  | 570.0 | 596.2      | 153.2           |
| AH4-02     | Concha    | 6         | 0.3  | 530  | 530.0 | 585.2      | 139.7           |
| AR2006-01  | Concha    | 8         | 0.3  | 740  | 740.0 | 627.6      | 142.1           |
| A808-02    | Concha    | 9         | 0.3  | 740  | 740.0 | 640.1      | 138.1           |
| A804-01    | Concha    | 11        | 0.3  | 889  | 889.0 | 651.7      | 150.9           |
|            |           |           |      |      |       |            |                 |
| AR2019-03  | Earp      | 1         | 8.8  | 23.1 | 14.3  | 14.3       |                 |
| AR2030-01  | Earp      | 2         | 4.4  | 85.2 | 80.8  | 47.6       | 47.0            |
| A849-01    | Earp      | 3         | 1.81 | 208  | 206.2 | 100.4      | 97.4            |
| A830-04    | Earp      | 4         | 15.3 | 178  | 162.7 | 116.0      | 85.4            |
| 1528-01    | Earp      | 5         | 4.4  | 182  | 177.6 | 128.3      | 79.0            |
| 1920-02    | Earp      | 6         | 1.16 | 249  | 247.8 | 148.2      | 85.8            |
| A845-01    | Earp      | 7         | 4.1  | 26.2 | 22.1  | 130.2      | 91.7            |
| AR2035-02  | Earp      | 8         | 1.9  | 171  | 169.1 | 135.1      | 86.0            |
| AR2017-02  | Earp      | 9         | 0.3  | 47.4 | 47.4  | 125.3      | 85.6            |
| A834-02    | Earp      | 10        | 5.6  | 109  | 103.4 | 123.1      | 81.0            |
| AR2000-03  | Earp      | 11        | 8.1  | 112  | 103.9 | 121.4      | 77.1            |
| AR2000-02  | Earp      | 12        | 10.9 | 62.2 | 51.3  | 115.6      | 76.2            |
| AR2014-05  | Earp      | 13        | 10   | 104  | 94.0  | 113.9      | 73.2            |
| AR2028B-02 | Earp      | 14        | 0.3  | 58.4 | 58.4  | 109.9      | 71.9            |
|            |           |           |      |      |       |            |                 |
| AR2009-04  | Epitaph   | 1         | 17.2 | 80.3 | 63.1  | 63.1       |                 |
| A847-01    | Epitaph   | 2         | 0.3  | 774  | 774.0 | 418.6      | 502.7           |
| A828-01    | Epitaph   | 3         | 5.47 | 165  | 159.5 | 332.2      | 385.6           |
| A860-02    | Epitaph   | 4         | 5    | 252  | 247.0 | 310.9      | 317.7           |
| AR2040-02  | Epitaph   | 5         | 0.3  | 707  | 707.0 | 390.1      | 327.3           |
| A850-01    | Epitaph   | 6         | 0.3  | 176  | 175.7 | 354.4      | 305.5           |
| A860-03    | Epitaph   | 7         | 0.3  | 405  | 405.0 | 361.6      | 279.5           |
| 1538-01    | Epitaph   | 8         | 0.3  | 621  | 621.0 | 394.0      | 274.6           |

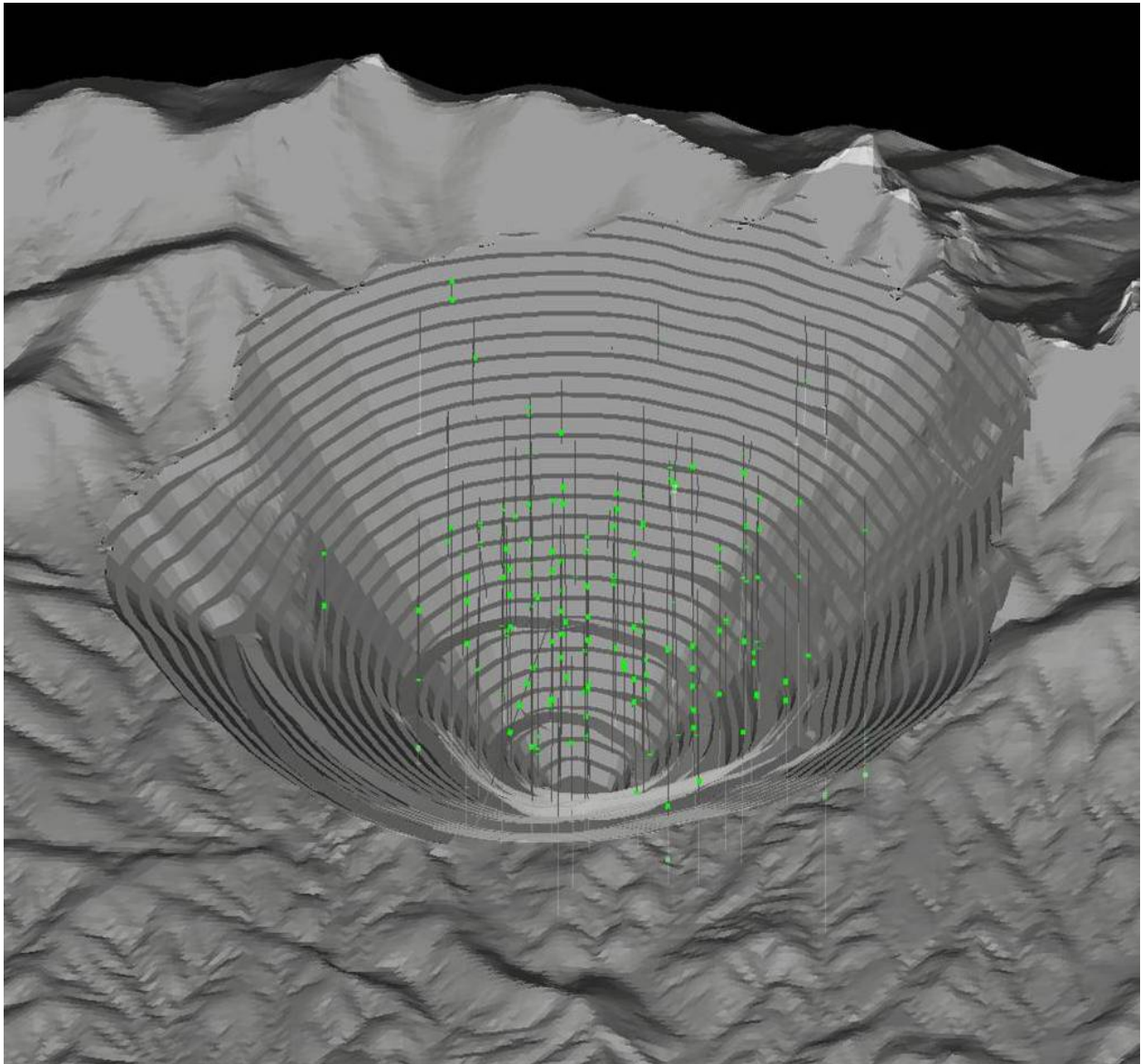
**Table B2 Summary of ABA Data Used to Evaluate Sampling Adequacy**

| Sample ID  | Rock Type | # Samples | AP   | NP   | NNP   | NNP - Mean | NNP - Std. Dev. |
|------------|-----------|-----------|------|------|-------|------------|-----------------|
| AR2002-03  | Epitaph   | 9         | 0.3  | 522  | 522.0 | 408.3      | 260.4           |
| AR2034-02  | Epitaph   | 10        | 0.3  | 928  | 928.0 | 460.2      | 295.4           |
| A829-01    | Epitaph   | 11        | 0.3  | 680  | 680.0 | 480.2      | 288.0           |
| A825-01    | Epitaph   | 12        | 0.3  | 933  | 933.0 | 517.9      | 304.1           |
| A801-01    | Epitaph   | 13        | 0.3  | 770  | 770   | 537.3      | 299.4           |
| A830-01    | Epitaph   | 14        | 0.3  | 638  | 638   | 544.5      | 288.9           |
| AR2001-03  | Epitaph   | 15        | 0.3  | 99.1 | 99.1  | 514.8      | 301.2           |
| AR2014-04  | Epitaph   | 16        | 0.3  | 584  | 584   | 519.2      | 291.5           |
| A801-01    | Epitaph   | 7         | 0.3  | 770  | 770.0 | 611.6      | 145.4           |
|            |           |           |      |      |       |            |                 |
| 1580-01    | Escabrosa | 1         | 0.3  | 34.8 | 34.8  | 34.8       |                 |
| 1507-01    | Escabrosa | 2         | 0.3  | 912  | 912.0 | 473.4      | 620.3           |
| A814-02    | Escabrosa | 3         | 0.3  | 874  | 874.0 | 606.9      | 495.8           |
| A872-01    | Escabrosa | 4         | 0.3  | 203  | 203.0 | 506.0      | 452.4           |
| AR2004-05  | Escabrosa | 5         | 0.3  | 880  | 880.0 | 580.8      | 426.0           |
| 1926-03    | Escabrosa | 6         | 0.3  | 862  | 862.0 | 627.6      | 398.0           |
| A812-01    | Escabrosa | 7         | 0.3  | 112  | 112.0 | 554.0      | 412.3           |
| 1461-01    | Escabrosa | 8         | 0.3  | 788  | 788.0 | 583.2      | 390.6           |
| 1506-02    | Escabrosa | 9         | 0.3  | 838  | 838.0 | 611.5      | 375.1           |
| A871-01    | Escabrosa | 10        | 0.6  | 570  | 569.4 | 607.3      | 353.9           |
|            |           |           |      |      |       |            |                 |
| AR2004-02  | Glance    | 2         | 0.3  | 722  | 722.0 | 577.0      | 205.1           |
| A805-01    | Glance    | 3         | 0.3  | 473  | 473.0 | 542.3      | 156.9           |
| 1596-02    | Glance    | 4         | 0.3  | 784  | 784.0 | 602.8      | 176.1           |
| A834-01    | Glance    | 10        | 0.3  | 519  | 519.0 | 628.0      | 135.7           |
|            |           |           |      |      |       |            |                 |
| A845-02    | Horquilla | 1         | 0.3  | 201  | 201.0 | 201.0      |                 |
| A878-02    | Horquilla | 2         | 2.19 | 175  | 172.8 | 186.9      | 19.9            |
| 1530-01    | Horquilla | 3         | 32.2 | 202  | 169.8 | 181.2      | 17.2            |
| AR2039-07  | Horquilla | 4         | 0.3  | 169  | 169.0 | 178.2      | 15.3            |
| A809-01    | Horquilla | 5         | 0.6  | 219  | 218.4 | 186.2      | 22.4            |
| A806-01    | Horquilla | 6         | 0.3  | 194  | 194.0 | 187.5      | 20.3            |
| 1596-03    | Horquilla | 7         | 6.25 | 212  | 205.8 | 190.1      | 19.7            |
| A842-01    | Horquilla | 8         | 0.3  | 224  | 224.0 | 194.3      | 21.8            |
| A866-02    | Horquilla | 9         | 0.3  | 766  | 766.0 | 257.9      | 191.6           |
| AR2007-02  | Horquilla | 10        | 0.9  | 97.8 | 96.9  | 241.8      | 187.7           |
| 1502-01    | Horquilla | 11        | 0.3  | 887  | 887.0 | 300.4      | 263.7           |
| AR2004-03  | Horquilla | 12        | 0.3  | 270  | 270.0 | 297.9      | 251.6           |
| AR2043-03  | Horquilla | 13        | 0.3  | 449  | 449.0 | 309.5      | 244.5           |
| AR2004-04  | Horquilla | 14        | 0.3  | 459  | 459.0 | 320.2      | 238.3           |
| AR2042-03  | Horquilla | 15        | 0.3  | 285  | 285.0 | 317.8      | 229.8           |
| AR2000-04  | Horquilla | 16        | 0.3  | 467  | 467.0 | 327.2      | 225.1           |
| AR2017-08  | Horquilla | 17        | 0.3  | 251  | 251.0 | 322.7      | 218.8           |
| AR2042-06  | Horquilla | 18        | 0.3  | 410  | 410.0 | 327.5      | 213.2           |
| AR 2030-07 | Horquilla | 19        | 0.8  | 412  | 411.2 | 331.9      | 208.1           |
| AR 2035-03 | Horquilla | 20        | 0.3  | 272  | 272.0 | 328.9      | 203.0           |

**Table B2 Summary of ABA Data Used to Evaluate Sampling Adequacy**

| Sample ID  | Rock Type  | # Samples | AP   | NP   | NNP   | NNP - Mean | NNP - Std. Dev. |
|------------|------------|-----------|------|------|-------|------------|-----------------|
| AR 2000-05 | Horquilla  | 21        | 0.3  | 862  | 862.0 | 354.3      | 229.5           |
| AR 2015-02 | Horquilla  | 22        | 0.3  | 874  | 874.0 | 377.9      | 249.9           |
| AR 2043-05 | Horquilla  | 23        | 42.7 | 272  | 229.3 | 371.5      | 246.1           |
| AR 2006-02 | Horquilla  | 24        | 0.3  | 167  | 167.0 | 363.0      | 244.3           |
| AR 2032-03 | Horquilla  | 25        | 0.3  | 154  | 154.0 | 354.6      | 242.8           |
| AR 2004-06 | Horquilla  | 26        | 0.3  | 590  | 590.0 | 363.7      | 242.3           |
|            |            |           |      |      |       |            |                 |
| A856-01    | Martin     | 1         | 0.3  | 707  | 707.0 | 707.0      |                 |
| 1916-01    | Martin     | 2         | 0.3  | 738  | 738.0 | 722.5      | 21.9            |
| A866-01    | Martin     | 3         | 0.3  | 599  | 599.0 | 681.3      | 73.0            |
| 1511-01    | Martin     | 4         | 0.3  | 863  | 863.0 | 726.8      | 108.6           |
| A878-01    | Martin     | 5         | 4.1  | 576  | 571.9 | 695.8      | 116.8           |
| 1506-03    | Martin     | 6         | 2    | 489  | 487.0 | 661.0      | 134.8           |
| 1461-02    | Martin     | 7         | 0.3  | 876  | 876.0 | 691.7      | 147.5           |
|            |            |           |      |      |       |            |                 |
| AR2039-02  | Overburden | 1         | 1.6  | 19   | 17.4  | 17.4       |                 |
| AR2039-05  | Overburden | 2         | 0.3  | 19.2 | 18.9  | 18.2       | 1.1             |
| AR2039-04  | Overburden | 3         | 0.3  | 4.2  | 4.2   | 13.5       | 8.1             |
| A821-01    | Overburden | 4         | 0.3  | 47.3 | 47.3  | 22.0       | 18.1            |
| 1485-01    | Overburden | 5         | 0.3  | 25.7 | 25.7  | 22.7       | 15.8            |
| AR2039-01  | Overburden | 6         | 1.9  | 9.5  | 7.6   | 20.2       | 15.4            |
|            |            |           |      |      |       |            |                 |
| AR2036-04  | QMP        | 1         | 0.3  | 0.3  | 0.0   | 0.0        |                 |
| AR2034-01  | QMP        | 2         | 0.3  | 2.1  | 2.1   | 1.1        | 1.5             |
| A855-01    | QMP        | 3         | 0.3  | 20.6 | 20.6  | 7.6        | 11.3            |
| AR2037-03  | QMP        | 4         | 0.3  | 36.7 | 36.7  | 14.9       | 17.3            |
| 1503-01    | QMP        | 5         | 0.3  | 5.6  | 5.6   | 13.0       | 15.5            |
| 1926-01    | QMP        | 6         | 0.3  | 12.2 | 12.2  | 12.9       | 13.9            |
| 1506-01    | QMP        | 7         | 0.3  | 9.3  | 9.3   | 12.4       | 12.7            |
| AR2036-02  | QMP        | 8         | 0.3  | 4.7  | 4.7   | 11.4       | 12.1            |
| A815-02    | QMP        | 9         | 0.3  | 10.1 | 10.1  | 11.3       | 11.3            |

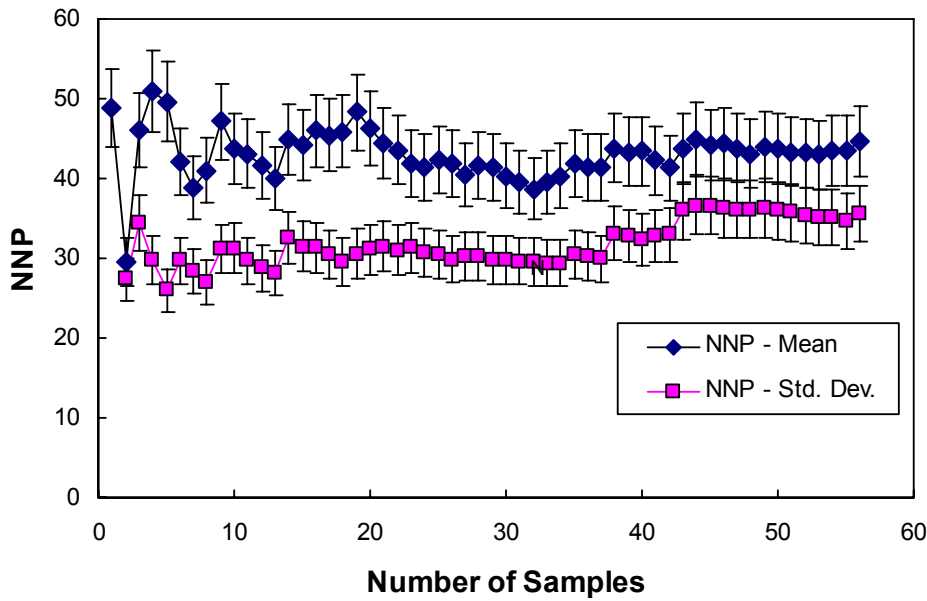
## **ILLUSTRATIONS**



**Illustration B1**      **Drill Holes and Samples Used to Characterize Non-Ore Rock**

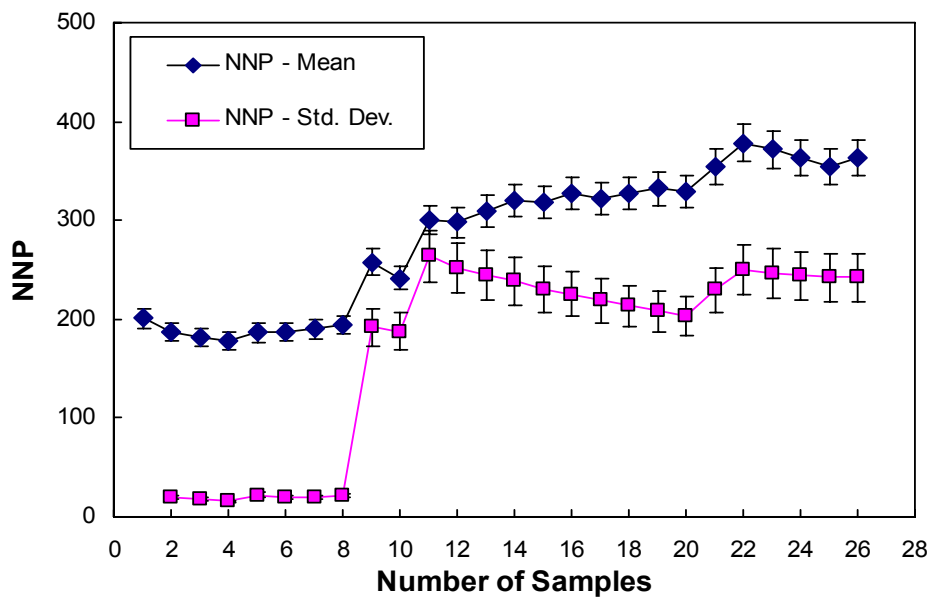


### Willow Canyon Formation, Arkose

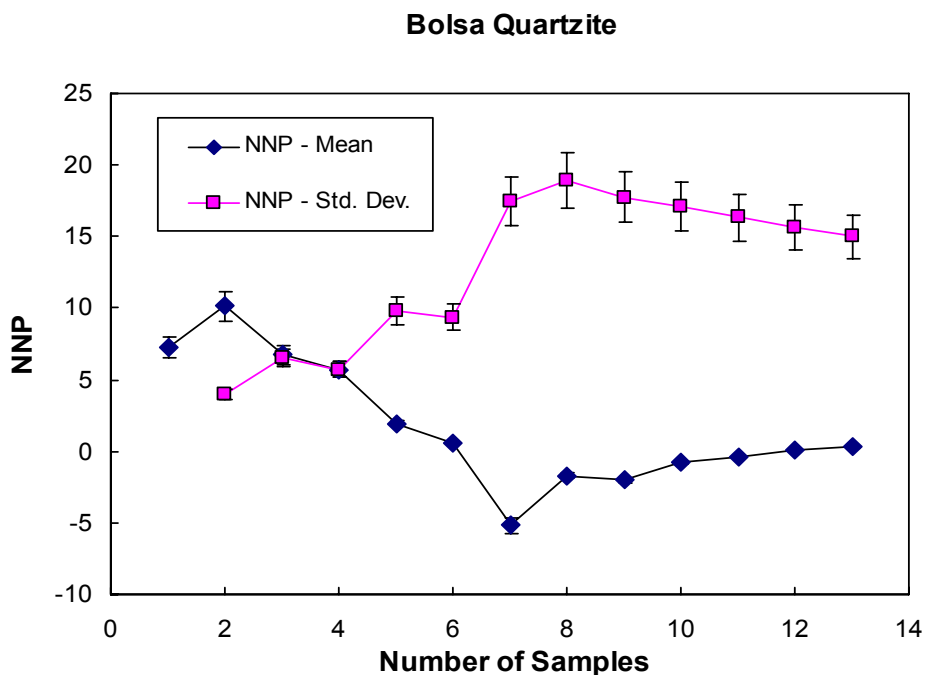


**Illustration B2** Moving Average and Standard Deviation of NNP Values for Rosemont Willow Canyon Formation Arkose Samples

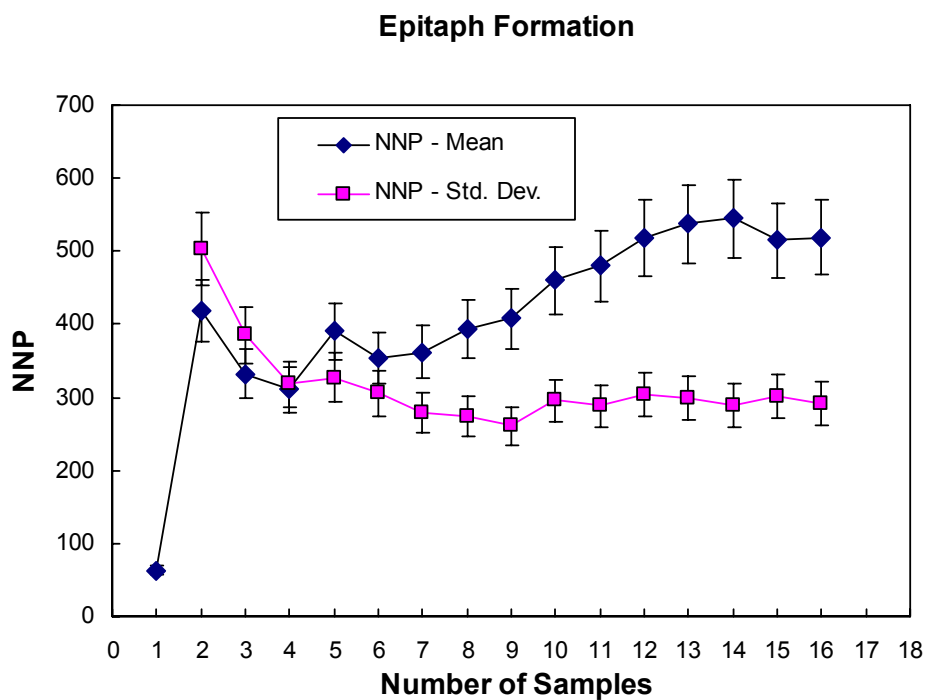
### Horquilla Limestone



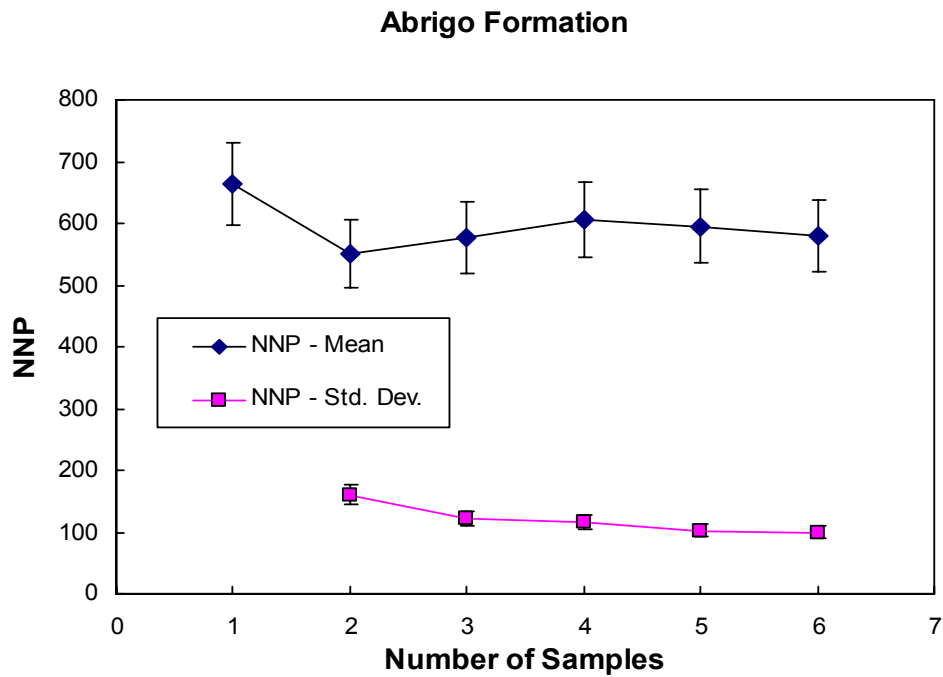
**Illustration B3** Moving Average and Standard Deviation of NNP Values for Rosemont Horquilla Limestone Samples



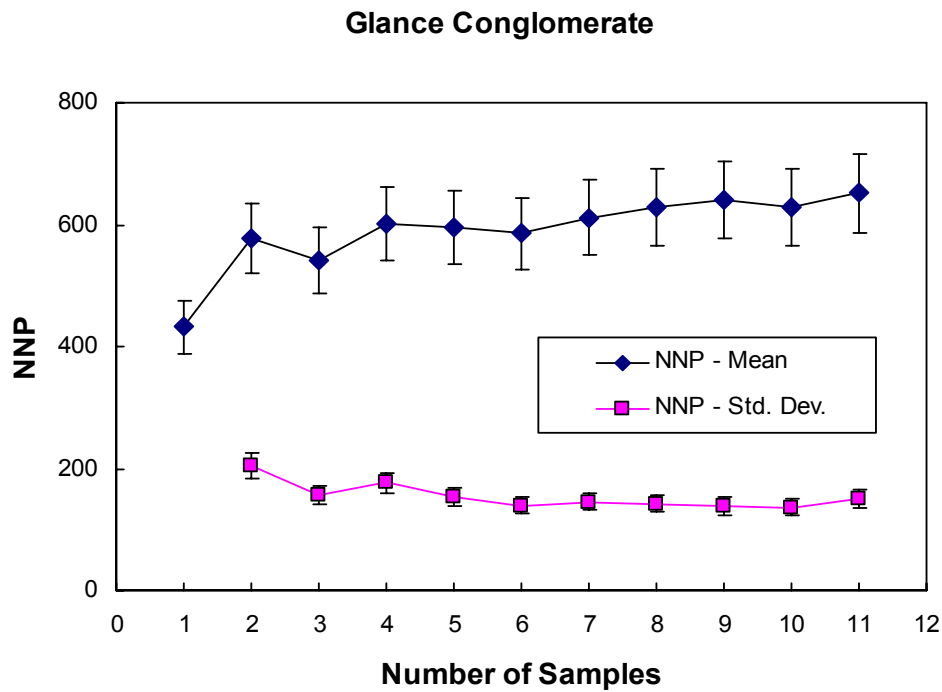
**Illustration B4** Moving Average and Standard Deviation of NNP Values for Rosemont Bolsa Quartzite Samples



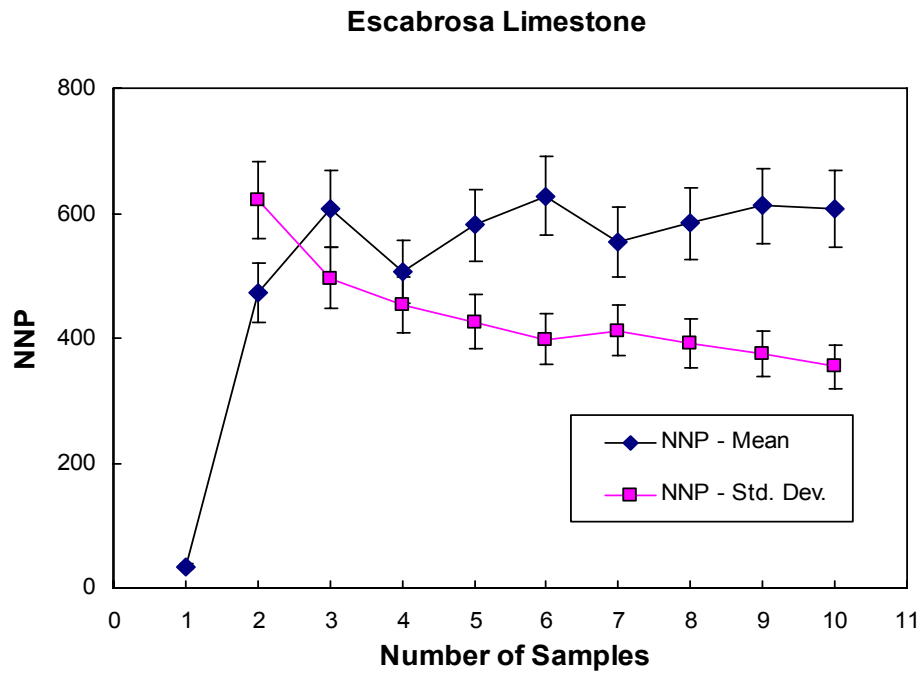
**Illustration B5** Moving Average and Standard Deviation of NNP Values for Rosemont Epitaph Formation Samples



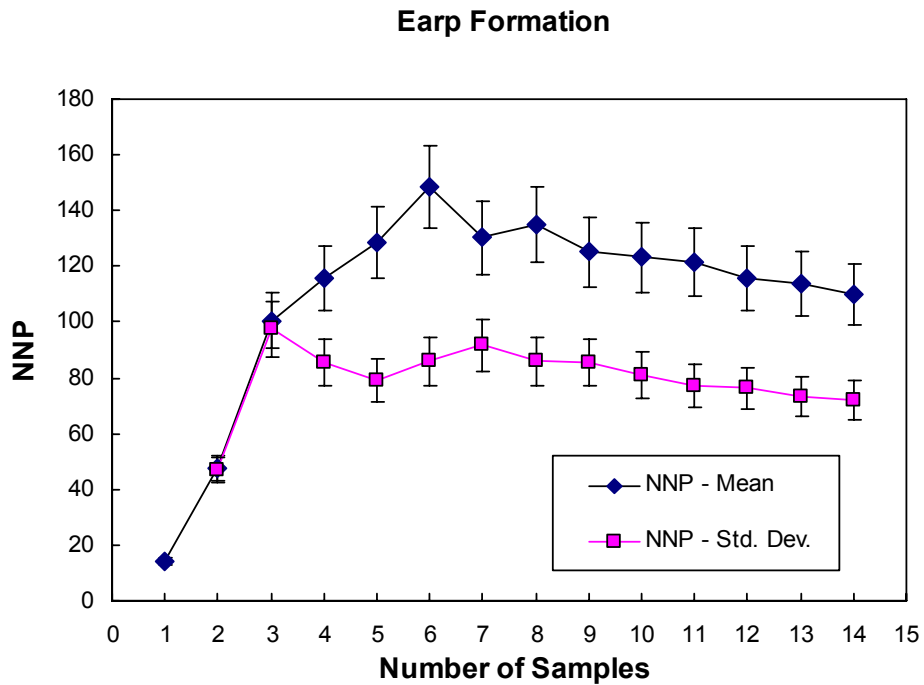
**Illustration B6** Moving Average and Standard Deviation of NNP Values for Rosemont Abrigo Formation Samples



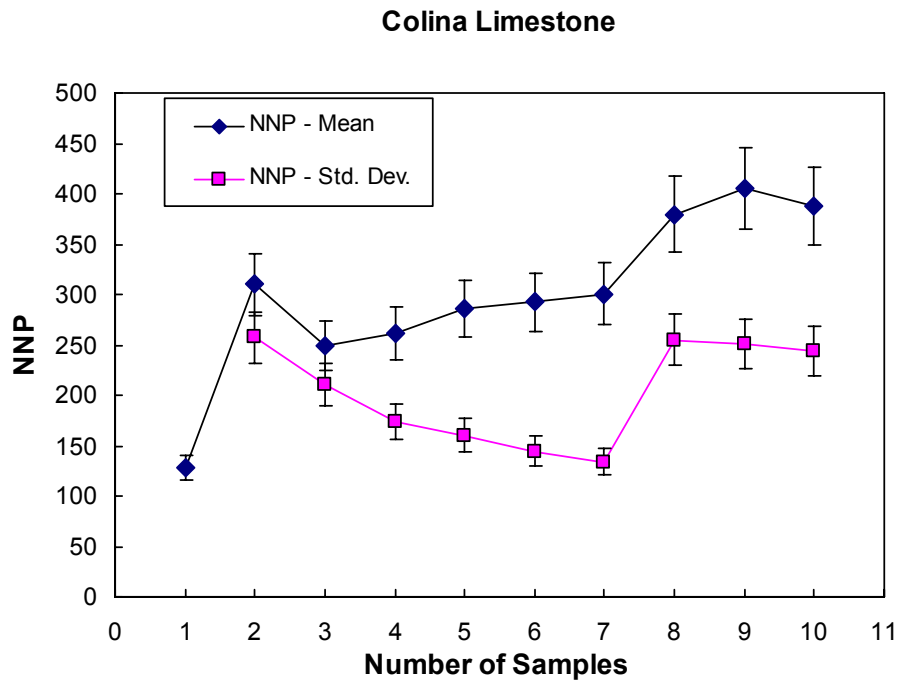
**Illustration B7** Moving Average and Standard Deviation of NNP Values for Rosemont Glance Conglomerate Samples



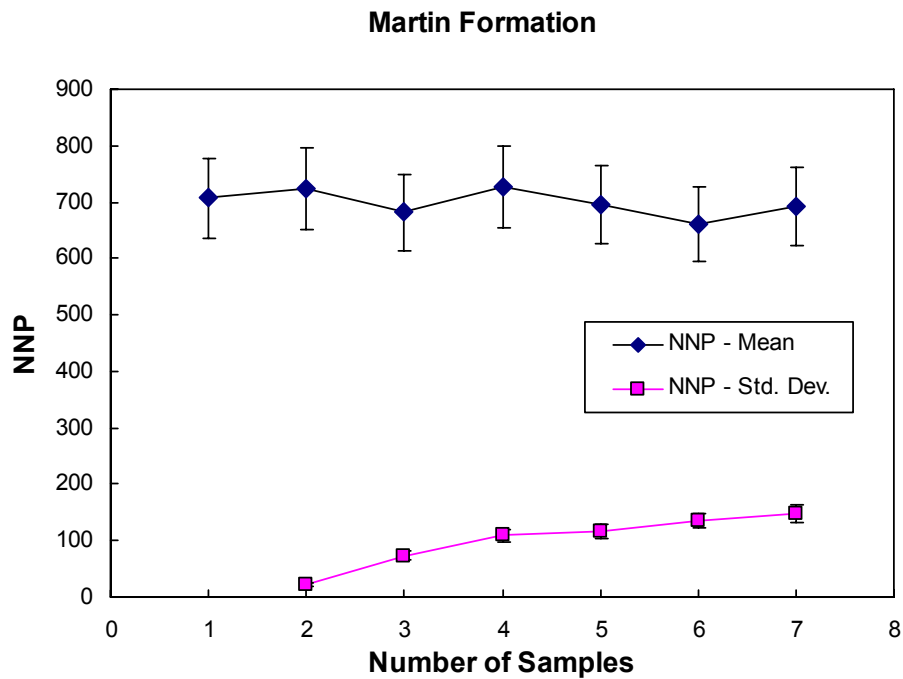
**Illustration B8** Moving Average and Standard Deviation of NNP Values for Rosemont Escabrosa Limestone Samples



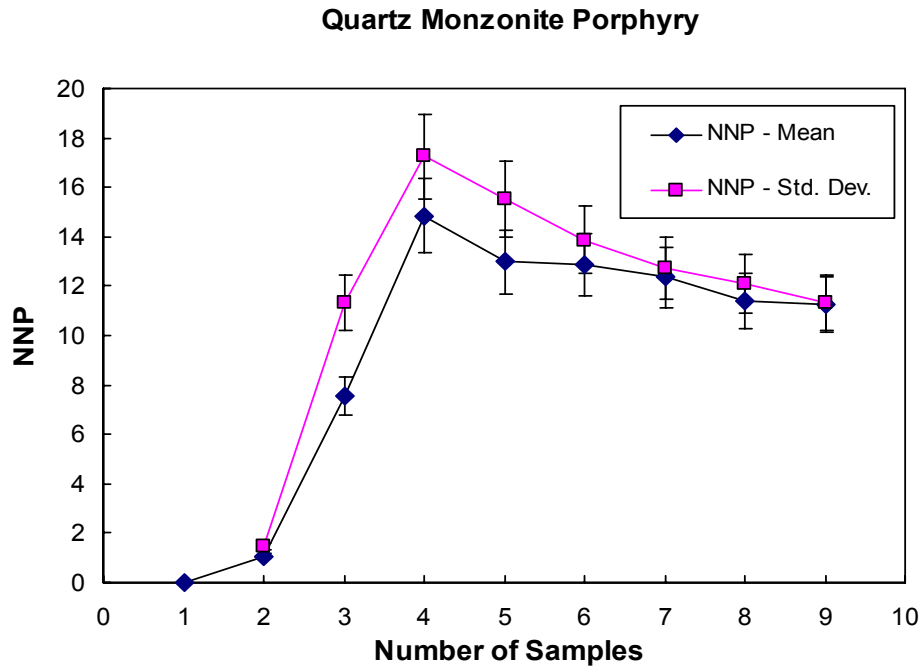
**Illustration B9** Moving Average and Standard Deviation of NNP Values for Rosemont Earp Formation Samples



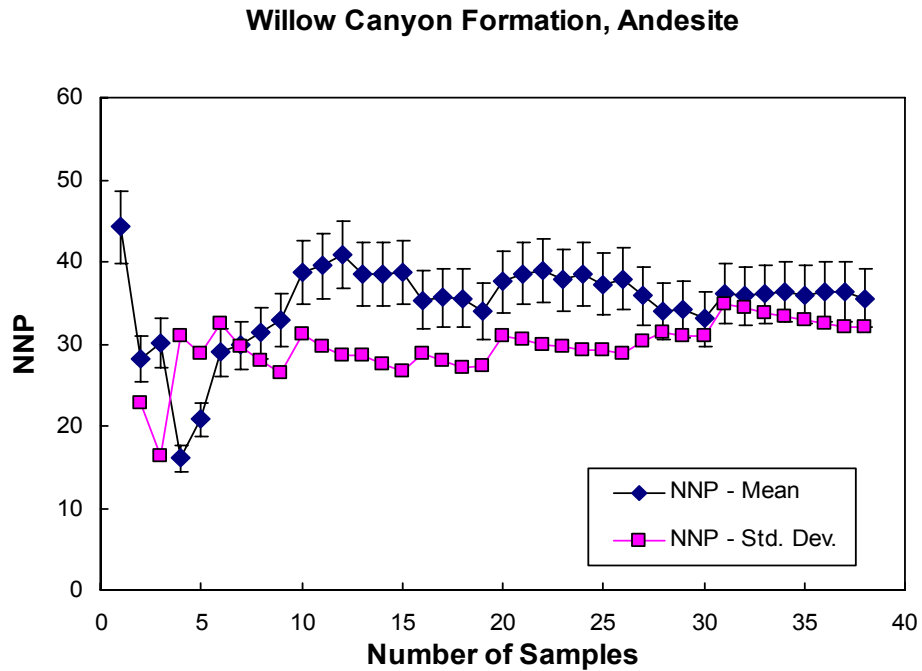
**Illustration B10** Moving Average and Standard Deviation of NNP Values for Rosemont Colina Limestone Samples



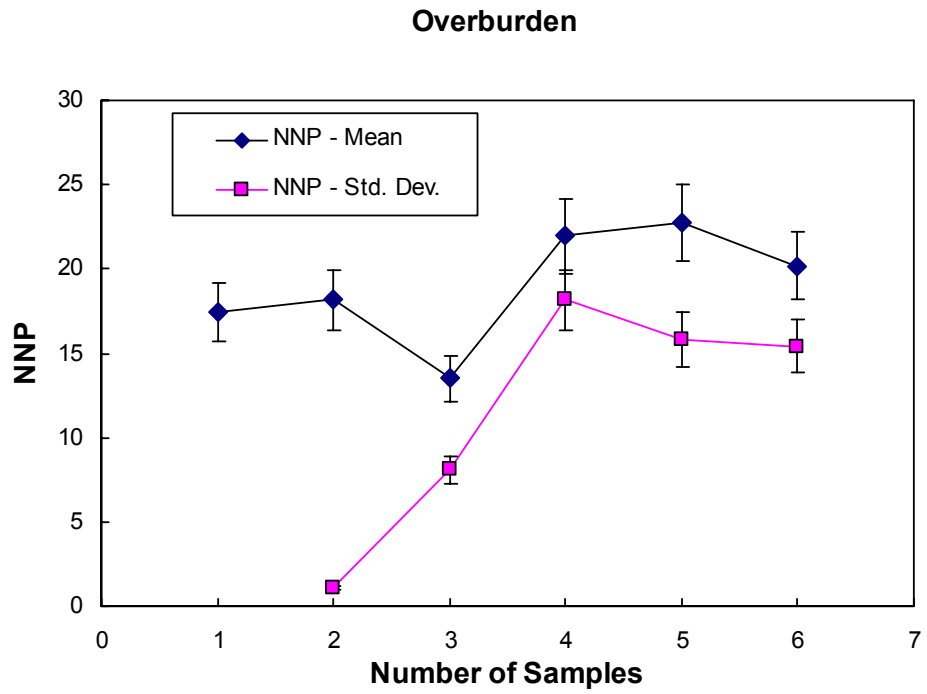
**Illustration B11** Moving Average and Standard Deviation of NNP Values for Rosemont Martin Formation Samples



**Illustration B12** Moving Average and Standard Deviation of NNP Values for Rosemont Quartz Monzonite Porphyry Samples



**Illustration B13** Moving Average and Standard Deviation of NNP Values for Rosemont Willow Canyon Formation Andesite Samples



**Illustration B14**      **Moving Average and Standard Deviation of NNP Values for Rosemont Overburden Samples**