RELATIONSHIPS BETWEEN RECHARGE, SEDIMENT CHEMISTRY, AND GROUND WATER QUALITY BENEATH THE SMELTERVILLE FLATS PORTION OF THE BUNKER HILL SUPERFUND SITE

A Thesis

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AUTHORIZATION TO SUBMIT
THESIS

This thesis of Jeffrey D. Swanson, submitted for the degree of Master of Science with a major in Hydrogeology and titled "Relationships Between Recharge, Sediment Chemistry, and Ground Water Quality Beneath the Smelterville Flats Portion of the Bunker Hill Superfund Site", has been reviewed in final form, as indicated by the signatures and dates given below. Permission is now granted to submit final copies to the College of Graduate Studies for approval.

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ABSTRACT

Periodic spatial and temporal heterogeneities in ground water quality have been observed in samples collected from piezometers located in the 40-acre tract of Smelterville Flats administered by the U.S. Bureau of Land Management (BLM). Smelterville Flats lies within the Bunker Hill Superfund Site which is located along the South Fork of the Coeur d' Alene River in northern Idaho. The Flats have been the repository of over 100 years of uncontrolled mine waste dumping. These mine wastes degrade the shallow ground water and are being studied to evaluate possible mitigative measures.

Natural recharge events such as spring snowmelt or locally intense rain storms are observed to influence temporal fluctuations in ground water quality and ground water levels observed at the BLM site. These recharge events must be considered in light of the metals content of the mine waste, the local fluvial sediment stratigraphy, and the local infiltration history. These factors control the residence time of any particular pulse of infiltrating moisture within the mine wastes and governs the impact of this infiltration on ground water quality and ground water levels.

Three months of artificial recharge conducted on the BLM site made no observable impact on measured ground water levels or ground water chemistry.

The spatial patterns of ground water quality in this study area are controlled by the geology, hydraulic conductivity, and metals content of mine waste in the neighborhood of the piezometer, as well as the local sedimentary stratigraphy. Poor quality shallow ground water samples can be associated with flotation slimes containing relatively high amounts of metals and having a relatively low hydraulic conductivity.

The mine wastes can be separated physically, statistically, and geochemically into jig tailings and flotation slimes. The jig tailings are oxidized in appearance, sandy, and typically contain about one-half the zinc content of the flotation slimes. The flotation slimes appear black to dark gray, and are composed of silt to clay-sized particles. The spatial distribution of the mine wastes within the BLM portion of Smelterville Flats is controlled by fluvial and lacustrine depositional environments, by the morphology of the pre-mining fluvial plain, by the production histories of the mine and mill wastes, and by subsequent surficial weathering and fluvial reworking.

Consideration of the impact of natural recharge events should be included in the design of extractive mitigative efforts at Smelterville Flats. Intense rainstorms or rapid snowmelt events commonly occur at Smelterville Flats. Dilution of in situ flow cells or flooding of process ponds could result in poor performance or unplanned excursions of process materials into the environment.

ACKNOWLEDGEMENTS

I wish to express my appreciation to Dr. Roy Williams and Dr. Dale Ralston for their guidance and support. I thank Dr. Martin Smith for his unflagging good humor and for sharing his ideas in those areas of our mutual interest. I thank the United States Bureau of Mines whose funding under Cooperative Agreement number C0278001 made this study possible. Thanks also to the many graduate students, both past and present, and to those members of the faculty and staff of the University who lent a hand or asked a question that enriched this work.

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CHAPTER 1. INTRODUCTION

Statement of the Problem

The South Fork of the Coeur d'Alene River drainage has been the recipient of over one hundred years of mining wastes and the byproducts of weathering of these wastes. A dam was constructed in 1901 to contain these wastes at the west end of Smelterville Flats. Smelterville Flats is an area where mine wastes have been deposited on the alluvial plain of the westward-flowing South Fork of the Coeur d'Alene River known locally as the Silver Valley. The Smelterville Flats are located in the southern portion of the Idaho panhandle approximately 100 miles east of Spokane, Washington along US Interstate 90 and two miles west of Kellogg, Idaho (Figure 1). The area examined herein comprises a portion of a 40-acre tract of Smelterville Flats administered by the U.S. Bureau of Land Management (BLM) (Figure 2).

Mine owners constructed the dam across the South Fork of the Coeur d'Alene River at the Pinehurst Narrows about four miles downstream from Kellogg, Idaho, in an attempt to limit the impact of mill and mine tailings on downstream agriculture. Until its destruction by flooding in the early 1930's, this dam formed a shallow impoundment several square miles in areal extent that filled with mine wastes consisting primarily of jig tailings and flotation slimes. Lead, zinc, cadmium, and other metals and oxidation byproducts leached from this waste material by rain, snowmelt, and ground water

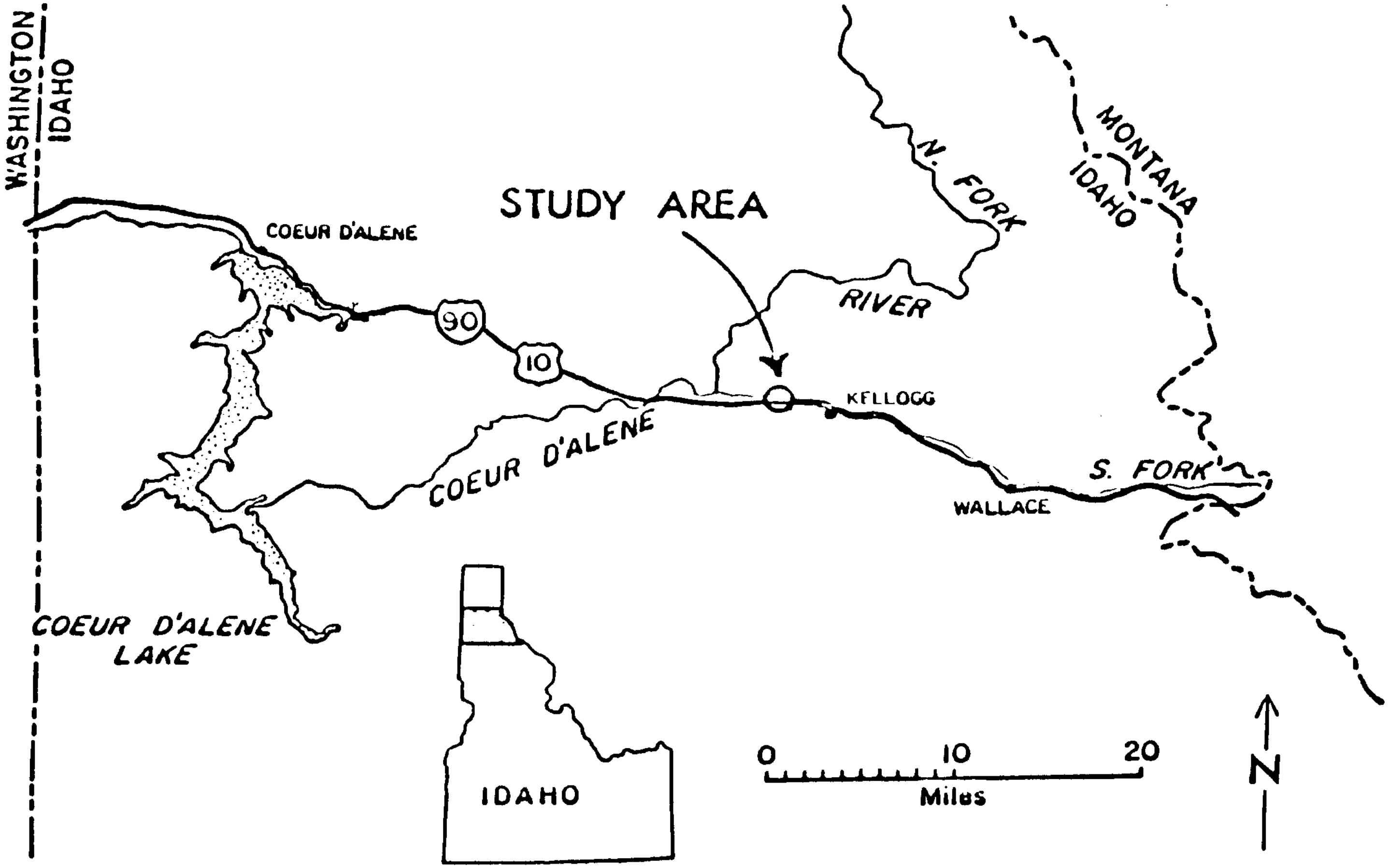


Figure 1.1. General Location Map of the Study Area.

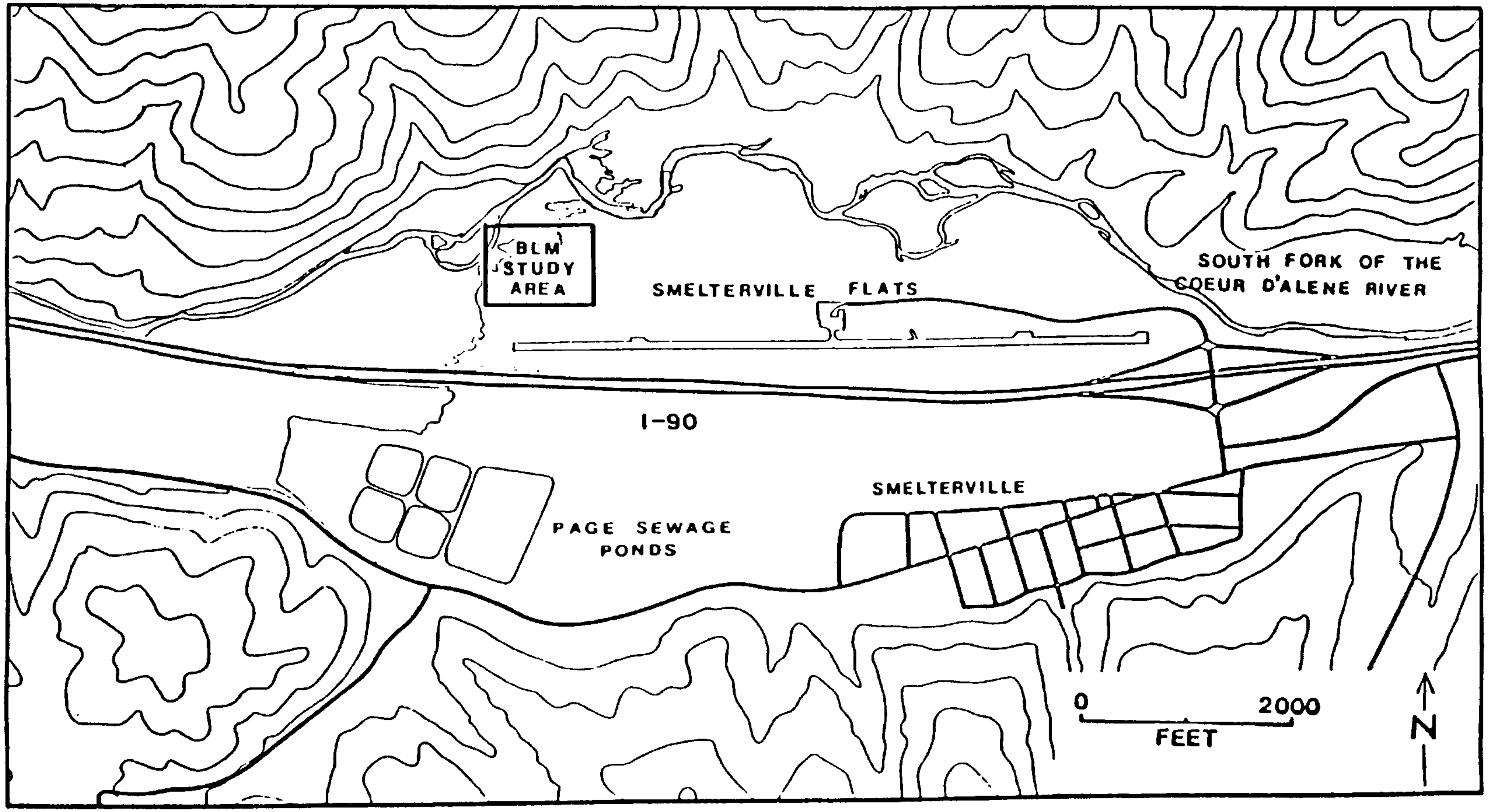


Figure 1.2. Location Map of the BLM Study Area within Smelterville Flats.

continue to degrade the water quality of both the shallow aquifer beneath Smelterville Flats and the South Fork of the Coeur d'Alene River. The Flats also constitute a source of dust contaminated with metals that is carried by westerly summer winds towards the communities of Smelterville and Kellogg, Idaho. Smelterville Flats is located within the Bunker Hill Superfund Site: a twenty-one square mile area encompassing the South Fork of the Coeur d' Alene River valley and the communities of Kellogg and Smelterville, Idaho.

The BLM began a two year revegetation program in June, 1990 in an effort to stop the wind-blown dust contaminated by metals from a 30-acre tract of public land on Smelterville Flats. The planned water application rates for this project were 20 to 40 inches for Summer, 1990, and double that rate for Summer, 1991. It was not well understood what impact, if any, this artificial recharge would have on water quality beneath the Smelterville Flats or on the South Fork of the Coeur d'Alene River.

The research discussed herein expands upon ground water studies within the BLM portion of Smelterville Flats. Research was initiated in 1989 and continued through 1990 and 1991.

Purpose

The purpose of this project is to investigate the relations between sediment chemistry, natural and artificial recharge, and ground water quality in order to provide necessary baseline information that will facilitate development of a reclamation program to mitigate ground water quality problems under the Smelterville Flats.

Objectives

The general objective of this project is to evaluate the effects of mine and mill waste and alluvial sediment chemistry, and natural and artificial infiltration on groundwater quality at the Bureau of Land Management research area on Smelterville Flats.

The specific objectives of this project are:

1. To review the hydrogeology and previous hydrogeological studies at the BLM site.
2. To present and evaluate water quality and water level data collected from the BLM site during Summer and Fall, 1990 and Spring, 1991. These data are evaluated in light of previous data collected by Kunkel (written communication) and Swope (1991) from Fall, 1988 to Spring, 1990, taking summer, 1990 irrigation into account.
3. To select a subarea of the BLM site and characterize the metals concentration in the shallow sediments within it and the associated ground water quality.
4. To present and analyze the results of the subarea sediment sampling study, and relate these results to the ground water quality patterns at the BLM site.
5. To formulate conclusions on the impacts of natural and artificial recharge on ground water quality at

Smelterville Flats, and how recharge may impact in situ remediation measures that are under consideration for the Smelterville Flats mine wastes.

Previous Investigations

Galbraith (1971) associated the leaching of heavy metals from mine wastes to the oxidation of sulfide minerals by micro-organisms. Floral and faunal uptake of lead from ground water was described. Galbraith concluded that ground water leaches heavy metals from mine wastes.

Norbeck (1974) mapped alluvial and mine waste materials within the South Fork of the Coeur d'Alene River valley, measured water levels from 86 industrial, municipal, and private water wells and ponds, and analyzed ground water from 49 locations. He identified anomalous concentrations of Ca, Cd, Fe, K, Mg, Mn, Na, Pb, Sb, Zn, low pH, and high conductivity in samples from industrial wells in Osburn, wells southwest of the Bunker Hill tailings pond, and from wells west of Smelterville. Well logs, depth soundings, seismic refraction, and electrical resistivity methods were used to estimate depth to bedrock for various locations in the South Fork of the Coeur d'Alene River valley. Zinc mass flux to the river in the vicinity of Smelterville was estimated as well.

Reece (1974) sampled mine waste sediments from various locations along the south fork and main stem of the Coeur d'Alene River, including Kellogg. Laboratory leach experiments were used to determine the efficiency of various methods to concentrate heavy metals from these sediments. X-ray diffraction indicated that sediments having higher concentrations of Fe, Zn, Pb, Mn, Cu, and Cd exhibit the strongest diffraction patterns for siderite, consistent with the fact that siderite is a common gangue mineral found in the district.

Morilla (1975) used a steady-state mathematical ground water flow model to characterize the flow regime within an abandoned tailings pile located on Smelterville Flats. He found that the quantity of infiltrating precipitation and the position and behavior of the local water table were the major controls on the ground water mound beneath the tailings pile.

Marcy (1979) studied the chemistry of the shallow ground water and of the surficial sediments (mine waste and alluvial) at Smelterville Flats. Two sediment types, a red sandy material and a gray silty, clayey material, were found to contain the highest concentrations of metals. The acid-producing potential of a sediment was determined to be controlled by the pyrite to carbonate ratio of that sediment.

By analysis of sediment and water samples taken from a network of shallow piezometers and soil pits located on Smelterville Flats, Norton (1980) concluded that metals concentrations in Smelterville Flats mine wastes are higher in the finer size fractions of the sediments. He postulated that ground water quality from any specific piezometer is controlled by the character of the sediments in the immediate vicinity of that well screen.

Dames & Moore (1988) conducted a preliminary hydrogeologic assessment of the Bunker Hill Superfund Site and characterized the valley fill sediments beneath Smelterville Flats as two alluvial aquifers separated by a lacustrine clay aquitard.

Adams (1989) identified an upward hydraulic gradient between the lower and upper aquifers beneath Smelterville Flats. He estimated the transmissivity of the lower aquifer to range from 60,000 to 80,000 ft^2/day and storativity to range from $4x10^{-5}$ to $7x10^{-5}$.

Dames & Moore (1990) concluded in a Final Hydrogeologic Assessment under the Superfund site Remedial Investigation \ Feasibility Study for the Bunker Hill complex that metal contamination beneath Smelterville Flats is stratified vertically. They estimated that the contribution of metals to the ground water flow system beneath the South Fork of the Coeur d'Alene River valley from infiltration through the mine and mill wastes deposited there is a small fraction of the contamination contributed by the Bunker Hill Mine Central Impoundment Area.

Kunkel (written communication) installed ten pairs of piezometers on the BLM site and measured water quality and water levels from Fall 1988 to Spring 1989. He estimated the transmissivity of the upper aquifer beneath Smelterville Flats to be 60,000 ft^2/day and the specific yield to be 0.04.

Swope (1991) measured ground water quality and ground water levels 16 times at the BLM site between Jan and May, 1990 and discovered a linear relationship between zinc and cadmium as well as zinc and lead concentrations in his water quality samples. An antecedent precipitation index model was devised to help predict trends in zinc concentrations with respect to recharge.

Kirschner (1990) defined four unconsolidated stratigraphic units that comprise the mine and mill wastes and alluvial sediments underlying Smelterville Flats in a subarea of the BLM site approximately 400 feet south of the area discussed herein.

Towatana (1990) found a positive correlation between soil pH and the sediment concentrations of Fe, Ca, and Mg. He concluded that water pH does not stongly influence metals solubility due to buffering by carbonate gangue minerals.

Method of Study

Piezometers

Kunkel installed the aforementioned ten pairs of piezometers on the BLM site so that one well of each pair monitored ground water levels within the lowermost portions of the mine and mill waste sediments: ranging in depth from 4 to 7 feet. Collared about five feet away from the first well, the other well of the pair was completed within the upper aquifer to a depth of 22 to 26 feet. Piezometer pair locations are shown in Figure 1.3. Shallow wells are suffixed "C" and the deep wells are suffixed "D" on the assay reports. These are collectively referred to herein as the BLM site wells or simply the BLM wells.

In the southern portion of the BLM site, Adams installed a 6 inch diameter pumping well and two wells with four 2 inch diameter piezometers "nested" in each well. The pumping well was completed in the lower aquifer. One piezometer from each nest was completed in the upper and lower aquifers, respectively. The two remaining piezometers from each nest were completed in the aquitard separating the upper and lower aquifers. The pumping well is labelled P-1 and the two piezometer nests are labelled MP-1 and MP-2 on Figure 1.3.

Ground Water Sampling

Ground water levels in the ten pairs of piezometers and the two piezometer nests were measured using a chalked steel tape or a Solinst 100 foot electrical tape. Averaged ground water levels reported herein represent the mean water level for either the shallow or the deep BLM site wells (C or D wells, respectively) as measured on that date.

Approximately three well volumes were removed from each well prior to sampling by a battery powered ISCO peristaltic pump or hand operated sump pump. Water temperature and temperature corrected electroconductivity were measured on site with a YSI Model 33 SCT meter; pH was measured on site with an Orion Research SA 250 pH meter. The samples were .45

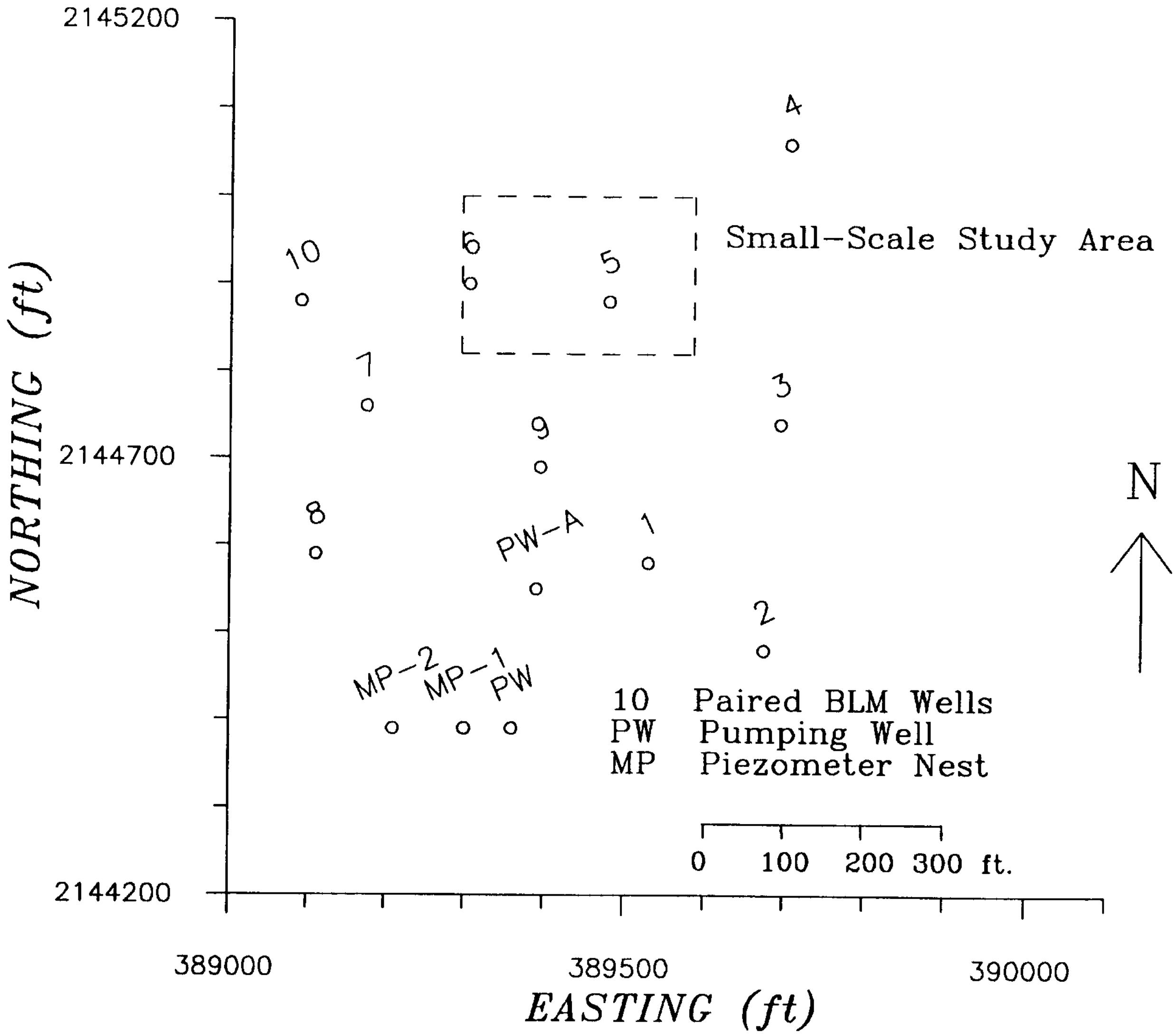


Figure 1.3. Smelterville Flats BLM Site Well Locations and Small-scale Study Area Map.

micron filtered, acidified below a pH of 2 with nitric acid and sent to Acme Analytical Labs, Vancouver, Canada for multi-element ICP analysis.

Duplicates, field blanks, and a suite of standard solutions spanning three orders of magnitude concentration were submitted with each sample set. Standard solutions were prepared by volumetric dilution of VWR 1000 ppm Zn and Cd reference standards (1991 VWR Catalog Numbers VW0780-3 and VW0715-3, respectively).

This study reports averaged metal concentrations in ground water as the back-transformed mean value of the natural log of that constituent for either the shallow or the deep BLM wells (C or D wells, respectively) sampled on that date.

Sediment Sampling

From the onset of ground water quality sampling at the BLM site, zinc concentrations from BLM shallow wells 1C, 5C, and 10C have regularly exceeded zinc concentrations from the other shallow wells by a factor of three to over twenty. Wells 5C and 6C, less than 200 feet apart, consistently differ by up to two orders of magnitude; the differences range from less than 50 mg/l in well 6C to over 1500 mg/l in well 5C.

In order to explore this phenomenon, and to begin characterization of the mine and mill waste sediments underlying Smelterville Flats, a small-scale study area encompassing BLM wells 5C and 6C was defined within the Smelterville Flats BLM site. The small-scale study area lies in the northeast portion of the BLM site, approximately 200 feet south of the South Fork of the Coeur d'Alene River and extends southward from the shoulder of an abandoned river meander that parallels the present channel. This area is labelled as "Small-scale Study Area" in Figure 1.3.

A first-pass program of surveying, shallow sediment sampling, and stratigraphic characterization within the small-scale study area was completed in late 1990. One hundred-eighty-five mine waste and alluvial sediment samples were taken from 29 core holes in the vicinity of BLM well pairs 5 and 6. Metals analyses results were received in late November, 1990. Review of analytical results in conjunction with geologic cross-sections constructed from the first-pass sampling data identified additional sample locations necessary for site characterization. A second-pass program of fifty-two samples were taken from nine additional core holes in early January, 1991. One hundred twenty-two "third pass" samples from 70 additional holes were acquired in April, 1991 and upon receipt and review of metals analyses were augmented in July, 1991 by 20 samples from 11 core holes to further define the sediments in the eastern and southern portions of the sample grid (Table 1.1).

Table 1.1. Sediment Sampling Chronology

Date	Samples Taken/ Core Holes	Comments
October, 1990	 44/7 141/22	First Pass: Split Spoon Hand Auger
January, 1991	52/9	Fill In Original Grid
April, 1991	122/70	Augment Eastern Grid
July, 1991	120/11	Augment East/South Grid
Totals	479/119	

Initially, samples of mine and mill waste sediments and alluvial sediments were collected using a two-inch O.D. steel split spoon sampler. After forty-four split spoon samples were obtained from seven core holes, the split spoon sampling technique was rejected in favor of a three-inch diameter hand auger for the following reasons:

1) It was determined the vertical stratigraphic variability at the BLM site, essentially unknown at the onset of this study, could be sampled at acceptable levels of precision and accuracy with a hand auger;

2) Clearly understanding the horizontal stratigraphic variability at the BLM site, also essentially unknown at the onset of this study, compelled an increase in the estimated number of samples and sample locations; and,

3) Hand auger sampling proved to be significantly faster than split spoon sampling.

A comparison of the univariate statistical descriptors and histograms of the metals content (lead and zinc) of mine waste samples collected by split spoon versus samples collected by hand auger did not bring out any notable differences between the two sets of samples. Split spoon samples were therefore assumed to be a subset of the hand auger sample population and the two sets of samples were grouped together for subsequent interpretation and hydrogeological analyses. All subsequent sediment samples were collected with the hand auger. Summary statistics and a comparison of histograms for the two sample sets are given in the Statistical Characterization of the Sediments section in Chapter 4. Univariate statistical analyses were performed with the GEO-EAS statistical software package (Englund and Sparks, 1988).

Classification of sediment types were initially based on field observation. Post plots of metal content vs. sediment class suggested that sets of sediments could be grouped together. Analysis of Variance was performed on these assumptions using SAS (SAS Institute, Inc., 1989). Results of this analysis are discussed in the Statistical Characterization of the Sediments section in Chapter 4.

All sediment sample intervals were dependent on the local thicknesses of observed sediment types. Sediment layers appreciably greater than 12 inches in thickness were split into at least two samples. A new sample was initiated at each observed major change in sediment type.

After logging a description, thickness, and depth, an assay sample and an identical backup sample for the same interval was collected along the length of the sampling tool. Split spoon samples were obtained by splitting the sediment lengthwise (i.e. depthwise) down the bore of the split spoon with a putty knife. One split went to assay, the other split was archived. None of the material collected by split spoon was discarded. Hand auger samples were obtained by removing by putty knife two continuous, parallel portions of sediment from along the barrel of the auger. Similarly, one split was submitted for assay, the other split was archived. The remainder of the material in the auger bore was discarded. The auger samples were approximately 3 to 4 times larger than the split spoon samples by volume per unit length. Samples were placed in Hubco 5 x 8 1/2 inch cotton sample bags and air dried. The samples were then submitted to Acme Analytical Labs, Vancouver, Canada for a total metals analysis utilizing a warm acid digestion followed by a multi-element ICP scan.

CHAPTER 2. SITE DESCRIPTION

Description of the Smelterville Flats BLM Site

Smelterville Flats is located in the southern panhandle of Idaho approximately 100 miles east of Spokane, Washington along Interstate Highway 90 and two miles west of Kellogg, Idaho. The Flats are part of the alluvial plain of the westward flowing South Fork of the Coeur d'Alene River known locally as the Silver Valley. The area examined herein comprises a portion of a 40 acre tract of Smelterville Flats administered by the U.S. Bureau of Land Management.

Geography and Climate

The South Fork of the Coeur d'Alene River basin lies within the Coeur d'Alene Mountains, part of the Bitteroot Mountains portion of the North American Cordillera. The elevation at the BLM Smelterville Flats site is 2200 feet above sea level. The steeply sloping ridges that bound the east-west-trending Silver Valley produce a local relief of over 4000 feet. The valley floor is narrow; it is rarely greater than one half mile in width. Cold, snowy winters and warm, dry summers typify the regional weather. Most of the 30.4 inches of average annual precipitation on the Kellogg area occurs as snowfall.

Geology

The bedrock underlying the Silver Valley area is part of the Precambrian Belt Supergroup. These rocks are Middle Proterozoic in age and are composed primarily of weakly metamorphosed fine-grained argillite and quartzite with lesser amounts of carbonate-bearing dolomitic rocks (Hobbs et al., 1965). Younger intrusive rocks cut the Belt rocks locally; faulting is common and complex. The bedrock has been assumed to play no other significant role in the local hydrogeology of Smelterville Flats than as a no-flow boundary.

Valley fill beneath the Smelterville Flats area is composed of locally sandy glacio-fluvial gravel overlain by lacustrine clay; the glacio-fluvial deposits are overlain by alluvial-fluvial sand and gravel. These unconsolidated sediments comprise the three major hydrostratigraphic units beneath Smelterville Flats as discussed in the following subsection. Three to ten feet of mine waste overlie these sediments and constitute the surficial materials on Smelterville Flats. This mine waste is the subject of the sediment study presented herein.

Hydrogeology

The alluvial valley fill beneath Smelterville Flats has been characterized by Dames & Moore (1990) and by Adams (1989). They both describe three hydrostratigraphic units: an upper aquifer, an aquitard, and a lower aquifer.

The upper aquifer, apart from the surficial mine waste material, is composed of fluvial silt, sand, and gravel. It is 15 to 30 feet thick in the Smelterville Flats area. Kunkel (1992) measured the transmissivity and specific yield of the upper aquifer to be 60,000 ft^2/day and 0.04, respectively. The upper aquifer receives recharge by direct infiltration of precipitation on the flats, by surface water lost from the South Fork of the Coeur d'Alene River in the eastern portion of this study area, and by ground water contributed by nearby tributary drainages. The upper aquifer discharges to the South Fork in the western portion of this study area. Ground water levels measured in piezometers completed in the lower aquifer indicate an upward component of ground water flow between the two aquifers. Although mainly unconfined (Dames and Moore, 1990), the upper aquifer is confined locally on the Flats by fine-grained alluvial and mine waste sediments.

The aquitard is composed of lacustrine silt- and clay-sized sediments with minor lensy sands. The aquitard is 30 to 60 feet thick in the Smelterville Flats area (Adams, 1989); it thins to the east where it eventually pinches out east of Kellogg (Dames and Moore, 1990). Geophysical logging performed by Adams (1989) suggests a paucity of clay minerals in the aquitard. This observation supports the postulated depositional environment of these sediments: a glaciated Belt rocks provenance for an arm of the ancestral Lake Coeur d'Alene dammed by a lobe of continental ice sheet in Wisconsin time (Hobbs et al., 1965).

The lower aquifer, formed of glacio/fluvial silt, sand, gravel, and cobbles, is about 15 feet thick in the BLM study area (Adams, 1989); it is about 45 feet thick near a Dames and Moore well just west of the Pinehurst Narrows (Dames and Moore, 1990). Transmissivity and storativity of the lower aquifer measured 60,000 to 80,000 ft^2/day and 4 to $7x10^{-5}$, respectively (Adams, 1989). Recharge to the lower aquifer is derived from ground water flow from upgradient sediments (from the east), from colluvial and alluvial sediments piercing the aquitard along the valley walls and at the mouths of nearby drainages, and from the aquitard where the vertical hydraulic gradient is downward. Discharge from the lower aquifer is probably through the alluvial/colluvial materials and aquitard where the local vertical hydraulic gradient is upward (Adams, 1989).

CHAPTER 3. GROUND WATER LEVEL AND GROUND WATER QUALITY

Ground Water Level Data

Introduction

Water levels were measured and water quality samples were taken from the BLM study area eight times from September, 1988 to June, 1989 by Kunkel, sixteen times from January, 1990 to May, 1990 by Swope, and 23 times by this author from June, 1990 to May, 1991. Figure 1.3 depicts sampled well locations in the BLM study area. In addition, a sample from the South Fork of the Coeur d'Alene River was taken for each well sample set in Swope's study and in this study. This sample site is approximately 250 feet northeast of BLM well 4C.

Horizontal Trends in Ground Water Levels

The horizontal hydraulic gradient across the BLM site as measured in the shallow wells in April, 1991 is 0.0049. The gradient direction trends N14W (azimuth 346°) and subparallels the South Fork (Figure 3.1). This 1991 magnitude and direction of the hydraulic gradient are in good agreement with the 1990 value of 0.0047 derived by Swope (1991). The refraction of the water level contour lines in the southeast and northwest portions of Figure 3.1 is an artifact of the contouring software. No ground water level information exists

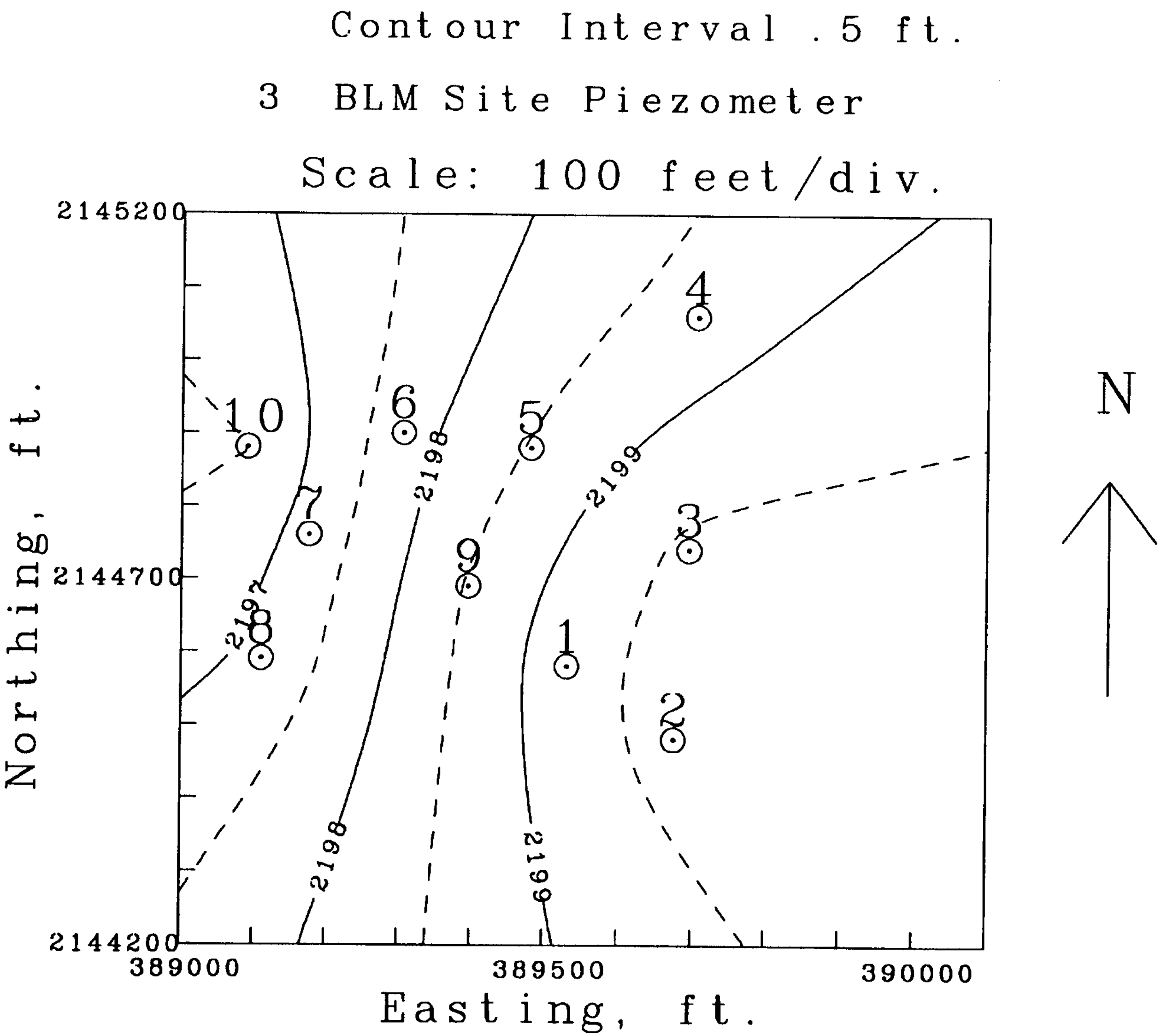


Figure 3.1. Ground Water Elevations at the Smelterville Flats BLM Site, April 19, 1991.

to suggest or disprove the existence of a ground water mound in the southeast portion of the small-scale study area. The effect of the contouring routine utilized by the graphical software is discussed in the Metals Distribution Within the Jig Tailing Unit section of Chapter 4. The South Fork of the Coeur d'Alene River approximates the northern boundary of the BLM site and is a gaining stream at this locality. Water level data are given in Appendix I.

Vertical Trends in Ground Water Levels

Figure 3.2 shows the average vertical hydraulic gradient measured at the BLM site for the major part of the last three years. These data show a downward directed vertical component of ground water flow between the mine and mill wastes and the underlying shallow aquifer for March through June, 1989, January through June, 1990, and November, 1990 through May, 1991; these were periods of warming temperatures and relatively high precipitation. An upward directed vertical component of ground water flow is evident from September, 1988 through early March, 1989, and July, 1991 through September,1991; these were seasonally very warm periods with low precipitation.

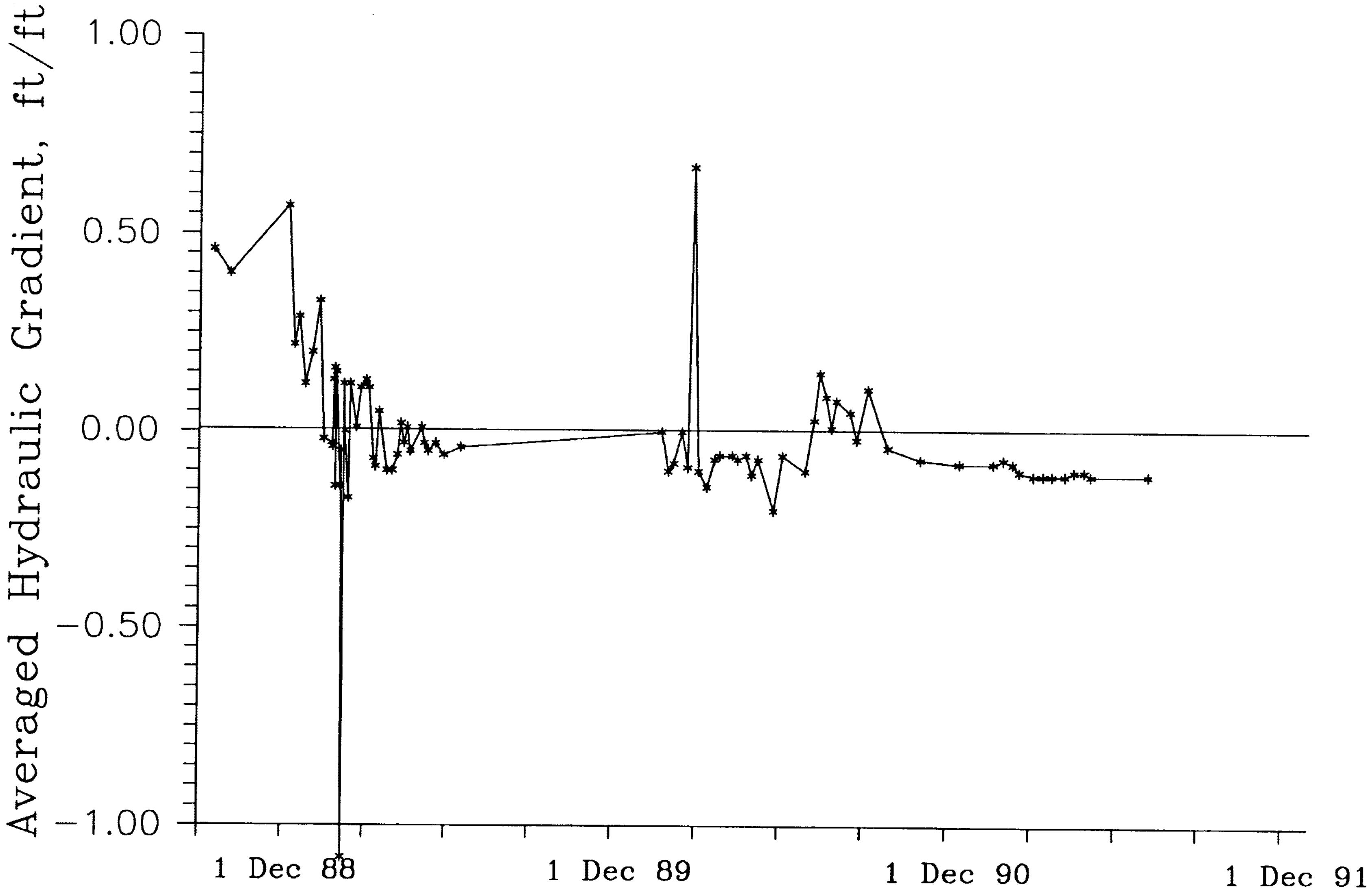


Figure 3.2. Averaged Vertical Hydraulic Gradient, Shallow vs. Deep Piezometers, Smelterville Flats BLM Site, Fall 1988 to Summer 1991.

Temporal Trends in Ground Water Levels

Water levels at the BLM site peaked in April, 1989; May, 1990; and again in April, 1991. Figure 3.3 presents a hydrograph of averaged water levels measured in the shallow (completed 4 to 7 feet below land surface) and deep (completed 22 to 26 feet below land surface) BLM monitoring wells (C wells and D wells, respectively). The data for the three winters monitored may reflect a slight downward overall trend of water level maxima for the study area.

Water levels rise during and after seasonal periods of precipitation and recharge, such as March, 1989; April through June, 1990; October through November, 1990; and February through March, 1991. Water levels also rise after relatively intense precipitation events of short duration such as those that occurred in late July, and mid-August, 1990 (Figure 3.4). A relatively short lag time is observed between an intense precipitation event and its effect on water levels; this short lag time is attributed to the small amount of time required for infiltrating moisture to reach the shallow water table in the upper aquifer. Although precipitation continues from December of 1988 and 1990 through January, 1989 and 1991, water levels are not elevated during that time because the precipitation falls as snow which is "stored" on land surface until the snow melts and allows infiltration of that moisture into the upper aquifer.

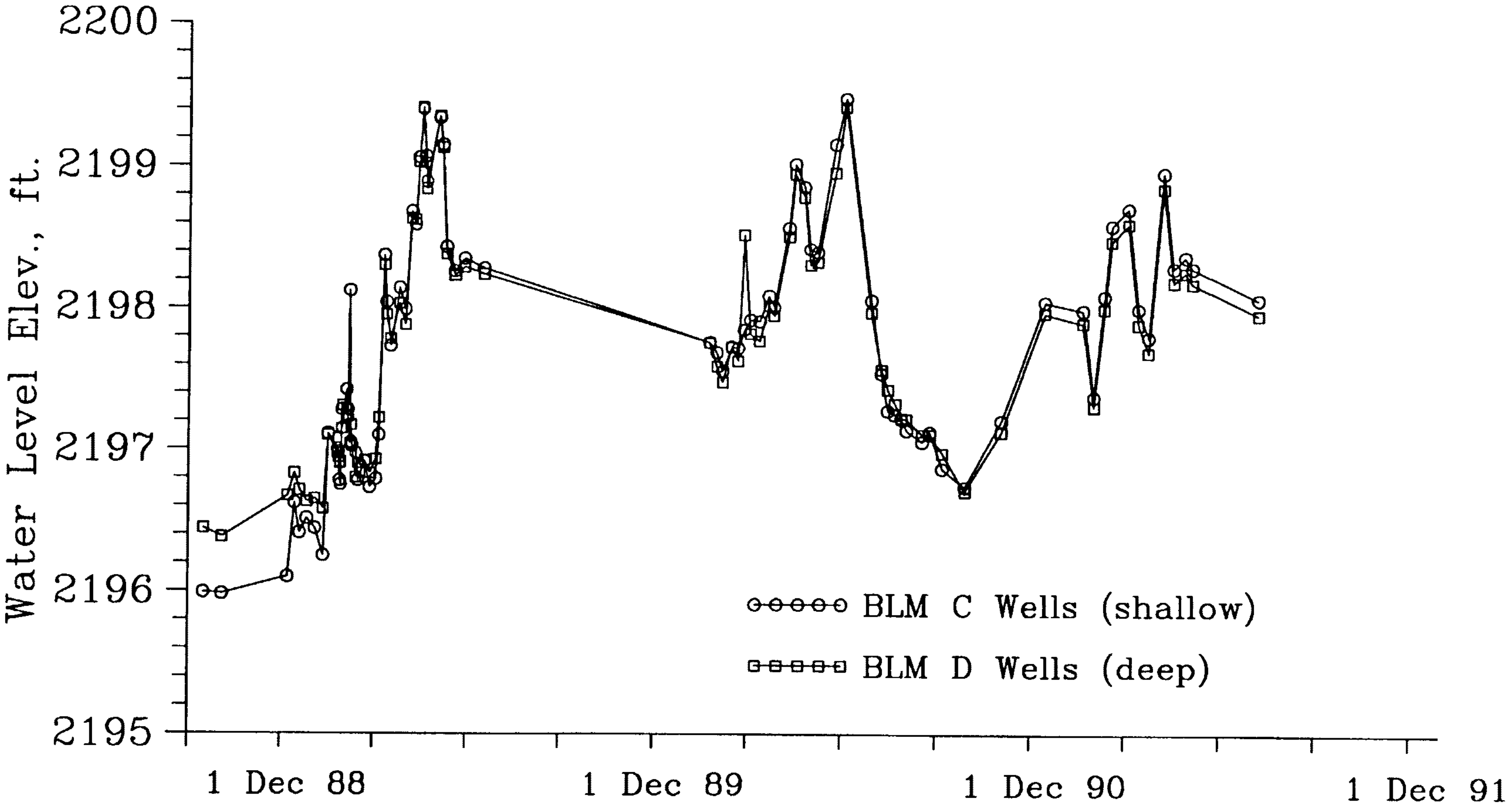


Figure 3.3. Averaged Ground Water Level Elevations, Shallow vs. Deep Piezometers, Smelterville Flats BLM Site, Fall 1988 to Summer 1991.

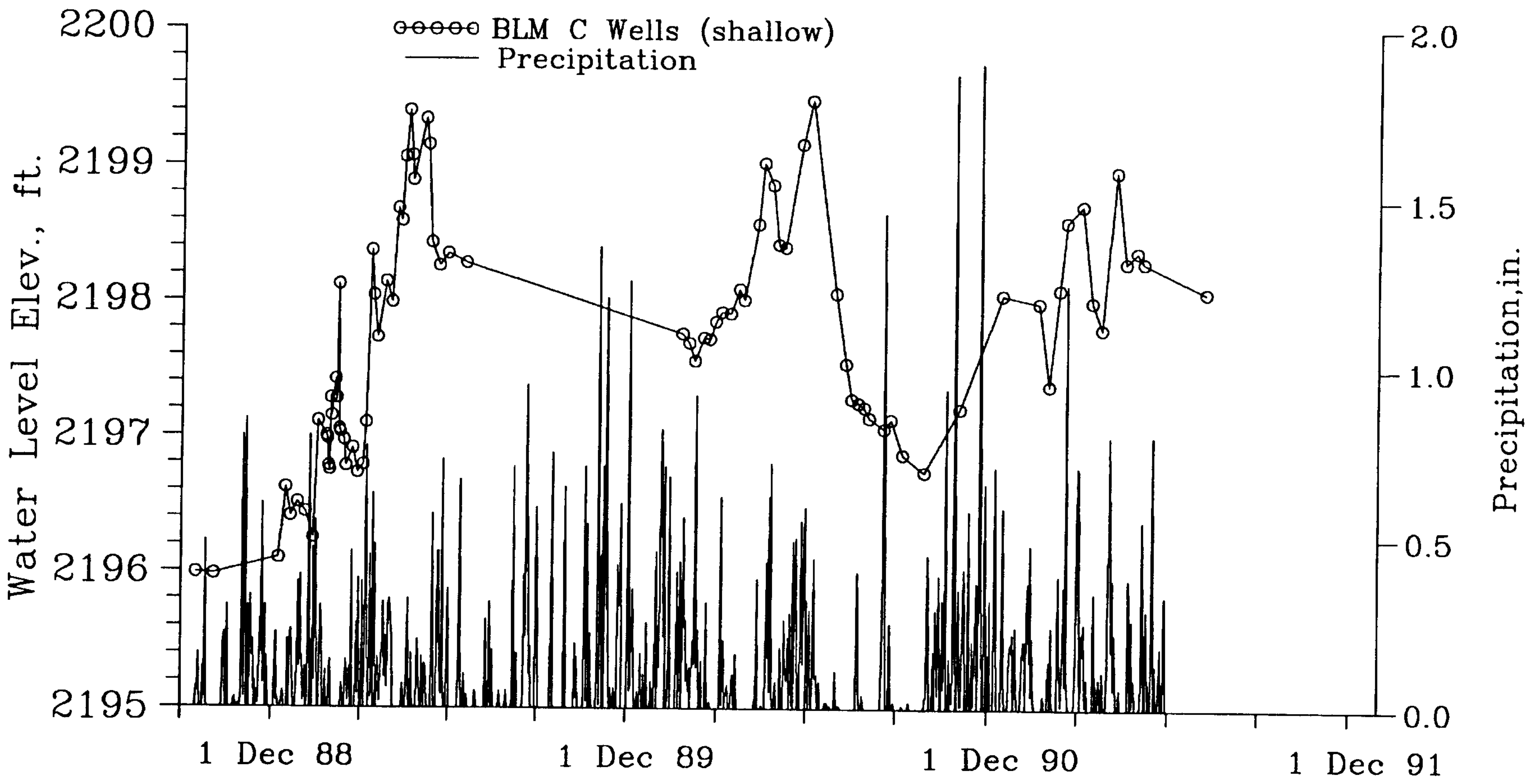


Figure 3.4. Averaged Water Levels of Shallow Piezometers, Smelterville Flats BLM Site, Fall 1988 to Summer 1991 and Local Precipitation.

Five shallow piezometers have been installed in the vicinity of BLM well 5C within the small-scale study area selected for the waste sediment characterization portion of this study as discussed in greater detail in the following chapter (Figure 4.3). Analysis of water levels and sediment records taken from these five piezometers in late October, 1990 suggests that an alluvial clay bed confines the upper aquifer in the immediate vicinity of these five piezometers.

Spray irrigation on the BLM site began June 16, 1990 at the rate of approximately one inch of water every other day; this application continued through August, 1990. The water was applied to 1/16th sections of the BLM site in a 12-hour-per section, eight-day rotation. The effect of this artificial precipitation is not readily discernible from the data plotted in Figure 3.3. One explanation for this is that the warm summertime temperatures in combination with evapotranspiration of the growing grasses at the site effectively reduced net infiltration to the water table to zero. An alternative explanation is that irrigation does not occur in the vicinity of all of the monitored wells preceding any given set of water level measurements. Consequently, any small measured increase in water levels in some of the wells due to irrigation is lost subsequent to averaging of the data.

Water Quality Data

Zinc Concentrations in Ground Water

This presentation follows the rationale of Swope (1991) and Riley (1990) in using zinc as the indicator of water quality because: a) zinc is monovalent and chemically stable in solution within the pH range of the ground water at Smelterville Flats, and b) zinc is ubiquitous in concentrations accurately measured by ICP analysis and therefore easily correlatable across the study area. Zinc analyses from water samples are given in Appendix I.

Zinc concentrations in water samples from the ten sets of BLM wells measured from less than 1 mg/l to nearly 2000 mg/l (Figures 3.5 to 3.8). Zinc concentrations are higher and much more variable temporally in the shallow wells than in the deep wells. The shallow wells as a group exhibit more variability in zinc concentration as a group than the deep wells, which follow roughly similar trends at much lower magnitudes of concentration than the shallow wells.

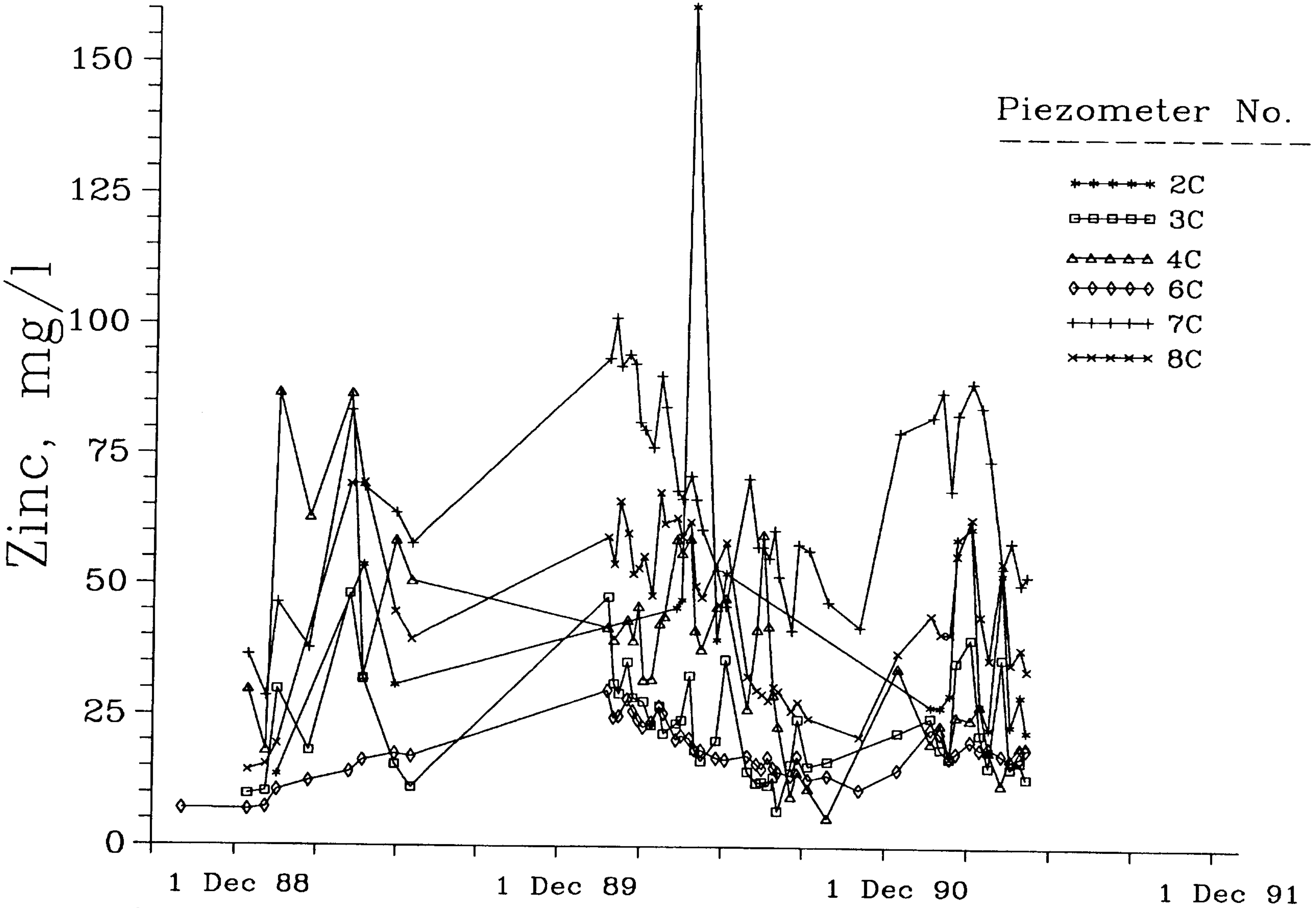


Figure 3.5. "Low" Group Zinc Concentrations of Shallow Piezometer Water Samples, Smelterville Flats BLM Well Array.

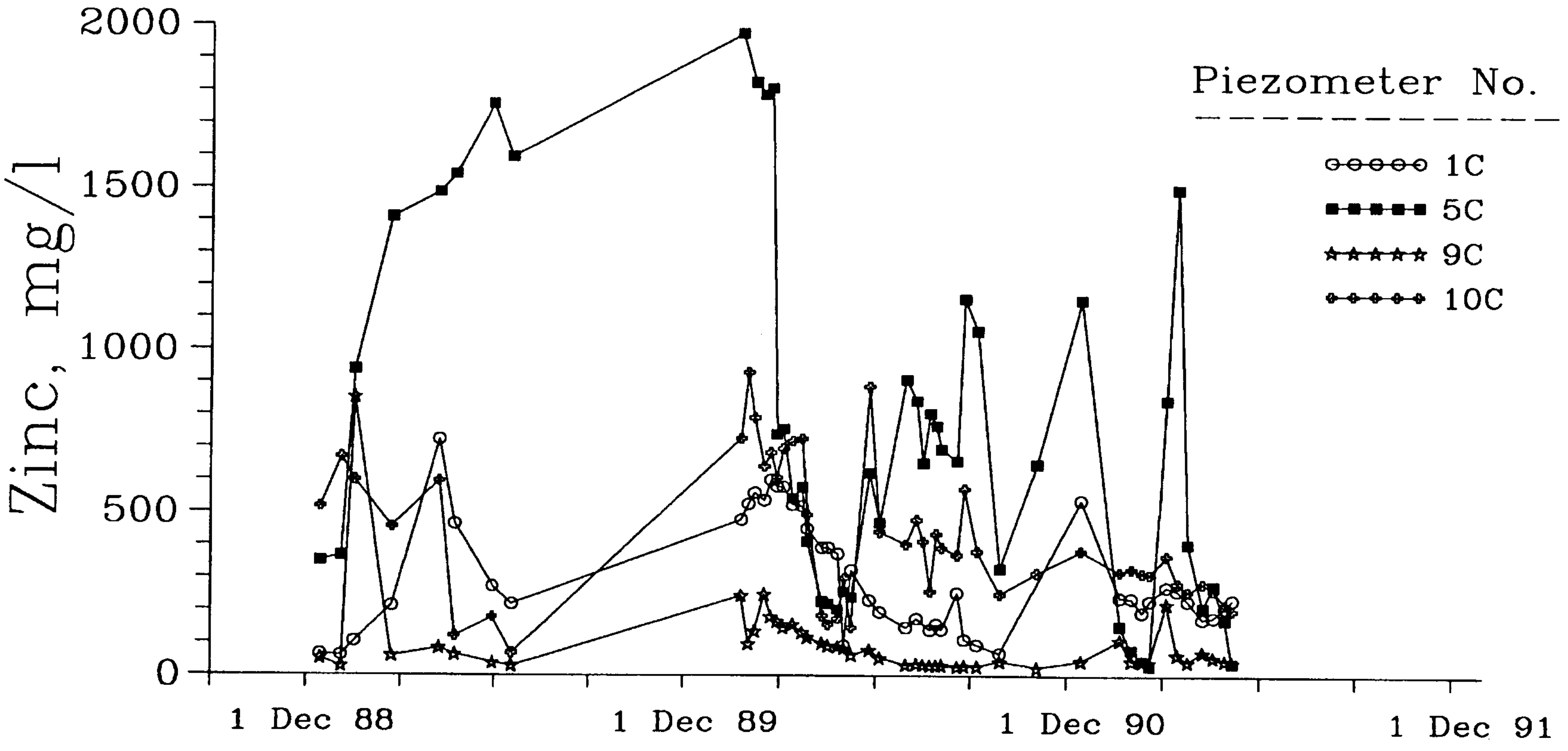


Figure 3.6. "High" Group Zinc Concentrations of Shallow Piezometer Water Samples, Smelterville Flats BLM Well Array.

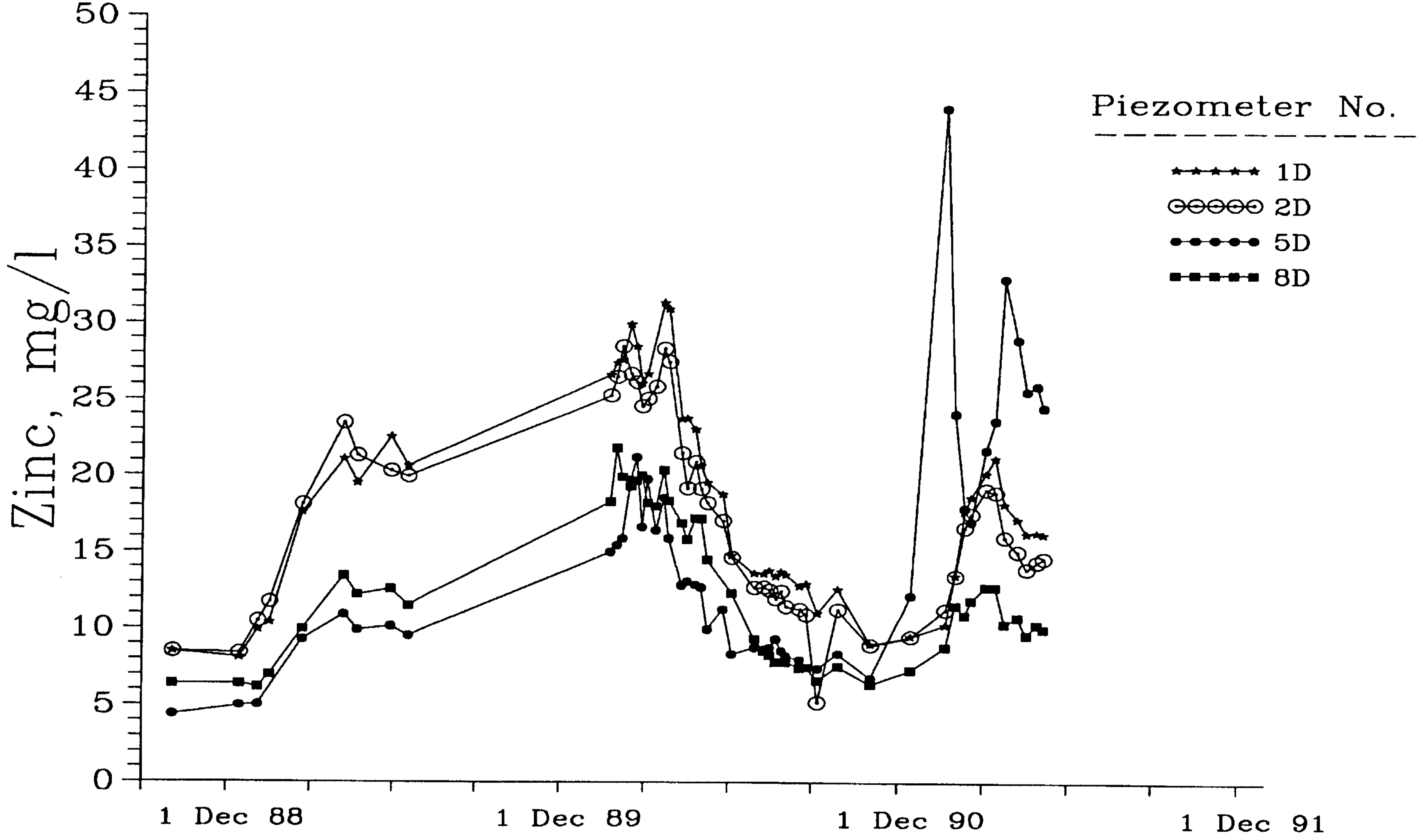


Figure 3.7. "High" Group Zinc Concentrations of Deep Piezometer Water Samples, Smelterville Flats BLM Well Array.

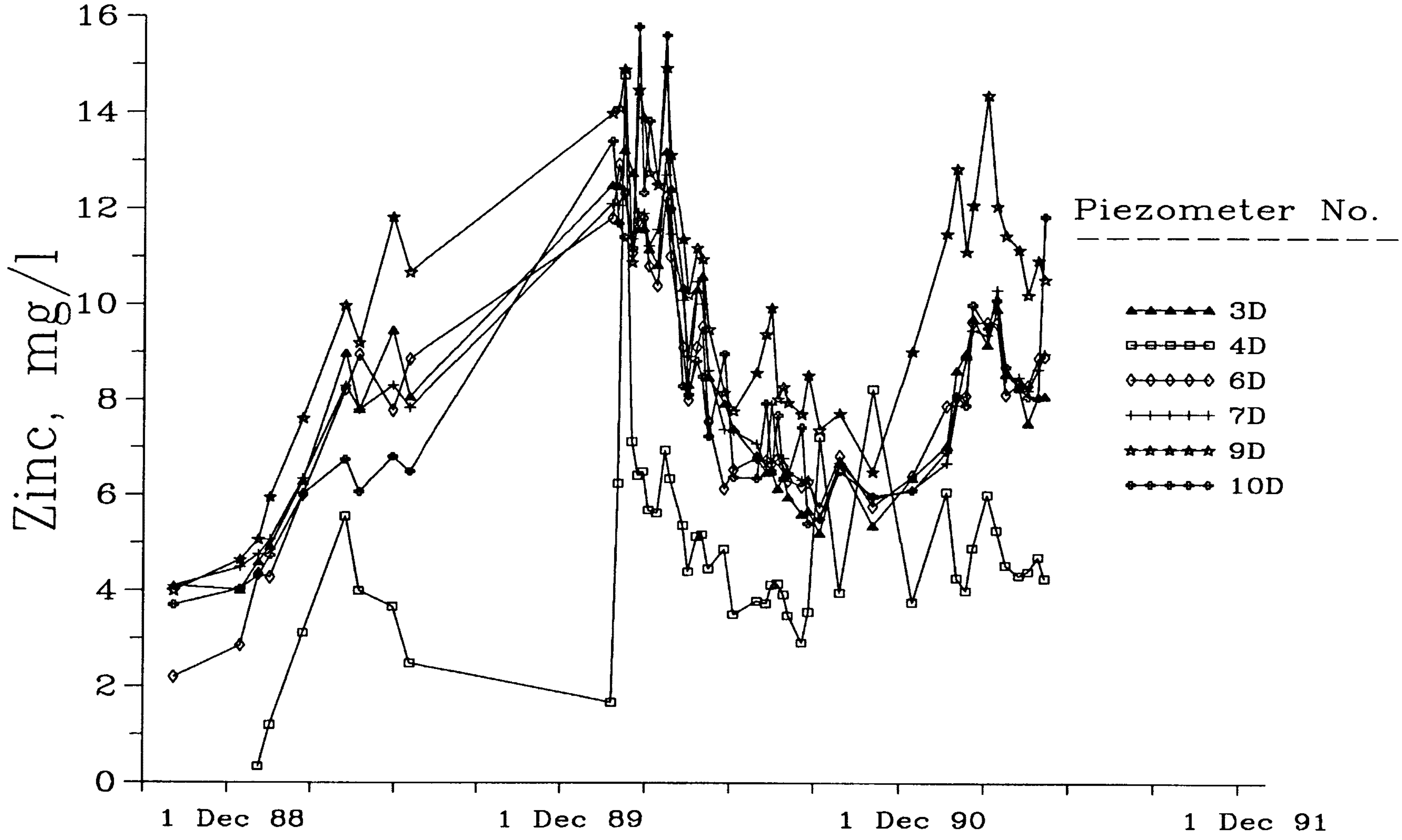


Figure 3.8. "Low" Group Zinc Concentrations of Deep Piezometer Water Samples, Smelterville Flats BLM Well Array.

The shallow-well samples are thought to be primarily derived from precipitation infiltrating mine waste sediments of relatively low hydraulic conductivity immediately overlying the well screens. The deep well samples are from the highly transmissive upper aquifer underlying all of Smelterville Flats, which is primarily recharged up gradient (east of the BLM site) by relatively high-quality water from the South Fork, by tributary drainages along the South Fork alluvial plain, and from precipitation and snowmelt. Lesser amounts of low-quality water are estimated to enter the upper aquifer from the CIA in Kellogg (Dames and Moore, 1990).

Electrical Conductivity Data

Electrical conductivity (EC) values measured for this study ranged from below 100 μmhos to over 3000 μmhos. Measurement precision is ±10 μmhos below 500 μmhos and ±100 μmhos above 500 μmhos. Figure 3.9 presents the log normalized (after Swope, 1991, pp. 27-28) and averaged EC for the shallow and deep BLM wells. Maximum average EC was reached in early April, 1989, late February, 1990 and rises throughout the spring of 1991. EC data from water samples are given in Appendix I.

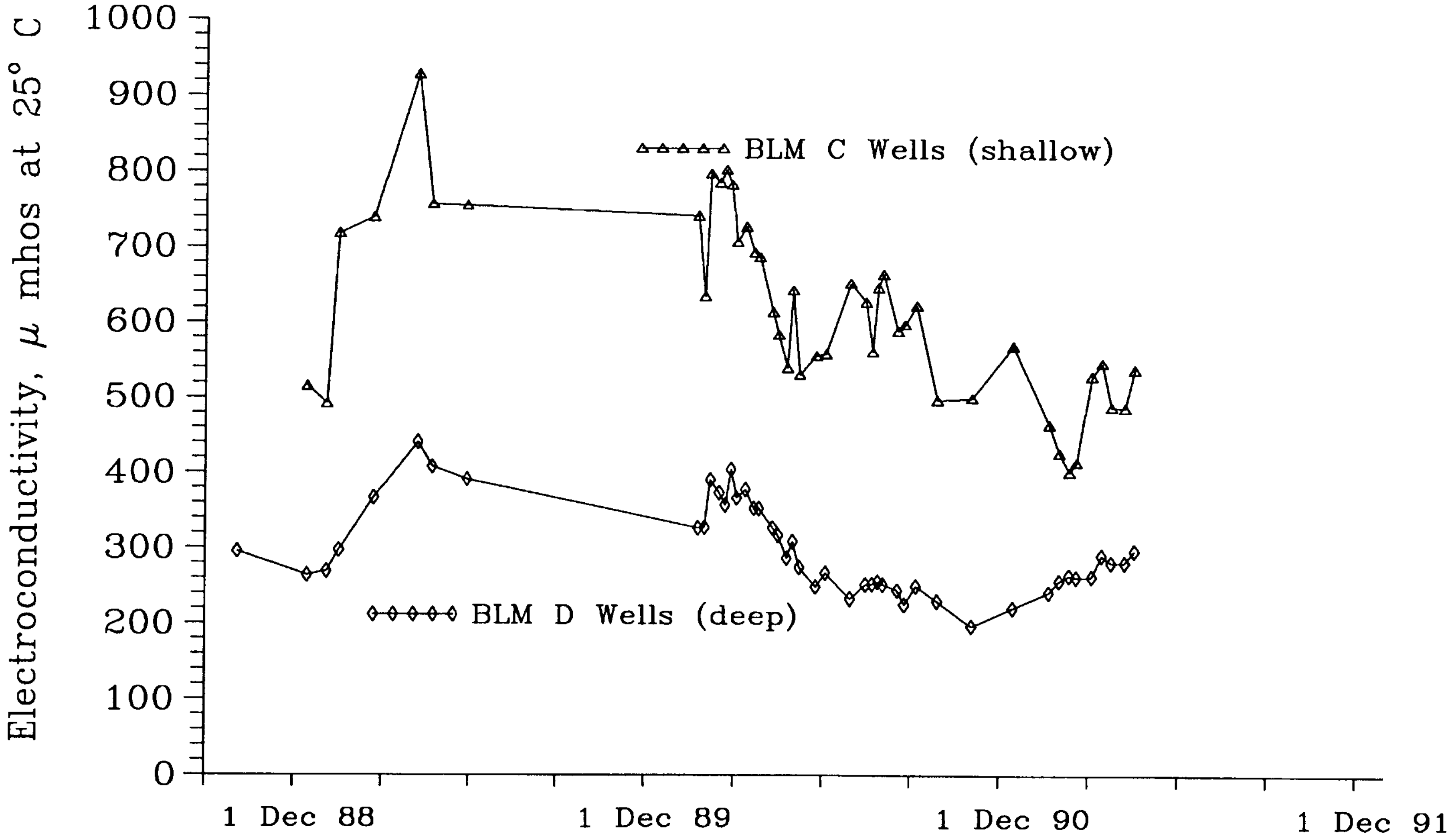


Figure 3.9. Log Normalized and Averaged Electroconductivity of Shallow vs. Deep Piezometer Water Samples, Smelterville Flats BLM Site, Fall 1988 to Summer 1991.

pH Data

Averaged pH data for the shallow and deep wells are presented in Figure 3.10. Measured values ranged between 4 and 7; averages range between 5 and 6.5. The shallow-well and deep-well data follow similar trends.

The change in average pH in 1990 from less than 5.5 up to about 6.5 then down to about 5.6 is of some interest. It is not understood clearly if this trend is due to natural phenomena or is an artifact of sampling. The ground water pH was measured while in contact with atmospheric oxygen and performed at varying times (up to several minutes) after extraction from the well bores; consequently some question exists as to what validity these data possess to describe ground water hydrochemistry. The pH meter reading was observed to fall up to one pH unit within one minute for some samples. This is inferred to represent the oxidation of Fe^{+2} to Fe^{+3}, producing hydrous iron hydroxides and hydrogen ions. pH data are given in Appendix I.

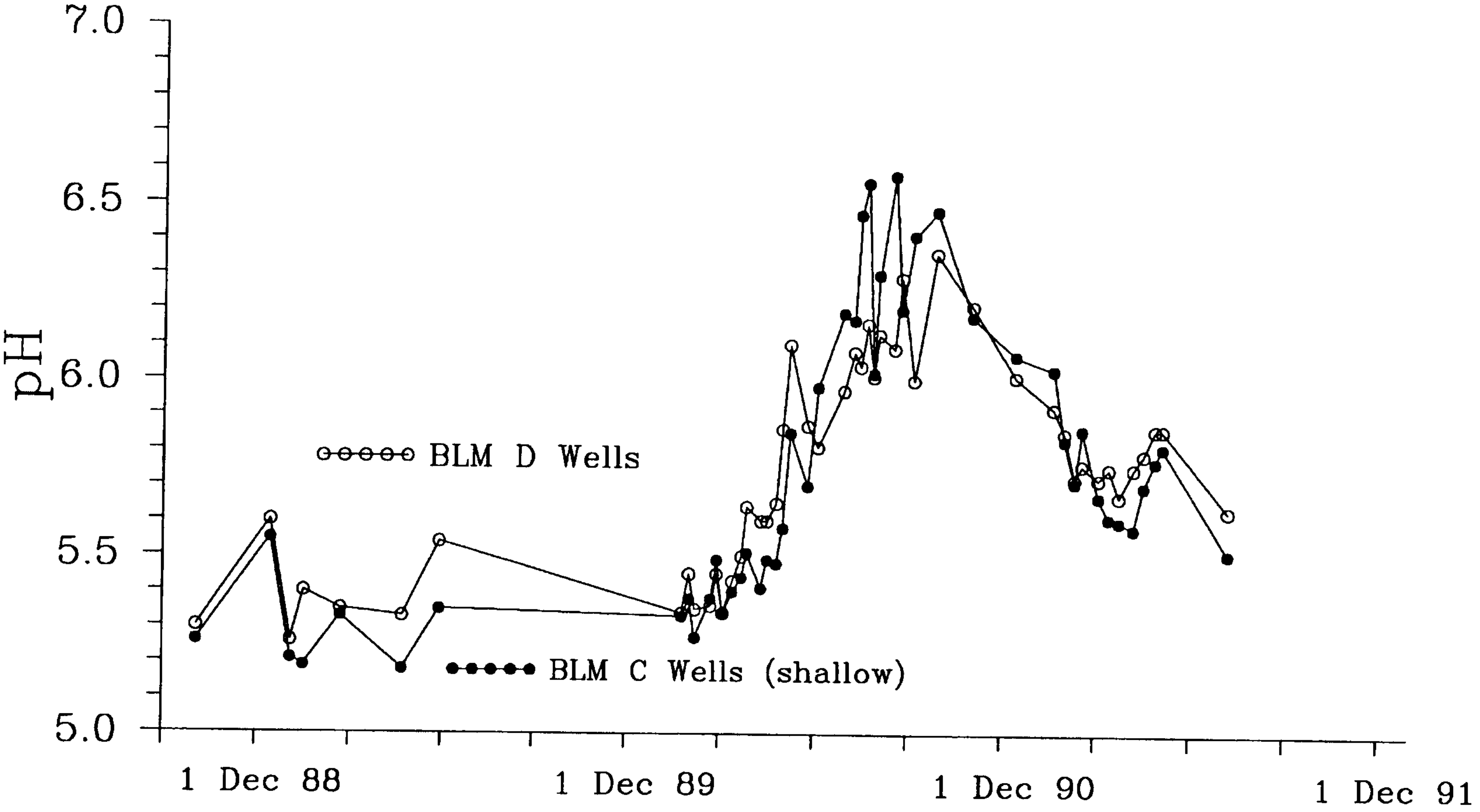


Figure 3.10. Averaged pH of Shallow vs. Deep Piezometer Water Samples, Smelterville Flats BLM Site, Fall 1988 to Summer 1991.

Water Temperature Data

Average water temperatures in 1989 and 1990 increased from 9 - 10 °C to 14 - 15 °C at the end of the 1989 data set and to 16 - 20 °C by late July 1990. Average low temperatures in February, 1991 were 7 - 8 °C and were increasing at 14 - 16 °C when data collection ceased in July. Water temperatures in the deep wells were warmer than in the shallow wells until about April in all three years of the study. All three data sets are truncated: calender year 1990 is the only complete 12 month subset for the study period. Figure 3.11 presents averaged water temperature data for the shallow and deep wells at the BLM site. Water temperature data are given in Appendix I.

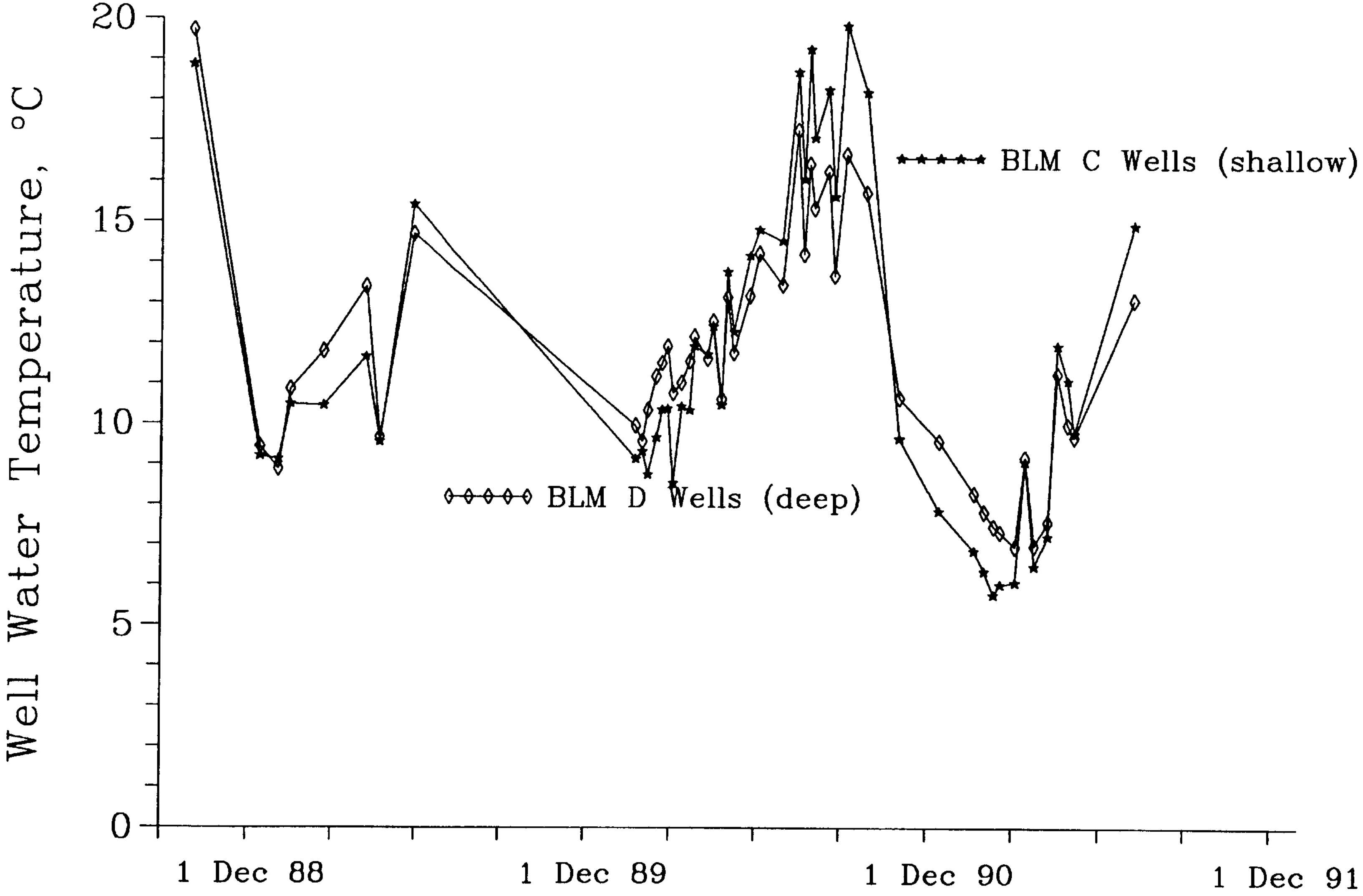


Figure 3.11. Log Normalized and Averaged Ground Water Temperature of Shallow vs. Deep Piezometer Water Samples, Smelterville Flats BLM Site, Fall 1988 to Summer 1991.

CHAPTER 4. WASTE SEDIMENT STUDY

Characterization of the Small-Scale Study Area

A preliminary program of surveying, shallow-sediment sampling, and stratigraphic characterization within the small-scale study area was completed in mid-October, 1990. Figures 4.1 and 4.2 constitute a contoured topographic map and a graphical ground surface plot of a surficial survey of the small-scale study area, with survey points posted as the small circles. The grid was laid out with Brunton compass and tape. Elevations were measured with level and level rod using the previously surveyed collars of BLM wells 5C and 6C as backsights. The south bank of the abandoned channel of the South Fork which forms the northern boundary of the area is clearly evident. Special attention to cultural features resulted in clustered survey points.

Land surface is at its highest elevation in the west-central portion of the study area. Although subtle, this "central highland" is probably an expression of the morphology of the alluvial/fluvial gravel which underlies the small-scale study area. The gravel is at its highest local elevation at the same location. This structure is interpreted to be an abandoned river meander or channel bank buried beneath the waste sediments. The surface expression is attenuated presumably as a result of reworking of the newly exposed mine and mill waste sediments by erosional processes following

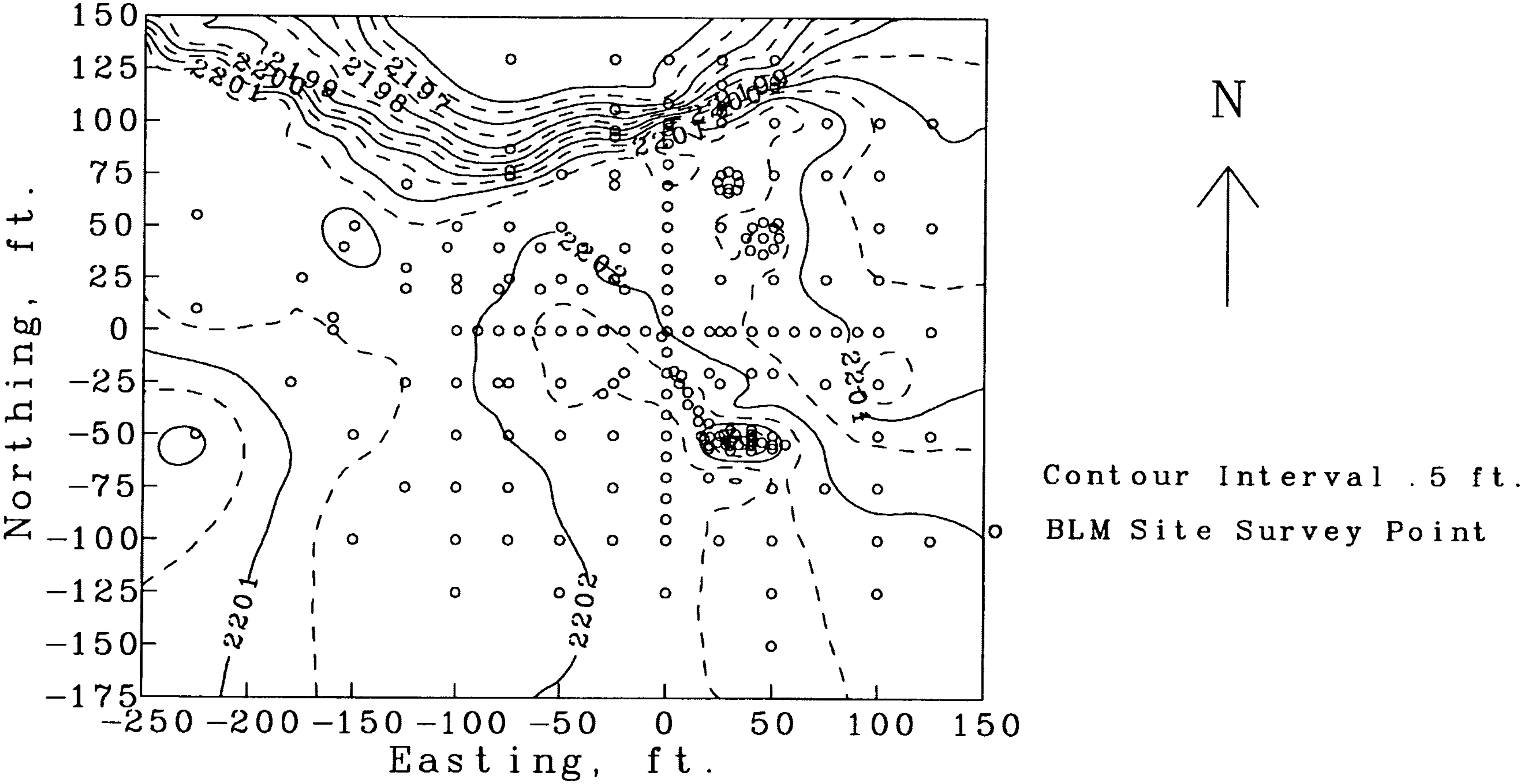


Figure 4.1. Topographic and Survey Point Location Map of the Smelterville Flats BLM Site Small-scale Study Area.

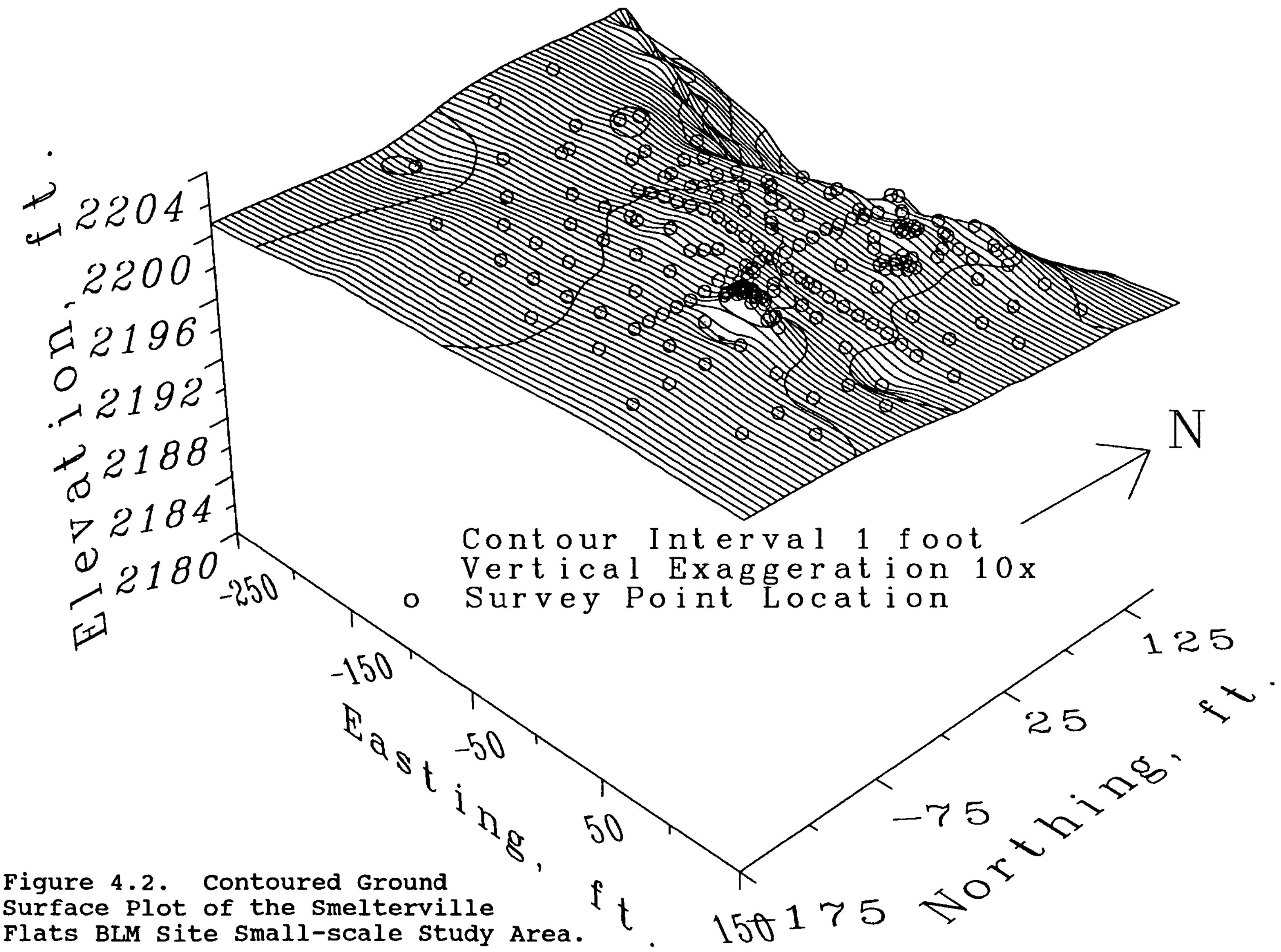


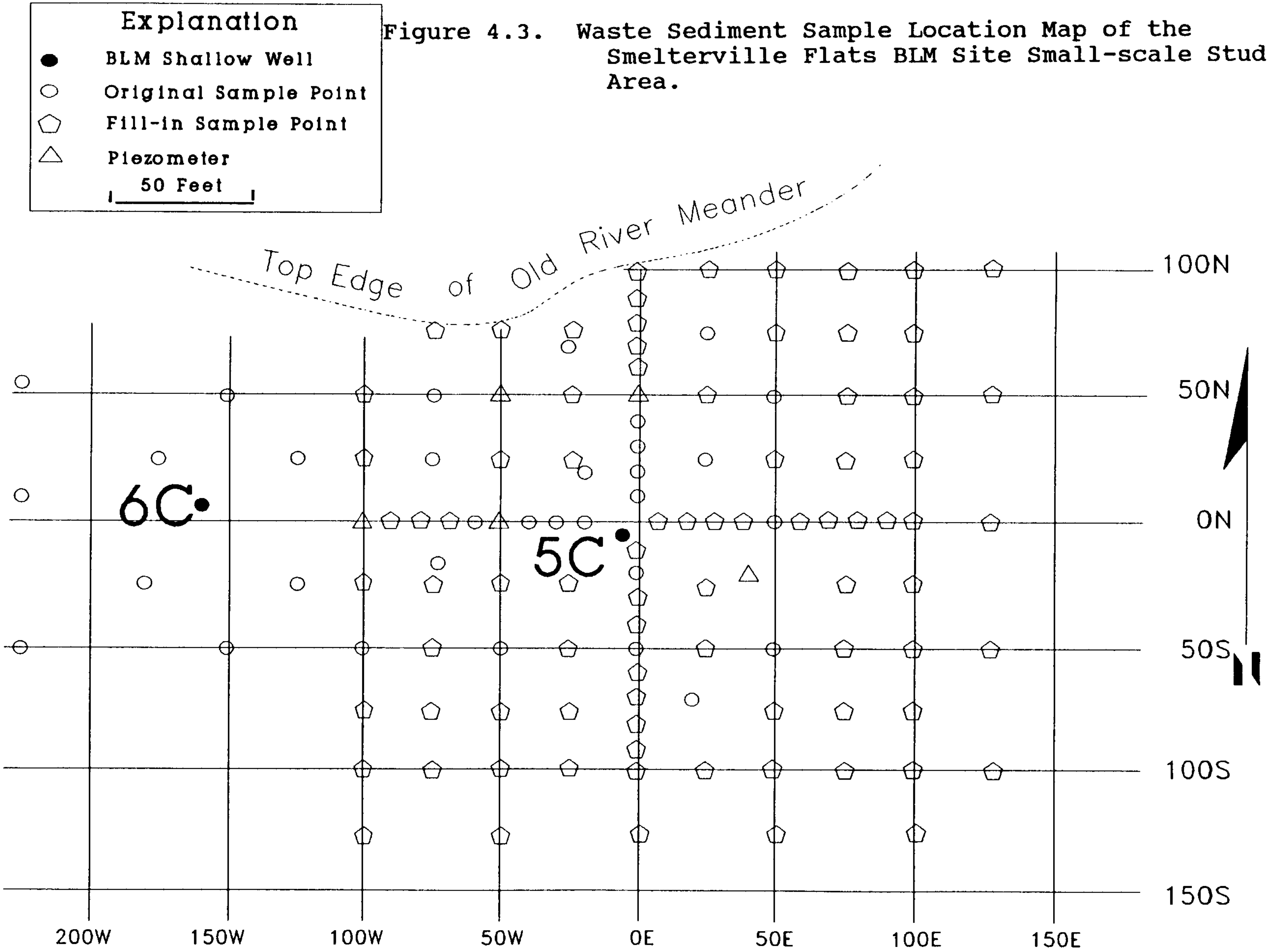
Figure 4.2. Contoured Ground Surface Plot of the Smelterville Flats BLM Site Small-scale Study Area.

the draining of the impoundment that occurred when the Pinehurst Narrows dam failed. The morphologies of the jig tailing, flotation slime, and clay units are influenced by this subsurface feature in the natural alluvial sediments that underlie the wastes.

Excluding the buried river meander shoulder, relief across the small-scale study area is uniformly low except for three features. The two small circular "humps" at 75N, 25E and at 50N, 50E are sediment/log piles. The oblong, east-west trending mound near 50S, 30E is a manmade feature of recent origin. The northeast quadrant of the grid, as well as the portions of the southeast quadrant lying roughly north of 25S and east of 100E, are devoid of vegetation. The rest of the sample grid area is covered by robust grasses planted in the summer of 1990 by the BLM.

Figure 4.3 shows the general layout of the sample grid and the locations of the sample core holes in relation to BLM wells 5C and 6C. Initial sampling consisted of one hundred-eighty-five mine waste and alluvial sediment samples taken from 29 split-spoon and hand-augured core holes in the vicinity of BLM wells 5C and 6C. Analytical results for metals in the samples were received in late November, 1990. Review of these preliminary sampling data revealed that additional samples were necessary for site characterization; consequently fifty-two samples from nine additional core holes were taken in early January, 1991. These additional data suggested that sediments interpreted to be flotation slimes,

Figure 4.3. Waste Sediment Sample Location Map of the Smelterville Flats BLM Site Small-scale Study Area.



a priority subject of this study with concomitant high lead and zinc concentrations, pinch out from east to west in the sediment sample grid area. This "facies change" gave the existing waste sediment data a "bimodal" distribution. In order to understand the waste sediment distribution in the eastern portion of the study area better, one hundred twenty-two additional samples from 70 holes were acquired in April, 1991. After metals analyses were received, 20 samples from 11 holes were taken in order to define further the wastes in the eastern and southern portions of the sample grid (Table 4.1).

Table 4.1. Sediment Sampling Chronology

Date	Samples Taken/Holes	Comments
October, 1990		Preliminary Sampling:
	44/7	Split Spoon Samples
	141/22	Auger Samples
January, 1991	52/9	Fill In Original Grid
April, 1991	122/70	Augment Eastern Grid
July, 1991	20/11	Augment East/South Grid
Totals	479/119	

Physical Characterization of the Sediments

The stratigraphic and geochemical nature of the mine and mill waste sediments and the alluvial sediments that underlie the small-scale study area were essentially unknown at the beginning of this study. Consequently, as a conservative initial approach, samples were collected and categorized on the basis of physical appearance of the material augered. These samples fell into 17 visually and/or physically dissimilar classes (Table 4.2). Visually homogeneous strata greater than one inch thick were sampled separately. Strata greater than one foot in thickness were sampled in fractions of equal thickness any of which did not exceed six inches of overall sediment layer thickness. A compilation of sediment sample locations, thicknesses, and brief sample descriptions are provided in Appendix II. Sediment metals content data are given in Appendix III.

Table 4.2. Initial Classification of Samples from BLM Small-scale Study Area

Sediment Class	Sediment Description
1	Red sandy
2	Red-brown sandy
3	Red-brown sandy with gray blebs
4	Yellow sandy
5	Yellow-brown sandy
6	Yellow-brown sandy with gray blebs
7	Orange sandy
8	Orange-brown sandy
9	Orange-brown sandy with gray blebs
10	Red-brown with/or yellow-brown with/or orange-brown sandy
11	Dark gray fine-grained
12	Dark gray clayey
13	Brown clay
14	Light/dark olive-green or blue clays
15	Gravel +/- sand, silt, clay
16	Light/medium gray sandy or silty +/- orange / red / brown staining
17	Organic material/ wood chips

It became readily apparent that certain classes of sediments are physically similar and that certain associations or combinations of sediments are predictable. Classes 1 through 10 are sandy and oxidized. Classes 11 and 12 occur together with Class 11 underlain by Class 12. They are fine-grained to very fine-grained, dark gray to black and underlie

Classes 1 through 10 if present. Mine waste sediments, Classes 1 through 12 overlie the organic layer, Class 17, if present. Alluvial clays (Classes 13 and 14) are found below the organic layer if present.

Figures 4.4 and 4.5 are plots of sediment class vs. lead and zinc content respectively. It is clear from both of these plots, especially from Figure 4.5, that the distributions of assay values are similar among Classes 1 through 10 and among Classes 11 and 12. It is also apparent that the lead assay distributions in Figure 4.4 are similar for all mine waste classes; and that the zinc assay distributions in Figure 4.5 differ markedly between classes 1 through 10 and classes 11 and 12.

Consequently, primarily on the basis of lead and zinc content and secondarily on the basis of physical appearance and geologic setting, Classes 1 through 10 were grouped together for sampling and mapping purposes; they are inferred to be jig tailings. Classes 11 and 12 were grouped together and interpreted to be flotation slimes. Alluvial clay and sandy gravel are the other two main sediment types. To assess the validity of these assumptions, an Analysis of Variance was done on the assay data. The results of the Analysis of Variance of metal assay values between and within the sediment groups are discussed in the Statistical Characterization of Sediments section of this chapter.

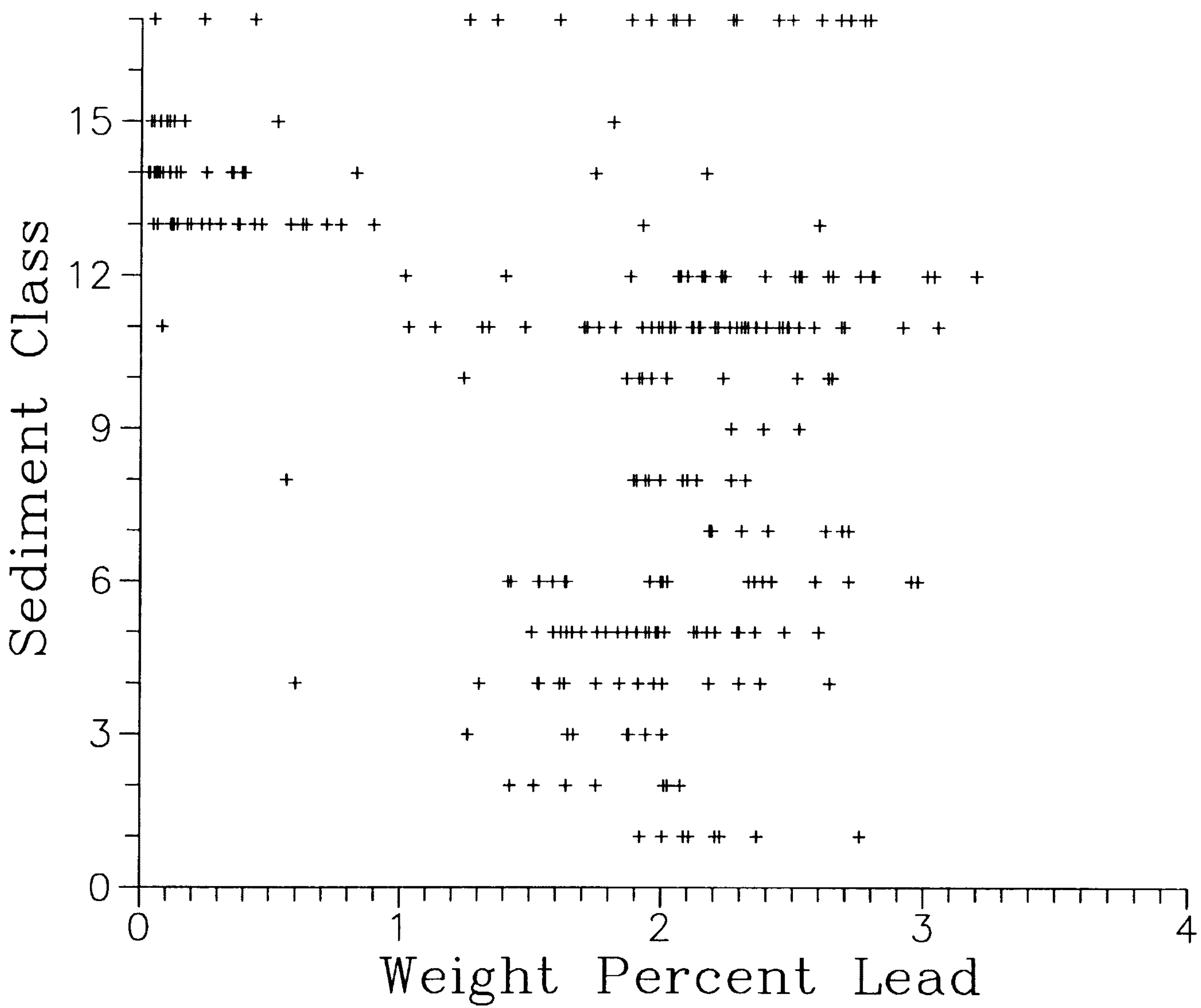


Figure 4.4. Lead Content in Weight Percent of Sediment Samples vs. Sediment Class, Smelterville Flats BLM Site Small-scale Study Area.

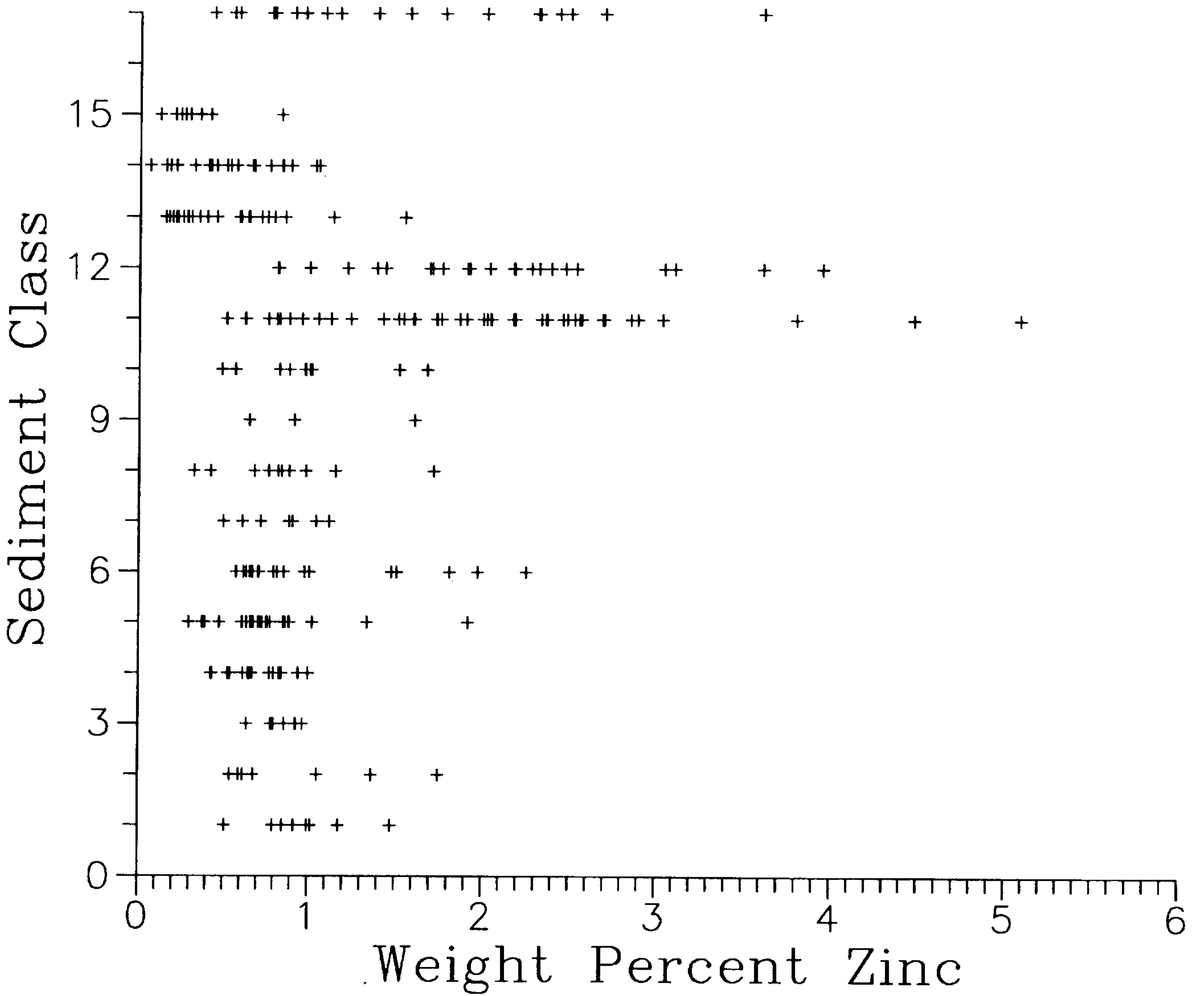


Figure 4.5. Zinc Content in Weight Percent of Sediment Samples vs. Sediment Class, Smelterville Flats BLM Site Small-scale Study Area.

Physical characteristics of the sediments within the small-scale study area are heterogeneous with respect to depth and areal location. Figure 4.6 is a diagrammatic stratigraphic cross section trending east-west through grid point 0N,0E which shows this relationship. Vertical exaggeration in Figure 4.6 is about 20 times horizontal. This section shows features that are typical of fluvial/lacustrine sedimentary systems. These features include fining upwards sequences, poorly sorted gravel, flat lying, "blanket" type well-sorted sediment layers, scour troughs, and sedimentary discontinuous in-filling of low areas (overbank clay deposits) (Matthews, 1974; Davis, 1983).

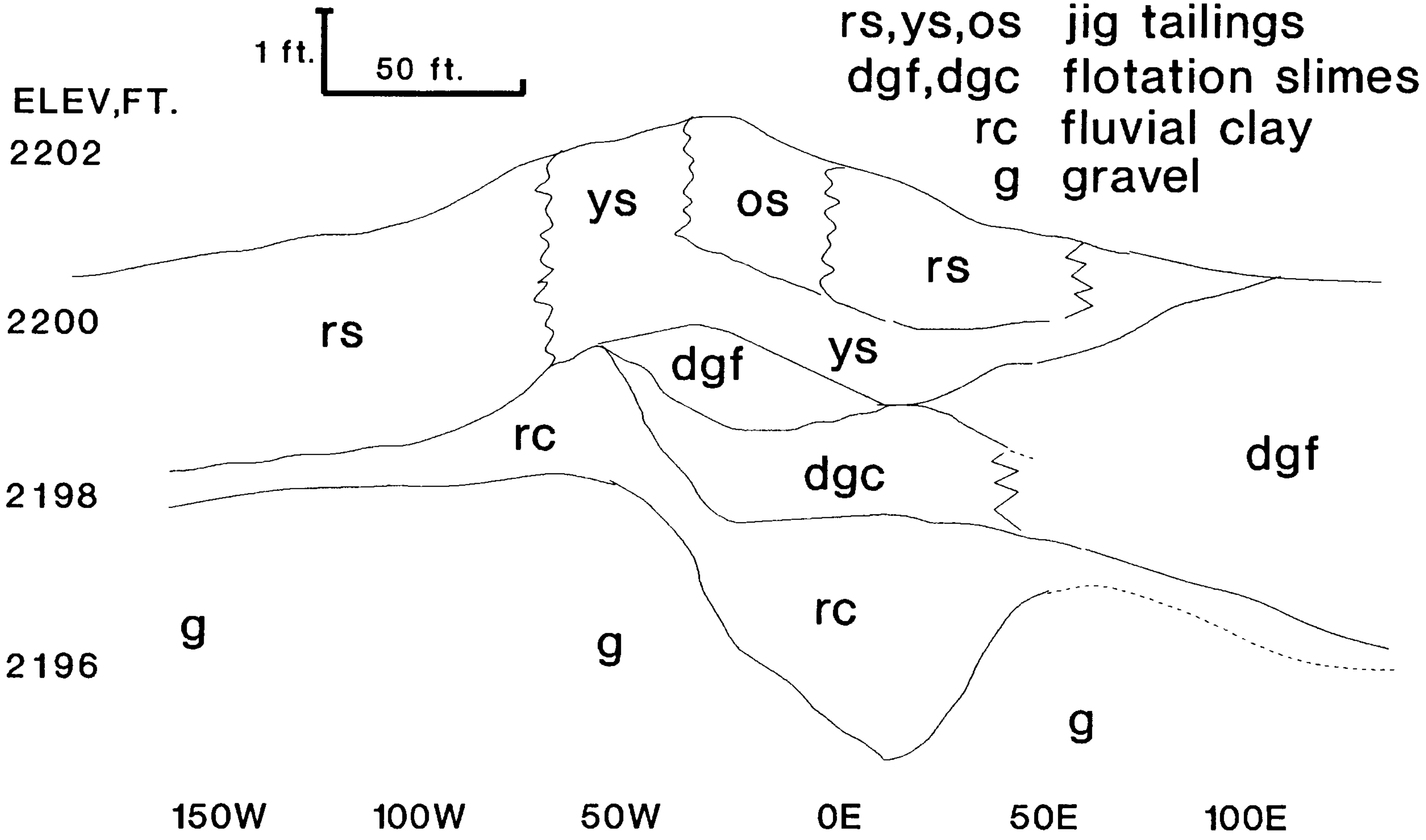


Figure 4.6. East-West Vertical Cross Section Showing Waste Sediment Heterogeneity, Smelterville Flats BLM Site Small-scale Study Area.

Gravel Unit

The gravel unit in this study is the upper portion of the upper aquifer as defined by Marcy, 1979 and by Dames and Moore, 1990. It is ubiquitous across the small-scale study area. The gravel is poorly sorted with grain size ranging from clay-sized particles to boulders with a maximum length greater than one foot. Figures 4.7 and 4.8 are a contoured topographic map and a graphical surface plot, respectively, of the gravel surface. Two features of the gravel are of note: 1) The gravel forms a topographic "high" in the west-central portion of the sample grid; and 2) the gravel defines a portion of a buried channel or meander that trends north to north-northeast from the southern border of the grid. The channel bends to the northwest in the northeast quadrant of the sample grid. These features are important structural controls on the overlying clay and mine waste units as discussed below.

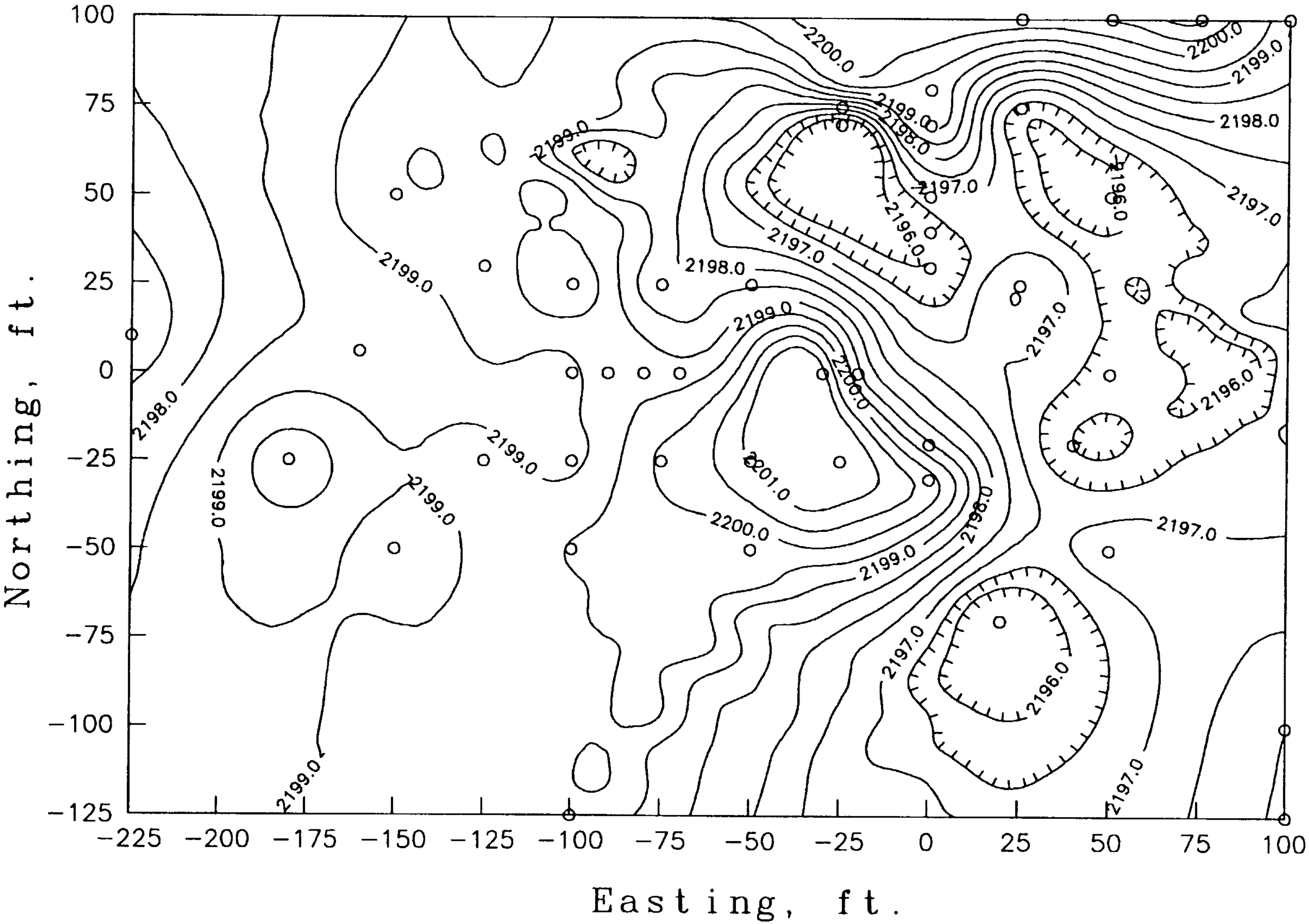


Figure 4.7. Contour Map of the Top of the Gravel Unit, Smelterville Flats BLM Site Small-scale Study Area. Contour Interval = 0.5 foot.

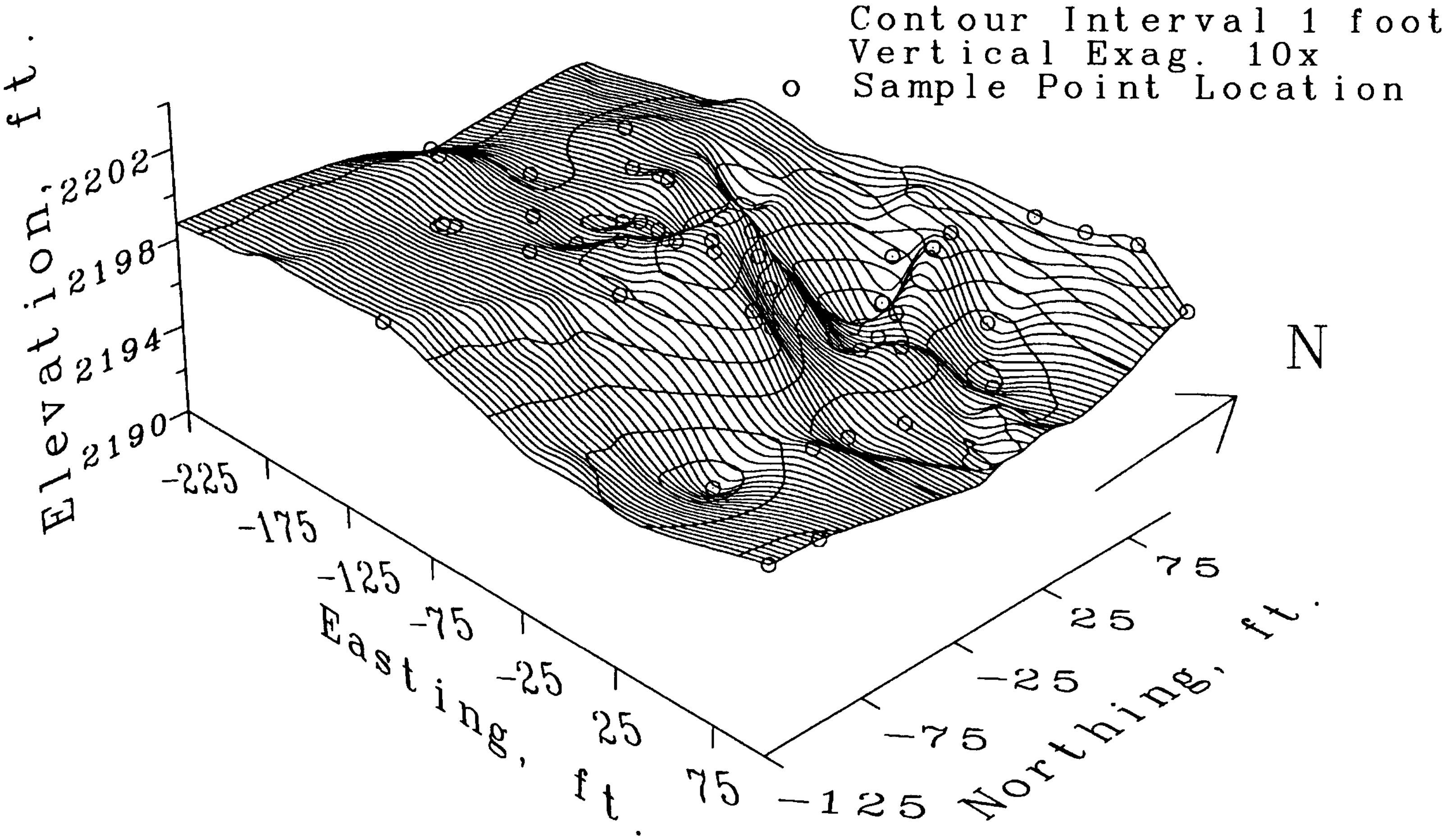


Figure 4.8. Contoured Surface Plot of the Top of the Gravel Unit, Smelterville Flats BLM Site Small-scale Study Area.

Clay Unit

The fluvial clays that were sampled typically are olive green or pale gray to blue. Rootlets are common; they may be iron stained near mine waste-sediment contacts. Figures 4.9 and 4.10 are a contoured topographic map and a graphical surface plot, respectively, of the elevations of the upper surface of the clay unit, with sample locations posted. The top surface of the clay undulates gently; it generally is highest at the west-central portion of the grid area, and declines from this local high in all directions. Figure 4.11 is an isopach map of the clay where penetrated. Contours are in feet. The clay unit is thinnest above the west-central gravel high. An atypically thick (over 5 feet) clay sequence occurs at location 75S/25E. The clay fills in a portion of the buried meander; the clay then extends upwards to its shallowest depth in the sample grid from this location.

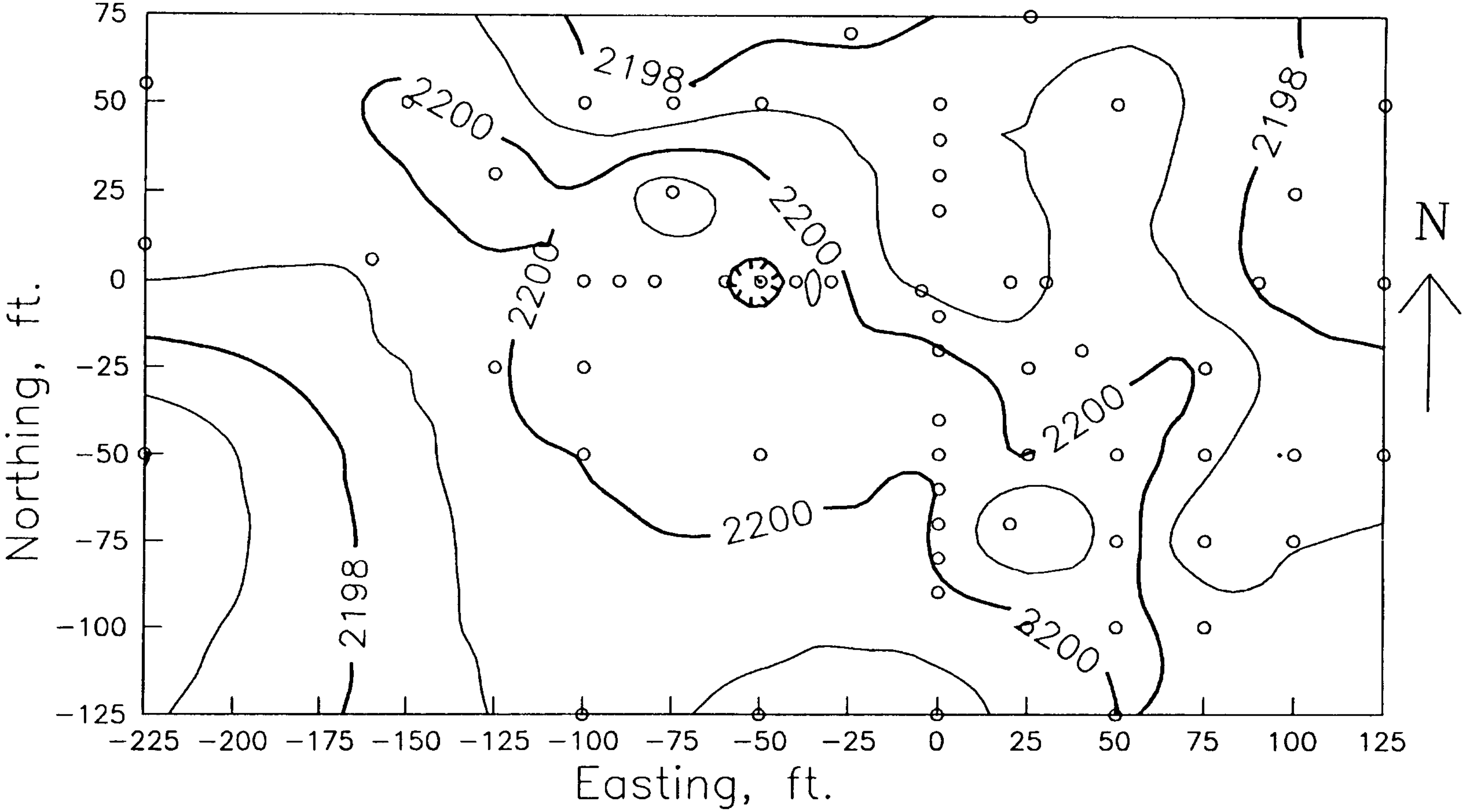


Figure 4.9. Contour Map of the Top of the Clay Unit, Smelterville Flats BLM Site Small-scale Study Area. Contour Interval = 1 foot.

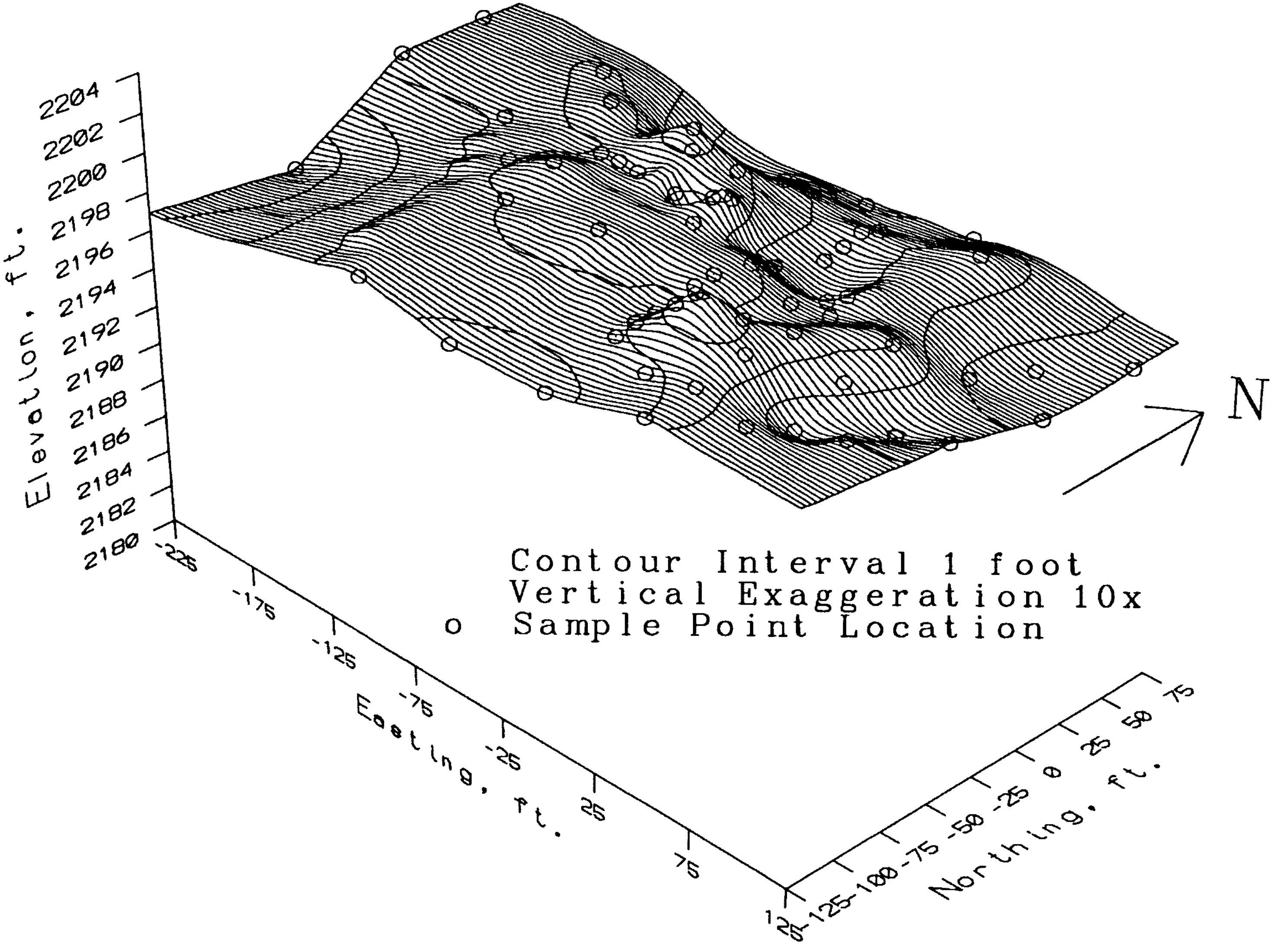


Figure 4.10. Contoured Surface Plot of the Top of the Clay Unit, Smelterville Flats BLM Site Small-scale Study Area.

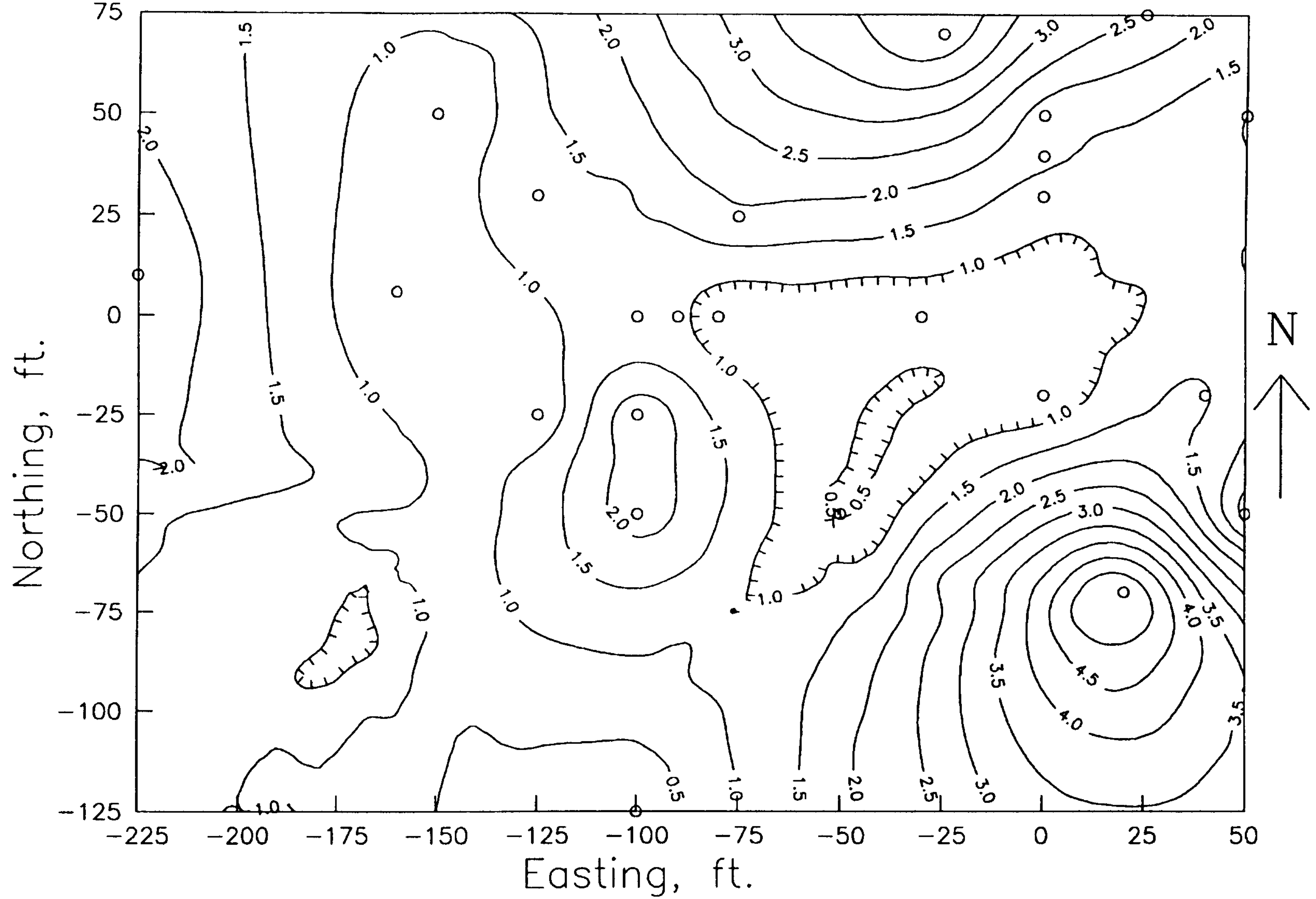


Figure 4.11. Isopach Map of the Clay Unit, Smelterville Flats BLM Site Small-scale Study Area. Contour Interval = 0.5 foot.

Organic Material

Organic material sampled in this study is of two principal types: 1) uncarbonized logs or wood chips that were encountered randomly in the stratigraphic column above the fluvial clays or gravels, or 2) a weakly to strongly carbonized "mat" of small twigs, leaves, and rootlets up to three inches thick. This organic matter commonly smells strongly of decay. This mat occurs at the contact between mine waste and fluvial sediments. This organic mat may reflect the pre-tailings impoundment erosional surface; if so it reflects the upper surface of the fluvial sediments. Figures 4.12 and 4.13 are a contour topographic map and a graphical surface plot, respectively, of the top of the organic mat with sample locations posted. Whether or not this organic material has been reworked by fluvial or erosional processes cannot be established. The mat does define a portion of what is thought to be a buried channel in the north-central part of the study area.

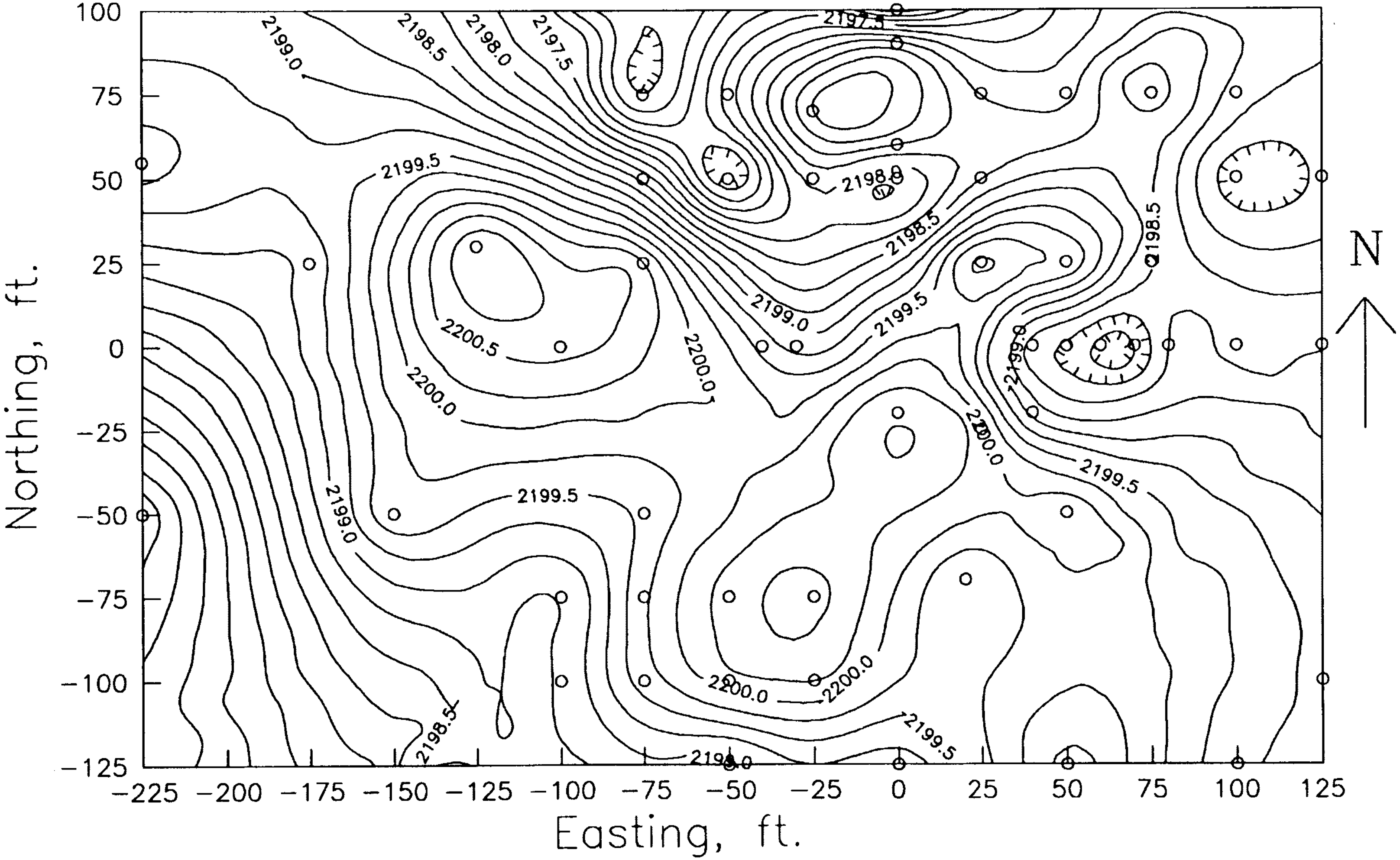


Figure 4.12. Contour Map of the Top of the Organic Layer, Smelterville Flats BLM Site Small-scale Study Area. Contour Interval = 0.25 foot.

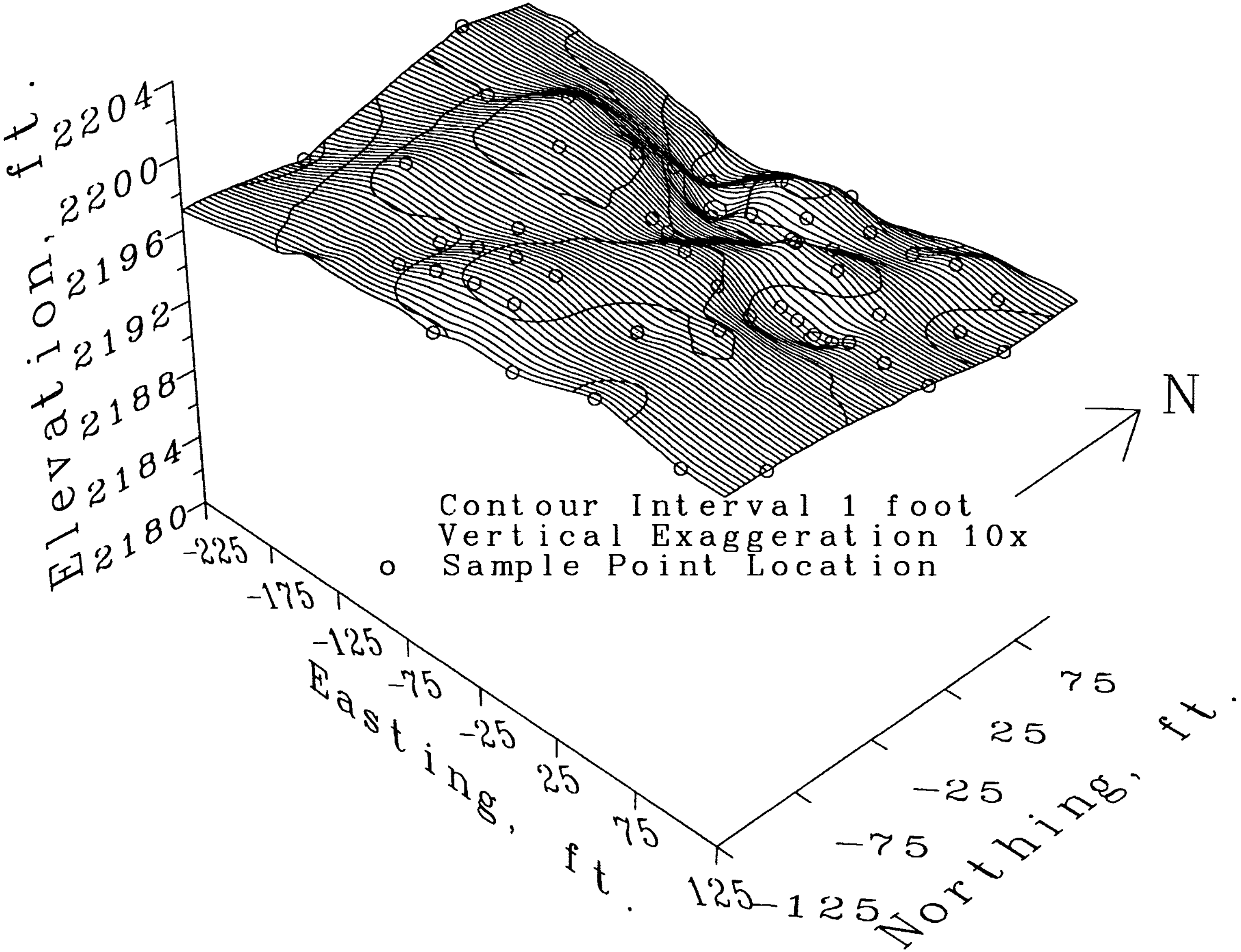


Figure 4.13. Contoured Surface Plot of the Top of the Organic Layer, Smelterville Flats BLM Site Small-scale Study Area.

Flotation Slimes

Figures 4.14 and 4.15 depict the top surface of the flotation slime unit in a contoured topographic map and a graphical plot of this surface, respectively, with sample hole locations posted. Figure 4.16 is an isopach map of the flotation slimes with thickness contours in feet. Sample hole locations also are posted. The flotation slimes are a flat lying, blanket-like deposit that apparently underlies the jig tailings conformably. The geometry of the flotation slime unit differs notably from that of the overlying jig tailings. To illustrate this characteristic, the top and bottom surfaces of the flotation slime unit are depicted together in Figure 4.17. Both upper and lower surfaces of the flotation slime unit exhibit more relief than the upper surface of the overlying jig tailing unit. This morphology is indicative of a subaqueous depositional regime, such as would be expected within an impoundment. The flotation slimes show pronounced thinning above underlying highs in the clay or gravel units. This property suggests that the flotation slime unit in the sample grid area was subjected to some subaerial erosion prior to the deposition of the overlying jig tailing unit. This unit is thinnest or absent in the west-central portion of the grid area; it thickens eastwards to the eastern grid boundary. This thickening is in contrast to the overlying jig tailing layer which thickens to the west, as discussed below.

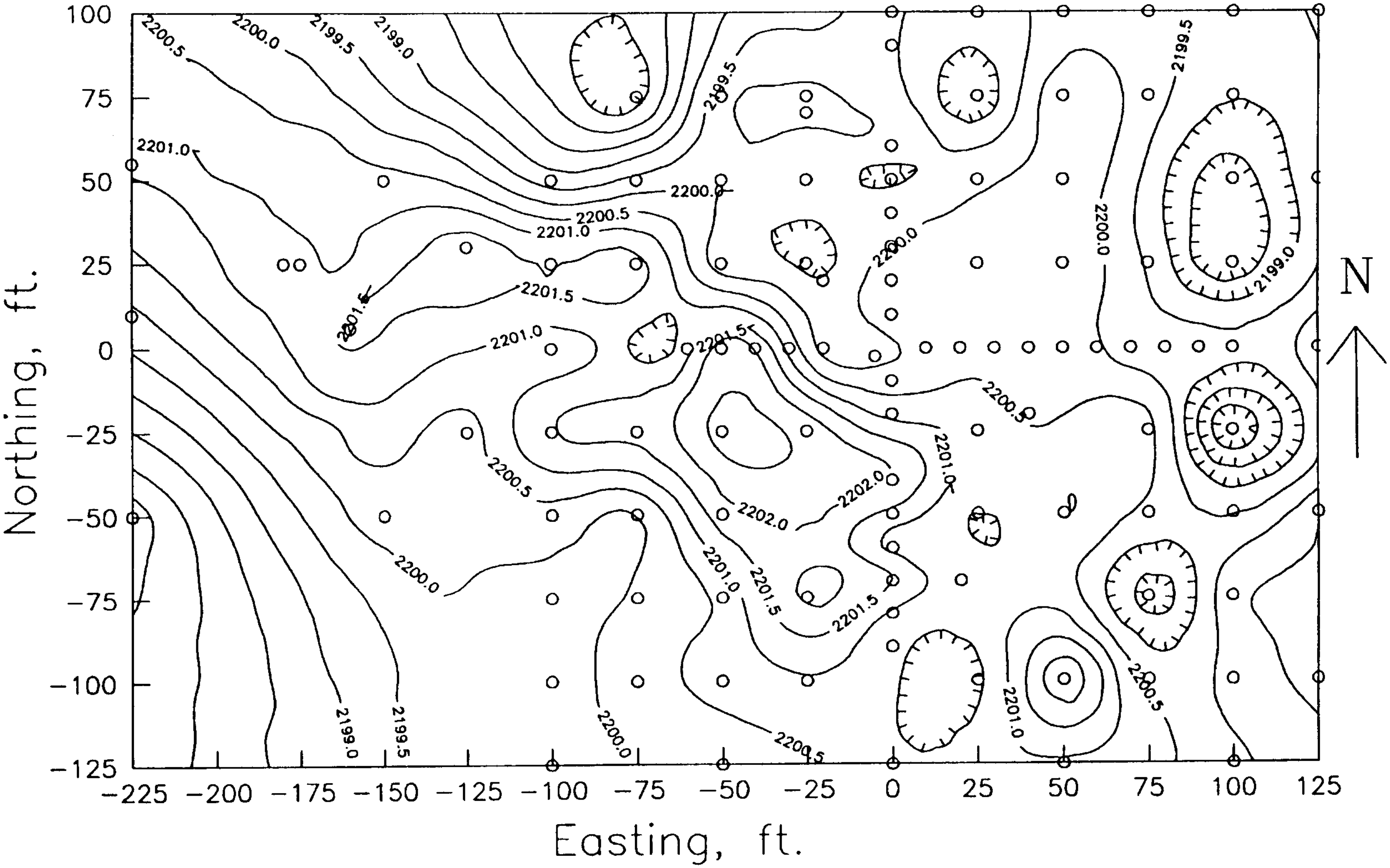


Figure 4.14. Contour Map of the Top of the Flotation Slimes, Smelterville Flats BLM Site Small-scale Study Area. Contour Interval = 0.5 foot.

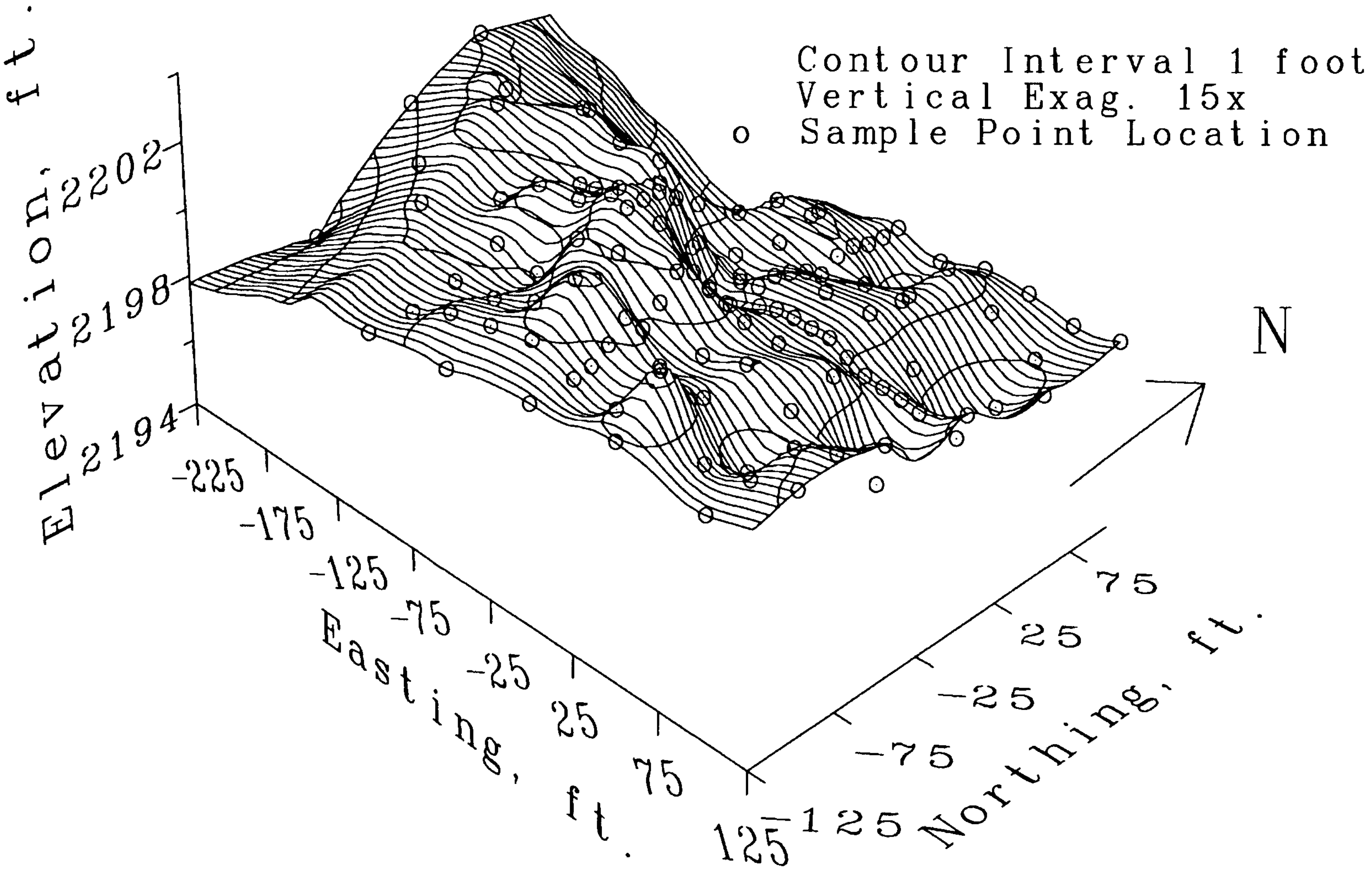


Figure 4.15. Contoured Surface Plot of the Top of the Flotation Slimes, Smelterville Flats BLM Site Small-scale Study Area.

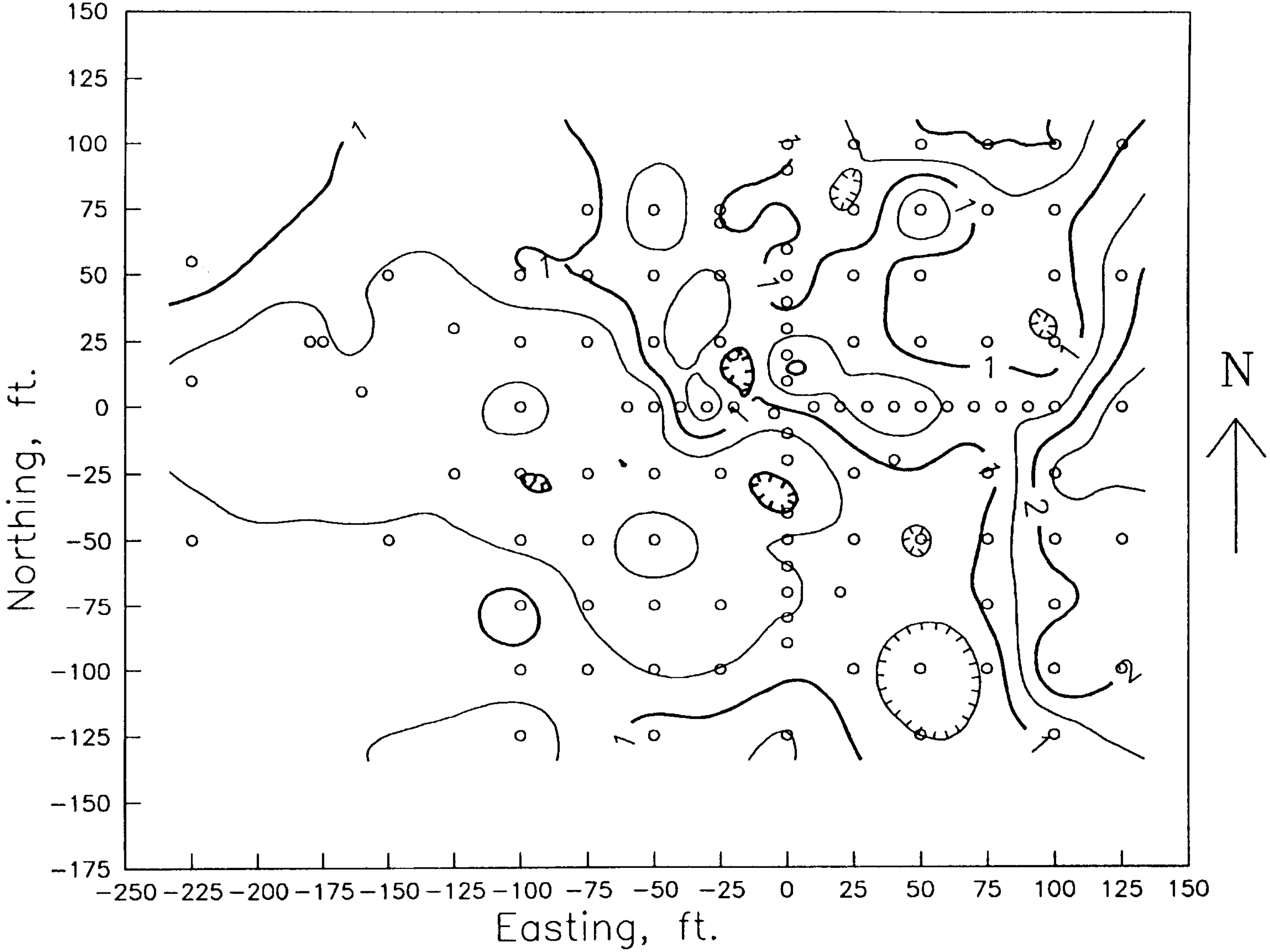


Figure 4.16. Isopach Map of the Flotation Slime Unit, Smelterville Flats BLM Site Small-scale Study Area. Contour Interval = 0.5 foot.

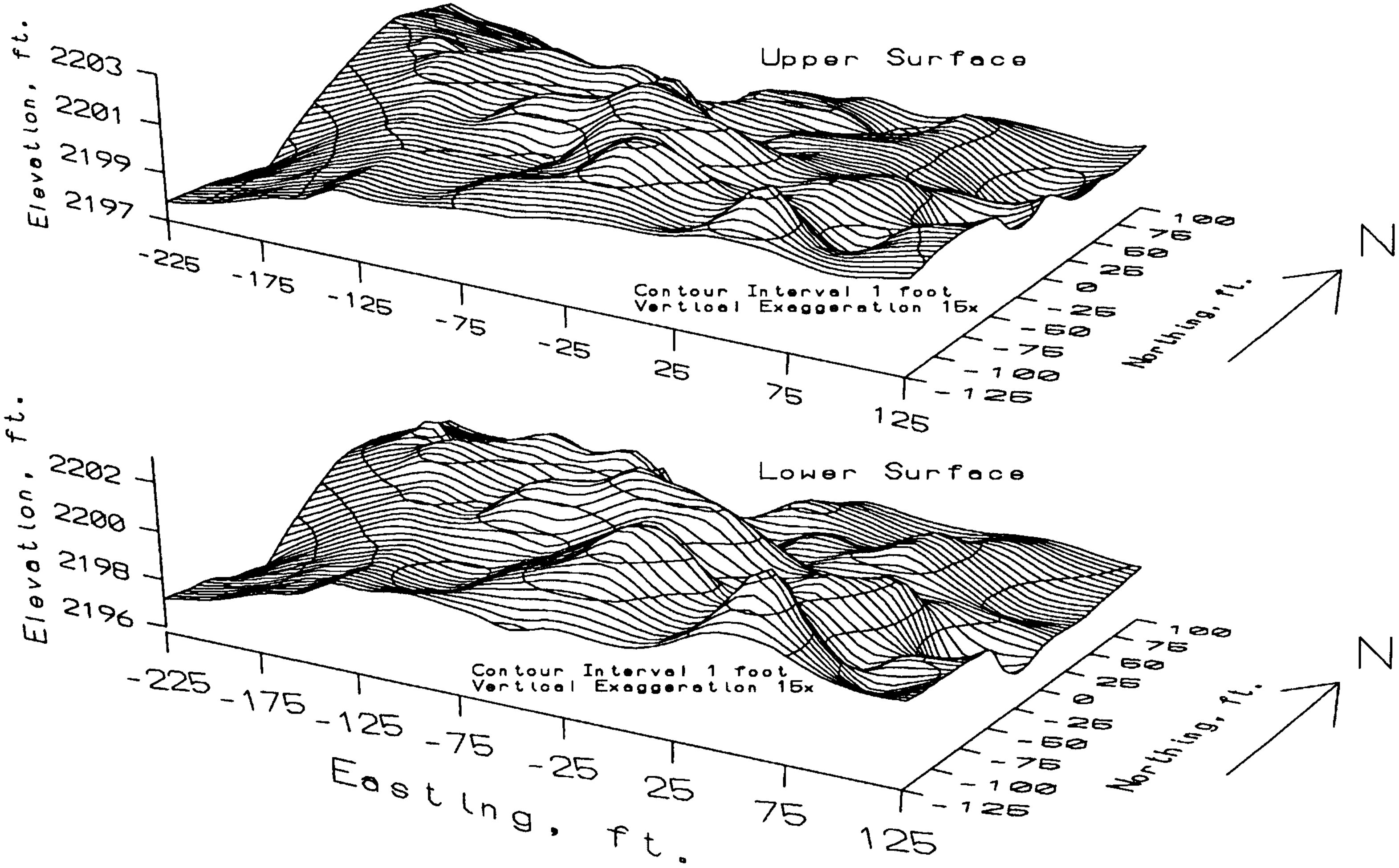


Figure 4.17. Contoured Surface Plot of the Top and Bottom of the Flotation Slimes, Smelterville Flats BLM Site Small-scale Study Area.

Jig Tailings

The upper surface of the jig tailings within the Small-scale Study Area on Smelterville Flats essentially defines land surface with cultural features removed (see Figures 4.1 and 4.2). Figure 4.18 is an isopach map of the jig tailings, with thickness contoured in feet, across the small-scale study area. Both figures have sample hole locations posted. The jig tailings are thinnest on the eastern edge and west-central portions of the sample area; they thicken to the west. At the four thicker regions in the eastern and central regions of the grid, 75N/25E, 25S/25W, 25N/100E, and 100S, the jig tailings fill depressions in the upper surface of the underlying flotation slimes. This westward thickening is evident in Figure 4.19, which is a multiple surface plot of the top and bottom surfaces of the jig tailings.

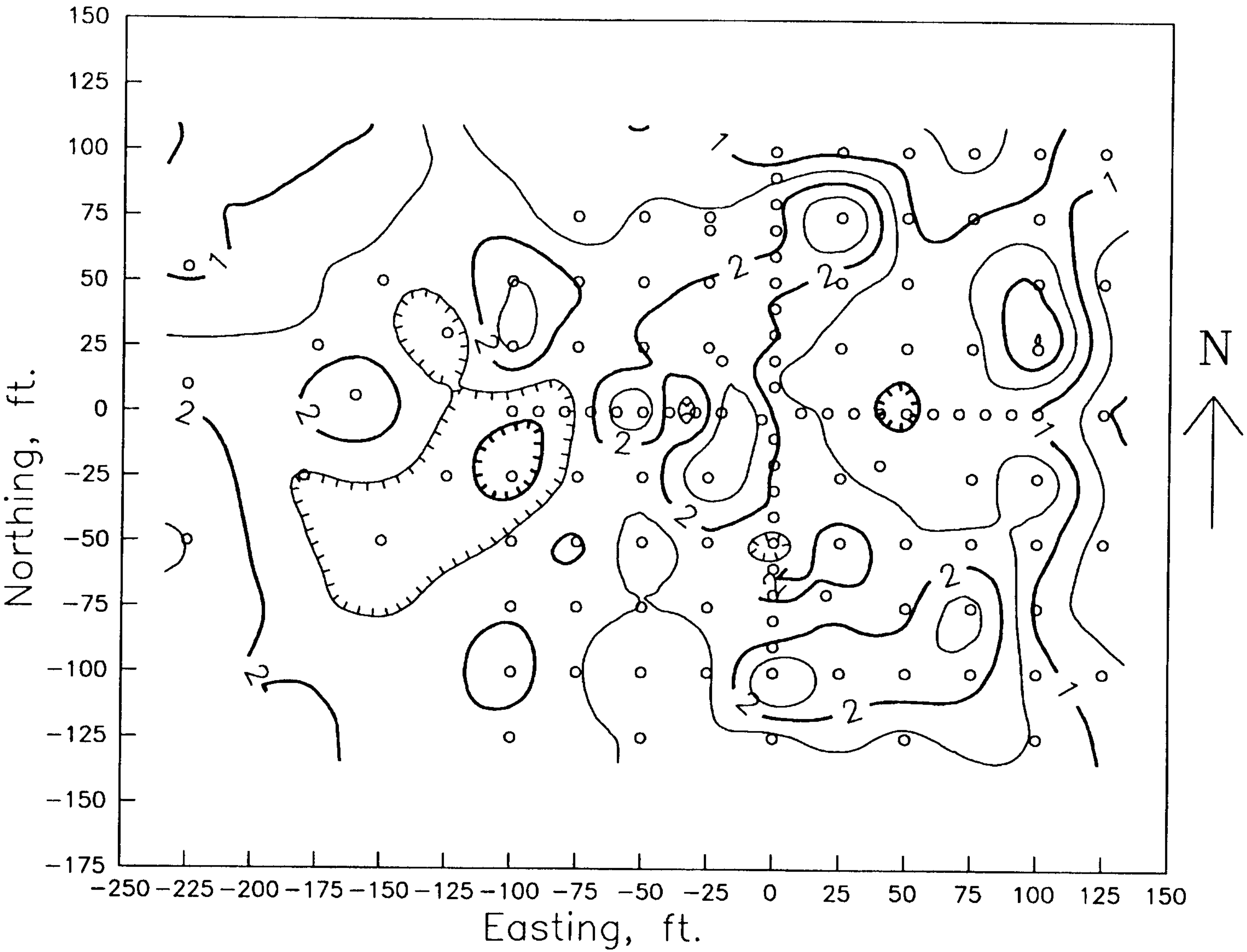


Figure 4.18. Isopach Map of the Jig Tailings Unit, Smelterville Flats BLM Site Small-scale Study Area. Contour Interval = 0.5 foot.

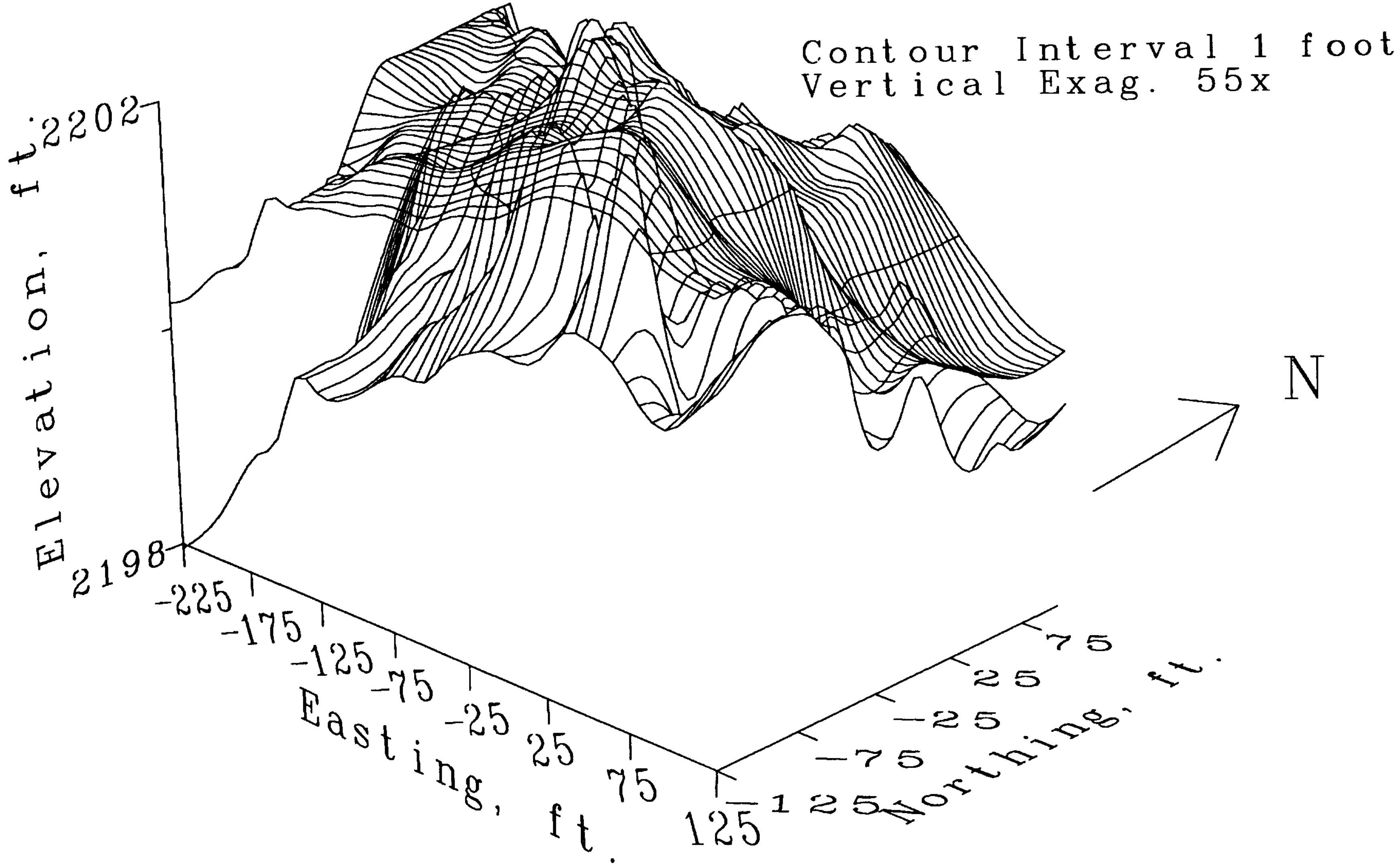


Figure 4.19. Contoured Surface Plot of the Top and Bottom of the Jig Tailings Unit, Smelterville Flats BLM Site Small scale Study Area.

In this study area, mine wastes apparently produced by a newer technology, i.e., chemical flotation, are overlain by mine waste produced by an older technology, i.e., gravity separation. This is a problem. The ultimate explanation will most likely have to take the following factors into account:

i) Possible sediment identification errors by this study:

ii) The production histories of the mine and mill wastes, including the phasing in of chemical flotation by local mills;

iii) "Younger" distal sediments deposited behind the dam subsequently overlain by "older" proximal sediments due to a change in gradient of the South Fork resulting from the destruction of the tailings dam;

iv) Reworking of the waste sediments by major storm or flood events such as occurred in January, 1973 or by the "mining" of the Smelterville Flats mine and mill wastes during World War II.

Statistical Characterization of the Sediments

Introduction

The following two sections address the validity of assumptions made in this study. The assumptions under scrutiny are:

i) That the split spoon sample data are not markedly differ from the auger sample data; and,

ii) That sediment Classes 1 through 10, inclusive, and Classes 11 and 12 are subdivisions of distinct sediment types, namely jig tailings and flotation slimes respectively.

These assumptions were derived from geologic field evidence and relations in combination with a preliminary examination of analytical assay results. Possibly different assumptions could be arrived at if a different (presumably random) set of samples were collected in the same fashion, or if someone with different training or experience were to collect and analyze the data. These two assumptions are tested using separate statistical techniques: Exploratory Data Analysis and Analysis of Variance.

Statistical Appraisal of the Split Spoon vs. Auger Sample Data

About 15 % (17 of 115) of the jig tailings samples and 18% (12 of 68) of the flotation slime samples in this study were collected by split spoon corer. The split spoon samples were approximately one-quarter the volume of the auger samples. The size of samples, i.e. sample support, can have a strong control over the quality and types of estimations that can be made from a given sample set (Isaaks and Srivastava, 1989). Of concern was what effect this change in sample support would have on the data quality and on subsequent analyses. A sample volume equaling that of the volume to be estimated would be statistically optimal. However, this would be neither practical nor cost-effective. This section will utilize two methods of statistical Exploratory Data Analysis (EDA) to confirm the assumption that the split spoon samples do not differ geochemically from the auger samples.

Statistical descriptors for the split spoon samples and the hand auger samples of the two major types of mine wastes are given in Tables 4.3 and 4.4. Similarities or differences between the two sets of data are not readily apparent from this tabulation. Relative frequency plots are a convenient method of comparing data sets postulated to come from the same population. Sample sets obtained from the same population should have similarly shaped histograms. The area under relative frequency plots equals one, facilitating the comparison of unequal sized sample sets.

The number of observations in each class interval in a relative frequency plot is divided by the number **n** of observations in the data set. Thus each class interval contains the proportion of that data set falling into that class. As the number of observations increases, the sample distribution more closely approximates the population distribution from which it is drawn (Devore, 1991). At some

Table 4.3. Summary Statistics of Split Spoon and Hand Auger Samples: Jig Tailings.

Summary Statistic	Split Spoon Samples		Hand Auger Samples	
Jig Tailings	**Zn**	**Pb**	**Zn**	**Pb**
n, Total Number	17	17	98	98
$\bar{x}$, Sample Mean	1.002	1.816	.746	1.982
s^2, Spl. Variance	.299	.381	.089	.219
s, Spl. Std. Dev.	.547	.617	.298	.468
% C.V.	54.627	33.968	39.946	23.589
Minimum	.251	.191	.220	.233
25th %	.551	1.505	.559	1.670
Median	.803	1.898	.704	1.979
75th %	1.332	2.001	.852	2.314
Maximum	2.149	2.980	1.819	2.954

Table 4.4. Summary Statistics of Split Spoon and Hand Auger Samples: Flotation Slimes.

Summary Statistic	Split Spoon Samples		Hand Auger Samples	
Flotation Slimes	**Zn**	**Pb**	**Zn**	**Pb**
n, Total Number	12	12	56	56
$\bar{x}$, Sample Mean	1.742	2.095	1.852	2.208
s^2, Spl. Variance	.609	.257	.999	.293
s, Spl. Std. Dev.	.780	.507	1.000	.541
% C.V.	44.781	24.193	53.978	24.504
Minimum	.382	1.033	.263	.082
25th %	.803	1.928	1.220	2.004
Median	2.088	2.149	1.732	2.238
75th %	2.329	2.288	2.230	2.523
Maximum	2.541	3.040	5.046	3.199

arbitrarily large value of **n** the relative frequency in a class approaches a limiting value, the **limiting relative frequency**, which can be assigned a probability. The greater the **n**, the "smoother" the histogram, and for the case of a continuously distributed random variable, such as sediment metal content, the closer it approximates the probability density function for that population.

Relative frequency histograms comparing the two collection methods for the jig tailing unit are shown in Figure 4.20, and for the flotation slime unit in Figure 4.21. It is clear from Figure 4.20 that the shapes of the split spoon histograms, even with only one fifth the **n** of the auger samples, closely mimic the shapes of auger histograms for both zinc and lead. This resemblance is strong evidence to support the assumption of similarity of collection techniques within the jig tailings.

The comparison is less definitive in the case of the flotation slime unit. In Figure 4.21 (c) and (d) the histograms for lead content are very similar. Keep in mind the low **n** value for the split spoon plot. Most of the probability "mass" is "piled up" in both plots between 2 and 2 1/2 weight percent lead. Note that these histograms also resemble those for the jig tailings (Fig. 4.20 (c) and (d)). Most of the probability again is near 2 weight percent in the zinc plots in Figure 4.21 (a) and (b).

Taking both the low **n** value of the split spoon plot and the difference in x-axis scaling between the two plots into

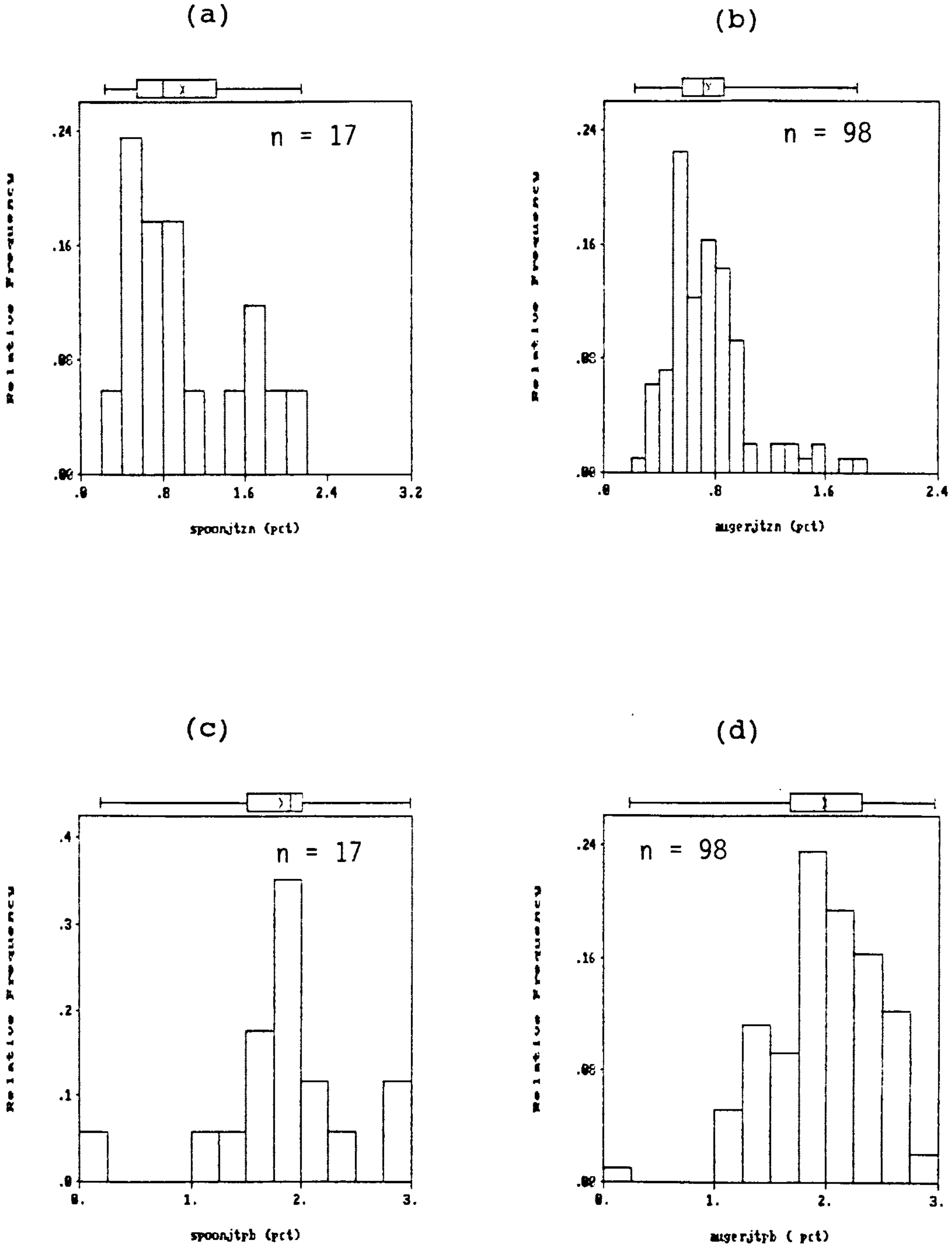


Figure 4.20. Relative Frequency vs. Zinc Content Histograms in Jig Tailings for Split Spoon Samples (a) and Auger Samples (b), and Relative Frequency vs. Lead Content Histograms for Split Spoon Samples (c) and Auger Samples (d).

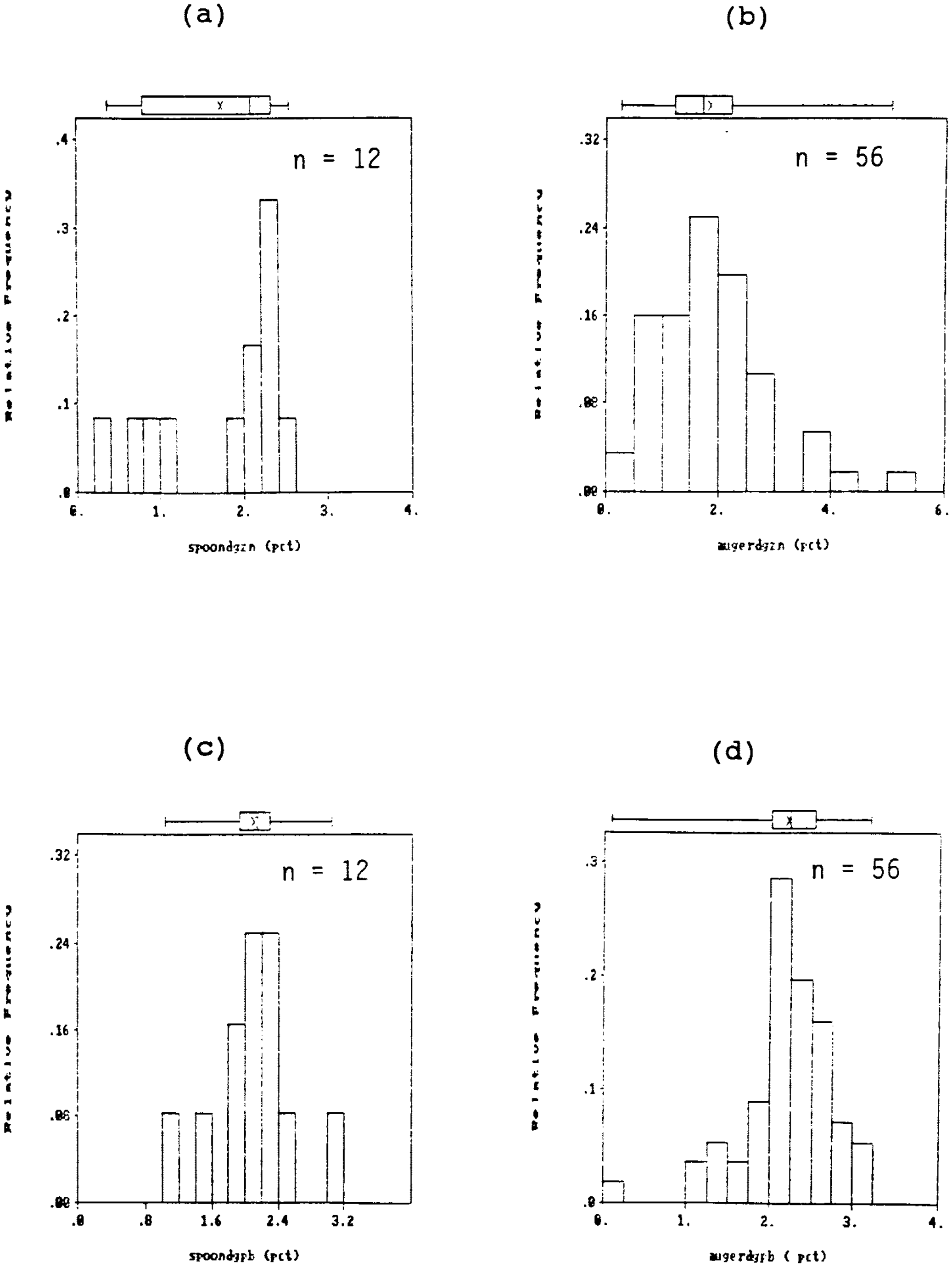


Figure 4.21. Relative Frequency vs. Zinc Content Histograms in Flotation Slimes for Split Spoon Samples (a) and Auger Samples (b), and Relative Frequency vs. Lead Content Histograms for Split Spoon Samples (c) and Auger Samples (d).

consideration, the major difference between these two plots is the greater variability of the high values in the hand auger sample data set. This is graphically illustrated by the box plots above the histograms. This greater range of sample values produces a sample variance for the auger sample set 60% larger than for the split spoon set: 0.999 wt.$\%^2$ zinc vs. 0.609 wt.$\%^2$ zinc. Yet other statistical descriptors such as the mean, median, and quartile values appear similar for the two data sets (Table 4.4). Although the two histograms vary somewhat in shape, this is not sufficient evidence alone to disprove that the two sample sets are related.

An EDA evaluation method that is not sensitive to outliers is the Q-Q plot. In a Q-Q plot, the 25th, 50th, and 75th quartiles for two sample sets are plotted against each other. The closer they plot to the 45° line, assuming the axes are the same scale, the more similar the distributions of the sample sets are to each other. Figure 4.22 presents Q-Q plots for the lead and zinc data for the two sediment types. Minimum and maximum values are also plotted to illustrate outliers. Figure 4.22 (c) compares the distributions of zinc content for the two sampling methods in the flotation slimes plot. The quartile values plot close to the 45° line and the effect of the maximum value is pronounced. The only Q-Q plot that does not exhibit linear behavior is zinc in the jig tailings (Figure 4.22 (a)). The 25th and 50th quartiles plot close to unity, but the 75th quartile for the split spoon

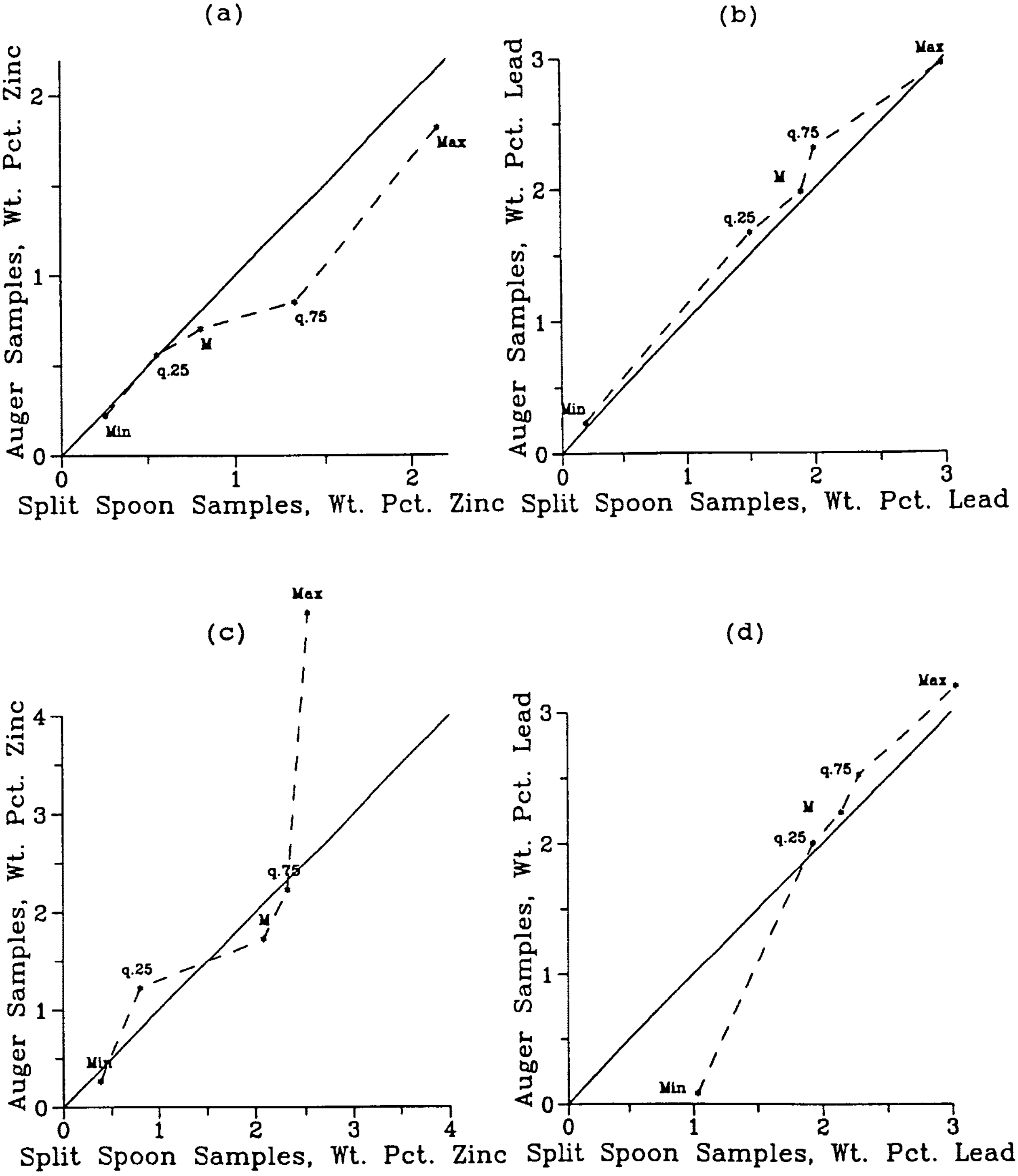


Figure 4.22. Q-Q Plots of Metal Content in Weight Percent in Split Spoon Samples vs. Auger Samples: Zinc Content in Jig Tailings (a), Lead Content in Jig Tailings (b), Zinc Content in Flotation Slimes (c), and Lead Content in Flotation Slimes (d). All axes are in weight percent.

sample set is markedly larger than that of the auger samples. Referring back to the relative frequency plot in Figure 4.20 (a), the additional relative frequency that increases the $q^{.75}$ value of the split spoon sample set is represented by just two observations: one in the 1.8 - 2.0 weight percent class and the other in the 2.0 - 2.2 weight percent class. This is an example of statistical significance not having much practical significance. Errors such as in analytical method, (described elsewhere herein), or reporting or recording analytical results have a much greater practical significance than two observations out of a total of 17. In summary, these EDA techniques strongly validate the assumption that there is no statistical difference between samples collected by the split spoon or the auger method.

Statistical Appraisal of the Sediment Class Data

As mentioned previously, physically similar sets of waste sediment samples could be tentatively grouped or separated by geochemical signature. To check the validity of the perceived physical and geochemical similarities and differences between the sediment classes more objectively, an Analysis of Variance (ANOVA) of the sediment assay means was done with SAS. As the assay data are log-normally distributed, the statistical tests discussed herein are performed on the natural log transform of the assay data. Sediment class group means were compared as were within-group means. Relative frquency histograms of the sediment class assays and the SAS output of all tests and comparisons discussed in this section comprise Appendix IV.

Table 4.5 presents single-factor or one-way ANOVA results for comparing the natural log of lead and zinc assays for waste sediment classes 1 through 10, the "jig tailings". The hypothesis being tested is: Are the means of the metal assays for these classes equal? The P-value given in column 6 is the smallest level of significance at which the null hypothesis, (which states in this case that they are equal), would be rejected when a specified test procedure is used (Devore, 1991). If the P-value is less than or equal to the level of significance chosen for a test, the null hypothesis is rejected. If the P-value is greater than the level of significance chosen for a test, the null hypothesis is not rejected. Thus at significance level, $\alpha = 0.01$, the null

Table 4.5. ANOVA Table for Sediment Classes 1 Through 10.

Dependent Variable: Lead				
Source	DF	Sum of Squares	F Value	Pr > F
Model	9	2.11820301	1.82	0.0735
Error	105	13.59690796		
Corrected Total	114	15.71511098		
Dependent Variable: Zinc				
Model	9	2.37210874	1.60	0.1258
Error	105	17.33890407		
Corrected Total	114	19.71101281		

hypothesisis is not rejected for both lead and zinc. In other words, the lead and zinc assays by class are not significantly different.

The P-value conveys information about the strength of evidence for rejection of the null hypothesis, regardless of the significance level chosen. (The consequences of making an error in either rejecting or not rejecting the null hypothesis must be considered when selecting a significance level). It is clear that the P-value for lead, 0.07, is markedly less than that for zinc, 0.12. This effect is graphically evident from the wider scatter of assay values for lead than zinc in Figures 4.4 and 4.5.

To clarify the lead assay findings above, several simultaneous comparison tests were then done in SAS. It is clear from these tests that regardless of the comparison test used, when ranked from lowest to highest, the means for the ten classes are not significantly different from their neighbors. The means span a range of values where, depending on the test employed, the end members may or may not significantly differ. The statistical difference in lead values between some of these sediments might reflect differences in depositional or weathering histories for those sediments, or more simply by small sample sizes in some of the sediment classes. But within the scope of this study, this is another example of statistical significance having little practical significance.

Sediment classes 11 and 12 were tested in a similar manner to sediment classes 1 through 10. The ANOVA results are reported in Table 4.6. The P-values indicate that the two sediment classes are not significantly different in lead or zinc content for significance levels less than about 0.16.

Table 4.6. ANOVA Table for Sediment Classes 11 and 12.

Dependent Variable: Lead				
Source	DF	Sum of Squares	F Value	Pr > F
Model	1	0.42846878	2.00	0.1625
Error	65	13.95153176		
Corrected Total	66	14.38000054		
Dependent Variable: Zinc				
Model	1	0.19502130	0.52	0.4746
Error	65	24.50287324		
Corrected Total	66	24.69789454		

Having demonstrated that the sediments comprising the "jig tailing" and "flotation slime" units are internally consistent, it remains to compare them to each other. Table 4.7 depicts the ANOVA results for this comparison test. It is clear from the P-values in column 6 of Table 4.8 that the two groups of sediments are very significantly different with regard to zinc content. The jig tailing and flotation slime lead assays do not significantly differ for significance levels less than about 0.1. Inspection of Figures 4.4 and 4.5

Table 4.7. ANOVA Table for Jig Tailings and Flotation Slimes.

Source	DF	Sum of Squares	F Value	Pr > F
Dependent Variable: Lead				
Model	1	0.42911030	2.57	0.1109
Error	180	30.09511152		
Corrected Total	181	30.52422181		
Dependent Variable: Zinc				
Model	1	26.35070763	106.81	0.0001
Error	180	44.40890735		
Corrected Total	181	70.75961498		

make these results less than surprising. The very different origin of these sediments make these results curious. The jig tailings are a by-product of gravity separation, whereas the flotation slimes derive from a more efficient ore-beneficiation technique.

Geochemical Characterization of the Sediments

Metals Distribution Within the Alluvial / Fluvial Sediments

The alluvial/fluvial sediments, including the aforementioned organic materials, are very low in lead and zinc content except where contaminated by close proximity to mine and mill wastes. The alluvial sediments most strongly contaminated with lead and zinc are the portions of those materials nearest the overlying mine waste materials. This contamination decreases from percent levels to ppm levels within the upper two feet of the alluvial layer. The organic material, (Class 17), most commonly overlies alluvial clay and gravel but it frequently occurs locally intercalated with waste units. The lead and zinc content of this organic material is a function of the local concentrations of the mine waste hosting it.

Metals Distribution Within the Jig Tailing Unit

Lead and zinc contents of the jig tailings unit are not dependent on sediment thickness. Figures 4.20 and 4.21 are graphs of lead and zinc content, respectively, versus jig tailing thickness. Data values are for all 108 sample locations within the small-scale study area where the jig tailings unit was encountered (Figure 4.18). The average jig tailings thickness and lead and zinc content are 1.69 feet, 1.97%, and 0.78% respectively. The metals content of the jig tailings is relatively uniform across the sample grid. Figures 4.22 and 4.23 are contour maps of lead and zinc content, respectively, by weight percent for the jig tailings unit.

The reader is reminded that map contour lines may be misleading, especially in areas between widely separated samples. The contours imply a correlation between (ostensibly neighborhood) sample metal content and metal content at the contour line location.

SURFER®, by Golden Software, Inc. was used to produce the contour maps in this study. It utilizes kriging in its contouring routine. Kriging is a spatial interpolator that takes into account the spatial distribution as well as the values of a set of samples. Kriging is regularly tailored to a data set by quantifying parameters such as nugget effect, directionality, and range of influence in the model variogram it uses to predict (map) data values in areas not sampled. The default model variogram within SURFER® is a 0 nugget, omnidirectional, linear model variogram (Golden Software, Inc., personal communication). The software variogram cannot be customized. The greatest effect of this difference in model variograms on estimated values will be observed in areas of sparse or no sampling (where any estimation procedure loses rigor). The primary purpose of the isoconcentration maps in this sediment study is to present large sets of data. Contour maps can convey general relations among data locations more clearly than simple post plots.

The metal content of the mine wastes on Smelterville Flats has been shown to exhibit spatial dependence (Smith and Swanson, 1992). This dependence is less predictable in regions between widely spaced sample locations. No assumptions about the spatially dependent nature of the metals content of the waste sediments are implied by these maps or this study.

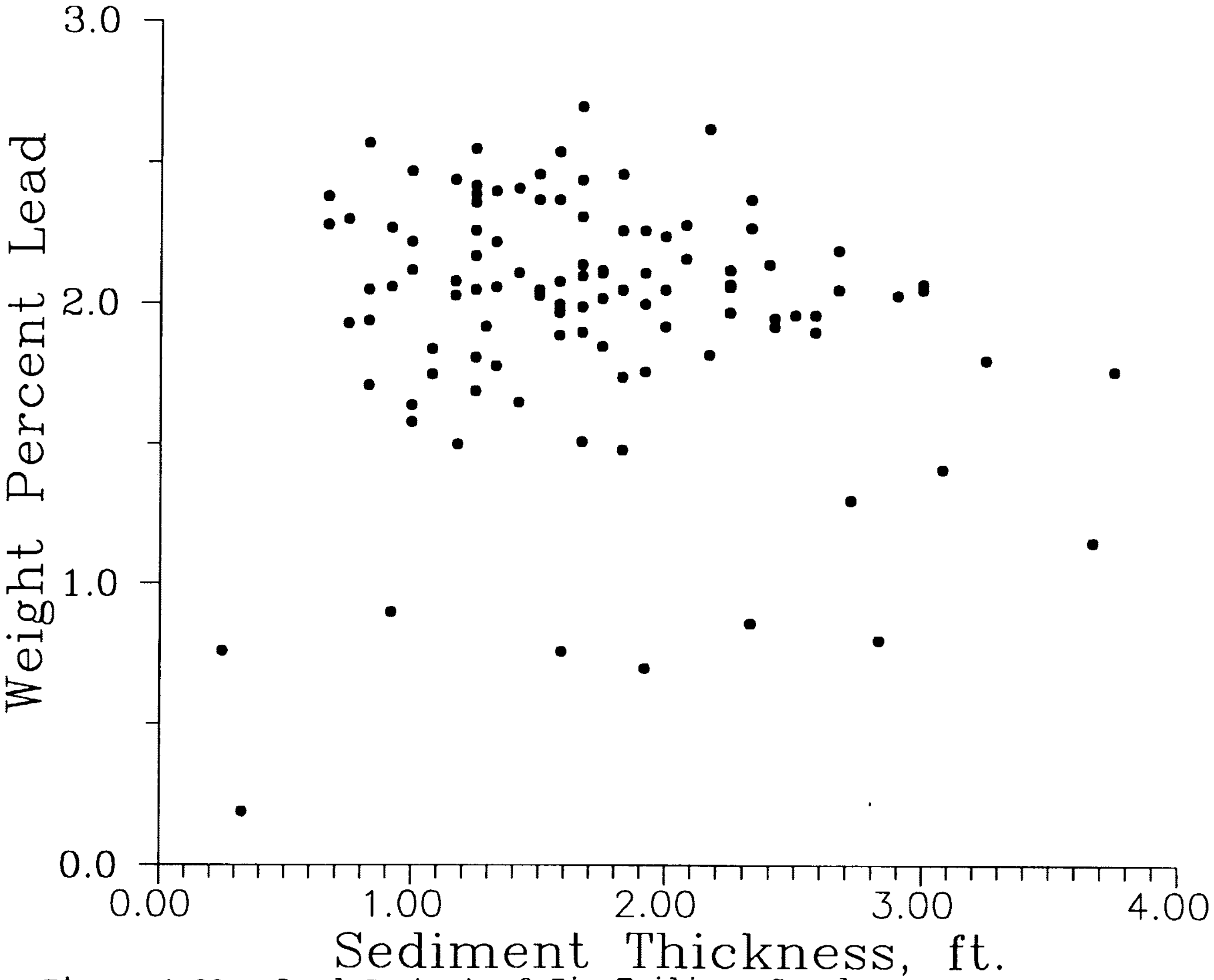


Figure 4.23. Lead Content of Jig Tailings Samples vs. Sediment Thickness, Smelterville Flats BLM Site Small-scale Study Area.

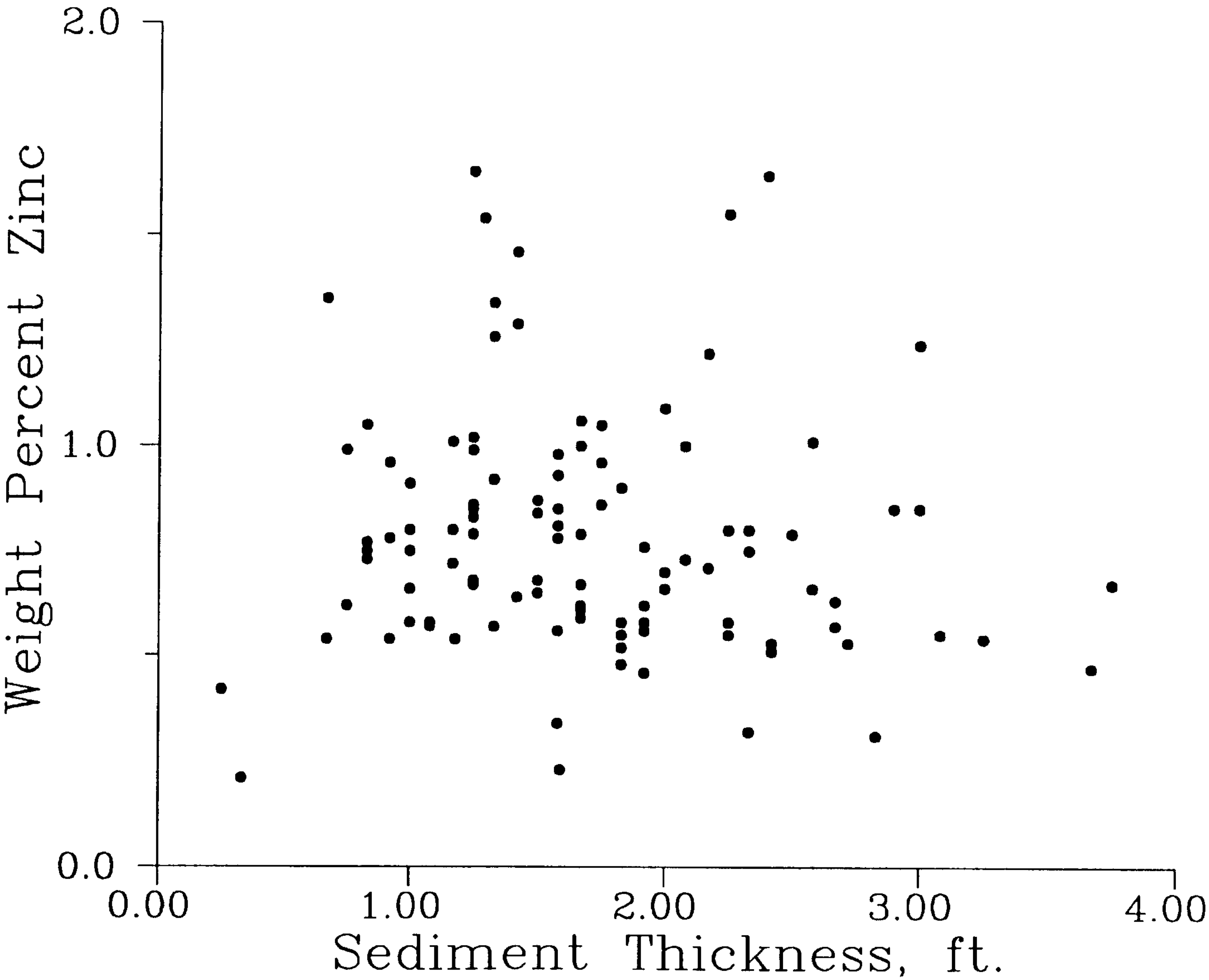


Figure 4.24. Zinc Content of Jig Tailings Samples vs. Sediment Thickness, Smelterville Flats BLM Site Small-scale Study Area.

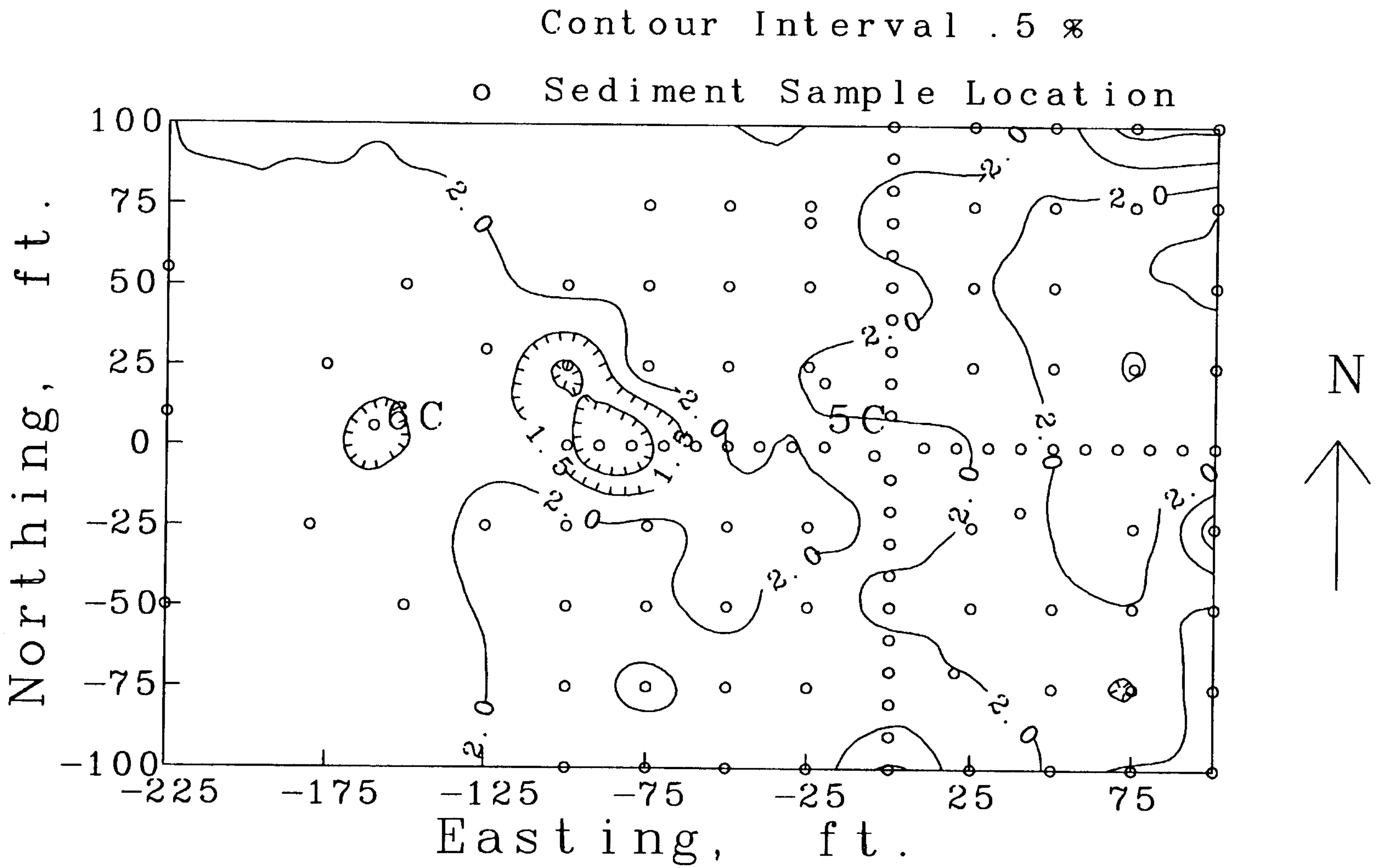


Figure 4.25. Contour Map of Lead Content in Weight Percent, Jig Tailings Unit, Smelterville Flats BLM Site Small-scale Study Area.

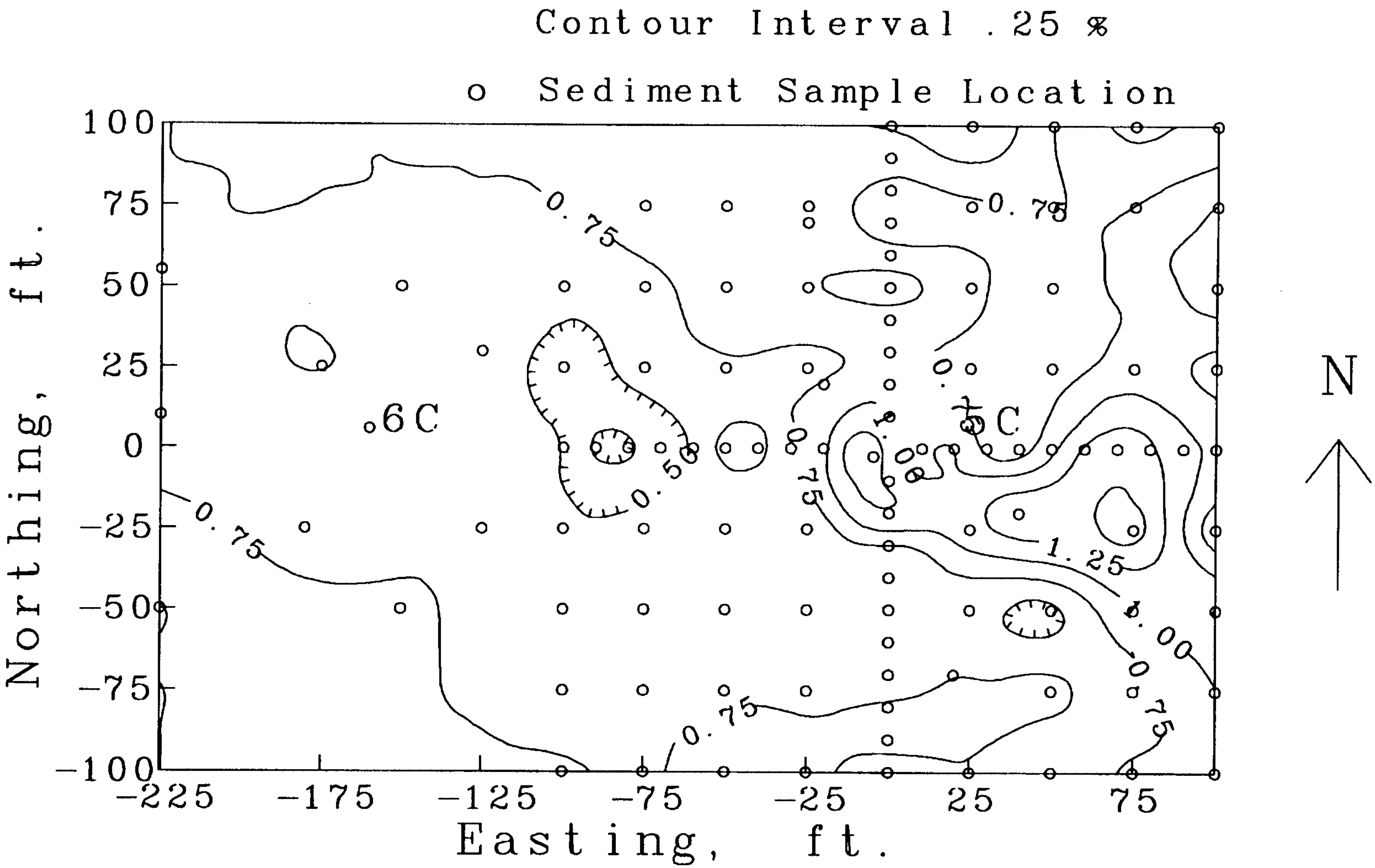


Figure 4.26. Contour Map of Zinc Content in Weight Percent, Jig Tailings Unit, Smelterville Flats BLM Site Small-scale Study Area.

Metals Distribution Within the Flotation Slime Unit

The flotation slime unit was encountered and sampled at 84 locations within the small-scale study area (see Figure 4.16). No correlation is obvious between the thickness of the flotation slime unit and its content of metals. Figures 4.24 and 4.25 are plots of lead and zinc content by weight percent, respectively, against sediment layer thickness for the flotation slimes at these locations. Average flotation slime thickness, and lead and zinc content are 1.02 feet, 2.66% and 2.02%, respectively. Average lead and zinc contents are higher in the flotation slimes than in the jig tailings. Figures 4.26 and 4.27 are contour maps of lead and zinc content by weight percent, respectively, for the flotation slimes. As shown by Figure 4.17, the flotation slimes unit thins or pinches out in the west-central portion of the sample grid. In this regard, the contour map of the average metals content by weight percent is somewhat misleading because information (i.e., the contours of metal content) is carried through regions that contribute little or no data to the plot.

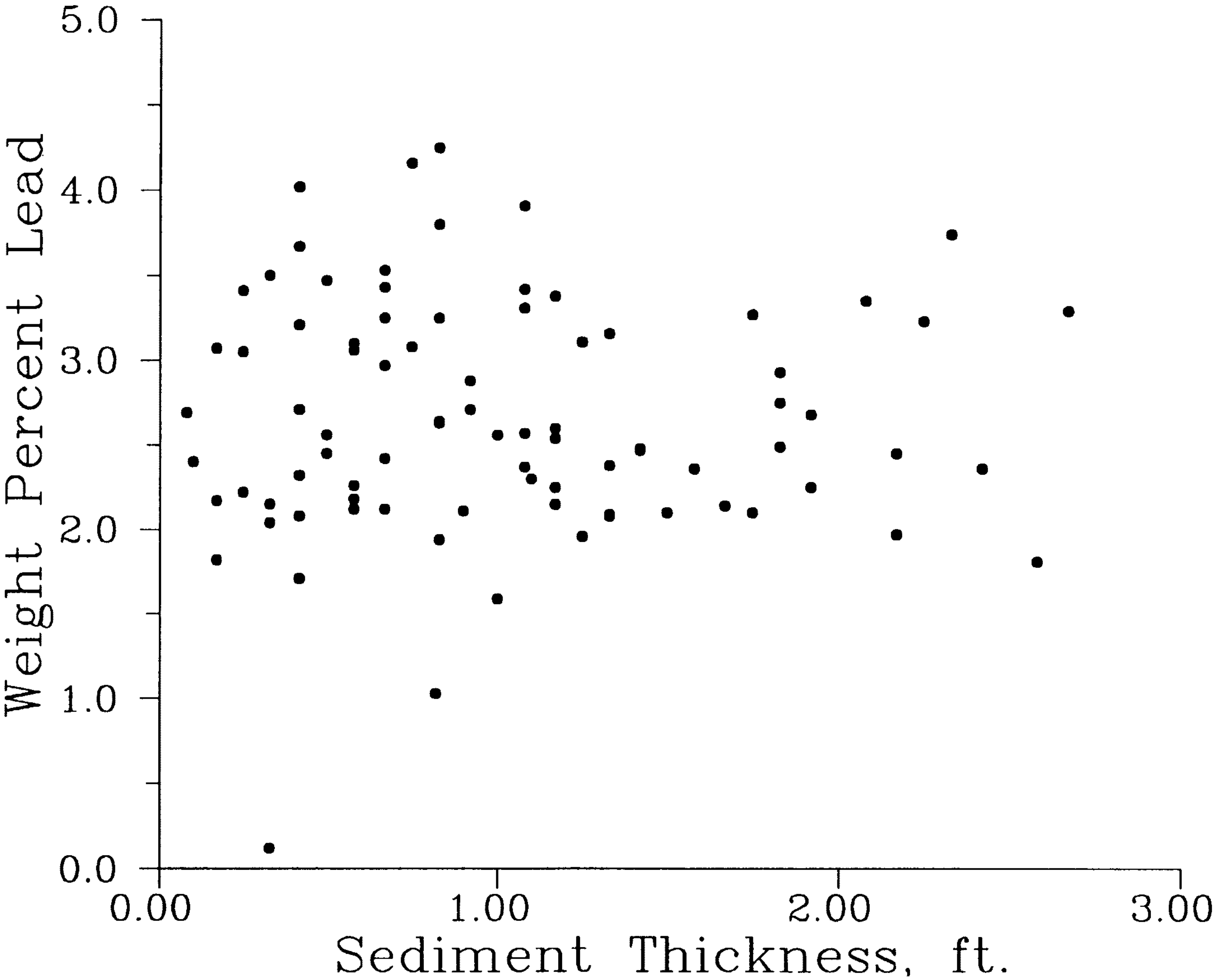


Figure 4.27. Lead Content of Flotation Slimes Samples vs. Sediment Thickness, Smelterville Flats BLM Site Small-scale Study Area.

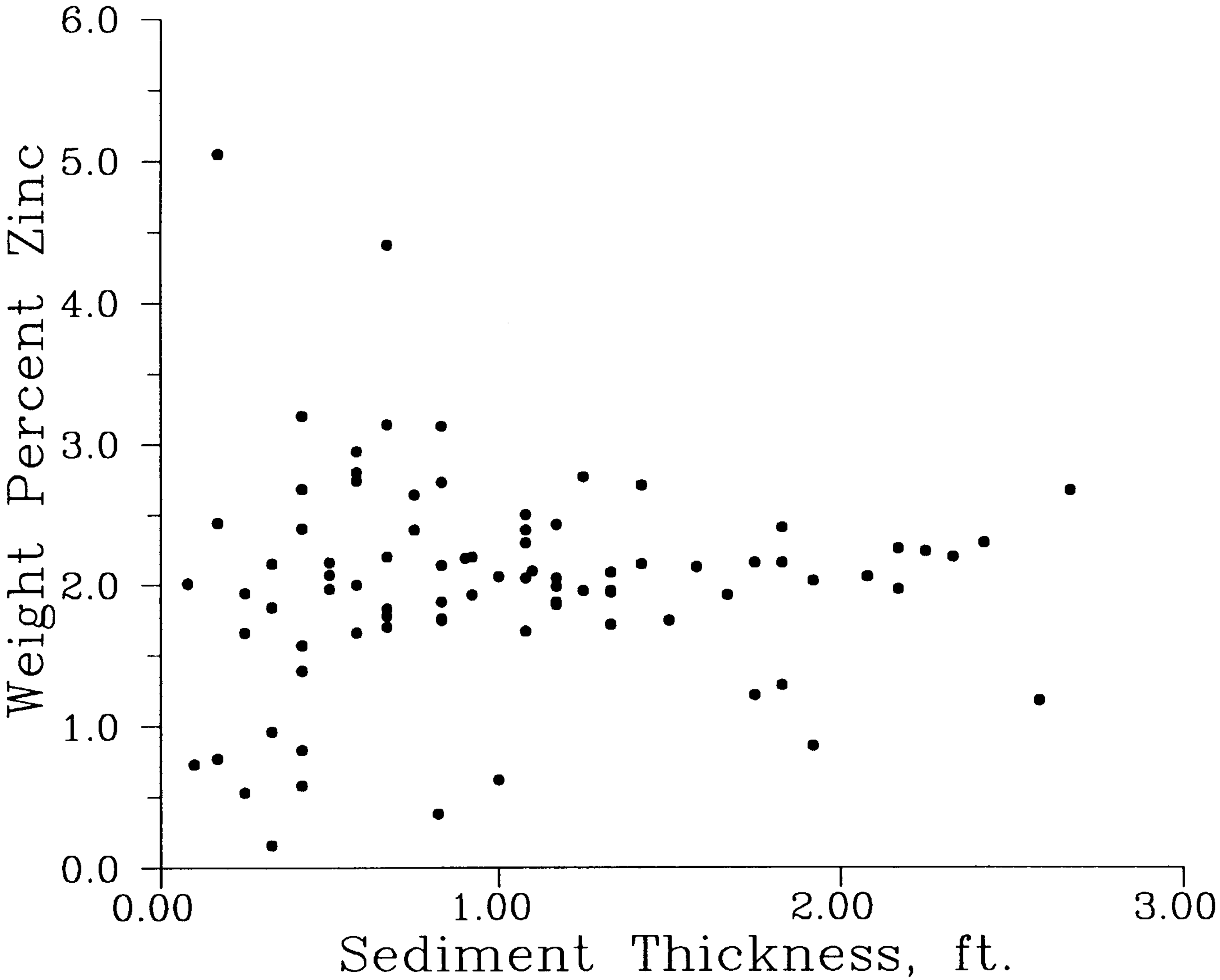


Figure 4.28. Zinc Content of Flotation Slimes Samples vs. Sediment Thickness, Smelterville Flats BLM Site Small-scale Study Area.

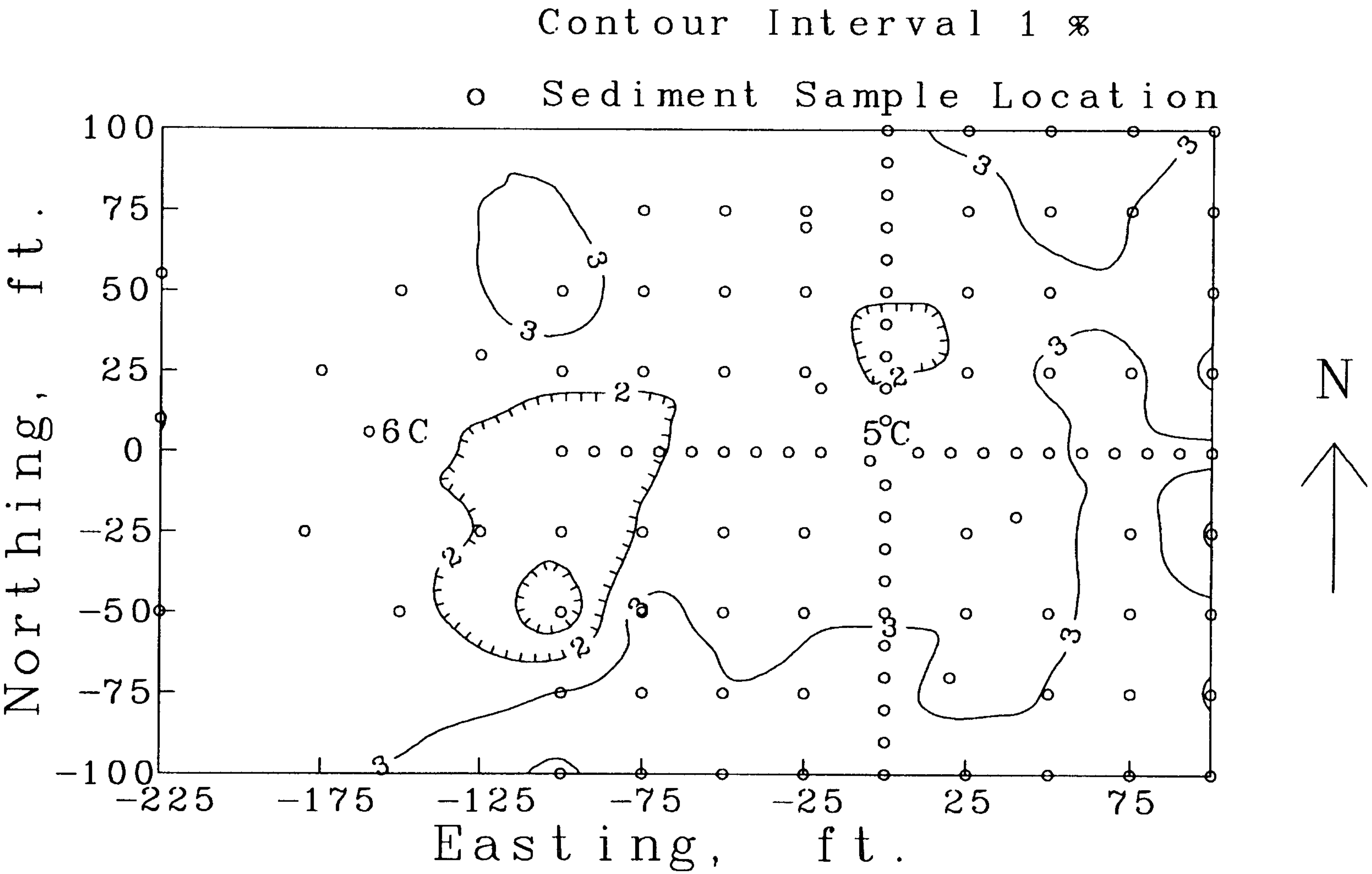


Figure 4.29. Contour Map of Lead Content in Weight Percent, Flotation Slimes Unit, Smelterville Flats BLM Site Small-scale Study Area.

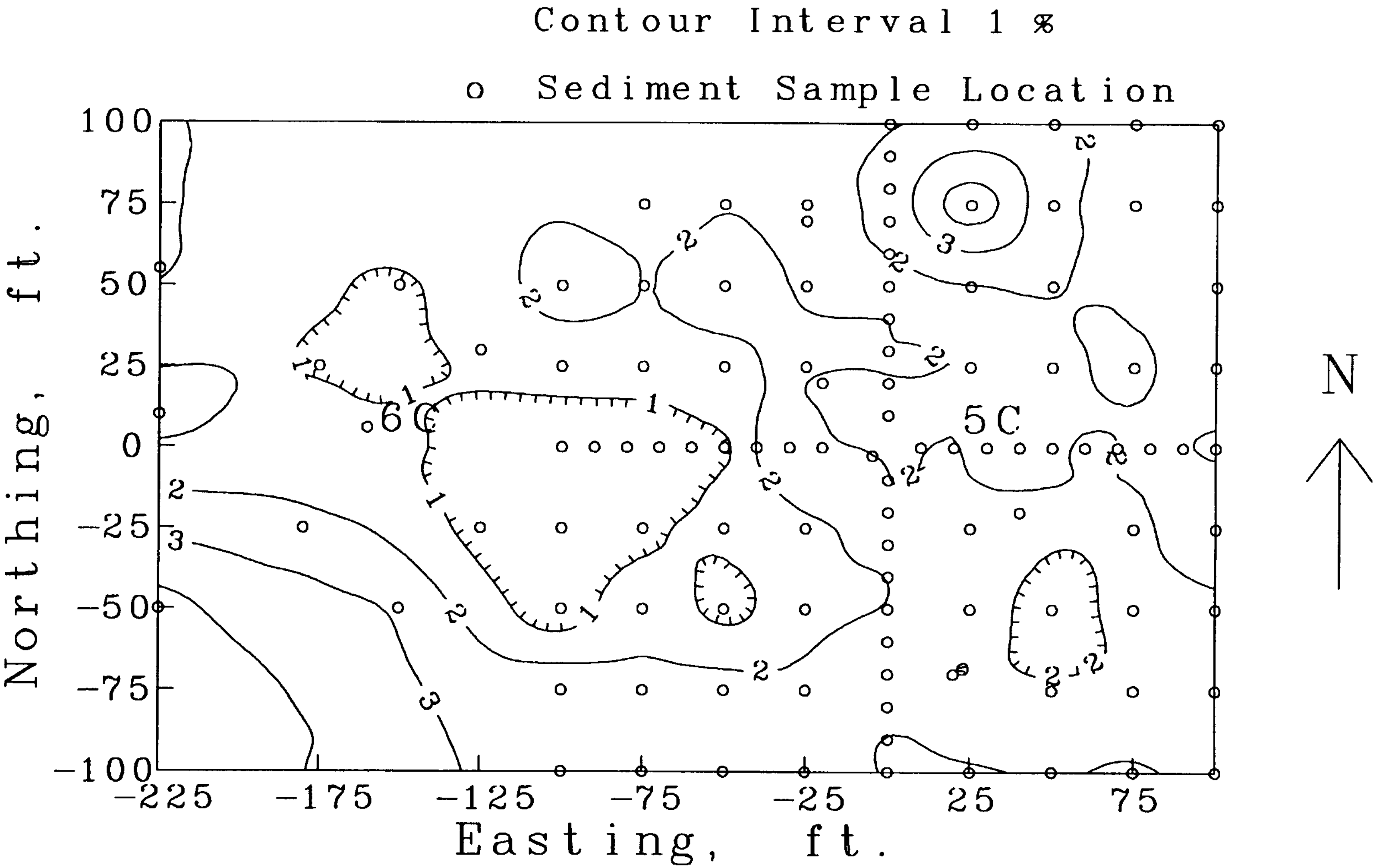


Figure 4.30. Contour Map of Zinc Content in Weight Percent, Flotation Slimes Unit, Smelterville Flats BLM Site Small-scale Study Area.

Comparison of Geochemistry with Previous Studies

Reece (1974) collected mine waste samples closest to this study from the Page tailing pond near Smelterville. The current site of a wastewater treatment facility, the Page tailings pond lies approximately one quarter mile south-southwest of this study. His results are tabulated as follows:

Sample Depth, ft.	Zn, wt.%	Pb, wt.%
surface	.51	.27
5	.43	.40
10	.34	.41

Reece was not addressing the physical characterization of the materials on Smelterville Flats and did not keep detailed sample records. His results, nonetheless, are very similar to the range of values reported in this and the other studies conducted on Smelterville Flats.

Norton (1980), in conjunction with Marcy (1979), sampled the Smelterville Flats mine and mill wastes by truck-mounted, hollow-stem auger, backhoe trenches, and shovel pits. Two of his sample sites were near the small-scale study area. One location, SP 4, was about 300 feet east of the grid, the other, SP 3, was about 500 ft to the southwest. Grab samples were collected every .5 foot at these locations and were sieved at .18 mm (-80 mesh). Both size fractions were analyzed. The -80 mesh analysis results are tabulated in Table 4.8.

Table 4.8. Summary of Lead and Zinc Content in Sediment Samples Taken by Norton (1980) Adjacent to this Study.

SP 3			
Sample Depth, ft.	**% Sample < 0.18 mm**	**Zinc, %**	**Lead, %**
0.8	94	0.7	1.8
1.3	84	1.5	3.0
1.8	73	0.7	2.0
2.3	76	2.0	3.2
2.8	93	2.9	4.6
SP 4			
Sample Depth, ft.	**% Sample < 0.18 mm**	**Zinc, %**	**Lead, %**
0.2	86	1.0	2.0
0.7	78	1.0	2.5
1.2	96	2.0	3.0
1.7	74	3.0	3.5
2.2	50	4.0	5.0
2.7	37	1.0	1.5

Norton and Marcy concluded that:

i) No uniform sedimentary bed exists across the Flats;

ii) Lead and zinc content cannot be accurately predicted for any particular sediment on the basis of physical appearance;

iii) Any size fraction can have high metals contents;

iv) The smaller size fractions generally contain higher metals content;

v) The larger size fractions generally contain lower metals contents; and,

vi) Lead content is generally highest in the .2 -.4 mm size fraction.

Their results are very similar to those obtained in this and other studies conducted on the Flats.

Towatana located one sample trench, trench T2, approximately 300 to 500 feet west of this study. He sampled the sediments on one-foot intervals and assayed for metals content after sieving each sample at 0.053, 0.212, 0.50, and 2.00 mm sieve sizes. The data in Table 4.9 are excerpted from his dissertation (Towatana, 1990, p. 35, 142).

Table 4.9. Grain Size Distributions and Lead and Zinc Concentrations from Waste Sediment Samples from Trench T2 (Towatana, 1990).

Depth ft.	**Silt/Clay Size Fraction (< 0.053 mm)**			**Fine Sand Size Fraction (< 0.212 mm)**			**Medium Sand Size Fraction (< 0.50 mm)**		
	% spl	**%Pb**	**%Zn**	**% spl**	**%Pb**	**%Zn**	**% spl**	**%Pb**	**%Zn**
0	9	5	2.4	70	4	1.8	15	2.3	1
1	13	10	2	57	3	2.5	22	2	1.5
2	47	7	5.5	37	4.4	4	16	7.4	5.4
2.5	5	.02	.4	19	.02	3	76	.03	3.6
3	8	.01	.35	26	.01	2.5	66	.01	2.5
4	9	.01	.6	30	.01	4	62	.02	5.3
5	8	.03	.5	32	.02	2	21	.02	3

Size fraction percents from Table 4.3 may not sum to 100% due to rounding and the exclusion of minor coarse-grained fractions. An approximate weighted average of lead and zinc content in the shallowest three samples of clay/silt- and fine sand-sized (<0.05 mm + < 0.2 mm) fractions combined, yields:

Depth, ft.	**Lead, wt.%**	**Zinc, wt.%**	**% Total Sample**
0 - 1	2.8	1.5	79
1 - 2	2.9	1.4	71
2 - 2.5	4.8	4	84

These size fractions approximate a -80 mesh sieved sample for comparison with the data in this study. Several conclusions can be drawn from this comparison:

1) Although Towatana did not sample trench T2 with regard to geology of the sediments, the jig tailing - flotation slime contact can be deduced from his data to be at or near 2 feet below the top of trench T2. Above this depth the zinc values less closely approximate the lead values than below this depth; similar behavior of the sediment assays from the small-scale study area are evident in Figure 4.5.

2) Towatana observed lead concentrations as high as 10 % in the fine-grained fraction of the sample from 1 to 2 ft. (Table 4.3), but this size fraction only constituted about 13 % of the total sample. The -80 mesh "estimate" for lead content of 2.9 % takes 71 % of the total sample into account. Inclusion of the coarser size fractions would depress this value even further.

3) Averaged values for lead and zinc content from T2 samples are well within the distributions of values reported for the mine wastes in this study, (Tables 4.4 and 4.5), with the exception of the 4.8 % lead value for sample 2 - 2.5 feet.

All of the sediment studies carried out at Smelterville Flats previous to this study reported similar metal values with the exception of several high values. These high values reported outside this study area are not unexpected. Earth science data sets containing a few very large values are common (Isaaks and Srivastava, 1989). No attempt was made by this author to characterize the variability of metals content across the entire Smelterville Flats area on the basis of sampling a 200 foot by 300 foot area.

Comparison of the Stratigraphy and Zinc Content of Sediments Adjacent to BLM Wells 5C and 6C

The results of sediment sampling adjacent to BLM wells 5C and 6C are presented graphically in Figure 4.31. Well 5C, which produces water samples consistently high in zinc, is completed in flotation slimes which are in turn underlain by an alluvial clay. Well 6C, supplying water samples consistently much lower in zinc concentration than well 5C, is completed in relatively low-grade jig tailings. The vertical bar graphs adjacent to the well logs are relative zinc content. The thickest portion of the 6C histogram is approximately 0.5% weight percent zinc; the thickest portion of the 5C histogram is approximately 2.5% weight percent zinc.

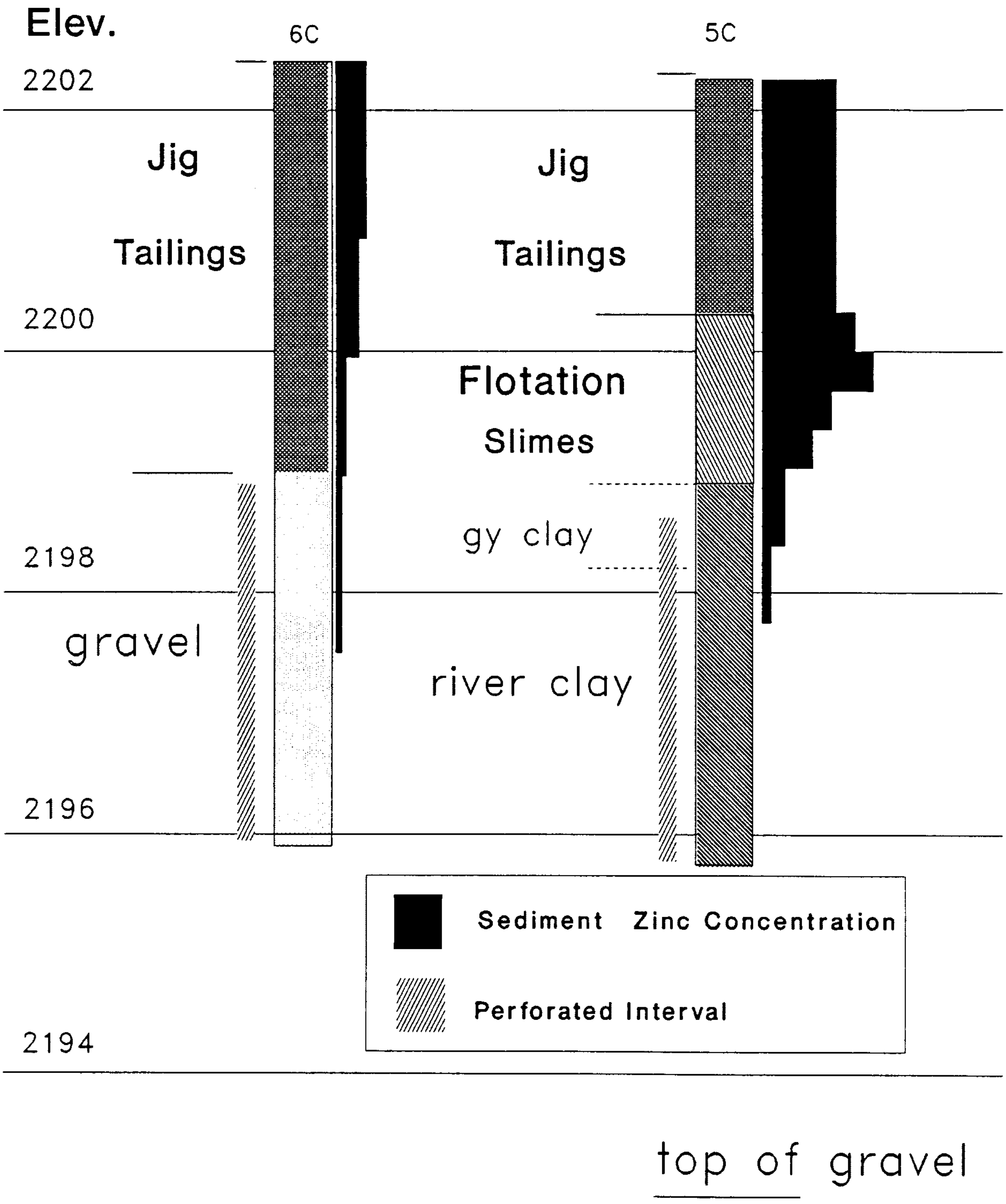


Figure 4.31. A Graphical Comparison of the Stratigraphy and Zinc Content of the Sediments Adjacent to BLM Wells 5C and 6C.

Geochemical Analyses

The initial geochemical analyses selected consisted of taking a .5 gram split of the -80 mesh (0.18 mm opening) sieved sample digested in 3 ml warm aqua regia and then diluted to 10 ml. Roughly 80% of the initial sediment samples for this study submitted for geochemical analysis either produced lead and/or zinc concentrations in the analyte that exceeded the linear range for the ICP lab equipment used by the lab, or the samples contained so much lead and zinc that the analytical procedure could not completely dissolve all of the metals.

Sixty-nine of those samples were reanalysed using a more sensitive analysis using a 1 gm sample digested in 50 ml aqua regia. The samples were selected for reanalysis on the basis of a) reported lead and zinc content, b) sediment type, and c) sample grid location.

Reassay values for lead and zinc are predominately higher than initially reported values. Seventeen of the 69 lead reassays, ranging from 1.6 to 2.9 weight percent, came back lower than reported in the original analysis. Lead reassay values deviate significantly from initial assay values above about 2% (Figure 4.32).

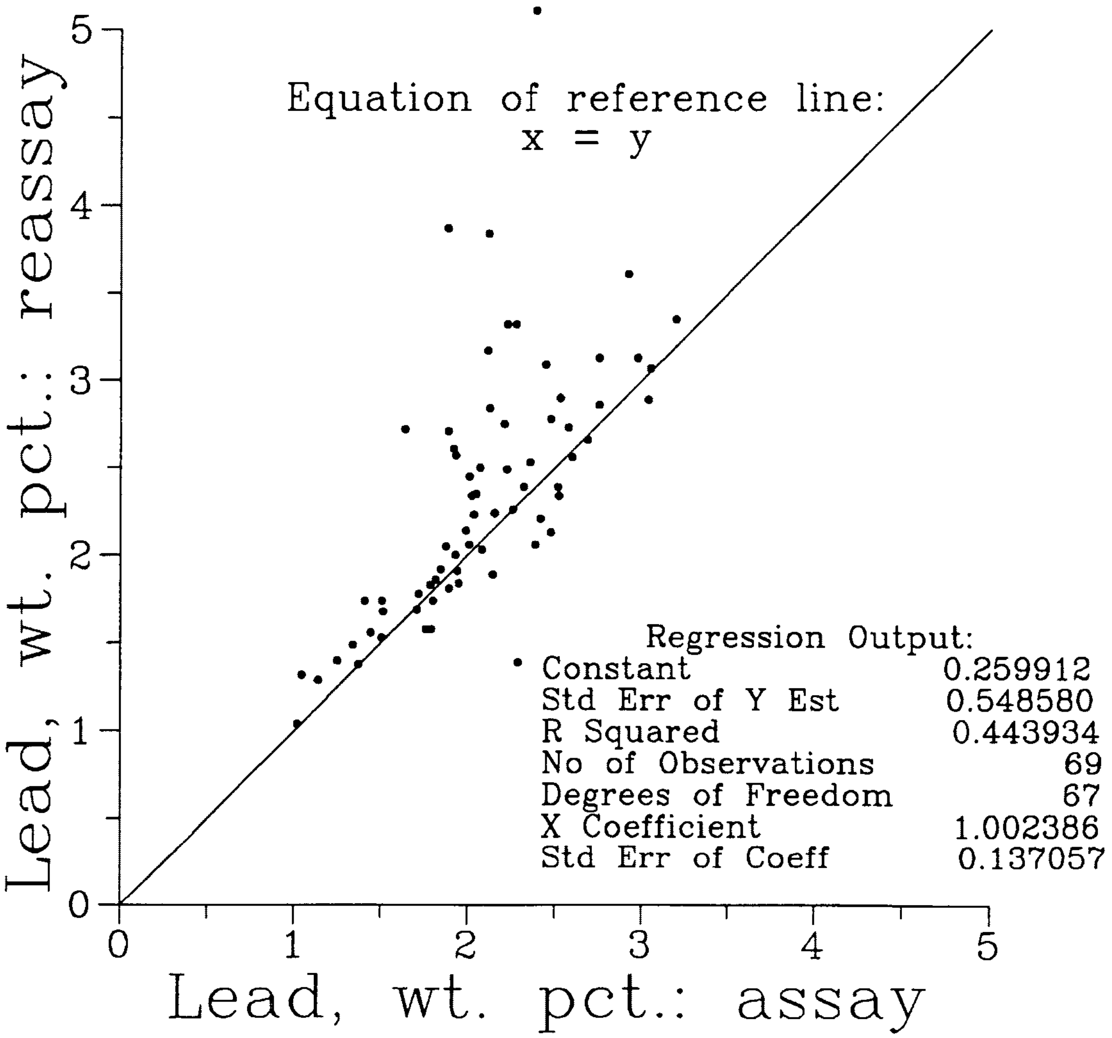


Figure 4.32. Lead Assay vs. Reassay Values in Weight Percent for Selected Smelterville Flats Sediment Samples.

Zinc reassay values are consistently higher than initial assay results as well. Twelve of the 69 zinc reassays, ranging from 0.5 to 3.3 weight percent, came back lower than reported in the original analysis. The zinc reassay values do not show as wide a variation from initially reported values as the lead analyses (Figure 4.33). The correlation between reanalysis and original assay values for both lead and zinc is poor, especially for lead. Cost considerations did not allow the reanalysis of all remaining samples.

Metals content of samples as discussed in this study should therefore be viewed as generally conservative; the true metals content in some cases may be greater than the analytical results reported.

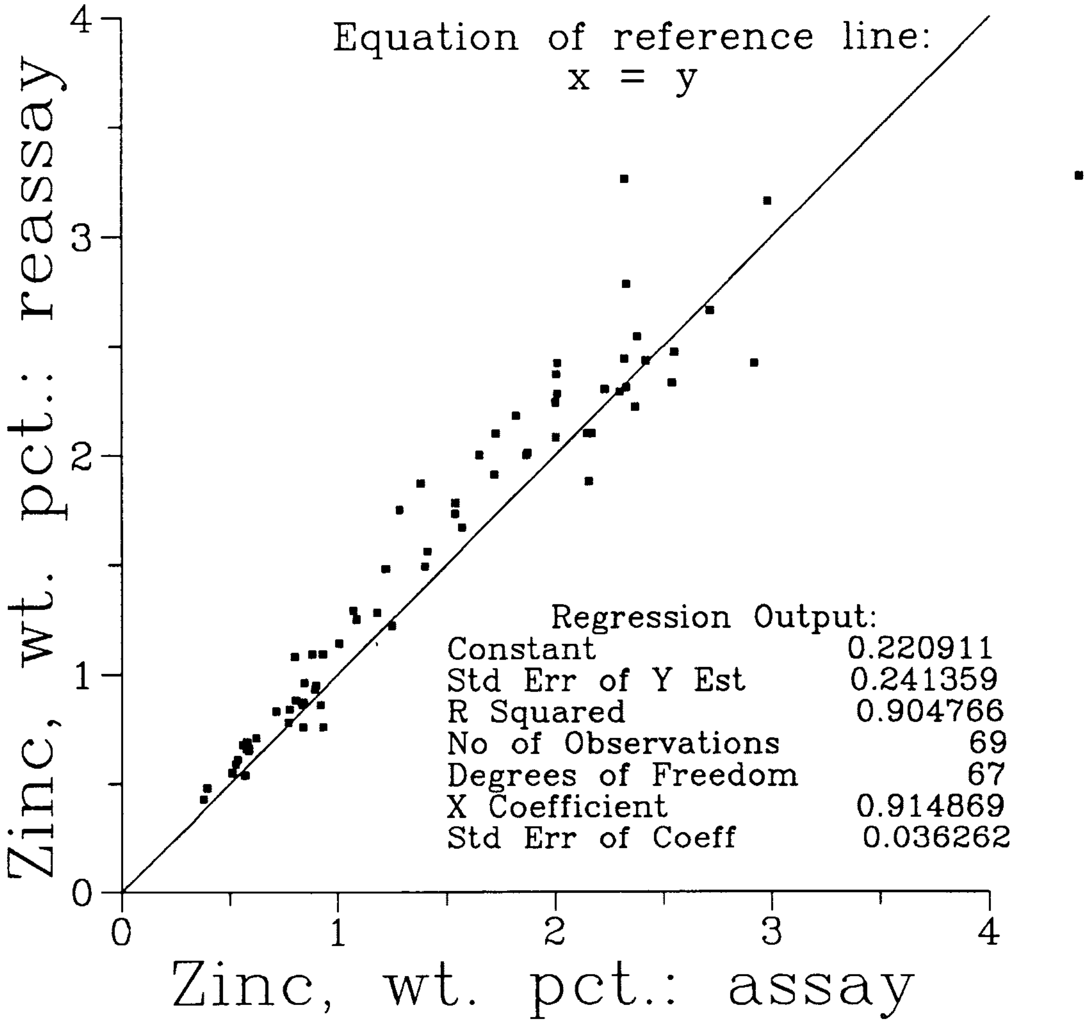


Figure 4.33. Zinc Assay vs. Reassay Values in Weight Percent for Selected Smelterville Flats Sediment Samples.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The following conclusions concerning the relations between natural and artificial recharge, sediment chemistry, and the ground water quality beneath Smelterville Flats are given as a result of this study:

1) The artificial recharge rates of 1 inch every other day during the summer of 1990 had no measurable impact on either average ground water levels, (i.e., measured at or very near the phreatic surface), or shallow ground water quality beneath the small-scale study area within the BLM portion of Smelterville Flats. This lack of impact can be attributed to a probable combination of evaporation and transpiration of the applied moisture and the periodic nature of the irrigation.

2) Significant natural recharge events such as intense local thundershowers or rapid spring snowmelts can measurably affect average ground water levels at the small-scale study area. These events may affect shallow ground water quality depending upon such factors as:

i) The metals content of the mine wastes proximal to the piezometer;

ii) The intensity and/or duration of a particular recharge event or series of events; and,

iii) The previous infiltration history at that locale.

3) Zinc concentrations in water samples acquired from the shallow set of wells completed in or near the bottom of

the mine wastes are higher and more variable than in water samples from the deeper wells completed in the upper aquifer 15 to 20 feet below the mine wastes. The shallow wells are in close physical association with the materials contributing metal ions to the ground water. The mine wastes are of lower hydraulic conductivity than the upper aquifer, which increases the residence time of infiltrating moisture and hence increasing the reaction time between the infiltrating moisture and the mine wastes. The residence time of downward percolating moisture through the mine waste material is enhanced locally by the presence of an alluvial clay layer between the mine wastes and the upper aquifer.

4) Zinc concentrations from the shallow wells segregate into a high concentration group and a low concentration group. Sediment sampling and analysis adjacent to BLM wells 5C and 6C, a member of each group respectively, points out several controlling factors:

i) The low-concentration well 6C is completed in jig tailings, which are relatively low in lead and zinc content and have a greater hydraulic conductivity than the flotation slime;

ii) The high-concentration well 5C is completed in the flotation slime unit, which contains relatively high amounts of lead and zinc and has a lower hydraulic conductivity than the jig tailings; and,

iii) The flotation slimes surrounding well 5C are locally underlain by an alluvial clay layer which acts as an aquitard to downward infiltration, perching that moisture in the mine waste. This perching enhances the effect of the low hydraulic conductivity of the mine waste, thereby increasing the residence time and subsequently increasing the available reaction time between the infiltrating precipitation and the mine waste.

5) Physical characteristics of the mine wastes and alluvial sediments are heterogeneous with respect to depth and areal location within the small-scale study area. Some factors controlling the spatial distribution of mine waste and alluvial sediments are:

i) The morphology of fluvial structures such as abandoned meanders or river banks which now underlie the mine wastes and of man-made structures such as dikes existing prior to the impounding of the South Fork of the Coeur d'Alene River;

ii) The depositional history of the mine wastes within the impoundment, including the production histories of local mines, and the location of the small-scale study area in relation to the upper end of the impoundment; and,

iii) Reworking of the mine wastes by mining, by subareal processes within the impoundment, by the South Fork both before and after the containment dam, and by surficial weathering after the failure of the dam.

6) The mine waste sediments can be divided into two major types on the basis of zinc content and physical appearance. Jig tailings are typically sandy, oxidized in

appearance, and average 0.78% weight percent zinc. Flotation slimes are typically silt-sized, unoxidized in appearance, and average 2.02% weight percent zinc.

7) Alluvial clay, gravel and organic materials which underlie or intercalate the mine wastes are more highly contaminated by lead and zinc where found in close proximity to mine wastes containing high levels of lead and zinc. This contamination within the alluvial sediments decreases rapidly with distance from the mine waste.

Recommendations

1) The sediments adjacent to the other BLM wells should be sampled and analyzed to verify that the water quality measured in the BLM wells is controlled by the mine wastes adjacent to those wells.

2) Recharge and recharge events must be considered when evaluating, designing, and implementing in-situ remediation techniques on Smelterville Flats. Flooding, dilution of, or damage to lixiviant ponds, in-situ flow cells, heap leach pads, flotation cells, or other facilities could result from a large recharge event or the subsequent rise in the water table following such an event. This might result in the loss of efficiency for a particular remedial technique, or the excursion of remedial process materials into the environment in an uncontrolled manner.

3) Future work on Smelterville Flats should emphasize characterizing the distribution of the mine wastes and

contained metals. This understanding of the resource is a necessary prerequisite for optimizing the selection of an extractive remediation technique.

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APPENDIX I:

WATER LEVEL, ELECTROCONDUCTIVITY, PH, WATER TEMPERATURE, AND ZINC CONCENTRATION DATA

25-Jan-90

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	25-Jan-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	25-Jan-90	2205.6	2198.87	10	5.06	1100	478
2C	25-Jan-90	2206.89	0	0	0	0	0
3C	25-Jan-90	2205.62	2199.47	9	5.16	315	47.72
4C	25-Jan-90	2204.46	2198.22	8.5	6.43	465	41.92
5C	25-Jan-90	2204.93	2198.49	9	5.33	3200	1976.17
6C	25-Jan-90	2204.19	2197.3	9	5.02	380	29.88
7C	25-Jan-90	2203.04	2196.64	9	5.28	550	93.65
8C	25-Jan-90	2204.38	2196.55	9	5.01	550	59.32
9C	25-Jan-90	2204.51	2198.09	10	4.85	750	245.17
10C	25-Jan-90	2202.2	2196.21	9	5.8	1550	727.83

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	25-Jan-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1D	25-Jan-90	2205.64	2198.91	9	5.08	415	26.66
2D	25-Jan-90	2206.61	2199.26	9	5.11	380	25.27
3D	25-Jan-90	2205.48	2199.13	9	5.41	315	12.51
4D	25-Jan-90	2204.33	2198.21	10	6.18	210	1.68
5D	25-Jan-90	2204.88	2197.9	10	5.27	350	15.02
6D	25-Jan-90	2203.97	2197.19	10	5.43	265	11.82
7D	25-Jan-90	2203.19	2196.62	11	5.28	320	12.12
8D	25-Jan-90	2204.23	2196.49	11	5	390	18.31
9D	25-Jan-90	2204.47	2197.97	11	5.18	370	14
10D	25-Jan-90	2202.26	2195.94	10	5.48	320	13.42

01-Feb-90

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	01-Feb-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	01-Feb-90	2205.6	2198.7	12	4.86	1150	527.09
2C	01-Feb-90	2206.89	2199.09	0	0	0	0
3C	01-Feb-90	2205.62	2198.99	9	5.34	380	31.17
4C	01-Feb-90	2204.46	2198.07	9	6.94	600	39.49
5C	01-Feb-90	2204.93	2198	0	0	0	0
6C	01-Feb-90	2204.19	2197.14	9	5.16	315	24.66
7C	01-Feb-90	2203.04	2196.51	9	5.27	550	101.46
8C	01-Feb-90	2204.38	2196.41	9	5.13	550	54.11
9C	01-Feb-90	2204.51	2197.91	9	5.1	550	98.12
10C	01-Feb-90	2202.2	2196.1	9	5.28	1950	931.61

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	01-Feb-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1D	01-Feb-90	2205.64	2198.59	11	5.15	315	27.45
2D	01-Feb-90	2206.61	2199.11	9	5.26	450	26.51
3D	01-Feb-90	2205.48	2198.9	9	5.6	300	12.48
4D	01-Feb-90	2204.33	2198.04	9	6	270	6.26
5D	01-Feb-90	2204.88	2197.74	9	5.39	345	15.46
6D	01-Feb-90	2203.97	2197.04	9	5.56	320	12.94
7D	01-Feb-90	2203.19	2196.49	10	5.4	320	12.09
8D	01-Feb-90	2204.23	2196.33	10	5.21	360	21.86
9D	01-Feb-90	2204.47	2197.82	10	5.32	330	14.11
10D	01-Feb-90	2202.26	2195.82	10	5.62	300	11.71

07-Feb-90

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	07-Feb-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	07-Feb-90	2205.6	2199.59	12	5.14	1200	561
2C	07-Feb-90	2206.89	0	0	0	0	0
3C	07-Feb-90	2205.62	2198.92	8	5.26	360	29.28
4C	07-Feb-90	2204.46	2197.96	0	0	0	0
5C	07-Feb-90	2204.93	2197.9	11	5.47	3200	1827.44
6C	07-Feb-90	2204.19	2197.07	8	5.14	370	24.96
7C	07-Feb-90	2203.04	2196.42	8.6	5.14	600	92.21
8C	07-Feb-90	2204.38	2196.33	8.5	5.07	500	66.2
9C	07-Feb-90	2204.51	2197.79	7	4.93	600	136.75
10C	07-Feb-90	2202.2	2196.03	8	6.03	1800	791.53

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	07-Feb-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1D	07-Feb-90	2205.64	2198.46	10	5.1	500	27.62
2D	07-Feb-90	2206.61	2198.99	13	5.08	520	28.52
3D	07-Feb-90	2205.48	2198.78	13.5	5.47	390	13.24
4D	07-Feb-90	2204.33	2197.93	10	5.99	400	14.8
5D	07-Feb-90	2204.88	2197.64	9	5.26	360	15.91
6D	07-Feb-90	2203.97	2196.93	10	5.49	340	12.33
7D	07-Feb-90	2203.19	2196.39	10	5.32	350	12.41
8D	07-Feb-90	2204.23	2196.24	10	5.1	400	19.97
9D	07-Feb-90	2204.47	2197.65	9	5.28	370	14.92
10D	07-Feb-90	2202.26	2195.77	10	5.45	330	11.42

16-Feb-90

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN

16-Feb-90

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	16-Feb-90	2205.6	2197.85	0	0	0	538.42
2C	16-Feb-90	2206.89	2199.28	10	0	0	0
3C	16-Feb-90	2205.62	2199.15	9		370	35.37
4C	16-Feb-90	2204.46	2198.29	10	0	600	43.4
5C	16-Feb-90	2204.93	2198.05	11.5		3100	1789.35
6C	16-Feb-90	2204.19	2197.25	10	0	410	28.19
7C	16-Feb-90	2203.04	2196.64	10	0	600	94.44
8C	16-Feb-90	2204.38	2196.57	9	0	600	60.04
9C	16-Feb-90	2204.51	2198.05	8	0	800	249.66
10C	16-Feb-90	2202.2	2196.17	10	0	1800	642.65

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	16-Feb-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1D	16-Feb-90	2205.64	2198.75	0	0	0	29.97
2D	16-Feb-90	2206.61	2199.31	10	0	460	26.69
3D	16-Feb-90	2205.48	2199.06	11.5	0	340	12.76
4D	16-Feb-90	2204.33	2198.19	11.5	0	290	7.14
5D	16-Feb-90	2204.88	2197.89	11	0	390	19.79
6D	16-Feb-90	2203.97	2197.15	12	0	360	11.09
7D	16-Feb-90	2203.19	2196.62	12	0	370	11.38
8D	16-Feb-90	2204.23	2196.5	11	0	440	19.32
9D	16-Feb-90	2204.47	2197.92	10	0	400	10.9
10D	16-Feb-90	2202.26	2195.92	12	0	350	11.19

22-Feb-90

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	22-Feb-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	22-Feb-90	2205.6	2198.76	8	4.29	1300	600.39
2C	22-Feb-90	2206.89	2199.09	0	0	0	0
3C	22-Feb-90	2205.62	2198.98	9	5.17	380	28.51
4C	22-Feb-90	2204.46	2198.06	9	6.93	500	39.45
5C	22-Feb-90	2204.93	2197.92	14	5.82	3200	1809.33
6C	22-Feb-90	2204.19	2197.24	11	4.91	410	25.91
7C	22-Feb-90	2203.04	2196.35	10	5.2	600	92.72
8C	22-Feb-90	2204.38	2196.53	10.5	5.05	600	52.19
9C	22-Feb-90	2204.51	2198.46	12	5.19	750	181.58
10C	22-Feb-90	2202.2	2195.8	11	5.87	1600	683.91

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	22-Feb-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN

1D	22-Feb-90	2205.64	2198.56	11	5.08	410	28.51
2D	22-Feb-90	2206.61	2199.13	10	5.05	480	26.15
3D	22-Feb-90	2205.48	2198.9	11.5	5.67	290	11.58
4D	22-Feb-90	2204.33	2198.04	11	6.03	300	6.43
5D	22-Feb-90	2204.88	2197.75	12	5.35	390	21.24
6D	22-Feb-90	2203.97	2196.47	12	5.39	350	11.76
7D	22-Feb-90	2203.19	2196.24	12	5.29	350	11.94
8D	22-Feb-90	2204.23	2196.63	12	5	440	19.71
9D	22-Feb-90	2204.47	2198.42	12	5.19	300	14.49
10D	22-Feb-90	2202.26	2196.16	12	5.55	320	15.8

28-Feb-90

WELL DATE MP WELEV TEMP PH EC ZN
28-Feb-90

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	28-Feb-90	2205.6	2198.88	9	5.05	1350	581.08
2C	28-Feb-90	2206.89	2199.22	0	0	0	0
3C	28-Feb-90	2205.62	2199.17	9	5.25	390	0
4C	28-Feb-90	2204.46	2198.26	11	6.91	600	46.07
5C	28-Feb-90	2204.93	2198.04	14.5	5.65	2000	740.44
6C	28-Feb-90	2204.19	2197.32	13.5	5.15	420	24.21
7C	28-Feb-90	2203.04	2196.7	9	5.32	600	81.47
8C	28-Feb-90	2204.38	2196.6	10	5.13	550	53.37
9C	28-Feb-90	2204.51	2198.07	9	4.93	750	166.09
10C	28-Feb-90	2202.2	2196.25	10	6.03	1700	609.09

WELL DATE MP WELEV TEMP PH EC ZN
28-Feb-90

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1D	28-Feb-90	2205.64	2198.74	11	5.18	600	26.08
2D	28-Feb-90	2206.61	2199.27	11.5	5.18	600	24.58
3D	28-Feb-90	2205.48	2199.06	11.5	5.48	350	11.62
4D	28-Feb-90	2204.33	2198.24	12.5	6.3	290	6.51
5D	28-Feb-90	2204.88	2197.94	12	5.39	390	16.66
6D	28-Feb-90	2203.97	2197.18	13	5.53	360	11.82
7D	28-Feb-90	2203.19	2196.67	12	5.37	380	11.92
8D	28-Feb-90	2204.23	2196.38	12	5.17	450	20.07
9D	28-Feb-90	2204.47	2197.93	12	5.3	390	13.9
10D	28-Feb-90	2202.26	2195.98	12	5.59	350	12.35

06-Mar-90

WELL DATE MP WELEV TEMP PH EC ZN
06-Mar-90

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	06-Mar-90	2205.6	2198.9	8	5.03	1250	579.53

2C	06-Mar-90	2206.89	2199.3	0	0	0	0
3C	06-Mar-90	2205.62	2199.23	9	5.29	370	27.78
4C	06-Mar-90	2204.46	2198.34	8	6.68	480	31.93
5C	06-Mar-90	2204.93	2198.12	8	5.51	1500	757.43
6C	06-Mar-90	2204.19	2197.39	9	5.16	390	22.85
7C	06-Mar-90	2203.04	2196.76	9	5.21	600	79.98
8C	06-Mar-90	2204.38	2196.68	9	5.16	600	55.57
9C	06-Mar-90	2204.51	2198.13	9	4.19	600	146.58
10C	06-Mar-90	2202.2	2196.35	8	5.8	1600	696.95

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	06-Mar-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1D	06-Mar-90	2205.64	2198.77	10	5.16	490	26.72
2D	06-Mar-90	2206.61	2199.32	11	4.19	490	25.06
3D	06-Mar-90	2205.48	2199.13	10	5.49	330	11.17
4D	06-Mar-90	2204.33	2198.33	11	6.2	280	5.7
5D	06-Mar-90	2204.88	2198.01	10	5.41	360	19.81
6D	06-Mar-90	2203.97	2197.27	11	5.55	330	10.82
7D	06-Mar-90	2203.19	2196.74	11	5.34	350	11.24
8D	06-Mar-90	2204.23	2196.6	12	5.2	420	18.25
9D	06-Mar-90	2204.47	2197.98	11	5.27	340	12.76
10D	06-Mar-90	2202.26	2196.07	11	5.59	340	13.84

15-Mar-90

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	15-Mar-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	15-Mar-90	2205.6	2198.9	11.5	5.38	1200	523.92
2C	15-Mar-90	2206.89	2199.28	0	0	0	0
3C	15-Mar-90	2205.62	2199.15	9	5.3	370	23.24
4C	15-Mar-90	2204.46	2198.3	10	6.89	500	32.12
5C	15-Mar-90	2204.93	2198.77	13	5.72	1400	544.07
6C	15-Mar-90	2204.19	2197.33	10	5.17	410	23.82
7C	15-Mar-90	2203.04	2196.71	10	5.36	600	76.57
8C	15-Mar-90	2204.38	2196.61	11	5.18	600	48.09
9C	15-Mar-90	2204.51	2198.11	10	4.19	700	156.29
10C	15-Mar-90	2202.2	2195.95	10	5.39	1800	720.06

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	15-Mar-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1D	15-Mar-90	2205.64	2198.75	11	5.22	600	0
2D	15-Mar-90	2206.61	2199.31	10.5	5	500	25.86
3D	15-Mar-90	2205.48	2199.1	11	5.5	340	10.85
4D	15-Mar-90	2204.33	2198.24	11	6.11	270	5.64

5D	15-Mar-90	2204.88	2197.96	10	5.34	370	16.45
6D	15-Mar-90	2203.97	2197.21	11	5.54	340	10.41
7D	15-Mar-90	2203.19	2196.62	12	5.37	365	11.59
8D	15-Mar-90	2204.23	2196.54	11.5	5.19	370	18.02
9D	15-Mar-90	2204.47	2197.96	11	5.3	380	12.51
10D	15-Mar-90	2202.26	2195.99	11.5	5.72	340	12.53

24-Mar-90

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	24-Mar-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	24-Mar-90	2205.6	2199.13	10.5	5.14	1100	520.39
2C	24-Mar-90	2206.89	2199.53	0	0	0	0
3C	24-Mar-90	2205.62	2199.45	10	5.27	340	26.87
4C	24-Mar-90	2204.46	2198.58	10	6.7	500	42.76
5C	24-Mar-90	2204.93	2198.33	11.5	5.67	1400	578.54
6C	24-Mar-90	2204.19	2197.6	10	5.15	390	26.85
7C	24-Mar-90	2203.04	2196.96	10	5.27	600	90.46
8C	24-Mar-90	2204.38	2196.81	11.5	5.1	600	67.94
9C	24-Mar-90	2204.51	2198.35	11	4.94	600	131.98
10C	24-Mar-90	2202.2	2196.17	9	5.68	1700	727.89

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	24-Mar-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1D	24-Mar-90	2205.64	2198.99	13	5.26	500	31.4
2D	24-Mar-90	2206.61	2199.55	10	5.08	460	28.37
3D	24-Mar-90	2205.48	2199.36	11	5.57	310	13.21
4D	24-Mar-90	2204.33	2198.54	12	6.3	250	6.96
5D	24-Mar-90	2204.88	2198.22	11	5.48	340	18.58
6D	24-Mar-90	2203.97	2197.48	11.5	5.6	310	12.26
7D	24-Mar-90	2203.19	2196.93	12	5.45	350	12.72
8D	24-Mar-90	2204.23	2196.73	12	5.27	420	20.4
9D	24-Mar-90	2204.47	2198.18	12	5.35	350	14.95
10D	24-Mar-90	2202.26	2196.23	11.5	5.66	320	15.62

29-Mar-90

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	29-Mar-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	29-Mar-90	2205.6	2199.03	12	5.36	1100	451.55
2C	29-Mar-90	2206.89	2199.42	0	0	0	0
3C	29-Mar-90	2205.62	2199.34	11	5.3	350	21.66
4C	29-Mar-90	2204.46	2198.47	12	6.8	600	44.15
5C	29-Mar-90	2204.93	2198.24	15	5.77	1200	412.17

6C	29-Mar-90	2204.19	2197.52	12	5.1	400	25.49
7C	29-Mar-90	2203.04	2196.9	11	5.2	600	84.43
8C	29-Mar-90	2204.38	2196.8	11.5	5.14	600	61.96
9C	29-Mar-90	2204.51	2198.26	11.5	4.88	600	117.28
10C	29-Mar-90	2202.2	2196.11	12	6.02	1450	494.63

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	29-Mar-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1D	29-Mar-90	2205.64	2198.89	12.5	5.27	500	30.98
2D	29-Mar-90	2206.61	2199.43	11.5	5.08	400	27.49
3D	29-Mar-90	2205.48	2199.24	11.5	5.54	340	12.44
4D	29-Mar-90	2204.33	2198.46	12	7.1	240	6.36
5D	29-Mar-90	2204.88	2198.13	12.5	5.48	350	15.92
6D	29-Mar-90	2203.97	2197.4	13.5	5.56	310	11.02
7D	29-Mar-90	2203.19	2196.88	12.5	5.9	350	11.48
8D	29-Mar-90	2204.23	2196.73	12	5.2	430	18.39
9D	29-Mar-90	2204.47	2198.1	12	5.31	360	13.14
10D	29-Mar-90	2202.26	2196.2	12	6.01	320	12.01

12-Apr-90

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	12-Apr-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	12-Apr-90	2205.6	2199.6	10.5	5.13	1000	393.47
2C	12-Apr-90	2206.89	2199.98	11.5	5.07	490	45.76
3C	12-Apr-90	2205.62	2199.92	12	5.17	350	23.6
4C	12-Apr-90	2204.46	2199.08	12	6.34	700	59
5C	12-Apr-90	2204.93	2198.8	15	5.85	900	228.37
6C	12-Apr-90	2204.19	2198.09	12	5.2	400	20.44
7C	12-Apr-90	2203.04	2197.44	11	5.25	500	68.31
8C	12-Apr-90	2204.38	2197.35	11.5	5.13	600	63.02
9C	12-Apr-90	2204.51	2198.81	11	4.98	600	100.11
10C	12-Apr-90	2202.2	2196.63	11.5	6.01	1000	184.17

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	12-Apr-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1D	12-Apr-90	2205.64	2199.44	11	5.3	450	23.76
2D	12-Apr-90	2206.61	2200.01	11	5.2	450	21.51
3D	12-Apr-90	2205.48	2199.82	11	5.54	290	10.37
4D	12-Apr-90	2204.33	2199.05	12	6.84	225	5.38
5D	12-Apr-90	2204.88	2198.7	11.5	5.54	320	12.87
6D	12-Apr-90	2203.97	2197.95	12	5.64	290	9.12
7D	12-Apr-90	2203.19	2197.42	12.5	5.45	320	10.11
8D	12-Apr-90	2204.23	2197.3	12	5.27	400	16.92

9D	12-Apr-90	2204.47	2198.67	11.5	5.35	330	11.38
10D	12-Apr-90	2202.26	2196.73	12	5.89	280	8.3

18-Apr-90

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	18-Apr-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	18-Apr-90	2205.6	2200.02	12.5	5.15	1000	394.22
2C	18-Apr-90	2206.89	2200.39	10	5.11	470	47.31
3C	18-Apr-90	2205.62	2200.36	12	5.31	330	24.25
4C	18-Apr-90	2204.46	2199.59	14	6.5	750	56.28
5C	18-Apr-90	2204.93	2199.24	14	5.98	800	220.98
6C	18-Apr-90	2204.19	2198.54	12	5.33	375	21.28
7C	18-Apr-90	2203.04	2197.91	12	5.27	500	66.66
8C	18-Apr-90	2204.38	2197.81	12	5.27	500	59.42
9C	18-Apr-90	2204.51	2199.24	14	4.98	600	92.09
10C	18-Apr-90	2202.2	2197.1	12.5	5.98	900	157.1

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	18-Apr-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1D	18-Apr-90	2205.64	2199.86	13	5.34	440	23.81
2D	18-Apr-90	2206.61	2200.41	11	5.28	425	19.2
3D	18-Apr-90	2205.48	2200.26	12	5.62	280	8.34
4D	18-Apr-90	2204.33	2199.55	12	7.01	210	4.41
5D	18-Apr-90	2204.88	2199.16	13	5.6	310	13.1
6D	18-Apr-90	2203.97	2198.41	13	5.71	280	8.01
7D	18-Apr-90	2203.19	2197.87	12	5.49	320	8.93
8D	18-Apr-90	2204.23	2197.66	13	5.28	400	15.84
9D	18-Apr-90	2204.47	2199.11	14	5.47	320	10.22
10D	18-Apr-90	2202.26	2197.21	13	5.15	270	8.12

27-Apr-90

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	27-Apr-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	27-Apr-90	2205.6	2199.91	11	5.17	900	375.07
2C	27-Apr-90	2206.89	2200.31	10	5.11	440	161.06
3C	27-Apr-90	2205.62	2200.26	10	5.32	320	32.75
4C	27-Apr-90	2204.46	2199.45	11.5	6.48	700	59.12
5C	27-Apr-90	2204.93	2199.1	10	6.05	700	203.49
6C	27-Apr-90	2204.19	2198.32	10	5.28	350	20.78
7C	27-Apr-90	2203.04	2197.69	10.5	5.26	460	71.19
8C	27-Apr-90	2204.38	2197.58	11	5.14	550	62.29
9C	27-Apr-90	2204.51	2199.11	11	4.99	460	89.06

10C	27-Apr-90	2202.2	2196.83	10	5.99	850	174.88

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	27-Apr-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1D	27-Apr-90	2205.64	2199.95	11.5	5.3	400	23.08
2D	27-Apr-90	2206.61	2200.33	10	5.22	385	20.94
3D	27-Apr-90	2205.48	2200.16	10	5.59	260	10.34
4D	27-Apr-90	2204.33	2199.33	10	6.9	190	5.15
5D	27-Apr-90	2204.88	2198.98	10	5.62	290	12.88
6D	27-Apr-90	2203.97	2198.19	11	5.69	250	9.12
7D	27-Apr-90	2203.19	2197.64	11	5.62	290	10.5
8D	27-Apr-90	2204.23	2197.49	11	5.25	350	17.24
9D	27-Apr-90	2204.47	2198.96	11	5.41	280	11.2
10D	27-Apr-90	2202.26	2196.91	11	5.89	250	8.83

03-May-90

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	03-May-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	03-May-90	2205.6	2199.42	13	5	800	92.41
2C	03-May-90	2206.89	2199.79	0	0	0	0
3C	03-May-90	2205.62	2199.75	13	5.4	310	18.52
4C	03-May-90	2204.46	2198.84	15	6.67	700	41.51
5C	03-May-90	2204.93	2198.62	16	6.1	900	256.92
6C	03-May-90	2204.19	2197.88	14	5.33	370	18.53
7C	03-May-90	2203.04	2197.69	13	5.36	460	66.65
8C	03-May-90	2204.38	2197.14	13	5.28	600	49.96
9C	03-May-90	2204.51	2198.62	13	5.15	480	83.71
10C	03-May-90	2202.2	2196.45	14.5	5.9	2500	299.48

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	03-May-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1D	03-May-90	2205.64	2199.26	12	5.23	415	20.71
2D	03-May-90	2206.61	2199.84	12.5	5.49	415	19.16
3D	03-May-90	2205.48	2199.64	13.5	5.61	285	10.61
4D	03-May-90	2204.33	2198.82	13	7.01	200	5.19
5D	03-May-90	2204.88	2198.54	13	5.61	310	12.72
6D	03-May-90	2203.97	2197.73	13	5.87	280	9.55
7D	03-May-90	2203.19	2197.2	15	6.83	310	10.03
8D	03-May-90	2204.23	2197.07	13	5.49	380	17.21
9D	03-May-90	2204.47	2198.47	15	5.71	300	10.97
10D	03-May-90	2202.26	2196.52	12	5.79	270	8.5

10-May-90

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	10-May-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	10-May-90	2205.6	2199.43	11	5.5	800	324.58
2C	10-May-90	2206.89	2199.84	0	0	0	0
3C	10-May-90	2205.62	2199.79	13	5.75	290	16.41
4C	10-May-90	2204.46	2198.91	13	6.6	700	37.86
5C	10-May-90	2204.93	2198.64	14	6.39	800	240.21
6C	10-May-90	2204.19	2197.89	12	5.81	330	18.47
7C	10-May-90	2203.04	2197.26	12	5.78	430	60.81
8C	10-May-90	2204.38	2197.17	12	5.45	500	47.78
9C	10-May-90	2204.51	2198.64	11	5.35	410	64.07
10C	10-May-90	2202.2	2196.45	13	6.01	900	148.31

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	10-May-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1D	10-May-90	2205.64	2199.28	11	5.6	370	19.6
2D	10-May-90	2206.61	2199.87	12	5.4	390	18.23
3D	10-May-90	2205.48	2199.68	13	5.82	250	8.5
4D	10-May-90	2204.33	2198.84	11	7.4	185	4.47
5D	10-May-90	2204.88	2198.51	12	6.44	270	9.98
6D	10-May-90	2203.97	2197.77	12	6.06	240	7.56
7D	10-May-90	2203.19	2197.22	12	6.25	270	8.63
8D	10-May-90	2204.23	2197.09	12	5.4	340	14.52
9D	10-May-90	2204.47	2198.5	11	5.75	265	9.5
10D	10-May-90	2202.26	2196.55	12	6.85	240	7.25

27-May-90

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	27-May-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	27-May-90	2205.6	2199.95	13	4.83	700	231.43
2C	27-May-90	2206.89	2201.39	15	5.52	400	39.69
3C	27-May-90	2205.62	2200.28	14	5.67	300	20.32
4C	27-May-90	2204.46	2199.39	20	6.7	600	46.08
5C	27-May-90	2204.93	2199.13	15	5.91	1200	621.43
6C	27-May-90	2204.19	2198.38	14	5.59	310	17.04
7C	27-May-90	2203.04	2197.82	14	0	420	52.96
8C	27-May-90	2204.38	0	0	0	0	0
9C	27-May-90	2204.51	2199.16	12	0	470	79.43
10C	27-May-90	2202.2	2196.92	12	0	1400	887.85

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN

27-May-90

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1D	27-May-90	2205.64	2199.81	12	5.01	370	18.82
2D	27-May-90	2206.61	2200.37	14	5.61	350	17.07
3D	27-May-90	2205.48	2200.16	14	5.86	240	7.94
4D	27-May-90	2204.33	2199.33	16	6.84	140	4.88
5D	27-May-90	2204.88	2199.02	12.5	5.84	270	11.28
6D	27-May-90	2203.97	2198.24	15	6.05	230	6.15
7D	27-May-90	2203.19	2197.71	12	0	210	7.39
8D	27-May-90	0	0	0	0	0	0
9D	27-May-90	2204.47	2199	12	0	270	8.17
10D	27-May-90	2202.26	2197	12	0	250	8.98

06-Jun-90

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	06-Jun-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	06-Jun-90	2205.6	2200.6	14	5.96	600	195.58
2C	06-Jun-90	2206.89	2201.03	19	5.07	260	52.37
3C	06-Jun-90	2205.62	2200.92	15	6.18	370	35.86
4C	06-Jun-90	2204.46	2199.96	16	6.38	700	47.67
5C	06-Jun-90	2204.93	2199.72	14	5.66	1500	470.32
6C	06-Jun-90	2204.19	2198.92	15	6.27	340	16.75
7C	06-Jun-90	2203.04	2198.29	14	6.04	400	46.09
8C	06-Jun-90	2204.38	2198.22	13	6.23	500	58.37
9C	06-Jun-90	2204.51	2199.76	14	6.32	430	55.3
10C	06-Jun-90	2202.2	2197.4	15	5.7	1700	441.51

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	06-Jun-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1D	06-Jun-90	2205.64	2200.44	14	5.76	380	14.79
2D	06-Jun-90	2206.61	2201.06	13	5.65	390	14.66
3D	06-Jun-90	2205.48	2200.8	16	6.22	250	7.41
4D	06-Jun-90	2204.33	2199.86	12	5.67	170	3.52
5D	06-Jun-90	2204.88	2199.58	15	6.04	270	8.37
6D	06-Jun-90	2203.97	2198.77	14	5.67	230	6.55
7D	06-Jun-90	2203.19	2198.45	15	5.55	260	7.36
8D	06-Jun-90	2204.23	2198.14	13	5.3	320	12.35
9D	06-Jun-90	2204.47	2199.6	15	6.02	260	7.78
10D	06-Jun-90	2202.26	2197.47	16	6.27	230	6.39

01-Jul-90

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	01-Jul-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	01-Jul-90	2205.6	2199.09	15	5.69	650	148.7
2C	01-Jul-90	2206.89	2199.48	0	0	0	0
3C	01-Jul-90	2205.62	2199.41	15	5.79	280	14.44
4C	01-Jul-90	2204.46	2198.49	15	6.5	800	26.49
5C	01-Jul-90	2204.93	2198.44	14	7.05	2600	909.5
6C	01-Jul-90	2204.19	2197.55	15	6.7	350	17.48
7C	01-Jul-90	2203.04	2196.91	15	6.27	600	70.64
8C	01-Jul-90	2204.38	2196.83	14	5.89	460	32.63
9C	01-Jul-90	2204.51	2198.3	13	5.35	370	33.5
10C	01-Jul-90	2202.2	2196.15	15	6.5	1600	403.26

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	01-Jul-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1D	01-Jul-90	2205.64	2198.94	15	6.11	250	13.63
2D	01-Jul-90	2206.61	2199.49	16	5.92	220	12.7
3D	01-Jul-90	2205.48	2199.28	14	5.67	220	6.81
4D	01-Jul-90	2204.33	2198.43	13	7.32	180	3.8
5D	01-Jul-90	2204.88	2198.14	13	6.25	250	8.81
6D	01-Jul-90	2203.97	2197.41	13	5.7	230	6.81
7D	01-Jul-90	2203.19	2196.89	13	5.67	250	7.09
8D	01-Jul-90	2204.23	2196.75	13	5.56	270	9.37
9D	01-Jul-90	2204.47	2198.16	12	5.35	270	8.59
10D	01-Jul-90	2202.26	2196.2	13	6.17	220	6.37

11-Jul-90

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	11-Jul-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	11-Jul-90	2205.6	2198.63	0	5.49	0	175.77
2C	11-Jul-90	2206.89	2199.04	0	0	0	0
3C	11-Jul-90	2205.62	2198.96	0	6.32	0	12.27
4C	11-Jul-90	2204.46	2198.05	0	6.34	0	41.72
5C	11-Jul-90	2204.93	2197.93	0	5.6	0	844.72
6C	11-Jul-90	2204.19	2197.15	0	5.97	0	15.97
7C	11-Jul-90	2203.04	2196.54	0	7.2	0	57.5
8C	11-Jul-90	2204.38	2196.44	0	6.16	0	30.04
9C	11-Jul-90	2204.51	2197.85	0	6.07	0	36.92
10C	11-Jul-90	2202.2	2194.82	0	6.4	0	478.44

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	11-Jul-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1D	11-Jul-90	2205.64	2199.51	0	5.7	0	13.61

2D	11-Jul-90	2206.61	2199.06	0	5.89	0	12.73
3D	11-Jul-90	2205.48	2198.85	0	6.09	0	6.49
4D	11-Jul-90	2204.33	2197.99	0	7.26	0	3.75
5D	11-Jul-90	2204.88	2197.74	0	6.16	0	8.71
6D	11-Jul-90	2203.97	2197.02	0	5.75	0	6.75
7D	11-Jul-90	2203.19	2196.53	0	5.7	0	6.62
8D	11-Jul-90	2204.23	2196.37	0	5.73	0	8.57
9D	11-Jul-90	2204.47	2197.75	0	5.73	0	9.4
10D	11-Jul-90	2202.26	2194.9	0	6.83	0	7.94

17-Jul-90

WELL DATE MP WELEV TEMP PH EC ZN

17-Jul-90

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	17-Jul-90	2205.6	2198.48	0	0	0	0
2C	17-Jul-90	2206.89	0	0	0	0	0
3C	17-Jul-90	2205.62	2198.77	19	6.66	300	12.51
4C	17-Jul-90	2204.46	2197.91	22	7.34	850	59.94
5C	17-Jul-90	2204.93	2197.74	19	5.55	1950	652.36
6C	17-Jul-90	2204.19	2197.01	18	6.22	320	15.07
7C	17-Jul-90	2203.04	2195.84	18	6.76	490	57.55
8C	17-Jul-90	2204.38	2196.32	17	6.25	460	29.29
9C	17-Jul-90	2204.51	2197.73	18	6.86	400	33.96
10C	17-Jul-90	2202.2	2195.74	19	6.12	1700	413.16

WELL DATE MP WELEV TEMP PH EC ZN

17-Jul-90

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1D	17-Jul-90	2205.64	2198.34	16	5.66	360	13.81
2D	17-Jul-90	2206.61	2198.88	16	5.65	350	12.53
3D	17-Jul-90	2205.48	2198.68	16	6.56	240	6.53
4D	17-Jul-90	2204.33	2197.83	17	7.1	210	4.14
5D	17-Jul-90	2204.88	2197.58	19	5.66	260	8.81
6D	17-Jul-90	2203.97	2196.89	18	5.6	150	6.67
7D	17-Jul-90	2203.19	2196.48	17	5.87	250	7.92
8D	17-Jul-90	2204.23	2196.24	18	5.99	280	8.31
9D	17-Jul-90	2204.47	2197.58	17	5.6	270	9.95
10D	17-Jul-90	2202.26	2195.82	19	6.76	230	6.54

24-Jul-90

WELL DATE MP WELEV TEMP PH EC ZN

24-Jul-90

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	24-Jul-90	2205.6	2198.38	15	6.32	600	141.51
2C	24-Jul-90	2206.89	0	0	0	0	0

3C	24-Jul-90	2205.62	2198.68	15	6.29	270	11.82
4C	24-Jul-90	2204.46	2197.74	18	7.1	800	42.37
5C	24-Jul-90	2204.93	2197.59	16	6.63	1900	805
6C	24-Jul-90	2204.19	2196.95	15	6.34	300	17.26
7C	24-Jul-90	2203.04	2196.34	15	6.81	470	55.38
8C	24-Jul-90	2204.38	2196.22	16	6.95	460	28.17
9C	24-Jul-90	2204.51	2197.61	17	6.23	390	31.76
10C	24-Jul-90	2202.2	2195.7	18	6.37	900	258.91

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	24-Jul-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1D	24-Jul-90	2205.64	2198.24	12	5.7	340	13.44
2D	24-Jul-90	2206.61	2198.77	14	6.85	330	11.96
3D	24-Jul-90	2205.48	2198.57	13	6.1	220	6.16
4D	24-Jul-90	2204.33	2197.74	17	7.42	200	4.16
5D	24-Jul-90	2204.88	2197.5	15	6.02	250	9.35
6D	24-Jul-90	2203.97	2196.82	14	6.35	230	6.78
7D	24-Jul-90	2203.19	2196.32	13	5.91	240	6.86
8D	24-Jul-90	2204.23	2196.14	14	5.4	260	7.85
9D	24-Jul-90	2204.47	2197.47	15	5.41	270	8.04
10D	24-Jul-90	2202.26	2195.75	16	6.4	230	7.69

30-Jul-90

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	30-Jul-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	30-Jul-90	2205.6	2198.36	18	5.74	650	158.26
2C	30-Jul-90	2206.89	0	0	0	0	0
3C	30-Jul-90	2205.62	2198.72	19	5.83	300	13.38
4C	30-Jul-90	2204.46	2197.68	0	6.4	900	29.28
5C	30-Jul-90	2204.93	2197.56	0	6.85	2100	766.4
6C	30-Jul-90	2204.19	2196.91	20	5.92	330	15.22
7C	30-Jul-90	2203.04	2196.3	19	6.29	490	60.63
8C	30-Jul-90	2204.38	2196.21	19	5.79	470	30.72
9C	30-Jul-90	2204.51	2197.62	19	5.62	400	32.05
10C	30-Jul-90	2202.2	2195.65	21	5.78	1800	435.47

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	30-Jul-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1D	30-Jul-90	2205.64	2198.21	14	5.84	340	13.74
2D	30-Jul-90	2206.61	2198.73	16	6.53	330	12.47
3D	30-Jul-90	2205.48	2198.68	16	5.66	220	6.39
4D	30-Jul-90	2204.33	2197.68	19	7.45	210	3.94
5D	30-Jul-90	2204.88	2197.44	17	5.72	250	8.59

6D	30-Jul-90	2203.97	2196.76	19	5.85	240	6.63
7D	30-Jul-90	2203.19	2196.33	16	5.7	250	6.79
8D	30-Jul-90	2204.23	2195.32	16	5.9	270	7.84
9D	30-Jul-90	2204.47	2197.45	16	5.43	270	8.29
10D	30-Jul-90	2202.26	2195.73	16	6.01	220	6.38

04-Aug-90

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	04-Aug-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	04-Aug-90	2205.6	2198.26	18	5.97	650	142.18
2C	04-Aug-90	2206.89	0	0	0	0	0
3C	04-Aug-90	2205.62	2198.54	18	0	0	6.93
4C	04-Aug-90	2204.46	2197.61	19	7.41	700	23.2
5C	04-Aug-90	2204.93	2197.49	16	6.48	1800	695.63
6C	04-Aug-90	2204.19	2196.83	17	6.35	300	14.45
7C	04-Aug-90	2203.04	2196.25	16	5.72	500	51.82
8C	04-Aug-90	2204.38	2196.13	17	6.42	490	29.9
9C	04-Aug-90	2204.51	2197.52	16	5.99	400	32.71
10C	04-Aug-90	2202.2	2195.6	17	6.09	1600	393.18

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	04-Aug-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1D	04-Aug-90	2205.64	2198.11	15	5.73	360	13.55
2D	04-Aug-90	2206.61	2198.65	17	6.62	350	11.47
3D	04-Aug-90	2205.48	2198.44	15	6.19	230	5.98
4D	04-Aug-90	2204.33	2197.58	18	7.8	160	3.5
5D	04-Aug-90	2204.88	2197.38	16	5.8	250	8.25
6D	04-Aug-90	2203.97	2196.71	16	5.72	230	6.32
7D	04-Aug-90	2203.19	2196.22	14	5.6	245	6.5
8D	04-Aug-90	2204.23	2196.04	14	5.8	265	7.85
9D	04-Aug-90	2204.47	2197.38	14	5.64	270	7.96
10D	04-Aug-90	2202.26	2195.67	15	6.41	230	6.45

19-Aug-90

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	19-Aug-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	19-Aug-90	2205.6	2198.13	18	6.5	500	254
2C	19-Aug-90	2206.89	0	0	0	0	0
3C	19-Aug-90	2205.62	2198.46	16	6.52	330	15.84
4C	19-Aug-90	2204.46	2197.52	22	6.8	700	9.8
5C	19-Aug-90	2204.93	2197.38	20	6.75	1900	659.19
6C	19-Aug-90	2204.19	2196.74	18	6.46	310	13.75

7C	19-Aug-90	2203.04	2196.15	18	7.32	450	41.53
8C	19-Aug-90	2204.38	2196.02	18	6.31	450	26.17
9C	19-Aug-90	2204.51	2197.41	17	6.31	370	28.33
10C	19-Aug-90	2202.2	2195.71	18	6.22	1700	371.11

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	19-Aug-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1D	19-Aug-90	2205.64	2197.99	17	5.32	320	12.81
2D	19-Aug-90	2206.61	2198.51	16	6.49	300	11.29
3D	19-Aug-90	2205.48	2198.34	14	5.95	200	5.63
4D	19-Aug-90	2204.33	2197.47	19	6.7	200	2.93
5D	19-Aug-90	2204.88	2197.28	16	6.28	250	8
6D	19-Aug-90	2203.97	2196.62	17	6.29	230	6.2
7D	19-Aug-90	2203.19	2196.15	16	5.63	240	6.34
8D	19-Aug-90	2204.23	2195.87	17	5.55	260	7.47
9D	19-Aug-90	2204.47	2197.25	15	5.7	260	7.72
10D	19-Aug-90	2202.26	2195.62	16	6.98	220	7.44

26-Aug-90

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	26-Aug-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	26-Aug-90	2205.6	2198.24	15	6.5	500	111.19
2C	26-Aug-90	2206.89	0	0	0	0	0
3C	26-Aug-90	2205.62	2198.51	16	6.51	370	24.54
4C	26-Aug-90	2204.46	2197.59	18	6.88	420	14.44
5C	26-Aug-90	2204.93	2197.49	17	6.5	2650	1159
6C	26-Aug-90	2204.19	2196.82	15	6.54	340	17.42
7C	26-Aug-90	2203.04	2196.24	15	5.3	600	58.01
8C	26-Aug-90	2204.38	2196.13	15	5.77	430	27.85
9C	26-Aug-90	2204.51	2197.51	14	5.71	340	30.65
10C	26-Aug-90	2202.2	2195.62	16	6.1	1600	573.69

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	26-Aug-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1D	26-Aug-90	2205.64	2198.1	13	5.79	300	12.96
2D	26-Aug-90	2206.61	2198.64	14	6.36	280	10.92
3D	26-Aug-90	2205.48	2198.42	15	5.84	200	5.69
4D	26-Aug-90	2204.33	2197.55	14	7.87	170	3.57
5D	26-Aug-90	2204.88	2197.35	14	6.2	230	7.49
6D	26-Aug-90	2203.97	2196.69	14	6.2	210	6.29
7D	26-Aug-90	2203.19	2196.2	13	5.8	220	6.35
8D	26-Aug-90	2204.23	2196.04	13	6.03	240	7.51
9D	26-Aug-90	2204.47	2197.35	13	5.67	240	8.54

10D	26-Aug-90	2202.26	2194.78	14	7.19	200	5.42

07-Sep-90

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	07-Sep-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	07-Sep-90	2205.6	2198	19	6.68	500	94.78
2C	07-Sep-90	2206.89	0	0	0	0	0
3C	07-Sep-90	2205.62	2198.25	17	6.43	310	15.5
4C	07-Sep-90	2204.46	2197.34	22	6.6	600	11.32
5C	07-Sep-90	2204.93	2196.89	20	6.63	2500	1059.8
6C	07-Sep-90	2204.19	2196.65	20	6.37	320	12.96
7C	07-Sep-90	2203.04	2196.04	21	6.45	600	56.87
8C	07-Sep-90	2204.38	2195.92	20	6.62	470	24.71
9C	07-Sep-90	2204.51	2197.29	19	6.18	400	29.73
10C	07-Sep-90	2202.2	2195.46	21	5.75	1700	382.1

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	07-Sep-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1D	07-Sep-90	2205.64	2197.85	16	5.58	320	11.06
2D	07-Sep-90	2206.61	2198.38	18	5.82	300	5.21
3D	07-Sep-90	2205.48	2198.17	16	6.38	210	5.23
4D	07-Sep-90	2204.33	2197.33	17	7.54	290	7.24
5D	07-Sep-90	2204.88	2197.13	18	5.87	240	7.44
6D	07-Sep-90	2203.97	2196.48	18	5.66	220	5.75
7D	07-Sep-90	2203.19	2196.02	17	5.78	230	5.52
8D	07-Sep-90	2204.23	2195.85	15	5.59	250	6.63
9D	07-Sep-90	2204.47	2197.12	16	5.35	260	7.39
10D	07-Sep-90	2202.26	2195.52	16	6.43	210	5.52

29-Sep-90

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	29-Sep-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	29-Sep-90	2205.6	2197.631	19	6.98	420	69.16
2C	29-Sep-90	2206.89	0	0	0	0	0
3C	29-Sep-90	2205.62	2197.906	16	6.6	250	16.41
4C	29-Sep-90	2204.46	2197.08	21	7.4	550	5.67
5C	29-Sep-90	2204.93	2196.93	19	6.54	1300	327.84
6C	29-Sep-90	2204.19	2196.357	18	5.43	260	13.7
7C	29-Sep-90	2203.04	2195.811	18	6.4	410	47
8C	29-Sep-90	2204.38	0	0	0	0	0
9C	29-Sep-90	2204.51	2196.963	17	6.2	380	44.33
10C	29-Sep-90	2202.2	2195.278	18	6.26	1250	250.75

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	29-Sep-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1D	29-Sep-90	2205.64	2197.499	15	5.7	285	12.61
2D	29-Sep-90	2206.61	2197.99	15	6.26	280	11.26
3D	29-Sep-90	2205.48	2197.829	15	6.1	200	6.69
4D	29-Sep-90	2204.33	2197.038	19	7.85	240	3.97
5D	29-Sep-90	2204.88	2196.859	17	6.4	230	8.4
6D	29-Sep-90	2203.97	2196.251	17	5.7	210	6.84
7D	29-Sep-90	2203.19	2195.779	14	6.2	210	6.69
8D	29-Sep-90	2204.23	2195.626	15	6.35	235	7.58
9D	29-Sep-90	2204.47	2196.845	14	6.06	230	7.74
10D	29-Sep-90	2202.26	2195.343	17	6.96	200	6.52

03-Nov-90

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	03-Nov-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	03-Nov-90	2205.6	2198.12	0	0	0	0
2C	03-Nov-90	2206.89	2198.45	0	0	0	0
3C	03-Nov-90	2205.62	2198.38	0	0	0	0
4C	03-Nov-90	2204.46	2197.61	0	0	0	0
5C	03-Nov-90	2204.93	2197.39	10	6.86	2000	648.52
6C	03-Nov-90	2204.19	2196.77	10	5.85	220	11.03
7C	03-Nov-90	2203.04	2196.21	10	6.29	340	42.13
8C	03-Nov-90	2204.38	2196.1	10	6.4	300	21.22
9C	03-Nov-90	2204.51	2197.43	9	5.58	260	25.57
10C	03-Nov-90	2202.2	2195.63	9	6.1	1350	315.31

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	03-Nov-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1D	03-Nov-90	2205.64	2197.98	11	6.55	240	9.02
2D	03-Nov-90	2206.61	2198.48	11	6.34	225	8.94
3D	03-Nov-90	2205.48	2198.28	10	6.67	190	5.38
4D	03-Nov-90	2204.33	2197.5	11	7.36	290	8.24
5D	03-Nov-90	2204.88	2197.28	9	5.97	100	6.82
6D	03-Nov-90	2203.97	2196.65	12	5.69	190	5.78
7D	03-Nov-90	2203.19	2196.19	11	5.63	200	5.95
8D	03-Nov-90	2204.23	2196.03	10	5.56	200	6.38
9D	03-Nov-90	2204.47	2197.29	10	5.63	200	6.51
10D	03-Nov-90	2202.26	2195.67	12	6.74	200	6

15-Dec-90

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	15-Dec-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	15-Dec-90	2205.6	2199.11	8	5.8	1200	537.41
2C	15-Dec-90	2206.89	2199.5	0	0	0	0
3C	15-Dec-90	2205.62	2199.37	8	5.94	260	21.99
4C	15-Dec-90	2204.46	2198.43	7	7.2	500	34.39
5C	15-Dec-90	2204.93	2198.27	7	6.18	2300	1155.48
6C	15-Dec-90	2204.19	2197.54	9	6.25	260	14.89
7C	15-Dec-90	2203.04	2196.94	8	5.85	470	79.68
8C	15-Dec-90	2204.38	2196.85	8	6.27	370	37.21
9C	15-Dec-90	2204.51	2198.31	9	5.55	340	46.94
10C	15-Dec-90	2202.2	2196.19	7	5.56	1150	382.61

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	15-Dec-90						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1D	15-Dec-90	2205.64	2198.95	10	6.18	270	9.54
2D	15-Dec-90	2206.61	2199.51	9	6.1	220	9.49
3D	15-Dec-90	2205.48	2199.28	9	5.86	190	6.38
4D	15-Dec-90	2204.33	2198.37	9	6.93	250	3.77
5D	15-Dec-90	2204.88	2198.14	9	6.04	220	12.19
6D	15-Dec-90	2203.97	2197.39	10	5.88	200	6.42
7D	15-Dec-90	2203.19	2196.9	10	5.9	240	6.14
8D	15-Dec-90	2204.23	2196.78	9	5.64	190	7.33
9D	15-Dec-90	2204.47	2198.16	11	5.48	250	9.04
10D	15-Dec-90	2202.26	2196.23	10	6.12	200	6.11

21-Jan-91

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	21-Jan-91						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	21-Jan-91	2205.6	2198.97	7	5.93	600	0
2C	21-Jan-91	2206.89	2199.41	7	6.24	360	0
3C	21-Jan-91	2205.62	2199.34	8	5.58	290	0
4C	21-Jan-91	2204.46	2198.42	6	6.58	460	0
5C	21-Jan-91	2204.93	2198.23	7	6.94	600	0
6C	21-Jan-91	2204.19	2197.44	8	5.77	290	0
7C	21-Jan-91	2203.04	2196.9	6	5.85	470	0
8C	21-Jan-91	2204.38	2196.82	7	6.1	410	0
9C	21-Jan-91	2204.51	2198.26	7	5.4	550	0
10C	21-Jan-91	2202.2	2196.11	6	5.91	900	0

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	21-Jan-91						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1D	21-Jan-91	2205.64	2198.81	9	5.99	320	0
2D	21-Jan-91	2206.61	2199.43	8	5.64	180	0
3D	21-Jan-91	2205.48	2199.17	10	5.88	220	0
4D	21-Jan-91	2204.33	2198.33	7	6.9	270	0
5D	21-Jan-91	2204.88	2198.09	9	5.53	370	0
6D	21-Jan-91	2203.97	2197.31	10	5.86	200	0
7D	21-Jan-91	2203.19	2196.87	8	5.92	250	0
8D	21-Jan-91	2204.23	2196.76	6	5.66	215	0
9D	21-Jan-91	2204.47	2198.09	10	5.35	300	0
10D	21-Jan-91	2202.26	2196.19	7	6.5	170	0

01-Feb-91

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	01-Feb-91						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	01-Feb-91	2205.6	2198.28	6	5.5	650	
2C	01-Feb-91	2206.89	2198.69	7	5.86	360	
3C	01-Feb-91	2205.62	2198.6	7	5.48	270	
4C	01-Feb-91	2204.46	2197.76	5	6.86	420	
5C	01-Feb-91	2204.93	2197.62	6	6.2	410	
6C	01-Feb-91	2204.19	2196.89	7	5.6	290	
7C	01-Feb-91	2203.04	2196.36	6	5.6	430	
8C	01-Feb-91	2204.38	2196.28	7	5.8	410	
9C	01-Feb-91	2204.51	2197.61	7	5.33	370	
10C	01-Feb-91	2202.2	2195.67	6	6.08	1000	

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	01-Feb-91						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1D	01-Feb-91	2205.64	2198.14	8	5.9	340	
2D	01-Feb-91	2206.61	2198.73	8	5.46	280	
3D	01-Feb-91	2205.48	2198.45	9	5.76	240	
4D	01-Feb-91	2204.33	2197.73	7	7.02	240	
5D	01-Feb-91	2204.88	2197.5	7	5.46	290	
6D	01-Feb-91	2203.97	2196.76	9	5.82	210	
7D	01-Feb-91	2203.19	2196.34	6	5.87	235	
8D	01-Feb-91	2204.23	2196.18	7	5.6	270	
9D	01-Feb-91	2204.47	2197.47	9	5.42	290	
10D	01-Feb-91	2202.26	2195.8	9	6.2	210	

11-Feb-91

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	11-Feb-91						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	11-Feb-91	2205.6	2199.06	6	5.54	550	
2C	11-Feb-91	2206.89	2199.47	6	5.6	340	
3C	11-Feb-91	2205.62	2199.42	6	5.52	260	
4C	11-Feb-91	2204.46	2198.55	5	6.61	420	
5C	11-Feb-91	2204.93	2198.33	6	5.69	340	
6C	11-Feb-91	2204.19	2197.56	7	5.62	280	
7C	11-Feb-91	2203.04	2197	5	6.01	400	
8C	11-Feb-91	2204.38	2196.92	6	5.46	410	
9C	11-Feb-91	2204.51	2198.34	6	5.4	350	
10C	11-Feb-91	2202.2	2196.22	5	5.69	1000	

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	11-Feb-91						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1D	11-Feb-91	2205.64	2198.89	8	5.4	350	
2D	11-Feb-91	2206.61	2199.49	7	5.4	300	
3D	11-Feb-91	2205.48	2199.22	8	5.71	250	
4D	11-Feb-91	2204.33	2198.48	6	6.7	240	
5D	11-Feb-91	2204.88	2198.21	7	5.61	280	
6D	11-Feb-91	2203.97	2197.42	8	5.87	220	
7D	11-Feb-91	2203.19	2196.98	8	5.57	250	
8D	11-Feb-91	2204.23	2196.84	8	5.4	270	
9D	11-Feb-91	2204.47	2198.18	8	5.47	280	
10D	11-Feb-91	2202.26	2196.32	7	6.04	230	

18-Feb-91

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	18-Feb-91						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	18-Feb-91	2205.6	2199.58	6	5.35	600	229.34
2C	18-Feb-91	2206.89	2200.03	6	5.42	370	59.15
3C	18-Feb-91	2205.62	2199.93	7	5.62	310	35.47
4C	18-Feb-91	2204.46	2199.06	4	6.57	420	25.19
5C	18-Feb-91	2204.93	2198.83	5	6.67	290	29.06
6C	18-Feb-91	2204.19	2198.04	7	6.12	250	18.13
7C	18-Feb-91	2203.04	2197.47	6	5.38	440	83.1
8C	18-Feb-91	2204.38	2197.4	7	5.41	430	56
9C	18-Feb-91	2204.51	2198.85	7	5.31	350	42.45
10C	18-Feb-91	2202.2	2196.68	6	6.72	1100	310.73

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	18-Feb-91						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1D	18-Feb-91	2205.64	2199.38	7	5.45	350	18.67
2D	18-Feb-91	2206.61	2200.01	7	5.45	350	17.52

3D	18-Feb-91	2205.48	2199.73	8	5.74	250	9.74
4D	18-Feb-91	2204.33	2198.97	5	6.96	180	4.91
5D	18-Feb-91	2204.88	2198.7	7	5.63	280	17.03
6D	18-Feb-91	2203.97	2197.87	8	5.85	240	9.64
7D	18-Feb-91	2203.19	2197.44	8	5.61	250	9.48
8D	18-Feb-91	2204.23	2197.31	8	5.48	280	11.9
9D	18-Feb-91	2204.47	2198.66	8	5.51	250	12.1
10D	18-Feb-91	2202.26	2196.76	8	5.88	240	10.01

06-Mar-91

WELL DATE MP WELEV TEMP PH EC ZN

06-Mar-91

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	06-Mar-91	2205.6	2199.77	6	5.33	700	271.94
2C	06-Mar-91	2206.89	2200.21	7	5.57	395	61.23
3C	06-Mar-91	2205.62	2200.09	7	5.48	320	39.8
4C	06-Mar-91	2204.46	2199.14	6	6.58	440	24.57
5C	06-Mar-91	2204.93	2198.94	5	6.2	1200	846.34
6C	06-Mar-91	2204.19	2198.14	6	5.36	270	20.34
7C	06-Mar-91	2203.04	2197.56	6	5.3	450	89.18
8C	06-Mar-91	2204.38	2197.5	6	5.34	440	62.99
9C	06-Mar-91	2204.51	2198.98	6	5.34	700	222.24
10C	06-Mar-91	2202.2	2196.76	6	6.16	1000	367.75

WELL DATE MP WELEV TEMP PH EC ZN

06-Mar-91

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1D	06-Mar-91	2205.64	2199.56	7	5.39	360	20.21
2D	06-Mar-91	2206.61	2200.19	6	5.4	330	19.14
3D	06-Mar-91	2205.48	2199.88	8	5.61	240	9.18
4D	06-Mar-91	2204.33	2199.04	6	6.85	240	6.03
5D	06-Mar-91	2204.88	2198.81	6	5.77	280	21.75
6D	06-Mar-91	2203.97	2197.96	8	5.8	230	9.65
7D	06-Mar-91	2203.19	2197.53	8	5.53	230	9.39
8D	06-Mar-91	2204.23	2197.41	7	5.39	280	12.75
9D	06-Mar-91	2204.47	2198.79	7	5.46	260	14.39
10D	06-Mar-91	2202.26	2196.81	7	6.02	220	9.53

16-Mar-91

WELL DATE MP WELEV TEMP PH EC ZN

16-Mar-91

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	16-Mar-91	2205.6	2199.02	9	5.46	800	261.2
2C	16-Mar-91	2206.89	2199.44	10	5.53	390	27.3
3C	16-Mar-91	2205.62	2199.32	9	5.48	310	21.62

4C	16-Mar-91	2204.46	2198.39	8	6.44	470	27.31
5C	16-Mar-91	2204.93	2198.23	9	5.77	1800	1497.71
6C	16-Mar-91	2204.19	2197.47	9	5.35	310	18.78
7C	16-Mar-91	2203.04	2196.89	10	5.36	470	84.47
8C	16-Mar-91	2204.38	2196.8	9	5.3	460	44.35
9C	16-Mar-91	2204.51	2198.26	9	5.32	440	65.9
10C	16-Mar-91	2202.2	2196.17	9	6.12	1000	283.97

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	16-Mar-91						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1D	16-Mar-91	2205.64	2198.79	10	5.47	380	21.22
2D	16-Mar-91	2206.61	2199.41	9	5.37	380	18.95
3D	16-Mar-91	2205.48	2199.11	9	5.65	250	9.94
4D	16-Mar-91	2204.33	2198.32	8	6.95	240	5.28
5D	16-Mar-91	2204.88	2198.12	9	5.92	320	23.67
6D	16-Mar-91	2203.97	2197.29	10	5.79	250	9.63
7D	16-Mar-91	2203.19	2196.88	9	5.57	270	10.33
8D	16-Mar-91	2204.23	2196.65	9	5.36	300	12.36
9D	16-Mar-91	2204.47	2198.09	10	5.43	300	12.08
10D	16-Mar-91	2202.26	2196.21	9	5.96	260	10.11

26-Mar-91

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	26-Mar-91						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	26-Mar-91	2205.6	2198.77	6	5.35	800	230.37
2C	26-Mar-91	2206.89	2199.18	7	5.37	360	22.74
3C	26-Mar-91	2205.62	2199.1	7	5.52	270	15.4
4C	26-Mar-91	2204.46	2198.18	6	6.7	400	18.53
5C	26-Mar-91	2204.93	2198.03	7	6.17	1200	403.05
6C	26-Mar-91	2204.19	2197.29	7	5.28	300	19.06
7C	26-Mar-91	2203.04	2196.74	6	5.29	460	74.19
8C	26-Mar-91	2204.38	2196.63	7	5.28	430	36.02
9C	26-Mar-91	2204.51	2198.03	6	5.15	390	44.48
10C	26-Mar-91	2202.2	2196.05	6	5.93	900	258.31

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	26-Mar-91						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1D	26-Mar-91	2205.64	2198.46	7	5.38	360	18.22
2D	26-Mar-91	2206.61	2199.16	7	5.37	370	15.99
3D	26-Mar-91	2205.48	2198.88	6	5.61	240	8.58
4D	26-Mar-91	2204.33	2198.13	7	6.8	230	4.55
5D	26-Mar-91	2204.88	2197.92	7	5.69	340	32.98
6D	26-Mar-91	2203.97	2197.12	7	5.81	230	8.13

7D	26-Mar-91	2203.19	2196.7	8	5.53	250	8.49
8D	26-Mar-91	2204.23	2196.55	7	5.34	290	10.35
9D	26-Mar-91	2204.47	2197.85	7	5.38	300	11.47
10D	26-Mar-91	2202.26	2196.09	7	5.8	250	8.71

09-Apr-91

WELL DATE MP WELEV TEMP PH EC ZN
09-Apr-91

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	09-Apr-91	2205.6	2199.99	7	5.22	700	174.9
2C	09-Apr-91	2206.89	2200.44	7	5.41	400	52.23
3C	09-Apr-91	2205.62	2200.34	7	5.5	320	36.11
4C	09-Apr-91	2204.46	2199.48	6.5	6.72	460	12.17
5C	09-Apr-91	2204.93	2199.2	6	5.65	750	210.13
6C	09-Apr-91	2204.19	2198.42	8	5.31	320	17.74
7C	09-Apr-91	2203.04	2197.81	7	5.51	385	53.61
8C	09-Apr-91	2204.38	2197.73	8	5.4	450	54.63
9C	09-Apr-91	2204.51	2199.21	8	5.12	445	74.01
10C	09-Apr-91	2202.2	2197.03	8	5.98	1000	283.17

WELL DATE MP WELEV TEMP PH EC ZN
09-Apr-91

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1D	09-Apr-91	2205.64	2199.77	7	5.38	360	17.2
2D	09-Apr-91	2206.61	2200.41	7	5.47	340	15.06
3D	09-Apr-91	2205.48	2200.13	8	5.7	240	8.27
4D	09-Apr-91	2204.33	2199.36	7	7.1	230	4.33
5D	09-Apr-91	2204.88	2199.09	7	5.6	330	29
6D	09-Apr-91	2203.97	2198.24	8	5.87	250	8.38
7D	09-Apr-91	2203.19	2197.78	8	5.59	260	8.49
8D	09-Apr-91	2204.23	2197.64	8	5.42	290	10.77
9D	09-Apr-91	2204.47	2199.03	8	5.45	300	11.17
10D	09-Apr-91	2202.26	2197.08	8	5.96	250	8.29

19-Apr-91

WELL DATE MP WELEV TEMP PH EC ZN
19-Apr-91

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	19-Apr-91	2205.6	2199.27	11	5.13	700	179.89
2C	19-Apr-91	2206.89	2199.67	13	5.49	410	23.28
3C	19-Apr-91	2205.62	2199.6	12	5.6	300	15.18
4C	19-Apr-91	2204.46	2198.71	11	6.74	550	17.26
5C	19-Apr-91	2204.93	2198.53	11	5.96	1000	277.11
6C	19-Apr-91	2204.19	2197.79	11	5.32	330	16.59
7C	19-Apr-91	2203.04	2197.19	14	5.45	460	58.49

8C	19-Apr-91	2204.38	2197.11	12	5.85	490	35.21
9C	19-Apr-91	2204.51	2198.54	13	5.35	470	58.25
10C	19-Apr-91	2202.2	2196.49	12	6.09	1250	263.29

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	19-Apr-91						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1D	19-Apr-91	2205.64	2199.05	12	5.34	380	16.27
2D	19-Apr-91	2206.61	2199.66	10	5.36	360	13.92
3D	19-Apr-91	2205.48	2199.38	11	5.72	260	7.54
4D	19-Apr-91	2204.33	2198.68	11	6.9	240	4.41
5D	19-Apr-91	2204.88	2198.42	10	5.79	350	25.59
6D	19-Apr-91	2203.97	2197.62	13	6.07	250	8.32
7D	19-Apr-91	2203.19	2197.17	11	5.59	280	8.22
8D	19-Apr-91	2204.23	2197.02	11	5.43	310	9.64
9D	19-Apr-91	2204.47	2198.35	12	5.67	320	10.23
10D	19-Apr-91	2202.26	2196.55	12	6.02	260	8.08

30-Apr-91

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	30-Apr-91						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	30-Apr-91	2205.6	2199.37	11	5.25	700	208.77
2C	30-Apr-91	2206.89	2199.77	11	5.43	380	28.97
3C	30-Apr-91	2205.62	2199.69	12	5.92	275	16.47
4C	30-Apr-91	2204.46	2198.81	12	6.65	600	19.44
5C	30-Apr-91	2204.93	2198.61	10	5.42	700	172.74
6C	30-Apr-91	2204.19	2197.86	11	5.38	310	17.21
7C	30-Apr-91	2203.04	2197.26	11	5.7	420	50.39
8C	30-Apr-91	2204.38	2197.16	11	6.03	460	37.99
9C	30-Apr-91	2204.51	2198.61	11	5.9	400	48.64
10C	30-Apr-91	2202.2	2196.53	11	6	1000	220.08

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	30-Apr-91						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1D	30-Apr-91	2205.64	2199.15	10	5.47	345	16.32
2D	30-Apr-91	2206.61	2199.75	10	5.5	350	14.37
3D	30-Apr-91	2205.48	2199.48	11	5.97	240	8.09
4D	30-Apr-91	2204.33	2198.74	10	6.88	250	4.72
5D	30-Apr-91	2204.88	2198.5	9	5.68	340	25.95
6D	30-Apr-91	2203.97	2197.69	10	6.01	260	8.9
7D	30-Apr-91	2203.19	2197.22	10	5.88	270	8.66
8D	30-Apr-91	2204.23	2197.08	10	5.6	300	10.29
9D	30-Apr-91	2204.47	2198.42	10	5.6	290	10.95
10D	30-Apr-91	2202.26	2196.59	10	5.96	240	8.07

07-May-91

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	07-May-91						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1C	07-May-91	2205.6	2199.23	9	5.29	700	234.17
2C	07-May-91	2206.89	2199.64	9	5.5	350	22.26
3C	07-May-91	2205.62	2199.57	10	5.71	250	13.3
4C	07-May-91	2204.46	2198.78	10	6.71	550	19.66
5C	07-May-91	2204.93	2198.53	10	6.29	350	39.78
6C	07-May-91	2204.19	2197.79	10	5.6	290	18.81
7C	07-May-91	2203.04	2197.23	10	5.89	380	52.01
8C	07-May-91	2204.38	2197.1	11	5.65	340	34.01
9C	07-May-91	2204.51	2198.5	9	5.41	360	43.34
10C	07-May-91	2202.2	2196.53	10	6.06	1100	201.58

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
	07-May-91						

WELL	DATE	MP	WELEV	TEMP	PH	EC	ZN
1D	07-May-91	2205.64	2199	9	5.41	340	16.22
2D	07-May-91	2206.61	2199.61	9	5.49	330	14.62
3D	07-May-91	2205.48	2199.37	10	5.8	230	8.11
4D	07-May-91	2204.33	2198.69	10	7.22	240	4.27
5D	07-May-91	2204.88	2198.4	10	5.75	320	24.53
6D	07-May-91	2203.97	2197.64	10	5.88	250	8.93
7D	07-May-91	2203.19	2197.19	10	5.79	250	9
8D	07-May-91	2204.23	2197.03	10	5.56	280	10.02
9D	07-May-91	2204.47	2198.32	9	5.48	280	10.55
10D	07-May-91	2202.26	2196.59	10	6.21	240	11.86

APPENDIX II: SEDIMENT SAMPLE LOCATIONS, THICKNESSES, AND DESCRIPTIONS

STAT. CLASSIF.

1 red sandy
2 rd-bn sandy
3 rd-bn sandy w/ gy blebs/ptgs
4 yl sandy
5 yl-bn sandy
6 yl-bn sandy w/ gy blebs/ptgs
7 or sandy
8 or-bn sandy
9 or-bn sandy w/ gy blebs/ptgs
10 rd-bn +/- yl-bn +/- or-bn
11 DGF
12 DGC
13 bn RC
14 lt/dk ol-gn or blue RC
15 gravel +/- sand,silt,clay
16 lt/med gy sandy, silty +/- or-rd-bn
17 org mat'l/wood chips

SAMPLE NUMBER	LOCATION NORTHING	EASTIN	+ STATISTICAL + CLASSIFICATION	+ SAMPLE + DESCRIPTION	FURTHER COMMENTS
1001	-2.5	-4.8	2	rd-bn sand	5C replicate
1002	-2.5	-4.8	8	yl-bn sand	
1003	-2.5	-4.8	12	dk-gy clayey	
1004	-2.5	-4.8	12	dk-gy clayey	
1005	-2.5	-4.8	13	bn clayey w/ roots	bk seams
1006	-2.5	-4.8	13	bn-gy clayey	rare pebbles
1007	-2.5	-4.8	14	med gy clay	rd-bn&yl FeOx,rare bk organics
1008	-2.5	-4.8	14	med gy clay	rare org.,no FeOx
1009	6	-160	2	rd-bn clay/silt/sand	6C Replicate
1010	6	-160	2	rd-bn clay/silt/sand	
1011	6	-160	13	or clay,lt-bn clay/silt	carb'd stringers
1012	6	-160	15	gravel	
1013	0	-100	2	rd-bn silty sand	clayey bk(carb?) ptgs;**JDS-P1
1013	0	-100	17	org. mat	lower .12 ft of spl
1014	0	-100	11	wkly carb'd wood&med bn clayey silty sand:DGF	
1015	0	-100	13	lt-bn-gy clayey silt	
1016	0	-100	15	sand,cobbls,grav,silt	
1017	0	-50	5	or-bn sand	*******JDS-P2
1018	0	-50	11	dk-gy dk-bn f.gr.	
1019	0	-50	5	or-bn sand	or-bn silt ptgs
1020	0	-50	5	or-bn sandy silt	
1021	0	-50	6	dk-gy&or-bn blebs	
1022	0	-50	17	bk org. mat	

1023	0	-50	13	or-bn clay silt	lower .6=lt bn-gy silty sand
1024	0	-50	8	yl-bn gravel	
1025	50	0	1	rd sand	***JDS-P3
1026	50	0	8	bn-yl sand	lt-gy clay seams
1027	50	0	12	DGC	bn-yl sandy seams
1028	50	0	6	bn-or sand+DGC	
1029	50	0	12	DGC	
1030	50	0	14	med-gy clay	
1030	50	0	17	org. mat	
1031	50	0	13	dk-gy/md-gy clay	
1032	50	0	14	dk-gy sandy	wet gravel@7'3"
1033	50	-50	1	rd sandy	*****JDS-P4 this location
1034	50	-50	7	yl sandy	
1035	50	-50	11	dk-gy sandy	
1036	50	-50	12	DGC	
1037	50	-50	13	med-gy clay	rootlets common
1037	50	-50	17	org. mat	wet@78";EOH@82",gravel
1038	-50	0	3	rd sandy w/ bk layers	root frags common
1039	-50	0	1	rd sandy	
1040	-50	0	11	gy clay+or-bn clayey silt:DGF	
1041	-50	0	13	lt-bn clay	
1042	0	-20	10	yl-bn,or-bn sand	lt gy clay partings
1043	0	-20	8	yl-bn sand	lt gy clay partings
1044	0	-20	11	dk,med-gy v.f.gr.	
1045	0	-20	11	dk,med-gy v.f.gr.	
1046	0	-20	13	pebbly,sandy clay	org. mat on upper sfc.
1047	0	-30	10	rd,yl-bn sand	
1048	0	-30	8	yl-bn sand-silt	med gy silty ptgs
1049	0	-30	11	dk-gy to bk f.gr.	
1050	0	-30	13	bn clay, carb. wood	org. mat on top
1050	0	-30	17	org. mat	
1051	0	-30	15	lt-gy sandy, wet	
1052	0	-40	5	or-bn sandy silt	med gy silt ptgs
1053	0	-40	11	lt-bn,lt-gy sandy	
1054	0	-40	11	lt-bn,lt-gy sandy	
1055	0	-40	11	dk gy f.gr.	
1055	0	-40	17	org. mat	
1056	0	-40	13	lt-bn med-gy clay	
1057	0	-60	5	or-bn sandy silt	
1058	0	-60	5	dk or-bn sandy silt	
1059	0	-60	14	med gy clayey&bn clay	
1060	0	-60	13	bn clay	"chunky",rootlets common
1061	0	-60	13	lt-bn clay	plastic
1062	10	0	2	rd-bn sandy	

1063	10	0	9	lt-yl-bn+lt-gy sandy	
1064	10	0	11	DGF	
1065	10	0	11	DGFFG	org mat@38",H20@5'
1066	10	0	12	dk gn-gy clay--DGC	no gravel @ 7.75 EOH
1067	20	0	10	rd & or-bn sandy	
1068	20	0	11	DGF	
1069	20	0	12	DGC	rootlets common
1070	20	0	14	med gn-gy clay	getting sandier
1071	30	0	8	yl-bn sand	
1072	30	0	8	yl-bn sand	gy layer@25-26"
1073	30	0	11	dk-gy	
1074	30	0	11	dk-gy	org mat@42-43"
1075	30	0	14	med gn-gy clay	
1076	40	0	2	rd-bn sand	
1077	40	0	8	yl-bn sand	mnr gy silty ptgs
1078	40	0	5	or-bn/lt-gy silty	brt or-bn str common
1079	40	0	11	med-gy silt	
1080	40	0	11	dk-gy silt	
1081	40	0	14	v.dk.gy/to dk ol-gy	root wad@ 42-46"
1082	-20	40	10	rd-bn,yl-bn sandy	***JDS-P5
1083	-20	40	6	DGF ptgs in or,gy sands	ptgs^ .25 to 1" thick
1084	-20	40	11	med gy-bn sand	uniformly sandy
1085	-20	40	11	DGF	
1086	-20	40	14	med gn-gy RC	
1086	-20	40	17	org. material	
1087	-20	40	11	DGF^clay&H20 than 1085	* spl out of seq.
1088	-20	40	14	med gy-gn RC w/ roots	EOH @ 6':wet sandy RC
1089	-20	0	10	rd-bn,or-bn sandy	
1090	-20	0	5	or-bn sandy	dk-gy@21"
1091	-20	0	11	DGF	
1091	-20	0	17	wood chips-no C noted	
1092	-20	0	5	or-bn+tan+wood	
1093	-20	0	14	lt gn-gy+rootlets	
1094	20	-20	2	rd-bn sandy	rare gy layers^>5" thick
1095	20	-20	8	yl-gy-bn sandy	
1096	20	-20	11	DFG	log @ 2.9'
2001	0	50	1	rd sandy	
2002	0	50	8	yl-bn sandy	
2003	0	50	11	DGF	
2004	0	50	11	DGF	
2005	0	50	11	DGF	
2006	0	50	12	DGC	org mat @ 38"
2007	25	25	7	YS	
2008	25	25	6	brt or & med-to dk-gy	alternating layers

2009	25	25	6	same	
2010	25	25	12	DGC	
2010	25	25	17	org mat'l	
2011	25	25	11	med gy sandy clay--DGF	
2012	25	25	12	dk gy RC w/rootlets-DGC	wet gravel @ 5',EOH
2013	50	50	1	rd sandy	
2014	50	50	11	lt to med-gy f.gr.	
2015	50	50	8	lt to med-yl-bn sandy	brt-or layers common
2016	50	50	7	YS	
2017	50	50	12	DGC	
2018	50	50	12	DGC	
2019	50	50	13	or&rd clay	^wood chips @ top of clay
2020	50	50	14	lt ol-gn-gy clay	wet gravel @ 74"
2021	-50	50	5	dk or-bn sandy	+dk-gy streaks;top3"gravelly
2022	-50	50	4	or sandy	dk-bn streaks
2023	-50	50	5	or&bn sandy	some gravel;twigs/roots common
2024	-50	50	5	brt-or&or-bn sandy	carb'd twigs common
2025	-50	50	5	same	all wood 18-28"
2026	-50	50	12	lt-gy clay	spl mostly wood
2026	-50	50	17	org mat'l	
2027	-50	50	11	med dk-gy sandy/f.gr.	#spl out of seq;brt-or blebs;grav@57"
2028	-50	50	13	or-bn clay w/ wood	#spl out of seq;wet gravel@63"
2029	-50	-50	6	or-bn sandy	dk gy layers
2030	-50	-50	11	dk bn f.gr.	
2031	-50	-50	6	or bn sandy&silty	gy-bn layers
2032	-50	-50	12	or-bn & gy blebby	
2033	-50	-50	13	lt-bn RC	dry gravel:32-50"
2034	-50	-100	6	or-bn & bn sandy	dk-gy streaks&grass roots
2035	-50	-100	6	same and silty	sandy to silty
2036	-50	-100	6	same	
2037	-50	-100	6	same	
2038	-50	-100	13	lt-bn RC	wood layer @ 31"
2039	-50	-100	14	sandy RC	wet gravel &EOH@57"
2040	25	-75	4	or sandy	rare gy layers
2041	25	-75	4	or sandy	w/ carb'd roots
2042	25	-75	5	or-bn f.gr.	carb'd roots v. common
2043	25	-75	10	or-bn + yl sandy	
2044	25	-75	10	or-bn + yl sandy	clay & org mat@ 18"
2044	25	-75			
2045	25	-75	13	lt bn RC	lt ol-bn RC@27";Grav.clay@47"
2046	50	-75	1	RS	old river meander 24' N
2047	50	-75	10	RS + YS	
2048	50	-75	10	RS + YS	
2048	50	-75			
2049	50	-75	6	OS w/ med-gy layers	med-gy layers f.gr.
2050	50	-75	6	same	

2051	50	-75	12	DGC	
2052	50	-75	11	DGF ?	! spl out of sequence
2053	50	-75	6	or & gy blebs(sandy?)	wood common
2053	50	-75	17	org mat'l	
2054	50	-75	12	or&gy clay:RC?	org mat@44",RC below;log,wet clay,EOH@4'
2054	50	-75	17	org mat'l	
2055	70	-25	10	RS+or sandy	
2056	70	-25	7	yl sandy	f.gr.gy layers
2057	70	-25	7	same	f.gr.gy-bn layers
2058	70	-25	7	same	!!!!old meander 23' N
2059	70	-25	11	DGF	or-bn&dk-gy blebs
2060	70	-25	11	DGF	
2061	70	-25	12	DGC?	high org,redolent smell
2061	70	-25	17	org mat'l	
2062	70	-25	12	DGC	same
2063	75	25	1	rd sandy	
2064	75	25	4	brt-or sandy	
2065	75	25	4	same	
2066	75	25	5	or-bn sandy	rare f.gr.bn-gy layers
2067	75	25	5	same	rare cobbles(thru 2070)
2068	75	25	5	same	
2069	75	25	5	same	sl. finer gr.
2070	75	25	5	same	incr.carb.wood;brt.or layers
2071	75	25	5	same	rare cobbles&wood chips
2072	75	25	4	or sandy	wood chips common
2073	75	25	4	same	
2074	75	25	11	5% gy sandy clay:DGF	
2074	75	25	17	95% org mat'l	
2075	75	25	4	or sandy(above mat)	!out of seq.
2076	75	25	14	ol-gn RC	v. twiggy/rooty
2077	75	25	14	ol-gn RC,sandier	
2078	-70	20	3	dk rd-bn w/ bk streaks	
2079	-70	20	3	same	
2080	-70	20	4	or sandy	rare bn&gy f.gr.layers
2081	-70	20	4	same	+wood chips
2082	-70	20	9	yl-bn sandy	med gy f.gr. blebs/ptgs
2083	-70	20	9	yl-bn sandy	rare gy layers
2084	-70	20	11	med gy f.gr.	FeOx blebs common
2085	-70	20	11	DGF	DGF@28";no FeOx
2086	-70	20	11	DGF/DGC	more clayey,wood chips common
2086	-70	20	17	org. mat'l	
2087	-70	20	12	lt gy clay	50% wood chips
2087	-70	20	17	org. mat'l	
2088	-70	20	14	dk ol-gn clay	sand incr to 67"
2089	-70	20	14	blue clay	FeOx blebs common;wet gravel@92"
2090	-25	-125	3	dk rd-bn-gy clay-silt	
2091	-25	-125	6	lt or-bn silty clay	
2092	-25	-125	12	dk bn/dk gy clay	

2093	-25	-125	15	sandy/grav RC
2094	30	-125	3	dk rd-bn sandy w/DGF ptgs
2095	30	-125	1	RS
2096	30	-125	12	wood+mnr bn clay:DGC
2097	30	-125	13	or-bn clay,bn silty clay
2098	30	-125	13	bn sandy clay w/DGF ptgs
2099	50	-150	3	dk rd-bn sandy w/DGF ptgs
2100	50	-150	3	dk rd-bn-gy silty sand
2101	50	-150	5	bn-or sandy
2102	50	-150	11	org mat+or-bn silt:DGF
2103	50	-150	13	or&bn "pellety" clay
2104	50	-150	15	lt-bn sandy gravel
2105	25	-175	15	grvelly dk rd-bn sandy silt
2106	25	-175	11	dk bn&dk gy silty sand
2107	25	-175	4	or sandy
2108	25	-175	11	org's&bn clay silt:DGF
2109	-50	-150	6	dk or-gy-bn sandy
2110	-50	-150	6	or sandy silt+DGF blebs
2111	-50	-150	12	lt-gy,or,bk sand&DGC
2112	-50	-150	17	org mat&or clayey silt
2113	-50	-150	15	yl-bn,gy sand+silt
2114	-50	-150	4	or sand
2115	-50	-150	15	med gy f.gr.,OS,lt-gy-gn sandy
2116	-50	-150	11	lt gy sandy
2117	-25	-180	5	dk bn& or sandy silt
2118	-25	-180	4	or silt w/wood chips
2119	-25	-180	14	lt-med-gy silt/sand/clay
2120	-25	-180	15	or-bn,med-gy sand&silt
2121	-50	-225	6	dk-bn sandy w/DGF ptgs
2122	-50	-225	4	or sandy
2123	-50	-225	7	yl sandy w/ or silt layers
2124	-50	-225	6	or-rd-bn&gy sand
2125	-50	-225	11	DGF
2126	-50	-225	17	org mat+med-gy clay-silt
2127	-50	-225	14	mottled dk-ol-bn silt/clay
2128	10	-225	5	dk bn sandy
2129	10	-225	5	dk-or-bn sandy
2130	10	-225	4	or sandy
2131	10	-225	11	lt-gy,or silt+lt-gy-bn silt/clay:DGF
2132	10	-225	13	bn clay
2133	10	-225	13	bn clay
2134	10	-225	14	lt-gy silt getting sandy
2135	55	-225	5	dk or-bn sandy
2136	55	-225	5	or-bn sandy

2137	55	-225	11	lt-gy sandy w/str Fe blebs
2138	55	-225	11	DGF
2139	55	-225	12	DGC
2140	55	-225	13	lt ol-gn&bn RC
2141	55	-225	13	bn RC

Location	Sample #	Depth	Sediment Description
ON 10E	2142	0" -- 7"	ORS
	2143	7" -- 21"	Yellow Sandy W/Gray Silty Partings
	2144	21" -- 32"	Coarse Grained Gray Blebby
		22" -- 24"	Saturated Layer
		23" -- 32"	DGF
			EOH - 32"
ON 20E	2145	0" -- 13"	ORS With Gray Partings at 6"
		13" -- 15"	Bright Orange Staining
		16"	End of ORS
	2146	16" -- 35"	DGF
		35" -- 37"	Organic Material
		37"	Dark Grey
			EOH - 43"
ON 30E	2147	0" -- 8"	ORS
		8" -- 13"	Yellow-Orange Sandy W/Clay Partings
	2148	13" -- 22"	Dark Grey Mixed With ORS
		23" -- 35"	Dark Grey Clay
			EOH - 35"
ON 40E	2149	0" -- 9"	ORS
		9" -- 13"	Yellow Sandy W/Clay Partings
		13" -- 15"	Yellow Sandy W/Clay Partings
	3000	15" -- 38"	DGF
		39" -- 46"	Organic Layer
			EOH - 43"
ON 60E	3001	0" -- 9"	ORS
		9" -- 17"	Orange Yellow Sandy W/Clay Partings
	3002	17" -- 38"	DGF
		38" -- 42"	Organic Layer
			EOH - 43"
ON 70E	3003	0" -- 10"	ORS
		10" -- 17"	Orange Yellow Sandy W/Clay Partings
	3004	17" -- 30"	DGF
		30" -- 42"	DGF W/Orange Layer at 42"
			EOH - 42" W/Organics
ON 80E	3005	0" -- 8'	ORS
		8" -- 16"	ORS W/Clay Partings
	3006	16" -- 29"	DGF
		29" -- 34"	Organics
			EOH - 34"

Location	Sample #	Depth	Sediment Description
0N 90E	3007	0" -- 12"	ORS
		6" -- 12"	ORS W/Gray Clay Partings
		12" -- 15"	ORS - Change to Grey Clay at 15"
		15"	Red Brn Oxizided Zone at 15"
	3008	15" -- 30"	Light Gray to Dark Gray Fine
		25" -- 30"	Clay Like Material Roots in DGF
		30" -- 40"	Gray Black Fines
		40" -- 47"	Green Clay Layer Very little Root Material
			EOH - 47" Bentonite Plug
25N 100E	3009	0" -- 23"	ORS W/Gray Partings
		23" -- 32'	? in Gray Clay & Roots
	3010	32" -- 37"	DGF - Clay
		37" -- 41"	Green Clay & Root Material
			EOH - 41" Bentonite Added
25N 50E	3011	0" -- 12"	ORS - Becomes more Yellowish at 9" & Clay Partings
	3012	12" -- 20"	DGF
		20"	Organic Layer
			EOH - 25"
25N 25W	3013	0" -- 20"	Brn Sand No Clay Partings
		18"	Orange Material
		20" -- 31"	Fe Staining
	3014	31" -- 53"	DGF
			EOH - 55" Bentonite Added
25N 50W			Sample Offset 15" to N of Stake to Avoid Wooden Trough
	3015	0" -- 25"	ORS
		20" -- 25"	Increase in Clay Partings
		25"	Very Clayey
	3016	30" -- 46"	DGF
		46" -- 51"	Gravel & Organics
			EOH - 51" Bentonite Added
25N 100W	3017	0" -- 20"	Dark Brn Sandy Mixed w/Wood
		20" -- 34"	Light Yellow Clay
		34" -- 40"	Gravel - NO DGF
			EOH - 40"
50N 100W	3018	0" -- 15"	Dark Brn Sandy Loam
		15" -- 22"	Dark Red Sandy W/Grey Partings
		22" -- 32"	Dark Red/Yellow Sandy W/Grey Partings
	3019	32" -- 45"	LGF
		45"	Organics
			EOH - 53" Bentonite Added

Location	Sample #	Depth	Sediment Description
50N 25W	3020	0" -- 7"	Red Brown Sandy
		7" -- 15"	Yellow Brown Sandy Loam
		15" -- 25"	Yellow Clay W/Partings
	3021	25" -- 45"	DGF
		45" -- 47"	Organics
			EOH - 47" Bentonite Added
50N 25E	3022	0" -- 9"	Red Sandy Loam
		9" -- 19"	Yellow/Brn Sandy
	3023	19" -- 37"	DGF
		37" -- 42"	Organics
			EOH - 42" Bentonite Added
50N 75E	No Sample	0" -- 13"	ORS
		13" -- 17"	ORS W/Grey Partings
		17"	Hit Log -- Unable to Relocate Sample Hole
60S 0E	3024	1" -- 7"	Dark Brown Silt & Sand
		7" -- 10"	Red Brown Fine Sand
		10" -- 15"	Red Brown Fine Sand
		15" -- 19"	Orange Brown Fine Sand
		19" -- 24"	Orange Brown Fine Sand
	3025	24" -- 33"	DGF
		33" -- 37"	Gray Green River Clay
70S 0E	3026	0" 7"	Dark Brown Silt & Sand
		7" -- 12"	Dark Brown Silt & Sand
		12" -- 17"	Red Brown Fine Sand
		17" -- 22"	Orange Brown Fine Sand
		22" -- 27"	Orange Brown Fine Sand
		27" -- 28"	DGF
		28" -- 44"	River Clay
80S 0E	3027	0" -- 5"	Dark Brown Silt
		5" — 7"	Red Brown Silt & Sand W/Grey Clay Partings
		7" -- 11"	Red Brown Silt & Sand W/Grey Clay Partings
		11" -- 15"	Red Brown Silt & Sand W/Grey Clay Partings
		15" — 20"	Red Brown Silt W/Increasing Gray Clay Partings
	3028	20" -- 26"	DGF
		26" -- 27"	DGF
		27" -- 31"	River Clay W/ Roots Etc.

Location	Sample #	Depth	Sediment Description
90S 0E	3029	0" -- 6"	Dark Brown Silty Sand
		6" -- 7"	Dark Brown Silty Sand
		7" -- 11"	Orange Brown Fine Sand
		11" -- 17"	Orange Brown Fine Sand
		17" -- 21"	Orange Brown Fine Sand
	3030	21" -- 27"	DGF
		27" -- 31"	DGF
		31" -- 37"	River Clay
100S 0E	3031	0" -- 7"	Dark Brown Silty Sand
		7" -- 10"	Dark Brown Silty Sand
		10: --- 17"	Orange Brown Fine Sand
		17" -- 24"	Orange Brown Fine Sand
	3032	24" -- 30"	Mixture Orange Brown & L/Brown Fine S
		30" -- 33"	Mixture Orange Brown & L/Brown Fine Sand
		33" -- 37"	Mixture Orange Brown & L/Brown Fine Sand
		37" -- 44"	Mixture Orange Brown & L/Brown Fine Sand
		44"	At Water Table No Recovery
100S 25E	3033	0" -- 6"	Dark Red Brown Silt
		6" -- 8"	Dark Red Brown Silt
		8" -- 12"	Orange Brown Fine Sand
		12" -- 18"	Orange Brown Fine Sand
		18" -- 23"	Orange Brown Fine Sand W/Gray Clay Partings
		23" — 28"	Orange Brown Fine Sand W/Gray Clay Partings
	3034	28" -- 33"	DGF
		33" -- 36"	DGF
		36" -- 37"	River Clay
100S 50E	3035	0" -- 10"	Dark Red Brown Silt
		10" -- 15"	Orange Brown Fine Sand
		15" -- 19"	Orange Brown Fine Sand
		19" -- 24"	Orange Brown Fine Sand
		24" -- 29"	Orange Brown Fine Sand W/Grey Layers
		29" -- 36"	River Clays & Roots
100S 75E	3036	0" -- 3"	Organics
		3" -- 5"	Dark Brown Loam
		5" -- 12"	ORS Some Gray Partings
		12" -- 17"	ORS Increasing Orange Color - Sand
		17" -- 23"	ORS Increasing Orange - More Gray Blebs
		23" -- 27"	ORS Gray Clay at Base
	3037	27" -- 32"	Dark Grey Fines - Clay
		32" -- 36"	Root Zone
			EOH - 36"

Location	Sample #	Depth	Sediment Description
100S 100E		0" -- 3"	Organic Zone No Sample
	3038	3" -- 15"	ORS Fine Sand
		13"	Clay Partings
		15" -- 18"	ORS Bright Orange Fine Sand W/Gray Clay Mix
	3039	18" -- 50"	DGF -- Brown (Oxidized ?) Sand Zone
		50" -- 56"	River Gravels
			EOH - 56" - Bentonite Added
75S 100E		0" -- 1"	Organic Material No Sample
	3040	1" -- 3"	ORS - Red Orange Silty
		3" -- 8"	ORS - Yellow Brn Silty W/Gray Partings
		8" -- 10"	ORS - Yellow Red Sandy
	3041	10" -- 16"	DGF - Grey Clay & Caving ORS
		16" -- 32"	DGF - Modeling Clay
		32" -- 37"	River Clay - Mixed W/Roots Structures
			EOH - 37"
75S 75E		0" -- 1"	Organic Zone - No Sample
	3042	1" -- 7"	ORS Reddish Brn Sandy Loam w/Pebbles
		7" -- 12"	ORS - Increasing Orange Red Gravelly Sand W/Wood
		12" -- 17"	ORS - Reddish Brown Gravel W/Sand
		17" -- 32"	ORS - Reddish Brown Sand & Gravel
		32" -- 38"	ORS - Mottled Reddish Brn Sand & Gravel W/Grey Sand
	3043	38" -- 45"	DGF - Modeling Clay
		45" -- 52"	DGF - Increasing Black Mottling W/Organic Material - Hole Caving
		52" -- 62"	River Clay W/Roots No Sample
			EOH - 62"
75S 50E		0" -- 2"	Surface Organic Layer
	3044	2" -- 8"	ORS W/Wood Fragments
		8" -- 23"	ORS - Orange Red Sandy Gossen Like W/Some Clay Partings
			End of Sample
		23" -- 29"	Organic Rich Gray - Green River Clay
			EOH - 29"
50S 100E		0" -- 1"	Surface Layer
	3045	1" -- 8"	ORS - Yellow Brown W/Clay Partings
		8" -- 11"	ORS - Mottled Yellow/Brown Sand W/More Clay
		11" -- 12"	ORS - Clay Zone
		12" -- 17"	ORS - Reddish Orange Sand
	3046	17" -- 25"	DGF - Massive Brown/Gray Clay
		25" -- 44"	DGF - Laminated Gray Clay - Hole Caving
		44" -- 47"	Root Zone - River Clay
			EOH - 47"

Location	Sample #	Depth	Sediment Description
50S 75E		0" -- 2"	Surface Layer - No Sample
	3047	2" -- 10"	Reddish - Brown Sandy ORS W/Pebbles
		10" -- 13"	Mottled Gray Sand in ORS
		13" -- 21"	ORS - Grades Into Lighter Gray Than Brn Then Reddish Orange like Sand
	3048	24" -- 37"	DGF - Massive Gray Clay
		37" -- 45"	River Clay Root Zone
			EOH - 45"
50S 25E		0" -- 2"	Surface Organic Layer
	3049	2" -- 8"	ORS - Pebbly Brown Sand
		8" -- 17"	ORS - Redish Brown To Orange Sand W/Pepples
		17" -- 31"	ORS - Orange - Yellow
	3050	31" -- 38	DGF - Gray Clay
		38" -- 45"	Gray Green River Clay Root Zone
25S 75E	3051	0" -- 1"	ORS - Sand Orange Brown at Surface -
		1" -- 6"	Yellow Brown Sand W/Clay Partings
		6" -- 15"	ORS Increasing Gray - Gray/Brn Clay Bright Orange Layrt At Bottom
	3052	15" -- 23"	DGF - Massive Gray - Brn Clay
		23" -- 29"	River Clay/Gravel & Roots
			EOH - 29" Bentonite added
100S 25W	3053	0" -- 15"	Orange/Red Sandy Loam
	3054	15" -- 20"	LGF/DGF
		22"	Organics
			EOH - 22" Bentonite Added
100S 50W	3055	0" -- 4"	Dark Brown Sand/Silt
		4" -- 8"	Orange Red Sandy W/Clay Partings
		Hit Log	Moved 12" E
		8" -- 12"	Orange Red Sandy W/Clay Partings
		12" -- 15"	LGF/Red Sandy
	3056	15" -- 20"	DGF
		21"	Organics
			EOH - 21"
100S 75W	3057	0" -- 8"	Dark Red Loam
		8" -- 15"	Orange Red Sandy
		15" -- 18"	Light Yellow Sandy W/Clay Partings
	3058	18" -- 27"	LGF
		27" -- 30"	Organics
			EOH - 32" Bentonite Added

Location	Sample #	Depth	Sediment Description
100S 100W	3059	0" -- 9"	Dark Red Loam
		9" -- 20"	Light Red /Orange Sandy
		20" -- 28"	Light Red/Orange Sandy W/Clay Partings
	3060	28" -- 38"	DGF
		38" -- 40"	Organics
			EOH - 42" Bentonite Added
75S 100W	3061	0" -- 18"	Orange/Red Sandy
		18" -- 23"	Orange/Red Sandy W/Clay Partings
	3062	23" -- 38"	LGF
		38" -- 42"	Organics
			EOH - 42"
75S 75W	3063	0" -- 14"	Orange Red Sandy
		14" -- 17"	Orange Red Sandy W/Clay Partings
		17" -- 20"	Hit Log
			Moved 12" E
	3064	20" -- 24"	DGF
		24"	Organics
			EOH - 25"
75S 50W	3065	0" -- 12"	ORS
		12" -- 18"	ORS W/Clay Partings
	3066	18" -- 20"	DGF
		20" -- 22"	Organics
			EOH - 24"
75S 25W	3067	0" -- 7"	ORS - Hit Log
			Moved 12" E
		7" -- 14"	ORS
		14" -- 20"	ORS W/Clay Partings
		21"	Organics
			EOH 22"
50S 25W	3068	0" -- 13"	ORS
		13" -- 22"	ORS W/Clay Partings
			No DGF
			EOH - 22"
50S 75W	3069	0" -- 3"	ORS
		3" -- 18"	Orange Sandy
		18" -- 27"	Orange Sandy W/Clay Partings
	3070	27" -- 30"	LGF Very Thin Layer
		30" -- 32"	Organics
			EOH - 32"

Location	Sample #	Depth	Sediment Description
25S 100W	3071	0" -- 8"	ORS
		8" -- 35"	River Clay
		36" -- 38"	River Gravels
			EOH - 38" Bentonite Added
25S 75W	3072	0" -- 20"	ORS
		20" -- 32"	River Clay
		32"	River Gravels
			EOH - 33" Bentonite Added
25S 50W	3073	0" -- 10"	ORS
		10" -- 20"	ORS W/Clay
		20" -- 28"	River Gravels
			EOH - 28" Bentonite Added
25S 25W	3074	0" -- 8"	ORS
		8" -- 39"	ORS W/Gravels
			No Clay Layer
			EOH - 39"
25S 100E	3075	0" -- 16"	ORS
		16" -- 23"	ORS ~~W/Clay~~ Parting
		25" -- 29"	Gravel Lens
	3076	29" -- 60"	DGF
			Unable To Determine Depth of DGF
			Auger Not Long Enough to Reach River Clays
			EOH - 60 "
0N 100E	3077	0" -- 8"	ORS
		8" -- 11"	ORS W/Clay Partings
	3078	11" -- 27"	DGF
		27" -- 33"	Organic Root Zone
			EOH - 40" Bentonite Added
25N 75E	3079	0" -- 15"	ORS
	3080	15" -- 25"	DGF
		26" --	Organic Root Zone
			EOH - 35" Bentonite Added
50N 100E	3081	0" -- 8"	ORS
		8" -- 26"	ORS W/Clay Partings
	3082	26" -- 34"	DGF
		34" -- 44"	Organic Root Zone
			EOH - 46" Bentonite Added

Location	Sample #	Depth	Sediment Description
75N 100E	3083	0" -- 8"	ORS
		8" -- 14"	ORS W/Clay Partings
	3084	14" -- 24'	DGF
		24"	Organics root Zone
			EOH - 30" Bentonite Added
75N 75E	3085	0" -- 3"	ORS
		3" -- 12"	ORS With Light Gray Clay Partings
	3086	12" -- 20"	LGF ORS Mix 90%/10%
		21"	Organics
			EOH - 23" Bentonite Added
75N 50E	3087	0" -- 8"	ORS
		8" -- 11"	Yellow Brown Sandy
	3088	11" -- 39"	DGF
		40"	Organics
			EOH - 44" Bentonite Added
100N 100E	3089	0" -- 11"	ORS
		11" -- 27"	~~Gravels Mixed~~ with Clay/Silt/Water
			Hole Caving -- Unable to Retrieve Material
			~~Below 27'~~
			EOH - 27" Enviroplug Added
100 N 75E	3090	0" -- 3"	ORS
		3" -- 45"	ORS ~~Mixed~~ With Gravels/Sand
			Hole Caving -- Unable to Retrieve Material
			~~Below 45"~~
			EOH - 47" Enviroplug Added
100N 50E	3091	0" -- 10"	Dark ORS
		10" -- 38"	ORS W/Gravels Hole Caving - Unable to Retrieve Sample Below 36"
			EOH - 36"
100N 25E	3092	0" -- 8"	ORS
	3093	8" -- 14"	DGF
		15"	River Gravels
			EOH - 28" Bentonite added
100N 0E	3094	0" -- 10"	ORS W/Clay Partings
	3095	10" -- 24"	DGF
		24" -- 26"	Organics
			EOH - 27" Bentonite added

Location	Sample #	Depth	Sediment Description
90N 0E	3096	0" -- 14"	ORS W/Clay Partings
	3097	14" -- 25"	DGF
		25"	Organics
			EOH - 28" Bentonite Added
80N 0E	3098	0" -- 24"	ORS
		25" -- 32"	River Gravels
			NO DGF
			EOH - 32" Bentonite Added
70N 0E	3099	0" -- 22"	ORS
		22" -- 29"	River Gravels
			No DGF
			EOH - 29" Bentonite Added
60N 0E	3100	0" -- 8"	ORS
		8" -- 18"	Sandy Yellow
	3101	19" -- 35"	DGF
		36"	Organics
			EOH - 37" Bentonite Added
75N 25W	3102	0" -- 7"	Ors
		7" -- 18"	Yellow Green Sandy
	3103	18' -- 28"	DGF W/Red Sandy Mix
		29"	River Gravels
			EOH - 32" Bentonite Added
75N 50W	3104	0" -- 11"	ORS
		11" -- 20"	Yellow Sandy/ORS
	3105	21" -- 47"	DGF
		48"	Organics
			EOH - 53" Bentonite Added
75N 75W	3106	0" -- 12"	ORS
	3107	13" -- 20"	DGF
		21"	Organics
			EOH - 28"
0N 90W	3108	0" -- 14"	River Gravels
		14" -- 18"	ORS W/Burnt Log Material
		18" -- 32"	~~Yellow~~ Brown Clays
			NO DGF
		32" -- 39"	River Gravels
			EOH - 39"

Location	Sample #	Depth	Sediment Description
0N 80W	3109	0" -- 7"	River Gravels
		7" --25"	ORS W/Organics
		25" -- 32"	~~Yellow Clay~~ W/ORS
		32" -- 41"	River Gravels
			NO DGF
			EOH - 41" Bentonite Added
0N 70W	3110	0" -- 12"	River Gravels
		12" -- 40"	ORS
			NO DGF
		41" -- 47"	River Gravels
			EOH - 48" Bentonite Added
10S 0E	3111	0" -- 7"	ORS
		17" -- 24"	Yellow Black Sandt
	3112	24" -- 30"	DGF
		30" -- 35"	Organics
		35" -- 41"	Clay
			EOH - 41"
30 ~~20~~S 0E	3113	0" -- 13"	ORS River Gravel Mix
		13" -- 20 "	ORS W/Clay Partings
		20" -- 34"	River Gravels
			NO DGF
			EOH - 34" Bentonite Added
40S 0E	3114	0" -- 22"	ORS
		22" -- 38"	Clays W/Organics
			NO DGF
			EOH - 38" Bentonite Added

SPLNUTYPE	NORTH	EAST	THK	SC	DESC
4001	100	125	1.1	1	med bn sandy w/ lt gy ptgs
4002	100	125	1.1	11	DGF
4003	50	125	1.9	11	DGF
4004	0	125	2.9	11	DGF
4005	-50	125	0.16	7	yellow sandy
4006	-50	125	2	11	DGF
4007	-100	125	0.66	7	yellow sandy
4008	-100	125	2	11	DGF
4009	-125	100	1.5	7	yellow sandy
4010	-125	100	2.25	11	DGF;organics at 49"
4011	-125	50	1.33	4	rd or sandy
4012	-125	50	0.66	11	DGF
4013	-125	0	1.25	4	orange sandy
4014	-125	0	1.6	11	DGF;or ptgs
4015	-125	-50	1.5	4	orange sandy w/ bn ptgs
4016	-125	-50	2.1	11	DGF
4017	-125	-100	1.75	4	or sandy
4018	-125	-100	0.16	11	DGF
4019	-25	25	1.5	8	or yellow sandy
4020	-25	25	0.66	11	DGF

APPENDIX III:
SEDIMENT SAMPLE METALS CONTENT DATA

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                                                 1=JIGS
                                                 2=FLOATS
                                                 3=ORGS
      SURFER MEGAFILE FOR SOILDAT INFO           4=CLAY
                                                 5=GRAV


SPLNUNORTHEASTICOLLAR  FROM     TO   .   THICK PB %  ZN %  SED
1001 -2.5 -4.8 2202.25 2202.25 2200.65  1.10  2.01  1.65  1
1002 -2.5 -4.8 2202.25 2200.65 2199.85  0.80  2.27  1.63  1
1003 -2.5 -4.8 2202.25 2199.85 2199.35  0.50  2.16  2.00  2
1004 -2.5 -4.8 2202.25 2199.35 2198.95  0.50  2.07  2.38  2
1005 -2.5 -4.8 2202.25 2198.95 2198.45  0.50  0.90  1.55  4
1006 -2.5 -4.8 2202.25 2198.45 2197.90  0.80  0.47  1.14  4
1007 -2.5 -4.8 2202.25  2197.9 2196.32  0.70  0.11  0.51  4
1008 -2.5 -4.8 2202.25 2196.32 2195.65  0.43  0.03  0.22  4
1009    6 -160 2201.77 2201.77 2200.17  1.30  1.36  0.60  1
1010    6 -160 2201.77 2200.17 2199.04  0.85  1.24  0.46  1
1011    6 -160 2201.77 2199.04 2198.47  0.65  0.23  0.19  4
1012    6 -160 2201.77 2198.47 2197.27  0.70  0.11  0.12  5
1013    0 -100 2201.74 2201.74 2200.56  1.18  1.50  0.54  1
1013    0 -100 2201.74 2200.56                2.04  0.44  3
1014    0 -100 2201.74 2200.56 2199.74  0.82  1.03  0.38  2
1015    0 -100 2201.74 2199.74 2198.64  1.10  0.37  0.31  4
1016    0 -100 2201.74 2198.64 2197.14  0.75  0.10  0.21  5
1017    0  -50 2202.83 2202.83 2202.55  0.28  1.83  0.78  1
1018    0  -50 2202.83 2202.55 2202.45  0.10  2.40  0.73  2
1019    0  -50 2202.83 2202.45 2201.35  1.10  1.51  0.68  1
1020    0  -50 2202.83 2201.35 2200.33  0.95  1.89  0.53  1
1021    0  -50 2202.83 2200.33 2199.83  0.50  2.98  1.41  1
1022    0  -50 2202.83 2199.83 2198.93  0.85  2.49  1.58  4
1023    0  -50 2202.83 2198.93 2198.33  1.30  0.14  0.29  4
1024    0  -50 2202.83 2198.33 2196.77  0.60  0.19  0.25  4
1025   50    0 2201.79 2201.79 2201.33  0.46  2.76  1.09  1
1026   50    0 2201.79 2201.33 2200.87  0.46  1.94  0.76  1
1027   50    0 2201.79 2200.87 2200.04  0.38  1.41  1.00  2
1028   50    0 2201.79 2200.04 2198.79  0.92  1.51  1.87  1
1029   50    0 2201.79 2198.79 2198.54  0.25  3.04  2.32  2
1030   50    0 2201.79 2198.54 2197.29  0.75  0.36  1.06  4
1030   50    0 2201.79 2197.29                0.24  0.98  3
1031   50    0 2201.79 2201.79 2196.91        0.31  0.40  4
1032   50    0 2201.79 2196.91 2195.29        0.07  0.06  5
1033   50  -50 2201.89 2201.89 2201.39  0.50  2.21  1.38  1
1034   50  -50 2201.89 2201.39 2200.06  0.33  2.31  0.42  1
1035   50  -50 2201.89 2200.06 2199.06  1.00  2.21  2.76  2
1036   50  -50 2201.89 2199.06 2198.89  0.17  2.10  2.11  2
1037   50  -50 2201.89 2198.89 2196.56  0.92  0.05  0.60  4
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1037	50	-50	2201.89	2196.56			0.05	0.59	3
1038	-50	0	2202.19	2202.19	2201.77	0.17	1.04	0.88	1
1039	-50	0	2202.19	2201.77	2201.19	0.25	2.11	0.43	1
1040	-50	0	2202.19	2201.19	2200.61	0.25	2.12	2.00	2
1041	-50	0	2202.19	2200.61	2199.19	0.50	0.64	0.46	4
1042	0	-20	2202.49	2202.49	2200.99	1.17	1.97	0.80	1
1043	0	-20	2202.49	2200.99	2199.59	0.79	2.08	0.90	1
1044	0	-20	2202.49	2199.59	2198.99	0.66	2.14	1.87	2
1045	0	-20	2202.49	2198.99	2198.49	0.50	2.45	2.33	2
1046	0	-20	2202.49	2198.49	2197.99	0.50	0.77	0.76	5
1047	0	-30	2202.58	2202.58	2201.25	1.33	1.84	0.90	1
1048	0	-30	2202.58	2201.25	2201.00	0.25	2.32	0.80	1
1049	0	-30	2202.58	2201	2199.58	0.66	2.48	2.71	2
1050	0	-30	2202.58	2199.58	2198.91	0.83	0.38	0.72	4
1050	0	-30	2202.58	2198.91			0.44	0.78	3
1051	0	-30	2202.58	2202.58	2196.41	0.33	0.53	0.42	5
1052	0	-40	2202.76	2202.76	2202.01	0.75	1.93	0.62	1
1053	0	-40	2202.76	2202.01	2200.86	0.25	1.34	0.38	2
1054	0	-40	2202.76	2200.86	2200.09	0.17	1.99	0.58	2
1055	0	-40	2202.76	2200.09	2199.59	0.17	2.58	1.22	2
1055	0	-40	2202.76	2199.59			2.44	1.17	3
1056	0	-40	2202.76	2202.76	2198.84	0.42	0.63	0.64	4
1057	0	-60	2202.61	2202.61	2201.69	0.92	1.69	0.65	1
1058	0	-60	2202.61	2201.69	2200.78	1.83	1.79	0.40	1
1059	0	-60	2202.61	2200.78	2200.61	0.17	2.17	0.77	2
1060	0	-60	2202.61	2200.61	2200.03	0.25	0.26	0.17	4
1061	0	-60	2202.61	2200.03	2199.19	0.17	0.11	0.22	4
1062	10	0	2202.05	2202.05	2201.13	0.25	1.64	1.28	1
1063	10	0	2202.05	2201.13	2200.30	0.50	2.39	0.83	1
1064	10	0	2202.05	2200.3	2199.80	0.42	2.52	2.42	2
1065	10	0	2202.05	2199.8	2199.05	0.50	2.48	2.30	2
1066	10	0	2202.05	2199.05	2198.38	0.25	1.02	1.18	2
1067	20	0	2201.75	2201.75	2200.42	0.50	1.78	0.92	1
1068	20	0	2201.75	2200.42	2199.08	0.33	1.72	1.54	2
1069	20	0	2201.75	2199.08	2198.25	0.17	2.23	2.98	2
1070	20	0	2201.75	2198.25	2196.58	0.17	0.40	0.42	4
1071	30	0	2201.98	2201.98	2200.65	0.50	1.83	0.69	1
1072	30	0	2201.98	2200.65	2199.81	0.33	1.82	0.74	1
1073	30	0	2201.98	2199.81	2199.15	0.33	1.71	1.72	2
1074	30	0	2201.98	2199.15	2198.56	0.33	2.22	2.20	2
1075	30	0	2201.98	2198.56	2197.40	0.17	0.39	0.66	4
	30	0	2201.98	2195.73					5
1076	40	0	2202.01	2202.01	2201.09	0.33	2.07	0.97	1
1077	40	0	2202.01	2201.09	2200.76	0.17	2.10	0.80	1
1078	40	0	2202.01	2200.76	2200.26	0.25	2.18	0.81	1
1079	40	0	2202.01	2200.26	2199.84	0.08	1.14	1.57	2
1080	40	0	2202.01	2199.84	2199.26	0.17	2.05	2.55	2
1081	40	0	2202.01	2199.26	2197.51	0.17	0.83	0.84	4

	40	0	2202.01	2196.09					5
1082	-20	40	2201.68	2201.68	2200.93	0.75	1.90	0.93	1
1083	-20	40	2201.68	2200.93	2200.39	0.54	1.94	2.15	1
1084	-20	40	2201.68	2200.39	2200.05	0.33	1.93	2.17	2
1085	-20	40	2201.68	2200.05	2199.64	0.42	2.26	2.37	2
1086	-20	40	2201.68	2199.3	2198.85	0.46	1.75	1.04	2
1086	-20	40	2201.68	2198.85			1.61	1.09	3
1087	-20	40	2201.68	2201.68	2199.30	0.33	2.29	2.54	2
1088	-20	40	2201.68	2199.3	2197.68	0.17	0.35	0.90	4
	-20	40	2201.68	2195.68					5
1089	-20	0	2202.54	2202.54	2201.37	0.50	1.86	1.58	1
1090	-20	0	2202.54	2201.37	2200.71	0.33	1.92	1.82	1
1091	-20	0	2202.54	2200.71	2200.62	0.17	2.69	2.01	2
1091	-20	0	2202.54	2200.62			2.79	1.78	3
1092	-20	0	2202.54	2202.54	2200.29	0.17	2.13	1.25	1
1093	-20	0	2202.54	2200.29	2199.79	0.17	0.25	0.57	4
	-20	0	2202.54	2198.87					5
1094	20	-20	2202.06	2202.06	2200.73	0.50	2.03	0.51	1
1095	20	-20	2202.06	2200.73	2199.56	0.50	1.89	1.07	1
1096	20	-20	2202.06	2199.56	2199.23	0.33	2.04	1.84	2
2001	0	50	2201.34	2201.34	2200.84	0.17	2.23	0.93	1
2002	0	50	2201.34	2200.84	2200.51	0.25	1.87	0.60	1
2003	0	50	2201.34	2200.51	2200.17	0.17	1.32	1.34	2
2004	0	50	2201.34	2200.17	2199.76	0.25	2.04	2.01	2
2005	0	50	2201.34	2199.76	2199.26	0.25	2.36	1.82	2
2006	0	50	2201.34	2199.26	2198.76	0.50	1.88	2.01	2
	0	50	2201.34	2198.17					3
	0	50	2201.34	2196.26					5
2007	25	25	2201.59	2201.59	2201.01	0.25	2.41	0.83	1
2008	25	25	2201.59	2201.01	2200.67	0.25	1.44	0.59	1
2009	25	25	2201.59	2200.67	2200.34	0.25	1.23	0.63	1
2010	25	25	2201.59	2200.34	2200.17	0.17	2.53	2.16	2
2010	25	25	2201.59	2200.17			1.96	2.02	3
2011	25	25	2201.59	2200.17	2199.67	0.50	2.33	2.21	2
2012	25	25	2201.59	2199.67	2199.01	0.17	2.81	1.86	2
	25	25	2201.59	2197.8					5
2013	50	50	2201.58	2201.58	2201.00	0.17	1.85	0.71	1
2014	50	50	2201.58	2201	2200.75	0.17	2.48	1.31	2
2015	50	50	2201.58	2200.75	2200.41	0.17	2.14	0.34	1
2016	50	50	2201.58	2200.41	2200.25	0.17	2.69	0.64	1
2017	50	50	2201.58	2200.25	2200.00	0.08	2.76	1.73	2
2018	50	50	2201.58	2200	2199.75	0.17	3.01	1.51	2
2019	50	50	2201.58	2199.75	2199.50	0.08	1.93	0.65	4
2020	50	50	2201.58	2199.5	2198.75	0.17	0.14	0.41	4
	50	50	2201.58	2195.41					5
2021	-50	50	2202.65	2202.65	2202.23	0.17	1.57	0.53	1
2022	-50	50	2202.65	2202.23	2201.82	0.17	1.10	0.35	1
2023	-50	50	2202.65	2201.82	2201.57	0.17	2.21	0.31	1

2024	-50	50	2202.65	2201.57	2201.23	0.17	2.29	0.22	1
2025	-50	50	2202.65	2201.23	2201.07	0.08	2.30	0.30	1
2026	-50	50	2202.65	2201.07	2200.23	0.08	2.51	1.23	2
2026	-50	50	2202.65	2200.23	2202.65		2.05	0.80	3
2027	-50	50	2202.65	2202.65	2200.65	0.17	2.92	1.54	2
2028	-50	50	2202.65	2200.65	2200.32	0.17	2.60	0.87	4
	-50	50	2202.65	2197.48					5
2029	-50	-50	2202.23	2202.23	2201.81	0.17	1.50	0.56	1
2030	-50	-50	2202.23	2201.81	2201.48	0.17	2.32	0.66	2
2031	-50	-50	2202.23	2201.48	2201.15	0.17	2.01	0.58	1
2032	-50	-50	2202.23	2201.15	2200.81	0.17	2.80	0.59	2
2033	-50	-50	2202.23	2200.81	2200.48	0.08	0.44	0.40	4
	-50	-50	2202.23	2199.56					5
2034	-50	-100	2201.85	2201.85	2201.27	0.17	1.38	0.50	1
2035	-50	-100	2201.85	2201.27	2200.93	0.17	2.42	0.59	1
2036	-50	-100	2201.85	2200.93	2200.68	0.17	2.95	0.62	1
2037	-50	-100	2201.85	2200.68	2200.27	0.17	2.71	0.54	1
2038	-50	-100	2201.85	2200.27	2199.93	0.17	0.12	0.16	2
2039	-50	-100	2201.85	2199.93	2197.68	0.17	0.08	0.18	4
	-50	-100	2201.85	2199.56					5
2040	25	-75	2201.94	2201.94	2201.36	0.17	2.64	0.54	1
2041	25	-75	2201.94	2201.36	2201.11	0.17	1.48	0.57	1
2042	25	-75	2201.94	2201.11	2200.86	0.17	2.60	0.77	1
2043	25	-75	2201.94	2200.86	2200.52	0.17	2.52	0.49	1
2044	25	-75	2201.94	2200.52	2200.44	0.17	2.64	0.89	1
2044	25	-75	2201.94	2200.44	2201.94		2.77	0.70	3
2045	25	-75	2201.94	2201.94	2200.02	0.17	0.58	0.28	4
	25	-75	2201.94	2198.02					5
2046	50	-75	2201.69	2201.69	2201.19	0.17	2.37	0.83	1
2047	50	-75	2201.69	2201.19	2200.86	0.17	2.24	0.75	1
2048	50	-75	2201.69	2200.86	2200.44	0.17	1.02	0.41	1
2048	50	-75	2201.69	2200.44	2201.69		2.60	0.92	3
2049	50	-75	2201.69	2201.69	2200.02	0.17	2.59	0.59	1
2050	50	-75	2201.69	2200.02	2199.69	0.17	2.02	0.73	1
2051	50	-75	2201.69	2199.69	2199.27	0.17	2.65	1.74	2
2052	50	-75	2201.69	2199.27	2199.44	0.17	1.76	1.40	2
2053	50	-75	2201.69	2199.44	2198.86	0.17	2.36	1.71	2
2053	50	-75	2201.69	2198.86			2.10	1.39	3
2054	50	-75	2201.69	2201.69	2198.52	0.17	2.39	2.92	2
2054	50	-75	2201.69	2198.52			2.27	2.70	3
	50	-75	2201.69	2198.02					4
2055	70	-25	2201.65	2201.65	2201.23	0.17	2.65	1.43	1
2056	70	-25	2201.65	2201.23	2200.82	0.17	2.63	0.96	1
2057	70	-25	2201.65	2200.82	2200.40	0.17	2.18	0.53	1
2058	70	-25	2201.65	2200.4	2200.07	0.17	2.71	0.80	1
2059	70	-25	2201.65	2200.07	2199.82	0.17	1.96	1.87	2
2060	70	-25	2201.65	2199.82	2199.57	0.17	1.48	1.68	2
2061	70	-25	2201.65	2199.57	2199.23	0.17	2.24	3.86	2

2061	70	-25	2201.65	2199.23		0.17	2.28	2.33	3
2062	70	-25	2201.65	2201.65	2198.90	0.17	3.20	2.23	2
	70	-25	2201.65	2197.82					4
	70	-25	2201.65	2193.32					5
2063	75	25	2202	2202	2201.58	0.17	1.95	0.91	1
2064	75	25	2202	2201.58	2201.25	0.17	1.37	0.75	1
2065	75	25	2202	2201.25	2200.83	0.17	1.50	0.57	1
2066	75	25	2202	2200.83	2200.50	0.17	1.48	0.58	1
2067	75	25	2202	2200.5	2200.17	0.17	1.74	0.58	1
2068	75	25	2202	2200.17	2199.83	0.17	1.83	0.63	1
2069	75	25	2202	2199.83	2199.58	0.17	1.65	0.56	1
2070	75	25	2202	2199.58	2199.33	0.17	2.47	0.56	1
2071	75	25	2202	2199.33	2199.17	0.17	2.14	0.64	1
2072	75	25	2202	2199.17	2198.83	0.17	1.38	0.54	1
2073	75	25	2202	2198.83	2198.42	0.17	1.91	0.91	1
2074	75	25	2202	2198.42	2198.25	0.17	1.82	5.05	2
2074	75	25	2202	2198.25			1.37	2.32	3
2075	75	25	2202	2198.42	2198.25	0.17	1.64	0.86	1
2076	75	25	2202	2198.17	2197.42	0.17	0.03	0.68	4
2077	75	25	2202	2197.42	2195.67	0.08	0.06	0.45	4
	75	25	2202	2195.67					5
2078	-70	20	2202.51	2202.51	2202.09	0.17	1.51	0.84	1
2079	-70	20	2202.51	2202.09	2201.76	0.17	1.54	0.70	1
2080	-70	20	2202.51	2201.76	2201.43	0.17	1.75	0.46	1
2081	-70	20	2202.51	2201.43	2201.18	0.17	2.38	0.45	1
2082	-70	20	2202.51	2201.18	2200.84	0.17	2.53	0.57	1
2083	-70	20	2202.51	2200.84	2200.59	0.17	2.27	1.52	1
2084	-70	20	2202.51	2200.59	2200.34	0.17	2.12	2.40	2
2085	-70	20	2202.51	2200.34	2200.09	0.17	2.48	2.91	2
2086	-70	20	2202.51	2200.09	2199.76	0.17	2.70	3.71	2
2086	-70	20	2202.51	2199.76			2.68	3.62	3
2087	-70	20	2202.51	2202.51	2199.43	0.17	2.52	3.51	2
2087	-70	20	2202.51	2199.43			2.71	2.44	3
2088	-70	20	2202.51	2202.51	2198.59	0.17	0.11	0.85	4
2089	-70	20	2202.51	2198.59	2196.68	0.17	0.06	0.40	4
	-70	20	2202.51	2194.84					5
2090	-25	-125	2201.49	2201.49	2200.41	1.083	1.95	0.56	1
2091	-25	-125	2201.49	2200.41	2200.24	0.167	2.39	0.77	1
2092	-25	-125	2201.49	2200.24	2199.82	0.417	2.08	0.58	2
2093	-25	-125	2201.49	2199.82	2199.24	0.583	0.13	0.21	4
	-25	-125	2201.49	2199.24					5
2094	30	-125	2201.9	2201.9	2201.48	0.417	1.79	0.78	1
2095	30	-125	2201.9	2201.48	2201.07	0.417	2.09	0.77	1
2096	30	-125	2201.9	2201.07	2200.65	0.417	2.63	0.78	3
2097	30	-125	2201.9	2200.65	2199.90	0.75	0.19	0.26	4
2098	30	-125	2201.9	2199.9	2199.23	0.667	0.12	0.15	4
	30	-125	2201.9	2199.23					5
2099	50	-150	2202.3	2202.3	2201.72	0.583	1.88	0.72	1

2100	50	-150	2202.3	2201.72	2201.13	0.583	1.80	0.84	1
2101	50	-150	2202.3	2201.13	2200.63	0.5	2.36	0.93	1
2102	50	-150	2202.3	2200.63	2200.22	0.417	2.32	0.83	2
2103	50	-150	2202.3	2200.22	2199.55	0.417	0.18	0.23	4
2104	50	-150	2202.3	2199.55	2198.22	1.333	0.17	0.27	5
2105	25	-175	2201.5	2201.5	2200.67	0.667	1.82	0.84	1
2106	25	-175	2201.5	2200.67	2200.33	0.333	2.00	0.91	2
2107	25	-175	2201.5	2200.33	2199.92	0.417	2.18	0.71	1
2108	25	-175	2201.5	2199.92	2199.33	0.583	2.31	1.02	2
	25	-175	2201.5	2199					3
2109	-50	-150	2201.3	2201.3	2200.88	0.417	1.38	0.72	1
2110	-50	-150	2201.3	2200.88	2200.30	0.583	1.89	0.89	1
2111	-50	-150	2201.3	2200.3	2199.72	0.583	2.23	1.50	2
2112	-50	-150	2201.3	2199.72	2198.63	1.083	1.27	0.56	3
2113	-50	-150	2201.3	2198.63	2197.88	0.333	0.07	0.36	5
2114	-50	-150	2201.3	2197.88	2197.13	0.25	0.23	0.36	5
2115	-50	-150	2201.3	2197.13	2196.88	0.25	0.05	0.24	5
2116	-50	-150	2201.3	2196.88	2196.72	0.167	0.08	0.26	5

2117	-25	-180	2201.4	2201.4	2200.65	0.75	1.34	0.53	1
2118	-25	-180	2201.4	2200.65	2199.98	0.667	1.95	0.76	1
2119	-25	-180	2201.4	2199.98	2198.23	1.75	0.05	0.32	5
2120	-25	-180	2201.4	2198.23	2197.40	0.833	0.04	0.30	5

2121	-50	-225	2199.8	2199.8	2199.13	0.667	1.25	0.92	1
2122	-50	-225	2199.8	2199.13	2198.38	0.75	1.84	0.69	1
2123	-50	-225	2199.8	2198.38	2197.47	0.917	2.19	1.03	1
2124	-50	-225	2199.8	2197.47	2197.22	0.25	2.33	1.39	1
2125	-50	-225	2199.8	2197.22	2196.55	0.667	2.12	4.41	2
2126	-50	-225	2199.8	2196.55	2195.97	0.583	1.88	2.50	3
2127	-50	-225	2199.8	2195.97	2194.63	1.167	0.15	0.54	4

2128	10	-225	2201.8	2201.8	2200.88	0.917	1.44	0.67	1
2129	10	-225	2201.8	2200.88	2200.13	0.75	1.53	0.59	1
2130	10	-225	2201.8	2200.13	2199.88	0.25	2.30	0.59	1
2131	10	-225	2201.8	2199.88	2199.63	0.25	3.05	0.53	2
2132	10	-225	2201.8	2199.63	2198.80	0.833	0.71	0.59	4
2133	10	-225	2201.8	2198.8	2197.63	1.167	0.12	0.35	4
2134	10	-225	2201.8	2197.63	2197.13	0.5	0.03	0.16	4
	10	-225	2201.8	2197					5
2135	55	-225	2201.9	2201.9	2201.32	0.583	1.87	0.80	1
2136	55	-225	2201.9	2201.32	2201.07	0.25	2.01	0.70	1
2137	55	-225	2201.9	2201.07	2200.57	0.5	2.15	0.59	2
2138	55	-225	2201.9	2200.57	2199.90	0.667	2.46	1.41	2
2139	55	-225	2201.9	2199.9	2199.65	0.25	2.17	1.57	2
	55	-225	2201.9	2199.65					3
2140	55	-225	2201.9	2199.65	2198.73	0.917	0.13	0.80	4
2141	55	-225	2201.9	2198.73	2198.32	0.417	0.06	0.72	4

2143	0	10	2201.8	2201.22	2200.05	1.17	2.03	0.72	1
2144	0	10	2201.8	2200.05	2199.13	0.92	2.71	1.93	2
2145	0	20	2201.67	2201.67	2200.00	1.67	2.14	1.06	1
2146	0	20	2201.67	2200.34	2198.75	1.58	2.36	2.13	2
	0	20	2201.67	2197.84					4
2147	0	30	2201.55	2201.55	2200.47	1.08	1.84	0.58	1
2148	0	30	2201.55	2200.47	2198.63	1.83	2.49	1.29	2
	0	30	2201.55	2199.63					4
2149	0	40	2201.5	2201.50	2200.25	1.25	1.81	0.83	1
3000	0	40	2201.5	2200.25	2198.33	1.92	2.68	2.03	2
	0	40	2201.5	2198.25					3
3001	0	60	2201.3	2201.30	2199.88	1.42	2.11	1.29	1
3002	0	60	2201.3	2199.88	2198.13	1.75	3.27	2.16	2
	0	60	2201.3	2198.13					3
3003	0	70	2201.2	2201.20	2199.78	1.42	2.41	1.46	1
3004	0	70	2201.2	2199.78	2198.70	1.08	3.31	2.05	2
	0	70	2201.2	2197.70					3
3005	0	80	2201.1	2201.10	2199.77	1.33	2.4	1.34	1
3006	0	80	2201.1	2199.77	2198.68	1.08	2.57	1.67	2
	0	80	2201.1	2198.68					3
3007	0	90	2201	2201.00	2199.75	1.25	2.26	1.02	1
3008	0	90	2201	2199.75	2197.67	2.08	3.35	2.06	2
	0	90	2201	2197.67					4
3009	25	100	2200.5	2200.50	2197.83	2.67	2.05	0.63	1
3010	25	100	2200.5	2197.83	2197.42	0.42	1.71	1.57	2
	25	100	2200.5	2197.42					4
3011	25	50	2201.46	2201.46	2200.46	1.00	2.12	0.58	1
3012	25	50	2201.46	2200.46	2199.79	0.67	3.25	1.83	2
	25	50	2201.46	2199.79					3
3013	25	-25	2201.72	2201.72	2199.14	2.58	1.96	0.66	1
3014	25	-25	2201.72	2199.14	2197.30	1.83	2.75	2.16	2
3015	25	-50	2202.25	2202.25	2200.17	2.08	2.16	0.73	1
3016	25	-50	2202.25	2199.75	2198.42	1.33	2.08	1.72	2
	25	-50	2202.25	2198.42					5
3017	25	-100	2201.72	2201.72	2198.89	2.83	0.8	0.31	1
	25	-100	2201.72	2200.05					5
3018	50	-100	2201.7	2201.70	2199.03	2.67	2.19	0.57	1
3019	50	-100	2201.7	2199.03	2197.95	1.08	3.91	2.5	2
	50	-100	2201.7	2197.95					4
3020	50	-25	2201.83	2201.83	2199.75	2.08	2.28	1	1
3021	50	-25	2201.83	2199.75	2198.08	1.67	2.14	1.93	2
	50	-25	2201.83	2198.08					3
3022	50	25	2201.5	2201.50	2199.92	1.58	1.97	0.81	1
3023	50	25	2201.5	2199.92	2198.42	1.50	2.1	1.75	2
	50	25	2201.5	2198.42					3
3024	-60	0	2202.23	2202.15	2200.23	1.92	2.26	0.46	1
3025	-60	0	2202.23	2200.23	2199.48	0.75	4.16	2.39	2
	-60	0	2202.23	2199.48					4

3026	-70	0	2202.27	2202.27	2200.02	2.25	2.07	0.58	1
	-70	0	2202.27	2199.94					4
3027	-80	0	2202.31	2202.31	2200.64	1.67	1.99	0.79	1
3028	-80	0	2202.31	2200.64	2200.06	0.58	3.06	2.8	2
	-80	0	2202.31	2200.06					4
3029	-90	0	2202.34	2202.34	2200.59	1.75	2.11	0.96	1
3030	-90	0	2202.34	2200.59	2199.76	0.83	3.8	3.13	2
	-90	0	2202.34	2199.76					4
3031	-100	0	2202.38	2202.38	2200.38	2.00	2.15	0.69	1
3032	-100	0	2202.38	2200.38	2198.71	1.67	0.15	0.25	1
3033	-100	25	2202.55	2202.55	2200.22	2.33	2.37	0.75	1
3034	-100	25	2202.55	2200.22	2199.55	0.67	3.43	3.14	2
	-100	25	2202.55	2199.55					4
3035	-100	50	2202.7	2202.70	2200.28	2.42	1.95	0.53	1
	-100	50	2202.7	2200.28					4
3036	-100	75	2202.45	2202.45	2200.20	2.25	2.06	0.8	1
3037	-100	75	2202.45	2200.20	2199.78	0.42	4.02	3.2	2
	-100	75	2202.45	2199.78					4
3038	-100	100	2202.19	2201.94	2200.69	1.25	2.05	0.79	1
3039	-100	100	2202.19	2200.69	2198.02	2.67	3.29	2.67	2
	-100	100	2202.19	2198.02					5
3040	-75	100	2201.8	2201.72	2200.97	0.75	2.3	0.99	1
3041	-75	100	2201.8	2200.97	2199.13	1.83	2.93	2.41	2
	-75	100	2201.8	2199.13					4
3042	-75	75	2202.06	2201.98	2198.89	3.08	1.41	0.55	1
3043	-75	75	2202.06	2198.89	2197.73	1.17	3.38	2.05	2
	-75	75	2202.06	2197.73					4
3044	-75	50	2202.68	2202.51	2200.76	1.75	1.85	0.86	1
	-75	50	2202.68	2200.76					4
3045	-50	100	2201.4	2201.32	2199.98	1.33	2.06	1.26	1
3046	-50	100	2201.4	2199.98	2197.73	2.25	3.23	2.24	2
	-50	100	2201.4	2197.73					4
3047	-50	75	2202.45	2202.28	2200.70	1.58	1.98	0.98	1
3048	-50	75	2202.45	2200.45	2199.37	1.08	3.42	2.39	2
	-50	75	2202.45	2199.37					4
3049	-50	25	2203	2202.83	2200.42	2.42	1.92	0.51	1
3050	-50	25	2203	2200.42	2199.83	0.58	3.1	2.74	2
	-50	25	2203	2199.83					4
3051	-25	75	2202.2	2202.20	2200.95	1.25	2.42	1.65	1
3052	-25	75	2202.2	2200.95	2200.28	0.67	3.53	2.2	2
	-25	75	2202.2	2200.28					4
3053	-100	-25	2202.17	2202.17	2200.92	1.25	2.39	0.85	1
3054	-100	-25	2202.17	2200.92	2200.50	0.42	3.67	2.4	2
	-100	-25	2202.17	2200.34					3
3055	-100	-50	2201.95	2201.95	2200.70	1.25	2.36	0.99	1
3056	-100	-50	2201.95	2200.70	2200.28	0.42	3.21	2.68	2
	-100	-50	2201.95	2200.20					3
3057	-100	-75	2201.93	2201.93	2200.43	1.50	2.05	0.68	1

3058	-100	-75	2201.93	2200.43	2199.68	0.75	3.08	2.64	2
	-100	-75	2201.93	2199.68					3
3059	-100	-100	2201.92	2201.92	2199.59	2.33	2.27	0.8	1
3060	-100	-100	2201.92	2199.59	2198.75	0.83	4.25	2.73	2
	-100	-100	2201.92	2198.75					3
3061	-75	-100	2201.82	2201.82	2199.90	1.92	2.11	0.58	1
3062	-75	-100	2201.82	2199.90	2198.65	1.25	3.11	2.77	2
	-75	-100	2201.82	2198.65					3
3063	-75	-75	2201.72	2201.72	2200.05	1.67	2.7	0.61	1
3064	-75	-75	2201.72	2200.05	2199.72	0.33	3.5	2.15	2
	-75	-75	2201.72	2199.72					3
3065	-75	-50	2202.03	2202.03	2200.53	1.50	2.15	0.67	1
3066	-75	-50	2202.03	2200.53	2200.36	0.17	3.07	2.44	2
	-75	-50	2202.03	2200.36					3
3067	-75	-25	2202.35	2202.35	2200.68	1.67	2.44	0.67	1
	-75	-25	2202.35	2200.60					3
3068	-50	-25	2202.35	2202.35	2200.52	1.83	2.46	0.58	1
3069	-50	-75	2202.04	2202.04	2199.79	2.25	2.12	0.55	1
3070	-50	-75	2202.04	2199.79	2199.54	0.25	3.41	1.94	2
	-50	-75	2202.04	2199.54					3
3071	-25	-100	2201.79	2201.79	2201.12	0.67	2.28	0.54	1
	-25	-100	2201.79	2201.12	2198.79	2.33			4
	-25	-100	2201.79	2198.79					5
3072	-25	-75	2201.79	2201.79	2200.12	1.67	2.1	0.59	1
	-25	-75	2201.79	2200.12					5
3073	-25	-50	2202.77	2202.77	2201.10	1.67	1.9	0.67	1
	-25	-50	2202.77	2201.10	2200.44	0.67			5
3074	-25	-25	2202.47	2202.47	2199.22	3.25	1.8	0.54	1
	-25	-25	2202.47	2201.80					5
3075	-25	100	2200.05	2200.05	2198.13	1.92	0.7	0.56	1
3076	-25	100	2200.05	2197.63	2195.05	2.58	1.81	1.18	2
3077	0	100	2200.69	2200.69	2199.77	0.92	2.27	0.96	1
3078	0	100	2200.69	2199.77	2198.44	1.33	3.16	2.09	2
	0	100	2200.69	2198.44					3
3079	25	75	2200.69	2200.69	2199.44	1.25	2.55	0.86	1
3080	25	75	2200.69	2199.44	2198.61	0.83	3.25	2.14	2
	25	75	2200.69	2198.52					3
3081	50	100	2200.31	2200.31	2198.14	2.17	2.62	1.22	1
3082	50	100	2200.31	2198.14	2197.48	0.67	2.42	1.78	2
	50	100	2200.31	2197.48					3
3083	75	100	2200.16	2200.16	2198.99	1.17	2.44	1.01	1
3084	75	100	2200.16	2198.99	2198.16	0.83	2.64	1.88	2
	75	100	2200.16	2198.16					3
3085	75	75	2200.75	2200.75	2199.75	1.00	2.22	0.75	1
3086	75	75	2200.75	2199.75	2199.08	0.67	2.97	1.7	2
	75	75	2200.75	2199.00					3
3087	75	50	2201.48	2201.48	2200.56	0.92	2.06	0.78	1
3088	75	50	2201.48	2200.56	2198.23	2.33	3.74	2.2	2

	75	50	2201.48	2198.15					3
3089	100	100	2199.98	2199.98	2199.06	0.92	0.9	0.54	1
	100	100	2199.98	2199.06					5
3090	100	75	2201.48	2201.48	2201.23	0.25	0.76	0.42	1
	100	75	2201.48	2201.23					5
3091	100	50	2201.48	2201.48	2200.65	0.83	1.71	0.73	1
	100	50	2201.48	2200.65					5
3092	100	25	2201.8	2201.80	2201.13	0.67	2.38	1.35	1
3093	100	25	2201.8	2201.13	2200.63	0.50	3.47	2.16	2
	100	25	2201.8	2200.55					5
3094	100	0	2198	2198.00	2197.17	0.83	2.57	1.05	1
3095	100	0	2198	2197.17	2196.00	1.17	2.6	1.86	2
	100	0	2198	2196.00					3
3096	90	0	2201	2201.00	2199.83	1.17	2.08	0.8	1
3097	90	0	2201	2199.83	2198.92	0.92	2.88	2.2	2
	90	0	2201	2198.92					3
3098	80	0	2201.35	2201.35	2199.35	2.00	1.92	0.7	1
	80	0	2201.35	2199.27					5
3099	70	0	2201.55	2201.55	2199.72	1.83	1.48	0.55	1
	70	0	2201.55	2199.72					5
3100	60	0	2201.75	2201.75	2200.25	1.50	2.03	0.84	1
3101	60	0	2201.75	2200.17	2198.83	1.33	2.38	1.96	2
	60	0	2201.75	2198.75					3
3102	75	-25	2201.65	2201.65	2200.15	1.50	2.46	0.87	1
3103	75	-25	2201.65	2200.15	2199.32	0.83	2.63	1.76	2
	75	-25	2201.65	2199.23					5
3104	75	-50	2201.69	2201.69	2200.02	1.67	2.31	1	1
3105	75	-50	2201.69	2199.94	2197.77	2.17	2.45	1.97	2
	75	-50	2201.69	2197.69					3
3106	75	-75	2198	2198.00	2197.00	1.00	2.47	0.91	1
3107	75	-75	2198	2196.92	2196.33	0.58	2.26	1.66	2
	75	-75	2198	2196.25					3
3108	0	-90	2202.1	2200.93	2200.60	1.50	0.19	0.21	1
	0	-90	2202.1	2200.60	2199.43	1.17			4
	0	-90	2202.1	2199.43					5
3109	0	-80	2202.24	2201.66	2200.07	2.08	0.76	0.23	1
	0	-80	2202.24	2200.07	2199.57	0.50			4
	0	-80	2202.24	2199.57					5
3110	0	-70	2202.32	2201.32	2198.99	2.33	0.86	0.32	1
	0	-70	2202.32	2198.90					5
3111	-10	0	2202.27	2202.27	2200.27	2.00	2.24	1.09	1
3112	-10	0	2202.27	2200.27	2199.77	0.50	2.45	1.97	2
	-10	0	2202.27	2199.35					4
3113	-30	0	2202.5	2202.50	2200.83	1.67	2.1	0.61	1
	-30	0	2202.5	2200.83					5
3114	-40	0	2202.47	2202.47	2200.64	1.83	2.05	0.48	1
	-40	0	2202.47	2200.64					4
4001	100	125	2199.98	2199.98	2198.73	1.25	1.78	0.56	1

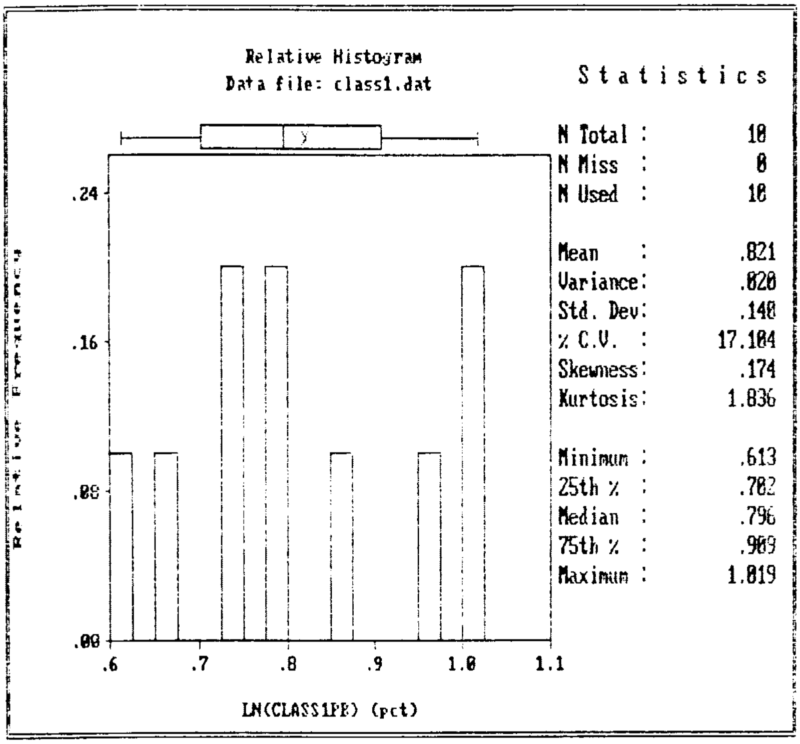
4002	100	125	2199.98	2198.73	2197.65	1.08	3.22	2	2
4003	50	125	2200.3	2199.55	2197.63	1.92	1.3	0.92	2
	50	125	2200.3	2197.80	2197.63	0.17			3
	50	125	2200.3	2197.63					4
4004	0	125	2200.69	2200.44	2197.52	2.92	3.39	1.59	2
	0	125	2200.69	2198.52	2197.52	1.00			3
	0	125	2200.69	2197.52					4
4005	-50	125	2201.4	2201.07	2200.90	0.17	2.35	1.07	1
4006	-50	125	2201.4	2200.90	2198.90	2.00	3.36	2.05	2
	-50	125	2201.4	2198.90					4
4007	-100	125	2202.19	2201.86	2201.19	0.67	2.57	0.89	1
4008	-100	125	2202.19	2201.19	2199.19	2.00	2.98	2.36	2
	-100	125	2202.19	2199.19					3
4009	-125	100	2202.19	2201.86	2200.36	1.50	2.44	0.75	1
4010	-125	100	2202.19	2200.36	2199.27	1.09	2.82	2.26	2
	-125	100	2202.19	2199.27	2198.11	1.17			3
	-125	100	2202.19	2198.11					5
4011	-125	50	2202.71	2202.21	2200.88	1.33	2.55	0.62	1
4012	-125	50	2202.71	2200.88	2200.38	0.50	3.79	2.22	2
	-125	50	2202.71	2200.38					3
	-125	50	2202.71	2200.04					4
4013	-125	0	2202.37	2201.87	2200.62	1.25	2.85	0.83	1
4014	-125	0	2202.37	2200.62	2199.04	1.58	3.82	2.53	2
	-125	0	2202.37	2199.04	2198.62	0.42			3
	-125	0	2202.37	2198.62					4
4015	-125	-50	2201.85	2201.60	2200.10	1.50	2.7	0.58	1
4016	-125	-50	2201.85	2200.10	2198.85	1.25	4.33	2.61	2
	-125	-50	2201.85	2198.77	2198.60	0.17			3
	-125	-50	2201.85	2198.60					4
4017	-125	-100	2201.9	2201.48	2199.73	1.75	2.8	1.03	1
4018	-125	-100	2201.9	2199.73	2199.57	0.17	4.82	3.23	2
	-125	-100	2201.9	2199.57	2199.48	0.08			4
	-125	-100	2201.9	2199.48					5
4019	-25	25	2202.5	2202.33	2200.83	1.50	3	0.83	1
4020	-25	25	2202.5	2200.83	2200.17	0.67	4.69	2.62	2
	-25	25	2202.5	2200.17	2199.58	0.59			3
	-25	25	2202.5	2199.58					4

```
      REASSAY FILE


SPLNUM    %        %        %        %
      OLD      OLD      NEW      NEW
SPLNUMPB       ZN       PB       ZN
 1001     2.01     1.65     2.45        2
 1003   2.1551   2.0042     2.24     2.08
 1004     2.07     2.38      2.5     2.54
 1013   1.5043   0.5362     1.53     0.61
 1021     2.98     1.41     3.13     1.56
 1025   2.7557   1.0856     2.86     1.25
 1027   1.4084    1.004     1.74     1.14
 1028   1.5071   1.8738     1.74     2.01
 1029     3.04     2.32     2.89     2.44
 1033     2.21     1.38     2.75     1.87
 1038   1.0439   0.8797     1.32     1.09
 1040   2.1159   1.9996     3.17     2.24
 1043   2.0829   0.8988     2.03     0.95
 1044   2.1425   1.8661     1.89        2
 1045     2.45     2.33     3.09     2.31
 1048    2.322    0.805     2.39     0.88
 1049   2.4787   2.7139     2.78     2.66
 1052   1.9322   0.6225     2.57     0.71
 1053     1.34     0.38     1.49     0.43
 1054     1.99     0.58     2.14     0.69
 1055   2.5801     1.22     2.73     1.48
 1058   1.7862   0.3961     1.83     0.48
 1062     1.64     1.28     2.72     1.75
 1063   2.3896   0.8339     2.06     0.86
 1064     2.52     2.42     2.39     2.43
 1065     2.48      2.3     2.13     2.29
 1066   1.0199   1.1795     1.04     1.28
 1068     1.72     1.54     1.78     1.78
 1069   2.2277   2.9817     3.32     3.16
 1073   1.7067   1.7211     1.69     1.91
 1079     1.14     1.57     1.29     1.67
 1080     2.05     2.55     2.35     2.47
 1083   1.9424   2.1488     1.91      2.1
 1084     1.93     2.17        2      2.1
 1085     2.26     2.37     2.26     2.22
 1087     2.29     2.54     1.39     2.33
 1090     1.92     1.82     2.61     2.18
 1091     2.69     2.01     2.66     2.42
 1092   2.1279   1.2476     2.84     1.22
 1094   2.0251   0.5113     2.34     0.55
 1095     1.89     1.07     2.71     1.29
```

2001	2.225	0.9295	2.49	1.09
2004	2.036	2.0055	2.23	2.37
2006	1.8836	2.0107	3.87	2.28
2008	1.4416	0.5863	1.56	0.65
2010	2.532	2.1566	2.9	1.88
2013	1.8462	0.7138	1.92	0.83
2017	2.7572	1.726	3.13	2.1
2027	2.9223	1.5393	3.61	1.73
2031	2.0082	0.5753	2.06	0.66
2035	2.42	0.59	2.21	0.66
2042	2.6014	0.7704	2.56	0.78
2052	1.76	1.4	1.58	1.49
2054	2.39	2.92	5.11	2.42
2061	2.28	2.33	3.32	2.78
2062	3.2	2.23	3.35	2.3
2074	1.37	2.32	1.38	3.26
2078	1.5144	0.845	1.68	0.96
2082	2.5251	0.5714	2.34	0.54
2090	1.9502	0.5599	1.84	0.68
2094	1.7893	0.7774	1.58	0.84
2100	1.8	0.84	1.74	0.76
2101	2.36	0.93	2.53	0.76
2105	1.8163	0.8411	1.86	0.87
2110	1.8926	0.8924	1.81	0.93
2121	1.25	0.92	1.4	0.86
2125	2.12	4.41	3.84	3.27
2131	3.0539	0.5273	3.07	0.59
2135	1.8742	0.8003	2.05	1.08

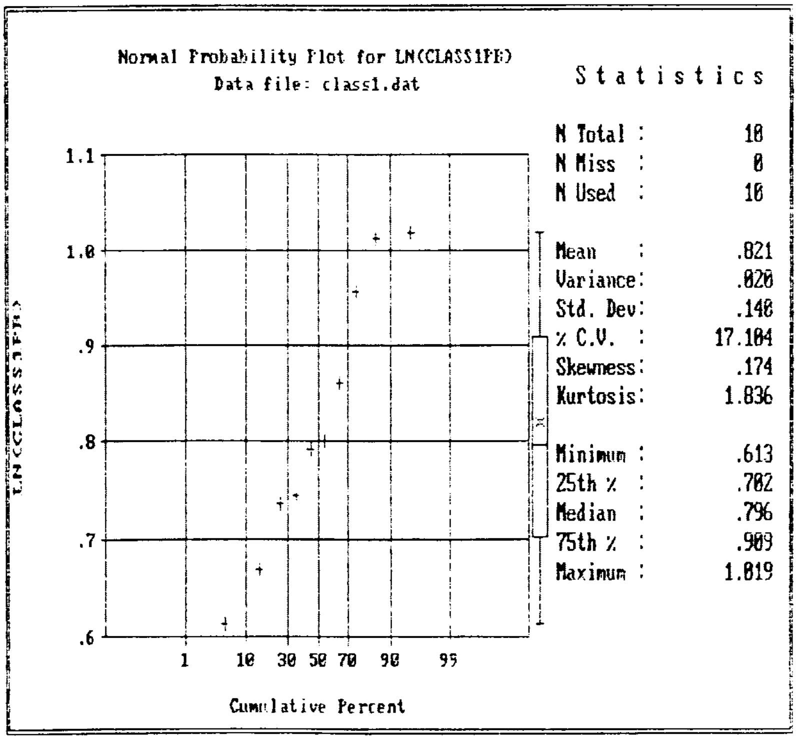
APPENDIX IV:

SEDIMENT CLASS ASSAY RELATIVE FREQUENCY HISTOGRAMS AND SAS OUTPUT OF WITHIN GROUP AND BETWEEN GROUP STATISTICAL ANALYSES



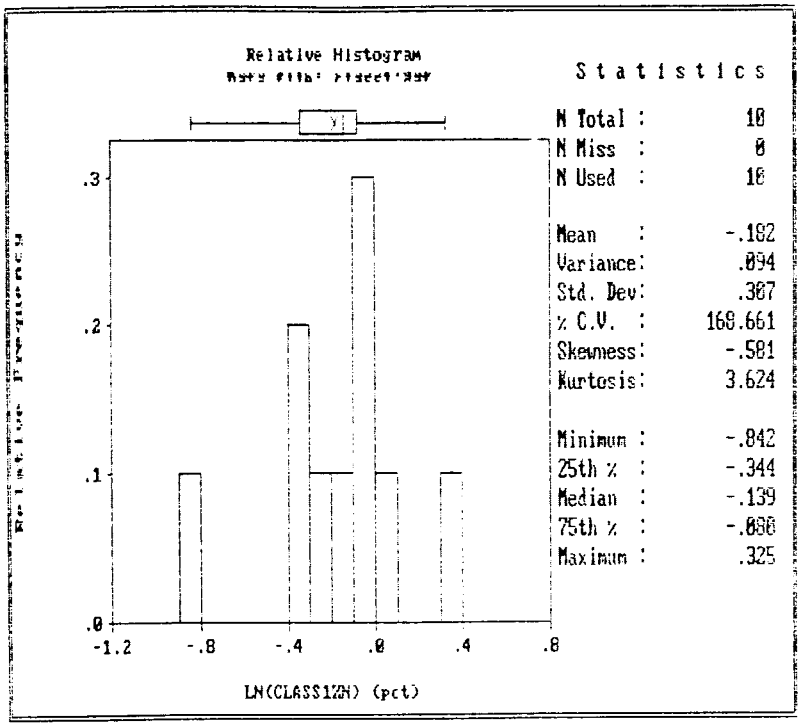
Relative Histogram
Data file: class1.dat

```
Statistics

N Total :      10
N Miss  :       0
N Used  :      10

Mean    :    .821
Variance:    .020
Std. Dev:    .140
% C.V.  :  17.104
Skewness:    .174
Kurtosis:   1.836

Minimum :    .613
25th %  :    .702
Median  :    .796
75th %  :    .909
Maximum :   1.019
```

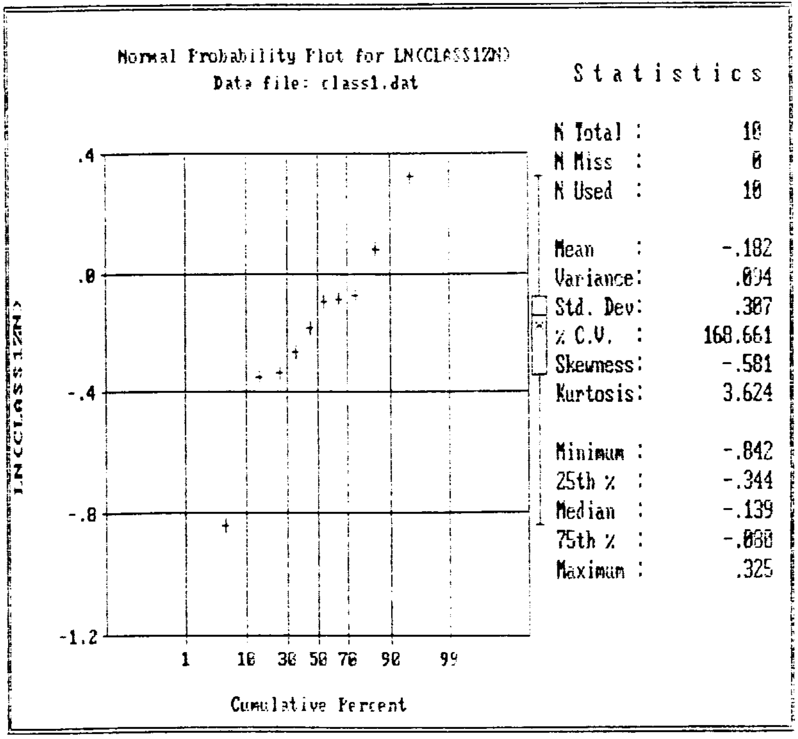


Normal Probability Plot for LN(CLASS1PB)
Data file: class1.dat

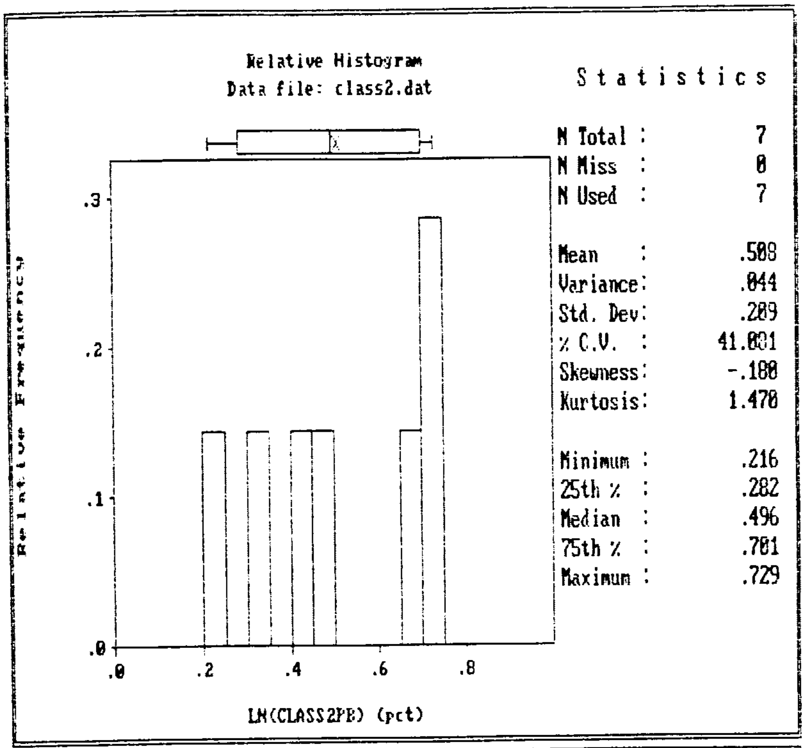
```
Statistics

N Total :      10
N Miss  :       0
N Used  :      10

Mean    :    .821
Variance:    .020
Std. Dev:    .140
% C.V.  :  17.104
Skewness:    .174
Kurtosis:   1.836

Minimum :    .613
25th %  :    .702
Median  :    .796
75th %  :    .909
Maximum :   1.019
```



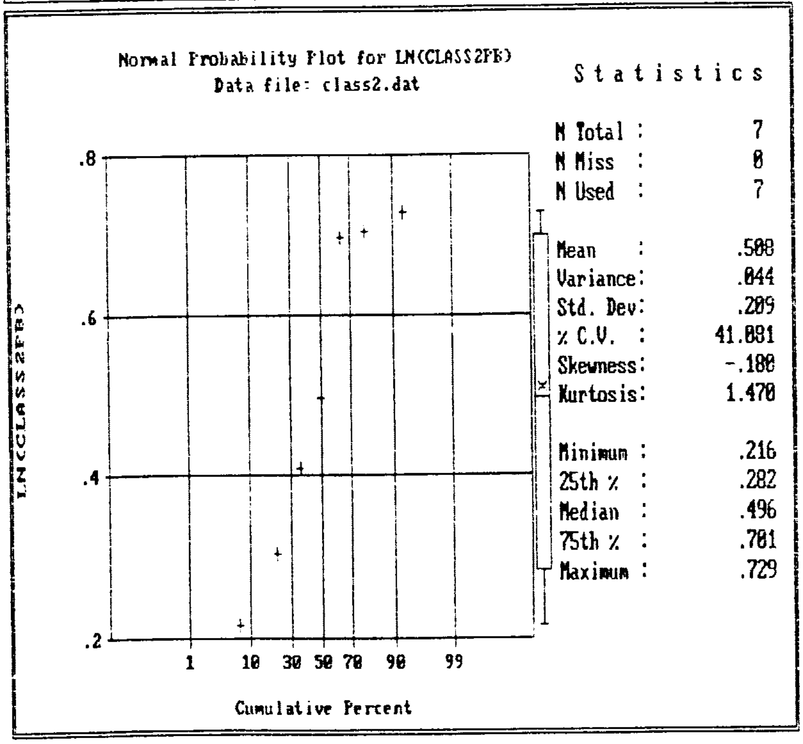
```
Statistics

N Total :        10
N Miss  :         0
N Used  :        10

Mean    :     -.182
Variance:      .094
Std. Dev:      .307
% C.V.  :   168.661
Skewness:     -.581
Kurtosis:     3.624

Minimum :     -.842
25th %  :     -.344
Median  :     -.139
75th %  :     -.080
Maximum :      .325
```



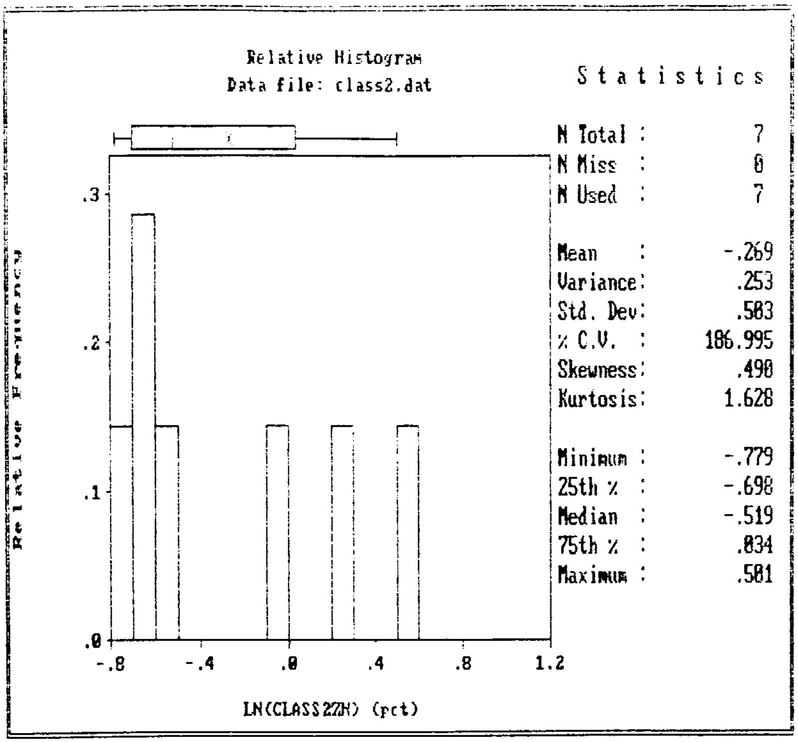
```
Statistics

N Total :        10
N Miss  :         0
N Used  :        10

Mean    :     -.182
Variance:      .094
Std. Dev:      .307
% C.V.  :   168.661
Skewness:     -.581
Kurtosis:     3.624

Minimum :     -.842
25th %  :     -.344
Median  :     -.139
75th %  :     -.080
Maximum :      .325
```



```
Statistics

N Total  :        7
N Miss   :        0
N Used   :        7

Mean     :     .508
Variance :     .044
Std. Dev :     .209
% C.V.   :   41.081
Skewness :    -.180
Kurtosis :    1.470

Minimum  :     .216
25th %   :     .282
Median   :     .496
75th %   :     .701
Maximum  :     .729
```



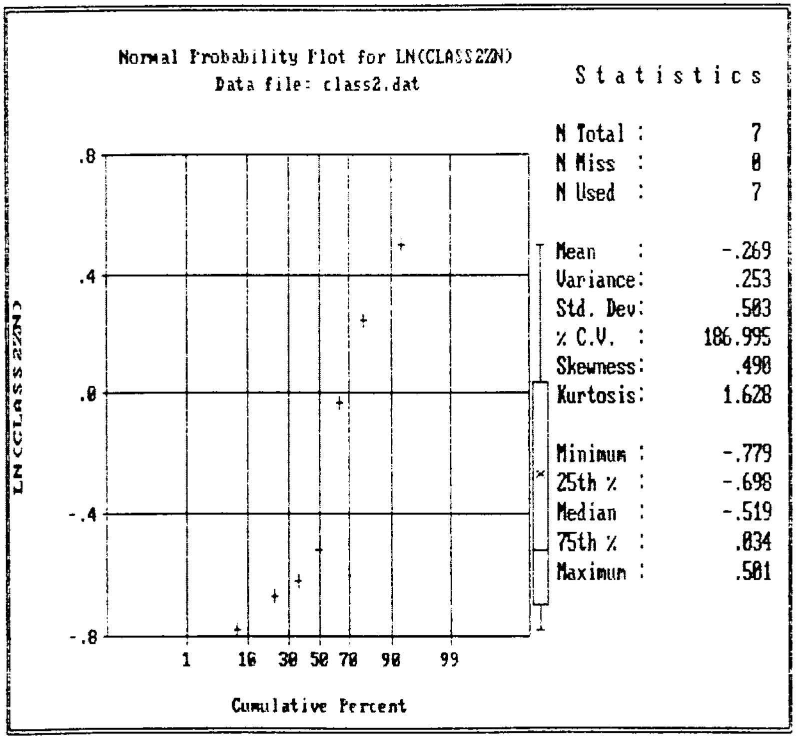
```
Statistics

N Total  :        7
N Miss   :        0
N Used   :        7

Mean     :     .508
Variance :     .044
Std. Dev :     .209
% C.V.   :   41.081
Skewness :    -.180
Kurtosis :    1.470

Minimum  :     .216
25th %   :     .282
Median   :     .496
75th %   :     .701
Maximum  :     .729
```



Relative Histogram
Data file: class2.dat

Statistics

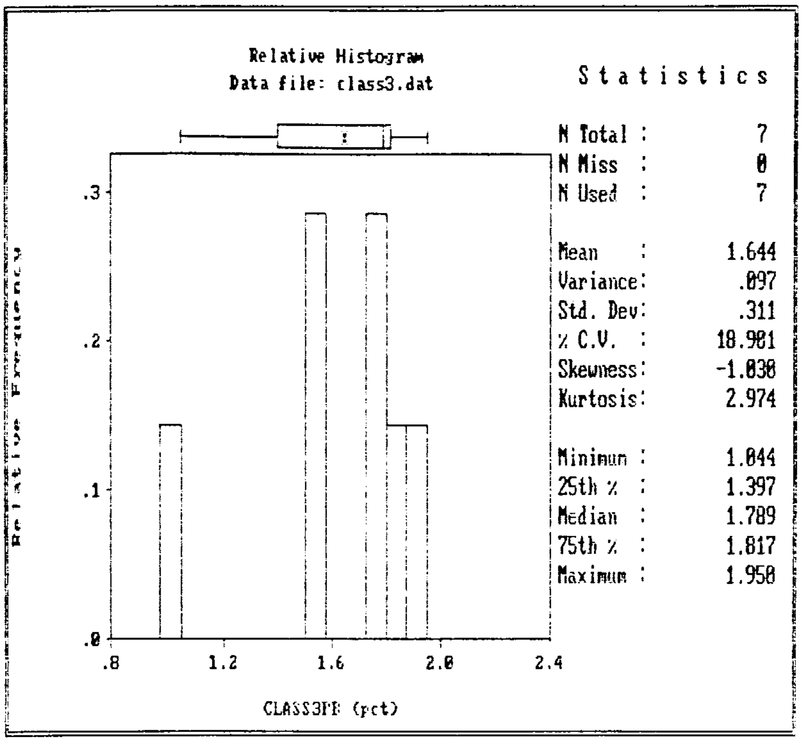
N Total :	7
N Miss :	0
N Used :	7
Mean :	-.269
Variance:	.253
Std. Dev:	.503
% C.V. :	186.995
Skewness:	.490
Kurtosis:	1.620
Minimum :	-.779
25th % :	-.698
Median :	-.519
75th % :	.034
Maximum :	.501



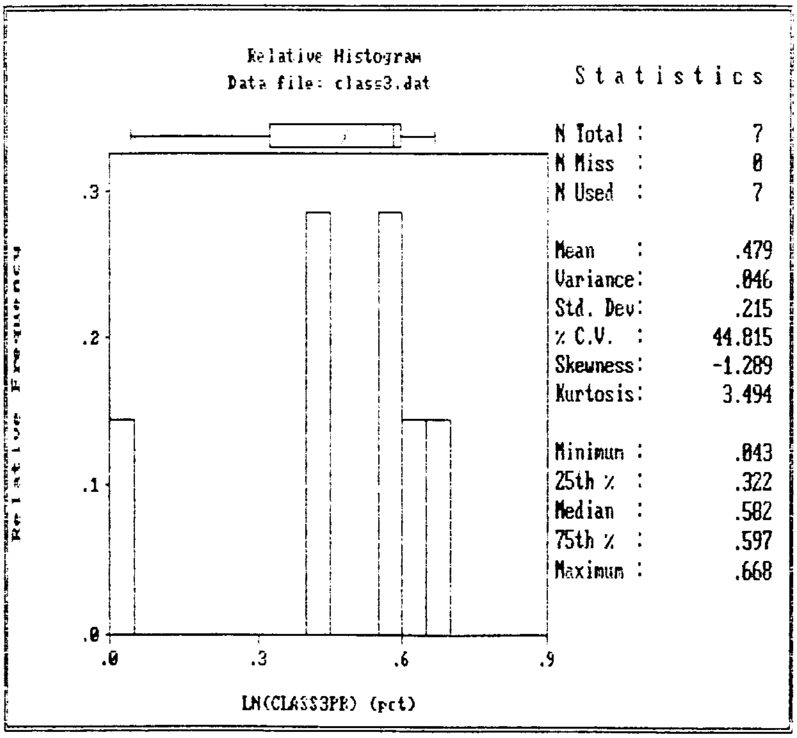
Normal Probability Plot for LN(CLASS2ZN)
Data file: class2.dat

Statistics

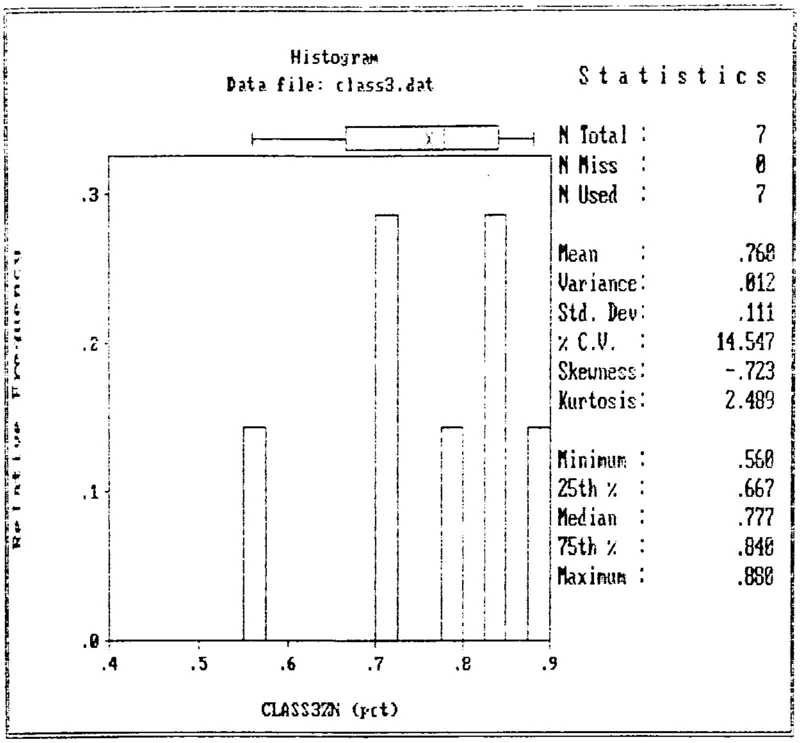
N Total :	7
N Miss :	0
N Used :	7
Mean :	-.269
Variance:	.253
Std. Dev:	.503
% C.V. :	186.995
Skewness:	.490
Kurtosis:	1.620
Minimum :	-.779
25th % :	-.698
Median :	-.519
75th % :	.034
Maximum :	.501



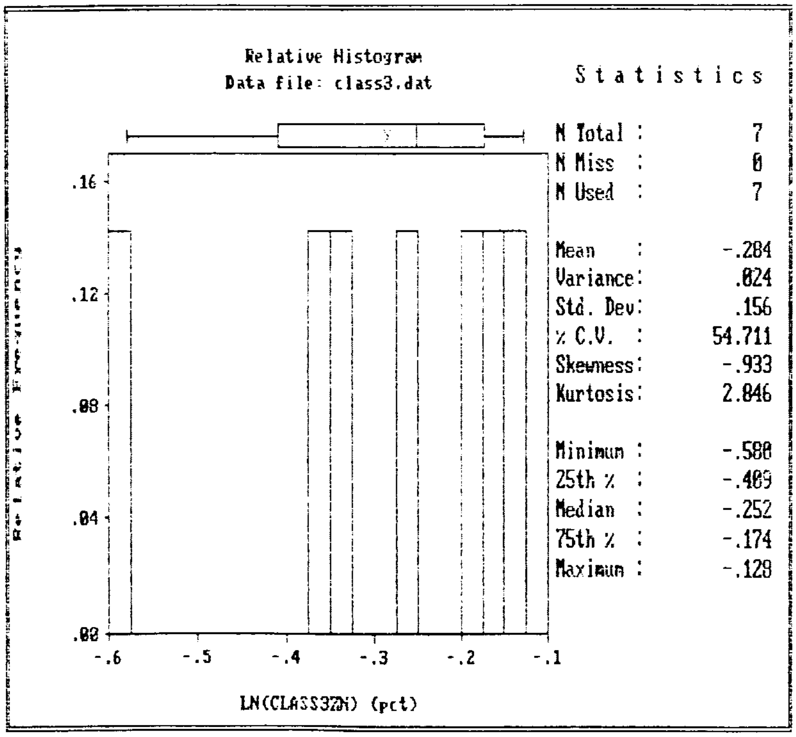
```
Statistics

N Total  :       7
N Miss   :       0
N Used   :       7

Mean     :   1.644
Variance :    .097
Std. Dev :    .311
% C.V.   :  18.901
Skewness :  -1.038
Kurtosis :   2.974

Minimum  :   1.044
25th %   :   1.397
Median   :   1.789
75th %   :   1.817
Maximum  :   1.950
```



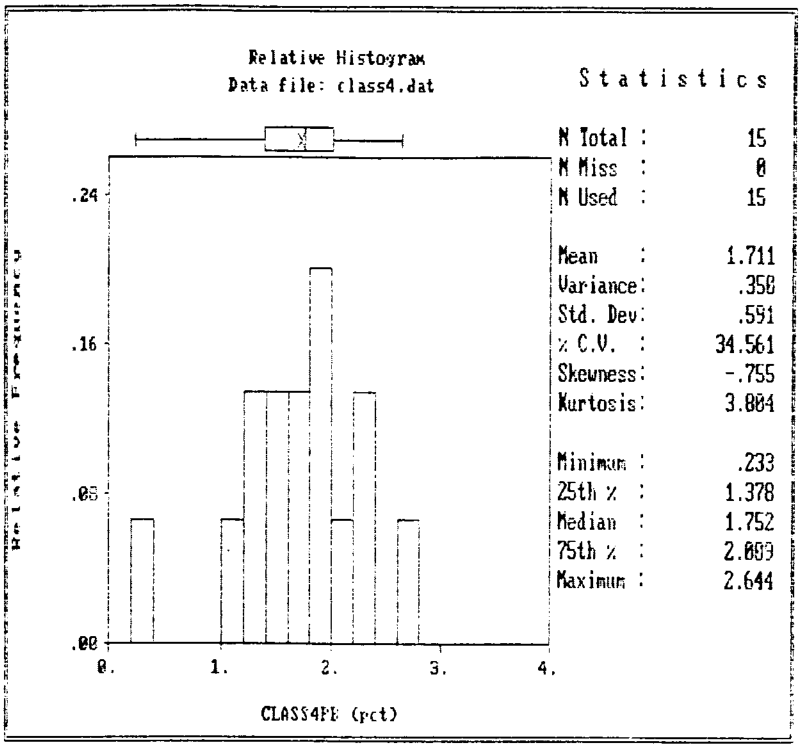
```
Statistics

N Total  :       7
N Miss   :       0
N Used   :       7

Mean     :    .479
Variance :    .046
Std. Dev :    .215
% C.V.   :  44.815
Skewness :  -1.289
Kurtosis :   3.494

Minimum  :    .043
25th %   :    .322
Median   :    .582
75th %   :    .597
Maximum  :    .668
```



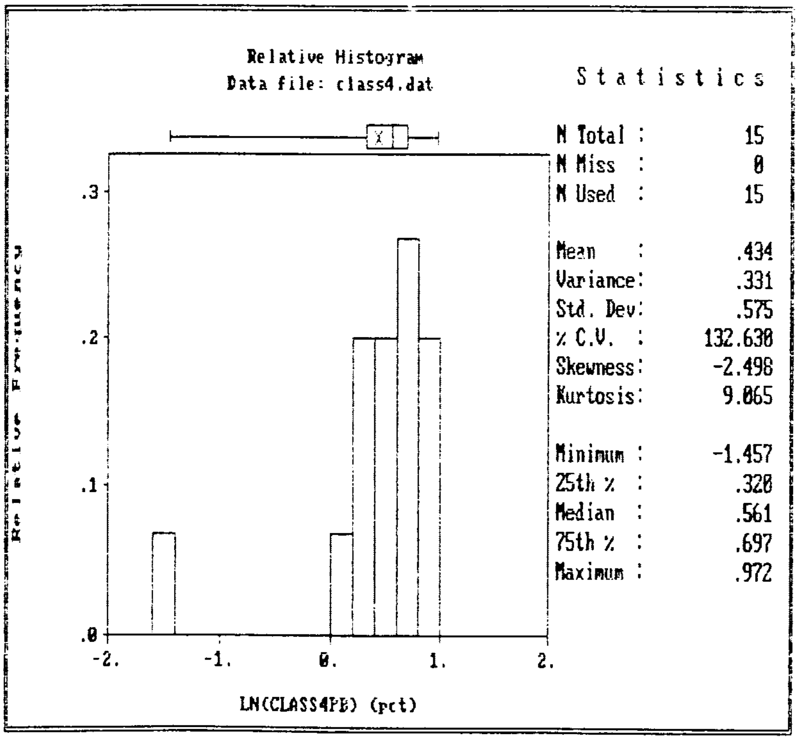
```
Statistics

N Total :        7
N Miss  :        0
N Used  :        7

Mean    :     .760
Variance:     .012
Std. Dev:     .111
% C.V.  :   14.547
Skewness:    -.723
Kurtosis:    2.489

Minimum :     .560
25th %  :     .667
Median  :     .777
75th %  :     .840
Maximum :     .880
```



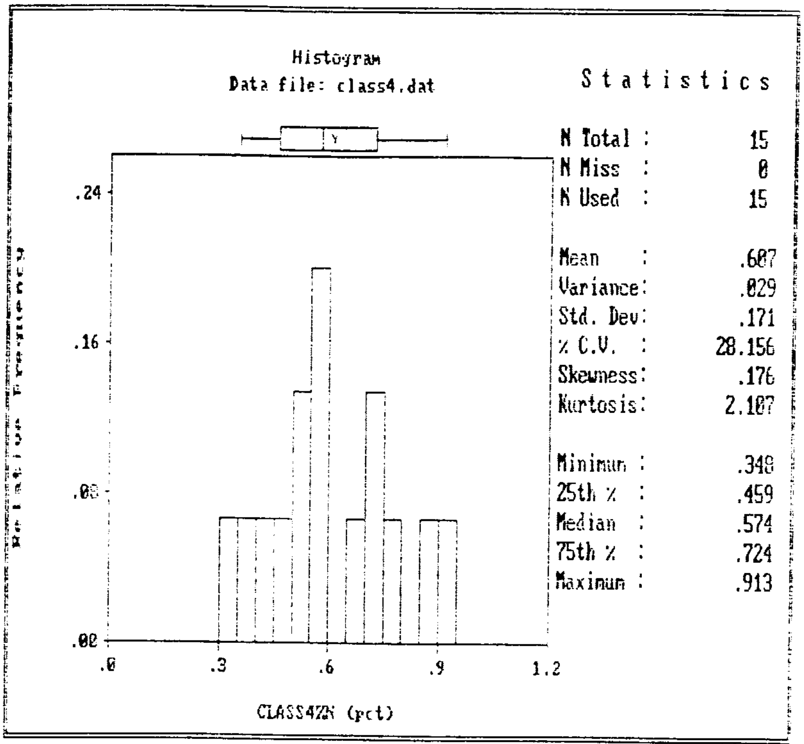
```
Statistics

N Total :        7
N Miss  :        0
N Used  :        7

Mean    :    -.284
Variance:     .024
Std. Dev:     .156
% C.V.  :   54.711
Skewness:    -.933
Kurtosis:    2.046

Minimum :    -.580
25th %  :    -.409
Median  :    -.252
75th %  :    -.174
Maximum :    -.128
```



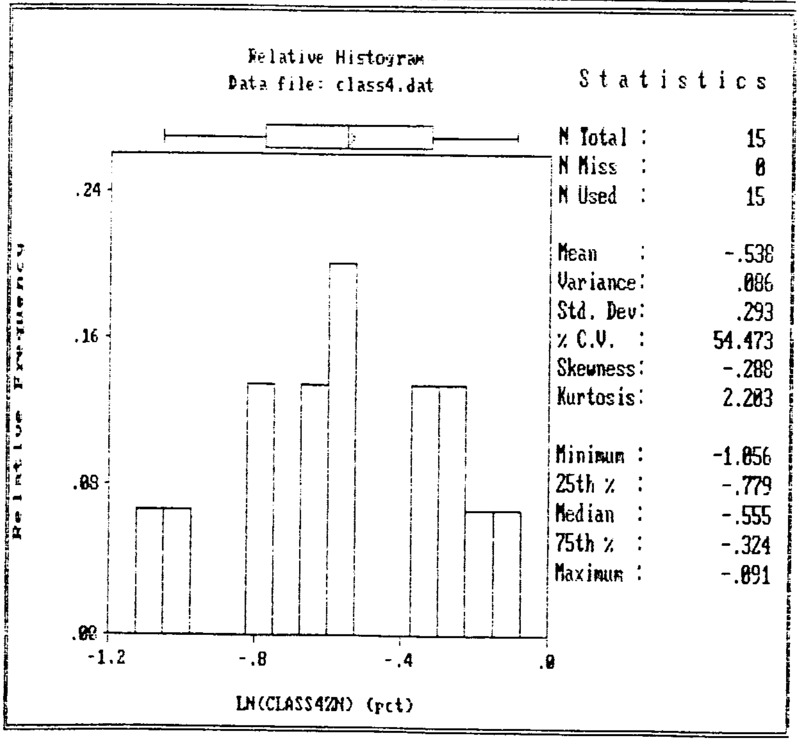
```
Statistics

N Total :        15
N Miss  :         0
N Used  :        15

Mean    :     1.711
Variance:      .350
Std. Dev:      .591
% C.V.  :    34.561
Skewness:     -.755
Kurtosis:     3.004

Minimum :      .233
25th %  :     1.378
Median  :     1.752
75th %  :     2.009
Maximum :     2.644
```



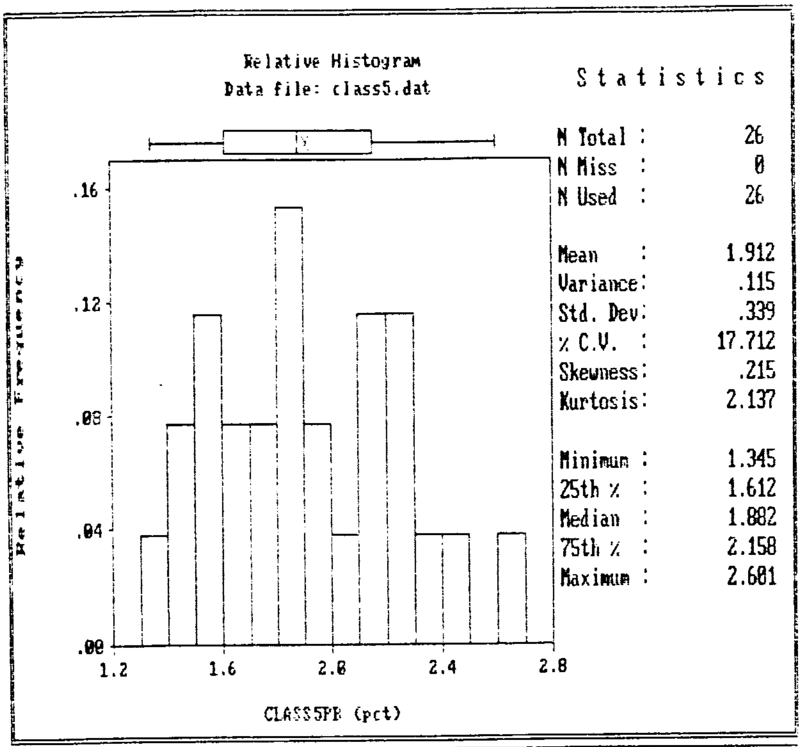
```
Statistics

N Total :        15
N Miss  :         0
N Used  :        15

Mean    :      .434
Variance:      .331
Std. Dev:      .575
% C.V.  :   132.630
Skewness:    -2.490
Kurtosis:     9.065

Minimum :    -1.457
25th %  :      .320
Median  :      .561
75th %  :      .697
Maximum :      .972
```



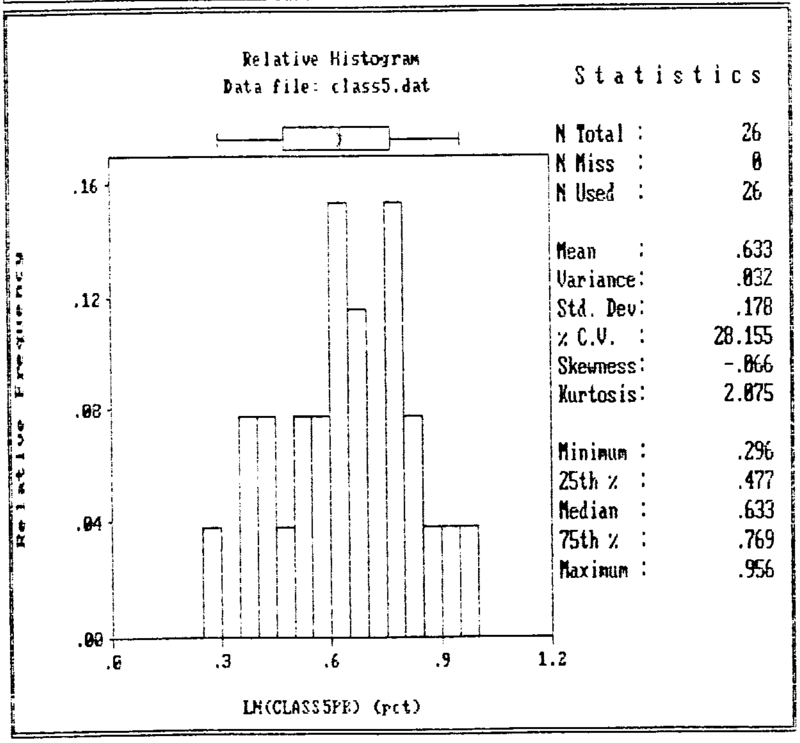
```
S t a t i s t i c s

N Total :        15
N Miss  :         0
N Used  :        15

Mean    :      .607
Variance:      .029
Std. Dev:      .171
% C.V.  :    28.156
Skewness:      .176
Kurtosis:     2.107

Minimum :      .348
25th %  :      .459
Median  :      .574
75th %  :      .724
Maximum :      .913
```



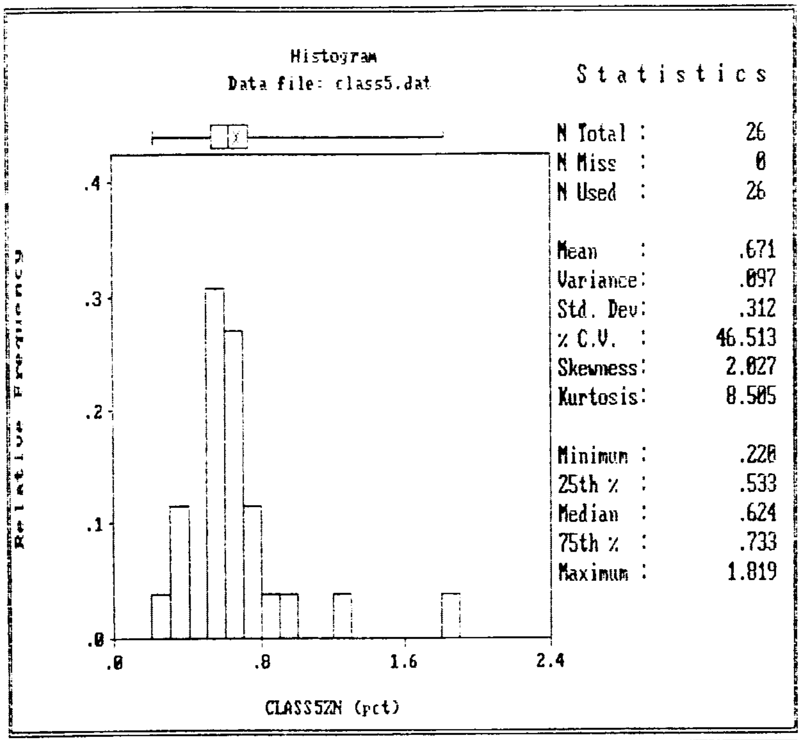
```
S t a t i s t i c s

N Total :        15
N Miss  :         0
N Used  :        15

Mean    :     -.538
Variance:      .086
Std. Dev:      .293
% C.V.  :    54.473
Skewness:     -.288
Kurtosis:     2.203

Minimum :    -1.056
25th %  :     -.779
Median  :     -.555
75th %  :     -.324
Maximum :     -.091
```



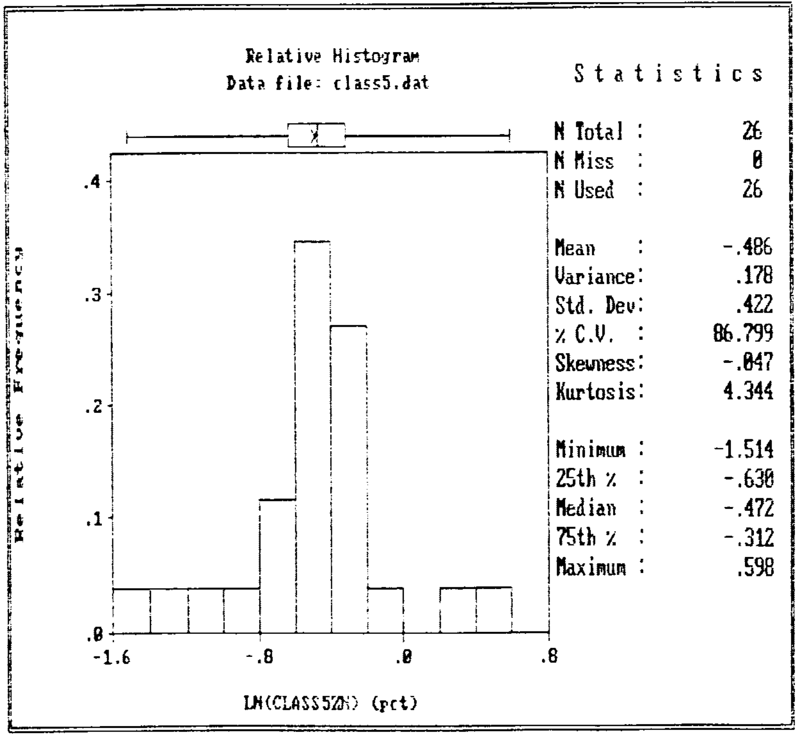
```
Statistics

N Total :        26
N Miss  :         0
N Used  :        26

Mean     :    1.912
Variance :     .115
Std. Dev :     .339
% C.V.   :   17.712
Skewness :     .215
Kurtosis :    2.137

Minimum :     1.345
25th %  :     1.612
Median  :     1.882
75th %  :     2.158
Maximum :     2.601
```



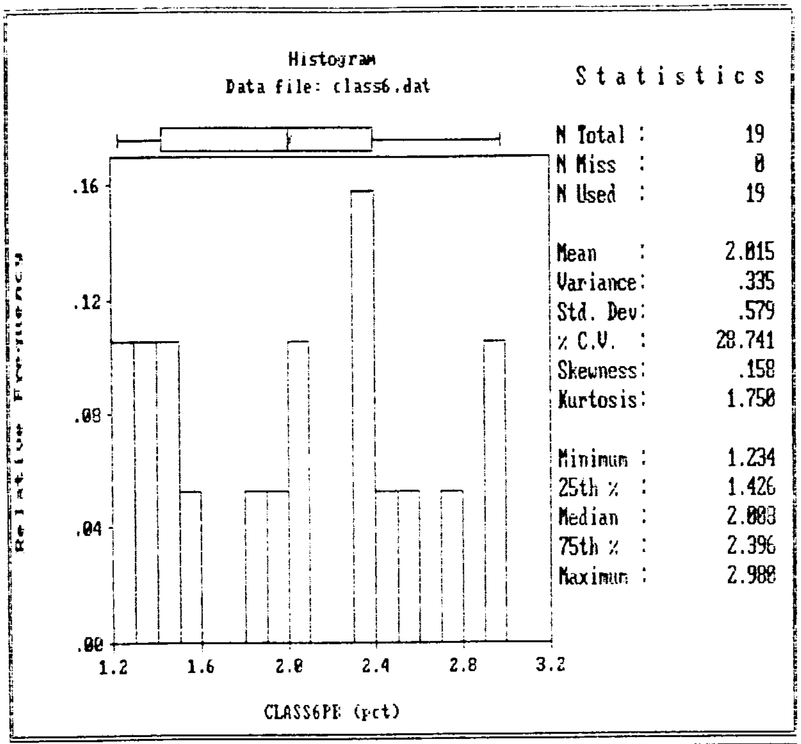
```
Statistics

N Total :        26
N Miss  :         0
N Used  :        26

Mean     :     .633
Variance :     .032
Std. Dev :     .178
% C.V.   :   28.155
Skewness :    -.066
Kurtosis :    2.075

Minimum :      .296
25th %  :      .477
Median  :      .633
75th %  :      .769
Maximum :      .956
```



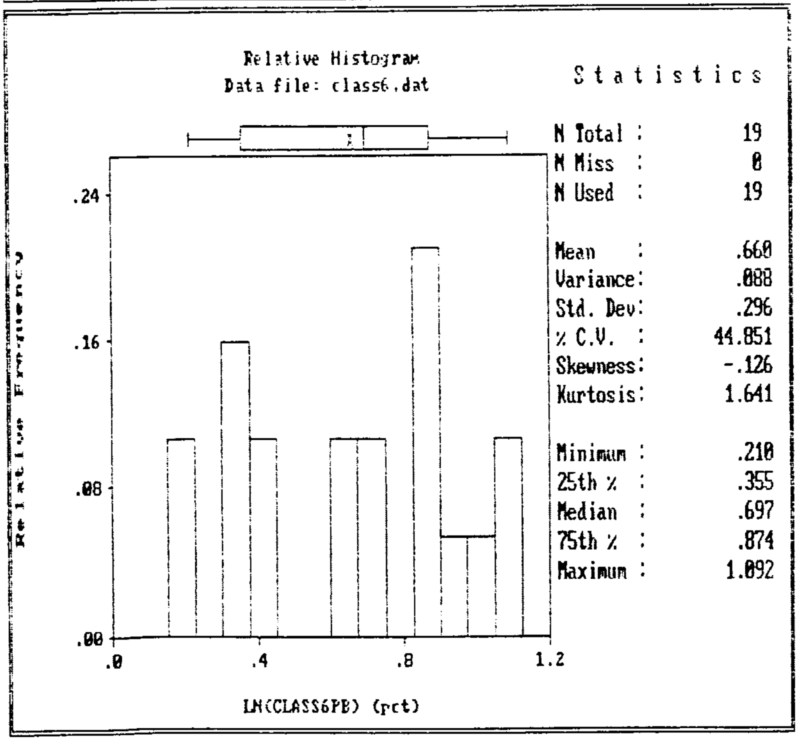
```
Statistics

N Total :        26
N Miss  :         0
N Used  :        26

Mean     :     .671
Variance:      .097
Std. Dev:      .312
% C.V.  :    46.513
Skewness:     2.027
Kurtosis:     8.505

Minimum :      .220
25th %  :      .533
Median  :      .624
75th %  :      .733
Maximum :     1.819
```



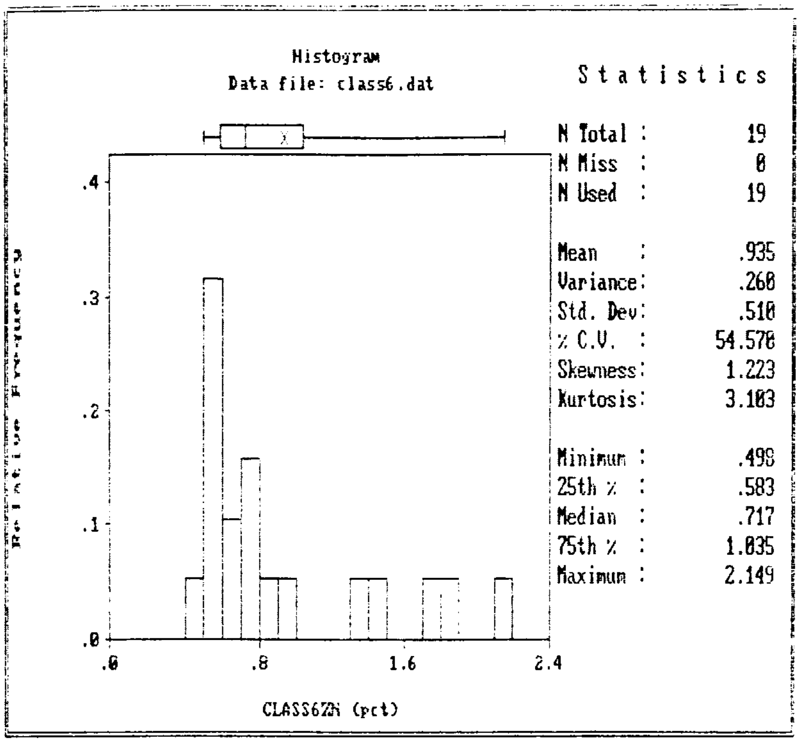
```
Statistics

N Total :        26
N Miss  :         0
N Used  :        26

Mean     :    -.486
Variance:      .178
Std. Dev:      .422
% C.V.  :    86.799
Skewness:     -.047
Kurtosis:     4.344

Minimum :    -1.514
25th %  :     -.630
Median  :     -.472
75th %  :     -.312
Maximum :      .598
```



```
Statistics

N Total :         19
N Miss  :          0
N Used  :         19

Mean    :      2.015
Variance:       .335
Std. Dev:       .579
% C.V.  :     28.741
Skewness:       .158
Kurtosis:      1.750

Minimum :      1.234
25th %  :      1.426
Median  :      2.003
75th %  :      2.396
Maximum :      2.980
```

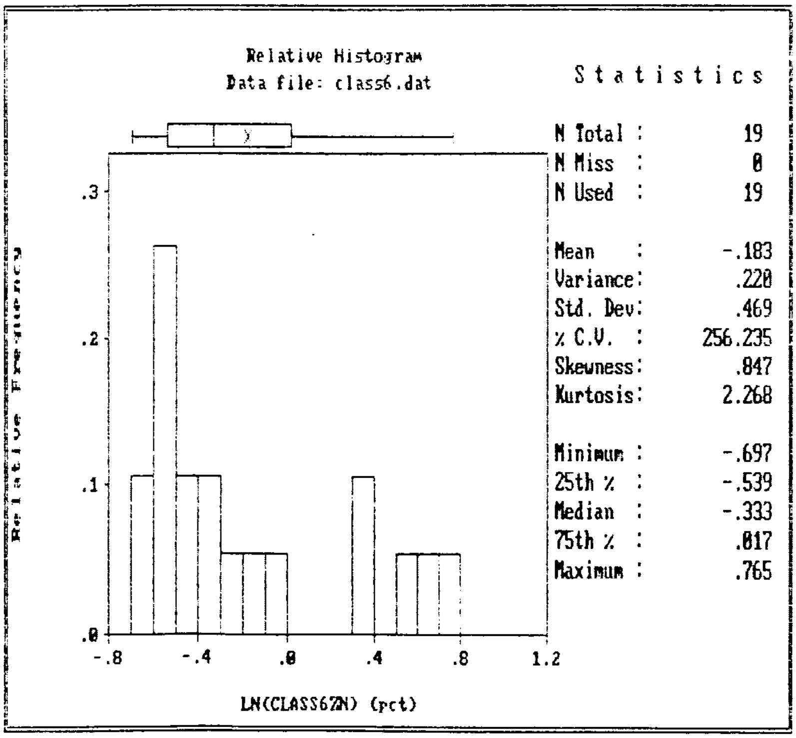


```
Statistics

N Total :         19
N Miss  :          0
N Used  :         19

Mean    :       .660
Variance:       .088
Std. Dev:       .296
% C.V.  :     44.851
Skewness:      -.126
Kurtosis:      1.641

Minimum :       .210
25th %  :       .355
Median  :       .697
75th %  :       .874
Maximum :      1.092
```



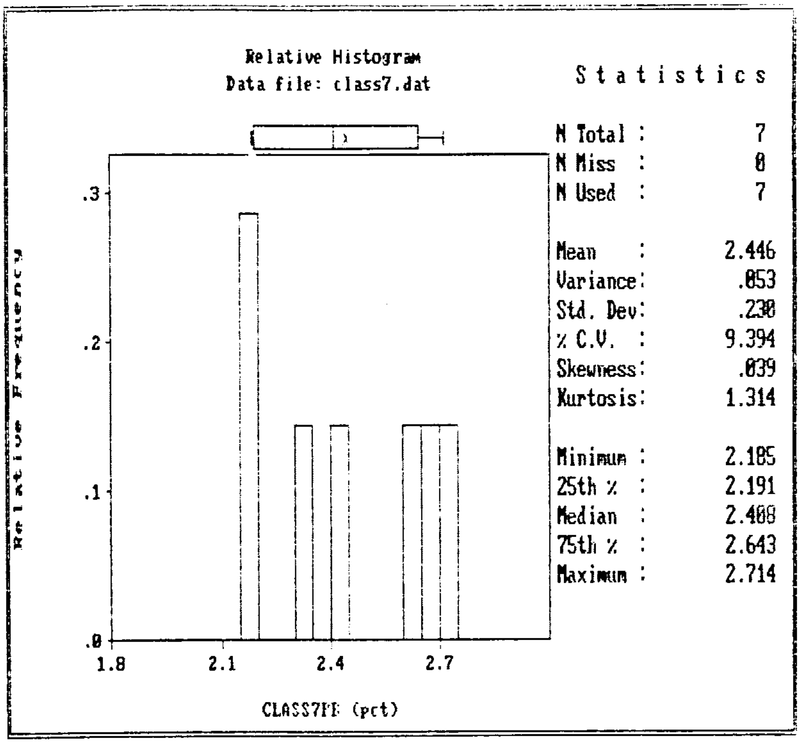
Histogram
Data file: class6.dat

```
Statistics

N Total :        19
N Miss  :         0
N Used  :        19

Mean    :      .935
Variance:      .268
Std. Dev:      .510
% C.V.  :    54.578
Skewness:     1.223
Kurtosis:     3.103

Minimum :      .498
25th %  :      .583
Median  :      .717
75th %  :     1.035
Maximum :     2.149
```

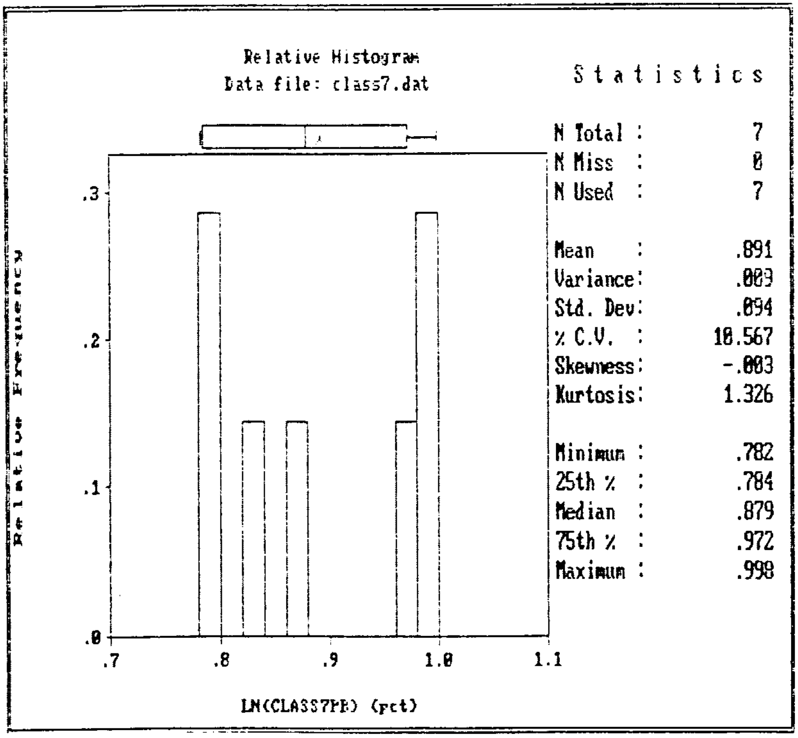


Relative Histogram
Data file: class6.dat

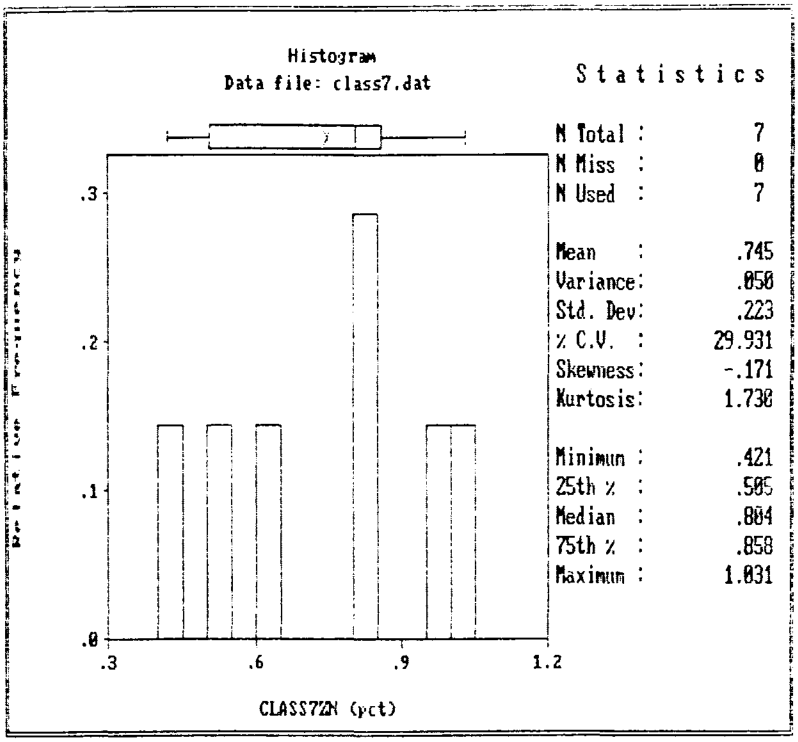
```
Statistics

N Total :        19
N Miss  :         0
N Used  :        19

Mean    :     -.183
Variance:      .220
Std. Dev:      .469
% C.V.  :   256.235
Skewness:      .847
Kurtosis:     2.268

Minimum :     -.697
25th %  :     -.539
Median  :     -.333
75th %  :      .017
Maximum :      .765
```



```
S t a t i s t i c s

N Total  :        7
N Miss   :        0
N Used   :        7

Mean     :    2.446
Variance :     .053
Std. Dev :     .230
% C.V.   :    9.394
Skewness :     .039
Kurtosis :    1.314

Minimum  :    2.105
25th %   :    2.191
Median   :    2.408
75th %   :    2.643
Maximum  :    2.714
```

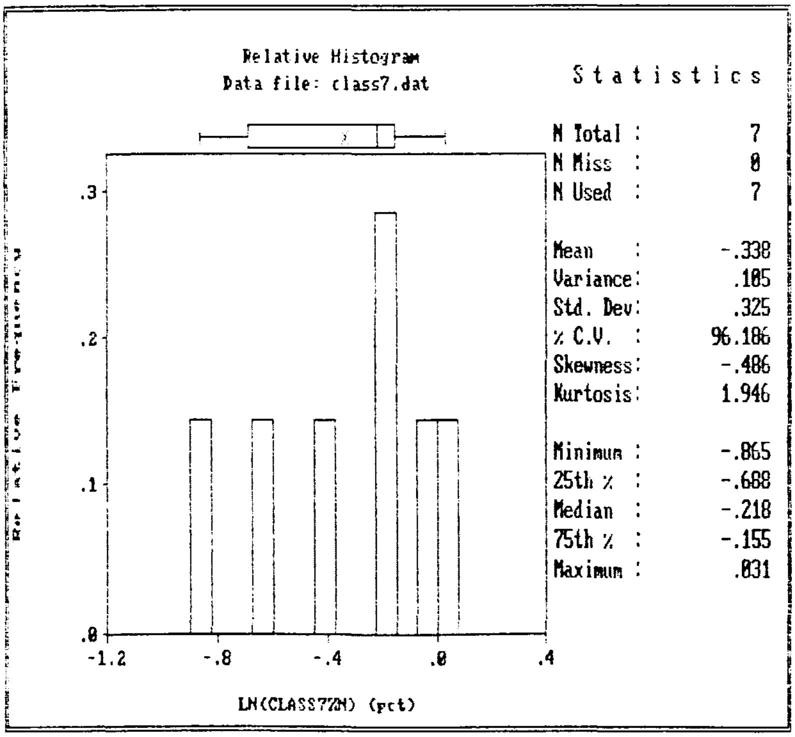


```
S t a t i s t i c s

N Total  :        7
N Miss   :        0
N Used   :        7

Mean     :     .891
Variance :     .009
Std. Dev :     .094
% C.V.   :   10.567
Skewness :    -.003
Kurtosis :    1.326

Minimum  :     .782
25th %   :     .784
Median   :     .879
75th %   :     .972
Maximum  :     .998
```



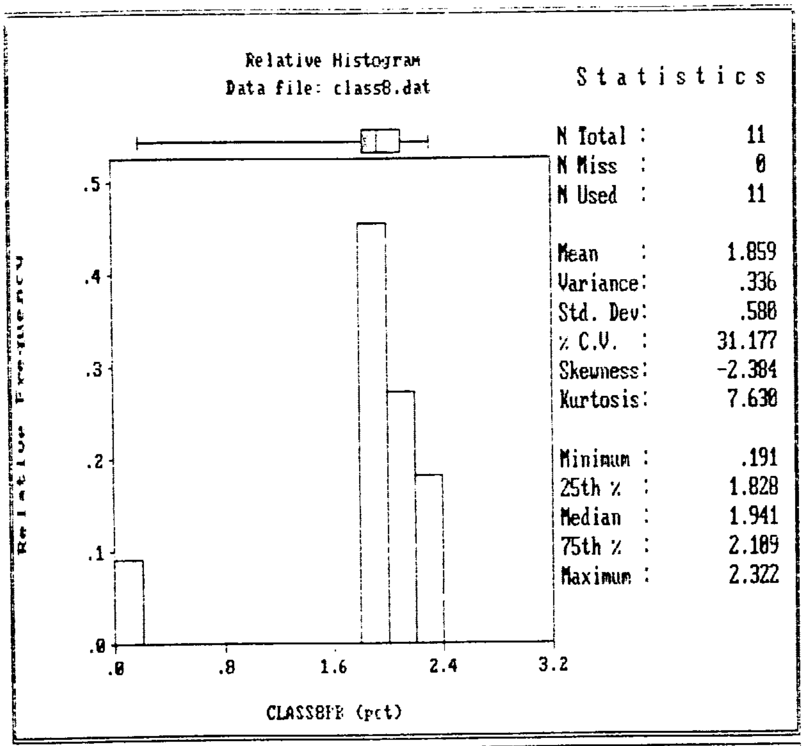
Histogram
Data file: class7.dat

```
S t a t i s t i c s

N Total :          7
N Miss  :          0
N Used  :          7

Mean    :       .745
Variance:       .050
Std. Dev:       .223
% C.V.  :     29.931
Skewness:      -.171
Kurtosis:      1.730

Minimum :       .421
25th %  :       .505
Median  :       .804
75th %  :       .858
Maximum :      1.031
```

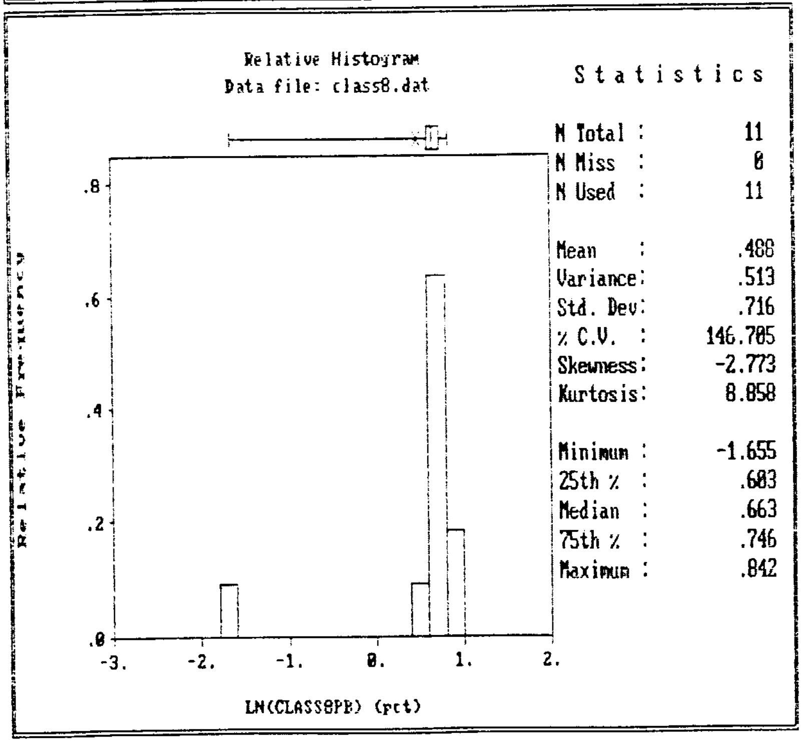


Relative Histogram
Data file: class7.dat

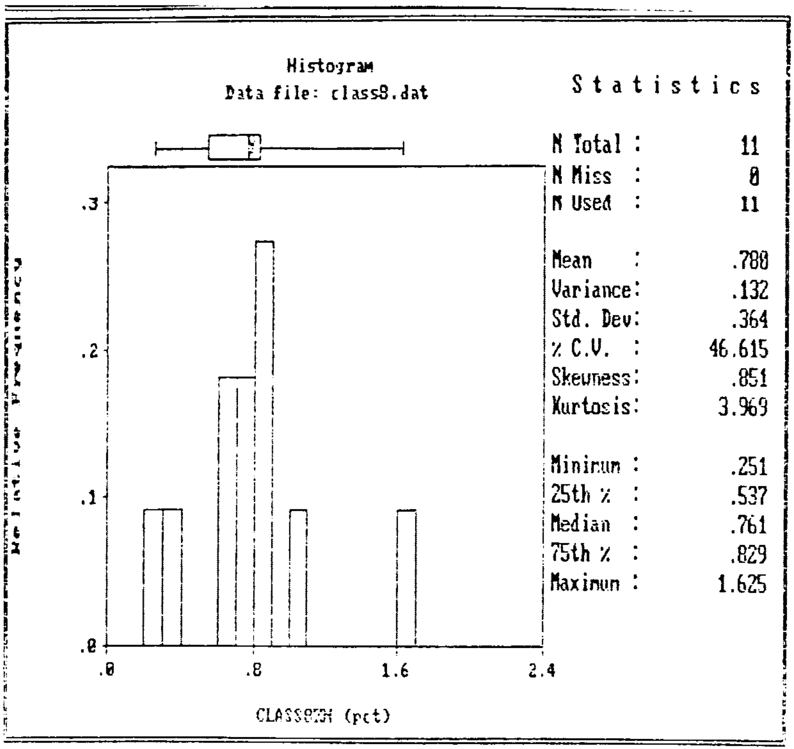
```
S t a t i s t i c s

N Total :          7
N Miss  :          0
N Used  :          7

Mean    :      -.338
Variance:       .105
Std. Dev:       .325
% C.V.  :     96.106
Skewness:      -.486
Kurtosis:      1.946

Minimum :      -.865
25th %  :      -.688
Median  :      -.218
75th %  :      -.155
Maximum :       .031
```



```
Statistics

N Total :        11
N Miss  :         0
N Used  :        11

Mean     :    1.859
Variance:      .336
Std. Dev:      .580
% C.V.   :   31.177
Skewness:    -2.384
Kurtosis:     7.630

Minimum :      .191
25th %  :     1.828
Median  :     1.941
75th %  :     2.109
Maximum :     2.322
```



```
Statistics

N Total :        11
N Miss  :         0
N Used  :        11

Mean     :     .488
Variance:      .513
Std. Dev:      .716
% C.V.   :  146.705
Skewness:    -2.773
Kurtosis:     8.858

Minimum :    -1.655
25th %  :      .603
Median  :      .663
75th %  :      .746
Maximum :      .842
```

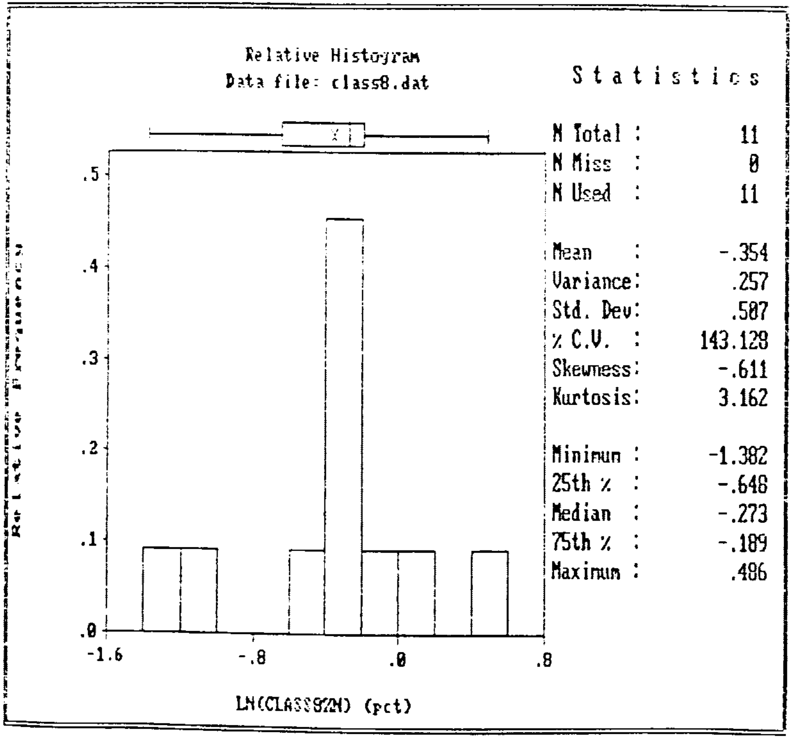


Statistics

N Total : 11
N Miss : 0
N Used : 11

Mean : .780
Variance: .132
Std. Dev: .364
% C.V. : 46.615
Skewness: .851
Kurtosis: 3.969

Minimum : .251
25th % : .537
Median : .761
75th % : .829
Maximum : 1.625

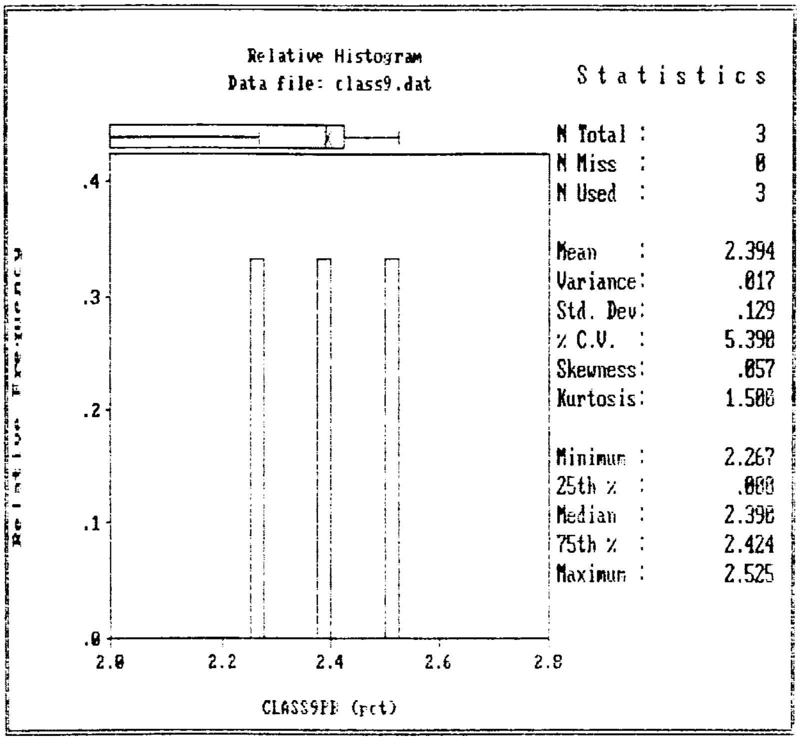


Statistics

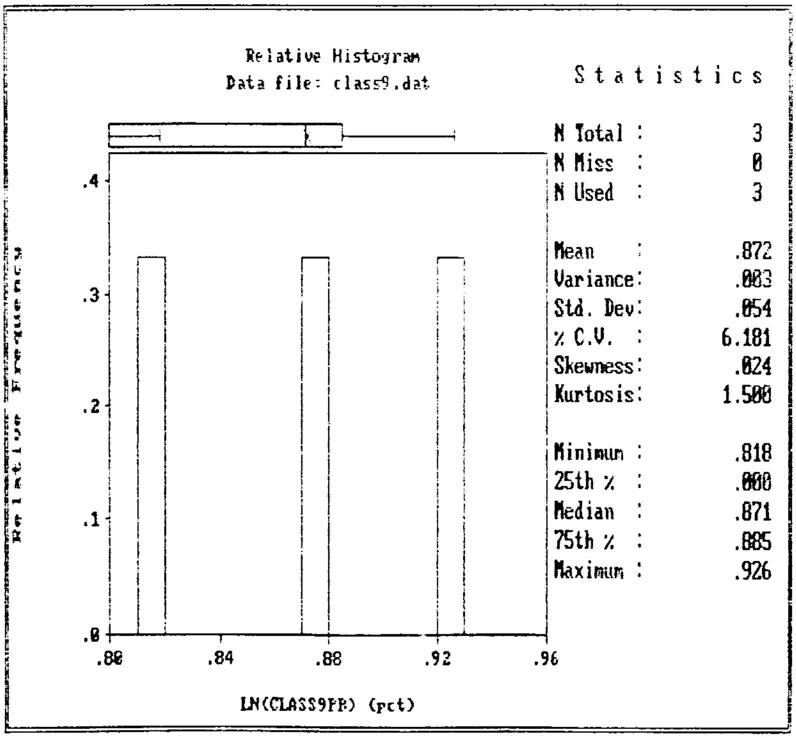
N Total : 11
N Miss : 0
N Used : 11

Mean : -.354
Variance: .257
Std. Dev: .507
% C.V. : 143.128
Skewness: -.611
Kurtosis: 3.162

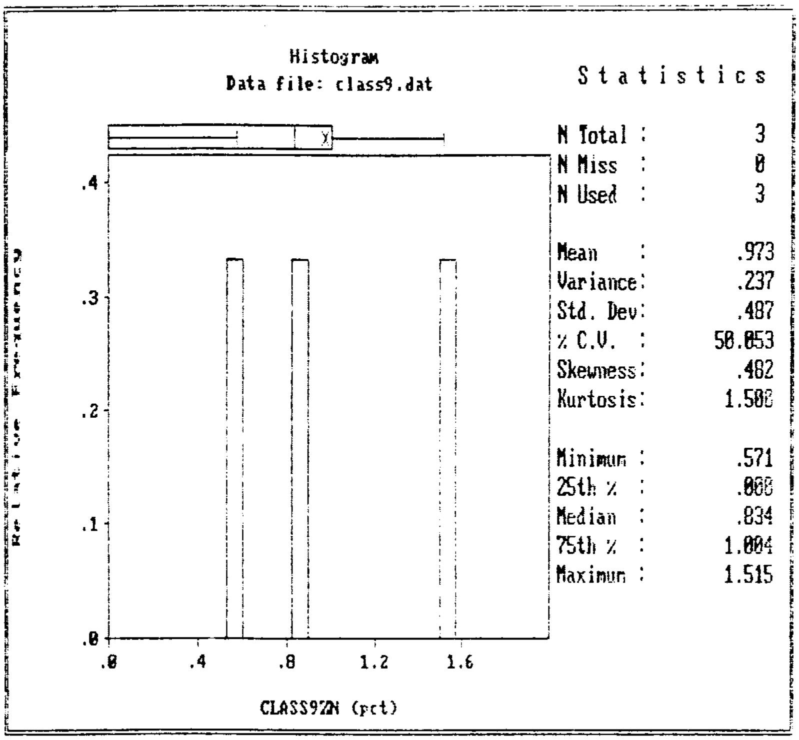
Minimum : -1.382
25th % : -.648
Median : -.273
75th % : -.189
Maximum : .486



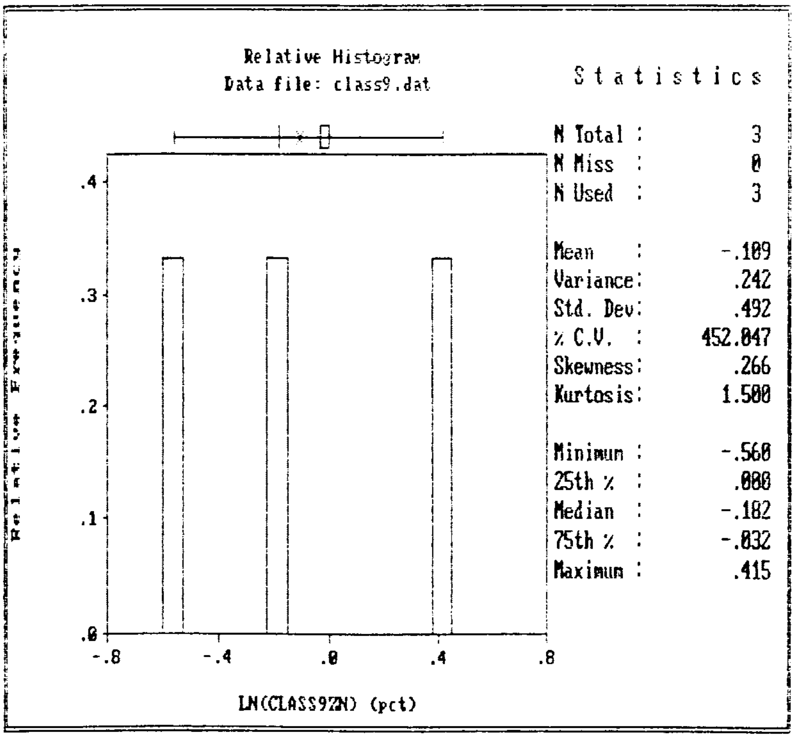
```
Relative Histogram
Data file: class9.dat

S t a t i s t i c s

N Total :        3
N Miss  :        0
N Used  :        3

Mean     :   2.394
Variance:     .017
Std. Dev:     .129
% C.V.   :   5.390
Skewness:     .057
Kurtosis:    1.500

Minimum :    2.267
25th %  :     .000
Median  :    2.390
75th %  :    2.424
Maximum :    2.525
```



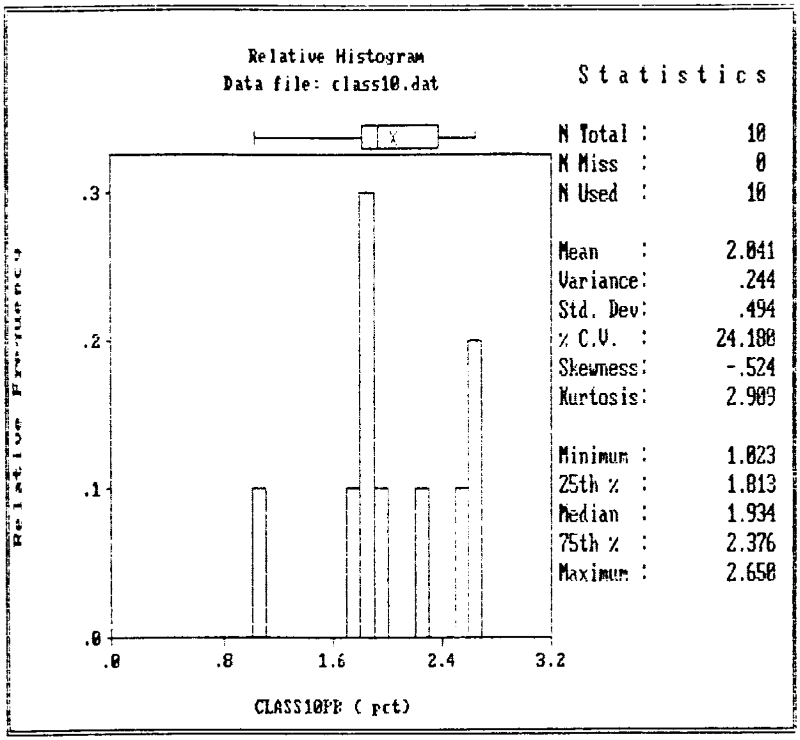
```
Relative Histogram
Data file: class9.dat

S t a t i s t i c s

N Total :        3
N Miss  :        0
N Used  :        3

Mean     :    .872
Variance:     .003
Std. Dev:     .054
% C.V.   :   6.181
Skewness:     .024
Kurtosis:    1.500

Minimum :     .818
25th %  :     .000
Median  :     .871
75th %  :     .885
Maximum :     .926
```



```
Histogram
Data file: class9.dat

S t a t i s t i c s

N Total :        3
N Miss  :        0
N Used  :        3

Mean    :     .973
Variance:     .237
Std. Dev:     .487
% C.V.  :   50.053
Skewness:     .402
Kurtosis:    1.500

Minimum :     .571
25th %  :     .000
Median  :     .834
75th %  :    1.004
Maximum :    1.515
```



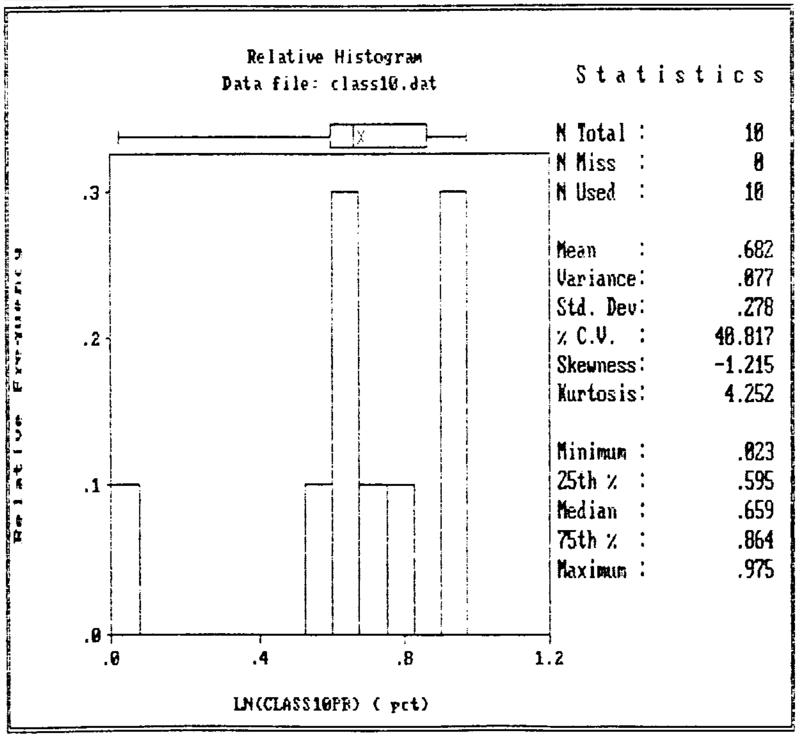
```
Relative Histogram
Data file: class9.dat

S t a t i s t i c s

N Total :        3
N Miss  :        0
N Used  :        3

Mean    :    -.109
Variance:     .242
Std. Dev:     .492
% C.V.  :  452.047
Skewness:     .266
Kurtosis:    1.500

Minimum :    -.560
25th %  :     .000
Median  :    -.182
75th %  :    -.032
Maximum :     .415
```



Relative Histogram
Data file: class10.dat

Statistics

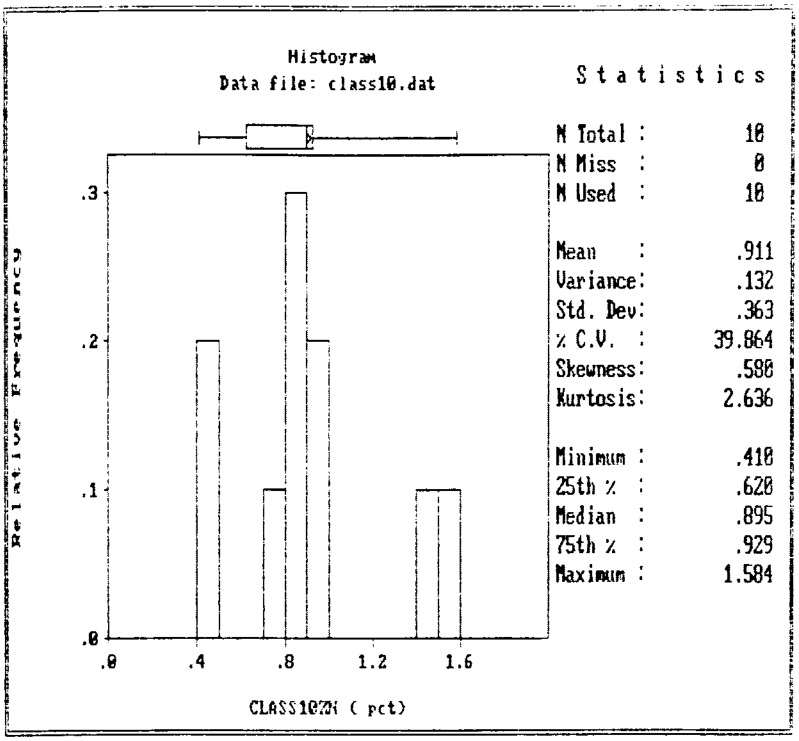
N Total :	10
N Miss :	0
N Used :	10
Mean :	2.041
Variance:	.244
Std. Dev:	.494
% C.V. :	24.188
Skewness:	-.524
Kurtosis:	2.909
Minimum :	1.023
25th % :	1.813
Median :	1.934
75th % :	2.376
Maximum :	2.658



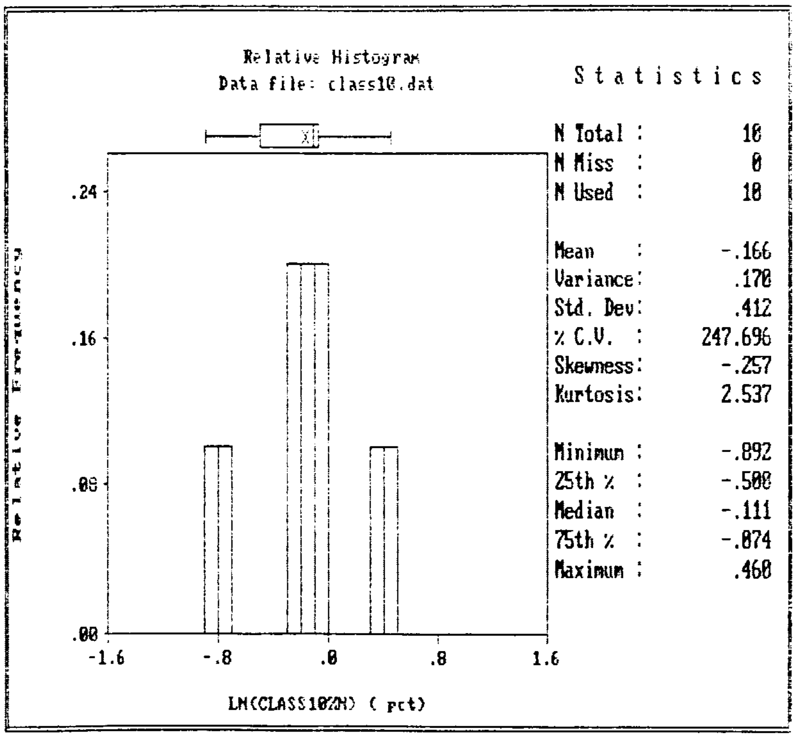
Relative Histogram
Data file: class10.dat

Statistics

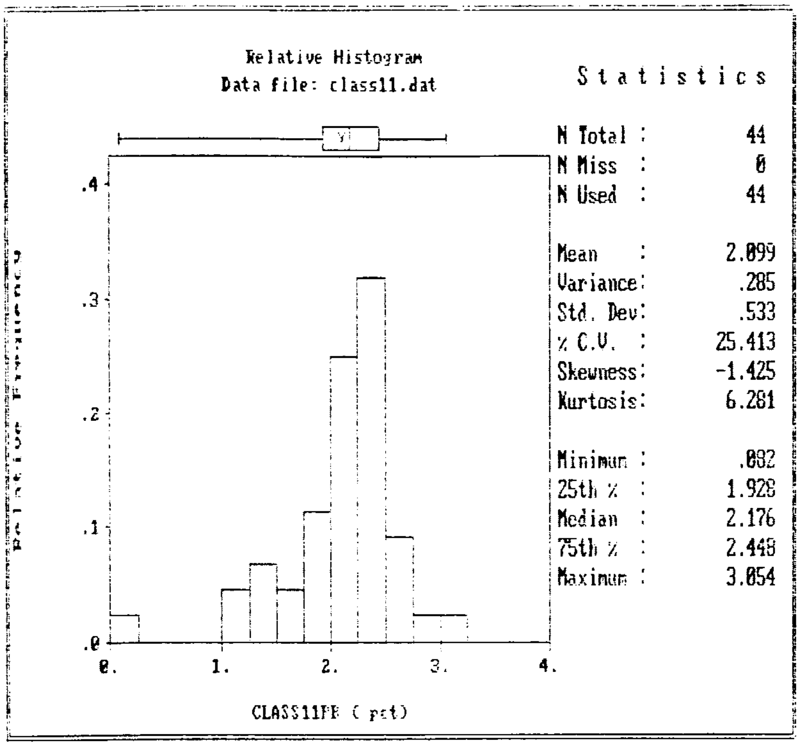
N Total :	10
N Miss :	0
N Used :	10
Mean :	.682
Variance:	.077
Std. Dev:	.278
% C.V. :	40.817
Skewness:	-1.215
Kurtosis:	4.252
Minimum :	.023
25th % :	.595
Median :	.659
75th % :	.864
Maximum :	.975



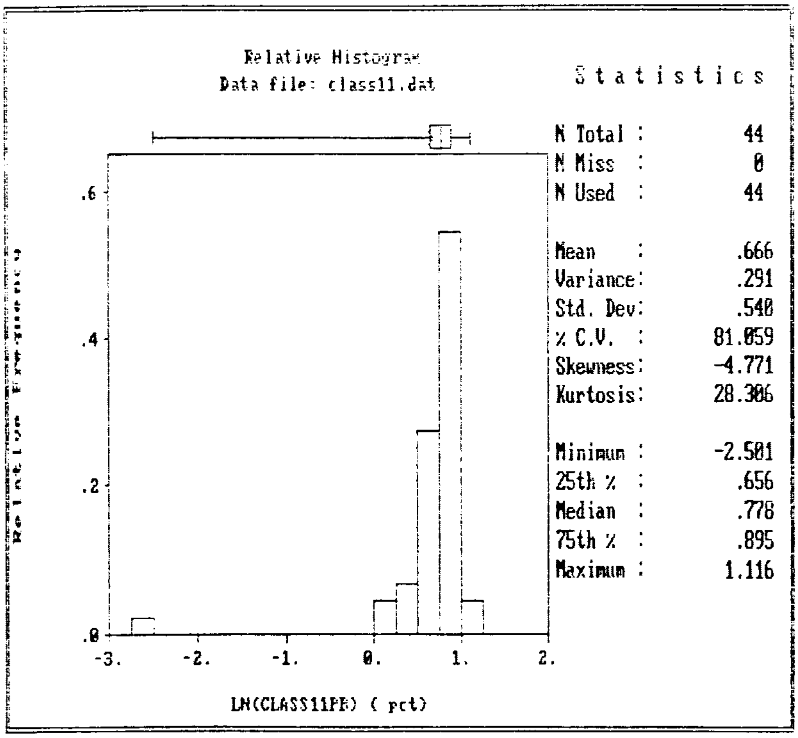
```
Statistics

N Total :        10
N Miss  :         0
N Used  :        10

Mean    :      .911
Variance:      .132
Std. Dev:      .363
% C.V.  :    39.864
Skewness:      .580
Kurtosis:     2.636

Minimum :      .410
25th %  :      .620
Median  :      .895
75th %  :      .929
Maximum :     1.584
```



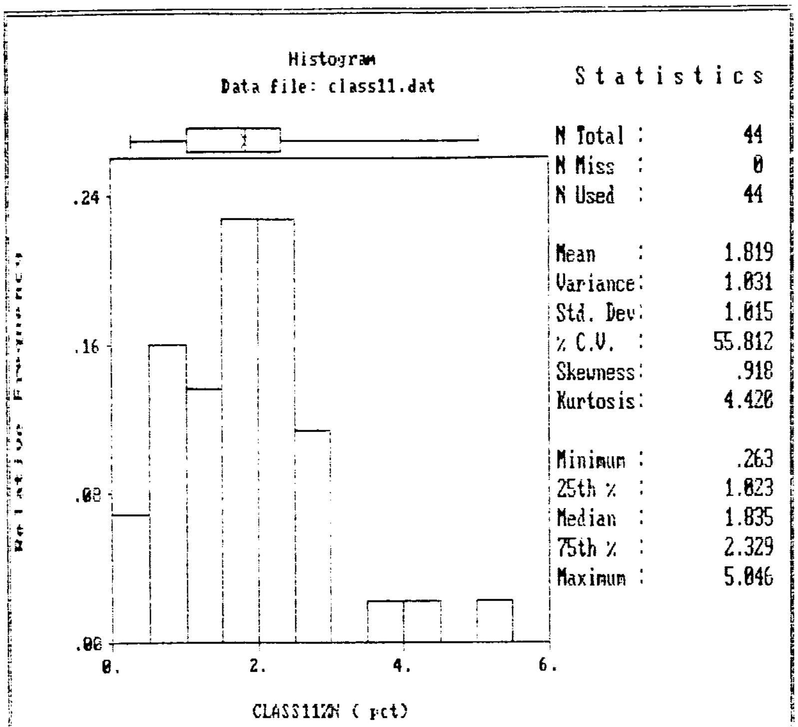
```
Statistics

N Total :        10
N Miss  :         0
N Used  :        10

Mean    :     -.166
Variance:      .170
Std. Dev:      .412
% C.V.  :   247.696
Skewness:     -.257
Kurtosis:     2.537

Minimum :     -.892
25th %  :     -.500
Median  :     -.111
75th %  :     -.074
Maximum :      .460
```



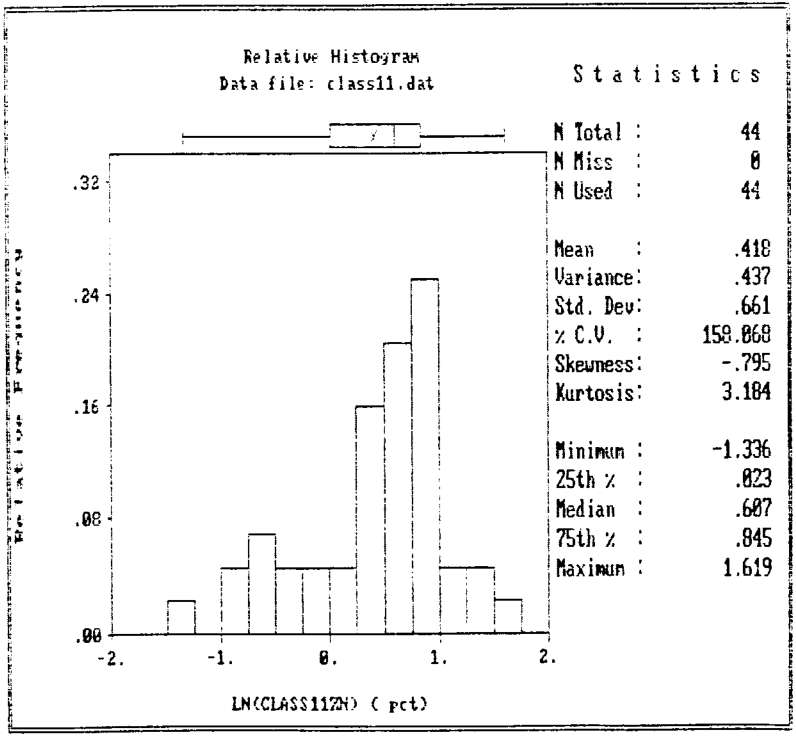
```
Statistics

N Total  :      44
N Miss   :       0
N Used   :      44

Mean     :   2.099
Variance :    .285
Std. Dev :    .533
% C.V.   :  25.413
Skewness :  -1.425
Kurtosis :   6.281

Minimum  :    .082
25th %   :   1.928
Median   :   2.176
75th %   :   2.448
Maximum  :   3.054
```



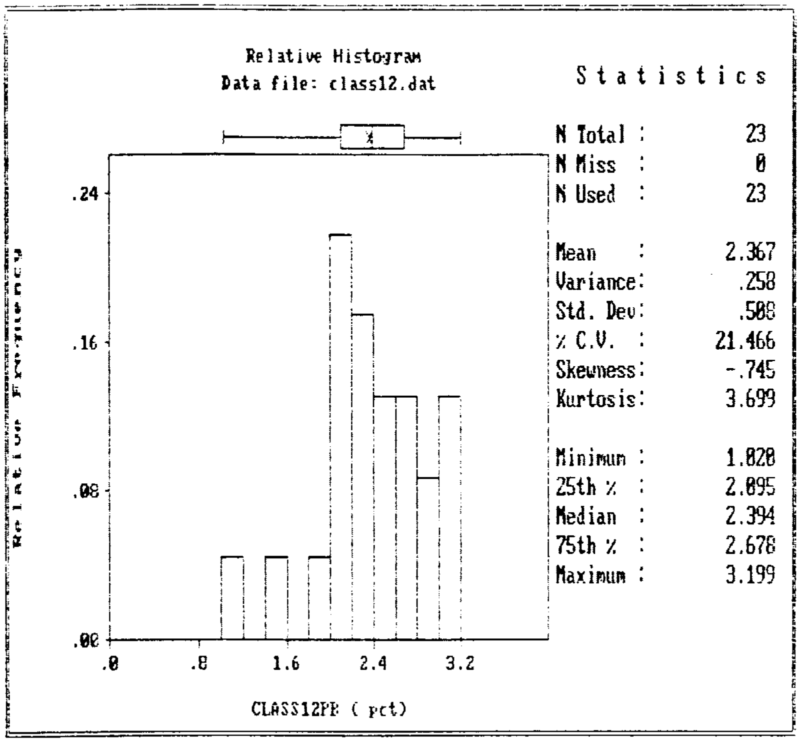
```
Statistics

N Total  :      44
N Miss   :       0
N Used   :      44

Mean     :    .666
Variance :    .291
Std. Dev :    .540
% C.V.   :  81.059
Skewness :  -4.771
Kurtosis :  28.306

Minimum  :  -2.501
25th %   :    .656
Median   :    .778
75th %   :    .895
Maximum  :   1.116
```



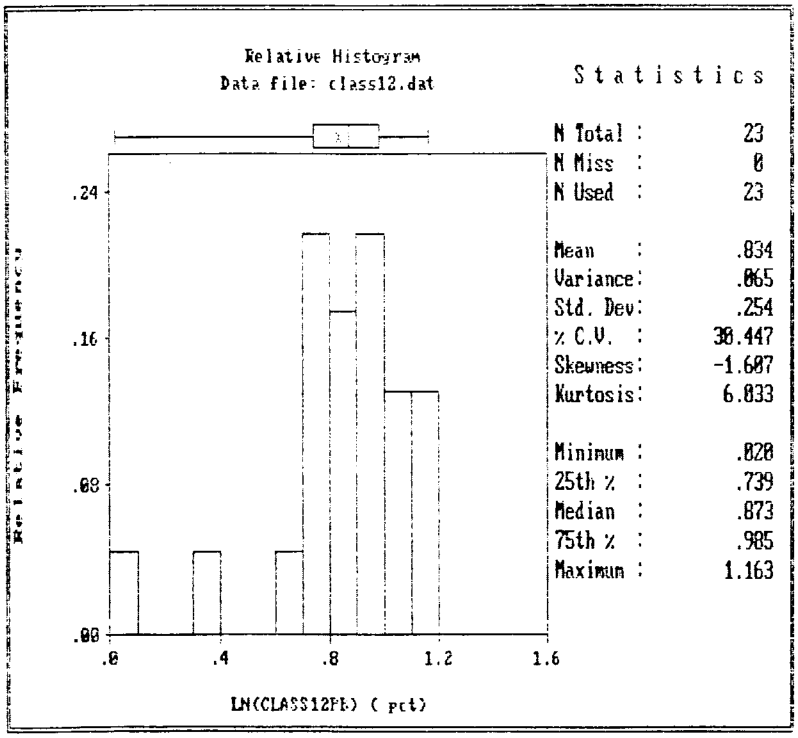
```
S t a t i s t i c s

N Total :        44
N Miss  :         0
N Used  :        44

Mean     :    1.819
Variance:     1.031
Std. Dev:     1.015
% C.V.   :   55.812
Skewness:      .918
Kurtosis:     4.420

Minimum :      .263
25th %   :    1.023
Median   :    1.835
75th %   :    2.329
Maximum :     5.046
```



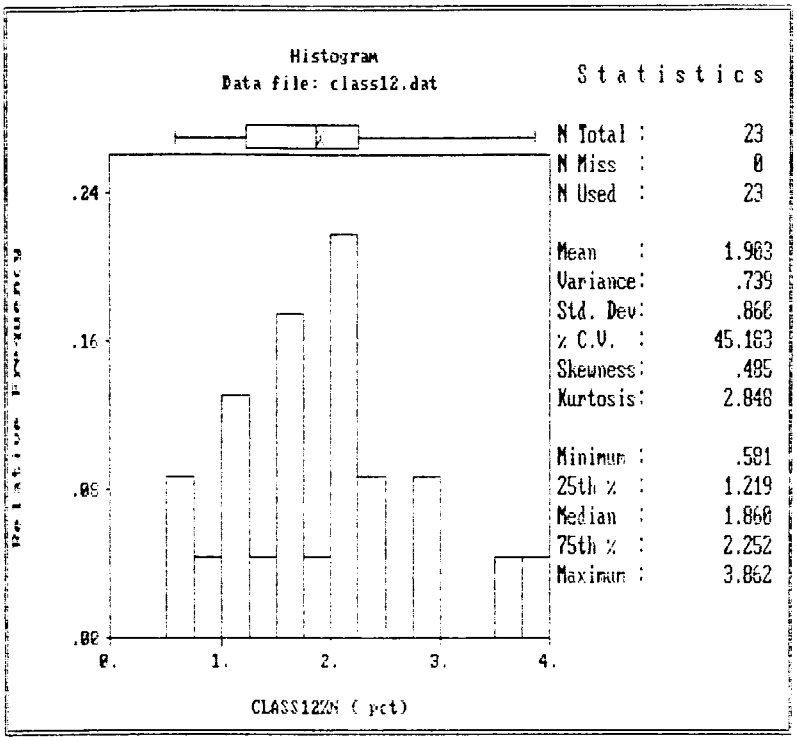
```
S t a t i s t i c s

N Total :        44
N Miss  :         0
N Used  :        44

Mean     :     .418
Variance:      .437
Std. Dev:      .661
% C.V.   :  158.068
Skewness:     -.795
Kurtosis:     3.184

Minimum :    -1.336
25th %   :     .023
Median   :     .607
75th %   :     .845
Maximum :     1.619
```



```
S t a t i s t i c s

N Total :         23
N Miss  :          0
N Used  :         23

Mean    :      2.367
Variance:       .258
Std. Dev:       .508
% C.V.  :     21.466
Skewness:      -.745
Kurtosis:      3.699

Minimum :      1.020
25th %  :      2.095
Median  :      2.394
75th %  :      2.678
Maximum :      3.199
```

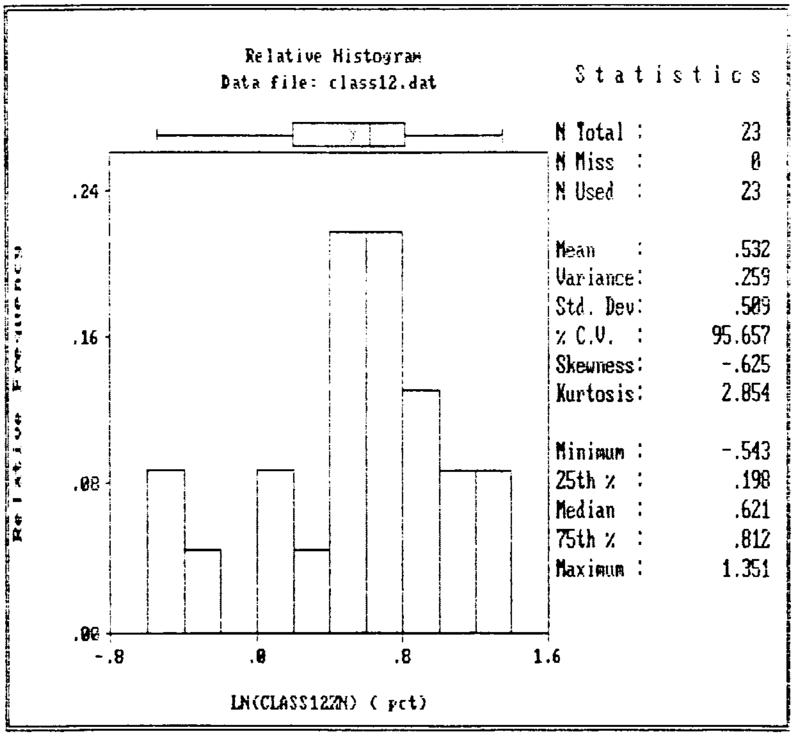


```
S t a t i s t i c s

N Total :         23
N Miss  :          0
N Used  :         23

Mean    :       .834
Variance:       .065
Std. Dev:       .254
% C.V.  :     30.447
Skewness:     -1.607
Kurtosis:      6.033

Minimum :       .020
25th %  :       .739
Median  :       .873
75th %  :       .985
Maximum :      1.163
```



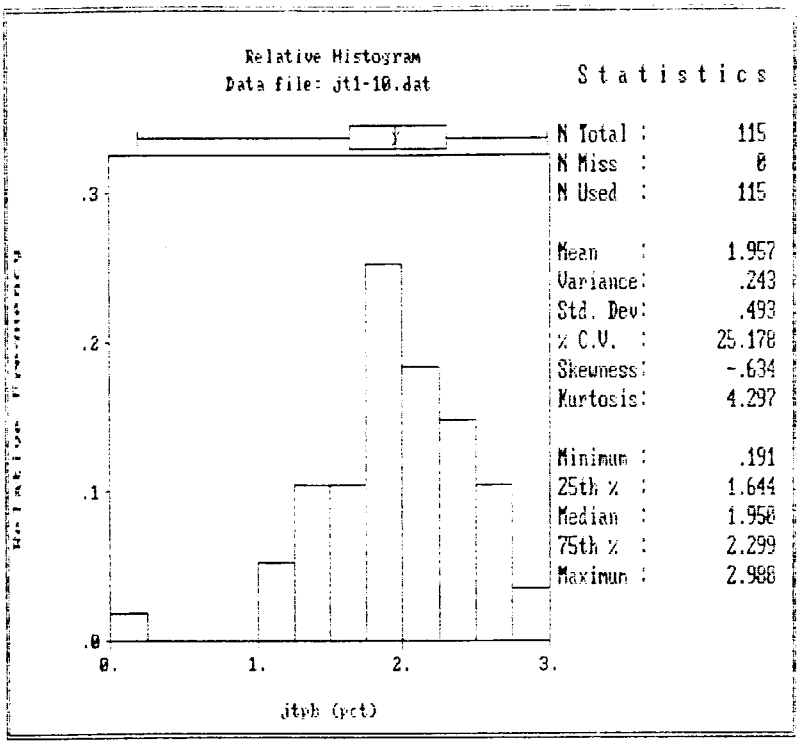
Histogram
Data file: class12.dat

```
S t a t i s t i c s

N Total :        23
N Miss  :         0
N Used  :        23

Mean    :     1.903
Variance:      .739
Std. Dev:      .860
% C.V.  :    45.183
Skewness:      .485
Kurtosis:     2.848

Minimum :      .581
25th %  :     1.219
Median  :     1.860
75th %  :     2.252
Maximum :     3.862
```

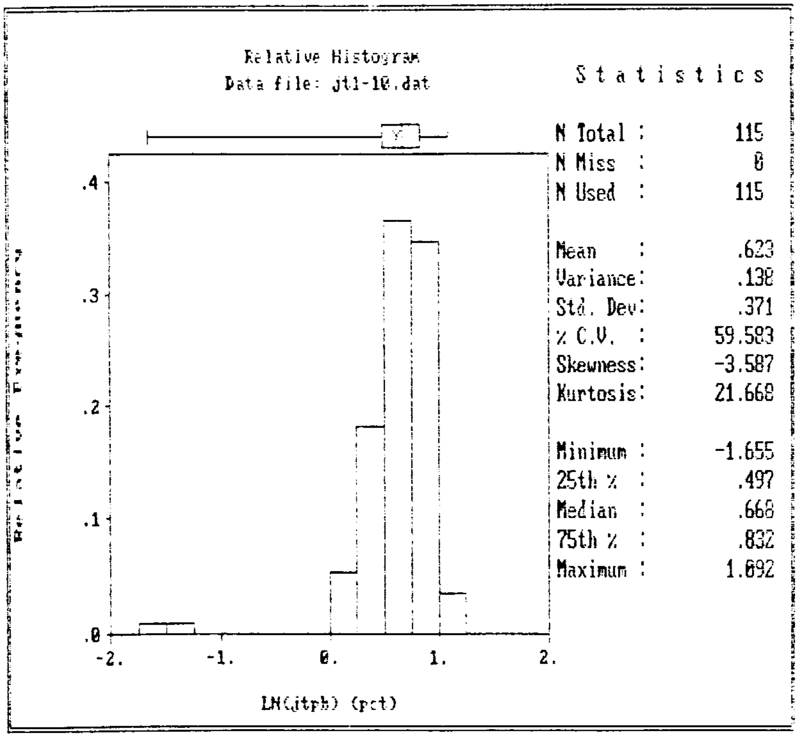


Relative Histogram
Data file: class12.dat

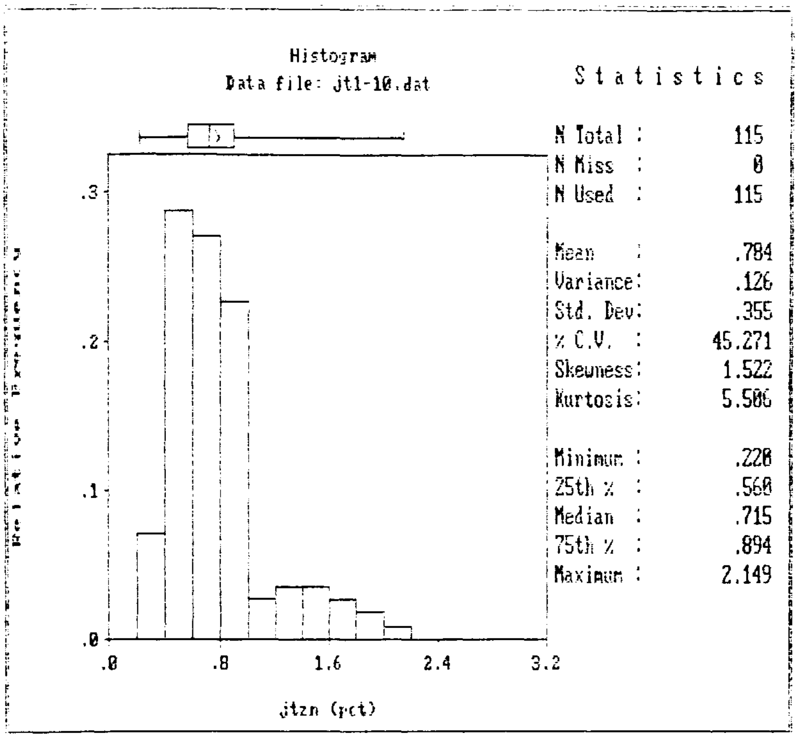
```
S t a t i s t i c s

N Total :        23
N Miss  :         0
N Used  :        23

Mean    :      .532
Variance:      .259
Std. Dev:      .509
% C.V.  :    95.657
Skewness:     -.625
Kurtosis:     2.854

Minimum :     -.543
25th %  :      .198
Median  :      .621
75th %  :      .812
Maximum :     1.351
```



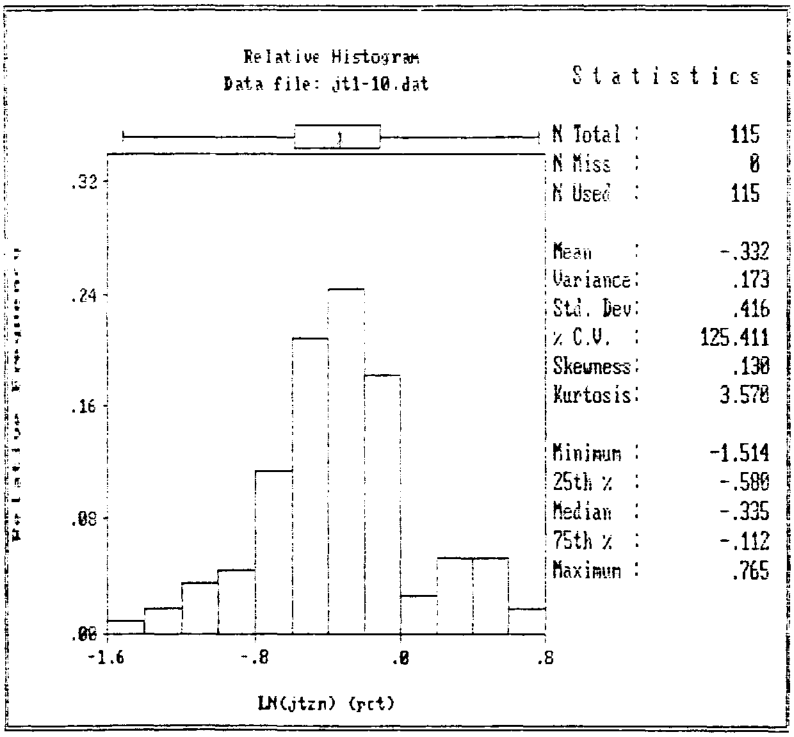
```
S t a t i s t i c s

N Total :          115
N Miss  :            0
N Used  :          115

Mean     :       1.957
Variance:         .243
Std. Dev:         .493
% C.V.  :       25.178
Skewness:        -.634
Kurtosis:        4.297

Minimum :         .191
25th %  :        1.644
Median  :        1.958
75th %  :        2.299
Maximum :        2.988
```



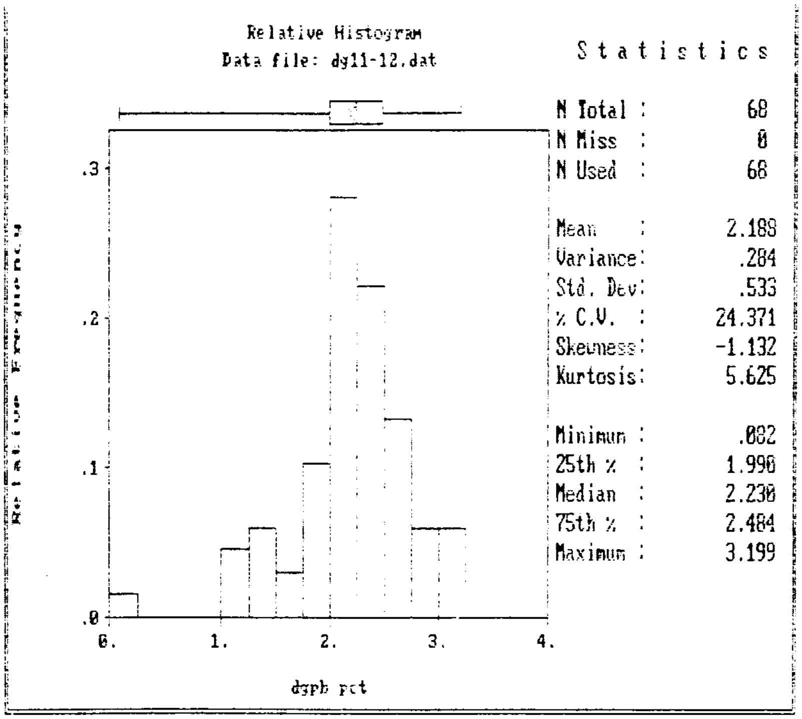
```
S t a t i s t i c s

N Total :          115
N Miss  :            0
N Used  :          115

Mean     :        .623
Variance:         .138
Std. Dev:         .371
% C.V.  :       59.583
Skewness:       -3.587
Kurtosis:       21.668

Minimum :       -1.655
25th %  :         .497
Median  :         .668
75th %  :         .832
Maximum :        1.092
```



```
Statistics

N Total :       115
N Miss  :         0
N Used  :       115

Mean    :      .784
Variance:      .126
Std. Dev:      .355
% C.V.  :    45.271
Skewness:     1.522
Kurtosis:     5.506

Minimum :      .220
25th %  :      .560
Median  :      .715
75th %  :      .894
Maximum :     2.149
```



```
Statistics

N Total :       115
N Miss  :         0
N Used  :       115

Mean    :     -.332
Variance:      .173
Std. Dev:      .416
% C.V.  :   125.411
Skewness:      .130
Kurtosis:     3.570

Minimum :    -1.514
25th %  :     -.580
Median  :     -.335
75th %  :     -.112
Maximum :      .765
```

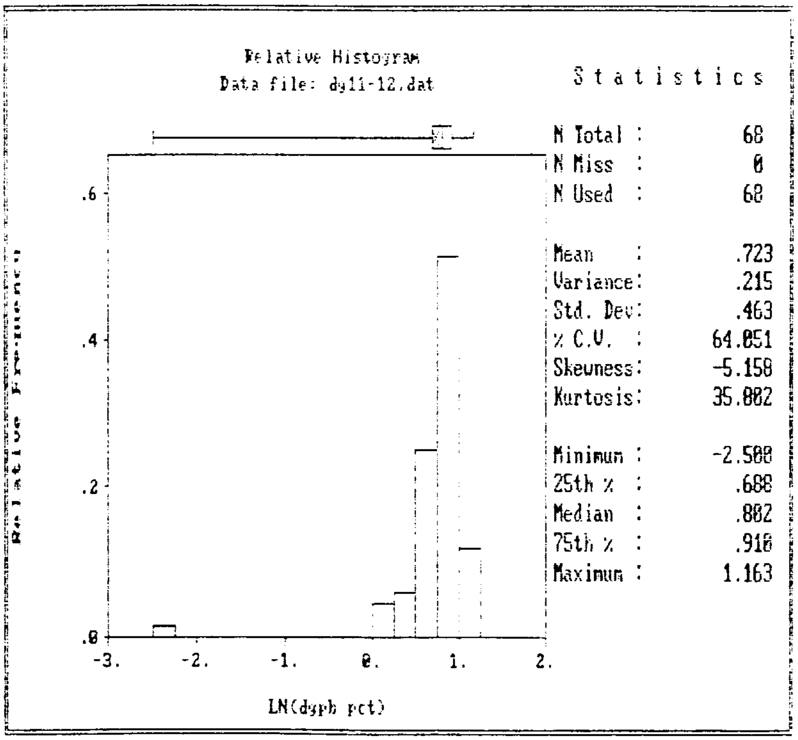


Statistics

N Total : 68
N Miss : 0
N Used : 68

Mean : 2.188
Variance : .284
Std. Dev : .533
% C.V. : 24.371
Skewness : -1.132
Kurtosis : 5.625

Minimum : .082
25th % : 1.990
Median : 2.230
75th % : 2.484
Maximum : 3.199

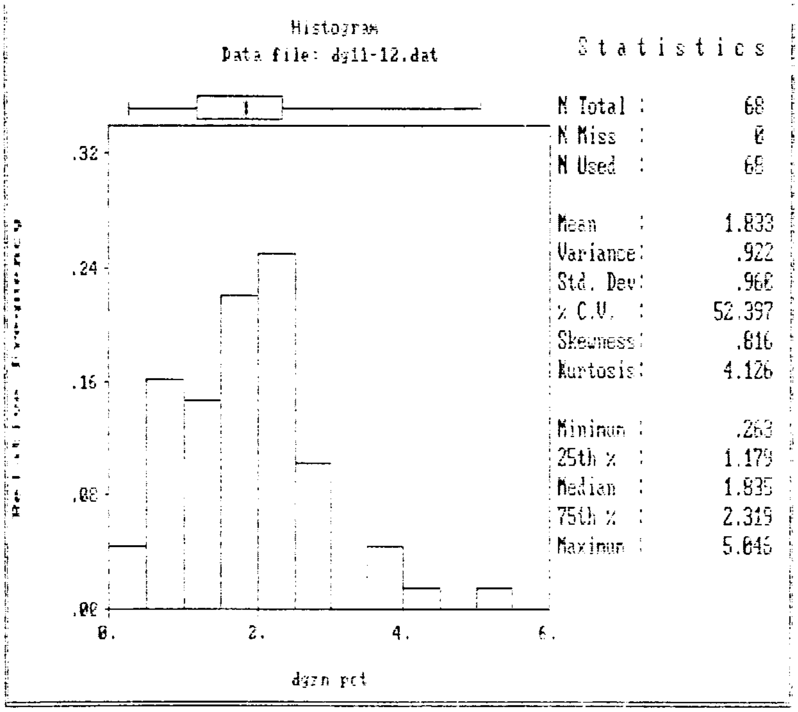


Statistics

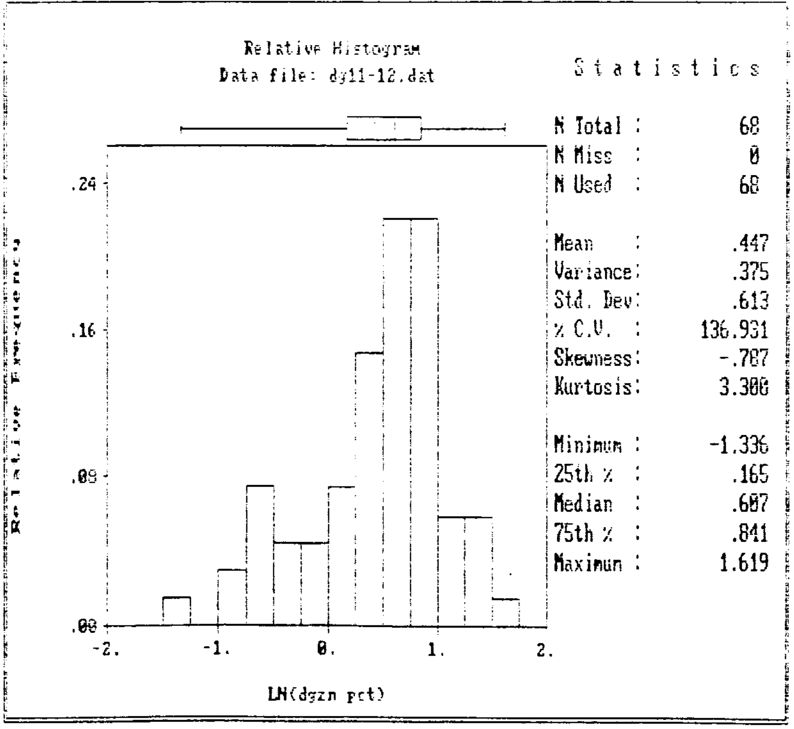
N Total : 68
N Miss : 0
N Used : 68

Mean : .723
Variance : .215
Std. Dev : .463
% C.V. : 64.051
Skewness : -5.150
Kurtosis : 35.802

Minimum : -2.500
25th % : .688
Median : .802
75th % : .910
Maximum : 1.163



```
S t a t i s t i c s

N Total :        68
N Miss  :         0
N Used  :        68

Mean    :     1.833
Variance:      .922
Std. Dev:      .960
% C.V.  :    52.397
Skewness:      .816
Kurtosis:     4.126

Minimum :      .263
25th %  :     1.179
Median  :     1.835
75th %  :     2.319
Maximum :     5.045
```



```
S t a t i s t i c s

N Total :        68
N Miss  :         0
N Used  :        68

Mean    :      .447
Variance:      .375
Std. Dev:      .613
% C.V.  :   136.931
Skewness:     -.787
Kurtosis:     3.308

Minimum :    -1.336
25th %  :      .165
Median  :      .607
75th %  :      .841
Maximum :     1.619
```

```
                                SAS

                  General Linear Models Procedure
                      Class Level Information

                Class    Levels    Values
                CLASS        10    1 2 3 4 5 6 7 8 9 10

                Number of observations in data set = 115

                  General Linear Models Procedure

Dependent Variable: LZINC

Source               DF    Sum of Squares     F Value       Pr > F

Model                 9        2.37210874        1.60       0.1258

Error               105       17.33890407

Corrected Total     114       19.71101281

                R-Square             C.V.                 LZINC Mean
                0.120344        -122.5604                -0.33156284


Source               DF          Type I SS    F Value       Pr > F

CLASS                 9         2.37210874       1.60       0.1258

Source               DF        Type III SS    F Value       Pr > F

CLASS                 9         2.37210874       1.60       0.1258

                  General Linear Models Procedure
Dependent Variable: LLEAD

Source               DF    Sum of Squares     F Value       Pr > F

Model                 9        2.11820301        1.82       0.0735

Error               105       13.59690796

Corrected Total     114       15.71511098

                R-Square             C.V.                 LLEAD Mean
                0.134788         57.74905                 0.62313280

Source               DF          Type I SS    F Value       Pr > F
CLASS                 9         2.11820301       1.82       0.0735

Source               DF        Type III SS    F Value       Pr > F

CLASS                 9         2.11820301       1.82       0.0735
```

```
                    General Linear Models Procedure
                   T tests (LSD) for variable: LZINC

          NOTE: This test controls the type I comparisonwise error rate
                not the experimentwise error rate.

             Alpha= 0.05  Confidence= 0.95  df= 105  MSE= 0.165132
                          Critical Value of T= 1.98282

      Comparisons significant at the 0.05 level are indicated by '***'.

                             Lower      Difference     Upper
                CLASS      Confidence    Between    Confidence
              Comparison      Limit        Means        Limit

             9    - 10       -0.473       0.058        0.588
             9    - 1        -0.457       0.073        0.604
             9    - 6        -0.426       0.074        0.575
             9    - 2        -0.396       0.160        0.716
             9    - 3        -0.380       0.176        0.732
             9    - 7        -0.327       0.229        0.785
             9    - 8        -0.279       0.246        0.770
             9    - 5        -0.114       0.377        0.868
             9    - 4        -0.080       0.429        0.939

            10    - 9        -0.588      -0.058        0.473
            10    - 1        -0.345       0.016        0.376
            10    - 6        -0.298       0.016        0.331
            10    - 2        -0.294       0.103        0.500
            10    - 3        -0.279       0.118        0.515
            10    - 7        -0.226       0.171        0.568
            10    - 8        -0.164       0.188        0.540
            10    - 5         0.020       0.319        0.619   ***
            10    - 4         0.043       0.372        0.701   ***

             1    - 9        -0.604      -0.073        0.457
             1    - 10       -0.376      -0.016        0.345
             1    - 6        -0.314       0.001        0.315
             1    - 2        -0.310       0.087        0.484
             1    - 3        -0.295       0.102        0.499
             1    - 7        -0.242       0.155        0.553
             1    - 8        -0.180       0.172        0.524
             1    - 5         0.004       0.304        0.603   ***
             1    - 4         0.027       0.356        0.685   ***

             6    - 9        -0.575      -0.074        0.426
             6    - 10       -0.331      -0.016        0.298
             6    - 1        -0.315      -0.001        0.314
             6    - 2        -0.270       0.086        0.443
             6    - 3        -0.255       0.101        0.458
             6    - 7        -0.202       0.155        0.511
             6    - 8        -0.134       0.172        0.477
             6    - 5         0.060       0.303        0.546   ***
             6    - 4         0.077       0.355        0.634   ***
```

```
2    - 9         -0.716     -0.160      0.396
2    - 10        -0.500     -0.103      0.294
2    - 1         -0.484     -0.087      0.310
2    - 6         -0.443     -0.086      0.270
2    - 3         -0.416      0.015      0.446
2    - 7         -0.362      0.068      0.499
2    - 8         -0.304      0.085      0.475
2    - 5         -0.126      0.217      0.560
2    - 4         -0.100      0.269      0.638

3    - 9         -0.732     -0.176      0.380
3    - 10        -0.515     -0.118      0.279
3    - 1         -0.499     -0.102      0.295
3    - 6         -0.458     -0.101      0.255
3    - 2         -0.446     -0.015      0.416
3    - 7         -0.377      0.053      0.484
3    - 8         -0.319      0.070      0.460
3    - 5         -0.142      0.201      0.545
3    - 4         -0.115      0.254      0.623

7    - 9         -0.785     -0.229      0.327
7    - 10        -0.568     -0.171      0.226
7    - 1         -0.553     -0.155      0.242
7    - 6         -0.511     -0.155      0.202
7    - 2         -0.499     -0.068      0.362
7    - 3         -0.484     -0.053      0.377
7    - 8         -0.373      0.017      0.406
7    - 5         -0.195      0.148      0.491
7    - 4         -0.168      0.201      0.569

8    - 9         -0.770     -0.246      0.279
8    - 10        -0.540     -0.188      0.164
8    - 1         -0.524     -0.172      0.180
8    - 6         -0.477     -0.172      0.134
8    - 2         -0.475     -0.085      0.304
8    - 3         -0.460     -0.070      0.319
8    - 7         -0.406     -0.017      0.373
8    - 5         -0.158      0.131      0.421
8    - 4         -0.136      0.184      0.504

5    - 9         -0.868     -0.377      0.114
5    - 10        -0.619     -0.319     -0.020    ***
5    - 1         -0.603     -0.304     -0.004    ***
5    - 6         -0.546     -0.303     -0.060    ***
5    - 2         -0.560     -0.217      0.126
5    - 3         -0.545     -0.201      0.142
5    - 7         -0.491     -0.148      0.195
5    - 8         -0.421     -0.131      0.158
5    - 4         -0.209      0.052      0.314

4    - 9         -0.939     -0.429      0.080
4    - 10        -0.701     -0.372     -0.043    ***
4    - 1         -0.685     -0.356     -0.027    ***
4    - 6         -0.634     -0.355     -0.077    ***
```

```
      4    - 2          -0.638      -0.269       0.100
      4    - 3          -0.623      -0.254       0.115
      4    - 7          -0.569      -0.201       0.168
      4    - 8          -0.504      -0.184       0.136
      4    - 5          -0.314      -0.052       0.209

                   General Linear Models Procedure

         Tukey's Studentized Range (HSD) Test for variable: LZINC

       NOTE: This test controls the type I experimentwise error rate.

          Alpha= 0.05  Confidence= 0.95  df= 105  MSE= 0.165132
                 Critical Value of Studentized Range= 4.572

    Comparisons significant at the 0.05 level are indicated by '***'.

                        Simultaneous              Simultaneous
                            Lower     Difference      Upper
              CLASS      Confidence     Between    Confidence
            Comparison      Limit        Means        Limit

      9    - 10         -0.807       0.058       0.922
      9    - 1          -0.791       0.073       0.938
      9    - 6          -0.742       0.074       0.890
      9    - 2          -0.746       0.160       1.067
      9    - 3          -0.731       0.176       1.082
      9    - 7          -0.678       0.229       1.135
      9    - 8          -0.610       0.246       1.101
      9    - 5          -0.424       0.377       1.178
      9    - 4          -0.402       0.429       1.260

      10   - 9          -0.922      -0.058       0.807
      10   - 1          -0.572       0.016       0.603
      10   - 6          -0.497       0.016       0.530
      10   - 2          -0.545       0.103       0.750
      10   - 3          -0.530       0.118       0.765
      10   - 7          -0.476       0.171       0.819
      10   - 8          -0.386       0.188       0.762
      10   - 5          -0.169       0.319       0.808
      10   - 4          -0.165       0.372       0.908

      1    - 9          -0.938      -0.073       0.791
      1    - 10         -0.603      -0.016       0.572
      1    - 6          -0.513       0.001       0.514
      1    - 2          -0.560       0.087       0.734
      1    - 3          -0.545       0.102       0.750
      1    - 7          -0.492       0.155       0.803
      1    - 8          -0.402       0.172       0.746
      1    - 5          -0.185       0.304       0.792
      1    - 4          -0.180       0.356       0.892

      6    - 9          -0.890      -0.074       0.742
      6    - 10         -0.530      -0.016       0.497
```

6	- 1	-0.514	-0.001	0.513
6	- 2	-0.495	0.086	0.667
6	- 3	-0.479	0.101	0.682
6	- 7	-0.426	0.155	0.736
6	- 8	-0.326	0.172	0.669
6	- 5	-0.094	0.303	0.699
6	- 4	-0.099	0.355	0.809
2	- 9	-1.067	-0.160	0.746
2	- 10	-0.750	-0.103	0.545
2	- 1	-0.734	-0.087	0.560
2	- 6	-0.667	-0.086	0.495
2	- 3	-0.687	0.015	0.717
2	- 7	-0.634	0.068	0.771
2	- 8	-0.550	0.085	0.720
2	- 5	-0.343	0.217	0.776
2	- 4	-0.332	0.269	0.870
3	- 9	-1.082	-0.176	0.731
3	- 10	-0.765	-0.118	0.530
3	- 1	-0.750	-0.102	0.545
3	- 6	-0.682	-0.101	0.479
3	- 2	-0.717	-0.015	0.687
3	- 7	-0.649	0.053	0.756
3	- 8	-0.565	0.070	0.705
3	- 5	-0.358	0.201	0.761
3	- 4	-0.348	0.254	0.855
7	- 9	-1.135	-0.229	0.678
7	- 10	-0.819	-0.171	0.476
7	- 1	-0.803	-0.155	0.492
7	- 6	-0.736	-0.155	0.426
7	- 2	-0.771	-0.068	0.634
7	- 3	-0.756	-0.053	0.649
7	- 8	-0.618	0.017	0.652
7	- 5	-0.411	0.148	0.708
7	- 4	-0.401	0.201	0.802
8	- 9	-1.101	-0.246	0.610
8	- 10	-0.762	-0.188	0.386
8	- 1	-0.746	-0.172	0.402
8	- 6	-0.669	-0.172	0.326
8	- 2	-0.720	-0.085	0.550
8	- 3	-0.705	-0.070	0.565
8	- 7	-0.652	-0.017	0.618
8	- 5	-0.341	0.131	0.604
8	- 4	-0.338	0.184	0.705
5	- 9	-1.178	-0.377	0.424
5	- 10	-0.808	-0.319	0.169
5	- 1	-0.792	-0.304	0.185
5	- 6	-0.699	-0.303	0.094
5	- 2	-0.776	-0.217	0.343
5	- 3	-0.761	-0.201	0.358

```
 5     - 7          -0.708      -0.148       0.411
 5     - 8          -0.604      -0.131       0.341
 5     - 4          -0.374       0.052       0.478

 4     - 9          -1.260      -0.429       0.402
 4     - 10         -0.908      -0.372       0.165
 4     - 1          -0.892      -0.356       0.180
 4     - 6          -0.809      -0.355       0.099
 4     - 2          -0.870      -0.269       0.332
 4     - 3          -0.855      -0.254       0.348
 4     - 7          -0.802      -0.201       0.401
 4     - 8          -0.705      -0.184       0.338
 4     - 5          -0.478      -0.052       0.374

               General Linear Models Procedure

          Bonferroni (Dunn) T tests for variable: LZINC

   NOTE: This test controls the type I experimentwise error rate
         but generally has a higher type II error rate than Tukey's
         for all pairwise comparisons.

      Alpha= 0.05  Confidence= 0.95  df= 105  MSE= 0.165132
                   Critical Value of T= 3.35340

Comparisons significant at the 0.05 level are indicated by '***'.

                   Simultaneous            Simultaneous
                       Lower    Difference     Upper
       CLASS        Confidence    Between    Confidence
     Comparison        Limit       Means        Limit

 9     - 10         -0.839       0.058       0.955
 9     - 1          -0.824       0.073       0.970
 9     - 6          -0.773       0.074       0.921
 9     - 2          -0.780       0.160       1.101
 9     - 3          -0.765       0.176       1.116
 9     - 7          -0.712       0.229       1.169
 9     - 8          -0.642       0.246       1.133
 9     - 5          -0.454       0.377       1.208
 9     - 4          -0.433       0.429       1.291

10     - 9          -0.955      -0.058       0.839
10     - 1          -0.594       0.016       0.625
10     - 6          -0.516       0.016       0.549
10     - 2          -0.569       0.103       0.774
10     - 3          -0.554       0.118       0.789
10     - 7          -0.500       0.171       0.843
10     - 8          -0.407       0.188       0.783
10     - 5          -0.188       0.319       0.826
10     - 4          -0.185       0.372       0.928

 1     - 9          -0.970      -0.073       0.824
 1     - 10         -0.625      -0.016       0.594
```

1 - 6	-0.532	0.001	0.533
1 - 2	-0.585	0.087	0.758
1 - 3	-0.569	0.102	0.774
1 - 7	-0.516	0.155	0.827
1 - 8	-0.423	0.172	0.768
1 - 5	-0.203	0.304	0.811
1 - 4	-0.200	0.356	0.912
6 - 9	-0.921	-0.074	0.773
6 - 10	-0.549	-0.016	0.516
6 - 1	-0.533	-0.001	0.532
6 - 2	-0.516	0.086	0.689
6 - 3	-0.501	0.101	0.704
6 - 7	-0.448	0.155	0.757
6 - 8	-0.345	0.172	0.688
6 - 5	-0.108	0.303	0.714
6 - 4	-0.115	0.355	0.826
2 - 9	-1.101	-0.160	0.780
2 - 10	-0.774	-0.103	0.569
2 - 1	-0.758	-0.087	0.585
2 - 6	-0.689	-0.086	0.516
2 - 3	-0.713	0.015	0.744
2 - 7	-0.660	0.068	0.797
2 - 8	-0.574	0.085	0.744
2 - 5	-0.364	0.217	0.797
2 - 4	-0.355	0.269	0.893
3 - 9	-1.116	-0.176	0.765
3 - 10	-0.789	-0.118	0.554
3 - 1	-0.774	-0.102	0.569
3 - 6	-0.704	-0.101	0.501
3 - 2	-0.744	-0.015	0.713
3 - 7	-0.675	0.053	0.782
3 - 8	-0.589	0.070	0.729
3 - 5	-0.379	0.201	0.782
3 - 4	-0.370	0.254	0.878
7 - 9	-1.169	-0.229	0.712
7 - 10	-0.843	-0.171	0.500
7 - 1	-0.827	-0.155	0.516
7 - 6	-0.757	-0.155	0.448
7 - 2	-0.797	-0.068	0.660
7 - 3	-0.782	-0.053	0.675
7 - 8	-0.642	0.017	0.676
7 - 5	-0.432	0.148	0.728
7 - 4	-0.423	0.201	0.824
8 - 9	-1.133	-0.246	0.642
8 - 10	-0.783	-0.188	0.407
8 - 1	-0.768	-0.172	0.423
8 - 6	-0.688	-0.172	0.345
8 - 2	-0.744	-0.085	0.574
8 - 3	-0.729	-0.070	0.589

```
    8    - 7          -0.676     -0.017       0.642
    8    - 5          -0.359      0.131       0.622
    8    - 4          -0.357      0.184       0.725

    5    - 9          -1.208     -0.377       0.454
    5    - 10         -0.826     -0.319       0.188
    5    - 1          -0.811     -0.304       0.203
    5    - 6          -0.714     -0.303       0.108
    5    - 2          -0.797     -0.217       0.364
    5    - 3          -0.782     -0.201       0.379
    5    - 7          -0.728     -0.148       0.432
    5    - 8          -0.622     -0.131       0.359
    5    - 4          -0.390      0.052       0.494

    4    - 9          -1.291     -0.429       0.433
    4    - 10         -0.928     -0.372       0.185
    4    - 1          -0.912     -0.356       0.200
    4    - 6          -0.826     -0.355       0.115
    4    - 2          -0.893     -0.269       0.355
    4    - 3          -0.878     -0.254       0.370
    4    - 7          -0.824     -0.201       0.423
    4    - 8          -0.725     -0.184       0.357
    4    - 5          -0.494     -0.052       0.390

                  General Linear Models Procedure

                 T tests (LSD) for variable: LLEAD

 NOTE: This test controls the type I comparisonwise error rate
       not the experimentwise error rate.

    Alpha= 0.05  Confidence= 0.95  df= 105  MSE= 0.129494
                 Critical Value of T= 1.98282

Comparisons significant at the 0.05 level are indicated by '***'.

                        Lower     Difference    Upper
       CLASS         Confidence    Between    Confidence
     Comparison         Limit       Means        Limit

    7    - 9         -0.4736     0.0188      0.5112
    7    - 1         -0.2814     0.0702      0.4219
    7    - 10        -0.1429     0.2088      0.5604
    7    - 6         -0.0847     0.2307      0.5462
    7    - 5         -0.0462     0.2576      0.5615
    7    - 2          0.0012     0.3826      0.7640   ***
    7    - 8          0.0578     0.4028      0.7478   ***
    7    - 3          0.0304     0.4118      0.7931   ***
    7    - 4          0.1307     0.4573      0.7839   ***

    9    - 7         -0.5112    -0.0188      0.4736
    9    - 1         -0.4183     0.0514      0.5211
    9    - 10        -0.2797     0.1900      0.6597
    9    - 6         -0.2313     0.2120      0.6552
```

9	- 5	-0.1962	0.2389	0.6739	
9	- 2	-0.1286	0.3638	0.8562	
9	- 8	-0.0807	0.3840	0.8488	
9	- 3	-0.0994	0.3930	0.8854	
9	- 4	-0.0128	0.4385	0.8898	
1	- 7	-0.4219	-0.0702	0.2814	
1	- 9	-0.5211	-0.0514	0.4183	
1	- 10	-0.1806	0.1385	0.4576	
1	- 6	-0.1182	0.1605	0.4393	
1	- 5	-0.0781	0.1874	0.4529	
1	- 2	-0.0393	0.3123	0.6640	
1	- 8	0.0208	0.3326	0.6443	***
1	- 3	-0.0101	0.3415	0.6932	
1	- 4	0.0957	0.3870	0.6783	***
10	- 7	-0.5604	-0.2088	0.1429	
10	- 9	-0.6597	-0.1900	0.2797	
10	- 1	-0.4576	-0.1385	0.1806	
10	- 6	-0.2568	0.0220	0.3007	
10	- 5	-0.2166	0.0489	0.3144	
10	- 2	-0.1778	0.1738	0.5254	
10	- 8	-0.1177	0.1940	0.5058	
10	- 3	-0.1486	0.2030	0.5546	
10	- 4	-0.0428	0.2485	0.5398	
6	- 7	-0.5462	-0.2307	0.0847	
6	- 9	-0.6552	-0.2120	0.2313	
6	- 1	-0.4393	-0.1605	0.1182	
6	- 10	-0.3007	-0.0220	0.2568	
6	- 5	-0.1884	0.0269	0.2423	
6	- 2	-0.1637	0.1518	0.4673	
6	- 8	-0.0983	0.1720	0.4424	
6	- 3	-0.1345	0.1810	0.4965	
6	- 4	-0.0199	0.2265	0.4730	
5	- 7	-0.5615	-0.2576	0.0462	
5	- 9	-0.6739	-0.2389	0.1962	
5	- 1	-0.4529	-0.1874	0.0781	
5	- 10	-0.3144	-0.0489	0.2166	
5	- 6	-0.2423	-0.0269	0.1884	
5	- 2	-0.1789	0.1249	0.4287	
5	- 8	-0.1115	0.1451	0.4018	
5	- 3	-0.1497	0.1541	0.4579	
5	- 4	-0.0317	0.1996	0.4310	
2	- 7	-0.7640	-0.3826	-0.0012	***
2	- 9	-0.8562	-0.3638	0.1286	
2	- 1	-0.6640	-0.3123	0.0393	
2	- 10	-0.5254	-0.1738	0.1778	
2	- 6	-0.4673	-0.1518	0.1637	
2	- 5	-0.4287	-0.1249	0.1789	
2	- 8	-0.3248	0.0202	0.3652	
2	- 3	-0.3522	0.0292	0.4106	

```
    2    - 4        -0.2519     0.0747     0.4013

    8    - 7        -0.7478    -0.4028    -0.0578  ***
    8    - 9        -0.8488    -0.3840     0.0807
    8    - 1        -0.6443    -0.3326    -0.0208  ***
    8    - 10       -0.5058    -0.1940     0.1177
    8    - 6        -0.4424    -0.1720     0.0983
    8    - 5        -0.4018    -0.1451     0.1115
    8    - 2        -0.3652    -0.0202     0.3248
    8    - 3        -0.3360     0.0090     0.3539
    8    - 4        -0.2288     0.0545     0.3377

    3    - 7        -0.7931    -0.4118    -0.0304  ***
    3    - 9        -0.8854    -0.3930     0.0994
    3    - 1        -0.6932    -0.3415     0.0101
    3    - 10       -0.5546    -0.2030     0.1486
    3    - 6        -0.4965    -0.1810     0.1345
    3    - 5        -0.4579    -0.1541     0.1497
    3    - 2        -0.4106    -0.0292     0.3522
    3    - 8        -0.3539    -0.0090     0.3360
    3    - 4        -0.2811     0.0455     0.3721

    4    - 7        -0.7839    -0.4573    -0.1307  ***
    4    - 9        -0.8898    -0.4385     0.0128
    4    - 1        -0.6783    -0.3870    -0.0957  ***
    4    - 10       -0.5398    -0.2485     0.0428
    4    - 6        -0.4730    -0.2265     0.0199
    4    - 5        -0.4310    -0.1996     0.0317
    4    - 2        -0.4013    -0.0747     0.2519
    4    - 8        -0.3377    -0.0545     0.2288
    4    - 3        -0.3721    -0.0455     0.2811

                  General Linear Models Procedure

       Tukey's Studentized Range (HSD) Test for variable: LLEAD

     NOTE: This test controls the type I experimentwise error rate.

        Alpha= 0.05  Confidence= 0.95  df= 105  MSE= 0.129494
              Critical Value of Studentized Range= 4.572

 Comparisons significant at the 0.05 level are indicated by '***'.

                   Simultaneous             Simultaneous
                      Lower     Difference     Upper
       CLASS       Confidence    Between    Confidence
     Comparison       Limit       Means        Limit

    7    - 9        -0.7840     0.0188     0.8216
    7    - 1        -0.5031     0.0702     0.6435
    7    - 10       -0.3646     0.2088     0.7821
    7    - 6        -0.2836     0.2307     0.7451
    7    - 5        -0.2377     0.2576     0.7530
    7    - 2        -0.2393     0.3826     1.0044
```

7 - 8	-0.1597	0.4028	0.9653
7 - 3	-0.2101	0.4118	1.0336
7 - 4	-0.0752	0.4573	0.9898

9 - 7	-0.8216	-0.0188	0.7840
9 - 1	-0.7144	0.0514	0.8173
9 - 10	-0.5758	0.1900	0.9558
9 - 6	-0.5108	0.2120	0.9347
9 - 5	-0.4705	0.2389	0.9482
9 - 2	-0.4390	0.3638	1.1666
9 - 8	-0.3737	0.3840	1.1418
9 - 3	-0.4098	0.3930	1.1958
9 - 4	-0.2973	0.4385	1.1743

1 - 7	-0.6435	-0.0702	0.5031
1 - 9	-0.8173	-0.0514	0.7144
1 - 10	-0.3817	0.1385	0.6588
1 - 6	-0.2940	0.1605	0.6150
1 - 5	-0.2455	0.1874	0.6203
1 - 2	-0.2610	0.3123	0.8857
1 - 8	-0.1757	0.3326	0.8409
1 - 3	-0.2318	0.3415	0.9148
1 - 4	-0.0879	0.3870	0.8620

10 - 7	-0.7821	-0.2088	0.3646
10 - 9	-0.9558	-0.1900	0.5758
10 - 1	-0.6588	-0.1385	0.3817
10 - 6	-0.4325	0.0220	0.4765
10 - 5	-0.3840	0.0489	0.4818
10 - 2	-0.3995	0.1738	0.7471
10 - 8	-0.3143	0.1940	0.7023
10 - 3	-0.3703	0.2030	0.7763
10 - 4	-0.2264	0.2485	0.7234

6 - 7	-0.7451	-0.2307	0.2836
6 - 9	-0.9347	-0.2120	0.5108
6 - 1	-0.6150	-0.1605	0.2940
6 - 10	-0.4765	-0.0220	0.4325
6 - 5	-0.3242	0.0269	0.3780
6 - 2	-0.3625	0.1518	0.6662
6 - 8	-0.2687	0.1720	0.6128
6 - 3	-0.3334	0.1810	0.6954
6 - 4	-0.1753	0.2265	0.6283

5 - 7	-0.7530	-0.2576	0.2377
5 - 9	-0.9482	-0.2389	0.4705
5 - 1	-0.6203	-0.1874	0.2455
5 - 10	-0.4818	-0.0489	0.3840
5 - 6	-0.3780	-0.0269	0.3242
5 - 2	-0.3705	0.1249	0.6203
5 - 8	-0.2733	0.1451	0.5636
5 - 3	-0.3413	0.1541	0.6495
5 - 4	-0.1776	0.1996	0.5768

```
    2    - 7          -1.0044      -0.3826       0.2393
    2    - 9          -1.1666      -0.3638       0.4390
    2    - 1          -0.8857      -0.3123       0.2610
    2    - 10         -0.7471      -0.1738       0.3995
    2    - 6          -0.6662      -0.1518       0.3625
    2    - 5          -0.6203      -0.1249       0.3705
    2    - 8          -0.5422       0.0202       0.5827
    2    - 3          -0.5927       0.0292       0.6510
    2    - 4          -0.4578       0.0747       0.6072

    8    - 7          -0.9653      -0.4028       0.1597
    8    - 9          -1.1418      -0.3840       0.3737
    8    - 1          -0.8409      -0.3326       0.1757
    8    - 10         -0.7023      -0.1940       0.3143
    8    - 6          -0.6128      -0.1720       0.2687
    8    - 5          -0.5636      -0.1451       0.2733
    8    - 2          -0.5827      -0.0202       0.5422
    8    - 3          -0.5535       0.0090       0.5714
    8    - 4          -0.4073       0.0545       0.5163

    3    - 7          -1.0336      -0.4118       0.2101
    3    - 9          -1.1958      -0.3930       0.4098
    3    - 1          -0.9148      -0.3415       0.2318
    3    - 10         -0.7763      -0.2030       0.3703
    3    - 6          -0.6954      -0.1810       0.3334
    3    - 5          -0.6495      -0.1541       0.3413
    3    - 2          -0.6510      -0.0292       0.5927
    3    - 8          -0.5714      -0.0090       0.5535
    3    - 4          -0.4870       0.0455       0.5780


    4    - 7          -0.9898      -0.4573       0.0752
    4    - 9          -1.1743      -0.4385       0.2973
    4    - 1          -0.8620      -0.3870       0.0879
    4    - 10         -0.7234      -0.2485       0.2264
    4    - 6          -0.6283      -0.2265       0.1753
    4    - 5          -0.5768      -0.1996       0.1776
    4    - 2          -0.6072      -0.0747       0.4578
    4    - 8          -0.5163      -0.0545       0.4073
    4    - 3          -0.5780      -0.0455       0.4870

                  General Linear Models Procedure

             Bonferroni (Dunn) T tests for variable: LLEAD

  NOTE: This test controls the type I experimentwise error rate
        but generally has a higher type II error rate than Tukey's
        for all pairwise comparisons.

    Alpha= 0.05  Confidence= 0.95  df= 105  MSE= 0.129494
                 Critical Value of T= 3.35340

Comparisons significant at the 0.05 level are indicated by '***'.
```

CLASS Comparison	Simultaneous Lower Confidence Limit	Difference Between Means	Simultaneous Upper Confidence Limit
7 - 9	-0.8139	0.0188	0.8515
7 - 1	-0.5245	0.0702	0.6649
7 - 10	-0.3859	0.2088	0.8034
7 - 6	-0.3028	0.2307	0.7643
7 - 5	-0.2562	0.2576	0.7715
7 - 2	-0.2625	0.3826	1.0276
7 - 8	-0.1807	0.4028	0.9862
7 - 3	-0.2333	0.4118	1.0568
7 - 4	-0.0951	0.4573	1.0096
9 - 7	-0.8515	-0.0188	0.8139
9 - 1	-0.7429	0.0514	0.8458
9 - 10	-0.6044	0.1900	0.9843
9 - 6	-0.5377	0.2120	0.9617
9 - 5	-0.4969	0.2389	0.9747
9 - 2	-0.4689	0.3638	1.1965
9 - 8	-0.4020	0.3840	1.1700
9 - 3	-0.4397	0.3930	1.2257
9 - 4	-0.3247	0.4385	1.2017
1 - 7	-0.6649	-0.0702	0.5245
1 - 9	-0.8458	-0.0514	0.7429
1 - 10	-0.4011	0.1385	0.6782
1 - 6	-0.3109	0.1605	0.6320
1 - 5	-0.2616	0.1874	0.6365
1 - 2	-0.2823	0.3123	0.9070
1 - 8	-0.1947	0.3326	0.8598
1 - 3	-0.2532	0.3415	0.9362
1 - 4	-0.1056	0.3870	0.8797
10 - 7	-0.8034	-0.2088	0.3859
10 - 9	-0.9843	-0.1900	0.6044
10 - 1	-0.6782	-0.1385	0.4011
10 - 6	-0.4495	0.0220	0.4934
10 - 5	-0.4001	0.0489	0.4979
10 - 2	-0.4209	0.1738	0.7685
10 - 8	-0.3332	0.1940	0.7213
10 - 3	-0.3917	0.2030	0.7977
10 - 4	-0.2441	0.2485	0.7412
6 - 7	-0.7643	-0.2307	0.3028
6 - 9	-0.9617	-0.2120	0.5377
6 - 1	-0.6320	-0.1605	0.3109
6 - 10	-0.4934	-0.0220	0.4495
6 - 5	-0.3373	0.0269	0.3911
6 - 2	-0.3817	0.1518	0.6854
6 - 8	-0.2851	0.1720	0.6292
6 - 3	-0.3525	0.1810	0.7146
6 - 4	-0.1903	0.2265	0.6433

5	- 7	-0.7715	-0.2576	0.2562
5	- 9	-0.9747	-0.2389	0.4969
5	- 1	-0.6365	-0.1874	0.2616
5	- 10	-0.4979	-0.0489	0.4001
5	- 6	-0.3911	-0.0269	0.3373
5	- 2	-0.3889	0.1249	0.6388
5	- 8	-0.2889	0.1451	0.5792
5	- 3	-0.3597	0.1541	0.6680
5	- 4	-0.1916	0.1996	0.5909
2	- 7	-1.0276	-0.3826	0.2625
2	- 9	-1.1965	-0.3638	0.4689
2	- 1	-0.9070	-0.3123	0.2823
2	- 10	-0.7685	-0.1738	0.4209
2	- 6	-0.6854	-0.1518	0.3817
2	- 5	-0.6388	-0.1249	0.3889
2	- 8	-0.5632	0.0202	0.6037
2	- 3	-0.6158	0.0292	0.6742
2	- 4	-0.4777	0.0747	0.6271
8	- 7	-0.9862	-0.4028	0.1807
8	- 9	-1.1700	-0.3840	0.4020
8	- 1	-0.8598	-0.3326	0.1947
8	- 10	-0.7213	-0.1940	0.3332
8	- 6	-0.6292	-0.1720	0.2851
8	- 5	-0.5792	-0.1451	0.2889
8	- 2	-0.6037	-0.0202	0.5632
8	- 3	-0.5745	0.0090	0.5924
8	- 4	-0.4246	0.0545	0.5335
3	- 7	-1.0568	-0.4118	0.2333
3	- 9	-1.2257	-0.3930	0.4397
3	- 1	-0.9362	-0.3415	0.2532
3	- 10	-0.7977	-0.2030	0.3917
3	- 6	-0.7146	-0.1810	0.3525
3	- 5	-0.6680	-0.1541	0.3597
3	- 2	-0.6742	-0.0292	0.6158
3	- 8	-0.5924	-0.0090	0.5745
3	- 4	-0.5069	0.0455	0.5979
4	- 7	-1.0096	-0.4573	0.0951
4	- 9	-1.2017	-0.4385	0.3247
4	- 1	-0.8797	-0.3870	0.1056
4	- 10	-0.7412	-0.2485	0.2441
4	- 6	-0.6433	-0.2265	0.1903
4	- 5	-0.5909	-0.1996	0.1916
4	- 2	-0.6271	-0.0747	0.4777
4	- 8	-0.5335	-0.0545	0.4246
4	- 3	-0.5979	-0.0455	0.5069

```
                    General Linear Models Procedure
                        Class Level Information

                     Class    Levels    Values

                     CLASS         2    11 12


                Number of observations in data set = 67


                    General Linear Models Procedure

Dependent Variable: LZINC

Source                  DF    Sum of Squares     F Value       Pr > F

Model                    1        0.19502130        0.52       0.4746

Error                   65       24.50287324

Corrected Total         66       24.69789454

                  R-Square              C.V.                LZINC Mean
                  0.007896          134.2378                0.45737995


Source                  DF          Type I SS    F Value       Pr > F
CLASS                    1         0.19502130       0.52       0.4746

Source                  DF        Type III SS    F Value       Pr > F

CLASS                    1         0.19502130       0.52       0.4746

                    General Linear Models Procedure
Dependent Variable: LLEAD

Source                  DF    Sum of Squares     F Value       Pr > F
Model                    1        0.42846878        2.00       0.1625

Error                   65       13.95153176

Corrected Total         66       14.38000054

                  R-Square              C.V.                LLEAD Mean
                  0.029796          64.00727                0.72381062


Source                  DF          Type I SS    F Value       Pr > F
CLASS                    1         0.42846878       2.00       0.1625

Source                  DF        Type III SS    F Value       Pr > F

CLASS                    1         0.42846878       2.00       0.1625
```

```
       General Linear Models Procedure
      T tests (LSD) for variable: LZINC

NOTE: This test controls the type I comparisonwise error rate
   not the experimentwise error rate.

      Alpha= 0.05  df= 65  MSE= 0.376967
        Critical Value of T= 2.00
      Least Significant Difference= 0.3155
      WARNING: Cell sizes are not equal.
     Harmonic Mean of cell sizes= 30.20896

Means with the same letter are not significantly different.
    T Grouping             Mean      N  CLASS

         A                0.532     23  12
         A
         A                0.418     44  11

 Tukey's Studentized Range (HSD) Test for variable: LZINC

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

      Alpha= 0.05  df= 65  MSE= 0.376967
    Critical Value of Studentized Range= 2.824
     Minimum Significant Difference= 0.3155
      WARNING: Cell sizes are not equal.
     Harmonic Mean of cell sizes= 30.20896

Means with the same letter are not significantly different.
   Tukey Grouping            Mean      N  CLASS

          A                 0.532     23  12
          A
          A                 0.418     44  11

    Bonferroni (Dunn) T tests for variable: LZINC

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

      Alpha= 0.05  df= 65  MSE= 0.376967
        Critical Value of T= 2.00
     Minimum Significant Difference= 0.3155
      WARNING: Cell sizes are not equal.
     Harmonic Mean of cell sizes= 30.20896

Means with the same letter are not significantly different.
    Bon Grouping            Mean      N  CLASS

         A                0.532     23  12
         A
         A                0.418     44  11
```

```
                General Linear Models Procedure
               T tests (LSD) for variable: LLEAD

NOTE: This test controls the type I comparisonwise error rate
      not the experimentwise error rate.

              Alpha= 0.05  df= 65  MSE= 0.214639
                  Critical Value of T= 2.00
             Least Significant Difference= 0.2381
               WARNING: Cell sizes are not equal.
             Harmonic Mean of cell sizes= 30.20896

Means with the same letter are not significantly different.
         T Grouping              Mean      N  CLASS

                  A             0.834     23  12
                  A
                  A             0.666     44  11

  Tukey's Studentized Range (HSD) Test for variable: LLEAD

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

              Alpha= 0.05  df= 65  MSE= 0.214639
          Critical Value of Studentized Range= 2.824
             Minimum Significant Difference= 0.2381
               WARNING: Cell sizes are not equal.
             Harmonic Mean of cell sizes= 30.20896

Means with the same letter are not significantly different.
       Tukey Grouping              Mean      N  CLASS

                    A             0.834     23  12
                    A
                    A             0.666     44  11

       Bonferroni (Dunn) T tests for variable: LLEAD

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

              Alpha= 0.05  df= 65  MSE= 0.214639
                  Critical Value of T= 2.00
             Minimum Significant Difference= 0.2381
               WARNING: Cell sizes are not equal.
             Harmonic Mean of cell sizes= 30.20896

Means with the same letter are not significantly different.
       Bon Grouping              Mean      N  CLASS

                   A             0.834     23  12
                   A
                   A             0.666     44  11
```

```
                     General Linear Models Procedure
                        Class Level Information

                        Class    Levels    Values
                        GROUP         2    1 2

                Number of observations in data set = 182
                    General Linear Models Procedure

Dependent Variable: LZINC

Source                 DF    Sum of Squares     F Value       Pr > F
Model                   1       26.35070763      106.81       0.0001

Error                 180       44.40890735

Corrected Total       181       70.75961498

                 R-Square              C.V.                LZINC Mean
                 0.372398         -1207.710               -0.04112786


Source                 DF         Type I SS     F Value       Pr > F
GROUP                   1       26.35070763      106.81       0.0001

Source                 DF       Type III SS     F Value       Pr > F

GROUP                   1       26.35070763      106.81       0.0001

                    General Linear Models Procedure
Dependent Variable: LLEAD

Source                 DF    Sum of Squares     F Value       Pr > F
Model                   1        0.42911030        2.57       0.1109

Error                 180       30.09511152

Corrected Total       181       30.52422181

                 R-Square              C.V.                LLEAD Mean
                 0.014058          61.93543                0.66019551


Source                 DF         Type I SS     F Value       Pr > F

GROUP                   1        0.42911030        2.57       0.1109

Source                 DF       Type III SS     F Value       Pr > F

GROUP                   1        0.42911030        2.57       0.1109
```

```
                  General Linear Models Procedure
                 T tests (LSD) for variable: LZINC

NOTE: This test controls the type I comparisonwise error rate
      not the experimentwise error rate.

            Alpha= 0.05  df= 180  MSE= 0.246716
                 Critical Value of T= 1.97
            Least Significant Difference= 0.1506
             WARNING: Cell sizes are not equal.
           Harmonic Mean of cell sizes= 84.67033

Means with the same letter are not significantly different.
         T Grouping              Mean      N  GROUP

                  A            0.4574     67  2

                  B           -0.3316    115  1

  Tukey's Studentized Range (HSD) Test for variable: LZINC

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

            Alpha= 0.05  df= 180  MSE= 0.246716
         Critical Value of Studentized Range= 2.791
           Minimum Significant Difference= 0.1506
             WARNING: Cell sizes are not equal.
           Harmonic Mean of cell sizes= 84.67033

Means with the same letter are not significantly different.
       Tukey Grouping              Mean      N  GROUP

                    A            0.4574     67  2

                    B           -0.3316    115  1

       Bonferroni (Dunn) T tests for variable: LZINC

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

            Alpha= 0.05  df= 180  MSE= 0.246716
                 Critical Value of T= 1.97
           Minimum Significant Difference= 0.1506
             WARNING: Cell sizes are not equal.
           Harmonic Mean of cell sizes= 84.67033

Means with the same letter are not significantly different.
        Bon Grouping              Mean      N  GROUP

                   A            0.4574     67  2

                   B           -0.3316    115  1
```

```
                General Linear Models Procedure
                T tests (LSD) for variable: LLEAD

      NOTE: This test controls the type I comparisonwise error rate
            not the experimentwise error rate.

               Alpha= 0.05  df= 180  MSE= 0.167195
                    Critical Value of T= 1.97
               Least Significant Difference= 0.124
                WARNING: Cell sizes are not equal.
              Harmonic Mean of cell sizes= 84.67033

      Means with the same letter are not significantly different.
               T Grouping            Mean      N  GROUP


                        A          0.7238     67  2
                        A
                        A          0.6231    115  1

       Tukey's Studentized Range (HSD) Test for variable: LLEAD

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

               Alpha= 0.05  df= 180  MSE= 0.167195
            Critical Value of Studentized Range= 2.791
              Minimum Significant Difference= 0.124
                WARNING: Cell sizes are not equal.
              Harmonic Mean of cell sizes= 84.67033

      Means with the same letter are not significantly different.

            Tukey Grouping            Mean      N  GROUP

                        A          0.7238     67  2
                        A
                        A          0.6231    115  1

            Bonferroni (Dunn) T tests for variable: LLEAD

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

               Alpha= 0.05  df= 180  MSE= 0.167195
                    Critical Value of T= 1.97
              Minimum Significant Difference= 0.124
                WARNING: Cell sizes are not equal.
              Harmonic Mean of cell sizes= 84.67033

      Means with the same letter are not significantly different.
             Bon Grouping            Mean      N  GROUP
                        A          0.7238     67  2
                        A
                        A          0.6231    115  1
```