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# Natural Background Geochemistry, Geomorphology, and Pedogenesis of Selected Soil Profiles and Bandelier Tuff Los Alamos, New Mexico

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# CONTENTS


**Abstract** 1

**Introduction** 3

Sampling Sites and Strategy for Soils and Bandelier Tuff 4

Sample Digestion and Analytical Techniques 9

Statistical Analysis of Background-Element Concentrations in Soils 11

**Part I. Characterization of Background Soil** 13

General Soil Parameters 13

Soil Horizons 13

Primary and Secondary Solid Phases and Parent Material 18

Clay-Size Material 21

Soil pH 25

Calcium-Carbonate Content 26

Cation Exchange Capacity 26

Solid Organic Carbon 27

Selected Trace-Elemental Distributions in Soils 27

Trace-Element Chemistry of the Bandelier Tuff 33

Summary of General Soil and Bandelier Tuff Characteristics 37

Recommendations for Soils and Bandelier Tuff 38

**Part II. Geochemistry, Geomorphology, and Pedogenesis of Six Selected Soil Profiles at Los Alamos, New Mexico** 39

**Introduction** 39

**Site 1. Lower Los Alamos Canyon, near Tsankawi** 42

Location and Geomorphic Setting 42

Soil Description 43

Soil Chemistry 44

**Site 2. EG&G Gully, East Road** 48

Location and Geomorphic Setting 48

Soil Description 49

Soil Chemistry 49

**Site 3. Upper Los Alamos Canyon, Los Alamos Reservoir Road** 54

Location and Geomorphic Setting 54

Soil Description 54

Soil Chemistry 55

**Site 4. Twomile Mesa, TA-69** 62

Location and Geomorphic Setting 62

Soil Description 63

Soil Chemistry 63

**Site 5. Water Tanks Trench, West Jemez Road** 73
Location and Geomorphic Setting 73
Soil Description 74
Soil Chemistry 75
**Site 6. Frijoles Mesa, State Route 4, El Cajete Pumice** 83
Location and Geomorphic Setting 83
Soil Description 84
Soil Chemistry 84
**Site 7. Ancho Canyon Mesa (TA-39), State Route 4** 90
Location and Geomorphic Setting 90
Soil Description 90
Soil Chemistry 91
**Site 8. Fracture Fill (TA-46)** 96
**Conclusions** 98
**Acknowledgments** 99
**References** 100
**Appendix A** 105
**Appendix B** 133

# FIGURES


Fig. 1. Location Map of Bandelier Tuff Samples Collected in Frijoles Canyon, Bandelier National Monument, New Mexico 6

Fig. 2. Stratigraphic section showing Bandelier Tuff Samples Collected within Section 1, Bandelier National Monument, New Mexico 7

Fig. 3. Stratigraphic section showing Bandelier Tuff Samples Collected within Section 2, Bandelier National Monument, New Mexico 7

Fig. 4. Map of Los Alamos National Laboratory Showing Soil and Tuff Sample Sites 8

Fig. 5. Element Concentrations in A Horizons, Background Soils, Los Alamos 16

Fig. 6. Element Concentration in B Horizons, Background Soils, Los Alamos 17

Fig. 7. Element Concentrations in C Horizons, Background Soils, Los Alamos 17

Fig. 8. Element Mean Concentrations, Background Soils, Los Alamos 18

Fig. 9. Product Index *vs* Weathering Potential Index for Background Soils, Los Alamos 20

Fig. 10. Background Soil Site *vs* Concentration Ranges of Clay-Size Material with Concentrations of Arsenic and Beryllium, Background Soils, Los Alamos 22

Fig. 11. Clay-Size Material *vs* $Al_2O_3$ Concentration in B Horizons, Background Soils, Los Alamos 23

Fig. 12. $SiO_2$ Concentration *vs* $Al_2O_3$ Concentration in B Horizons, Background Soils, Los Alamos 24

Fig. 13. Clay-Size Material *vs* Fe Concentration in B Horizons, Background Soils, Los Alamos 25

Fig. 14. Clay-Size Material *vs* Cation Exchange Capacity in Background Soils, Los Alamos 27

Fig. 15. Analyte *vs* Comparison of Sample Digestion Using $HNO_3$ or HF (Be, Pb) with Analytical Techniques, Background Soils, Los Alamos 29

Fig. 16. Log Activity Diagram of $Fe^{3+}$ Maintained by Fe (III) Oxides and Soil-Fe 31

Fig. 17. Iron Concentration *vs* As Concentration in Background Soils, Los Alamos 32

Fig. 18. Iron Concentration *vs* Be Concentration in Background Soils, Los Alamos 32

Fig. 19. Concentration of U in Frijoles Canyon Section 1, Bandelier Tuff 35

Fig. 20. Concentration of U in Frijoles Canyon Section 2, Bandelier Tuff 35

Fig. 21. Concentration of Th in Frijoles Canyon Section 1, Bandelier Tuff 35

Fig. 22. Concentration of Th in Frijoles Canyon Section 2, Bandelier Tuff 35

Fig. 23. Concentration of Be in Frijoles Canyon Section 1, Bandelier Tuff 36

Fig. 24. Concentration of Be in Frijoles Canyon Section 2, Bandelier Tuff 36

Fig. 25. Concentration of Cs in Frijoles Canyon Section 1, Bandelier Tuff 36

Fig. 26. Concentration of Cs in Frijoles Canyon Section 2, Bandelier Tuff 36

Fig. 27. Concentration of Ba in Frijoles Canyon Section 1, Bandelier Tuff 37

Fig. 28. Concentration of Ba in Frijoles Canyon Section 2, Bandelier Tuff 37

Fig. 29. Map of Sample Site 1 in Lower Los Alamos Canyon 42

Fig. 30. Cross Section of Radiocarbon Site in Lower Los Alamos Canyon 43

Fig. 31. Iron Concentration *vs* Depth in Background Soil; Site 1, Lower Los Alamos Canyon 46

Fig. 32. Uranium and Th Concentration *vs* Depth in Background Soil; Site 1, Lower Los Alamos Canyon 46

Fig. 33. Beryllium and As Concentration *vs* Depth in Background Soil; Site 1, Lower Los Alamos Canyon 47

Fig. 34. Map of EG&G Gully Sample Site 2 48

Fig. 35. Cross Section of EG&G Gully at Soil Sample Site 2, Showing Stratigraphy of Deposit Within Shallow Mesa-Top Valley and Location of Radiocarbon Dates 49

Fig. 36. Iron Concentration *vs* Depth in Background Soil; Site 2, EG&G Gully 50

Fig. 37. Thorium Concentration and Silt-Size Material *vs* Depth in Background Soil; Site 2, EG&G Gully 51

Fig. 38. Uranium Concentration *vs* Depth in Background Soil; Site 2, EG&G Gully 51

Fig. 39. Uranium and $CaCO_3$ Concentrations and Sand-Size Material *vs* Depth in Background Soil; Site 2, EG&G Gully 52

Fig. 40. Arsenic, Be, and Fe Concentrations and Clay-Size Material *vs Depth* in Background Soil; Site 2, EG&G Gully 53

Fig. 41. Beryllium Concentration *vs* Depth in Background Soil; Site 2, EG&G Gully 53

Fig. 42. Map of Sample Site 3 in Upper Los Alamos Canyon 55

Fig. 43. Cross Section of Upper Los Alamos Canyon at Soil Sample Site 3, Showing Colluvium at Base of Steep Slopes Interfingering with Stream Deposits 56

Fig. 44. Simplified Stratigraphy Exposed in Roadcut at Radiocarbon Sample Site in Upper Los Alamos Canyon 57

Fig. 45. Iron Concentration *vs* Depth in Background Soil; Site 3, Upper Los Alamos Canyon 58

Fig. 46. Thorium Concentration and Silt-Size and Clay-Size Material *vs* Depth in Back-ground Soil; Site 2, Upper Los Alamos Canyon 58

Fig. 47. Solid Organic Carbon and U Concentration *vs* Depth in Background Soil; Site 3, Upper Los Alamos Canyon 59

Fig. 48. Uranium Concentration, Solid Organic Carbon, and Sand-, Silt-, and Clay-Size Particles *vs* Depth in Background Soil; Site 3, Upper Los Alamos Canyon 59

Fig. 49. Arsenic, Be, and Fe Concentrations *vs* Depth in Background Soil; Site 3, Upper Los Alamos Canyon 60

Fig. 50. Beryllium Concentration *vs* Depth in Background Soil; Site 3, Upper Los Alamos Canyon 60

Fig. 51. Arsenic and Fe Concentrations *vs* Depth in Background Soil; Site 3, Upper Los Alamos Canyon 61

Fig. 52. Map Showing Sample Site 4 on Twomile Mesa and Distribution of Mesa-Top Alluvial Gravels 62

Fig. 53. Iron Concentration and Clay-Size Material *vs* Depth in Background Soil; Site 4, Twomile Mesa-North 65

Fig. 54. Iron Concentration, Clay-Size Material, and Solid Organic Carbon *vs* Depth in Background Soil; Site 4, Twomile Mesa-South 65

Fig. 55. Thorium Concentration and Clay-Size Material *vs* Depth in Background Soil; Site 4, Twomile Mesa-North 66

Fig. 56. Thorium Concentration and Clay-Size Material *vs* Depth in Background Soil; Site 4, Twomile Mesa-South 66

Fig. 57. Uranium Concentration, Solid Organic Carbon, and Clay-Size Material *vs* Depth in Background Soil; Site 4, Twomile Mesa-North 67

Fig. 58. Uranium Concentration, Solid Organic Carbon, and Clay-Size Material *vs* Depth in Background Soil; Site 4, Twomile Mesa-South 67

Fig. 59. Uranium Concentration *vs* Solid Organic Carbon in Background Soil; Site 4, Twomile Mesa 68

Fig. 60. Arsenic, Be, and Fe Concentrations *vs* Depth in Background Soil; Site 4, Twomile Mesa-North 69

Fig. 61. Arsenic, Be, and Fe Concentrations *vs* Depth in Background Soil; Site 4, Twomile Mesa-South 69

Fig. 62. Arsenic *vs* Fe in Background Soil; Site 4, Twomile Mesa 70

Fig. 63. Beryllium *vs* Fe in Background Soil; Site 4, Twomile Mesa 70

Fig. 64. Arsenic Concentration *vs* Depth in Background Soil; Site 4, Twomile Mesa-North 72

Fig. 65. Arsenic Concentration *vs* Depth in Background Soil; Site 4, Twomile Mesa-South 72
Fig. 66. Map of Sample Site 5 at Water Tanks Trench 73
Fig. 67. Stratigraphy at East End of Water Tanks Trench 1, Showing Colluvial Layers, El Cajete Pumice, Krotovinas (Animal Burrows), and Location of Radiocarbon Dates 74
Fig. 68. Iron Concentration and Clay-Size Material *vs* Depth in Background Soil; Site 5, Water Tanks Trench 75
Fig. 69. Thorium Concentration and Clay-Size Material *vs* Depth in Background Soil; Site 5, Water Tanks Trench 76
Fig. 70. Uranium Concentration and Solid Organic Carbon *vs* Depth in Background Soil; Site 5, Water Tanks Trench 77
Fig. 71. Arsenic, Be, and Fe Concentrations *vs* Depth in Background Soil; Site 5, Water Tanks Trench 77
Fig. 72. Beryllium Concentration *vs* Depth in Background Soil; Site 5, Water Tanks Trench 78
Fig. 73. Arsenic Concentration and $CaCO_3$ *vs* Depth in Background Soil; Site 5, Water Tanks Trench 79
Fig. 74. Arsenic Concentration *vs* $CaCO_3$ in Background Soil; Site 5, Water Tanks Trench 79
Fig. 75. Oxidized and Reduced Zones *vs* Element or Species in Background Soil; Site 5, Water Tanks Trench 80
Fig. 76. Organic Matter *vs* Element or Species in Background Soil; Site 5, Water Tanks Trench 81
Fig. 77. Carbonate Zone *vs* Element or Species in Background Soil; Site 5, Water Tanks Trench 82
Fig. 78. Map Showing Samples Site 6 on Frijoles Mesa, along State Route 4, and Nearby Borrow Pit 83
Fig. 79. Iron Concentration and Clay-Size Material *vs* Depth in Background Soil; Site 6, Frijoles Mesa 85
Fig. 80. Iron Concentration and Solid Organic Carbon *vs* Depth in Background Soil; Site 6, Frijoles Mesa 85
Fig. 81. Thorium Concentration and Clay-Size Material *vs* Depth in Background Soil; Site 6, Frijoles Mesa 86
Fig. 82. Uranium Concentration and Solid Organic Carbon *vs* Depth in Background Soil; Site 6, Frijoles Mesa 87
Fig. 83. Uranium Concentration and $CaCO_3$ *vs* Depth in Background Soil; Site 6, Frijoles Mesa 87
Fig. 84. Arsenic, Be, and Fe Concentrations in Depth in Background Soil; Site 6, Frijoles Mesa 88
Fig. 85. Beryllium Concentration *vs* Depth in Background Soil; Site 6, Frijoles Mesa 88
Fig. 86. Arsenic Concentration and Solid Organic Carbon *vs* Depth in Background Soil; Site 6, Frijoles Mesa 89
Fig. 87. Map Showing Sample Site 7 on Ancho Canyon Mesa, along State Route 4, and Distribution of El Cajete Pumice 90
Fig. 88. Schematic Sketch of Stratigraphic Relations at Soil Sample Site 7 along State Route 4 Roadcut 91
Fig. 89. Iron Concentration *vs* Depth in Background Soil; Site 7, Ancho Canyon Mesas 92
Fig. 90. Thorium Concentration and Clay-Size Fraction *vs* Depth in Background Soil; Site 7, Ancho Canyon Mesas 92
Fig. 91. Uranium Concentration, Solid Organic Carbon, and $CaCO_3$ *vs* Depth in Background Soil; Site 7, Ancho Canyon Mesas 93
Fig. 92. Arsenic, Be, and Fe Concentrations and Clay-Size Material *vs* Depth in Background Soil; Site 7, Ancho Canyon Mesas 94
Fig. 93. Beryllium Concentration *vs* Depth in Background Soil; Site 7, Ancho Canyon Mesas 94
Fig. 94. Outer (Coarse) Fracture Material and Inner (Fine) Fracture Material *vs* Element or Species in Background Soil; Site 8, Fracture Fill 96

# Natural Background Geochemistry, Geomorphology, and Pedogenesis of Selected Soil Profiles and Bandelier Tuff Los Alamos, New Mexico

by

**Patrick A. Longmire, Steven L. Reneau, Paula M. Watt, Leslie D. McFadden, Jamie N. Gardner, Clarence J. Duffy, and Randall T. Ryti**

## ABSTRACT

During 1992 and 1993, the Bandelier Tuff and several soil profiles were sampled to determine background elemental concentrations for Los Alamos National Laboratory (hereafter referred to as the Laboratory). Soil samples were incompletely digested using $HNO_3$ at pH 1 before chemical analyses, which provided partial element concentrations in solid phases. Soil and Bandelier Tuff samples were also analyzed by instrumental neutron activation analysis and delayed neutron activation analysis to determine total element concentrations. These soil digestion procedures provide a comparison of elements incorporated within the primary minerals (total digestion) with those elements concentrated in surface coatings (partial digestion), including clay minerals, iron oxides, amorphous ferric hydroxide, and ferric oxyhydroxide. Additional analytical methods consisted of inductively coupled plasma spectroscopy, atomic absorption, x-ray fluorescence, and ion chromatography.

Soils present on the Pajarito Plateau are extremely variable in physical and chemical properties such as particle size, percent calcium carbonate, clay mineralogy, iron oxides, and trace-element chemistry. Soils have higher concentrations of aluminum, arsenic, barium, calcium, cerium,

cobalt, chromium, and iron than in the Bandelier Tuff samples. The Bandelier Tuff has higher concentrations of beryllium, lead, sodium, potassium, thorium, and uranium than the soils. Higher concentrations of trace elements are found in well-developed soils than in the weakly developed soils found on the Pajarito Plateau. Clay minerals and iron oxides, which have relatively high surface areas, occur within B horizons and control trace-element distributions in soils. The B horizons contain higher concentrations of trace elements relative to A and C horizons. Variations in soil-element concentrations are also affected by climate, topography, and the parent materials, which include alluvial fans, sheet wash material, colluvium, wind-blown sediment, El Cajete pumice, and the Bandelier Tuff.

Because background-element concentrations in soils forming on the Pajarito Plateau vary with parent material, the degree of soil development, and other factors, site-specific conditions must be considered to select the most appropriate samples. The results of chemical analyses discussed in this report represent the most appropriate (noncontaminated) published chemical data available to establish background-elemental distributions in soils throughout the Laboratory.

Comparisons of site and background data are needed as part of the Resource Conservation and Recovery Act corrective action process developed by the US Environmental Protection Agency. The upper tolerance limit (UTL) is equal to the mean plus the standard deviation multiplied by k-factors (one-sided normal factors), using the $99^{th}$ percentile at 95% confidence. This report contains UTL values for different elements (metals and nonmetals) in soils. In this initial data set, soils horizons are grouped together to make it possible to calculate an UTL value for each element. Values of UTL in soils for naturally occurring radioisotopes of potassium, thorium, and uranium at the Laboratory are also presented in this report. Additional statistical analyses, including calculation of a horizon-specific UTL for each element, will be performed as more background-element data are collected for soils. Site data greater than the UTL-calculated threshold value are considered to exceed the normal maximum background concentration for a particular element. Because of the limited number of Bandelier Tuff and soil samples collected, this initial data set is not necessarily representative of the full suite of soils and tuff present at the Laboratory and may not include the full range of natural concentrations for all elements and species. However, additional Bandelier Tuff and soil samples continue to be collected and will be included in the Laboratory-wide background database.

## INTRODUCTION

To determine the environmental impact of Los Alamos National Laboratory's activities on surface waters, groundwaters, soils, sediments, and Bandelier Tuff requires thorough knowledge of the background-element chemistry for both geological and hydrological media. Background media are defined as soils, sediments, rocks, surface waters, and groundwaters unaffected by Laboratory operations. Background element concentrations in soils and the Bandelier Tuff are presented in this report; element and solute distributions within sediments, surface waters, and groundwaters will be addressed in future studies. Statistical and geochemical comparisons of background samples and contaminated or nonbackground samples are needed to identify and evaluate environmental contamination.

During the spring and summer of 1992 and 1993, the Bandelier Tuff and several soil profiles were characterized and sampled to determine background-element concentrations (Longmire *et al.*, 1993; Watt and McFadden, 1992). During this time, 38 samples of the Bandelier Tuff and 75 soil samples were submitted for chemical analyses. Soil samples were analyzed for both total element and partial element concentrations, using hydrofluoric acid(HF)-neutron activation and nitric acid ($HNO_3$), respectively. However, the Bandelier Tuff samples were only analyzed for total element concentrations. Because of the geochemical variability of soils and Bandelier Tuff as well as the limited number of samples analyzed, this data set is not necessarily representative of the full suite of soils and Bandelier Tuff present at the Laboratory and may not include the full range of natural concentrations for all elements.

Geochemical characteristics of soils on the Pajarito Plateau vary widely and are related to local variations in parent material, topography, soil age, surficial processes, climate, and vegetation. As part of the Laboratory-wide background geochemical characterization, sites were chosen for detailed soil sampling and analysis to provide a partial selection of the wide range of soil-geomorphic settings occurring at the Laboratory. The geomorphic setting of each sample site was carefully described to provide a better understanding of the variations in soil characteristics. With additional background-element data to be collected in the future, it will be possible to relate the geochemical characteristics at a site to the geomorphic setting and accomplish reasonable extrapolation of the soils data.

This investigation is relevant to the Environmental Restoration (ER) Project, because background-element concentrations are used in conjunction with screening action levels (SALs) in risk-assessment calculations for different contaminants. These background-element data are also necessary to develop sampling and remediation strategies for sites, to understand processes controlling contaminant transport, and to distinguish between contaminated and noncontaminated media. These data may also be used to establish cleanup levels for sites that will be remediated in the future.

The goal of the ER Project Laboratory background study described in this report is to provide natural background-element data on soils and Bandelier Tuff

at the Laboratory. This report

(1) summarizes results of soil characterization conducted by Watt and McFadden (1992),

(2) describes analytical and statistical methods used to define and characterize background chemical (analyte) distributions in soils and Bandelier Tuff,

(3) discusses soil development (pedogenesis) and soil chemistry relationships, and

(4) describes how these background data may be statistically compared to nonbackground (potential release site) or contaminant analytical data.

In addition, this report addresses characterization studies outlined in the Laboratory's Hazardous and Solid Waste Amendments (HSWA) permit, Task III (Facility Investigation), Section A (Environmental Setting) 2 (Soils), Items a, b, f, g, i, k, l, m, p, and q.

Sampling sites for this study were selected both within and around the perimeter of the Laboratory to provide the most representative locations of the Laboratory's background environment. Soil samples were collected within trenches, from sides of drainages, and along roadcuts exposed within and around the perimeter of the Laboratory—generally upwind from any potential air-borne contamination—as well as from different depths within various soil horizons. Fresh samples of Bandelier Tuff were collected in Frijoles Canyon immediately south of the Laboratory, an excellent location for Laboratory-specific background samples.

## Sampling Sites and Strategy for Soils and Bandelier Tuff

Soil sampling sites, including mesa tops, canyon bottoms, and colluvial slopes, ranged from Ponderosa pine and fir forests in the wetter, western part of the Laboratory to piñon/juniper woodland in the drier, eastern part (Table 1). The parent materials for the soils included weathered and eroded Bandelier Tuff, alluvium partially derived from Tschicoma dacite in the Sierra de los Valles, wind-blown dust, and El Cajete pumice. Six of the eight sample sites were within the soil mapping area of Nyhan *et al.* (1978), and includes five of their thirteen soil series, although the sample sites were not necessarily typical of soils within each series as described by Nyhan *et al.* (1978).

Whole-rock samples of Bandelier Tuff, collected in Frijoles Canyon within Bandelier National Monument (BNM), represent all stratigraphic units present within the Tshirege Member of the Bandelier Tuff that outcrops in the central and eastern portions of the Laboratory. The background concentrations are probably also representative of tuff found in these units in other parts of the Laboratory. Fresh tuff material collected during this investigation consisted of several kilogram-size samples. Mapping units of the Tshirege Member of the Bandelier Tuff referenced in this report follow the usage of Vaniman and Wohletz (1990) and Goff (1995). Figure 1 shows sampling locations for the Bandelier Tuff within Frijoles Canyon south of the Laboratory boundary in BNM. However, additional, higher stratigraphic units of the Tshirege Member in the western portion of the Laboratory

**Table 1. Summary of Soil Sample Sites**

| Sample Site | Technical Area | Elevation (ft) | Vegetation | Topographic Setting | Surficial Material |
|---|---|---|---|---|---|
| 1. Lower Los Alamos Canyon | TA-72 | 6350 | piñon-juniper | canyon bottom | late Holocene fan (last 2800 years) |
| 2. EG&G Gully | TA-73 | 6950 | piñon-juniper | mesa top valley | Holocene valley fill (last 8700 years) |
| 3. Upper Los Alamos Canyon | TA-62 | 7260 | fir | canyon bottom | late Holocene colluvium (last 3300 yr) |
| 4. Twomile Mesa | TA-69 | 7590 | Ponderosa pine | mesa top | old alluvial deposit (post-1.2 Ma) |
| 5. Water Tanks Trench | TA-16 | 7720 | Ponderosa pine | base of scarp | Holocene colluvium |
| 6. Frijoles Mesa | TA-49 | 6940 | Ponderosa pine | mesa top | El Cajete pumice (~60 ka) |
| 7. Ancho Canyon Mesa | TA-39 | 6570 | piñon-juniper | mesa top | pre-El Cajete soil (pre-60 ka) |
| 8. Fracture Fill | TA-46 | 6980 | piñon-juniper | mesa top | pre-El Cajete soil? |

have not yet been analyzed. Locations for tuff sampling within the Bandelier sections are shown in Figs. 2 and 3. Samples were taken from surface exposures, but material from obvious weathering rinds was excluded. The sampling, to this stage, has been largely limited to the upper (Tshirege) Member of the Bandelier Tuff; only two samples are from the lower (Otowi) Member. Approximately 110 additional samples of the Bandelier Tuff, including the Tshirege and Otowi Members, have been collected by D. Broxton and analytical results of these samples will be provided in a separate report.

Soil samples were collected from eight geographically distinct localities around the perimeter of the Laboratory (shown in Fig. 4). The areas selected for detailed soil characterization are listed below.

Site 1, lower Los Alamos Canyon, north of Tsankawi ruins near State Route 4 (TA-72)

Site 2, EG&G Gully located immediately south of State Route 502 near EG&G (TQA-73)

Site 3, upper Los Alamos Canyon, Los Alamos reservoir road (TA-62)

Site 4, Twomile Mesa within the central portion of TA-69

Site 5, Water Tanks Trench (TA-16), West Jemez Road (State Route 501)

Site 6, Frijoles Mesa (TA-49), State Route 4

Site 7, Ancho Canyon mesas along State Route 4 (TA-39)

Site 8, fracture fill in a fresh roadcut (TA-46).

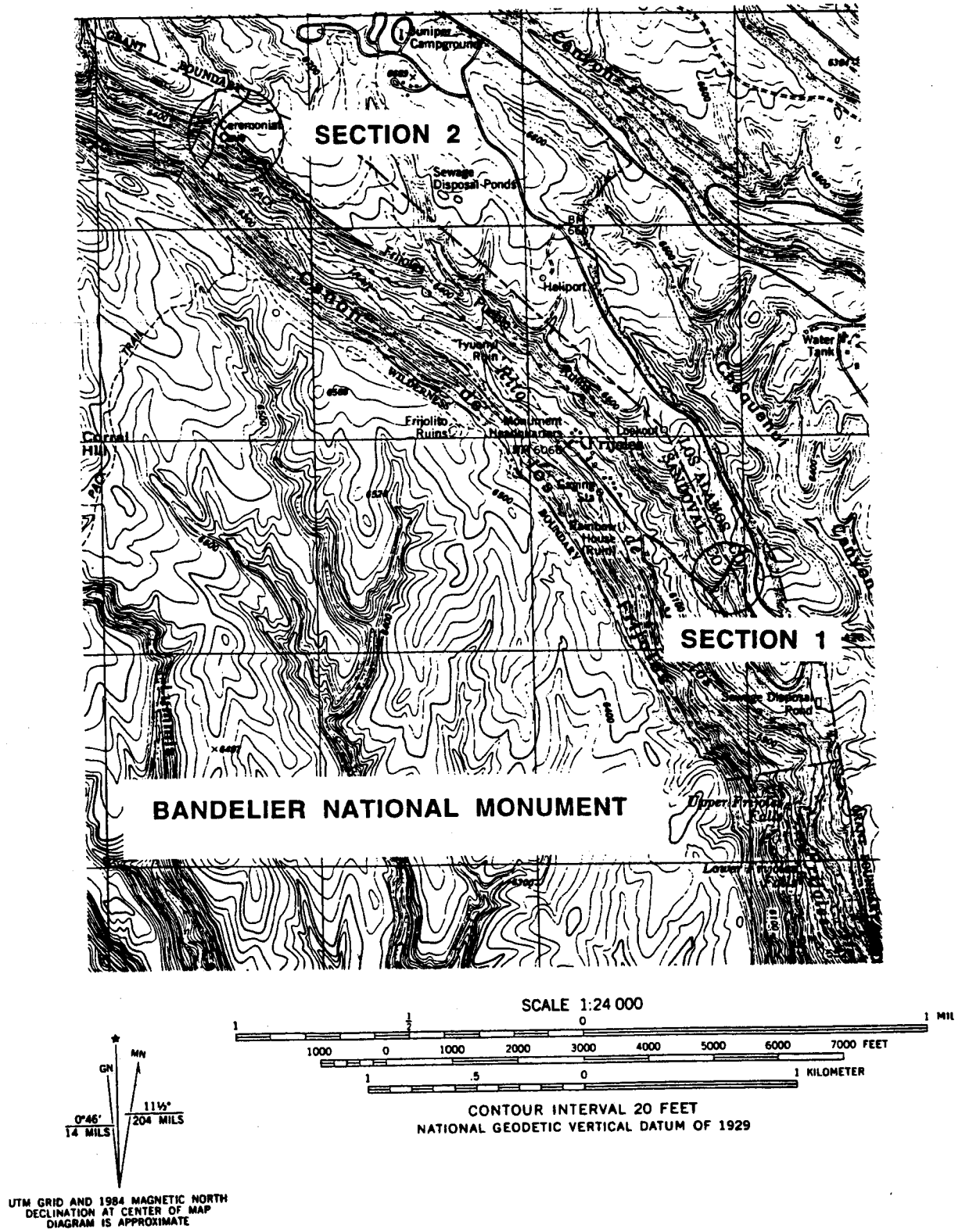



***Fig. 1. Location map of Bandelier Tuff samples collected in Frijoles Canyon, Bandelier National Monument, New Mexico.***

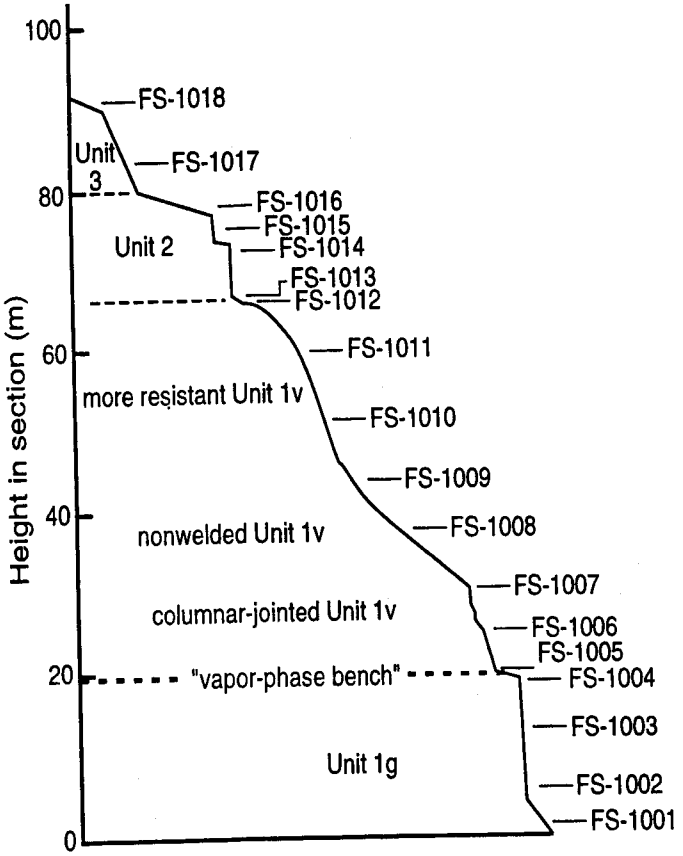



***Fig. 2. Stratigraphic section showing Bandelier Tuff samples collected within Section 1, Bandelier National Monument, New Mexico.***

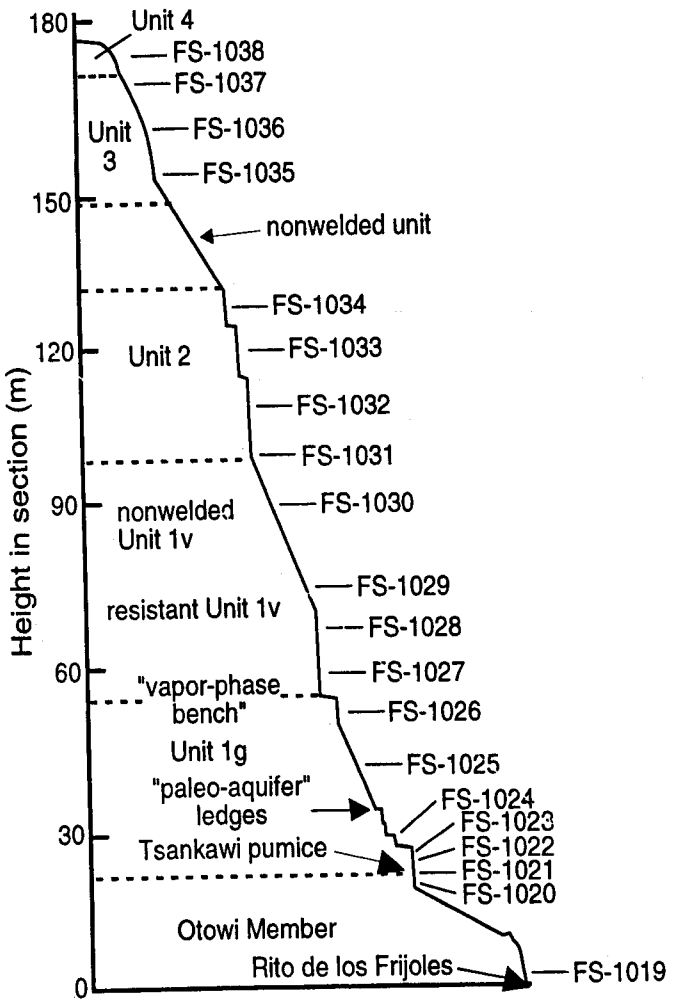



***Fig. 3. Stratigraphic section showing Bandelier Tuff samples collected within Section 2, Bandelier National Monument, New Mexico.***

These localities allowed partial sampling of the varying degrees of soil development occurring on the Pajarito Plateau. At each location, soil samples were collected at various depths (0 to 300 cm) corresponding to the different soil horizons and weathered Bandelier Tuff. These sites were selected to sample soils influenced by a range of parent materials, topographic settings, local climates, and ages.

The limited number of sample sites precluded coverage of all types of soil present at the Laboratory. In addition, because only one soil profile was sampled from each setting, the natural background variability in soils occurring at similar settings has not yet been evaluated. At some soil profiles, several soil samples consisting of oxidation-reduction zones, calcium carbonate lenses, and solid organic carbon associated with

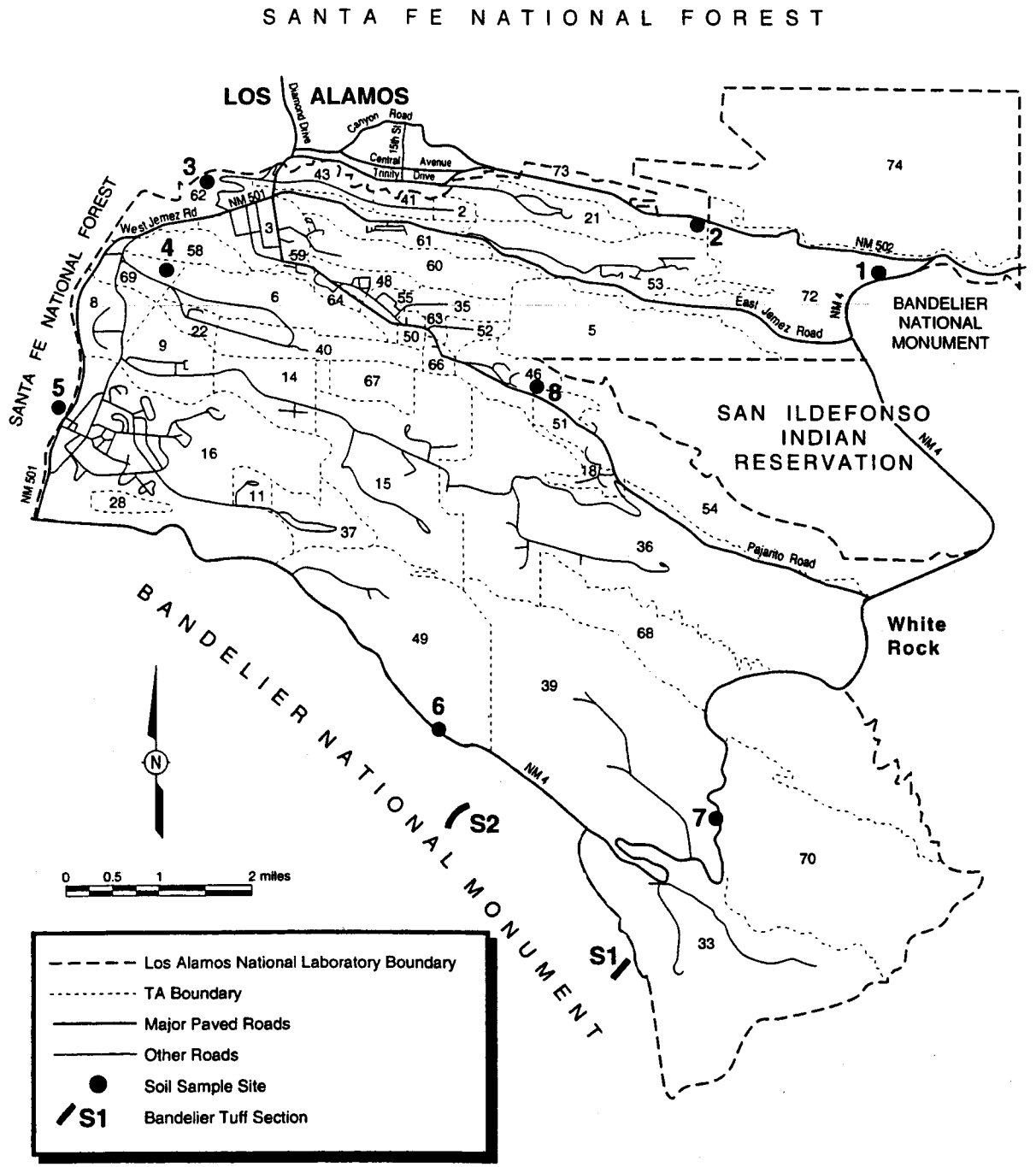



***Fig. 4. Map of Los Alamos National Laboratory showing soil and tuff sample sites.***

root zones were collected within a given horizon. Additional soil characterization studies will be conducted to determine element concentrations and soil parameters within the same soil horizon(s) at specific soil profiles. For these reasons, this data set is not necessarily representative of the full suite of soils present at the Laboratory and may not include the full range of natural concentrations for all elements.

The different soil horizons were classified and characterized according to their texture, consistency (wet/dry), particle-size distribution, color, clay-mineral content, calcium-carbonate content, organic-carbon content, soil pH, cation exchange capacity (CEC), and bulk density (Watt and McFadden, 1992). Field descriptions comply with guidelines and standard procedures for characterizing soils as described in Birkeland (1984) and Methods of Soils Analysis (American Society of Agronomy, 1986).

Soil samples were passed through a 20 mesh sieve to remove pebbles and twigs. Soil samples were either air-dried or dried in a forced-air-circulation oven at 105°C for 24 hours and then were ground with a corundum mortar and pestle. A standard method for preparing samples of Bandelier Tuff for chemical analyses was used. A large sample of Bandelier Tuff was broken into smaller pieces, which were then placed in a mechanical shaker box (either ceramic or tungsten) and pulverized into a powder. Because of their indurated nature, the Bandelier Tuff samples were more thoroughly ground than the soil samples. All equipment was cleaned and sterilized after each sample preparation.

## Sample Digestion and Analytical Techniques

Rock and soil samples were analyzed for a suite of elements using EPA-SW846 methods and other analytical techniques available at the Laboratory. The elements antimony (Sb), arsenic (As), barium (Ba), beryllium (Be), chromium (Cr), lead (Pb), mercury (Hg), silver (Ag), thorium (Th), and uranium (U) are of primary concern to the ER Project because numerous solid waste management units (SWMUs) at the Laboratory potentially contain elevated concentrations of these elements. The SAL for all elements of concern are presented in Table 2. Other elements and compounds of secondary importance to the ER Project include aluminum (Al), bromine (Br), cadmium (Cd), calcium (Ca), cesium (Cs), chlorine (Cl), cobalt (Co), copper (Cu), gallium (Ga), gold (Au),

**Table 2. 1995 Screening Action Levels for Selected Elements in Soil**

| Element | SAL | Element | SAL |
|---|---|---|---|
| Al | 78,000 | Se | 380 |
| Sb | 31 | Ag | 380 |
| Ba | 5,300 | Sr-90 | 4.4 |
| Cd | 38 | Sr | 46,000 |
| Cs-137 | 5.1 | Tl | 6.4 |
| Cr (III) | 80,000 | Th-232 | 0.77 |
| Cr (VI) | 30 | U-depleted | 130 (ppm) |
| Co | 4,600 | U-natural | 29 (ppm) |
| Cu | 2,800 | | |
| Pb | 400 | U-233 | 86 |
| Mn | 390 | U-234 | 13 |
| Hg | 23 | U-235 | 10 |
| Mo | 380 | U-238 | 67 |
| Ni | 1,500 | V | 540 |
| | | Zn | 23,000 |

[a] SALs are reported in milligram/kilogram (mg/kg, ppm), except for isotopes of cesium, strontium, thorium, and uranium, which reported in pCi/g. Data provided by the US Environmental Protection Agency, Region III (October 27, 1995).

hafnium (Hf), indium (In), iodine (I), iron (Fe), magnesium (Mg), manganese (Mn), potassium (K), rare earth elements (REE), rubidium (Rb), scandium (Sc), selenium (Se), sodium (Na), strontium (Sr), sulfate ($SO_4^{2-}$), tantalum (Ta), thallium (Tl), titanium (Ti), tungsten (W), vanadium (V), zinc (Zn), and zirconium (Zr). Radioactive isotopes were not analyzed in this investigation because the Laboratory's Group ESH-18 performs annual sampling of soils and sediments for these constituents in both background (equivalent to fallout activities of radionuclides) and facility areas. Additional sampling of background soils for radionuclides may be conducted in the future.

Following sample preparation, Bandelier Tuff and soil samples were submitted to Group EES-1 for x- ray fluorescence (XRF), to Group CST-15 (formerly INC-5) for instrumental and delayed neutron activation analysis (INAA and DNAA), and to Group CST-9 (formerly EM-9) for EPA-SW846 methods including inductively coupled plasma mass spectrometry (ICPMS), inductively coupled plasma emission spectroscopy (ICPES), electrothermal vapor atomic absorption (ETVAA), cold vapor atomic absorption spectroscopy (CVAA), and ion chromatography (IC) analyses. The x-ray fluorescence, INAA, and DNAA techniques provide total element concentration within a solid sample. Appendix A contains INAA and DNAA results for Bandelier Tuff and soils and Appendix B describes EPA SW846 results for soils. Table 3 provides a listing of each analyte and appropriate analytical techniques. The procedures used for these analyses are described in detail in Gautier and Gladney (1986), Gladney *et al.* (1981), Gladney *et al.* (1980), and Garcia (1990).

**Table 3. EPA-SW846 and LANL Analytical Techniques Used in LANL Background Soil Investigation**

| Element | Technique | Element | Technique |
|---|---|---|---|
| Al | ICPES | Mn | ICPES |
| As | ETVAA | Na | ICPES |
| Ba | ICPES | Ni | ICPES |
| Be | ICPES | Pb | ICPES |
| Ca | ICPES | Sb | ICPES |
| Cd | ICPES | Se | ETVAA |
| Cl | IC | Si | XRF |
| Co | ICPES | $SO_4$ | IC |
| Cr | ICPES | Ta | ICPMS |
| Cu | ICPES | Th | ICPMS |
| Fe | ICPES | Ti | XRF |
| Hg | CVAA | Tl | ICPMS |
| K | ICPES | U | ICPMS |
| Mg | ICPES | V | ICPES |

*ICPES*—inductively coupled plasma emission spectroscopy
*ICPMS*—inductively coupled plasma mass spectrometry
*IC*—ion chromatography
*CVAA*—cold vapor atomic absorption spectroscopy
*ETVAA*—electrothermal vapor atomic absorption spectroscopy
*XRF*—x ray fluorescence

Quality assurance was provided by concurrent analysis of different National Institute of Standards and Technology (NIST), US Environmental Protection Agency (US EPA), and US Geological Survey (USGS) reference materials described by Gladney *et al.* (1981) and Garcia (1990).

Soil samples were analyzed for total element concentrations following complete digestion using INAA and DNAA. Aliquots or splits from the same samples were also digested using concentrated $HNO_3$, HCl, and $H_2O_2$ (EPA Method 3050A) and were analyzed for the same elements using EPA SW846 methods, including ICPES, ICPMS, IC, and ETVAA. The lowest detection limits for specific analytes and species using ICPES, ICPMS, IC, and ETVAA were

0.08 (Be), 0.12 (Ta), 12 (sulfate), and 0.3 (As) ppm, respectively. Precision values for Be, Ta, sulfate, and As were ±10%, ±10%, ±10%, and ±20%, respectively. Precision values for other elements typically were ±10%. Quality-control samples, including duplicates and spiked samples, were analyzed at frequencies specified by the US EPA.

Soil samples submitted for ICPMS, ICPES, ETVAA, CVAA, and IC analyses were either completely digested using HF (Be, Cd, and Pb) or partly digested (extracted) using nitric acid ($HNO_3$). The sample digestion/dissolution step controls the leachability and, ultimately, the concentration of each analyte reported by the analytical laboratory. Many trace and major elements, including Al, Ba, Na, K, U, and Th, are structurally incorporated within primary mineral lattices and amorphous solids (primarily glass). Subsequently, HF digestion of a sample results in higher concentrations for elements than partial digestion using $HNO_3$ would provide. Other trace elements, including As and Be, are mainly concentrated on surfaces of soil particles that consist of clay minerals and ferric oxyhydroxide-ferric hydroxide (termed iron oxides) through adsorption processes. Under these circumstances, HF and $HNO_3$ digestions yield similar analyte concentrations. Therefore, the type of digestion of environmental samples strongly influences analytical results. Consistent and appropriate digestion procedures should be used to allow comparability of data.

Element leaching from soils is evaluated by comparing analytical results from $HNO_3$ digestion to those obtained from HF digestion. Large differences in concentrations of the total element and $HNO_3$-digested samples suggest that minimal redistribution of elements from primary silicates to secondary surface coatings has occurred and most of the element is chemically bound or tied up within the primary silicate minerals. Small differences in element concentrations between $HNO_3$-digested samples and total-element analyses suggest that elements have been largely mobilized and concentrated on surfaces and/or coprecipitated with acid-soluble phases.

### Statistical Analysis of Background-Element Concentrations in Soils

Comparisons between site and background data are needed as part of the Resource Conservation and Recovery Act (RCRA) corrective-action process developed by the EPA. This report contains UTL values for different elements (metals and nonmetals). In this initial data set, soil horizons are grouped together for calculating an UTL value for each element. Additional statistical analyses, including calculation of a horizon-specific UTL for each element, will be performed as more background-element data are collected for soils. The ER Project follows the general guidance provided in *"Statistical Analysis of Ground-Water Monitoring Data"* (EPA, 1989). Details of this approach are presented in the background comparison guidance document for the ER Project (Ryti, 1995). Two types of statistical comparisons to background data are presented in this guidance document. The first method is based on calculation of the UTL for background data. The UTL is equal to the mean plus the standard deviation multiplied by k-factors (one-sided normal tolerance factors), using the 99$^{th}$ percentile at 95% confi-

dence. The UTL is a "hot measurement" test—meaning that site data that are greater than the UTL-calculated threshold value are "in excess" of normal maximum background concentration for a particular element. Values of UTL for naturally occurring metals and nonmetals in soil samples, which encompassed A, B, and C horizons at the Laboratory, are presented in Table 4. These values are also extrapolated for radioisotopes of K, Th, and U by assuming natural abundance of each isotope.

**Table 4. List of Upper Tolerance Limits (UTLs) for LANL Soil Background Data**

| Analyte | SAL (mg/kg) | Mean[a] (mg/kg) | Standard Deviation (mg/kg) | UTL 99%,0.95 (mg/kg) | N | N > DL |
|---|---|---|---|---|---|---|
| Aluminum (LT) | 78,000 | 19000 | 13800 | 123000 | 47 | 47 |
| Antimony | 31 | 2.45 | 0.36 | 2.5 (MAX) | 46 | 2 |
| Arsenic | | 4.4 | 2.5 | 11.6 | 46 | 46 |
| Barium (LT) | 5,300 | 161 | 129 | 1140 | 47 | 47 |
| Beryllium | | 1.15 | 0.75 | 3.31 | 47 | 47 |
| Cadmium | 38 | 0.39 | 0.54 | 2.7 (MAX) | 47 | 5 |
| Calcium (LT) | | 5790 | 12500 | 54400 | 47 | 47 |
| Chromium (Total)[b] | | 11.7 | 7.8 | 34.2 | 47 | 47 |
| Cobalt | 4,600 | 15.2 | 7.6 | 51.1 | 47 | 47 |
| Copper | 2,800 | 5.3 | 3.6 | 15.7 | 47 | 45 |
| Iron | | 14500 | 7320 | 35600 | 47 | 47 |
| Lead | 400 | 15.0 | 8.3 | 39.0 | 47 | 44 |
| Magnesium (LT) | | 2920 | 2150 | 16100 | 47 | 47 |
| Manganese | 390 | 343 | 238 | 1030 | 47 | 47 |
| Mercury | 23 | 0.05 | 0.01 | 0.1 (MAX) | 48 | 4 |
| Molybdenum | 380 | NA | NA | NA | NA | NA |
| Nickel | 1,500 | 9.7 | 5.9 | 26.7 | 47 | 45 |
| Potassium | | 2420 | 1304 | 6180 | 47 | 47 |
| Selenium | 380 | 0.43 | 0.41 | 1.7 (MAX) | 46 | 23 |
| Silver | 380 | NA | NA | NA | NA | NA |
| Sodium | | 577 | 453 | 1880 | 47 | 47 |
| Strontium | 46,000 | NA | NA | NA | NA | NA |
| Thallium | 6.4 | 0.27 | 0.24 | 0.9 (MAX) | 45 | 21 |
| Uranium, natural | 29 | 0.86 | 0.43 | 2.09 | 46 | 46 |
| Vanadium | 540 | 25 | 14 | 66 | 47 | 47 |
| Zinc | 23,000 | 41 | 21 | 101 | 47 | 47 |
| 40-Potassium[c] | | 21.6 | 5.07 | 36.1 | 50 | 50 |
| 232-Thorium[c] | 0.77 | 1.71 | 0.34 | 2.68 | 50 | 50 |
| 234-Uranium[c] | 13 | 1.21 | 0.29 | 2.03 | 50 | 50 |
| 235-Uranium[c] | 10 | 0.052 | 0.012 | 0.088 | 50 | 50 |
| 238-Uranium[c] | 67 | 1.14 | 0.27 | 1.90 | 50 | 50 |

[a]Concentration values <DL (detection limit) were replaced by 1/2 of the DL.
[b]SAL for Chromium-III is 80,000 mg/kg and for Chromium-VI is 30 mg/kg.
[c]Data are converted from elemental concentrations reported in this LANL background report (units are pCi/g).
LT - UTL is based on log transformed data.
NA - data not available for LANL background.
MAX - Maximum value is reported, rather than the UTL.

# PART I.

# CHARACTERIZATION OF BACKGROUND SOILS AND THE BANDELIER TUFF— AN OVERVIEW

## General Soil Parameters

Part I of this report presents an overview of soil characterization studies reported by Watt and McFadden (1992) and Longmire *et al.* (1993). Part II presents detailed discussions on the geochemistry, geomorphology, and pedology of each site. Results of these studies show that Laboratory soils have extreme diversity and variability in both soil properties and chemistry. Each soil profile described by Watt and McFadden (1992), according to procedures provided by Birkeland (1984), has been separated into soil horizons, and each soil horizon has been characterized

- *in the field* by its structure, color, consistency, clay films, and pore and root content; and
- *in the laboratory* for pH, calcium carbonate content, cation exchange capacity (CEC), solid-organic carbon content, particle-size distribution, bulk density, and iron content.

A summary of these soil parameters is presented in this report and more detailed information about these parameters is contained in Watt and McFadden (1992).

## Soil Horizons

Soil consists of layers, or *horizons*, of mineral and/or organic matter in variable thicknesses that parallel the land surface and differ from the parent material in their morphological, physical, chemical, and mineralogical properties as well as their biological characteristics (Joffe, 1949; Birkeland, 1984; Soil Survey Staff, 1975). Soil horizons at the Laboratory generally are unconsolidated and consist of the O, A, B, K, C, and R horizons described below.

*O horizons* are characterized by surface accumulation of organic material (pine needles, leaves, twigs, and other forest litter) overlying a mineral soil (Birkeland, 1984). Several O horizons were described by Watt and McFadden (1992) at Site 4, Twomile Mesa.

*A horizons* are present at all soil profiles except Site 6, Frijoles Mesa, State Route 4 (Watt and McFadden, 1992). An A horizon accumulates humified organic matter mixed with a mineral fraction and occurs at the surface or below an O horizon.

*B horizons* underlie an O or A horizon and show little or no evidence of the original rock structure (Birkeland, 1984). The B horizon contains clay minerals, iron oxides, organic coatings, and other geochemically reactive phases that concentrate major and trace elements. Laboratory soils consist of

(1) weakly developed B horizons (see Table 5, *w* designations) that have minimal changes in physical and chemical properties relative to the parent material,

(2) clay-rich B horizons that have resulted in an increase in clay-size material over time (*t* designation in Table 5), and

(3) B horizons that have been influenced by the accumulation of calcium carbonate (*k* designation in Table 5).

Numerous B horizons were described at different soil profiles investigated during this study (Watt and McFadden, 1992). B horizons can also form as transitional horizons (that is, BA, BC; see Table 5) sharing physical and chemical attributes common to either A or C horizons.

*K horizons* are subsurface horizons so impregnated with alkaline earth carbonate that the morphology is determined by the carbonate (Gile *et al.*, 1966; Birkeland, 1984). Some well-developed soils at the eastern perimeter of the Laboratory contain K horizons at Site 4 and Site 7, Ancho Canyon mesas (Watt and McFadden, 1992).

*C horizons* are subsurface horizons that lack properties of A and B horizons but include chemical weathering such as accumulation of silica and calcium carbonate, mineral oxidation, and gleying (Birkeland, 1984). C horizons are ubiquitous at the Laboratory and are associated with parent materials (Watt and McFadden, 1992).

*R horizons* consist of consolidated bedrock underlying soil horizons (Birkeland, 1984).

Concentration distributions, including minimum, arithmetic mean, and maximum, for several elements within the A, B, and C horizons are shown in Figs. 5, 6, and 7, respectively. Soil samples were digested using $HNO_3$ before chemical analyses that employed EPA-SW846 analytical methods. Concentration units are parts per million (ppm) for most elements shown in these figures except Al and Fe, which are reported as weight percent (wt%). The number of samples collected from each horizon varies; most samples were collected from B horizons (n = 27), which are geochemically important because of their high concentration of iron oxides and clay minerals that control the transport and fate of contaminants at sites. A smaller number of samples was collected from the A and C horizons (n = 12 for each horizon). Most of the elements are log-normally distributed in the soil horizons, however, and the log-normal mean is greater than the arithmetic mean. Ranges in element distribution can exceed a factor of 10 for most of the elements plotted in Figs. 5, 6, and 7. These illustrations can be used to compare the concentration of element ranges with site-specific soil data if it is clear from which soil horizon(s) the

**Table 5. Soil Sample Location and Soil Horizon Collected During Soil Background Investigation**

| Soil Profile | Sample Number FS | Sample Date (year, month, day) | Soil Horizon |
|---|---|---|---|
| Lower Los Alamos Canyon near Tsankawi | | | |
| | 2077 | 92 06 25 | A |
| | 2078 | 92 06 25 | C |
| | 2079 | 92 06 25 | 2Cb |
| EG&G Gully, East Road | 2021 | 92 08 07 | A1 |
| | 2013 | 92 08 07 | Bt |
| | 2011 | 92 08 07 | Bw |
| | 2012 | 92 08 07 | CB |
| | 2010 | 92 08 07 | Bwb |
| | 2022 | 92 08 07 | CBb |
| | 2023 | | C |
| Upper Los Alamos Canyon, Los Alamos Reservoir Road | | | |
| | 2018F | 92 08 01 | A1 |
| | 2017F | 92 08 01 | A2 |
| | 2024 | 92 08 01 | BA, 2020F = duplicate |
| | 2019F | 92 08 01 | Bw |
| | 2016F | 92 08 01 | C |
| | 2000 | 92 08 07 | Ab |
| | 2000F | 92 08 07 | Ab, fine |
| | 2015F | 92 08 01 | Bwb |
| Twomile Mesa North Trench End | | | |
| | 2035 | 92 06 08 | A, 2036 = duplicate |
| | 2027 | 92 06 08 | Bw |
| | 2056 | 92 06 08 | 2Bt1b |
| | 2028 | 92 06 08 | 2Bt2b |
| | 2043 | 92 06 08 | 2Bt3b |
| | 2033 | 92 06 05 | Fracture Fill |
| | 2037 | | E |
| | 2039 | | Crb |
| | 2040 | | BC |
| | 2042 | | A |
| | 2052 | | AE |
| | 2059 | | Cr |
| | 2062 | 92 06 06 | R |
| | 2065 | 92 06 08 | Bt3 |
| | 2067 | | Bt1 |
| Twomile Mesa South Trench End | | | |
| | 2045 | 92 06 10 | A |
| | 2066 | 92 06 10 | Bw |
| | 2068 | 92 06 10 | 2Bt1b, 2069 = duplicate |
| | 2044 | 92 06 10 | 2Bt2b |
| | 2031 | 92 06 10 | CBt |
| | 2026 | 92 06 10 | R |
| | 2038 | | B/R |
| | 2055 | 92 06 10 | Humic layer |
| Ancho Canyon Mesa, TA-39, State Road 4 | | | |
| | 2032 | 92 06 12 | A1 |
| | 2053 | 92 06 12 | A2 |
| | 2061 | 92 06 12 | Bt |
| | 2057 | 92 06 12 | Bwkb, 2058 = duplicate |
| | 2046 | 92 06 12 | Btkb, 2047 = duplicate |
| | 2034 | 92 06 12 | Bwkb |
| | 2060 | 92 06 12 | 2Cr |

**Table 5. (cont)**

| Soil Profile | Sample Number | Sample Date (year, month, day, time) | Soil Horizon |
|---|---|---|---|
| Water Tanks Trench, TA-16, West Jemez Road | | | |
| | 2054 | 92 06 18 | A |
| | 2064 | 92 06 18 | BA |
| | 2051 | 92 06 18 | 2Bt1b |
| | 2049 | 92 06 18 | 2Bt2b, 2041 = duplicate |
| | 2048 | 92 06 18 | 2Bt3b |
| | 2063 | 92 06 18 | 2CB |
| | 2001 | 92 06 24 | Base Colluvium |
| | 2006 | 92 06 24 | $CaCO_3$ Zone 3, 2025 = duplicate |
| | 2007 | 92 06 24 | $CaCO_3$ Zone 2 |
| | 2008 | 92 06 15 | Oxidized Zone |
| | 2009 | 92 06 15 | Reduced Zone |
| | 2030 | 92 06 18 | $CaCO_3$ Zone 1 |
| | 2050 | 92 06 10 | Organic Matter |
| Fracture, TA-46 | | | |
| | 2070 | 92 09 16 | Bandelier Tuff, fresh sample |
| | 2071 | 92 09 16 | Fracture Fill A |
| | 2072 | 92 06 16 | Fracture Fill B |
| | 2073 | 92 06 16 | A |
| | 2074 | 92 06 16 | Bandelier Tuff, fresh sample |
| | 2075 | 92 06 16 | Coarse Fracture Fill (outer) |
| | 2076 | 92 06 16 | Fine Fracture Fill (inner) |
| Frijoles Mesa, TA-49 State Route 4 | | | |
| | 2004 | 92 06 24 | Bw |
| | 2005 | 92 06 24 | Bwk |
| | 2002 | 92 06 24 | 2CB |
| | 2003 | 92 06 24 | R, Bandelier Tuff (weathered) |

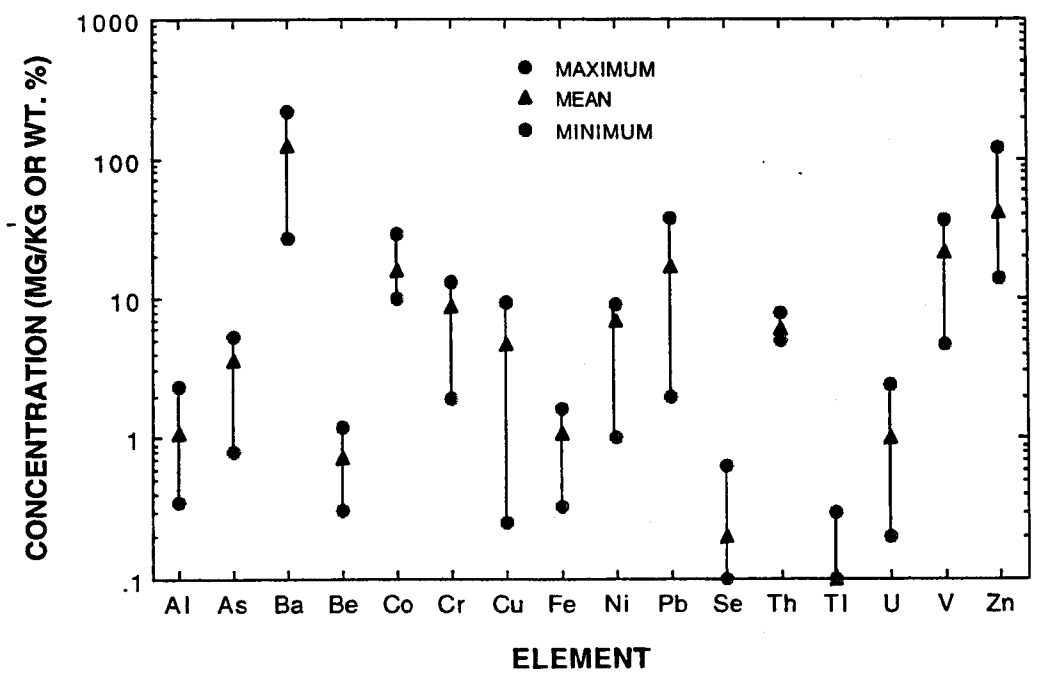



***Fig. 5. Element concentrations in A horizons of background soils, Los Alamos., New Mexico. Concentrations of Al and Fe are in units of wt.%; other elements are in units of mg/kg (ppm).***

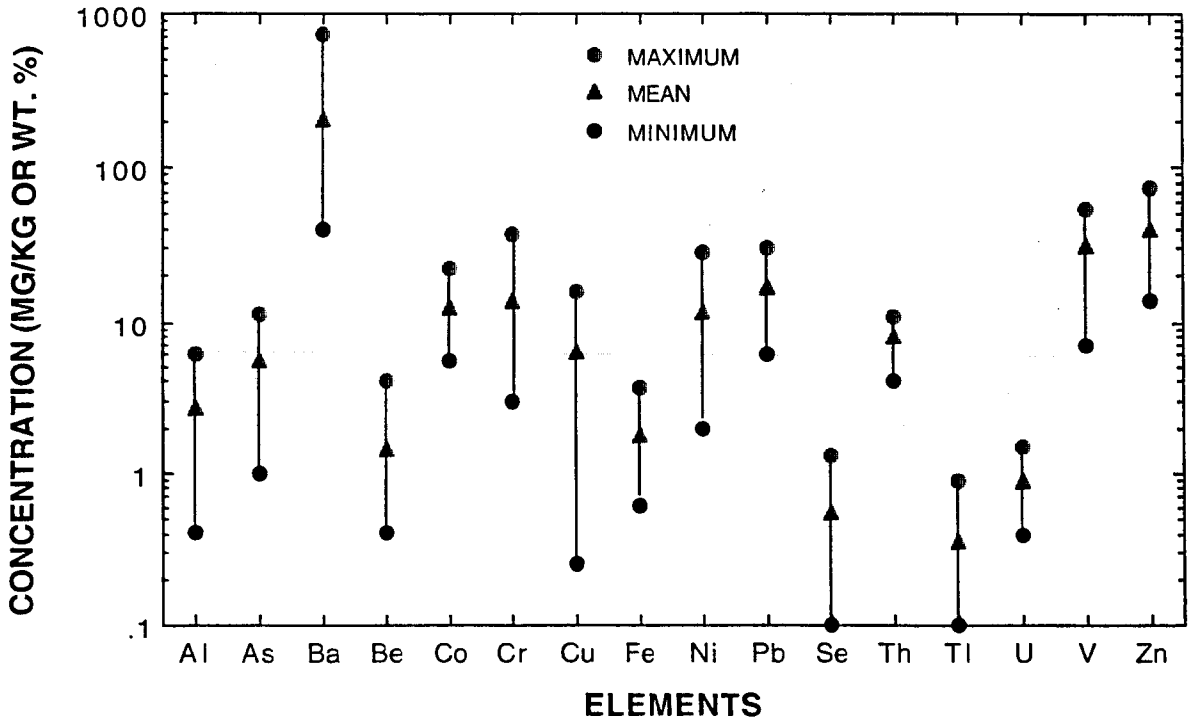



***Fig. 6. Element concentrations in B horizons of background soils, Los Alamos, New Mexico. Concentrations of Al and Fe are in units of wt.%; other elements are in units of mg/kg (ppm).***

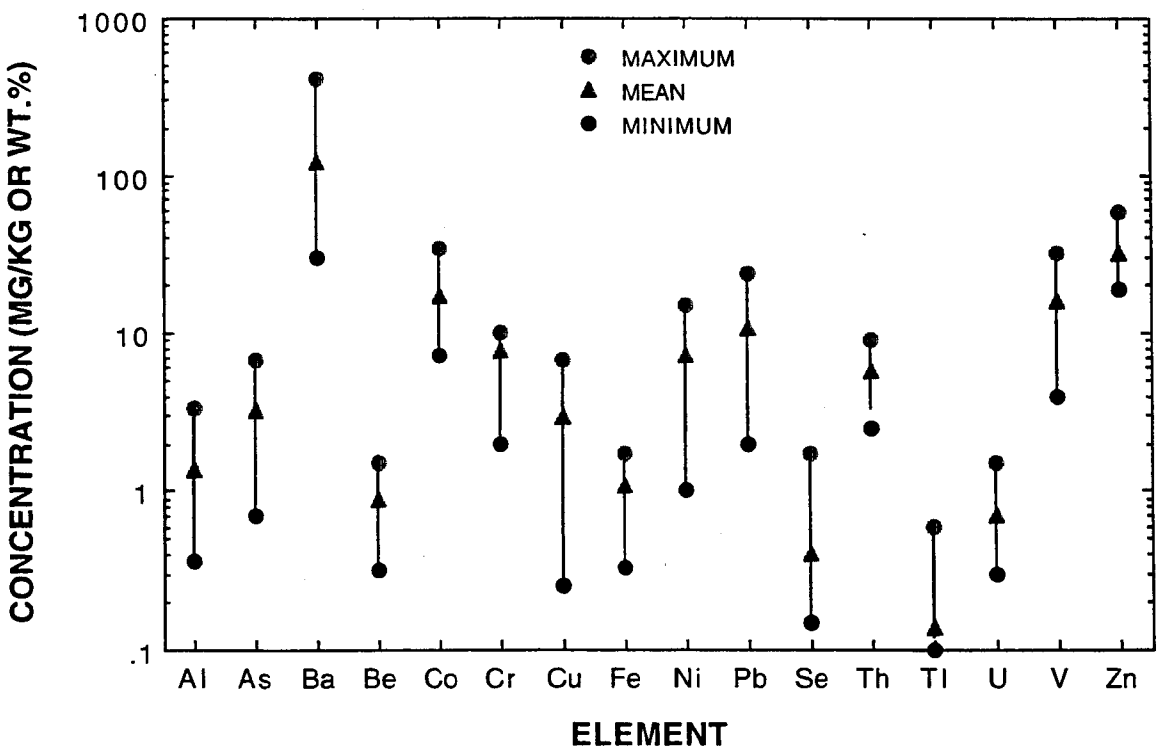



***Fig. 7. Element concentrations in C horizons of background soils, Los Alamos, New Mexico. Concentrations of Al and Fe are in units of wt.%; other elements are in units of mg/kg (ppm).***

samples are collected. Additional statistical analyses will be performed as more background-element data are collected.

Figure 8 shows mean-element concentrations within A, B, and C horizons for Laboratory soils. In general, the B horizon concentrations of most trace elements (Al, As, Ba, Be, Cr, Cu, Fe, Ni, Se, Th, Tl, and V) are higher than those of A and C horizons. This trace-element enrichment within B horizons results from the presence of geochemically-reactive phases (primarily clay minerals and iron oxides) and is discussed in more detail in the following sections of this report. The A horizons sampled during this investigation contain higher concentrations of U and Zn than the B and C horizons, and the C horizon concentrations of Co are higher than those of the A and B horizons.

## Primary and Secondary Solid Phases and Parent Material

Variations in soil-element concentrations are related both to chemical characteristics of a particular soil horizon and to parent material, which includes alluvial fans, sheet-wash material, colluvium, fallout pumice (El Cajete), wind-blown sediment (loess), the Bandelier Tuff, and Tshicoma dacite. Mineralogical data have been collected from most of the Bandelier Tuff, and the following discussion focuses

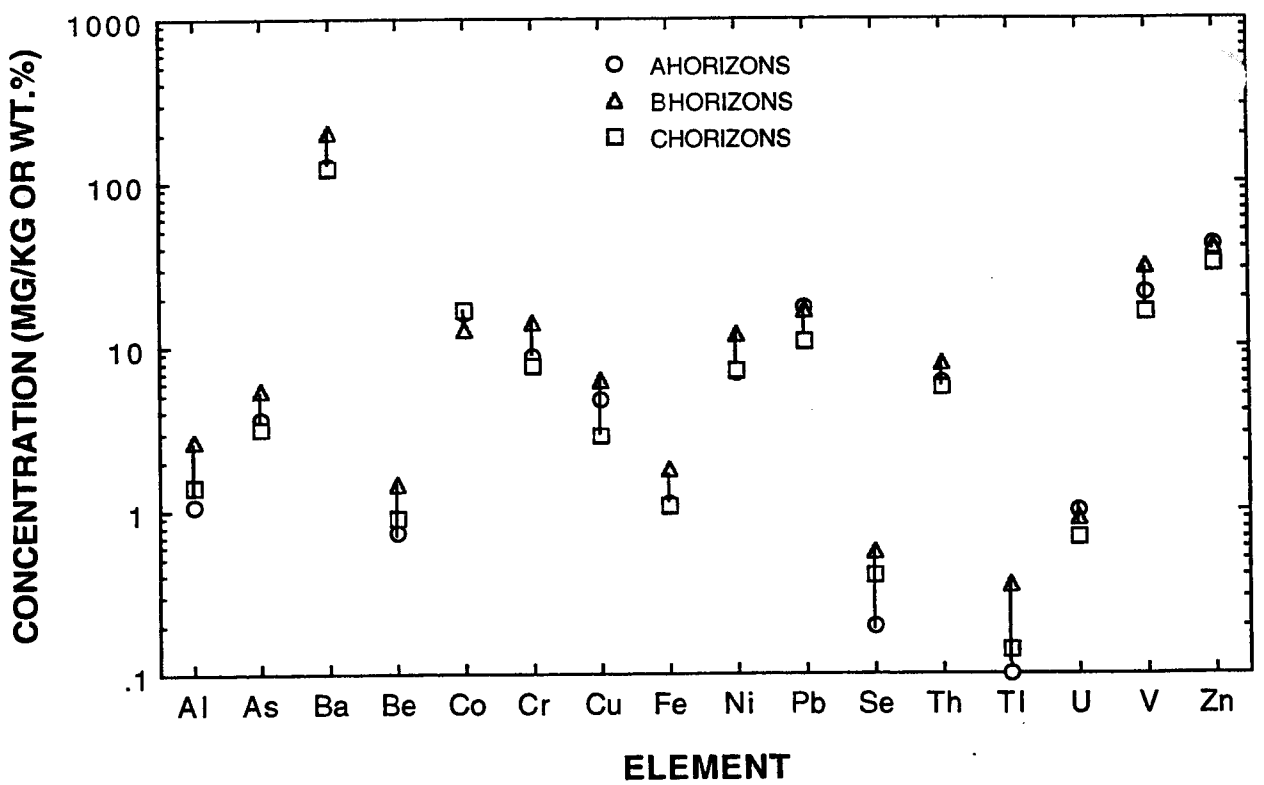



***Fig. 8. Element mean concentrations of background soils, Los Alamos, New Mexico. Concentrations of Al and Fe are in units of wt.%; other elements are in units of mg/kg (ppm).***

on Bandelier Tuff as an initial source of parent material for soils. Primary major minerals, secondary soil minerals, and solid organic matter occur within the soil profiles sampled and characterized during this investigation.

Primary major minerals and solid phases found in the Bandelier Tuff include tridymite, quartz, feldspar, and glass (Broxton *et al.*, 1995). Minor and trace minerals comprise smectite, hornblende, mica, hematite, magnetite, kaolinite, gypsum, allanite, and chevkinite.

Secondary soil minerals include aluminum oxides, iron oxides, smectite, illite, kaolinite, calcite, gypsum, and manganese oxides. Some of the more important secondary soil phases, organic matter, and their associated trace elements include Fe and Al oxides (Be, B, P, V, Mn, Ni, Zn, Mo, As, Se, U); Mn oxides (P, Fe, Co, Ni, Zn, Mo, As, Se, Pb); calcium carbonates (As, Se, P, V, Mn, Fe, Co, Cd, U); illites (B, V, Ni, Co, Cr, Cu, Zn, Mo, As, Se, Pb); smectites (B, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Pb, U); and organic matter (Al, V, Cr, Mn, Fe, Ni, Cu, Zn, Cd, Pb, U) (Sposito, 1989). These trace elements are chemically associated with solid phases through adsorption and coprecipitation reactions.

The origin(s) of soils on the Pajarito Plateau is a complex issue to address because the parent material consists of a variety of the geologic media listed above. The 1.2- to 1.6-Ma Bandelier Tuff (Tshirege and Otowi Members) probably is the main parent material for most of the soils at the Laboratory. The Bandelier Tuff contains varying amounts of glass (0 to 88 wt%) (Broxton *et al.*, 1995), which is the most soluble silicate phase and is of great importance as a parent material. The fine size and glassy nature of the particles, as well as the high porosity and permeability of the Bandelier Tuff and related sedimentary deposits, enhance weathering and physicochemical and biological interactions in soils. Glass is a major constituent of the soils observed at the Laboratory. Rapid weathering of glass releases elements to solution faster than crystalline phases can form. Subsequently, soil solutions become oversaturated with poorly ordered solid phases such as ferrihydrite, allophane, and imogolite. Formation of noncrystalline or poorly developed crystalline iron oxides rather than crystalline forms is initially more favored in soils derived from volcanic ash in wet climates (Shoji *et al.*, 1993; Childs *et al.* 1991). Weathering conditions for glass in the Bandelier Tuff at higher elevations with more precipitation may contribute to the formation of ferrihydrite ($Fe_{10}O_{15}{\cdot}9H_2O$) and amorphous $Fe(OH)_3$ in A horizons, in which high concentrations of silicic acid and iron are released to solution. Such detailed mineralogical characterization of the soils found on the Pajarito Plateau will provide useful information about the stability of these trace minerals.

If there is a pedogenic relationship between the Bandelier Tuff and soils, there should be similarities in major- and trace-element chemistry between the two geologic media. Figure 9 shows the product index *vs* the weathering potential index for two diverse soil profiles (Site 1: Lower Los Alamos Canyon; poorly developed, and Site 7: Ancho Canyon mesas; well developed) and the Bandelier Tuff. The product index and weathering potential index, presented in Birkeland (1984), are

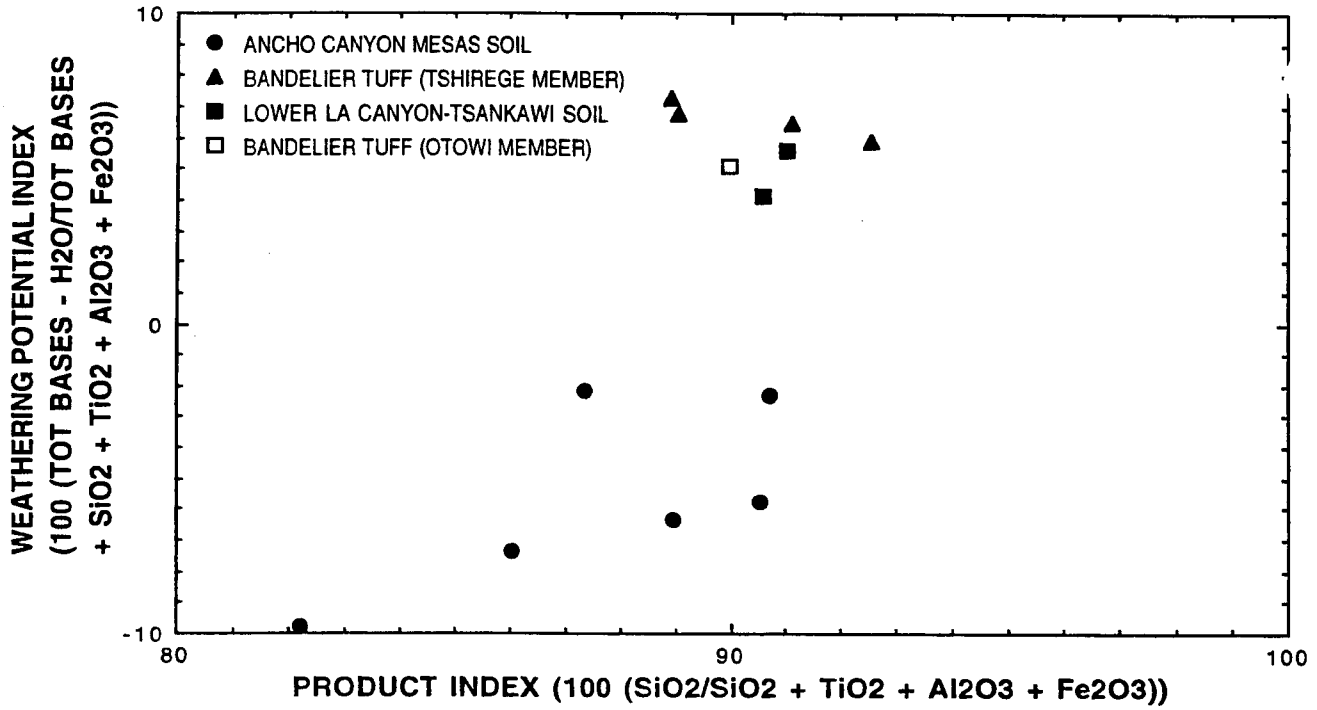



***Fig. 9. Product index vs weathering potential index for background soils, Los Alamos, New Mexico.***

quantitative parameters that decrease as soil development proceeds as a result of increasing clay-mineral and iron-oxide content and silica remobilization. The product index and weathering potential index do not differentiate dust accumulation from chemical and physical weathering, and dust accumulation probably is an important component in soil formation on the Pajarito Plateau.

Titanium concentrations can also increase in soils over time because of the low solubility of resistate minerals, including rutile and anatase, which contribute to decreasing product and weathering potential indices. Alternatively, Ti could be concentrated within the dust; the additional chemical characterization of dust will certainly provide useful data for this investigation. Elements that act as bases in soil solution, including $Ca^{2+}$, $Mg^{2+}$, $Na^{+}$, and $K^{+}$, can either be leached or concentrated in soils, depending on specific dissolution-desorption (leaching) and precipitation-adsorption (concentrating) reactions.

The Bandelier Tuff is characterized by a narrow weathering potential index (5.8 to 7.4) and a moderately narrow product index (88.9 to 92.4). Titanium concentrations are highest in Unit 4 (youngest) and are lowest in Unit 1 (oldest) of the Tshirege Member. Consequently, Unit 1 has the highest product index (92.4) and Unit 4 has the lowest product index (88.9); Unit 3 (89.0) is lower than Unit 2 (91.0). The weathering potential index can be positive when water content is less than the summation of total bases, or it can be negative when the water content is greater than the

summation of total bases. A negative weathering potential index occurs as hydrated minerals, such as clay minerals and gypsum, accumulate in soils. Well-developed soils generally have a lower weathering potential index than poorly developed soils do. Field observations indicate that the poorly developed soil at Site 1 is mainly derived from the Bandelier Tuff (primarily the Otowi Member) and possibly from preexisting soils; accordingly, this site plots close to the Otowi Member and Unit 2 of the Tshirege Member (Fig. 9). Soils at Site 7 are well developed and consequently, their product and weather potential indices are lower than those of the Bandelier Tuff and Site 1 soils. From field observations and the relatively low product index and weathering potential index values shown in Fig. 9, it appears that soils at Site 7 are not directly derived from the Bandelier Tuff and probably have multiple sources of parent material. Soils at the other sites are expected to plot between these two end-member soils as shown in Fig. 9. Further work will be required to reveal the sources of parent material for soils forming on the Pajarito Plateau.

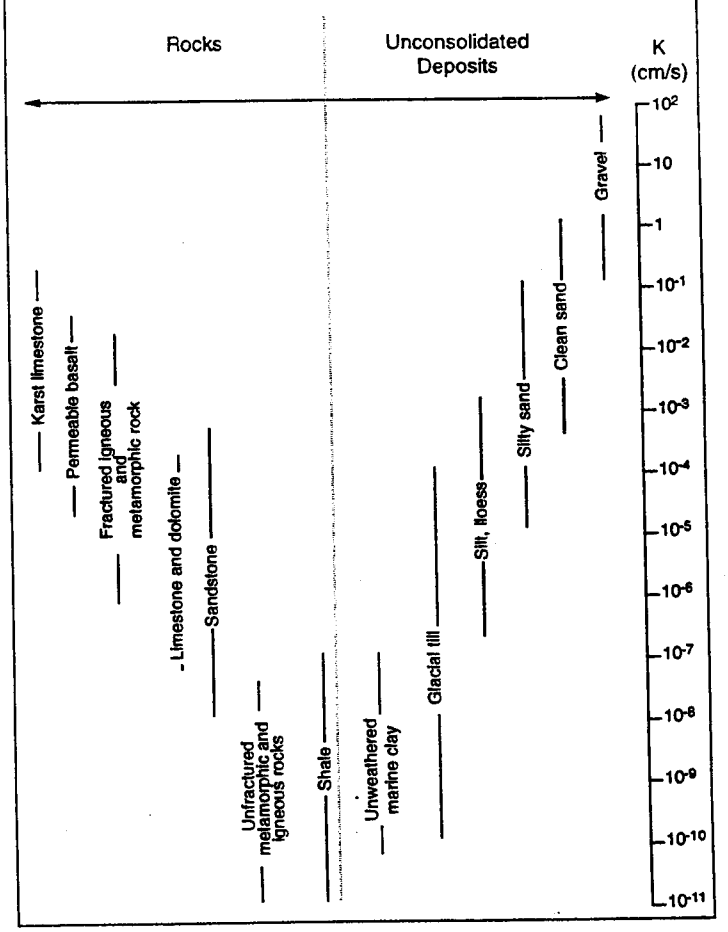
## Clay-Size Material

The occurrence of clay-rich horizons is particularly relevant to the transport and fate of numerous inorganic and organic contaminants found at the Laboratory. Variation in clay-mineral content is significant within the soils and, consequently, the extent of contaminant mobility varies with the presence of geochemically reactive phases, including clay minerals, iron oxides, solid organic matter, and carbonate minerals.

Clay-rich horizons typically alter the local hydrologic environment by providing low permeability and low hydraulic conductivity zones, increasing the water-holding capacity of the horizon and contributing to an overall increase in the degree of chemical weathering (Sposito, 1989; McBride, 1994).

Table 6 shows ranges of hydraulic conductivities for different rocks and unconsolidated deposits; these ranges may also apply to unconsolidated deposits found on the Pajarito Plateau.

**Table 6. Range of Values of Hydraulic Conductivity (Modified from Freeze and Cherry, 1979)**



Soils found on the Pajarito Plateau display textures that vary from clay- and silt-size material to gravel. Hydraulic conductivities of soils found on the Pajarito Plateau thus probably range from $10^{-6}$ to 10 cm/s (see Table 6), although few data are available at the Laboratory.

Clay-size material (<2 µm) in all the soil samples ranges from 2.4 wt% at Site 1 (lower Los Alamos Canyon near State Route 4) within a C horizon to 63 wt% at Site 4 (Twomile Mesa, TA-69) within a B horizon (Watt and McFadden, 1992). This size fraction, however, is heterogeneous in mineralogy and does not consist entirely of clay minerals, as discussed below. In clay-size fractions, characteristically, the smallest particle diameters have relatively large surface areas—an important factor in controlling the extent of adsorption of trace elements. Figure 10 illustrates this point by comparing the concentration ranges of As and Be to abundances of clay-size material at Sites 1 and 7 on a mesa at TA-39 (Ancho Canyon mesas). The As and Be are found in higher concentrations at Site 7, where the soil is characterized by higher abundances of clay-size material concentrated within B horizons. The TA-39 soil is more developed than that of the lower Los Alamos Canyon soil; thus, higher concentrations of trace elements can be expected in the more strongly developed soils at the Laboratory.

Heterogeneity in the clay-size material can reflect variations in parent material, age, topography, eolian input, and degree of chemical weathering (Birkeland, 1984; Sposito, 1989; and McBride, 1994).

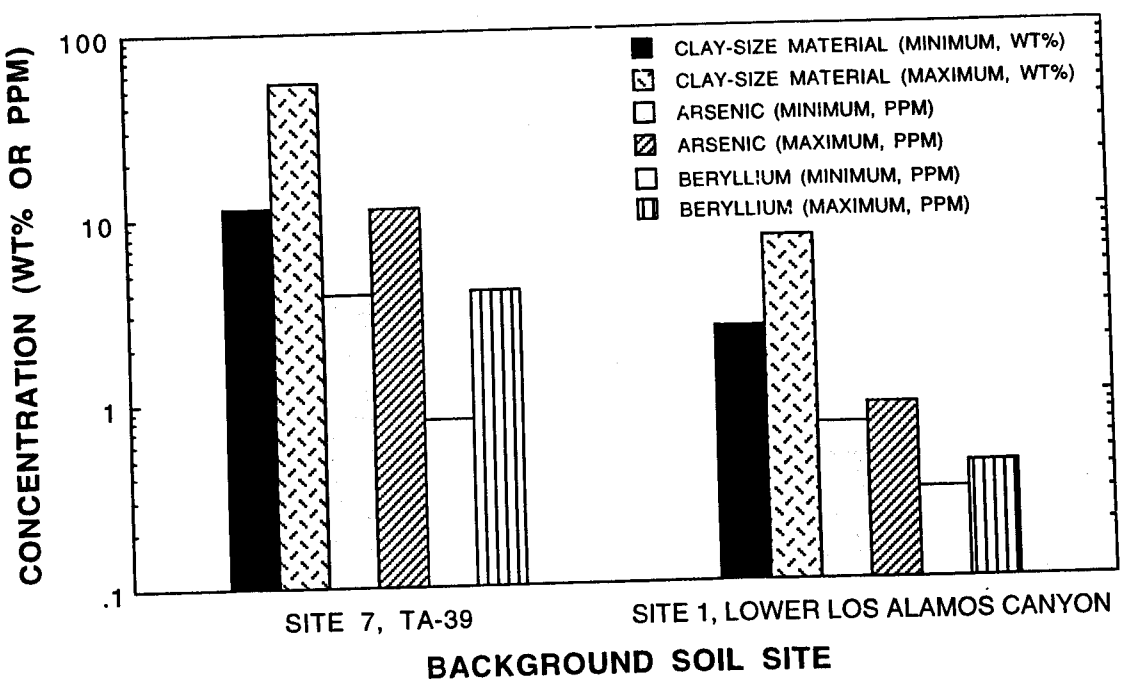



***Fig. 10. Background soil site vs concentration ranges of clay-size material (wt%) with concentrations of arsenic and beryllium (ppm), background soils, Los Alamos, New Mexico.***

An increase in clay content may reflect the presence of dust, pedogenic clays or may be related to original composition of the parent material.

Figure 11, a bivariate plot of clay-size material *vs* total $Al_2O_3$ content for all of the B horizons sampled during this study, shows a positive correlation ($r^2 = 0.65$) between these two variables. Most of the B horizons have less than 60 wt% clay-size material (Watt and McFadden, 1992), which suggests that the $Al_2O_3$ content of the soils reflect the $Al_2O_3$ content of the different parent materials, including colluvium, dust, sheet wash material, and the Bandelier Tuff. Trace to minor amounts of clay minerals mixed with the dominant framework silicate minerals (feldspars) and glass contribute to the $Al_2O_3$ content of the soils. Clay minerals within the clay-size fraction include illite, kaolinite, and mixed-layer smectite; results are from x-ray diffraction analyses (XRD) (Davenport, 1993, and personal communication, P. Eberly, Department of Earth and Planetary Sciences, University of New Mexico, September 15, 1993 ). Typical $Al_2O_3$ concentrations (in wt%) found in different clay minerals, including the mean and range, are 21.93 (15.20 to 34.00) for smectites/montmorillonites-beidellites; 26.35 (21.40 to 34.64) for illites; 24.79 (18.1 to 34.50) for mixed layer illite/montmorillonites; and 37.05 (29.96 to 40.22) for kaolinites (Weaver and Pollard, 1973). Structurally disordered aluminosilicates such as allophane and imogolite probably are also present in the clay-size fraction.

Figure 12 is a bivariate plot of $SiO_2$ *vs* $Al_2O_3$ for B-horizon soil samples and shows an inverse relationship between these two oxides. Clay minerals have lower $SiO_2$ concentrations than feldspars; however, they generally have higher

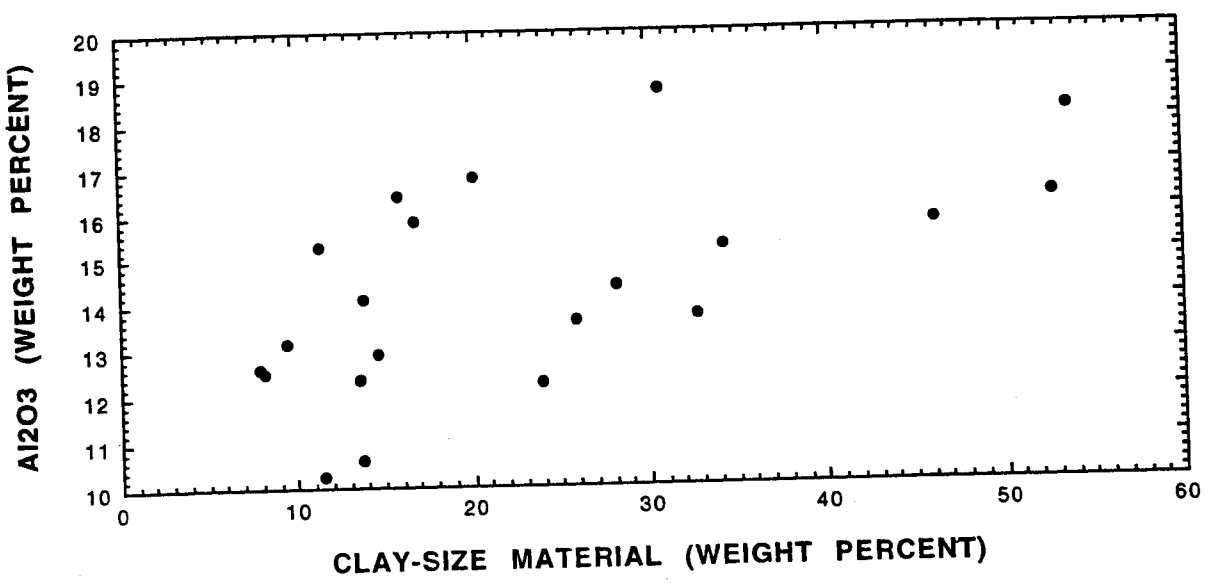



*Fig. 11. Clay-size material* vs *$Al_2O_3$ concentration in B horizons, background soils, Los Alamos, New Mexico.*

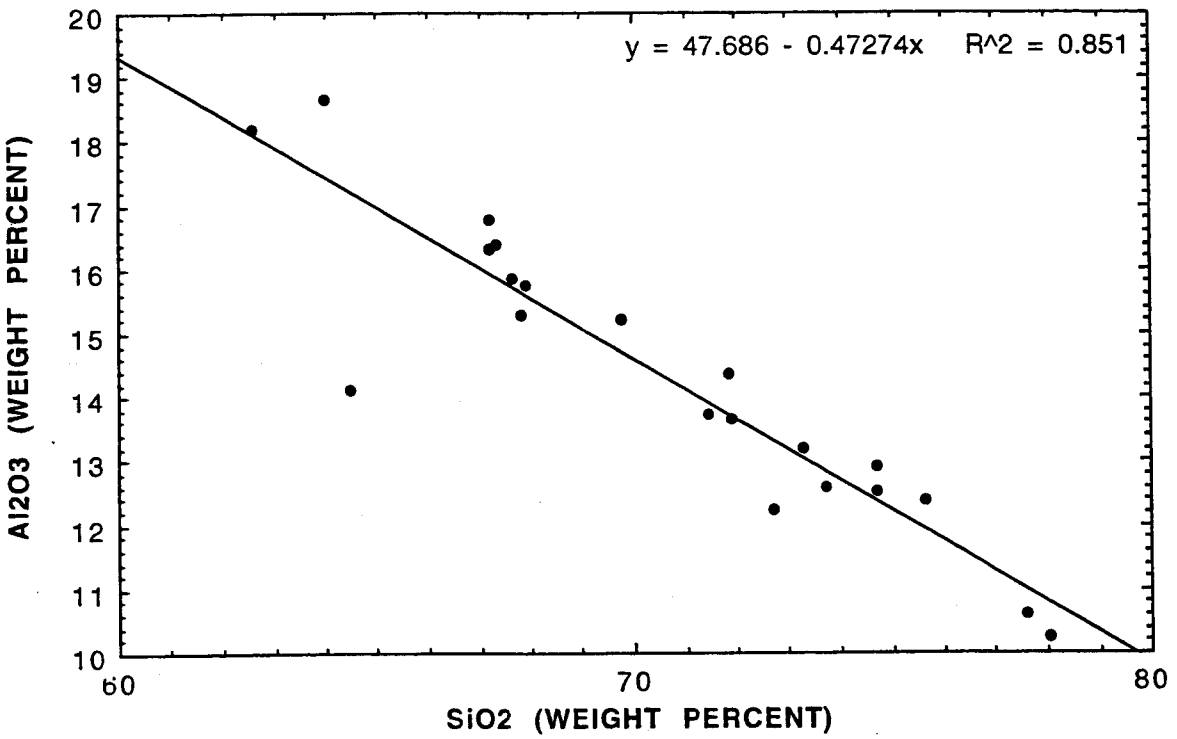



***Fig. 12.*** ***$SiO_2$ Concentration vs $Al_2O_3$ concentration in B horizons of background soils, Los Alamos, New Mexico.***

concentrations of $Al_2O_3$ than feldspars (Sposito, 1989; McBride, 1994). The enrichment of $Al_2O_3$ and depletion of silica in clay minerals result from hydrolysis reactions involving glass and framework silicates. Chemical weathering of glass, represented by $Al_2O_3$-$SiO_2$, to form allophane ($Si_3Al_4O_{12}{\cdot}nH_2O$) and imogolite ($Al_2SiO_3(OH)_4$) are shown in the following reactions:

$$2(Al_2O_3\text{-}SiO_2) + H_4SiO_4{}^0 = Si_3Al_4O_{12}{\cdot}2H_2O \qquad (1)$$

and

$$2(Al_2O_3\text{-}SiO_2) + 2H_2O = Al_2SiO_3(OH)_4 \ . \qquad (2)$$

Feldspars may weather to smectite through hydrolysis:

$$4KAlSi_3O_8 + 0.5Ca^{2+} + 2H^+ + 10H_2O = K[Si_{7.5}Al_{0.5}]Al_{3.5}Ca_{0.5}O_{20}(OH)_4 + 4.5Si(OH)_4{}^0 + 3K^+ \ . \qquad (3)$$

Equation (3) illustrates that the weathering of primary silicates is characterized by loss of tetrahedrally coordinated Al, consumption of protons, and release of silica, $Ca^{2+}$, and $K^+$. Gibbsite and kaolinite are the final weathering minerals formed from feldspars.
In addition to hydrolysis reactions, translocation of material from overlying horizons may also concentrate clay minerals in B horizons.

Figure 13 is a bivariate plot of clay-size material *vs* Fe content for all of the B horizons sampled during the study. The correlation ($r^2 = 0.72$) between these two variables is good—suggesting that iron oxides probably occur as coatings and intergrowths with clay minerals—which is consistent with mineralogical results reported by Sposito (1989) and McBride (1994). The dominant Fe-bearing phases occurring in the Pajarito Plateau soils probably include amorphous $Fe(OH)_3$, goethite ($\alpha$-FeOOH), and hematite ($\alpha$-$Fe_2O_3$); however, the exact mineralogy has not been determined from XRD analyses. These phases have been reported in numerous soils characterized worldwide (Sposito, 1989; Dixon and Weed, 1990).

## Soil pH

Laboratory-determined soil pH values range from 5.2 (for a sample obtained from an O horizon at Site 4, Twomile Mesa at TA-69) to 8.2 (for a sample collected from a carbonate-rich zone at Site 5, Water Tanks Trench, TA-16 (Watt and McFadden, 1992). Solid organic carbon, possibly present as humic and fulvic acids, is concentrated in O and A horizons containing carboxylic acids that deprotonate under moderately acidic (4.5) conditions. Other organic acids with pka ($-\log_{10} K_{acid}$)values ranging from 3 to 7 may also control soil pH within the O and A horizons. This deprotonation results in acidic pH conditions within O and A horizons. In addition, enhanced biological activity

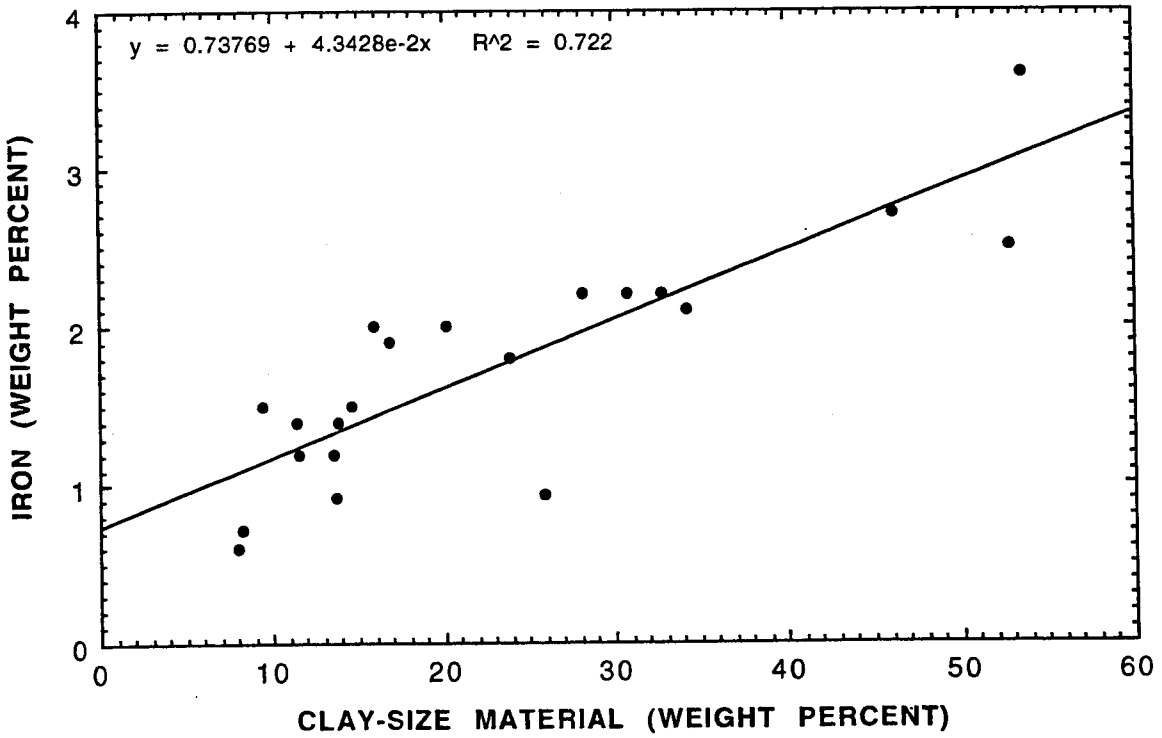



***Fig. 13. Clay-size material vs Fe concentration in B horizons, background soils, Los Alamos., New Mexico.***

in O horizons produces a high partial pressure of $CO_2$ gas, which reacts with soil-pore water and thereby decreases soil pH. Poorly developed soils at Laboratory sites tend to have lower pH values (5.4 to 6.5) in the absence of carbonate horizons; well-developed soils have higher pH values (7.0 to 8.2), which are primarily attributed to the presence of calcium carbonate (K) horizons. The B horizons at the Laboratory tend to show variability in pH values (5.4 to 7.9) but also tend to be dominantly characterized by alkaline pH values. Soil pH in pore waters of the B, C, and K horizons is dominantly controlled by calcium carbonate and partial pressure of $CO_2$ gas (Sposito, 1989; Drever, 1988). Soil pH is an important parameter that controls precipitation/dissolution and adsorption/desorption reactions. Anion exchange and adsorption usually occurs under lower pH conditions than those of cation exchange and adsorption. Contaminants found in aqueous solutions at the Laboratory probably occur both as anions ($UO_2(CO_3)_2^{2-}$, $H_2AsO_4^-$, $HAsO_4^{2-}$, $Cl^-$) and as cations ($Ba^{2+}$, $BeOH^+$, $^3H^+$ as HTO), based on speciation calculations using thermochemical data tabulated in Grenthe *et al.* (1992) and Rai and Zachara (1984).

### Calcium Carbonate Content

Calcium carbonate content of the soils is highly variable, ranging from 0.1 wt% in a CBt horizon at Site 4, Twomile Mesa, to 100 wt% in a K horizon at Site 7, Ancho Canyon mesas (Watt and McFadden, 1992). Most of the calcium carbonate found in soils on the Pajarito Plateau probably originates from wind-blown or atmospheric sources (Watt and McFadden, 1992). Carbonate chemistry is important in controlling soil pH, providing active adsorption sites for anionic and cationic adsorbates, providing ligands for metal complexing—especially for uranyl [U(VI)], enhancing the stability of smectite characterized by a high cation exchange capacity (CEC), and controlling hydraulic conductivity. Carbonate-rich horizons likely reflect climatic conditions that favor relatively high amounts of atmospheric dust that is available for deposition. Calcium carbonate is an important adsorbent for cations ($Cd^{2+}$, $Zn^{2+}$, $Mn^{2+}$, $Co^{2+}$, $Ni^{2+}$, $Ba^{2+}$) and anions ($PO_4^{3-}$, $SeO_3^{2-}$, and possibly $UO_2(CO_3)_2^{2-}$), where solution pH and calcium carbonate concentration are the most important factors controlling adsorption processes (Zachara *et al.*, 1993). Calcium carbonate content is discussed in more detail in specific soil profile sections below.

### Cation Exchange Capacity

The CEC varies from 3 to 28.5 meq/100 g of soil, which is reflective of the different types of clay minerals present in the soils. Figure 14 is a bivariate plot of measured CEC values *vs* clay-size material, showing that CEC generally increases with increasing clay content. Because the B horizons have the highest clay mineral content, they also have the highest CEC. Higher CEC values are associated with 2:1 (octahedral:tetrahedral layers) clay minerals, such as smectite or mixed-layer smectite, whereas the lower CEC values are representative of 1:1 clay minerals, including kaolinite (Sposito, 1989; McBride, 1994). Clay minerals with higher CEC values are geochemically more reactive (as a result of larger surface area) than those with lower CEC values. Clay minerals and other adsorbents with larger surface areas have higher adsorption capacities than clay minerals with smaller surface areas (Sposito, 1989; McBride, 1994).

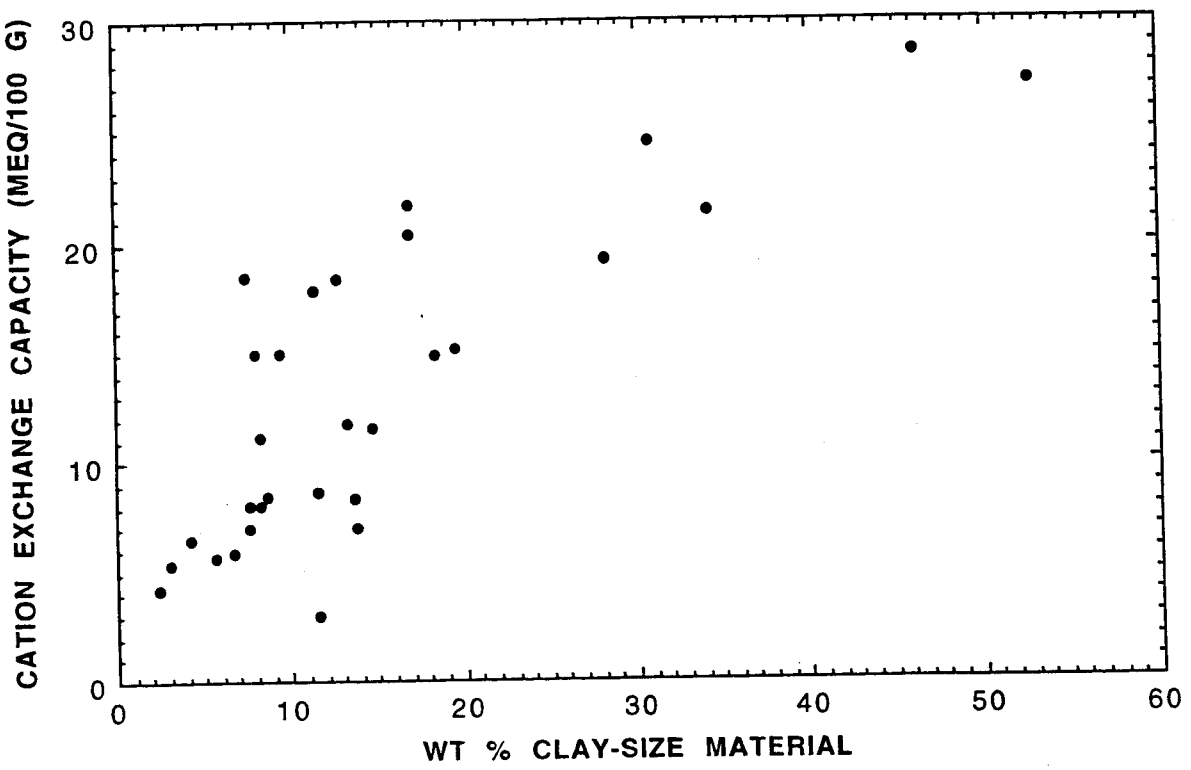



***Fig. 14. Clay-size material vs cation exchange capacity in background soils, Los Alamos, New Mexico.***

## Solid Organic Carbon

Solid organic carbon (SOC) content ranges from 0.1 to 2.8 wt% for soil samples characterized during this investigation. The SOC content typically is highest in the O horizons, especially at Site 3, upper Los Alamos Canyon. In general, soil profiles described at or near the western perimeter of the Laboratory at higher elevations tend to have a higher SOC content than soil profiles described at the eastern boundary of the Laboratory at lower elevations. Humic substances, consisting of humic and fulvic acid compose most of the SOC found in soils (Thurman, 1985; Stevenson, 1994; Sposito, 1989). Solid organic carbon is important in controlling soil pH within O and A horizons chiefly by forming carboxylate anions and releasing protons to solution, providing ligands for metal complexing, enhancing oxidation-reduction reactions with Fe and Mn minerals (Stumm and Morgan, 1981), providing hydrophobic sorption sites for anthropogenic organic compounds such as benzene, trichloroethene, and trichloroethane (Thurman, 1985; McBride, 1994), and providing relatively high CEC values for specific horizons (Sposito, 1989).

## Selected Trace-Elemental Distributions in Soils

Results of selected trace-element distributions found in background soils are summarized in Table 7. Complete soil analyses are provided in Appendixes A and B. Soil digestion procedures

**TABLE 7. Background Elemental Concentrations in Soils, Los Alamos, New Mexico**

| | Nitric Acid Dissolution (EPA-SW846) | | | INAA or DNAA (Uranium Only) | | |
|---|---|---|---|---|---|---|
| Element | Number of Samples | Mean | Range | Number of Samples | Mean | Range |
| As | 72 | 4.9 | 0.5 - 13.6 | 67 | 5.04 | 1.20 - 10.81 |
| Ba | 72 | 176 | 24 - 730 | 75 | 459 | 125 - 829 |
| Be | 72 | 1.23 | 0.18 - 4.00 | | - | - |
| | 75 | 2.37[b] | 1.00 - 4.40 | | | |
| Co | 72 | 15.2 | 5.5 - 34 | 75 | 7.14 | 0.44 - 23.35 |
| Cr | 72 | 12.2 | 1.9 - 37.0 | 74 | 34.74 | 2.03 - 71.07 |
| Cu | 67 | 6.6 | 0.6 - 16.0 | | - | - |
| Fe (wt%) | 72 | 1.51 | 0.33 - 3.60 | 75 | 2.37 | 1.09 - 4.86 |
| Ni | 70 | 10.3 | 2.0 - 28.0 | | - | - |
| Pb | 69 | 16.7 | 4.0 - 37.0 | | - | - |
| | | 28.4[b] | 18.0 - 56.0 | | | |
| Se | 41 | 0.75 | 0.30 - 2.40 | | - | - |
| Th | 72 | 7.1 | 0.6 - 15.0 | 75 | 16.06 | 10.09 - 27.30 |
| Ti | 40 | 0.42 | 0.20 - 0.90 | | - | - |
| U | 72 | 0.94 | 0.20 - 2.40 | 75 | 3.41 | 1.54 - 6.73 |
| V | 72 | 26.6 | 4.0 - 56.0 | 72 | 48.95 | 11.54 - 113.10 |

[a]Data are reported in parts per million (ppm) unless otherwise noted.
[b]Hydrofluoric acid used in sample dissolution.

consisted of HF (Be, Cd, and Pb) or $HNO_3$ sample digestion before chemical analyses—using EPA-SW846 methods—including AA, ICPES, ICPMS, and IC as well as other available analytical techniques such as INAA and DNAA.

Arithmetic mean and ranges for analyte concentrations are also provided in Table 7. Generally, these data are similar to soil data reported from other sources summarized in Table 8, including Ferenbaugh *et al.* (1990) for Sigma Mesa on the Pajarito Plateau and Schacklette and Boerngen (1984) for many different locations in the United States. Samples collected by Ferenbaugh *et al.* (1990) consist of shallow (6-in.) grab samples from a portion of Sigma Mesa, but without specific reference to soil horizon(s). Laboratory soils contain higher concentrations of Th and U (see Table 7) than are shown for other soils listed in Table 8 because of their different parent materials (sheet-wash material, colluvium, wind-blown sediment, El Cajete), which were derived from U- and Th-rich volcanic rocks on the Pajarito Plateau.

Concentrations for Laboratory soils fall within the range of elemental concentrations reported elsewhere in the United States (Schacklette and Boerngen, 1984, Table 8); however, the mean values for Laboratory soils are higher for some elements, including Be, Br, Mn, Pb, Rb, Th, Ti, and U. (Table 5 provides brief descriptions of soil and rock samples collected at each soil profile in this study.)

Figure 15 shows concentration ranges for several analytes determined by different

**Table 8. Elemental Concentrations in Soils**

| Element | Farenbaugh *et al.* (1990) Sigma Mesa, Los Alamos Mean | Range | Schacklette and Boerngen (1984) Random Locations, USA Mean | Range |
|---|---|---|---|---|
| Al (%) | 5.8 | 5.3 - 6.7 | 5.8 | 0.5 - >10 |
| As | 3.9 | 1.3 - 6.7 | 5.5 | <0.1 - 97 |
| Ba | 410 | 120 - 810 | 580 | 70 - 5,000 |
| Be | 1.9 | 1.1 - 3.3 | 0.68 | <1 - 15 |
| Br | 1.9 | 0.40 - 5.7 | 0.52 | <0.5 - 11 |
| Cd (ppb) | 170 | 30 - 520 | - | - |
| Cl | <100 | - | - | - |
| Cr | 27 | 4.2 - 136 | 41 | 3 - 2,000 |
| Cu | 10 | 2.0 - 18 | 21 | 2 - 300 |
| F | 240 | 50 - 390 | 280 | <10 - 1,900 |
| Fe (%) | 1.7 | 1.0 - 2.6 | 2.1 | 0.1 - >10 |
| Hg (ppb) | 18 | 7.0 - 29 | 46 | <10 - 4,600 |
| Mn | 510 | 330 - 840 | 380 | 30 - 5,000 |
| Ni | 8.9 | 1.6 - 19 | 15 | <5 - 700 |
| Pb | 24 | 8.0 - 98 | 17 | <10 - 700 |
| Rb | 120 | 90 - 160 | 69 | <20 - 210 |
| Th | - | - | 9.1 | 2.4 - 31 |
| Ti (%) | 0.26 | 0.079 - 0.49 | 0.22 | 0.05 - 2.0 |
| U | - | - | 2.5 | 0.68 - 7.9 |
| Zn | 54 | 38 - 71 | 55 | 10 - 2,100 |

[a]Data are reported in parts per million (ppm) unless otherwise noted.

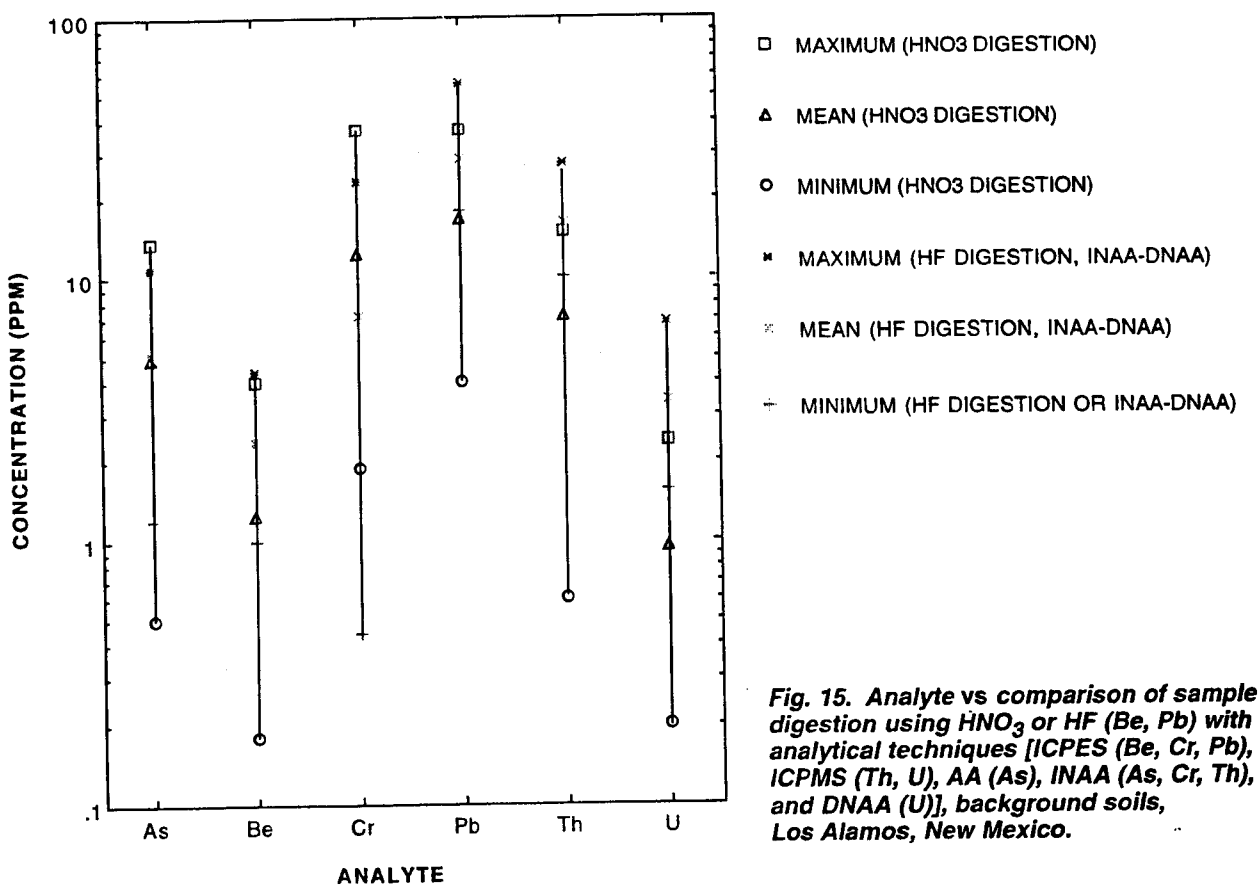



***Fig. 15. Analyte vs comparison of sample digestion using $HNO_3$ or HF (Be, Pb) with analytical techniques [ICPES (Be, Cr, Pb), ICPMS (Th, U), AA (As), INAA (As, Cr, Th), and DNAA (U)], background soils, Los Alamos, New Mexico.***

digestion procedures and analytical techniques. The analytical methods DNNA, INAA, and HF digestion with ICPES and ICPMS generally result in higher elemental concentrations (maximum, mean, and minimum values) than partial digestion using $HNO_3$. Instrumental neutron activation analysis and DNAA as well as HF digestion procedures provide total elemental analysis. Concentration distributions of Ba, Be, Cr, Pb, Th, and U in background soils are greater in the whole soil than in the $HNO_3$ digestion fraction. Lower quantitation limits were achieved using $HNO_3$ digestion with ICPES and ICPMS, which provide lower minimum values for the analytes shown in Fig. 15.

Concentration distributions of As in background soils are similar for both INAA and $HNO_3$ digestion with ETVAA. This may result from complete dissolution of amorphous $Fe(OH)_3$ or a related phase at pH 1 during $HNO_3$ digestion. Amorphous $Fe(OH)_3$ is a strong adsorbent for As and other trace elements (Sposito, 1984; Leckie *et al.*, 1980; Rai and Zachara, 1984); complete dissolution of this phase at pH 1 results in the desorption of As. Figure 16 shows solubilities of several low-temperature, Fe-bearing phases that occur in soils in which amorphous $Fe(OH)_3$ is the most soluble phase over a wide range of pH values. Thermochemical data were taken from Lindsay (1979) to construct Fig. 16. Complete dissolution of $Fe(OH)_3$ soil - Fe (Fig.16) at pH 1 results in Fe concentrations of 1.45 wt% (Log activity Fe = -0.59), which suggests that this phase may control Fe distributions in soils at the Laboratory. Other Fe-bearing phases that may be present, however, do not completely dissolve during $HNO_3$ digestion, as evidenced by the higher mean and larger range found for this element when INAA is used (Table 7). These phases probably include magnetite, hematite, and structurally incorporated Fe that occur within primary silicate minerals such as clinopyroxene and hornblende. Partial dissolution of iron-rich clay minerals (nontronite) also occurs under the acidic conditions of $HNO_3$ digestion, which may release some additional Fe to solution. Mineralogical characterization of iron oxides in soils would provide useful information on the stability of these important adsorbents.

Different trace elements summarized in Table 7 are distributed in background soils by the following processes (Sposito, 1989):

(1) trace elements that are concentrated primarily on surfaces of soil particles through chemical weathering (for example, As),

(2) trace elements that remain concentrated within soil particle matrices consisting of primary minerals (silicates) and glass (for example, Ba, Th, and U), and

(3) trace elements that are distributed as a combination of processes 1 and 2 (for example, Be, Cr, Pb, and V).

Process 1 is due mainly to adsorption of trace elements onto surfaces of clay minerals, iron oxides, solid organic matter, and calcium carbonate, whereas process 2 is dominated by coprecipitation within primary minerals (Sposito, 1989). Results of this investigation show that Ba, Th, and U tend to show less leaching from primary silicate minerals and glass than As and Be, which have become concentrated on surfaces of soil particles

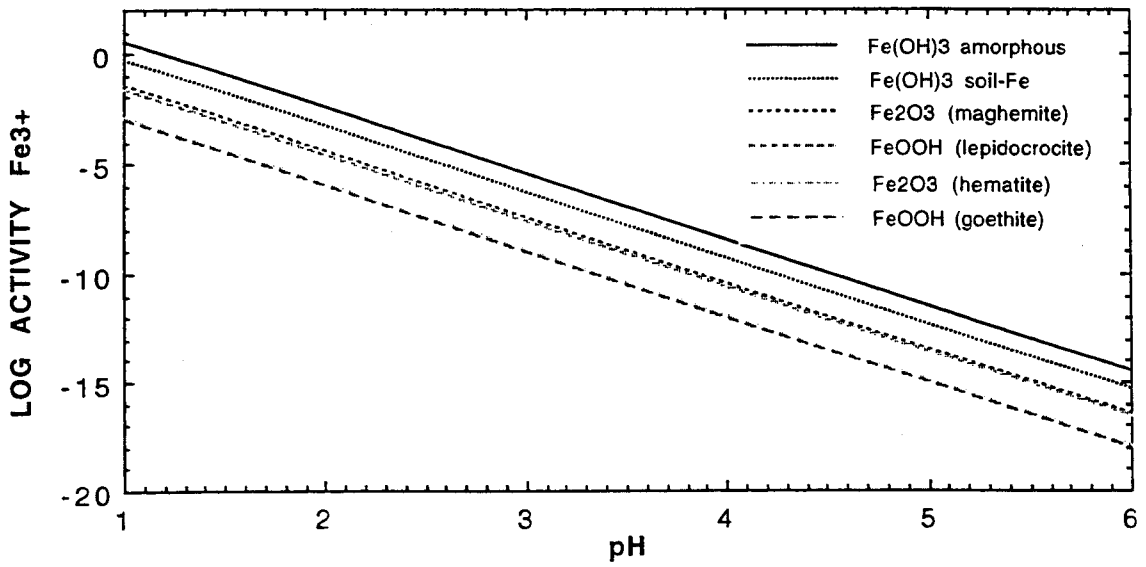



***Fig. 16. Log activity diagram of $Fe^{3+}$ in equilibrium with Fe (III) oxides and soil-Fe.***

through chemical weathering that leads to element remobilization. Uranium(IV) probably is the dominant valence state of this actinide within primary phases (allanite, perrierite, and chevkinite; Broxton *et al.*, 1995) present in soil and the Bandelier Tuff. This inference is based on significant differences observed between total element and $HNO_3$-digested fraction, which suggests little leaching of U has occurred. Factors controlling the extent of element leaching from primary soil phases include solid-state diffusion, solubility of the host phase, dissolution kinetics, solution flux, pH, Eh, and speciation of the trace element.

Examples of adsorption-dominated processes that involve Fe, As, and Be and that occur during pedogenesis were studied. Figures 17 and 18 are bivariate plots of Fe *vs* As and Fe *vs* Be, respectively, for samples collected from A, B, and C horizons. Because clay minerals and iron oxides are concentrated within B horizons, adsorption processes are more common than in the A and C horizons. It has been shown experimentally that amorphous $Fe(OH)_3$ has a surface area of ~306 $m^2/g$, whereas measured surface areas of lepidocrocite and hematite are 45 and 1.8 $m^2/g$, respectively (Stumm and Morgan, 1981). Other important properties of these adsorbents include surface charge, speciated form of adsorbate, and properties of electrical double layer, pH, and Eh. Amorphous $Fe(OH)_3$ has a higher sorptive capacity for transition metals and metaloids, primarily because its surface area is larger than that of lepidocrocite and hematite [see experimental data reported in Stumm and Morgan (1981), Sposito (1984), McBride (1994), and Stumm (1992)].

Most specific adsorbents, including calcium carbonate, iron oxides, manganese oxides, and amorphous aluminosilicates, have a pH-dependent surface charge. These phases are positively charged below their point of zero charge (PZC) and negatively charged at pH values above the PZC.

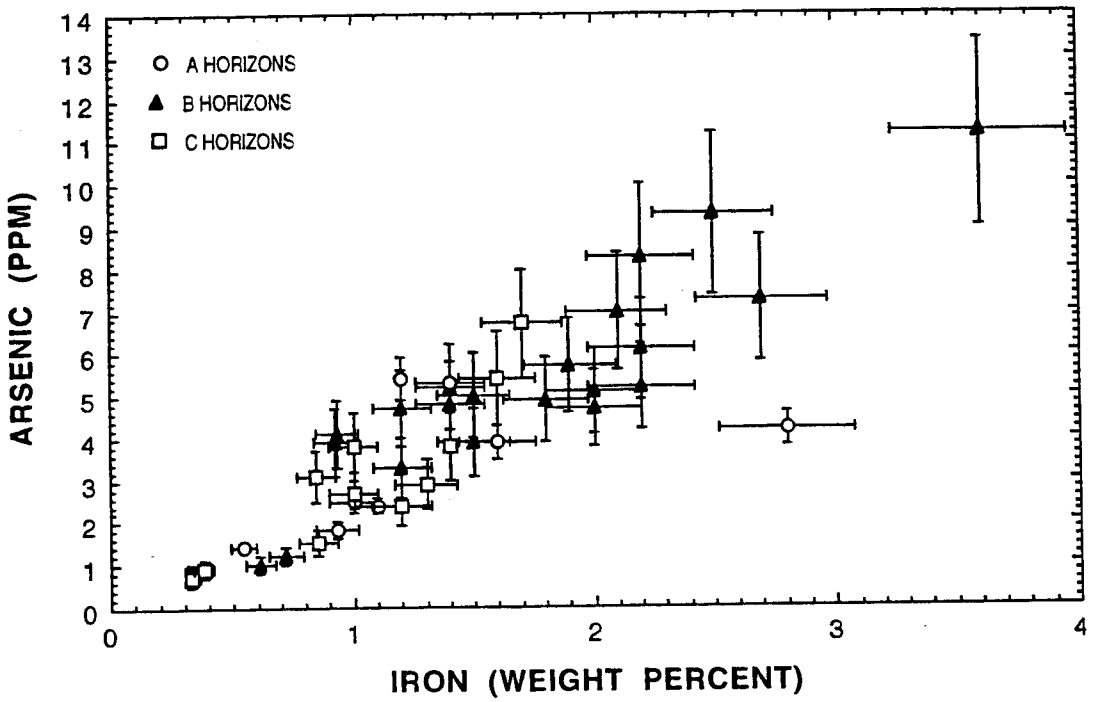



***Fig. 17.** Iron concentration vs As concentration in background soils, Los Alamos, New Mexico. Error bars represent ± 1 standard deviation.*

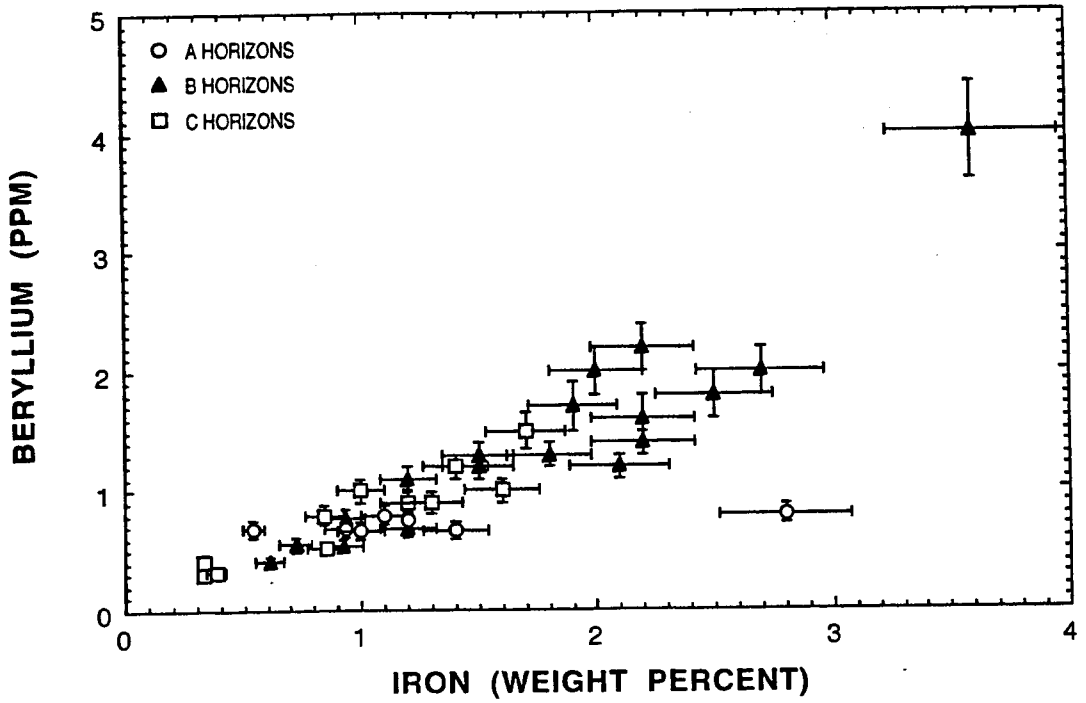



***Fig. 18.** Iron concentration vs Be concentration in background soils, Los Alamos, New Mexico. Error bars represent ±1 standard deviation.*

At the point of zero charge, solid phases lack net surface charge corresponding to $pH_{PZC}$. The PZC has a specific value for each adsorbent (Sposito, 1984: Stumm, 1992). Decreasing soil-pore water pH or groundwater pH increases positive surface charge and enhances anion adsorption, whereas increasing pH favors cation adsorption through increasing negative surface charge.

Cations, including Be, Cd, Pb, and Cu, are specifically adsorbed and undergo ion exchange; ion exchange becomes important when the specific adsorption capacity is exceeded (Sposito, 1984). For example, $Na^+$ and $Ba^{2+}$ are removed from solution primarily through cation exchange. Increasing cation adsorption with increasing pH results from hydrolysis of cations and decrease in positive charge of amphoteric adsorbents.

Ligands that form stable complexes with cations dissolved in soil-pore water or groundwater decrease free cation activity and cation adsorption. From background water-quality data collected in Los Alamos Canyon, it appears that bicarbonate—and possibly humate and fulvate—is probably the most important ligand found in natural waters at the Laboratory (Longmire, unpublished data). Presence of major cations such as $Ca^{2+}$, $Mg^{2+}$, $K^+$, and $Na^+$ and specifically adsorbed ions of $UO_2^{2+}$, $Be^{2+}$, and $Cd^{2+}$ in solution tend to limit adsorption through competition for cation exchange sites and specific adsorption sites, respectively.

Oxyanions, including $MoO_4^{2-}$, $SeO_4^{2-}$, $SeO_3^{2-}$, $CrO_4^{2-}$, $AsO_4^{2-}$, $AsO_3^{2-}$, and $SO_4^{2}$, are specifically adsorbed onto positively charged solids, such as calcium carbonate, clay minerals, amorphous $Fe(OH)_3$, and $\alpha$-FeOOH), with maximum sorption under acidic conditions. Adsorption of oxyanions onto iron oxides and aluminum oxides decreases in the following order: As > Cr ≥ Mo ≥ Se = $SO_4$ (Rai and Zachara, 1984).

### Trace Element Chemistry of the Bandelier Tuff

The Bandelier Tuff was derived from explosive volcanic eruptions in the Valles caldera in the Jemez Mountains west of the Laboratory. The Bandelier Tuff consists of upper (Tshirege) and lower (Otowi) members):

- *Otowi Member*, consisting primarily of nonwelded, lithic-rich, rhyolitic ignimbrite (1.61 Ma), and
- *Tshirege Member*, composed of nonwelded to welded rhyolitic ignimbrite (1.22 Ma)

(Smith and Bailey, 1966; Smith *et al.*, 1970; Gardner *et al.*, 1986). Goff (1995) subdivided the Tshirege Member into five subunits and a basal pyroclastic fall unit. Units 2 and 3 in the Tshirege Member are of the most relevance to SWMUs (solid waste management units) located on mesa tops. The Otowi Member is exposed along sides of major canyons, including Los Alamos, DP, and Pueblo Canyons; this member is important in studies of SWMUs located in these canyons.

In Los Alamos and DP Canyons, the Otowi Member consists of white, massive, nonwelded, rhyolitic ignimbrite containing ~5% pumice clasts >2 cm in diameter and ~5% clasts of pre-Bandelier Tuff lithologies of sand to cobble size (Goff, 1995). The ignimbrite matrix consists of poorly sorted ash, pumice, crystal, and lithic fragments.

Phenocrysts in pumice consist of 20% quartz and 80% sanidine (Broxton *et al.*, 1995). The Otowi Member has a smaller range of glass content (66 to 71 wt%) than the Tshirege Member (17 to 88 wt%) (Broxton *et al.*, 1995).

The Tshirege Member is exposed throughout the Pajarito Plateau and is characterized by variations in welding, devitrification textures, and in distribution of flow and cooling units (Baltz *et al.*, 1963; Weir and Purtymun, 1962; Vaniman and Wohletz, 1990 and 1991). Detailed descriptions of the Tshirege Member at TA-21, presented in Broxton *et al.* (1995) and Goff (1995), are representative of much of the Bandelier Tuff in the central portion of the Laboratory.

Trace elements found in the Bandelier Tuff are of importance to the ER Project. Uranium and Th distributions in the Bandelier Tuff fall below the $^{238}U$ SAL (67 pCi/g, 201 ppm) but are above the $^{232}Th$ SAL (0.77 pCi/g, 46 ppm). A separate report will provide additional trace-element data on the Bandelier Tuff to supplement these initial values determined from INAA and DNAA. Background concentrations of many elements of concern vary between the stratigraphic layers within the Bandelier Tuff. For example, Be, Cs, Th, and U all show trends of decreasing concentration with increasing height in the Tshirege Member; specific stratigraphic layers typically display less internal variation than is present between adjacent layers. There is some overlap of elemental distributions, however, between the units where tuff samples were taken near unit contacts. Trace-element distributions in the Bandelier Tuff are controlled by trace-element fractionation that occurred during magma genesis and eruptive history. The elemental distributions for U, Th, Ba, Be, and Cs are shown in Figs. 19 through 28 (samp. locations for Bandelier Tuff are noted in Figs. 1, 2, and 3). Appendix A lists the results of chemical analyses of Bandelier Tuff samples (reported FS 1000 numbers) using INAA and DNAA, which provide total element concentrations. Typical U values decrease from ~8 ppm in unit 1g to ~3 ppm in unit 4 (Figs. 19 and 20) and Th values decrease from 30 to 15 ppm (Figs. 21 and 22). Uranium and Th probably occur in glass and in trace phases, including allanite [$(Y, Ce,Ca)_2$-$(Al, Fe)_3(SiO_4)_3OH$], perrierite [$(Ca,Ce,Y, Th)_4$- $(Fe, Mg)_2(Ti,Fe)_3 Si_4O_{22}$], and chevkinite [$(Ca,Ce,Th)_4(Fe, Mg)_2(Ti,Fe)_3Si_4O_{22}$] (Broxton *et al.*, 1995). The ionic radius of U(IV) in VIII coordination is 1.00 Å, which substitutes for Ca(II) with an ionic radius of 1.04 Å (Shannon and Prewitt, 1969).

Distributions for Ba, Be, and Cs in the Tshirege Member are shown in Figs. 23 and 24, 25 and 26, and 27 and 28, respectively. Barium concentrations fluctuate with height from unit 1g (80 to 131 ppm) to Unit 2 (113 to 150 ppm) and increase in unit 3 (113 to 192) and unit 4 (414 ppm) (Figs. 23 and 24). Beryllium concentrations (Figs. 25 and 26) and Cs concentrations (Figs. 27 and 28) decrease from ~6 ppm to ~2 ppm with increasing height. The few samples of Otowi Member obtained for this study show that concentrations of U, Th, Be, and Cs within the Otowi Member fall between the minimum and maximum observed within the Tshirege Member. The average concentration obtained from the Otowi Member for U is ~5 ppm, for Th, ~18 ppm, for Be, ~5 ppm, and for Cs, ~4 ppm. These total elemental concentrations show the natural variations within the Bandelier Tuff; however, additional

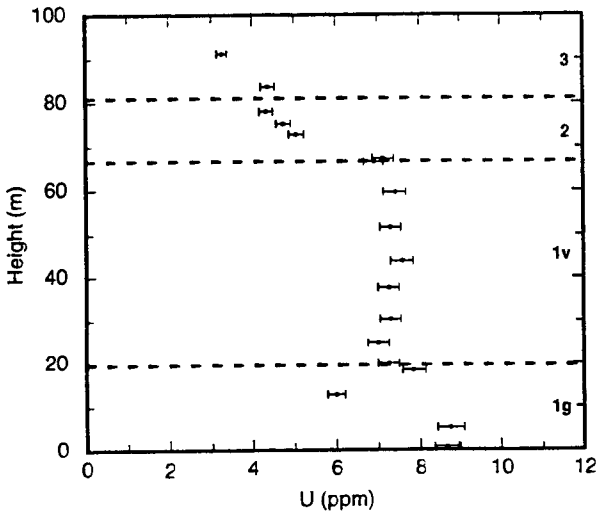



***Fig. 19. Concentration of U in Frijoles Canyon Section 1, Bandelier Tuff. Numbers indicate Tshirge Member units. Error bars represent ± 1 standard deviation.***

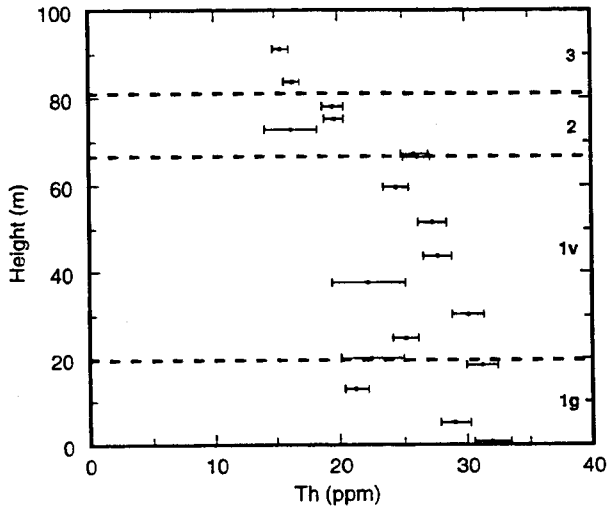



***Fig. 21. Concentration of Th in Frijoles Canyon Section 1, Bandelier Tuff. Numbers indicate Tshirge Member units. Error bars represent ± 1 standard deviation.***

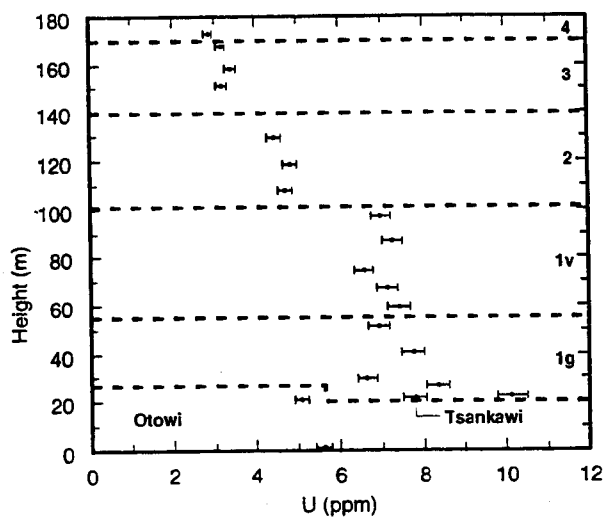



***Fig. 20. Concentration of U in Frijoles Canyon Section 2, Bandelier Tuff. Numbers indicate Tshirge Member units. Error bars represent ± 1 standard deviation.***

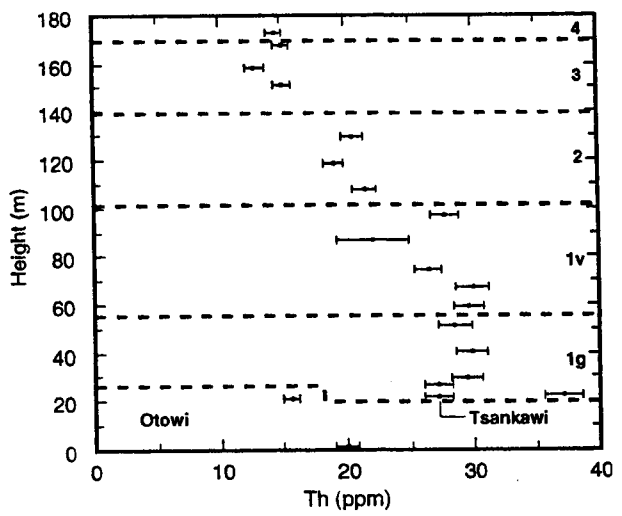



***Fig. 22. Concentration of Th in Frijoles Canyon Section 2, Bandelier Tuff. Numbers indicate Tshirge Member units. Error bars represent ± 1 standard deviation.***

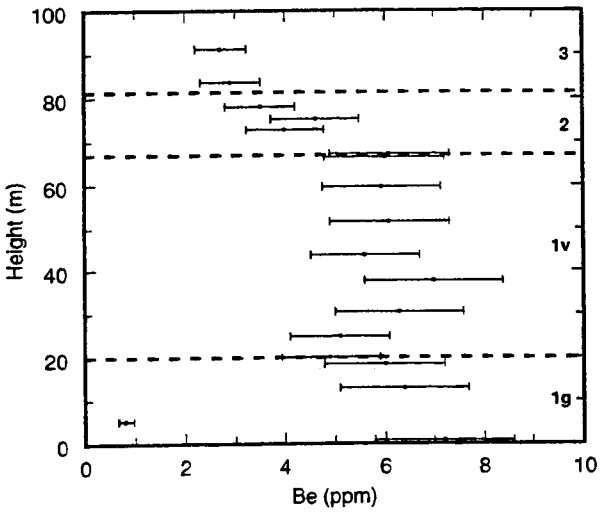



*Fig. 23. Concentration of Be in Frijoles Canyon Section 1, Bandelier Tuff. Numbers indicate Tshirge Member units. Error bars represent ± 1 standard deviation.*

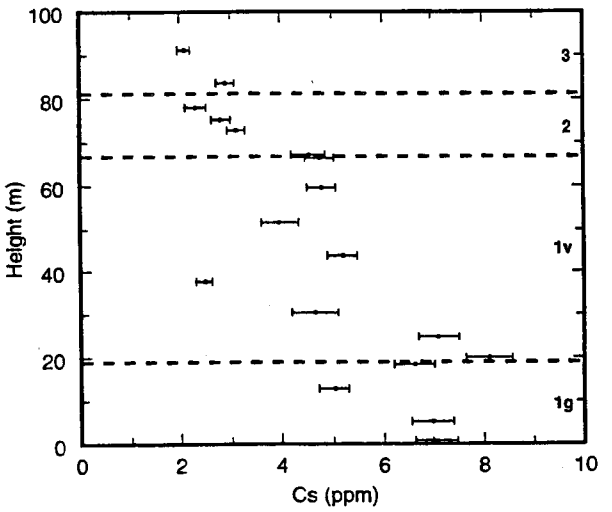



*Fig. 25. Concentration of Cs in Frijoles Canyon Section 1, Bandelier Tuff. Numbers indicate Tshirge Member units. Error bars represent ± 1 standard deviation.*

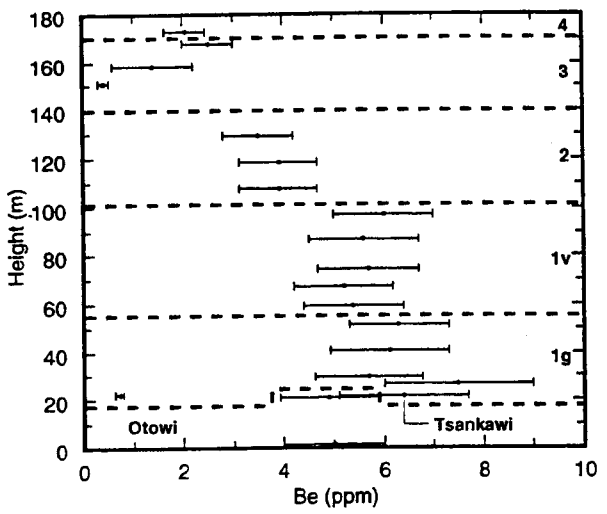



*Fig. 24. Concentration of Be in Frijoles Canyon Section 2, Bandelier Tuff. Numbers indicate Tshirge Member units. Error bars represent ± 1 standard deviation.*

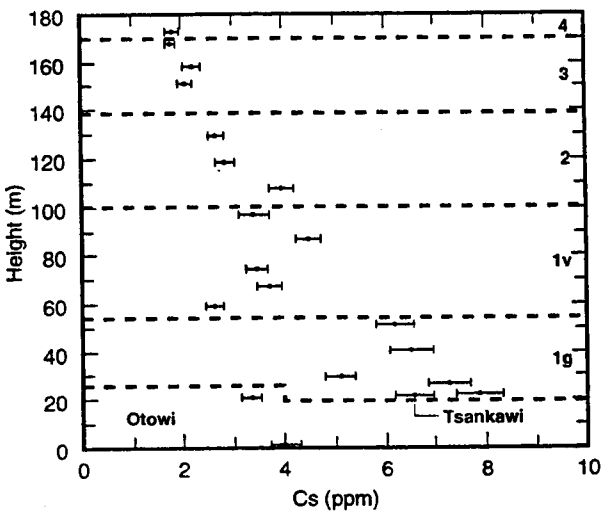



*Fig. 26. Concentration of Cs in Frijoles Canyon Section 2, Bandelier Tuff. Numbers indicate Tshirge Member units. Error bars represent ± 1 standard deviation.*

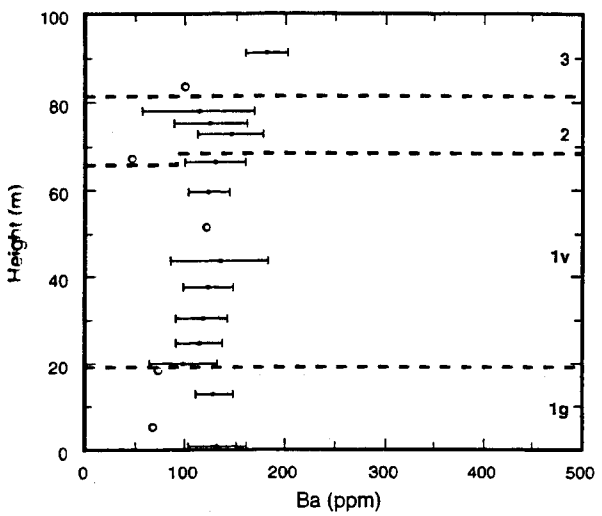



*Fig. 27. Concentration of Ba in Frijoles Canyon Section 1, Bandelier Tuff. Open circles indicate analyses below detection limits. Numbers indicate Tshirge Member units. Error bars represent ± 1 standard deviation.*

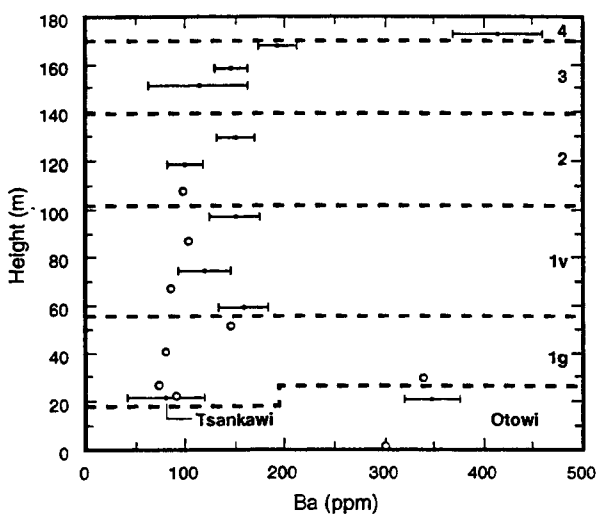



*Fig. 28. Concentration of Ba in Frijoles Canyon Section 2, Bandelier Tuff. Open circles indicate analyses below detection limits. Numbers indicate Tshirge Member units. Error bars represent ± 1 standard deviation.*

elemental data from $HNO_3$ digestion are not available, and these data would be helpful for comparing background to contaminated Bandelier Tuff.

The Bandelier Tuff generally shows less variation in trace-element chemistry than do soils. However, Be, Th, and U are found in higher concentrations in the Bandelier Tuff than in soils. It is generally believed that these differences occur because the Bandelier Tuff is the primary parent material for only a small percentage of the soils on the Pajarito Plateau.

## Summary of General Soil and Bandelier Tuff Characteristics

Soils present on the Pajarito Plateau are extremely variable in physical and chemical properties, including particle size, percent calcium carbonate, clay mineralogy, iron oxides, and trace-element chemistry. The concentrations of Al, As, Ba, Ca, Cs, Co, Cr, and Fe are higher in soils than in Bandelier Tuff samples. The Bandelier Tuff, however, is characterized by higher concentrations of Be, Pb, Na, K, Th, and U. Because of the dependence of As and Be on soil development, the selection of appropriate background samples for a specific site should include a consideration of local and Laboratory-wide soil characteristics.

Well-developed soils have higher concentrations of trace elements than do the weakly developed soils found on the Pajarito Plateau. The B horizons have higher concentrations of trace elements than the A and C horizons. High abundances of clay minerals and iron oxides, characterized by relatively high surface areas, control trace-element concentrations in soils within B horizons.

In addition, variations in soil-element concentrations are related to chemical characteristics of a particular soil horizon and to the parent material, which includes of alluvial fans, sheet-wash material, colluvium, wind-blown sediment, and the Bandelier Tuff.

**Recommendations for Soils and Bandelier Tuff**

- Integrate physical sciences (chemistry, geology, hydrology) with all aspects of background-element investigations (risk analysis and statistics).
- Characterize Laboratory-wide and site-specific background element distributions in soils and Bandelier Tuff using a multidisciplinary approach that involves the Decision Support Council, Earth Sciences Council, and Field Units.
- Standardize field sampling procedures and require better field descriptions of sampling sites.
- Use consistent sample preparation and digestion ($HNO_3$) procedures before chemical analyses to compare background samples to SWMU samples. EPA SW846 methods recommend that nitric acid and other reagents are suitable for digesting solid samples.
- Expand the background-element data bases for soils (mesa top, slope, and canyons) and Bandelier Tuff to calculate the mean, standard deviation, and UTLs for different elements in specific soil horizons and Bandelier Tuff mapping units. Additional reports that describe background for soils, sediments, Bandelier Tuff, ground-water, and surface water will be prepared in the future.
- Determine soil-horizon-specific background concentrations at SWMU sites. Compare the site-background data to Laboratory-wide data and integrate the physical sciences with statistical analyses.
- Use results of background and site characterization to the fullest extent to achieve maximum success and benefits of remediation strategies.

# PART II.

# GEOCHEMISTRY, GEOMORPHOLOGY, AND PEDOGENESIS OF SIX SELECTED SOIL PROFILES AT LOS ALAMOS, NEW MEXICO

## INTRODUCTION

Part II of this report presents descriptions of the geochemistry, geomorphic setting, and soil profiles at the background-soil sampling sites on the Pajarito Plateau. The geomorphic setting is described to provide a better understanding of factors that have influenced the variations in soil characteristics. Eventually, it may be possible to relate the geochemical characteristics of a site to the geomorphic setting—allowing reasonable extrapolation of the background-soils data. The geomorphic characterization of each site also provides insight into the history of landscape change on the Pajarito Plateau, which will aid in constraining future transport of contaminated soils at the Laboratory. Site-specific geochemistry of each soil profile is also presented in this part. Geochemical characteristics of soils on the Pajarito Plateau vary widely, depending on local variations in parent material, topography, soil age, surficial processes, climate, and vegetation.

The ages of the sampled deposits range from several thousand years to perhaps as much as one million years. Ages for the younger deposits were determined by radiocarbon dating of charcoal contained within the deposits; the radiocarbon ages were converted to calibrated calendar ages by using the computer program of Stuiver and Reimer (1993). In general, older ages were obtained for samples collected from the parent material and sediments underlying younger soils horizons. At least two radiocarbon dates were obtained from individual sites to provide a check on the reliability of the ages. Ages of some of the older deposits were inferred from their relation to the El Cajete Pumice, which was erupted from a vent in the Valles caldera. Although conflicting ages have been obtained for the El Cajete pumice, the available data suggest an age of 50 to 60 ka (thousands of radiocarbon years before present) (see Reneau *et al.*, 1995). The oldest background-soil sample site includes alluvial clasts deposited on Twomile Mesa before initial incision of canyons on the western part of the Pajarito Plateau; the only age constraint is post-1.22 Ma, the age of the Tshirege Member of the Bandelier Tuff (Izett and Obradovich, 1994).

Trace-element geochemistry of each soil profile varies as a function of soil age,

mineralogy of soil and parent material, amount and composition of eolian dust, degree of chemical weathering, and hydrology. General discussions of the geochemical characteristics of As, Be, Fe, Th, and U (below) provide a context for understanding their likely behavior within Laboratory soils.

Under environmental pH conditions (5 to 9) encountered in most soils, dissolved As occurs as neutral species or oxyanions in +3 ($H_3AsO_3^0$, $H_2AsO_3^-$) or +5 ($H_2AsO_4^-$, $HAsO_4^{2-}$) valence states. Studies of As adsorption onto adsorbent surfaces show that uptake is controlled to a large degree by the content of extractable Fe and Al hydrous oxides that occur as amorphous or cryptocrystalline phases (Jacobs *et al.*, 1979; Wauchope, 1975; Livesey and Huang, 1981). Arsenic adsorption is largely controlled by the surface area of the adsorbent, and experimental studies have shown that the sorptive capacities of amorphous $Fe(OH)_3$ and $Al(OH)_3$ (Ferguson and Anderson, 1974; Anderson *et al.*, 1976; Pierce and Moore, 1980; Gupta and Chen, 1978; Leckie *et al.*, 1980; Wangen *et al.*, 1982) are higher than those of lattice silicates (Frost and Griffin, 1977; Huang, 1975). Adsorption of As(V) ($AsO_4^{3-}$) onto Fe oxides is similar to that of $PO_4^{3-}$ (Wauchope, 1975; Holm *et al.*, 1979), whereas As(III) retention is considerably less (Gupta and Chen, 1978; Ferguson and Anderson, 1974; Holm *et al.*, 1979). Both As(III) and As (V) species probably are stable in soil-pore waters at different sites, depending on Eh. Precipitation/dissolution reactions of As in soils have not been extensively investigated. Some As minerals, including AsS, $As_2S_3$, and $FeAsO_4$, are stable over wide ranges of Eh and pH conditions; however, several investigators conclude adsorption processes dominate over precipitation reactions that involve As retention in soils. The enrichment of As in soil correlates with soil development—specifically the formation of B horizons containing iron oxides, clay minerals, and solid organic matter as dominant adsorbents.

Beryllium is an important element at the Laboratory because of its use in detonation of ballistics. Beryllium forms hydroxo complexes ($BeOH^+$, $Be(OH)_2^0$, and $Be(OH)_3^-$) above pH 6 (Rai and Zachara, 1984). There are very few data available on adsorption and precipitation/dissolution reactions of Be. Available thermochemical data suggest that $\beta$-$Be(OH)_2$ is moderately insoluble and that this phase precipitates rapidly from solution (Rai and Zachara, 1984). There is some evidence that Be adsorption onto soil surfaces (iron oxides and clay minerals) is pH-dependent. Column experiments conducted by Alesii *et al.* (1980) and Korte *et al.* (1976) show that Be was more strongly attenuated then were Zn, Cd, Ni, and Hg. These investigators report that only Cu and Pb showed less mobility than Be. Korte *et al.* (1976) suggest that calcareous soils high in clay minerals appear to be effective in Be retention. Calcareous, clay-mineral-rich soils are found at Site 7, Ancho Canyon mesas, and other locations at the Laboratory, and these studies may have relevance to the present investigation.

Iron, in the forms of iron oxide, amorphous ferric hydroxide, and ferric oxyhydroxide, is an important soil constituent. Arsenic, Be, Ni, and other trace elements correlate well with Fe in the soil profiles

characterized in this investigation. Iron forms free species ($Fe^{2+}$ and $Fe^{3+}$) and hydroxo complexes ($Fe(OH)_2^+$, $Fe(OH)_3^0$, and $Fe(OH)_4^-$) above pH 6 (Rai and Zachara, 1984). Iron forms several sparingly soluble phases in soil, including $Fe_3(OH)_8$, amorphous $Fe(OH)_3$, and $\alpha$-FeOOH, under different oxidation-reduction conditions. These solids are important adsorbents for many transition metals found at the Laboratory and elsewhere.

Thorium and U are important actinide elements that occur naturally in the Bandelier Tuff and soils on the Pajarito Plateau; these elements also occur above background concentrations as a result of Laboratory activities. An understanding of background elemental distributions of Th and U will provide constraints on the fate and transport of anthropogenic actinides. Under relatively oxidizing conditions, U(VI) forms stable carbonato complexes ($UO_2CO_3^0$, $UO_2(CO_3)_2^{2-}$, and $UO_2(CO_3)_3^{4-}$) above pH 6 (Langmuir, 1978; Brookins, 1988). These carbonato complexes adsorb onto surfaces of iron oxides and clay minerals; however, Tripathy (1984) and Hsi and Langmuir (1985) investigated the desorption of these complexes under alkaline pH conditions and Longmire (1991) confirmed their findings in the field at uranium-mill tailings impoundments. Thorium is stable in the 4+ valence state and forms hydroxo complexes ($Th(OH)_3^+$ and $Th(OH)_4^0$) above pH 4 in organic-free solution (Langmuir and Herman, 1980). Thorium hydroxo species strongly adsorbed onto iron oxides and clay minerals.

Soil and Bandelier Tuff samples were analyzed for total-element concentrations using DNAA for U and INAA for Fe, As, Th, and other elements. The same soil samples were digested using concentrated $HNO_3$ and were then analyzed for the same elements by EPA-SW846 methods—including ICPES, ICPMS, IC, and ETVAA. In most instances, the element concentrations from $HNO_3$ digestion are less than the total-element concentrations determined from INAA and DNAA. Element leaching from soils is evaluated by comparing analytical results from $HNO_3$ digestion to those obtained from INAA and DNAA. Large differences in concentrations of the total element and $HNO_3$-digested samples suggest that minimal leaching has occurred and most of the element is chemically bound or tied up within the silicate mineral. Small differences in element concentrations between $HNO_3$-digested samples and total-element analyses suggest that elements have been mobilized and concentrated on surfaces and/or coprecipitated with acid-soluble phases such as ferric hydroxide, ferric oxyhydroxide, calcium carbonate, and clay minerals such as smectite and kaolinite.

## SITE 1—LOWER LOS ALAMOS CANYON, NEAR TSANKAWI

### Location and Geomorphic Setting

The soil sampling site in lower Los Alamos Canyon is located on the outside of a bend in the stream channel, where the stream has eroded the bank and exposed a 2-m-thick sedimentary section (Fig. 29). The exposure is of the lowe end of a fan derived from erosion of nonwelded units of the Bandelier Tuff—predominantly the Otowi Member and the lowest part of the Tshirege Member. Sediments of the Puye Formation that underlie the Otowi Member also

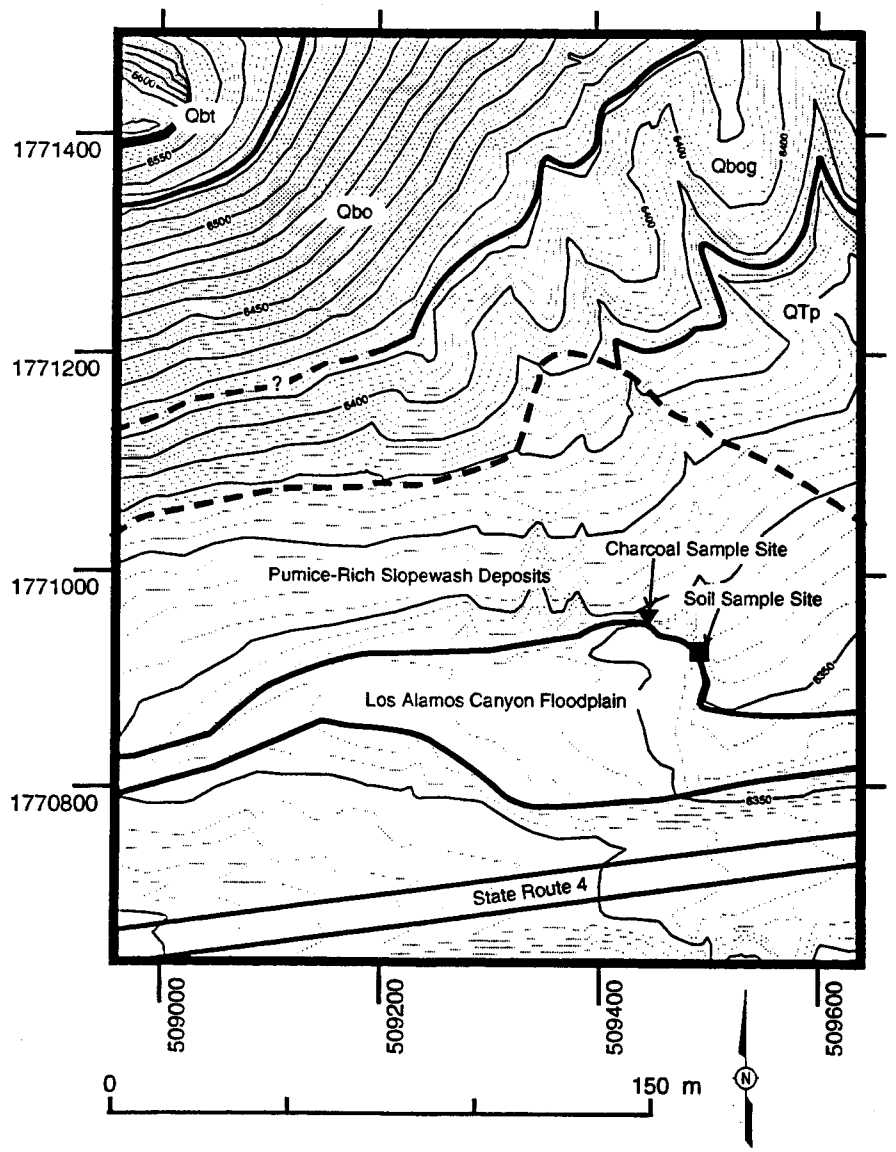



***Fig. 29. Map of sample site 1 in lower Los Alamos Canyon. Qbt = Tshirege Member, Bandelier Tuff; Qbo = Otowi Member; Qbog = Guaje Pumice Bed; QTp = Puye Formation. Topographic base, with 2-ft contours, from FIMAD.***

contribute some material to the fan. The fan immediately overlies Los Alamos Canyon stream gravels (Fig. 30) and records the burial of a gravel bar by progradation of the fan, presumably during a period of rapid erosion of the adjacent slopes. This site may be representative of deposits derived from nonwelded parts of the Bandelier Tuff that have had minimal time for soil development. The sample site probably belongs to the Totavi gravelly, loamy sand soil series, as mapped by Nyhan *et al.* (1978) further west in lower Los Alamos Canyon.

Two radiocarbon dates were obtained from this exposure: one was from detrital charcoal contained within the basal fan sediments and one was from a burned stump that was rooted in the stream gravels (Fig. 30, Table 9). These dates are statistically indistinguishable at ~2.6 ka [calibrated (cal) calendar age of ~2.8 ka; Table 10] and indicate that soil overlying this fan developed during a period of less than 2800 years. The dates also document that the stream channel was near its present level ~2800 years ago. In addition, these dates document extensive erosion of these slopes that occurred before the arrival of homesteaders and Anasazi Indians; however, the period of erosion in lower Los Alamos Canyon was later than that recorded at the EG&G gully (site 2), as is discussed later.

## Soil Description

Soil samples collected from the lower Los Alamos Canyon site are listed in Table 5. This site represents a poorly developed soil characterized by A, C, and 2Cb horizons (Watt and McFadden, 1992). Thicknesses of these horizons are A (0 to 10 cm), C (10 to 22 cm), and 2Cb (22+ cm). Organic carbon values range from 0.1 to 2.7 wt%, and the highest abundance is within the A horizon. This soil profile contains clay-size material ranging from 2.4 to 7.4 wt%. Sand-size material varies from 73.5 to 83.4 wt%, indicating that this soil profile has a relatively high hydraulic conductivity in comparision to that of the clay-rich soils found on the Pajarito Plateau (Table 6; K ranges from $10^{-3}$ to 1 cm/s). Silt-size material ranges from 14.2 to 20.6 wt% at this soil site.

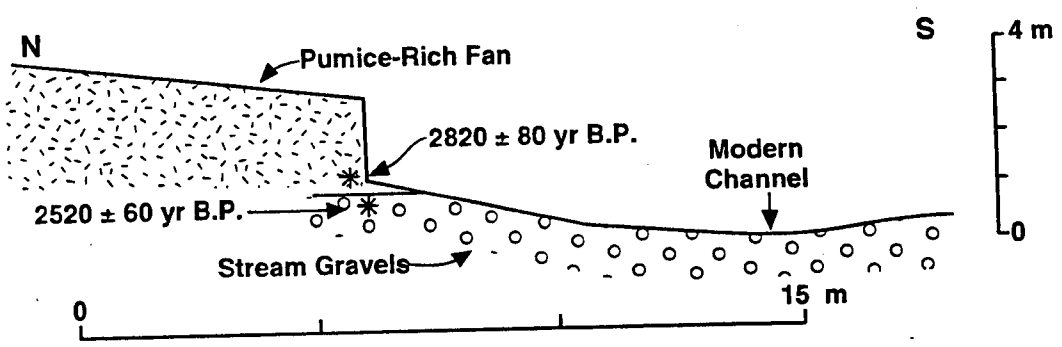



*Fig. 30. Cross section of radiocarbon site in lower Los Alamos Canyon showing pumice-rich fan overlying Los Alamos Canyon stream gravels. Soil sample site 1 is 15 m to southeast.*

**Table 9. Radiocarbon Dates From 1992 Laboratory-Wide Studies Soil Sample Sites**

| Laboratory Number[a] | $^{14}C$ Date (yr B.P.) | Calibrated Age[b] | Notes |
|---|---|---|---|
| EG&G Gully, shallow valley fill on townsite mesa | | | |
| Beta-55622 | 8050±130[c] | 8980 cal BP (8337-9522) | 2.45-2.5 m deep; coarse sediments below buried soil |
| Beta-59677 | 7875±85 | 8580 cal BP (8327-9206) | 3.55 m deep; 0.6+ m above base (ETH-10060) |
| Beta-55626 | 3970±80 | 4420 cal BP (3930-4848) | 0.78-0.86 m deep; burn layer |
| Upper Los Alamos Canyon, 7255' stream elev., soil beneath fir forest | | | |
| Beta-55620 | 3060±100[c] | 3270-3340 cal BP (2771-3809) | 1.35 m deep, charcoal in colluvial deposit |
| Beta-55621 | 2150±100[c] | 2150 cal BP (1639-2472) | 0.8-0.9 m deep, charcoal in buried soil |
| Lower Los Alamos Canyon, 6345' stream elev., pumice-rich fan | | | |
| Beta-55623 | 2820±80 | 2880-2930 cal BP (2509-3380) | 1.9 m deep; basal slopewash |
| Beta-55624 | 2520±60 | 2720 cal BP (2326-2852) | 2.25 m deep; stump rooted in stream gravels |
| Water Tanks Trench, West Jemez Road[d] | | | |
| Beta-56176 | 1120±80[c] | 1060 cal BP (723-1342) | 0.25 m deep, loess? |
| TO-3414 | 5840±90 | 6670 cal BP (6289-7156) | 0.65 m deep |

[a]Laboratory numbers: Beta indicate analyses by Beta Analytic Inc., TO indicates AMS (accelerator mass spectrometry) analyses by Toronto; and ETH indicates an AMS analysis by ETH-Zurich.
[b]Calibrated ages were obtained using the computer program CALIB 3.0 (Stuiver and Reimer, 1993), with an error multiplier of 2.0 and 2σ uncertainty. Ages in ( ) are 2σ range. For samples that were not corrected for $\delta^{13}C$ in laboratory, the $\delta^{13}C$ value was assumed to be 23.2 ± 0.9 o/oo based on $\delta^{13}C$ values of 16 samples collected from the Pajarito Plateau.
[c]Radiocarbon date was not corrected for $\delta^{13}C$ in laboratory.
[d]Radiocarbon dates presented in Wong *et al.* (1995).

## Soil Chemistry

The A horizon of this soil profile is characterized by an acidic pH (5.4), possibly resulting from deprotonation of organic acids—specifically humic substances consisting of carboxylic acids (Sposito, 1989; Stevenson, 1994; Thurman, 1985). Calcium carbonate concentrations are relatively low, varying from 0.4 to 0.6 wt%, within the soil horizons at this site (Watt and McFadden, 1992). The underlying C and 2Cb horizons are slightly less acidic (pH of 6.6 for C and 6.5 for 2Cb), indicating that some $CaCO_3$ (0.6 wt%) is present as a buffering agent.

The element chemistry for soils collected at this site is provided in Appendix A (INAA and DNAA) and Appendix B (EPA SW846 methods). Total Fe concentrations range from 1.14 to 1.31 wt% (Fig. 31). Nitric acid-digested Fe concentrations range from 0.33 to 0.38 wt% and comprise 25 to 29% of total Fe. These concentration distributions suggest that most of the Fe occurs in refractory phases such as hornblende, magnetite, and biotite, and only small amounts of acid-digested iron oxides are present. Adsorption of trace elements onto iron oxides and clay minerals probably is minimal in this undeveloped soil profile because of the absence of B horizons and the lack of appreciable abundances of clay-size material that consists partially of clay minerals and iron oxides.

This poorly developed soil is low in most trace elements, except Th and U, which occur in higher concentrations in the parent material (Otowi Member) than in the Tshirege Member (see Appendices A and B). These two elements probably are concentrated primarily in glass and accessory mineral phases (Broxton *et al.*, 1995). Figure 32 shows distributions of Th and U *vs* depth. Total Th and U concentrations increase in depth, and these two elements are enriched in the 2Cb horizon. There are larger differences between total element and acid-digested concentrations of Th than of U. Thorium appears to be less leachable than U, although Th is more abundant than U in soils and Bandelier Tuff. If extensive leaching of Th and U had occurred, a narrower range between total element and the acid-digested fraction would be observed.

Figure 33 shows distributions of As and Be *vs* depth. Beryllium is higher in the C and 2Cb horizons, whereas As shows higher concentrations in the A and 2Cb horizons. Total Be and As concentrations range from 3.2 to 4.4 ppm and from 1.20 to 1.68 ppm, respectively. Acid-digested Be composes 7 to 10% of total Be present in the soil at this site. Distributions of acid-digestible As range from 48 to 58% of total As. Arsenic is possibly associated with eolian dust, Tschicoma Formation dacites, and volcanic glass. Arsenic distributions in soils probably are controlled by adsorption and coprecipitation reactions involving illite and oxides-hydroxides of Al, Fe, and Mn (Sposito, 1989). Natural leaching of these two elements from primary silicate and possibly sulfide phases probably has not occurred to a significant extent because the $HNO_3$-digested fraction is considerably less than total-element concentrations. Judging by the larger concentration differences observed between total element and the acid-digested fraction, Be appears to be less leachable than As. Beryllium is primarily enriched in feldspars replacing silicon (Si) within tetrahedral sites (Bues, 1966). Ionic radii of $Be^{2+}$ and $Si^{4+}$ are 0.27 and 0.26 Å, respectively, for IV coordination (Shannon and Prewitt, 1969). Bues (1966) reports that 85 to 98% of the total Be may be bound in the feldspar structure before mineral dissolution, dominated by hydrolysis reactions that lead to the formation of clay minerals.

**Table 10. Averaged Radiocarbon Ages**

| Sample Site | Averaged $^{14}C$ Age (yr B.P.)[a] | Calibrated Age[b] | Samples |
|---|---|---|---|
| Lower Los Alamos Canyon | 2629 ± 97 | 2750 cal BP (2373-2930) | Beta-55623, Beta-55624 |
| EG&G gully, basal unit | 7937 ± 144 | 8670-8710 cal BP (8405-9221) | Beta-55622, Beta-59677 |

[a]Averaged radiocarbon ages were obtained using CALIB 3.0 (Stuiver and Reimer, 1993) with an error multiplier of 2.0 for the original analyses. Average ages were only obtained from the same or adjacent units at a site where there is no statistically significant difference between sample ages.

[b]Calibrated ages were obtained using CALIB 3.0 (Stuiver and Reimer, 1993), with 2σ uncertainty. Ages in ( ) are 2σ range.

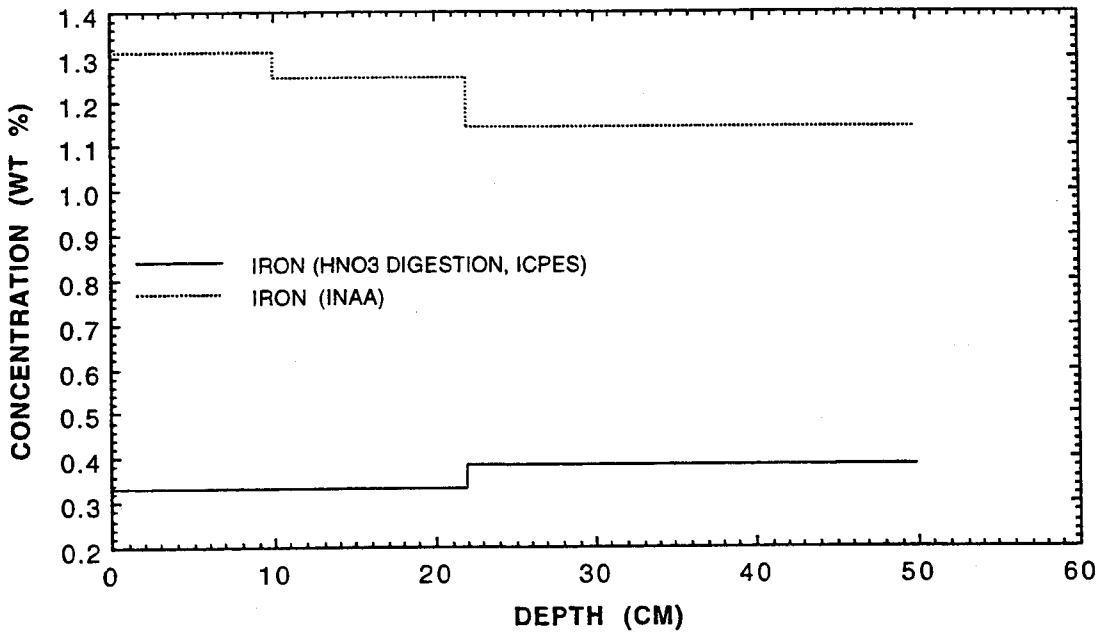



***Fig. 31. Iron concentration vs depth in background soil; Site 1, lower Los Alamos Canyon.***

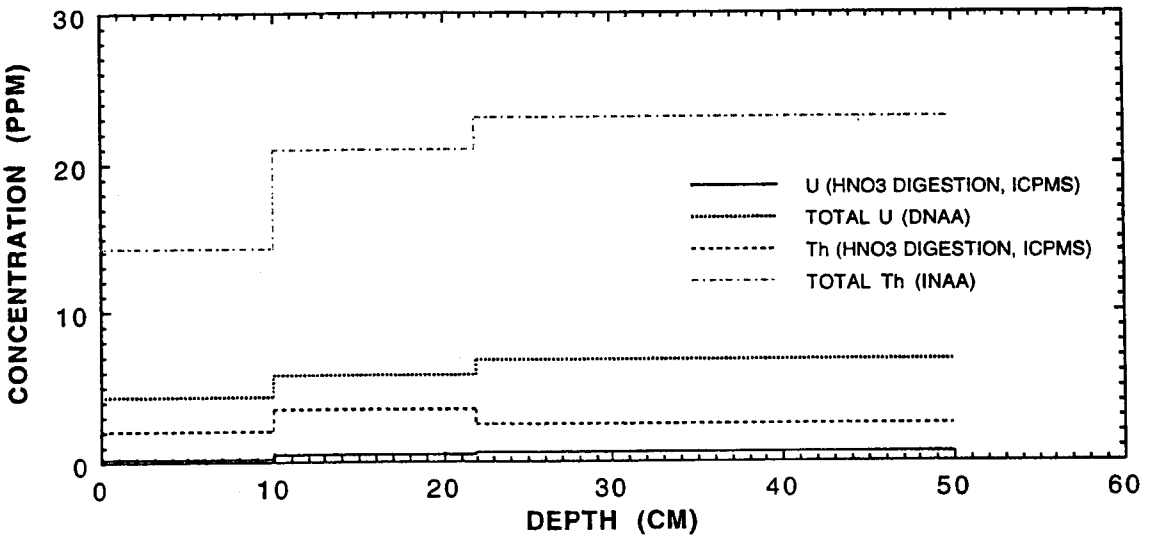



***Fig. 32. Uranium and Th concentrations vs depth in background soil; Site 1, lower Los Alamos Canyon.***

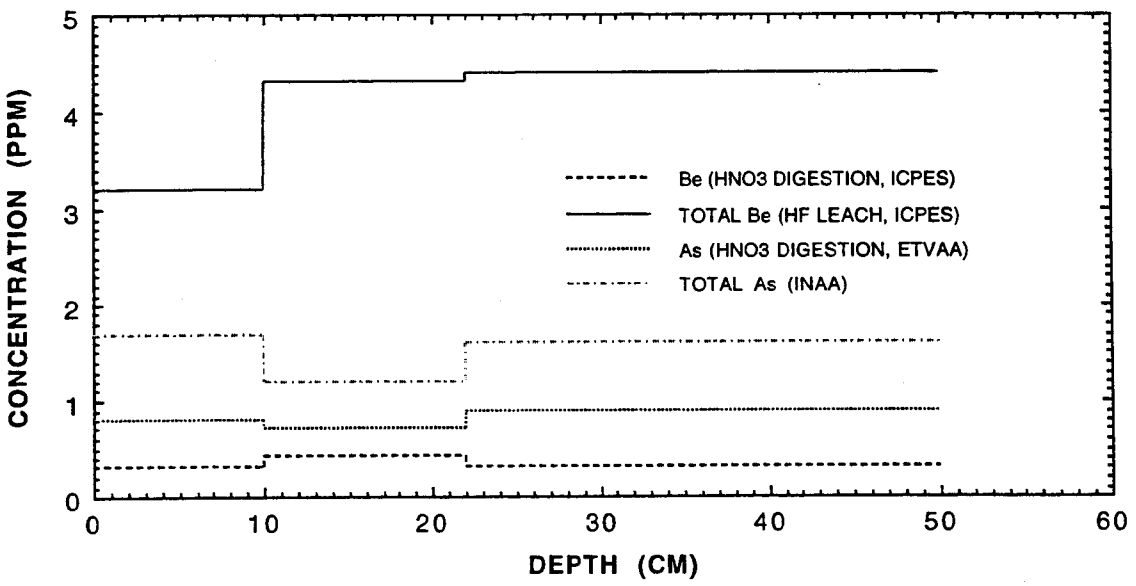



***Fig. 33. Beryllium and As concentration vs depth in background soil; Site 1, lower Los Alamos Canyon.***

## SITE 2—EG&G GULLY, EAST ROAD

### Location and Geomorphic Setting

"EG&G Gully" (its informal name) is located on the south side of East Road (State Route 502) near the EG&G building (Fig. 34). The gully is incised 3 to 4 m into a sedimentary deposit that partially fills a shallow mesa-top valley (Fig. 35). This valley heads ~300 m (1000 ft) to the west and is cut into Unit 3 of the Tshirege Member of the Bandelier Tuff; it drains over a waterfall into Pueblo Canyon to the east. The source of the valley fill is material eroded off the mesa to the west and probably includes a combination of weathered tuff and soils previously developed on the mesa top; the latter probably includes components of wind-blown dust deposited on the Pajarito Plateau. The extensive areas of bedrock that occur on the surrounding slopes were presumably exposed by erosion as the valley fill was deposited. This sample site was mapped as part of the Hackroy soil series by Nyhan *et al.* (1978); however, soils here are much thicker than typical for the series and may, in part, represent redeposition of eroded Hackroy soils. The source and composition of the sediments in this valley fill may be representative of similar settings where sediment eroded from the mesa tops is deposited, but the age and soil development of such deposits may vary significantly.

The valley fill is composed of two units separated by a buried soil that represents a period of stability of the valley (Fig. 35). The lower unit includes weakly stratified sands and silty sands overlaid by stratified layers with abundant fine gravels, which were probably deposited by

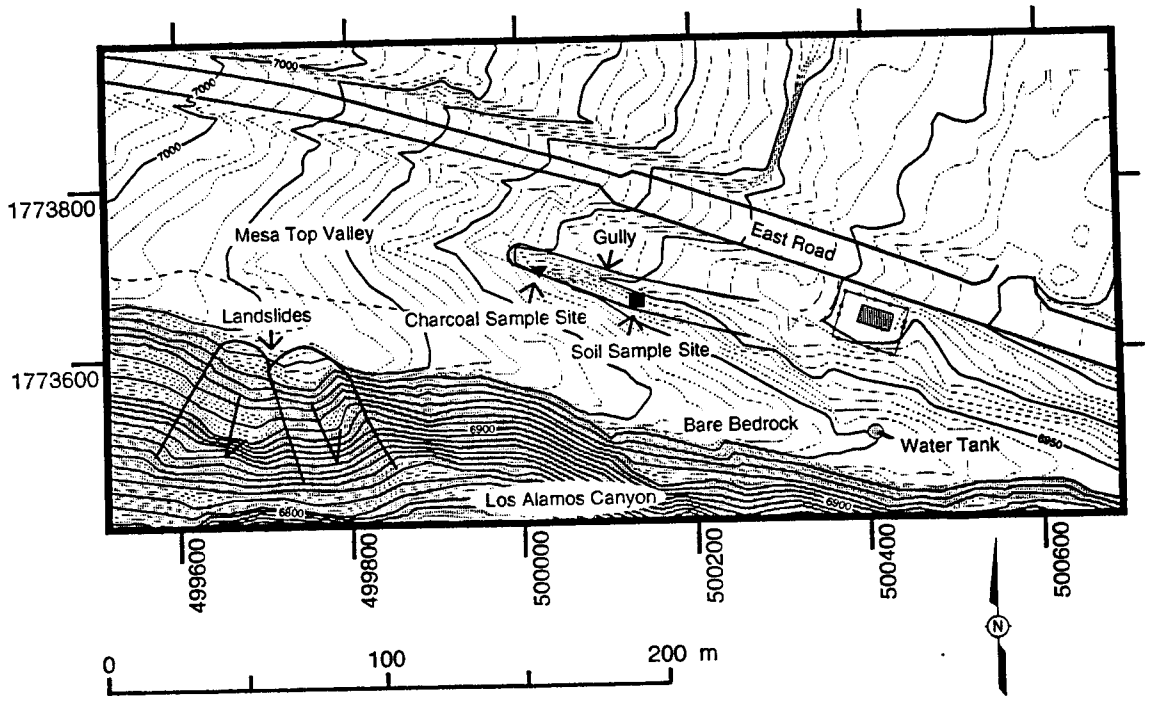



*Fig. 34. Map of EG&G Gully soil sample site 2; topographic base, with 2-ft contours, from FIMAD.*

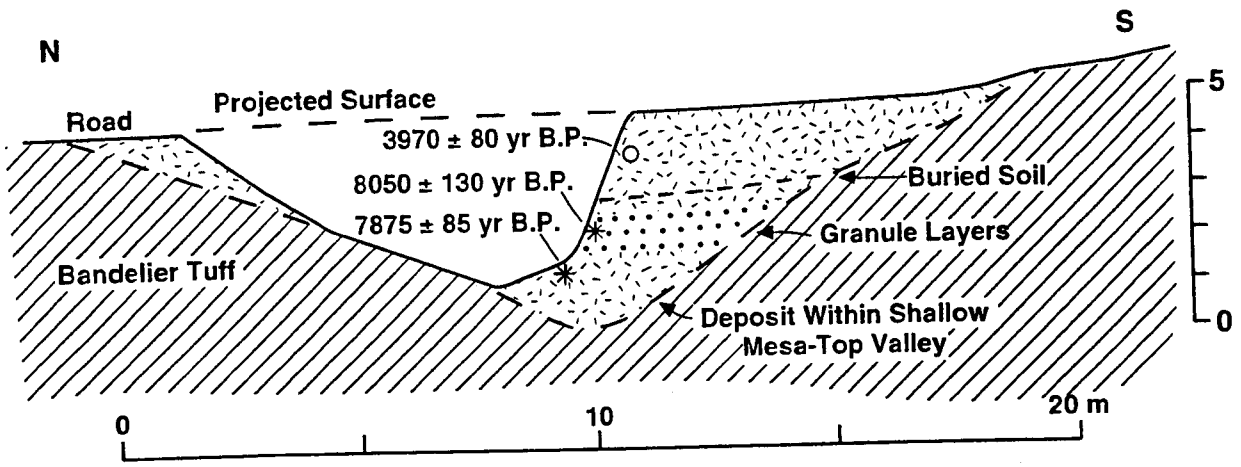



*Fig. 35. Cross section of EG&G Gully at soil sample site 2, showing stratigraphy of deposit within shallow mesa-top valley and location of radiocarbon dates. Uppermost radiocarbon date was obtained 40 m to west.*

intermittent stream flow. Radiocarbon dates obtained from detrital charcoal collected from both the upper and lower parts of the lower unit at the background-soil sample site are indistinguishable at ~7.9 to 8.0 ka (8.7 cal ka; Tables 9 and 10). These dated samples were separated by 1 m, and their similarity suggests that deposition of this lower unit was very rapid. The upper unit consists of unstratified silts and sands that were probably deposited by shallow overland flow. A radiocarbon date of ~4.0 ka (4.4 cal ka, Table 9) was obtained from a burn layer sample taken within this unit to the west of the soil sample site. These dated samples indicate that the buried soil separating the units probably formed during a period of 4300 years or less (between 8.7 and 4.4 cal ka) and that the uppermost soil also formed over a period of 4400 years or less (post-4.4 cal ka). The dates also suggest that significant erosion of mesa-top soils occurred in this area before the arrival of homesteaders and Anasazi Indians and it was presumably induced by local or regional climatic events.

## Soil Description

Soil samples collected at the EG&G site are listed in Table 5. Soil at this site consists of the following horizons with associated depths and thicknesses: A (0 to 15 cm), Bw (15 to 42 cm), Bt (42 to 70 cm), CB (70 to 133 cm), C (133 to 186 cm), Bwb (186 to 300 cm), and CBb (300+ cm) (Watt and McFadden, 1992). Clay-size material in this soil profile varies from 4.1 to 14.6 wt%. Sand-size material varies from 20.4 to 65.6 wt%, indicating that this soil profile may have a moderate range of hydraulic conductivities (Table 6; K values range from $10^{-5}$ to $10^{-2}$ cm/s). Silt-size material ranges from 22.8 to 70.1 wt% at this soil site. Solid organic carbon values range from 0.2 to 0.3 wt%, and the highest value is associated with the Bw horizon.

## Soil Chemistry

A neutral pH value (7.0) in this soil profile is associated with the A horizon, whereas the most alkaline pH value (8.0) is associated with the Bwb horizon (Watt and McFadden, 1992). The horizons underlying

the A horizon are more alkaline, indicating that the minor amounts of $CaCO_3$ provide some buffering capacity. Calcium carbonate concentrations are relatively low within the soil horizons at this site; they vary from 0.7 to 1.6 wt% (Watt and McFadden, 1992).

Element chemistry for soils collected at this site are provided in Appendix A (INAA and DNAA) and Appendix B (EPA SW846 methods). Total Fe concentrations range from 1.80 to 2.20 wt% (Fig. 36). Acid-digested Fe concentrations range from 0.5 to 1.5 wt% and make up 30 to 68% of total Fe. These concentration distributions suggest that Fe occurs both in refractory phases such as hornblende, magnetite, and biotite and in $HNO_3$-digested Fe phases, including iron oxides. Adsorption processes may control trace-element enrichment to some extent in this weakly developed soil profile because the B horizons contain clay-size material that consists of framework silicates, clay minerals, iron oxides, organic matter, and glass.

This weakly developed soil is also low in most trace elements, except Th and U (see Appendices A and B). Distributions of Th and U *vs* depth are shown in Figs. 37 and 38, respectively. Thorium is highest in the Bt and Bwb horizons, whereas U is highest in the CBb horizon. Total Th and U concentrations fluctuate in depth; however, there are larger differences between total element and the acid-digested concentrations for U than for Th. Acid-digested Th and U make up 37 to 49 wt% and 11 to 24 wt% of total-element distributions, respectively. Acid-digested Th is associated with the silt-size fraction (Fig. 37), which mainly consists of primary silicates. A general association between percent of sand-size particle and percent

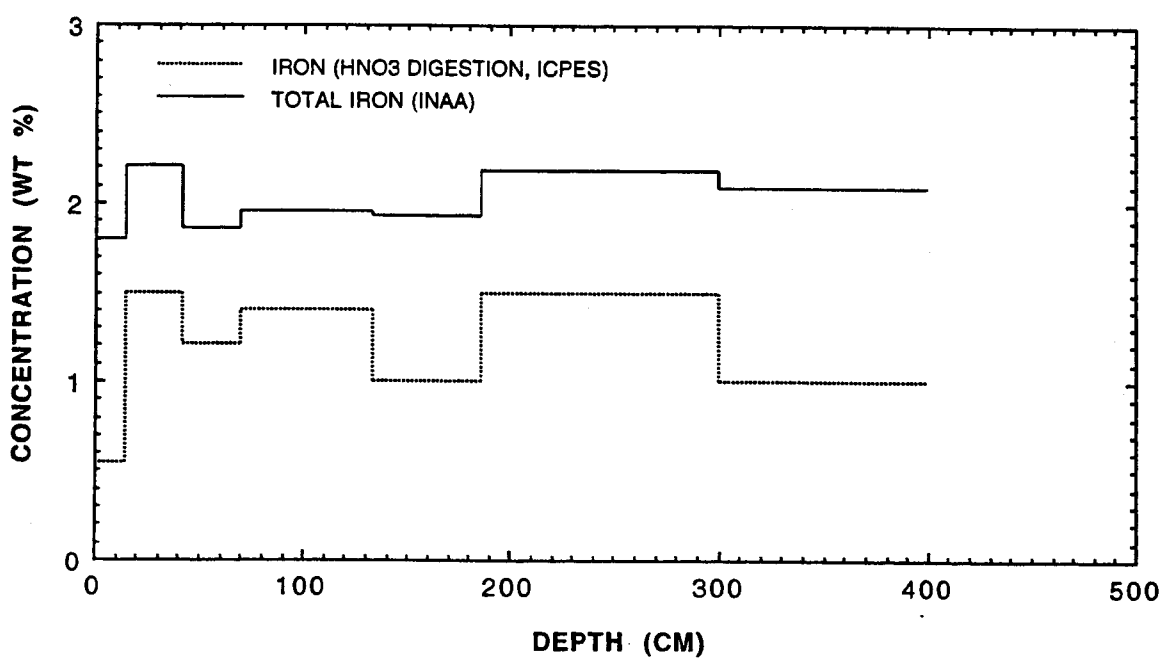



***Fig. 36. Iron concentration vs depth in background soil; site 2, EG&G Gully.***

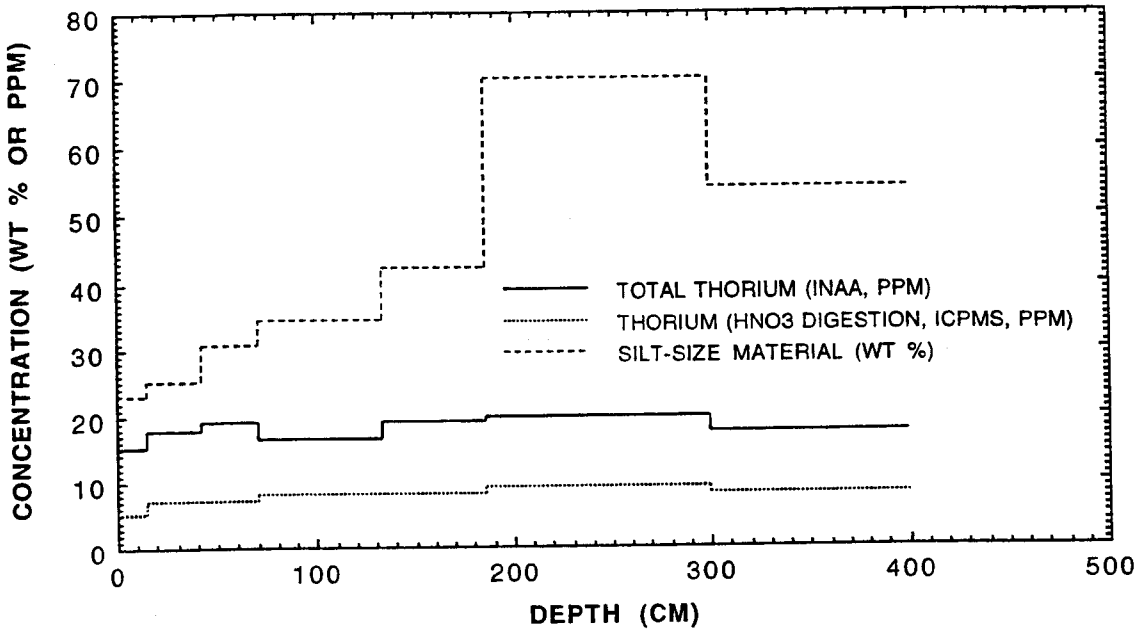



***Fig. 37. Thorium concentration and silt-size material vs depth in background soil; site 2, EG&G Gully.***

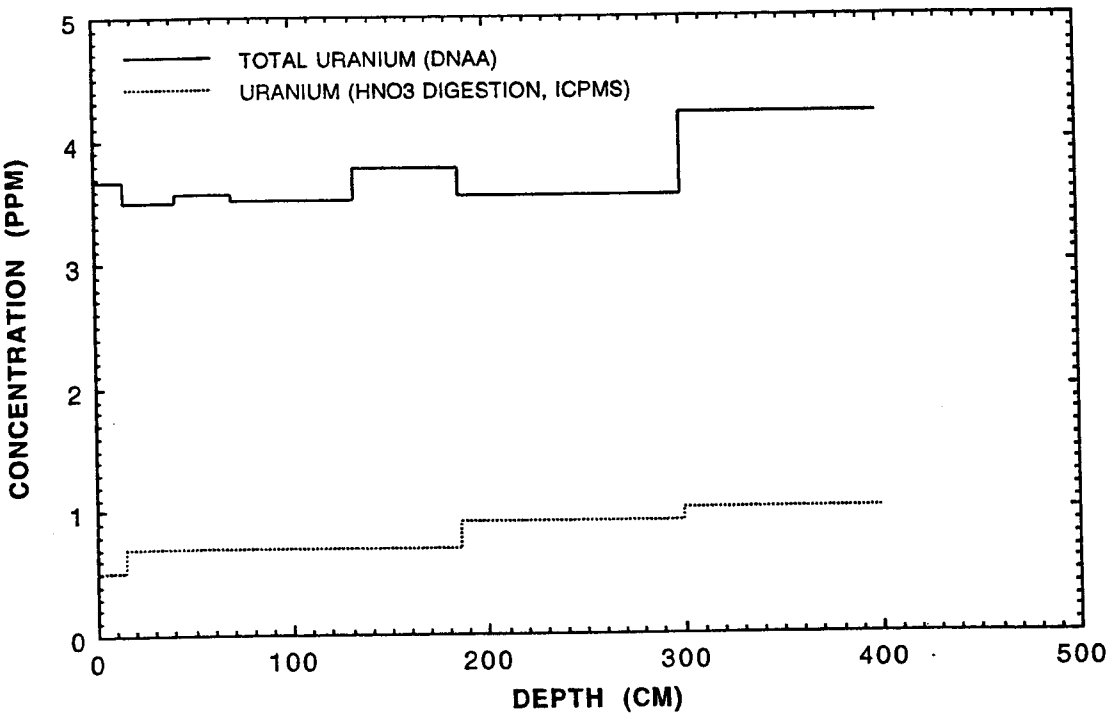



***Fig. 38. Uranium concentration vs depth in background soil; site 2, EG&G Gully.***

of $CaCO_3$ and U is present (Fig. 39). Surface complexation of U onto $CaCO_3$, however, is not likely at this site because $HNO_3$–digested U does not strongly correlate with carbonate at this site (compare Figs. 38 and 39). Uranium is dominantly concentrated within matrices of primary silicate phases (Broxton *et al.*, 1995), which are coated by $CaCO_3$. This suggests that U adsorption onto clay minerals and iron oxides is minimal at this stage of soil development. Adsorption processes involving U, however, may become more important as chemical weathering proceeds.

Figure 40 shows distributions of clay-size material, As, Be, and Fe ($HNO_3$- digested samples) versus depth. These elements show a strong association with clay-size material suggesting that adsorption of As and Be onto iron oxides and/or clay minerals may partially control trace-element enrichment at this site. Total Be concentrations range from 2.4 to 3.4 ppm, whereas acid-digested Be concentrations range from 0.7 to 1.3 ppm (Fig. 41). Acid-digested Be comprises 29 to 46% of the total Be, which suggests that Be is distributed both within primary silicate phases and secondary soil minerals. Distributions of acid-digested As and total As were not calculated, because As concentrations in some of the acid-digested samples exceed the total element concentration and analytical error in the INAA data is suspected.

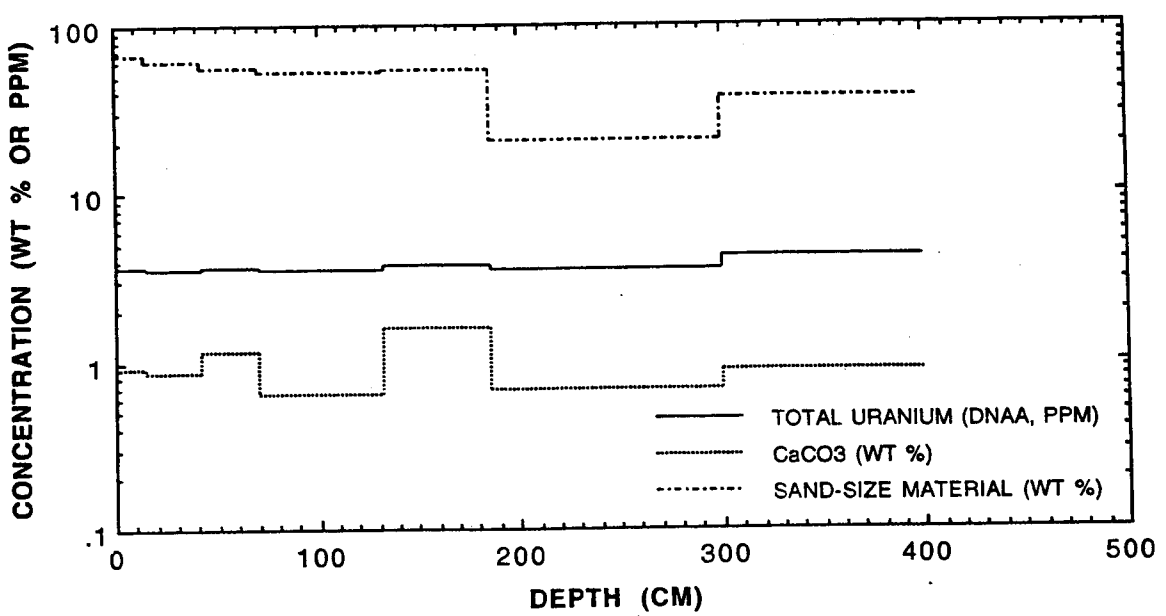



*Fig. 39. Uranium and $CaCO_3$ concentrations and sand-size material vs depth in background soil; site 2, EG&G Gully.*

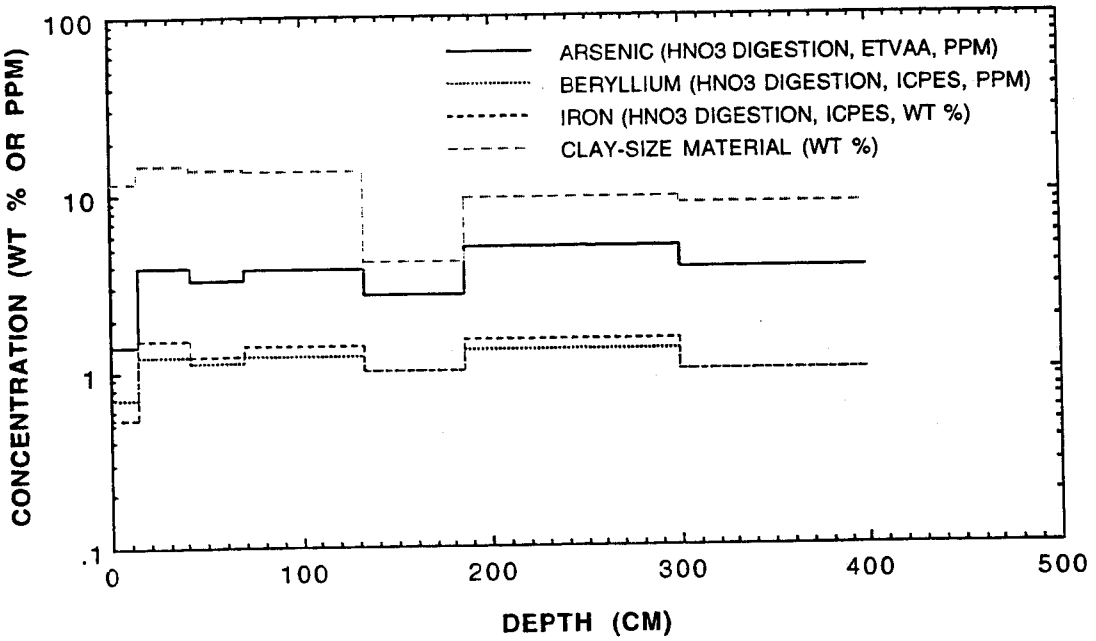



***Fig. 40. Arsenic, Be, and Fe concentrations and clay-size material vs depth in background soil; site 2, EG&G Gully.***

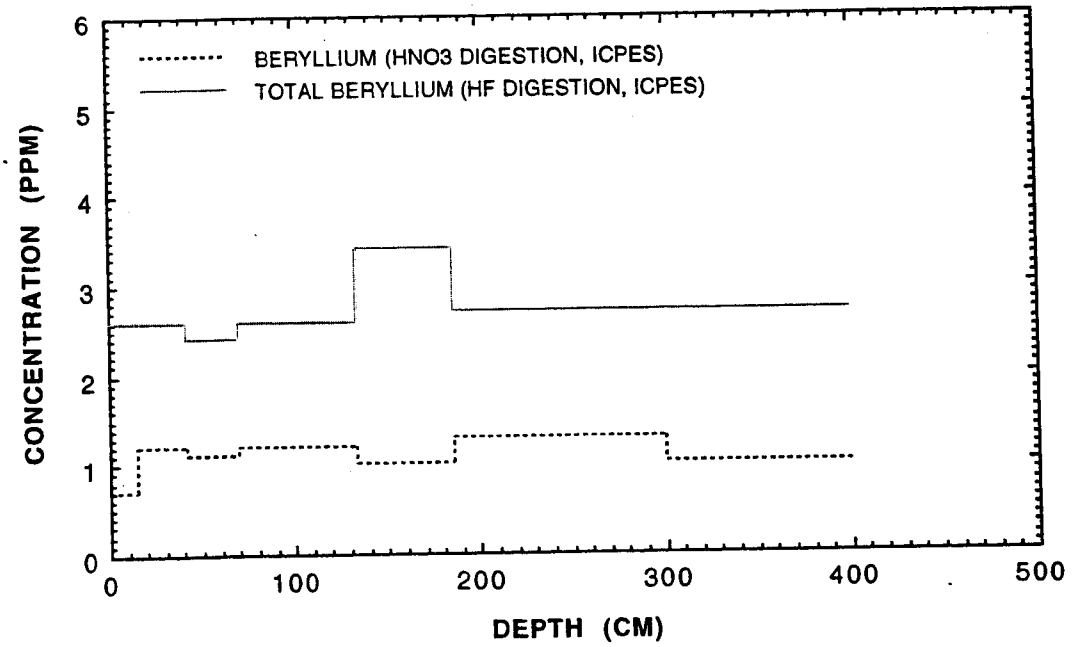



***Fig. 41. Beryllium concentration vs depth in background soil; Site 2, EG&G Gully.***

## Site 3—Upper Los Alamos Canyon, Los Alamos Reservoir Road

### Location and Geomorphic Setting

The soil sampling site in upper Los Alamos Canyon is a road-cut exposure on the south side of the canyon, at the base of a steep, forested, north-facing slope mantled with colluvium (Figs. 42 and 43). The slope extends 55 vertical m (180 ft) above the sample site, and the colluvium probably includes Bandelier Tuff derived from several cooling units within the Tshirege Member. A series of discrete rocky colluvial layers is present, in part separated by buried soils, and the colluvium grades onto the canyon floor. The colluvium contains abundant angular clasts of tuff, and the buried soils indicate episodic deposition of colluvium at this site. The exposure also includes layers of well-sorted sand and silty sand, probably deposited from floods in Los Alamos Canyon. The sample site was mapped as part of the *Rock Outcrop-Colle-Painted Cave Complex* by Nyhan *et al.* (1978), and may be representative of many canyon-bottom locations in the western part of the Laboratory.

Two radiocarbon dates were obtained for detrital charcoal collected from two of the colluvial units: 2.2 and 3.1 ka from depths of 0.85 and 1.35 m, respectively (Fig. 44; Table 9). These dates indicate that the uppermost organic-rich soil developed within a period of less than 2000 years and suggest that at this location the canyon floor has been near its present level for at least several thousand years, as also is indicated in lower Los Alamos Canyon.

### Soil Description

Soil samples collected from the upper Alamos Canyon site are listed in Table 5. Soil forming at this site is within a backslope-to-footslope transition zone that contains thick vegetation (Watt and McFadden, 1992). This soil is cumulic and is characterized by organic-rich horizons dominated by humic substances (humic and fulvic acids). The soil profile exposed at this site consists of the following horizons with associated depths and thicknesses: A1 (0 to 6 cm), A2 (6 to 47 cm), BA (47 to 60 cm), Bw (60 to 82 cm), BAb (82 to 84 cm), Bwb (84 to 108 cm), C (108 to 162 cm), and Ab2 (162+ cm) (Watt and McFadden, 1992). The poorly developed BA horizon probably has developed from oxidation or leaching of the cumulic A horizon. Most of the parent material for this soil is colluvial, and many large Bandelier Tuff clasts are present within most of the horizons.

This soil profile contains moderate clay concentrations with an abundance of clay-size material that varies from 7.9 to 18.3 wt% (Watt and McFadden, 1992). Sand-size material varies from 32.2 to 59.0 wt%, indicating that this soil profile may have a moderate range of hydraulic conductivities (Table 6; K values ranging from $10^{-4}$ to 10 cm/s). Silt-size material ranges from 35.3 to 50.1 wt%. Solid organic carbon values range from 0.2 to 2.8 wt%, and the highest value is associated with the A2 horizon. This soil is very high in solid organic carbon compared to other soil profiles characterized in this study as a result of the thick forest cover and the north-facing slope.

## Soil Chemistry

This soil is partially characterized by neutral to near-neutral pH values of 7.0 to 7.7, with pH increasing with depth. The lowest pH value in this soil profile is associated with the A1 horizon, and the highest pH value is associated with the Cb horizon (Watt and McFadden, 1992). Calcium carbonate abundances are relatively low at this site, varying from 0.3 to 3.4 wt% (Watt and McFadden, 1992).

Element chemistry for soils collected at this site are provided in Appendix A (INAA and DNAA) and Appendix B (EPA SW846 methods). Total Fe concentrations range from 1.2 to 1.6 wt% (Fig. 45). The acid-digested fraction of Fe is enriched in the A2 and BA2 horizons.

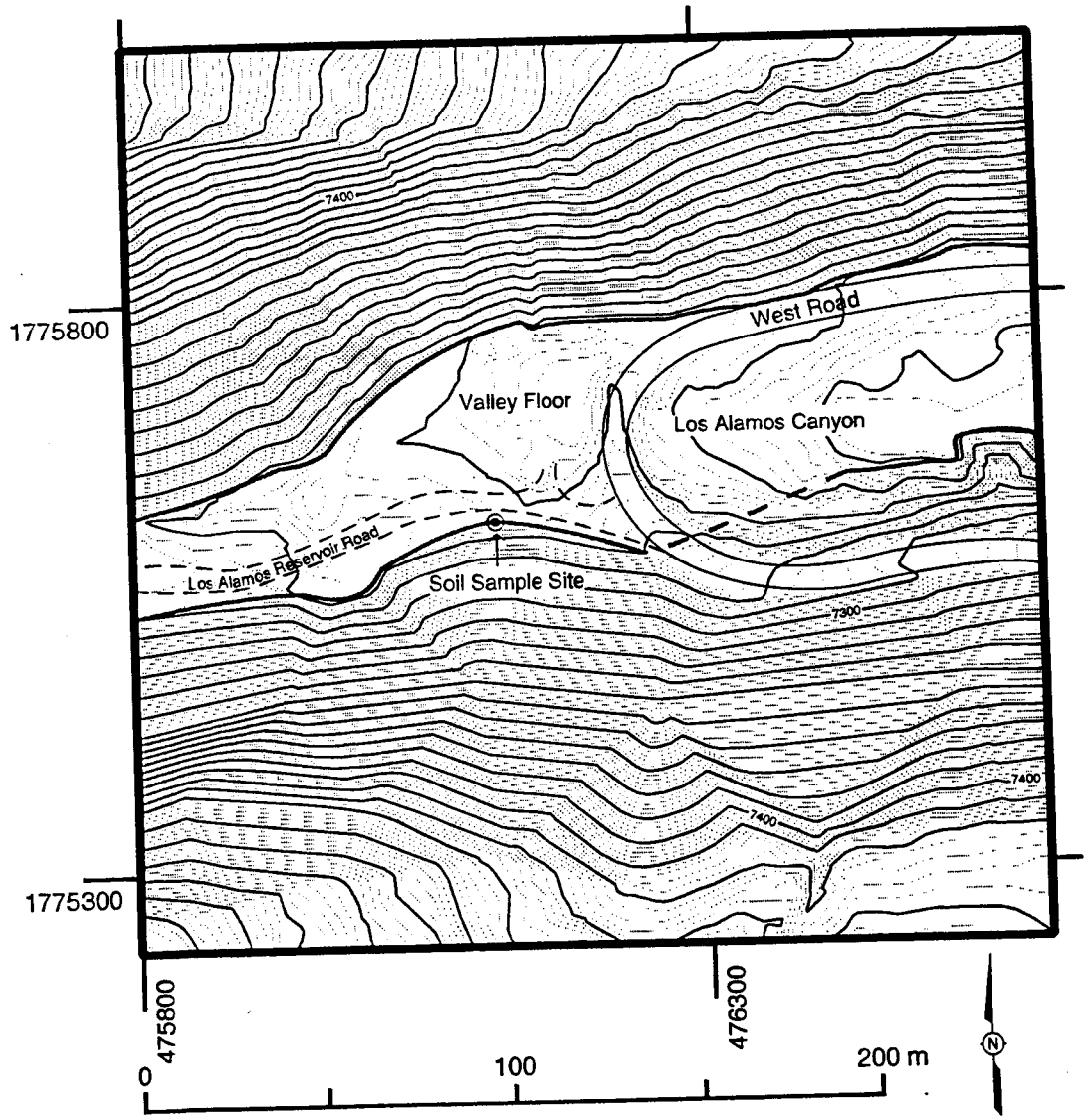



*Fig. 42. Map of soil sample site 3 in upper Los Alamos Canyon; topographic base, with 2-ft contours, from FIMAD.*

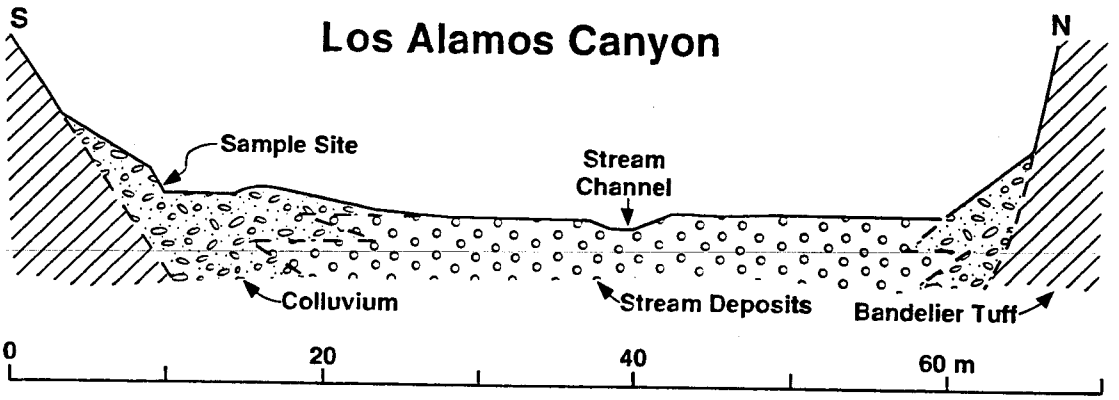



***Fig. 43. Cross section of upper Los Alamos Canyon at soil sample site 3, showing colluvium at base of steep slopes interfingering with stream deposits.***

Acid-digested Fe concentrations range from 0.6 to 1.1 wt%, making up 41 to 79% of total Fe. These concentration distributions suggest that Fe occurs both in refractory phases such as hornblende, magnetite, and biotite and in $HNO_3$–digested Fe phases, including ferric oxyhydroxide, amorphous ferric hydroxide, and ferrihydrite associated with solid organic carbon. Adsorption processes involving iron oxides and clay minerals may control trace-element distributions in this organic-rich soil profile.

Distribution of elemental Th *vs* depth is shown in Fig. 46; total Th concentrations range from 12.2 to 14.0 ppm. Concentrations of acid-digested Th range from 4.0 to 5.0 ppm and make up 37 to 49% of total Th at this soil profile. Thorium generally is associated in part with the silt-size fraction (Fig. 46), which mainly consists of primary silicates.

Distributions of total U, acid-digested U, and solid organic carbon fluctuate with depth (Fig. 47). Total U is highest in the A1 and Ab2 horizons in this soil profile. Total concentrations of U range from 3.7 to 4.3 ppm and $HNO_3$–digested U concentrations range from 0.3 to 2.4 ppm. Acid-digested U makes up 17 to 56% of total U (Fig. 47). Nitric acid-digested U correlates well with the clay-size fraction and, to a lesser extent, with the silt-size fraction (Fig. 48). Within the A horizons at this site, uranyl species may undergo ligand exchange reactions with humic acids (HA), consisting predominantly of carboxylic acids (COOH), as shown by the following:

$$UO_2^{2+} + HACOOH^0 = HACOOUO_2^{+} + H^+ \qquad (4)$$

($\text{Log } \beta_1 = 4.11 \pm 0.02$) and (Shanbhag and Choppin, 1981)

$$HACOOH^0 + HACOOUO_2^+ = (HACOO)_2UO_2^0 + H^+. \quad (5)$$

($\text{Log } \beta_2 = 8.94 \pm 0.03$)
(Shanbhag and Choppin, 1981)

However, judging by distributions of total and $HNO_3$-digested U (Fig. 48), most of the U probably is concentrated in primary silicate phases, including glass.

Figure 49 shows distributions of As, Be, and Fe *vs* depth. These elements are strongly associated with each other, suggesting that adsorption of As and Be onto surfaces of iron oxide and/or clay minerals controls distributions of trace elements at this site. Arsenic, Be, and Fe are enriched within the A2, BAb, and Ab2 horizons (Fig. 49). Total Be concentrations range from 1.8 to 2.4 ppm, and $HNO_3$–digested Be concentrations range from 0.4 to 0.8 ppm (Fig. 50). Acid-digested Be makes up 28 to 44% of total Be, which suggests that most of the Be is distributed within primary phases and some is associated with secondary soil minerals. Figure 51 shows distributions of $HNO_3$–digested As, total As, and $HNO_3$–digested Fe *vs* depth. Total As concentrations range from 2.0 to 4 ppm, and $HNO_3$–digested As concentrations range from 1.0 to 2.5 ppm (Fig. 51). The acid-digested fraction of As makes up 45 to 81% of total As.

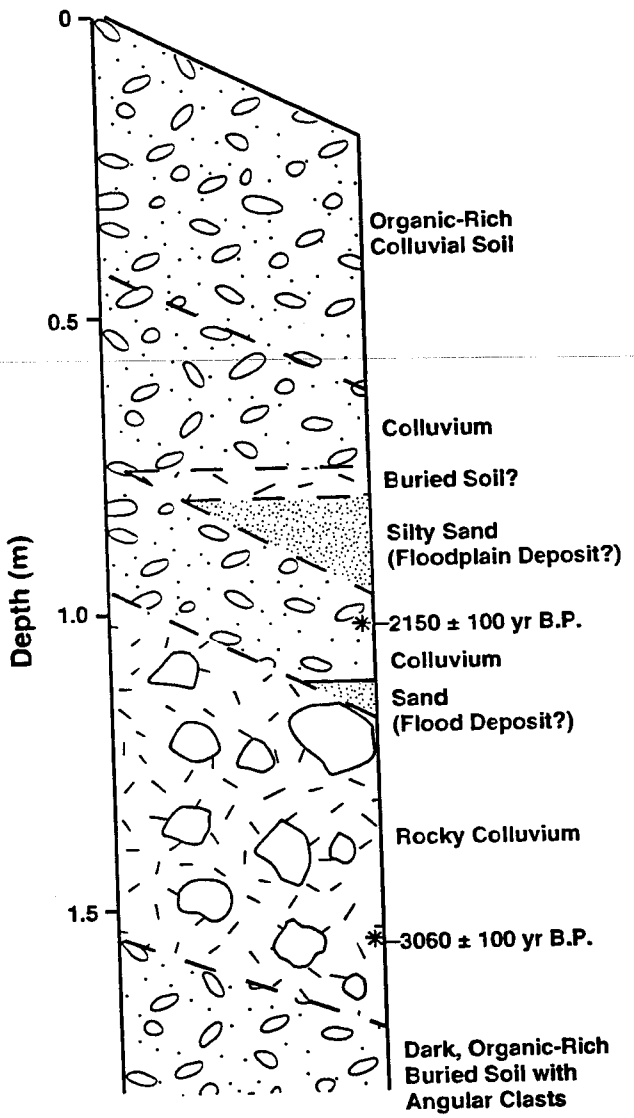



***Fig. 44. Simplified stratigraphy exposed in roadcut at radiocarbon sample site in upper Los Alamos Canyon; soil samples were collected 1 m to east.***

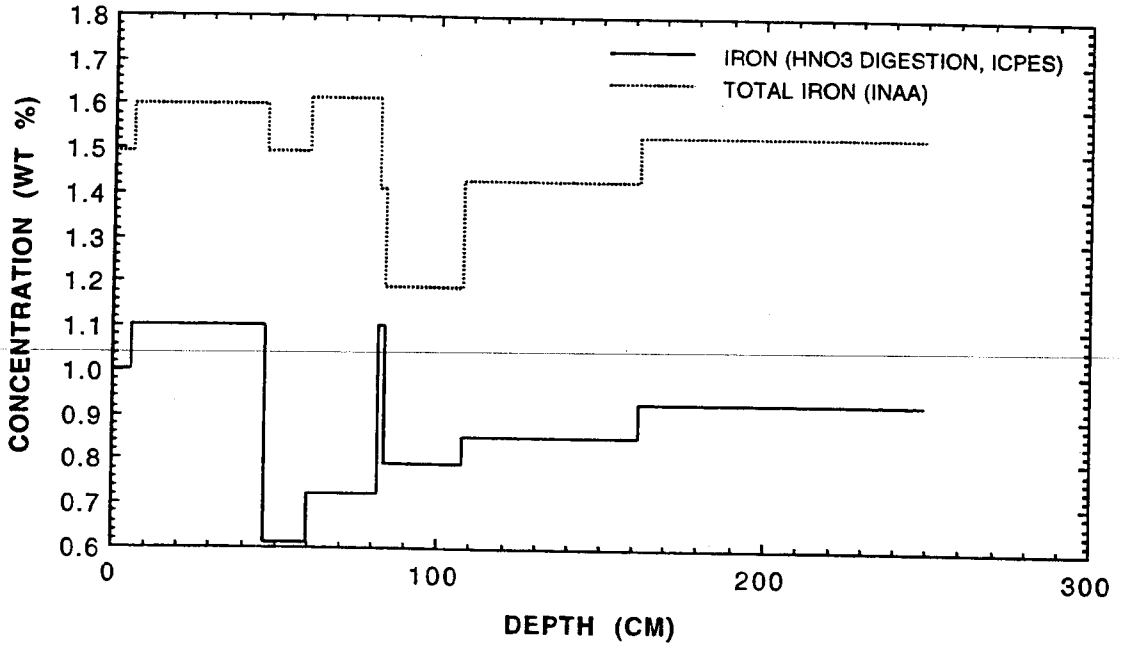



***Fig. 45.** Iron concentration vs depth in background soil; site 3, upper Los Alamos Canyon.*

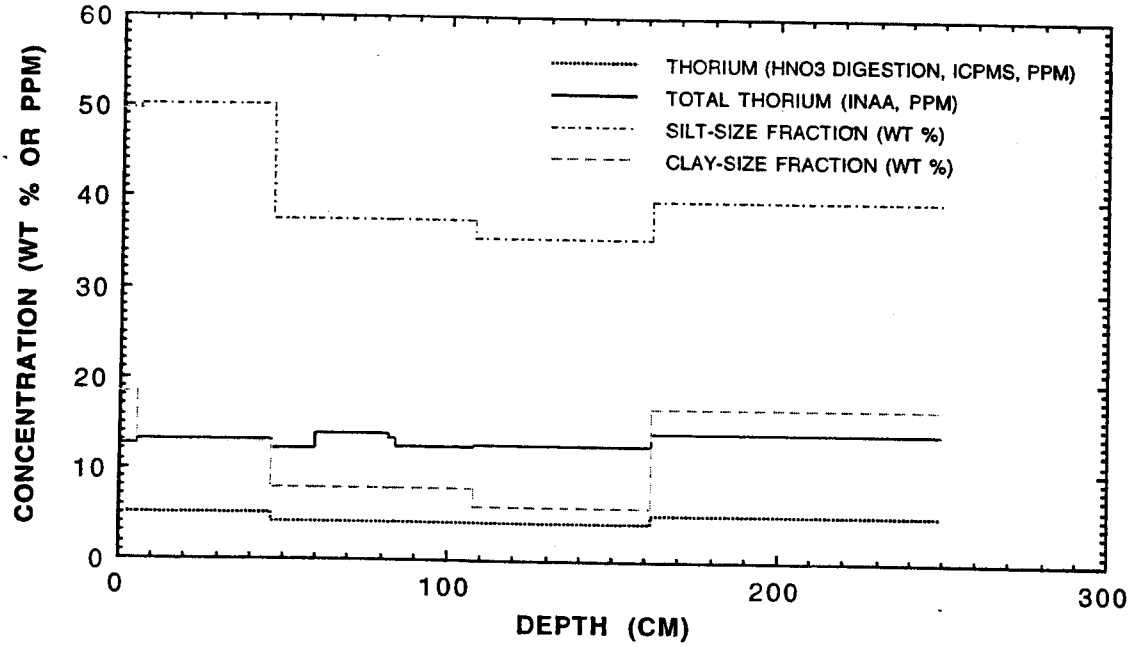



***Fig. 46.** Thorium concentration and silt-size and clay-size material vs depth in background soil; site 2, upper Los Alamos Canyon.*

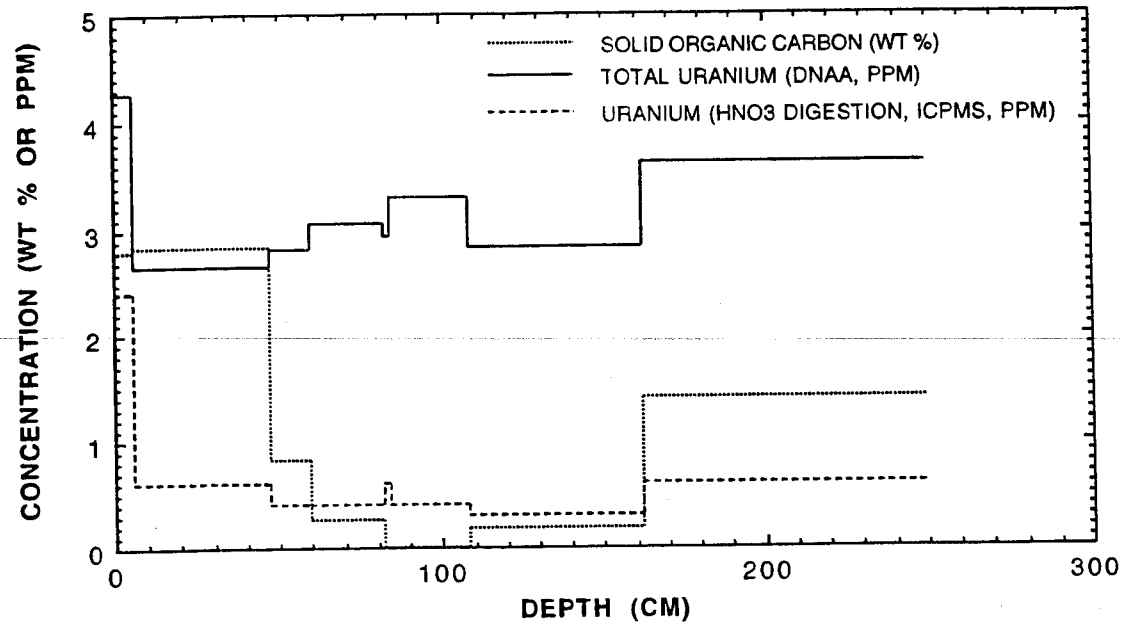



*Fig. 47. Solid organic carbon and uranium concentration vs depth in background soil; site 3, upper Los Alamos Canyon.*

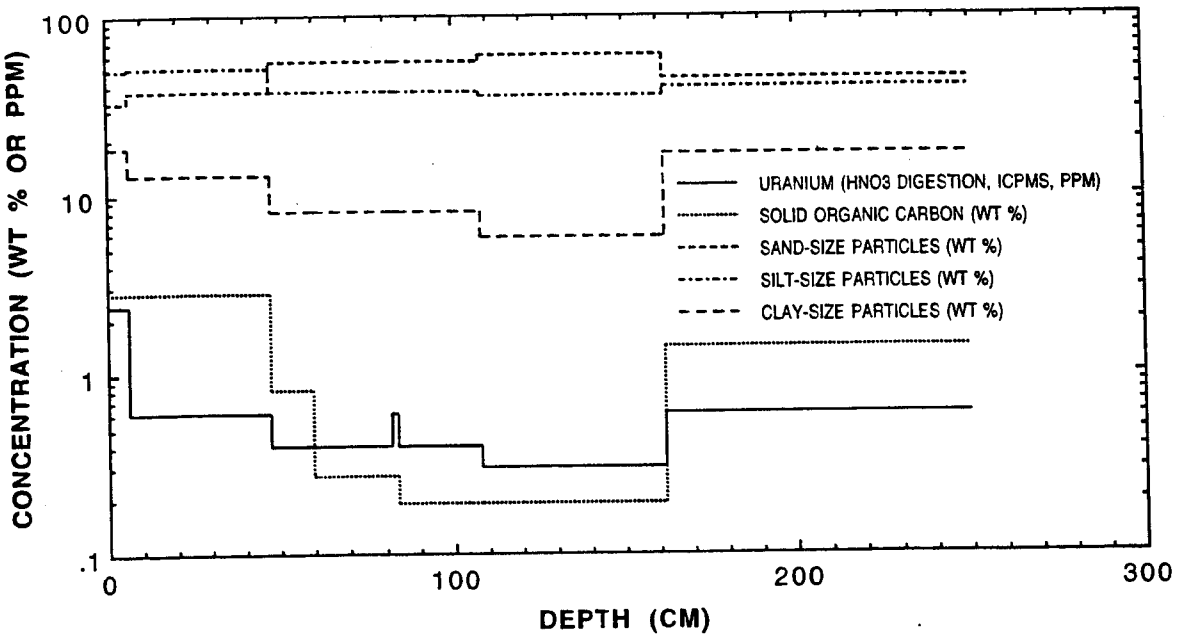



*Fig. 48. Uranium concentration, solid organic carbon, and sand-, silt-, and clay-size materials vs depth in background soil; site 3, upper Los Alamos Canyon.*

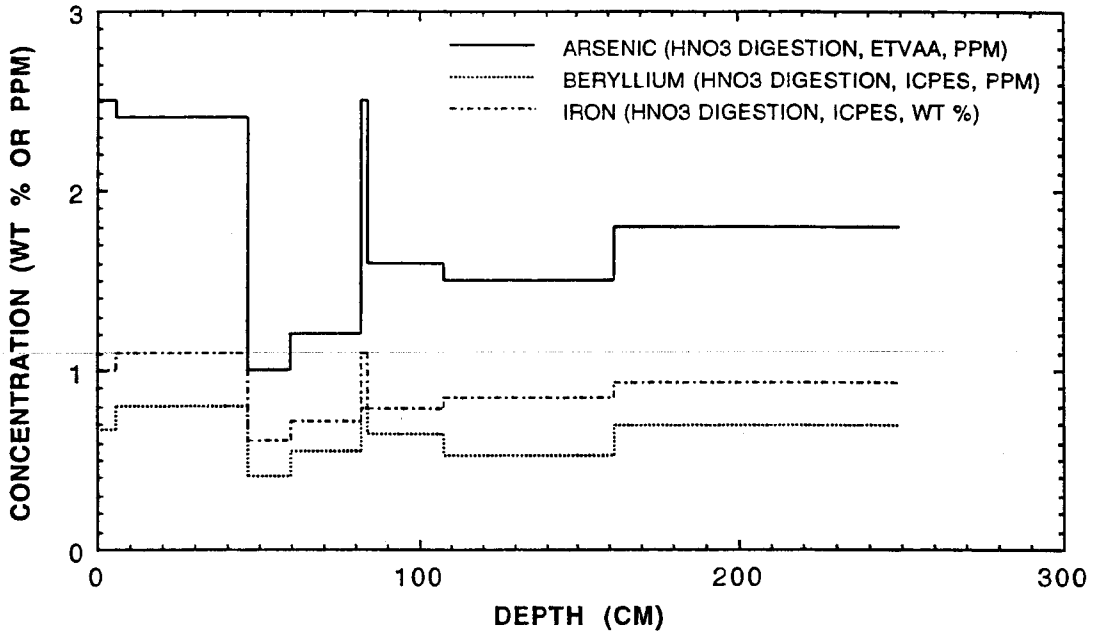



*Fig. 49. Arsenic, Be, and Fe concentrations vs depth in background soil; site 3, upper Los Alamos Canyon.*

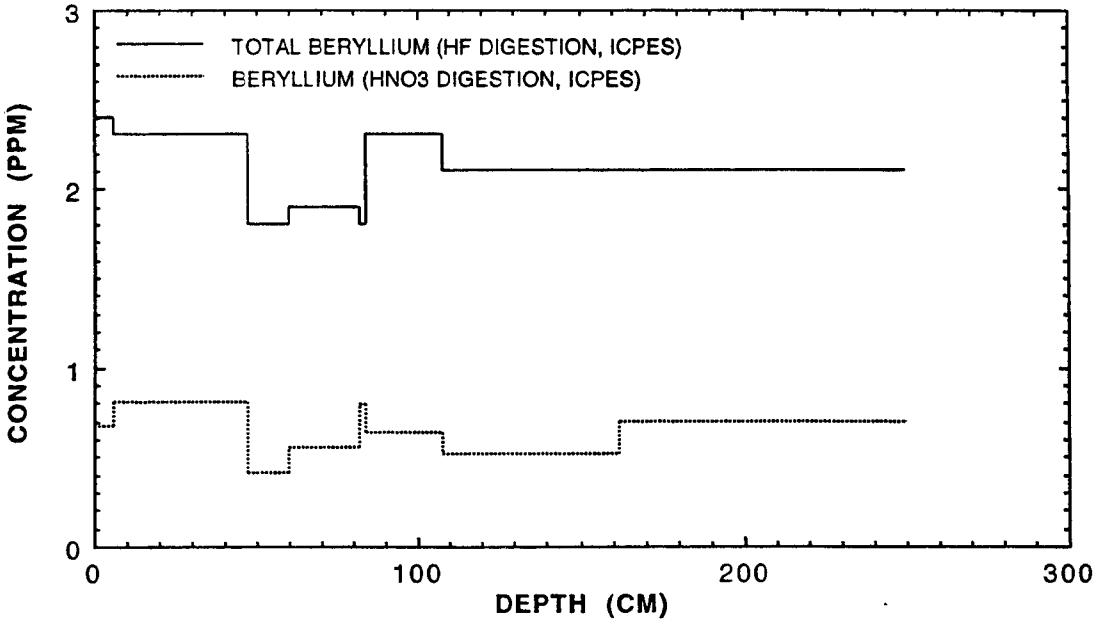



*Fig. 50. Beryllium concentration vs depth in background soil; site 3, upper Los Alamos Canyon.*

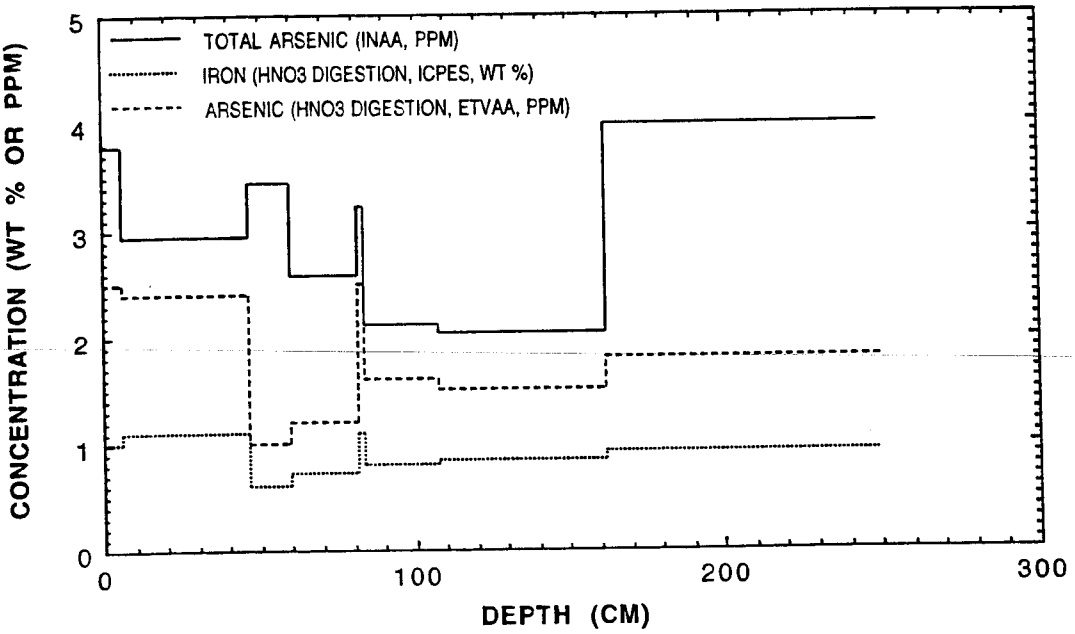



*Fig. 51. Arsenic and Fe concentrations vs depth in background soil; site 3, upper Los Alamos Canyon.*

## SITE 4—TWOMILE MESA, TA-69

### Location and Geomorphic Setting

The soil sampling site is on a mesa top near Twomile Canyon, in a 1-m-deep trench that was excavated by EES-15 for field studies of runoff and infiltration (Fig. 52). The trench exposed a soil, up to 0.9 m thick, that overlies Unit 4 of the Tshirege Member of the Bandelier Tuff. Within the soil, scattered stream-rounded cobbles of Tschicoma dacite record the presence of a stream flowing across Twomile Mesa. Deposits of similar old alluvial gravels are widespread on this mesa (Fig. 52). These gravels were deposited by a stream that drained the Sierra de los Valles at this location before the major canyons were cut—perhaps as part of a broad alluvial fan. Twomile Canyon has since incised 18 m (60 ft) below the mesa. The age of these gravels is not known, but they presumably date from early in the post-1.2-Ma history of the Pajarito Plateau. These sediments also suggest that little net erosion of bedrock has occurred at this mesa-top location since before the canyons incised into the tuff. The sample site was mapped as *Typic Eutroboralfs* by Nyhan *et al.* (1978).

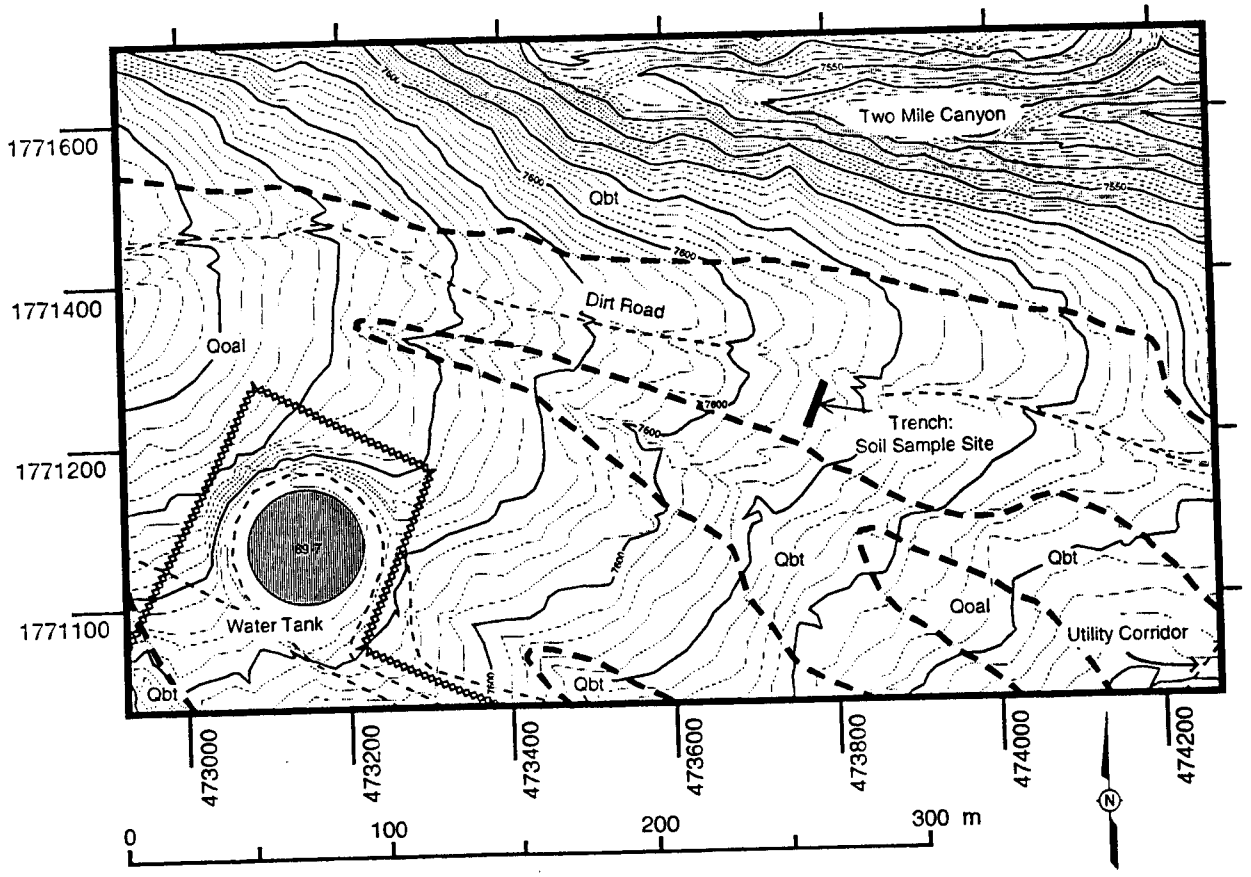



*Fig. 52. Map showing sample site 4 on Twomile Mesa and distribution of mesa-top alluvial gravels (Qoal) overlying Tshirege Member of the Bandelier Tuff (Qbt); topographic base, with 2-ft contours, from FIMAD.*

The well-developed soils found here may be similar to soils developed on old alluvial deposits elsewhere on the western part of the Pajarito Plateau.

## Soil Description

Soil samples collected from the Twomile Mesa site are listed in Table 5. Two soil profiles were described in a single trench at this site because the soil exhibited considerable variation in degree of development, color, texture, and horizon thickness from one end of the trench to the other (Watt and McFadden, 1992). Soil at the north end of the trench is more developed than soil at the south end. Near the middle of the trench, the soil is thinner and an A horizon overlies a bedrock high. This A horizon is present along the entire length of the trench, forming a calcareous loess cap (Watt and McFadden, 1992). This loess cap may represent eolian material deposited after the end of the last glaciation (late Wisconsian). Fractures, common at this site, are lined with calcite and filled with organic matter mixed with reddish clay minerals. Some of the calcite-fracture lining may be of loess origin: water may have transported this material from the land surface downward into fractures. Alternatively, calcite may have precipitated *in situ* in response to evaporation of pore water within the clay-rich fractures. This phenomenon is observed at TA-54, as described in detail by Davenport (1993). Laboratory optical petrography studies suggest that the clay filling has been translocated from overlying B horizons to depths of 70 cm or more (Watt and McFadden, 1992). Soil formed at this site developed in part on alluvium that overlies the Bandelier Tuff.

The soil profile exposed in the north end of the trench consists of the following horizons with associated depths and thicknesses: A (0 to 14 cm), Bw (14 to 19 cm), 2Bt1b (19 to 50 cm), 2Bt2b (50 to 64 cm), 2Bt3b (64 to 75 cm), and R (75+ cm) (Watt and McFadden, 1992). This soil profile contains a moderately high clay content, and clay-size material varies from 7.6 to 52.8 wt%. Sand-size material varies from 21.6 to 37.8 wt%, indicating that this soil profile at the north end of the trench may have a relatively low hydraulic conductivity (Table 6; K values range from $10^{-6}$ to 10 cm/s), although both open and filled fractures are present. Silt-size material ranges from 25.0 to 63.3 wt%. Solid organic carbon values range from 0.2 to 1.2 wt%, and the highest value is associated with the A horizon.

Soil exposed in the south end of the trench consists of the following horizons with associated depths and thicknesses: A (0 to 9 cm), Bw (9 to 20 cm), 2Bt1b (20 to 30 cm), 2Bt2b (30 to 43 cm), CBt (43 to 58 cm), and R (70+ cm) (Watt and McFadden, 1992). This soil profile contains a moderate clay content with clay-size material that varies from 8.2 to 34.2 wt%. Sand-size material varies from 17.5 to 29.2 wt%, indicating that this soil profile at the south end of the trench has a higher hydraulic conductivity than the soil profile at the north end of the trench. Silt-size material ranges from 48.3 to 63.7 wt%. Solid organic carbon values range from 0.2 to 1.0 wt%, and the highest value is associated with the A horizon.

## Soil Chemistry

The well-developed soil investigated at the Twomile Mesa site has formed from chemical leaching and precipitation and

remobilization of clay minerals, calcium carbonate, and iron oxides. This soil is much more developed than the soils at background sites 1, 2, and 3. Soil samples collected from the north end of the trench are characterized by acidic to near-neutral pH values (ranging from 5.1 to 7.4), which increase with depth. The lowest pH value measured in the north soil profile is associated with an O horizon, whereas the highest pH value is associated with a 2Bt3b horizon (Watt and McFadden, 1992). Calcium carbonate concentrations vary from 0.4 to 1.0 wt% at the north end of the trench (Watt and McFadden, 1992).

Soil samples collected from the south end of the trench are characterized by acidic pH values ranging from 5.6 to 6.4, varying with depth. The lowest pH value measured in the south soil profile is associated with an A horizon, whereas the highest pH value is associated with a 2Bt2b horizon (Watt and McFadden, 1992). Calcium carbonate abundances range from 0.1 to 1.0 wt% at the south end of the trench (Watt and McFadden, 1992).

Element chemistry for soils collected at this site is provided in Appendix A (INAA and DNAA) and Appendix B (EPA SW846 methods). Total Fe concentrations in soil at the north end of the trench range from 1.7 to 3.4 wt% (Fig. 53). Concentrations of acid-digested Fe range from 1.2 to 2.7 wt% and makes up 65 to 83% of the total Fe. Total Fe concentrations at the south end of the trench range from 1.8 to 3.2 wt% (Fig. 54). Concentrations of acid-digested Fe at the south end of the trench range from 0.9 to 2.2 wt%, making up 48 to 74% of total Fe. These concentration distributions show that, in some horizons, most of the Fe occurs in $HNO_3$–digested Fe phases, possibly including ferric oxyhydroxide and ferrihydrite. Some of the Fe also occurs in refractory phases such as magnetite, hornblende, and biotite. Adsorption processes may account for trace-element enrichment in this Fe-rich soil profile because of buried B horizons that are characterized by clay-size material consisting of framework silicates, solid organic carbon, clay minerals, iron oxides, and glass. In both profiles, Fe content is strongly correlated with clay content (Figs. 53 and 54).

Distribution of Th concentrations *vs* depth at the north end of the trench is shown in Fig. 55. Total Th concentrations range from 12.7 to 18.1 ppm and generally increase with depth. Concentrations of acid-digested Th range from 4 to 11 ppm and make up 23 to 61% of total Th at the north end of the trench. Total Th is correlated with the clay-size fraction (Fig. 55). Distribution of Th concentration *vs* depth at the south end of the trench is shown in Fig. 56, where total Th concentrations range from 13.31 to 14.62 ppm. Concentrations of Th vary with depth at the south end of the trench. Concentrations of acid-digested Th range from 6.0 to 9.0 ppm and make up 52 to 62% of total Th at the south end of the trench. Total Th is correlated with the clay-size fraction (Fig. 56), suggesting that adsorption of Th onto clay minerals and iron oxides is an important enrichment process that occurs at this site.

Distributions of total U, acid-digested U, and solid organic carbon *vs depth* at the north and south ends of the trench are shown in Figs. 57 and 58, respectively. Some of the U present in the Twomile Mesa soil has been leached from primary phase(s) and redistributed in secondary soil phases. Uranium distributions vary with depth at this soil site.

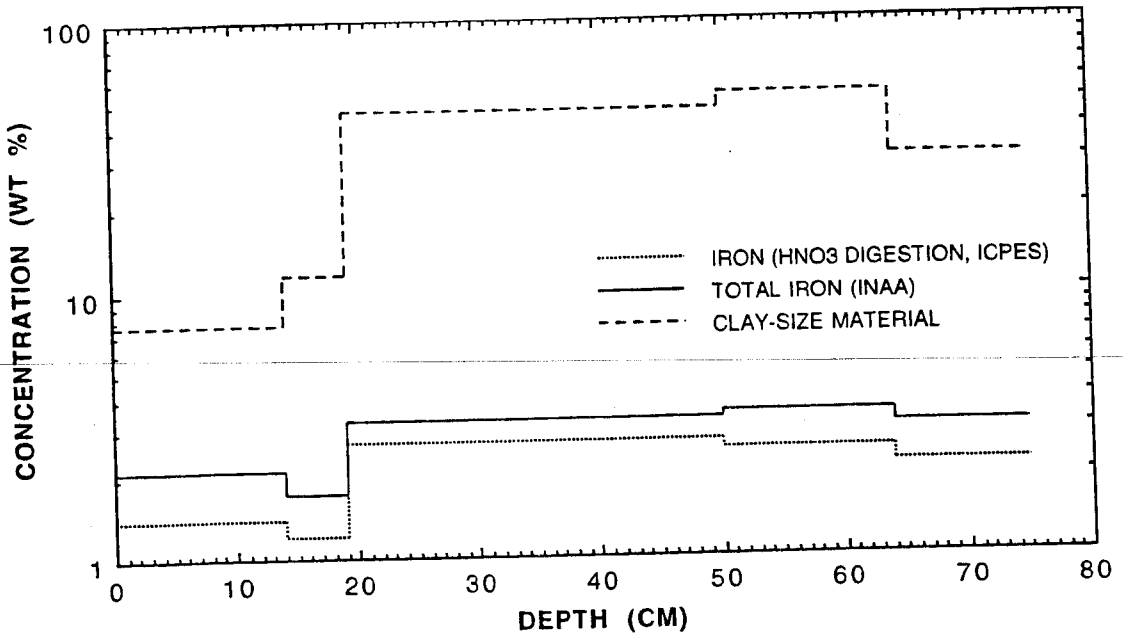



*Fig. 53. Iron concentration and clay-size material vs depth in background soil; site 4, Twomile Mesa-North.*

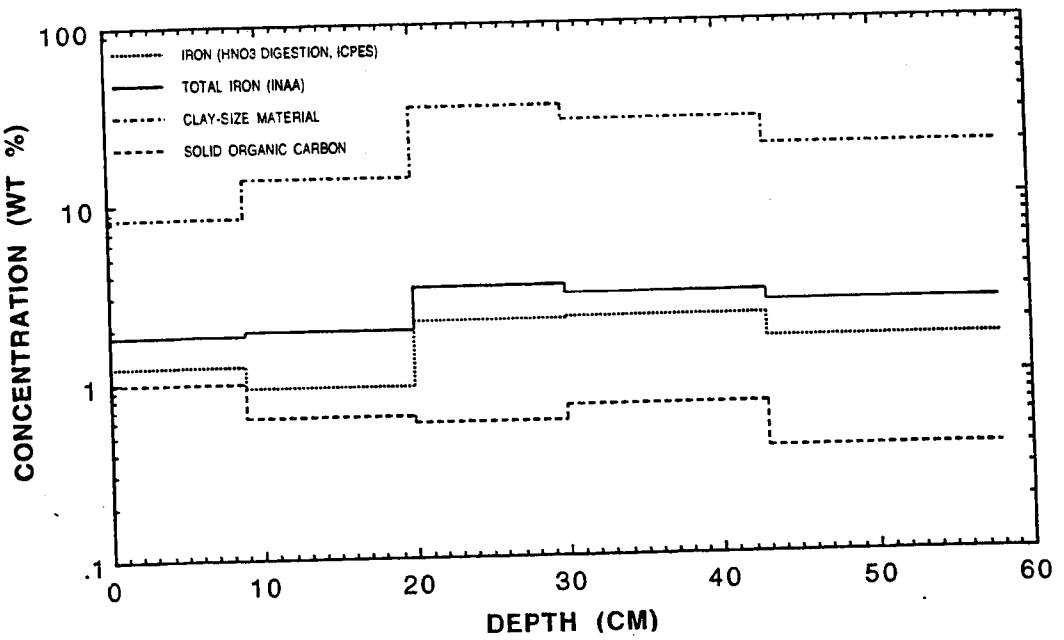



*Fig. 54. Iron concentration, clay-size material, and solid organic carbon vs depth in background soil; site 4, Twomile Mesa-South.*

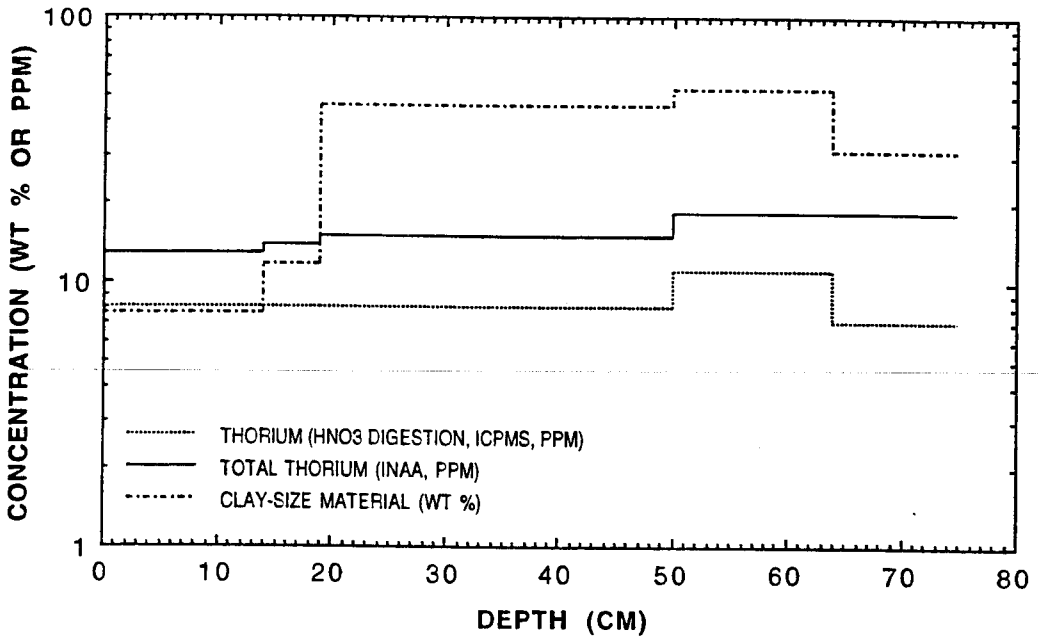



*Fig. 55. Thorium concentration and clay-size material vs depth in background soil; site 4, Twomile Mesa-North.*

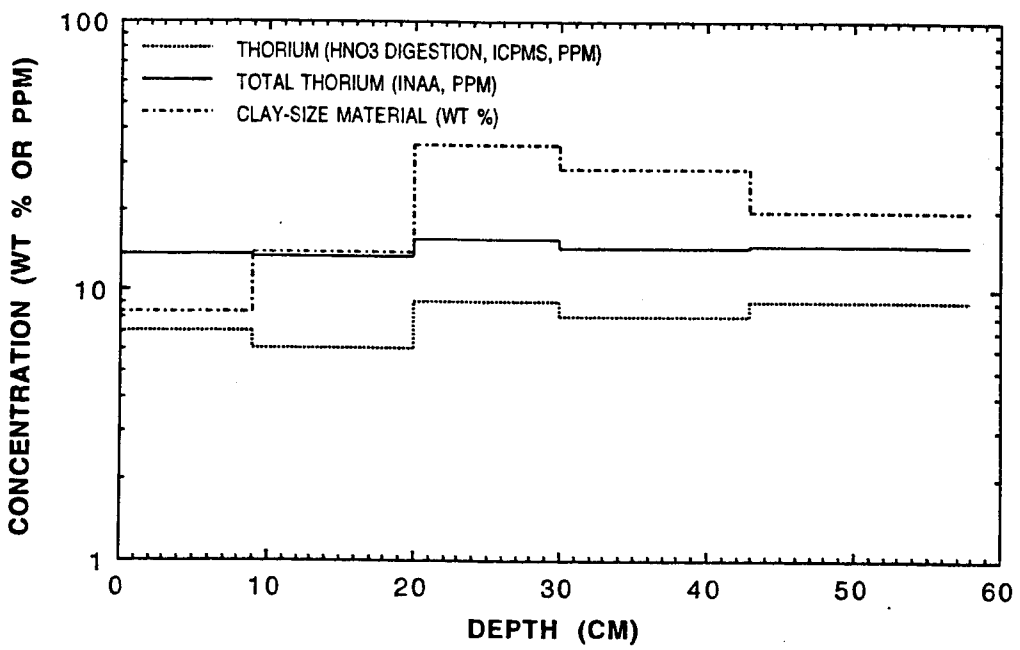



*Fig. 56. Thorium concentration and clay-size material vs depth in background soil; site 4, Twomile Mesa-South.*

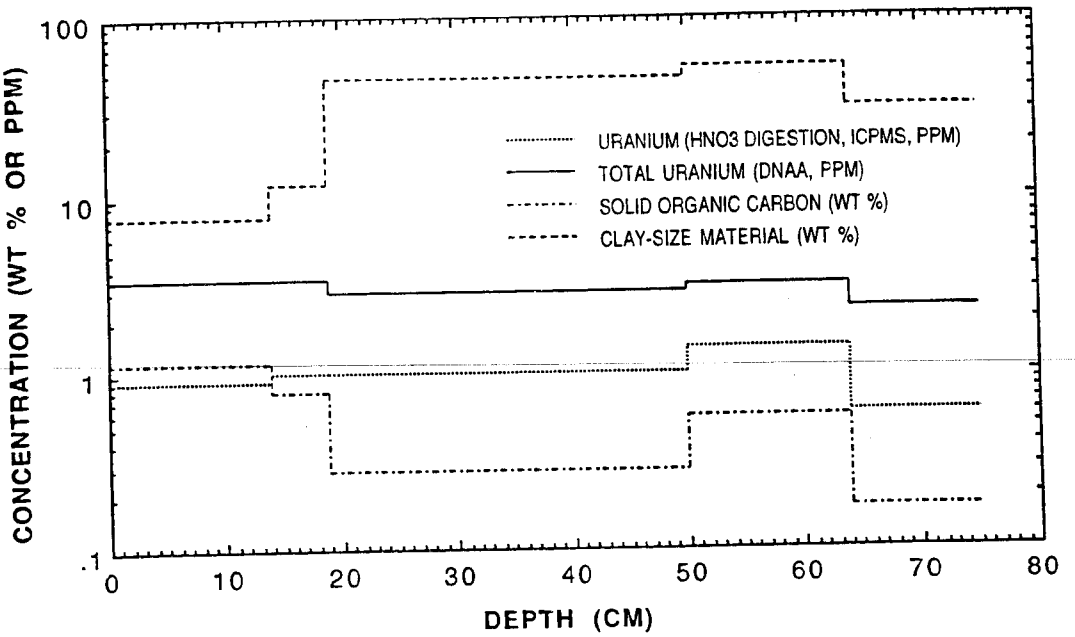



*Fig. 57. Uranium concentration, solid organic carbon, and clay-size material vs depth in background soil; site 4, Twomile Mesa-North.*

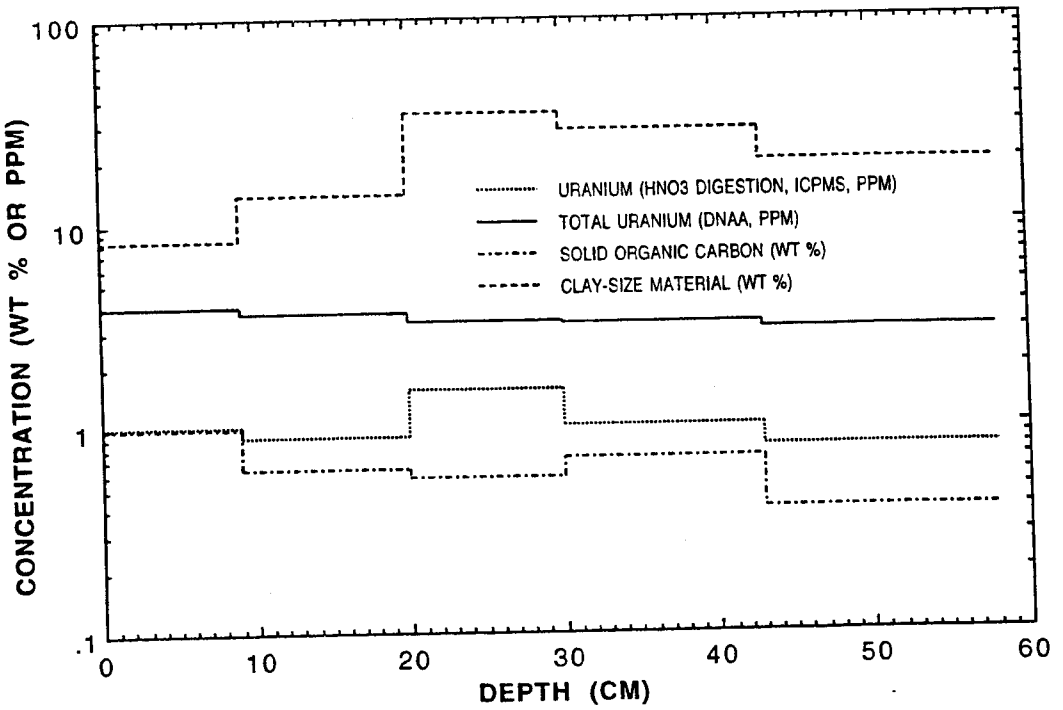



*Fig. 58. Uranium concentration, solid organic carbon, and clay-size material vs depth in background soil; site 4, Twomile Mesa-South.*

Concentrations of total U at the north end of the trench range from 2.4 to 3.5 ppm, whereas concentrations of acid-digested U range from 0.4 to 1.4 ppm. Acid-digested U makes up 25 to 44% of total U at the north end of the trench. Concentrations of total U at the south end of the trench range from 3.0 to 3.8 ppm, and concentrations of acid-digested U range from 0.8 to 1.5 ppm. The acid-digested U makes up 25 to 46% of total U at the south end of the trench. Acid-digested U correlates with clay-size fraction within both soil profiles (Figs. 57 and 58). From the distributions of Al, Fe, and solid organic carbon, it appears that clay minerals present in the soil are coated with iron oxides and solid organic carbon. Total U correlates well ($r^2 = 0.86$) with solid organic carbon (Fig. 59). It has been experimentally shown that uranyl undergoes ligand exchange reactions with humic acids, where carboxylic acids provide active binding sites (Longmire, 1991; Shanbhag and Choppin, 1981).

Figures 60 and 61 show distributions of As, Be, and Fe *vs* depth at the north and south ends of the trench, respectively. Arsenic and Be are highest within Bw, 2Bt1b, 2Bt2b, and 2Bt3b horizons (Figs. 60 and 61). These elements show a strong correlation with each other ($r^2 = 0.81$ for As and Fe and $r^2 = 0.79$ for Be and Fe) (Figs. 62 and 63). This correlation suggests that adsorption of As and Be onto surfaces of iron oxides and/or clay minerals is an important process for controlling trace element distributions at the Twomile Mesa site. At the north end of the trench, total Be concentrations in soil range from 1.6 to 3.1 ppm, and $HNO_3$–digested Be concentrations range from 0.7 to 2.2 ppm. This fraction of Be makes up 42 to 95% of total Be at the north end of the trench. At the south end of the trench, total Be concentrations range from 1.0 to 2.2 ppm, and $HNO_3$–digested Be concentrations range from 0.5 to 1.4 ppm, which constitutes 34 to 75% of total Be. These distributions

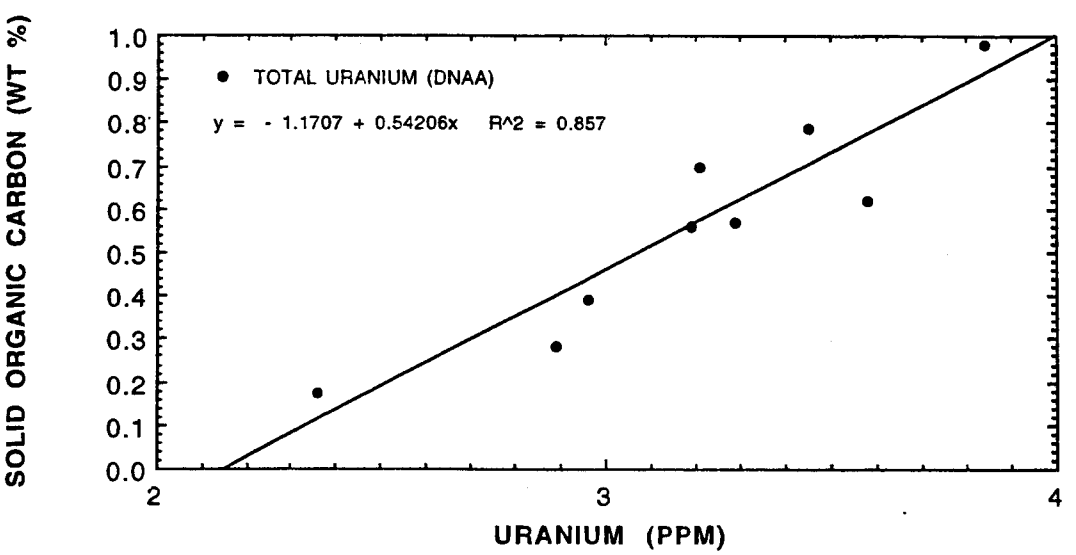



***Fig. 59. Uranium concentration vs solid organic carbon in background soil; Site 4, Twomile Mesa.***

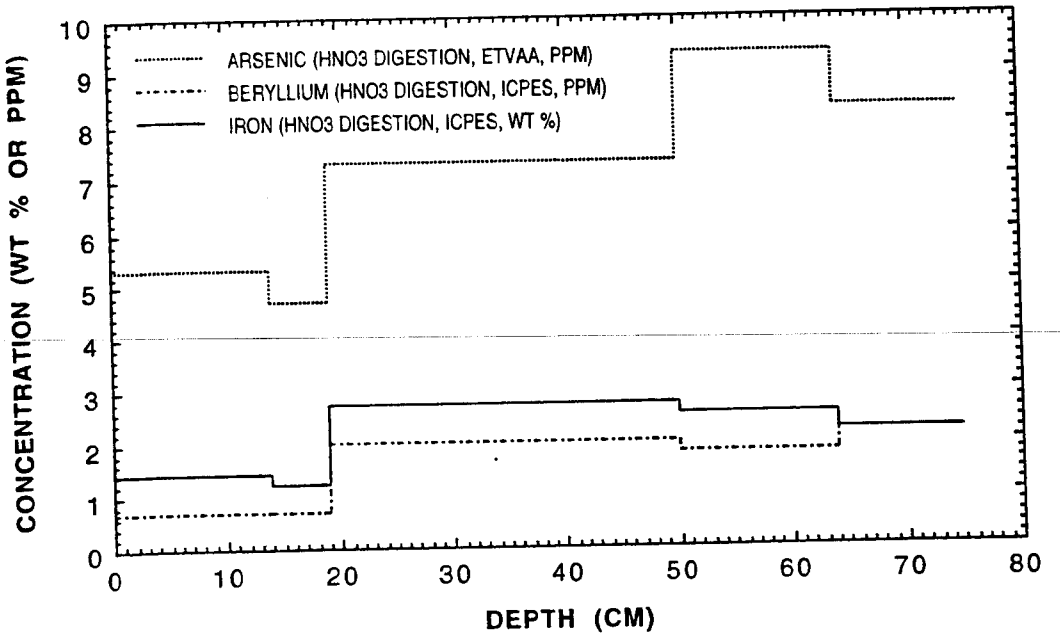



*Fig. 60. Arsenic, Be, and Fe concentrations vs depth in background soil; site 4, Twomile Mesa-North.*

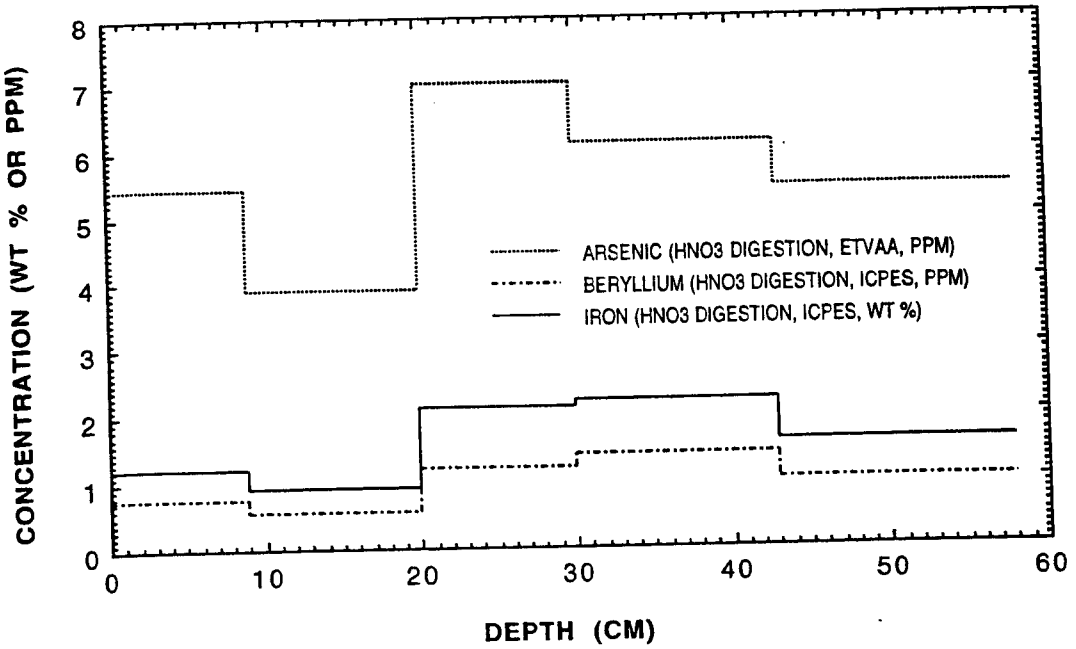



*Fig. 61. Arsenic, Be, and Fe concentrations vs depth in background soil; site 4, Twomile Mesa-South.*

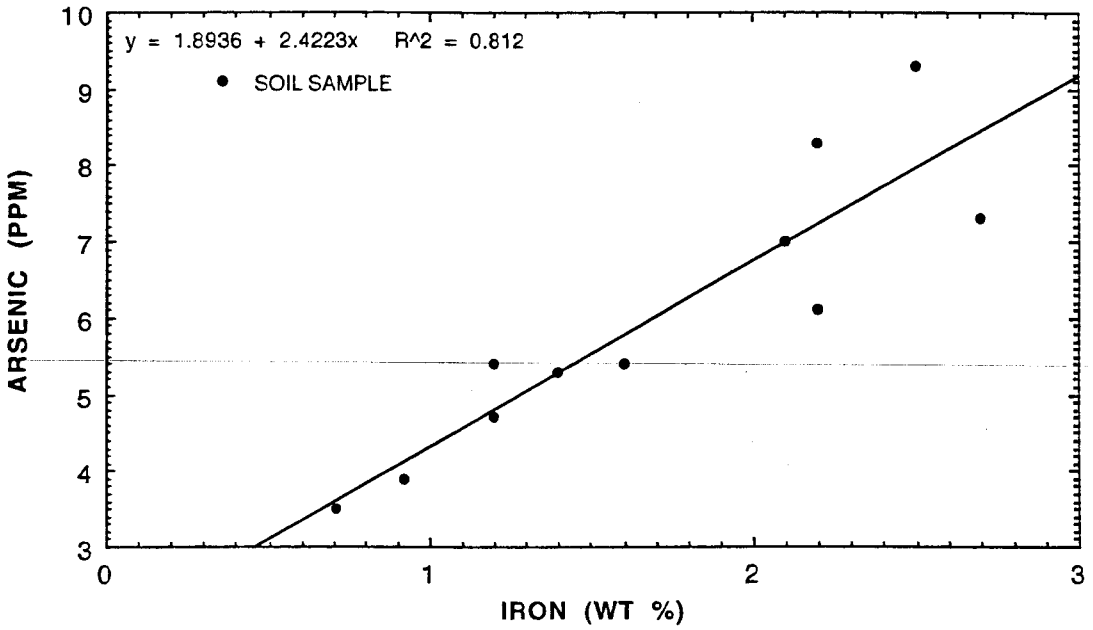



*Fig. 62. Arsenic vs Fe concentrations in background soil; site 4, Twomile Mesa.*

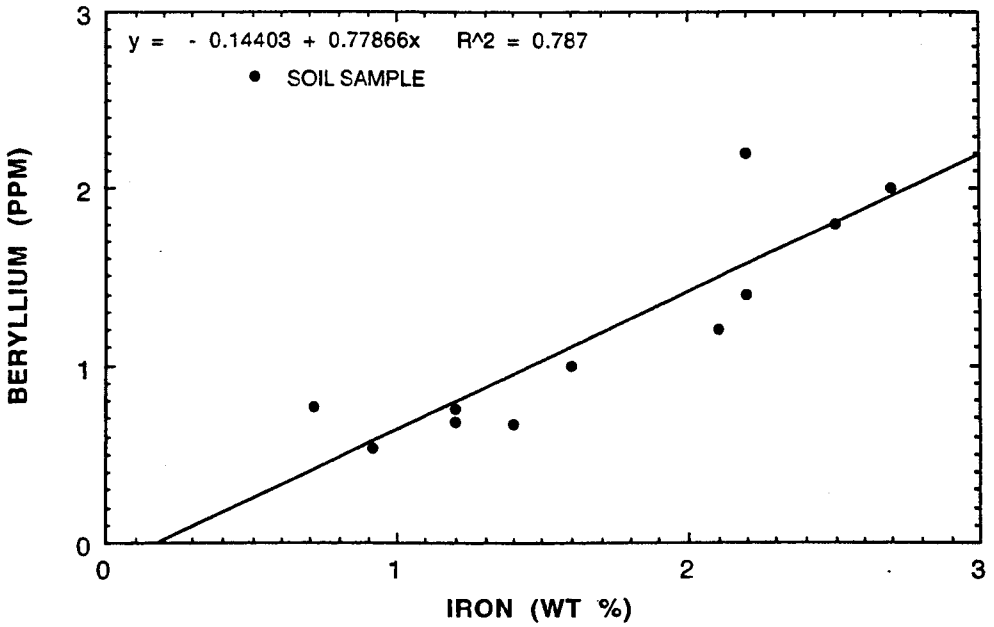



*Fig. 63. Beryllium vs Fe concentrations in background soil; site 4, Twomile Mesa.*

suggest that, in some soil horizons, Be is mainly is concentrated within secondary soil phases and minor amounts are associated with primary phases at the Twomile Mesa site.

Figure 64 shows distributions of $HNO_3$–digested As and total As (above 50 cm depth) at the north end of the trench. Total As concentrations range from 3.7 to 7.3 ppm, and $HNO_3$–digested As concentrations range from 4.7 to 9.3 ppm. The acid-digested fraction of As makes up 45 to 81% of total As. Distributions of $HNO_3$–digested As and total As at the south end of the trench are shown in Fig. 65. Total As concentrations range from 5.1 to 8.8 ppm, and $HNO_3$-digested As concentrations range from 3.9 to 7.0 ppm. The acid-digested fraction of As in this well-developed soil constitutes 62 to 74% of total As at the south end of the trench. Adsorption processes involving iron oxides and clay minerals may account for As enrichment within the Bw and other horizons at this site.

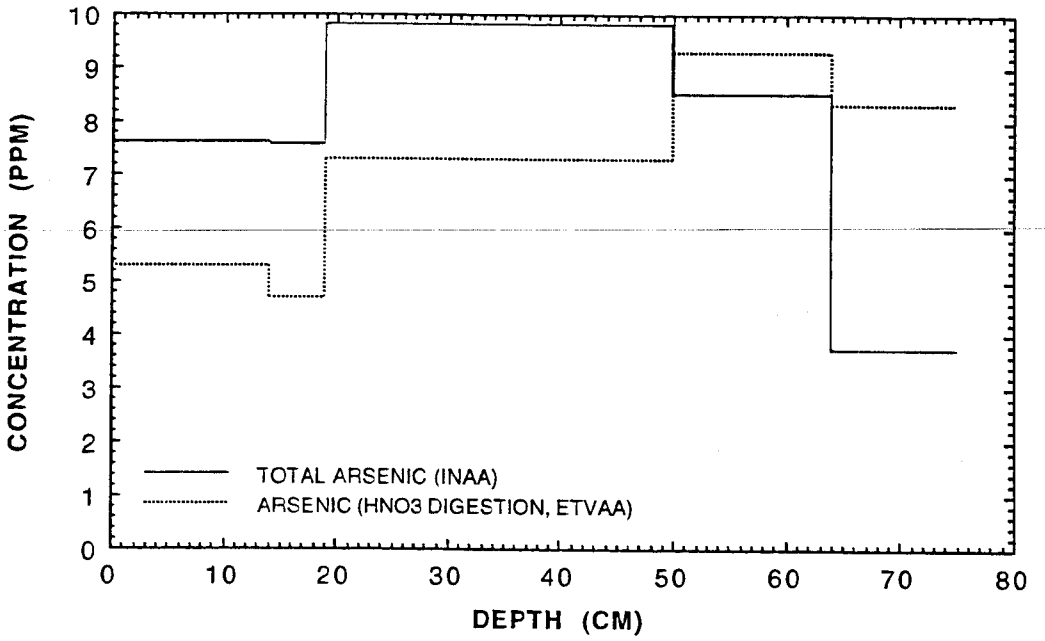



*Fig. 64. Arsenic concentration* vs *depth in background soil; site 4, Twomile Mesa-North.*

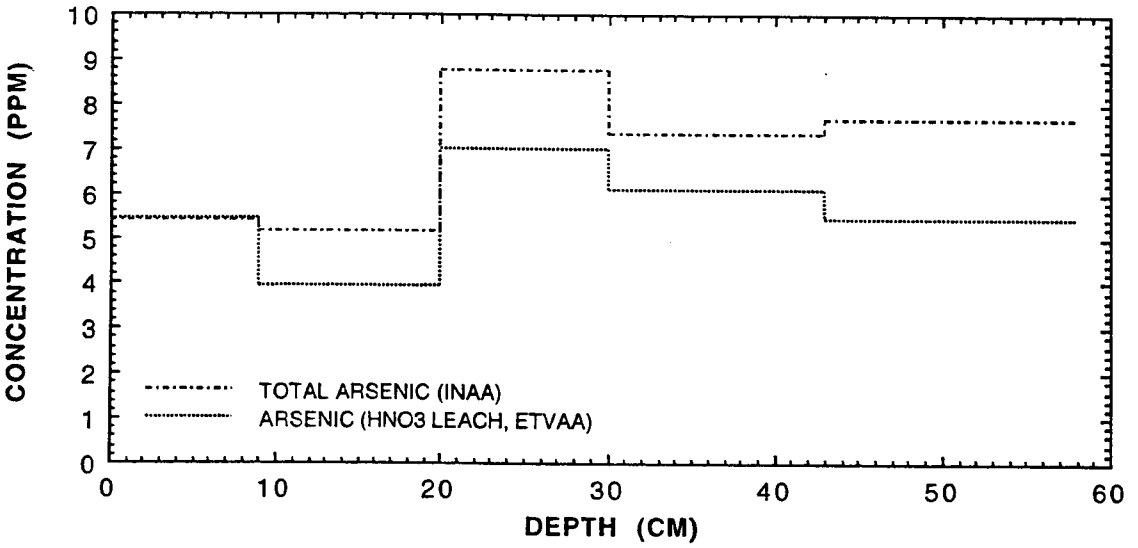



*Fig. 65. Arsenic concentration* vs *depth in background soil; site 4, Twomile Mesa-South.*

## Site 5—Water Tanks Trench, West Jemez Road

### Location and Geomorphic Setting

The Water Tanks soil sampling site was within a trench excavated between Cañon de Valle and Water Canyon, west of West Jemez Road near TA-16, as part of the Seismic Hazards Investigation Program (Wong *et al.*, 1995) (Fig. 66). The trench exposed a sequence of colluvial deposits that occur at the base of a steep, forested slope, which represents the main scarp of the Pajarito fault zone (Gardner and House, 1987; Wong *et al.*, 1995). Also exposed in the trench is a pure layer of El Cajete pumice, up to 1.2 m thick (Fig. 66). The upper part of the El Cajete pumice has been heavily disrupted by bioturbation, and the 0.5- to 1.3-m-thick overlying colluvial soil includes abundant pumice as well as some Bandelier Tuff clasts. Holocene radiocarbon dates of ~1.1 and 5.8 ka have been obtained from the colluvium above the El Cajete pumice (Fig. 67, Table 9). The colluvial deposits below the pumice layer contain no El Cajete pumice, but include abundant angular clasts of Bandelier Tuff (Tshirege Member) and thus are presumably older

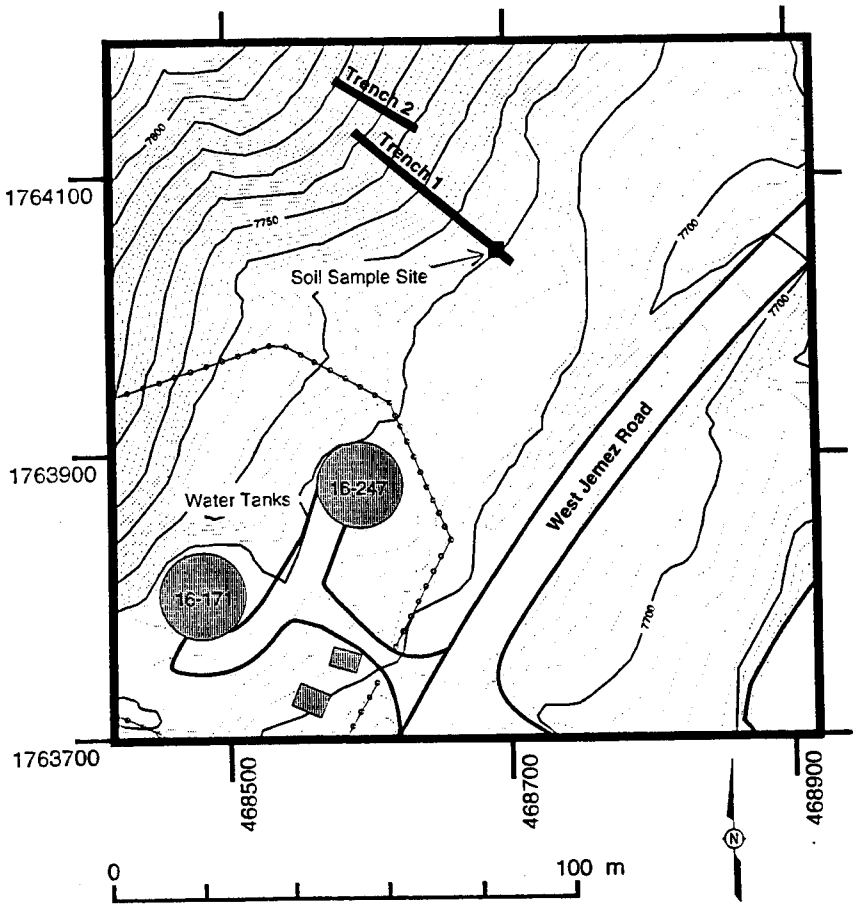



*Fig. 66. Map of soil sample site 5 at Water Tanks Trench; topographic base, with 2-ft contours, from FIMAD.*

than 50 to 60 ka. The soils at this site were mapped as part of the *Rock Outcrop-Pines-Tentrock Complex* by Nyhan *et al.* (1978) and may be representative of other sites along the base of the fault scarp at the western edge of the Laboratory.

The present source for the colluvium extends 35 vertical m (100 ft) up the slope, which represents ~40% of the total scarp height. The slope at and above the sample site is slightly outwardly convex, which causes a divergence of colluvium transported down the slope. Upslope of the sample site, net erosion of the slope has occurred since 50 to 60 ka, resulting in complete stripping of the El Cajete pumice 40 m (130 ft) to the west. The relatively small amount of material deposited on top of the El Cajete pumice at this site may be related to this divergence of colluvium.

## Soil Description

Soil samples collected from the Water Tanks trench site are listed in Table 5; the soil in the trench is formed from sheetwash, alluvium, colluvium, and loess that overlie reworked El Cajete pumice. The soil is well developed and contains clay-rich horizons (Watt and McFadden, 1992). The soil profile at this site consists of the following horizons with associated depths and thicknesses: A (0 to 6 cm), BA (6 to 18 cm), 2Bt1b (18 to 35 cm), 2Bt2b (35 to 53 cm), 2Bt3b (53 to 64 cm), and 3CB (64+ cm). In addition, three discontinuous $CaCO_3$ zones occur at several depths: $K_1$ (42 to 64 cm), $K_2$ (64 to 76 cm), and $K_3$ (70 to 80 cm) (Watt and McFadden, 1992). Although the origin of these $CaCO_3$ zones is not well understood, from field observations it appears that they may be associated with

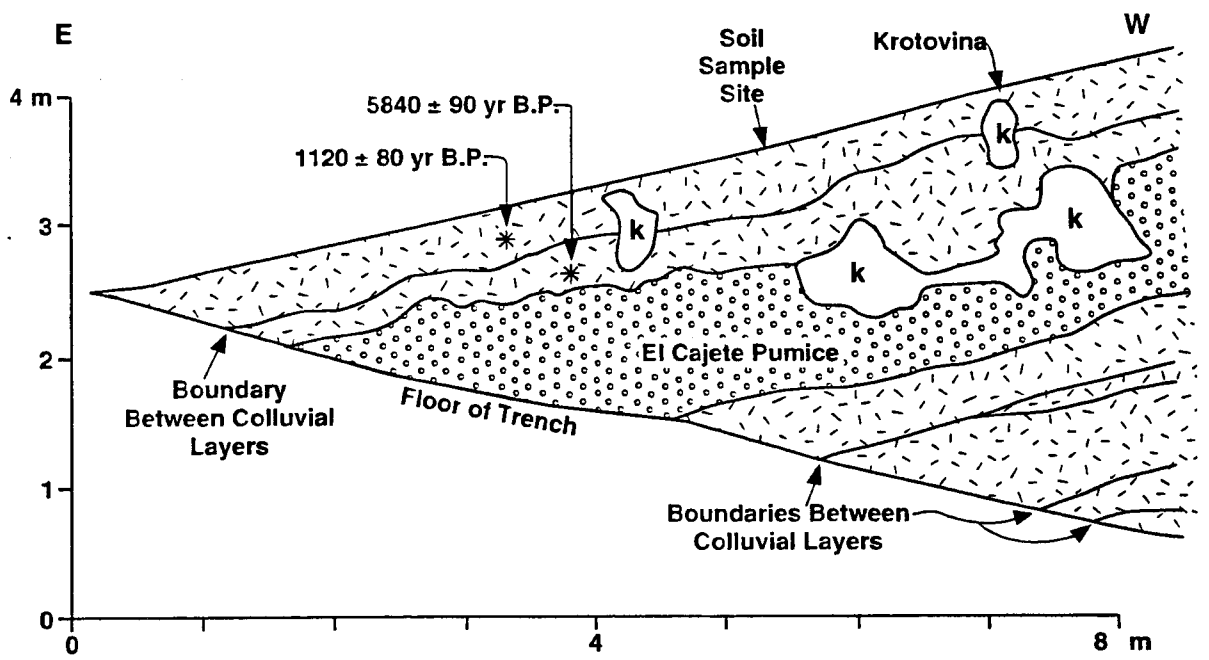



***Fig. 67. Stratigraphy at east end of Water Tanks Trench 1, showing colluvial layers, El Cajete pumice, krotovinas (animal burrows), and location of radiocarbon dates. Modified from trench log of Wong et al., (1995). Log is of south trench wall, and soil samples were collected from the north wall.***

root systems or fungal hyphae. Oxidation and reduction zones also occur in the soil profile, particularly immediately beneath the El Cajete pumice (3CB horizon) and may be related to perched water within the vadose or unsaturated zone.

The A horizon is well developed and contains variable amounts of organic carbon. Organic carbon values range from 0.3 to 2.5 wt%, and the highest abundance is associated with lenses of organic matter. This soil profile contains moderately high clay content ranging from 13.8 to 25.9 wt% (Watt and McFadden, 1992). Sand-size material ranges from 26.6 to 77.1 wt%, indicating that this soil profile may have a higher hydraulic conductivity (Table 6; K values range from $10^{-5}$ to $10^{-2}$ cm/s) than clay-rich soils found at other areas on the Pajarito Plateau. Silt-size material varies from 6.6 to 49.5 wt% at this soil site.

## Soil Chemistry

This soil is characterized by acidic to alkaline pH values, ranging from 6.0 to 8.2, that increase with depth.The lowest pH value in this soil profile is associated with the BA horizon, whereas the highest pH value is associated with the $CaCO_3$–rich-zones Calcium carbonate abundances vary from 0.5 to 19.6 wt% (Watt and McFadden, 1992).

Element chemistry for soils collected at this site are provided in Appendix A (INAA and DNAA) and Appendix B (EPA SW846 methods). Distributions of total Fe, $HNO_3$–digested Fe, and clay-size material *vs* depth are shown in Fig. 68. Total Fe concentrations range from 2.1 to 3.2 wt%, and Fe content is generally correlated with clay content. Acid-soluble Fe concentrations range from 0.9 to 2.6 wt% and constitute 37 to 81% of total Fe.

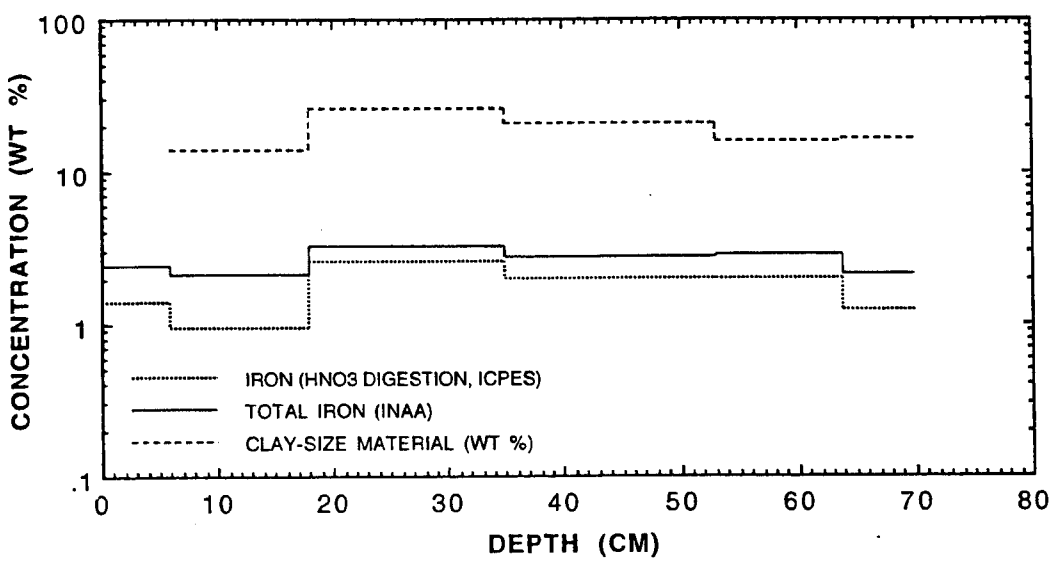



***Fig. 68. Iron concentration and clay-size material vs depth in background soil; site 5, Water Tanks Trench.***

These concentration distributions suggest that Fe occurs both in refractory phases, such as hornblende, magnetite, and biotite, and in $HNO_3$–digested Fe phases, including ferric oxyhydroxide and ferrihydrite. Adsorption of trace elements onto calcium carbonate, iron oxides, and clay minerals is likely to control trace-element distributions in this organic-rich soil profile containing several B horizons.

Distributions of total Th, acid-digested Th, and clay-size material vary with depth (Fig. 69). Total Th concentrations range from 17.2 to 20.0 ppm. Acid-digested Th concentrations range from 4.0 to 8.0 ppm and make up 20 to 51% of total Th. The acid-digested fraction of Th, however, does not correlate with clay-size material (Fig. 69). From percentage distributions of acid-digested and total Th, it appears that most of the Th has not leached from primary silicate phases.

Distributions of total U, acid-digested U, and solid organic carbon vary with depth (Fig. 70). Concentrations of total U range from 3.1 to 4.0 ppm. Concentrations of acid-digested U range from 0.7 to 2.0 ppm and this fraction makes up 20 to 51% of total U. Acid-digested U correlates with solid organic carbon (Fig. 70). Overall, most of the U present in this soil has not been leached from the primary silicate phase(s).

Figure 71 shows distributions of As, Be, and Fe *vs depth* at this soil site. Beryllium is associated with Fe in several soil horizons at this site. Arsenic is enriched within the A and 2Bt2b horizons, whereas Be and Fe are enriched within the 2Bt1b horizon (Fig. 71). Concentrations of total Be range from 2.0 to 3.3 ppm, whereas concentrations of $HNO_3$–digested Be range from 0.8 to 2.6 ppm, consisting of 35 to 81% of total Be (Fig. 72). This suggests that in some soil horizons at this site,

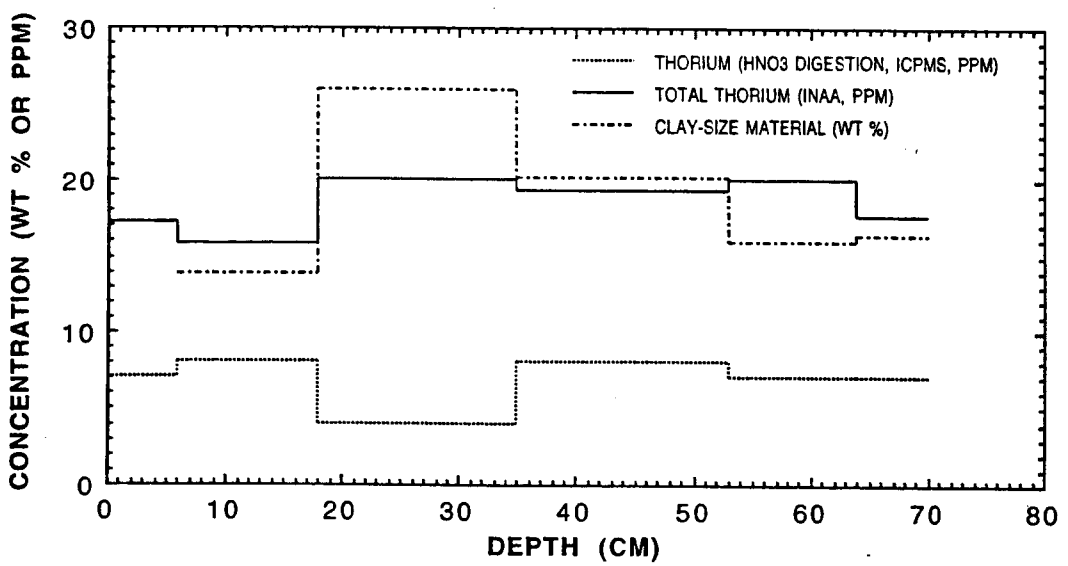



***Fig. 69. Thorium concentration and clay-size material vs depth in background soil; site 5, Water Tanks Trench.***

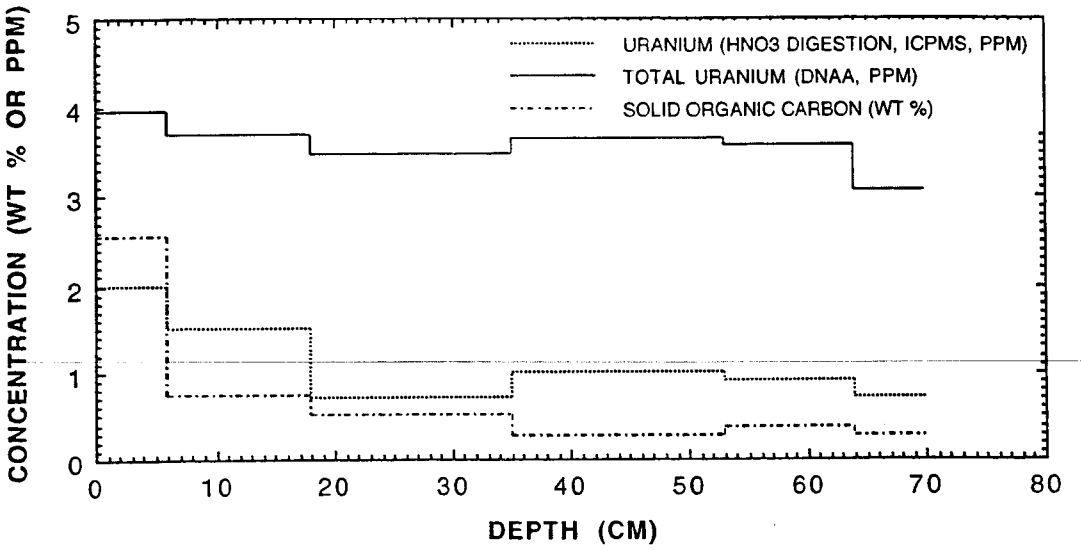



*Fig. 70. Uranium concentration and solid organic carbon vs depth in background soil; site 5, Water Tanks Trench.*

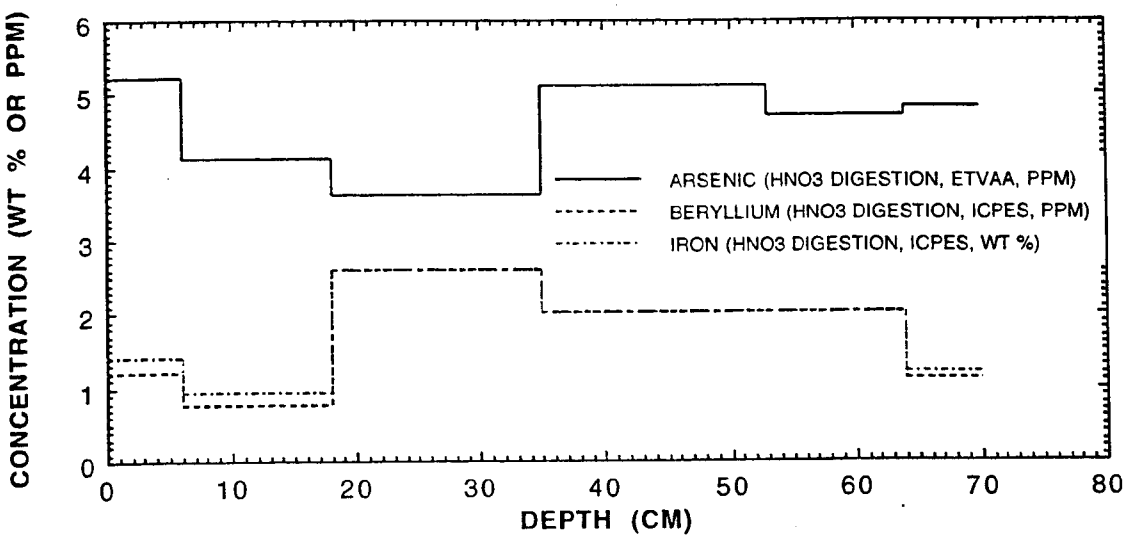



*Fig. 71. Arsenic, Be, and Fe concentrations vs depth in background soil; site 5, Water Tanks Trench.*

Be is dominantly distributed within secondary soil minerals and solid phases and some Be is distributed within primary silicate phases.

Figure 73 shows distributions of $HNO_3$-digested As and calcium carbonate *vs* depth. Arsenic shows strong correlation ($r^2 = 0.82$) with calcium carbonate (Fig. 74). Adsorption reactions with calcium carbonate may be the dominant process controlling As enrichment at this site. Results of experimental investigations conducted by Zachara *et al.* (1993) show that maximum adsorption of $PO_4^{3-}$ and $SeO_3^{2-}$ onto calcite occurs below pH 7.0, whereas $Cd^{2+}$, $Zn^{2+}$, and $Mn^{2+}$ show maximum adsorption below or at pH 8.5. Recent studies using a streaming-potential method suggest that $Ca^{2+}$ and $CO_3^{2-}$ are the dominant surface species and that other species, including $H^+$ and $OH^-$, have no significant effect on the surface charge (Thompson and Pownall, 1989). Calcite carries a positive charge below pH 9.0 in saturated calcium carbonate solutions that are in contact with atmospheric $PCO_2$ ($10^{-3.5}$ atm) (Foxall *et al.*, 1979).

These studies may be helpful for understanding As distributions at this site because adsorption characteristics of $AsO_3^{3-}$ and $AsO_4^{3-}$ onto iron oxides and other adsorbents are similar to those of $PO_4^{3-}$, $SeO_3^{2-}$, and $SeO_4^{2-}$ species (Leckie *et al.*, 1980). However, similar trends between As and calcium carbonate were not as strongly observed at other soil profiles characterized during this investigation. From surface area measurements, it appears that iron oxides probably are stronger adsorbents than calcium carbonate (Stumm and Morgan, 1981).

Several oxidation-reduction zones are present at the Water Tanks Trench site below the El Cajete pumice. Figure 75 shows element and species concentrations in oxidized and reduced zones normalized to the underlying colluvium,

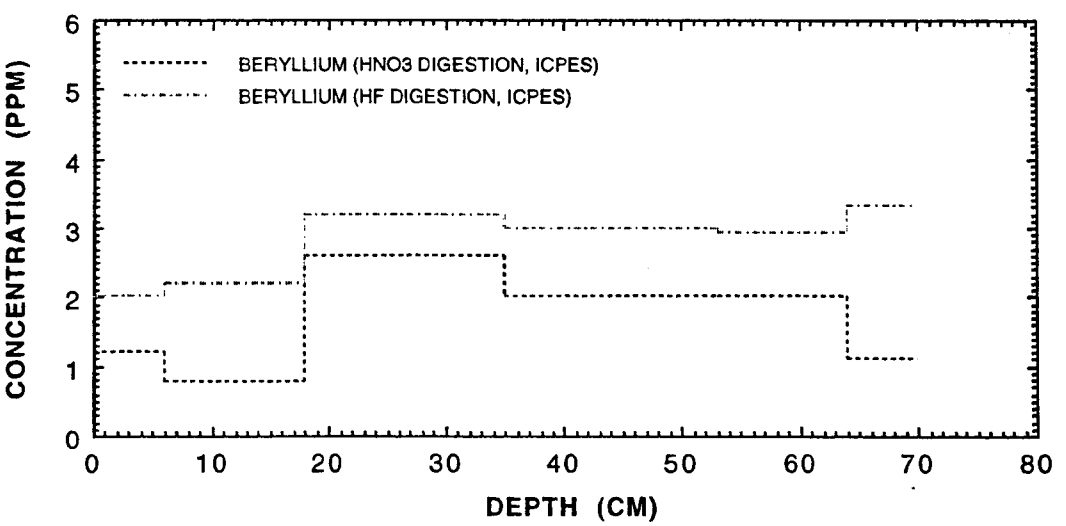



***Fig. 72. Beryllium concentration vs depth in background soil; site 5, Water Tanks Trench.***

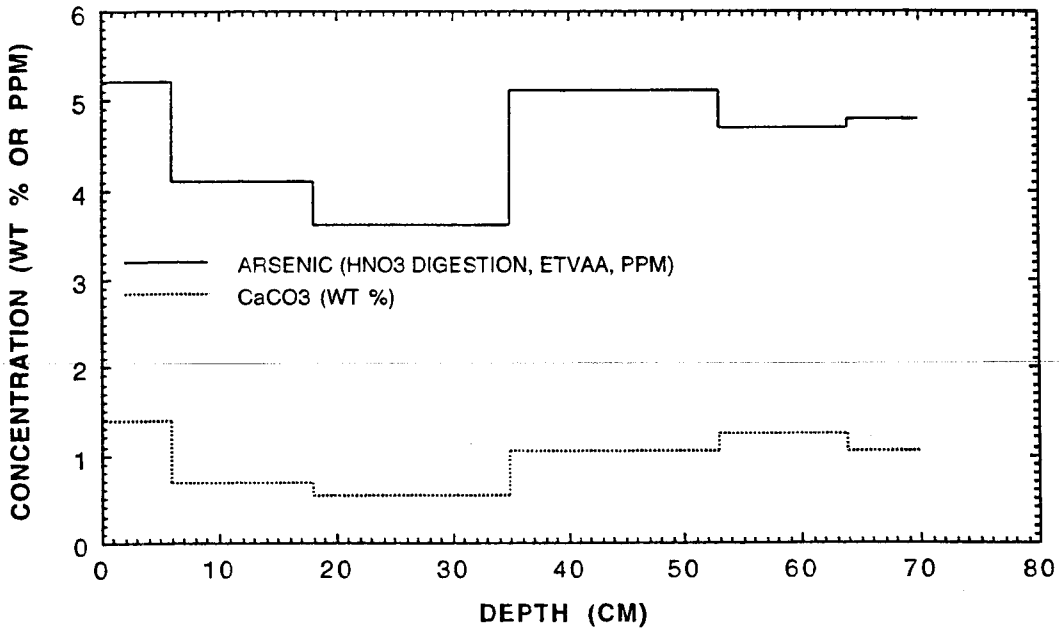



*Fig. 73. Arsenic concentration and $CaCO_3$ vs depth in background soil; site 5, Water Tanks Trench.*

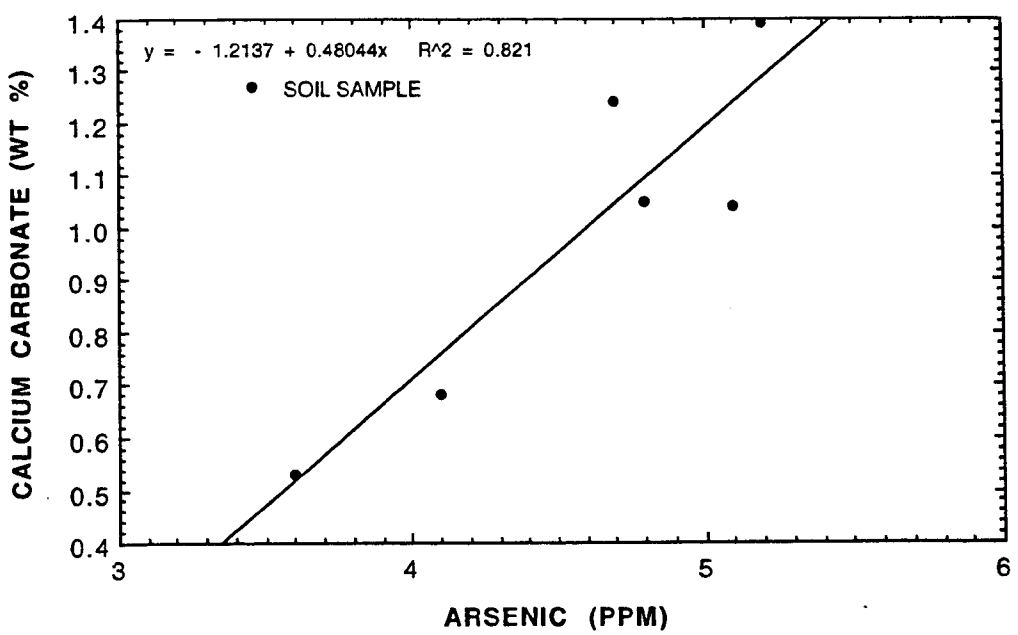



*Fig. 74. Arsenic concentration vs $CaCO_3$ in background soil; site 5, Water Tanks Trench.*

which is the parent material at this soil site. Values of >100 indicate enrichment of an element or species within the oxidation-reduction zone relative to base colluvium. Conversely, values of <100 indicate the depletion of an element or species within the oxidation-reduction zone relative to the colluvium. Arsenic, Co, Cr, Fe, Mn, Ni, and U are more enriched in the oxidized material, whereas Cr and U are more enriched in the reduced material than in the colluvium (Fig. 75). Manganese shows the most enrichment (by a factor of 2.85) within the oxidized material, which is possibly the result of Mn adsorption onto iron oxides and/or precipitation of $MnO_2$ or MnOOH. Adsorption of As, Be, Co, Cr, Ni and U onto iron oxide may account for trace-element enrichment under relatively oxidizing conditions. Arsenic, Be, Cl, Co, Fe, Mn, Ni, and $SO_4$ are more depleted in the reduced material than in the colluvium. Under relatively reducing conditions, iron and manganese oxides are soluble and, subsequently, desorption of As, Co, and Ni may occur and the soils are depleted in these trace elements. Lead appears to be insensitive to redox processes at this site and may be concentrated in primary silicate minerals such as feldspars.

Figure 76 shows element and species concentrations in solid organic matter normalized to the base colluvium. Arsenic, Be, Co, Cr, Fe, Mn, Ni, Pb, and U are higher in the solid organic

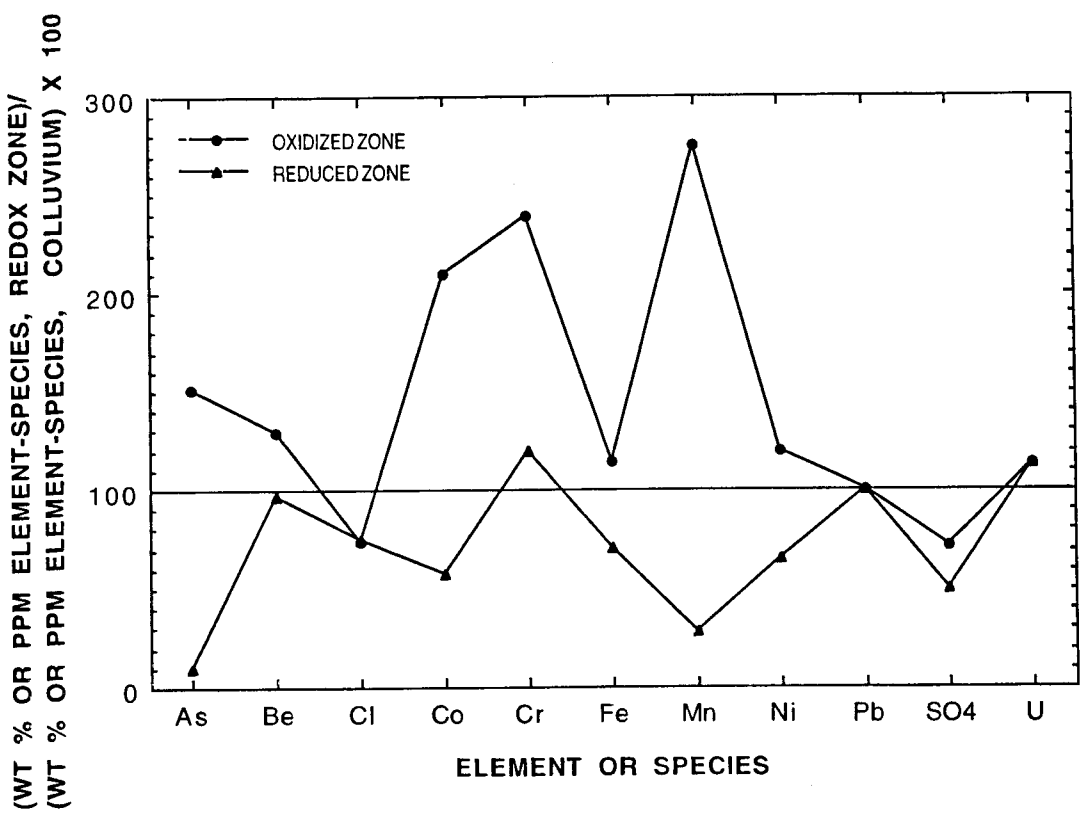



**Fig. 75. Oxidized and reduced zones vs element or species in background soil; site 5, Water Tanks Trench.**

matter, whereas Cl is lower in the solid organic matter (Fig. 76). Ligand exchange reactions involving carboxylate anion with cations (including Be, Co, Cr, Ni, Pb, and U) may enhance trace-element enrichment within soil horizons containing solid organic matter.

Figure 77 shows element and species concentrations in calcium carbonate zone 1 normalized to the underlying colluvium. Arsenic, Ba, Be, Cl, Cr, $SO_4$, and U are enriched by varying amounts in the calcium carbonate zone, whereas Co, Fe, Ni, and Pb are higher in the base colluvium (Fig. 77). Sulfate shows the most enrichment (by a factor of 4.1), which suggests the presence of gypsum as a component of eolian dust within calcium carbonate zones. Beryllium, Cl, and Cr show little enrichment (Fig. 77) in these zones. Formation of uranyl carbonato complexes may have resulted in remobilization of U within the soil profile, followed by adsorption onto calcium carbonate. Uranyl carbonato complexes may undergo surface-exchange reactions with $CO_3$ surface groups present on calcite, as shown by:

$$X\text{-}CO_3^0 + UO_2(CO_3)_2^{2-} = X\text{-}(CO_3)_2UO_2^0 + CO_3^{2-} \quad (6)$$

The calcite adsorbent surface is represented by X in Eq. 4. Based on concepts discussed by Zachara *et al.* (1993), adsorption of $UO_2(CO_3)_2^{2-}$ should parallel increasing

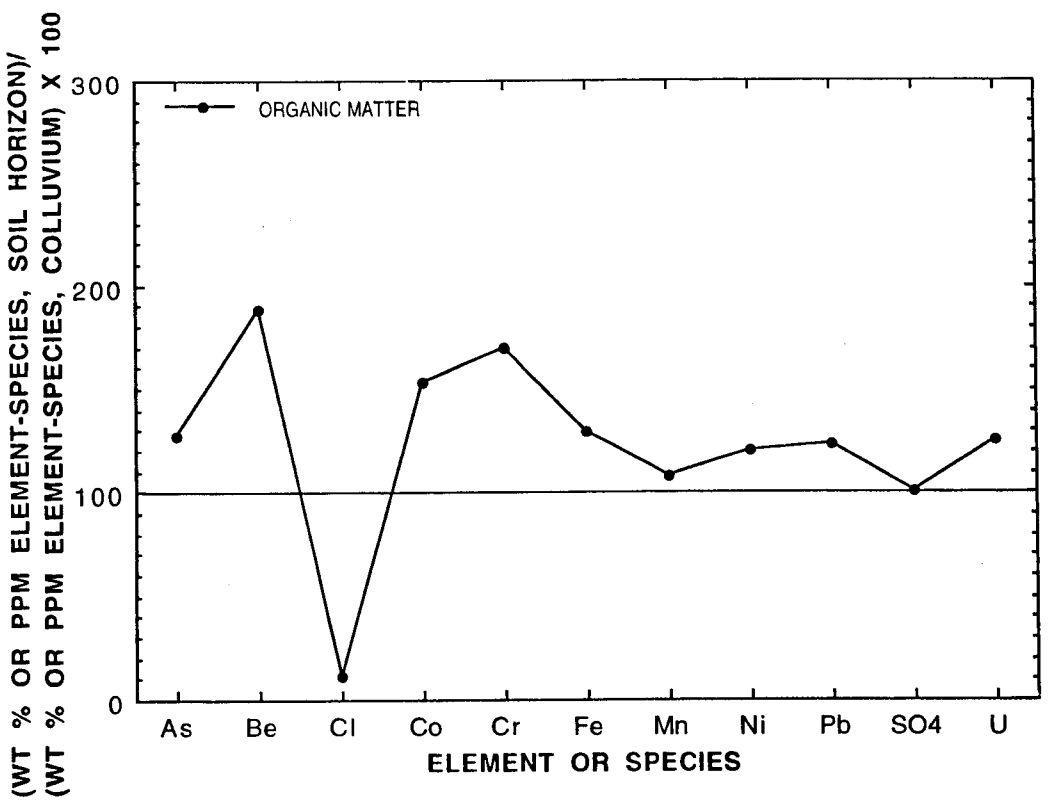



***Fig. 76. Organic matter vs element or species in background soil; site 5, Water Tanks Trench.***

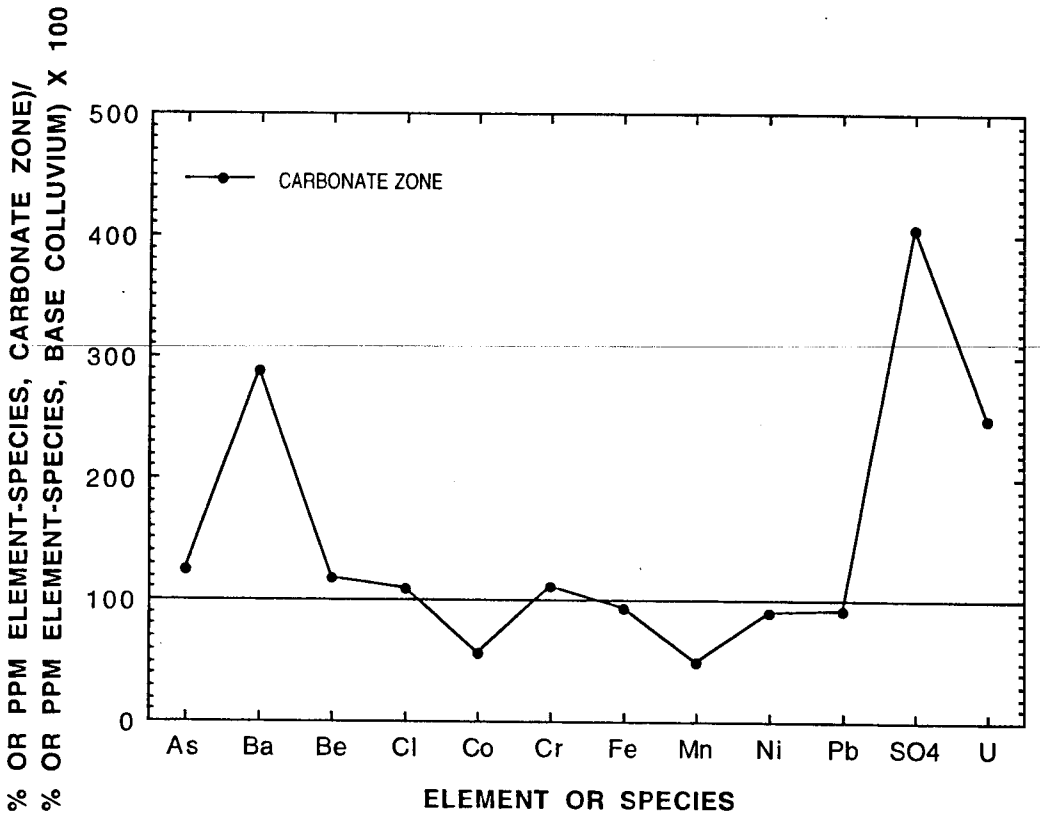



***Fig. 77. Carbonate zone vs element or species in background soil; site 5, Water Tanks Trench.***

positive surface charge on calcite and decreasing solution concentrations of $HCO_3^-$ and $CO_3^{2-}$. Adsorption of uranyl carbonato complexes onto calcium carbonate is maximum below a $pH_{pzc}$ value of 9, where a net-positive surface charge prevails. This soil is characterized by pH values ranging from 6.0 to 8.2, which enhances uranyl carbanoto complexes onto calcite. Barium enrichment may result from adsorption onto calcium carbonato and/or precipitation of barium carbonate.

## Site 6—Frijoles Mesa, State Route 4, El Cajete Pumice

### Location and Geomorphic Setting

The soil sampling site is at a shallow excavation on Frijoles Mesa beneath a Ponderosa pine forest on the boundary between the Laboratory and Bandelier National Monument (BNM), where a culvert discharges on the south side of State Route 4 (Fig. 78). The excavation exposed a 0.3- to 0.8-m-thick layer of pure El Cajete pumice that overlies a buried soil and underlies a 0.4- to 0.9-m-thick layer of pumice-rich surface soil. The El Cajete pumice has been described by Self *et al.* (1988). The buried soil is 1.2 m deep, and although it is not exposed here, unit 4 of the Tshirege Member underlies the buried soil. The upper part of the El Cajete pumice bed has been heavily disrupted by bioturbation, as it was at the Water Tanks site (Site 5), causing large local variations in thickness.

Soils at this site were mapped as part of the Frijoles soil series by Nyhan *et al.* (1978) and may be representative of other mesa-top locations in the Ponderosa pine belt that are covered by El Cajete pumice.

The modern soil is developed on the upper part of the El Cajete pumice and probably contains a mixture of weathered pumice and windblown dust deposited since emplacement of the pumice bed.

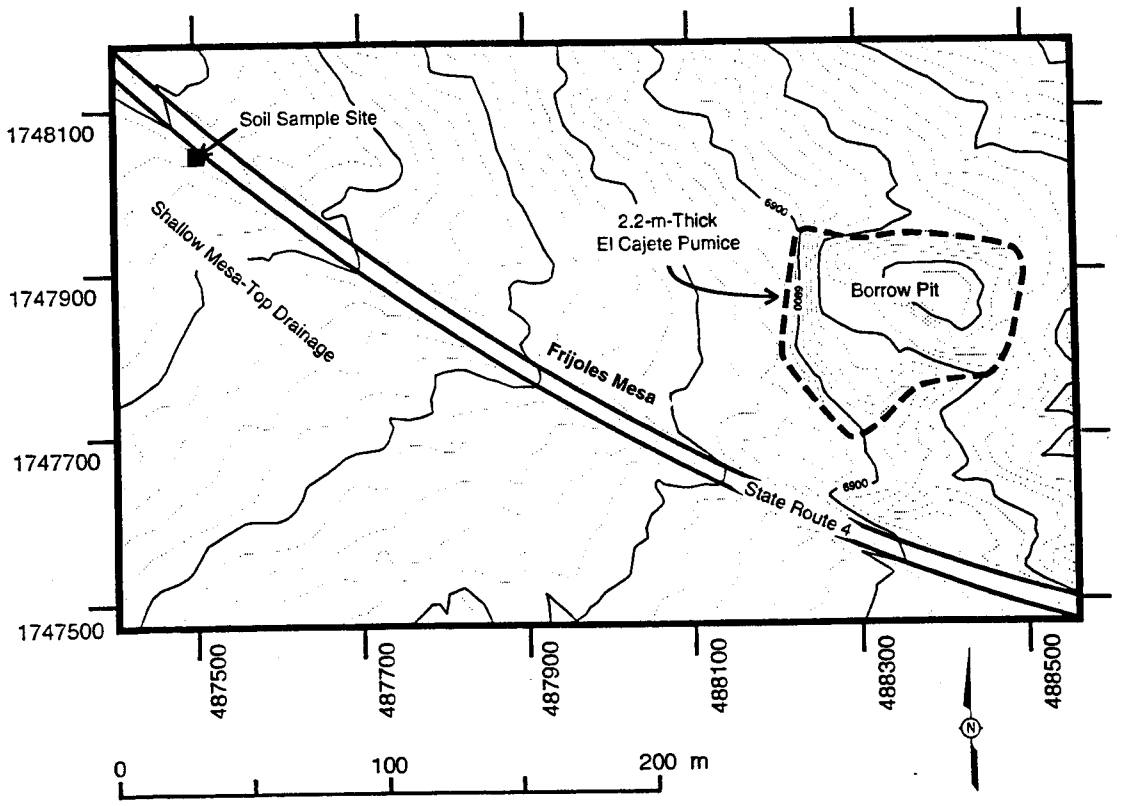



***Fig. 78. Map showing soil sample site 6 on Frijoles Mesa, along State Route 4, and nearby borrow pit; topographic base, with 2-ft contours, from FIMAD.***

The site is ~10 m northeast of the axis of a shallow mesa-top drainage. There is evidence for recent erosion of the soil by surface runoff, and an unknown thickness of soil has eroded from this site. In a nearby borrow pit (225 m to the east; Fig. 78), the El Cajete pumice reaches a thickness of 2.2 m and is overlain by 0.35 m of soil. The El Cajete pumice is significantly greater at the borrow pit than at the sample site, which suggests that 1 m or more of pumice and soil has been eroded at the sample site since 50 to 60 ka. However, the presence of the pumice bed here demonstrates that the mesa top is relatively stable and that no erosion of the tuff bedrock occurred at this site since 50 to 60 ka.

### Soil Description

Soil samples collected from the Frijoles Mesa site are listed in Table 5. The soil at this site is poorly developed (Watt and McFadden, 1992) and consists of the following horizons with associated depths and thicknesses: A (0 to 5 cm), Bw (5 to 22 cm), Bwk (22 to 53 cm), and 2CBk (53+ cm). Organic carbon values range from 0.2 to 0.4 wt%; the highest abundance is associated with the 2CB horizon. This soil profile contains clay-size material ranging from 6.6 to 16.9 wt% (Watt and McFadden, 1992). Sand-size material varies from 35.2 to 54.8 wt%, indicating that this soil profile may have a moderate range of hydraulic conductivities (Table 6; K values range from $10^{-5}$ to $10^{-1}$ cm/s). Silt-size material ranges from 33.9 to 58.1 wt% at this soil site.

### Soil Chemistry

This soil is characterized by alkaline pH values ranging from 7.5 to 8.9, which increase with depth. The lowest pH value in this soil profile is associated with the A horizon, and the highest pH value is associated with the 2CBk horizon (Watt and McFadden, 1992). Calcium carbonate abundances vary from 0.5 to 3.9 wt% (Watt and McFadden, 1992).

Element chemistry for soils collected at this site are provided in Appendix A (INAA and DNAA) and Appendix B (EPA SW846 methods). Concentrations of total Fe, $HNO_3$–digested Fe, and clay-size material *vs* depth are shown in Fig. 79. Total Fe concentrations range from 2.5 to 3.0 wt%. Acid-soluble Fe concentrations range from 1.4 to 1.9 wt% and make up 55 to 64% of total Fe. Iron generally correlates with clay-size material (Fig. 79), which suggests that Fe has been moderately remobilized and concentrated in the clay-size material. Some Fe probably occurs both in refractory phases (such as hornblende, magnetite, and biotite) and in $HNO_3$–digested Fe phases, including ferric oxyhydroxide and possibly ferri-hydrite associated with solid organic carbon and clay minerals (Fig. 80).

Concentrations of total Th, acid-digested Th, and clay-size material vary with depth (Fig. 81). Concentrations of total Th range from 13.7 to 22.5 ppm, and concentrations of acid-digested Th range from 6.0 to 8.0 ppm. Acid-digested Th makes up 36 to 58% of total Th. This fraction correlates with clay-size material (Fig. 81), suggesting that Th may have redistributed within the clay-size fraction—possibly through adsorption processes. From percentage distributions of acid digested and total Th in the Bwk horizon, it appears that most of the Th may have leached from primary phases.

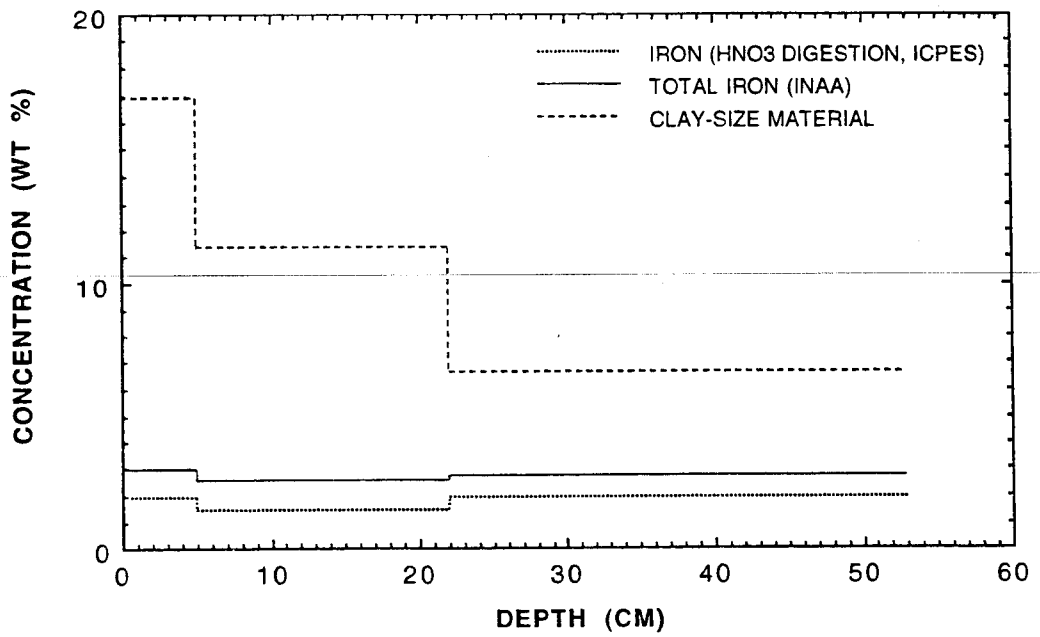



*Fig. 79. Iron concentration and clay-size material vs depth in background soil; site 6, Frijoles Mesa.*

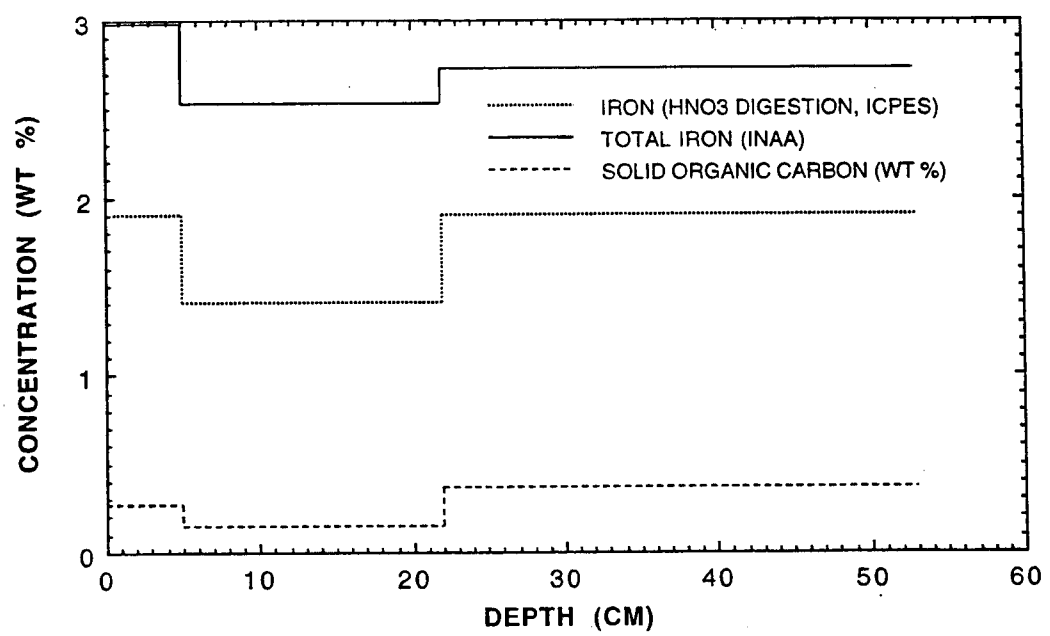



*Fig. 80. Iron concentration and solid organic carbon vs depth in background soil; site 6, Frijoles Mesa.*

Concentrations of total U, acid-digested U, and solid organic carbon vary with depth (Fig. 82). Total U concentrations range from 3.1 to 3.9 ppm, and acid-digested U concentrations range from 0.6 to 1.6 ppm. Acid-digested U composes 15 to 41% of total U; this fraction is associated with solid organic carbon (Fig. 82) and $CaCO_3$ (Fig. 83) in the 2Cbk horizon. Figure 83 implies that some of the U is associated with $CaCO_3$ coatings mantling sand-size particles. Surface complexation of U onto $CaCO_3$ may be likely at this site because $HNO_3$–digested U correlates with $CaCO_3$ in the 2Cbk horizon (Fig. 83). In addition, uranyl species also undergo ligand exchange with humic acids (Longmire, 1991; Shanbhag and Choppin, 1981), and this process may account for the correlation between U and organic carbon observed in the 2CBk horizon (Fig. 82). As a consequence of these relationships, solid organic carbon and calcium carbonate correlate well with each other (compare Figs. 82 and 83). This correlation may be the result of similar sources for the two solid phases and/or oxidation of organic matter to calcium carbonate through biological respiration. Most of the U present in this soil, however, has not been leached from the primary silicate phase(s).

Figure 84 shows distributions of As, Be, and Fe *vs* depth at the soil site. Beryllium and As show a strong correlation with Fe. Total Be concentrations range from 2.0 to 2.5 ppm, whereas $HNO_3$–digested Be concentrations range from 1.2 to 1.7 ppm. Acid-digested Be constitutes 49 to 85% of total Be (Fig. 85), which suggests that, in the A horizon, Be is mainly distributed within secondary soil minerals.

Figure 86 shows distributions of $HNO_3$–digested As and solid organic carbon

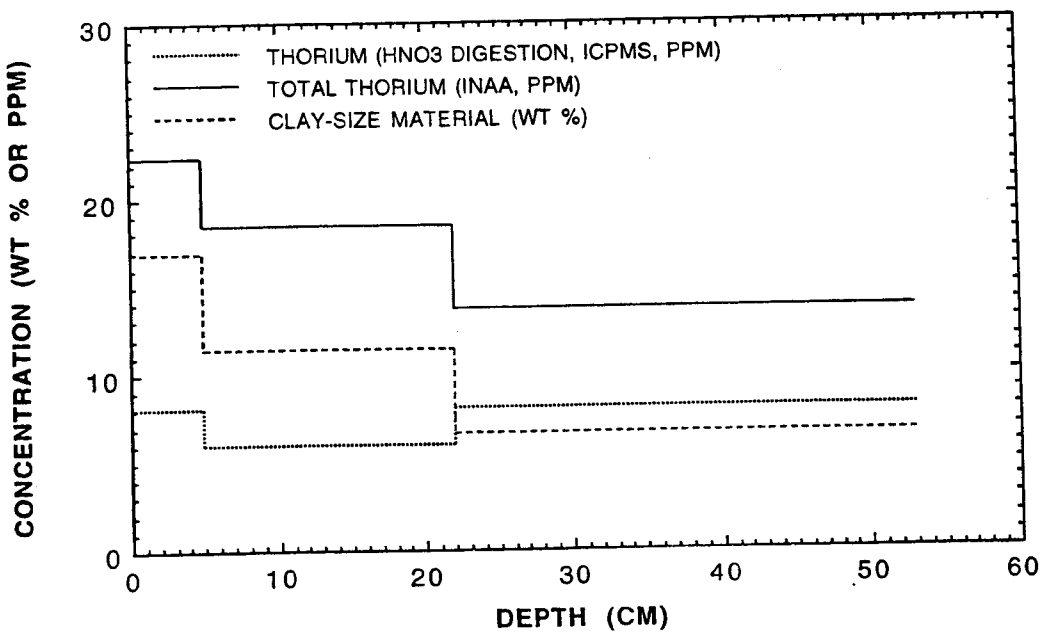



***Fig. 81. Thorium concentration and clay-size material vs depth in background soil; site 6, Frijoles Mesa.***

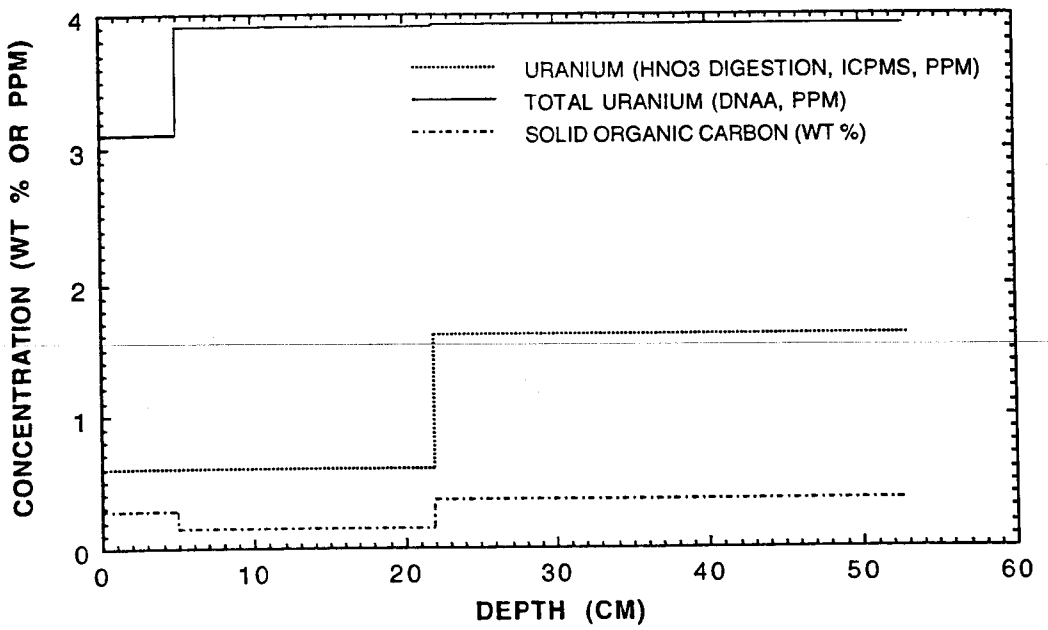



***Fig. 82. Uranium concentration and solid organic carbon vs depth in background soil; site 6, Frijoles Mesa.***

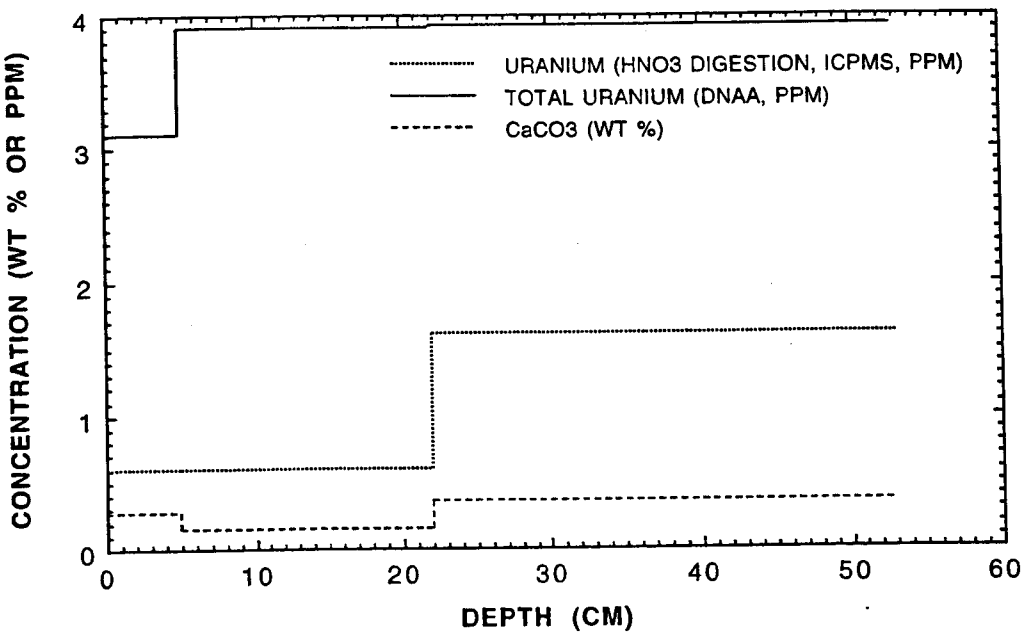



***Fig. 83. Uranium concentration and $CaCO_3$ vs depth in background soil; site 6, Frijoles Mesa.***

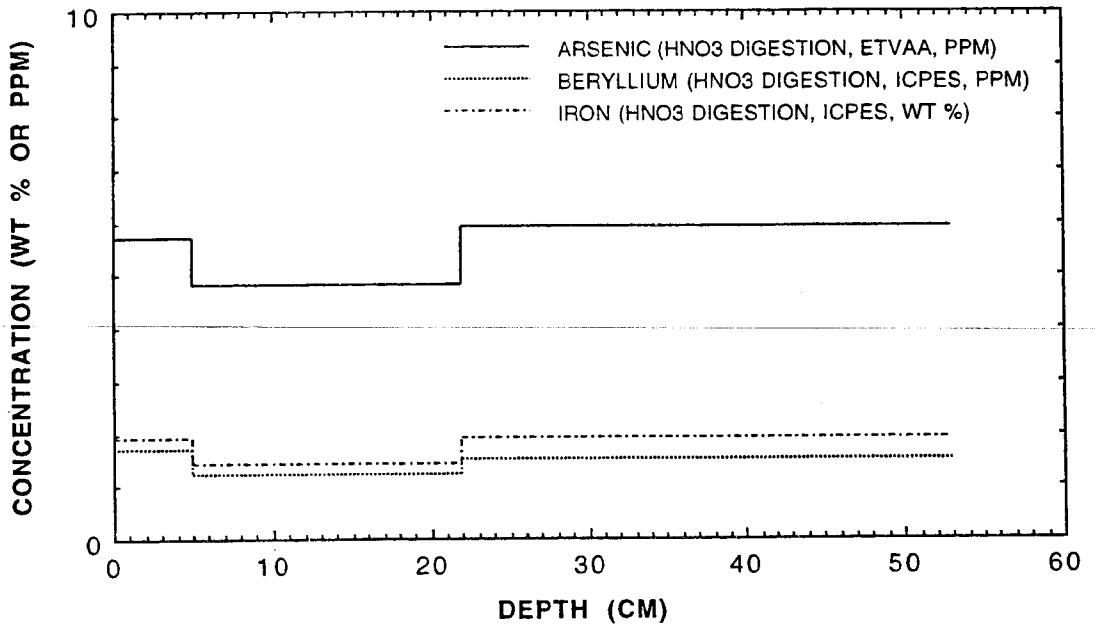



*Fig. 84. Arsenic, Be, and Fe concentrations vs depth in background soil; site 6, Frijoles Mesa.*

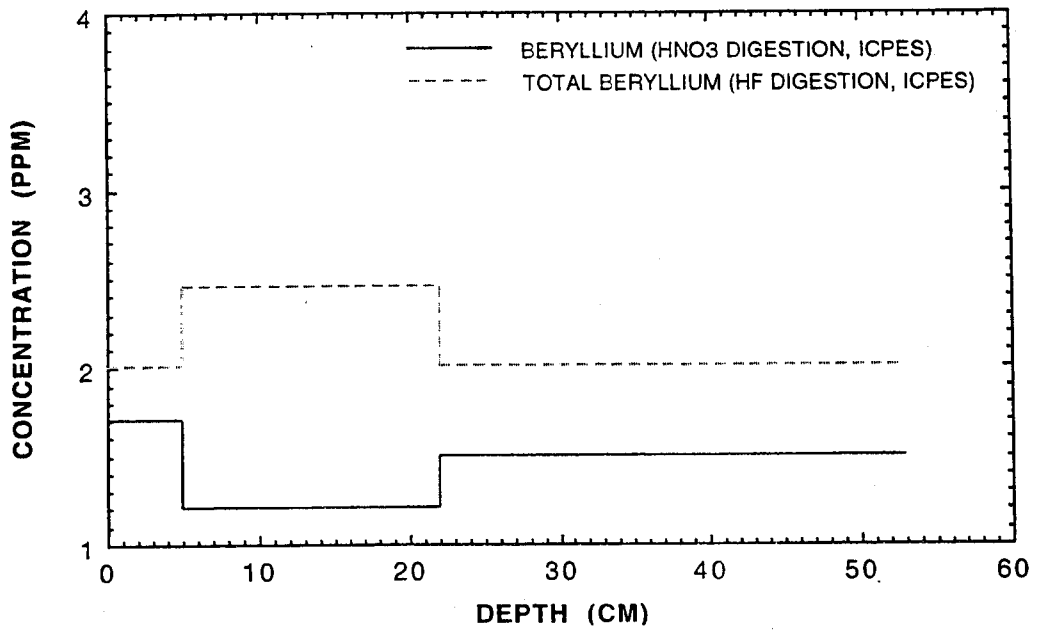



*Fig. 85. Beryllium concentration vs depth in background soil; site 6, Frijoles Mesa.*

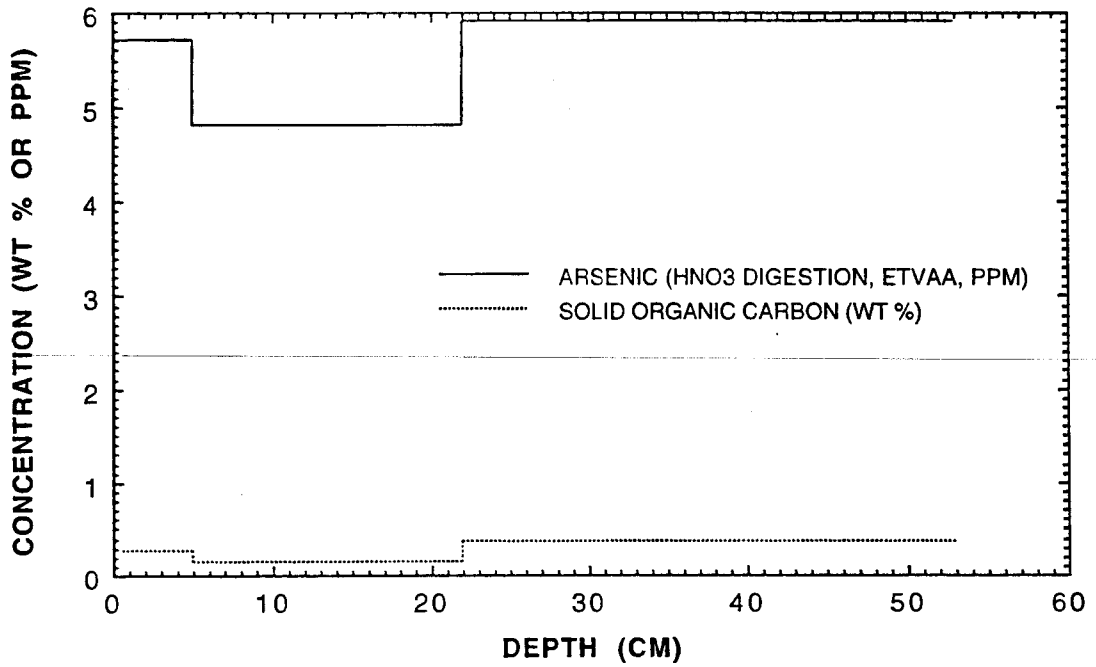



***Fig. 86. Arsenic concentration and solid organic carbon vs depth in background soil; site 6, Frijoles Mesa.***

where As concentrations range from 4.8 to 5.9 ppm. Distributions of acid-digested As and total As were not calculated because some of the digested fraction samples exceeded the total fraction and analytical error in the INAA data is suspected. In spite of this analytical uncertainty, adsorption of As onto solid organic matter, through ligand-exchange reactions, may account for As enrichment within the 2CBk horizon at this site (Fig. 86).

## Site 7—Ancho Canyon Mesas (TA-39), State Route 4

### Location and Geomorphic Setting

The background-soil sampling site is in a roadcut along State Route 4 between tributaries of Ancho Canyon (Fig. 87) under a sparse pinon-juniper woodland, where about 0.6 m of soil overlies unit 3 of the Tshirege Member. The soil is fine-textured and probably includes a significant component of windblown material in addition to eroded tuff. There is abundant evidence of recent surface erosion in this area, including exposed roots of pinon pines and juniper trees. Locally, the soils have been completely stripped to bedrock. In addition, deposits of pure El Cajete pumice occur on the sloping shoulders of the mesa here, and these deposits originally overlaid the sampled soil (Fig. 88). The soil is thus formed in material deposited before 50 to 60 ka. Similar surface characteristics are widespread in this area, including exposure of pre-El Cajete pumice soils by erosion, and the soil sample site may be representative of many mesa top locations in the eastern part of Laboratory. The sample site was mapped as part of the Hackroy soil series by Nyhan *et al.* (1978); this series seems to represent old mesa-top soils that were buried by the El Cajete pumice and were later exposed by erosion (see also Reneau *et al.*, 1995).

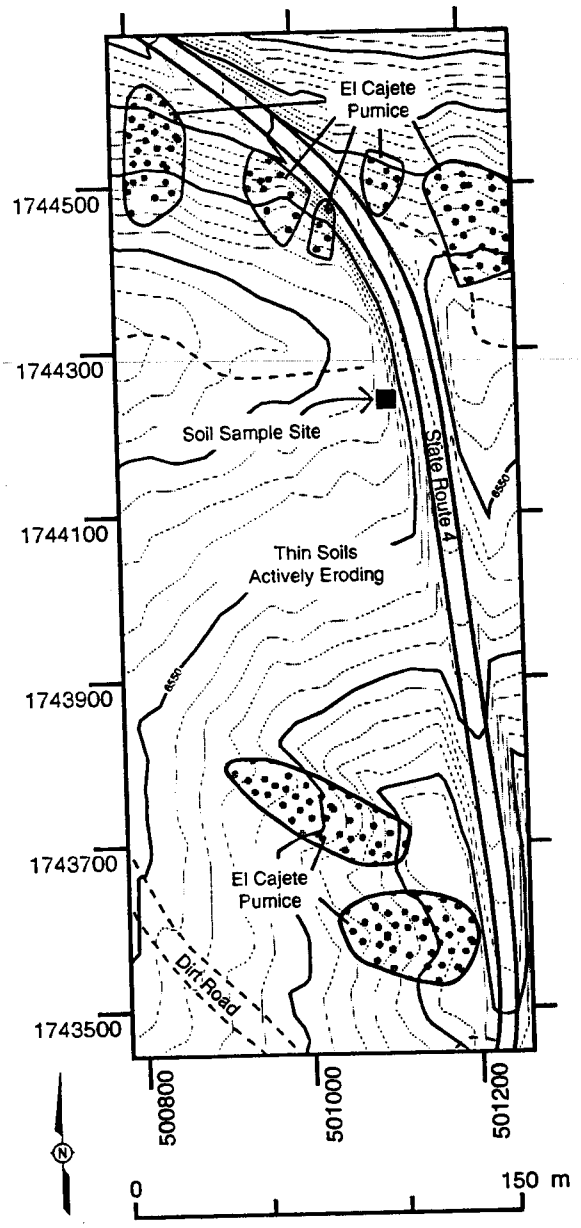



*Fig. 87. Map showing soil sample site 7 on Ancho Canyon mesa along State Route 4 and distribution of El Cajete pumice; topographic base, with 2-ft contours, from FIMAD.*

### Soil Description

Soil samples collected from the TA-39 site are listed in Table 5. The soil at this site is well developed and consists of the following horizons with associated depths and thicknesses: A 1 (0 to 6 cm), A2 (6 to 13 cm), Bt (13 to 20 cm), Bwkb (20 to 44 cm), Btkb (44 to 54 cm), K (54 to 62 cm), and 2R (62+ cm) (Watt and McFadden, 1992). Organic carbon values range from 0.2 to 0.5 wt%, and the highest concentration is associated with the A1 horizon. This soil profile contains a

significant amount of clay-size material ranging from 11.6 to 53.6 wt% (Watt and McFadden, 1992). Sand-size material varies from 12.7 to 36.9 wt%, indicating that this soil profile may have a moderate range of low hydraulic conductivities (Table 6; K values range from $10^{-6}$ to $10^{-3}$ cm/s) in comparision to coarser grained soils found at other areas on the Pajarito Plateau. Silt-size material ranges from 33.7 to 54.0 wt% at this soil site.

## Soil Chemistry

This soil is characterized by acidic to alkaline pH values that range from 6.5 to 8.1, which increase with depth. The lowest pH value in this soil profile is associated with the A1 horizon, whereas the highest pH value is associated with the K horizon (Watt and McFadden, 1992). Calcium-carbonate abundances vary from 1.0 wt% in the A1 horizon to 100 wt% in the K horizon (Watt and McFadden, 1992). Some of the calcium carbonate in this soil could be derived from leaching of the overlying loess cap, and calcium carbonate-rich horizons represent present and/or past depths of the wetting front (Birkeland, 1984). Calcium-carbonate zones occur in this soil profile at depths of 20 and 54 cm. The deeper K horizon occurs immediately above the Bandelier Tuff bedrock and may represent precipitation of $CaCO_3$ at a major permeability or hydraulic conductivity boundary.

Element chemistry for soils collected at this site are provided in Appendix A (INAA and DNAA) and Appendix B (EPA SW846 methods). Figure 89 shows distributions of total Fe and $HNO_3$–digested Fe *vs* depth. Total Fe concentrations range from 2.0 to 4.0 wt%. Acid-soluble Fe concentrations range from 1.3 to 3.6 wt%, making up 58 to 89% of total Fe. Iron concentrations are highest in the Bt and Btkb horizons at this site, which suggests that Fe has been remobilized and concentrated in the clay-size material. These concentration distributions suggest that, in most soil horizons at this site, Fe mainly occurs in $HNO_3$–digested Fe phases, which may include ferric oxyhydroxide and ferrihydrite.

Distributions of total Th, acid-digested Th, and clay-size material with depth are shown in Fig. 90. Concentrations of total Th range from 11.8 to 19.9 ppm, and concentrations of acid-digested Th range from 7.0 to 11.0 ppm. Acid-digested Th constitutes 47 to 76% of total Th. This

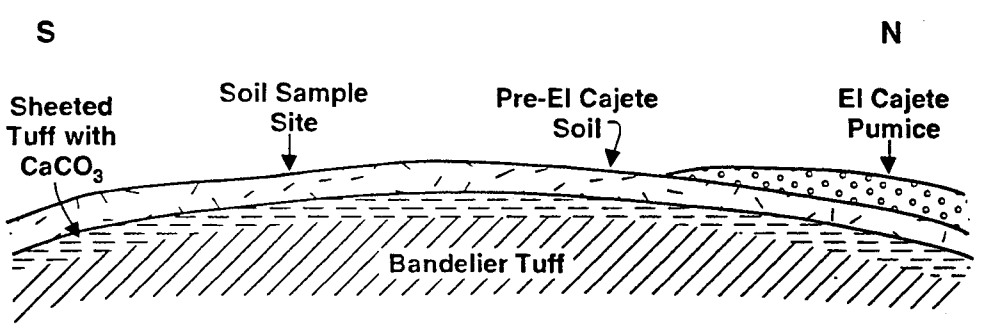



***Fig. 88. Schematic of stratigraphic relations at soil sample site 7 along State Route 4 roadcut.***

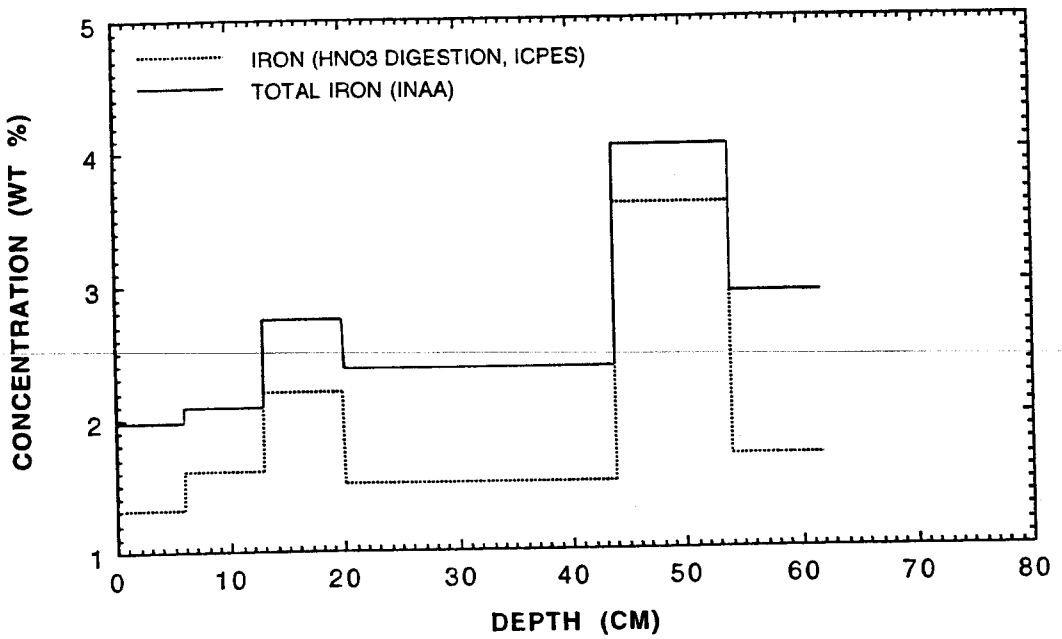



*Fig. 89. Iron concentration vs depth in background soil; site 7, Ancho Canyon mesas.*

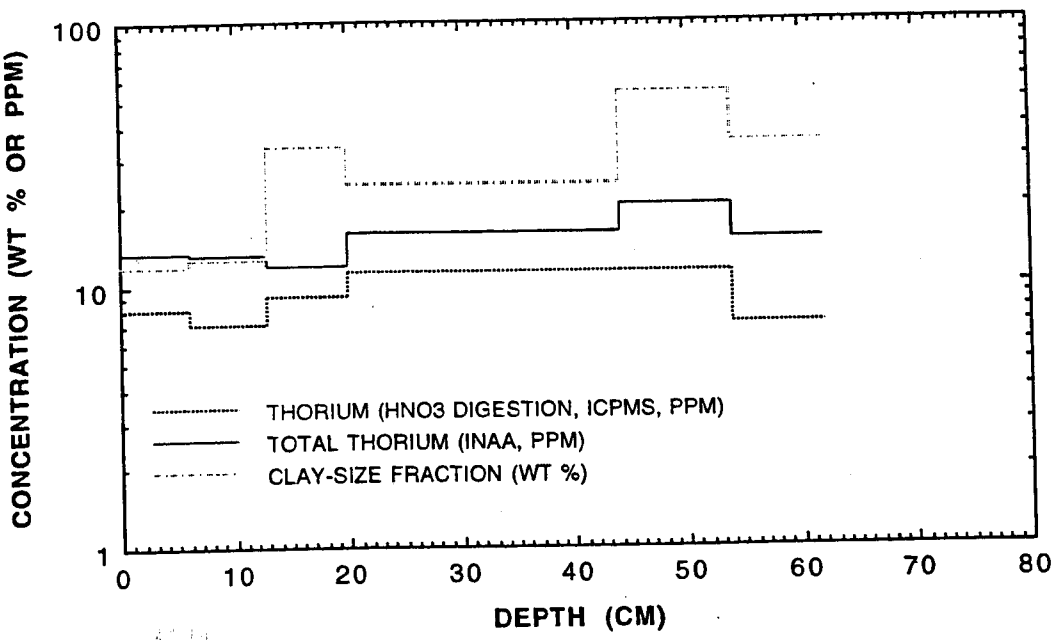



*Fig. 90. Thorium concentration and clay-size fraction vs depth in background soil; site 7, Ancho Canyon mesas.*

fraction correlates with clay-size material (Fig. 90), suggesting that Th may have been redistributed within the soil—possibly through leaching and subsequent adsorption. From percentage distributions of acid-digested and total Th in the Btkb horizon, it appears that most of the Th has been leached from primary phases.

Distributions of total U, acid-digested U, calcium carbonate, and solid organic carbon *vs* depth are shown in Fig. 91. Total U concentrations range from 2.2 to 3.7 ppm, and acid-digested U concentrations range from 0.9 to 1.5 ppm. Acid-leach U makes up 27 to 50% of total U, and this fraction correlates with solid organic carbon in all of the soil horizons and with $CaCO_3$ in the K horizon. These data in Fig. 91 imply that some of the U is associated with $CaCO_3$ coatings that mantle sand-size particles. Surface complexation of U onto $CaCO_3$ may be likely at this site because $HNO_3$–digested U does correlate with $CaCO_3$ in the K horizon (Fig. 91). A moderate amount of U present in this soil has been leached from the primary silicate phase(s).

Figure 92 shows distributions of As, Be, Fe, and clay-size material *vs* depth at the soil site. Beryllium and As show strong correlations with both Fe and clay content, and these elements are concentrated within the Bt and Btkb horizons. Total Be concentrations range from 1.6 to 3.9 ppm, and $HNO_3$–digested Be concentrations range from 0.8 to 4.0 ppm. Distributions of acid-digested As and total As were not calculated because in some instances the digested fraction exceeded total fraction and analytical error in the INAA data is suspected. In spite of this analytical uncertainty, adsorption of As onto

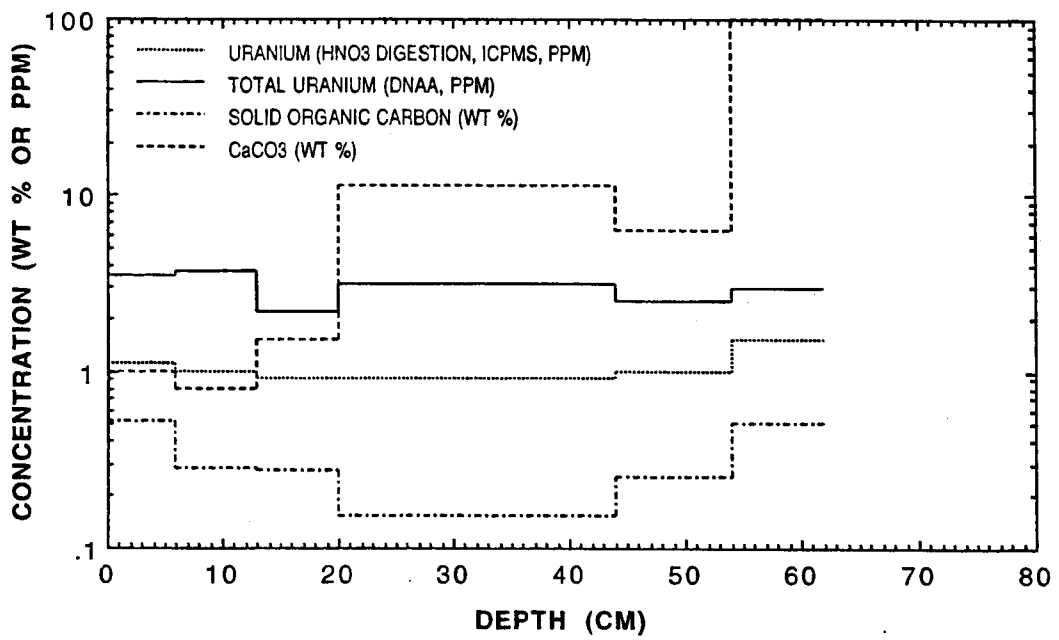



***Fig. 91. Uranium concentration, solid organic carbon, and $CaCO_3$ vs depth in background soil; site 7, Ancho Canyon mesas.***

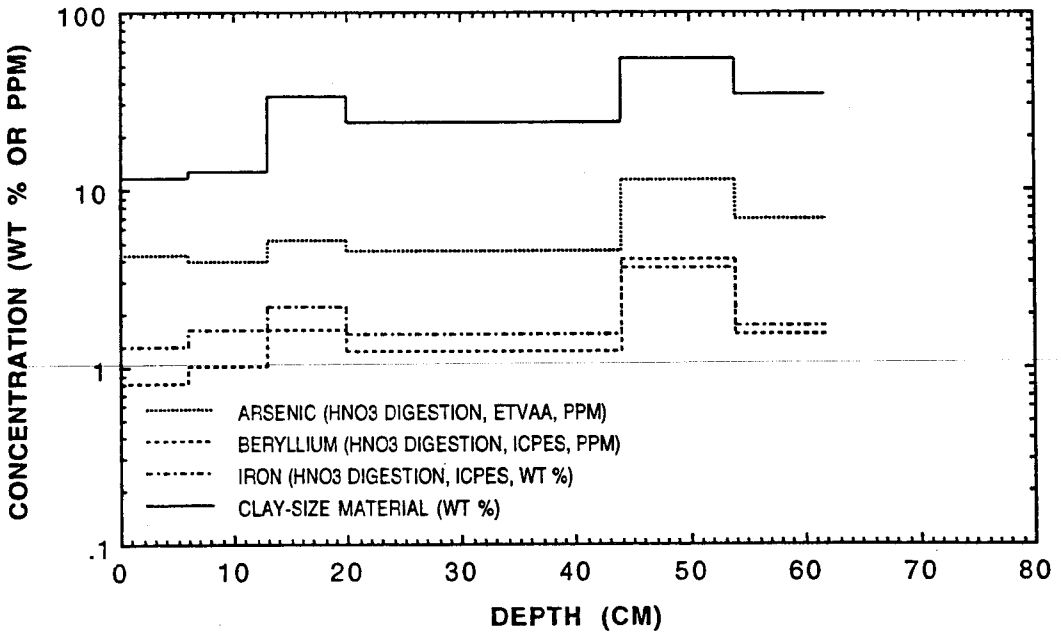



***Fig. 92. Arsenic, Be, and Fe concentrations and clay-size material vs depth in background soil; site 7, Ancho Canyon mesas.***

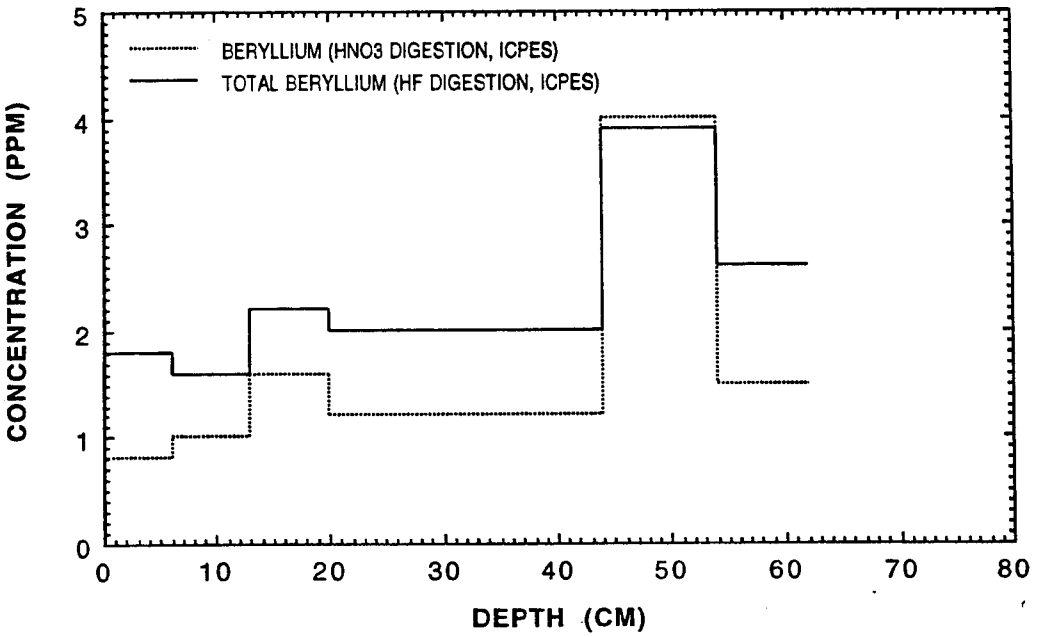



***Fig. 93. Beryllium concentration vs depth in background soil; site 7, Ancho Canyon mesas.***

iron oxides, calcium carbonate, and clay minerals may account for As distributions within the Bt and Btkb horizons at this site (Fig. 92). Acid-digested Be constitutes 44 to almost 100% of total Be (Fig. 93), which suggests that Be in the Bt and Btkb horizons is mainly associated with secondary soil minerals.

### SITE 8—FRACTURE FILL (TA-46)

Fractures within the Bandelier Tuff represent a potential pathway for contaminant migration, and material that fills fractures can provide useful data for understanding movement of water, minerals, and solutes within the fractures. Samples of soil, fresh Bandelier Tuff, and fracture fill collected from TA-46 (Site 8) (Fig. 94) are listed in Table 5. The soil overlying one of the fractures consists of loess associated with a weakly developed A horizon containing organic matter. The fracture fill contains clay minerals, calcium carbonate, iron oxides, manganese oxides, and solid organic matter mixed with fragments of Bandelier Tuff. Other fractures within the Bandelier Tuff at this site are open and devoid of fill material. These open fractures do not contain geochemically reactive phases; consequently, migration of contaminants could be significant. Conversely, the filled fractures contain clay-size material, indicating that this type of fracture may have a relatively low hydraulic conductivity (Table 6; K values range from $10^{-6}$ to $10^{-3}$ cm/s) in comparision to open fractures. The translocation of clay minerals from overlying soil through fractures has been described by Davenport (1993), suggesting that the fracture fills at TA-54 are developed at least partially from overlying soils. Movement of the wetting front controls the rate of translocated fracture-fill material. This fracture fill at TA-46 probably has a high adsorption capacity for solutes, although bulk movement of this material occurs along fractures.

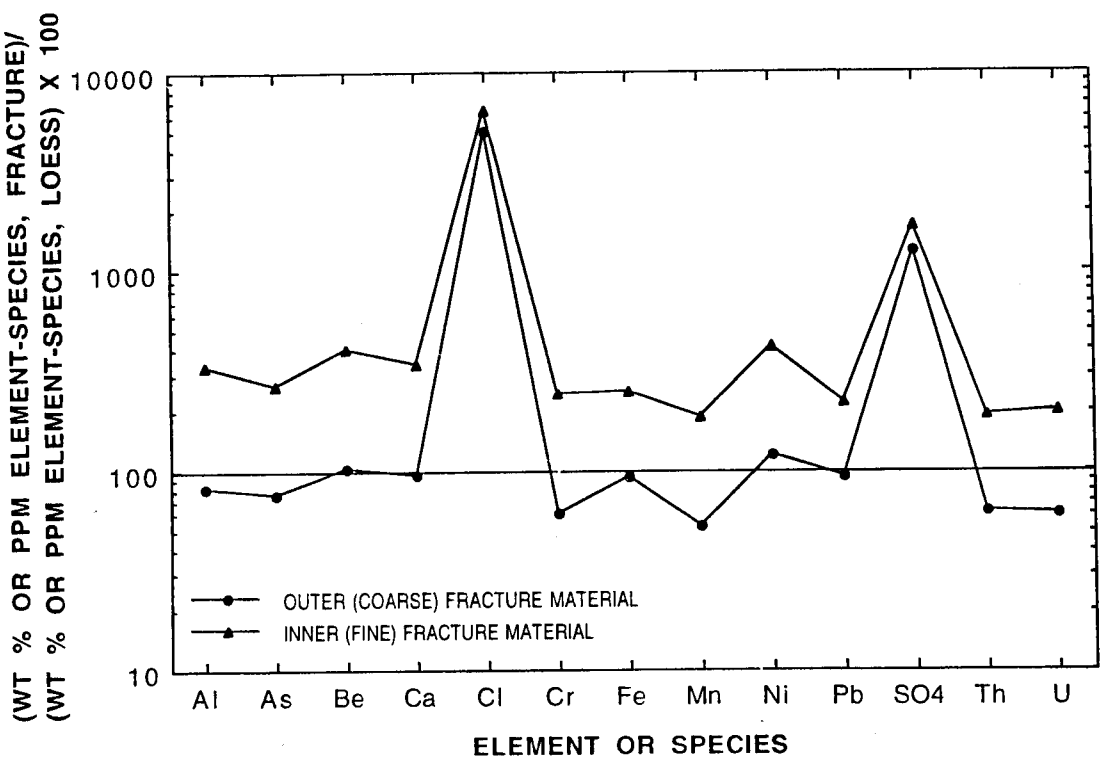



***Fig. 94. Outer (coarse) fracture material and inner (fine) fracture material vs element or species in background soil; site 8, fracture fill.***

The fracture fill sampled at TA-46 is characterized by an outer, coarse-grained zone consisting of weathered Bandelier Tuff that contains iron oxide coatings. The inner, fine-grained fracture fill contains clay minerals, calcium carbonate, solid organic matter, and iron oxides. Both sides of the inner fracture fill show a sharp transition to outer fracture material. Element chemistry for soils collected at this site are provided in Appendix A (INAA and DNAA) and Appendix B (EPA SW846 methods). Figure 94 shows element and species concentrations in fracture-fill material normalized to the overlying soil that may partially or largely represent the source of fracture fill at this site. Values of >100 indicate higher concentrations of an element or species within the fracture fill (outer and inner) relative to the overlying soil. Conversely, values of <100 indicate that an element or species is higher within the soil than in the fracture fill. The outer zone of the fracture is more enriched in Cl, Ni, and $SO_4$ than the overlying soil (Fig. 94), and this zone has lesser amounts of Al, As, Cr, Fe, Mn, Th, and U than the soil. Beryllium is evenly distributed between the outer fracture zone and overlying soil. Extensive leaching in the outer zone probably has occurred, resulting in depletion of trace elements. The inner zone of the fracture is higher in Al, As, Be, Ca, Cl, Cr, Fe, Mn, Ni, Pb, $SO_4$, Th, and U than the soil (Fig. 94). Chlorine and $SO_4$ show the most enrichment within the fracture. Enrichment of $SO_4$ and Ca suggests the presence of gypsum as a component of eolian dust within the fracture fill. Adsorption of As, Be, Cr, Ni, Pb, Th, and U onto iron oxides, calcium carbonate, manganese oxides, solid organic matter, and/or clay minerals may account for trace-element enrichment in the inner fracture zone.

## CONCLUSIONS

Soils present on the Pajarito Plateau are extremely variable in physical and chemical properties such as particle-size distribution, percent calcium carbonate, clay mineralogy, iron oxides, and trace-element chemistry. Variations in background-soil elemental concentrations are related to climate, topography, parent material, soil age, surficial processes, pore-water chemistry, and vegetation. Parent materials consist of alluvial fan deposits, sheetwash material, colluvium, El Cajete pumice, and—in some instances—the Bandelier Tuff. The age of the sampled deposits range from several thousand years to perhaps as old as one million years.

Lower Los Alamos Canyon (Site 1) represents a poorly developed soil characterized by A, C, and 2Cb horizons. This soil profile contains clay-size material varying from 2.4 to 7.4 wt%. At Site 1, $HNO_3$–digested Be and As concentrations range from 0.3 to 0.4 ppm and from 0.7 to 0.9 ppm, respectively. Conversely, soil described at the Ancho Canyon mesas (site 7) is well developed and consists of the following horizons: A1, A2, Bt, Bwkb, Btkb, and K. This soil profile contains significant amounts of clay and $CaCO_3$; abundances of clay-size material range from 11.6 to 53.6 wt%. At site 7, $HNO_3$–digested As and Be concentrations range from 0.8 to 4.0 ppm and from 3.0 to 11.2 ppm, respectively.

Well-developed soils contain more trace elements than the weakly developed soils found on the Pajarito Plateau. The B horizons are characterized by higher concentrations of trace elements than the A and C horizons. High abundances of clay minerals and iron oxides, characterized by relatively high surface areas, within B horizons control trace-element distributions in soils. Soils have higher concentrations of Al, As, Ba, Ca, Cs, Co, Cr, and Fe than the Bandelier Tuff samples; the Bandelier Tuff, however, is higher in Be, Pb, Na, K, Th, and U.

Different trace elements possibly are distributed in background soils by several processes:

(1) trace elements that are concentrated primarily on surfaces of soil particles through chemical weathering; for example, As;

(2) trace elements that remain concentrated within soil-particle matrices consisting of primary minerals (silicates) and glass; for example, Ba, Th, and U; and

(3) trace elements that are distributed as a combination of processes (1) and (2); for example, Be, Cr, Pb, and V.

Process (1) is chiefly the result of adsorption of trace elements onto surfaces of clay minerals, iron oxides, solid organic matter, and calcium carbonate. Process (2) is dominated by coprecipitation of trace elements within primary minerals. Barium, Th, and U tend to show less leaching from primary silicate minerals and glass than As and Be, which have become concentrated on surfaces of soil particles through chemical weathering that leads to element remobilization. Uranium(IV) probably is the dominant valence state within primary phases present in soil. This conclusion is based on significant differences observed between total element and $HNO_3$–digested

fraction, suggesting some leaching of U has occurred in poorly developed soils at the Laboratory. Characterization of soil mineralogy and pore-water chemistry will provide useful information on geochemical processes, such as adsorption and precipitation reactions, that control trace-element distributions in soils.

Because of the limited number of Bandelier Tuff and soil samples collected, this data set may not be representative of the full suite of soils and Bandelier Tuff present at the Laboratory and may not include the full range of natural concentrations for all elements. However, the available data and information have defined many of the geochemical interactions that exist in the Pajarito Plateau soils and have provided a guide for interpreting analyses obtained from possibly contaminated sites. Comparing the geomorphic setting and soil-profile characteristics for sites of concern with those of these background soils, will make it possible to provide better site-specific constraints on geochemical or natural backgrounds.

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# APPENDIX A

## TABLE A-I
## Bandelier Tuff Analyses

| | Na | Standard Deviation | Mg | Standard Deviation | Al | Standard Deviation | Cl | Standard Deviation | K | Standard Deviation | Ca | Standard Deviation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FS-1001 | 33930.00 | 1764.36 | <2340.00 | | 66730.00 | 1868.44 | 1777.00 | 140.38 | 40660.00 | 2642.90 | 2304.00 | 329.47 |
| FS-1002 | 30280.00 | 1332.32 | <2729.00 | | 64340.00 | 1801.52 | 1369.00 | 104.04 | 36350.00 | 2399.10 | <2070.00 | |
| FS-1003 | 25000.00 | 1175.00 | <3122.00 | | 50600.00 | 1467.40 | 889.00 | 82.68 | 28760.00 | 2415.84 | <2056.00 | |
| FS-1004 | 33090.00 | 1753.77 | <2360.00 | | 68090.00 | 1906.52 | 531.90 | 46.81 | 40150.00 | 2609.75 | 2255.00 | 331.48 |
| FS-1005 | 29620.00 | 1273.66 | <2742.00 | | 64680.00 | 1811.04 | 168.90 | 62.49 | 36640.00 | 2418.24 | 10070.00 | 735.11 |
| FS-1006 | 31445.00 | 1446.47 | <3867.00 | | 65590.00 | 1868.67 | 720.30 | 70.53 | 36440.00 | 2876.78 | 5450.00 | 541.58 |
| FS-1007 | 33940.00 | 1764.88 | <2252.00 | | 66990.00 | 1875.72 | 849.60 | 77.31 | 39010.00 | 2769.71 | <2078.00 | |
| FS-1008 | 31440.00 | 1351.92 | <2716.00 | | 66640.00 | 1865.92 | 172.30 | 31.53 | 37380.00 | 2467.08 | <1972.00 | |
| FS-1009 | 32960.00 | 1549.12 | <4173.00 | | 66720.00 | 1934.88 | 711.90 | 61.22 | 36140.00 | 2421.38 | <2055.00 | |
| FS-1010 | 36230.00 | 1920.19 | <2395.00 | | 69930.00 | 1958.04 | 473.00 | 43.04 | 39470.00 | 2565.55 | 5277.00 | 2052.75 |
| FS-1011 | 31970.00 | 1374.71 | <2669.00 | | 65950.00 | 1846.60 | 434.90 | 39.58 | 38400.00 | 2534.40 | <1988.00 | |
| FS-1012 | 34755.00 | 1723.19 | <3141.50 | | 65940.00 | 1878.84 | 273.15 | 32.38 | 38915.00 | 3807.29 | 3473.00 | 430.65 |
| FS-1013 | 36220.00 | 1883.44 | <2237.00 | | 68590.00 | 1920.52 | 360.30 | 63.41 | 39900.00 | 3351.60 | 2824.00 | 353.00 |
| FS-1014 | 31150.00 | 1339.45 | <2520.00 | | 65280.00 | 1827.84 | 134.30 | 19.74 | 38130.00 | 2516.58 | 3289.00 | 371.66 |
| FS-1015 | 32130.00 | 1510.11 | <3595.00 | | 65440.00 | 1832.32 | <173.40 | | 35400.00 | 2336.40 | <2043.00 | |
| FS-1016 | 34330.00 | 1819.49 | <2143.00 | | 66900.00 | 1873.20 | <119.50 | | 41360.00 | 2729.76 | <1807.00 | |
| FS-1017 | 30790.00 | 1323.97 | <2588.00 | | 65000.00 | 1820.00 | 204.80 | 36.25 | 38090.00 | 2513.94 | <1842.00 | |
| FS-1018 | 31590.00 | 1484.73 | <3811.00 | | 66370.00 | 1858.36 | 378.40 | 41.25 | 38200.00 | 2521.20 | 2472.00 | 417.77 |
| FS-1019 | 27300.00 | 1446.90 | 6571.00 | 722.81 | 73210.00 | 2049.88 | 471.10 | 55.59 | 37170.00 | 2453.22 | 11770.00 | 2907.19 |
| FS-1020 | 27580.00 | 1185.94 | 3297.00 | 771.50 | 73820.00 | 2066.96 | 338.30 | 49.73 | 35850.00 | 2366.10 | 9139.00 | 639.73 |
| FS-1021 | 24310.00 | 1142.57 | <3734.00 | | 55930.00 | 1621.97 | 1632.00 | 124.03 | 33830.00 | 2266.61 | <2530.00 | |
| FS-1022 | 31610.00 | 1675.33 | <2408.00 | | 68090.00 | 1906.52 | 1883.00 | 139.34 | 42500.00 | 2932.50 | <1929.00 | |
| FS-1023 | 26890.00 | 1156.27 | <2549.00 | | 63720.00 | 1784.16 | 1239.00 | 102.84 | 41740.00 | 3673.12 | <1871.00 | |
| FS-1024 | 13960.00 | 670.08 | <3054.00 | | 63640.00 | 1781.92 | 289.80 | 30.43 | 29210.00 | 2132.33 | 16960.00 | 1000.64 |
| FS-1025 | 30030.00 | 1561.56 | <2359.00 | | 68030.00 | 1904.84 | 565.50 | 49.20 | 47920.00 | 3162.72 | <1956.00 | |
| FS-1026 | 28180.00 | 1225.77 | <2644.00 | | 69195.00 | 1937.46 | 402.10 | 44.73 | 41900.00 | 3757.45 | <1899.00 | |
| FS-1027 | 31860.00 | 1529.28 | <4116.00 | | 68200.00 | 1977.80 | 500.10 | 48.51 | 37870.00 | 4089.96 | <2142.00 | |
| FS-1028 | 31230.00 | 1592.73 | <2257.00 | | 65740.00 | 1840.72 | 259.20 | 28.77 | 39560.00 | 2610.96 | <1849.00 | |
| FS-1029 | 30890.00 | 1359.16 | <2511.00 | | 63870.00 | 1788.36 | 208.60 | 37.34 | 36430.00 | 2659.39 | <1915.00 | |
| FS-1030 | 32570.00 | 1530.79 | <3778.00 | | 66260.00 | 1855.28 | 342.40 | 36.64 | 36220.00 | 4962.14 | <1777.00 | |
| FS-1031 | 34420.00 | 1789.84 | <2150.00 | | 67630.00 | 1893.64 | 102.60 | 26.06 | 37410.00 | 2805.75 | <1843.00 | |
| FS-1032 | 32110.00 | 1380.73 | <2378.00 | | 64830.00 | 1815.24 | <107.50 | | 40470.00 | 3642.30 | <1798.00 | |
| FS-1033 | 31690.00 | 1521.12 | <3395.00 | | 66700.00 | 2668.00 | <162.20 | | 36280.00 | 2684.72 | <1957.00 | |
| FS-1034 | 33820.00 | 1826.28 | <2060.00 | | 64990.00 | 1819.72 | <115.00 | | 36050.00 | 2703.75 | <1978.00 | |
| FS-1035 | 31900.00 | 1339.80 | <2456.00 | | 66630.00 | 1865.64 | <104.40 | | 36230.00 | 2970.86 | 1745.00 | 305.38 |
| FS-1036 | 31320.00 | 1440.72 | <3512.50 | | 66745.00 | 1868.86 | <170.55 | | 36125.00 | 2726.60 | <2301.50 | |
| FS-1037 | 33090.00 | 1753.77 | <2160.00 | | 68530.00 | 1918.84 | 120.50 | 30.00 | 40310.00 | 2982.94 | 2183.00 | 329.63 |
| FS-1036 | 34303.33 | 1621.29 | 3035.00 | 664.66 | 76531.66 | 2142.89 | <133.65 | | 39430.00 | 3031.54 | 5800.67 | 545.86 |

| | Sc | Standard Deviation | Ti | Standard Deviation | V | Standard Deviation | Cr | Standard Deviation | Mn | Standard Deviation | Fe | Standard Deviation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FS-1001 | 1.06 | 0.06 | <3883.00 | | <6.74 | | 2.39 | 0.59 | 552.60 | 24.31 | 11100.00 | 599.40 |
| FS-1002 | 1.15 | 0.07 | <4673.00 | | <7.67 | | <1.82 | | 598.00 | 23.92 | 11550.00 | 716.10 |
| FS-1003 | 0.98 | 0.05 | <5160.00 | | <7.84 | | 4.52 | 0.62 | 444.50 | 18.22 | 8818.00 | 458.54 |
| FS-1004 | 1.21 | 0.07 | <4166.00 | | <7.00 | | <1.54 | | 667.60 | 33.38 | 11170.00 | 659.03 |
| FS-1005 | 1.19 | 0.08 | <4533.00 | | <7.27 | | 4.99 | 0.65 | 541.00 | 21.64 | 10600.00 | 540.60 |
| FS-1006 | 1.05 | 0.06 | <6364.00 | | <9.60 | | 3.85 | 0.56 | 554.80 | 22.19 | 10136.50 | 531.47 |
| FS-1007 | 1.16 | 0.06 | 432.50 | 155.70 | <6.34 | | 3.13 | 0.60 | 531.50 | 25.51 | 11040.00 | 640.32 |
| FS-1008 | 1.11 | 0.06 | <4385.00 | | <7.25 | | 4.35 | 0.53 | 553.30 | 24.35 | 10690.00 | 641.40 |
| FS-1009 | 1.07 | 0.06 | <6867.00 | | <10.37 | | 4.27 | 0.68 | 581.70 | 22.69 | 10680.00 | 544.68 |
| FS-1010 | 1.56 | 0.08 | <4011.00 | | <6.96 | | 5.90 | 0.75 | 683.70 | 36.92 | 12440.00 | 684.20 |
| FS-1011 | 1.17 | 0.07 | <4355.00 | | <7.21 | | 4.76 | 0.57 | 539.80 | 22.67 | 10250.00 | 533.00 |
| FS-1012 | 1.17 | 0.06 | <5291.00 | | <8.24 | | 4.54 | 0.60 | 637.95 | 25.98 | 11645.00 | 624.48 |
| FS-1013 | 1.10 | 0.06 | <3661.00 | | <6.23 | | 1.97 | 0.51 | 525.80 | 30.50 | 10710.00 | 610.47 |
| FS-1014 | 1.36 | 0.08 | <4131.00 | | <6.66 | | 4.80 | 0.55 | 518.10 | 21.76 | 10650.00 | 660.30 |
| FS-1015 | 1.34 | 0.07 | <6055.00 | | <9.05 | | 2.38 | 0.48 | 574.90 | 24.72 | 11080.00 | 565.08 |
| FS-1016 | 1.63 | 0.09 | <3466.00 | | <5.90 | | <1.31 | | 459.70 | 20.69 | 11080.00 | 709.12 |
| FS-1017 | 1.45 | 0.08 | <4103.00 | | <6.53 | | 3.61 | 0.51 | 428.90 | 16.73 | 10490.00 | 597.93 |
| FS-1018 | 1.57 | 0.08 | <6076.00 | | <9.19 | | 2.84 | 0.52 | 465.70 | 18.63 | 10310.00 | 525.81 |
| FS-1019 | 5.59 | 0.30 | 1943.00 | 318.65 | 42.25 | 2.75 | 49.85 | 3.14 | 834.50 | 37.55 | 22850.00 | 1462.40 |
| FS-1020 | 4.08 | 0.22 | 1505.00 | 290.46 | 21.50 | 2.17 | 12.00 | 0.89 | 465.80 | 19.56 | 17080.00 | 888.16 |
| FS-1021 | 1.01 | 0.05 | <6524.00 | | <9.58 | | 2.86 | 1.33 | 558.70 | 21.79 | 9777.00 | 518.18 |
| FS-1022 | 0.91 | 0.05 | <4051.00 | | <7.10 | | <0.91 | | 626.90 | 29.46 | 11470.00 | 699.67 |
| FS-1023 | 0.88 | 0.06 | <4304.00 | | <7.01 | | 2.70 | 0.52 | 574.40 | 22.40 | 10020.00 | 591.18 |
| FS-1024 | 0.93 | 0.05 | <6017.00 | | <8.62 | | <2.66 | | 639.70 | 24.95 | 10560.00 | 538.56 |
| FS-1025 | 1.19 | 0.06 | <4020.00 | | <6.93 | | <1.68 | | 589.80 | 28.90 | 11480.00 | 619.92 |
| FS-1026 | 1.18 | 0.08 | <4507.50 | | <7.42 | | 3.94 | 0.63 | 581.30 | 23.87 | 11475.00 | 618.80 |
| FS-1027 | 1.17 | 0.06 | <7024.00 | | <10.49 | | 3.72 | 0.61 | 663.10 | 25.86 | 11490.00 | 620.46 |
| FS-1028 | 1.17 | 0.06 | 721.00 | 186.02 | <6.60 | | 1.79 | 0.48 | 663.40 | 33.17 | 11260.00 | 641.82 |
| FS-1029 | 1.36 | 0.07 | <4138.00 | | <6.92 | | 3.12 | 0.59 | 514.60 | 22.13 | 10750.00 | 612.75 |
| FS-1030 | 1.14 | 0.06 | <6129.00 | | <9.28 | | 3.84 | 0.51 | 558.20 | 22.33 | 10750.00 | 806.25 |
| FS-1031 | 1.36 | 0.07 | <3610.00 | | <6.24 | | 5.94 | 0.65 | 590.00 | 26.55 | 11390.00 | 580.89 |
| FS-1032 | 1.69 | 0.09 | <3831.00 | | <6.43 | | 5.08 | 0.63 | 510.10 | 20.91 | 11300.00 | 745.80 |
| FS-1033 | 1.25 | 0.07 | <5561.00 | | <8.45 | | 1.63 | 0.37 | 502.10 | 19.58 | 10770.00 | 710.82 |
| FS-1034 | 1.31 | 0.07 | <3365.00 | | <5.79 | | <2.08 | | 482.00 | 25.06 | 10220.00 | 541.66 |
| FS-1035 | 1.63 | 0.09 | <3873.00 | | <6.26 | | 1.17 | 0.46 | 360.40 | 14.42 | 10740.00 | 579.96 |
| FS-1036 | 1.92 | 0.11 | 1068.00 | 243.50 | <8.40 | | 2.07 | 0.41 | 382.75 | 15.49 | 10890.00 | 796.05 |
| FS-1037 | 1.86 | 0.10 | <3622.00 | | <6.17 | | 5.80 | 0.67 | 449.20 | 21.56 | 11570.00 | 590.07 |
| FS-1036 | 3.81 | 0.21 | 1528.33 | 285.13 | 9.63 | 1.83 | 9.90 | 0.93 | 558.48 | 24.02 | 17843.33 | 1015.54 |

| | Co | Standard Deviation | Cu | Standard Deviation | Zn | Standard Deviation | Ga | Standard Deviation | As | Standard Deviation | Se | Standard Deviation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FS-1001 | 0.83 | 0.11 | <322.90 | | 115.80 | 15.75 | 29.86 | 5.08 | 1.68 | 0.40 | <2.27 | |
| FS-1002 | <0.31 | | <307.60 | | 95.66 | 31.95 | 24.22 | 4.77 | <2.63 | | <3.85 | |
| FS-1003 | 0.71 | 0.06 | <333.30 | | 63.26 | 8.60 | <28.45 | | <3.46 | | <3.62 | |
| FS-1004 | 1.27 | 0.11 | <322.00 | | 110.50 | 15.03 | 25.40 | 5.82 | 3.04 | 0.53 | <2.28 | |
| FS-1005 | 0.55 | 0.21 | <301.60 | | 83.97 | 32.08 | <23.85 | | 1.80 | 0.46 | <4.11 | |
| FS-1006 | 0.66 | 0.14 | <413.90 | | 96.83 | 21.66 | 32.61 | 5.84 | 1.39 | 0.43 | <4.04 | |
| FS-1007 | 1.22 | 0.09 | <309.40 | | 88.49 | 12.30 | <24.54 | | 1.00 | 0.31 | <2.13 | |
| FS-1008 | 0.49 | 0.19 | <300.40 | | 78.40 | 29.56 | <24.46 | | <2.57 | | <3.81 | |
| FS-1009 | 0.83 | 0.08 | <437.10 | | 79.85 | 10.94 | <40.36 | | 2.03 | 0.50 | <4.92 | |
| FS-1010 | 1.13 | 0.09 | <322.90 | | 100.50 | 13.67 | 14.53 | 4.40 | 1.38 | 0.38 | <2.13 | |
| FS-1011 | <0.35 | | <298.80 | | 78.09 | 28.58 | <24.65 | | 1.68 | 0.40 | <3.81 | |
| FS-1012 | 0.81 | 0.10 | <370.35 | | 84.23 | 11.32 | 26.22 | 5.30 | <3.47 | | <3.84 | |
| FS-1013 | 0.72 | 0.08 | <309.50 | | 89.34 | 12.24 | <25.61 | | <2.37 | | <1.93 | |
| FS-1014 | 0.83 | 0.16 | <283.90 | | 56.88 | 24.86 | <23.89 | | <2.43 | | <3.27 | |
| FS-1015 | 0.77 | 0.06 | <385.80 | | 62.76 | 8.54 | <36.56 | | <4.03 | | <3.68 | |
| FS-1016 | 1.11 | 0.09 | <288.60 | | 71.19 | 9.90 | 15.10 | 4.70 | <2.29 | | <1.85 | |
| FS-1017 | 0.51 | 0.18 | <281.70 | | <43.50 | | <25.37 | | <2.55 | | <3.43 | |
| FS-1018 | 1.04 | 0.08 | <403.00 | | 41.34 | 6.12 | <39.67 | | <4.24 | | <3.86 | |
| FS-1019 | 8.88 | 0.48 | <299.40 | | 112.40 | 15.17 | 33.70 | 5.59 | 1.47 | 0.34 | <2.59 | |
| FS-1020 | 3.98 | 0.27 | <267.10 | | <46.20 | | <23.63 | | <2.30 | | <3.97 | |
| FS-1021 | 0.78 | 0.08 | <399.60 | | 86.31 | 11.74 | <38.01 | | 2.31 | 0.47 | <4.15 | |
| FS-1022 | 0.70 | 0.09 | <326.10 | | 130.90 | 17.67 | 34.21 | 6.53 | 3.15 | 0.52 | <1.14 | |
| FS-1023 | <0.29 | | <284.00 | | 83.24 | 29.55 | <25.60 | | 0.94 | 0.28 | <3.58 | |
| FS-1024 | 0.75 | 0.07 | <313.40 | | 101.00 | 13.53 | 30.35 | 4.83 | <3.02 | | <4.58 | |
| FS-1025 | 1.18 | 0.11 | <323.40 | | 131.30 | 17.86 | <29.12 | | 1.99 | 0.44 | <2.38 | |
| FS-1026 | 0.92 | 0.15 | <299.25 | | 98.65 | 23.48 | <35.28 | | 2.13 | 0.47 | <3.14 | |
| FS-1027 | 0.86 | 0.08 | <444.40 | | 86.79 | 11.7^ | <45.53 | | <4.55 | | <4.17 | |
| FS-1028 | 1.78 | 0.18 | <306.30 | | 87.37 | 12.06 | <27.72 | | <2.34 | | <2.10 | |
| FS-1029 | 0.98 | 0.08 | <280.60 | | 76.66 | 10.66 | <38.26 | | <2.61 | | <1.97 | |
| FS-1030 | 0.54 | 0.17 | <401.10 | | 59.45 | 25.50 | <58.83 | | <4.35 | | <3.66 | |
| FS-1031 | 1.04 | 0.08 | <302.50 | | 73.05 | 9.86 | <39.68 | | 1.70 | 0.41 | <4.35 | |
| FS-1032 | 1.38 | 0.10 | <260.80 | | 80.09 | 10.89 | <37.87 | | <2.52 | | <1.86 | |
| FS-1033 | 0.76 | 0.15 | <363.20 | | 50.21 | 22.90 | <55.89 | | <4.00 | | <3.11 | |
| FS-1034 | 1.34 | 0.08 | <284.80 | | 54.13 | 7.58 | <40.44 | | <2.40 | | <3.93 | |
| FS-1035 | 1.07 | 0.09 | <274.40 | | 53.52 | 7.81 | <41.37 | | <2.66 | | <1.85 | |
| FS-1036 | 0.64 | 0.17 | <374.10 | | <6.42 | | <62.06 | | <4.31 | | <3.24 | |
| FS-1037 | 1.39 | 0.10 | <297.80 | | 39.85 | 5.94 | <43.18 | | <2.52 | | <3.69 | |
| FS-1036 | 3.14 | 0.20 | <335.42 | | 62.79 | 9.09 | <53.58 | | 2.62 | 0.55 | <3.50 | |

| | Br | Standard Deviation | Rb | Standard Deviation | Sr | Standard Deviation | Zr | Standard Deviation | Ag | Standard Deviation | In | Standard Deviation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FS-1001 | 1.70 | 0.50 | 234.60 | 11.26 | <276.80 | | 227.70 | 33.02 | <1.95 | | <0.25 | |
| FS-1002 | 2.39 | 0.59 | 234.00 | 11.23 | <325.10 | | 310.20 | 75.38 | <2.47 | | <0.31 | |
| FS-1003 | 2.57 | 0.80 | 168.80 | 8.10 | <351.60 | | 204.00 | 28.15 | <2.16 | | <0.30 | |
| FS-1004 | <3.07 | | 217.40 | 10.44 | <285.30 | | 220.30 | 33.27 | <2.00 | | <0.25 | |
| FS-1005 | 2.56 | 0.51 | 200.30 | 9.61 | <312.40 | | 235.40 | 35.78 | <2.40 | | <0.31 | |
| FS-1006 | <4.80 | | 206.40 | 9.80 | <438.55 | | 254.80 | 47.33 | <2.38 | | <0.37 | |
| FS-1007 | 6.73 | 0.81 | 210.70 | 10.11 | <262.60 | | 206.30 | 31.98 | <1.90 | | <0.24 | |
| FS-1008 | <3.64 | | 205.40 | 9.86 | <309.70 | | 265.00 | 38.16 | <2.31 | | <0.30 | |
| FS-1009 | <5.42 | | 217.00 | 10.42 | <474.60 | | 219.90 | 33.20 | <2.72 | | <0.40 | |
| FS-1010 | <3.01 | | 195.00 | 9.36 | <283.00 | | 225.30 | 33.79 | <1.94 | | <0.25 | |
| FS-1011 | <3.64 | | 193.10 | 9.27 | <308.70 | | 234.60 | 35.66 | <2.25 | | <0.30 | |
| FS-1012 | <3.90 | | 207.75 | 9.87 | <370.25 | | 235.25 | 32.33 | <2.51 | | <0.32 | |
| FS-1013 | <2.93 | | 190.90 | 9.35 | <255.50 | | 184.10 | 27.61 | <1.71 | | <0.23 | |
| FS-1014 | <3.36 | | 147.80 | 7.24 | <286.30 | | 227.80 | 31.21 | <2.09 | | <0.28 | |
| FS-1015 | <4.67 | | 144.30 | 7.07 | <409.60 | | 205.60 | 28.37 | <2.28 | | <0.35 | |
| FS-1016 | <2.81 | | 124.20 | 6.33 | <236.90 | | 144.10 | 34.30 | <1.77 | | <0.22 | |
| FS-1017 | <3.50 | | 124.20 | 6.21 | <281.40 | | 223.90 | 32.24 | <2.16 | | <0.28 | |
| FS-1018 | <4.89 | | 110.30 | 5.63 | <418.30 | | 231.10 | 37.67 | <2.50 | | <0.36 | |
| FS-1019 | <2.56 | | 162.00 | 8.42 | <290.80 | | 165.80 | 53.39 | <2.90 | | <0.23 | |
| FS-1020 | <3.17 | | 157.40 | 7.71 | <275.50 | | 229.90 | 35.63 | <2.95 | | <0.27 | |
| FS-1021 | 1.89 | 0.48 | 242.90 | 11.66 | <441.40 | | 247.30 | 35.86 | <2.66 | | <0.36 | |
| FS-1022 | 2.82 | 0.70 | 272.90 | 13.10 | <288.30 | | 217.30 | 34.77 | <2.07 | | <0.25 | |
| FS-1023 | 2.34 | 0.78 | 259.50 | 12.20 | <305.70 | | 249.10 | 36.37 | <2.21 | | <0.29 | |
| FS-1024 | <3.43 | | 488.40 | 22.47 | 653.90 | 120.32 | 243.70 | 33.87 | <2.63 | | <0.30 | |
| FS-1025 | 2.07 | 0.52 | 211.80 | 10.38 | <286.60 | | 196.80 | 33.85 | <2.12 | | <0.25 | |
| FS-1026 | <3.38 | | 194.90 | 9.55 | <312.65 | | 264.05 | 42.57 | <2.21 | | <0.30 | |
| FS-1027 | <5.14 | | 178.60 | 8.75 | <483.80 | | 259.40 | 43.84 | <2.74 | | <0.40 | |
| FS-1028 | <2.75 | | 198.10 | 9.71 | <276.00 | | 173.20 | 27.89 | <1.86 | | <0.24 | |
| FS-1029 | <3.17 | | 188.70 | 9.06 | <287.90 | | 227.10 | 32.48 | <1.77 | | <0.28 | |
| FS-1030 | <4.44 | | 198.30 | 9.52 | <421.00 | | 270.10 | 37.54 | <2.17 | | <0.36 | |
| FS-1031 | <2.59 | | 202.30 | 9.51 | <254.60 | | 216.30 | 30.93 | <2.47 | | <0.23 | |
| FS-1032 | <3.10 | | 145.90 | 7.15 | <270.60 | | 183.60 | 25.70 | <1.71 | | <0.26 | |
| FS-1033 | <4.08 | | 145.90 | 7.00 | <381.60 | | 246.70 | 32.81 | <1.95 | | <0.33 | |
| FS-1034 | <2.55 | | 145.80 | 7.00 | <238.40 | | 195.40 | 27.36 | <2.30 | | <0.21 | |
| FS-1035 | <3.21 | | 100.60 | 5.23 | <266.40 | | 200.20 | 28.43 | <1.76 | | <0.27 | |
| FS-1036 | <4.30 | | 100.85 | 5.14 | <375.55 | | 258.80 | 34.14 | <2.21 | | <0.34 | |
| FS-1037 | <2.66 | | 105.60 | 5.39 | <242.30 | | 226.30 | 30.55 | <2.62 | | <0.22 | |
| FS-1036 | <3.55 | | 79.13 | 4.57 | <327.17 | | 368.82 | 50.10 | <2.95 | | <0.30 | |

| | Sb | Standard Deviation | I | Standard Deviation | Cs | Standard Deviation | Ba | Standard Deviation | La | Standard Deviation | Ce | Standard Deviation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FS-1001 | <0.45 | | <16.20 | | 7.06 | 0.42 | 131.40 | 28.65 | 56.09 | 2.92 | 113.70 | 5.00 |
| FS-1002 | <0.40 | | <19.20 | | 7.01 | 0.42 | <67.45 | | 56.71 | 2.89 | 117.00 | 5.26 |
| FS-1003 | <0.52 | | <23.52 | | 5.02 | 0.30 | 128.30 | 17.83 | 42.71 | 2.52 | 87.99 | 3.87 |
| FS-1004 | <0.24 | | <17.07 | | 6.63 | 0.41 | <73.70 | | 54.03 | 3.13 | 113.60 | 5.00 |
| FS-1005 | <0.39 | | <18.57 | | 8.10 | 0.46 | 97.65 | 33.79 | 51.72 | 2.90 | 106.80 | 4.70 |
| FS-1006 | <0.55 | | <29.05 | | 7.11 | 0.41 | 114.10 | 22.56 | 52.05 | 2.84 | 105.06 | 4.72 |
| FS-1007 | <0.43 | | <15.75 | | 4.65 | 0.44 | 116.60 | 25.30 | 54.19 | 3.14 | 117.20 | 5.16 |
| FS-1008 | <0.38 | | <18.28 | | 2.47 | 0.15 | 122.00 | 24.40 | 51.10 | 3.07 | 102.40 | 4.61 |
| FS-1009 | <0.67 | | <30.98 | | 5.20 | 0.30 | 133.90 | 48.61 | 59.32 | 3.68 | 121.20 | 5.33 |
| FS-1010 | <0.43 | | <17.00 | | 3.96 | 0.37 | <120.80 | | 57.05 | 3.14 | 116.70 | 5.13 |
| FS-1011 | <0.37 | | <18.39 | | 4.80 | 0.28 | 122.70 | 20.25 | 59.08 | 3.19 | 111.20 | 5.00 |
| FS-1012 | <0.47 | | <23.70 | | 4.75 | 0.28 | 129.50 | 29.28 | 57.96 | 3.31 | 117.65 | 5.18 |
| FS-1013 | <0.41 | | <15.22 | | 4.53 | 0.32 | <48.02 | | 59.05 | 3.42 | 107.80 | 4.74 |
| FS-1014 | <0.34 | | <17.17 | | 3.12 | 0.18 | 144.50 | 32.22 | 56.87 | 3.30 | 111.00 | 4.99 |
| FS-1015 | <0.57 | | <27.65 | | 2.81 | 0.18 | 124.90 | 35.22 | 66.14 | 3.97 | 122.20 | 5.38 |
| FS-1016 | <0.39 | | <14.23 | | 2.31 | 0.21 | 113.10 | 54.63 | 69.80 | 3.70 | 120.50 | 5.30 |
| FS-1017 | <0.35 | | <16.89 | | 2.90 | 0.17 | <100.50 | | 68.29 | 4.03 | 110.20 | 4.96 |
| FS-1018 | <0.59 | | <27.80 | | 2.09 | 0.12 | 180.60 | 21.31 | 57.99 | 3.42 | 107.90 | 4.75 |
| FS-1019 | <0.36 | | <17.12 | | 3.99 | 0.30 | <300.40 | | 45.47 | 2.36 | 84.40 | 3.71 |
| FS-1020 | <0.32 | | <16.19 | | 3.34 | 0.20 | 348.30 | 27.52 | 45.85 | 2.75 | 81.71 | 3.76 |
| FS-1021 | <0.55 | | <28.96 | | 6.58 | 0.38 | 79.85 | 38.73 | 45.09 | 2.57 | 91.00 | 4.00 |
| FS-1022 | 0.70 | 0.13 | <17.27 | | 7.87 | 0.46 | <91.32 | | 62.81 | 3.52 | 124.60 | 5.48 |
| FS-1023 | <0.33 | | <18.12 | | 7.28 | 0.41 | <73.65 | | 53.43 | 2.94 | 99.75 | 4.59 |
| FS-1024 | <0.42 | | <26.42 | | 5.09 | 0.31 | <339.60 | | 48.49 | 2.86 | 102.20 | 4.50 |
| FS-1025 | <0.40 | | <16.70 | | 6.52 | 0.44 | <79.56 | | 59.04 | 3.07 | 112.10 | 4.93 |
| FS-1026 | 0.24 | 0.07 | <18.51 | | 6.18 | 0.38 | <144.75 | | 57.24 | 3.06 | 114.70 | 5.15 |
| FS-1027 | <0.61 | | <32.05 | | 2.61 | 0.17 | 158.30 | 25.49 | 57.16 | 3.20 | 121.50 | 5.35 |
| FS-1028 | <0.37 | | <16.54 | | 3.70 | 0.24 | <85.87 | | 55.29 | 2.93 | 122.50 | 5.39 |
| FS-1029 | <0.28 | | <17.17 | | 3.46 | 0.22 | 118.40 | 26.05 | 52.80 | 3.01 | 103.80 | 4.57 |
| FS-1030 | <0.47 | | <27.92 | | 4.47 | 0.25 | <103.00 | | 55.53 | 3.33 | 109.60 | 4.93 |
| FS-1031 | <0.31 | | <15.23 | | 3.40 | 0.29 | 149.80 | 24.87 | 67.29 | 3.77 | 131.80 | 5.80 |
| FS-1032 | <0.27 | | <15.68 | | 3.95 | 0.26 | <97.88 | | 75.35 | 4.29 | 157.10 | 6.91 |
| FS-1033 | <0.42 | | <25.23 | | 2.84 | 0.20 | 99.62 | 17.04 | 47.36 | 2.70 | 102.60 | 4.62 |
| FS-1034 | <0.30 | | <14.27 | | 2.66 | 0.16 | 150.10 | 19.21 | 59.45 | 3.15 | 133.30 | 5.87 |
| FS-1035 | <0.28 | | <15.81 | | 2.06 | 0.15 | 113.10 | 49.88 | 54.95 | 3.08 | 105.40 | 4.64 |
| FS-1036 | <0.44 | | <24.75 | | 2.20 | 0.17 | 145.60 | 16.69 | 62.40 | 3.49 | 103.60 | 4.66 |
| FS-1037 | <0.31 | | <14.53 | | 1.79 | 0.11 | 192.30 | 19.04 | 61.81 | 3.34 | 120.50 | 5.30 |
| FS-1036 | <0.34 | | <19.82 | | 1.82 | 0.13 | 413.70 | 45.33 | 75.94 | 4.06 | 134.38 | 5.96 |

| | Nd | Standard Deviation | Sm | Standard Deviation | Eu | Standard Deviation | Tb | Standard Deviation | Dy | Standard Deviation | Yb | Standard Deviation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FS-1001 | 36.28 | 3.56 | 11.42 | 0.53 | <0.16 | | 2.34 | 0.21 | 14.96 | 1.32 | 8.46 | 0.48 |
| FS-1002 | 63.07 | 5.30 | 10.29 | 0.47 | 0.09 | 0.01 | 2.44 | 0.21 | 15.57 | 1.23 | 7.75 | 0.85 |
| FS-1003 | 40.03 | 3.40 | 10.30 | 0.48 | 0.11 | 0.01 | 1.94 | 0.17 | 10.41 | 0.92 | 7.84 | 0.45 |
| FS-1004 | 43.87 | 4.56 | 10.05 | 0.47 | 0.18 | 0.09 | 2.12 | 0.20 | 12.21 | 0.96 | 7.30 | 0.43 |
| FS-1005 | 56.27 | 4.78 | 9.64 | 0.44 | <0.18 | | 2.35 | 0.23 | 14.13 | 1.13 | 7.90 | 0.99 |
| FS-1006 | 51.96 | 4.39 | 12.26 | 0.58 | 0.12 | 0.01 | 2.11 | 0.19 | 12.52 | 1.00 | 9.23 | 0.53 |
| FS-1007 | 44.56 | 4.50 | 10.02 | 0.47 | <0.17 | | 2.10 | 0.19 | 11.76 | 0.99 | 6.99 | 0.41 |
| FS-1008 | 51.87 | 4.46 | 9.83 | 0.45 | <0.17 | | 2.39 | 0.23 | 13.34 | 1.33 | 7.19 | 0.95 |
| FS-1009 | 56.78 | 4.77 | 13.20 | 0.61 | 0.13 | 0.01 | 2.47 | 0.22 | 13.65 | 1.08 | 10.63 | 0.62 |
| FS-1010 | 30.36 | 3.07 | 10.59 | 0.50 | 0.21 | 0.08 | 2.11 | 0.19 | 12.06 | 0.99 | 6.93 | 0.39 |
| FS-1011 | 62.94 | 5.16 | 10.73 | 0.49 | 0.11 | 0.01 | 2.29 | 0.20 | 14.06 | 1.12 | 6.85 | 0.75 |
| FS-1012 | 55.30 | 4.56 | 12.62 | 0.59 | 0.11 | 0.01 | 2.26 | 0.20 | 12.31 | 1.03 | 8.19 | 0.52 |
| FS-1013 | 37.04 | 4.04 | 11.46 | 0.54 | 0.16 | 0.08 | 2.12 | 0.19 | 12.64 | 1.07 | 6.71 | 0.39 |
| FS-1014 | 53.74 | 4.51 | 8.65 | 0.40 | 0.20 | 0.07 | 1.85 | 0.18 | 9.05 | 0.79 | 5.03 | 0.45 |
| FS-1015 | 55.78 | 4.52 | 12.47 | 0.57 | 0.27 | 0.06 | 1.94 | 0.17 | 10.15 | 1.48 | 7.41 | 0.45 |
| FS-1016 | 49.80 | 4.53 | 10.37 | 0.49 | 0.26 | 0.06 | 1.60 | 0.14 | 8.71 | 0.70 | 4.20 | 0.27 |
| FS-1017 | 60.14 | 4.99 | 10.47 | 0.48 | 0.24 | 0.04 | 1.79 | 0.16 | 9.26 | 0.79 | 4.48 | 0.55 |
| FS-1018 | 51.08 | 4.29 | 9.61 | 0.43 | 0.38 | 0.02 | 1.37 | 0.12 | 8.11 | 0.84 | 4.47 | 0.34 |
| FS-1019 | 32.67 | 3.99 | 7.56 | 0.36 | 0.53 | 0.06 | 1.22 | 0.16 | 6.18 | 0.54 | 3.89 | 0.26 |
| FS-1020 | 43.76 | 3.94 | 6.46 | 0.30 | 0.52 | 0.03 | 1.14 | 0.11 | 4.61 | 0.51 | 2.96 | 0.30 |
| FS-1021 | 47.84 | 4.31 | 10.60 | 0.50 | <0.13 | | 1.99 | 0.18 | 12.17 | 1.06 | 8.66 | 0.49 |
| FS-1022 | 34.27 | 3.84 | 13.01 | 0.60 | 0.08 | 0.01 | 2.61 | 0.24 | 15.47 | 1.25 | 9.86 | 0.53 |
| FS-1023 | 59.71 | 5.14 | 9.93 | 0.46 | <0.13 | | 2.27 | 0.21 | 14.13 | 1.26 | 9.00 | 0.49 |
| FS-1024 | 46.42 | 4.18 | 0.81 | 0.06 | 0.41 | 0.19 | 1.98 | 0.18 | 11.14 | 1.18 | 10.14 | 0.55 |
| FS-1025 | 33.14 | 3.71 | 11.66 | 0.55 | 0.17 | 0.08 | 2.27 | 0.22 | 13.62 | 1.05 | 8.44 | 0.47 |
| FS-1026 | 44.96 | 4.15 | 10.68 | 0.50 | 0.19 | 0.08 | 2.40 | 0.22 | 14.19 | 1.14 | 8.32 | 0.60 |
| FS-1027 | 58.36 | 5.02 | 13.21 | 0.61 | 0.10 | 0.01 | 2.34 | 0.21 | 13.34 | 1.11 | 9.95 | 0.56 |
| FS-1028 | 31.01 | 3.41 | 10.82 | 0.50 | 0.21 | 0.06 | 2.04 | 0.19 | 12.08 | 1.06 | 6.73 | 0.38 |
| FS-1029 | 40.23 | 3.90 | 9.41 | 0.43 | 0.19 | 0.05 | 2.02 | 0.18 | 11.72 | 1.77 | 7.13 | 0.71 |
| FS-1030 | 58.42 | 4.79 | 12.08 | 0.56 | 0.17 | 0.08 | 2.50 | 0.23 | 12.89 | 1.24 | 9.07 | 0.50 |
| FS-1031 | 71.58 | 5.65 | 13.05 | 0.60 | 0.18 | 0.02 | 2.65 | 0.24 | 14.03 | 1.19 | 7.73 | 0.48 |
| FS-1032 | 47.91 | 4.26 | 11.27 | 0.51 | 0.28 | 0.05 | 1.95 | 0.18 | 11.65 | 1.36 | 6.10 | 0.57 |
| FS-1033 | 38.79 | 3.34 | 7.84 | 0.37 | 0.21 | 0.05 | 1.18 | 0.11 | 6.56 | 0.60 | 5.62 | 0.50 |
| FS-1034 | 52.68 | 4.27 | 8.06 | 0.37 | 0.28 | 0.11 | 1.61 | 0.14 | 7.73 | 0.66 | 4.60 | 0.27 |
| FS-1035 | 36.65 | 3.52 | 6.90 | 0.31 | 0.31 | 0.05 | 1.11 | 0.11 | 6.66 | 0.63 | 3.34 | 0.40 |
| FS-1036 | 52.14 | 4.28 | 9.40 | 0.44 | 0.31 | 0.04 | 1.26 | 0.12 | 6.22 | 0.54 | 4.58 | 0.29 |
| FS-1037 | 49.76 | 4.08 | 7.56 | 0.36 | 0.40 | 0.04 | 1.27 | 0.12 | 6.38 | 0.54 | 3.64 | 0.29 |
| FS-1036 | 57.22 | 5.02 | 8.77 | 0.41 | 0.84 | 0.05 | 1.19 | 0.12 | 5.80 | 0.65 | 3.65 | 0.37 |

| | Lu | Standard Deviation | Hf | Standard Deviation | Ta | Standard Deviation | W | Standard Deviation | Au | Standard Deviation | Hg | Standard Deviation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FS-1001 | 1.22 | 0.06 | 10.53 | 0.88 | 8.16 | 0.55 | 4.53 | 0.87 | <0.02 | | <0.44 | |
| FS-1002 | 1.22 | 0.06 | 10.75 | 0.59 | 8.17 | 0.51 | 7.18 | 3.03 | <0.02 | | <0.63 | |
| FS-1003 | 0.93 | 0.04 | 7.43 | 0.42 | 5.66 | 0.36 | 3.37 | 0.71 | <0.02 | | <0.53 | |
| FS-1004 | 1.10 | 0.05 | 10.38 | 0.50 | 7.70 | 0.48 | 3.30 | 1.42 | <0.02 | | <0.44 | |
| FS-1005 | 1.08 | 0.05 | 9.60 | 0.46 | 7.23 | 0.54 | 2.27 | 0.61 | <0.02 | | <0.61 | |
| FS-1006 | 1.05 | 0.05 | 9.07 | 0.51 | 6.89 | 0.42 | 4.31 | 1.12 | <0.02 | | <0.60 | |
| FS-1007 | 1.06 | 0.05 | 10.64 | 0.61 | 7.12 | 0.51 | 4.37 | 0.87 | <0.02 | | <0.42 | |
| FS-1008 | 1.02 | 0.05 | 9.78 | 0.48 | 7.02 | 0.41 | 3.12 | 1.13 | <0.02 | | <0.56 | |
| FS-1009 | 1.18 | 0.06 | 9.65 | 0.50 | 7.33 | 0.44 | 3.87 | 0.83 | <0.02 | | <0.69 | |
| FS-1010 | 1.02 | 0.05 | 9.21 | 0.69 | 6.33 | 0.40 | 3.85 | 0.88 | <0.02 | | <0.41 | |
| FS-1011 | 1.07 | 0.05 | 9.48 | 0.56 | 6.60 | 0.41 | <5.60 | | <0.02 | | <0.55 | |
| FS-1012 | 1.12 | 0.05 | 9.12 | 0.48 | 6.70 | 0.42 | 19.73 | 4.85 | <0.02 | | <0.63 | |
| FS-1013 | 1.01 | 0.05 | 8.65 | 0.44 | 6.12 | 0.39 | <6.23 | | <0.02 | | <0.38 | |
| FS-1014 | 0.77 | 0.04 | 7.69 | 0.48 | 4.76 | 0.29 | <5.24 | | <0.02 | | <0.49 | |
| FS-1015 | 0.89 | 0.04 | 7.77 | 0.50 | 4.55 | 0.30 | <9.04 | | <0.02 | | <0.54 | |
| FS-1016 | 0.71 | 0.04 | 7.99 | 0.46 | 3.98 | 0.31 | <3.59 | | <0.02 | | <0.37 | |
| FS-1017 | 0.72 | 0.04 | 7.84 | 0.52 | 3.92 | 0.24 | <5.51 | | <0.02 | | <0.51 | |
| FS-1018 | 0.66 | 0.03 | 6.89 | 0.39 | 3.33 | 0.21 | <9.53 | | <0.02 | | <0.56 | |
| FS-1019 | 0.65 | 0.04 | 6.34 | 0.35 | 4.92 | 0.42 | 2.04 | 0.77 | <0.01 | | <0.53 | |
| FS-1020 | 0.58 | 0.03 | 6.34 | 0.48 | 4.10 | 0.29 | <5.05 | | <0.01 | | <0.62 | |
| FS-1021 | 1.15 | 0.06 | 9.29 | 0.45 | 7.57 | 0.52 | 5.89 | 1.09 | <0.02 | | <0.68 | |
| FS-1022 | 1.40 | 0.07 | 12.13 | 0.75 | 9.70 | 0.56 | 5.41 | 0.97 | <0.02 | | <0.48 | |
| FS-1023 | 1.22 | 0.06 | 10.25 | 0.63 | 8.03 | 0.59 | 3.47 | 1.66 | <0.01 | | <0.58 | |
| FS-1024 | 1.16 | 0.06 | 10.33 | 0.48 | 8.44 | 0.55 | <3.10 | | <0.02 | | <0.67 | |
| FS-1025 | 1.21 | 0.06 | 9.74 | 0.65 | 7.10 | 0.45 | 4.78 | 1.14 | <0.02 | | <0.47 | |
| FS-1026 | 1.15 | 0.06 | 9.78 | 0.58 | 7.38 | 0.51 | 2.59 | 0.73 | <0.01 | | <0.52 | |
| FS-1027 | 1.18 | 0.06 | 10.52 | 0.56 | 7.75 | 0.48 | 5.40 | 1.91 | <0.02 | | <0.68 | |
| FS-1028 | 1.07 | 0.05 | 9.25 | 0.40 | 6.88 | 0.43 | 3.86 | 1.17 | <0.02 | | <0.41 | |
| FS-1029 | 0.93 | 0.05 | 9.03 | 0.71 | 6.15 | 0.40 | 3.43 | 1.19 | <0.01 | | <0.39 | |
| FS-1030 | 1.02 | 0.05 | 9.58 | 0.56 | 6.90 | 0.43 | 2.68 | 0.82 | <0.02 | | <0.53 | |
| FS-1031 | 1.12 | 0.05 | 9.45 | 0.45 | 7.03 | 0.45 | <6.62 | | <0.01 | | <0.61 | |
| FS-1032 | 0.83 | 0.04 | 8.07 | 0.41 | 4.55 | 0.31 | <5.85 | | <0.01 | | <0.36 | |
| FS-1033 | 0.58 | 0.03 | 8.16 | 0.51 | 4.67 | 0.31 | <9.62 | | <0.02 | | <0.46 | |
| FS-1034 | 0.72 | 0.04 | 7.86 | 0.41 | 4.58 | 0.29 | <6.64 | | <0.01 | | <0.55 | |
| FS-1035 | 0.53 | 0.03 | 7.45 | 0.41 | 2.95 | 0.24 | <6.16 | | <0.01 | | <0.35 | |
| FS-1036 | 0.51 | 0.03 | 7.31 | 0.41 | 3.10 | 0.22 | 18.87 | 2.60 | <0.02 | | <0.48 | |
| FS-1037 | 0.58 | 0.03 | 7.33 | 0.37 | 3.16 | 0.25 | <6.98 | | <0.01 | | <0.57 | |
| FS-1036 | 0.55 | 0.03 | 9.79 | 0.59 | 2.66 | 0.20 | 20.03 | 3.67 | <0.01 | | <0.58 | |

| | Th | Standard Deviation | U | Standard Deviation | Be | Standard Deviation | Cd | Standard Deviation | Pb | Standard Deviation |
|---|---|---|---|---|---|---|---|---|---|---|
| FS-1001 | 31.95 | 1.44 | 8.63 | 0.30 | 7.20 | 1.40 | <1.00 | | 57.00 | 6.00 |
| FS-1002 | 28.99 | 1.16 | 8.74 | 0.31 | 0.82 | 0.16 | <1.00 | | <14.00 | |
| FS-1003 | 21.32 | 0.85 | 5.98 | 0.21 | 6.40 | 1.30 | <1.00 | | 44.00 | 4.00 |
| FS-1004 | 31.20 | 1.31 | 7.85 | 0.27 | 6.00 | 1.20 | <1.00 | | 48.00 | 5.00 |
| FS-1005 | 22.56 | 2.46 | 7.26 | 0.25 | 4.90 | 1.00 | <1.00 | | 41.00 | 4.00 |
| FS-1006 | 25.20 | 1.01 | 7.02 | 0.25 | 5.10 | 1.00 | <1.00 | | 43.30 | 4.20 |
| FS-1007 | 30.08 | 1.23 | 7.31 | 0.26 | 6.30 | 1.30 | <1.00 | | 26.00 | 3.00 |
| FS-1008 | 22.27 | 2.85 | 7.27 | 0.25 | 7.00 | 1.40 | <1.00 | | 54.00 | 5.00 |
| FS-1009 | 27.67 | 1.11 | 7.59 | 0.27 | 5.60 | 1.10 | <1.00 | | 52.00 | 5.00 |
| FS-1010 | 27.30 | 1.09 | 7.30 | 0.26 | 6.10 | 1.20 | <1.00 | | 39.00 | 4.00 |
| FS-1011 | 24.54 | 0.98 | 7.41 | 0.26 | 5.95 | 1.20 | <1.00 | | 32.50 | 4.00 |
| FS-1012 | 26.09 | 1.04 | 6.91 | 0.24 | 6.00 | 1.20 | <1.00 | | 30.90 | 3.00 |
| FS-1013 | 25.93 | 1.06 | 7.12 | 0.25 | 6.10 | 1.20 | <1.00 | | 27.00 | 3.00 |
| FS-1014 | 16.25 | 2.08 | 5.05 | 0.18 | 4.00 | 0.80 | <1.00 | | 19.00 | 4.00 |
| FS-1015 | 19.67 | 0.79 | 4.73 | 0.17 | 4.60 | 0.90 | <1.00 | | 25.00 | 2.00 |
| FS-1016 | 19.55 | 0.80 | 4.32 | 0.16 | 3.50 | 0.70 | <1.00 | | <14.00 | |
| FS-1017 | 16.32 | 0.67 | 4.37 | 0.16 | 2.90 | 0.60 | <1.00 | | 22.00 | 2.00 |
| FS-1018 | 15.43 | 0.63 | 3.28 | 0.12 | 2.70 | 0.50 | <1.00 | | 27.00 | 3.00 |
| FS-1019 | 19.94 | 0.96 | 5.61 | 0.20 | 5.00 | 1.00 | <1.00 | | 31.00 | 3.00 |
| FS-1020 | 15.62 | 0.61 | 5.08 | 0.18 | 4.90 | 1.00 | <1.00 | | 32.00 | 3.00 |
| FS-1021 | 27.13 | 1.09 | 7.80 | 0.27 | 6.40 | 1.30 | <1.00 | | 49.00 | 5.00 |
| FS-1022 | 37.06 | 1.52 | 10.13 | 0.35 | 0.72 | 0.10 | <1.00 | | <14.00 | |
| FS-1023 | 27.17 | 1.09 | 8.33 | 0.29 | 7.50 | 1.50 | <1.00 | | 51.30 | 5.10 |
| FS-1024 | 29.39 | 1.26 | 6.65 | 0.24 | 5.70 | 1.10 | <1.00 | | 45.60 | 4.60 |
| FS-1025 | 29.76 | 1.22 | 7.75 | 0.28 | 6.12 | 1.20 | <1.00 | | 39.30 | 4.00 |
| FS-1026 | 28.42 | 1.33 | 6.93 | 0.24 | 6.30 | 1.00 | <1.00 | | 45.90 | 4.40 |
| FS-1027 | 29.53 | 1.18 | 7.41 | 0.26 | 5.40 | 1.00 | <1.00 | | 36.00 | 3.60 |
| FS-1028 | 29.87 | 1.28 | 7.14 | 0.25 | 5.20 | 1.00 | <1.00 | | 40.40 | 4.00 |
| FS-1029 | 26.37 | 1.05 | 6.58 | 0.23 | 5.70 | 1.00 | <1.00 | | 31.00 | 3.10 |
| FS-1030 | 22.10 | 2.83 | 7.27 | 0.25 | 5.60 | 1.10 | <1.00 | | 51.00 | 5.10 |
| FS-1031 | 27.64 | 1.11 | 6.98 | 0.24 | 6.00 | 1.00 | <1.00 | | 24.00 | 2.00 |
| FS-1032 | 21.50 | 0.90 | 4.71 | 0.16 | 3.90 | 0.80 | <1.00 | | 26.00 | 3.00 |
| FS-1033 | 19.14 | 0.77 | 4.82 | 0.17 | 3.90 | 0.80 | <1.00 | | 29.70 | 3.00 |
| FS-1034 | 20.53 | 0.82 | 4.45 | 0.16 | 3.50 | 0.70 | <1.00 | | 22.00 | 2.00 |
| FS-1035 | 15.05 | 0.71 | 3.18 | 0.12 | 0.42 | 0.10 | <1.00 | | <14.00 | |
| FS-1036 | 12.90 | 0.80 | 3.40 | 0.12 | 1.40 | 0.80 | <1.00 | | 18.00 | 4.00 |
| FS-1037 | 15.05 | 0.62 | 3.17 | 0.12 | 2.50 | 0.50 | <1.00 | | 21.00 | 2.00 |
| FS-1036 | 14.50 | 0.64 | 2.88 | 0.11 | 2.05 | 0.40 | <1.00 | | 36.00 | 4.00 |

# TABLE A-II
# SOIL ANALYSES

FRAMEWORK SOIL SAMPLES ORDERED BY FS NUMBER

| SAMPLE NUMBER | DATE COLLECTED | NEUTRON ACTIVATION ANALYSIS SAMPLE WEIGHT (g) TARE | GROSS | NET | COMMENTS |
|---|---|---|---|---|---|
| FS-2000 | 92 08 07 09 54 | 2.259 | 6.977 | 4.718 | ULAC-08 |
| FS-2000F | 92 08 07 09 54 | 2.264 | 5.633 | 3.369 | ULAC-08 Fine fraction |
| FS-2001 | 92 06 24 10 12 | 2.235 | 6.927 | 4.692 | TA-16 base colluvium-14 |
| FS-2002 | 92 06 24 14 10 | 2.257 | 4.533 | 2.276 | TA-49 CB-06 |
| FS-2003 | 92 06 24 14 02 | 2.257 | 6.890 | 4.633 | TA-49 altered B-05 (Bandelier Tuff) |
| FS-2004 | 92 06 24 13 25 | 2.257 | 5.778 | 3.521 | TA-49 BW-02 |
| FS-2005 | 92 06 24 12 59 | 2.236 | 4.871 | 2.635 | TA-49 Bwk-04 |
| FS-2006 | 92 06 24 09 50 | 2.256 | 6.039 | 3.783 | TA-16 WTT1 CO3 Zone |
| FS-2007 | 92 06 24 09 16 | 2.260 | 5.558 | 3.298 | TA-16 CO3 Zone |
| FS-2008 | 92 06 15 16 00 | 2.257 | 6.334 | 4.077 | TA-16 WTT1 oxd. CVZP-10 |
| FS-2009 | 92 06 15 15 45 | 2.262 | 6.498 | 4.236 | TA-16 WTT1 reduced CVZP-01 |
| FS-2010 | 92 08 07 14 22 | 2.259 | 5.727 | 3.468 | EGG Btb-06 |
| FS-2011 | 92 08 07 14 16 | 2.255 | 6.605 | 4.350 | EGG Bw-03 |
| FS-2012 | 92 08 07 14 22 | 2.262 | 6.347 | 4.085 | EGG CB-04 |
| FS-2013 | 92 08 07 14 12 | 2.257 | 6.646 | 4.389 | EGG Bt-02 |
| FS-2014F | 92 08 01 15 49 | 2.236 | 4.530 | 2.294 | ULAC BAb-05 Fine Fraction |
| FS-2015F | 92 08 01 15 53 | 2.261 | 6.658 | 4.397 | ULAC Bwb-06 Fine Fraction |
| FS-2016F | 92 08 01 15 55 | 2.260 | 6.411 | 4.151 | ULAC C-07 Fine Fraction |
| FS-2017F | 92 08 01 15 41 | 2.200 | 5.073 | 2.873 | ULAC A2-02 Fine Fraction |
| FS-2018F | 92 08 01 15 38 | 2.261 | 5.010 | 2.749 | ULAC A1-01 Fine Fraction |
| FS-2019F | 92 08 01 15 46 | 2.263 | 5.942 | 3.679 | ULAC BW-04 Fine Fraction |
| FS-2020F | 92 08 01 15 44 | 2.262 | 6.603 | 4.341 | ULAC BA-03 Fine Fraction |
| FS-2021 | 92 08 07 14 06 | 2.258 | 6.638 | 4.380 | EGG A-01 |
| FS-2022 | 92 08 07 15 27 | 2.257 | 5.767 | 3.510 | EGG CBb-07 |
| FS-2023 | 92 08 07 14 26 | 2.258 | 5.977 | 3.719 | EGG C-05 |
| FS-2024 | 92 08 01 15 44 | 2.268 | 6.572 | 4.304 | ULAC BA-03 Fine Fraction, FS-2020F Duplicate |
| FS-2025 | 92 06 24 09 50 | 2.264 | 6.115 | 3.851 | TA-16 WTT1 CO3 Zone, FS-2006 Duplicate |
| FS-2026 | 92 06 10 12 50 | 2.256 | 5.988 | 3.732 | TA-69-25S weathered R |
| FS-2027 | 92 06 08 14 39 | 2.252 | 6.699 | 4.447 | TA-16-10 BW |
| FS-2028 | 92 06 08 14 10 | 2.261 | 6.893 | 4.632 | TA-69 Bt2 |
| FS-2029 | 92 06 10 13 29 | 2.257 | 5.687 | 3.430 | TA-69-25S fracture fill |
| FS-2030 | 92 06 18 14 00 | 2.263 | 5.206 | 2.943 | TA-16-10 CO3 rich |
| FS-2031 | 92 06 10 12 10 | 2.257 | 7.330 | 5.073 | TA-69 South 24 C1 Bt |
| FS-2032 | 92 06 12 12 17 | 2.258 | 6.775 | 4.517 | TA-39-36-A1 |
| FS-2033 | 92 06 05 16 20 | 2.260 | 6.484 | 4.224 | TA-69-2N |
| FS-2034 | 92 06 12 13 14 | 2.257 | 7.068 | 4.811 | TA-39-40 Bwkb |
| FS-2035 | 92 06 08 14 51 | 2.262 | 7.212 | 4.950 | TA-69NA-11 |
| FS-2036 | 92 06 08 14 51 | 2.258 | 7.115 | 4.857 | TA-69NA-11, FS-2035 Duplicate |
| FS-2037 | | 2.257 | 6.742 | 4.485 | TA-69E |
| FS-2038 | | 2.262 | 6.058 | 3.796 | TA-69 South Br |
| FS-2039 | | 2.256 | 5.823 | 3.567 | TA-69 Crb |
| FS-2040 | | 2.258 | 5.954 | 3.696 | TA-69 BC |
| FS-2041 | 92 06 18 11 30 | 2.259 | 5.865 | 3.606 | TA-16-06 |
| FS-2042 | | 2.257 | 6.985 | 4.728 | TA-69-A (11) |
| FS-2043 | 92 06 08 13 48 | 2.259 | 6.006 | 3.747 | TA-69-07N 2Bt3b |
| FS-2044 | 92 06 10 11 50 | 2.256 | 6.867 | 4.611 | TA-69S-23 2Bt2b |
| FS-2045 | 92 06 10 11 05 | 2.259 | 6.701 | 4.442 | TA-69S-19 A |
| FS-2046 | 92 06 12 13 30 | 2.255 | 6.167 | 3.912 | TA-39-S-41 Btkb |
| FS-2047 | 92 06 12 13 30 | 2.262 | 6.264 | 4.002 | TA-39-S-41 Btkb, FS-2046 Duplicae |
| FS-2048 | 92 06 18 11 15 | 2.260 | 5.922 | 3.662 | TA-16 WTT1-05 |
| FS-2049 | 92 06 18 11 45 | 2.238 | 6.505 | 4.267 | TA-16 WTT1-07 |
| FS-2050 | 92 06 10 11 35 | 2.259 | 6.242 | 3.983 | TA-16 Org. Mat. |
| FS-2051 | | 2.260 | 6.486 | 4.226 | TA-16-07 |
| FS-2052 | | 2.261 | 7.321 | 5.060 | TA-69 AE |
| FS-2053 | 92 06 12 12 34 | 2.257 | 7.037 | 4.780 | TA-39-37-A2 |
| FS-2054 | 92 06 18 13 45 | 2.263 | 5.953 | 3.690 | TA-16-A-09 |
| FS-2055 | 92 06 10 11 00 | 2.259 | 5.766 | 3.507 | TA-69S Humic Layer (no. 18) |

| | | | | |
|---|---|---|---|---|
| FS-2056 | 92 06 08 14 21 | 2.266 | 6.803 | 4.537 | TA-69-N-09-2Bt1b |
| FS-2057 | 92 06 12 12 55 | 2.262 | 6.688 | 4.426 | TA-39-39-Bwkb |
| FS-2058 | 92 06 12 12 55 | 2.242 | 6.723 | 4.481 | TA-39-39-Bwkb, FS-2057 Duplicate |
| FS-2059 | | 2.253 | 5.985 | 3.732 | TA-69Cr |
| FS-2060 | 92 06 12 13 50 | 2.259 | 5.913 | 3.654 | TA-39-42-2Cr |
| FS-2061 | 92 06 12 12 46 | 2.263 | 6.911 | 4.648 | TA-39-38-Bt |
| FS-2062 | 92 06 06 13 35 | 2.253 | 6.052 | 3.799 | TA-69 NR |
| FS-2063 | 92 06 18 11 00 | 2.260 | 6.052 | 3.792 | TA-16 WTT1-04 |
| FS-2064 | 92 06 18 12 20 | 2.264 | 6.280 | 4.016 | TA-16 WTTT1-8 |
| FS-2065 | 92 06 08 15 15 | 2.263 | 6.341 | 4.078 | TA-69 Bt3 |
| FS-2066 | 92 06 10 11 25 | 2.235 | 6.900 | 4.665 | TA-69-S-20 Bw |
| FS-2067 | | 2.267 | 6.677 | 4.410 | TA-69 Bt1 |
| FS-2068 | 92 06 10 11 40 | 2.256 | 6.953 | 4.697 | TA-69-S-22 2Bt1b |
| FS-2069 | 92 06 10 11 40 | 2.258 | 6.988 | 4.730 | TA-69-S-22 2Bt1b, FS-2068 Duplicate |
| FS-2070 | 92 09 16 12 17 | 2.610 | 6.723 | 4.113 | TA-46-01-01 Bandelier Tuff |
| FS-2071 | 92 09 16 12 25 | 2.611 | 5.482 | 2.871 | TA-46-01-02 Fracture Fill A |
| FS-2072 | 92 09 16 12 30 | 2.609 | 5.567 | 2.958 | TA-46-01-03 Fracture Fill B |
| FS-2073 | 92 09 16 12 40 | 2.609 | 6.906 | 4.297 | TA-46-01-04 soil |
| FS-2074 | 92 09 16 12 45 | 2.609 | 6.507 | 3.898 | TA-46-02-05 Bandelier Tuff |
| FS-2075 | 92 09 16 12 50 | 2.613 | 7.146 | 4.533 | TA-46-02-06 Coarse Fracture Fill (outer) |
| FS-2076 | 92 09 16 13 00 | 2.610 | 6.825 | 4.215 | TA-46-02-07 Fine Fracture Fill (inner) |
| FS-2077 | 92 06 25 10 57 | 2.263 | 6.840 | 4.577 | BSS-TS-06-01 AC Tsankawi |
| FS-2078 | 92 06 25 11 15 | 2.262 | 6.230 | 3.968 | BSS-TS-06-02 C1 Tsankawi |
| FS-2079 | 92 06 25 11 40 | 2.262 | 5.750 | 3.488 | BSS-TS-06-03 C2 Tsankawi |

| | Na | Standard Deviation | Mg | Standard Deviation | Al | Standard Deviation | Cl | Standard Deviation | K | Standard Deviation | Ca | Standard Deviation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FS-2000 | 27380.00 | 1259.48 | <3815.00 | | 69530.00 | 1946.84 | <177.30 | | 32050.00 | 2531.95 | 5988.00 | 562.87 |
| FS-2000F | 25130.00 | 1331.89 | <2667.00 | | 66160.00 | 1918.64 | <134.70 | | 33890.00 | 2677.31 | 6475.00 | 582.75 |
| FS-2001 | 14770.00 | 620.34 | 4949.00 | 608.73 | 64430.00 | 1804.04 | <77.85 | | 25280.00 | 1971.84 | 4691.00 | 394.04 |
| FS-2002 | 23530.00 | 1105.91 | 8239.00 | 1128.74 | 87080.00 | 2525.32 | 854.10 | 78.58 | 31780.00 | 2764.86 | 14190.00 | 1007.49 |
| FS-2003 | 14600.00 | 744.60 | 5543.00 | 598.64 | 66990.00 | 1875.72 | <79.98 | | 23240.00 | 1905.68 | 3434.00 | 326.23 |
| FS-2004 | 15990.00 | 671.58 | 6648.00 | 784.46 | 88760.00 | 2485.28 | 111.20 | 15.46 | 19860.00 | 1827.12 | 12430.00 | 770.66 |
| FS-2005 | 19270.00 | 905.69 | 6870.00 | 858.75 | 85100.00 | 2382.80 | 325.20 | 63.74 | 26770.00 | 2543.15 | 18940.00 | 1174.28 |
| FS-2006 | 16665.00 | 875.03 | 6719.00 | 645.95 | 89265.00 | 2499.42 | 129.00 | 22.06 | 24270.00 | 2529.73 | 9609.50 | 633.97 |
| FS-2007 | 19020.00 | 817.86 | 5634.00 | 777.49 | 88020.00 | 2464.56 | 208.90 | 23.40 | 23140.00 | 2013.18 | 14370.00 | 2830.89 |
| FS-2008 | 19310.00 | 868.95 | <3767.00 | | 69380.00 | 1942.64 | <162.80 | | 26430.00 | 2220.12 | 3278.00 | 406.47 |
| FS-2009 | 18180.00 | 927.18 | 4434.00 | 576.42 | 67790.00 | 1898.12 | <78.61 | | 24040.00 | 1971.28 | 2914.00 | 294.31 |
| FS-2010 | 20280.00 | 872.04 | 3237.00 | 702.43 | 75150.00 | 2104.20 | 152.60 | 21.97 | 32330.00 | 2974.36 | 5410.00 | 1920.55 |
| FS-2011 | 22750.00 | 978.25 | 4271.00 | 751.70 | 68240.00 | 1910.72 | 104.10 | 48.82 | 29660.00 | 2402.46 | 3675.00 | 389.55 |
| FS-2012 | 22460.00 | 1033.16 | 5753.00 | 811.17 | 71800.00 | 2010.40 | 193.90 | 24.24 | 31860.00 | 2516.94 | 4882.00 | 468.67 |
| FS-2013 | 23840.00 | 1263.52 | 3032.00 | 551.82 | 73520.00 | 2058.56 | 158.30 | 21.05 | 31980.00 | 2462.46 | 5598.00 | 453.44 |
| FS-2014F | 21320.00 | 916.76 | <3027.00 | | 60360.00 | 1750.44 | <131.20 | | 29610.00 | 2694.51 | 13870.00 | 957.03 |
| FS-2015F | 27580.00 | 1323.84 | <3279.00 | | 66310.00 | 1856.68 | <152.60 | | 35760.00 | 2860.80 | 3388.00 | 399.78 |
| FS-2016F | 28530.00 | 1540.62 | <1971.00 | | 67540.00 | 1891.12 | <104.90 | | 36210.00 | 2860.59 | 1911.00 | 328.69 |
| FS-2017F | 20140.00 | 866.02 | 3400.00 | 710.60 | 59970.00 | 1739.13 | <124.70 | | 21790.00 | 2070.05 | 18670.00 | 1138.87 |
| FS-2018F | 20490.00 | 963.03 | <4325.00 | | 59710.00 | 1731.59 | <198.20 | | 27670.00 | 2434.96 | 13850.00 | 997.20 |
| FS-2019F | 26180.00 | 1256.64 | 1807.00 | 495.12 | 70850.00 | 1983.80 | <111.30 | | 34900.00 | 3036.30 | 5836.00 | 501.90 |
| FS-2020F | 27050.00 | 1204.07 | <2906.00 | | 67255.00 | 1883.14 | <128.35 | | 29150.00 | 2539.21 | 6687.00 | 550.53 |
| FS-2021 | 24540.00 | 1153.38 | <3287.00 | | 67700.00 | 1895.60 | 203.90 | 34.05 | 31960.00 | 2620.72 | 4238.00 | 436.51 |
| FS-2022 | 19420.00 | 1009.84 | 3607.00 | 595.16 | 71290.00 | 1996.12 | 202.50 | 23.08 | 28340.00 | 2380.56 | 6782.00 | 522.21 |
| FS-2023 | 22950.00 | 963.90 | 4099.00 | 705.03 | 73390.00 | 2054.92 | 198.20 | 35.48 | 29480.00 | 2505.80 | 7088.00 | 545.78 |
| FS-2026 | 18860.00 | 810.98 | 6084.00 | 748.33 | 104900.00 | 2937.20 | 239.60 | 24.44 | 21460.00 | 2103.08 | 5921.00 | 473.68 |
| FS-2027 | 13530.00 | 676.50 | <2693.00 | | 58090.00 | 1626.52 | <119.10 | | 22260.00 | 1958.88 | 4454.00 | 400.86 |
| FS-2028 | 12270.00 | 625.77 | 6441.00 | 573.25 | 91170.00 | 2461.59 | 69.12 | 15.76 | 21030.00 | 1976.82 | 5156.00 | 391.86 |
| FS-2029 | 3392.00 | 149.25 | 13410.00 | 871.65 | 113600.00 | 3067.20 | 127.60 | 20.93 | 13040.00 | 1447.44 | 9127.00 | 2418.66 |
| FS-2030 | 17090.00 | 769.05 | 8150.00 | 986.15 | 77800.00 | 2178.40 | 241.60 | 34.79 | 23010.00 | 2324.01 | 37070.00 | 1890.57 |
| FS-2031 | 15150.00 | 818.10 | 3490.00 | 471.15 | 68400.00 | 1915.20 | <80.92 | | 26180.00 | 2853.62 | 2010.00 | 245.22 |
| FS-2032 | 15020.00 | 630.84 | 5029.00 | 663.83 | 60890.00 | 1704.92 | <83.99 | | 21740.00 | 2174.00 | 6357.00 | 470.42 |
| FS-2033 | 10120.00 | 495.88 | 10610.00 | 870.02 | 109200.00 | 2948.40 | <110.00 | | 17160.00 | 1767.48 | 8748.00 | 586.12 |
| FS-2034 | 16040.00 | 802.00 | 5828.00 | 582.80 | 71260.00 | 1995.28 | <79.81 | | 20410.00 | 1796.08 | 10230.00 | 613.80 |
| FS-2035 | 14745.00 | 662.82 | 1785.00 | 442.68 | 51680.00 | 1472.84 | <114.57 | | 23130.00 | 2090.34 | 3956.50 | 395.63 |
| FS-2037 | 15560.00 | 871.36 | 2347.00 | 424.81 | 55360.00 | 1550.08 | <79.86 | | 20780.00 | 2057.22 | 1932.00 | 245.36 |
| FS-2038 | 10300.00 | 463.50 | 6404.00 | 627.59 | 79110.00 | 2215.08 | <78.04 | | 15090.00 | 1690.08 | 12000.00 | 732.00 |
| FS-2039 | 26860.00 | 1262.42 | <3670.00 | | 81180.00 | 2273.04 | 855.60 | 68.45 | 42000.00 | 4116.00 | <3002.00 | |
| FS-2040 | 22090.00 | 1148.68 | 5070.00 | 633.75 | 92220.00 | 2582.16 | 939.50 | 72.34 | 26880.00 | 3118.08 | 5365.00 | 456.02 |
| FS-2041 | 14780.00 | 650.32 | 7443.00 | 826.17 | 94120.00 | 2635.36 | 123.40 | 18.51 | 20640.00 | 2621.28 | 7821.00 | 570.93 |
| FS-2042 | 13430.00 | 604.35 | <2631.00 | | 49680.00 | 1391.04 | <114.80 | | 22420.00 | 2354.10 | 3543.00 | 354.30 |
| FS-2043 | 16880.00 | 725.84 | 5652.00 | 678.24 | 99700.00 | 2791.60 | 573.70 | 50.49 | 24880.00 | 1666.96 | 5742.00 | 453.62 |
| FS-2044 | 10850.00 | 509.95 | 6106.00 | 622.81 | 79360.00 | 2222.08 | <100.80 | | 19350.00 | 1296.45 | 5520.00 | 447.12 |
| FS-2045 | 14740.00 | 781.22 | <1597.00 | | 54510.00 | 1526.28 | <79.37 | | 23090.00 | 1547.03 | 5468.00 | 421.04 |
| FS-2046 | 8286.00 | 368.41 | 12770.00 | 913.74 | 100470.00 | 2762.26 | 85.70 | 16.63 | 18630.00 | 1369.10 | 13425.00 | 772.22 |
| FS-2048 | 16960.00 | 898.88 | 6956.00 | 681.69 | 88720.00 | 2484.16 | 159.50 | 19.94 | 25760.00 | 1751.68 | 8316.00 | 590.44 |
| FS-2049 | 14720.00 | 632.96 | 5172.00 | 636.16 | 87870.00 | 2460.36 | 110.60 | 49.00 | 23960.00 | 1605.32 | 6299.00 | 466.13 |
| FS-2050 | 10710.00 | 492.66 | 5470.00 | 672.81 | 69440.00 | 1944.32 | <107.00 | | 18800.00 | 1391.20 | 8071.00 | 564.97 |
| FS-2051 | 13880.00 | 707.88 | 6732.00 | 605.88 | 93850.00 | 2533.95 | 114.30 | 16.46 | 21480.00 | 1460.64 | 7357.00 | 529.70 |
| FS-2052 | 15070.00 | 648.01 | 1787.00 | 427.09 | 52940.00 | 1482.32 | <76.91 | | 23010.00 | 1541.67 | 3605.00 | 342.48 |
| FS-2053 | 14190.00 | 652.74 | 4123.00 | 560.73 | 59180.00 | 1657.04 | <115.80 | | 21950.00 | 1492.60 | 6453.00 | 490.43 |
| FS-2054 | 17740.00 | 940.22 | 3995.00 | 547.32 | 76830.00 | 2151.24 | 162.30 | 20.45 | 24770.00 | 1709.13 | 9582.00 | 632.41 |
| FS-2055 | 13420.00 | 577.06 | 4405.00 | 572.65 | 50280.00 | 1458.12 | <85.43 | | 18860.00 | 1339.06 | 6587.00 | 520.37 |
| FS-2056 | 11990.00 | 563.53 | 6625.00 | 689.00 | 85930.00 | 2406.04 | <102.90 | | 21460.00 | 1459.28 | 6274.00 | 470.55 |
| FS-2057 | 13580.00 | 645.86 | 5508.00 | 614.71 | 69245.00 | 1938.86 | <81.01 | | 22935.00 | 1559.58 | 13150.00 | 755.97 |

| | Na | Standard Deviation | Mg | Standard Deviation | Al | Standard Deviation | Cl | Standard Deviation | K | Standard Deviation | Ca | Standard Deviation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FS-2059 | 25140.00 | 1181.58 | <3490.00 | | 80410.00 | 2251.48 | 966.90 | 76.39 | 36040.00 | 2450.72 | 4277.00 | 436.25 |
| FS-2060 | 10800.00 | 540.00 | 10670.00 | 746.90 | 74310.00 | 1932.06 | 187.30 | 20.60 | 16270.00 | 1236.52 | 80380.00 | 3295.58 |
| FS-2061 | 20090.00 | 843.78 | <1989.00 | | 69310.00 | 1802.06 | 624.90 | 88.74 | 26840.00 | 1851.96 | 6917.00 | 2165.02 |
| FS-2062 | 12560.00 | 615.44 | 9748.00 | 857.82 | 96630.00 | 2512.38 | <131.80 | | 24990.00 | 1749.30 | 9449.00 | 670.88 |
| FS-2063 | 17400.00 | 904.80 | 5101.00 | 632.52 | 73740.00 | 1917.24 | 256.80 | 24.91 | 22210.00 | 1576.91 | 7837.00 | 2437.31 |
| FS-2064 | 21300.00 | 937.20 | <2349.00 | | 76010.00 | 1976.26 | <102.40 | | 26680.00 | 1867.60 | 6384.00 | 497.95 |
| FS-2065 | 12860.00 | 604.42 | 7725.00 | 710.70 | 111100.00 | 2888.60 | 350.40 | 32.24 | 20620.00 | 1484.64 | 8155.00 | 570.85 |
| FS-2066 | 14920.00 | 775.84 | 3624.00 | 507.36 | 57940.00 | 1506.44 | <77.94 | | 23150.00 | 2037.20 | 4063.00 | 381.92 |
| FS-2067 | 9185.00 | 394.95 | 6641.00 | 657.46 | 94440.00 | 3399.84 | <66.63 | | 20920.00 | 1443.48 | 5911.00 | 455.15 |
| FS-2068 | 10805.00 | 535.68 | 6233.00 | 604.76 | 84700.00 | 2623.05 | <88.05 | | 19165.00 | 1351.04 | 5155.50 | 424.18 |
| FS-2070 | 32560.00 | 1400.08 | <2498.00 | | 67450.00 | 1821.15 | 124.90 | 29.35 | 41100.00 | 2794.80 | <1978.00 | |
| FS-2071 | 2700.00 | 121.50 | 16790.00 | 1040.98 | 101400.00 | 2636.40 | <76.92 | | 10390.00 | 841.59 | 14180.00 | 893.34 |
| FS-2072 | 3271.00 | 160.28 | 15190.00 | 911.40 | 108300.00 | 2815.80 | <51.79 | | 11540.00 | 877.04 | 10770.00 | 700.05 |
| FS-2073 | 21090.00 | 885.78 | 1331.00 | 412.61 | 76120.00 | 1979.12 | <91.98 | | 30720.00 | 2119.68 | 4116.00 | 374.56 |
| FS-2074 | 31380.00 | 1474.86 | <3672.00 | | 67110.00 | 1811.97 | 212.70 | 27.65 | 37350.00 | 2988.00 | <1848.00 | |
| FS-2075 | 30630.00 | 1654.02 | <3470.00 | | 81960.00 | 2622.72 | 696.90 | 78.75 | 32120.00 | 2248.40 | 3472.00 | 614.54 |
| FS-2076 | 14540.00 | 639.76 | 8993.00 | 1277.01 | 105800.00 | 2750.80 | 549.70 | 86.85 | 19120.00 | 1472.24 | 5094.00 | 662.22 |
| FS-2077 | 25950.00 | 1193.70 | <2288.00 | | 63930.00 | 1790.04 | 372.20 | 33.50 | 31070.00 | 2827.37 | 4497.00 | 445.20 |
| FS-2078 | 28160.00 | 1492.48 | <3493.00 | | 67570.00 | 1891.96 | 771.60 | 62.50 | 35570.00 | 2667.75 | 4988.00 | 468.87 |
| FS-2079 | 27170.00 | 1168.31 | <2167.00 | | <1524.00 | | <118.40 | | 32930.00 | 2469.75 | <1114.00 | |

| | Sc | Standard Deviation | Ti | Standard Deviation | V | Standard Deviation | Cr | Standard Deviation | Mn | Standard Deviation | Fe | Standard Deviation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FS-2000 | 2.98 | 0.16 | 1284.00 | 296.60 | 18.94 | 2.48 | 10.90 | 0.82 | 1161.00 | 45.28 | 15320.00 | 1026.44 |
| FS-2000F | 3.88 | 0.22 | 1951.00 | 360.93 | 20.61 | 2.82 | 22.54 | 1.60 | 1552.00 | 74.50 | 16030.00 | 817.53 |
| FS-2001 | 6.74 | 0.36 | 3688.00 | 505.26 | 59.40 | 2.97 | 45.25 | 2.85 | 507.30 | 20.80 | 22260.00 | 1491.42 |
| FS-2002 | 5.88 | 0.31 | 2718.00 | 453.91 | 36.54 | 2.92 | 19.42 | 1.48 | 480.10 | 19.68 | 21750.00 | 1457.25 |
| FS-2003 | 8.09 | 0.44 | 4102.00 | 537.36 | 60.50 | 2.90 | 57.41 | 3.56 | 647.70 | 28.50 | 27230.00 | 1470.42 |
| FS-2004 | 7.76 | 0.41 | 2975.00 | 428.40 | 66.69 | 3.47 | 45.51 | 3.00 | 503.50 | 24.17 | 29820.00 | 1997.94 |
| FS-2005 | 6.70 | 0.37 | 3226.00 | 474.22 | 49.35 | 3.31 | 32.29 | 2.10 | 513.10 | 20.52 | 25320.00 | 1291.32 |
| FS-2006 | 7.80 | 0.43 | 3471.00 | 468.58 | 59.56 | 3.04 | 46.53 | 2.95 | 545.80 | 24.84 | 28545.00 | 1498.56 |
| FS-2007 | 6.81 | 0.36 | 3157.00 | 467.24 | 56.57 | 3.17 | 34.55 | 2.31 | 486.90 | 19.96 | 26470.00 | 1508.79 |
| FS-2008 | 6.36 | 0.35 | 3585.00 | 526.99 | 51.85 | 3.37 | 29.24 | 1.90 | 1329.00 | 51.83 | 23830.00 | 1691.93 |
| FS-2009 | 6.78 | 0.37 | 3374.00 | 441.99 | 41.55 | 2.24 | 47.73 | 2.96 | 185.70 | 8.17 | 15900.00 | 810.90 |
| FS-2010 | 5.94 | 0.31 | 2507.00 | 363.52 | 34.94 | 2.38 | 30.36 | 2.06 | 473.00 | 23.65 | 21730.00 | 1260.34 |
| FS-2011 | 4.29 | 0.23 | 1783.00 | 285.28 | 24.61 | 1.94 | 20.00 | 1.42 | 400.80 | 17.64 | 18300.00 | 1152.90 |
| FS-2012 | 4.82 | 0.26 | 1970.00 | 311.26 | 31.73 | 2.44 | 20.71 | 1.37 | 478.00 | 19.12 | 19730.00 | 1302.18 |
| FS-2013 | 4.91 | 0.26 | 2298.00 | 324.02 | 34.25 | 2.16 | 31.34 | 2.04 | 483.40 | 23.69 | 21830.00 | 1266.14 |
| FS-2014F | 3.42 | 0.18 | 2066.00 | 382.21 | 25.17 | 2.77 | 14.72 | 1.31 | 772.80 | 36.32 | 14070.00 | 759.78 |
| FS-2015F | 2.28 | 0.12 | 1205.00 | 219.31 | 16.25 | 1.84 | 9.08 | 0.72 | 396.00 | 15.84 | 11920.00 | 703.28 |
| FS-2016F | 2.80 | 0.15 | 1802.00 | 282.91 | 14.62 | 1.78 | 18.51 | 1.28 | 451.70 | 21.68 | 14340.00 | 731.34 |
| FS-2017F | 3.97 | 0.21 | 1571.00 | 391.18 | 26.25 | 2.91 | 20.12 | 1.51 | 1449.00 | 56.51 | 16020.00 | 865.08 |
| FS-2018F | 3.75 | 0.21 | 2323.00 | 448.34 | 23.77 | 2.90 | 19.71 | 1.40 | 1323.00 | 51.60 | 14940.00 | 761.94 |
| FS-2019F | 3.83 | 0.21 | 1922.00 | 313.29 | 22.62 | 2.06 | 22.61 | 1.54 | 574.70 | 24.71 | 16150.00 | 823.65 |
| FS-2020F | 3.02 | 0.16 | 1524.00 | 273.50 | 15.24 | 1.96 | 13.83 | 1.03 | 499.90 | 21.90 | 14865.00 | 877.49 |
| FS-2021 | 3.70 | 0.20 | 2472.00 | 385.63 | 21.09 | 2.13 | 16.75 | 1.17 | 501.40 | 19.55 | 17870.00 | 1304.51 |
| FS-2022 | 5.86 | 0.33 | 2812.00 | 402.12 | 40.95 | 2.50 | 39.25 | 2.51 | 494.40 | 26.70 | 20820.00 | 1499.04 |
| FS-2023 | 5.00 | 0.27 | 1606.00 | 287.47 | 24.42 | 2.20 | 24.60 | 1.72 | 429.20 | 18.03 | 19520.00 | 1112.64 |
| FS-2026 | 7.12 | 0.38 | 2372.00 | 379.52 | 47.93 | 2.92 | 32.40 | 2.24 | 404.10 | 17.78 | 29270.00 | 1931.82 |
| FS-2027 | 5.46 | 0.29 | 4648.00 | 613.54 | 57.66 | 3.11 | 39.03 | 2.46 | 530.10 | 20.67 | 17430.00 | 1167.81 |
| FS-2028 | 9.53 | 0.54 | 3885.00 | 501.17 | 76.79 | 3.38 | 60.04 | 3.72 | 251.80 | 10.83 | 34390.00 | 3129.49 |
| FS-2029 | 13.80 | 0.73 | 2310.00 | 328.02 | 84.23 | 3.79 | 58.35 | 3.79 | 194.30 | 9.72 | 43370.00 | 2558.83 |
| FS-2030 | 5.78 | 0.32 | 2634.00 | 395.10 | 46.73 | 3.04 | 24.04 | 1.68 | 472.60 | 19.85 | 22390.00 | 1567.30 |
| FS-2031 | 6.15 | 0.35 | 4070.00 | 533.17 | 60.41 | 2.90 | 49.86 | 3.09 | 703.30 | 31.65 | 25580.00 | 2199.88 |
| FS-2032 | 5.44 | 0.29 | 3707.00 | 511.57 | 54.22 | 2.82 | 43.13 | 2.76 | 557.40 | 21.74 | 19590.00 | 1038.27 |
| FS-2033 | 11.32 | 0.61 | 3647.00 | 488.70 | 72.70 | 3.42 | 43.94 | 2.77 | 205.80 | 8.23 | 40310.00 | 2015.50 |
| FS-2034 | 7.09 | 0.39 | 3672.00 | 481.03 | 55.46 | 2.77 | 50.29 | 3.12 | 468.00 | 20.59 | 23680.00 | 1586.56 |
| FS-2035 | 4.57 | 0.24 | 3743.00 | 528.16 | 61.42 | 3.22 | 39.83 | 2.51 | 1053.55 | 42.14 | 21365.00 | 1173.13 |
| FS-2037 | 5.12 | 0.28 | 4553.00 | 587.34 | 50.32 | 2.52 | 46.10 | 2.90 | 454.60 | 21.37 | 15680.00 | 799.68 |
| FS-2038 | 8.01 | 0.42 | 1617.00 | 245.78 | 48.36 | 2.56 | 29.16 | 2.10 | 189.30 | 8.33 | 25110.00 | 1456.38 |
| FS-2039 | 4.25 | 0.23 | 1434.00 | 285.37 | 18.87 | 2.25 | 10.86 | 0.91 | 326.20 | 13.37 | 19170.00 | 1303.56 |
| FS-2040 | 7.10 | 0.42 | 1645.00 | 254.98 | 34.64 | 2.32 | 26.74 | 1.85 | 232.20 | 9.98 | 27010.00 | 1566.58 |
| FS-2041 | 7.64 | 0.41 | 3025.00 | 432.58 | 57.67 | 3.11 | 35.65 | 2.42 | 438.30 | 20.16 | 28090.00 | 1685.40 |
| FS-2042 | 4.74 | 0.26 | 4413.00 | 600.17 | 45.34 | 2.68 | 37.61 | 2.33 | 658.80 | 26.35 | 15580.00 | 810.16 |
| FS-2043 | 8.38 | 0.44 | 1815.00 | 284.95 | 47.35 | 2.65 | 30.95 | 2.14 | 227.20 | 11.81 | 30920.00 | 2195.32 |
| FS-2044 | 8.41 | 0.45 | 5029.00 | 658.80 | 79.45 | 3.50 | 46.85 | 2.90 | 412.80 | 16.92 | 29750.00 | 1636.25 |
| FS-2045 | 5.34 | 0.29 | 4454.00 | 579.02 | 44.54 | 2.45 | 52.12 | 3.18 | 586.60 | 25.81 | 18000.00 | 918.00 |
| FS-2046 | 12.41 | 0.67 | 2969.00 | 408.90 | 83.44 | 3.75 | 57.29 | 3.58 | 375.70 | 16.16 | 40255.00 | 2310.73 |
| FS-2048 | 7.59 | 0.42 | 2854.00 | 385.29 | 52.88 | 2.75 | 41.83 | 2.68 | 393.00 | 17.68 | 28090.00 | 1460.68 |
| FS-2049 | 7.44 | 0.41 | 2982.00 | 420.46 | 62.17 | 3.11 | 41.57 | 2.70 | 446.20 | 19.63 | 26890.00 | 1532.73 |
| FS-2050 | 7.18 | 0.39 | 4492.00 | 597.44 | 68.78 | 3.30 | 42.57 | 2.64 | 440.60 | 17.62 | 25620.00 | 1639.68 |
| FS-2051 | 8.77 | 0.49 | 3285.00 | 433.62 | 62.38 | 2.93 | 49.69 | 3.13 | 483.50 | 20.31 | 32120.00 | 1670.24 |
| FS-2052 | 4.42 | 0.23 | 4557.00 | 606.08 | 55.74 | 2.79 | 36.78 | 2.32 | 688.80 | 28.93 | 15490.00 | 882.93 |
| FS-2053 | 5.94 | 0.32 | 4386.00 | 578.95 | 56.66 | 2.89 | 43.97 | 2.68 | 615.50 | 25.24 | 20850.00 | 1063.35 |
| FS-2054 | 6.19 | 0.34 | 2904.00 | 400.75 | 45.16 | 2.62 | 35.99 | 2.30 | 493.00 | 23.17 | 23710.00 | 1849.38 |
| FS-2055 | 4.46 | 0.24 | 4193.00 | 574.44 | 43.46 | 2.56 | 37.38 | 2.43 | 531.80 | 21.80 | 15110.00 | 831.05 |
| FS-2056 | 8.95 | 0.48 | 4008.00 | 525.05 | 76.78 | 3.38 | 45.50 | 2.82 | 246.40 | 10.35 | 32650.00 | 1697.80 |
| FS-2057 | 7.33 | 0.40 | 3797.50 | 509.52 | 62.10 | 3.04 | 49.33 | 3.10 | 543.85 | 22.58 | 23935.00 | 1411.04 |

| | Sc | Standard Deviation | Ti | Standard Deviation | V | Standard Deviation | Cr | Standard Deviation | Mn | Standard Deviation | Fe | Standard Deviation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FS-2059 | 4.75 | 0.26 | 1981.00 | 309.04 | 18.88 | 1.96 | 11.43 | 0.96 | 345.00 | 14.15 | 19940.00 | 1036.88 |
| FS-2060 | 8.75 | 0.49 | 2016.00 | 280.22 | 58.23 | 2.74 | 46.77 | 2.99 | 298.80 | 11.95 | 29220.00 | 1986.96 |
| FS-2061 | 4.31 | 0.23 | 1531.00 | 251.08 | 22.94 | 1.81 | 13.16 | 1.08 | 223.60 | 8.50 | 17360.00 | 1215.20 |
| FS-2062 | 12.04 | 0.65 | 5438.00 | 717.82 | 96.99 | 4.36 | 61.51 | 3.81 | 733.50 | 28.61 | 38890.00 | 2022.28 |
| FS-2063 | 5.33 | 0.30 | 2035.00 | 293.04 | 36.64 | 2.16 | 22.35 | 1.59 | 301.70 | 15.39 | 20960.00 | 1278.56 |
| FS-2064 | 5.09 | 0.27 | 2937.00 | 428.80 | 35.84 | 2.62 | 28.31 | 1.93 | 539.60 | 21.04 | 21050.00 | 1199.85 |
| FS-2065 | 10.38 | 0.56 | 3214.00 | 437.10 | 59.91 | 3.06 | 40.08 | 2.53 | 231.00 | 11.09 | 37490.00 | 1911.99 |
| FS-2066 | 5.69 | 0.31 | 4712.00 | 612.56 | 52.69 | 2.58 | 49.02 | 3.04 | 536.90 | 23.62 | 19060.00 | 1124.54 |
| FS-2067 | 10.07 | 0.53 | 3816.00 | 511.34 | 87.81 | 3.78 | 57.51 | 3.62 | 395.70 | 17.81 | 35940.00 | 2192.34 |
| FS-2068 | 8.95 | 0.48 | 4638.50 | 605.44 | 82.68 | 3.60 | 56.07 | 3.45 | 491.55 | 20.40 | 32865.00 | 1758.07 |
| FS-2070 | 1.29 | 0.07 | <3844.00 | | <6.40 | | 2.03 | 0.47 | 361.90 | 16.29 | 10860.00 | 608.16 |
| FS-2071 | 17.90 | 0.97 | 2280.00 | 323.76 | 113.10 | 4.86 | 60.18 | 3.79 | 203.00 | 8.53 | 46230.00 | 2496.42 |
| FS-2072 | 18.80 | 1.03 | 2380.00 | 321.30 | 101.30 | 4.15 | 71.07 | 4.48 | 208.60 | 8.76 | 48640.00 | 2626.56 |
| FS-2073 | 5.23 | 0.28 | 2079.00 | 313.93 | 42.37 | 2.42 | 28.22 | 1.92 | 322.90 | 12.92 | 21690.00 | 1409.85 |
| FS-2074 | 1.45 | 0.08 | <5780.00 | | <8.84 | | <1.60 | | 376.90 | 14.32 | 11240.00 | 573.24 |
| FS-2075 | 6.16 | 0.33 | 2163.00 | 324.45 | 23.56 | 2.00 | 19.96 | 1.44 | 310.80 | 14.30 | 24190.00 | 1499.78 |
| FS-2076 | 15.73 | 0.83 | 1659.00 | 313.55 | 75.41 | 3.85 | 42.93 | 2.88 | 624.90 | 25.00 | 39310.00 | 2555.15 |
| FS-2077 | 2.42 | 0.13 | 1185.00 | 237.00 | 13.47 | 1.95 | 9.93 | 0.78 | 403.90 | 16.16 | 13060.00 | 679.12 |
| FS-2078 | 2.32 | 0.13 | 1188.00 | 256.61 | 11.54 | 2.00 | 9.28 | 0.82 | 433.40 | 17.34 | 12470.00 | 635.97 |
| FS-2079 | 2.13 | 0.11 | <3607.00 | | <6.41 | | 9.26 | 0.90 | 474.50 | 18.98 | 11370.00 | 716.31 |

| | Co | Standard Deviation | Cu | Standard Deviation | Zn | Standard Deviation | Ga | Standard Deviation | As | Standard Deviation | Se | Standard Deviation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FS-2000 | 2.80 | 0.21 | <402.90 | | 54.57 | 22.81 | <60.79 | | <3.98 | | <3.44 | |
| FS-2000F | 4.06 | 0.22 | <349.00 | | 64.74 | 9.06 | <45.31 | | 1.63 | 0.43 | <4.63 | |
| FS-2001 | 8.58 | 0.46 | <204.30 | | 55.22 | 8.12 | <33.64 | | 4.38 | 0.56 | <2.58 | |
| FS-2002 | 5.93 | 0.44 | <456.60 | | <13.48 | | <83.90 | | 4.76 | 0.88 | <5.94 | |
| FS-2003 | 9.82 | 0.53 | <215.30 | | <19.20 | | <35.48 | | 7.01 | 0.82 | <5.38 | |
| FS-2004 | 9.10 | 0.48 | <238.30 | | 58.92 | 9.13 | <41.37 | | 2.24 | 0.44 | <3.05 | |
| FS-2005 | 7.55 | 0.48 | <400.10 | | <10.92 | | <75.61 | | 4.86 | 0.80 | <5.72 | |
| FS-2006 | 9.12 | 0.49 | <238.25 | | <21.22 | | <43.65 | | 5.33 | 0.68 | <5.59 | |
| FS-2007 | 8.59 | 0.54 | <262.50 | | 53.35 | 8.59 | <46.46 | | 3.73 | 0.60 | <2.99 | |
| FS-2008 | 10.26 | 0.56 | <387.20 | | <28.15 | | <63.24 | | 7.36 | 0.91 | <4.67 | |
| FS-2009 | 4.00 | 0.22 | <210.30 | | <20.36 | | <40.80 | | 1.42 | 0.32 | <4.98 | |
| FS-2010 | 6.67 | 0.37 | <258.30 | | 70.29 | 10.19 | <48.42 | | 2.06 | 0.39 | <2.79 | |
| FS-2011 | 4.27 | 0.24 | <228.70 | | 57.12 | 8.34 | <41.28 | | 1.53 | 0.33 | <2.24 | |
| FS-2012 | 4.87 | 0.31 | <335.10 | | <35.21 | | <63.77 | | 2.53 | 0.54 | <4.22 | |
| FS-2013 | 5.94 | 0.31 | <245.20 | | 45.16 | 6.64 | <42.02 | | 2.51 | 0.45 | <4.76 | |
| FS-2014F | 4.12 | 0.24 | <321.90 | | 64.31 | 10.03 | <55.96 | | <3.23 | | <2.93 | |
| FS-2015F | 1.95 | 0.19 | <348.50 | | <23.40 | | <66.71 | | 2.13 | 0.51 | <3.24 | |
| FS-2016F | 3.04 | 0.17 | <266.90 | | 41.60 | 6.07 | <46.54 | | 2.03 | 0.46 | <3.86 | |
| FS-2017F | 4.83 | 0.28 | <330.20 | | 146.20 | 19.59 | <50.69 | | <2.94 | | <2.71 | |
| FS-2018F | 3.87 | 0.33 | <453.70 | | 94.92 | 39.01 | <78.60 | | 3.78 | 0.70 | <4.62 | |
| FS-2019F | 4.01 | 0.23 | <284.30 | | 45.38 | 6.76 | <50.46 | | <2.58 | | <4.52 | |
| FS-2020F | 3.03 | 0.20 | <306.85 | | 60.89 | 8.71 | <61.28 | | <3.43 | | <2.78 | |
| FS-2021 | 3.87 | 0.26 | <344.50 | | <32.04 | | <70.13 | | 2.80 | 0.58 | <3.85 | |
| FS-2022 | 6.78 | 0.37 | <252.00 | | <20.27 | | <47.78 | | 4.99 | 0.67 | <5.37 | |
| FS-2023 | 5.29 | 0.30 | <258.10 | | 61.44 | 9.09 | <51.55 | | 3.64 | 0.62 | <2.56 | |
| FS-2026 | 9.31 | 0.53 | <245.10 | | 65.90 | 9.75 | <51.54 | | 4.91 | 0.69 | <2.88 | |
| FS-2027 | 10.91 | 0.59 | <276.50 | | <8.09 | | <60.63 | | 7.56 | 0.92 | <4.13 | |
| FS-2028 | 7.39 | 0.39 | <186.40 | | <21.10 | | <42.93 | | 8.51 | 0.96 | <5.57 | |
| FS-2029 | 6.82 | 0.48 | <158.90 | | 106.70 | 14.83 | <44.23 | | 10.30 | 1.54 | <3.53 | |
| FS-2030 | 6.92 | 0.44 | <367.50 | | <15.23 | | <83.28 | | 4.95 | 0.75 | <5.00 | |
| FS-2031 | 12.32 | 0.64 | <216.50 | | <16.69 | | <41.49 | | 7.64 | 0.88 | <4.67 | |
| FS-2032 | 8.29 | 0.45 | <209.10 | | 49.72 | 7.51 | <44.48 | | 2.99 | 0.47 | <2.48 | |
| FS-2033 | 7.12 | 0.41 | <250.50 | | 60.40 | 25.97 | <69.66 | | 8.23 | 0.96 | <5.45 | |
| FS-2034 | 9.75 | 0.52 | <207.40 | | 65.70 | 9.20 | <44.25 | | 4.21 | 0.58 | <4.89 | |
| FS-2035 | 13.73 | 0.73 | <273.30 | | <7.78 | | <54.17 | | 7.58 | 0.93 | <3.19 | |
| FS-2037 | 22.53 | 1.19 | <207.80 | | <16.24 | | <45.99 | | 5.25 | 0.65 | <4.81 | |
| FS-2038 | 4.19 | 0.39 | <180.50 | | 66.97 | 9.71 | <49.31 | | 3.26 | 0.52 | <2.71 | |
| FS-2039 | 1.72 | 0.22 | <384.20 | | <34.34 | | <99.75 | | <5.21 | | <4.37 | |
| FS-2040 | 4.28 | 0.24 | <256.20 | | <20.43 | | <61.53 | | 4.90 | 0.69 | <5.31 | |
| FS-2041 | 7.54 | 0.41 | <231.40 | | <10.28 | | <71.07 | | 3.90 | 0.63 | <3.06 | |
| FS-2042 | 7.29 | 0.41 | <271.40 | | <10.22 | | <80.74 | | 5.68 | 0.75 | <3.96 | |
| FS-2043 | 5.24 | 0.29 | <220.40 | | 76.30 | 10.91 | <20.15 | | 3.71 | 0.51 | <2.82 | |
| FS-2044 | 8.19 | 0.45 | <249.70 | | <23.06 | | 17.68 | 3.34 | 7.33 | 0.83 | <4.62 | |
| FS-2045 | 8.22 | 0.48 | <208.50 | | <16.77 | | <16.54 | | 5.35 | 0.60 | <4.69 | |
| FS-2046 | 10.95 | 0.60 | <216.35 | | 62.80 | 25.75 | 20.13 | 3.51 | 8.27 | 0.91 | <4.32 | |
| FS-2048 | 7.24 | 0.39 | <229.30 | | <21.55 | | <20.33 | | 4.45 | 0.56 | <5.39 | |
| FS-2049 | 7.75 | 0.42 | <212.00 | | <8.99 | | <18.67 | | 4.58 | 0.58 | <2.64 | |
| FS-2050 | 7.91 | 0.45 | <261.30 | | <13.52 | | <25.08 | | 7.26 | 0.82 | <4.65 | |
| FS-2051 | 9.02 | 0.48 | <208.70 | | <21.89 | | 13.99 | 3.72 | 5.36 | 0.63 | <5.43 | |
| FS-2052 | 14.65 | 0.79 | <199.20 | | 19.97 | 4.23 | <17.55 | | 5.11 | 0.61 | <2.20 | |
| FS-2053 | 9.41 | 0.52 | <271.10 | | <21.93 | | <26.60 | | 5.04 | 0.63 | <4.28 | |
| FS-2054 | 6.56 | 0.35 | <242.20 | | <20.14 | | <21.64 | | 3.36 | 0.67 | <5.18 | |
| FS-2055 | 7.06 | 0.39 | <212.30 | | 43.67 | 7.03 | <20.12 | | 3.91 | 0.51 | <2.56 | |
| FS-2056 | 7.00 | 0.40 | <244.20 | | <37.68 | | 17.06 | 3.75 | 9.80 | 1.08 | <4.86 | |
| FS-2057 | 9.16 | 0.49 | <207.50 | | <14.39 | | 7.81 | 2.35 | 5.12 | 0.61 | <3.89 | |

| | Co | Standard Deviation | Cu | Standard Deviation | Zn | Standard Deviation | Ga | Standard Deviation | As | Standard Deviation | Se | Standard Deviation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FS-2059 | 1.72 | 0.21 | <363.30 | | <42.04 | | <41.89 | | 2.93 | 0.53 | <4.37 | |
| FS-2060 | 7.37 | 0.40 | <202.00 | | <23.76 | | <20.74 | | 4.92 | 0.58 | <5.89 | |
| FS-2061 | 2.51 | 0.15 | <209.40 | | 60.87 | 8.58 | <22.88 | | 3.12 | 0.47 | <2.03 | |
| FS-2062 | 12.63 | 0.68 | <320.50 | | 63.70 | 28.09 | 37.39 | 6.02 | 9.33 | 1.06 | <5.88 | |
| FS-2063 | 5.09 | 0.28 | <229.00 | | <18.09 | | <23.00 | | 2.00 | 0.33 | <4.66 | |
| FS-2064 | 7.30 | 0.39 | <246.70 | | 51.78 | 7.87 | <25.89 | | 3.86 | 0.54 | <2.49 | |
| FS-2065 | 6.58 | 0.39 | <277.60 | | 52.16 | 25.92 | 26.40 | 4.30 | 6.78 | 0.81 | <5.13 | |
| FS-2066 | 9.73 | 0.52 | <203.80 | | <16.57 | | <20.10 | | 5.14 | 0.60 | <4.68 | |
| FS-2067 | 16.56 | 0.88 | <187.60 | | 68.53 | 10.07 | <19.42 | | 8.93 | 0.97 | <3.01 | |
| FS-2068 | 9.49 | 0.51 | <226.75 | | <24.55 | | 15.03 | 3.41 | 8.76 | 0.97 | <4.90 | |
| FS-2070 | 1.05 | 0.08 | <274.80 | | 39.92 | 6.19 | <32.25 | | <2.58 | | <1.71 | |
| FS-2071 | 6.73 | 0.42 | <232.30 | | <71.93 | | 32.14 | 11.80 | 10.81 | 1.19 | <6.96 | |
| FS-2072 | 7.30 | 0.39 | <171.80 | | <35.18 | | 23.38 | 4.51 | 9.73 | 1.05 | <7.72 | |
| FS-2073 | 6.95 | 0.38 | <227.20 | | 43.97 | 6.90 | <27.34 | | 3.05 | 0.44 | <2.37 | |
| FS-2074 | 0.44 | 0.17 | <392.40 | | <5.32 | | <50.40 | | 3.49 | 0.67 | <3.08 | |
| FS-2075 | 3.42 | 0.19 | <286.30 | | 132.30 | 17.20 | <31.13 | | 2.86 | 0.46 | <4.48 | |
| FS-2076 | 23.35 | 1.31 | <288.60 | | 92.97 | 13.20 | <28.20 | | 10.12 | 1.34 | <3.45 | |
| FS-2077 | 2.26 | 0.19 | <247.20 | | <42.39 | | <50.54 | | <3.36 | | <3.23 | |
| FS-2078 | 2.04 | 0.13 | <365.00 | | 47.08 | 6.87 | <37.44 | | 1.20 | 0.33 | <4.20 | |
| FS-2079 | 2.17 | 0.14 | <291.40 | | 79.40 | 11.27 | <40.48 | | 1.59 | 0.39 | <2.14 | |

| | Br | Standard Deviation | Rb | Standard Deviation | Sr | Standard Deviation | Zr | Standard Deviation | Ag | Standard Deviation | In | Standard Deviation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FS-2000 | 6.52 | 0.78 | 113.90 | 5.81 | <498.80 | | 293.00 | 49.81 | <2.46 | | <0.37 | |
| FS-2000F | 11.69 | 1.26 | 103.90 | 5.61 | <380.90 | | 314.50 | 42.77 | <3.62 | | <0.27 | |
| FS-2001 | <2.36 | | 108.10 | 5.95 | <236.00 | | 399.20 | 53.49 | <2.75 | | <0.21 | |
| FS-2002 | 4.90 | 0.71 | 151.00 | 8.15 | <501.70 | | 174.00 | 39.50 | <4.73 | | <0.41 | |
| FS-2003 | <2.02 | | 134.40 | 6.85 | <221.20 | | 485.20 | 98.98 | <4.25 | | <0.17 | |
| FS-2004 | 7.35 | 0.85 | 126.90 | 6.98 | <278.30 | | 225.00 | 42.53 | <3.44 | | <0.25 | |
| FS-2005 | 11.62 | 1.30 | 131.70 | 7.51 | <455.60 | | 319.30 | 60.99 | <4.62 | | <0.37 | |
| FS-2006 | 2.43 | 0.45 | 143.15 | 7.44 | <231.65 | | 279.70 | 59.59 | <4.66 | | <0.19 | |
| FS-2007 | 1.45 | 0.42 | 132.40 | 7.28 | <291.10 | | 246.50 | 56.20 | <3.36 | | <0.26 | |
| FS-2008 | <3.79 | | 119.10 | 6.19 | <526.20 | | 439.80 | 77.40 | <3.67 | | <0.36 | |
| FS-2009 | 1.97 | 0.41 | 121.50 | 6.20 | <170.50 | | 441.00 | 53.80 | <3.88 | | <0.15 | |
| FS-2010 | 3.10 | 0.55 | 131.10 | 7.08 | <279.30 | | 290.70 | 47.97 | <3.07 | | <0.26 | |
| FS-2011 | 1.67 | 0.41 | 122.40 | 6.36 | <241.20 | | 265.10 | 37.64 | <2.34 | | <0.23 | |
| FS-2012 | 6.74 | 0.98 | 124.80 | 6.49 | <365.20 | | 392.70 | 50.27 | <3.17 | | <0.30 | |
| FS-2013 | 2.12 | 0.34 | 120.50 | 6.27 | <219.40 | | 377.50 | 47.19 | <3.54 | | <0.19 | |
| FS-2014F | 9.79 | 1.31 | 101.50 | 5.99 | <383.90 | | 203.70 | 66.41 | <2.92 | | <0.33 | |
| FS-2015F | 2.54 | 0.42 | 106.00 | 5.41 | <356.00 | | 273.20 | 63.38 | <2.27 | | <0.31 | |
| FS-2016F | 2.39 | 0.46 | 104.00 | 5.30 | <229.50 | | 327.80 | 45.89 | <2.89 | | <0.20 | |
| FS-2017F | 12.13 | 1.37 | 93.13 | 5.77 | <444.70 | | 238.10 | 37.14 | <2.83 | | <0.34 | |
| FS-2018F | 6.26 | 0.81 | 104.60 | 5.75 | <609.90 | | 332.40 | 47.53 | <3.52 | | <0.42 | |
| FS-2019F | 3.05 | 0.42 | 111.40 | 5.90 | <255.50 | | 323.10 | 41.68 | <3.42 | | <0.21 | |
| FS-2020F | 3.08 | 0.49 | 88.79 | 4.79 | <328.95 | | 296.15 | 48.10 | <2.34 | | <0.29 | |
| FS-2021 | <3.93 | | 109.80 | 5.71 | <373.10 | | 456.00 | 54.72 | <2.85 | | <0.31 | |
| FS-2022 | 2.10 | 0.61 | 136.10 | 7.08 | <236.00 | | 432.00 | 78.19 | <4.24 | | <0.20 | |
| FS-2023 | 7.74 | 1.26 | 130.70 | 6.93 | <271.50 | | 226.00 | 70.29 | <2.75 | | <0.26 | |
| FS-2026 | 2.79 | 0.43 | 93.07 | 5.96 | <255.90 | | 281.00 | 44.96 | <3.23 | | <0.25 | |
| FS-2027 | 2.74 | 0.70 | 90.69 | 5.17 | <339.80 | | 585.90 | 69.72 | <3.20 | | <0.25 | |
| FS-2028 | 9.28 | 1.18 | 110.70 | 6.20 | <164.90 | | 488.90 | 58.67 | <4.60 | | 0.07 | 0.03 |
| FS-2029 | 9.34 | 1.17 | 104.80 | 6.92 | <185.90 | | <175.70 | | <4.41 | | <0.17 | |
| FS-2030 | 8.90 | 1.01 | 122.90 | 6.76 | <417.30 | | 282.90 | 67.61 | <4.05 | | <0.33 | |
| FS-2031 | 4.14 | 0.56 | 105.90 | 5.82 | <221.20 | | 522.20 | 60.05 | <3.72 | | <0.17 | |
| FS-2032 | 2.73 | 0.60 | 90.73 | 5.17 | <250.70 | | 449.70 | 70.60 | <2.57 | | <0.21 | |
| FS-2033 | 10.29 | 1.15 | 112.30 | 6.63 | <270.00 | | 344.30 | 54.06 | <4.70 | | <0.23 | |
| FS-2034 | 7.24 | 0.81 | 114.30 | 6.17 | <198.80 | | 344.20 | 77.45 | <3.95 | | <0.16 | |
| FS-2035 | 1.58 | 0.39 | 89.81 | 5.21 | <370.15 | | 620.55 | 74.15 | <2.70 | | <0.26 | |
| FS-2037 | 2.03 | 0.29 | 87.75 | 5.09 | <196.60 | | 636.70 | 78.31 | <3.66 | | <0.16 | |
| FS-2038 | 4.61 | 0.65 | 64.97 | 4.68 | <191.90 | | <128.40 | | <3.22 | | <0.19 | |
| FS-2039 | <4.67 | | 98.15 | 5.50 | <383.20 | | 336.40 | 45.75 | <3.25 | | <0.34 | |
| FS-2040 | 4.86 | 0.57 | 107.80 | 6.14 | <199.90 | | 277.70 | 41.10 | <4.46 | | <0.19 | |
| FS-2041 | 2.66 | 0.58 | 122.60 | 7.11 | <261.20 | | 169.50 | 29.66 | <3.36 | | <0.24 | |
| FS-2042 | <3.23 | | 83.60 | 4.60 | <351.30 | | 666.80 | 76.02 | <2.89 | | <0.25 | |
| FS-2043 | 5.06 | 0.78 | 87.40 | 5.42 | <216.80 | | 279.80 | 49.24 | <2.59 | | <0.22 | |
| FS-2044 | 3.97 | 0.48 | 114.70 | 5.96 | <295.10 | | 440.20 | 88.48 | <3.82 | | <0.23 | |
| FS-2045 | <1.77 | | 87.68 | 4.82 | 170.40 | 55.55 | 704.30 | 78.18 | <3.47 | | <0.16 | |
| FS-2046 | 12.26 | 1.40 | 111.00 | 6.49 | <259.05 | | 247.00 | 47.42 | 1.61 | 0.51 | <0.21 | |
| FS-2048 | 2.89 | 0.52 | 139.80 | 7.27 | <213.40 | | 260.20 | 66.09 | <4.53 | | <0.18 | |
| FS-2049 | 1.71 | 0.66 | 121.20 | 6.54 | <235.60 | | 192.90 | 61.92 | <2.97 | | <0.21 | |
| FS-2050 | 9.14 | 0.99 | 104.30 | 5.63 | <317.80 | | 400.40 | 52.45 | <3.74 | | <0.24 | |
| FS-2051 | 3.71 | 0.44 | 139.80 | 7.27 | <204.80 | | 276.70 | 50.36 | <4.63 | | <0.16 | |
| FS-2052 | <2.21 | | 87.68 | 5.00 | <247.50 | | 445.90 | 77.59 | <2.24 | | <0.21 | |
| FS-2053 | 4.59 | 0.61 | 102.00 | 5.41 | <339.00 | | 670.00 | 76.38 | <3.21 | | <0.25 | |
| FS-2054 | 2.53 | 0.35 | 118.30 | 6.39 | <223.10 | | 288.70 | 49.37 | <4.17 | | <0.18 | |
| FS-2055 | 2.53 | 0.41 | 73.69 | 4.50 | <257.00 | | 438.30 | 53.91 | <2.62 | | <0.22 | |
| FS-2056 | 9.80 | 1.08 | 104.50 | 5.75 | <267.60 | | 435.50 | 59.23 | <3.99 | | <0.22 | |
| FS-2057 | 18.91 | 2.05 | 99.21 | 5.55 | <224.10 | | 417.75 | 52.54 | <3.53 | | <0.18 | |

| | Br | Standard Deviation | Rb | Standard Deviation | Sr | Standard Deviation | Zr | Standard Deviation | Ag | Standard Deviation | In | Standard Deviation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FS-2059 | 2.08 | 0.47 | 95.18 | 5.43 | <372.50 | | 431.70 | 53.96 | <3.38 | | <0.32 | |
| FS-2060 | 16.24 | 1.77 | 90.24 | 5.59 | <189.70 | | 270.30 | 44.60 | <5.01 | | <0.15 | |
| FS-2061 | 2.60 | 0.90 | 70.87 | 4.18 | <202.50 | | 163.00 | 33.58 | <2.23 | | <0.21 | |
| FS-2062 | 25.55 | 2.71 | 134.00 | 7.37 | <411.70 | | 492.10 | 66.93 | <5.07 | | <0.30 | |
| FS-2063 | 2.42 | 0.36 | 109.50 | 5.91 | <194.90 | | 148.00 | 68.08 | <3.85 | | <0.17 | |
| FS-2064 | 1.61 | 0.48 | 110.40 | 6.18 | <274.50 | | 351.70 | 72.10 | <2.64 | | <0.25 | |
| FS-2065 | 10.81 | 1.21 | 113.90 | 6.61 | <292.00 | | 390.60 | 55.47 | <4.53 | | <0.25 | |
| FS-2066 | 1.99 | 0.32 | 89.97 | 5.04 | <205.30 | | 522.60 | 76.30 | <3.61 | | <0.16 | |
| FS-2067 | 8.50 | 0.97 | 118.20 | 6.74 | <215.10 | | 239.30 | 48.34 | <3.46 | | <0.19 | |
| FS-2068 | 4.39 | 0.55 | 120.10 | 6.42 | <257.65 | | 405.70 | 66.60 | <4.17 | | <0.19 | |
| FS-2070 | <3.31 | | 100.10 | 5.31 | <267.30 | | 189.30 | 26.12 | <1.59 | | <0.27 | |
| FS-2071 | 7.96 | 0.87 | 92.22 | 6.73 | <284.30 | | <311.80 | | <6.66 | | 0.17 | 0.04 |
| FS-2072 | 6.52 | 0.71 | 97.09 | 6.41 | 242.20 | 63.46 | <316.30 | | <7.52 | | 0.13 | 0.04 |
| FS-2073 | 3.83 | 0.59 | 108.80 | 5.98 | <227.90 | | 282.70 | 68.98 | <2.56 | | <0.23 | |
| FS-2074 | <4.48 | | 108.40 | 5.53 | <394.80 | | 257.50 | 33.99 | <2.11 | | <0.35 | |
| FS-2075 | 9.23 | 1.01 | 43.95 | 3.21 | <567.70 | | 198.70 | 32.39 | <3.74 | | <0.49 | |
| FS-2076 | 46.88 | 5.25 | 65.38 | 4.90 | <746.10 | | <144.60 | | <4.19 | | <0.69 | |
| FS-2077 | <3.38 | | 113.70 | 5.68 | <252.20 | | 215.90 | 31.52 | <2.29 | | <0.25 | |
| FS-2078 | 1.50 | 0.60 | 159.00 | 7.79 | <389.80 | | 239.00 | 36.57 | <2.84 | | <0.33 | |
| FS-2079 | 1.38 | 0.42 | 148.20 | 7.56 | <249.00 | | 190.40 | 33.89 | <2.09 | | <0.22 | |

| | Sb | Standard Deviation | I | Standard Deviation | Cs | Standard Deviation | Ba | Standard Deviation | La | Standard Deviation | Ce | Standard Deviation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FS-2000 | <0.38 | | <32.98 | | 3.15 | 0.18 | 314.20 | 68.50 | 49.52 | 2.82 | 91.17 | 4.10 |
| FS-2000F | 0.46 | 0.08 | <22.70 | | 3.57 | 0.23 | 516.70 | 34.10 | 49.25 | 2.66 | 93.69 | 4.12 |
| FS-2001 | 0.46 | 0.07 | <13.83 | | 4.01 | 0.35 | 478.60 | 146.45 | 44.25 | 2.48 | 91.94 | 4.05 |
| FS-2002 | 0.47 | 0.13 | <32.97 | | 5.09 | 0.32 | 629.00 | 42.77 | 42.11 | 2.32 | 85.66 | 4.03 |
| FS-2003 | 1.05 | 0.10 | <12.97 | | 6.29 | 0.38 | 745.10 | 43.96 | 75.92 | 3.87 | 84.88 | 3.90 |
| FS-2004 | 0.28 | 0.07 | <16.62 | | 6.04 | 0.35 | 553.20 | 138.85 | 43.29 | 2.42 | 81.92 | 3.69 |
| FS-2005 | 0.43 | 0.09 | <30.49 | | 5.67 | 0.36 | 697.50 | 43.94 | 41.40 | 2.40 | 78.10 | 3.67 |
| FS-2006 | 0.62 | 0.09 | <13.85 | | 6.73 | 0.39 | 768.15 | 53.54 | 48.12 | 2.45 | 88.25 | 4.06 |
| FS-2007 | <0.25 | | 7.06 | 2.18 | 5.32 | 0.45 | 477.10 | 39.12 | 44.05 | 2.51 | 88.07 | 3.96 |
| FS-2008 | 0.53 | 0.09 | <34.89 | | 5.35 | 0.34 | 587.00 | 36.98 | 48.76 | 2.83 | 101.30 | 4.56 |
| FS-2009 | 0.52 | 0.08 | <9.93 | | 4.86 | 0.29 | 635.00 | 45.08 | 56.42 | 2.82 | 70.37 | 3.10 |
| FS-2010 | 0.27 | 0.08 | <16.37 | | 5.31 | 0.35 | 258.60 | 72.41 | 47.14 | 2.64 | 93.72 | 4.12 |
| FS-2011 | 0.31 | 0.07 | <14.17 | | 3.73 | 0.23 | 230.50 | 88.97 | 54.42 | 2.88 | 105.80 | 4.66 |
| FS-2012 | 0.54 | 0.11 | <24.48 | | 4.29 | 0.27 | 319.10 | 26.80 | 51.47 | 3.04 | 95.81 | 4.31 |
| FS-2013 | 0.45 | 0.08 | <12.98 | | 4.12 | 0.26 | 387.10 | 36.00 | 55.78 | 2.68 | 105.10 | 4.73 |
| FS-2014F | <0.30 | | <22.55 | | 3.27 | 0.20 | 296.90 | 48.39 | 43.98 | 2.55 | 84.55 | 3.80 |
| FS-2015F | <0.38 | | <23.60 | | 2.87 | 0.18 | 206.30 | 20.63 | 41.81 | 2.34 | 82.01 | 3.69 |
| FS-2016F | <0.27 | | <13.56 | | 2.76 | 0.17 | 288.30 | 23.93 | 48.68 | 2.48 | 97.42 | 4.29 |
| FS-2017F | <0.27 | | <26.59 | | 2.91 | 0.20 | 343.20 | 97.13 | 45.65 | 2.42 | 85.68 | 3.86 |
| FS-2018F | 0.43 | 0.10 | <40.59 | | 3.23 | 0.22 | 493.00 | 56.69 | 43.06 | 2.37 | 81.71 | 3.84 |
| FS-2019F | 0.34 | 0.09 | <15.01 | | 3.61 | 0.21 | 416.90 | 29.60 | 55.04 | 2.70 | 103.30 | 4.55 |
| FS-2020F | <0.31 | | <20.74 | | 2.68 | 0.22 | 339.85 | 25.76 | 45.33 | 2.38 | 84.33 | 3.79 |
| FS-2021 | 0.37 | 0.08 | <24.77 | | 3.51 | 0.20 | 279.90 | 51.50 | 55.88 | 3.07 | 100.90 | 4.54 |
| FS-2022 | 0.71 | 0.09 | <13.80 | | 5.12 | 0.30 | 542.50 | 37.43 | 48.58 | 2.57 | 99.60 | 4.58 |
| FS-2023 | 0.27 | 0.07 | <15.87 | | 4.38 | 0.32 | 386.20 | 45.19 | 52.65 | 2.79 | 101.70 | 4.47 |
| FS-2026 | 0.52 | 0.08 | <15.59 | | 5.19 | 0.49 | 434.60 | 102.57 | 53.74 | 2.90 | 132.90 | 5.85 |
| FS-2027 | 0.97 | 0.10 | <22.15 | | 3.70 | 0.21 | 587.80 | 122.85 | 36.69 | 2.05 | 76.51 | 3.52 |
| FS-2028 | 1.01 | 0.09 | 6.52 | 1.56 | 7.23 | 0.41 | 634.50 | 45.05 | 66.27 | 3.38 | 117.30 | 5.40 |
| FS-2029 | 1.27 | 0.11 | 6.89 | 1.56 | 8.65 | 0.61 | 183.80 | 39.33 | 41.48 | 2.32 | 66.65 | 3.07 |
| FS-2030 | 0.40 | 0.09 | 29.42 | 4.06 | 4.97 | 0.30 | 828.90 | 51.39 | 37.61 | 2.26 | 72.07 | 3.39 |
| FS-2031 | 1.11 | 0.10 | <13.13 | | 4.65 | 0.26 | 764.00 | 45.08 | 42.94 | 2.10 | 99.55 | 4.58 |
| FS-2032 | 0.47 | 0.07 | <14.83 | | 3.14 | 0.24 | 463.70 | 112.68 | 39.56 | 2.22 | 70.72 | 3.18 |
| FS-2033 | 0.73 | 0.10 | <18.58 | | 7.86 | 0.45 | 524.70 | 86.58 | 49.04 | 3.14 | 93.92 | 4.32 |
| FS-2034 | 0.60 | 0.08 | <11.85 | | 5.31 | 0.30 | 610.80 | 39.70 | 40.17 | 1.93 | 76.08 | 3.50 |
| FS-2035 | 0.81 | 0.08 | <23.57 | | 2.79 | 0.22 | 528.00 | 74.75 | 37.73 | 2.08 | 73.51 | 3.35 |
| FS-2037 | 0.75 | 0.08 | <11.68 | | 3.41 | 0.20 | 690.00 | 43.47 | 39.89 | 1.99 | 100.30 | 4.61 |
| FS-2038 | 1.15 | 0.10 | 6.36 | 1.81 | 4.97 | 0.34 | 288.00 | 34.85 | 36.49 | 1.82 | 82.35 | 3.71 |
| FS-2039 | <0.43 | | <25.62 | | 3.24 | 0.20 | 374.50 | 83.51 | 70.87 | 4.11 | 116.80 | 5.26 |
| FS-2040 | 0.64 | 0.10 | <12.14 | | 5.10 | 0.29 | 558.70 | 43.02 | 53.99 | 2.81 | 107.50 | 4.95 |
| FS-2041 | 0.29 | 0.07 | <15.49 | | 5.87 | 0.44 | 560.00 | 45.36 | 47.98 | 2.49 | 80.56 | 3.63 |
| FS-2042 | 1.08 | 0.09 | <23.28 | | 2.86 | 0.18 | 609.90 | 45.13 | 35.32 | 2.05 | 68.96 | 3.17 |
| FS-2043 | 0.53 | 0.10 | <13.26 | | 5.59 | 0.37 | 356.20 | 82.99 | 51.35 | 2.77 | 102.90 | 4.53 |
| FS-2044 | 0.72 | 0.09 | <19.95 | | 6.35 | 0.36 | 543.60 | 48.92 | 37.70 | 2.11 | 67.78 | 3.12 |
| FS-2045 | 0.88 | 0.10 | <12.42 | | 3.33 | 0.20 | 614.90 | 36.89 | 36.52 | 1.90 | 71.59 | 3.15 |
| FS-2046 | 0.72 | 0.09 | <16.77 | | 8.26 | 0.61 | 371.50 | 45.32 | 42.03 | 2.39 | 99.81 | 4.54 |
| FS-2048 | 0.47 | 0.10 | <12.49 | | 6.03 | 0.36 | 723.70 | 44.15 | 44.67 | 2.28 | 84.82 | 3.90 |
| FS-2049 | 0.46 | 0.08 | <13.70 | | 5.97 | 0.39 | 508.80 | 138.39 | 47.55 | 2.47 | 79.84 | 3.59 |
| FS-2050 | 1.00 | 0.11 | <20.70 | | 5.45 | 0.32 | 493.90 | 46.43 | 39.86 | 2.15 | 61.55 | 2.89 |
| FS-2051 | 0.59 | 0.08 | <12.16 | | 7.11 | 0.48 | 648.10 | 45.37 | 42.89 | 2.27 | 81.82 | 3.76 |
| FS-2052 | 0.61 | 0.09 | <14.73 | | 2.49 | 0.18 | 548.80 | 35.12 | 37.10 | 1.97 | 74.64 | 3.28 |
| FS-2053 | <0.34 | | <22.38 | | 3.54 | 0.25 | 502.10 | 33.64 | 39.31 | 2.20 | 81.09 | 3.73 |
| FS-2054 | 0.52 | 0.11 | <13.41 | | 4.79 | 0.28 | 579.70 | 38.26 | 39.32 | 2.12 | 87.41 | 4.11 |
| FS-2055 | 0.89 | 0.10 | <15.22 | | 2.66 | 0.22 | 415.30 | 33.22 | 32.95 | 1.98 | 58.19 | 2.62 |
| FS-2056 | 1.03 | 0.10 | <17.94 | | 6.36 | 0.36 | 511.20 | 71.06 | 54.60 | 3.06 | 104.40 | 4.70 |
| FS-2057 | 0.60 | 0.09 | 5.64 | 2.07 | 5.09 | 0.39 | 631.40 | 80.83 | 40.70 | 2.14 | 74.56 | 3.39 |

| | Sb | Standard Deviation | I | Standard Deviation | Cs | Standard Deviation | Ba | Standard Deviation | La | Standard Deviation | Ce | Standard Deviation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FS-2059 | <0.51 | | <24.51 | | 2.90 | 0.22 | 282.20 | 28.22 | 74.77 | 4.11 | 121.10 | 5.45 |
| FS-2060 | 0.66 | 0.10 | 11.78 | 2.20 | 6.02 | 0.42 | 624.10 | 273.36 | 93.50 | 4.58 | 81.49 | 3.83 |
| FS-2061 | <0.25 | | <11.99 | | 2.85 | 0.23 | 291.70 | 43.76 | 50.51 | 2.83 | 78.52 | 3.45 |
| FS-2062 | 1.10 | 0.12 | <28.19 | | 8.14 | 0.54 | 640.60 | 49.97 | 52.40 | 3.04 | 99.30 | 4.57 |
| FS-2063 | <0.27 | | <11.37 | | 4.03 | 0.30 | 618.50 | 40.20 | 31.70 | 1.87 | 72.68 | 3.42 |
| FS-2064 | 0.65 | 0.11 | <16.16 | | 4.00 | 0.27 | 349.30 | 66.37 | 46.21 | 2.40 | 78.98 | 3.55 |
| FS-2065 | 0.84 | 0.10 | 12.18 | 2.13 | 7.22 | 0.41 | 335.70 | 33.91 | 54.85 | 3.13 | 102.60 | 4.72 |
| FS-2066 | 0.75 | 0.09 | <12.25 | | 3.57 | 0.21 | 651.10 | 39.07 | 38.08 | 1.94 | 69.78 | 3.21 |
| FS-2067 | 0.94 | 0.09 | <13.00 | | 6.78 | 0.47 | 292.30 | 76.29 | 46.34 | 2.36 | 128.80 | 5.67 |
| FS-2068 | 0.97 | 0.09 | <16.56 | | 6.84 | 0.41 | 596.30 | 40.15 | 37.01 | 1.92 | 72.10 | 3.32 |
| FS-2070 | <0.30 | | <15.77 | | 2.19 | 0.16 | 124.80 | 24.84 | 56.91 | 3.07 | 99.36 | 4.37 |
| FS-2071 | 1.59 | 0.12 | <18.59 | | 10.08 | 0.65 | 396.30 | 52.71 | 32.58 | 1.86 | 63.16 | 3.16 |
| FS-2072 | 1.44 | 0.11 | 4.05 | 1.39 | 10.71 | 0.61 | 377.20 | 50.92 | 33.50 | 1.94 | 79.26 | 3.88 |
| FS-2073 | 0.32 | 0.08 | <13.90 | | 4.14 | 0.40 | 254.30 | 112.65 | 50.96 | 2.85 | 92.79 | 4.08 |
| FS-2074 | <0.48 | | <25.82 | | 2.67 | 0.16 | 126.00 | 19.66 | 51.18 | 3.02 | 99.17 | 4.46 |
| FS-2075 | <0.31 | | <27.51 | | 3.26 | 0.20 | 414.10 | 54.25 | 43.21 | 2.29 | 73.80 | 3.39 |
| FS-2076 | 0.65 | 0.09 | <36.97 | | 8.72 | 0.66 | 139.80 | 32.01 | 78.22 | 4.22 | 161.80 | 7.12 |
| FS-2077 | <0.34 | | <14.91 | | 2.90 | 0.18 | 163.90 | 61.46 | 36.53 | 2.30 | 69.09 | 3.18 |
| FS-2078 | <0.25 | | <25.68 | | 4.27 | 0.29 | 234.60 | 29.09 | 44.92 | 2.34 | 90.41 | 4.16 |
| FS-2079 | <0.25 | | <14.73 | | 4.08 | 0.32 | 235.10 | 35.03 | 45.96 | 2.67 | 82.45 | 3.63 |

| | Nd | Standard Deviation | Sm | Standard Deviation | Eu | Standard Deviation | Tb | Standard Deviation | Dy | Standard Deviation | Yb | Standard Deviation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FS-2000 | 38.64 | 3.40 | 7.33 | 0.34 | 0.46 | 0.05 | 1.05 | 0.11 | 5.49 | 0.50 | 4.43 | 0.28 |
| FS-2000F | 33.68 | 3.33 | 5.96 | 0.29 | 0.70 | 0.06 | 1.00 | 0.10 | 4.21 | 0.45 | 3.02 | 0.20 |
| FS-2001 | 26.35 | 3.29 | 5.89 | 0.28 | 1.04 | 0.08 | 0.84 | 0.10 | 3.37 | 0.37 | 3.33 | 0.46 |
| FS-2002 | 31.65 | 3.67 | 5.48 | 0.28 | 0.82 | 0.06 | <0.16 | | 4.07 | 0.44 | 3.12 | 0.27 |
| FS-2003 | 53.21 | 4.52 | 9.04 | 0.42 | 1.65 | 0.09 | 1.29 | 0.12 | 5.93 | 0.48 | 4.20 | 0.29 |
| FS-2004 | 27.34 | 3.85 | 5.41 | 0.27 | 0.91 | 0.08 | 0.59 | 0.08 | 5.43 | 0.56 | 3.04 | 0.38 |
| FS-2005 | 26.79 | 2.60 | 5.48 | 0.25 | 0.79 | 0.05 | 0.68 | 0.07 | 3.74 | 0.43 | 3.61 | 0.26 |
| FS-2006 | 37.76 | 3.66 | 5.68 | 0.27 | 1.14 | 0.06 | 0.90 | 0.09 | 4.96 | 0.45 | 3.43 | 0.20 |
| FS-2007 | 24.19 | 3.82 | 5.32 | 0.27 | 0.85 | 0.08 | 0.63 | 0.07 | 3.69 | 0.47 | 3.50 | 0.26 |
| FS-2008 | 38.22 | 3.63 | 7.50 | 0.35 | 0.93 | 0.05 | 0.90 | 0.08 | 4.91 | 0.51 | 3.96 | 0.25 |
| FS-2009 | 43.48 | 3.83 | 6.47 | 0.31 | 1.24 | 0.09 | 0.93 | 0.09 | 5.37 | 0.43 | 3.34 | 0.21 |
| FS-2010 | 35.84 | 4.16 | 6.11 | 0.28 | 0.74 | 0.04 | 1.14 | 0.11 | 6.12 | 0.61 | 4.49 | 0.28 |
| FS-2011 | 38.33 | 3.91 | 7.24 | 0.34 | 0.59 | 0.05 | 1.18 | 0.12 | 7.21 | 0.63 | 4.28 | 0.54 |
| FS-2012 | 41.69 | 3.79 | 8.14 | 0.38 | 0.63 | 0.05 | 1.06 | 0.10 | 6.02 | 0.55 | 4.98 | 0.30 |
| FS-2013 | 41.82 | 3.72 | 6.91 | 0.32 | 0.72 | 0.05 | 1.15 | 0.10 | 6.05 | 0.49 | 3.75 | 0.34 |
| FS-2014F | 18.17 | 2.11 | 4.79 | 0.23 | 0.51 | 0.03 | 0.74 | 0.09 | 3.43 | 0.53 | 2.26 | 0.41 |
| FS-2015F | 34.73 | 3.20 | 6.01 | 0.29 | 0.40 | 0.04 | 0.88 | 0.09 | 5.23 | 0.48 | 3.89 | 0.26 |
| FS-2016F | 35.11 | 3.23 | 5.39 | 0.26 | 0.57 | 0.05 | 0.91 | 0.09 | 4.71 | 0.42 | 2.57 | 0.18 |
| FS-2017F | 29.97 | 4.05 | 5.11 | 0.25 | 0.62 | 0.06 | 0.88 | 0.11 | 3.35 | 0.52 | 3.04 | 0.24 |
| FS-2018F | 26.02 | 2.39 | 6.82 | 0.33 | 0.58 | 0.04 | 0.88 | 0.08 | 4.91 | 0.56 | 3.97 | 0.26 |
| FS-2019F | 39.52 | 3.64 | 6.28 | 0.30 | 0.64 | 0.03 | 0.86 | 0.08 | 4.50 | 0.42 | 3.06 | 0.20 |
| FS-2020F | 31.31 | 3.25 | 5.08 | 0.24 | 0.56 | 0.04 | 0.64 | 0.06 | 3.61 | 0.41 | 2.63 | 0.28 |
| FS-2021 | 43.08 | 3.83 | 8.42 | 0.40 | 0.57 | 0.07 | 1.21 | 0.12 | 6.13 | 0.59 | 4.75 | 0.28 |
| FS-2022 | 47.14 | 4.29 | 6.89 | 0.33 | 0.91 | 0.07 | 1.27 | 0.14 | 6.53 | 0.63 | 4.48 | 0.40 |
| FS-2023 | 32.73 | 4.09 | 6.55 | 0.31 | 0.57 | 0.06 | 1.12 | 0.11 | 6.67 | 0.63 | 3.85 | 0.46 |
| FS-2026 | 20.28 | 3.93 | 5.67 | 0.26 | 0.79 | 0.08 | 0.76 | 0.09 | 3.77 | 0.46 | 3.34 | 0.22 |
| FS-2027 | 21.96 | 2.24 | 5.74 | 0.28 | 0.92 | 0.09 | <0.10 | | 4.14 | 0.40 | 3.62 | 0.22 |
| FS-2028 | 45.76 | 4.21 | 7.05 | 0.33 | 1.31 | 0.07 | 0.94 | 0.10 | 5.55 | 0.46 | 3.25 | 0.32 |
| FS-2029 | 44.13 | 6.05 | 4.70 | 0.22 | 0.66 | 0.05 | 0.40 | 0.09 | 4.71 | 0.44 | 2.66 | 0.23 |
| FS-2030 | 28.83 | 3.57 | 5.35 | 0.27 | 0.75 | 0.05 | 0.68 | 0.07 | 3.93 | 0.42 | 3.83 | 0.26 |
| FS-2031 | 29.93 | 3.02 | 5.24 | 0.25 | 1.06 | 0.07 | 0.69 | 0.08 | 3.85 | 0.34 | 2.81 | 0.17 |
| FS-2032 | 32.01 | 3.94 | 5.65 | 0.27 | 0.87 | 0.06 | 0.75 | 0.08 | 5.82 | 0.56 | 3.97 | 0.36 |
| FS-2033 | 36.27 | 3.92 | 6.34 | 0.30 | 0.92 | 0.06 | 0.71 | 0.10 | 4.53 | 0.54 | 3.36 | 0.24 |
| FS-2034 | 31.55 | 3.22 | 5.20 | 0.25 | 1.03 | 0.07 | 0.82 | 0.08 | 4.72 | 0.40 | 3.28 | 0.24 |
| FS-2035 | 31.65 | 3.52 | 5.05 | 0.24 | 0.86 | 0.09 | 0.70 | 0.09 | 3.94 | 0.44 | 3.54 | 0.39 |
| FS-2037 | 31.70 | 3.30 | 5.10 | 0.24 | 1.06 | 0.08 | 0.76 | 0.07 | 4.34 | 0.43 | 3.43 | 0.19 |
| FS-2038 | 12.44 | 1.68 | 4.22 | 0.21 | 0.50 | 0.05 | 0.43 | 0.07 | 3.23 | 0.36 | 2.08 | 0.26 |
| FS-2039 | 54.83 | 4.93 | 11.41 | 0.54 | 0.87 | 0.05 | 1.26 | 0.12 | 6.58 | 0.63 | 4.82 | 0.30 |
| FS-2040 | 37.03 | 3.81 | 5.30 | 0.27 | 0.65 | 0.06 | 0.74 | 0.07 | 4.53 | 0.39 | 3.01 | 0.20 |
| FS-2041 | 25.26 | 4.22 | 5.42 | 0.25 | 0.85 | 0.06 | 0.64 | 0.07 | 4.07 | 0.46 | 3.42 | 0.21 |
| FS-2042 | 25.06 | 2.86 | 5.47 | 0.26 | 0.82 | 0.04 | 0.71 | 0.08 | 4.34 | 0.40 | 4.01 | 0.23 |
| FS-2043 | 22.07 | 3.46 | 5.97 | 0.27 | 0.68 | 0.06 | 0.66 | 0.08 | 4.47 | 0.77 | 2.78 | 0.35 |
| FS-2044 | 31.09 | 3.11 | 6.15 | 0.29 | 1.03 | 0.06 | 0.78 | 0.07 | 4.42 | 0.56 | 3.60 | 0.23 |
| FS-2045 | 35.71 | 3.29 | 4.93 | 0.23 | 0.94 | 0.04 | 0.90 | 0.09 | 4.02 | 0.36 | 3.52 | 0.25 |
| FS-2046 | 32.96 | 3.85 | 6.89 | 0.32 | 1.05 | 0.05 | 0.84 | 0.09 | 5.84 | 0.65 | 3.52 | 0.31 |
| FS-2048 | 36.55 | 3.55 | 5.22 | 0.25 | 0.99 | 0.06 | 0.81 | 0.08 | 4.91 | 0.50 | 2.85 | 0.23 |
| FS-2049 | 13.69 | 1.59 | 5.57 | 0.26 | 0.97 | 0.07 | 0.68 | 0.09 | 3.37 | 0.56 | 3.05 | 0.39 |
| FS-2050 | 27.25 | 2.43 | 6.12 | 0.29 | 1.06 | 0.05 | 0.75 | 0.08 | 5.22 | 0.46 | 3.95 | 0.26 |
| FS-2051 | 33.94 | 3.36 | 5.41 | 0.26 | 0.98 | 0.07 | 0.83 | 0.08 | 4.34 | 0.38 | 2.76 | 0.17 |
| FS-2052 | 27.12 | 3.17 | 4.68 | 0.22 | 0.90 | 0.07 | 0.57 | 0.06 | 4.06 | 0.45 | 2.93 | 0.20 |
| FS-2053 | 34.13 | 3.28 | 6.98 | 0.33 | 1.03 | 0.08 | 0.83 | 0.08 | 5.48 | 0.48 | 4.63 | 0.38 |
| FS-2054 | 32.90 | 3.32 | 4.76 | 0.22 | 0.96 | 0.06 | 0.77 | 0.07 | 4.04 | 0.38 | 2.70 | 0.19 |
| FS-2055 | 23.03 | 3.34 | 4.08 | 0.19 | 0.80 | 0.08 | 0.58 | 0.08 | 3.86 | 0.45 | 2.33 | 0.27 |
| FS-2056 | 47.09 | 4.24 | 8.80 | 0.40 | 1.30 | 0.08 | 1.18 | 0.11 | 6.81 | 0.58 | 4.56 | 0.27 |
| FS-2057 | 32.58 | 3.55 | 5.89 | 0.27 | 1.07 | 0.06 | 0.85 | 0.09 | 4.45 | 0.44 | 3.37 | 0.28 |

| | Nd | Standard Deviation | Sm | Standard Deviation | Eu | Standard Deviation | Tb | Standard Deviation | Dy | Standard Deviation | Yb | Standard Deviation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FS-2059 | 61.31 | 5.27 | 11.28 | 0.52 | 0.79 | 0.05 | 1.35 | 0.14 | 6.88 | 0.70 | 4.88 | 0.35 |
| FS-2060 | 71.68 | 6.02 | 12.55 | 0.58 | 2.15 | 0.09 | 1.96 | 0.18 | 10.38 | 0.79 | 5.14 | 0.29 |
| FS-2061 | 31.27 | 3.35 | 5.47 | 0.25 | 0.51 | 0.04 | 0.72 | 0.07 | 4.24 | 0.39 | 2.13 | 0.45 |
| FS-2062 | 42.69 | 4.35 | 9.79 | 0.45 | 1.45 | 0.08 | 1.25 | 0.12 | 7.26 | 0.89 | 5.87 | 0.35 |
| FS-2063 | 23.71 | 2.77 | 3.64 | 0.17 | 0.68 | 0.04 | 0.54 | 0.05 | 3.21 | 0.30 | 2.22 | 0.17 |
| FS-2064 | 6.68 | 1.50 | 5.24 | 0.24 | 0.77 | 0.06 | 0.68 | 0.08 | 2.68 | 0.38 | 3.52 | 0.68 |
| FS-2065 | 39.12 | 3.99 | 6.30 | 0.30 | 0.94 | 0.05 | 0.68 | 0.08 | 4.20 | 0.38 | 2.84 | 0.22 |
| FS-2066 | 28.14 | 2.93 | 5.13 | 0.25 | 1.08 | 0.07 | 0.76 | 0.07 | 4.64 | 0.74 | 3.08 | 0.25 |
| FS-2067 | 35.50 | 4.33 | 6.02 | 0.28 | 1.06 | 0.06 | 0.82 | 0.10 | 4.77 | 0.46 | 3.19 | 0.27 |
| FS-2068 | 26.47 | 2.71 | 5.56 | 0.26 | 1.04 | 0.06 | 0.70 | 0.07 | 4.25 | 0.42 | 3.31 | 0.20 |
| FS-2070 | 45.47 | 4.37 | 6.18 | 0.28 | 0.25 | 0.05 | 0.99 | 0.09 | 4.96 | 0.51 | 3.65 | 0.35 |
| FS-2071 | 21.85 | 2.73 | 4.57 | 0.22 | 0.70 | 0.06 | 0.59 | 0.08 | 3.74 | 0.37 | 3.02 | 0.20 |
| FS-2072 | 23.54 | 3.60 | 3.93 | 0.19 | 0.61 | 0.05 | 0.67 | 0.08 | 3.59 | 0.31 | 2.59 | 0.28 |
| FS-2073 | 55.81 | 5.13 | 5.70 | 0.26 | 0.62 | 0.04 | 0.77 | 0.08 | 5.33 | 0.50 | 3.29 | 0.57 |
| FS-2074 | 43.43 | 3.91 | 8.09 | 0.38 | 0.24 | 0.02 | 1.07 | 0.10 | 5.89 | 0.51 | 4.38 | 0.31 |
| FS-2075 | 35.22 | 3.31 | 4.92 | 0.22 | 0.95 | 0.06 | 0.57 | 0.07 | 3.38 | 0.55 | 1.33 | 0.21 |
| FS-2076 | 54.48 | 5.72 | 10.66 | 0.50 | 1.00 | 0.07 | 1.16 | 0.11 | 4.29 | 0.85 | 3.15 | 0.58 |
| FS-2077 | 33.59 | 3.22 | 6.38 | 0.30 | 0.30 | 0.04 | 0.96 | 0.09 | 3.40 | 0.38 | 3.76 | 0.23 |
| FS-2078 | 44.49 | 4.00 | 6.61 | 0.32 | 0.37 | 0.05 | 1.37 | 0.16 | 7.30 | 1.12 | 4.36 | 0.25 |
| FS-2079 | 34.85 | 4.32 | 6.85 | 0.32 | 0.28 | 0.05 | 1.45 | 0.15 | 8.72 | 1.79 | 5.08 | 0.62 |

| | Lu | Standard Deviation | Hf | Standard Deviation | Ta | Standard Deviation | W | Standard Deviation | Au | Standard Deviation | Hg | Standard Deviation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FS-2000 | 0.47 | 0.03 | 8.42 | 0.45 | 3.13 | 0.21 | 13.74 | 2.84 | <0.01 | | <0.54 | |
| FS-2000F | 0.45 | 0.03 | 8.19 | 0.43 | 2.34 | 0.15 | <6.95 | | <0.01 | | <0.74 | |
| FS-2001 | 0.59 | 0.04 | 13.73 | 0.91 | 1.50 | 0.10 | <4.71 | | <0.01 | | <0.51 | |
| FS-2002 | 0.45 | 0.03 | 5.43 | 0.55 | 3.18 | 0.20 | <13.21 | | <0.02 | | <0.93 | |
| FS-2003 | 0.67 | 0.04 | 13.28 | 0.81 | 1.59 | 0.13 | <5.57 | | <0.01 | | <0.84 | |
| FS-2004 | 0.48 | 0.03 | 9.40 | 0.63 | 2.73 | 0.20 | <5.76 | | <0.01 | | <0.63 | |
| FS-2005 | 0.47 | 0.03 | 6.70 | 0.43 | 2.98 | 0.19 | <11.86 | | <0.02 | | <0.92 | |
| FS-2006 | 0.54 | 0.03 | 8.88 | 0.53 | 3.01 | 0.23 | 6.25 | 1.94 | <0.01 | | <0.90 | |
| FS-2007 | 0.42 | 0.03 | 7.68 | 0.40 | 2.87 | 0.24 | <1.47 | | <0.01 | | <0.61 | |
| FS-2008 | 0.51 | 0.03 | 10.60 | 0.78 | 2.24 | 0.15 | <9.56 | | <0.01 | | <0.75 | |
| FS-2009 | 0.55 | 0.03 | 11.80 | 0.68 | 1.86 | 0.16 | <5.92 | | <0.01 | | <0.78 | |
| FS-2010 | 0.56 | 0.04 | 8.93 | 0.43 | 3.17 | 0.21 | <6.23 | | <0.01 | | <0.57 | |
| FS-2011 | 0.57 | 0.03 | 9.74 | 0.67 | 3.37 | 0.24 | 13.26 | 5.69 | <0.01 | | <0.45 | |
| FS-2012 | 0.56 | 0.03 | 9.60 | 0.62 | 3.13 | 0.19 | <9.70 | | <0.01 | | <0.67 | |
| FS-2013 | 0.64 | 0.03 | 11.09 | 0.98 | 3.12 | 0.19 | <6.20 | | <0.01 | | <0.72 | |
| FS-2014F | 0.30 | 0.03 | 7.45 | 0.31 | 2.26 | 0.15 | <7.41 | | <0.01 | | <0.57 | |
| FS-2015F | 0.42 | 0.02 | 7.60 | 0.51 | 2.84 | 0.17 | <9.97 | | <0.01 | | <0.50 | |
| FS-2016F | 0.42 | 0.02 | 8.68 | 0.52 | 2.49 | 0.15 | <6.62 | | <0.01 | | <0.60 | |
| FS-2017F | 0.33 | 0.03 | 7.72 | 0.35 | 2.00 | 0.17 | <6.62 | | <0.01 | | <0.54 | |
| FS-2018F | 0.49 | 0.03 | 8.26 | 0.63 | 2.47 | 0.18 | 12.99 | 3.68 | <0.02 | | <0.74 | |
| FS-2019F | 0.48 | 0.03 | 9.23 | 0.36 | 2.46 | 0.16 | 8.72 | 2.18 | <0.01 | | <0.71 | |
| FS-2020F | 0.42 | 0.03 | 8.82 | 0.57 | 2.27 | 0.16 | <8.17 | | <0.01 | | <0.48 | |
| FS-2021 | 0.57 | 0.03 | 10.85 | 0.74 | 3.02 | 0.20 | <10.26 | | <0.01 | | <0.60 | |
| FS-2022 | 0.66 | 0.04 | 11.62 | 0.73 | 3.15 | 0.21 | 5.47 | 2.08 | <0.01 | | <0.85 | |
| FS-2023 | 0.64 | 0.04 | 9.13 | 0.68 | 3.06 | 0.24 | <6.54 | | <0.01 | | <0.52 | |
| FS-2026 | 0.30 | 0.03 | 10.22 | 0.76 | 2.46 | 0.22 | <6.39 | | <0.01 | | <0.60 | |
| FS-2027 | 0.47 | 0.03 | 14.60 | 1.05 | 1.69 | 0.12 | <8.43 | | <0.01 | | <0.70 | |
| FS-2028 | 0.58 | 0.04 | 11.94 | 0.69 | 2.06 | 0.17 | <6.02 | | <0.01 | | <0.91 | |
| FS-2029 | 0.22 | 0.04 | 5.76 | 0.33 | 1.91 | 0.13 | <5.80 | | <0.01 | | <0.78 | |
| FS-2030 | 0.45 | 0.03 | 6.98 | 0.38 | 2.78 | 0.17 | 6.28 | 2.29 | <0.01 | | <0.85 | |
| FS-2031 | 0.48 | 0.03 | 13.02 | 0.82 | 1.87 | 0.14 | 2.82 | 0.87 | <0.01 | | <0.75 | |
| FS-2032 | 0.47 | 0.03 | 13.72 | 1.26 | 1.50 | 0.14 | <5.36 | | <0.01 | | <0.50 | |
| FS-2033 | 0.44 | 0.03 | 9.59 | 0.62 | 2.66 | 0.17 | <9.68 | | <0.01 | | <0.93 | |
| FS-2034 | 0.58 | 0.03 | 11.69 | 0.78 | 2.02 | 0.12 | <5.89 | | 0.02 | | <0.79 | |
| FS-2035 | 0.50 | 0.03 | 15.90 | 1.19 | 1.53 | 0.13 | <7.21 | | <0.01 | | <0.56 | |
| FS-2037 | 0.57 | 0.04 | 15.71 | 1.04 | 1.71 | 0.12 | <5.92 | | 0.04 | | <0.76 | |
| FS-2038 | 0.27 | 0.03 | 5.06 | 0.31 | 1.51 | 0.11 | <5.67 | | <0.01 | | <0.58 | |
| FS-2039 | 0.57 | 0.04 | 8.40 | 0.71 | 2.53 | 0.17 | <13.06 | | <0.01 | | <0.70 | |
| FS-2040 | 0.44 | 0.03 | 8.40 | 0.46 | 2.84 | 0.20 | <7.75 | | <0.01 | | <0.87 | |
| FS-2041 | 0.45 | 0.04 | 7.30 | 0.39 | 2.74 | 0.19 | <5.72 | | <0.01 | | <0.63 | |
| FS-2042 | 0.51 | 0.03 | 15.93 | 1.55 | 1.53 | 0.10 | <10.34 | | <0.01 | | <0.65 | |
| FS-2043 | 0.30 | 0.03 | 7.47 | 0.38 | 2.33 | 0.20 | 7.23 | 1.21 | <0.01 | | <0.59 | |
| FS-2044 | 0.44 | 0.03 | 11.03 | 0.84 | 2.06 | 0.13 | 2.13 | 0.51 | <0.01 | | <0.75 | |
| FS-2045 | 0.58 | 0.03 | 18.56 | 1.02 | 1.62 | 0.11 | 8.53 | 2.58 | <0.01 | | <0.73 | |
| FS-2046 | 0.39 | 0.03 | 7.93 | 0.39 | 2.26 | 0.17 | 2.96 | 0.73 | <0.01 | | <0.81 | |
| FS-2048 | 0.46 | 0.03 | 7.49 | 0.49 | 2.94 | 0.19 | 2.02 | 0.66 | <0.01 | | <0.87 | |
| FS-2049 | 0.41 | 0.03 | 8.50 | 0.37 | 2.56 | 0.22 | <3.91 | | <0.01 | | <0.54 | |
| FS-2050 | 0.46 | 0.03 | 11.18 | 0.79 | 1.86 | 0.12 | <5.83 | | <0.01 | | <0.76 | |
| FS-2051 | 0.50 | 0.03 | 8.12 | 0.50 | 2.89 | 0.21 | 3.19 | 0.69 | <0.01 | | <0.87 | |
| FS-2052 | 0.46 | 0.03 | 14.97 | 1.30 | 1.58 | 0.13 | <3.61 | | <0.01 | | <0.44 | |
| FS-2053 | 0.57 | 0.03 | 16.79 | 1.23 | 1.78 | 0.11 | <6.08 | | <0.01 | | <0.68 | |
| FS-2054 | 0.49 | 0.03 | 8.48 | 0.47 | 2.59 | 0.18 | 2.22 | 0.64 | <0.01 | | <0.83 | |
| FS-2055 | 0.29 | 0.02 | 13.69 | 0.79 | 1.27 | 0.09 | <3.98 | | <0.01 | | <0.50 | |
| FS-2056 | 0.54 | 0.03 | 11.32 | 0.80 | 1.93 | 0.13 | <6.41 | | <0.01 | | <0.80 | |
| FS-2057 | 0.51 | 0.03 | 11.03 | 0.63 | 1.96 | 0.14 | <4.01 | | <0.01 | | <0.67 | |

| | Lu | Standard Deviation | Hf | Standard Deviation | Ta | Standard Deviation | W | Standard Deviation | Au | Standard Deviation | Hg | Standard Deviation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FS-2059 | 0.52 | 0.03 | 10.35 | 0.72 | 2.83 | 0.19 | 17.07 | 2.34 | <0.02 | | <0.70 | |
| FS-2060 | 0.75 | 0.04 | 6.40 | 0.39 | 1.88 | 0.15 | <4.61 | | <0.01 | | <0.96 | |
| FS-2061 | 0.38 | 0.03 | 6.32 | 0.38 | 1.84 | 0.16 | <4.32 | | 0.04 | | <0.41 | |
| FS-2062 | 0.68 | 0.04 | 13.73 | 0.80 | 2.48 | 0.16 | <7.30 | | <0.01 | | <1.01 | |
| FS-2063 | 0.36 | 0.02 | 4.16 | 0.21 | 2.51 | 0.16 | <4.75 | | <0.01 | | <0.74 | |
| FS-2064 | 0.31 | 0.03 | 10.06 | 0.64 | 2.23 | 0.19 | <4.80 | | <0.01 | | <0.51 | |
| FS-2065 | 0.42 | 0.03 | 9.64 | 0.54 | 2.93 | 0.21 | 3.99 | 1.88 | <0.01 | | <0.89 | |
| FS-2066 | 0.55 | 0.03 | 15.45 | 1.00 | 1.75 | 0.12 | <4.13 | | <0.01 | | <0.73 | |
| FS-2067 | 0.32 | 0.03 | 10.04 | 0.54 | 1.94 | 0.15 | 1.62 | 0.50 | <0.01 | | <0.63 | |
| FS-2068 | 0.46 | 0.03 | 10.29 | 0.62 | 2.25 | 0.15 | <4.91 | | <0.01 | | <0.82 | |
| FS-2070 | 0.49 | 0.03 | 7.64 | 0.47 | 3.23 | 0.23 | <5.71 | | <0.01 | | <0.34 | |
| FS-2071 | 0.36 | 0.04 | 5.77 | 0.64 | 1.92 | 0.16 | 2.51 | 0.48 | <0.01 | | <1.26 | |
| FS-2072 | 0.43 | 0.04 | 5.93 | 0.46 | 1.95 | 0.14 | 2.89 | 1.01 | <0.01 | | <1.37 | |
| FS-2073 | 0.47 | 0.03 | 9.80 | 0.59 | 2.50 | 0.24 | <4.87 | | <0.01 | | <0.49 | |
| FS-2074 | 0.51 | 0.03 | 7.29 | 0.39 | 3.41 | 0.20 | <9.91 | | <0.02 | | <0.50 | |
| FS-2075 | 0.23 | 0.02 | 6.74 | 0.42 | 1.55 | 0.12 | <5.81 | | <0.01 | | <0.72 | |
| FS-2076 | 0.31 | 0.03 | 7.33 | 0.31 | 1.77 | 0.16 | 2.42 | 0.69 | 0.02 | | <0.75 | |
| FS-2077 | 0.47 | 0.03 | 6.21 | 0.39 | 3.55 | 0.22 | <7.99 | | <0.01 | | <0.50 | |
| FS-2078 | 0.68 | 0.04 | 7.49 | 0.41 | 5.42 | 0.35 | <5.75 | | <0.01 | | <0.62 | |
| FS-2079 | 0.64 | 0.04 | 7.65 | 0.39 | 5.67 | 0.39 | 2.81 | 0.67 | <0.01 | | <0.44 | |

| | Th | Standard Deviation | U | Standard Deviation | Be | Standard Deviation | Cd | Standard Deviation | Pb | Standard Deviation |
|---|---|---|---|---|---|---|---|---|---|---|
| FS-2000 | 14.00 | 0.74 | 3.61 | 0.13 | 2.10 | 0.40 | <1.00 | | 26.50 | 2.00 |
| FS-2000F | 13.30 | 0.64 | 3.26 | 0.12 | 2.10 | 0.40 | <1.00 | | 26.50 | 2.00 |
| FS-2001 | 15.08 | 0.65 | 3.33 | 0.12 | 2.00 | 0.40 | <1.00 | | 25.00 | 2.00 |
| FS-2002 | 23.23 | 1.72 | 4.91 | 0.19 | 2.85 | 0.50 | <1.00 | | 26.00 | 3.00 |
| FS-2003 | 13.68 | 0.57 | 3.92 | 0.14 | 2.00 | 0.40 | <1.00 | | 27.00 | 3.00 |
| FS-2004 | 22.35 | 1.30 | 3.10 | 0.12 | 2.00 | 0.30 | <1.00 | | 24.50 | 2.00 |
| FS-2005 | 18.39 | 0.72 | 3.90 | 0.15 | 2.45 | 0.50 | <1.00 | | 26.60 | 2.70 |
| FS-2006 | 19.42 | 0.81 | 3.93 | 0.15 | 2.60 | 0.50 | 1.70 | 0.80 | 25.90 | 2.50 |
| FS-2007 | 22.21 | 0.87 | 4.36 | 0.16 | 2.40 | 0.40 | <1.00 | | 28.00 | 3.00 |
| FS-2008 | 16.23 | 0.63 | 3.45 | 0.13 | 2.10 | 0.40 | <1.00 | | 22.00 | 2.00 |
| FS-2009 | 14.12 | 0.59 | 3.21 | 0.12 | 2.70 | 0.50 | <1.00 | | 32.00 | 3.00 |
| FS-2010 | 19.64 | 0.84 | 3.55 | 0.13 | 2.70 | 0.50 | <1.00 | | 32.00 | 3.00 |
| FS-2011 | 18.87 | 1.04 | 3.56 | 0.13 | 1.00 | 0.20 | <1.00 | | <14.00 | |
| FS-2012 | 16.46 | 0.64 | 3.51 | 0.13 | 2.60 | 0.50 | <1.00 | | 26.00 | 3.00 |
| FS-2013 | 17.64 | 0.72 | 3.49 | 0.13 | 2.40 | 0.50 | <1.00 | | 25.00 | 2.00 |
| FS-2014F | 13.17 | 0.63 | 2.94 | 0.12 | 1.80 | 0.40 | <1.00 | | 22.00 | 2.00 |
| FS-2015F | 12.24 | 0.48 | 3.30 | 0.12 | 2.30 | 0.40 | <1.00 | | 24.00 | 2.00 |
| FS-2016F | 12.62 | 0.53 | 2.84 | 0.10 | 2.10 | 0.40 | <1.00 | | 28.00 | 3.00 |
| FS-2017F | 12.95 | 0.53 | 2.65 | 0.10 | 2.30 | 0.40 | <1.00 | | 25.00 | 2.00 |
| FS-2018F | 12.48 | 0.50 | 4.25 | 0.16 | 2.40 | 0.40 | <1.00 | | 56.00 | 6.00 |
| FS-2019F | 13.85 | 0.58 | 3.05 | 0.11 | 1.90 | 0.40 | <1.00 | | 28.00 | 3.00 |
| FS-2020F | 12.20 | 0.53 | 2.81 | 0.10 | 1.80 | 0.40 | 1.60 | 0.80 | 26.00 | 2.00 |
| FS-2021 | 15.06 | 0.59 | 3.66 | 0.13 | 2.60 | 0.50 | <1.00 | | 21.00 | 2.00 |
| FS-2022 | 17.38 | 0.82 | 4.20 | 0.16 | 2.70 | 0.50 | <1.00 | | 26.00 | 3.00 |
| FS-2023 | 18.81 | 0.81 | 3.77 | 0.14 | 3.40 | 0.60 | <1.00 | | 29.00 | 3.00 |
| FS-2026 | 16.77 | 0.69 | 2.54 | 0.10 | 2.50 | 0.50 | <1.00 | | 29.00 | 3.00 |
| FS-2027 | 13.66 | 1.60 | 3.45 | 0.13 | 1.60 | 0.30 | <1.00 | | 30.00 | 3.00 |
| FS-2028 | 17.96 | 0.77 | 3.19 | 0.12 | 2.30 | 0.40 | <1.00 | | 33.00 | 3.00 |
| FS-2029 | 17.18 | 0.69 | 2.17 | 0.09 | 3.30 | 0.70 | <1.00 | | 23.00 | 2.00 |
| FS-2030 | 16.34 | 0.64 | 4.79 | 0.18 | 2.40 | 0.50 | <1.00 | | 26.00 | 3.00 |
| FS-2031 | 14.62 | 0.66 | 2.96 | 0.11 | 1.70 | 0.30 | <1.00 | | 25.00 | 2.00 |
| FS-2032 | 13.03 | 0.52 | 3.46 | 0.13 | 1.80 | 0.40 | <1.00 | | 25.00 | 2.00 |
| FS-2033 | 17.16 | 0.67 | 2.19 | 0.08 | 3.00 | 0.60 | <1.00 | | 29.00 | 3.00 |
| FS-2034 | 15.56 | 0.61 | 3.09 | 0.11 | 2.00 | 0.40 | <1.00 | | 30.00 | 3.00 |
| FS-2035 | 12.74 | 0.51 | 3.43 | 0.12 | 1.55 | 0.30 | <1.00 | | 26.50 | 3.00 |
| FS-2037 | 13.84 | 0.58 | 3.59 | 0.13 | 1.50 | 0.30 | <1.00 | | 25.00 | 2.00 |
| FS-2038 | 12.40 | 0.50 | 3.47 | 0.13 | 2.20 | 0.40 | <1.00 | | 21.00 | 2.00 |
| FS-2039 | 13.14 | 0.57 | 2.92 | 0.11 | 2.10 | 0.40 | <1.00 | | 26.00 | 3.00 |
| FS-2040 | 16.84 | 0.67 | 2.74 | 0.10 | 2.30 | 0.40 | <1.00 | | 28.00 | 3.00 |
| FS-2041 | 20.04 | 0.88 | 3.51 | 0.13 | 2.80 | 0.60 | <1.00 | | 25.00 | 2.00 |
| FS-2042 | 11.05 | 0.70 | 3.57 | 0.13 | 1.40 | 0.30 | <1.00 | | <14.00 | |
| FS-2043 | 18.10 | 1.00 | 2.36 | 0.09 | 3.10 | 0.60 | <1.00 | | 34.00 | 3.00 |
| FS-2044 | 14.35 | 0.56 | 3.21 | 0.12 | 2.20 | 0.40 | <1.00 | | 28.00 | 3.00 |
| FS-2045 | 13.53 | 0.57 | 3.84 | 0.14 | 1.00 | 0.20 | <1.00 | | 20.00 | 2.00 |
| FS-2046 | 19.91 | 0.82 | 2.52 | 0.09 | 3.90 | 0.70 | 1.20 | 0.80 | 35.00 | 3.00 |
| FS-2048 | 19.96 | 0.78 | 3.57 | 0.13 | 2.95 | 0.60 | <1.00 | | 25.50 | 2.50 |
| FS-2049 | 19.27 | 0.81 | 3.64 | 0.13 | 3.00 | 0.60 | <1.00 | | 32.00 | 3.00 |
| FS-2050 | 12.72 | 0.50 | 3.28 | 0.12 | 1.90 | 0.40 | <1.00 | | 26.00 | 3.00 |
| FS-2051 | 19.93 | 0.78 | 3.48 | 0.13 | 3.20 | 0.60 | <1.00 | | 30.00 | 3.00 |
| FS-2052 | 12.52 | 0.55 | 3.81 | 0.13 | 1.40 | 0.30 | <1.00 | | 25.00 | 2.00 |
| FS-2053 | 12.80 | 0.50 | 3.67 | 0.13 | 1.60 | 0.30 | <1.00 | | 23.00 | 2.00 |
| FS-2054 | 17.20 | 0.67 | 3.96 | 0.14 | 2.00 | 0.40 | <1.00 | | 44.00 | 4.00 |
| FS-2055 | 10.46 | 0.42 | 3.56 | 0.13 | 1.10 | 0.20 | <1.00 | | 33.00 | 3.00 |
| FS-2056 | 14.82 | 0.58 | 2.89 | 0.10 | 2.10 | 0.40 | <1.00 | | 30.00 | 3.00 |
| FS-2057 | 15.28 | 0.68 | 3.12 | 0.12 | 1.95 | 0.40 | <1.00 | | 27.00 | 2.00 |

| | Th | Standard Deviation | U | Standard Deviation | Be | Standard Deviation | Cd | Standard Deviation | Pb | Standard Deviation |
|---|---|---|---|---|---|---|---|---|---|---|
| FS-2059 | 13.56 | 1.30 | 3.14 | 0.12 | 2.30 | 0.50 | <1.00 | | 29.00 | 3.00 |
| FS-2060 | 14.79 | 0.64 | 2.99 | 0.11 | 2.60 | 0.50 | <1.00 | | 23.00 | 2.00 |
| FS-2061 | 11.79 | 0.46 | 2.18 | 0.08 | 2.20 | 0.40 | <1.00 | | 24.00 | 2.00 |
| FS-2062 | 18.01 | 0.74 | 3.72 | 0.14 | 2.70 | 0.50 | <1.00 | | 32.00 | 3.00 |
| FS-2063 | 17.56 | 0.68 | 3.07 | 0.11 | 3.30 | 0.60 | <1.00 | | 29.00 | 3.00 |
| FS-2064 | 15.76 | 0.88 | 3.70 | 0.14 | 2.20 | 0.40 | <1.00 | | 21.50 | 2.00 |
| FS-2065 | 17.91 | 0.70 | 2.28 | 0.09 | 1.95 | 0.40 | <1.00 | | 28.50 | 3.00 |
| FS-2066 | 13.31 | 0.52 | 3.58 | 0.13 | 1.60 | 0.30 | <1.00 | | 25.00 | 2.00 |
| FS-2067 | 18.29 | 0.80 | 3.41 | 0.13 | 3.00 | 0.60 | <1.00 | | 38.00 | 4.00 |
| FS-2068 | 15.52 | 0.61 | 3.29 | 0.12 | 2.20 | 0.40 | <1.00 | | 35.00 | 4.00 |
| FS-2070 | 15.22 | 0.67 | 3.47 | 0.13 | 2.40 | 0.50 | <1.00 | | 18.00 | 2.00 |
| FS-2071 | 17.03 | 0.66 | 2.50 | 0.10 | 2.00 | 0.40 | <1.00 | | 20.00 | 2.00 |
| FS-2072 | 19.26 | 0.79 | 2.62 | 0.10 | 4.30 | 0.90 | <1.00 | | 41.00 | 4.00 |
| FS-2073 | 17.99 | 0.77 | 3.85 | 0.14 | 2.30 | 0.50 | <1.00 | | 26.00 | 3.00 |
| FS-2074 | 14.58 | 0.71 | 3.51 | 0.13 | 2.20 | 0.40 | <1.00 | | 19.00 | 2.00 |
| FS-2075 | 10.09 | 0.39 | 1.54 | 0.06 | 1.60 | 0.30 | <1.00 | | 27.00 | 3.00 |
| FS-2076 | 27.30 | 1.06 | 3.21 | 0.12 | 3.90 | 0.80 | <1.00 | | 42.00 | 4.00 |
| FS-2077 | 14.17 | 0.55 | 4.34 | 0.15 | 3.20 | 0.60 | <1.00 | | 34.00 | 3.00 |
| FS-2078 | 20.88 | 0.88 | 5.77 | 0.20 | 4.30 | 0.90 | <1.00 | | 30.00 | 3.00 |
| FS-2079 | 23.01 | 1.08 | 6.73 | 0.24 | 4.40 | 0.90 | <1.00 | | 56.00 | 6.00 |

# APPENDIX B

## Soil Analyses

REPORT NUMBER: 22725

********** EM-9 ANALYTICAL REPORT **********

Prepared by: MKOBY on 8-Feb-1994

REQUEST NUMBER: 15463 MATRIX: SS ANALYST: MET PROGRAM CODE: M702

OWNER: Pat A. Longmire GROUP: CST-10 MAIL-STOP: C346 PHONE: 5-6493

NOTEBOOK: R8149 PAGE: 259

CUSTOMER SAMPLES:

| CUSTOMER NUM | SAMPLE NUM | ANALYSIS | ANALYTICAL TECHNIQUE | ANALYTICAL RESULT | ANALYTICAL UNCERTAINTY | UNITS | COMPLETION DATE | COMMENT |
|---|---|---|---|---|---|---|---|---|
| FS2000 | 93.16797 | AL | ICPES | 6500. | 650. | UG/G | 9/09/93 | 08275HA |
| FS2000 | 93.16797 | AS | ETVAA | 1.8 | 0.4 | UG/G | 9/07/93 | |
| FS2000 | 93.16797 | BA | ICPES | 160. | 16. | UG/G | 9/09/93 | 08275HA |
| FS2000 | 93.16797 | BE | ICPES | 0.69 | 0.07 | UG/G | 9/09/93 | 08275HA |
| FS2000 | 93.16797 | CA | ICPES | 4500. | 450. | UG/G | 9/09/93 | 08275HA |
| FS2000 | 93.16797 | CD | ICPES | < 0.4 | | UG/G | 9/09/93 | 08275HA |
| FS2000 | 93.16797 | CL | IC | 17.6 | 1.8 | UG/G | 9/10/93 | |
| FS2000 | 93.16797 | CO | ICPES | 10. | 1. | UG/G | 9/09/93 | 08275HA |
| FS2000 | 93.16797 | CR | ICPES | 4.6 | 0.5 | UG/G | 9/09/93 | 08275HA |
| FS2000 | 93.16797 | CU | ICPES | 5.5 | 0.6 | UG/G | 9/09/93 | 08275HA |
| FS2000 | 93.16797 | FE | ICPES | 9300. | 930. | UG/G | 9/09/93 | 08275HA |
| FS2000 | 93.16797 | HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2000 | 93.16797 | K | ICPES | 1300. | 130. | UG/G | 9/09/93 | 08275HA |
| FS2000 | 93.16797 | MG | ICPES | 1200. | 120. | UG/G | 9/09/93 | 08275HA |
| FS2000 | 93.16797 | MN | ICPES | 1100. | 110. | UG/G | 9/09/93 | 08275HA |
| FS2000 | 93.16797 | NA | ICPES | 200. | 20. | UG/G | 9/09/93 | 08275HA |
| FS2000 | 93.16797 | NI | ICPES | 5.6 | 0.6 | UG/G | 9/09/93 | 08275HA |
| FS2000 | 93.16797 | PB | ICPES | 12. | 2. | UG/G | 9/09/93 | 08275HA |
| FS2000 | 93.16797 | SB | ICPES | < 5. | | UG/G | 9/09/93 | 08275HA |
| FS2000 | 93.16797 | SE | ETVAA | < 0.3 | | UG/G | 9/07/93 | |
| FS2000 | 93.16797 | SO4 | IC | 23. | 2.3 | UG/G | 11/19/93 | |
| FS2000 | 93.16797 | TA | ICPMS | < 0.2 | | UG/G | 10/19/93 | 08275LA |
| FS2000 | 93.16797 | TH | ICPMS | 5. | 0.3 | UG/G | 10/19/93 | 08275LA |
| FS2000 | 93.16797 | TL | ICPMS | < 0.2 | | UG/G | 10/19/93 | 08275LA |
| FS2000 | 93.16797 | U | ICPMS | 0.6 | 0.2 | UG/G | 10/19/93 | 08275LA |
| FS2000 | 93.16797 | V | ICPES | 10. | 1. | UG/G | 9/09/93 | 08275HA |
| FS2000 | 93.16797 | ZN | ICPES | 58. | 6. | UG/G | 9/09/93 | 08275HA |
| FS2001 | 93.16798 | AL | ICPES | 12000. | 1200. | UG/G | 9/09/93 | 08275HA |
| FS2001 | 93.16798 | AS | ETVAA | 5.1 | 1. | UG/G | 9/07/93 | |
| FS2001 | 93.16798 | BA | ICPES | 150. | 15. | UG/G | 9/09/93 | 08275HA |
| FS2001 | 93.16798 | BE | ICPES | 0.93 | 0.09 | UG/G | 9/09/93 | 08275HA |
| FS2001 | 93.16798 | CA | ICPES | 2100. | 210. | UG/G | 9/09/93 | 08275HA |
| FS2001 | 93.16798 | CD | ICPES | < 0.4 | | UG/G | 9/09/93 | 08275HA |
| FS2001 | 93.16798 | CL | IC | 16.3 | 1.6 | UG/G | 9/10/93 | |
| FS2001 | 93.16798 | CO | ICPES | 15. | 2. | UG/G | 9/09/93 | 08275HA |
| FS2001 | 93.16798 | CR | ICPES | 10. | 1. | UG/G | 9/09/93 | 08275HA |
| FS2001 | 93.16798 | CU | ICPES | 8.3 | 0.8 | UG/G | 9/09/93 | 08275HA |

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|---|---|---|---|---|---|---|---|
| FS2001 | 93.16798 FE | ICPES | 14000. | 1400. | UG/G | 9/09/93 | 08275HA |
| FS2001 | 93.16798 HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2001 | 93.16798 K | ICPES | 2400. | 240. | UG/G | 9/09/93 | 08275HA |
| FS2001 | 93.16798 MG | ICPES | 2700. | 270. | UG/G | 9/09/93 | 08275HA |
| FS2001 | 93.16798 MN | ICPES | 400. | 40. | UG/G | 9/09/93 | 08275HA |
| FS2001 | 93.16798 NA | ICPES | 350. | 35. | UG/G | 9/09/93 | 08275HA |
| FS2001 | 93.16798 NI | ICPES | 10. | 1. | UG/G | 9/09/93 | 08275HA |
| FS2001 | 93.16798 PB | ICPES | 13. | 4. | UG/G | 9/09/93 | 08275HA |
| FS2001 | 93.16798 SB | ICPES | < 5. | | UG/G | 9/09/93 | 08275HA |
| FS2001 | 93.16798 SE | ETVAA | < 0.3 | | UG/G | 9/07/93 | |
| FS2001 | 93.16798 SO4 | IC | 32. | 3.2 | UG/G | 11/19/93 | |
| FS2001 | 93.16798 TA | ICPMS | < 0.2 | | UG/G | 10/19/93 | 08275LA |
| FS2001 | 93.16798 TH | ICPMS | 8. | 1. | UG/G | 10/19/93 | 08275LA |
| FS2001 | 93.16798 TL | ICPMS | 0.2 | 0.2 | UG/G | 10/19/93 | 08275LA |
| FS2001 | 93.16798 U | ICPMS | 0.8 | 0.2 | UG/G | 10/19/93 | 08275LA |
| FS2001 | 93.16798 V | ICPES | 26. | 3. | UG/G | 9/09/93 | 08275HA |
| FS2001 | 93.16798 ZN | ICPES | 48. | 5. | UG/G | 9/09/93 | 08275HA |
| FS2002 | 93.16799 AL | ICPES | 13000. | 1300. | UG/G | 9/09/93 | 08275HA |
| FS2002 | 93.16799 AS | ETVAA | 3.1 | 0.6 | UG/G | 9/07/93 | |
| FS2002 | 93.16799 BA | ICPES | 120. | 12. | UG/G | 9/09/93 | 08275HA |
| FS2002 | 93.16799 BE | ICPES | 0.8 | 0.08 | UG/G | 9/09/93 | 08275HA |
| FS2002 | 93.16799 CA | ICPES | 2800. | 280. | UG/G | 9/09/93 | 08275HA |
| FS2002 | 93.16799 CD | ICPES | < 0.4 | | UG/G | 9/09/93 | 08275HA |
| FS2002 | 93.16799 CL | IC | 303. | 30. | UG/G | 9/10/93 | |
| FS2002 | 93.16799 CO | ICPES | 22. | 2. | UG/G | 9/09/93 | 08275HA |
| FS2002 | 93.16799 CR | ICPES | 8. | 0.8 | UG/G | 9/09/93 | 08275HA |
| FS2002 | 93.16799 CU | ICPES | 3. | 0.3 | UG/G | 9/09/93 | 08275HA |
| FS2002 | 93.16799 FE | ICPES | 8400. | 840. | UG/G | 9/09/93 | 08275HA |
| FS2002 | 93.16799 HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2002 | 93.16799 K | ICPES | 2200. | 220. | UG/G | 9/09/93 | 08275HA |
| FS2002 | 93.16799 MG | ICPES | 1800. | 180. | UG/G | 9/09/93 | 08275HA |
| FS2002 | 93.16799 MN | ICPES | 100. | 10. | UG/G | 9/09/93 | 08275HA |
| FS2002 | 93.16799 NA | ICPES | 1700. | 170. | UG/G | 9/09/93 | 08275HA |
| FS2002 | 93.16799 NI | ICPES | 8. | 1. | UG/G | 9/09/93 | 08275HA |
| FS2002 | 93.16799 PB | ICPES | < 4. | | UG/G | 9/09/93 | 08275HA |
| FS2002 | 93.16799 SB | ICPES | < 5. | | UG/G | 9/09/93 | 08275LA |
| FS2002 | 93.16799 SE | ETVAA | < 0.3 | | UG/G | 9/07/93 | |
| FS2002 | 93.16799 SO4 | IC | 446. | 45. | UG/G | 11/19/93 | |
| FS2002 | 93.16799 TA | ICPMS | < 0.2 | | UG/G | 10/19/93 | 08275LA |
| FS2002 | 93.16799 TH | ICPMS | 5. | 0.2 | UG/G | 10/19/93 | 08275LA |
| FS2002 | 93.16799 TL | ICPMS | < 0.2 | | UG/G | 10/19/93 | 08275LA |
| FS2002 | 93.16799 U | ICPMS | 0.6 | 0.2 | UG/G | 10/19/93 | 08275LA |
| FS2002 | 93.16799 V | ICPES | 17. | 2. | UG/G | 9/09/93 | 08275HA |
| FS2002 | 93.16799 ZN | ICPES | 21. | 2. | UG/G | 9/09/93 | 08275HA |
| FS2003 | 93.16800 AL | ICPES | 21000. | 2100. | UG/G | 9/09/93 | 08275HA |
| FS2003 | 93.16800 AS | ETVAA | 5.9 | 1.1 | UG/G | 9/07/93 | |
| FS2003 | 93.16800 BA | ICPES | 220. | 22. | UG/G | 9/09/93 | 08275HA |
| FS2003 | 93.16800 BE | ICPES | 1.5 | 0.2 | UG/G | 9/09/93 | 08275HA |
| FS2003 | 93.16800 CA | ICPES | 2200. | 220. | UG/G | 9/09/93 | 08275HA |
| FS2003 | 93.16800 CD | ICPES | < 0.4 | | UG/G | 9/09/93 | 08275HA |
| FS2003 | 93.16800 CL | IC | 17.6 | 1.8 | UG/G | 9/10/93 | |
| FS2003 | 93.16800 CO | ICPES | 11. | 1. | UG/G | 9/09/93 | 08275HA |
| FS2003 | 93.16800 CR | ICPES | 17. | 2. | UG/G | 9/09/93 | 08275HA |
| FS2003 | 93.16800 CU | ICPES | 11. | 1. | UG/G | 9/09/93 | 08275HA |
| FS2003 | 93.16800 FE | ICPES | 19000. | 1900. | UG/G | 9/09/93 | 08275HA |
| FS2003 | 93.16800 HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2003 | 93.16800 K | ICPES | 3600. | 360. | UG/G | 9/09/93 | 08275HA |
| FS2003 | 93.16800 MG | ICPES | 3600. | 360. | UG/G | 9/09/93 | 08275HA |
| FS2003 | 93.16800 MN | ICPES | 460. | 46. | UG/G | 9/09/93 | 08275HA |
| FS2003 | 93.16800 NA | ICPES | 520. | 52. | UG/G | 9/09/93 | 08275HA |

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|---|---|---|---|---|---|---|---|
| FS2003 | 93.16800 | NI | ICPES | 14. | 1. | UG/G | 9/09/93 | 08275HA |
| FS2003 | 93.16800 | PB | ICPES | 15. | 4. | UG/G | 9/09/93 | 08275HA |
| FS2003 | 93.16800 | SB | ICPES | < 5. | | UG/G | 9/09/93 | 08275HA |
| FS2003 | 93.16800 | SE | ETVAA | 0.36 | 0.3 | UG/G | 9/07/93 | |
| FS2003 | 93.16800 | SO4 | IC | 52. | 5.2 | UG/G | 11/19/93 | |
| FS2003 | 93.16800 | TA | ICPMS | < 0.2 | | UG/G | 10/19/93 | 08275LA |
| FS2003 | 93.16800 | TH | ICPMS | 8. | 0.2 | UG/G | 10/19/93 | 08275LA |
| FS2003 | 93.16800 | TL | ICPMS | 0.4 | 0.2 | UG/G | 10/19/93 | 08275LA |
| FS2003 | 93.16800 | U | ICPMS | 1.6 | 0.3 | UG/G | 10/19/93 | 08275LA |
| FS2003 | 93.16800 | V | ICPES | 36. | 4. | UG/G | 9/09/93 | 08275HA |
| FS2003 | 93.16800 | ZN | ICPES | 48. | 5. | UG/G | 9/09/93 | 08275HA |
| FS2004 | 93.16801 | AL | ICPES | 30000. | 3000. | UG/G | 9/09/93 | 08275HA |
| FS2004 | 93.16801 | AS | ETVAA | 5.7 | 1.1 | UG/G | 9/07/93 | |
| FS2004 | 93.16801 | BA | ICPES | 290. | 29. | UG/G | 9/09/93 | 08275HA |
| FS2004 | 93.16801 | BE | ICPES | 1.7 | 0.2 | UG/G | 9/09/93 | 08275HA |
| FS2004 | 93.16801 | CA | ICPES | 4200. | 420. | UG/G | 9/09/93 | 08275HA |
| FS2004 | 93.16801 | CD | ICPES | < 0.4 | | UG/G | 9/09/93 | 08275HA |
| FS2004 | 93.16801 | CL | IC | 30.4 | 3. | UG/G | 9/10/93 | |
| FS2004 | 93.16801 | CO | ICPES | 14. | 1. | UG/G | 9/09/93 | 08275HA |
| FS2004 | 93.16801 | CR | ICPES | 16. | 2. | UG/G | 9/09/93 | 08275HA |
| FS2004 | 93.16801 | CU | ICPES | 5.4 | 0.5 | UG/G | 9/09/93 | 08275HA |
| FS2004 | 93.16801 | FE | ICPES | 19000. | 1900. | UG/G | 9/09/93 | 08275HA |
| FS2004 | 93.16801 | HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2004 | 93.16801 | K | ICPES | 3700. | 370. | UG/G | 9/09/93 | 08275HA |
| FS2004 | 93.16801 | MG | ICPES | 3400. | 340. | UG/G | 9/09/93 | 08275HA |
| FS2004 | 93.16801 | MN | ICPES | 310. | 31. | UG/G | 9/09/93 | 08275HA |
| FS2004 | 93.16801 | NA | ICPES | 520. | 52. | UG/G | 9/09/93 | 08275HA |
| FS2004 | 93.16801 | NI | ICPES | 13. | 1. | UG/G | 9/09/93 | 08275HA |
| FS2004 | 93.16801 | PB | ICPES | 20. | 4. | UG/G | 9/09/93 | 08275HA |
| FS2004 | 93.16801 | SB | ICPES | < 5. | | UG/G | 9/09/93 | 08275HA |
| FS2004 | 93.16801 | SE | ETVAA | 0.8 | 0.3 | UG/G | 9/07/93 | |
| FS2004 | 93.16801 | SO4 | IC | 54. | 5.4 | UG/G | 11/19/93 | |
| FS2004 | 93.16801 | TA | ICPMS | < 0.2 | | UG/G | 10/19/93 | 08275LA |
| FS2004 | 93.16801 | TH | ICPMS | 8. | 0.4 | UG/G | 10/19/93 | 08275LA |
| FS2004 | 93.16801 | TL | ICPMS | 0.2 | 0.2 | UG/G | 10/19/93 | 08275LA |
| FS2004 | 93.16801 | U | ICPMS | 0.6 | 0.2 | UG/G | 10/19/93 | 08275LA |
| FS2004 | 93.16801 | V | ICPES | 36. | 4. | UG/G | 9/09/93 | 08275HA |
| FS2004 | 93.16801 | ZN | ICPES | 42. | 4. | UG/G | 9/09/93 | 08275HA |
| FS2005 | 93.16802 | AL | ICPES | 23000. | 2300. | UG/G | 9/09/93 | 08275HA |
| FS2005 | 93.16802 | AS | ETVAA | 4.8 | 1. | UG/G | 9/07/93 | |
| FS2005 | 93.16802 | BA | ICPES | 250. | 25. | UG/G | 9/09/93 | 08275HA |
| FS2005 | 93.16802 | BE | ICPES | 1.2 | 0.1 | UG/G | 9/09/93 | 08275HA |
| FS2005 | 93.16802 | CA | ICPES | 7500. | 750. | UG/G | 9/09/93 | 08275HA |
| FS2005 | 93.16802 | CD | ICPES | < 0.4 | | UG/G | 9/09/93 | 08275HA |
| FS2005 | 93.16802 | CL | IC | 56.5 | 5.6 | UG/G | 9/10/93 | |
| FS2005 | 93.16802 | CO | ICPES | 19. | 2. | UG/G | 9/09/93 | 08275HA |
| FS2005 | 93.16802 | CR | ICPES | 12. | 1. | UG/G | 9/09/93 | 08275HA |
| FS2005 | 93.16802 | CU | ICPES | 3.6 | 0.4 | UG/G | 9/09/93 | 08275HA |
| FS2005 | 93.16802 | FE | ICPES | 14000. | 1400. | UG/G | 9/09/93 | 08275HA |
| FS2005 | 93.16802 | HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2005 | 93.16802 | K | ICPES | 2900. | 290. | UG/G | 9/09/93 | 08275HA |
| FS2005 | 93.16802 | MG | ICPES | 2700. | 2700. | UG/G | 9/09/93 | 08275HA |
| FS2005 | 93.16802 | MN | ICPES | 210. | 21. | UG/G | 9/09/93 | 08275HA |
| FS2005 | 93.16802 | NA | ICPES | 1000. | 100. | UG/G | 9/09/93 | 08275HA |
| FS2005 | 93.16802 | NI | ICPES | 11. | 1. | UG/G | 9/09/93 | 08275HA |
| FS2005 | 93.16802 | PB | ICPES | 10. | 2. | UG/G | 9/09/93 | 08275HA |
| FS2005 | 93.16802 | SB | ICPES | < 5. | | UG/G | 9/09/93 | 08275HA |
| FS2005 | 93.16802 | SE | ETVAA | 0.5 | 0.3 | UG/G | 9/07/93 | |
| FS2005 | 93.16802 | SO4 | IC | 143. | 14. | UG/G | 11/19/93 | |
| FS2005 | 93.16802 | TA | ICPMS | < 0.2 | | UG/G | 10/19/93 | 08275LA |

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|---|---|---|---|---|---|---|---|
| FS2005 | 93.16802 TH | ICPMS | 6. | 0.3 | UG/G | 10/19/93 | 08275LA |
| FS2005 | 93.16802 TL | ICPMS | < 0.2 | | UG/G | 10/19/93 | 08275LA |
| FS2005 | 93.16802 U | ICPMS | 0.6 | 0.2 | UG/G | 10/19/93 | 08275LA |
| FS2005 | 93.16802 V | ICPES | 30. | 3. | UG/G | 9/09/93 | 08275HA |
| FS2005 | 93.16802 ZN | ICPES | 32. | 3. | UG/G | 9/09/93 | 08275HA |
| FS2006 | 93.16803 AL | ICPES | 31000. | 3100. | UG/G | 9/09/93 | 08275HA |
| FS2006 | 93.16803 AS | ETVAA | 5.9 | 1.2 | UG/G | 9/07/93 | |
| FS2006 | 93.16803 BA | ICPES | 340. | 34. | UG/G | 9/09/93 | 08275HA |
| FS2006 | 93.16803 BE | ICPES | 1.6 | 0.2 | UG/G | 9/09/93 | 08275HA |
| FS2006 | 93.16803 CA | ICPES | 3800. | 380. | UG/G | 9/09/93 | 08275HA |
| FS2006 | 93.16803 CD | ICPES | < 0.4 | | UG/G | 9/09/93 | 08275HA |
| FS2006 | 93.16803 CL | IC | 13.3 | 1.3 | UG/G | 9/10/93 | |
| FS2006 | 93.16803 CO | ICPES | 11. | 1. | UG/G | 9/09/93 | 08275HA |
| FS2006 | 93.16803 CR | ICPES | 15. | 2. | UG/G | 9/09/93 | 08275HA |
| FS2006 | 93.16803 CU | ICPES | 6.4 | 0.6 | UG/G | 9/09/93 | 08275HA |
| FS2006 | 93.16803 FE | ICPES | 19000. | 1900. | UG/G | 9/09/93 | 08275HA |
| FS2006 | 93.16803 HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2006 | 93.16803 K | ICPES | 3300. | 330. | UG/G | 9/09/93 | 08275HA |
| FS2006 | 93.16803 MG | ICPES | 4000. | 400. | UG/G | 9/09/93 | 08275HA |
| FS2006 | 93.16803 MN | ICPES | 300. | 30. | UG/G | 9/09/93 | 08275HA |
| FS2006 | 93.16803 NA | ICPES | 470. | 47. | UG/G | 9/09/93 | 08275HA |
| FS2006 | 93.16803 NI | ICPES | 12. | 1. | UG/G | 9/09/93 | 08275HA |
| FS2006 | 93.16803 PB | ICPES | 14. | 3. | UG/G | 9/09/93 | 08275HA |
| FS2006 | 93.16803 SB | ICPES | < 5. | | UG/G | 9/09/93 | 08275HA |
| FS2006 | 93.16803 SE | ETVAA | 0.9 | 0.3 | UG/G | 9/07/93 | |
| FS2006 | 93.16803 SO4 | IC | 79. | 8. | UG/G | 11/19/93 | |
| FS2006 | 93.16803 TA | ICPMS | < 0.2 | | UG/G | 10/19/93 | 08275LA |
| FS2006 | 93.16803 TH | ICPMS | 9. | 0.4 | UG/G | 10/19/93 | 08275LA |
| FS2006 | 93.16803 TL | ICPMS | 0.2 | 0.2 | UG/G | 10/19/93 | 08275LA |
| FS2006 | 93.16803 U | ICPMS | 1.4 | 0.3 | UG/G | 10/19/93 | 08275LA |
| FS2006 | 93.16803 V | ICPES | 34. | 3. | UG/G | 9/09/93 | 08275HA |
| FS2006 | 93.16803 ZN | ICPES | 42. | 4. | UG/G | 9/09/93 | 08275HA |
| FS2007 | 93.16804 AL | ICPES | 29000. | 2900. | UG/G | 9/09/93 | 08275HA |
| FS2007 | 93.16804 AS | ETVAA | 4.8 | 1. | UG/G | 9/07/93 | |
| FS2007 | 93.16804 BA | ICPES | 220. | 22. | UG/G | 9/09/93 | 08275HA |
| FS2007 | 93.16804 BE | ICPES | 1.3 | 0.1 | UG/G | 9/09/93 | 08275HA |
| FS2007 | 93.16804 CA | ICPES | 7800. | 780. | UG/G | 9/09/93 | 08275HA |
| FS2007 | 93.16804 CD | ICPES | < 0.4 | | UG/G | 9/09/93 | 08275HA |
| FS2007 | 93.16804 CL | IC | 16.6 | 1.7 | UG/G | 9/10/93 | |
| FS2007 | 93.16804 CO | ICPES | 16. | 2. | UG/G | 9/09/93 | 08275HA |
| FS2007 | 93.16804 CR | ICPES | 13. | 1. | UG/G | 9/09/93 | 08275HA |
| FS2007 | 93.16804 CU | ICPES | 4.7 | 0.5 | UG/G | 9/09/93 | 08275HA |
| FS2007 | 93.16804 FE | ICPES | 16000. | 1600. | UG/G | 9/09/93 | 08275HA |
| FS2007 | 93.16804 HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2007 | 93.16804 K | ICPES | 3000. | 300. | UG/G | 9/09/93 | 08275HA |
| FS2007 | 93.16804 MG | ICPES | 3400. | 340. | UG/G | 9/09/93 | 08275HA |
| FS2007 | 93.16804 MN | ICPES | 220. | 22. | UG/G | 9/09/93 | 08275HA |
| FS2007 | 93.16804 NA | ICPES | 990. | 99. | UG/G | 9/09/93 | 08275HA |
| FS2007 | 93.16804 NI | ICPES | 12. | 1. | UG/G | 9/09/93 | 08275HA |
| FS2007 | 93.16804 PB | ICPES | 10. | 3. | UG/G | 9/09/93 | 08275HA |
| FS2007 | 93.16804 SB | ICPES | < 5. | | UG/G | 9/09/93 | 08275HA |
| FS2007 | 93.16804 SE | ETVAA | 0.4 | 0.3 | UG/G | 9/07/93 | |
| FS2007 | 93.16804 SO4 | IC | 117. | 12. | UG/G | 11/19/93 | |
| FS2007 | 93.16804 TA | ICPMS | < 0.2 | | UG/G | 10/19/93 | 08275LA |
| FS2007 | 93.16804 TH | ICPMS | 6. | 0.3 | UG/G | 10/19/93 | 08275LA |
| FS2007 | 93.16804 TL | ICPMS | < 0.2 | | UG/G | 10/19/93 | 08275LA |
| FS2007 | 93.16804 U | ICPMS | 1.3 | 0.3 | UG/G | 10/19/93 | 08275LA |
| FS2007 | 93.16804 V | ICPES | 31. | 3. | UG/G | 9/09/93 | 08275HA |
| FS2007 | 93.16804 ZN | ICPES | 36. | 4. | UG/G | 9/09/93 | 08275HA |
| FS2008 | 93.16805 AL | ICPES | 16000. | 1600. | UG/G | 9/09/93 | 08275HA |

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|---|---|---|---|---|---|---|---|
| FS2008 | 93.16805 | AS | ETVAA | 7.7 | 1.5 | UG/G | 9/07/93 | |
| FS2008 | 93.16805 | BA | ICPES | 200. | 20. | UG/G | 9/09/93 | 08275HA |
| FS2008 | 93.16805 | BE | ICPES | 1.2 | 0.1 | UG/G | 9/09/93 | 08275HA |
| FS2008 | 93.16805 | CA | ICPES | 1900. | 190. | UG/G | 9/09/93 | 08275HA |
| FS2008 | 93.16805 | CD | ICPES | < 0.4 | | UG/G | 9/09/93 | 08275HA |
| FS2008 | 93.16805 | CL | IC | 12.1 | 1.2 | UG/G | 9/10/93 | |
| FS2008 | 93.16805 | CO | ICPES | 21. | 2. | UG/G | 9/09/93 | 08275HA |
| FS2008 | 93.16805 | CR | ICPES | 11. | 1. | UG/G | 9/09/93 | 08275HA |
| FS2008 | 93.16805 | CU | ICPES | 7.4 | 0.7 | UG/G | 9/09/93 | 08275HA |
| FS2008 | 93.16805 | FE | ICPES | 16000. | 1600. | UG/G | 9/09/93 | 08275HA |
| FS2008 | 93.16805 | HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2008 | 93.16805 | K | ICPES | 2700. | 270. | UG/G | 9/09/93 | 08275HA |
| FS2008 | 93.16805 | MG | ICPES | 2400. | 240. | UG/G | 9/09/93 | 08275HA |
| FS2008 | 93.16805 | MN | ICPES | 1100. | 110. | UG/G | 9/09/93 | 08275HA |
| FS2008 | 93.16805 | NA | ICPES | 410. | 41. | UG/G | 9/09/93 | 08275HA |
| FS2008 | 93.16805 | NI | ICPES | 12. | 1. | UG/G | 9/09/93 | 08275HA |
| FS2008 | 93.16805 | PB | ICPES | 13. | 3. | UG/G | 9/09/93 | 08275HA |
| FS2008 | 93.16805 | SB | ICPES | < 5. | | UG/G | 9/09/93 | 08275HA |
| FS2008 | 93.16805 | SE | ETVAA | < 0.3 | | UG/G | 9/07/93 | |
| FS2008 | 93.16805 | SO4 | IC | 23. | 2.3 | UG/G | 11/19/93 | |
| FS2008 | 93.16805 | TA | ICPMS | < 0.2 | | UG/G | 10/19/93 | 08275LA |
| FS2008 | 93.16805 | TH | ICPMS | 9. | 0.5 | UG/G | 10/19/93 | 08275LA |
| FS2008 | 93.16805 | TL | ICPMS | 0.5 | 0.2 | UG/G | 10/19/93 | 08275LA |
| FS2008 | 93.16805 | U | ICPMS | 0.9 | 0.2 | UG/G | 10/19/93 | 08275LA |
| FS2008 | 93.16805 | V | ICPES | 33. | 3. | UG/G | 9/09/93 | 08275HA |
| FS2008 | 93.16805 | ZN | ICPES | 45. | 5. | UG/G | 9/09/93 | 08275HA |
| FS2009 | 93.16806 | AL | ICPES | 14000. | 1400. | UG/G | 9/09/93 | 08275HA |
| FS2009 | 93.16806 | AS | ETVAA | 0.5 | 0.3 | UG/G | 9/07/93 | |
| FS2009 | 93.16806 | BA | ICPES | 120. | 12. | UG/G | 9/09/93 | 08275HA |
| FS2009 | 93.16806 | BE | ICPES | 0.9 | 0.09 | UG/G | 9/09/93 | 08275HA |
| FS2009 | 93.16806 | CA | ICPES | 1900. | 190. | UG/G | 9/09/93 | 08275HA |
| FS2009 | 93.16806 | CD | ICPES | < 0.4 | | UG/G | 9/09/93 | 08275HA |
| FS2009 | 93.16806 | CL | IC | 12.2 | 1.2 | UG/G | 9/10/93 | |
| FS2009 | 93.16806 | CO | ICPES | 8.7 | 0.9 | UG/G | 9/09/93 | 08275HA |
| FS2009 | 93.16806 | CR | ICPES | 12. | 1. | UG/G | 9/09/93 | 08275HA |
| FS2009 | 93.16806 | CU | ICPES | 9.4 | 0.9 | UG/G | 9/09/93 | 08275HA |
| FS2009 | 93.16806 | FE | ICPES | 10000. | 1000. | UG/G | 9/09/93 | 08275HA |
| FS2009 | 93.16806 | HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2009 | 93.16806 | K | ICPES | 2800. | 280. | UG/G | 9/09/93 | 08275HA |
| FS2009 | 93.16806 | MG | ICPES | 2700. | 270. | UG/G | 9/09/93 | 08275HA |
| FS2009 | 93.16806 | MN | ICPES | 110. | 11. | UG/G | 9/09/93 | 08275HA |
| FS2009 | 93.16806 | NA | ICPES | 220. | 22. | UG/G | 9/09/93 | 08275HA |
| FS2009 | 93.16806 | NI | ICPES | 6.5 | 0.7 | UG/G | 9/09/93 | 08275HA |
| FS2009 | 93.16806 | PB | ICPES | 13. | 6. | UG/G | 9/09/93 | 08275HA |
| FS2009 | 93.16806 | SB | ICPES | < 5. | | UG/G | 9/09/93 | 08275HA |
| FS2009 | 93.16806 | SE | ETVAA | < 0.3 | | UG/G | 9/07/93 | |
| FS2009 | 93.16806 | SO4 | IC | 16. | 1.6 | UG/G | 11/19/93 | |
| FS2009 | 93.16806 | TA | ICPMS | < 0.2 | | UG/G | 10/19/93 | 08275LA |
| FS2009 | 93.16806 | TH | ICPMS | 0.6 | 0.2 | UG/G | 10/19/93 | 08275LA |
| FS2009 | 93.16806 | TL | ICPMS | < 0.2 | | UG/G | 10/19/93 | 08275LA |
| FS2009 | 93.16806 | U | ICPMS | 0.3 | 0.2 | UG/G | 10/19/93 | 08275LA |
| FS2009 | 93.16806 | V | ICPES | 17. | 2. | UG/G | 9/09/93 | 08275HA |
| FS2009 | 93.16806 | ZN | ICPES | 39. | 4. | UG/G | 9/09/93 | 08275HA |
| FS2010 | 93.16807 | AL | ICPES | 19000. | 1900. | UG/G | 9/09/93 | 08275HA |
| FS2010 | 93.16807 | AS | ETVAA | 5. | 1. | UG/G | 9/07/93 | |
| FS2010 | 93.16807 | BA | ICPES | 140. | 14. | UG/G | 9/09/93 | 08275HA |
| FS2010 | 93.16807 | BE | ICPES | 1.3 | 0.1 | UG/G | 9/09/93 | 08275HA |
| FS2010 | 93.16807 | CA | ICPES | 3200. | 320. | UG/G | 9/09/93 | 08275HA |
| FS2010 | 93.16807 | CD | ICPES | < 0.4 | | UG/G | 9/09/93 | 08275HA |
| FS2010 | 93.16807 | CL | IC | 12.8 | 1.3 | UG/G | 9/10/93 | |

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|---|---|---|---|---|---|---|---|
| FS2010 | 93.16807 CO | ICPES | 19. | 2. | UG/G | 9/09/93 | 08275HA |
| FS2010 | 93.16807 CR | ICPES | 11. | 1. | UG/G | 9/09/93 | 08275HA |
| FS2010 | 93.16807 CU | ICPES | 5.5 | 0.6 | UG/G | 9/09/93 | 08275HA |
| FS2010 | 93.16807 FE | ICPES | 15000. | 1500. | UG/G | 9/09/93 | 08275HA |
| FS2010 | 93.16807 HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2010 | 93.16807 K | ICPES | 2800. | 280. | UG/G | 9/09/93 | 08275HA |
| FS2010 | 93.16807 MG | ICPES | 2900. | 290. | UG/G | 9/09/93 | 08275HA |
| FS2010 | 93.16807 MN | ICPES | 380. | 38. | UG/G | 9/09/93 | 08275HA |
| FS2010 | 93.16807 NA | ICPES | 430. | 43. | UG/G | 9/09/93 | 08275HA |
| FS2010 | 93.16807 NI | ICPES | 9. | 2. | UG/G | 9/09/93 | 08275HA |
| FS2010 | 93.16807 PB | ICPES | 13. | 2. | UG/G | 9/09/93 | 08275HA |
| FS2010 | 93.16807 SB | ICPES | < 5. | | UG/G | 9/09/93 | 08275HA |
| FS2010 | 93.16807 SE | ETVAA | 0.3 | 0.3 | UG/G | 9/07/93 | |
| FS2010 | 93.16807 SO4 | IC | 36. | 3.6 | UG/G | 11/19/93 | |
| FS2010 | 93.16807 TA | ICPMS | < 0.2 | | UG/G | 10/19/93 | 08275LA |
| FS2010 | 93.16807 TH | ICPMS | 9. | 0.4 | UG/G | 10/19/93 | 08275LA |
| FS2010 | 93.16807 TL | ICPMS | 0.2 | 0.2 | UG/G | 10/19/93 | 08275LA |
| FS2010 | 93.16807 U | ICPMS | 0.9 | 0.2 | UG/G | 10/19/93 | 08275LA |
| FS2010 | 93.16807 V | ICPES | 23. | 2. | UG/G | 9/09/93 | 08275HA |
| FS2010 | 93.16807 ZN | ICPES | 57. | 6. | UG/G | 9/09/93 | 08275HA |
| FS2011 | 93.16808 AL | ICPES | 15000. | 1500. | UG/G | 9/09/93 | 08275HA |
| FS2011 | 93.16808 AS | ETVAA | 3.3 | 0.7 | UG/G | 9/07/93 | |
| FS2011 | 93.16808 BA | ICPES | 85. | 9. | UG/G | 9/09/93 | 08275HA |
| FS2011 | 93.16808 BE | ICPES | 1.1 | 0.1 | UG/G | 9/09/93 | 08275HA |
| FS2011 | 93.16808 CA | ICPES | 1900. | 190. | UG/G | 9/09/93 | 08275HA |
| FS2011 | 93.16808 CD | ICPES | < 0.4 | | UG/G | 9/09/93 | 08275HA |
| FS2011 | 93.16808 CL | IC | 17.3 | 1.7 | UG/G | 9/10/93 | |
| FS2011 | 93.16808 CO | ICPES | 22. | 2. | UG/G | 9/09/93 | 08275HA |
| FS2011 | 93.16808 CR | ICPES | 9. | 1. | UG/G | 9/09/93 | 08275HA |
| FS2011 | 93.16808 CU | ICPES | 3. | 0.3 | UG/G | 9/09/93 | 08275HA |
| FS2011 | 93.16808 FE | ICPES | 12000. | 1200. | UG/G | 9/09/93 | 08275HA |
| FS2011 | 93.16808 HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2011 | 93.16808 K | ICPES | 2000. | 200. | UG/G | 9/09/93 | 08275HA |
| FS2011 | 93.16808 MG | ICPES | 2100. | 210. | UG/G | 9/09/93 | 08275HA |
| FS2011 | 93.16808 MN | ICPES | 320. | 32. | UG/G | 9/09/93 | 08275HA |
| FS2011 | 93.16808 NA | ICPES | 240. | 24. | UG/G | 9/09/93 | 08275HA |
| FS2011 | 93.16808 NI | ICPES | 6. | 0.6 | UG/G | 9/09/93 | 08275HA |
| FS2011 | 93.16808 PB | ICPES | 10. | 1. | UG/G | 9/09/93 | 08275HA |
| FS2011 | 93.16808 SB | ICPES | < 5. | | UG/G | 9/09/93 | 08275HA |
| FS2011 | 93.16808 SE | ETVAA | < 0.3 | | UG/G | 9/07/93 | |
| FS2011 | 93.16808 SO4 | IC | 32. | 3.2 | UG/G | 11/19/93 | |
| FS2011 | 93.16808 TA | ICPMS | < 0.2 | | UG/G | 10/19/93 | 08275LA |
| FS2011 | 93.16808 TH | ICPMS | 7. | 0.3 | UG/G | 10/19/93 | 08275LA |
| FS2011 | 93.16808 TL | ICPMS | < 0.2 | | UG/G | 10/19/93 | 08275LA |
| FS2011 | 93.16808 U | ICPMS | 0.7 | 0.2 | UG/G | 10/19/93 | 08275LA |
| FS2011 | 93.16808 V | ICPES | 17. | 2. | UG/G | 9/09/93 | 08275HA |
| FS2011 | 93.16808 ZN | ICPES | 42. | 4. | UG/G | 9/09/93 | 08275HA |
| FS2012 | 93.16809 AL | ICPES | 16000. | 1600. | UG/G | 9/09/93 | 08275HA |
| FS2012 | 93.16809 AS | ETVAA | 3.8 | 0.8 | UG/G | 9/07/93 | |
| FS2012 | 93.16809 BA | ICPES | 93. | 9. | UG/G | 9/09/93 | 08275HA |
| FS2012 | 93.16809 BE | ICPES | 1.2 | 0.1 | UG/G | 9/09/93 | 08275HA |
| FS2012 | 93.16809 CA | ICPES | 2700. | 270. | UG/G | 9/09/93 | 08275HA |
| FS2012 | 93.16809 CD | ICPES | < 0.4 | | UG/G | 9/09/93 | 08275HA |
| FS2012 | 93.16809 CL | IC | 19.7 | 2. | UG/G | 9/10/93 | |
| FS2012 | 93.16809 CO | ICPES | 20. | 2. | UG/G | 9/09/93 | 08275HA |
| FS2012 | 93.16809 CR | ICPES | 10. | 1. | UG/G | 9/09/93 | 08275HA |
| FS2012 | 93.16809 CU | ICPES | 3.6 | 0.4 | UG/G | 9/09/93 | 08275HA |
| FS2012 | 93.16809 FE | ICPES | 14000. | 1400. | UG/G | 9/09/93 | 08275HA |
| FS2012 | 93.16809 HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2012 | 93.16809 K | ICPES | 2300. | 230. | UG/G | 9/09/93 | 08275HA |

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|---|---|---|---|---|---|---|---|
| FS2012 | 93.16809 MG | ICPES | 2400. | 240. | UG/G | 9/09/93 | 08275HA |
| FS2012 | 93.16809 MN | ICPES | 330. | 33. | UG/G | 9/09/93 | 08275HA |
| FS2012 | 93.16809 NA | ICPES | 310. | 31. | UG/G | 9/09/93 | 08275HA |
| FS2012 | 93.16809 NI | ICPES | 9. | 2. | UG/G | 9/09/93 | 08275HA |
| FS2012 | 93.16809 PB | ICPES | 11. | 3. | UG/G | 9/09/93 | 08275HA |
| FS2012 | 93.16809 SB | ICPES | < 5. | | UG/G | 9/09/93 | 08275HA |
| FS2012 | 93.16809 SE | ETVAA | < 0.3 | | UG/G | 9/07/93 | |
| FS2012 | 93.16809 SO4 | IC | 82. | 8.2 | UG/G | 11/19/93 | |
| FS2012 | 93.16809 TA | ICPMS | < 0.2 | | UG/G | 10/19/93 | 08275LA |
| FS2012 | 93.16809 TH | ICPMS | 8. | 0.4 | UG/G | 10/19/93 | 08275LA |
| FS2012 | 93.16809 TL | ICPMS | < 0.2 | | UG/G | 10/19/93 | 08275LA |
| FS2012 | 93.16809 U | ICPMS | 0.7 | 0.2 | UG/G | 10/19/93 | 08275LA |
| FS2012 | 93.16809 V | ICPES | 18. | 2. | UG/G | 9/09/93 | 08275HA |
| FS2012 | 93.16809 ZN | ICPES | 43. | 4. | UG/G | 9/09/93 | 08275HA |
| FS2013 | 93.16810 AL | ICPES | 17000. | 1700. | UG/G | 9/09/93 | 08275HA |
| FS2013 | 93.16810 AS | ETVAA | 3.9 | 0.8 | UG/G | 9/07/93 | |
| FS2013 | 93.16810 BA | ICPES | 110. | 11. | UG/G | 9/09/93 | 08275HA |
| FS2013 | 93.16810 BE | ICPES | 1.2 | 0.1 | UG/G | 9/09/93 | 08275HA |
| FS2013 | 93.16810 CA | ICPES | 2000. | 200. | UG/G | 9/09/93 | 08275HA |
| FS2013 | 93.16810 CD | ICPES | < 0.4 | | UG/G | 9/09/93 | 08275HA |
| FS2013 | 93.16810 CL | IC | 14.6 | 1.5 | UG/G | 9/10/93 | |
| FS2013 | 93.16810 CO | ICPES | 13. | 1. | UG/G | 9/09/93 | 08275HA |
| FS2013 | 93.16810 CR | ICPES | 11. | 1. | UG/G | 9/09/93 | 08275HA |
| FS2013 | 93.16810 CU | ICPES | 2.9 | 0.3 | UG/G | 9/09/93 | 08275HA |
| FS2013 | 93.16810 FE | ICPES | 15000. | 1500. | UG/G | 9/09/93 | 08275HA |
| FS2013 | 93.16810 HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2013 | 93.16810 K | ICPES | 2100. | 210. | UG/G | 9/09/93 | 08275HA |
| FS2013 | 93.16810 MG | ICPES | 2200. | 220. | UG/G | 9/09/93 | 08275HA |
| FS2013 | 93.16810 MN | ICPES | 370. | 37. | UG/G | 9/09/93 | 08275HA |
| FS2013 | 93.16810 NA | ICPES | 250. | 25. | UG/G | 9/09/93 | 08275HA |
| FS2013 | 93.16810 NI | ICPES | 10. | 1. | UG/G | 9/09/93 | 08275HA |
| FS2013 | 93.16810 PB | ICPES | 10. | 3. | UG/G | 9/09/93 | 08275HA |
| FS2013 | 93.16810 SB | ICPES | < 5. | | UG/G | 9/09/93 | 08275HA |
| FS2013 | 93.16810 SE | ETVAA | < 0.3 | | UG/G | 9/07/93 | |
| FS2013 | 93.16810 SO4 | IC | 30. | 3. | UG/G | 11/19/93 | |
| FS2013 | 93.16810 TA | ICPMS | < 0.2 | | UG/G | 10/19/93 | 08275LA |
| FS2013 | 93.16810 TH | ICPMS | 7. | 0.4 | UG/G | 10/19/93 | 08275LA |
| FS2013 | 93.16810 TL | ICPMS | < 0.2 | | UG/G | 10/19/93 | 08275LA |
| FS2013 | 93.16810 U | ICPMS | 0.7 | 0.2 | UG/G | 10/19/93 | 08275LA |
| FS2013 | 93.16810 V | ICPES | 22. | 2. | UG/G | 9/09/93 | 08275HA |
| FS2013 | 93.16810 ZN | ICPES | 45. | 5. | UG/G | 9/09/93 | 08275HA |
| FS2014 | 93.16811 AL | ICPES | 9500. | 950. | UG/G | 9/09/93 | 08275HA |
| FS2014 | 93.16811 AS | ETVAA | 2.5 | 0.5 | UG/G | 9/07/93 | |
| FS2014 | 93.16811 BA | ICPES | 110. | 11. | UG/G | 9/09/93 | 08275HA |
| FS2014 | 93.16811 BE | ICPES | 0.79 | 0.08 | UG/G | 9/09/93 | 08275HA |
| FS2014 | 93.16811 CA | ICPES | 8500. | 850. | UG/G | 9/09/93 | 08275HA |
| FS2014 | 93.16811 CD | ICPES | < 0.4 | | UG/G | 9/09/93 | 08275HA |
| FS2014 | 93.16811 CL | IC | 0.0 | | UG/G | 9/10/93 | NO SAMPLE |
| FS2014 | 93.16811 CO | ICPES | 41. | 4. | UG/G | 9/09/93 | 08275HA |
| FS2014 | 93.16811 CR | ICPES | 6.7 | 0.7 | UG/G | 9/09/93 | 08275HA |
| FS2014 | 93.16811 CU | ICPES | 6.1 | 0.6 | UG/G | 9/09/93 | 08275HA |
| FS2014 | 93.16811 FE | ICPES | 11000. | 1100. | UG/G | 9/09/93 | 08275HA |
| FS2014 | 93.16811 HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2014 | 93.16811 K | ICPES | 1900. | 190. | UG/G | 9/09/93 | 08275HA |
| FS2014 | 93.16811 MG | ICPES | 1800. | 180. | UG/G | 9/09/93 | 08275HA |
| FS2014 | 93.16811 MN | ICPES | 660. | 66. | UG/G | 9/09/93 | 08275HA |
| FS2014 | 93.16811 NA | ICPES | 420. | 42. | UG/G | 9/09/93 | 08275HA |
| FS2014 | 93.16811 NI | ICPES | 12. | 1. | UG/G | 9/09/93 | 08275HA |
| FS2014 | 93.16811 PB | ICPES | 9. | 4. | UG/G | 9/09/93 | 08275HA |
| FS2014 | 93.16811 SB | ICPES | < 5. | | UG/G | 9/09/93 | 08275HA |

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|---|---|---|---|---|---|---|---|
| FS2014 | 93.16811 SE | ETVAA | < 0.3 | | UG/G | 9/07/93 | |
| FS2014 | 93.16811 SO4 | IC | 0.0 | | UG/G | 11/19/93 | NO SAMPLE |
| FS2014 | 93.16811 TA | ICPMS | < 0.2 | | UG/G | 10/19/93 | 08275LA |
| FS2014 | 93.16811 TH | ICPMS | 4. | 0.2 | UG/G | 10/19/93 | 08275LA |
| FS2014 | 93.16811 TL | ICPMS | < 0.2 | | UG/G | 10/19/93 | 08275LA |
| FS2014 | 93.16811 U | ICPMS | 0.6 | 0.2 | UG/G | 10/19/93 | 08275LA |
| FS2014 | 93.16811 V | ICPES | 14. | 1. | UG/G | 9/09/93 | 08275HA |
| FS2014 | 93.16811 ZN | ICPES | 60. | 6. | UG/G | 9/09/93 | 08275HA |
| FS2015 | 93.16812 AL | ICPES | 5900. | 590. | UG/G | 9/09/93 | 08275HA |
| FS2015 | 93.16812 AS | ETVAA | 1.6 | 0.3 | UG/G | 9/07/93 | |
| FS2015 | 93.16812 BA | ICPES | 40. | 4. | UG/G | 9/09/93 | 08275HA |
| FS2015 | 93.16812 BE | ICPES | 0.64 | 0.06 | UG/G | 9/09/93 | 08275HA |
| FS2015 | 93.16812 CA | ICPES | 1500. | 150. | UG/G | 9/09/93 | 08275HA |
| FS2015 | 93.16812 CD | ICPES | < 0.4 | | UG/G | 9/09/93 | 08275HA |
| FS2015 | 93.16812 CL | IC | 17.2 | 1.7 | UG/G | 9/10/93 | |
| FS2015 | 93.16812 CO | ICPES | 28. | 3. | UG/G | 9/09/93 | 08275HA |
| FS2015 | 93.16812 CR | ICPES | 4. | 0.4 | UG/G | 9/09/93 | 08275HA |
| FS2015 | 93.16812 CU | ICPES | 1.6 | 0.2 | UG/G | 9/09/93 | 08275HA |
| FS2015 | 93.16812 FE | ICPES | 7900. | 790. | UG/G | 9/09/93 | 08275HA |
| FS2015 | 93.16812 HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2015 | 93.16812 K | ICPES | 1100. | 110. | UG/G | 9/09/93 | 08275HA |
| FS2015 | 93.16812 MG | ICPES | 890. | 90. | UG/G | 9/09/93 | 08275HA |
| FS2015 | 93.16812 MN | ICPES | 340. | 34. | UG/G | 9/09/93 | 08275HA |
| FS2015 | 93.16812 NA | ICPES | 330. | 33. | UG/G | 9/09/93 | 08275HA |
| FS2015 | 93.16812 NI | ICPES | 3. | 1. | UG/G | 9/09/93 | 08275HA |
| FS2015 | 93.16812 PB | ICPES | 8. | 0.8 | UG/G | 9/09/93 | 08275HA |
| FS2015 | 93.16812 SB | ICPES | < 5. | | UG/G | 9/09/93 | 08275HA |
| FS2015 | 93.16812 SE | ETVAA | < 0.3 | | UG/G | 9/07/93 | |
| FS2015 | 93.16812 SO4 | IC | 23. | 2.3 | UG/G | 11/19/93 | |
| FS2015 | 93.16812 TA | ICPMS | < 0.2 | | UG/G | 10/19/93 | 08275LA |
| FS2015 | 93.16812 TH | ICPMS | 4. | 0.2 | UG/G | 10/19/93 | 08275LA |
| FS2015 | 93.16812 TL | ICPMS | < 0.2 | | UG/G | 10/19/93 | 08275LA |
| FS2015 | 93.16812 U | ICPMS | 0.4 | 0.2 | UG/G | 10/19/93 | 08275LA |
| FS2015 | 93.16812 V | ICPES | 8.3 | 0.8 | UG/G | 9/09/93 | 08275HA |
| FS2015 | 93.16812 ZN | ICPES | 42. | 4. | UG/G | 9/09/93 | 08275HA |
| FS2016 | 93.16813 AL | ICPES | 5100. | 510. | UG/G | 9/09/93 | 08275HA |
| FS2016 | 93.16813 AS | ETVAA | 1.5 | 0.3 | UG/G | 9/07/93 | |
| FS2016 | 93.16813 BA | ICPES | 34. | 3. | UG/G | 9/09/93 | 08275HA |
| FS2016 | 93.16813 BE | ICPES | 0.52 | 0.05 | UG/G | 9/09/93 | 08275HA |
| FS2016 | 93.16813 CA | ICPES | 1300. | 130. | UG/G | 9/09/93 | 08275HA |
| FS2016 | 93.16813 CD | ICPES | < 0.4 | | UG/G | 9/09/93 | 08275HA |
| FS2016 | 93.16813 CL | IC | 14.1 | 1.4 | UG/G | 9/10/93 | |
| FS2016 | 93.16813 CO | ICPES | 24. | 2. | UG/G | 9/09/93 | 08275HA |
| FS2016 | 93.16813 CR | ICPES | 3.7 | 0.4 | UG/G | 9/09/93 | 08275HA |
| FS2016 | 93.16813 CU | ICPES | 1.2 | 0.1 | UG/G | 9/09/93 | 08275HA |
| FS2016 | 93.16813 FE | ICPES | 8500. | 850. | UG/G | 9/09/93 | 08275HA |
| FS2016 | 93.16813 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2016 | 93.16813 K | ICPES | 770. | 77. | UG/G | 9/09/93 | 08275HA |
| FS2016 | 93.16813 MG | ICPES | 780. | 78. | UG/G | 9/09/93 | 08275HA |
| FS2016 | 93.16813 MN | ICPES | 310. | 31. | UG/G | 9/09/93 | 08275HA |
| FS2016 | 93.16813 NA | ICPES | 190. | 19. | UG/G | 9/09/93 | 08275HA |
| FS2016 | 93.16813 NI | ICPES | 5. | 1. | UG/G | 9/09/93 | 08275HA |
| FS2016 | 93.16813 PB | ICPES | 13. | 2. | UG/G | 9/09/93 | 08275HA |
| FS2016 | 93.16813 SB | ICPES | < 5. | | UG/G | 9/09/93 | 08275HA |
| FS2016 | 93.16813 SE | ETVAA | < 0.3 | | UG/G | 9/07/93 | |
| FS2016 | 93.16813 SO4 | IC | 16. | 1.6 | UG/G | 11/19/93 | |
| FS2016 | 93.16813 TA | ICPMS | < 0.2 | | UG/G | 10/19/93 | 08275LA |
| FS2016 | 93.16813 TH | ICPMS | 4. | 0.2 | UG/G | 10/19/93 | 08275LA |
| FS2016 | 93.16813 TL | ICPMS | < 0.2 | | UG/G | 10/19/93 | 08275LA |
| FS2016 | 93.16813 U | ICPMS | 0.3 | 0.2 | UG/G | 10/19/93 | 08275LA |

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| FS2016 | 93.16813 V | ICPES | 9. | 1. | UG/G | 9/09/93 | 08275HA |
| FS2016 | 93.16813 ZN | ICPES | 39. | 4. | UG/G | 9/09/93 | 08275HA |
| FS2017 | 93.16814 AL | ICPES | 8600. | 860. | UG/G | 9/09/93 | 08275HA |
| FS2017 | 93.16814 AS | ETVAA | 2.4 | 0.5 | UG/G | 9/07/93 | |
| FS2017 | 93.16814 BA | ICPES | 180. | 18. | UG/G | 9/09/93 | 08275HA |
| FS2017 | 93.16814 BE | ICPES | 0.8 | 0.08 | UG/G | 9/09/93 | 08275HA |
| FS2017 | 93.16814 CA | ICPES | 10000. | 1000. | UG/G | 9/09/93 | 08275HA |
| FS2017 | 93.16814 CD | ICPES | < 0.4 | | UG/G | 9/09/93 | 08275HA |
| FS2017 | 93.16814 CL | IC | 16.1 | 1.6 | UG/G | 9/10/93 | |
| FS2017 | 93.16814 CO | ICPES | 14. | 1. | UG/G | 9/09/93 | 08275HA |
| FS2017 | 93.16814 CR | ICPES | 6. | 0.6 | UG/G | 9/09/93 | 08275HA |
| FS2017 | 93.16814 CU | ICPES | 8.6 | 0.9 | UG/G | 9/09/93 | 08275HA |
| FS2017 | 93.16814 FE | ICPES | 11000. | 1100. | UG/G | 9/09/93 | 08275HA |
| FS2017 | 93.16814 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2017 | 93.16814 K | ICPES | 1800. | 180. | UG/G | 9/09/93 | 08275HA |
| FS2017 | 93.16814 MG | ICPES | 1600. | 160. | UG/G | 9/09/93 | 08275HA |
| FS2017 | 93.16814 MN | ICPES | 1000. | 100. | UG/G | 9/09/93 | 08275HA |
| FS2017 | 93.16814 NA | ICPES | 230. | 23. | UG/G | 9/09/93 | 08275HA |
| FS2017 | 93.16814 NI | ICPES | 8. | 2. | UG/G | 9/09/93 | 08275HA |
| FS2017 | 93.16814 PB | ICPES | 9. | 3. | UG/G | 9/09/93 | 08275HA |
| FS2017 | 93.16814 SB | ICPES | < 5. | | UG/G | 9/09/93 | 08275HA |
| FS2017 | 93.16814 SE | ETVAA | 0.65 | 0.3 | UG/G | 9/07/93 | |
| FS2017 | 93.16814 SO4 | IC | 32. | 3.2 | UG/G | 11/19/93 | |
| FS2017 | 93.16814 TA | ICPMS | < 0.2 | | UG/G | 10/19/93 | 08275LA |
| FS2017 | 93.16814 TH | ICPMS | 5. | 0.3 | UG/G | 10/19/93 | 08275LA |
| FS2017 | 93.16814 TL | ICPMS | < 0.2 | | UG/G | 10/19/93 | 08275LA |
| FS2017 | 93.16814 U | ICPMS | 0.6 | 0.2 | UG/G | 10/19/93 | 08275LA |
| FS2017 | 93.16814 V | ICPES | 12. | 1. | UG/G | 9/09/93 | 08275HA |
| FS2017 | 93.16814 ZN | ICPES | 120. | 12. | UG/G | 9/09/93 | 08275HA |
| FS2018 | 93.16815 AL | ICPES | 8400. | 840. | UG/G | 9/09/93 | 08275HA |
| FS2018 | 93.16815 AS | ETVAA | 2.5 | 0.5 | UG/G | 9/08/93 | |
| FS2018 | 93.16815 BA | ICPES | 220. | 22. | UG/G | 9/09/93 | 08275HA |
| FS2018 | 93.16815 BE | ICPES | 0.67 | 0.07 | UG/G | 9/09/93 | 08275HA |
| FS2018 | 93.16815 CA | ICPES | 9900. | 990. | UG/G | 9/09/93 | 08275HA |
| FS2018 | 93.16815 CD | ICPES | < 0.4 | | UG/G | 9/09/93 | 08275HA |
| FS2018 | 93.16815 CL | IC | 39.4 | 3.9 | UG/G | 9/10/93 | |
| FS2018 | 93.16815 CO | ICPES | 15. | 2. | UG/G | 9/09/93 | 08275HA |
| FS2018 | 93.16815 CR | ICPES | 6.9 | 0.7 | UG/G | 9/09/93 | 08275HA |
| FS2018 | 93.16815 CU | ICPES | 9.5 | 1. | UG/G | 9/09/93 | 08275HA |
| FS2018 | 93.16815 FE | ICPES | 10000. | 100. | UG/G | 9/09/93 | 08275HA |
| FS2018 | 93.16815 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2018 | 93.16815 K | ICPES | 2000. | 200. | UG/G | 9/09/93 | 08275HA |
| FS2018 | 93.16815 MG | ICPES | 1800. | 180. | UG/G | 9/09/93 | 08275HA |
| FS2018 | 93.16815 MN | ICPES | 1100. | 110. | UG/G | 9/09/93 | 08275HA |
| FS2018 | 93.16815 NA | ICPES | 350. | 35. | UG/G | 9/09/93 | 08275HA |
| FS2018 | 93.16815 NI | ICPES | 6. | 1. | UG/G | 9/09/93 | 08275HA |
| FS2018 | 93.16815 PB | ICPES | 38. | 4. | UG/G | 9/09/93 | 08275HA |
| FS2018 | 93.16815 SB | ICPES | < 5. | | UG/G | 10/19/93 | 08315HA |
| FS2018 | 93.16815 SE | ETVAA | 0.5 | 0.2 | UG/G | 9/08/93 | |
| FS2018 | 93.16815 SO4 | IC | 52. | 5.2 | UG/G | 11/19/93 | |
| FS2018 | 93.16815 TA | ICPMS | < 0.2 | | UG/G | 9/23/93 | 08315LA |
| FS2018 | 93.16815 TH | ICPMS | 5. | 0.5 | UG/G | 9/23/93 | 08315LA |
| FS2018 | 93.16815 TL | ICPMS | < 0.2 | | UG/G | 9/23/93 | 08315LA |
| FS2018 | 93.16815 U | ICPMS | 2.4 | 0.3 | UG/G | 9/23/93 | 08315LA |
| FS2018 | 93.16815 V | ICPES | 14. | 1. | UG/G | 9/09/93 | 08275HA |
| FS2018 | 93.16815 ZN | ICPES | 100. | 10. | UG/G | 9/09/93 | 08275HA |
| FS2019 | 93.16816 AL | ICPES | 5800. | 580. | UG/G | 9/09/93 | 08315HA |
| FS2019 | 93.16816 AS | ETVAA | 1.2 | 0.2 | UG/G | 9/08/93 | |
| FS2019 | 93.16816 BA | ICPES | 57. | 6. | UG/G | 9/09/93 | 08315HA |
| FS2019 | 93.16816 BE | ICPES | 0.55 | 0.06 | UG/G | 9/09/93 | 08315HA |

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|---|---|---|---|---|---|---|---|
| FS2019 | 93.16816 CA | ICPES | 2100. | 210. | UG/G | 9/09/93 | 08315HA |
| FS2019 | 93.16816 CD | ICPES | < 0.4 | | UG/G | 9/09/93 | 08315HA |
| FS2019 | 93.16816 CL | IC | 16.7 | 1.7 | UG/G | 9/10/93 | |
| FS2019 | 93.16816 CO | ICPES | 11. | 1. | UG/G | 9/09/93 | 08315HA |
| FS2019 | 93.16816 CR | ICPES | 3.7 | 0.4 | UG/G | 9/09/93 | 08315HA |
| FS2019 | 93.16816 CU | ICPES | 1.6 | 0.8 | UG/G | 9/09/93 | 08315HA |
| FS2019 | 93.16816 FE | ICPES | 7200. | 720. | UG/G | 9/09/93 | 08315HA |
| FS2019 | 93.16816 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2019 | 93.16816 K | ICPES | 1200. | 120. | UG/G | 9/09/93 | 08315HA |
| FS2019 | 93.16816 MG | ICPES | 1000. | 100. | UG/G | 9/09/93 | 08315HA |
| FS2019 | 93.16816 MN | ICPES | 400. | 40. | UG/G | 9/09/93 | 08315HA |
| FS2019 | 93.16816 NA | ICPES | 240. | 24. | UG/G | 9/09/93 | 08315HA |
| FS2019 | 93.16816 NI | ICPES | 3.2 | 0.9 | UG/G | 9/09/93 | 08315HA |
| FS2019 | 93.16816 PB | ICPES | 6. | 2. | UG/G | 9/09/93 | 08315HA |
| FS2019 | 93.16816 SB | ICPES | < 5. | | UG/G | 10/19/93 | 08315HA |
| FS2019 | 93.16816 SE | ETVAA | < 0.2 | | UG/G | 9/08/93 | |
| FS2019 | 93.16816 SO4 | IC | 22. | 2.2 | UG/G | 11/19/93 | |
| FS2019 | 93.16816 TA | ICPMS | < 0.2 | | UG/G | 9/23/93 | 08315LA |
| FS2019 | 93.16816 TH | ICPMS | 4. | 0.2 | UG/G | 9/23/93 | 08315LA |
| FS2019 | 93.16816 TL | ICPMS | < 0.2 | | UG/G | 9/23/93 | 08315LA |
| FS2019 | 93.16816 U | ICPMS | 0.4 | 0.2 | UG/G | 9/23/93 | 08315LA |
| FS2019 | 93.16816 V | ICPES | 9. | 1. | UG/G | 9/09/93 | 08315HA |
| FS2019 | 93.16816 ZN | ICPES | 32. | 3. | UG/G | 9/09/93 | 08315HA |
| FS2020 | 93.16817 AL | ICPES | 4100. | 410. | UG/G | 9/09/93 | 08315HA |
| FS2020 | 93.16817 AS | ETVAA | 1. | 0.2 | UG/G | 9/08/93 | |
| FS2020 | 93.16817 BA | ICPES | 56. | 6. | UG/G | 9/09/93 | 08315HA |
| FS2020 | 93.16817 BE | ICPES | 0.41 | 0.04 | UG/G | 9/09/93 | 08315HA |
| FS2020 | 93.16817 CA | ICPES | 2300. | 230. | UG/G | 9/09/93 | 08315HA |
| FS2020 | 93.16817 CD | ICPES | < 0.4 | | UG/G | 9/09/93 | 08315HA |
| FS2020 | 93.16817 CL | IC | 15.9 | 1.6 | UG/G | 9/10/93 | |
| FS2020 | 93.16817 CO | ICPES | 18. | 2. | UG/G | 9/09/93 | 08315HA |
| FS2020 | 93.16817 CR | ICPES | 3. | 0.3 | UG/G | 9/09/93 | 08315HA |
| FS2020 | 93.16817 CU | ICPES | 2. | 1. | UG/G | 9/09/93 | 08315HA |
| FS2020 | 93.16817 FE | ICPES | 6100. | 610. | UG/G | 9/09/93 | 08315HA |
| FS2020 | 93.16817 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2020 | 93.16817 K | ICPES | 930. | 93. | UG/G | 9/09/93 | 08315HA |
| FS2020 | 93.16817 MG | ICPES | 680. | 68. | UG/G | 9/09/93 | 08315HA |
| FS2020 | 93.16817 MN | ICPES | 380. | 38. | UG/G | 9/09/93 | 08315HA |
| FS2020 | 93.16817 NA | ICPES | 240. | 24. | UG/G | 9/09/93 | 08315HA |
| FS2020 | 93.16817 NI | ICPES | 2. | 0.2 | UG/G | 9/09/93 | 08315HA |
| FS2020 | 93.16817 PB | ICPES | 10. | 4. | UG/G | 9/09/93 | 08315HA |
| FS2020 | 93.16817 SB | ICPES | < 5. | | UG/G | 10/19/93 | 08315HA |
| FS2020 | 93.16817 SE | ETVAA | < 0.2 | | UG/G | 9/08/93 | |
| FS2020 | 93.16817 SO4 | IC | 17. | 1.7 | UG/G | 11/19/93 | |
| FS2020 | 93.16817 TA | ICPMS | < 0.2 | | UG/G | 9/23/93 | 08315LA |
| FS2020 | 93.16817 TH | ICPMS | 4. | 0.4 | UG/G | 9/23/93 | 08315LA |
| FS2020 | 93.16817 TL | ICPMS | < 0.2 | | UG/G | 9/23/93 | 08315LA |
| FS2020 | 93.16817 U | ICPMS | 0.4 | 0.2 | UG/G | 9/23/93 | 08315LA |
| FS2020 | 93.16817 V | ICPES | 7. | 0.7 | UG/G | 9/09/93 | 08315HA |
| FS2020 | 93.16817 ZN | ICPES | 29. | 3. | UG/G | 9/09/93 | 08315HA |
| FS2021 | 93.16818 AL | ICPES | 6700. | 670. | UG/G | 9/09/93 | 08315HA |
| FS2021 | 93.16818 AS | ETVAA | 1.4 | 0.3 | UG/G | 9/08/93 | |
| FS2021 | 93.16818 BA | ICPES | 58. | 6. | UG/G | 9/09/93 | 08315HA |
| FS2021 | 93.16818 BE | ICPES | 0.69 | 0.07 | UG/G | 9/09/93 | 08315HA |
| FS2021 | 93.16818 CA | ICPES | 1300. | 130. | UG/G | 9/09/93 | 08315HA |
| FS2021 | 93.16818 CD | ICPES | < 0.4 | | UG/G | 9/09/93 | 08315HA |
| FS2021 | 93.16818 CL | IC | 14. | 1.4 | UG/G | 9/10/93 | |
| FS2021 | 93.16818 CO | ICPES | 10. | 1. | UG/G | 9/09/93 | 08315HA |
| FS2021 | 93.16818 CR | ICPES | 4.4 | 0.4 | UG/G | 9/09/93 | 08315HA |
| FS2021 | 93.16818 CU | ICPES | 3.3 | 0.3 | UG/G | 9/09/93 | 08315HA |

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| FS2021 | 93.16818 FE | ICPES | 5400. | 540. | UG/G | 9/09/93 | 08315HA |
| FS2021 | 93.16818 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2021 | 93.16818 K | ICPES | 1200. | 120. | UG/G | 9/09/93 | 08315HA |
| FS2021 | 93.16818 MG | ICPES | 1100. | 110. | UG/G | 9/09/93 | 08315HA |
| FS2021 | 93.16818 MN | ICPES | 200. | 20. | UG/G | 9/09/93 | 08315HA |
| FS2021 | 93.16818 NA | ICPES | 140. | 14. | UG/G | 9/09/93 | 08315HA |
| FS2021 | 93.16818 NI | ICPES | 4.8 | 0.5 | UG/G | 9/09/93 | 08315HA |
| FS2021 | 93.16818 PB | ICPES | 7. | 4. | UG/G | 9/09/93 | 08315HA |
| FS2021 | 93.16818 SB | ICPES | < 5. | | UG/G | 10/19/93 | 08315HA |
| FS2021 | 93.16818 SE | ETVAA | < 0.2 | | UG/G | 9/08/93 | |
| FS2021 | 93.16818 SO4 | IC | 30. | 3. | UG/G | 11/19/93 | |
| FS2021 | 93.16818 TA | ICPMS | < 0.2 | | UG/G | 9/23/93 | 08315LA |
| FS2021 | 93.16818 TH | ICPMS | 5. | 0.2 | UG/G | 9/23/93 | 08315LA |
| FS2021 | 93.16818 TL | ICPMS | < 0.2 | | UG/G | 9/23/93 | 08315LA |
| FS2021 | 93.16818 U | ICPMS | 0.5 | 0.2 | UG/G | 9/23/93 | 08315LA |
| FS2021 | 93.16818 V | ICPES | 9.3 | 0.9 | UG/G | 9/09/93 | 08315HA |
| FS2021 | 93.16818 ZN | ICPES | 26. | 3. | UG/G | 9/09/93 | 08315HA |
| FS2022 | 93.16819 AL | ICPES | 12000. | 1200. | UG/G | 9/09/93 | 08315HA |
| FS2022 | 93.16819 AS | ETVAA | 3.8 | 0.8 | UG/G | 9/08/93 | |
| FS2022 | 93.16819 BA | ICPES | 140. | 14. | UG/G | 9/09/93 | 08315HA |
| FS2022 | 93.16819 BE | ICPES | 1. | 0.1 | UG/G | 9/09/93 | 08315HA |
| FS2022 | 93.16819 CA | ICPES | 2500. | 250. | UG/G | 9/09/93 | 08315HA |
| FS2022 | 93.16819 CD | ICPES | < 0.4 | | UG/G | 9/09/93 | 08315HA |
| FS2022 | 93.16819 CL | IC | 44.7 | 4.5 | UG/G | 9/10/93 | |
| FS2022 | 93.16819 CO | ICPES | 12. | 1. | UG/G | 9/09/93 | 08315HA |
| FS2022 | 93.16819 CR | ICPES | 8. | 0.8 | UG/G | 9/09/93 | 08315HA |
| FS2022 | 93.16819 CU | ICPES | 4.3 | 0.4 | UG/G | 9/09/93 | 08315HA |
| FS2022 | 93.16819 FE | ICPES | 10000. | 1000. | UG/G | 9/09/93 | 08315HA |
| FS2022 | 93.16819 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2022 | 93.16819 K | ICPES | 2200. | 220. | UG/G | 9/09/93 | 08315HA |
| FS2022 | 93.16819 MG | ICPES | 2200. | 220. | UG/G | 9/09/93 | 08315HA |
| FS2022 | 93.16819 MN | ICPES | 300. | 30. | UG/G | 9/09/93 | 08315HA |
| FS2022 | 93.16819 NA | ICPES | 680. | 68. | UG/G | 9/09/93 | 08315HA |
| FS2022 | 93.16819 NI | ICPES | 8.2 | 0.8 | UG/G | 9/09/93 | 08315HA |
| FS2022 | 93.16819 PB | ICPES | 12. | 3. | UG/G | 9/09/93 | 08315HA |
| FS2022 | 93.16819 SB | ICPES | < 5. | | UG/G | 10/19/93 | 08315HA |
| FS2022 | 93.16819 SE | ETVAA | 0.3 | 0.2 | UG/G | 9/08/93 | |
| FS2022 | 93.16819 SO4 | IC | 116. | 12. | UG/G | 11/19/93 | |
| FS2022 | 93.16819 TA | ICPMS | < 0.2 | | UG/G | 9/23/93 | 08315LA |
| FS2022 | 93.16819 TH | ICPMS | 8. | 3. | UG/G | 9/23/93 | 08315LA |
| FS2022 | 93.16819 TL | ICPMS | < 0.2 | | UG/G | 9/23/93 | 08315LA |
| FS2022 | 93.16819 U | ICPMS | 1. | 0.2 | UG/G | 9/23/93 | 08315LA |
| FS2022 | 93.16819 V | ICPES | 18. | 2. | UG/G | 9/09/93 | 08315HA |
| FS2022 | 93.16819 ZN | ICPES | 35. | 4. | UG/G | 9/09/93 | 08315HA |
| FS2023 | 93.16820 AL | ICPES | 14000. | 1400. | UG/G | 9/09/93 | 08315HA |
| FS2023 | 93.16820 AS | ETVAA | 2.7 | 0.5 | UG/G | 9/08/93 | |
| FS2023 | 93.16820 BA | ICPES | 120. | 12. | UG/G | 9/09/93 | 08315HA |
| FS2023 | 93.16820 BE | ICPES | 1. | 0.1 | UG/G | 9/09/93 | 08315HA |
| FS2023 | 93.16820 CA | ICPES | 3700. | 370. | UG/G | 9/09/93 | 08315HA |
| FS2023 | 93.16820 CD | ICPES | < 0.4 | | UG/G | 9/09/93 | 08315HA |
| FS2023 | 93.16820 CL | IC | 38.3 | 3.8 | UG/G | 9/10/93 | |
| FS2023 | 93.16820 CO | ICPES | 13. | 1. | UG/G | 9/09/93 | 08315HA |
| FS2023 | 93.16820 CR | ICPES | 8.4 | 0.8 | UG/G | 9/09/93 | 08315HA |
| FS2023 | 93.16820 CU | ICPES | 3.7 | 0.4 | UG/G | 9/09/93 | 08315HA |
| FS2023 | 93.16820 FE | ICPES | 10000. | 1000. | UG/G | 9/09/93 | 08315HA |
| FS2023 | 93.16820 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2023 | 93.16820 K | ICPES | 2300. | 230. | UG/G | 9/09/93 | 08315HA |
| FS2023 | 93.16820 MG | ICPES | 2200. | 220. | UG/G | 9/09/93 | 08315HA |
| FS2023 | 93.16820 MN | ICPES | 240. | 24. | UG/G | 9/09/93 | 08315HA |
| FS2023 | 93.16820 NA | ICPES | 330. | 33. | UG/G | 9/09/93 | 08315HA |

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| FS2023 | 93.16820 NI | ICPES | 8. | 1. | UG/G | 9/09/93 | 08315HA |
| FS2023 | 93.16820 PB | ICPES | 11. | 4. | UG/G | 9/09/93 | 08315HA |
| FS2023 | 93.16820 SB | ICPES | < 5. | | UG/G | 10/19/93 | 08315HA |
| FS2023 | 93.16820 SE | ETVAA | < 0.2 | | UG/G | 9/08/93 | |
| FS2023 | 93.16820 SO4 | IC | 403. | 40. | UG/G | 11/19/93 | |
| FS2023 | 93.16820 TA | ICPMS | < 0.2 | | UG/G | 9/23/93 | 08315LA |
| FS2023 | 93.16820 TH | ICPMS | 8. | 0.4 | UG/G | 9/23/93 | 08315LA |
| FS2023 | 93.16820 TL | ICPMS | < 0.2 | | UG/G | 9/23/93 | 08315LA |
| FS2023 | 93.16820 U | ICPMS | 0.7 | 0.2 | UG/G | 9/23/93 | 08315LA |
| FS2023 | 93.16820 V | ICPES | 15. | 2. | UG/G | 9/09/93 | 08315HA |
| FS2023 | 93.16820 ZN | ICPES | 35. | 4. | UG/G | 9/09/93 | 08315HA |
| FS2026 | 93.16821 AL | ICPES | 37000. | 3700. | UG/G | 9/09/93 | 08315HA |
| FS2026 | 93.16821 AS | ETVAA | 5.4 | 1.1 | UG/G | 9/08/93 | |
| FS2026 | 93.16821 BA | ICPES | 190. | 19. | UG/G | 9/09/93 | 08315HA |
| FS2026 | 93.16821 BE | ICPES | 1.7 | 0.2 | UG/G | 9/09/93 | 08315HA |
| FS2026 | 93.16821 CA | ICPES | 3300. | 330. | UG/G | 9/09/93 | 08315HA |
| FS2026 | 93.16821 CD | ICPES | < 0.4 | | UG/G | 9/09/93 | 08315HA |
| FS2026 | 93.16821 CL | IC | 47.8 | 4.8 | UG/G | 9/10/93 | |
| FS2026 | 93.16821 CO | ICPES | 12. | 1. | UG/G | 9/09/93 | 08315HA |
| FS2026 | 93.16821 CR | ICPES | 16. | 2. | UG/G | 9/09/93 | 08315HA |
| FS2026 | 93.16821 CU | ICPES | 3.9 | 0.4 | UG/G | 9/09/93 | 08315HA |
| FS2026 | 93.16821 FE | ICPES | 22000. | 2200. | UG/G | 9/09/93 | 08315HA |
| FS2026 | 93.16821 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2026 | 93.16821 K | ICPES | 2800. | 280. | UG/G | 9/09/93 | 08315HA |
| FS2026 | 93.16821 MG | ICPES | 4000. | 400. | UG/G | 9/09/93 | 08315HA |
| FS2026 | 93.16821 MN | ICPES | 240. | 24. | UG/G | 9/09/93 | 08315HA |
| FS2026 | 93.16821 NA | ICPES | 710. | 71. | UG/G | 9/09/93 | 08315HA |
| FS2026 | 93.16821 NI | ICPES | 13. | 1. | UG/G | 9/09/93 | 08315HA |
| FS2026 | 93.16821 PB | ICPES | 20. | 4. | UG/G | 9/09/93 | 08315HA |
| FS2026 | 93.16821 SB | ICPES | < 5. | | UG/G | 10/19/93 | 08315HA |
| FS2026 | 93.16821 SE | ETVAA | 1.2 | 0.2 | UG/G | 9/08/93 | |
| FS2026 | 93.16821 SO4 | IC | 196. | 20. | UG/G | 11/19/93 | |
| FS2026 | 93.16821 TA | ICPMS | < 0.2 | | UG/G | 9/23/93 | 08315LA |
| FS2026 | 93.16821 TH | ICPMS | 9. | 1. | UG/G | 9/23/93 | 08315LA |
| FS2026 | 93.16821 TL | ICPMS | 0.7 | 0.2 | UG/G | 9/23/93 | 08315LA |
| FS2026 | 93.16821 U | ICPMS | 0.8 | 0.2 | UG/G | 9/23/93 | 08315LA |
| FS2026 | 93.16821 V | ICPES | 31. | 3. | UG/G | 9/09/93 | 08315HA |
| FS2026 | 93.16821 ZN | ICPES | 48. | 5. | UG/G | 9/09/93 | 08315HA |
| FS2027 | 93.16822 AL | ICPES | 13000. | 1300. | UG/G | 9/09/93 | 08315HA |
| FS2027 | 93.16822 AS | ETVAA | 4.7 | 0.9 | UG/G | 9/08/93 | |
| FS2027 | 93.16822 BA | ICPES | 100. | 10. | UG/G | 9/09/93 | 08315HA |
| FS2027 | 93.16822 BE | ICPES | 0.68 | 0.07 | UG/G | 9/09/93 | 08315HA |
| FS2027 | 93.16822 CA | ICPES | 1600. | 160. | UG/G | 9/09/93 | 08315HA |
| FS2027 | 93.16822 CD | ICPES | < 0.4 | | UG/G | 9/09/93 | 08315HA |
| FS2027 | 93.16822 CL | IC | 17.1 | 1.7 | UG/G | 9/10/93 | |
| FS2027 | 93.16822 CO | ICPES | 18. | 2. | UG/G | 9/09/93 | 08315HA |
| FS2027 | 93.16822 CR | ICPES | 11. | 1. | UG/G | 9/09/93 | 08315HA |
| FS2027 | 93.16822 CU | ICPES | 3. | 0.3 | UG/G | 9/09/93 | 08315HA |
| FS2027 | 93.16822 FE | ICPES | 12000. | 1200. | UG/G | 9/09/93 | 08315HA |
| FS2027 | 93.16822 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2027 | 93.16822 K | ICPES | 2000. | 200. | UG/G | 9/09/93 | 08315HA |
| FS2027 | 93.16822 MG | ICPES | 1800. | 180. | UG/G | 9/09/93 | 08315HA |
| FS2027 | 93.16822 MN | ICPES | 350. | 35. | UG/G | 9/09/93 | 08315HA |
| FS2027 | 93.16822 NA | ICPES | 320. | 32. | UG/G | 9/09/93 | 08315HA |
| FS2027 | 93.16822 NI | ICPES | 7. | 1. | UG/G | 9/09/93 | 08315HA |
| FS2027 | 93.16822 PB | ICPES | 20. | 2. | UG/G | 9/09/93 | 08315HA |
| FS2027 | 93.16822 SB | ICPES | < 5. | | UG/G | 10/19/93 | 08315HA |
| FS2027 | 93.16822 SE | ETVAA | 0.4 | 0.2 | UG/G | 9/08/93 | |
| FS2027 | 93.16822 SO4 | IC | 26. | 2.6 | UG/G | 11/19/93 | |
| FS2027 | 93.16822 TA | ICPMS | < 0.2 | | UG/G | 9/23/93 | 08315LA |

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| FS2027 | 93.16822 | TH | ICPMS | 8. | 2. | UG/G | 9/23/93 08315LA |
| FS2027 | 93.16822 | TL | ICPMS | 0.2 | 0.2 | UG/G | 9/23/93 08315LA |
| FS2027 | 93.16822 | U | ICPMS | 1. | 0.2 | UG/G | 9/23/93 08315LA |
| FS2027 | 93.16822 | V | ICPES | 31. | 3. | UG/G | 9/09/93 08315HA |
| FS2027 | 93.16822 | ZN | ICPES | 21. | 2. | UG/G | 9/09/93 08315HA |
| FS2028 | 93.16823 | AL | ICPES | 39000. | 3900. | UG/G | 9/09/93 08315HA |
| FS2028 | 93.16823 | AS | ETVAA | 9.3 | 1.9 | UG/G | 9/09/93 |
| FS2028 | 93.16823 | BA | ICPES | 140. | 14. | UG/G | 9/09/93 08315HA |
| FS2028 | 93.16823 | BE | ICPES | 1.8 | 0.2 | UG/G | 9/09/93 08315HA |
| FS2028 | 93.16823 | CA | ICPES | 4100. | 410. | UG/G | 9/09/93 08315HA |
| FS2028 | 93.16823 | CD | ICPES | < 0.4 | | UG/G | 9/09/93 08315HA |
| FS2028 | 93.16823 | CL | IC | 59.5 | 5.9 | UG/G | 9/10/93 |
| FS2028 | 93.16823 | CO | ICPES | 8.1 | 0.8 | UG/G | 9/09/93 08315HA |
| FS2028 | 93.16823 | CR | ICPES | 21. | 2. | UG/G | 9/09/93 08315HA |
| FS2028 | 93.16823 | CU | ICPES | 8.2 | 0.8 | UG/G | 9/09/93 08315HA |
| FS2028 | 93.16823 | FE | ICPES | 25000. | 2500. | UG/G | 9/09/93 08315HA |
| FS2028 | 93.16823 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 |
| FS2028 | 93.16823 | K | ICPES | 3700. | 370. | UG/G | 9/09/93 08315HA |
| FS2028 | 93.16823 | MG | ICPES | 4700. | 470. | UG/G | 9/09/93 08315HA |
| FS2028 | 93.16823 | MN | ICPES | 190. | 19. | UG/G | 9/09/93 08315HA |
| FS2028 | 93.16823 | NA | ICPES | 600. | 60. | UG/G | 9/09/93 08315HA |
| FS2028 | 93.16823 | NI | ICPES | 16. | 2. | UG/G | 9/09/93 08315HA |
| FS2028 | 93.16823 | PB | ICPES | 20. | 3. | UG/G | 9/09/93 08315HA |
| FS2028 | 93.16823 | SB | ICPES | < 5. | | UG/G | 10/19/93 08315HA |
| FS2028 | 93.16823 | SE | ETVAA | 1.2 | 0.2 | UG/G | 9/08/93 |
| FS2028 | 93.16823 | SO4 | IC | 98. | 10. | UG/G | 11/19/93 |
| FS2028 | 93.16823 | TA | ICPMS | < 0.2 | | UG/G | 9/23/93 08315LA |
| FS2028 | 93.16823 | TH | ICPMS | 11. | 1. | UG/G | 9/23/93 08315LA |
| FS2028 | 93.16823 | TL | ICPMS | 0.7 | 0.2 | UG/G | 9/23/93 08315LA |
| FS2028 | 93.16823 | U | ICPMS | 1.4 | 0.2 | UG/G | 9/23/93 08315LA |
| FS2028 | 93.16823 | V | ICPES | 45. | 5. | UG/G | 9/09/93 08315HA |
| FS2028 | 93.16823 | ZN | ICPES | 60. | 6. | UG/G | 9/09/93 08315HA |
| FS2029 | 93.16824 | AL | ICPES | 43000. | 4300. | UG/G | 9/09/93 08315HA |
| FS2029 | 93.16824 | AS | ETVAA | 6.2 | 1.2 | UG/G | 9/08/93 |
| FS2029 | 93.16824 | BA | ICPES | 150. | 15. | UG/G | 9/09/93 08315HA |
| FS2029 | 93.16824 | BE | ICPES | 2. | 0.2 | UG/G | 9/09/93 08315HA |
| FS2029 | 93.16824 | CA | ICPES | 4200. | 420. | UG/G | 9/09/93 08315HA |
| FS2029 | 93.16824 | CD | ICPES | < 0.4 | | UG/G | 9/09/93 08315HA |
| FS2029 | 93.16824 | CL | IC | 103. | 10. | UG/G | 9/10/93 |
| FS2029 | 93.16824 | CO | ICPES | 8.5 | 0.9 | UG/G | 9/09/93 08315HA |
| FS2029 | 93.16824 | CR | ICPES | 23. | 2. | UG/G | 9/09/93 08315HA |
| FS2029 | 93.16824 | CU | ICPES | 8.5 | 0.9 | UG/G | 9/09/93 08315HA |
| FS2029 | 93.16824 | FE | ICPES | 26000. | 2600. | UG/G | 9/09/93 08315HA |
| FS2029 | 93.16824 | HG | CVAA | 0.2 | 0.1 | UG/G | 8/31/93 |
| FS2029 | 93.16824 | K | ICPES | 4100. | 410. | UG/G | 9/09/93 08315HA |
| FS2029 | 93.16824 | MG | ICPES | 5000. | 500. | UG/G | 9/09/93 08315HA |
| FS2029 | 93.16824 | MN | ICPES | 200. | 20. | UG/G | 9/09/93 08315HA |
| FS2029 | 93.16824 | NA | ICPES | 510. | 51. | UG/G | 9/09/93 08315HA |
| FS2029 | 93.16824 | NI | ICPES | 16. | 2. | UG/G | 9/09/93 08315HA |
| FS2029 | 93.16824 | PB | ICPES | 26. | 3. | UG/G | 9/09/93 08315HA |
| FS2029 | 93.16824 | SB | ICPES | < 5. | | UG/G | 10/19/93 08315HA |
| FS2029 | 93.16824 | SE | ETVAA | 1.1 | 0.2 | UG/G | 9/08/93 |
| FS2029 | 93.16824 | SO4 | IC | 199. | 20. | UG/G | 11/19/93 |
| FS2029 | 93.16824 | TA | ICPMS | < 0.2 | | UG/G | 9/23/93 08315LA |
| FS2029 | 93.16824 | TH | ICPMS | 11. | 2. | UG/G | 9/23/93 08315LA |
| FS2029 | 93.16824 | TL | ICPMS | 0.7 | 0.2 | UG/G | 9/23/93 08315LA |
| FS2029 | 93.16824 | U | ICPMS | 1.4 | 0.3 | UG/G | 9/23/93 08315LA |
| FS2029 | 93.16824 | V | ICPES | 50. | 5. | UG/G | 9/09/93 08315HA |
| FS2029 | 93.16824 | ZN | ICPES | 52. | 5. | UG/G | 9/09/93 08315HA |
| FS2030 | 93.16825 | AL | ICPES | 24000. | 2400. | UG/G | 9/09/93 08315HA |

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| FS2030 | 93.16825 | AS | ETVAA | 6.3 | 1.3 | UG/G | 9/08/93 | |
| FS2030 | 93.16825 | BA | ICPES | 430. | 43. | UG/G | 9/09/93 | 08315HA |
| FS2030 | 93.16825 | BE | ICPES | 1.1 | 0.1 | UG/G | 9/09/93 | 08315HA |
| FS2030 | 93.16825 | CA | ICPES | 26000. | 26000. | UG/G | 9/09/93 | 08315HA |
| FS2030 | 93.16825 | CD | ICPES | < 0.4 | | UG/G | 9/09/93 | 08315HA |
| FS2030 | 93.16825 | CL | IC | 17.8 | 1.8 | UG/G | 9/10/93 | |
| FS2030 | 93.16825 | CO | ICPES | 8.4 | 0.8 | UG/G | 9/09/93 | 08315HA |
| FS2030 | 93.16825 | CR | ICPES | 11. | 1. | UG/G | 9/09/93 | 08315HA |
| FS2030 | 93.16825 | CU | ICPES | 3.8 | 0.4 | UG/G | 9/09/93 | 08315HA |
| FS2030 | 93.16825 | FE | ICPES | 13000. | 1300. | UG/G | 9/09/93 | 08315HA |
| FS2030 | 93.16825 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2030 | 93.16825 | K | ICPES | 3200. | 320. | UG/G | 9/09/93 | 08315HA |
| FS2030 | 93.16825 | MG | ICPES | 3800. | 380. | UG/G | 9/09/93 | 08315HA |
| FS2030 | 93.16825 | MN | ICPES | 200. | 20. | UG/G | 9/09/93 | 08315HA |
| FS2030 | 93.16825 | NA | ICPES | 1200. | 120. | UG/G | 9/09/93 | 08315HA |
| FS2030 | 93.16825 | NI | ICPES | 9. | 1. | UG/G | 9/09/93 | 08315HA |
| FS2030 | 93.16825 | PB | ICPES | 12. | 1. | UG/G | 9/09/93 | 08315HA |
| FS2030 | 93.16825 | SB | ICPES | < 5. | | UG/G | 10/19/93 | 08315HA |
| FS2030 | 93.16825 | SE | ETVAA | 0.6 | 0.2 | UG/G | 9/08/93 | |
| FS2030 | 93.16825 | SO4 | IC | 130. | 13. | UG/G | 11/19/93 | |
| FS2030 | 93.16825 | TA | ICPMS | < 0.2 | | UG/G | 9/23/93 | 08315LA |
| FS2030 | 93.16825 | TH | ICPMS | 8. | 1. | UG/G | 9/23/93 | 08315LA |
| FS2030 | 93.16825 | TL | ICPMS | 0.2 | 0.2 | UG/G | 9/23/93 | 08315LA |
| FS2030 | 93.16825 | U | ICPMS | 2. | 1. | UG/G | 9/23/93 | 08315LA |
| FS2030 | 93.16825 | V | ICPES | 28. | 3. | UG/G | 9/09/93 | 08315HA |
| FS2030 | 93.16825 | ZN | ICPES | 26. | 3. | UG/G | 9/09/93 | 08315HA |
| FS2031 | 93.16826 | AL | ICPES | 20000. | 2000. | UG/G | 9/09/93 | 08315HA |
| FS2031 | 93.16826 | AS | ETVAA | 5.4 | 1.1 | UG/G | 9/08/93 | |
| FS2031 | 93.16826 | BA | ICPES | 220. | 22. | UG/G | 9/09/93 | 08315HA |
| FS2031 | 93.16826 | BE | ICPES | 1. | 0.1 | UG/G | 9/09/93 | 08315HA |
| FS2031 | 93.16826 | CA | ICPES | 1800. | 180. | UG/G | 9/09/93 | 08315HA |
| FS2031 | 93.16826 | CD | ICPES | < 0.4 | | UG/G | 9/09/93 | 08315HA |
| FS2031 | 93.16826 | CL | IC | 16.7 | 1.7 | UG/G | 9/10/93 | |
| FS2031 | 93.16826 | CO | ICPES | 11. | 1. | UG/G | 9/09/93 | 08315HA |
| FS2031 | 93.16826 | CR | ICPES | 13. | 1. | UG/G | 9/09/93 | 08315HA |
| FS2031 | 93.16826 | CU | ICPES | 4.8 | 0.5 | UG/G | 9/09/93 | 08315HA |
| FS2031 | 93.16826 | FE | ICPES | 16000. | 1600. | UG/G | 9/09/93 | 08315HA |
| FS2031 | 93.16826 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2031 | 93.16826 | K | ICPES | 2200. | 220. | UG/G | 9/09/93 | 08315HA |
| FS2031 | 93.16826 | MG | ICPES | 2800. | 280. | UG/G | 9/09/93 | 08315HA |
| FS2031 | 93.16826 | MN | ICPES | 350. | 35. | UG/G | 9/09/93 | 08315HA |
| FS2031 | 93.16826 | NA | ICPES | 360. | 36. | UG/G | 9/09/93 | 08315HA |
| FS2031 | 93.16826 | NI | ICPES | 8. | 1. | UG/G | 9/09/93 | 08315HA |
| FS2031 | 93.16826 | PB | ICPES | 16. | 5. | UG/G | 9/09/93 | 08315HA |
| FS2031 | 93.16826 | SB | ICPES | < 5. | | UG/G | 10/19/93 | 08315HA |
| FS2031 | 93.16826 | SE | ETVAA | 0.6 | 0.2 | UG/G | 9/08/93 | |
| FS2031 | 93.16826 | SO4 | IC | 70. | 7. | UG/G | 11/19/93 | |
| FS2031 | 93.16826 | TA | ICPMS | < 0.2 | | UG/G | 9/23/93 | 08315LA |
| FS2031 | 93.16826 | TH | ICPMS | 9. | 2. | UG/G | 9/23/93 | 08315LA |
| FS2031 | 93.16826 | TL | ICPMS | < 0.2 | | UG/G | 9/23/93 | 08315LA |
| FS2031 | 93.16826 | U | ICPMS | 0.8 | 0.2 | UG/G | 9/23/93 | 08315LA |
| FS2031 | 93.16826 | V | ICPES | 32. | 3. | UG/G | 9/09/93 | 08315HA |
| FS2031 | 93.16826 | ZN | ICPES | 31. | 3. | UG/G | 9/09/93 | 08315HA |
| FS2032 | 93.16827 | AL | ICPES | 14000. | 1400. | UG/G | 9/09/93 | 08315HA |
| FS2032 | 93.16827 | AS | ETVAA | 4.2 | 0.8 | UG/G | 9/08/93 | |
| FS2032 | 93.16827 | BA | ICPES | 130. | 13. | UG/G | 9/09/93 | 08315HA |
| FS2032 | 93.16827 | BE | ICPES | 0.8 | 0.08 | UG/G | 9/09/93 | 08315HA |
| FS2032 | 93.16827 | CA | ICPES | 2000. | 200. | UG/G | 9/09/93 | 08315HA |
| FS2032 | 93.16827 | CD | ICPES | < 0.4 | | UG/G | 9/09/93 | 08315HA |
| FS2032 | 93.16827 | CL | IC | 14.6 | 1.5 | UG/G | 9/10/93 | |

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| FS2032 | 93.16827 CO | ICPES | 12. | 1. | UG/G | 9/09/93 | 08315HA |
| FS2032 | 93.16827 CR | ICPES | 12. | 1. | UG/G | 9/09/93 | 08315HA |
| FS2032 | 93.16827 CU | ICPES | 5.5 | 0.6 | UG/G | 9/09/93 | 08315HA |
| FS2032 | 93.16827 FE | ICPES | 13000. | 1300. | UG/G | 9/09/93 | 08315HA |
| FS2032 | 93.16827 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2032 | 93.16827 K | ICPES | 2900. | 290. | UG/G | 9/09/93 | 08315HA |
| FS2032 | 93.16827 MG | ICPES | 2500. | 250. | UG/G | 9/09/93 | 08315HA |
| FS2032 | 93.16827 MN | ICPES | 420. | 42. | UG/G | 9/09/93 | 08315HA |
| FS2032 | 93.16827 NA | ICPES | 270. | 27. | UG/G | 9/09/93 | 08315HA |
| FS2032 | 93.16827 NI | ICPES | 8.7 | 0.9 | UG/G | 9/09/93 | 08315HA |
| FS2032 | 93.16827 PB | ICPES | 20. | 5. | UG/G | 9/09/93 | 08315HA |
| FS2032 | 93.16827 SB | ICPES | < 5. | | UG/G | 10/19/93 | 08315HA |
| FS2032 | 93.16827 SE | ETVAA | < 0.2 | | UG/G | 9/08/93 | |
| FS2032 | 93.16827 SO4 | IC | 26. | 2.6 | UG/G | 11/19/93 | |
| FS2032 | 93.16827 TA | ICPMS | < 0.2 | | UG/G | 9/23/93 | 08315LA |
| FS2032 | 93.16827 TH | ICPMS | 8. | 1. | UG/G | 9/23/93 | 08315LA |
| FS2032 | 93.16827 TL | ICPMS | 0.2 | 0.2 | UG/G | 9/23/93 | 08315LA |
| FS2032 | 93.16827 U | ICPMS | 1.1 | 0.2 | UG/G | 9/23/93 | 08315LA |
| FS2032 | 93.16827 V | ICPES | 28. | 3. | UG/G | 9/09/93 | 08315HA |
| FS2032 | 93.16827 ZN | ICPES | 36. | 4. | UG/G | 9/09/93 | 08315HA |
| FS2033 | 93.16828 AL | ICPES | 52000. | 5200. | UG/G | 9/09/93 | 08315HA |
| FS2033 | 93.16828 AS | ETVAA | 10.8 | 2.2 | UG/G | 9/09/93 | |
| FS2033 | 93.16828 BA | ICPES | 360. | 36. | UG/G | 9/09/93 | 08315HA |
| FS2033 | 93.16828 BE | ICPES | 2.5 | 0.3 | UG/G | 9/09/93 | 08315HA |
| FS2033 | 93.16828 CA | ICPES | 5700. | 570. | UG/G | 9/09/93 | 08315HA |
| FS2033 | 93.16828 CD | ICPES | < 0.4 | | UG/G | 9/09/93 | 08315HA |
| FS2033 | 93.16828 CL | IC | 99.8 | 10. | UG/G | 9/10/93 | |
| FS2033 | 93.16828 CO | ICPES | 8.7 | 0.9 | UG/G | 9/09/93 | 08315HA |
| FS2033 | 93.16828 CR | ICPES | 21. | 2. | UG/G | 9/09/93 | 08315HA |
| FS2033 | 93.16828 CU | ICPES | 8.8 | 0.9 | UG/G | 9/09/93 | 08315HA |
| FS2033 | 93.16828 FE | ICPES | 28000. | 2800. | UG/G | 9/09/93 | 08315HA |
| FS2033 | 93.16828 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2033 | 93.16828 K | ICPES | 4600. | 460. | UG/G | 9/09/93 | 08315HA |
| FS2033 | 93.16828 MG | ICPES | 6300. | 630. | UG/G | 9/09/93 | 08315HA |
| FS2033 | 93.16828 MN | ICPES | 120. | 12. | UG/G | 9/09/93 | 08315HA |
| FS2033 | 93.16828 NA | ICPES | 590. | 59. | UG/G | 9/09/93 | 08315HA |
| FS2033 | 93.16828 NI | ICPES | 20. | 2. | UG/G | 9/09/93 | 08315HA |
| FS2033 | 93.16828 PB | ICPES | 23. | 2. | UG/G | 9/09/93 | 08315HA |
| FS2033 | 93.16828 SB | ICPES | < 5. | | UG/G | 10/19/93 | 08315HA |
| FS2033 | 93.16828 SE | ETVAA | 1.5 | 0.3 | UG/G | 9/08/93 | |
| FS2033 | 93.16828 SO4 | IC | 189. | 19. | UG/G | 11/19/93 | |
| FS2033 | 93.16828 TA | ICPMS | < 0.2 | | UG/G | 9/23/93 | 08315LA |
| FS2033 | 93.16828 TH | ICPMS | 14. | 2. | UG/G | 9/23/93 | 08315LA |
| FS2033 | 93.16828 TL | ICPMS | 0.9 | 0.2 | UG/G | 9/23/93 | 08315LA |
| FS2033 | 93.16828 U | ICPMS | 0.9 | 0.6 | UG/G | 9/23/93 | 08315LA |
| FS2033 | 93.16828 V | ICPES | 38. | 4. | UG/G | 9/09/93 | 08315HA |
| FS2033 | 93.16828 ZN | ICPES | 58. | 6. | UG/G | 9/09/93 | 08315HA |
| FS2034 | 93.16829 AL | ICPES | 20000. | 2000. | UG/G | 9/09/93 | 08315HA |
| FS2034 | 93.16829 AS | ETVAA | 4.5 | 0.9 | UG/G | 9/08/93 | |
| FS2034 | 93.16829 BA | ICPES | 230. | 23. | UG/G | 9/09/93 | 08315HA |
| FS2034 | 93.16829 BE | ICPES | 1.2 | 0.1 | UG/G | 9/09/93 | 08315HA |
| FS2034 | 93.16829 CA | ICPES | 6400. | 640. | UG/G | 9/09/93 | 08315HA |
| FS2034 | 93.16829 CD | ICPES | < 0.4 | | UG/G | 9/09/93 | 08315HA |
| FS2034 | 93.16829 CL | IC | 15.2 | 1.5 | UG/G | 9/10/93 | |
| FS2034 | 93.16829 CO | ICPES | 9.3 | 0.9 | UG/G | 9/09/93 | 08315HA |
| FS2034 | 93.16829 CR | ICPES | 14. | 1. | UG/G | 9/09/93 | 08315HA |
| FS2034 | 93.16829 CU | ICPES | 5. | 0.5 | UG/G | 9/09/93 | 08315HA |
| FS2034 | 93.16829 FE | ICPES | 15000. | 1500. | UG/G | 9/09/93 | 08315HA |
| FS2034 | 93.16829 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2034 | 93.16829 K | ICPES | 2800. | 280. | UG/G | 9/09/93 | 08315HA |

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| FS2034 | 93.16829 | MG | ICPES | 3700. | 370. | UG/G | 9/09/93 08315HA |
| FS2034 | 93.16829 | MN | ICPES | 350. | 35. | UG/G | 9/09/93 08315HA |
| FS2034 | 93.16829 | NA | ICPES | 640. | 64. | UG/G | 9/09/93 08315HA |
| FS2034 | 93.16829 | NI | ICPES | 11. | 1. | UG/G | 9/09/93 08315HA |
| FS2034 | 93.16829 | PB | ICPES | 15. | 2. | UG/G | 9/09/93 08315HA |
| FS2034 | 93.16829 | SB | ICPES | < 5. | | UG/G | 10/19/93 08315HA |
| FS2034 | 93.16829 | SE | ETVAA | 0.4 | 0.2 | UG/G | 9/08/93 |
| FS2034 | 93.16829 | SO4 | IC | 53. | 5.3 | UG/G | 11/19/93 |
| FS2034 | 93.16829 | TA | ICPMS | < 0.2 | | UG/G | 9/23/93 08315LA |
| FS2034 | 93.16829 | TH | ICPMS | 11. | 2. | UG/G | 9/23/93 08315LA |
| FS2034 | 93.16829 | TL | ICPMS | 0.4 | 0.2 | UG/G | 9/23/93 08315LA |
| FS2034 | 93.16829 | U | ICPMS | 0.9 | 0.2 | UG/G | 9/23/93 08315LA |
| FS2034 | 93.16829 | V | ICPES | 30. | 3. | UG/G | 9/09/93 08315HA |
| FS2034 | 93.16829 | ZN | ICPES | 35. | 4. | UG/G | 9/09/93 08315HA |
| FS2035 | 93.16830 | AL | ICPES | 9400. | 940. | UG/G | 9/09/93 08315HA |
| FS2035 | 93.16830 | AS | ETVAA | 5.3 | 1.1 | UG/G | 9/08/93 |
| FS2035 | 93.16830 | BA | ICPES | 100. | 10. | UG/G | 9/09/93 08315HA |
| FS2035 | 93.16830 | BE | ICPES | 0.67 | 0.07 | UG/G | 9/09/93 08315HA |
| FS2035 | 93.16830 | CA | ICPES | 1200. | 120. | UG/G | 9/09/93 08315HA |
| FS2035 | 93.16830 | CD | ICPES | < 0.4 | | UG/G | 9/09/93 08315HA |
| FS2035 | 93.16830 | CL | IC | 16.8 | 1.7 | UG/G | 9/10/93 |
| FS2035 | 93.16830 | CO | ICPES | 24. | 2. | UG/G | 9/09/93 08315HA |
| FS2035 | 93.16830 | CR | ICPES | 10. | 1. | UG/G | 9/09/93 08315HA |
| FS2035 | 93.16830 | CU | ICPES | < 0.5 | | UG/G | 9/09/93 08315HA |
| FS2035 | 93.16830 | FE | ICPES | 14000. | 1400. | UG/G | 9/09/93 08315HA |
| FS2035 | 93.16830 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 |
| FS2035 | 93.16830 | K | ICPES | 1600. | 160. | UG/G | 9/09/93 08315HA |
| FS2035 | 93.16830 | MG | ICPES | 1300. | 130. | UG/G | 9/09/93 08315HA |
| FS2035 | 93.16830 | MN | ICPES | 770. | 77. | UG/G | 9/09/93 08315HA |
| FS2035 | 93.16830 | NA | ICPES | 250. | 25. | UG/G | 9/09/93 08315HA |
| FS2035 | 93.16830 | NI | ICPES | 6. | 1. | UG/G | 9/09/93 08315HA |
| FS2035 | 93.16830 | PB | ICPES | 18. | 3. | UG/G | 9/09/93 08315HA |
| FS2035 | 93.16830 | SB | ICPES | < 5. | | UG/G | 10/19/93 08315HA |
| FS2035 | 93.16830 | SE | ETVAA | < 0.2 | | UG/G | 9/08/93 |
| FS2035 | 93.16830 | SO4 | IC | 63. | 6.3 | UG/G | 11/19/93 |
| FS2035 | 93.16830 | TA | ICPMS | < 0.2 | | UG/G | 9/23/93 08315LA |
| FS2035 | 93.16830 | TH | ICPMS | 8. | 1. | UG/G | 9/23/93 08315LA |
| FS2035 | 93.16830 | TL | ICPMS | < 0.2 | | UG/G | 9/23/93 08315LA |
| FS2035 | 93.16830 | U | ICPMS | 0.9 | 0.3 | UG/G | 9/23/93 08315LA |
| FS2035 | 93.16830 | V | ICPES | 37. | 4. | UG/G | 9/09/93 08315HA |
| FS2035 | 93.16830 | ZN | ICPES | 17. | 2. | UG/G | 9/09/93 08315HA |
| FS2037 | 93.16831 | AL | ICPES | 9700. | 970. | UG/G | 9/09/93 08315HA |
| FS2037 | 93.16831 | AS | ETVAA | 4.1 | 0.8 | UG/G | 9/08/93 |
| FS2037 | 93.16831 | BA | ICPES | 73. | 7. | UG/G | 9/09/93 08315HA |
| FS2037 | 93.16831 | BE | ICPES | 0.68 | 0.07 | UG/G | 9/09/93 08315HA |
| FS2037 | 93.16831 | CA | ICPES | 1200. | 120. | UG/G | 9/09/93 08315HA |
| FS2037 | 93.16831 | CD | ICPES | < 0.4 | | UG/G | 9/09/93 08315HA |
| FS2037 | 93.16831 | CL | IC | 17.7 | 1.8 | UG/G | 9/10/93 |
| FS2037 | 93.16831 | CO | ICPES | 26. | 3. | UG/G | 9/09/93 08315HA |
| FS2037 | 93.16831 | CR | ICPES | 9. | 0.9 | UG/G | 9/09/93 08315HA |
| FS2037 | 93.16831 | CU | ICPES | 3.4 | 0.3 | UG/G | 9/09/93 08315HA |
| FS2037 | 93.16831 | FE | ICPES | 10000. | 1000. | UG/G | 9/09/93 08315HA |
| FS2037 | 93.16831 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 |
| FS2037 | 93.16831 | K | ICPES | 1400. | 140. | UG/G | 9/09/93 08315HA |
| FS2037 | 93.16831 | MG | ICPES | 1500. | 150. | UG/G | 9/09/93 08315HA |
| FS2037 | 93.16831 | MN | ICPES | 410. | 41. | UG/G | 9/09/93 08315HA |
| FS2037 | 93.16831 | NA | ICPES | 230. | 23. | UG/G | 9/09/93 08315HA |
| FS2037 | 93.16831 | NI | ICPES | 4.6 | 0.5 | UG/G | 9/09/93 08315HA |
| FS2037 | 93.16831 | PB | ICPES | 19. | 2. | UG/G | 9/09/93 08315HA |
| FS2037 | 93.16831 | SB | ICPES | < 5. | | UG/G | 10/19/93 08315HA |

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| FS2037 | 93.16831 | SE | ETVAA | < 0.2 | | UG/G | 9/08/93 | |
| FS2037 | 93.16831 | SO4 | IC | 24. | 2.4 | UG/G | 11/19/93 | |
| FS2037 | 93.16831 | TA | ICPMS | < 0.2 | | UG/G | 9/23/93 | 08315LA |
| FS2037 | 93.16831 | TH | ICPMS | 8. | 1. | UG/G | 9/23/93 | 08315LA |
| FS2037 | 93.16831 | TL | ICPMS | 0.2 | 0.2 | UG/G | 9/23/93 | 08315LA |
| FS2037 | 93.16831 | U | ICPMS | 1. | 0.2 | UG/G | 9/23/93 | 08315LA |
| FS2037 | 93.16831 | V | ICPES | 28. | 3. | UG/G | 9/09/93 | 08315HA |
| FS2037 | 93.16831 | ZN | ICPES | 16. | 2. | UG/G | 9/09/93 | 08315HA |
| FS2038 | 93.16832 | AL | ICPES | 37000. | 3700. | UG/G | 9/09/93 | 08315HA |
| FS2038 | 93.16832 | AS | ETVAA | 7.9 | 1.6 | UG/G | 9/09/93 | |
| FS2038 | 93.16832 | BA | ICPES | 280. | 28. | UG/G | 9/09/93 | 08315HA |
| FS2038 | 93.16832 | BE | ICPES | 1.5 | 0.2 | UG/G | 9/09/93 | 08315HA |
| FS2038 | 93.16832 | CA | ICPES | 8500. | 850. | UG/G | 9/09/93 | 08315HA |
| FS2038 | 93.16832 | CD | ICPES | < 0.4 | | UG/G | 9/09/93 | 08315HA |
| FS2038 | 93.16832 | CL | IC | 40.6 | 4.1 | UG/G | 9/10/93 | |
| FS2038 | 93.16832 | CO | ICPES | 12. | 1. | UG/G | 9/09/93 | 08315HA |
| FS2038 | 93.16832 | CR | ICPES | 17. | 2. | UG/G | 9/09/93 | 08315HA |
| FS2038 | 93.16832 | CU | ICPES | 5. | 0.5 | UG/G | 9/09/93 | 08315HA |
| FS2038 | 93.16832 | FE | ICPES | 20000. | 2000. | UG/G | 9/09/93 | 08315HA |
| FS2038 | 93.16832 | HG | CVAA | 0.1 | 0.1 | UG/G | 8/31/93 | |
| FS2038 | 93.16832 | K | ICPES | 3900. | 390. | UG/G | 9/09/93 | 08315HA |
| FS2038 | 93.16832 | MG | ICPES | 5600. | 560. | UG/G | 9/09/93 | 08315HA |
| FS2038 | 93.16832 | MN | ICPES | 110. | 11. | UG/G | 9/09/93 | 08315HA |
| FS2038 | 93.16832 | NA | ICPES | 1000. | 100. | UG/G | 9/09/93 | 08315HA |
| FS2038 | 93.16832 | NI | ICPES | 14. | 1. | UG/G | 9/09/93 | 08315HA |
| FS2038 | 93.16832 | PB | ICPES | 16. | 4. | UG/G | 9/09/93 | 08315HA |
| FS2038 | 93.16832 | SB | ICPES | < 5. | | UG/G | 10/19/93 | 08315HA |
| FS2038 | 93.16832 | SE | ETVAA | 0.8 | 0.2 | UG/G | 9/28/93 | |
| FS2038 | 93.16832 | SO4 | IC | 217. | 22. | UG/G | 11/19/93 | |
| FS2038 | 93.16832 | TA | ICPMS | < 0.2 | | UG/G | 9/23/93 | 08315LA |
| FS2038 | 93.16832 | TH | ICPMS | 9. | 2. | UG/G | 9/23/93 | 08315LA |
| FS2038 | 93.16832 | TL | ICPMS | 0.9 | 0.2 | UG/G | 9/23/93 | 08315LA |
| FS2038 | 93.16832 | U | ICPMS | 1. | 0.2 | UG/G | 9/23/93 | 08315LA |
| FS2038 | 93.16832 | V | ICPES | 30. | 3. | UG/G | 9/09/93 | 08315HA |
| FS2038 | 93.16832 | ZN | ICPES | 47. | 5. | UG/G | 9/09/93 | 08315HA |
| FS2039 | 93.16833 | AL | ICPES | 12000. | 1200. | UG/G | 9/09/93 | 08315HA |
| FS2039 | 93.16833 | AS | ETVAA | 2.4 | 0.5 | UG/G | 9/10/93 | |
| FS2039 | 93.16833 | BA | ICPES | 35. | 4. | UG/G | 9/09/93 | 08315HA |
| FS2039 | 93.16833 | BE | ICPES | 0.9 | 0.09 | UG/G | 9/09/93 | 08315HA |
| FS2039 | 93.16833 | CA | ICPES | 1700. | 170. | UG/G | 9/09/93 | 08315HA |
| FS2039 | 93.16833 | CD | ICPES | < 0.4 | | UG/G | 9/09/93 | 08315HA |
| FS2039 | 93.16833 | CL | IC | 20. | 2. | UG/G | 9/10/93 | |
| FS2039 | 93.16833 | CO | ICPES | 11. | 1. | UG/G | 9/09/93 | 08315HA |
| FS2039 | 93.16833 | CR | ICPES | 5.7 | 0.6 | UG/G | 9/09/93 | 08315HA |
| FS2039 | 93.16833 | CU | ICPES | 0.6 | 0.2 | UG/G | 9/09/93 | 08315HA |
| FS2039 | 93.16833 | FE | ICPES | 12000. | 1200. | UG/G | 9/09/93 | 08315HA |
| FS2039 | 93.16833 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2039 | 93.16833 | K | ICPES | 1900. | 190. | UG/G | 9/09/93 | 08315HA |
| FS2039 | 93.16833 | MG | ICPES | 1400. | 140. | UG/G | 9/09/93 | 08315HA |
| FS2039 | 93.16833 | MN | ICPES | 81. | 8. | UG/G | 9/09/93 | 08315HA |
| FS2039 | 93.16833 | NA | ICPES | 1200. | 120. | UG/G | 9/09/93 | 08315HA |
| FS2039 | 93.16833 | NI | ICPES | 3.3 | 0.4 | UG/G | 9/09/93 | 08315HA |
| FS2039 | 93.16833 | PB | ICPES | 4. | 2. | UG/G | 9/09/93 | 08315HA |
| FS2039 | 93.16833 | SB | ICPES | < 5. | | UG/G | 10/19/93 | 08315HA |
| FS2039 | 93.16833 | SE | ETVAA | < 0.2 | | UG/G | 9/10/93 | |
| FS2039 | 93.16833 | SO4 | IC | 32. | 3.2 | UG/G | 11/19/93 | |
| FS2039 | 93.16833 | TA | ICPMS | < 0.2 | | UG/G | 10/15/93 | 09025L |
| FS2039 | 93.16833 | TH | ICPMS | 3. | 0.2 | UG/G | 10/15/93 | 09025L |
| FS2039 | 93.16833 | TL | ICPMS | < 0.2 | | UG/G | 10/15/93 | 09025L |
| FS2039 | 93.16833 | U | ICPMS | 0.5 | 0.2 | UG/G | 10/15/93 | 09025L |

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| FS2039 | 93.16833 | V | ICPES | 12. | 1. | UG/G | 9/09/93 | 08315HA |
| FS2039 | 93.16833 | ZN | ICPES | 28. | 3. | UG/G | 9/09/93 | 08315HA |
| FS2040 | 93.16834 | AL | ICPES | 25000. | 2500. | UG/G | 9/09/93 | 08315HA |
| FS2040 | 93.16834 | AS | ETVAA | 5.4 | 1. | UG/G | 9/10/93 | |
| FS2040 | 93.16834 | BA | ICPES | 730. | 73. | UG/G | 9/09/93 | 08315HA |
| FS2040 | 93.16834 | BE | ICPES | 1. | 0.1 | UG/G | 9/09/93 | 08315HA |
| FS2040 | 93.16834 | CA | ICPES | 3200. | 320. | UG/G | 9/09/93 | 08315HA |
| FS2040 | 93.16834 | CD | ICPES | < 0.4 | | UG/G | 9/09/93 | 08315HA |
| FS2040 | 93.16834 | CL | IC | 200. | 20. | UG/G | 9/10/93 | |
| FS2040 | 93.16834 | CO | ICPES | 6. | 0.6 | UG/G | 9/09/93 | 08315HA |
| FS2040 | 93.16834 | CR | ICPES | 11. | 1. | UG/G | 9/09/93 | 08315HA |
| FS2040 | 93.16834 | CU | ICPES | 4. | 0.4 | UG/G | 9/09/93 | 08315HA |
| FS2040 | 93.16834 | FE | ICPES | 17000. | 1700. | UG/G | 9/09/93 | 08315HA |
| FS2040 | 93.16834 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2040 | 93.16834 | K | ICPES | 2600. | 260. | UG/G | 9/09/93 | 08315HA |
| FS2040 | 93.16834 | MG | ICPES | 3200. | 320. | UG/G | 9/09/93 | 08315HA |
| FS2040 | 93.16834 | MN | ICPES | 78. | 8. | UG/G | 9/09/93 | 08315HA |
| FS2040 | 93.16834 | NA | ICPES | 1100. | 110. | UG/G | 9/09/93 | 08315HA |
| FS2040 | 93.16834 | NI | ICPES | 9. | 0.9 | UG/G | 9/09/93 | 08315HA |
| FS2040 | 93.16834 | PB | ICPES | 13. | 3. | UG/G | 9/09/93 | 08315HA |
| FS2040 | 93.16834 | SB | ICPES | < 5. | | UG/G | 10/19/93 | 08315HA |
| FS2040 | 93.16834 | SE | ETVAA | 0.4 | 0.2 | UG/G | 9/10/93 | |
| FS2040 | 93.16834 | SO4 | IC | 442. | 44. | UG/G | 11/19/93 | |
| FS2040 | 93.16834 | TA | ICPMS | < 0.2 | | UG/G | 10/15/93 | 09025L |
| FS2040 | 93.16834 | TH | ICPMS | 6. | 1. | UG/G | 10/15/93 | 09025L |
| FS2040 | 93.16834 | TL | ICPMS | 0.4 | 0.2 | UG/G | 10/15/93 | 09025L |
| FS2040 | 93.16834 | U | ICPMS | 0.7 | 0.2 | UG/G | 10/15/93 | 09025L |
| FS2040 | 93.16834 | V | ICPES | 20. | 2. | UG/G | 9/09/93 | 08315HA |
| FS2040 | 93.16834 | ZN | ICPES | 37. | 4. | UG/G | 9/09/93 | 08315HA |
| FS2041 | 93.16835 | AL | ICPES | 24000. | 2400. | UG/G | 9/24/93 | |
| FS2041 | 93.16835 | AS | ETVAA | 7.3 | 1.5 | UG/G | 9/10/93 | |
| FS2041 | 93.16835 | BA | ICPES | 350. | 35. | UG/G | 9/24/93 | |
| FS2041 | 93.16835 | BE | ICPES | 1.9 | 0.2 | UG/G | 9/24/93 | |
| FS2041 | 93.16835 | CA | ICPES | 2600. | 260. | UG/G | 9/24/93 | |
| FS2041 | 93.16835 | CD | ICPES | 3. | 0.7 | UG/G | 9/24/93 | |
| FS2041 | 93.16835 | CL | IC | 12.5 | 1.3 | UG/G | 9/10/93 | |
| FS2041 | 93.16835 | CO | ICPES | 8. | 1. | UG/G | 9/24/93 | |
| FS2041 | 93.16835 | CR | ICPES | 12. | 1. | UG/G | 9/24/93 | |
| FS2041 | 93.16835 | CU | ICPES | 9. | 0.9 | UG/G | 9/24/93 | |
| FS2041 | 93.16835 | FE | ICPES | 17000. | 1700. | UG/G | 9/24/93 | |
| FS2041 | 93.16835 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2041 | 93.16835 | K | ICPES | 2600. | 260. | UG/G | 9/24/93 | |
| FS2041 | 93.16835 | MG | ICPES | 3400. | 340. | UG/G | 9/24/93 | |
| FS2041 | 93.16835 | MN | ICPES | 270. | 27. | UG/G | 9/24/93 | |
| FS2041 | 93.16835 | NA | ICPES | 250. | 25. | UG/G | 9/24/93 | |
| FS2041 | 93.16835 | NI | ICPES | 12. | 1. | UG/G | 9/24/93 | |
| FS2041 | 93.16835 | PB | ICPES | 14. | 1. | UG/G | 9/24/93 | |
| FS2041 | 93.16835 | SB | ICPES | < 5. | | UG/G | 10/19/93 | 08315HA |
| FS2041 | 93.16835 | SE | ETVAA | 0.6 | 0.2 | UG/G | 9/10/93 | |
| FS2041 | 93.16835 | SO4 | IC | 61. | 6.1 | UG/G | 11/19/93 | |
| FS2041 | 93.16835 | TA | ICPMS | < 0.2 | | UG/G | 10/15/93 | 09025L |
| FS2041 | 93.16835 | TH | ICPMS | 9. | 0.4 | UG/G | 10/15/93 | 09025L |
| FS2041 | 93.16835 | TL | ICPMS | 0.4 | 0.2 | UG/G | 10/15/93 | 09025L |
| FS2041 | 93.16835 | U | ICPMS | 1. | 0.2 | UG/G | 10/15/93 | 09025L |
| FS2041 | 93.16835 | V | ICPES | 27. | 3. | UG/G | 9/24/93 | |
| FS2041 | 93.16835 | ZN | ICPES | 30. | 3. | UG/G | 9/24/93 | |
| FS2042 | 93.16836 | AL | ICPES | 7000. | 700. | UG/G | 9/24/93 | |
| FS2042 | 93.16836 | AS | ETVAA | 4.8 | 1. | UG/G | 9/10/93 | |
| FS2042 | 93.16836 | BA | ICPES | 100. | 10. | UG/G | 9/24/93 | |
| FS2042 | 93.16836 | BE | ICPES | 0.51 | 0.05 | UG/G | 9/24/93 | |

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|---|---|---|---|---|---|---|---|
| FS2042 | 93.16836 CA | ICPES | 1200. | 120. | UG/G | 9/24/93 | |
| FS2042 | 93.16836 CD | ICPES | 1.2 | 0.8 | UG/G | 9/24/93 | |
| FS2042 | 93.16836 CL | IC | 14. | 1.4 | UG/G | 9/10/93 | |
| FS2042 | 93.16836 CO | ICPES | 15. | 2. | UG/G | 9/24/93 | |
| FS2042 | 93.16836 CR | ICPES | 8.3 | 0.8 | UG/G | 9/24/93 | |
| FS2042 | 93.16836 CU | ICPES | 3.2 | 0.3 | UG/G | 9/24/93 | |
| FS2042 | 93.16836 FE | ICPES | 11000. | 1100. | UG/G | 9/24/93 | |
| FS2042 | 93.16836 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2042 | 93.16836 K | ICPES | 1300. | 130. | UG/G | 9/24/93 | |
| FS2042 | 93.16836 MG | ICPES | 1300. | 130. | UG/G | 9/24/93 | |
| FS2042 | 93.16836 MN | ICPES | 630. | 63. | UG/G | 9/24/93 | |
| FS2042 | 93.16836 NA | ICPES | 170. | 17. | UG/G | 9/24/93 | |
| FS2042 | 93.16836 NI | ICPES | 8.3 | 0.8 | UG/G | 9/24/93 | |
| FS2042 | 93.16836 PB | ICPES | 17. | 5. | UG/G | 9/24/93 | |
| FS2042 | 93.16836 SB | ICPES | < 5. | | UG/G | 10/19/93 | |
| FS2042 | 93.16836 SE | ETVAA | < 0.2 | | UG/G | 9/10/93 | |
| FS2042 | 93.16836 SO4 | IC | 27. | 2.7 | UG/G | 11/19/93 | |
| FS2042 | 93.16836 TA | ICPMS | < 0.2 | | UG/G | 10/15/93 | 09025L |
| FS2042 | 93.16836 TH | ICPMS | 5. | 0.4 | UG/G | 10/15/93 | 09025L |
| FS2042 | 93.16836 TL | ICPMS | < 0.2 | | UG/G | 10/15/93 | 09025L |
| FS2042 | 93.16836 U | ICPMS | 1. | 0.2 | UG/G | 10/15/93 | 09025L |
| FS2042 | 93.16836 V | ICPES | 27. | 3. | UG/G | 9/24/93 | |
| FS2042 | 93.16836 ZN | ICPES | 16. | 2. | UG/G | 9/24/93 | |
| FS2043 | 93.16837 AL | ICPES | 33000. | 3300. | UG/G | 9/24/93 | |
| FS2043 | 93.16837 AS | ETVAA | 8.3 | 1.7 | UG/G | 9/10/93 | |
| FS2043 | 93.16837 BA | ICPES | 340. | 34. | UG/G | 9/24/93 | |
| FS2043 | 93.16837 BE | ICPES | 2.2 | 0.2 | UG/G | 9/24/93 | |
| FS2043 | 93.16837 CA | ICPES | 5300. | 530. | UG/G | 9/24/93 | |
| FS2043 | 93.16837 CD | ICPES | < 2. | | UG/G | 9/24/93 | |
| FS2043 | 93.16837 CL | IC | 109. | 11. | UG/G | 9/10/93 | |
| FS2043 | 93.16837 CO | ICPES | 8. | 0.8 | UG/G | 9/24/93 | |
| FS2043 | 93.16837 CR | ICPES | 16. | 2. | UG/G | 9/24/93 | |
| FS2043 | 93.16837 CU | ICPES | 10. | 1. | UG/G | 9/24/93 | |
| FS2043 | 93.16837 FE | ICPES | 22000. | 2200. | UG/G | 9/24/93 | |
| FS2043 | 93.16837 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2043 | 93.16837 K | ICPES | 3000. | 300. | UG/G | 9/24/93 | |
| FS2043 | 93.16837 MG | ICPES | 5000. | 500. | UG/G | 9/24/93 | |
| FS2043 | 93.16837 MN | ICPES | 93. | 9. | UG/G | 9/24/93 | |
| FS2043 | 93.16837 NA | ICPES | 670. | 67. | UG/G | 9/24/93 | |
| FS2043 | 93.16837 NI | ICPES | 17. | 2. | UG/G | 9/24/93 | |
| FS2043 | 93.16837 PB | ICPES | 20. | 2. | UG/G | 9/24/93 | |
| FS2043 | 93.16837 SB | ICPES | < 5. | | UG/G | 10/19/93 | |
| FS2043 | 93.16837 SE | ETVAA | 0.9 | 0.2 | UG/G | 9/10/93 | |
| FS2043 | 93.16837 SO4 | IC | 212. | 21. | UG/G | 11/19/93 | |
| FS2043 | 93.16837 TA | ICPMS | < 0.2 | | UG/G | 10/15/93 | 09025L |
| FS2043 | 93.16837 TH | ICPMS | 7. | 1. | UG/G | 10/15/93 | 09025L |
| FS2043 | 93.16837 TL | ICPMS | 0.6 | 0.2 | UG/G | 10/15/93 | 09025L |
| FS2043 | 93.16837 U | ICPMS | 0.6 | 0.2 | UG/G | 10/15/93 | 09025L |
| FS2043 | 93.16837 V | ICPES | 24. | 2. | UG/G | 9/24/93 | |
| FS2043 | 93.16837 ZN | ICPES | 44. | 4. | UG/G | 9/24/93 | |
| FS2044 | 93.16838 AL | ICPES | 25000. | 2500. | UG/G | 9/24/93 | |
| FS2044 | 93.16838 AS | ETVAA | 6.1 | 1.2 | UG/G | 9/10/93 | |
| FS2044 | 93.16838 BA | ICPES | 160. | 1. | UG/G | 9/24/93 | |
| FS2044 | 93.16838 BE | ICPES | 1.4 | 0.1 | UG/G | 9/24/93 | |
| FS2044 | 93.16838 CA | ICPES | 2700. | 270. | UG/G | 9/24/93 | |
| FS2044 | 93.16838 CD | ICPES | < 2. | | UG/G | 9/24/93 | |
| FS2044 | 93.16838 CL | IC | 13.7 | 1.4 | UG/G | 9/10/93 | |
| FS2044 | 93.16838 CO | ICPES | 8.8 | 0.9 | UG/G | 9/24/93 | |
| FS2044 | 93.16838 CR | ICPES | 19. | 2. | UG/G | 9/24/93 | |
| FS2044 | 93.16838 CU | ICPES | 11. | 1. | UG/G | 9/24/93 | |

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|---|---|---|---|---|---|---|---|
| FS2044 | 93.16838 | FE | ICPES | 22000. | 2200. | UG/G | 9/24/93 | |
| FS2044 | 93.16838 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2044 | 93.16838 | K | ICPES | 2200. | 220. | UG/G | 9/24/93 | |
| FS2044 | 93.16838 | MG | ICPES | 3700. | 370. | UG/G | 9/24/93 | |
| FS2044 | 93.16838 | MN | ICPES | 350. | 35. | UG/G | 9/24/93 | |
| FS2044 | 93.16838 | NA | ICPES | 280. | 28. | UG/G | 9/24/93 | |
| FS2044 | 93.16838 | NI | ICPES | 13. | 2. | UG/G | 9/24/93 | |
| FS2044 | 93.16838 | PB | ICPES | 21. | 4. | UG/G | 9/24/93 | |
| FS2044 | 93.16838 | SB | ICPES | < 5. | | UG/G | 10/19/93 | |
| FS2044 | 93.16838 | SE | ETVAA | 0.5 | 0.2 | UG/G | 9/10/93 | |
| FS2044 | 93.16838 | SO4 | IC | 22. | 2.2 | UG/G | 11/19/93 | |
| FS2044 | 93.16838 | TA | ICPMS | < 0.2 | | UG/G | 10/15/93 | 09025L |
| FS2044 | 93.16838 | TH | ICPMS | 8. | 1. | UG/G | 10/15/93 | 09025L |
| FS2044 | 93.16838 | TL | ICPMS | 0.5 | 0.2 | UG/G | 10/15/93 | 09025L |
| FS2044 | 93.16838 | U | ICPMS | 1. | 0.2 | UG/G | 10/15/93 | 09025L |
| FS2044 | 93.16838 | V | ICPES | 40. | 4. | UG/G | 9/24/93 | |
| FS2044 | 93.16838 | ZN | ICPES | 33. | 3. | UG/G | 9/24/93 | |
| FS2045 | 93.16839 | AL | ICPES | 9200. | 920. | UG/G | 9/24/93 | |
| FS2045 | 93.16839 | AS | ETVAA | 5.4 | 1.1 | UG/G | 9/10/93 | |
| FS2045 | 93.16839 | BA | ICPES | 100. | 10. | UG/G | 9/24/93 | |
| FS2045 | 93.16839 | BE | ICPES | 0.75 | 0.08 | UG/G | 9/24/93 | |
| FS2045 | 93.16839 | CA | ICPES | 1800. | 180. | UG/G | 9/24/93 | |
| FS2045 | 93.16839 | CD | ICPES | < 2. | | UG/G | 9/24/93 | |
| FS2045 | 93.16839 | CL | IC | 14.8 | 1.5 | UG/G | 9/10/93 | |
| FS2045 | 93.16839 | CO | ICPES | 21. | 2. | UG/G | 9/24/93 | |
| FS2045 | 93.16839 | CR | ICPES | 11. | 1. | UG/G | 9/24/93 | |
| FS2045 | 93.16839 | CU | ICPES | 5. | 0.5 | UG/G | 9/24/93 | |
| FS2045 | 93.16839 | FE | ICPES | 12000. | 1200. | UG/G | 9/24/93 | |
| FS2045 | 93.16839 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2045 | 93.16839 | K | ICPES | 1700. | 170. | UG/G | 9/24/93 | |
| FS2045 | 93.16839 | MG | ICPES | 1700. | 170. | UG/G | 9/24/93 | |
| FS2045 | 93.16839 | MN | ICPES | 550. | 55. | UG/G | 9/24/93 | |
| FS2045 | 93.16839 | NA | ICPES | 180. | 18. | UG/G | 9/24/93 | |
| FS2045 | 93.16839 | NI | ICPES | 7.5 | 0.8 | UG/G | 9/24/93 | |
| FS2045 | 93.16839 | PB | ICPES | 18. | 2. | UG/G | 9/24/93 | |
| FS2045 | 93.16839 | SB | ICPES | < 5. | | UG/G | 10/19/93 | |
| FS2045 | 93.16839 | SE | ETVAA | < 0.2 | | UG/G | 9/10/93 | |
| FS2045 | 93.16839 | SO4 | IC | 30. | 3. | UG/G | 11/19/93 | |
| FS2045 | 93.16839 | TA | ICPMS | < 0.2 | | UG/G | 10/15/93 | 09025L |
| FS2045 | 93.16839 | TH | ICPMS | 7. | 0.4 | UG/G | 10/15/93 | 09025L |
| FS2045 | 93.16839 | TL | ICPMS | < 0.2 | | UG/G | 10/15/93 | 09025L |
| FS2045 | 93.16839 | U | ICPMS | 1. | 0.2 | UG/G | 10/15/93 | 09025L |
| FS2045 | 93.16839 | V | ICPES | 28. | 3. | UG/G | 9/24/93 | |
| FS2045 | 93.16839 | ZN | ICPES | 21. | 2. | UG/G | 9/24/93 | |
| FS2046 | 93.16840 | AL | ICPES | 61000. | 6100. | UG/G | 9/24/93 | |
| FS2046 | 93.16840 | AS | ETVAA | 11.2 | 2.2 | UG/G | 9/10/93 | |
| FS2046 | 93.16840 | BA | ICPES | 320. | 32. | UG/G | 9/24/93 | |
| FS2046 | 93.16840 | BE | ICPES | 4. | 0.4 | UG/G | 9/24/93 | |
| FS2046 | 93.16840 | CA | ICPES | 14000. | 1400. | UG/G | 9/24/93 | |
| FS2046 | 93.16840 | CD | ICPES | 2.7 | 0.3 | UG/G | 9/24/93 | |
| FS2046 | 93.16840 | CL | IC | 53.4 | 5.3 | UG/G | 9/10/93 | |
| FS2046 | 93.16840 | CO | ICPES | 11. | 1. | UG/G | 9/24/93 | |
| FS2046 | 93.16840 | CR | ICPES | 37. | 4. | UG/G | 9/24/93 | |
| FS2046 | 93.16840 | CU | ICPES | 16. | 2. | UG/G | 9/24/93 | |
| FS2046 | 93.16840 | FE | ICPES | 36000. | 3600. | UG/G | 9/24/93 | |
| FS2046 | 93.16840 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2046 | 93.16840 | K | ICPES | 6800. | 680. | UG/G | 9/24/93 | |
| FS2046 | 93.16840 | MG | ICPES | 10000. | 1000. | UG/G | 9/24/93 | |
| FS2046 | 93.16840 | MN | ICPES | 290. | 29. | UG/G | 9/24/93 | |
| FS2046 | 93.16840 | NA | ICPES | 1800. | 180. | UG/G | 9/24/93 | |

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|---|---|---|---|---|---|---|---|
| FS2046 | 93.16840 NI | ICPES | 28. | 3. | UG/G | 9/24/93 | |
| FS2046 | 93.16840 PB | ICPES | 30. | 3. | UG/G | 9/24/93 | |
| FS2046 | 93.16840 SB | ICPES | < 5. | | UG/G | 10/19/93 | |
| FS2046 | 93.16840 SE | ETVAA | 1. | 0.2 | UG/G | 9/10/93 | |
| FS2046 | 93.16840 SO4 | IC | 199. | 20. | UG/G | 11/19/93 | |
| FS2046 | 93.16840 TA | ICPMS | < 0.2 | | UG/G | 10/15/93 | 09025L |
| FS2046 | 93.16840 TH | ICPMS | 11. | 1. | UG/G | 10/15/93 | 09025L |
| FS2046 | 93.16840 TL | ICPMS | 0.6 | 0.2 | UG/G | 10/15/93 | 09025L |
| FS2046 | 93.16840 U | ICPMS | 1. | 0.2 | UG/G | 10/15/93 | 09025L |
| FS2046 | 93.16840 V | ICPES | 56. | 6. | UG/G | 9/24/93 | |
| FS2046 | 93.16840 ZN | ICPES | 75. | 7. | UG/G | 9/24/93 | |
| FS2048 | 93.16841 AL | ICPES | 32000. | 3200. | UG/G | 9/29/93 | |
| FS2048 | 93.16841 AS | ETVAA | 4.7 | 0.9 | UG/G | 9/10/93 | |
| FS2048 | 93.16841 BA | ICPES | 300. | 30. | UG/G | 9/29/93 | |
| FS2048 | 93.16841 BE | ICPES | 2. | 0.2 | UG/G | 9/29/93 | |
| FS2048 | 93.16841 CA | ICPES | 2900. | 290. | UG/G | 9/29/93 | |
| FS2048 | 93.16841 CD | ICPES | 1. | 1. | UG/G | 9/29/93 | |
| FS2048 | 93.16841 CL | IC | 26.6 | 2.7 | UG/G | 9/10/93 | |
| FS2048 | 93.16841 CO | ICPES | 15. | 2. | UG/G | 9/29/93 | |
| FS2048 | 93.16841 CR | ICPES | 17. | 2. | UG/G | 9/29/93 | |
| FS2048 | 93.16841 CU | ICPES | 7.7 | 0.8 | UG/G | 9/29/93 | |
| FS2048 | 93.16841 FE | ICPES | 20000. | 2000. | UG/G | 9/29/93 | |
| FS2048 | 93.16841 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2048 | 93.16841 K | ICPES | 3100. | 310. | UG/G | 9/29/93 | |
| FS2048 | 93.16841 MG | ICPES | 4000. | 400. | UG/G | 9/29/93 | |
| FS2048 | 93.16841 MN | ICPES | 260. | 26. | UG/G | 9/29/93 | |
| FS2048 | 93.16841 NA | ICPES | 630. | 63. | UG/G | 9/29/93 | |
| FS2048 | 93.16841 NI | ICPES | 14. | 1. | UG/G | 9/29/93 | |
| FS2048 | 93.16841 PB | ICPES | 19. | 5. | UG/G | 9/29/93 | |
| FS2048 | 93.16841 SB | ICPES | < 5. | | UG/G | 10/19/93 | |
| FS2048 | 93.16841 SE | ETVAA | 0.6 | 0.2 | UG/G | 9/10/93 | |
| FS2048 | 93.16841 SO4 | IC | 65. | 6.5 | UG/G | 11/19/93 | |
| FS2048 | 93.16841 TA | ICPMS | < 0.2 | | UG/G | 10/15/93 | 09025L |
| FS2048 | 93.16841 TH | ICPMS | 7. | 1. | UG/G | 10/15/93 | 09025L |
| FS2048 | 93.16841 TL | ICPMS | 0.4 | 0.2 | UG/G | 10/15/93 | 09025L |
| FS2048 | 93.16841 U | ICPMS | 0.9 | 0.2 | UG/G | 10/15/93 | 09025L |
| FS2048 | 93.16841 V | ICPES | 32. | 3. | UG/G | 9/29/93 | |
| FS2048 | 93.16841 ZN | ICPES | 35. | 4. | UG/G | 9/29/93 | |
| FS2049 | 93.16842 AL | ICPES | 32000. | 3200. | UG/G | 9/29/93 | |
| FS2049 | 93.16842 AS | ETVAA | 5.1 | 1. | UG/G | 9/10/93 | |
| FS2049 | 93.16842 BA | ICPES | 270. | 27. | UG/G | 9/29/93 | |
| FS2049 | 93.16842 BE | ICPES | 2. | 0.2 | UG/G | 9/29/93 | |
| FS2049 | 93.16842 CA | ICPES | 2800. | 280. | UG/G | 9/29/93 | |
| FS2049 | 93.16842 CD | ICPES | 3.6 | 0.8 | UG/G | 9/29/93 | |
| FS2049 | 93.16842 CL | IC | 12.6 | 1.3 | UG/G | 9/10/93 | |
| FS2049 | 93.16842 CO | ICPES | 9. | 1. | UG/G | 9/29/93 | |
| FS2049 | 93.16842 CR | ICPES | 17. | 2. | UG/G | 9/29/93 | |
| FS2049 | 93.16842 CU | ICPES | 9.4 | 0.9 | UG/G | 9/29/93 | |
| FS2049 | 93.16842 FE | ICPES | 20000. | 2000. | UG/G | 9/29/93 | |
| FS2049 | 93.16842 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2049 | 93.16842 K | ICPES | 3000. | 300. | UG/G | 9/29/93 | |
| FS2049 | 93.16842 MG | ICPES | 3800. | 380. | UG/G | 9/29/93 | |
| FS2049 | 93.16842 MN | ICPES | 280. | 28. | UG/G | 9/29/93 | |
| FS2049 | 93.16842 NA | ICPES | 280. | 28. | UG/G | 9/29/93 | |
| FS2049 | 93.16842 NI | ICPES | 16. | 2. | UG/G | 9/29/93 | |
| FS2049 | 93.16842 PB | ICPES | 20. | 2. | UG/G | 9/29/93 | |
| FS2049 | 93.16842 SB | ICPES | < 5. | | UG/G | 10/19/93 | |
| FS2049 | 93.16842 SE | ETVAA | 0.6 | 0.2 | UG/G | 9/10/93 | |
| FS2049 | 93.16842 SO4 | IC | 45. | 4.5 | UG/G | 11/19/93 | |
| FS2049 | 93.16842 TA | ICPMS | < 0.2 | | UG/G | 10/15/93 | 09025L |

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|---|---|---|---|---|---|---|---|
| FS2049 | 93.16842 TH | ICPMS | 8. | 1. | UG/G | 10/15/93 | 09025L |
| FS2049 | 93.16842 TL | ICPMS | 0.2 | 0.2 | UG/G | 10/15/93 | 09025L |
| FS2049 | 93.16842 U | ICPMS | 1. | 0.2 | UG/G | 10/15/93 | 09025L |
| FS2049 | 93.16842 V | ICPES | 34. | 3. | UG/G | 9/29/93 | |
| FS2049 | 93.16842 ZN | ICPES | 37. | 4. | UG/G | 9/29/93 | |
| FS2050 | 93.16843 AL | ICPES | 21000. | 2100. | UG/G | 9/29/93 | |
| FS2050 | 93.16843 AS | ETVAA | 6.5 | 1.3 | UG/G | 9/10/93 | |
| FS2050 | 93.16843 BA | ICPES | 180. | 18. | UG/G | 9/29/93 | |
| FS2050 | 93.16843 BE | ICPES | 1.3 | 0.1 | UG/G | 9/29/93 | |
| FS2050 | 93.16843 CA | ICPES | 6000. | 600. | UG/G | 9/29/93 | |
| FS2050 | 93.16843 CD | ICPES | 2. | 1. | UG/G | 9/29/93 | |
| FS2050 | 93.16843 CL | IC | 18.1 | 1.8 | UG/G | 9/10/93 | |
| FS2050 | 93.16843 CO | ICPES | 23. | 2. | UG/G | 9/29/93 | |
| FS2050 | 93.16843 CR | ICPES | 17. | 2. | UG/G | 9/29/93 | |
| FS2050 | 93.16843 CU | ICPES | 10. | 1. | UG/G | 9/29/93 | |
| FS2050 | 93.16843 FE | ICPES | 18000. | 1800. | UG/G | 9/29/93 | |
| FS2050 | 93.16843 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2050 | 93.16843 K | ICPES | 2500. | 250. | UG/G | 9/29/93 | |
| FS2050 | 93.16843 MG | ICPES | 3300. | 330. | UG/G | 9/29/93 | |
| FS2050 | 93.16843 MN | ICPES | 430. | 43. | UG/G | 9/29/93 | |
| FS2050 | 93.16843 NA | ICPES | 280. | 28. | UG/G | 9/29/93 | |
| FS2050 | 93.16843 NI | ICPES | 12. | 1. | UG/G | 9/29/93 | |
| FS2050 | 93.16843 PB | ICPES | 16. | 2. | UG/G | 9/29/93 | |
| FS2050 | 93.16843 SB | ICPES | < 5. | | UG/G | 10/19/93 | |
| FS2050 | 93.16843 SE | ETVAA | 0.3 | 0.2 | UG/G | 9/10/93 | |
| FS2050 | 93.16843 SO4 | IC | 32. | 3.2 | UG/G | 11/19/93 | |
| FS2050 | 93.16843 TA | ICPMS | < 0.2 | | UG/G | 10/15/93 | 09025L |
| FS2050 | 93.16843 TH | ICPMS | 7. | 1. | UG/G | 10/15/93 | 09025L |
| FS2050 | 93.16843 TL | ICPMS | 0.4 | 0.2 | UG/G | 10/15/93 | 09025L |
| FS2050 | 93.16843 U | ICPMS | 1. | 0.2 | UG/G | 10/15/93 | 09025L |
| FS2050 | 93.16843 V | ICPES | 40. | 4. | UG/G | 9/29/93 | |
| FS2050 | 93.16843 ZN | ICPES | 27. | 3. | UG/G | 9/29/93 | |
| FS2051 | 93.16844 AL | ICPES | 48000. | 4800. | UG/G | 9/29/93 | |
| FS2051 | 93.16844 AS | ETVAA | 3.6 | 0.7 | UG/G | 9/10/93 | |
| FS2051 | 93.16844 BA | ICPES | 300. | 30. | UG/G | 9/29/93 | |
| FS2051 | 93.16844 BE | ICPES | 2.6 | 0.3 | UG/G | 9/29/93 | |
| FS2051 | 93.16844 CA | ICPES | 3700. | 370. | UG/G | 9/29/93 | |
| FS2051 | 93.16844 CD | ICPES | < 2. | | UG/G | 9/29/93 | |
| FS2051 | 93.16844 CL | IC | 22.1 | 2.2 | UG/G | 9/10/93 | |
| FS2051 | 93.16844 CO | ICPES | 11. | 1. | UG/G | 9/29/93 | |
| FS2051 | 93.16844 CR | ICPES | 23. | 2. | UG/G | 9/29/93 | |
| FS2051 | 93.16844 CU | ICPES | 12. | 1. | UG/G | 9/29/93 | |
| FS2051 | 93.16844 FE | ICPES | 26000. | 2600. | UG/G | 9/29/93 | |
| FS2051 | 93.16844 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2051 | 93.16844 K | ICPES | 4300. | 430. | UG/G | 9/29/93 | |
| FS2051 | 93.16844 MG | ICPES | 5300. | 530. | UG/G | 9/29/93 | |
| FS2051 | 93.16844 MN | ICPES | 300. | 30. | UG/G | 9/29/93 | |
| FS2051 | 93.16844 NA | ICPES | 330. | 33. | UG/G | 9/29/93 | |
| FS2051 | 93.16844 NI | ICPES | 19. | 2. | UG/G | 9/29/93 | |
| FS2051 | 93.16844 PB | ICPES | 22. | 9. | UG/G | 9/29/93 | |
| FS2051 | 93.16844 SB | ICPES | < 5. | | UG/G | 10/19/93 | |
| FS2051 | 93.16844 SE | ETVAA | 0.3 | 0.2 | UG/G | 9/10/93 | |
| FS2051 | 93.16844 SO4 | IC | 57. | 6. | UG/G | 11/19/93 | |
| FS2051 | 93.16844 TA | ICPMS | < 0.2 | | UG/G | 10/15/93 | 09025L |
| FS2051 | 93.16844 TH | ICPMS | 4. | 0.5 | UG/G | 10/15/93 | 09025L |
| FS2051 | 93.16844 TL | ICPMS | < 0.2 | | UG/G | 10/15/93 | 09025L |
| FS2051 | 93.16844 U | ICPMS | 0.7 | 0.2 | UG/G | 10/15/93 | 09025L |
| FS2051 | 93.16844 V | ICPES | 42. | 4. | UG/G | 9/29/93 | |
| FS2051 | 93.16844 ZN | ICPES | 50. | 5. | UG/G | 9/29/93 | |
| FS2052 | 93.16845 AL | ICPES | 9500. | 950. | UG/G | 9/29/93 | |

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|---|---|---|---|---|---|---|---|
| FS2052 | 93.16845 AS | ETVAA | 5.3 | 1.1 | UG/G | 9/10/93 | |
| FS2052 | 93.16845 BA | ICPES | 100. | 10. | UG/G | 9/29/93 | |
| FS2052 | 93.16845 BE | ICPES | 0.77 | 0.08 | UG/G | 9/29/93 | |
| FS2052 | 93.16845 CA | ICPES | 1300. | 130. | UG/G | 9/29/93 | |
| FS2052 | 93.16845 CD | ICPES | 1.4 | 0.8 | UG/G | 9/29/93 | |
| FS2052 | 93.16845 CL | IC | 14.3 | 1.4 | UG/G | 9/10/93 | |
| FS2052 | 93.16845 CO | ICPES | 27. | 3. | UG/G | 9/29/93 | |
| FS2052 | 93.16845 CR | ICPES | 12. | 1. | UG/G | 9/29/93 | |
| FS2052 | 93.16845 CU | ICPES | 3. | 0.3 | UG/G | 9/29/93 | |
| FS2052 | 93.16845 FE | ICPES | 13000. | 1300. | UG/G | 9/29/93 | |
| FS2052 | 93.16845 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2052 | 93.16845 K | ICPES | 1400. | 140. | UG/G | 9/29/93 | |
| FS2052 | 93.16845 MG | ICPES | 1500. | 150. | UG/G | 9/29/93 | |
| FS2052 | 93.16845 MN | ICPES | 590. | 59. | UG/G | 9/29/93 | |
| FS2052 | 93.16845 NA | ICPES | 260. | 26. | UG/G | 9/29/93 | |
| FS2052 | 93.16845 NI | ICPES | 7. | 3. | UG/G | 9/29/93 | |
| FS2052 | 93.16845 PB | ICPES | 18. | 4. | UG/G | 9/29/93 | |
| FS2052 | 93.16845 SB | ICPES | < 5. | | UG/G | 10/19/93 | |
| FS2052 | 93.16845 SE | ETVAA | < 0.2 | | UG/G | 9/10/93 | |
| FS2052 | 93.16845 SO4 | IC | 44. | 4.4 | UG/G | 11/19/93 | |
| FS2052 | 93.16845 TA | ICPMS | < 0.2 | | UG/G | 10/15/93 | 09025L |
| FS2052 | 93.16845 TH | ICPMS | 6. | 0.4 | UG/G | 10/15/93 | 09025L |
| FS2052 | 93.16845 TL | ICPMS | 0.2 | 0.2 | UG/G | 10/15/93 | 09025L |
| FS2052 | 93.16845 U | ICPMS | 1. | 0.2 | UG/G | 10/15/93 | 09025L |
| FS2052 | 93.16845 V | ICPES | 35. | 4. | UG/G | 9/29/93 | |
| FS2052 | 93.16845 ZN | ICPES | 14. | 1. | UG/G | 9/29/93 | |
| FS2053 | 93.16846 AL | ICPES | 15000. | 1500. | UG/G | 9/29/93 | |
| FS2053 | 93.16846 AS | ETVAA | 3.9 | 0.8 | UG/G | 9/10/93 | |
| FS2053 | 93.16846 BA | ICPES | 130. | 13. | UG/G | 9/29/93 | |
| FS2053 | 93.16846 BE | ICPES | 1. | 0.1 | UG/G | 9/29/93 | |
| FS2053 | 93.16846 CA | ICPES | 2200. | 220. | UG/G | 9/29/93 | |
| FS2053 | 93.16846 CD | ICPES | < 0.4 | | UG/G | 9/29/93 | |
| FS2053 | 93.16846 CL | IC | 12.9 | 1.3 | UG/G | 9/10/93 | |
| FS2053 | 93.16846 CO | ICPES | 15. | 2. | UG/G | 9/29/93 | |
| FS2053 | 93.16846 CR | ICPES | 16. | 2. | UG/G | 9/29/93 | |
| FS2053 | 93.16846 CU | ICPES | 8. | 0.8 | UG/G | 9/29/93 | |
| FS2053 | 93.16846 FE | ICPES | 16000. | 1600. | UG/G | 9/29/93 | |
| FS2053 | 93.16846 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2053 | 93.16846 K | ICPES | 2500. | 250. | UG/G | 9/29/93 | |
| FS2053 | 93.16846 MG | ICPES | 2800. | 280. | UG/G | 9/29/93 | |
| FS2053 | 93.16846 MN | ICPES | 500. | 500. | UG/G | 9/29/93 | |
| FS2053 | 93.16846 NA | ICPES | 270. | 27. | UG/G | 9/29/93 | |
| FS2053 | 93.16846 NI | ICPES | 12. | 3. | UG/G | 9/29/93 | |
| FS2053 | 93.16846 PB | ICPES | 16. | 2. | UG/G | 9/29/93 | |
| FS2053 | 93.16846 SB | ICPES | < 5. | | UG/G | 10/19/93 | 09025L |
| FS2053 | 93.16846 SE | ETVAA | < 0.2 | | UG/G | 9/10/93 | |
| FS2053 | 93.16846 SO4 | IC | 30. | 3. | UG/G | 11/19/93 | |
| FS2053 | 93.16846 TA | ICPMS | < 0.2 | | UG/G | 10/15/93 | 09025L |
| FS2053 | 93.16846 TH | ICPMS | 7. | 1. | UG/G | 10/15/93 | 09025L |
| FS2053 | 93.16846 TL | ICPMS | 0.2 | 0.2 | UG/G | 10/15/93 | 09025L |
| FS2053 | 93.16846 U | ICPMS | 1. | 0.2 | UG/G | 10/15/93 | 09025L |
| FS2053 | 93.16846 V | ICPES | 35. | 4. | UG/G | 9/29/93 | |
| FS2053 | 93.16846 ZN | ICPES | 33. | 3. | UG/G | 9/29/93 | |
| FS2054 | 93.16847 AL | ICPES | 23000. | 2300. | UG/G | 9/24/93 | |
| FS2054 | 93.16847 AS | ETVAA | 5.2 | 1. | UG/G | 9/10/93 | |
| FS2054 | 93.16847 BA | ICPES | 190. | 19. | UG/G | 9/24/93 | |
| FS2054 | 93.16847 BE | ICPES | 1.2 | 0.1 | UG/G | 9/24/93 | |
| FS2054 | 93.16847 CA | ICPES | 3000. | 300. | UG/G | 9/24/93 | |
| FS2054 | 93.16847 CD | ICPES | < 0.4 | | UG/G | 9/24/93 | |
| FS2054 | 93.16847 CL | IC | 18.6 | 1.9 | UG/G | 9/10/93 | |

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|---|---|---|---|---|---|---|---|
| FS2054 | 93.16847 CO | ICPES | 12. | 1. | UG/G | 9/24/93 | |
| FS2054 | 93.16847 CR | ICPES | 13. | 1. | UG/G | 9/24/93 | |
| FS2054 | 93.16847 CU | ICPES | 6. | 0.6 | UG/G | 9/24/93 | |
| FS2054 | 93.16847 FE | ICPES | 14000. | 1400. | UG/G | 9/24/93 | |
| FS2054 | 93.16847 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2054 | 93.16847 K | ICPES | 2700. | 270. | UG/G | 9/24/93 | |
| FS2054 | 93.16847 MG | ICPES | 2600. | 260. | UG/G | 9/24/93 | |
| FS2054 | 93.16847 MN | ICPES | 300. | 30. | UG/G | 9/24/93 | |
| FS2054 | 93.16847 NA | ICPES | 660. | 66. | UG/G | 9/24/93 | |
| FS2054 | 93.16847 NI | ICPES | 9. | 0.9 | UG/G | 9/24/93 | |
| FS2054 | 93.16847 PB | ICPES | 37. | 4. | UG/G | 9/24/93 | |
| FS2054 | 93.16847 SB | ICPES | < 5. | | UG/G | 10/19/93 | 09025L |
| FS2054 | 93.16847 SE | ETVAA | < 0.2 | | UG/G | 9/10/93 | |
| FS2054 | 93.16847 SO4 | IC | 44. | 4.4 | UG/G | 11/19/93 | |
| FS2054 | 93.16847 TA | ICPMS | < 0.2 | | UG/G | 10/15/93 | 09025L |
| FS2054 | 93.16847 TH | ICPMS | 7. | 0.5 | UG/G | 10/15/93 | 09025L |
| FS2054 | 93.16847 TL | ICPMS | 0.2 | 0.2 | UG/G | 10/15/93 | 09025L |
| FS2054 | 93.16847 U | ICPMS | 2. | 0.2 | UG/G | 10/15/93 | 09025L |
| FS2054 | 93.16847 V | ICPES | 29. | 3. | UG/G | 9/24/93 | |
| FS2054 | 93.16847 ZN | ICPES | 40. | 4. | UG/G | 9/24/93 | |
| FS2055 | 93.16848 AL | ICPES | 11000. | 1100. | UG/G | 9/24/93 | |
| FS2055 | 93.16848 AS | ETVAA | 4.6 | 0.9 | UG/G | 9/10/93 | |
| FS2055 | 93.16848 BA | ICPES | 140. | 14. | UG/G | 9/24/93 | |
| FS2055 | 93.16848 BE | ICPES | 0.7 | 0.07 | UG/G | 9/24/93 | |
| FS2055 | 93.16848 CA | ICPES | 3100. | 310. | UG/G | 9/24/93 | |
| FS2055 | 93.16848 CD | ICPES | 0.5 | 0.1 | UG/G | 9/24/93 | |
| FS2055 | 93.16848 CL | IC | 18.9 | 1.9 | UG/G | 9/10/93 | |
| FS2055 | 93.16848 CO | ICPES | 34. | 3. | UG/G | 9/24/93 | |
| FS2055 | 93.16848 CR | ICPES | 10. | 1. | UG/G | 9/24/93 | |
| FS2055 | 93.16848 CU | ICPES | 9.4 | 0.9 | UG/G | 9/24/93 | |
| FS2055 | 93.16848 FE | ICPES | 11000. | 1100. | UG/G | 9/24/93 | |
| FS2055 | 93.16848 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2055 | 93.16848 K | ICPES | 1900. | 190. | UG/G | 9/24/93 | |
| FS2055 | 93.16848 MG | ICPES | 1800. | 180. | UG/G | 9/24/93 | |
| FS2055 | 93.16848 MN | ICPES | 450. | 45. | UG/G | 9/24/93 | |
| FS2055 | 93.16848 NA | ICPES | 200. | 20. | UG/G | 9/24/93 | |
| FS2055 | 93.16848 NI | ICPES | 5.5 | 0.6 | UG/G | 9/24/93 | |
| FS2055 | 93.16848 PB | ICPES | 26. | 5. | UG/G | 9/24/93 | |
| FS2055 | 93.16848 SB | ICPES | < 5. | | UG/G | 10/19/93 | |
| FS2055 | 93.16848 SE | ETVAA | < 0.2 | | UG/G | 9/10/93 | |
| FS2055 | 93.16848 SO4 | IC | 60. | 6. | UG/G | 11/19/93 | |
| FS2055 | 93.16848 TA | ICPMS | < 0.2 | | UG/G | 10/15/93 | 09025L |
| FS2055 | 93.16848 TH | ICPMS | 5. | 0.2 | UG/G | 10/15/93 | 09025L |
| FS2055 | 93.16848 TL | ICPMS | 0.2 | 0.2 | UG/G | 10/15/93 | 09025L |
| FS2055 | 93.16848 U | ICPMS | 2. | 0.2 | UG/G | 10/15/93 | 09025L |
| FS2055 | 93.16848 V | ICPES | 25. | 3. | UG/G | 9/24/93 | |
| FS2055 | 93.16848 ZN | ICPES | 31. | 3. | UG/G | 9/24/93 | |
| FS2056 | 93.16849 AL | ICPES | 43000. | 4300. | UG/G | 9/24/93 | |
| FS2056 | 93.16849 AS | ETVAA | 7.3 | 1.5 | UG/G | 9/10/93 | |
| FS2056 | 93.16849 BA | ICPES | 130. | 13. | UG/G | 9/24/93 | |
| FS2056 | 93.16849 BE | ICPES | 2. | 0.2 | UG/G | 9/24/93 | |
| FS2056 | 93.16849 CA | ICPES | 4500. | 450. | UG/G | 9/24/93 | |
| FS2056 | 93.16849 CD | ICPES | < 0.4 | | UG/G | 9/24/93 | |
| FS2056 | 93.16849 CL | IC | 27.3 | 2.7 | UG/G | 9/10/93 | |
| FS2056 | 93.16849 CO | ICPES | 10. | 1. | UG/G | 9/24/93 | |
| FS2056 | 93.16849 CR | ICPES | 26. | 3. | UG/G | 9/24/93 | |
| FS2056 | 93.16849 CU | ICPES | 9. | 0.9 | UG/G | 9/24/93 | |
| FS2056 | 93.16849 FE | ICPES | 27000. | 2700. | UG/G | 9/24/93 | |
| FS2056 | 93.16849 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2056 | 93.16849 K | ICPES | 4000. | 400. | UG/G | 9/24/93 | |

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|---|---|---|---|---|---|---|---|
| FS2056 | 93.16849 | MG | ICPES | 5500. | 550. | UG/G | 9/24/93 | |
| FS2056 | 93.16849 | MN | ICPES | 180. | 18. | UG/G | 9/24/93 | |
| FS2056 | 93.16849 | NA | ICPES | 350. | 35. | UG/G | 9/24/93 | |
| FS2056 | 93.16849 | NI | ICPES | 19. | 2. | UG/G | 9/24/93 | |
| FS2056 | 93.16849 | PB | ICPES | 25. | 3. | UG/G | 9/24/93 | |
| FS2056 | 93.16849 | SB | ICPES | < 5. | | UG/G | 10/19/93 | |
| FS2056 | 93.16849 | SE | ETVAA | 0.7 | 0.2 | UG/G | 9/10/93 | |
| FS2056 | 93.16849 | SO4 | IC | 35. | 3.5 | UG/G | 11/19/93 | |
| FS2056 | 93.16849 | TA | ICPMS | < 0.2 | | UG/G | 10/15/93 | 09025L |
| FS2056 | 93.16849 | TH | ICPMS | 8. | 1. | UG/G | 10/15/93 | 09025L |
| FS2056 | 93.16849 | TL | ICPMS | 0.7 | 0.2 | UG/G | 10/15/93 | 09025L |
| FS2056 | 93.16849 | U | ICPMS | 1. | 0.2 | UG/G | 10/15/93 | 09025L |
| FS2056 | 93.16849 | V | ICPES | 55. | 6. | UG/G | 9/24/93 | |
| FS2056 | 93.16849 | ZN | ICPES | 55. | 6. | UG/G | 9/24/93 | |
| FS2057 | 93.16850 | AL | ICPES | 25000. | 2500. | UG/G | 9/24/93 | |
| FS2057 | 93.16850 | AS | ETVAA | 4.9 | 1. | UG/G | 9/10/93 | |
| FS2057 | 93.16850 | BA | ICPES | 370. | 37. | UG/G | 9/24/93 | |
| FS2057 | 93.16850 | BE | ICPES | 1.3 | 0.1 | UG/G | 9/24/93 | |
| FS2057 | 93.16850 | CA | ICPES | 9700. | 970. | UG/G | 9/24/93 | |
| FS2057 | 93.16850 | CD | ICPES | 0.6 | 0.3 | UG/G | 9/24/93 | |
| FS2057 | 93.16850 | CL | IC | 39.1 | 3.9 | UG/G | 9/10/93 | |
| FS2057 | 93.16850 | CO | ICPES | 15. | 2. | UG/G | 9/24/93 | |
| FS2057 | 93.16850 | CR | ICPES | 18. | 2. | UG/G | 9/24/93 | |
| FS2057 | 93.16850 | CU | ICPES | 8. | 0.8 | UG/G | 9/24/93 | |
| FS2057 | 93.16850 | FE | ICPES | 18000. | 1800. | UG/G | 9/24/93 | |
| FS2057 | 93.16850 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2057 | 93.16850 | K | ICPES | 3300. | 330. | UG/G | 9/24/93 | |
| FS2057 | 93.16850 | MG | ICPES | 4400. | 440. | UG/G | 9/24/93 | |
| FS2057 | 93.16850 | MN | ICPES | 490. | 49. | UG/G | 9/24/93 | |
| FS2057 | 93.16850 | NA | ICPES | 570. | 57. | UG/G | 9/24/93 | |
| FS2057 | 93.16850 | NI | ICPES | 13. | 1. | UG/G | 9/24/93 | |
| FS2057 | 93.16850 | PB | ICPES | 17. | 5. | UG/G | 9/24/93 | |
| FS2057 | 93.16850 | SB | ICPES | < 5. | | UG/G | 10/19/93 | |
| FS2057 | 93.16850 | SE | ETVAA | < 0.2 | | UG/G | 9/10/93 | |
| FS2057 | 93.16850 | SO4 | IC | 74. | 7.4 | UG/G | 11/19/93 | |
| FS2057 | 93.16850 | TA | ICPMS | < 0.2 | | UG/G | 10/15/93 | 09025L |
| FS2057 | 93.16850 | TH | ICPMS | 8. | 1. | UG/G | 10/15/93 | 09025L |
| FS2057 | 93.16850 | TL | ICPMS | 0.5 | 0.2 | UG/G | 10/15/93 | 09025L |
| FS2057 | 93.16850 | U | ICPMS | 0.9 | 0.2 | UG/G | 10/15/93 | 09025L |
| FS2057 | 93.16850 | V | ICPES | 40. | 4. | UG/G | 9/24/93 | |
| FS2057 | 93.16850 | ZN | ICPES | 39. | 4. | UG/G | 9/24/93 | |
| FS2059 | 93.16851 | AL | ICPES | 14000. | 1400. | UG/G | 9/24/93 | |
| FS2059 | 93.16851 | AS | ETVAA | 2.9 | 0.6 | UG/G | 9/14/93 | |
| FS2059 | 93.16851 | BA | ICPES | 30. | 3. | UG/G | 9/24/93 | |
| FS2059 | 93.16851 | BE | ICPES | 0.9 | 0.09 | UG/G | 9/24/93 | |
| FS2059 | 93.16851 | CA | ICPES | 2000. | 200. | UG/G | 9/24/93 | |
| FS2059 | 93.16851 | CD | ICPES | < 0.4 | | UG/G | 9/24/93 | |
| FS2059 | 93.16851 | CL | IC | 18.2 | 1.8 | UG/G | 9/10/93 | |
| FS2059 | 93.16851 | CO | ICPES | 9. | 0.9 | UG/G | 9/24/93 | |
| FS2059 | 93.16851 | CR | ICPES | 7.3 | 0.7 | UG/G | 9/24/93 | |
| FS2059 | 93.16851 | CU | ICPES | 1.3 | 0.1 | UG/G | 9/24/93 | |
| FS2059 | 93.16851 | FE | ICPES | 13000. | 1300. | UG/G | 9/24/93 | |
| FS2059 | 93.16851 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2059 | 93.16851 | K | ICPES | 1900. | 190. | UG/G | 9/24/93 | |
| FS2059 | 93.16851 | MG | ICPES | 1800. | 180. | UG/G | 9/24/93 | |
| FS2059 | 93.16851 | MN | ICPES | 76. | 8. | UG/G | 9/24/93 | |
| FS2059 | 93.16851 | NA | ICPES | 1200. | 120. | UG/G | 9/24/93 | |
| FS2059 | 93.16851 | NI | ICPES | 6.5 | 0.6 | UG/G | 9/24/93 | |
| FS2059 | 93.16851 | PB | ICPES | < 4. | | UG/G | 9/24/93 | |
| FS2059 | 93.16851 | SB | ICPES | < 5. | | UG/G | 10/19/93 | |

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|---|---|---|---|---|---|---|---|
| FS2059 | 93.16851 | SE | ETVAA | < 0.2 | | UG/G | 9/14/93 | |
| FS2059 | 93.16851 | SO4 | IC | 25. | 2.5 | UG/G | 11/19/93 | |
| FS2059 | 93.16851 | TA | ICPMS | < 0.2 | | UG/G | 10/15/93 | BATCH 09085L |
| FS2059 | 93.16851 | TH | ICPMS | 3. | 0.2 | UG/G | 10/15/93 | BATCH 09085L |
| FS2059 | 93.16851 | TL | ICPMS | < 0.2 | | UG/G | 10/15/93 | BATCH 09085L |
| FS2059 | 93.16851 | U | ICPMS | 0.4 | 0.2 | UG/G | 10/15/93 | BATCH 09085L |
| FS2059 | 93.16851 | V | ICPES | 14. | 1. | UG/G | 9/24/93 | |
| FS2059 | 93.16851 | ZN | ICPES | 31. | 3. | UG/G | 9/24/93 | |
| FS2060 | 93.16852 | AL | ICPES | 33000. | 3300. | UG/G | 9/24/93 | |
| FS2060 | 93.16852 | AS | ETVAA | 6.7 | 1.3 | UG/G | 9/14/93 | |
| FS2060 | 93.16852 | BA | ICPES | 410. | 41. | UG/G | 1/10/94 | |
| FS2060 | 93.16852 | BE | ICPES | 1.5 | 0.2 | UG/G | 1/10/94 | |
| FS2060 | 93.16852 | CA | ICPES | 87000. | 8700. | UG/G | 1/10/94 | |
| FS2060 | 93.16852 | CD | ICPES | < 0.4 | | UG/G | 1/10/94 | |
| FS2060 | 93.16852 | CL | IC | 168. | 17. | UG/G | 9/10/93 | |
| FS2060 | 93.16852 | CO | ICPES | 7.2 | 0.7 | UG/G | 1/10/94 | |
| FS2060 | 93.16852 | CR | ICPES | 15. | 2. | UG/G | 1/10/94 | |
| FS2060 | 93.16852 | CU | ICPES | 6.8 | 0.7 | UG/G | 1/10/94 | |
| FS2060 | 93.16852 | FE | ICPES | 17000. | 1700. | UG/G | 1/10/94 | |
| FS2060 | 93.16852 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2060 | 93.16852 | K | ICPES | 4200. | 420. | UG/G | 1/10/94 | |
| FS2060 | 93.16852 | MG | ICPES | 7400. | 740. | UG/G | 1/10/94 | |
| FS2060 | 93.16852 | MN | ICPES | 160. | 16. | UG/G | 1/10/94 | |
| FS2060 | 93.16852 | NA | ICPES | 1600. | 1. | 60/G | 1/10/94 | |
| FS2060 | 93.16852 | NI | ICPES | 15. | 2. | 60/G | 1/10/94 | |
| FS2060 | 93.16852 | PB | ICPMS | 12. | 1. | UG/G | 10/15/93 | BATCH 09085L |
| FS2060 | 93.16852 | SB | ICPES | < 5. | | UG/G | 10/15/93 | |
| FS2060 | 93.16852 | SE | ETVAA | 1.7 | 0.3 | UG/G | 9/14/93 | |
| FS2060 | 93.16852 | SO4 | IC | 1.2 | 0.1 | MG/G | 11/19/93 | |
| FS2060 | 93.16852 | TA | ICPMS | < 0.2 | | UG/G | 10/19/93 | BATCH 09085L |
| FS2060 | 93.16852 | TH | ICPMS | 7. | 1. | UG/G | 10/15/93 | BATCH 09085L |
| FS2060 | 93.16852 | TL | ICPMS | 0.6 | 0.2 | UG/G | 10/15/93 | BATCH 09085L |
| FS2060 | 93.16852 | U | ICPMS | 1.5 | 0.5 | UG/G | 10/15/93 | BATCH 09085L |
| FS2060 | 93.16852 | V | ICPES | 29. | 3. | UG/G | 1/10/94 | |
| FS2060 | 93.16852 | ZN | ICPES | 57. | 6. | UG/G | 1/10/94 | |
| FS2061 | 93.16853 | AL | ICPES | 30000. | 3000. | UG/G | 9/24/93 | |
| FS2061 | 93.16853 | AS | ETVAA | 5.2 | 1. | UG/G | 9/14/93 | |
| FS2061 | 93.16853 | BA | ICPES | 210. | 21. | UG/G | 9/24/93 | |
| FS2061 | 93.16853 | BE | ICPES | 1.6 | 0.2 | UG/G | 9/24/93 | |
| FS2061 | 93.16853 | CA | ICPES | 4000. | 400. | UG/G | 9/24/93 | |
| FS2061 | 93.16853 | CD | ICPES | < 0.4 | | UG/G | 9/24/93 | |
| FS2061 | 93.16853 | CL | IC | 13.6 | 1.4 | UG/G | 9/10/93 | |
| FS2061 | 93.16853 | CO | ICPES | 13. | 1. | UG/G | 9/24/93 | |
| FS2061 | 93.16853 | CR | ICPES | 21. | 2. | UG/G | 9/24/93 | |
| FS2061 | 93.16853 | CU | ICPES | 9.8 | 0.9 | UG/G | 9/24/93 | |
| FS2061 | 93.16853 | FE | ICPES | 22000. | 2200. | UG/G | 9/24/93 | |
| FS2061 | 93.16853 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2061 | 93.16853 | K | ICPES | 3800. | 380. | UG/G | 9/24/93 | |
| FS2061 | 93.16853 | MG | ICPES | 5400. | 540. | UG/G | 9/24/93 | |
| FS2061 | 93.16853 | MN | ICPES | 480. | 48. | UG/G | 9/24/93 | |
| FS2061 | 93.16853 | NA | ICPES | 410. | 41. | UG/G | 9/24/93 | |
| FS2061 | 93.16853 | NI | ICPES | 17. | 2. | UG/G | 9/24/93 | |
| FS2061 | 93.16853 | PB | ICPES | 16. | 3. | UG/G | 9/24/93 | |
| FS2061 | 93.16853 | SB | ICPES | < 5. | | UG/G | 10/19/93 | |
| FS2061 | 93.16853 | SE | ETVAA | 0.5 | 0.2 | UG/G | 9/14/93 | |
| FS2061 | 93.16853 | SO4 | IC | 30. | 3. | UG/G | 11/19/93 | |
| FS2061 | 93.16853 | TA | ICPMS | < 0.2 | | UG/G | 10/15/93 | BATCH 09085L |
| FS2061 | 93.16853 | TH | ICPMS | 9. | 1. | UG/G | 10/15/93 | BATCH 09085L |
| FS2061 | 93.16853 | TL | ICPMS | 0.2 | 0.2 | UG/G | 10/15/93 | BATCH 09085L |
| FS2061 | 93.16853 | U | ICPMS | 0.9 | 0.2 | UG/G | 10/15/93 | BATCH 09085L |

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|---|---|---|---|---|---|---|---|
| FS2061 | 93.16853 V | ICPES | 47. | 5. | UG/G | 9/24/93 | |
| FS2061 | 93.16853 ZN | ICPES | 53. | 5. | UG/G | 9/24/93 | |
| FS2062 | 93.16854 AL | ICPES | 8000. | 800. | UG/G | 10/15/93 | |
| FS2062 | 93.16854 AS | ETVAA | 3.5 | 0.7 | UG/G | 9/14/93 | |
| FS2062 | 93.16854 BA | ICPES | 270. | 27. | UG/G | 10/15/93 | |
| FS2062 | 93.16854 BE | ICPES | 0.76 | 0.08 | UG/G | 10/15/93 | |
| FS2062 | 93.16854 CA | ICPES | 3200. | 320. | UG/G | 10/15/93 | |
| FS2062 | 93.16854 CD | ICPES | < 0.4 | | UG/G | 10/15/93 | |
| FS2062 | 93.16854 CL | IC | 46.2 | 4.6 | UG/G | 9/10/93 | |
| FS2062 | 93.16854 CO | ICPES | 9.1 | 0.9 | UG/G | 10/15/93 | |
| FS2062 | 93.16854 CR | ICPES | 4.4 | 0.5 | UG/G | 10/15/93 | |
| FS2062 | 93.16854 CU | ICPES | < 0.5 | | UG/G | 10/15/93 | |
| FS2062 | 93.16854 FE | ICPES | 7100. | 710. | UG/G | 10/15/93 | |
| FS2062 | 93.16854 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2062 | 93.16854 K | ICPES | 1100. | 110. | UG/G | 10/15/93 | |
| FS2062 | 93.16854 MG | ICPES | 1600. | 160. | UG/G | 10/15/93 | |
| FS2062 | 93.16854 MN | ICPES | 54. | 5. | UG/G | 10/15/93 | |
| FS2062 | 93.16854 NA | ICPES | 500. | 50. | UG/G | 10/15/93 | |
| FS2062 | 93.16854 NI | ICPES | 4.4 | 0.4 | UG/G | 10/15/93 | |
| FS2062 | 93.16854 PB | ICPMS | 8. | 1. | UG/G | 10/15/93 | BATCH 09085L |
| FS2062 | 93.16854 SB | ICPES | < 5. | | UG/G | 10/19/93 | 09085HA-2 |
| FS2062 | 93.16854 SE | ETVAA | < 0.2 | | UG/G | 9/14/93 | |
| FS2062 | 93.16854 SO4 | IC | 95. | 10. | UG/G | 11/19/93 | |
| FS2062 | 93.16854 TA | ICPMS | < 0.2 | | UG/G | 10/15/93 | BATCH 09085L |
| FS2062 | 93.16854 TH | ICPMS | 4. | 0.2 | UG/G | 10/15/93 | BATCH 09085L |
| FS2062 | 93.16854 TL | ICPMS | 0.2 | 0.2 | UG/G | 10/15/93 | BATCH 09085L |
| FS2062 | 93.16854 U | ICPMS | 0.4 | 0.2 | UG/G | 10/15/93 | BATCH 09085L |
| FS2062 | 93.16854 V | ICPES | 9. | 1. | UG/G | 10/15/93 | |
| FS2062 | 93.16854 ZN | ICPES | 17. | 2. | UG/G | 10/15/93 | |
| FS2063 | 93.16855 AL | ICPES | 19000. | 1900. | UG/G | 10/15/93 | |
| FS2063 | 93.16855 AS | ETVAA | 4.8 | 1. | UG/G | 9/14/93 | |
| FS2063 | 93.16855 BA | ICPES | 180. | 18. | UG/G | 10/15/93 | |
| FS2063 | 93.16855 BE | ICPES | 1.1 | 0.1 | UG/G | 10/15/93 | |
| FS2063 | 93.16855 CA | ICPES | 2100. | 210. | UG/G | 10/15/93 | |
| FS2063 | 93.16855 CD | ICPES | < 0.4 | | UG/G | 10/15/93 | |
| FS2063 | 93.16855 CL | IC | 15.8 | 1.6 | UG/G | 9/10/93 | |
| FS2063 | 93.16855 CO | ICPES | 14. | 1. | UG/G | 10/15/93 | |
| FS2063 | 93.16855 CR | ICPES | 8.7 | 0.9 | UG/G | 10/15/93 | |
| FS2063 | 93.16855 CU | ICPES | 2. | 0.4 | UG/G | 10/15/93 | |
| FS2063 | 93.16855 FE | ICPES | 12000. | 1200. | UG/G | 10/15/93 | |
| FS2063 | 93.16855 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2063 | 93.16855 K | ICPES | 2200. | 220. | UG/G | 10/15/93 | |
| FS2063 | 93.16855 MG | ICPES | 2500. | 250. | UG/G | 10/15/93 | |
| FS2063 | 93.16855 MN | ICPES | 120. | 12. | UG/G | 10/15/93 | |
| FS2063 | 93.16855 NA | ICPES | 830. | 83. | UG/G | 10/15/93 | |
| FS2063 | 93.16855 NI | ICPES | 7.7 | 0.8 | UG/G | 10/15/93 | |
| FS2063 | 93.16855 PB | ICPES | 13. | 6. | UG/G | 10/15/93 | |
| FS2063 | 93.16855 SB | ICPES | < 5. | | UG/G | 10/19/93 | 09085HA-2 |
| FS2063 | 93.16855 SE | ETVAA | 0.8 | 0.2 | UG/G | 9/14/93 | |
| FS2063 | 93.16855 SO4 | IC | 80. | 8. | UG/G | 11/19/93 | |
| FS2063 | 93.16855 TA | ICPMS | < 0.2 | | UG/G | 10/15/93 | BATCH 09085L |
| FS2063 | 93.16855 TH | ICPMS | 7. | 0.4 | UG/G | 10/15/93 | BATCH 09085L |
| FS2063 | 93.16855 TL | ICPMS | < 0.2 | | UG/G | 10/15/93 | BATCH 09085L |
| FS2063 | 93.16855 U | ICPMS | 0.7 | 0.2 | UG/G | 10/15/93 | BATCH 09085L |
| FS2063 | 93.16855 V | ICPES | 20. | 2. | UG/G | 10/15/93 | |
| FS2063 | 93.16855 ZN | ICPES | 23. | 2. | UG/G | 10/15/93 | |
| FS2064 | 93.16856 AL | ICPES | 10000. | 1000. | UG/G | 10/15/93 | |
| FS2064 | 93.16856 AS | ETVAA | 4.1 | 0.8 | UG/G | 9/14/93 | |
| FS2064 | 93.16856 BA | ICPES | 140. | 14. | UG/G | 10/15/93 | |
| FS2064 | 93.16856 BE | ICPES | 0.77 | 0.08 | UG/G | 10/15/93 | |

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|---|---|---|---|---|---|---|---|
| FS2064 | 93.16856 | CA | ICPES | 1900. | 190. | UG/G | 10/15/93 | |
| FS2064 | 93.16856 | CD | ICPES | < 0.4 | | UG/G | 10/15/93 | |
| FS2064 | 93.16856 | CL | IC | 16.8 | 1.7 | UG/G | 9/10/93 | |
| FS2064 | 93.16856 | CO | ICPES | 11. | 1. | UG/G | 10/15/93 | |
| FS2064 | 93.16856 | CR | ICPES | 6.1 | 0.6 | UG/G | 10/15/93 | |
| FS2064 | 93.16856 | CU | ICPES | < 0.5 | | UG/G | 10/15/93 | |
| FS2064 | 93.16856 | FE | ICPES | 9300. | 930. | UG/G | 10/15/93 | |
| FS2064 | 93.16856 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2064 | 93.16856 | K | ICPES | 1500. | 150. | UG/G | 10/15/93 | |
| FS2064 | 93.16856 | MG | ICPES | 1600. | 160. | UG/G | 10/15/93 | |
| FS2064 | 93.16856 | MN | ICPES | 280. | 28. | UG/G | 10/15/93 | |
| FS2064 | 93.16856 | NA | ICPES | 220. | 22. | UG/G | 10/15/93 | |
| FS2064 | 93.16856 | NI | ICPES | 5. | 3. | UG/G | 10/15/93 | |
| FS2064 | 93.16856 | PB | ICPES | 14. | 1. | UG/G | 10/15/93 | |
| FS2064 | 93.16856 | SB | ICPES | < 5. | | UG/G | 10/19/93 | 09085HA-2 |
| FS2064 | 93.16856 | SE | ETVAA | 0.6 | 0.2 | UG/G | 9/14/93 | |
| FS2064 | 93.16856 | SO4 | IC | 31. | 3. | UG/G | 11/19/93 | |
| FS2064 | 93.16856 | TA | ICPMS | < 0.2 | | UG/G | 10/15/93 | BATCH 09085L |
| FS2064 | 93.16856 | TH | ICPMS | 8. | 1. | UG/G | 10/15/93 | BATCH 09085L |
| FS2064 | 93.16856 | TL | ICPMS | 0.2 | 0.2 | UG/G | 10/15/93 | BATCH 09085L |
| FS2064 | 93.16856 | U | ICPMS | 1.5 | 0.5 | UG/G | 10/15/93 | BATCH 09085L |
| FS2064 | 93.16856 | V | ICPES | 17. | 2. | UG/G | 10/15/93 | |
| FS2064 | 93.16856 | ZN | ICPES | 21. | 2. | UG/G | 10/15/93 | |
| FS2065 | 93.16857 | AL | ICPES | 24000. | 2400. | UG/G | 10/15/93 | |
| FS2065 | 93.16857 | AS | ETVAA | 6.9 | 1.4 | UG/G | 9/14/93 | |
| FS2065 | 93.16857 | BA | ICPES | 140. | 14. | UG/G | 10/15/93 | |
| FS2065 | 93.16857 | BE | ICPES | 1.4 | 0.1 | UG/G | 10/15/93 | |
| FS2065 | 93.16857 | CA | ICPES | 5600. | 560. | UG/G | 10/15/93 | |
| FS2065 | 93.16857 | CD | ICPES | < 0.4 | | UG/G | 10/15/93 | |
| FS2065 | 93.16857 | CL | IC | 168. | 17. | UG/G | 9/10/93 | |
| FS2065 | 93.16857 | CO | ICPES | 5.5 | 0.6 | UG/G | 10/15/93 | |
| FS2065 | 93.16857 | CR | ICPES | 9.5 | 0.9 | UG/G | 10/15/93 | |
| FS2065 | 93.16857 | CU | ICPES | 3.8 | 0.7 | UG/G | 10/15/93 | |
| FS2065 | 93.16857 | FE | ICPES | 15000. | 1500. | UG/G | 10/15/93 | |
| FS2065 | 93.16857 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2065 | 93.16857 | K | ICPES | 2000. | 200. | UG/G | 10/15/93 | |
| FS2065 | 93.16857 | MG | ICPES | 3700. | 370. | UG/G | 10/15/93 | |
| FS2065 | 93.16857 | MN | ICPES | 76. | 7. | UG/G | 10/15/93 | |
| FS2065 | 93.16857 | NA | ICPES | 610. | 61. | UG/G | 10/15/93 | |
| FS2065 | 93.16857 | NI | ICPES | 9. | 3. | UG/G | 10/15/93 | |
| FS2065 | 93.16857 | PB | ICPES | 19. | 8. | UG/G | 10/15/93 | |
| FS2065 | 93.16857 | SB | ICPES | < 5. | | UG/G | 10/19/93 | 09085HA-2 |
| FS2065 | 93.16857 | SE | ETVAA | 1.1 | 0.2 | UG/G | 9/14/93 | |
| FS2065 | 93.16857 | SO4 | IC | 324. | 32. | UG/G | 11/19/93 | |
| FS2065 | 93.16857 | TA | ICPMS | < 0.2 | | UG/G | 10/15/93 | BATCH 09085L |
| FS2065 | 93.16857 | TH | ICPMS | 10. | 1. | UG/G | 10/15/93 | BATCH 09085L |
| FS2065 | 93.16857 | TL | ICPMS | 0.7 | 0.2 | UG/G | 10/15/93 | BATCH 09085L |
| FS2065 | 93.16857 | U | ICPMS | 0.9 | 0.2 | UG/G | 10/15/93 | BATCH 09085L |
| FS2065 | 93.16857 | V | ICPES | 21. | 2. | UG/G | 10/15/93 | |
| FS2065 | 93.16857 | ZN | ICPES | 28. | 3. | UG/G | 10/15/93 | |
| FS2066 | 93.16858 | AL | ICPES | 7000. | 700. | UG/G | 10/15/93 | |
| FS2066 | 93.16858 | AS | ETVAA | 3.9 | 0.8 | UG/G | 9/14/93 | |
| FS2066 | 93.16858 | BA | ICPES | 84. | 8. | UG/G | 10/15/93 | |
| FS2066 | 93.16858 | BE | ICPES | 0.54 | 0.05 | UG/G | 10/15/93 | |
| FS2066 | 93.16858 | CA | ICPES | 1300. | 130. | UG/G | 10/15/93 | |
| FS2066 | 93.16858 | CD | ICPES | < 0.4 | | UG/G | 10/15/93 | |
| FS2066 | 93.16858 | CL | IC | 12.3 | 1.2 | UG/G | 9/10/93 | |
| FS2066 | 93.16858 | CO | ICPES | 6.6 | 0.7 | UG/G | 10/15/93 | |
| FS2066 | 93.16858 | CR | ICPES | 6.6 | 0.7 | UG/G | 10/15/93 | |
| FS2066 | 93.16858 | CU | ICPES | 2.7 | 0.3 | UG/G | 10/15/93 | |

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|---|---|---|---|---|---|---|---|
| FS2066 | 93.16858 FE | ICPES | 9200. | 920. | UG/G | 10/15/93 | |
| FS2066 | 93.16858 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2066 | 93.16858 K | ICPES | 970. | 97. | UG/G | 10/15/93 | |
| FS2066 | 93.16858 MG | ICPES | 1500. | 150. | UG/G | 10/15/93 | |
| FS2066 | 93.16858 MN | ICPES | 350. | 35. | UG/G | 10/15/93 | |
| FS2066 | 93.16858 NA | ICPES | 58. | 6. | UG/G | 10/15/93 | |
| FS2066 | 93.16858 NI | ICPES | 7. | 3. | UG/G | 10/15/93 | |
| FS2066 | 93.16858 PB | ICPES | 15. | 9. | UG/G | 10/15/93 | |
| FS2066 | 93.16858 SB | ICPES | < 5. | | UG/G | 10/19/93 | 09085HA-2 |
| FS2066 | 93.16858 SE | ETVAA | 0.3 | 0.2 | UG/G | 9/14/93 | |
| FS2066 | 93.16858 SO4 | IC | 14. | 1.4 | UG/G | 11/19/93 | |
| FS2066 | 93.16858 TA | ICPMS | < 0.2 | | UG/G | 10/15/93 | BATCH 09085L |
| FS2066 | 93.16858 TH | ICPMS | 6. | 0.4 | UG/G | 10/15/93 | BATCH 09085L |
| FS2066 | 93.16858 TL | ICPMS | < 0.2 | | UG/G | 10/15/93 | BATCH 09085L |
| FS2066 | 93.16858 U | ICPMS | 0.9 | 0.2 | UG/G | 10/15/93 | BATCH 09085L |
| FS2066 | 93.16858 V | ICPES | 22. | 2. | UG/G | 10/15/93 | |
| FS2066 | 93.16858 ZN | ICPES | 14. | 1. | UG/G | 10/15/93 | |
| FS2067 | 93.16859 AL | ICPES | 33000. | 3300. | UG/G | 10/15/93 | |
| FS2067 | 93.16859 AS | ETVAA | 9.2 | 1.8 | UG/G | 9/14/93 | |
| FS2067 | 93.16859 BA | ICPES | 88. | 9. | UG/G | 10/15/93 | |
| FS2067 | 93.16859 BE | ICPES | 1.9 | 0.2 | UG/G | 10/15/93 | |
| FS2067 | 93.16859 CA | ICPES | 4000. | 400. | UG/G | 10/15/93 | |
| FS2067 | 93.16859 CD | ICPES | < 0.4 | | UG/G | 10/15/93 | |
| FS2067 | 93.16859 CL | IC | 23.8 | 2.4 | UG/G | 9/10/93 | |
| FS2067 | 93.16859 CO | ICPES | 10. | 1. | UG/G | 10/15/93 | |
| FS2067 | 93.16859 CR | ICPES | 19. | 2. | UG/G | 10/15/93 | |
| FS2067 | 93.16859 CU | ICPES | 7.9 | 0.8 | UG/G | 10/15/93 | |
| FS2067 | 93.16859 FE | ICPES | 24000. | 2400. | UG/G | 10/15/93 | |
| FS2067 | 93.16859 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2067 | 93.16859 K | ICPES | 2700. | 270. | UG/G | 10/15/93 | |
| FS2067 | 93.16859 MG | ICPES | 4200. | 420. | UG/G | 10/15/93 | |
| FS2067 | 93.16859 MN | ICPES | 220. | 22. | UG/G | 10/15/93 | |
| FS2067 | 93.16859 NA | ICPES | 330. | 33. | UG/G | 10/15/93 | |
| FS2067 | 93.16859 NI | ICPES | 13. | 2. | UG/G | 10/15/93 | |
| FS2067 | 93.16859 PB | ICPES | 25. | 6. | UG/G | 10/15/93 | |
| FS2067 | 93.16859 SB | ICPES | < 5. | | UG/G | 10/19/93 | 09085HA-2 |
| FS2067 | 93.16859 SE | ETVAA | 1.3 | 0.3 | UG/G | 9/14/93 | |
| FS2067 | 93.16859 SO4 | IC | 29. | 3. | UG/G | 11/19/93 | |
| FS2067 | 93.16859 TA | ICPMS | < 0.2 | | UG/G | 10/15/93 | BATCH 09085L |
| FS2067 | 93.16859 TH | ICPMS | 9. | 1. | UG/G | 10/15/93 | BATCH 09085L |
| FS2067 | 93.16859 TL | ICPMS | 0.6 | 0.2 | UG/G | 10/15/93 | BATCH 09085L |
| FS2067 | 93.16859 U | ICPMS | 1.5 | 0.2 | UG/G | 10/15/93 | BATCH 09085L |
| FS2067 | 93.16859 V | ICPES | 45. | 5. | UG/G | 10/15/93 | |
| FS2067 | 93.16859 ZN | ICPES | 41. | 4. | UG/G | 10/15/93 | |
| FS2068 | 93.16860 AL | ICPES | 27000. | 2700. | UG/G | 10/15/93 | |
| FS2068 | 93.16860 AS | ETVAA | 7. | 1.4 | UG/G | 9/14/93 | |
| FS2068 | 93.16860 BA | ICPES | 160. | 16. | UG/G | 10/15/93 | |
| FS2068 | 93.16860 BE | ICPES | 1.2 | 0.1 | UG/G | 10/15/93 | |
| FS2068 | 93.16860 CA | ICPES | 2800. | 280. | UG/G | 10/15/93 | |
| FS2068 | 93.16860 CD | ICPES | < 0.4 | | UG/G | 10/15/93 | |
| FS2068 | 93.16860 CL | IC | 14.8 | 1.5 | UG/G | 9/10/93 | |
| FS2068 | 93.16860 CO | ICPES | 12. | 1. | UG/G | 10/15/93 | |
| FS2068 | 93.16860 CR | ICPES | 17. | 2. | UG/G | 10/15/93 | |
| FS2068 | 93.16860 CU | ICPES | 7.9 | 0.8 | UG/G | 10/15/93 | |
| FS2068 | 93.16860 FE | ICPES | 21000. | 2100. | UG/G | 10/15/93 | |
| FS2068 | 93.16860 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2068 | 93.16860 K | ICPES | 2400. | 240. | UG/G | 10/15/93 | |
| FS2068 | 93.16860 MG | ICPES | 3800. | 380. | UG/G | 10/15/93 | |
| FS2068 | 93.16860 MN | ICPES | 300. | 30. | UG/G | 10/15/93 | |
| FS2068 | 93.16860 NA | ICPES | 210. | 21. | UG/G | 10/15/93 | |

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| FS2068 | 93.16860 | NI | ICPES | 10. | 6. | UG/G | 10/15/93 | |
| FS2068 | 93.16860 | PB | ICPES | 20. | 14. | UG/G | 10/15/93 | |
| FS2068 | 93.16860 | SB | ICPES | < 5. | | UG/G | 10/19/93 | 09085HA-2 |
| FS2068 | 93.16860 | SE | ETVAA | 1.2 | 0.2 | UG/G | 9/14/93 | |
| FS2068 | 93.16860 | SO4 | IC | 24. | 2.4 | UG/G | 11/19/93 | |
| FS2068 | 93.16860 | TA | ICPMS | < 0.2 | | UG/G | 10/15/93 | BATCH 09085L |
| FS2068 | 93.16860 | TH | ICPMS | 9. | 1. | UG/G | 10/15/93 | BATCH 09085L |
| FS2068 | 93.16860 | TL | ICPMS | 0.4 | 0.2 | UG/G | 10/15/93 | BATCH 09085L |
| FS2068 | 93.16860 | U | ICPMS | 1.5 | 0.2 | UG/G | 10/15/93 | BATCH 09085L |
| FS2068 | 93.16860 | V | ICPES | 41. | 4. | UG/G | 10/15/93 | |
| FS2068 | 93.16860 | ZN | ICPES | 33. | 3. | UG/G | 10/15/93 | |
| FS2070 | 93.16861 | AL | ICPES | 1100. | 110. | UG/G | 10/15/93 | |
| FS2070 | 93.16861 | AS | ETVAA | 0.6 | 0.2 | UG/G | 9/14/93 | |
| FS2070 | 93.16861 | BA | ICPES | 8.7 | 0.9 | UG/G | 10/15/93 | |
| FS2070 | 93.16861 | BE | ICPES | 0.18 | 0.02 | UG/G | 1/10/94 | |
| FS2070 | 93.16861 | CA | ICPES | 540. | 54. | UG/G | 1/10/94 | |
| FS2070 | 93.16861 | CD | ICPES | < 0.4 | | UG/G | 1/10/94 | |
| FS2070 | 93.16861 | CL | IC | 15.5 | 1.6 | UG/G | 9/10/93 | |
| FS2070 | 93.16861 | CO | ICPES | 21. | 2. | UG/G | 1/10/94 | |
| FS2070 | 93.16861 | CR | ICPES | 0.6 | 0.06 | UG/G | 1/10/94 | |
| FS2070 | 93.16861 | CU | ICPES | 0.7 | 0.2 | UG/G | 1/10/94 | |
| FS2070 | 93.16861 | FE | ICPES | 4300. | 430. | UG/G | 1/10/94 | |
| FS2070 | 93.16861 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2070 | 93.16861 | K | ICPES | 300. | 100. | UG/G | 1/10/94 | |
| FS2070 | 93.16861 | MG | ICPES | 220. | 22. | UG/G | 1/10/94 | |
| FS2070 | 93.16861 | MN | ICPES | 190. | 19. | UG/G | 1/10/94 | |
| FS2070 | 93.16861 | NA | ICPES | 270. | 27. | UG/G | 1/10/94 | |
| FS2070 | 93.16861 | NI | ICPES | < 2. | | UG/G | 1/10/94 | |
| FS2070 | 93.16861 | PB | ICPES | < 4. | | UG/G | 10/15/93 | 09085HA |
| FS2070 | 93.16861 | SB | ICPES | < 5. | | UG/G | 10/15/93 | |
| FS2070 | 93.16861 | SE | ETVAA | < 0.2 | | UG/G | 9/14/93 | |
| FS2070 | 93.16861 | SO4 | IC | 28. | 3. | UG/G | 11/19/93 | |
| FS2070 | 93.16861 | TA | ICPMS | < 0.2 | | UG/G | 10/15/93 | BATCH 09085L |
| FS2070 | 93.16861 | TH | ICPMS | 5. | 0.6 | UG/G | 10/15/93 | BATCH 09085L |
| FS2070 | 93.16861 | TL | ICPMS | < 0.2 | | UG/G | 10/15/93 | BATCH 09085L |
| FS2070 | 93.16861 | U | ICPMS | 0.7 | 0.2 | UG/G | 10/15/93 | BATCH 09085L |
| FS2070 | 93.16861 | V | ICPES | < 0.5 | | UG/G | 10/18/93 | |
| FS2070 | 93.16861 | ZN | ICPES | 27. | 3. | UG/G | 10/18/93 | REDIGEST |
| FS2071 | 93.16862 | AL | ICPES | 50000. | 5000. | UG/G | 10/18/93 | |
| FS2071 | 93.16862 | AS | ETVAA | 10.6 | 2.1 | UG/G | 9/14/93 | |
| FS2071 | 93.16862 | BA | ICPES | 300. | 30. | UG/G | 10/18/93 | |
| FS2071 | 93.16862 | BE | ICPES | 3.2 | 0.3 | UG/G | 10/18/93 | |
| FS2071 | 93.16862 | CA | ICPES | 11000. | 1100. | UG/G | 10/18/93 | |
| FS2071 | 93.16862 | CD | ICPES | < 0.4 | | UG/G | 10/18/93 | |
| FS2071 | 93.16862 | CL | IC | 13.7 | 1.4 | UG/G | 9/10/93 | |
| FS2071 | 93.16862 | CO | ICPES | 8.1 | 0.8 | UG/G | 10/18/93 | |
| FS2071 | 93.16862 | CR | ICPES | 27. | 3. | UG/G | 10/18/93 | |
| FS2071 | 93.16862 | CU | ICPES | 9. | 0.9 | UG/G | 10/18/93 | |
| FS2071 | 93.16862 | FE | ICPES | 31000. | 3100. | UG/G | 10/18/93 | |
| FS2071 | 93.16862 | HG | CVAA | 0.2 | 0.1 | UG/G | 8/31/93 | |
| FS2071 | 93.16862 | K | ICPES | 4300. | 430. | UG/G | 10/18/93 | |
| FS2071 | 93.16862 | MG | ICPES | 12000. | 1200. | UG/G | 10/18/93 | |
| FS2071 | 93.16862 | MN | ICPES | 130. | 13. | UG/G | 10/18/93 | |
| FS2071 | 93.16862 | NA | ICPES | 870. | 87. | UG/G | 10/18/93 | |
| FS2071 | 93.16862 | NI | ICPES | 22. | 2. | UG/G | 10/18/93 | 09085HA |
| FS2071 | 93.16862 | PB | ICPES | 22. | 2. | UG/G | 10/15/93 | 09085HA |
| FS2071 | 93.16862 | SB | ICPES | < 5. | | UG/G | 10/15/93 | 09085HA-2 |
| FS2071 | 93.16862 | SE | ETVAA | 0.9 | 0.2 | UG/G | 9/14/93 | |
| FS2071 | 93.16862 | SO4 | IC | 161. | 16. | UG/G | 11/19/93 | |
| FS2071 | 93.16862 | TA | ICPMS | < 0.2 | | UG/G | 10/15/93 | BATCH 09085L |

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| FS2071 | 93.16862 TH | ICPMS | 10. | 1. | UG/G | 10/15/93 | BATCH 09085L |
| FS2071 | 93.16862 TL | ICPMS | 0.5 | 0.2 | UG/G | 10/15/93 | BATCH 09085L |
| FS2071 | 93.16862 U | ICPMS | 0.9 | 0.2 | UG/G | 10/15/93 | BATCH 09085L |
| FS2071 | 93.16862 V | ICPES | 53. | 5. | UG/G | 10/18/93 | 09085HA |
| FS2071 | 93.16862 ZN | ICPES | 64. | 6. | UG/G | 10/18/93 | 09085HA |
| FS2072 | 93.16863 AL | ICPES | 21000. | 2100. | UG/G | 10/18/93 | 09085HA |
| FS2072 | 93.16863 AS | ETVAA | 5.4 | 1. | UG/G | 9/14/93 | |
| FS2072 | 93.16863 BA | ICPES | 180. | 18. | UG/G | 10/18/93 | 09085HA |
| FS2072 | 93.16863 BE | ICPES | 1. | 0.1 | UG/G | 10/18/93 | 09085HA |
| FS2072 | 93.16863 CA | ICPES | 2900. | 290. | UG/G | 10/18/93 | 09085HA |
| FS2072 | 93.16863 CD | ICPES | < 0.4 | | UG/G | 10/18/93 | 09085HA |
| FS2072 | 93.16863 CL | IC | 13. | 1.3 | UG/G | 9/10/93 | |
| FS2072 | 93.16863 CO | ICPES | 10. | 1. | UG/G | 10/18/93 | 09085HA |
| FS2072 | 93.16863 CR | ICPES | 10. | 1. | UG/G | 10/18/93 | 09085HA |
| FS2072 | 93.16863 CU | ICPES | 4.5 | 0.5 | UG/G | 10/18/93 | 09085HA |
| FS2072 | 93.16863 FE | ICPES | 13000. | 1300. | UG/G | 10/18/93 | 09085HA |
| FS2072 | 93.16863 HG | CVAA | 0.1 | 0.1 | UG/G | 8/31/93 | |
| FS2072 | 93.16863 K | ICPES | 2300. | 230. | UG/G | 10/18/93 | 09085HA |
| FS2072 | 93.16863 MG | ICPES | 2400. | 240. | UG/G | 10/18/93 | 09085HA |
| FS2072 | 93.16863 MN | ICPES | 280. | 28. | UG/G | 10/18/93 | 09085HA |
| FS2072 | 93.16863 NA | ICPES | 540. | 54. | UG/G | 10/18/93 | 09085HA |
| FS2072 | 93.16863 NI | ICPES | 7. | 4. | UG/G | 10/18/93 | 09085HA |
| FS2072 | 93.16863 PB | ICPES | 35. | 8. | UG/G | 10/15/93 | 09085HA |
| FS2072 | 93.16863 SB | ICPES | < 5. | | UG/G | 10/15/93 | 09085HA-2 |
| FS2072 | 93.16863 SE | ETVAA | 0.7 | 0.2 | UG/G | 9/14/93 | |
| FS2072 | 93.16863 SO4 | IC | 304. | 30. | UG/G | 11/19/93 | |
| FS2072 | 93.16863 TA | ICPMS | < 0.2 | | UG/G | 10/15/93 | BATCH 09085L |
| FS2072 | 93.16863 TH | ICPMS | 6. | 0.5 | UG/G | 10/15/93 | BATCH 09085L |
| FS2072 | 93.16863 TL | ICPMS | < 0.2 | | UG/G | 10/15/93 | BATCH 09085L |
| FS2072 | 93.16863 U | ICPMS | 1.6 | 0.2 | UG/G | 10/15/93 | BATCH 09085L |
| FS2072 | 93.16863 V | ICPES | 24. | 2. | UG/G | 10/18/93 | BATCH 09085L |
| FS2072 | 93.16863 ZN | ICPES | 36. | 4. | UG/G | 10/18/93 | 09085HA |
| FS2073 | 93.16864 AL | ICPES | 17000. | 1700. | UG/G | 10/18/93 | 09085HA |
| FS2073 | 93.16864 AS | ETVAA | 5.1 | 1. | UG/G | 9/14/93 | |
| FS2073 | 93.16864 BA | ICPES | 100. | 10. | UG/G | 10/18/93 | 09085HA |
| FS2073 | 93.16864 BE | ICPES | 0.85 | 0.09 | UG/G | 10/18/93 | 09085HA |
| FS2073 | 93.16864 CA | ICPES | 1800. | 180. | UG/G | 10/18/93 | 09085HA |
| FS2073 | 93.16864 CD | ICPES | < 0.4 | | UG/G | 10/18/93 | 09085HA |
| FS2073 | 93.16864 CL | IC | 11.4 | 1.1 | UG/G | 9/10/93 | |
| FS2073 | 93.16864 CO | ICPES | 18. | 2. | UG/G | 10/18/93 | 09085HA |
| FS2073 | 93.16864 CR | ICPES | 10. | 1. | UG/G | 10/18/93 | 09085HA |
| FS2073 | 93.16864 CU | ICPES | 1.7 | 0.6 | UG/G | 10/18/93 | 09085HA |
| FS2073 | 93.16864 FE | ICPES | 12000. | 1200. | UG/G | 10/18/93 | 09085HA |
| FS2073 | 93.16864 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2073 | 93.16864 K | ICPES | 1800. | 180. | UG/G | 10/18/93 | 09085HA |
| FS2073 | 93.16864 MG | ICPES | 2200. | 220. | UG/G | 10/18/93 | 09085HA |
| FS2073 | 93.16864 MN | ICPES | 170. | 17. | UG/G | 10/18/93 | 09085HA |
| FS2073 | 93.16864 NA | ICPES | 130. | 13. | UG/G | 10/18/93 | 09085HA |
| FS2073 | 93.16864 NI | ICPES | 6. | 1. | UG/G | 10/18/93 | 09085HA |
| FS2073 | 93.16864 PB | ICPES | 14. | 10. | UG/G | 10/15/93 | 09085HA |
| FS2073 | 93.16864 SB | ICPES | < 5. | | UG/G | 10/15/93 | 09085HA-2 |
| FS2073 | 93.16864 SE | ETVAA | 0.7 | 0.2 | UG/G | 9/14/93 | |
| FS2073 | 93.16864 SO4 | IC | 27. | 2.7 | UG/G | 11/19/93 | |
| FS2073 | 93.16864 TA | ICPMS | < 0.2 | | UG/G | 10/15/93 | BATCH 09085L |
| FS2073 | 93.16864 TH | ICPMS | 8. | 1. | UG/G | 10/15/93 | BATCH 09085L |
| FS2073 | 93.16864 TL | ICPMS | 0.3 | 0.2 | UG/G | 10/15/93 | BATCH 09085L |
| FS2073 | 93.16864 U | ICPMS | 1. | 0.3 | UG/G | 10/15/93 | BATCH 09085L |
| FS2073 | 93.16864 V | ICPES | 23. | 2. | UG/G | 10/18/93 | 09085HA |
| FS2073 | 93.16864 ZN | ICPES | 25. | 3. | UG/G | 10/18/93 | 09085HA |
| FS2074 | 93.16865 AL | ICPES | 1900. | 190. | UG/G | 10/18/93 | |

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| FS2074 | 93.16865 AS | ETVAA | 1.5 | 0.3 | UG/G | 9/14/93 | |
| FS2074 | 93.16865 BA | ICPES | 4.8 | 0.5 | UG/G | 10/18/93 | |
| FS2074 | 93.16865 BE | ICPES | 0.29 | 0.03 | UG/G | 10/18/93 | |
| FS2074 | 93.16865 CA | ICPES | 200. | 20. | UG/G | 10/18/93 | |
| FS2074 | 93.16865 CD | ICPES | < 0.4 | | UG/G | 1/10/94 | |
| FS2074 | 93.16865 CL | IC | 31.7 | 3.2 | UG/G | 9/10/93 | |
| FS2074 | 93.16865 CO | ICPES | 46. | 5. | UG/G | 1/10/94 | |
| FS2074 | 93.16865 CR | ICPES | < 0.5 | | UG/G | 1/10/94 | |
| FS2074 | 93.16865 CU | ICPES | < 0.5 | | UG/G | 1/10/94 | |
| FS2074 | 93.16865 FE | ICPES | 5400. | 540. | UG/G | 1/10/94 | |
| FS2074 | 93.16865 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2074 | 93.16865 K | ICPES | 970. | 97. | UG/G | 1/10/94 | |
| FS2074 | 93.16865 MG | ICPES | 180. | 18. | UG/G | 1/10/94 | |
| FS2074 | 93.16865 MN | ICPES | 180. | 18. | UG/G | 1/10/94 | |
| FS2074 | 93.16865 NA | ICPES | 810. | 81. | UG/G | 1/10/94 | |
| FS2074 | 93.16865 NI | ICPES | < 2. | | UG/G | 1/10/94 | |
| FS2074 | 93.16865 PB | ICPMS | 3. | 0.4 | UG/G | 10/15/93 | BATCH 09085L |
| FS2074 | 93.16865 SB | ICPES | < 5. | | UG/G | 10/15/93 | |
| FS2074 | 93.16865 SE | ETVAA | < 0.2 | | UG/G | 9/14/93 | |
| FS2074 | 93.16865 SO4 | IC | 19. | 2. | UG/G | 11/19/93 | |
| FS2074 | 93.16865 TA | ICPMS | < 0.2 | | UG/G | 10/15/93 | BATCH 09085L |
| FS2074 | 93.16865 TH | ICPMS | 5. | 0.4 | UG/G | 10/15/93 | BATCH 09085L |
| FS2074 | 93.16865 TL | ICPMS | < 0.2 | | UG/G | 10/15/93 | BATCH 09085L |
| FS2074 | 93.16865 U | ICPMS | 0.9 | 0.2 | UG/G | 10/15/93 | BATCH 09085L |
| FS2074 | 93.16865 V | ICPES | 2.8 | 0.3 | UG/G | 1/10/94 | |
| FS2074 | 93.16865 ZN | ICPES | 26. | 3. | UG/G | 1/10/94 | |
| FS2075 | 93.16866 AL | ICPES | 14000. | 1400. | UG/G | 10/18/93 | 09085HA |
| FS2075 | 93.16866 AS | ETVAA | 3.9 | 0.8 | UG/G | 9/14/93 | |
| FS2075 | 93.16866 BA | ICPES | 24. | 2. | UG/G | 10/18/93 | 09085HA |
| FS2075 | 93.16866 BE | ICPES | 0.86 | 0.09 | UG/G | 10/18/93 | 09085HA |
| FS2075 | 93.16866 CA | ICPES | 1700. | 170. | UG/G | 10/18/93 | 09085HA |
| FS2075 | 93.16866 CD | ICPES | < 0.4 | | UG/G | 10/18/93 | 09085HA |
| FS2075 | 93.16866 CL | IC | 574. | 57. | UG/G | 9/10/93 | |
| FS2075 | 93.16866 CO | ICPES | 21. | 2. | UG/G | 10/18/93 | 09085HA |
| FS2075 | 93.16866 CR | ICPES | 6. | 0.9 | UG/G | 10/18/93 | 09085HA |
| FS2075 | 93.16866 CU | ICPES | 3.9 | 0.4 | UG/G | 10/18/93 | 09085HA |
| FS2075 | 93.16866 FE | ICPES | 11000. | 1100. | UG/G | 10/18/93 | 09085HA |
| FS2075 | 93.16866 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2075 | 93.16866 K | ICPES | 1200. | 120. | UG/G | 10/18/93 | 09085HA |
| FS2075 | 93.16866 MG | ICPES | 2200. | 220. | UG/G | 10/18/93 | 09085HA |
| FS2075 | 93.16866 MN | ICPES | 88. | 9. | UG/G | 10/18/93 | 09085HA |
| FS2075 | 93.16866 NA | ICPES | 670. | 67. | UG/G | 10/18/93 | 09085HA |
| FS2075 | 93.16866 NI | ICPES | 7. | 3. | UG/G | 10/18/93 | 09085HA |
| FS2075 | 93.16866 PB | ICPES | 13. | 4. | UG/G | 10/15/93 | 09085HA |
| FS2075 | 93.16866 SB | ICPES | < 5. | | UG/G | 10/15/93 | 09085HA-2 |
| FS2075 | 93.16866 SE | ETVAA | 0.3 | 0.2 | UG/G | 9/14/93 | |
| FS2075 | 93.16866 SO4 | IC | 342. | 34. | UG/G | 11/19/93 | |
| FS2075 | 93.16866 TA | ICPMS | < 0.2 | | UG/G | 10/15/93 | BATCH 09085L |
| FS2075 | 93.16866 TH | ICPMS | 5. | 0.5 | UG/G | 10/15/93 | BATCH 09085L |
| FS2075 | 93.16866 TL | ICPMS | < 0.2 | | UG/G | 10/15/93 | BATCH 09085L |
| FS2075 | 93.16866 U | ICPMS | 0.6 | 0.2 | UG/G | 10/15/93 | BATCH 09085L |
| FS2075 | 93.16866 V | ICPES | 14. | 1. | UG/G | 10/18/93 | 09085HA |
| FS2075 | 93.16866 ZN | ICPES | 43. | 4. | UG/G | 10/18/93 | 09085HA |
| FS2076 | 93.16867 AL | ICPES | 56000. | 5600. | UG/G | 10/18/93 | 09085HA |
| FS2076 | 93.16867 AS | ETVAA | 13.6 | 2.7 | UG/G | 9/14/93 | |
| FS2076 | 93.16867 BA | ICPES | 89. | 9. | UG/G | 10/18/93 | 09085HA |
| FS2076 | 93.16867 BE | ICPES | 3.4 | 0.3 | UG/G | 10/18/93 | 09085HA |
| FS2076 | 93.16867 CA | ICPES | 6200. | 620. | UG/G | 10/18/93 | 09085HA |
| FS2076 | 93.16867 CD | ICPES | < 0.4 | | UG/G | 10/18/93 | 09085HA |
| FS2076 | 93.16867 CL | IC | 724. | 72. | UG/G | 9/10/93 | |

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| FS2076 | 93.16867 CO | ICPES | 27. | 3. | UG/G | 10/18/93 | 09085HA |
| FS2076 | 93.16867 CR | ICPES | 24. | 2. | UG/G | 10/18/93 | 09085HA |
| FS2076 | 93.16867 CU | ICPES | 15. | 3. | UG/G | 10/18/93 | 09085HA |
| FS2076 | 93.16867 FE | ICPES | 30000. | 3000. | UG/G | 10/18/93 | 09085HA |
| FS2076 | 93.16867 HG | CVAA | 0.1 | 0.1 | UG/G | 8/31/93 | |
| FS2076 | 93.16867 K | ICPES | 4600. | 460. | UG/G | 10/18/93 | 09085HA |
| FS2076 | 93.16867 MG | ICPES | 7000. | 700. | UG/G | 10/18/93 | 09085HA |
| FS2076 | 93.16867 MN | ICPES | 520. | 52. | UG/G | 10/18/93 | 09085HA |
| FS2076 | 93.16867 NA | ICPES | 2000. | 200. | UG/G | 10/18/93 | 09085HA |
| FS2076 | 93.16867 NI | ICPES | 25. | 3. | UG/G | 10/18/93 | 09085HA |
| FS2076 | 93.16867 PB | ICPES | 31. | 8. | UG/G | 10/15/93 | 09085HA |
| FS2076 | 93.16867 SB | ICPES | < 5. | | UG/G | 10/15/93 | 09085HA-2 |
| FS2076 | 93.16867 SE | ETVAA | 2.4 | 0.5 | UG/G | 9/14/93 | |
| FS2076 | 93.16867 SO4 | IC | 462. | 46. | UG/G | 11/19/93 | |
| FS2076 | 93.16867 TA | ICPMS | < 0.2 | | UG/G | 10/15/93 | BATCH 09085L |
| FS2076 | 93.16867 TH | ICPMS | 15. | 2. | UG/G | 10/15/93 | BATCH 09085L |
| FS2076 | 93.16867 TL | ICPMS | 0.7 | 0.2 | UG/G | 10/15/93 | BATCH 09085L |
| FS2076 | 93.16867 U | ICPMS | 2. | 0.5 | UG/G | 10/15/93 | BATCH 09085L |
| FS2076 | 93.16867 V | ICPES | 47. | 5. | UG/G | 10/18/93 | 09085HA |
| FS2076 | 93.16867 ZN | ICPES | 66. | 6. | UG/G | 10/18/93 | 09085HA |
| FS2077 | 93.16868 AL | ICPES | 3500. | 350. | UG/G | 10/18/93 | 09085HA |
| FS2077 | 93.16868 AS | ETVAA | 0.8 | 0.2 | UG/G | 9/14/93 | |
| FS2077 | 93.16868 BA | ICPES | 27. | 3. | UG/G | 10/18/93 | 09085HA |
| FS2077 | 93.16868 BE | ICPES | 0.31 | 0.03 | UG/G | 10/18/93 | 09085HA |
| FS2077 | 93.16868 CA | ICPES | 1100. | 110. | UG/G | 10/18/93 | 09085HA |
| FS2077 | 93.16868 CD | ICPES | < 0.4 | | UG/G | 10/18/93 | 09085HA |
| FS2077 | 93.16868 CL | IC | 16.4 | 1.6 | UG/G | 9/10/93 | |
| FS2077 | 93.16868 CO | ICPES | 29. | 3. | UG/G | 10/18/93 | 09085HA |
| FS2077 | 93.16868 CR | ICPES | 1.9 | 0.8 | UG/G | 10/18/93 | 09085HA |
| FS2077 | 93.16868 CU | ICPES | < 0.5 | | UG/G | 10/18/93 | 09085HA |
| FS2077 | 93.16868 FE | ICPES | 3300. | 330. | UG/G | 10/18/93 | 09085HA |
| FS2077 | 93.16868 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2077 | 93.16868 K | ICPES | 750. | 84. | UG/G | 10/18/93 | 09085HA |
| FS2077 | 93.16868 MG | ICPES | 880. | 88. | UG/G | 10/18/93 | 09085HA |
| FS2077 | 93.16868 MN | ICPES | 140. | 14. | UG/G | 10/18/93 | 09085HA |
| FS2077 | 93.16868 NA | ICPES | 660. | 66. | UG/G | 10/18/93 | 09085HA |
| FS2077 | 93.16868 NI | ICPES | < 2. | | UG/G | 10/18/93 | 09085HA |
| FS2077 | 93.16868 PB | ICPES | < 4. | | UG/G | 10/15/93 | 09085HA |
| FS2077 | 93.16868 SB | ICPES | < 5. | | UG/G | 10/15/93 | 09085HA-2 |
| FS2077 | 93.16868 SE | ETVAA | < 0.2 | | UG/G | 9/14/93 | |
| FS2077 | 93.16868 SO4 | IC | 20. | 2. | UG/G | 11/19/93 | |
| FS2077 | 93.16868 TA | ICPMS | < 0.2 | | UG/G | 10/15/93 | BATCH 09085L |
| FS2077 | 93.16868 TH | ICPMS | 2. | 0.2 | UG/G | 10/15/93 | BATCH 09085L |
| FS2077 | 93.16868 TL | ICPMS | < 0.2 | | UG/G | 10/15/93 | BATCH 09085L |
| FS2077 | 93.16868 U | ICPMS | 0.2 | 0.2 | UG/G | 10/15/93 | BATCH 09085L |
| FS2077 | 93.16868 V | ICPES | 4.6 | 0.5 | UG/G | 10/18/93 | 09085HA |
| FS2077 | 93.16868 ZN | ICPES | 14. | 1. | UG/G | 10/18/93 | 09085HA |
| FS2078 | 93.16869 AL | ICPES | 4400. | 440. | UG/G | 10/18/93 | 09085HA |
| FS2078 | 93.16869 AS | ETVAA | 0.7 | 0.2 | UG/G | 12/17/93 | |
| FS2078 | 93.16869 BA | ICPES | 31. | 3. | UG/G | 10/18/93 | 09085HA |
| FS2078 | 93.16869 BE | ICPES | 0.42 | 0.04 | UG/G | 10/18/93 | 09085HA |
| FS2078 | 93.16869 CA | ICPES | 900. | 90. | UG/G | 10/18/93 | 09085HA |
| FS2078 | 93.16869 CD | ICPES | < 0.4 | | UG/G | 10/18/93 | 09085HA |
| FS2078 | 93.16869 CL | IC | 58.9 | 5.9 | UG/G | 9/10/93 | |
| FS2078 | 93.16869 CO | ICPES | 34. | 3. | UG/G | 10/18/93 | 09085HA |
| FS2078 | 93.16869 CR | ICPES | 2.1 | 0.2 | UG/G | 10/18/93 | 09085HA |
| FS2078 | 93.16869 CU | ICPES | < 0.5 | | UG/G | 10/18/93 | 09085HA |
| FS2078 | 93.16869 FE | ICPES | 3300. | 330. | UG/G | 10/18/93 | 09085HA |
| FS2078 | 93.16869 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2078 | 93.16869 K | ICPES | 1100. | 110. | UG/G | 10/18/93 | 09085HA |

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|---|---|---|---|---|---|---|---|---|
| FS2078 | 93.16869 | MG | ICPES | 900. | 90. | UG/G | 10/18/93 | 09085HA |
| FS2078 | 93.16869 | MN | ICPES | 140. | 14. | UG/G | 10/18/93 | 09085HA |
| FS2078 | 93.16869 | NA | ICPES | 770. | 77. | UG/G | 10/18/93 | 09085HA |
| FS2078 | 93.16869 | NI | ICPES | < 2. | | UG/G | 10/18/93 | 09085HA |
| FS2078 | 93.16869 | PB | ICPES | 7. | 2. | UG/G | 10/18/93 | 09085HA |
| FS2078 | 93.16869 | SE | ETVAA | < 0.2 | | UG/G | 12/17/93 | |
| FS2078 | 93.16869 | SO4 | IC | 16. | 1.6 | UG/G | 11/19/93 | |
| FS2078 | 93.16869 | TA | ICPMS | < 0.12 | | UG/G | 1/13/94 | |
| FS2078 | 93.16869 | TH | ICPMS | 3.4 | 0.2 | UG/G | 1/13/94 | |
| FS2078 | 93.16869 | U | ICPMS | 0.4 | 0.04 | UG/G | 1/13/94 | |
| FS2078 | 93.16869 | V | ICPES | 4.4 | 0.4 | UG/G | 10/18/93 | 09085HA |
| FS2078 | 93.16869 | ZN | ICPES | 19. | 2. | UG/G | 10/18/93 | 09085HA |
| FS2079 | 93.16870 | AL | ICPES | 3700. | 370. | UG/G | 10/18/93 | 09085HA |
| FS2079 | 93.16870 | AS | ETVAA | 0.9 | 0.2 | UG/G | 12/17/93 | |
| FS2079 | 93.16870 | BA | ICPES | 35. | 4. | UG/G | 10/18/93 | 09085HA |
| FS2079 | 93.16870 | BE | ICPES | 0.32 | 0.03 | UG/G | 10/18/93 | 09085HA |
| FS2079 | 93.16870 | CA | ICPES | 1500. | 150. | UG/G | 10/18/93 | 09085HA |
| FS2079 | 93.16870 | CD | ICPES | < 0.4 | | UG/G | 10/18/93 | 09085HA |
| FS2079 | 93.16870 | CL | IC | 15.7 | 1.6 | UG/G | 9/10/93 | |
| FS2079 | 93.16870 | CO | ICPES | 24. | 2. | UG/G | 10/18/93 | 09085HA |
| FS2079 | 93.16870 | CR | ICPES | 2. | 0.3 | UG/G | 10/18/93 | 09085HA |
| FS2079 | 93.16870 | CU | ICPES | 3.1 | 2.7 | UG/G | 10/18/93 | 09085HA |
| FS2079 | 93.16870 | FE | ICPES | 3800. | 380. | UG/G | 10/18/93 | 09085HA |
| FS2079 | 93.16870 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2079 | 93.16870 | K | ICPES | 1100. | 110. | UG/G | 10/18/93 | 09085HA |
| FS2079 | 93.16870 | MG | ICPES | 910. | 91. | UG/G | 10/18/93 | 09085HA |
| FS2079 | 93.16870 | MN | ICPES | 150. | 15. | UG/G | 10/18/93 | 09085HA |
| FS2079 | 93.16870 | NA | ICPES | 830. | 83. | UG/G | 10/18/93 | 09085HA |
| FS2079 | 93.16870 | NI | ICPES | 6. | 3. | UG/G | 10/18/93 | 09085HA |
| FS2079 | 93.16870 | PB | ICPES | 24. | 12. | UG/G | 10/18/93 | 09085HA |
| FS2079 | 93.16870 | SB | ICPES | < 5. | | UG/G | 11/01/93 | 09085HA-2 |
| FS2079 | 93.16870 | SE | ETVAA | < 0.2 | | UG/G | 12/17/93 | |
| FS2079 | 93.16870 | SO4 | IC | 19. | 2. | UG/G | 11/19/93 | |
| FS2079 | 93.16870 | TA | ICPMS | < 0.125 | | UG/G | 1/13/94 | |
| FS2079 | 93.16870 | TH | ICPMS | 2.5 | 0.2 | UG/G | 1/13/94 | |
| FS2079 | 93.16870 | TL | ICPMS | < 0.125 | | UG/G | 1/13/94 | |
| FS2079 | 93.16870 | U | ICPMS | 0.6 | 0.04 | UG/G | 1/13/94 | |
| FS2079 | 93.16870 | V | ICPES | 4. | 1. | UG/G | 10/18/93 | 09085HA |
| FS2079 | 93.16870 | ZN | ICPES | 21. | 2. | UG/G | 10/18/93 | 09085HA |

CUSTOMER SAMPLE DUPLICATES:

| CUSTOMER NUM | SAMPLE NUM | ANALYSIS | ANALYTICAL TECHNIQUE | ANALYTICAL RESULT | ANALYTICAL UNCERTAINTY | UNITS | COMPLETION DATE | COMMENT |
|---|---|---|---|---|---|---|---|---|
| FS2000 | 93.16797 | HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2000 | 93.16797 | HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2001 | 93.16798 | HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2001 | 93.16798 | HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2002 | 93.16799 | HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2002 | 93.16799 | HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2003 | 93.16800 | AS | ETVAA | 6.4 | 1.3 | UG/G | 9/07/93 | |
| FS2003 | 93.16800 | HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2003 | 93.16800 | HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2003 | 93.16800 | SB | ICPMS | < 0.2 | | UG/G | 10/19/93 | 08275LA |
| FS2003 | 93.16800 | SE | ETVAA | 0.34 | 0.3 | UG/G | 9/07/93 | |
| FS2003 | 93.16800 | TA | ICPMS | < 0.2 | | UG/G | 10/19/93 | 08275LA |
| FS2003 | 93.16800 | TH | ICPMS | 8. | 0.2 | UG/G | 10/19/93 | 08275LA |
| FS2003 | 93.16800 | TL | ICPMS | 0.4 | 0.2 | UG/G | 10/19/93 | 08275LA |

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|---|---|---|---|---|---|---|---|
| FS2003 | 93.16800 U | ICPMS | 1.6 | 0.3 | UG/G | 10/19/93 | 08275LA |
| FS2004 | 93.16801 HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2004 | 93.16801 HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2005 | 93.16802 HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2005 | 93.16802 HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2006 | 93.16803 HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2006 | 93.16803 HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2007 | 93.16804 HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2007 | 93.16804 HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2008 | 93.16805 HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2008 | 93.16805 HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2009 | 93.16806 AL | ICPES | 14000. | 1400. | UG/G | 9/09/93 | 08275HA |
| FS2009 | 93.16806 BA | ICPES | 110. | 11. | UG/G | 9/09/93 | 08275HA |
| FS2009 | 93.16806 BE | ICPES | 0.92 | 0.09 | UG/G | 9/09/93 | 08275HA |
| FS2009 | 93.16806 CA | ICPES | 1800. | 180. | UG/G | 9/09/93 | 08275HA |
| FS2009 | 93.16806 CD | ICPES | < 0.4 | | UG/G | 9/09/93 | 08275HA |
| FS2009 | 93.16806 CO | ICPES | 8.3 | 0.8 | UG/G | 9/09/93 | 08275HA |
| FS2009 | 93.16806 CR | ICPES | 12. | 1. | UG/G | 9/09/93 | 08275HA |
| FS2009 | 93.16806 CU | ICPES | 8.8 | 0.9 | UG/G | 9/09/93 | 08275HA |
| FS2009 | 93.16806 FE | ICPES | 9600. | 960. | UG/G | 9/09/93 | 08275HA |
| FS2009 | 93.16806 HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2009 | 93.16806 HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2009 | 93.16806 K | ICPES | 2800. | 280. | UG/G | 9/09/93 | 08275HA |
| FS2009 | 93.16806 MG | ICPES | 2700. | 270. | UG/G | 9/09/93 | 08275HA |
| FS2009 | 93.16806 MN | ICPES | 100. | 10. | UG/G | 9/09/93 | 08275HA |
| FS2009 | 93.16806 NA | ICPES | 220. | 22. | UG/G | 9/09/93 | 08275HA |
| FS2009 | 93.16806 NI | ICPES | 6.5 | 0.7 | UG/G | 9/09/93 | 08275HA |
| FS2009 | 93.16806 PB | ICPES | 10. | 3. | UG/G | 9/09/93 | 08275HA |
| FS2009 | 93.16806 SB | ICPES | < 5. | | UG/G | 9/09/93 | 08275HA |
| FS2009 | 93.16806 V | ICPES | 17. | 2. | UG/G | 9/09/93 | 08275HA |
| FS2009 | 93.16806 ZN | ICPES | 38. | 4. | UG/G | 9/09/93 | 08275HA |
| FS2010 | 93.16807 HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2010 | 93.16807 HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2011 | 93.16808 HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2011 | 93.16808 HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2012 | 93.16809 HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2012 | 93.16809 HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2013 | 93.16810 HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2013 | 93.16810 HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2014 | 93.16811 HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2014 | 93.16811 HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2015 | 93.16812 HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2015 | 93.16812 HG | CVAA | < 0.1 | | UG/G | 8/27/93 | |
| FS2016 | 93.16813 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2016 | 93.16813 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2017 | 93.16814 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2017 | 93.16814 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2018 | 93.16815 AS | ETVAA | 2.5 | 0.5 | UG/G | 9/08/93 | |
| FS2018 | 93.16815 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2018 | 93.16815 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2018 | 93.16815 SB | ICPMS | < 0.2 | | UG/G | 10/19/93 | 08315LA |
| FS2018 | 93.16815 SE | ETVAA | 0.5 | 0.2 | UG/G | 9/08/93 | |
| FS2018 | 93.16815 TA | ICPMS | < 0.2 | | UG/G | 9/23/93 | 08315LA |
| FS2018 | 93.16815 TH | ICPMS | 5. | 0.5 | UG/G | 9/23/93 | 08315LA |
| FS2018 | 93.16815 TL | ICPMS | < 0.2 | | UG/G | 9/23/93 | 08315LA |
| FS2018 | 93.16815 U | ICPMS | 2.4 | 0.3 | UG/G | 9/23/93 | 08315LA |
| FS2019 | 93.16816 AL | ICPES | 7600. | 760. | UG/G | 9/09/93 | 08315HA |
| FS2019 | 93.16816 BA | ICPES | 61. | 6. | UG/G | 9/09/93 | 08315HA |
| FS2019 | 93.16816 BE | ICPES | 0.53 | 0.05 | UG/G | 9/09/93 | 08315HA |
| FS2019 | 93.16816 CA | ICPES | 2200. | 220. | UG/G | 9/09/93 | 08315HA |

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|---|---|---|---|---|---|---|---|
| FS2019 | 93.16816 CD | ICPES | < 0.4 | | UG/G | 9/09/93 | 08315HA |
| FS2019 | 93.16816 CO | ICPES | 11. | 1. | UG/G | 9/09/93 | 08315HA |
| FS2019 | 93.16816 CR | ICPES | 5. | 0.5 | UG/G | 9/09/93 | 08315HA |
| FS2019 | 93.16816 CU | ICPES | 1. | 0.1 | UG/G | 9/09/93 | 08315HA |
| FS2019 | 93.16816 FE | ICPES | 8900. | 890. | UG/G | 9/09/93 | 08315HA |
| FS2019 | 93.16816 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2019 | 93.16816 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2019 | 93.16816 K | ICPES | 1500. | 150. | UG/G | 9/09/93 | 08315HA |
| FS2019 | 93.16816 MG | ICPES | 1200. | 120. | UG/G | 9/09/93 | 08315HA |
| FS2019 | 93.16816 MN | ICPES | 430. | 43. | UG/G | 9/09/93 | 08315HA |
| FS2019 | 93.16816 NA | ICPES | 310. | 31. | UG/G | 9/09/93 | 08315HA |
| FS2019 | 93.16816 NI | ICPES | 4.7 | 0.6 | UG/G | 9/09/93 | 08315HA |
| FS2019 | 93.16816 PB | ICPES | < 4. | | UG/G | 9/09/93 | 08315HA |
| FS2019 | 93.16816 SB | ICPES | < 5. | | UG/G | 9/09/93 | 08315HA |
| FS2019 | 93.16816 V | ICPES | 12. | 1. | UG/G | 9/09/93 | 08315HA |
| FS2019 | 93.16816 ZN | ICPES | 38. | 4. | UG/G | 9/09/93 | 08315HA |
| FS2020 | 93.16817 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2020 | 93.16817 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2021 | 93.16818 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2021 | 93.16818 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2022 | 93.16819 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2022 | 93.16819 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2023 | 93.16820 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2023 | 93.16820 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2026 | 93.16821 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2026 | 93.16821 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2027 | 93.16822 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2027 | 93.16822 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2028 | 93.16823 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2028 | 93.16823 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2029 | 93.16824 HG | CVAA | 0.2 | 0.1 | UG/G | 8/31/93 | |
| FS2029 | 93.16824 HG | CVAA | 0.2 | 0.1 | UG/G | 8/31/93 | |
| FS2030 | 93.16825 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2030 | 93.16825 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2031 | 93.16826 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2031 | 93.16826 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2032 | 93.16827 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2032 | 93.16827 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2033 | 93.16828 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2033 | 93.16828 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2034 | 93.16829 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2034 | 93.16829 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2035 | 93.16830 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2035 | 93.16830 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2037 | 93.16831 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2037 | 93.16831 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2038 | 93.16832 HG | CVAA | 0.1 | 0.1 | UG/G | 8/31/93 | |
| FS2038 | 93.16832 HG | CVAA | 0.1 | 0.1 | UG/G | 8/31/93 | |
| FS2039 | 93.16833 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2039 | 93.16833 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2040 | 93.16834 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2040 | 93.16834 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2041 | 93.16835 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2041 | 93.16835 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2042 | 93.16836 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2042 | 93.16836 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2043 | 93.16837 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2043 | 93.16837 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2044 | 93.16838 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2044 | 93.16838 HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |

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|---|---|---|---|---|---|---|---|
| FS2045 | 93.16839 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2045 | 93.16839 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2046 | 93.16840 | AL | ICPES | 62000. | 6200. | UG/G | 9/24/93 | |
| FS2046 | 93.16840 | AS | ETVAA | 5.7 | 1.1 | UG/G | 9/10/93 | |
| FS2046 | 93.16840 | BA | ICPES | 320. | 32. | UG/G | 9/29/93 | |
| FS2046 | 93.16840 | BE | ICPES | 3.9 | 0.4 | UG/G | 9/24/93 | |
| FS2046 | 93.16840 | CA | ICPES | 14000. | 1400. | UG/G | 9/24/93 | |
| FS2046 | 93.16840 | CD | ICPES | 2.5 | 0.3 | UG/G | 9/24/93 | |
| FS2046 | 93.16840 | CO | ICPES | 12. | 1. | UG/G | 9/24/93 | |
| FS2046 | 93.16840 | CR | ICPES | 36. | 4. | UG/G | 9/24/93 | |
| FS2046 | 93.16840 | CU | ICPES | 16. | 2. | UG/G | 9/24/93 | |
| FS2046 | 93.16840 | FE | ICPES | 36000. | 3600. | UG/G | 9/24/93 | |
| FS2046 | 93.16840 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2046 | 93.16840 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2046 | 93.16840 | K | ICPES | 6900. | 690. | UG/G | 9/24/93 | |
| FS2046 | 93.16840 | MG | ICPES | 10000. | 1000. | UG/G | 9/24/93 | |
| FS2046 | 93.16840 | MN | ICPES | 290. | 29. | UG/G | 9/24/93 | |
| FS2046 | 93.16840 | NA | ICPES | 1800. | 180. | UG/G | 9/24/93 | |
| FS2046 | 93.16840 | NI | ICPES | 30. | 3. | UG/G | 9/24/93 | |
| FS2046 | 93.16840 | PB | ICPES | 26. | 7. | UG/G | 9/24/93 | |
| FS2046 | 93.16840 | SB | ICPMS | < 0.1 | | UG/G | 10/19/93 | 09025L |
| FS2046 | 93.16840 | SE | ETVAA | 0.8 | 0.2 | UG/G | 9/10/93 | |
| FS2046 | 93.16840 | TA | ICPMS | < 0.2 | | UG/G | 10/15/93 | 09025L |
| FS2046 | 93.16840 | TH | ICPMS | 10. | 1. | UG/G | 10/15/93 | 09025L |
| FS2046 | 93.16840 | TL | ICPMS | 0.7 | 0.2 | UG/G | 10/15/93 | 09025L |
| FS2046 | 93.16840 | U | ICPMS | 1. | 0.2 | UG/G | 10/15/93 | 09025L |
| FS2046 | 93.16840 | V | ICPES | 57. | 6. | UG/G | 9/24/93 | |
| FS2046 | 93.16840 | ZN | ICPES | 76. | 8. | UG/G | 9/24/93 | |
| FS2048 | 93.16841 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2048 | 93.16841 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2049 | 93.16842 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2049 | 93.16842 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2050 | 93.16843 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2050 | 93.16843 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2051 | 93.16844 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2051 | 93.16844 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2052 | 93.16845 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2052 | 93.16845 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2053 | 93.16846 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2053 | 93.16846 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2054 | 93.16847 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2054 | 93.16847 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2055 | 93.16848 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2055 | 93.16848 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2056 | 93.16849 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2056 | 93.16849 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2057 | 93.16850 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2057 | 93.16850 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2059 | 93.16851 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2059 | 93.16851 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2060 | 93.16852 | HG | CVAA | 0.1 | 0.1 | UG/G | 8/31/93 | |
| FS2060 | 93.16852 | HG | CVAA | 0.1 | 0.1 | UG/G | 8/31/93 | |
| FS2061 | 93.16853 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2061 | 93.16853 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2062 | 93.16854 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2062 | 93.16854 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2063 | 93.16855 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2063 | 93.16855 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2064 | 93.16856 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2064 | 93.16856 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |

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|---|---|---|---|---|---|---|---|---|
| FS2065 | 93.16857 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2065 | 93.16857 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2066 | 93.16858 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2066 | 93.16858 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2067 | 93.16859 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2067 | 93.16859 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2068 | 93.16860 | AS | ETVAA | 7.7 | 1.5 | UG/G | 9/14/93 | |
| FS2068 | 93.16860 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2068 | 93.16860 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2068 | 93.16860 | SB | ICPMS | < 0.2 | | UG/G | 10/19/93 | 09085L |
| FS2068 | 93.16860 | SE | ETVAA | 1. | 0.2 | UG/G | 9/14/93 | |
| FS2068 | 93.16860 | TA | ICPMS | < 0.2 | | UG/G | 10/15/93 | BATCH 09085L |
| FS2068 | 93.16860 | TH | ICPMS | 8. | 1. | UG/G | 10/15/93 | BATCH 09085L |
| FS2068 | 93.16860 | TL | ICPMS | 0.4 | 0.2 | UG/G | 10/15/93 | BATCH 09085L |
| FS2068 | 93.16860 | U | ICPMS | 1.5 | 0.2 | UG/G | 10/15/93 | BATCH 09085L |
| FS2070 | 93.16861 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2070 | 93.16861 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2071 | 93.16862 | HG | CVAA | 0.2 | 0.1 | UG/G | 8/31/93 | |
| FS2071 | 93.16862 | HG | CVAA | 0.2 | 0.1 | UG/G | 8/31/93 | |
| FS2072 | 93.16863 | HG | CVAA | 0.1 | 0.1 | UG/G | 8/31/93 | |
| FS2072 | 93.16863 | HG | CVAA | 0.1 | 0.1 | UG/G | 8/31/93 | |
| FS2073 | 93.16864 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2073 | 93.16864 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2074 | 93.16865 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2074 | 93.16865 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2075 | 93.16866 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2075 | 93.16866 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2076 | 93.16867 | HG | CVAA | 0.1 | 0.1 | UG/G | 8/31/93 | |
| FS2076 | 93.16867 | HG | CVAA | 0.1 | 0.1 | UG/G | 8/31/93 | |
| FS2077 | 93.16868 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2077 | 93.16868 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2078 | 93.16869 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2078 | 93.16869 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2079 | 93.16870 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |
| FS2079 | 93.16870 | HG | CVAA | < 0.1 | | UG/G | 8/31/93 | |

MATRIX SPIKES:

| CUSTOMER NUM | SAMPLE NUM | ANALYSIS | ANALYTICAL TECHNIQUE | AMOUNT SPIKED | AMOUNT RECOVERED | UNITS | COMPLETION DATE | COMMENT |
|---|---|---|---|---|---|---|---|---|
| FS2003 | 93.16800 | AS | ETVAA | 10. | 7.9 | UG/L | 9/07/93 | |
| FS2003 | 93.16800 | SE | ETVAA | 10. | 9.9 | UG/L | 9/07/93 | |
| FS2018 | 93.16815 | AS | ETVAA | 10. | 6. | UG/L | 9/08/93 | |
| FS2018 | 93.16815 | SE | ETVAA | 10. | 7. | UG/L | 9/08/93 | |
| FS2046 | 93.16840 | SE | ETVAA | 10. | 3. | UG/L | 9/10/93 | |
| FS2068 | 93.16860 | AS | ETVAA | 10. | 9.9 | UG/L | 9/14/93 | |
| FS2068 | 93.16860 | SE | ETVAA | 10. | 2.6 | UG/L | 9/14/93 | |

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REPORT NUMBER: 22725 (continued)

********** EM-9 QUALITY ASSURANCE REPORT *********

Prepared by: MKOBY on 8-Feb-1994

REQUEST NUMBER: 15463 MATRIX: SS ANALYST: MET PROGRAM CODE: M702

OWNER: Pat A. Longmire GROUP: CST-10 MAIL-STOP: C346 PHONE: 5-6493

NOTEBOOK: R8149 PAGE: 259

SUMMARY OF CONTROL STATUS OF OPEN (NON-BLIND) QC SAMPLES RUN WITH THIS BATCH

| SAMPLE NUM | ANALYSIS | ANALYTICAL RESULT | ANALYTICAL UNCERTAINTY | UNITS | QC VALUE | QC UNCERTAINTY | COMPLETION DATE | COMMENT |
|---|---|---|---|---|---|---|---|---|
| 00.00594 | AS | 4.1 | 0.8 | UG/G | 2. | 0.2 | 9/09/93 | WARNING G |
| 00.00598 | AS | 3.43 | 0.69 | UG/G | 2.51 | 0.13 | 9/07/93 | UNDER CON |
| 00.00598 | AS | 2.7 | 0.5 | UG/G | 2.51 | 0.13 | 9/10/93 | UNDER CONTROL |
| 00.00598 | AS | 2.3 | 0.5 | UG/G | 2.51 | 0.13 | 9/14/93 | UNDER CONTROL |
| 00.00598 | PB | 8.3 | 1.6 | UG/G | 14. | 3. | 11/18/93 | UNDER CONTROL |
| 00.00598 | TL | 94. | 38. | NG/G | 180. | | 11/18/93 | WARNING 2-3 SIG |
| 00.23669 | CL | 47. | 5. | MG/L | 51.4 | 1.85 | 9/10/93 | UNDER CONTROL |
| 00.23669 | SO4 | 18. | 2. | MG/L | 20. | 1.42 | 11/19/93 | UNDER CONTROL |
| 00.28602 | AS | 66. | 13. | UG/L | 70. | 3. | 9/10/93 | UNDER CONTROL |
| 00.28602 | AS | 71.6 | 14.3 | UG/L | 70. | 3. | 9/07/93 | UNDER CONTROL |
| 00.28602 | AS | 64. | 13. | UG/L | 70. | 3. | 9/08/93 | UNDER CONTROL |
| 00.28602 | SE | 48.8 | 9.8 | UG/L | 50. | 2. | 9/07/93 | UNDER CONTROL |
| 00.28602 | SE | 49. | 10. | UG/L | 50. | 2. | 9/10/93 | UNDER CONTROL |
| 00.28602 | SE | 50. | 10. | UG/L | 50. | 2. | 9/08/93 | UNDER CONTROL |

SUMMARY OF CONTROL STATUS OF BLIND QC SAMPLES RUN WITH THIS BATCH

| SAMPLE NUM | ANALYSIS | ANALYTICAL RESULT | ANALYTICAL UNCERTAINTY | UNITS | QC VALUE | QC UNCERTAINTY | COMPLETION DATE | COMMENT |
|---|---|---|---|---|---|---|---|---|
| 93.16880 | AL | < 0.1 | | MG/L | 0.0 | | 9/09/93 | UNDER CONTROL |
| 93.16880 | BA | 0.8 | 0.08 | MG/L | 0.8 | 0.03 | 9/09/93 | UNDER CONTROL |
| 93.16880 | BE | 1.1 | 0.1 | MG/L | 1.13 | 0.05 | 9/09/93 | UNDER CONTROL |
| 93.16880 | CA | 10. | 1. | MG/L | 10.02 | 0.43 | 9/09/93 | UNDER CONTROL |
| 93.16880 | CD | 0.17 | 0.02 | MG/L | 0.2 | 0.01 | 9/09/93 | UNDER CONTROL |
| 93.16880 | CO | 3.4 | 0.3 | MG/L | 3.76 | 0.16 | 9/09/93 | UNDER CONTROL |
| 93.16880 | CR | 0.34 | 0.03 | MG/L | 0.37 | 0.02 | 9/09/93 | UNDER CONTROL |
| 93.16880 | CU | 0.006 | 0.001 | MG/L | 0.0 | | 9/09/93 | OUT OF CO |
| 93.16880 | FE | 2.6 | 0.3 | MG/L | 2.68 | 0.12 | 9/09/93 | UNDER CON |
| 93.16880 | K | 1. | 0.7 | MG/L | 1. | 0.04 | 9/09/93 | UNDER CONTROL |

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|---|---|---|---|---|---|---|---|
| 93.16880 MG | 10. | 1. | MG/L | 10.03 | 0.43 | 9/09/93 | UNDER CONTROL |
| 93.16880 MN | 4.3 | 0.4 | MG/L | 4.4 | 0.19 | 9/09/93 | UNDER CONTROL |
| 93.16880 NA | 1.1 | 0.1 | MG/L | 1. | 0.04 | 9/09/93 | UNDER CONTROL |
| 93.16880 NI | 2.2 | 0.2 | MG/L | 2.1 | 0.09 | 9/09/93 | UNDER CONTROL |
| 93.16880 PB | 1. | 0.1 | MG/L | 1.01 | 0.04 | 9/09/93 | UNDER CONTROL |
| 93.16880 SB | < 0.04 | | MG/L | 0.0 | | 9/09/93 | UNDER CONTROL |
| 93.16880 V | 0.2 | 0.02 | MG/L | 0.2 | 0.01 | 9/09/93 | UNDER CONTROL |
| 93.16880 ZN | 0.3 | 0.03 | MG/L | 0.2 | 0.01 | 9/09/93 | OUT OF CONTROL |
| 93.16882 AL | 1. | 0.1 | MG/L | 1. | 0.04 | 9/09/93 | UNDER CONTROL |
| 93.16882 BA | 0.1 | 0.01 | MG/L | 0.1 | 0.004 | 9/09/93 | UNDER CONTROL |
| 93.16882 BE | 0.46 | 0.05 | MG/L | 0.5 | 0.02 | 9/09/93 | UNDER CONTROL |
| 93.16882 CA | 42. | 4. | MG/L | 50.12 | 2.16 | 9/09/93 | UNDER CONTROL |
| 93.16882 CD | < 0.003 | | MG/L | 0.0 | | 9/09/93 | UNDER CONTROL |
| 93.16882 CO | < 0.004 | | MG/L | 0.0 | | 9/09/93 | UNDER CONTROL |
| 93.16882 CR | 0.11 | 0.01 | MG/L | 0.12 | 0.01 | 9/09/93 | UNDER CONTROL |
| 93.16882 CU | 3.3 | 0.3 | MG/L | 3.51 | 0.15 | 9/09/93 | UNDER CONTROL |
| 93.16882 FE | 0.29 | 0.03 | MG/L | 0.2 | 0.01 | 9/09/93 | WARNING 2-3 SIG |
| 93.16882 K | 3.5 | 0.4 | MG/L | 3.99 | 0.17 | 9/09/93 | UNDER CONTROL |
| 93.16882 MG | 4.5 | 0.5 | MG/L | 4.82 | 0.21 | 9/09/93 | UNDER CONTROL |
| 93.16882 MN | 2.9 | 0.3 | MG/L | 3.3 | 0.14 | 9/09/93 | UNDER CONTROL |
| 93.16882 NA | 5.4 | 0.5 | MG/L | 4. | 0.17 | 9/09/93 | WARNING 2-3 SIG |
| 93.16882 NI | 0.77 | 0.08 | MG/L | 0.8 | 0.03 | 9/09/93 | UNDER CONTROL |
| 93.16882 PB | 3.1 | 0.3 | MG/L | 3.52 | 0.15 | 9/09/93 | UNDER CONTROL |
| 93.16882 SB | 0.36 | 0.04 | MG/L | 0.4 | 0.02 | 9/09/93 | UNDER CONTROL |
| 93.16882 V | 2.4 | 0.2 | MG/L | 2.7 | 0.12 | 9/09/93 | UNDER CONTROL |
| 93.16882 ZN | 1. | 0.1 | MG/L | 1.1 | 0.05 | 9/09/93 | UNDER CONTROL |
| 93.16887 AL | 73. | 7. | MG/L | 74.88 | 3.22 | 9/29/93 | UNDER CONTROL |
| 93.16887 BA | 7.5 | 0.8 | MG/L | 7.02 | 0.3 | 9/29/93 | UNDER CONTROL |
| 93.16887 BE | < 0.001 | | MG/L | 0.0 | | 9/29/93 | UNDER CONTROL |
| 93.16887 CA | 2. | 0.2 | MG/L | 2. | 0.09 | 9/29/93 | UNDER CONTROL |
| 93.16887 CD | 2. | 0.2 | MG/L | 1.74 | 0.07 | 9/29/93 | UNDER CONTROL |
| 93.16887 CO | 0.37 | 0.04 | MG/L | 0.38 | 0.02 | 9/29/93 | UNDER CONTROL |
| 93.16887 CR | 4.1 | 0.4 | MG/L | 3.99 | 0.17 | 9/29/93 | UNDER CONTROL |
| 93.16887 CU | 3.2 | 0.3 | MG/L | 3.01 | 0.13 | 9/29/93 | UNDER CONTROL |
| 93.16887 FE | 4.2 | 0.4 | MG/L | 4.18 | 0.18 | 9/29/93 | UNDER CONTROL |
| 93.16887 K | 20. | 2. | MG/L | 19.95 | 0.86 | 9/29/93 | UNDER CONTROL |
| 93.16887 MG | 2.5 | 0.3 | MG/L | 2.41 | 0.1 | 9/29/93 | UNDER CONTROL |
| 93.16887 MN | < 0.002 | | MG/L | 0.0 | | 9/29/93 | UNDER CONTROL |
| 93.16887 NA | 5. | 0.5 | MG/L | 4.5 | 0.19 | 9/29/93 | UNDER CONTROL |
| 93.16887 NI | 0.11 | 0.01 | MG/L | 0.1 | 0.004 | 9/29/93 | UNDER CONTROL |
| 93.16887 PB | 3.9 | 0.4 | MG/L | 4.53 | 0.19 | 1/10/94 | UNDER CONTROL |
| 93.16887 SB | 0.22 | 0.02 | MG/L | 0.2 | 0.01 | 9/29/93 | UNDER CONTROL |
| 93.16887 V | 1.3 | 0.1 | MG/L | 1.3 | 0.06 | 9/29/93 | UNDER CONTROL |
| 93.16887 ZN | 1. | 0.1 | MG/L | 0.95 | 0.04 | 9/29/93 | UNDER CONTROL |
| 93.16892 AL | 35. | 4. | MG/L | 49.92 | 2.15 | 10/18/93 | OUT OF CONTROL |
| 93.16892 BA | < 0.001 | | MG/L | 0.0 | | 10/18/93 | UNDER CONTROL |
| 93.16892 BE | 0.055 | 0.006 | MG/L | 0.08 | 0.003 | 10/18/93 | OUT OF CONTROL |
| 93.16892 CA | 2.1 | 0.2 | MG/L | 2.51 | 0.11 | 10/18/93 | UNDER CONTROL |
| 93.16892 CD | 1. | 0.1 | MG/L | 1.49 | 0.06 | 10/18/93 | OUT OF CONTROL |
| 93.16892 CO | 0.067 | 0.007 | MG/L | 0.1 | 0.004 | 10/18/93 | OUT OF CONTROL |
| 93.16892 CR | 2. | 0.2 | MG/L | 2.99 | 0.13 | 10/18/93 | OUT OF CONTROL |
| 93.16892 CU | 1.8 | 0.2 | MG/L | 2.51 | 0.11 | 10/18/93 | OUT OF CONTROL |
| 93.16892 FE | 1.2 | 0.1 | MG/L | 1.69 | 0.07 | 10/18/93 | OUT OF CONTROL |
| 93.16892 K | 2.1 | 1.7 | MG/L | 2.99 | 0.13 | 10/18/93 | UNDER CONTROL |
| 93.16892 MG | 0.38 | 0.04 | MG/L | 0.0 | | 10/18/93 | OUT OF CONTROL |
| 93.16892 MN | 1.5 | 0.2 | MG/L | 2.2 | 0.09 | 10/18/93 | OUT OF CONTROL |
| 93.16892 NA | 2.1 | 0.2 | MG/L | 3. | 0.13 | 10/18/93 | OUT OF CONTROL |
| 93.16892 NI | 2.9 | 0.3 | MG/L | 4.1 | 0.18 | 10/18/93 | OUT OF CONTROL |
| 93.16892 PB | 1.4 | 0.1 | MG/L | 2.01 | 0.09 | 10/18/93 | OUT OF CONTROL |
| 93.16892 SB | 1.1 | 0.1 | MG/L | 1.5 | 0.06 | 10/18/93 | OUT OF CONTROL |

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|---|---|---|---|---|---|---|---|
| 93.16892 V | 2.3 | 0.2 | MG/L | 3.2 | 0.14 | 10/18/93 | OUT OF CONTROL |
| 93.16892 ZN | 1.2 | 0.1 | MG/L | 1.87 | 0.08 | 10/18/93 | OUT OF CONTROL |
| 93.16893 AL | 22. | 2. | MG/L | 24.96 | 1.07 | 10/18/93 | UNDER CONTROL |
| 93.16893 BA | 4.6 | 0.5 | MG/L | 5.01 | 0.22 | 10/18/93 | UNDER CONTROL |
| 93.16893 BE | 1.5 | 0.2 | MG/L | 1.75 | 0.08 | 10/18/93 | UNDER CONTROL |
| 93.16893 CA | 3.2 | 0.3 | MG/L | 3.01 | 0.13 | 10/18/93 | UNDER CONTROL |
| 93.16893 CD | 0.85 | 0.09 | MG/L | 1. | 0.04 | 10/18/93 | UNDER CONTROL |
| 93.16893 CO | 4.2 | 0.4 | MG/L | 5.02 | 0.22 | 10/18/93 | UNDER CONTROL |
| 93.16893 CR | 1.7 | 0.2 | MG/L | 1.99 | 0.09 | 10/18/93 | UNDER CONTROL |
| 93.16893 CU | 1.4 | 0.1 | MG/L | 1.5 | 0.06 | 10/18/93 | UNDER CONTROL |
| 93.16893 FE | 1.1 | 0.1 | MG/L | 1.19 | 0.05 | 10/18/93 | UNDER CONTROL |
| 93.16893 K | 12. | 1. | MG/L | 14.96 | 0.64 | 10/18/93 | WARNING 2-3 SIG |
| 93.16893 MG | 1. | 0.1 | MG/L | 0.6 | 0.03 | 10/18/93 | OUT OF CONTROL |
| 93.16893 MN | 1.5 | 0.2 | MG/L | 1.65 | 0.07 | 10/18/93 | UNDER CONTROL |
| 93.16893 NA | < 0.1 | | MG/L | 0.0 | | 10/18/93 | UNDER CONTROL |
| 93.16893 NI | 2.4 | 0.2 | MG/L | 2.7 | 0.12 | 10/18/93 | UNDER CONTROL |
| 93.16893 PB | 3.5 | 0.4 | MG/L | 4.03 | 0.17 | 10/18/93 | UNDER CONTROL |
| 93.16893 SB | 3.4 | 0.3 | MG/L | 3.75 | 0.16 | 10/18/93 | UNDER CONTROL |
| 93.16893 V | 1.4 | 0.1 | MG/L | 1.6 | 0.07 | 10/18/93 | UNDER CONTROL |
| 93.16893 ZN | 1.3 | 0.1 | MG/L | 1.55 | 0.07 | 10/18/93 | WARNING 2-3 SIG |
| 93.16897 AL | 4.3 | 0.4 | MG/L | 4.99 | 0.21 | 10/18/93 | UNDER CONTROL |
| 93.16897 BA | 2.9 | 0.3 | MG/L | 3.21 | 0.14 | 10/18/93 | UNDER CONTROL |
| 93.16897 BE | 1.4 | 0.1 | MG/L | 1.63 | 0.07 | 10/18/93 | UNDER CONTROL |
| 93.16897 CA | 3.4 | 0.3 | MG/L | 3.51 | 0.15 | 10/18/93 | UNDER CONTROL |
| 93.16897 CD | 0.5 | 0.05 | MG/L | 0.6 | 0.03 | 10/18/93 | UNDER CONTROL |
| 93.16897 CO | 3.6 | 0.4 | MG/L | 4.52 | 0.19 | 10/18/93 | WARNING 2-3 SIG |
| 93.16897 CR | 0.82 | 0.08 | MG/L | 1. | 0.04 | 10/18/93 | WARNING 2-3 SIG |
| 93.16897 CU | 0.89 | 0.09 | MG/L | 1. | 0.04 | 10/18/93 | UNDER CONTR |
| 93.16897 FE | 3. | 0.3 | MG/L | 3.18 | 0.14 | 10/18/93 | UNDER CONT |
| 93.16897 K | < 0.6 | | MG/L | 0.0 | | 10/18/93 | UNDER CONTROL |
| 93.16897 MG | 0.79 | 0.08 | MG/L | 0.4 | 0.02 | 10/18/93 | OUT OF CONTROL |
| 93.16897 MN | 0.93 | 0.09 | MG/L | 1.1 | 0.05 | 10/18/93 | UNDER CONTROL |
| 93.16897 NA | 1.7 | 0.2 | MG/L | 2. | 0.09 | 10/18/93 | UNDER CONTROL |
| 93.16897 NI | 0.075 | 0.009 | MG/L | 0.0 | | 10/18/93 | OUT OF CONTROL |
| 93.16897 PB | 1.3 | 0.1 | MG/L | 1.51 | 0.06 | 10/18/93 | UNDER CONTROL |
| 93.16897 SB | 4.4 | 0.4 | MG/L | 5. | 0.22 | 10/18/93 | UNDER CONTROL |
| 93.16897 V | 0.69 | 0.07 | MG/L | 0.8 | 0.03 | 10/18/93 | UNDER CONTROL |
| 93.16897 ZN | < 0.01 | | MG/L | 0.0 | | 10/18/93 | UNDER CONTROL |
| 93.16900 AL | 2.2 | 0.2 | MG/L | 2. | 0.09 | 1/10/94 | UNDER CONTROL |
| 93.16900 BA | 0.38 | 0.04 | MG/L | 0.4 | 0.02 | 1/10/94 | UNDER CONTROL |
| 93.16900 BE | 0.78 | 0.08 | MG/L | 0.88 | 0.04 | 1/10/94 | UNDER CONTROL |
| 93.16900 CA | 0.16 | 0.02 | MG/L | 0.0 | | 1/10/94 | OUT OF CONTROL |
| 93.16900 CD | 0.06 | 0.01 | MG/L | 0.1 | 0.004 | 1/10/94 | OUT OF CONTROL |
| 93.16900 CO | 2.2 | 0.2 | MG/L | 2.51 | 0.11 | 1/10/94 | UNDER CONTROL |
| 93.16900 CR | < 0.004 | | MG/L | 0.0 | | 1/10/94 | UNDER CONTROL |
| 93.16900 CU | 3.5 | 0.4 | MG/L | 4.01 | 0.17 | 1/10/94 | UNDER CONTROL |
| 93.16900 FE | 0.73 | 0.07 | MG/L | 0.7 | 0.03 | 1/10/94 | UNDER CONTROL |
| 93.16900 K | 5. | 0.5 | MG/L | 4.99 | 0.21 | 1/10/94 | UNDER CONTROL |
| 93.16900 MG | 3.7 | 0.4 | MG/L | 3.76 | 0.16 | 1/10/94 | UNDER CONTROL |
| 93.16900 MN | 3.4 | 0.3 | MG/L | 3.85 | 0.17 | 1/10/94 | UNDER CONTROL |
| 93.16900 NA | 4.3 | 0.4 | MG/L | 5.01 | 0.22 | 1/10/94 | UNDER CONTROL |
| 93.16900 NI | 0.26 | 0.03 | MG/L | 0.3 | 0.01 | 1/10/94 | UNDER CONTROL |
| 93.16900 PB | 2.4 | 0.2 | MG/L | 2.52 | 0.11 | 1/10/94 | UNDER CONTROL |
| 93.16900 SB | 0.68 | 0.08 | MG/L | 0.75 | 0.03 | 1/10/94 | UNDER CONTROL |
| 93.16900 V | 2.2 | 0.2 | MG/L | 2.4 | 0.1 | 1/10/94 | UNDER CONTROL |
| 93.16900 ZN | 0.45 | 0.05 | MG/L | 0.42 | 0.02 | 1/10/94 | UNDER CONTROL |
| 93.16901 AS | 0.0671 | 0.0134 | MG/L | 0.07 | 0.003 | 9/07/93 | UNDER CONTROL |
| 93.16901 SE | 0.0701 | 0.014 | MG/L | 0.074 | 0.003 | 9/07/93 | UNDER CONTR |
| 93.16901 TL | 0.057 | 0.006 | MG/L | 0.062 | 0.003 | 2/08/94 | UNDER CONTR |
| 93.16901 U | < 0.001 | | MG/L | 0.0 | | 10/19/93 | UNDER CONTROL |

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|---|---|---|---|---|---|---|---|
| 93.16902 | AS | 0.0703 | 0.014 | MG/L | 0.074 | 0.003 | 9/09/93 | UNDER CONTROL |
| 93.16902 | SE | 0.082 | 0.016 | MG/L | 0.08 | 0.003 | 9/09/93 | UNDER CONTROL |
| 93.16902 | TL | 0.058 | 0.007 | MG/L | 0.058 | 0.002 | 9/20/93 | UNDER CONTROL |
| 93.16902 | U | 0.077 | 0.008 | MG/L | 0.08 | 0.003 | 9/23/93 | UNDER CONTROL |
| 93.16903 | AS | 0.0824 | 0.0165 | MG/L | 0.09 | 0.004 | 9/10/93 | UNDER CONTROL |
| 93.16903 | SE | 0.0921 | 0.018 | MG/L | 0.098 | 0.004 | 9/10/93 | UNDER CONTROL |
| 93.16903 | TL | 0.04 | 0.003 | MG/L | 0.034 | 0.001 | 10/15/93 | UNDER CONTROL |
| 93.16903 | U | 0.11 | 0.02 | MG/L | 0.096 | 0.004 | 10/15/93 | UNDER CONTROL |
| 93.16904 | AS | 0.069 | 0.014 | MG/L | 0.068 | 0.003 | 9/14/93 | UNDER CONTROL |
| 93.16904 | SE | 0.061 | 0.012 | MG/L | 0.066 | 0.003 | 9/14/93 | UNDER CONTROL |
| 93.16904 | TL | < 0.001 | | MG/L | 0.0 | | 10/15/93 | UNDER CONTROL |
| 93.16904 | U | 0.1 | 0.03 | MG/L | 0.078 | 0.003 | 10/15/93 | UNDER CONTROL |
| 93.16905 | AS | 0.087 | 0.017 | MG/L | 0.082 | 0.004 | 11/15/93 | UNDER CONTROL |
| 93.16905 | SE | 0.074 | 0.015 | MG/L | 0.084 | 0.004 | 11/15/93 | UNDER CONTROL |
| 93.16905 | TL | 0.05 | 0.002 | MG/L | 0.046 | 0.002 | 11/17/93 | UNDER CONTROL |
| 93.16905 | U | 0.11 | 0.011 | MG/L | 0.088 | 0.004 | 11/17/93 | UNDER CONTROL |
| 93.16906 | AS | < 0.002 | | MG/L | 0.078 | 0.003 | 11/15/93 | OUT OF CONTROL |
| 93.16906 | SE | 0.072 | 0.014 | MG/L | 0.082 | 0.004 | 11/15/93 | UNDER CONTROL |
| 93.16906 | TL | 0.06 | 0.003 | MG/L | 0.052 | 0.002 | 11/17/93 | WARNING 2-3 SIG |
| 93.16906 | U | 0.1 | 0.01 | MG/L | 0.084 | 0.004 | 11/17/93 | UNDER CONTROL |
| 93.16907 | AS | 0.088 | 0.018 | MG/L | 0.086 | 0.004 | 11/15/93 | UNDER CONTROL |
| 93.16907 | SE | 0.081 | 0.016 | MG/L | 0.094 | 0.004 | 11/15/93 | UNDER CONTROL |
| 93.16907 | TL | 0.047 | 0.008 | MG/L | 0.042 | 0.002 | 11/17/93 | UNDER CONTROL |
| 93.16907 | U | 0.112 | 0.011 | MG/L | 0.092 | 0.004 | 11/17/93 | UNDER CONTROL |
| 93.16978 | CL | 47. | 5. | MG/L | 51.4 | 1.85 | 9/10/93 | UNDER CONTROL |
| 93.16979 | CL | 38. | 4. | MG/L | 41.1 | 1.48 | 9/10/93 | UNDER CONTROL |
| 93.16980 | CL | 47. | 5. | MG/L | 51.4 | 1.85 | 9/10/93 | UNDER CONTROL |
| 93.16981 | CL | 37. | 4. | MG/L | 41.1 | 1.48 | 9/10/93 | UNDER CONTROL |
| 93.16982 | CL | 47. | 5. | MG/L | 51.4 | 1.85 | 9/10/93 | UNDER CONTROL |
| 93.16983 | CL | 47. | 5. | MG/L | 51.4 | 1.85 | 9/10/93 | UNDER CONTROL |
| 93.16984 | CL | 37. | 4. | MG/L | 41.1 | 1.48 | 9/10/93 | UNDER CONTROL |
| 93.16986 | HG | 2.5 | 0.3 | UG/G | 4. | 0.4 | 8/31/93 | WARNING 2-3 SIG |
| 93.16986 | HG | 2.2 | 0.2 | UG/G | 4. | 0.4 | 8/31/93 | OUT OF CONTROL |
| 93.16986 | HG | 2. | 0.2 | UG/G | 4. | 0.4 | 8/31/93 | OUT OF CONTROL |
| 93.16987 | HG | 0.1 | 0.1 | UG/G | 0.1 | 0.01 | 8/31/93 | UNDER CONTROL |
| 93.16987 | HG | 0.1 | 0.1 | UG/G | 0.1 | 0.01 | 8/31/93 | UNDER CONTROL |
| 93.16987 | HG | 0.1 | 0.1 | UG/G | 0.1 | 0.01 | 8/31/93 | UNDER CONTROL |
| 93.16988 | HG | 1.9 | 0.2 | UG/G | 3. | 0.3 | 8/31/93 | OUT OF CONTROL |
| 93.16988 | HG | 1.8 | 0.2 | UG/G | 3. | 0.3 | 8/31/93 | OUT OF CONTROL |
| 93.16988 | HG | 2. | 0.2 | UG/G | 3. | 0.3 | 8/31/93 | WARNING 2-3 SIG |
| 93.16988 | HG | 1.9 | 0.2 | UG/G | 3. | 0.3 | 8/31/93 | OUT OF CONTROL |
| 93.16988 | HG | 1.9 | 0.2 | UG/G | 3. | 0.3 | 8/31/93 | OUT OF CONTROL |
| 93.16988 | HG | 1.8 | 0.2 | UG/G | 3. | 0.3 | 8/31/93 | OUT OF CONTROL |
| 93.16989 | HG | 3.4 | 0.3 | UG/G | 4.99 | 0.5 | 8/31/93 | WARNING 2-3 SIG |
| 93.16989 | HG | 2.8 | 0.3 | UG/G | 4.99 | 0.5 | 8/31/93 | OUT OF CONTROL |
| 93.16989 | HG | 2.9 | 0.3 | UG/G | 4.99 | 0.5 | 8/31/93 | OUT OF CONTROL |
| 93.16989 | HG | 3.4 | 0.3 | UG/G | 4.99 | 0.5 | 8/31/93 | WARNING 2-3 SIG |
| 93.16989 | HG | 3.3 | 0.3 | UG/G | 4.99 | 0.5 | 8/31/93 | WARNING 2-3 SIG |
| 93.16989 | HG | 3.3 | 0.3 | UG/G | 4.99 | 0.5 | 8/31/93 | WARNING 2-3 SIG |
| 93.16991 | HG | < 100. | | NG/G | 25. | 2.5 | 8/31/93 | UNDER CONTROL |
| 93.16991 | HG | < 100. | | NG/G | 25. | 2.5 | 8/31/93 | UNDER CONTROL |
| 93.16991 | HG | < 100. | | NG/G | 25. | 2.5 | 8/31/93 | UNDER CONTROL |
| 93.16992 | HG | 0.5 | 0.1 | UG/G | 0.5 | 0.05 | 8/31/93 | UNDER CONTROL |
| 93.16992 | HG | 0.4 | 0.1 | UG/G | 0.5 | 0.05 | 8/31/93 | UNDER CONTROL |
| 93.16992 | HG | 0.6 | 0.1 | UG/G | 0.5 | 0.05 | 8/31/93 | UNDER CONTROL |
| 93.16993 | HG | 1.3 | 0.1 | UG/G | 1.5 | 0.15 | 8/31/93 | UNDER CONTROL |
| 93.16993 | HG | 1.3 | 0.1 | UG/G | 1.5 | 0.15 | 8/31/93 | UNDER CONTROL |
| 93.16993 | HG | 1. | 0.1 | UG/G | 1.5 | 0.15 | 8/31/93 | WARNING 2-3 SIG |
| 93.16993 | HG | 1.2 | 0.1 | UG/G | 1.5 | 0.15 | 8/31/93 | UNDER CONTROL |
| 93.16993 | HG | 1.2 | 0.1 | UG/G | 1.5 | 0.15 | 8/31/93 | UNDER CONTROL |

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|---|---|---|---|---|---|---|---|
| 93.16993 HG | 0.9 | 0.1 | UG/G | 1.5 | 0.15 | 8/31/93 | OUT OF CONTROL |
| 93.16994 TH | 0.15 | 0.02 | MG/L | 0.13 | 0.01 | 2/08/94 | UNDER CONTROL |
| 93.16995 TH | 0.2 | 0.04 | MG/L | 0.19 | 0.01 | 9/20/93 | UNDER CONTROL |
| 93.16996 TH | 0.15 | 0.01 | MG/L | 0.15 | 0.01 | 10/15/93 | UNDER CONTROL |
| 93.16997 TH | 0.09 | 0.01 | MG/L | 0.09 | 0.004 | 10/15/93 | UNDER CONTROL |
| 93.16998 TH | 0.153 | 0.01 | MG/L | 0.17 | 0.01 | 11/17/93 | UNDER CONTROL |
| 93.16999 TH | 0.08 | 0.012 | MG/L | 0.07 | 0.003 | 11/17/93 | UNDER CONTROL |

REPORT NUMBER: 22725

| Analyst | Reviewer | Section Leader | QA Officer |
|---|---|---|---|
| 2/9/94 | 2/9/94 | 2/8/94 | 2/8/94 |
| Date | Date | Date | Date |

No Sample Discrepancies Noted by Sample Management Section

The control status of the preceeding data was evaluated using the standard statistical criteria set forth in 'Quality Assurance for Health and Environmental Chemistry: 1991,' LA-12436-MS, Vol. I, pp. 21-22.

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