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CHEMICAL COMPOSITION OF WEATHERED AND LESS WEATHERED STRATA OF THE MEADE PEAK PHOSPHATIC SHALE MEMBER OF THE PERMIAN PHOSPHORIA FORMATION
B. Measured Sections C and D, Dry Valley, Caribou County, Idaho

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ABSTRACT

This study reports bulk chemical composition of rocks collected from two exposed, measured stratigraphic sections at a phosphate mine in southeastern Idaho. The samples constitute a set of channel-sampled intervals across the entire thickness of the Meade Peak Phosphatic Shale Member of the Phosphoria Formation at two locations exposed during mining. The samples characterize the lower phosphate ore, interlayered middle waste rock, upper ore, and upper waste units of the member. The rocks from measured section C lie closer to the original, pre-mined ground surface than those of measured section D and, hence, are more oxidized and weathered than those of Section D. Section C includes a channel sample of the overlying Rex Chert Member, and Section D includes a channel sample of the underlying Grandeur dolomite, with both samples taken immediately adjacent to the Meade Peak Member.

INTRODUCTION

Background

The U.S. Geological Survey (USGS) has studied the Permian Phosphoria Formation in southeastern Idaho and the Western U.S. Phosphate Field throughout much of the twentieth century. In response to a request by the U.S. Bureau of Land Management (BLM), a new series of resource and geoenvironmental studies was initiated by the USGS in 1998. Present studies consist of (1) integrated, multidisciplinary research directed toward resource and reserve estimations of phosphate in selected 7.5-minute quadrangles; (2) elemental residence, mineralogical and petrochemical characteristics; (3) mobilization and reaction pathways, transport, and disposition of potentially toxic elements associated with the occurrence, development, and use of phosphate; (4) geophysical signatures; and (5) improving the understanding of depositional origin. To carry out these studies, the USGS has formed cooperative research relationships with two Federal agencies, BLM and the U.S. Forest Service (USFS), which are responsible for land management and resource conservation on public lands; and with five private companies currently leasing or developing phosphate resources in southeastern Idaho. The companies are Agrium U.S. Inc. (Rasmussen Ridge mine), FMC Corporation (Dry Valley mine), Rhodia Inc. (Wooley Valley mine-inactive), J.R. Simplot Company (Smoky Canyon mine), and Solutia Inc. (Enoch Valley mine). Because raw data acquired during the project will require time to interpret, the data are released in open-file reports for prompt availability to other workers. The open-file reports associated with this series of resource and geoenvironmental studies are submitted to each of the Federal and industry cooperators for technical review; however, the USGS is solely responsible for the data contained in the reports.

Location and General Geology

The location of the measured sections is shown in figure 1. The sections lie approximately 25 km northeast of Soda Springs, Idaho, in an area of southeastern Idaho that has had extensive phosphate mining over the past several decades and currently has four active phosphate mines. Service (1966) provides an evaluation of the western phosphate industry in Idaho and a brief description of the mining history, ore occurrence, and geology. More detailed discussion of the Phosphoria Formation in the Western Phosphate Field is given by McKelvey and others (1959). Cressman and Swanson (1964) discuss detailed stratigraphy and petrology of these same rock units in nearby southwestern Montana. Gulbrandsen and Krier (1980) discuss general aspects of the large and rich phosphorus resources in the Phosphoria Formation in the vicinity of the Soda Springs, Idaho. Gulbrandsen (1966, 1975, and 1979) summarizes bulk chemical compositional data for various lithologies of the phosphatic intervals in the Phosphoria Formation.

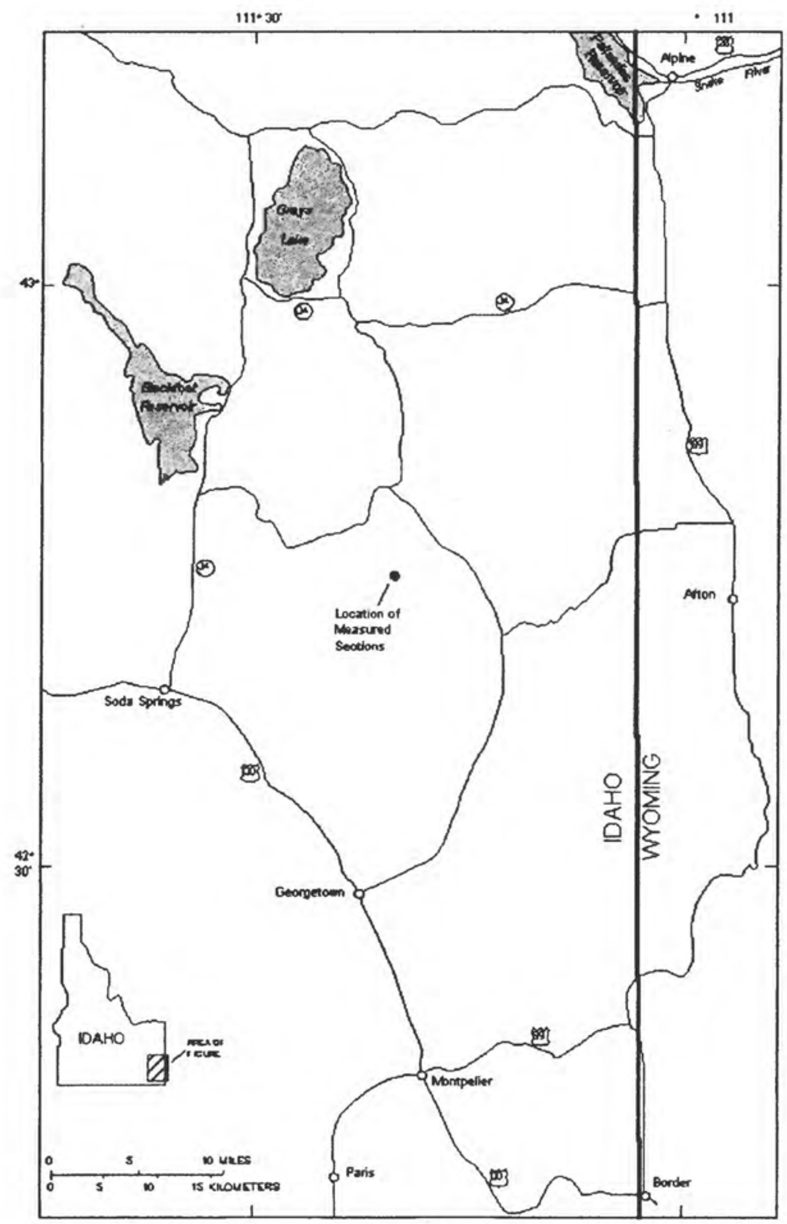

Figure 1. Index map of southeastern Idaho showing location of measured sections from which samples were collected.

Correlation with Measured Sections

Stratigraphic sections of the Phosphoria Formation were measured and sampled by the USGS at the Dry Valley mine in southeastern Idaho. Brief descriptions of the stratigraphic sections from which the samples discussed in this report have been taken are already published (Tysdal and others, 2000), although no thin section, X-ray, or analytical technique other than gamma-ray spectrometry has been used to augment the field descriptions of the rock units of that report. This report lists the analytical information for rock sequences described from those sections. The two reports are best used together in a complementary fashion to obtain both descriptive and analytical information about the rock sections. Informal bed names—introduced by Hale (1967, p. 152) and used generally throughout southeastern Idaho—are included in a column of each of the data tables in this report and in accompanying figures that graphically display the analytical data. Informal bed names used only within a specific mine are not presented here. English units of measurement are used throughout this report to facilitate direct correspondence with units in the extensive historical literature on the Phosphoria and with current industry usage. Thicknesses and interval boundary footages listed here are true thickness of the strata at the sample site; these thicknesses are corrected for apparent thickening due to dip of the strata at the exposed sections at the mine benches.

The Phosphoria Formation in the vicinity of the measured sections consists of three members, which in ascending order are the Meade Peak Phosphatic Shale, the Rex Chert, and the informally named cherty shale (McKelvey and others, 1959; Hale, 1967; Rioux and others, 1975). The measured sections of this report focus on the Meade Peak Phosphatic Shale Member. The Meade Peak unconformably overlies the Grandeur Tongue of the Permian Park City Formation, and the cherty shale member is overlain by the Triassic Dinwoody Formation.

Both sections were measured at essentially the same geographic position, but section wpsC (western phosphate section C) was of rock about 150 ft higher in elevation than that of section wpsD, and much closer to the land surface that existed just prior to mining. Measuring a pair of sections close together, but at different depths below this land surface, permits evaluation of important effects of weathering on rock geochemistry. Except for upper waste strata of wpsD, the two sections were measured on horizontal surfaces exposed by mining equipment. The two sections are of similar thickness, as expected. The upper ore zone of section wpsD was not exposed on the floor of the open-pit mine because it was mostly covered by talus and waste-pile debris at the base of the pit wall. Waste above the upper ore zone of wpsD was measured on the pit wall.

METHODS

Field Sampling

The samples within the measured sections that were obtained for geochemical and petrological analysis were taken as channeled samples across the entire thickness of the interval, as noted in the data tables. The choice of sampling intervals is intended to characterize strata of more or less uniform lithology and of a broad thickness that can be handled by typical mine equipment should the results of our analyses suggest that separate handling of such zones would be advantageous. Within these broad intervals, we have sampled finer-scale strata, sometimes as little as one foot thick, where we have noted a lithology different or distinctive from the broad interval as a whole.

Approximately 500g to 1 kg of rock were collected for each sample interval. Rock samples were scraped or chiseled in a consistent manner across each interval of uniform lithology in order to obtain a representative single sample of the entire interval. The bulk samples were shipped to the laboratories of the USGS in Denver, Colorado, for sample preparation.

Rock Sample Preparation

Rock samples were dried in air at ambient temperature. The coarse-fraction samples were disaggregated in a mechanical jaw crusher and a split was then ground in a ceramic plate grinder to <100 mesh (<0.15 mm). Splits of the latter material were provided to various collaborators and to the contract laboratory for analysis. All splits were obtained with a riffle splitter to ensure similarity with the whole sample. A set of splits for all samples was archived. Splits of about ~50 g were sent to the contract laboratory where they were prepared for analysis.

Analysis

Samples were analyzed for 40 major, minor, and trace elements using acid digestion in conjunction with inductively coupled plasma-atomic emission spectrometry (ICP-AES). For 40-element analysis (referred to as ICP-40), a split was dissolved using a low-temperature (<150°C) digestion with concentrated hydrochloric, hydrofluoric, nitric, and perchloric acids (Crock and others, 1983). The analytical contractor has modified this procedure to shorten the digestion time (P. Lamothe, USGS, oral communication). The acidic sample solution was taken to dryness and the residue was dissolved with 1 ml of aqua regia and then diluted to 10.0 g with 1% (volume/volume) nitric acid. This technique also provides analysis of Bi and Sn. However, an inconsistent bias in the Bi and Sn data exists presently for the analytical contractor (P. Lamothe, USGS, oral communication). Consequently, the concentration data for these two elements have been eliminated from the original analytical data set. Sr concentrations are determined in both the ICP-40 and ICP-16 (see below) techniques. However, some detection errors occurred in the data set analyzed for Sr by ICP-40 for Section D. Consequently, that set was eliminated from the data files. The ICP-40 technique measures Au above 8 ppm, and Ta above 40 ppm; however, no samples from either of the two sections had concentrations above these detection limits. Consequently, those data were eliminated from the data files.

Another split of the sample was fused in lithium metaborate then analyzed by ICP-AES after acid dissolution of the fusion mixture. This technique (referred to as ICP-16) provides a separate analysis of Si, all other major rock-forming elements, and a few trace elements. Most importantly, this is the only analytical technique of those used that measures Si in these siliceous, phosphatic shale samples. Although the Meade Peak Phosphatic Shale Member is known mostly for its phosphatic content, it also contains minor to important amounts of siliceous components, which result from aluminosilicate minerals, quartz, or biogenic silica. Si measurement is not possible using the 4-acid digestion ICP-40 technique because the Si is lost as a volatile fluoride compound during digestion. Analysis of major elements using the fusion technique also provides a compositional check on the concentrations of these same elements as measured by acid digestion. Ti and Cr were analyzed using both ICP techniques. However, the fusion technique is superior to acid digestion for analysis of resistant minerals containing those elements. Consequently, the analytical data for these two elements using the ICP-40 technique have been eliminated from the data set and only those concentration data for the fusion technique are reported. The ICP-16 technique also measures Nb above 8 ppm; however, no samples from Section D had concentrations above these detection limits. Consequently, those data were eliminated from the data file.

Se analysis was performed using hydride generation followed by atomic absorption (AA) spectroscopy. The hydride and AA technique also is used for the analysis of As, Sb, and Tl. For the analysis of Se and As, the hydride analytical technique is superior to other analytical techniques. Consequently, the analytical data for Se by energy-dispersive x-ray fluorescence and for As using acid digestion ICP-AES have been eliminated from the data set and only those for the hydride technique are reported.

Te is measured using AA graphite furnace spectroscopy. Total S and total C are measured using combustion in a LECO furnace followed by gas chromatographic measurement. For the other forms of carbon, carbonate carbon is measured as evolved CO_2 after acidification of the sample, and organic carbon is calculated as the difference between total and carbonate carbon. Crock and Lichte (1982) and Jackson and others (1988) discuss additional analytical methodology.

X-ray diffraction (XRD) was used to provide a semi-quantitative estimate of apatite and other mineral abundance. In the case of phosphate, this estimate is obtained from the relative peak heights on the x-ray diffractogram of the 211 lattice-plane diffraction peak of the apatite. This technique measures only the phosphate associated with the mineral carbonate-fluorapatite, which is the common sedimentary form of apatite in these rocks. In theory, the relative peak height is directly proportional to the concentration of the carbonate-fluorapatite. This technique provides a minimum estimate of total phosphate because it is possible that small amounts of phosphate occur in other forms that are not detected by this method. For example, phosphate in organic compounds, amorphous forms, or in minerals other than carbonate-fluorapatite would be not be detected using this x-ray analysis.

Each of the two sections is accompanied by a profile of the equivalent uranium (eU) measurements taken with a gamma-ray spectrometer. Concentrations of eU are given in parts per million (ppm). Section wpsC was measured with an Exploranium GR-320 and section wpsD was measured with a GAD-6 spectrometer. These instruments measure gross gamma-ray flux (including cosmic rays) and provide a quantitative measure of K, U, and Th. Determination of the abundance of U and Th occurs via detection and counting of gamma rays of specific energy associated with a particular daughter radionuclide for each element, ^{214}Bi with a 1.76 MeV (million electron volt) gamma-ray in the case of uranium. Calculation of total abundance of U and Th assumes secular equilibrium between the measured daughter nuclide and the parent isotope and all intermediate daughter nuclides for each individual element. Potassium abundance is determined from the measurement of gamma rays associated with the decay of ^{40}K. The spectrometer integrates detection over a 2π geometry of approximately 1/2 m^3 and has proportionally higher detection sensitivity to those gamma rays that are emitted closer to the detector. The calibration equations for the two spectrometers assume this geometry on a planar surface and are based on analysis of concrete pads of known composition of the three elements. The calibration coefficients, as well as the constants for subtracted background counts, are a function of latitude, altitude, rock density, and moisture. The coefficients become less reliable as location and rock conditions change from those of the calibration.

In Tysdal and others (1999), we plotted eU concentration data after normalization of the highest eU concentration of section wpsA, 373 ppm, to 200 ppm and of section wpsB from a high of 468 ppm to a scaled high value of 282 ppm. For the eU data graphed in Tysdal and others (1999) and tabulated in Herring and others (1999) the original eU measurement can be extracted from the plotted values by multiplying by scaling factors of 1.87 for section spsA and 1.66 for section wpsB. This scaling was done because published reports from the 1970's and earlier on uranium and eU concentrations in the Meade Peak Phosphatic Shale Member state that few uranium concentrations from this member exceed 200 ppm (see Swanson, 1970, and references therein) and we had little independent check on accuracy of the spectrometer data. However, new analytical data as part of our study question these past published relationships.

Recently, we re-analyzed a subset of samples using delayed neutron (DN) analysis, which has a precision of better than 3 percent and an accuracy of generally better than 5 percent (McKown and Millard, 1987). The relationship between the two measurement techniques is shown in figure 2 for 70 samples. The DN analysis can be used to assess the uranium concentration data in Herring and others (1999), which were obtained using ICP-40 measurements with a lower detection limit of 100 ppm. For a common set of 12 samples where ICP-AES measurements for uranium concentrations are greater than the detection limit of 100 ppm, this technique shows that ICP-40 measurements average 12 percent greater than those of DN and have a relative standard deviation of 12 percent. Given this relative credibility in the ICP-40 technique as verified by DN analysis, the frequency of uranium concentrations >100 ppm among the set of all composited stratigraphic samples of the Meade Peak Phosphatic Shale Member consequently can be estimated. For 182 channel samples of sections wpsA, wpsB, wpsC, and wpsD as measured by ICP-40, 18 percent of the uranium concentrations are >100 ppm, with 16 percent between 100 and 200 ppm and 2 percent >200 ppm. These channel samples average over intervals from 1 to 15 feet of true stratigraphic thickness. Clearly, each channel sample will have some uranium concentrations that are indeed higher, perhaps considerably so, than the interval average. Consequently, we believe that uranium concentrations in excess of 200 ppm are not as scarce as reported by Swanson (1970 and references therein) and that uranium concentration measurements from the gamma-ray spectrometers are reasonably correct and should be reported as measured rather than scaling them against an assumed upper limit value.

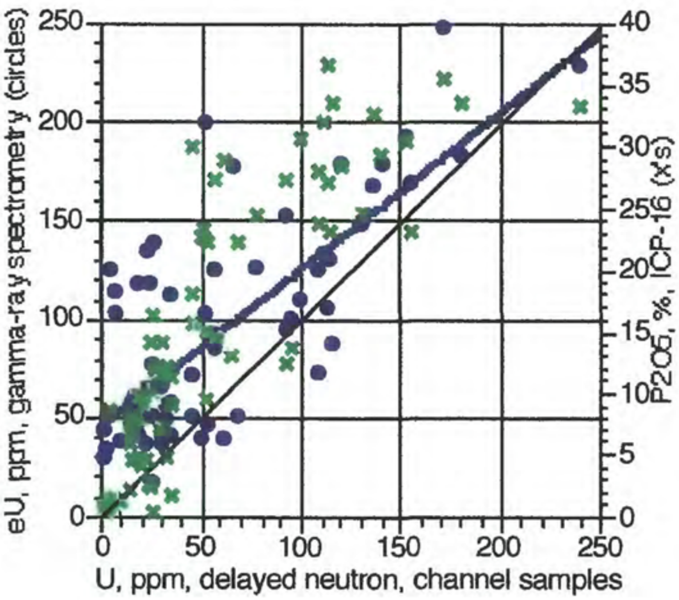

Figure 2. Comparison of measured uranium concentration by delayed neutron analysis in channel samples with gamma-ray spectroscopy measurements taken at 1-foot true-thickness stations through the same intervals and arithmetically averaged (circles). The 1:1 and least-squares regression (heavier line; $R^2 = 0.55$) lines are shown. Concentrations of P_2O_5 in percent are shown for the same samples (x's).

Previous studies of the Phosphoria Formation maintain that there is a consistent relationship between eU and total uranium contents and between total uranium and phosphate contents (McKelvey, 1956). Our measurements indicate considerable scatter in both relationships (fig. 2; Herring and others, 1999; Herring, unpub. data). Measured eU concentrations, even between adjoining 1 foot intervals of consistent lithologic character, often exhibit considerable variability. We expect that this results from: (1) fine-scale variability in the concentration of uranium; (2) the effect of the geometry of the dipping rocks; or (3) from lack of secular equilibrium. Scatter in the U to P_2O_5 relationship results from uranium removal or addition by syndepositional effects and (or) by post-depositional alteration, especially weathering. The uranium is mostly located in the phosphate mineral lattice as a substitute for Ca; location of the decay (daughter) products is uncertain. For the phosphatic rocks of the Phosphoria Formation, total gamma-ray counts are dominated by decay of uranium and its various daughter products. K_2O is generally <1 percent in the phosphorite and <3 percent in the middle waste shale; Th concentrations are generally <15 ppm in ore and waste shale (Altschuler and others, 1958; Swanson, 1970; Herring and others, 1999; Herring, unpub. data).

The measurements for eU were obtained on high-resolution, 1-foot (true-thickness) spacing across both of the sampled sections. These concentration data are graphed in the preliminary report on the stratigraphic descriptions of sections C and D (Tysdal and others, 2000). The eU concentrations reported for the channel-sampled intervals in the data tables are obtained by averaging the 1-foot measurements over the spacing that corresponds to each channel-sampled interval.

RESULTS

Analytical results of the rock analyses for the more-weathered stratigraphic section C and less-weathered section D (wpsC and wpsD) are listed in data tables 1 and 2, respectively. The tables include listings of the concentrations of the major rock-forming elements as oxides as well as elements. The oxide concentrations are calculated from the elemental concentrations using standard stoichiometric conversions. Table 1 also includes analytical data for a previously un-analyzed channel sample from section B (wpsB) that extends from the upper waste unit into the overlying Rex Chert Member. Interval base and top footages are specified relative to the stratigraphic base of the Meade Peak Phosphatic Shale Member. This base is defined specifically as the base of the Fish-scale marker stratum, a bioclastic phosphorite unit. Measured footage numbers increase upward through the sections. The concentration data in tables 1 and 2 are listed as reported by the contract laboratory and other collaborators. There has been no statistical manipulation of the data or consideration of qualified values. Qualified values of concentration result from detection of elements that are present but at concentrations less than their lower detection limits (LDL). They are listed in the data table with "<" preceding the LDL. No replacement values for these qualified concentrations, typically done with most traditional data summarization and analysis (for example, see Cohen, 1959), are included.

As a measure of analytical accuracy, a phosphatic rock analytical standard accompanied the rock samples that were submitted to the contract laboratory. The reported analysis and best ongoing average values of this standard is given in table 3. Analyses of the standards SARM and SARL that are routinely included as a part of the quality control monitoring of the contract laboratory also are included in table 3. Finally, we introduce three carefully prepared standards to be used as ongoing monitors of analytical accuracy for this project (Wilson and others, in preparation). These standards are finely ground splits of composite channel samples of two sections of middle waste rock and one of ore from Section B. This section was described by Tysdal and others (1999) and its analytical data were reported by Herring and others (1999). The preparation and use of these standards are intended to provide better analytical quality control for the project, especially because the standards have similar mineralogy and composition to the typical rocks being analyzed within the project. The first reported set of analyses for these standards is listed in table 3.

As a measure of analytical precision, the analytical sample set includes 6 replicated sample pairs for section C and 9 pairs for section D. These samples are identified in the data tables. Table 3 includes a listing of the average relative standard difference and average relative standard deviation for each element for all replicated samples that did not have qualified data in their concentrations.

The samples were submitted to the contract laboratory in a randomized sequence. This eliminates systematic errors from sources such as, for example, instrumental drift. The abbreviations for analytical techniques in the column headings of tables 1, 2, and 3 for analytical methodology are defined as follows:

XRD: X-ray diffraction
Hydr. AA: hydride generation followed by atomic absorption
CVAA: cold vapor atomic absorption
ICP-16: inductively-coupled plasma spectrometry, fusion digestion
ICP-40: inductively-coupled plasma spectrometry, acid digestion.

Concentrations of various elements in the channel samples of the two sections are graphed in figure 3. The few "less-than" concentrations reported for some of these elements have been replaced with their lower detection limits for graphing.

ACKNOWLEDGMENTS

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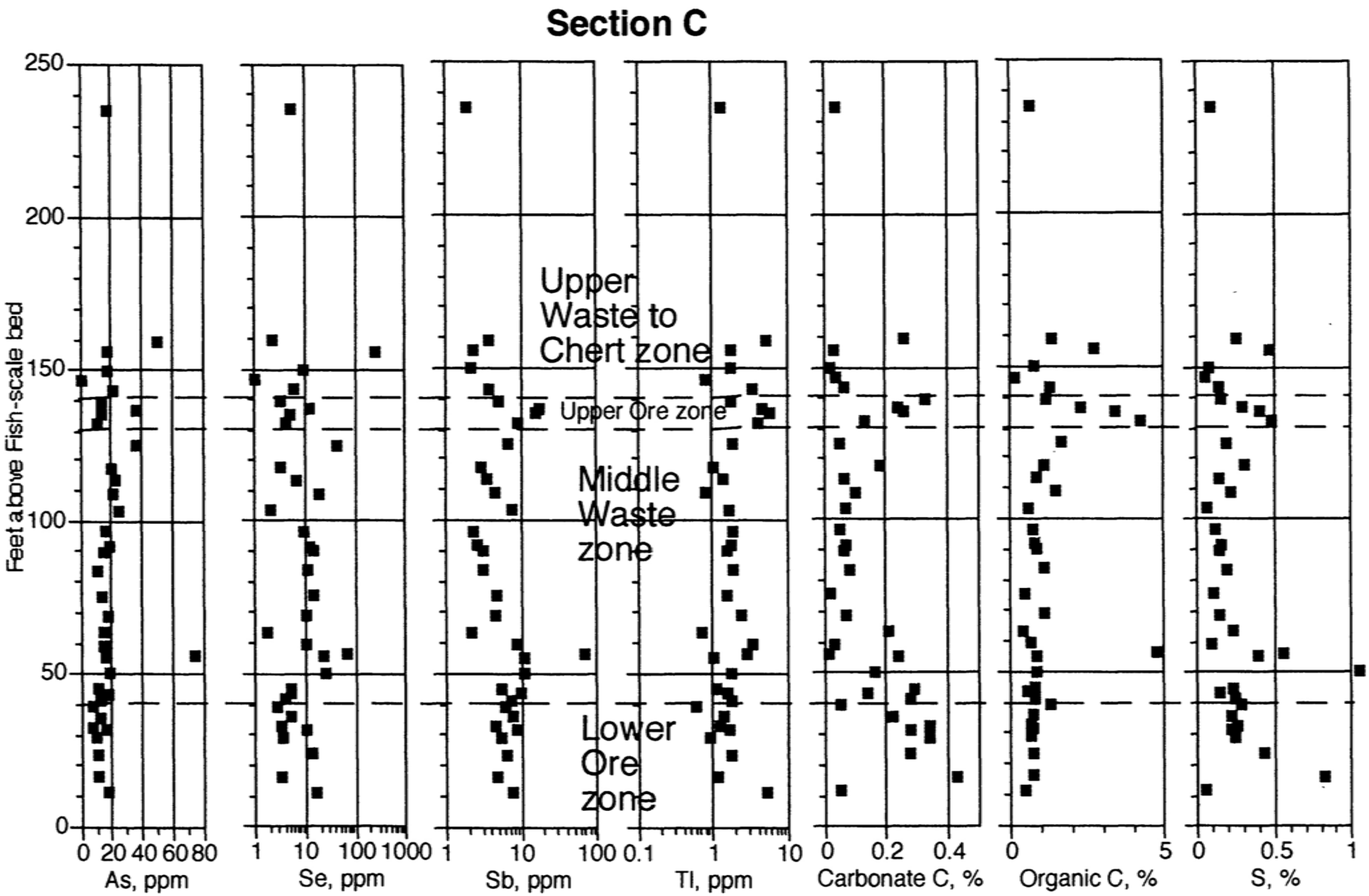
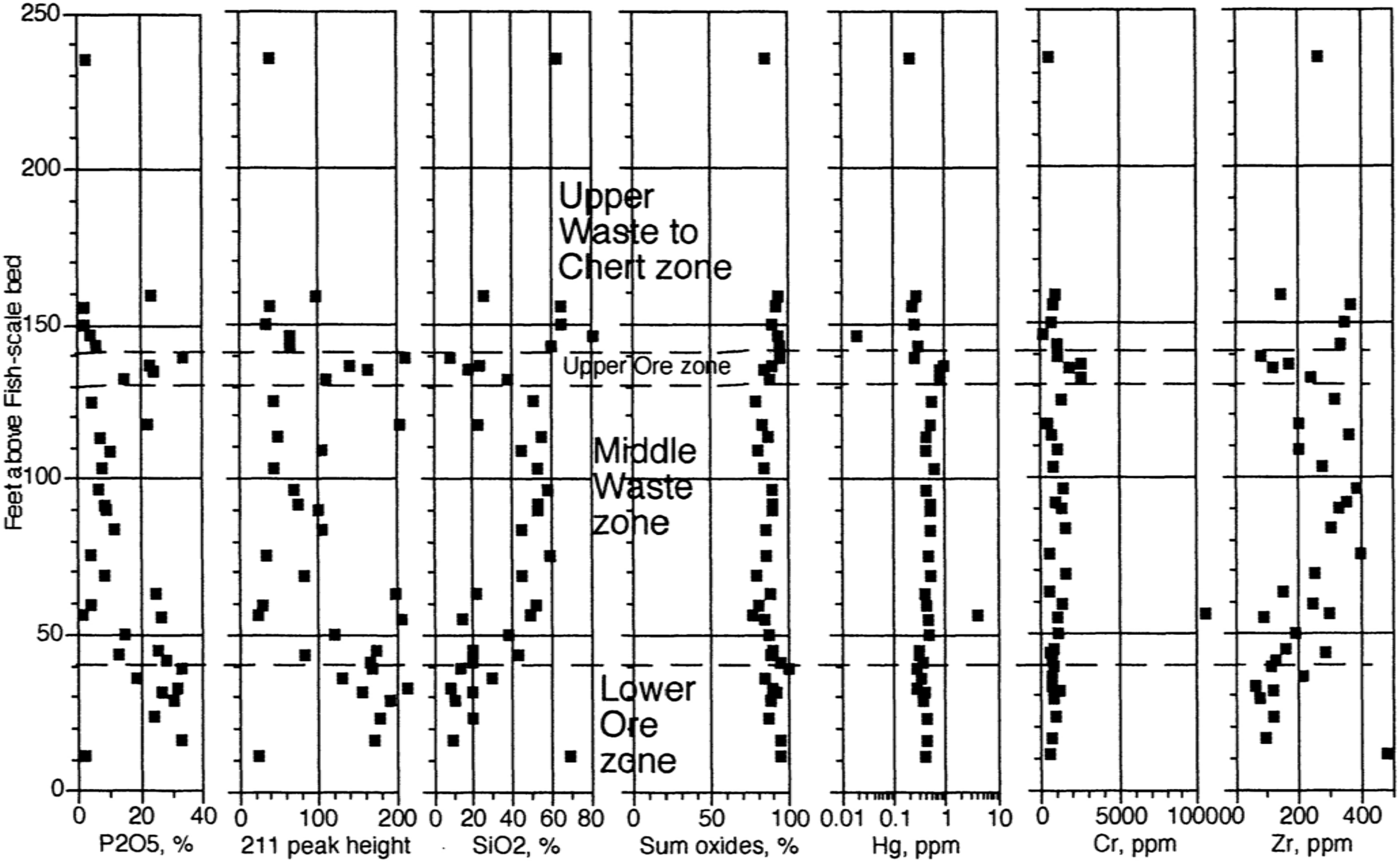
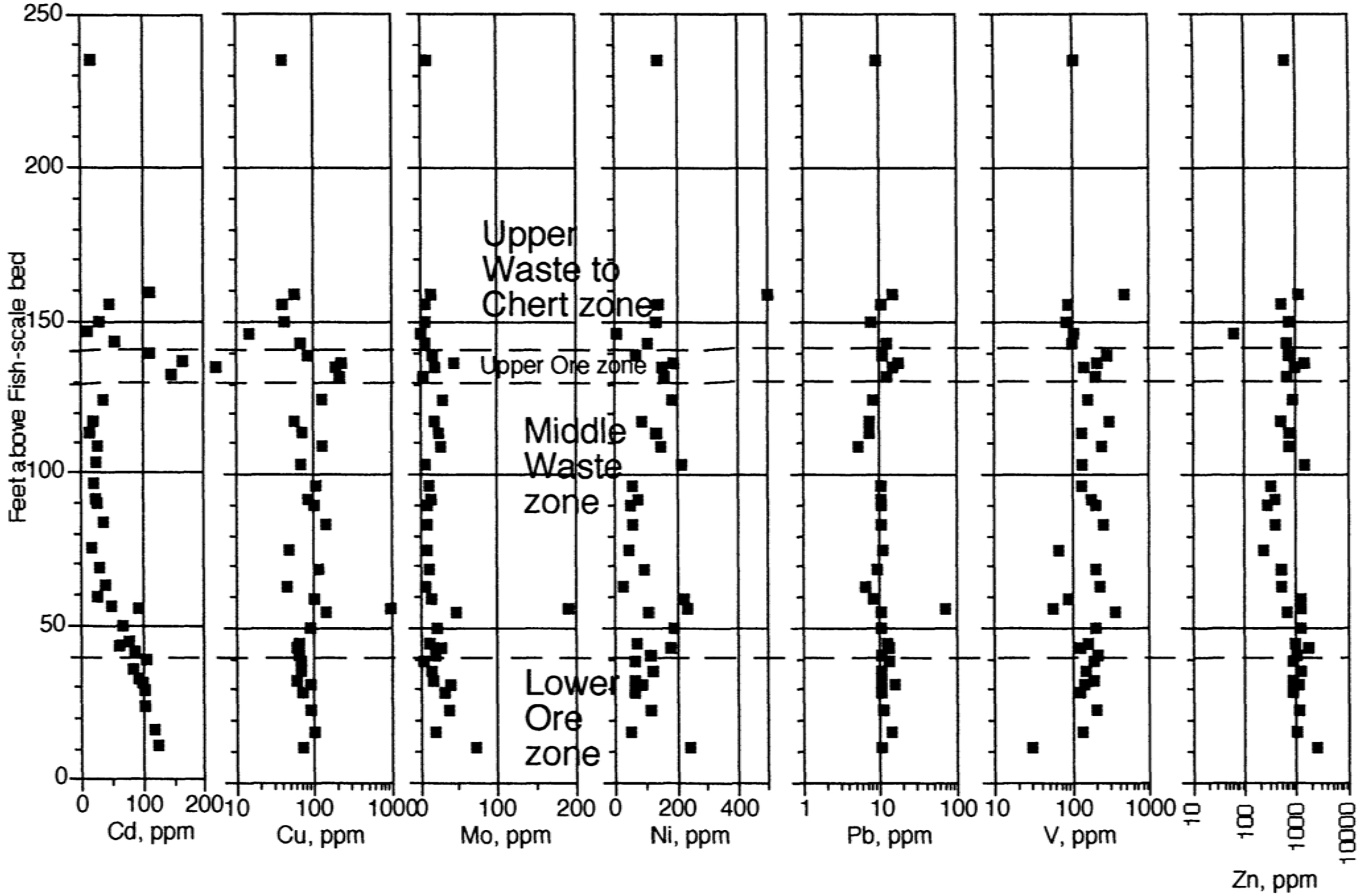

Section C
Feet above Fish-scale bed
Upper Waste to Chert zone
Upper Ore zone
Middle Waste zone
Lower Ore zone
As, ppm
Se, ppm
Sb, ppm
Tl, ppm
Carbonate C, %
Organic C, %
S, %

Section C

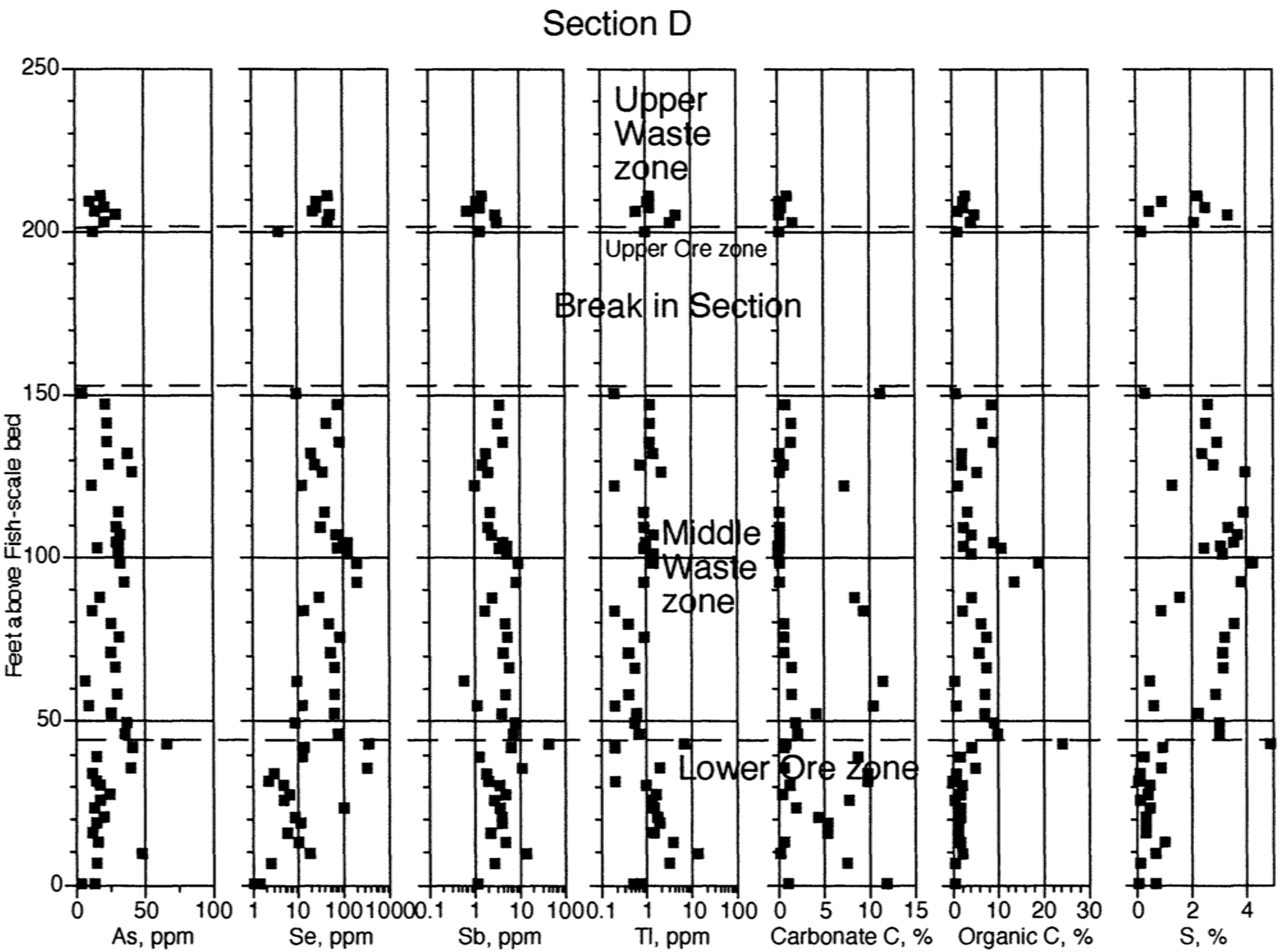


Upper Waste to Chert zone
Upper Ore zone
Middle Waste zone
Lower Ore zone
Feet above Fish-scale bed
250
200
150
100
50
0
0 20 40
P2O5, %
0 100 200
211 peak height
0 20 40 60 80
SiO2, %
0 50 100
Sum oxides, %
0.01 0.1 1 10
Hg, ppm
0 5000 10000
Cr, ppm
0 200 400
Zr, ppm

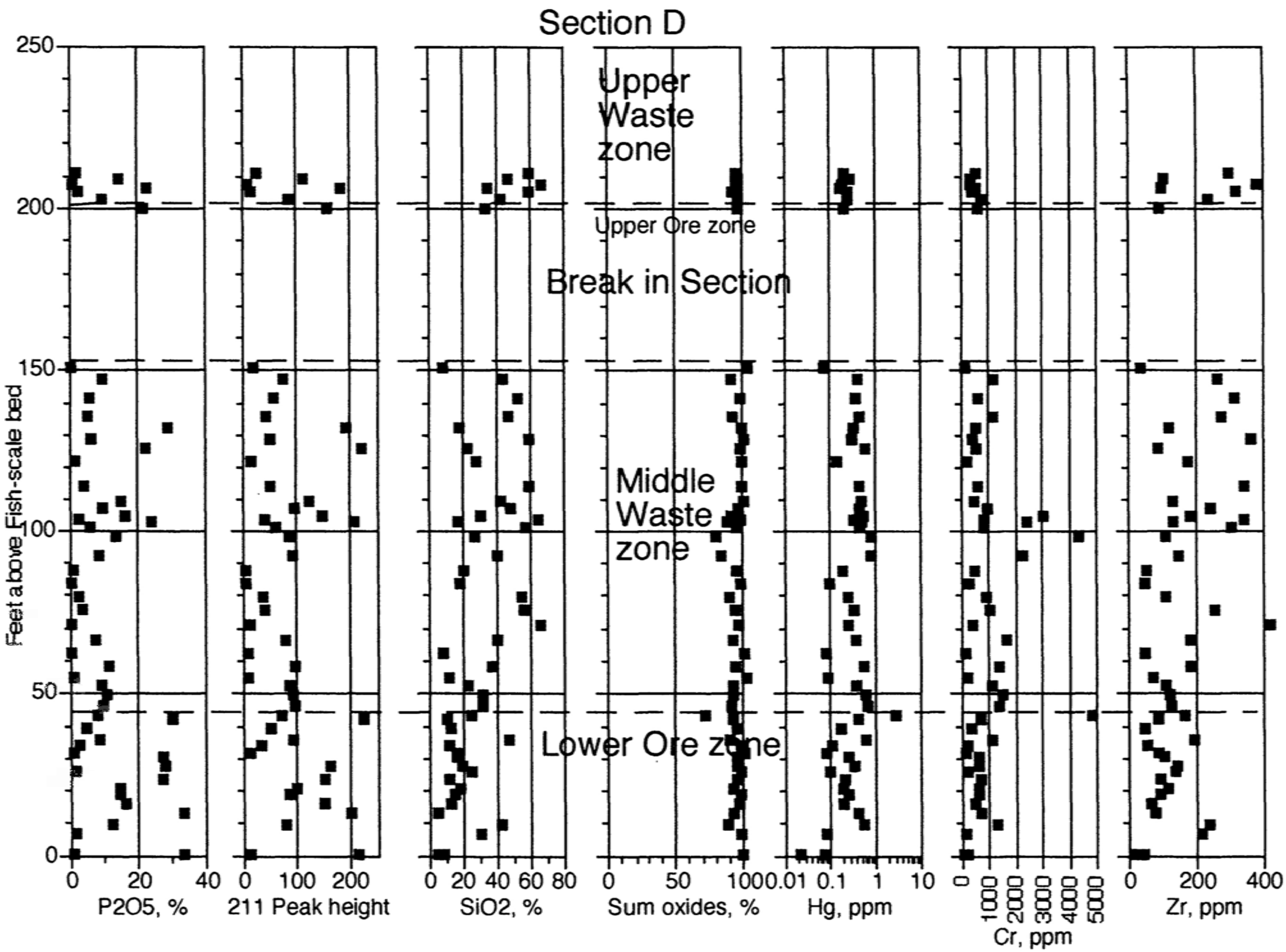
Section C

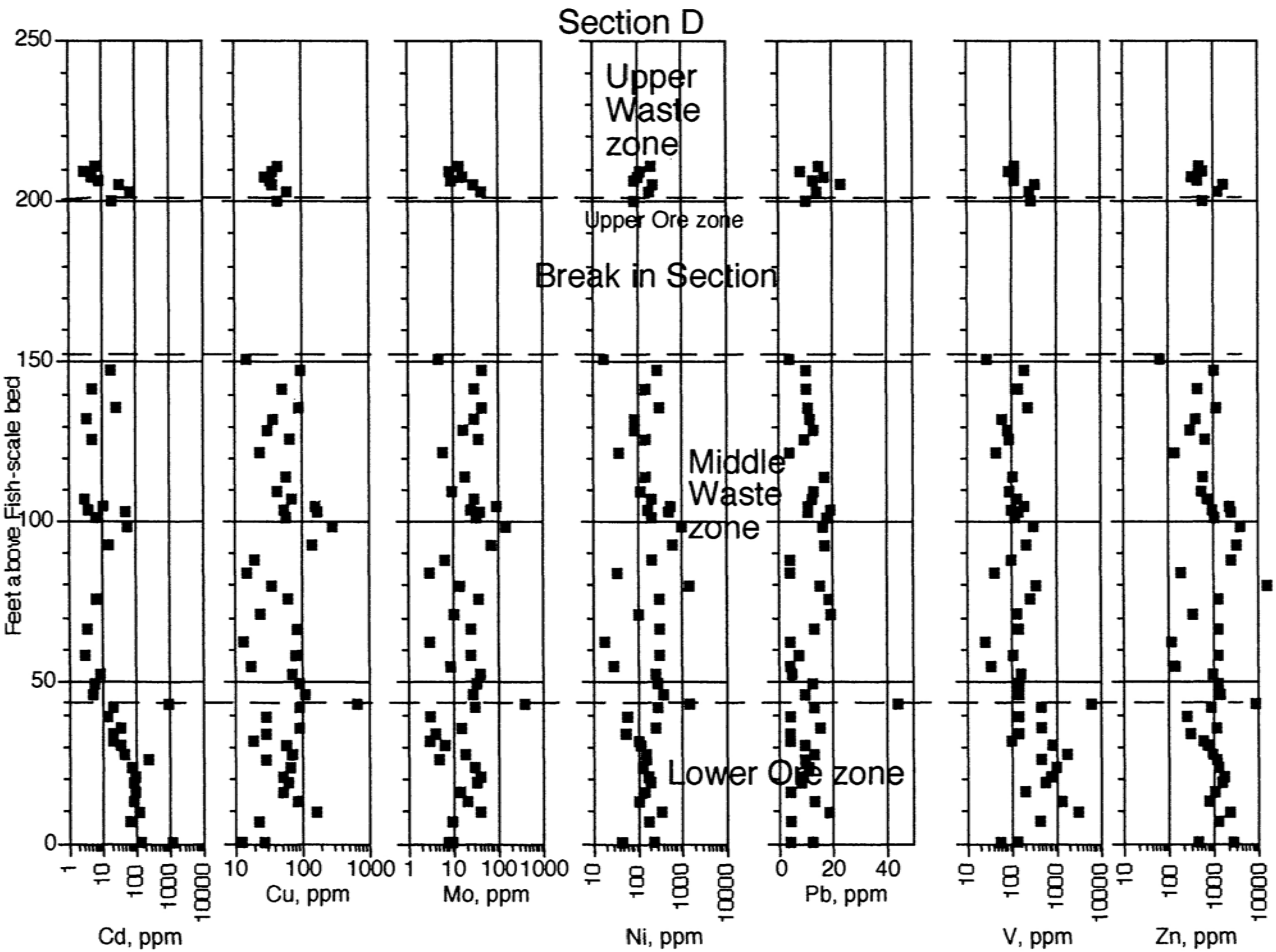


Feet above Fish-scale bed
250
200
150
100
50
0
Upper Waste to Chert zone
Upper Ore zone
Middle Waste zone
Lower Ore zone
0
100
200
Cd, ppm
10
100
1000
Cu, ppm
0
100
200
Mo, ppm
0
200
400
Ni, ppm
1
10
100
Pb, ppm
10
100
1000
V, ppm
10
100
1000
10000
Zn, ppm



Section D
Upper Waste zone
Upper Ore zone
Break in Section
Middle Waste zone
Lower Ore zone
Feet above Fish-scale bed
250
200
150
100
50
0
As, ppm
Se, ppm
Sb, ppm
Tl, ppm
Carbonate C, %
Organic C, %
S, %


Section D
Upper Waste zone
Upper Ore zone
Break in Section
Middle Waste zone
Lower Ore zone
Feet above Fish-scale bed
P2O5, %
211 Peak height
SiO2, %
Sum oxides, %
Hg, ppm
Cr, ppm
Zr, ppm



Section D
Upper Waste zone
Upper Ore zone
Break in Section
Middle Waste zone
Lower Ore zone
Feet above Fish-scale bed
250
200
150
100
50
0
Cd, ppm
Cu, ppm
Mo, ppm
Ni, ppm
Pb, ppm
V, ppm
Zn, ppm

Section C Field No.	Lab No.	Unit within Meade Peak Member	Lithology	Interval base, ft	Interval top, ft	Interval thickness, ft	Interval midpoint, ft	Se, ppm, Hyd.	As, ppm, hydride	Hg, ppm, CVAA	Sb, ppm, Hyd.	Te, ppm, FAA	Tl, ppm, ICP-MS
WPSC011C	C-123865	Footwall Mudstone	mudstone	10	12	2	11.0	17.2	17.9	0.4	7.8	0.3	5.2
WPSC015C	C-123849	Lower Ore zone, A-Bed Ore	phosphorite	12	20	8	16.0	3.2	11.1	0.44	4.5	<0.1	0.9
WPSC015X	C-123871		duplicate of previous sample				16.0	3.2	11.4	0.43	5.1	<0.1	1.4
WPSC020C	C-123877	Lower Ore zone, A-Cap	mudstone	20	26.3	6.3	23.2	14.3	11.8	0.42	6.4	<0.1	1.7
WPSC028C	C-123856	Lower Ore zone, Lower B Ore	phosphorite	26.3	31	4.7	28.7	3.5	10.6	0.34	5.5	0.2	0.9
WPSC031C	C-123876	Lower Ore zone, B-Mudstone	phosphorite	31	31.5	0.5	31.3	10.2	16	0.39	8.6	0.3	1.6
WPSC032C	C-123867	Lower Ore zone, Upper B Ore	phosphorite	31.5	33	1.5	32.3	3.3	7.1	0.27	4.5	0.3	1.2
WPSC035C	C-123857	Lower Ore zone, False Cap	mudstone	33	38	5	35.5	5.3	12.6	0.32	7.9	0.1	1.4
WPSC039C	C-123866	Lower Ore zone, C-Bed	phosphorite	38	40	2	39.0	2.9	8.1	0.28	6	<0.1	0.6
WPSC041C	C-123873	Middle Waste	mudstone	40	42	2	41.0	3.8	12.5	0.35	7.3	0.3	1.7
WPSC043C	C-123842	Middle Waste	mudstone	42	44	2	43.0	5.4	17.3	0.29	9.6	0.2	1.5
WPSC045C	C-123852	Middle Waste	phosphorite	44	45	1	44.5	5.4	11.8	0.29	5.5	<0.1	1.1
WPSC050C	C-123875	Middle Waste	mudstone	45	54.5	9.5	49.8	24.7	20.3	0.46	11.5	0.2	1.6
WPSC050X	C-123885		duplicate of previous sample				49.8	27	17.9	0.46	10.7	0.2	1.8
WPSC055C	C-123882	Middle Waste	phosphorite	54.5	55.5	1	55.0	24.4	16.1	0.46	11.2	<0.1	1
WPSC056C	C-123881	Middle Waste	carbon seam	55.5	55.8	0.3	55.7	70.3	74.1	4.22	71	0.2	2.8
WPSC060C	C-123884	Middle Waste	mudstone	55.8	62	6.2	58.9	10.5	15.6	0.41	8.8	0.3	3.4
WPSC063C	C-123861	Middle Waste	chert	62	64	2	63.0	1.9	16.5	0.39	2.3	<0.1	0.7
WPSC063X	C-123864		duplicate of previous sample				63.0	1.8	14.7	0.41	2.1	0.3	0.7
WPSC070C	C-123854	Middle Waste	mudstone	64	73	9	68.5	10.7	17.6	0.52	4.6	0.1	2.4
WPSC075C	C-123843	Middle Waste	dolomite	73	77	4	75.0	16.1	12.8	0.45	4	<0.1	1.4
WPSC075X	C-123855		duplicate of previous sample				75.0	14.8	15	0.43	5.4	0.1	1.6
WPSC080C	C-123863	Middle Waste	mudstone	77	89	12	83.0	12.1	11.5	0.52	3.1	0.6	1.8
WPSC090C	C-123850	Middle Waste	nodular phosp	89	90	1	89.5	15.2	15.4	0.49	3.2	<0.1	1.5
WPSC091C	C-123845	Middle Waste	mudstone	90	92.25	2.25	91.1	12.3	19.4	0.5	2.7	0.1	1.7
WPSC096C	C-123880	Middle Waste	mudstone, dol	92.25	100	7.75	96.1	9.5	16.4	0.42	2.4	<0.1	1.8
WPSC104C	C-123879	Middle Waste	mudstone	100	106	6	103.0	2.1	24.6	0.62	7.7	<0.1	1.6
WPSC108C	C-123859	Middle Waste	mudstone	106	110.5	4.5	108.3	19.7	21.6	0.41	4.5	<0.1	0.8
WPSC112C	C-123878	Middle Waste	mudstone, ph	110.5	115.2	4.7	112.9	6.7	23.2	0.43	3.5	<0.1	1.4
WPSC116C	C-123860	Middle Waste	Phosphorite	115.25	118.5	3.25	116.9	3.3	20.7	0.49	3	<0.1	1
WPSC122C	C-123858	Middle Waste	mudstone, ph	118.5	130	11.5	124.3	43.2	36	0.55	6.8	<0.1	1.9
WPSC133C	C-123851	Upper Ore zone, D-1 Ore	phosphorite	130	134	4	132.0	4.5	11.1	0.76	9	0.2	3.7
WPSC133X	C-123848		duplicate of previous sample				132.0	4.3	11.6	0.75	9.6	<0.1	4.3
WPSC135C	C-123853	Upper Ore zone, D-2 Ore	phosphorite	134	136.3	2.3	135.2	5.1	13.8	0.78	15.8	0.2	5.8
WPSC137C	C-123870	Upper Ore zone, D-Mudstone	mudstone	136.3	137	0.7	136.7	12.7	36.6	0.91	17.8	0.4	4.4
WPSC138C	C-123868	Upper Ore zone, D-3 Ore	phosphorite	137	141	4	139.0	3.3	14.4	0.25	5.2	0.2	1.7
WPSC144C	C-123847	Upper Waste	mudstone	141	145	4	143.0	6.3	21.8	0.31	3.9	0.1	3.3
WPSC146C	C-123862	Upper Waste	chert	145	147	2	146.0	1	1.3	0.02	<0.6	<0.1	0.8
WPSC150C	C-123869	Upper Waste	mudstone, ph	147	152	5	149.5	9.6	17.8	0.26	2.2	0.3	1.9
WPSC150X	C-123886		duplicate of previous sample				149.5	10.2	17	0.25	2.2	0.2	1.6
WPSC155C	C-123846	Upper Waste	mudstone, silt	152	158.5	6.5	155.3	259	17.4	0.22	2.3	0.1	1.7
WPSC159C	C-123872	F-Bed	phosphorite	158.5	159	0.5	158.8	2.3	50	0.27	3.9	<0.1	5.1
WPSC170C	C-123844	Upper Waste to chert		159	310	151	234.5	5.6	17.3	0.21	2	0.2	1.3
Section B													
WPSB170C	C-123883	Upper Waste to chert	mudstone	163	190	27	176.5	47.9	9.7	0.2	1.7	0.5	2.1

Section C (wpsC) Sample Geochemistry

Section C Field No.	C, %, Combustion	CO2, %, Acidification	Carbonate C, %, Acidification	Organic C, %, difference	S, %, Combustion	Al, %, ICP-16	Ca, %, ICP-16	Fe, %, ICP-16	K, %, ICP-16	Mg, %, ICP 16	Na, %, ICP-16	P, %, ICP-16	Si, %, ICP-16	Ti, %, ICP-16	AlOx, %, ICP-16	CaOx, %, ICP-16
WPSC011C	0.5	0.17	0.05	0.45	0.05	5.85	2.43	2.48	2.15	0.46	0.28	0.96	32.3	0.46	11.1	3.4
WPSC015C	1.13	1.62	0.44	0.69	0.83	1.09	33.2	0.55	0.32	0.16	0.68	14.2	4.64	0.06	2.1	46.4
WPSC015X	1.15	1.53	0.42	0.73	0.81	1.05	33.3	0.55	0.31	0.16	0.65	14.6	4.43	0.06	2.0	46.6
WPSC020C	1.01	1.02	0.28	0.73	0.44	2.01	24.5	0.92	0.78	0.21	0.32	10.6	9.42	0.12	3.8	34.3
WPSC028C	1	1.26	0.34	0.66	0.24	1.13	30.4	0.57	0.4	0.14	0.19	13.4	5.1	0.06	2.1	42.5
WPSC031C	1.02	1.04	0.28	0.74	0.22	1.93	26.9	0.97	0.91	0.22	0.19	11.8	9.42	0.13	3.6	37.6
WPSC032C	1.02	1.26	0.34	0.68	0.26	0.93	31.9	0.51	0.33	0.11	0.19	13.9	4.02	0.05	1.8	44.6
WPSC035C	0.96	0.79	0.22	0.74	0.22	2.69	18.5	1.27	1.2	0.21	0.2	8.08	14.3	0.22	5.1	25.9
WPSC039C	1.34	0.17	0.05	1.29	0.28	1.26	33	0.71	0.57	0.14	0.21	14.5	6.61	0.09	2.4	46.2
WPSC041C	1.04	1.01	0.28	0.76	0.24	1.93	27.7	1	0.84	0.16	0.2	12.3	9.24	0.13	3.6	38.8
WPSC043C	0.69	0.51	0.14	0.55	0.14	3.82	13.1	1.78	1.68	0.22	0.16	5.62	20.4	0.32	7.2	18.3
WPSC045C	1.08	1.07	0.29	0.79	0.23	1.84	25.7	0.91	0.8	0.17	0.2	11.2	9.49	0.14	3.5	36.0
WPSC050C	1.05	0.6	0.16	0.89	1.89	4.07	15	1.75	1.97	0.22	0.22	6.51	18.5	0.26	7.7	21.0
WPSC050X	1.03	0.63	0.17	0.86	0.21	3.73	14.2	1.65	1.86	0.21	0.22	6.32	17.4	0.24	7.0	19.9
WPSC055C	1.08	0.89	0.24	0.84	0.4	1.61	26.2	1.13	0.73	0.12	0.26	11.7	6.86	0.09	3.0	36.7
WPSC056C	4.74	0.05	0.01	4.73	0.56	5.79	2.46	3.35	2.52	0.85	0.12	0.71	23.3	0.38	10.9	3.4
WPSC060C	0.69	0.12	0.03	0.66	0.09	6.22	3.3	2.42	1.88	0.21	0.24	1.65	24.6	0.36	11.7	4.6
WPSC063C	0.63	0.78	0.21	0.42	0.23	2.1	20.9	2.13	0.76	0.09	0.21	9.87	10.1	0.16	4.0	29.2
WPSC063X	0.64	0.75	0.2	0.44	0.23	2.31	25	2.32	0.84	0.11	0.24	11.8	10.7	0.17	4.4	35.0
WPSC070C	1.14	0.24	0.07	1.07	0.15	4.45	7.35	2.16	1.5	0.2	0.31	3.59	21.3	0.31	8.4	10.3
WPSC075C	0.49	0.07	0.02	0.47	0.12	5.15	3.05	2.19	2.15	0.16	0.27	1.78	26.7	0.44	9.7	4.3
WPSC075X	0.47	0.08	0.02	0.45	0.08	5.34	3.27	2.51	2.3	0.17	0.25	1.94	28.5	0.46	10.1	4.6
WPSC080C	1.21	0.29	0.08	1.13	0.19	4.07	10.8	2.11	1.47	0.25	0.21	4.99	21.2	0.31	7.7	15.1
WPSC090C	0.88	0.21	0.06	0.82	0.14	4.55	8.26	2.11	1.78	0.19	0.3	3.86	25.1	0.38	8.6	11.6
WPSC091C	0.88	0.24	0.07	0.81	0.16	4.43	8.19	2.43	1.66	0.14	0.52	3.84	25.1	0.37	8.4	11.5
WPSC096C	0.78	0.18	0.05	0.73	0.12	4.58	6.3	2.06	1.82	0.18	0.47	2.97	27.3	0.4	8.7	8.8
WPSC104C	0.65	0.24	0.07	0.58	0.07	6.05	4.99	1.68	1.27	0.12	0.25	3.43	24.8	0.28	11.4	7.0
WPSC108C	1.55	0.38	0.1	1.45	0.22	3.06	10.4	1.32	1.14	0.11	0.43	4.48	21.1	0.23	5.8	14.5
WPSC112C	0.92	0.22	0.06	0.86	0.14	4	7.37	1.75	1.52	0.08	0.87	3.21	25.7	0.35	7.6	10.3
WPSC116C	1.28	0.66	0.18	1.10	0.31	1.69	22	1.03	0.6	0.05	0.49	9.64	10.8	0.14	3.2	30.8
WPSC122C	1.7	0.18	0.05	1.65	0.2	4.47	4.99	2.1	1.78	0.16	0.74	2.07	24.1	0.36	8.4	7.0
WPSC133C	4.33	0.53	0.14	4.19	0.5	3.44	15.8	1.39	1.39	0.21	0.2	6.71	16.3	0.25	6.5	22.1
WPSC133X	4.4	0.46	0.13	4.27	0.48	4.11	15.1	1.54	1.69	0.25	0.23	6.33	19.4	0.3	7.8	21.1
WPSC135C	3.69	0.95	0.26	3.43	0.41	2.01	24.7	0.92	0.76	0.19	0.12	10.7	8.27	0.14	3.8	34.6
WPSC137C	2.53	0.89	0.24	2.29	0.29	2.54	23.3	1.42	0.94	0.27	0.13	10.1	11.1	0.18	4.8	32.6
WPSC138C	1.47	1.21	0.33	1.14	0.16	1.1	33.7	0.52	0.33	0.12	0.11	14.8	4.36	0.06	2.1	47.1
WPSC144C	1.32	0.22	0.06	1.26	0.15	5.58	6.37	2.36	1.98	0.41	0.43	2.72	28.5	0.42	10.5	8.9
WPSC146C	0.22	0.15	0.04	0.18	0.05	0.25	4.35	0.12	0.06	0.02	0.05	1.85	38	0.01	0.5	6.1
WPSC150C	0.78	0.09	0.02	0.76	0.08	5.23	2.35	2.05	1.91	0.38	0.57	0.99	31.4	0.41	9.9	3.3
WPSC150X	0.85	0.07	0.02	0.83	0.08	5.35	1.92	2.14	1.98	0.39	0.58	0.8	30.1	0.42	10.1	2.7
WPSC155C	2.74	0.1	0.03	2.71	0.47	6.18	2.44	2.77	2.17	0.48	0.61	1.04	30.4	0.46	11.7	3.4
WPSC159C	1.63	0.95	0.26	1.37	0.26	2.02	24	1.8	0.65	0.24	0.16	10.4	12.4	0.14	3.8	33.6
WPSC170C	0.67	0.13	0.04	0.63	0.09	4.37	2.97	1.89	1.51	0.35	0.27	1.24	29.6	0.33	8.3	4.2
Section B																
WPSB170C	3.01	0.13	0.04	2.97	1.34	1.73	2.71	0.87	0.48	0.16	0.08	1.18	31.1	0.09	3.3	3.8

Section C (wpsC) Sample Geochemistry

Section C Field No.	FeOx, %, ICP-16	KOx, %, ICP-16	MgOx, %, ICP-16	NaOx, %, ICP-16	POx, %, ICP-16	SiOx, %, ICP-16	TiOx, %, ICP-16	Sum Oxides	Apatite 211 peak ht.	Apatite 211 peak height, % highest value, both sections	Ba, ppm, ICP-16	Cr, ppm, ICP-16	Mn, ppm, ICP-16	Nb, ppm, ICP-16
WPSC011C	3.55	2.59	0.76	0.38	2.2	69.1	0.77	93.8	26	6%	356	522	399	19
WPSC015C	0.79	0.39	0.27	0.92	32.5	9.9	0.10	93.4	171	37%	157	684	<100	14
WPSC015X	0.79	0.37	0.27	0.88	33.5	9.5	0.10	93.9			123	682	<100	<10
WPSC020C	1.32	0.94	0.35	0.43	24.3	20.1	0.20	85.7	178	38%	141	966	139	<10
WPSC028C	0.82	0.48	0.23	0.26	30.7	10.9	0.10	88.2	191	41%	95	818	<100	<10
WPSC031C	1.39	1.10	0.36	0.26	27.0	20.1	0.22	91.8	156	34%	183	1210	155	12
WPSC032C	0.73	0.40	0.18	0.26	31.9	8.6	0.08	88.5	214	46%	118	683	146	<10
WPSC035C	1.82	1.45	0.35	0.27	18.5	30.6	0.37	84.3	132	28%	178	677	102	14
WPSC039C	1.02	0.69	0.23	0.28	33.2	14.1	0.15	98.3	170	37%	141	777	<100	<10
WPSC041C	1.43	1.01	0.27	0.27	28.2	19.8	0.22	93.5	166	36%	150	644	255	<10
WPSC043C	2.55	2.02	0.36	0.22	12.9	43.6	0.53	87.7	82	18%	242	562	196	<10
WPSC045C	1.30	0.96	0.28	0.27	25.7	20.3	0.23	88.4	175	38%	144	835	<100	<10
WPSC050C	2.50	2.37	0.36	0.30	14.9	39.6	0.43	89.1	122	26%	219	1080	288	<10
WPSC050X	2.36	2.24	0.35	0.30	14.5	37.2	0.40	84.3			189	1010	270	<10
WPSC055C	1.62	0.88	0.20	0.35	26.8	14.7	0.15	84.4	207	45%	66	1100	109	13
WPSC056C	4.79	3.04	1.41	0.16	1.6	49.8	0.63	75.9	25	5%	300	10510	171	<10
WPSC060C	3.46	2.27	0.35	0.32	3.8	52.6	0.60	79.8	30	6%	233	1350	582	11
WPSC063C	3.05	0.92	0.15	0.28	22.6	21.6	0.27	82.1	199	43%	153	536	<100	11
WPSC063X	3.32	1.01	0.18	0.32	27.0	22.9	0.28	94.4			216	687	<100	<10
WPSC070C	3.09	1.81	0.33	0.42	8.2	45.6	0.52	78.6	84	18%	268	1570	<100	<10
WPSC075C	3.13	2.59	0.27	0.36	4.1	57.1	0.73	82.3	35	8%	305	553	<100	14
WPSC075X	3.59	2.77	0.28	0.34	4.4	61.0	0.77	87.8			300	619	<100	<10
WPSC080C	3.02	1.77	0.41	0.28	11.4	45.3	0.52	85.6	106	23%	251	1560	<100	<10
WPSC090C	3.02	2.14	0.32	0.40	8.8	53.7	0.63	89.2	100	22%	310	1360	<100	<10
WPSC091C	3.47	2.00	0.23	0.70	8.8	53.7	0.62	89.3	76	16%	270	986	<100	<10
WPSC096C	2.95	2.19	0.30	0.63	6.8	58.4	0.67	89.4	71	15%	351	1400	<100	12
WPSC104C	2.40	1.53	0.20	0.34	7.9	53.0	0.47	84.3	44	9%	562	848	220	<10
WPSC108C	1.89	1.37	0.18	0.58	10.3	45.1	0.38	80.1	106	23%	167	1120	<100	<10
WPSC112C	2.50	1.83	0.13	1.17	7.4	55.0	0.58	86.4	51	11%	221	626	130	15
WPSC116C	1.47	0.72	0.08	0.66	22.1	23.1	0.23	82.3	204	44%	115	460	<100	<10
WPSC122C	3.00	2.14	0.27	1.00	4.7	51.5	0.60	78.7	45	10%	222	1370	<100	<10
WPSC133C	1.99	1.67	0.35	0.27	15.4	34.9	0.42	83.5	112	24%	240	2410	<100	<10
WPSC133X	2.20	2.04	0.41	0.31	14.5	41.5	0.50	90.4			286	2710	<100	<10
WPSC135C	1.32	0.92	0.32	0.16	24.5	17.7	0.23	83.5	163	35%	157	1870	<100	<10
WPSC137C	2.03	1.13	0.45	0.18	23.1	23.7	0.30	88.4	142	31%	194	2570	<100	<10
WPSC138C	0.74	0.40	0.20	0.15	33.9	9.3	0.10	94.1	211	45%	111	1050	<100	11
WPSC144C	3.37	2.39	0.68	0.58	6.2	61.0	0.70	94.4	66	14%	351	1010	<100	13
WPSC146C	0.17	0.07	0.03	0.07	4.2	81.3	0.02	92.4	66	14%	219	124	<100	<10
WPSC150C	2.93	2.30	0.63	0.77	2.3	67.2	0.68	89.9	36	8%	316	633	<100	11
WPSC150X	3.06	2.39	0.65	0.78	1.8	64.4	0.70	86.6			305	616	<100	14
WPSC155C	3.96	2.61	0.80	0.82	2.4	65.0	0.77	91.5	40	9%	347	852	262	15
WPSC159C	2.57	0.78	0.40	0.22	23.8	26.5	0.23	92.0	97	21%	390	953	2860	<10
WPSC170C	2.70	1.82	0.58	0.36	2.8	63.3	0.55	84.6	41	9%	273	603	284	<10
Section B														
WPSB170C	1.24	0.58	0.27	0.11	2.7	66.5	0.15	78.6			144	536	<100	<10

Section C (wpsC) Sample Geochemistry

Section C Field No.	Sr, ppm, ICP-16	Y, ppm, ICP-16	Zr, ppm, ICP-16	Al, %, ICP-40	Ca, %, ICP-40	Fe, %, ICP-40	K, %, ICP-40	Mg, %, ICP-40	Na, %, ICP-40	P, %, ICP-40	Ag, ppm, ICP-40	Ba, ppm, ICP-40	Be, ppm, ICP-40	Bi, ppm, ICP-40	Cd, ppm, ICP-40	Ce, ppm, ICP-40	Co, ppm, ICP-40
WPSC011C	98	47	480	5.615	2.153	2.22	2.02	0.42	0.27	0.805	<2	304	<1	<50	126	63	6
WPSC015C	985	137	104	1.09	28.8	0.42	0.33	0.147	0.69	13.3	<2	107	<1	<50	118	13	<2
WPSC015X	967	137	90	1.13	28.6	0.27	0.34	0.147	0.695	13.2	<2	108	<1	<50	119	13	<2
WPSC020C	583	195	117	2.28	23.1	0.73	0.88	0.226	0.36	10.4	8	160	<1	<50	101	31	<2
WPSC028C	581	116	75	1.305	29.4	0.59	0.48	0.147	0.23	14	<2	113	<1	<50	104	8	<2
WPSC031C	508	140	117	2.19	24.7	0.88	1.01	0.226	0.215	11.5	<2	175	<1	<50	99	24	<2
WPSC032C	572	183	65	1.035	29.1	0.49	0.37	0.116	0.215	13.8	<2	93	<1	<50	93	19	<2
WPSC035C	382	133	211	3.21	18.6	1.24	1.43	0.215	0.245	8.335	<2	207	<1	<50	85	44	2
WPSC039C	624	198	113	1.31	28.3	0.36	0.6	0.131	0.21	13	<2	109	<1	<50	105	20	<2
WPSC041C	521	208	123	2.195	24.8	0.89	0.95	0.163	0.205	11.5	2	119	<1	<50	86	37	4
WPSC043C	288	118	284	4.13	12.7	1.82	1.83	0.226	0.185	5.69	2	243	<1	<50	61	65	6
WPSC045C	549	158	156	2.02	23.5	0.64	0.91	0.173	0.225	10.8	<2	136	<1	<50	76	25	<2
WPSC050C	545	198	189	4.455	13.3	1.72	2	0.221	0.23	6.155	11	206	<1	<50	69	56	5
WPSC050X	515	185	184	4.495	13.8	1.75	2.11	0.221	0.24	6.29	10	206	<1	<50	69	54	4
WPSC055C	1110	323	89	1.935	25.6	1.13	0.85	0.137	0.295	11.9	5	87	<1	<50	92	50	<2
WPSC056C	161	61	297	6.21	2.357	3.27	2.55	0.856	0.12	0.64	<2	298	<1	<50	50	39	<2
WPSC060C	863	84	244	7.285	3.46	2.55	2.11	0.236	0.26	1.69	7	267	<1	<50	26	60	23
WPSC063C	1430	199	149	2.515	21.8	1.1	0.94	0.095	0.25	9.63	<2	171	2	<50	40	60	<2
WPSC063X	1680	234	154	2.44	22.8	1.36	0.9	0.1	0.25	10.3	<2	167	2	<50	41	58	<2
WPSC070C	1090	182	249	5.2	7.51	2.37	1.75	0.21	0.37	3.73	5	282	1	<50	30	69	<2
WPSC075C	304	64	386	5.735	3.229	2.37	2.38	0.168	0.305	1.895	<2	312	<1	<50	18	72	<2
WPSC075X	297	64	414	5.715	3.213	2.55	2.42	0.179	0.27	1.94	2	323	<1	<50	18	64	<2
WPSC080C	684	251	303	4.54	10.4	2.14	1.63	0.257	0.23	4.885	4	251	1	<50	35	84	<2
WPSC090C	567	203	327	4.81	7.933	2.08	1.68	0.189	0.32	3.765	6	291	1	<50	26	66	<2
WPSC091C	537	180	352	4.63	7.77	2.39	1.62	0.137	0.545	3.815	5	257	<1	<50	23	62	<2
WPSC096C	592	135	387	4.99	5.996	2.05	1.88	0.184	0.49	2.785	7	332	1	<50	19	58	<2
WPSC104C	5340	129	276	6.455	4.715	1.68	1.37	0.116	0.255	3.325	3	570	2	<50	23	54	22
WPSC108C	583	209	204	3.595	11.1	1.47	1.37	0.126	0.505	4.91	6	218	1	<50	26	52	2
WPSC112C	420	130	361	4.54	7.056	1.83	1.69	0.089	0.96	3.115	3	224	<1	<50	14	59	3
WPSC116C	1360	267	200	2.02	22.2	1.11	0.74	0.058	0.59	10.2	3	127	1	<50	20	60	<2
WPSC122C	314	143	313	5.225	5.408	2.33	2.09	0.173	0.865	2.33	8	290	1	<50	36	57	<2
WPSC133C	779	199	213	3.485	14.8	1.29	1.41	0.2	0.2	6.54	15	209	<1	<50	149	37	<2
WPSC133X	788	213	261	3.98	13.1	1.4	1.61	0.231	0.22	5.675	15	245	<1	<50	147	43	<2
WPSC135C	932	138	117	2.245	23.3	0.79	0.85	0.189	0.135	10.7	<2	161	<1	<50	219	19	<2
WPSC137C	690	210	172	2.785	21.9	1.07	1.02	0.278	0.135	9.27	<2	185	<1	<50	165	34	<2
WPSC138C	964	276	80	1.23	29.2	0.49	0.37	0.116	0.11	14.1	<2	84	<1	<50	113	18	<2
WPSC144C	296	111	336	5.505	5.707	2.19	1.8	0.373	0.415	2.455	3	306	<1	<50	54	64	4
WPSC146C	198	107	<10	0.22	4.158	0.14	0.06	0.016	0.05	1.845	<2	220	<1	<50	10	13	<2
WPSC150C	122	93	344	5.46	2.247	2	1.94	0.378	0.585	0.935	<2	294	1	<50	30	58	3
WPSC150X	101	81	353	5.795	1.958	2.17	2.07	0.404	0.625	0.775	<2	302	1	<50	31	60	3
WPSC155C	122	94	364	5.845	2.347	2.49	2.02	0.441	0.565	1.01	<2	317	<1	<50	45	59	<2
WPSC159C	647	481	147	2.155	20.9	1.7	0.7	0.236	0.165	9.625	4	355	<1	<50	111	61	25
WPSC170C	120	104	265	4.775	3.092	2	1.67	0.368	0.295	1.315	<2	292	1	<50	16	52	4
Section B																	
WPSB170C	116	103	68	1.875	2.882	0.97	0.57	0.189	0.075	1.29	<2	179	<1	<50	11	17	<2

Section C Field No.	Cu, ppm, ICP-40	Eu, ppm, ICP-40	Ga, ppm, ICP-40	Ho, ppm, ICP-40	La, ppm, ICP-40	Li, ppm, ICP-40	Mn. ppm, ICP-40	Mo, ppm, ICP-40	Nb, ppm, ICP-40	Nd, ppm, ICP-40	Ni, ppm, ICP-40	Pb, ppm, ICP-40	Sc, ppm, ICP-40	Sn, ppm, ICP-40	Sr, ppm, ICP-40	Th, ppm, ICP-40	U, ppm, ICP-40
WPSC011C	71	<2	<4	<4	35	27	345	72	<4	29	244	10	8	<50	82	12	<100
WPSC015C	99	<2	<4	<4	96	11	39	19	<4	29	55	12	<2	<50	880	<6	115
WPSC015X	105	<2	<4	<4	99	12	38	20	<4	34	55	15	<2	<50	873	<6	137
WPSC020C	88	2	<4	5	166	21	118	37	<4	63	114	11	<2	<50	572	<6	<100
WPSC028C	72	<2	<4	<4	88	14	87	32	<4	30	68	10	3	<50	580	<6	120
WPSC031C	90	2	<4	4	106	22	150	40	<4	42	93	15	2	<50	492	<6	130
WPSC032C	59	2	<4	<4	134	11	147	18	<4	44	63	10	3	<50	552	<6	125
WPSC035C	67	2	<4	4	109	19	95	16	<4	51	124	10	<2	<50	387	<6	<100
WPSC039C	67	3	<4	4	136	13	28	6	<4	56	65	13	<2	<50	560	<6	<100
WPSC041C	65	3	<4	4	158	13	234	19	<4	65	118	10	2	<50	497	<6	<100
WPSC043C	61	3	<4	<4	97	20	181	27	<4	52	180	13	8	<50	273	8	<100
WPSC045C	65	2	<4	<4	115	17	48	12	<4	52	74	12	<2	<50	519	<6	127
WPSC050C	89	4	<4	5	159	21	293	23	<4	77	190	9	9	<50	503	<6	<100
WPSC050X	92	4	<4	4	162	21	266	24	<4	79	190	11	9	<50	527	<6	<100
WPSC055C	147	6	<4	8	270	14	98	47	<4	149	109	10	5	<50	1140	<6	<100
WPSC056C	979	4	<4	<4	52	79	146	192	<4	57	235	70	17	<50	154	20	<100
WPSC060C	100	<2	<4	<4	97	26	598	16	<4	51	223	8	12	<50	868	9	<100
WPSC063C	44	5	<4	5	203	10	8	7	<4	122	27	7	<2	<50	1520	<6	<100
WPSC063X	47	5	<4	6	206	11	11	6	<4	124	26	6	<2	<50	1530	<6	<100
WPSC070C	112	4	<4	4	167	26	58	13	<4	89	97	9	10	<50	1090	7	<100
WPSC075C	45	2	<4	<4	64	17	<4	9	<4	54	50	11	11	<50	306	15	<100
WPSC075X	49	3	6	<4	64	17	4	10	<4	48	49	10	12	<50	285	13	<100
WPSC080C	144	5	<4	6	185	25	30	9	<4	116	62	10	10	<50	665	8	<100
WPSC090C	99	4	6	5	139	21	19	11	<4	91	52	10	10	<50	530	7	<100
WPSC091C	85	4	<4	5	115	16	91	15	<4	74	79	10	10	<50	499	8	<100
WPSC096C	107	3	4	<4	92	21	48	12	<4	58	62	10	10	<50	567	7	<100
WPSC104C	68	3	<4	<4	102	13	187	7	<4	58	214	<4	8	<50	<2	6	<100
WPSC108C	127	4	4	6	146	19	51	27	<4	87	145	5	9	<50	618	8	<100
WPSC112C	71	3	<4	4	87	10	122	25	<4	62	133	7	8	<50	403	<6	<100
WPSC116C	57	6	<4	7	200	7	71	20	<4	131	90	7	5	<50	1390	<6	<100
WPSC122C	128	3	<4	<4	106	20	10	29	<4	62	185	8	10	<50	333	8	<100
WPSC133C	207	3	<4	<4	120	20	5	5	<4	60	154	10	5	<50	730	<6	<100
WPSC133X	219	3	5	<4	117	23	4	6	<4	65	169	14	8	<50	674	<6	<100
WPSC135C	189	2	<4	<4	85	14	10	21	<4	42	152	14	<2	<50	903	<6	139
WPSC137C	230	3	<4	5	126	22	17	46	<4	62	194	17	2	<50	673	<6	148
WPSC138C	85	3	<4	5	158	8	74	18	<4	76	71	11	3	<50	887	<6	<100
WPSC144C	66	3	8	<4	81	30	59	8	<4	62	111	12	9	<50	257	9	<100
WPSC146C	15	2	<4	<4	85	4	77	2	<4	63	12	<4	<2	<50	182	<6	<100
WPSC150C	42	3	7	<4	70	24	42	8	<4	56	126	8	9	<50	110	11	<100
WPSC150X	45	3	<4	<4	65	26	48	9	<4	50	141	7	10	<50	98	10	<100
WPSC155C	41	2	8	<4	64	27	197	7	<4	45	144	10	10	<50	107	11	<100
WPSC159C	57	8	<4	9	309	18	2680	14	<4	181	493	14	7	<50	588	<6	<100
WPSC170C	41	3	<4	4	78	24	284	10	<4	60	140	9	9	<50	116	7	<100
Section B																	
WPSB170C	52	3	<4	4	70	18	46	23	<4	49	179	<4	4	<50	121	<6	<100

Section C Field No.	V, ppm, ICP-40	Y, ppm, ICP-40	Yb, ppm, ICP-40	Zn, ppm, ICP-40	eU, un-scaled, ppm, channel interval avg.
WPSC011C	692	30	3	2440	58
WPSC015C	1160	129	6	991	167
WPSC015X	1180	131	6	1020	
WPSC020C	555	203	9	1130	127
WPSC028C	1560	125	6	833	187
WPSC031C	1680	144	7	1060	156
WPSC032C	1120	187	9	824	176
WPSC035C	1320	147	8	1230	157
WPSC039C	1450	187	9	818	158
WPSC041C	922	209	10	1000	166
WPSC043C	909	122	7	1660	177
WPSC045C	1660	161	8	894	151
WPSC050C	400	199	10	1240	104
WPSC050X	414	203	10	1240	
WPSC055C	516	355	16	672	113
WPSC056C	8280	55	9	1230	113
WPSC060C	407	88	6	1200	48
WPSC063C	119	224	10	520	39
WPSC063X	127	232	10	515	
WPSC070C	301	196	10	495	35
WPSC075C	223	66	5	229	28
WPSC075X	266	66	5	233	
WPSC080C	231	255	13	386	41
WPSC090C	181	201	10	276	40
WPSC091C	190	174	10	403	41
WPSC096C	196	134	8	321	40
WPSC104C	234	131	7	1380	45
WPSC108C	195	235	13	713	43
WPSC112C	184	132	8	692	39
WPSC116C	126	291	14	480	46
WPSC122C	258	160	9	850	54
WPSC133C	861	202	10	641	90
WPSC133X	955	194	10	717	
WPSC135C	2160	142	8	952	141
WPSC137C	2200	209	12	1370	169
WPSC138C	852	273	13	700	165
WPSC144C	402	98	6	635	70
WPSC146C	36	104	4	62	53
WPSC150C	228	89	5	669	52
WPSC150X	231	79	5	748	
WPSC155C	400	88	7	519	44
WPSC159C	454	461	23	1140	73
WPSC170C	203	106	7	610	25
Section B					
WPSB170C	176	111	6	826	

Field number	Lab No.	Unit within Meade Peak Member	Lithology	Interval base, ft	Interval top, ft	Interval thickness, ft	Interval midpoint, ft	As, ppm, Hydr. AA	Se, ppm, Hydr. AA	Sb, ppm, Hydr. AA	Te, ppm, Hydr. AA	Tl, ppm, Hydr. AA	CO2, %, acidification	Carbonate C, %, acidification	C, %, combustion	Organic C, %, difference	S, %, combustion	Hg, ppm, CVAA	Al, %, ICP 16
WPSD000C	C-136272	Top of Grandeur	limestone	0.00	0.00	0.00	0.00	4.3	1.0	<0.6	<0.1	0.3	43.3	11.8	11.9	0.1	<0.05	<0.02	0.22
WPSD000X	C-136278		duplicate of previous sample					3.4	1.2	<0.6	<0.1	0.6	43.5	11.9	12.0	0.1	<0.05	<0.02	0.23
WPSD0.5C	C-136238	Lower Ore Unit, Fish-scale Bed	phosphorite	0.00	0.50	0.50	0.25	12.8	1.4	1.1	<0.1	0.7	3.8	1.0	1.3	0.2	0.65	0.07	0.35
WPSD006C	C-136262	Lower Ore Unit, Footwall Mudstone	dolomite	5.00	7.80	2.80	6.40	14.3	2.6	2.6	<0.1	2.8	27.0	7.4	7.8	0.5	0.07	0.08	2.18
WPSD009C	C-136288	Lower Ore Unit, Footwall Mudstone	red mudstone	7.80	10.50	2.70	9.15	47.2	20.0	14.0	0.2	11.8	1.0	0.3	2.1	1.8	0.63	0.56	3.42
WPSD014C	C-136274	Lower Ore Unit, A-Bed Ore	phosphorite	10.50	14.70	4.20	12.60	15.2	10.6	5.0	<0.1	3.4	2.1	0.6	2.0	1.4	1.01	0.40	0.45
WPSD016C	C-136251	Lower Ore Unit, A Cap	phosphorite	14.70	17.00	2.30	15.85	12.0	6.1	2.3	<0.1	1.3	19.7	5.4	6.4	1.0	0.32	0.19	0.81
WPSD018C	C-136232	Lower Ore Unit, A Cap	dolomite	17.00	19.80	2.80	18.40	14.5	11.3	4.1	<0.1	1.8	19.3	5.3	6.6	1.4	0.29	0.25	1.58
WPSD020C	C-136269	Lower Ore Unit, Lower B Ore	dolomite	19.80	21.00	1.20	20.40	19.8	8.9	4.1	<0.1	1.7	16.1	4.4	5.8	1.4	0.30	0.19	1.59
WPSD023C	C-136240	Lower Ore Unit, Lower B Ore	phosphorite	21.00	25.00	4.00	23.00	13.3	105.0	3.6	0.1	1.4	6.5	1.8	3.2	1.4	0.43	0.21	1.07
WPSD025C	C-136263	Lower Ore Unit, B Mudstone	limestone	25.00	26.00	1.00	25.50	17.7	5.1	2.7	<0.1	1.2	28.0	7.6	8.0	0.4	0.08	0.10	2.21
WPSD027C	C-136256	Lower Ore Unit, Upper B Ore	phosphorite	26.00	29.00	3.00	27.50	24.4	7.7	4.2	<0.1	1.6	1.3	0.4	2.0	1.6	0.41	0.35	1.51
WPSD027X	C-136228		duplicate of previous sample					24.1	6.0	5.1	<0.1	1.4	1.2	0.3	1.9	1.5	0.40	0.33	1.72
WPSD030C	C-136264	Lower Ore Unit, Upper B Ore	phosphorite	29.00	31.00	2.00	30.00	17.8	5.1	3.7	<0.1	0.9	4.5	1.2	3.4	2.1	0.47	0.26	1.34
WPSD031C	C-136273	Lower Ore Unit, False Cap	dolomite	31.00	32.00	1.00	31.50	14.0	2.4	2.1	<0.1	0.2	36.0	9.8	9.9	0.1	<0.05	0.08	1.56
WPSD033C	C-136249	Lower Ore Unit, False Cap		32.00	34.80	2.80	33.40	11.1	3.2	1.8	<0.1	<0.1	36.0	9.8	10.4	0.6	0.11	0.11	1.16
WPSD036C	C-136250	Lower Ore Unit, False Cap		34.80	36.50	1.70	35.65	40.1	325.0	11.2	0.2	1.8	1.8	0.5	5.4	4.9	0.85	0.59	5.06
WPSD039C	C-136267	Lower Ore Unit, False Cap	dolomite	36.50	41.00	4.50	38.75	15.1	13.1	1.3	<0.1	<0.1	31.9	8.7	10.1	1.4	0.21	0.17	1.12
WPSD041C	C-136266	Lower Ore Unit, C Bed	phosphorite	41.00	42.00	1.00	41.50	40.3	14.9	6.3	<0.1	0.2	2.4	0.7	4.6	4.0	0.94	0.41	0.87
WPSD043C	C-136233	Lower Ore Unit, C Bed	phosphorite	42.00	43.75	1.75	42.88	66.4	361.0	45.1	0.2	6.0	2.7	0.7	25.0	24.3	4.86	2.73	3.05
WPSD046C	C-136261	Middle Waste		43.75	48.00	4.25	45.88	34.8	78.9	7.2	0.1	0.6	7.7	2.1	11.8	9.7	3.01	0.68	3.85
WPSD049C	C-136239	Middle Waste		48.00	50.00	2.00	49.00	36.8	9.3	7.7	<0.1	0.5	6.6	1.8	10.8	9.0	3.01	0.57	4.34
WPSD052C	C-136237	Middle Waste	siltstone	50.00	54.00	4.00	52.00	23.5	68.4	4.1	<0.1	0.7	15.3	4.2	11.4	7.2	2.31	0.40	2.94
WPSD052X	C-136255		duplicate of previous sample					27.1	64.8	3.6	<0.1	0.4	15.3	4.2	11.0	6.8	2.24	0.36	2.89
WPSD055C	C-136242	Middle Waste	dolomite	54.00	55.25	1.25	54.63	9.2	12.8	1.0	<0.1	0.2	38.0	10.4	11.5	1.1	0.57	0.07	1.11
WPSD055X	C-136224		duplicate of previous sample					9.5	12.9	1.3	<0.1	0.2	38.4	10.5	11.2	0.7	0.55	0.11	1.10
WPSD058C	C-136275	Middle Waste		55.25	61.00	5.75	58.13	29.1	66.9	5.0	<0.1	0.4	5.2	1.4	8.6	7.2	2.89	0.52	3.85
WPSD062C	C-136281	Middle Waste	dolomite	61.00	63.00	2.00	62.00	6.1	10.2	0.6	<0.1	<0.1	41.9	11.4	11.6	0.2	0.42	0.08	0.79
WPSD067C	C-136223	Middle Waste		63.00	69.50	6.50	66.25	27.1	59.0	5.6	<0.1	0.6	5.3	1.4	8.9	7.4	3.15	0.34	4.76
WPSD067X	C-136279		duplicate of previous sample					30.0	74.5	5.7	0.1	0.4	5.7	1.6	8.9	7.3	3.13	0.37	4.49
WPSD071C	C-136234	Middle Waste		69.50	72.00	2.50	70.75	25.5	52.5	4.5	<0.1	0.4	2.2	0.6	6.5	5.9	3.18	0.26	5.28
WPSD075C	C-136226	Middle Waste		72.00	79.00	7.00	75.50	30.7	91.2	5.3	<0.1	0.8	2.2	0.6	7.9	7.3	3.23	0.34	5.40
WPSD080C	C-136286	Middle Waste		79.00	80.00	1.00	79.50	26.0	50.0	4.8	<0.1	0.4	1.9	0.5	6.6	6.1	3.58	0.25	5.17
WPSD084C	C-136283	Middle Waste	dolomite	80.00	87.00	7.00	83.50	11.4	13.9	1.7	<0.1	0.2	34.0	9.3	11.4	2.1	0.88	0.10	1.58
WPSD087C	C-136276	Middle Waste		87.00	87.50	0.50	87.25	16.6	30.4	2.4	<0.1	<0.1	30.1	8.2	12.1	3.9	1.59	0.19	2.28
WPSD093C	C-136257	Middle Waste		87.50	96.30	8.80	91.90	35.7	209.0	8.4	0.1	0.8	0.4	0.1	13.7	13.6	3.86	0.81	4.01
WPSD098C	C-136246	Middle Waste	phosphorite	96.30	100.00	3.70	98.15	32.9	193.0	8.7	<0.1	1.5	0.6	0.2	19.1	18.9	4.02	0.82	2.61
WPSD098X	C-136268		duplicate of previous sample					33.5	218.0	9.4	0.2	1.2	0.5	0.1	19.3	19.2	4.56	0.82	3.06
WPSD101C	C-136236	Middle Waste		100.00	102.00	2.00	101.00	31.4	156.0	5.6	0.1	1.4	0.2	0.1	4.4	4.3	3.19	0.47	5.27
WPSD101X	C-136243		duplicate of previous sample					31.3	115.0	5.0	<0.1	1.2	0.2	0.1	4.2	4.1	3.09	0.44	5.20
WPSD102C	C-136285	Middle Waste	carbon seam	102.00	102.50	0.50	102.25	16.5	80.6	3.8	0.1	0.8	0.9	0.2	10.8	10.6	2.43	0.47	1.71
WPSD103C	C-136231	Middle Waste		102.50	104.00	1.50	103.25	30.8	110.0	5.5	0.1	0.9	0.1	0.0	2.5	2.5	3.09	0.35	5.39
WPSD104C	C-136270	Middle Waste	carbon seam	104.00	104.50	0.50	104.25	31.8	139.0	4.4	0.1	0.9	0.6	0.2	9.4	9.3	3.80	0.54	3.63
WPSD104X	C-136230		duplicate of previous sample					28.7	116.0	4.2	0.2	0.9	0.6	0.2	9.4	9.2	3.37	0.52	3.59
WPSD108C	C-136259	Middle Waste		104.50	108.75	4.25	106.63	32.5	76.7	2.4	<0.1	1.3	0.3	0.1	4.3	4.3	3.72	0.45	4.66
WPSD109C	C-136271	Middle Waste		108.75	109.25	0.50	109.00	29.8	33.4	2.1	<0.1	0.8	0.4	0.1	2.5	2.3	3.33	0.51	3.98
WPSD114C	C-136287	Middle Waste		109.25	117.50	8.25	113.38	31.8	39.9	2.3	<0.1	0.8	0.9	0.3	3.5	3.2	3.94	0.43	5.75
WPSD120C	C-136282	Middle Waste	dolomite	117.50	125.50	8.00	121.50	11.6	12.6	1.0	<0.1	0.2	26.8	7.3	8.3	0.9	1.30	0.14	2.40
WPSD126C	C-136235	Middle Waste	carbon seam	125.50	126.00	0.50	125.75	41.5	37.7	2.0	<0.1	2.0	0.8	0.2	5.4	5.1	4.01	0.61	2.67
WPSD130C	C-136254	Middle Waste		126.00	131.50	5.50	128.75	24.7	26.1	1.6	<0.1	0.7	2.4	0.7	2.5	1.9	2.83	0.31	4.70
WPSD132C	C-136244	Middle Waste		131.50	132.50	1.00	132.00	35.8	20.6	2.0	<0.1	1.3	0.8	0.2	2.1	1.8	2.38	0.33	1.56
WPSD132X	C-136260		duplicate of previous sample					39.9	21.3	1.7	<0.1	1.3	0.7	0.2	2.1	1.9	2.47	0.37	1.53
WPSD137C	C-136277	Middle Waste		132.50	139.00	6.50	135.75	22.4	85.1	4.3	0.1	1.1	5.4	1.5	10.4	8.9	2.93	0.45	3.88
WPSD142C	C-136222	Middle Waste		139.00	144.00	5.00	141.50	23.3	45.9	3.2	<0.1	1.1	5.4	1.5	8.0	6.6	2.53	0.36	4.10
WPSD147C	C-136245	Middle Waste		144.00	150.00	6.00	147.00	21.3	84.0	3.8	<0.1	1.1	3.2	0.9	9.7	8.8	2.60	0.40	3.47
WPSD151C	C-136252	Middle Waste	dolomite	150.00	151.00	1.00	150.50	4.3	10.0	<0.6	<0.1	0.2	41.2	11.2	11.8	0.6	0.34	0.07	0.72
		--BREAK IN SECTION--																	
WPSD199C	C-136284	Upper Ore Section, D Bed Ore	phosphorite	199.00	200.00	1.00	199.50	13.7	4.1	1.4	0.1	0.9	0.8	0.2	1.3	1.0	0.17	0.21	2.46
WPSD203C	C-136225	Upper Waste		200.00	205.50	5.50	202.75	21.5	51.1	3.4	<0.1	3.2	5.9	1.6	5.8	4.2	2.09	0.24	4.01
WPSD205C	C-136253	Upper Waste	wet mudstone	204.50	205.50	1.00	205.00	29.2	56.9	2.9	<0.1	4.3	0.3	0.1	5.0	4.9	3.38	0.25	5.43
WPSD206C	C-136258	Upper Waste	phosphorite	205.50	206.25	0.75	205.88	14.5	23.1	0.9	<0.1	0.5	0.9	0.2	1.4	1.2	0.44	0.17	1.32
WPSD206X	C-136265		duplicate of previous sample					15.3	22.1	<0.6	<0.1	0.6	0.9	0.2	1.3	1.1	0.46	0.17	1.29
WPSD207C	C-136241	Upper Waste		206.25	208.50	2.25	207.38	20.9	29.2	1.4	<0.1	1.1	1.3	0.4	2.7	2.4	2.55	0.19	5.30
WPSD209C	C-136280	Upper Waste	phosphate nodules	208.50	209.00	0.50	208.75	10.8	29.1	1.1	<0.1	1.0	0.5	0.1	2.7	2.6	0.94	0.27	3.38
WPSD210C	C-136248	Upper Waste		209.00	213.00	4.00	211.00	18.6	47.7	1.5	<0.1	1.1	3.6	1.0	3.9	2.9	2.22	0.20	5.61

Field number	Ca, %, ICP-16	Fe, %, ICP 16	K, %, ICP-16	Mg, %, ICP-16	Na, %, ICP-16	P, %, ICP-16	Si, %, ICP-16	Ti, %, ICP-16	AlOx, %, ICP-16	CaOx, %, ICP-16	FeOx, %, ICP-16	KOx, %, ICP-16	MgOx, %, ICP-16	NaOx, %, ICP-16	POx, %, ICP-16	SiOx, %, ICP-16	TiOx, %, ICP-16	Apatite 211 peak ht., XRD	Apatite 211 peak height, % highest value, both sections	Ba, ppm, ICP-16	Cr, ppm, ICP-16	Mn, ppm, ICP-16	Sr, ppm, ICP-16	Y, ppm, ICP-16
WPSD000C	22.6	0.14	0.20	10.70	0.07	0.3	2.4	0.01	0.42	31.6	0.20	0.24	17.74	0.09	0.7	5.2	0.02	15	7%	<10	43	<100	180	13
WPSD000X	22.8	0.12	0.21	10.30	0.06	0.3	2.5	0.01	0.43	31.9	0.17	0.25	17.08	0.08	0.7	5.3	0.02			10	56	100	180	10
WPSD0.5C	35.5	0.13	0.15	0.09	0.50	14.6	4.1	0.02	0.66	49.7	0.19	0.18	0.15	0.67	33.5	8.7	0.03	216	95%	50	195	<100	1060	340
WPSD006C	14.2	0.78	0.99	7.39	0.44	0.5	14.2	0.18	4.12	19.9	1.12	1.19	12.25	0.59	1.1	30.4	0.30	15	7%	111	97	139	119	19
WPSD009C	12.6	1.72	1.74	0.44	0.37	5.4	20.3	0.26	6.46	17.6	2.46	2.10	0.73	0.50	12.3	43.4	0.43	78	34%	208	1270	<100	515	91
WPSD014C	33.3	0.29	0.34	0.15	0.74	14.6	2.4	0.03	0.85	46.6	0.41	0.41	0.25	1.00	33.5	5.2	0.05	201	89%	69	634	<100	1220	121
WPSD016C	25.2	0.39	0.43	5.17	0.24	7.1	6.2	0.05	1.53	35.3	0.56	0.52	8.57	0.32	16.2	13.2	0.08	151	67%	48	444	<100	480	144
WPSD018C	23.8	0.59	0.79	5.18	0.34	6.4	7.3	0.10	2.98	33.3	0.84	0.95	8.59	0.46	14.6	15.5	0.17	86	38%	94	563	<100	499	105
WPSD020C	21.7	0.65	0.82	4.18	0.39	6.4	8.6	0.12	3.00	30.4	0.93	0.99	6.93	0.53	14.6	18.5	0.20	101	44%	99	629	<100	407	56
WPSD023C	29.7	0.48	0.51	1.66	0.32	11.9	5.7	0.07	2.02	41.6	0.69	0.61	2.75	0.43	27.3	12.1	0.12	154	68%	86	639	<100	631	137
WPSD025C	24.1	0.87	1.00	1.54	0.56	0.7	11.5	0.16	4.17	33.7	1.24	1.21	2.55	0.75	1.5	24.6	0.27	28	12%	107	201	197	207	25
WPSD027C	28.5	0.73	0.83	0.16	0.38	12.4	8.4	0.12	2.85	39.9	1.04	1.00	0.27	0.51	28.4	17.9	0.20	162	71%	113	604	<100	685	165
WPSD027X	27.5	0.82	0.85	0.17	0.40	12.0	9.8	0.14	3.25	38.5	1.17	1.02	0.28	0.54	27.5	21.0	0.23			127	648	<100	681	161
WPSD030C	28.1	0.59	0.81	0.93	0.35	11.9	7.3	0.09	2.53	39.3	0.84	0.98	1.54	0.47	27.3	15.7	0.15	151	67%	103	605	<100	628	174
WPSD031C	19.9	0.59	0.57	8.25	0.70	0.3	7.6	0.11	2.95	27.8	0.84	0.69	13.68	0.94	0.6	16.1	0.18	15	7%	41	83	183	171	15
WPSD033C	20.7	0.44	0.67	8.40	0.32	1.1	5.4	0.07	2.19	29.0	0.63	0.81	13.93	0.43	2.5	11.6	0.12	36	16%	33	208	132	260	26
WPSD036C	9.4	1.85	2.65	0.58	0.49	3.6	22.1	0.29	9.56	13.1	2.65	3.19	0.96	0.66	8.3	47.3	0.48	92	41%	250	1100	<100	342	198
WPSD039C	20.8	0.43	0.83	7.36	0.26	2.0	6.1	0.07	2.12	29.1	0.61	1.00	12.20	0.35	4.6	13.0	0.12	53	23%	50	306	141	354	60
WPSD041C	30.0	0.75	0.61	0.30	0.44	13.1	5.0	0.05	1.64	42.0	1.07	0.74	0.50	0.59	30.0	10.6	0.08	227	100%	122	635	425	1610	442
WPSD043C	10.4	1.74	1.41	0.54	0.20	3.4	11.9	0.19	5.76	14.5	2.49	1.70	0.90	0.27	7.8	25.5	0.32	73	32%	137	4830	<100	487	157
WPSD046C	15.1	1.69	1.78	0.76	0.59	4.3	14.7	0.22	7.27	21.1	2.42	2.14	1.26	0.80	9.8	31.4	0.37	98	43%	194	1340	145	660	101
WPSD049C	15.2	1.76	1.81	0.74	0.59	4.6	15.1	0.22	8.20	21.3	2.52	2.18	1.23	0.80	10.5	32.3	0.37	92	41%	192	1500	146	731	79
WPSD052C	19.1	1.33	1.27	1.99	0.46	3.8	11.0	0.17	5.55	26.7	1.90	1.53	3.30	0.62	8.7	23.5	0.28	88	39%	141	1100	201	707	103
WPSD052X	19.1	1.32	1.31	2.00	0.49	3.9	10.9	0.17	5.46	26.7	1.89	1.58	3.32	0.66	8.9	23.3	0.28			133	1120	194	695	102
WPSD055C	22.0	0.51	0.42	8.72	0.34	0.3	5.3	0.08	2.10	30.8	0.73	0.51	14.46	0.46	0.7	11.3	0.13	9	4%	37	173	343	346	18
WPSD055X	22.4	0.52	0.38	9.14	0.33	0.3	5.6	0.08	2.08	31.3	0.74	0.46	15.15	0.44	0.7	12.0	0.13			32	180	360	364	16
WPSD058C	14.3	1.79	1.70	0.70	0.65	5.0	17.4	0.25	7.27	20.0	2.56	2.05	1.16	0.88	11.4	37.2	0.42	98	43%	198	1350	156	686	85
WPSD062C	23.9	0.40	0.36	7.76	0.31	0.2	3.7	0.06	1.49	33.4	0.57	0.43	12.87	0.42	0.4	8.0	0.10	10	4%	24	130	296	422	14
WPSD067C	11.8	2.03	1.97	0.59	0.75	3.4	19.3	0.29	8.99	16.5	2.90	2.37	0.98	1.01	7.7	41.3	0.48	79	35%	230	1700	164	610	92
WPSD067X	11.0	1.97	1.92	0.56	0.71	3.2	18.4	0.27	8.48	15.4	2.82	2.31	0.93	0.96	7.2	39.4	0.45			215	1590	156	538	85
WPSD071C	1.5	2.24	1.81	0.56	1.74	0.1	31.1	0.45	9.97	2.2	3.20	2.18	0.93	2.35	0.1	66.5	0.75	15	7%	254	389	179	78	18
WPSD075C	4.5	2.16	2.06	0.64	1.14	1.5	26.2	0.36	10.20	6.3	3.09	2.48	1.06	1.54	3.4	56.0	0.60	41	18%	260	1020	145	292	78
WPSD080C	3.5	2.15	2.11	0.51	0.51	1.1	25.7	0.28	9.77	4.9	3.07	2.54	0.85	0.69	2.5	55.0	0.47	37	16%	69	879	102	106	51
WPSD084C	18.0	0.67	0.76	8.18	0.25	0.2	8.4	0.09	2.98	25.2	0.96	0.92	13.56	0.34	0.4	17.9	0.15	8	4%	41	266	159	205	15
WPSD087C	14.2	0.99	1.00	8.07	0.38	0.2	9.6	0.13	4.31	19.9	1.42	1.21	13.38	0.51	0.4	20.6	0.22	5	2%	31	478	178	151	22
WPSD093C	8.6	1.94	1.64	0.21	0.61	3.7	19.1	0.24	7.57	12.0	2.77	1.98	0.35	0.82	8.5	40.9	0.40	92	41%	189	2270	<100	566	157
WPSD098C	15.3	1.63	1.03	0.28	0.30	6.8	12.2	0.15	4.93	21.4	2.33	1.24	0.46	0.40	15.5	26.1	0.25	88	39%	147	4170	<100	766	457
WPSD098X	11.6	1.87	1.26	0.30	0.33	5.2	13.8	0.17	5.78	16.2	2.67	1.52	0.50	0.44	12.0	29.5	0.28			150	4520	<100	568	356
WPSD101C	4.6	2.33	1.98	0.11	1.29	2.0	27.2	0.39	9.96	6.4	3.33	2.39	0.18	1.74	4.6	58.2	0.65	61	27%	253	823	119	271	95
WPSD101X	6.7	2.23	1.91	0.11	1.27	2.9	26.3	0.37	9.82	9.3	3.19	2.30	0.18	1.71	6.7	56.3	0.62		0%	256	773	112	380	125
WPSD102C	23.8	0.90	0.77	0.18	0.33	10.6	8.3	0.11	3.23	33.3	1.29	0.93	0.30	0.44	24.3	17.7	0.18	209	92%	175	2430	<100	1210	518
WPSD103C	3.0	2.43	2.07	0.10	1.39	1.1	30.6	0.41	10.18	4.2	3.47	2.49	0.17	1.87	2.6	65.5	0.68	40	18%	247	802	141	177	62
WPSD104C	16.1	2.17	1.66	0.30	0.31	7.2	13.7	0.24	6.86	22.5	3.10	2.00	0.50	0.42	16.5	29.3	0.40	148	65%	195	3040	<100	957	234
WPSD104X	16.8	2.00	1.61	0.30	0.30	7.2	14.7	0.24	6.78	23.5	2.86	1.94	0.50	0.40	16.5	31.4	0.40			230	3010	<100	1060	248
WPSD108C	9.5	2.53	1.89	0.14	1.06	4.2	22.5	0.32	8.80	13.3	3.62	2.28	0.23	1.43	9.6	48.1	0.53	96	42%	235	947	105	568	121
WPSD109C	14.5	2.44	1.70	0.08	0.91	6.6	19.8	0.27	7.52	20.3	3.49	2.05	0.13	1.23	15.1	42.4	0.45	126	56%	218	491	117	882	171
WPSD114C	4.6	2.97	2.22	0.34	1.20	1.8	27.8	0.40	10.86	6.5	4.25	2.68	0.56	1.62	4.2	59.5	0.67	52	23%	255	609	164	290	78
WPSD120C	14.9	1.10	0.93	6.59	0.73	0.6	13.4	0.18	4.53	20.8	1.57	1.12	10.93	0.98	1.3	28.7	0.30	17	7%	82	171	364	289	33
WPSD126C	22.2	2.77	1.11	0.14	0.60	9.7	10.9	0.19	5.04	31.1	3.96	1.34	0.23	0.81	22.2	23.3	0.32	222	98%	168	517	<100	1590	225
WPSD130C	7.1	2.21	1.88	0.69	1.26	2.6	27.7	0.35	8.88	9.9	3.16	2.27	1.14	1.70	6.0	59.3	0.58	53	23%	218	383	162	410	75
WPSD132C	28.1	1.54	0.63	0.06	0.60	12.7	8.8	0.10	2.95	39.3	2.20	0.76	0.10	0.81	29.1	18.8	0.17	194	85%	150	511	<100	1780	356
WPSD132X	27.9	1.51	0.73	0.05	0.59	12.5	8.7	0.10	2.89	39.0	2.16	0.88	0.08	0.80	.28.6	18.7	0.17			141	501	<100	1730	348
WPSD137C	9.8	1.77	1.58	0.50	0.82	2.4	22.0	0.29	7.33	13.6	2.53	1.90	0.83	1.11	5.4	47.1	0.48	46	20%	202	1170	184	410	128
WPSD142C	8.9	1.84	1.53	1.13	1.21	2.5	24.9	0.33	7.74	12.5	2.63	1.84	1.87	1.63	5.7	53.3	0.55	60	26%	209	586	188	425	116
WPSD147C	11.6	1.42	1.29	0.31	0.85	4.1	20.7	0.26	6.55	16.2	2.03	1.55	0.51	1.15	9.4	44.3	0.43	75	33%	201	1130	131	577	182
WPSD151C	24.8	0.29	0.24	8.89	0.24	0.1	4.1	0.05	1.36	34.7	0.41	0.29	14.74	0.32	0.3	8.8	0.08	22	10%	27	137	522	399	19
WPSD199C	21.6	1.09	0.84	0.17	0.56	9.6	15.8	0.20	4.65	30.2	1.56	1.01	0.28	0.75	21.9	33.8	0.33	161	71%	173	604	<100	575	231
WPSD203C	13.1	1.59	1.45	1.08	0.62	4.1	20.2	0.28	7.57	18.3	2.27	1.75	1.79	0.84	9.4	43.2	0.47	87	38%	216	761	208	298	124
WPSD205C	2.8	2.39	1.69	0.32	1.21	1.1	27.9	0.39	10.26	3.9	3.42	2.04	0.53	1.63	2.5	59.7	0.65	18	8%	248	408	112	131	50
WPSD206C	22.9	0.95	0.55	0.13	0.23	10.1	16.4	0.08	2.49	32.0	1.36	0.66	0.22	0.31	23.1	35.1	0.13	184	81%	254	514	513	663	278
WPSD206X	22.5	0.90	0.51	0.12	0.24	10.1	15.9	0.08	2.44	31.5	1.29	0.61	0.20	0.32	23.1	34.0	0.13			244	481	531	641	279
WPSD207C	1.6	2.18	1.72	0.47	1.04	0.2	31.4	0.41	10.01	2.3	3.12	2.07	0.78	1.40	0.5	67.2	0.68	10	4%	267	323	153	78	29
WPSD209C	14.6	1.30	1.19	0.23	0.73	6.4	22.0	0.24	8.38	20.4	1.86	1.43	0.38	0.98	14.7	47.1	0.40	116	51%	204	350	<100	359	220
WPSD210C	5.2	2.12	1.88	0.48	0.76	0.9	28.0	0.38	10.60	7.2	3.03	2.27	0.80	1.02	2.0	59.9	0.63	27	12%	272	532	175	129	103

Field number	Zr, ppm, ICP-16	Al, %, ICP-40	Ca, %, ICP 40	Fe, %, ICP 40	K, %, ICP-40	Mg, %, ICP-40	Na, %, ICP 40	P, %, ICP 40	Ti, %, ICP-40	Ag, ppm, ICP-40	Ba, ppm, ICP-40	Be, ppm, ICP-40	Cd, ppm, ICP-40	Ce, ppm, ICP-40	Co, ppm, ICP-40	Cr, ppm, ICP-40	Cu, ppm, ICP-40	Eu, ppm, ICP-40	Ga, ppm, ICP-40	Ho, ppm, ICP-40	La, ppm, ICP-40	Li, ppm, ICP-40	Mn, ppm, ICP-40	Mo, ppm, ICP-40
WPSD000C	13	0.2	21.5	0.1	0.1	11.0	0.0	0.3	0.0	<2	8	<1	150	<5	<2	35	14	<2	<4	<4	8	2	94	10
WPSD000X	17	0.2	16.9	0.1	0.1	8.4	0.0	0.2	0.0	<2	7	<1	149	<5	<2	29	11	<2	<4	<4	7	<2	76	7
WPSD0.5C	40	0.3	31.9	0.1	0.2	0.1	0.5	14.7	0.0	<2	33	<1	1250	49	3	101	27	6	<4	5	260	5	12	10
WPSD006C	213	2.3	14.0	0.8	1.0	7.6	0.5	0.5	0.1	<2	116	<1	70	23	3	93	23	<2	<4	<4	17	9	133	10
WPSD009C	237	3.5	12.6	1.7	1.8	0.4	0.4	5.4	0.2	4	223	<1	129	42	6	671	167	<2	14	<4	71	30	77	40
WPSD014C	71	0.4	24.9	0.2	0.2	0.1	0.6	12.3	0.0	3	60	<1	87	12	4	382	88	<2	4	<4	85	7	29	21
WPSD016C	63	0.8	22.1	0.4	0.5	5.2	0.2	7.1	0.0	5	43	<1	99	22	2	204	51	<2	<4	<4	121	6	71	15
WPSD018C	88	1.6	22.0	0.6	0.9	5.1	0.4	6.5	0.1	6	91	<1	92	20	4	325	63	<2	4	<4	78	12	82	35
WPSD020C	114	1.4	16.9	0.5	0.7	3.5	0.3	5.3	0.1	3	87	<1	96	14	2	346	53	<2	<4	<4	37	9	63	40
WPSD023C	88	1.1	26.6	0.4	0.5	1.6	0.3	12.1	0.0	3	76	<1	81	17	2	354	68	<2	5	<4	98	10	28	32
WPSD025C	137	2.3	23.1	0.9	1.0	1.5	0.6	0.6	0.1	2	110	<1	258	19	5	42	29	<2	<4	<4	21	8	194	5
WPSD027C	129	1.6	25.0	0.7	0.8	0.1	0.4	12.4	0.1	5	112	<1	45	33	2	414	72	2	8	<4	118	13	39	19
WPSD027X	154	1.8	25.8	0.5	0.9	0.2	0.4	12.0	0.1	5	122	<1	46	28	3	376	75	2	9	<4	115	15	44	21
WPSD030C	99	1.4	27.9	0.5	0.8	0.9	0.3	12.0	0.0	6	103	<1	34	29	<2	414	60	2	5	<4	135	12	22	7
WPSD031C	86	1.7	19.4	0.6	0.6	8.5	0.7	0.3	0.1	2	44	<1	22	15	4	18	19	<2	5	<4	14	2	189	3
WPSD033C	51	1.3	20.6	0.5	0.8	9.0	0.3	1.1	0.0	2	32	<1	22	11	2	244	30	<2	<4	<4	23	<2	133	4
WPSD036C	190	5.2	8.9	1.8	2.4	0.5	0.5	3.5	0.2	12	245	<1	35	61	4	1040	91	4	17	<4	157	28	55	16
WPSD039C	47	1.0	15.8	0.4	0.7	6.1	0.2	1.7	0.0	<2	40	<1	14	9	2	122	29	<2	<4	<4	45	2	111	3
WPSD041C	85	0.9	27.4	0.8	0.5	0.3	0.4	13.2	0.0	7	128	<1	21	54	7	356	93	7	5	7	329	8	410	32
WPSD043C	161	3.1	10.4	1.7	1.5	0.5	0.2	3.9	0.1	80	148	<1	988	37	7	1530	677	4	15	<4	122	36	60	437
WPSD046C	121	4.0	14.5	1.7	1.8	0.7	0.6	4.4	0.1	5	203	2	5	41	7	695	110	2	13	<4	89	21	132	28
WPSD049C	117	4.4	13.9	1.7	1.9	0.6	0.6	4.3	0.1	5	180	2	6	34	6	1010	93	3	14	<4	67	21	116	36
WPSD052C	110	3.1	17.3	1.3	1.4	1.7	0.5	3.8	0.1	4	134	<1	8	31	5	406	73	<2	8	<4	81	18	172	42
WPSD052X	104	3.1	18.3	1.3	1.4	2.0	0.5	4.0	0.1	3	140	<1	9	36	5	328	76	2	6	<4	90	16	192	39
WPSD055C	60	1.2	22.0	0.5	0.5	9.0	0.4	0.3	0.0	<2	29	<1	<2	8	4	69	20	<2	<4	<4	17	2	342	10
WPSD055X	71	1.0	16.7	0.4	0.4	7.2	0.3	0.2	0.0	<2	23	<1	<2	5	3	144	15	<2	<4	<4	14	<2	266	8
WPSD058C	177	4.0	13.1	1.8	1.7	0.7	0.6	4.7	0.1	3	188	2	3	41	7	420	83	2	12	<4	73	21	138	27
WPSD062C	44	0.7	17.8	0.3	0.3	6.4	0.3	0.1	0.0	<2	19	<1	<2	6	3	22	14	<2	<4	<4	11	<2	232	3
WPSD067C	185	4.9	11.3	2.0	2.1	0.5	0.8	3.4	0.1	4	216	2	4	42	7	996	90	3	19	<4	77	30	138	26
WPSD067X	176	4.7	10.4	2.0	2.0	0.5	0.7	3.1	0.2	3	219	2	3	42	7	1350	85	2	17	<4	74	27	134	24
WPSD071C	416	5.2	1.5	2.2	1.9	0.5	1.6	0.1	0.2	2	252	1	<2	49	8	370	24	<2	10	<4	25	9	155	11
WPSD075C	251	5.5	4.5	2.2	2.2	0.6	1.1	1.5	0.2	5	250	<1	7	53	10	233	65	3	17	<4	75	19	123	37
WPSD080C	107	5.3	3.5	2.2	2.1	0.5	0.5	1.1	0.2	<2	72	<1	<2	40	12	454	36	<2	9	<4	71	3	71	15
WPSD084C	44	1.3	12.9	0.5	0.6	6.3	0.2	0.1	0.0	<2	30	<1	<2	7	3	36	16	<2	<4	<4	15	3	117	3
WPSD087C	49	2.0	11.0	0.8	0.8	6.6	0.3	0.2	0.1	<2	24	<1	<2	12	4	69	20	<2	6	<4	25	<2	136	7
WPSD093C	145	4.2	8.6	2.0	1.7	0.2	0.6	3.9	0.1	16	201	<1	16	50	7	556	144	3	13	<4	151	34	61	71
WPSD098C	107	2.7	14.7	1.6	1.1	0.3	0.3	6.8	0.1	14	146	2	59	57	6	1490	288	6	20	7	369	49	34	153
WPSD098X	110	3.2	11.2	1.9	1.3	0.3	0.3	5.3	0.1	21	153	1	58	54	6	1510	300	5	20	6	301	60	40	166
WPSD101C	311	5.4	4.5	2.4	2.1	0.1	1.3	2.0	0.2	9	261	2	7	62	9	281	62	2	15	<4	92	14	103	34
WPSD101X	294	5.5	6.3	2.3	2.0	0.1	1.3	2.7	0.2	8	249	2	7	71	9	620	57	3	16	<4	119	14	83	33
WPSD102C	128	1.8	22.0	0.9	0.7	0.2	0.3	10.5	0.0	3	176	4	53	64	3	2460	176	8	23	9	444	25	27	40
WPSD103C	338	5.7	3.0	2.4	2.2	0.1	1.4	1.3	0.2	7	245	1	4	62	8	850	56	<2	15	<4	61	12	99	26
WPSD104C	195	3.8	15.3	2.2	1.7	0.3	0.3	7.2	0.1	6	204	2	12	57	7	1300	162	4	28	5	214	44	69	110
WPSD104X	165	3.6	15.3	1.9	1.7	0.3	0.3	7.4	0.1	6	183	2	10	64	6	1060	162	4	26	4	219	43	65	92
WPSD108C	242	4.9	8.8	2.5	2.0	0.1	1.1	4.1	0.2	4	239	2	3	50	7	774	74	3	17	<4	100	23	87	30
WPSD109C	129	4.1	14.5	2.4	1.7	0.1	0.9	6.5	0.1	<2	217	2	<2	56	7	450	44	5	11	<4	142	9	97	10
WPSD114C	341	5.4	4.6	3.0	2.2	0.3	1.1	1.9	0.2	<2	266	2	<2	50	8	530	59	2	11	<4	65	15	135	19
WPSD120C	176	2.6	14.6	1.1	1.0	6.7	0.8	0.5	0.1	<2	86	<1	<2	27	5	51	25	<2	9	<4	31	3	353	6
WPSD126C	86	2.7	21.0	1.5	1.2	0.1	0.6	9.0	0.0	3	146	2	5	77	4	357	66	6	12	<4	181	11	42	39
WPSD130C	363	4.9	6.6	2.2	1.9	0.7	1.3	2.5	0.1	<2	226	1	<2	52	8	305	31	<2	11	<4	75	8	125	17
WPSD132C	97	1.6	26.0	1.6	0.7	0.1	0.6	12.9	0.0	<2	141	2	3	107	4	329	38	7	8	5	302	7	53	31
WPSD132X	137	1.6	26.3	1.2	0.7	0.1	0.6	12.5	0.0	<2	141	2	4	107	3	399	36	7	8	7	295	7	46	31
WPSD137C	272	4.0	8.9	1.8	1.6	0.5	0.8	2.2	0.1	6	212	<1	29	52	7	374	96	2	14	<4	90	22	167	46
WPSD142C	310	4.1	8.1	1.8	1.6	1.0	1.1	2.5	0.2	6	197	1	5	59	6	571	53	2	4	<4	79	10	161	32
WPSD147C	265	3.6	11.4	1.4	1.4	0.3	0.9	4.2	0.1	8	205	<1	19	54	6	338	97	3	12	<4	118	18	115	47
WPSD151C	36	0.6	18.1	0.2	0.2	7.0	0.2	0.1	0.0	<2	17	<1	<2	<5	<2	20	16	<2	<4	<4	10	<2	400	5
WPSD199C	90	2.6	20.1	0.9	0.8	0.2	0.6	9.3	0.1	4	180	<1	21	53	4	355	47	3	6	<4	150	8	38	<2
WPSD203C	233	4.2	12.0	1.6	1.6	1.0	0.6	4.2	0.2	6	210	<1	80	43	6	702	63	2	13	<4	78	27	191	44
WPSD205C	320	5.7	2.7	2.4	1.7	0.3	1.2	1.0	0.3	3	237	<1	37	47	11	413	38	<2	16	<4	38	19	93	32
WPSD206C	94	1.4	21.2	0.9	0.5	0.1	0.2	10.2	0.0	<2	256	<1	9	50	3	242	36	5	5	5	221	7	486	10
WPSD206X	96	1.4	22.4	0.4	0.5	0.1	0.2	10.2	0.0	<2	272	<1	8	46	3	368	36	6	<4	4	230	7	427	9
WPSD207C	379	5.4	1.6	2.2	1.8	0.5	1.0	0.2	0.2	<2	290	2	5	25	8	123	30	<2	12	<4	20	18	141	17
WPSD209C	100	3.4	12.6	1.3	1.1	0.2	0.7	6.1	0.1	<2	198	1	3	89	4	375	38	4	9	<4	161	12	36	9
WPSD210C	296	5.8	5.2	2.1	1.9	0.4	0.8	0.9	0.3	<2	277	2	7	57	7	498	46	2	16	<4	68	24	155	14

Field number	Nb, ppm, ICP-40	Nd, ppm, ICP-40	Ni, ppm, ICP-40	Pb, ppm, ICP-40	Sc, ppm, ICP-40	Th, ppm, ICP-40	U, ppm, ICP-40	V, ppm, ICP-40	Y, ppm, ICP-40	Yb, ppm, ICP-40	Zn, ppm, ICP-40	eU, un-scaled, ppm, channel interval avg.
WPSD000C	<4	<9	45	<4	<2	<6	<100	62	11	<1	450	125
WPSD000X	<4	<9	44	<4	<2	<6	<100	49	9	<1	436	
WPSD0.5C	<4	163	233	12	<2	6	<100	130	351	13	2640	87
WPSD006C	<4	<9	172	4	3	<6	<100	402	17	2	1300	38
WPSD009C	<4	47	341	18	7	11	<100	3190	96	7	2290	109
WPSD014C	<4	32	106	13	<2	<6	198	1360	117	5	794	192
WPSD016C	<4	46	141	4	3	<6	<100	195	149	6	1050	63
WPSD018C	<4	30	193	8	3	<6	<100	533	109	5	1570	85
WPSD020C	<4	16	181	8	2	7	<100	780	53	3	1610	150
WPSD023C	<4	37	129	11	<2	<6	<100	1010	142	6	1240	152
WPSD025C	<4	11	167	9	4	<6	<100	480	26	2	1140	114
WPSD027C	<4	53	150	13	<2	8	118	1680	172	8	918	125
WPSD027X	<4	49	165	12	<2	<6	109	1810	167	8	1010	
WPSD030C	<4	56	126	9	<2	<6	<100	788	187	7	712	92
WPSD031C	<4	<9	105	<4	2	<6	<100	102	16	1	594	42
WPSD033C	<4	<9	55	<4	<2	<6	<100	143	27	2	288	29
WPSD036C	4	84	267	15	11	8	<100	478	205	9	1110	48
WPSD039C	<4	19	62	<4	2	<6	<100	146	58	3	250	48
WPSD041C	<4	174	275	13	5	7	<100	439	469	20	819	79
WPSD043C	<4	93	1400	44	11	14	<100	6050	166	13	8220	68
WPSD046C	<4	50	383	9	10	8	<100	145	106	6	1380	40
WPSD049C	<4	47	298	12	8	8	<100	140	78	4	1250	37
WPSD052C	<4	47	247	5	7	<6	<100	153	108	5	960	35
WPSD052X	<4	47	249	4	8	<6	<100	163	108	6	938	
WPSD055C	<4	9	37	<4	<2	<6	<100	40	18	<1	166	21
WPSD055X	<4	<9	27	<4	<2	<6	<100	32	14	<1	115	
WPSD058C	<4	49	306	7	9	<6	<100	114	88	5	1260	29
WPSD062C	<4	<9	19	<4	<2	<6	<100	27	12	<1	110	26
WPSD067C	<4	54	316	12	11	8	<100	145	94	5	1230	28
WPSD067X	<4	51	312	14	11	7	<100	141	90	5	1180	
WPSD071C	9	16	110	19	7	8	<100	131	10	2	330	22
WPSD075C	5	46	304	18	11	11	<100	249	79	5	1230	27
WPSD080C	5	42	1490	15	14	<6	<100	339	53	4	14530	18
WPSD084C	<4	<9	38	<4	3	<6	<100	40	13	<1	184	17
WPSD087C	<4	11	223	4	5	<6	<100	97	20	1	2370	28
WPSD093C	<4	83	617	17	12	8	<100	206	170	8	3200	52
WPSD098C	<4	173	991	17	11	11	<100	312	471	18	4070	100
WPSD098X	<4	148	1050	16	11	8	<100	324	383	14	4110	
WPSD101C	<4	53	226	18	10	9	<100	136	101	6	1160	48
WPSD101X	<4	69	205	17	9	10	<100	115	129	6	987	
WPSD102C	<4	216	492	11	9	10	<100	149	541	20	2470	38
WPSD103C	8	42	172	19	9	10	<100	102	65	4	922	32
WPSD104C	<4	108	562	12	10	7	<100	202	250	10	2170	45
WPSD104X	<4	112	538	9	11	9	<100	192	257	11	2140	
WPSD108C	4	64	209	12	9	11	<100	130	126	6	702	52
WPSD109C	<4	115	116	13	9	6	<100	93	180	8	541	53
WPSD114C	6	50	168	17	11	8	<100	108	83	5	563	31
WPSD120C	<4	14	43	<4	4	<6	<100	45	34	2	136	21
WPSD126C	<4	132	166	9	<2	<6	<100	92	238	11	648	50
WPSD130C	<4	41	90	13	9	9	<100	79	77	4	290	29
WPSD132C	<4	192	93	13	7	12	<100	64	374	15	425	42
WPSD132X	<4	187	86	10	<2	8	<100	60	367	14	395	
WPSD137C	<4	54	318	11	8	8	<100	233	130	7	1100	38
WPSD142C	5	50	159	10	8	10	<100	146	118	7	428	28
WPSD147C	<4	70	291	10	7	8	<100	189	191	9	1040	32
WPSD151C	<4	<9	19	<4	<2	<6	<100	29	15	<1	66	33
WPSD199C	<4	81	90	10	<2	<6	<100	279	246	11	600	134
WPSD203C	<4	49	186	14	8	11	<100	269	128	7	1270	120
WPSD205C	8	32	231	23	10	10	<100	339	50	4	1640	96
WPSD206C	<4	151	90	16	3	8	<100	126	293	10	423	
WPSD206X	<4	160	88	10	<2	<6	<100	118	302	10	418	112
WPSD207C	7	20	113	17	9	7	<100	122	29	3	333	71
WPSD209C	<4	102	126	8	6	11	<100	93	230	10	553	
WPSD210C	9	58	206	15	10	10	<100	118	108	6	466	

ACCURACY-Standard Reference SARL	Lab No.	As, ppm, Hyd.	Se, ppm, Hyd.	Sb, ppm, Hyd.	Te, ppm, FAA	Tl, ppm, FAA	C, %, Combustion	CO2, %, Acidification	Carbonate C, %, Acidification	Organic C, %, difference	S, %, Combustion	Hg, ppm, CVAA	Al, %, ICP-16	Ca, %, ICP-16	Fe, %, ICP-16	K, %, ICP-16	Mg, %, ICP-16
analyzed as	C-136289	16.1	0.9	4.8	0.7	1.1	0.41	0.11	1.1	0.99	0.08	0.18	5.70	1.10	2.54	2.86	0.50
analyzed as	C-136291	16.1	0.8	5.2	0.7	1.2	0.4	0.11	1.1	0.99	0.07	0.17	5.82	1.09	2.61	2.96	0.52
analyzed as	C-136293	17.8	0.8	4.6	0.7	1.2	0.4	0.11	1.1	0.99	0.08	0.19	5.83	1.05	2.56	2.95	0.52
Average		16.7	0.8	4.9	0.7	1.2	0.4	0.11	1.1	0.99	0.08	0.18	5.78	1.08	2.57	2.92	0.51
Accepted Value		16.5	0.9	5.1	0.6	1.4	0.40	0.11	0.97	0.86	0.07	0.16	5.79	1.06	2.67	2.98	0.55
Rel. Std. Diff.		1%	-7%	-5%	17%	-17%	1%	0%	13%	15%	10%	16%	0%	2%	-4%	-2%	-7%
Standard Reference SARM																	
analyzed as	C-136290	37.2	0.3	6.2	1.0	2.4	0.09	0.02	0.3	0.28	0.12	0.12	5.98	0.58	3.09	2.88	0.46
analyzed as	C-136292	37.9	0.3	6.2	1.1	2.4	0.09	0.02	0.28	0.26	0.12	0.11	5.87	0.56	2.93	2.84	0.45
analyzed as	C-136294	40.8	0.3	6.1	1.0	2.6	0.08	0.02	0.30	0.28	0.11	0.12	6.1	0.58	3.12	2.95	0.47
Average		38.6	0.3	6.2	1.0	2.5	0.09	0.02	0.29	0.27	0.12	0.12	5.98	0.57	3.05	2.89	0.46
Accepted Value		37	0.33	5.6	0.68	2.8	0.07	0.02	0.30	0.28	0.13	0.117	6.09	0.58	3.22	2.92	0.50
Rel. Std. Diff.		4%	-9%	10%	52%	-12%	24%	0%	-2%	-2%	-10%	0%	-2%	-1%	-5%	-1%	-8%
PBV-1 Bone Valley Phosphorite, split 16																	
analyzed as	C-122917	12.6	2.5	1.8	0.2	1.7	3.84	1.05	1.45	0.40	0.55	0.09	0.54	34.8	0.90	0.12	0.24
analyzed as	C-123874	10.5	2.6	1.6	0.1	2.1	3.85	1.05	1.46	0.41	0.58	0.09	0.52	33.6	0.85	0.13	0.23
Average		11.6	2.55	1.7	0.15	1.9	3.845	1.05	1.455	0.405	0.57	0.09	0.53	34.2	0.88	0.13	0.24
Rel. Std. Dev.		13%	3%	8%	47%	15%	0.2%	0.0%	0.5%	2%	4%	0%	3%	2%	4%	6%	3%
Project Standards, no replication																	
POW-1	C-136227	10.9	54.3	1.5	<0.1	1.9	0.15	0.04	3.03	2.99	1.29	0.22	2.22	3.02	1	0.56	0.2
POW-2	C-136247	31.9	134	7	<0.1	2.4	4.46	1.22	7.52	6.3	0.86	0.49	3.48	14.8	1.45	1.31	1.09
POI-1	C-136229	19.1	43.1	1.8	<0.1	1.5	2.49	0.68	3.7	3.02	2.55	0.22	5.83	4.13	2.39	1.97	1.07
PRECISION- duplicates analyses																	
Section C																	
Number		6	6	6	2	6	6	6	6	6	6	6	6	6	6	6	6
Avg. Std. Diff.		9%	6%	11%	20%	17%	11%	4%	3%	5%	34%	3%	8%	9%	7%	8%	8%
Avg. Std. Dev.		6%	4%	8%	14%	12%	8%	3%	2%	3%	24%	2%	5%	7%	5%	6%	6%
Section D																	
Number		10	10	8	1	10	10	10	10	10	9	9	10	10	10	10	10
Avg. Std. Diff.		8%	14%	13%	67%	23%	7%	5%	3%	12%	5%	10%	5%	9%	7%	7%	5%
Avg. Std. Dev.		6%	10%	9%	47%	16%	5%	4%	2%	8%	4%	7%	3%	6%	5%	5%	4%

ACCURACY-Standard Reference SARL	Na, %, ICP-16	P, %, ICP-16	Si, %, ICP-16	Ti, %, ICP-16	Ba, ppm, ICP-16	Cr, ppm, ICP-16	Mn, ppm, ICP-16	Nb, ppm, ICP-16	Sr, ppm, ICP-16	Y, ppm, ICP-16	Zr, ppm, ICP 16	Al, % ICP-40	Ca, ppm, ICP-40	Fe, %, ICP-40	K, %, ICP-40	Mg, %, ICP 40	Na, %, ICP 40	P, %, ICP-40	Ti, %, ICP-40
analyzed as	1.47	0.08	31.3	0.29	827	101	2010	38	142	53	358	6.06	1.10	2.58	2.93	0.52	1.55	0.08	0.29
analyzed as	1.50	0.07	32.9	0.31	871	112	2120	31	151	53	358	5.93	1.09	2.60	2.91	0.51	1.47	0.07	0.29
analyzed as	1.51	0.07	32.6	0.30	868	110	2110	39	150	53	372	5.97	1.05	2.53	2.89	0.50	1.52	0.07	0.29
Average	1.49	0.07	32.3	0.30	855	108	2080	36	148	53	363	5.98	1.08	2.57	2.91	0.51	1.51	0.07	0.29
Accepted Value	1.53	0.09	33.6	0.25	879	110	2094	35	158	44	408	5.79	1.06	2.67	2.98	0.55	1.53	0.09	0.25
Rel. Std. Diff.	-2%	-19%	-4%	20%	-3%	-2%	-1%	3%	-7%	20%	-11%	3%	2%	-4%	-2%	-7%	-1%	-18%	16%
Standard Reference SARM																			
analyzed as	1.15	0.07	32.5	0.35	762	98	5310	42	150	34	348	6.06	0.58	3.04	2.88	0.44	1.09	0.07	0.34
analyzed as	1.10	0.06	31.2	0.34	735	101	5040	25	145	35	316	6.04	0.56	2.96	2.88	0.45	1.10	0.07	0.34
analyzed as	1.16	0.07	32.8	0.37	776	116	5360	36	153	37	361	6.18	0.58	3.02	2.94	0.45	1.11	0.07	0.34
Average	1.14	0.07	32.2	0.35	758	105	5237	34	149	35	342	6.09	0.58	3.01	2.90	0.45	1.10	0.07	0.34
Accepted Value	1.19	0.08	33.5	0.35	764	101	5200	31	156	33	370	6.09	0.58	3.22	2.92	0.50	1.19	0.08	0.35
Rel. Std. Diff.	-4%	-17%	-4%	1%	-1%	4%	1%	11%	-4%	7%	-8%	0%	-1%	-7%	-1%	-11%	-7%	-17%	-3%
PBV-1 Bone Valley Phosphorite, split 16																			
analyzed as	0.41	14.7	1.84	0.1	87	91	355	<10	1160	163	226	0.56	31.3	0.59	0.15	0.25	0.54	14	0.048
analyzed as	0.46	13.9	1.81	0.1	86	51	313	17	1270	175	109	0.58	31.0	0.87	0.17	0.24	0.54	14	0.050
Average	0.44	14.3	1.83	0.1	86.5	71	334	17	1215	169	168	0.57	31.2	0.73	0.16	0.24	0.54	14	0.049
Rel. Std. Dev.	8%	4%	1%	0%	1%	40%	9%		6%	5%	49%	2%	1%	27%	9%	1%	1%	0%	3%
Project Standards, no replication																			
POW-1	0.07	1.28	38	0.11	172	607	<100	<10	138	123	82	1.99	3.0	0.99	0.57	0.182	0.074	1.292	0.085
POW-2	0.56	5.62	15.8	0.23	246	1270	<100	<10	579	166	182	3.54	14.5	1.46	1.41	1.054	0.58	5.764	0.116
POI-1	0.56	1.13	26.8	0.39	255	501	229	<10	130	91	279	6.08	4.1	2.45	2.13	1.086	0.584	1.201	0.268
PRECISION- duplicates analyses																			
Section C																			
Number	6	6	6	6	6	6	1	1	6	6	6	6	6	6	6	6	6	6	6
Avg. Std. Diff.	7%	10%	7%	7%	16%	10%	6%	24%	8%	7%	8%	5%	6%	15%	6%	5%	6%	7%	25%
Avg. Std. Dev.	5%	7%	5%	5%	11%	7%	5%	17%	5%	5%	6%	3%	4%	11%	4%	4%	4%	5%	18%
Section D																			
Number	10	10	10	10	9	10	5	0	10	10	10	10	10	10	10	10	10	10	10
Avg. Std. Diff.	6%	9%	6%	4%	8%	7%	5%		10%	11%	13%	9%	14%	20%	10%	10%	8%	13%	22%
Avg. Std. Dev.	4%	6%	4%	3%	5%	5%	3%		7%	8%	9%	6%	10%	14%	7%	7%	6%	9%	16%

ACCURACY-Standard Reference SARL	Ag, ppm, ICP-40	As, ppm, ICP-40	Au, ppm, ICP-40	Ba, ppm, ICP-40	Be, ppm, ICP-40	Bi, ppm, ICP-40	Cd, ppm, ICP-40	Ce, ppm, ICP-40	Co, ppm, ICP-40	Cr, ppm, ICP-40	Cu, ppm, ICP-40	Eu, ppm, ICP-40	Ga, ppm, ICP-40	Ho, ppm, ICP-40	La, ppm, ICP-40	Li, ppm, ICP 40	Mn, ppm, ICP-40	Mo, ppm, ICP-40
analyzed as	3	22	<8	937	4	<50	3	155	8	65	358	<2	14	<4	74	25	2080	14
analyzed as	3	19	<8	919	5	<50	2	161	9	108	340	<2	14	<4	78	25	2140	13
analyzed as	3	25	<8	916	4	<50	3	156	7	38	353	<2	19	<4	76	25	1970	14
Average	3	22		924	4		3	157	8	70	350		16		76	25	2063	14
Accepted Value	2.6	16.5	0.325	879	3.2	1.1	2.5	150	7.5	110	370	1.5	17	1.9	75	28	2094	13
Rel. Std. Diff.	17%	33%		5%	34%		7%	5%	7%	-36%	-5%		-8%		1%	-11%	-1%	5%
Standard Reference SARM																		
analyzed as	4	38	<8	793	2	<50	5	111	11	70	299	<2	10	<4	53	25	5230	12
analyzed as	5	36	<8	801	2	<50	6	122	11	75	303	<2	13	<4	59	26	5140	12
analyzed as	5	42	<8	816	2	<50	5	111	12	64	298	<2	9	<4	55	26	5230	13
Average	5	39		803	2		5	115	11	70	300		11		56	26	5200	12
Accepted Value	3.1	37	0.345	764	2.4	1.33	4.76	120	11	101	320	0.67	20	1.72	61	30	5200	12
Rel. Std. Diff.	51%	5%		5%	-17%		12%	-4%	3%	-31%	-6%		-47%		-9%	-14%	0%	3%
PBV-1 Bone Valley Phosphorite, split 16																		
analyzed as	<2	<10	<8	84	2	<10	3	150	6	70	11	5	<4	5	112	3	281	9
analyzed as	<2	<10	<8	85	2	<50	3	162	6	90	7	5	<4	6	119	3	319	9
Average				84.5	2		3	156	6	80	9	5		5.5	115.5	3	300	9
Rel. Std. Dev.				1%	0%		0%	5%	0%	18%	31%	0%		13%	4%	0%	9%	0%
Project Standards, no replication																		
POW-1	<2	15	<8	176	<1	<50	11	19	5	95	54	2	5	<4	71	17	33	22
POW-2	8	23	<8	246	<1	<50	51	44	3	1160	101	3	11	<4	123	18	66	31
POI-1	<2	23	<8	268	1	<50	9	55	12	163	43	3	19	<4	66	25	208	18
PRECISION- duplicates analyses																		
Section C																		
Number	2	0	0	6	2	0	6	6	2	6	6	5	0	2	6	6	5	6
Avg. Std. Diff.	5%			4%	0%		1%	6%	11%	30%	6%	8%		20%	3%	7%	16%	11%
Avg. Std. Dev.	3%			3%	0%		1%	4%	8%	21%	4%	6%		14%	2%	5%	11%	8%
Section D																		
Number	6	8	0	10	5	0	9	9	9	10	10	7	7	4	10	8	10	10
Avg. Std. Diff.	18%	11%		8%	13%		11%	13%	13%	31%	8%	17%	9%	23%	10%	7%	14%	12%
Avg. Std. Dev.	13%	8%		5%	9%		8%	9%	9%	22%	6%	12%	7%	16%	7%	5%	10%	9%

ACCURACY-Standard Reference SARL	Nb, ppm, ICP-40	Nd, ppm, ICP-40	Ni, ppm, ICP-40	Pb, ppm, ICP-40	Sc, ppm, ICP-40	Sn, ppm, ICP-40	Sr, ppm, ICP-40	Ta, ppm, ICP-40	Th, ppm, ICP-40	U, ppm, ICP-40	V, ppm, ICP-40	Y, ppm, ICP-40	Yb, ppm, ICP-40	Zn, ppm, ICP-40
analyzed as	22	59	51	565	8	<50	153	<40	24	<100	141	42	5	469
analyzed as	21	61	52	567	8	<50	148	<40	25	<100	136	41	5	442
analyzed as	21	61	53	577	8	<50	150	<40	24	<100	136	43	5	425
Average	21	60	52	570	8		150		24		138	42	5	445
Accepted Value	35	66	52	578	7.8	6	158	2.8	19	5.2	140	44	4.6	420
Rel. Std. Diff.	-39%	-9%	0%	-1%	3%		-5%		28%		-2%	-5%	9%	6%
Standard Reference SARM														
analyzed as	35	41	40	947	8	<50	146	<40	18	<100	69	25	3	937
analyzed as	32	47	41	936	8	<50	145	<40	19	<100	70	26	3	918
analyzed as	30	44	41	979	8	<50	149	<40	18	<100	70	25	3	929
Average	32	44	41	954	8		147		18		70	25	3	928
Accepted Value	31	51	41	960	8.3	9.4	156	1.3	18	2.6	66	33	3.2	888
Rel. Std. Diff.	4%	-14%	-1%	-1%	-4%		-6%		2%		6%	-23%	-6%	5%
PBV-1 Bone Valley Phosphorite, split 16														
analyzed as	<4	88	15	18	<2	<50	1190	<40	11	<100	70	186	13	72
analyzed as	<4	87	15	17	6	<50	1250	<40	12	<100	72	183	12	71
Average		87.5	15	17.5	6		1220		11.5		71	184.5	12.5	71.5
Rel. Std. Dev.		1%	0%	4%			3%		6%		2%	1%	6%	1%
Project Standards, no replication														
POW-1	<4	51	193	5	5	<50	127	<40	<6	<100	184	127	6	869
POW-2	<4	65	216	9	8	<50	561	<40	7	<100	690	175	8	1140
POI-1	6	51	422	21	11	<50	125	<40	12	<100	160	94	6	1380
PRECISION- duplicates analyses														
Section C														
Number	0	6	6	6	4	0	6	0	2	1	6	6	6	6
Avg. Std. Diff.		9%	4%	19%	16%		5%		12%	17%	7%	4%	0%	5%
Avg. Std. Dev.		6%	3%	13%	12%		4%		8%	12%	5%	3%	0%	3%
Section D														
Number	0	8	10	8	5	0	8	0	5	1	10	10	8	10
Avg. Std. Diff.		8%	8%	20%	7%		15%		24%	8%	10%	10%	7%	8%
Avg. Std. Dev.		6%	5%	14%	5%		11%		17%	6%	7%	7%	5%	6%